BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF AMEREN ENERGY MEDINA	)	AS 21-________
VALLEY COGEN, LLC (OLD MEREDOSIA)	)	(Adjusted Standard - Land)
FOR ADJUSTED STANDARDS	)	
FROM 35 ILL. ADM. CODE PART 845	)	

NOTICE OF FILING

To: Don Brown, Clerk
Pollution Control Board
100 West Randolph St. Suite 11-500
Chicago, Illinois 60601

Christine Zeivel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19267
Springfield, IL 62795-9276

Please take notice that on May 11, 2021, the Petitioner filed electronically with the Office of the Clerk of the Illinois Pollution Control Board, the attached **AMEREN'S INDEX OF EXHIBITS** in the above captioned proceedings, copies of which are hereby served upon you.

Dated: May 11, 2021

Respectfully submitted,
Ameren Energy Medina Valley Cogen, LLC, Petitioner.

By: /s/ CLAIRE A. MANNING

BROWN, HAY & STEPHENS, LLP
Claire A. Manning, #3124724
Anthony D. Schuering, #6333319
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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

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PETITION OF AMEREN ENERGY MEDINA	)	AS 21-________
VALLEY COGEN, LLC (OLD MEREDOSIA)	)	(Adjusted Standard - Land)
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FROM 35 ILL. ADM. CODE PART 845	)	

AMEREN'S INDEX OF EXHIBITS

Exhibit 1: Meredosia Station Closure Plan Documents.

Exhibit 2: Ameren's 2019 Annual Report for the Meredosia Power Station.

Exhibit 3: Elevation Rendering of Meredosia Old Ash Pond.

Exhibit 4: Site Assessment – Meredosia Power Station (May 10, 2011).

Exhibit 5: Liquefication Analysis Report for the Meredosia Fly Ash and Closed Ash Ponds.

Dated: May 11, 2021

Respectfully submitted,
Ameren Energy Medina Valley Cogen, LLC, Petitioner.

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CERTIFICATE OF SERVICE

Please take notice that on May 11, 2021, the Petitioner filed electronically with the Office of the Clerk of the Illinois Pollution Control Board, the foregoing Notice of Filing and Ameren's Index of Exhibits, copies of which are hereby served upon the following:

Don Brown, Clerk Pollution Control Board 100 West Randolph St. Suite 11-500 Chicago, Illinois 60601	Christine Zeivel Illinois Environmental Protection Agency 1021 North Grand Avenue East P.O. Box 19267 Springfield, IL 62795-9276

/s/ CLAIRE A. MANNING

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EXHIBIT 1

Copy to records 06L

W1370300005 06L

GEOTECHNOLOGY INC
FROM THE GROUND UP

CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 15, 2016

J024917.01

FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 15, 2016

deliverables/J024917.01 Meredosia Closure Plan RF.doc

J024917.01

CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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J024917.01

CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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(continued)

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J024917.01

CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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ATTACHMENTS

J024917.01

CLOSURE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

This Closure Plan for the AmerenEnergy Medina Valley Cogen, LLC Meredosia Power Station (Meredosia Power Station) Fly Ash Pond and Bottom Ash Pond Coal Combustion Waste Surface Impoundments has been prepared in general accordance with the requirements of the site-specific rule in 35 Illinois Administrative Code (IAC) Part 840.101 through 840.152 and the United States Environmental Protection Agency (USEPA) regulation at 40 Code of Federal Regulations (CFR) Parts 257 and 261. Supporting documents to this Closure Plan are listed in the Reference Section of this report.

2.0 SITE LAYOUT

The Meredosia power Station is located at 800 South Washington Street, Meredosia, Illinois. The Fly Ash and Bottom Ash Ponds are located southwest of the coal pile and plant facilities. The site location and topography are shown on Plate 1. The existing structures, ash ponds, and boring/monitoring wells are shown on Plate 2.

3.0 SITE HISTORY

The Meredosia Power Station is located south of Meredosia in Morgan County, Illinois, which is located in west-central Illinois. The Meredosia Power Station ash ponds are located in the south half of Section 21 and the north half of Section 28, T.16N, R.13W. The plant generated electricity from 1948 until February 2012. The plant is located on the floodplain east of the Illinois River. A third ash pond referred to as the "Old Ash Pond" was reportedly closed, and will not be further discussed in this report. Reportedly, the Bottom Ash and Fly Ash Ponds were constructed of native materials.

The Bottom Ash Pond was constructed in 1972 with a design surface area of 11 acres, a height of 24 feet and a volume of approximately 90 acre-feet. The Bottom Ash Pond had received low-volume wastewater, bottom ash and storm water runoff. The site operates under NPDES Permit IL0000116, Outfall 003, which is for the Bottom Ash Pond. Reportedly, the Bottom Ash Pond did not have standing water within two months of the plant closure.

The Fly Ash Pond was constructed in 1968. The Fly Ash Pond has a surface area of 34 acres, a height of 24 feet and a volume of approximately 500 acre-feet. The Fly Ash Pond reportedly received fly ash, low-volume wastewater and storm water runoff. The site operates under NPDES Permit IL0000116, Outfall 004, which is for the Fly Ash Pond. The Fly Ash Pond was reportedly dry by October 2012.

A feasibility analysis was performed regarding the closure options for the Fly Ash and Bottom Ash Ponds on the site. The options included no action, complete clean closure, soil/geosynthetic composite cap, and partial clean closure with a ClosureTurf® cap alternatives. The no closure option was not selected due to the known groundwater impacts at the site and facility decommissioning activities. Clean closure of both ponds was cost and time prohibitive due to ash disposal and subsequent backfilling and grading of the site. The soil/geosynthetic composite cap option was not selected due to the long term maintenance issues, lack of personnel on site to perform maintenance activities, cost, and the longer time frame needed to close the ponds. Partial clean closure of the bottom ash pond, moving the bottom ash to the fly ash pond, and capping the fly ash pond and bottom ash pond berm with ClosureTurf® was selected as an effective and efficient option.

4.0 SLOPE STABILITY ANALYSIS

Slope stability analysis consists of comparing the driving forces within a cross-section of slope to the resisting forces and calculating the factor of safety. Per the Illinois Department Natural Resources (IDNR)[1], embankments should have a minimum factor of safety of 1.5 for long-term static stability, and 1.0 for the pseudo-static condition (seismic condition). Major flood conditions and rapid drawdown conditions were also analyzed due to the proximity of the site to the Illinois River. Slope stability analysis discussion, section profiles, and calculated critical failure arcs at selected locations are presented in Appendix A. Global stability analysis results, at current groundwater elevations in relation to mean sea level (MSL) and design grades for the Fly Ash and Bottom Ash Ponds, are summarized in the following table.

[1] *Rules for Construction and Maintenance of Dams*, Illinois Department of Natural Resources, Office of Water Resources, Springfield, Illinois.

SUMMARY OF STABILITY ANALYSES			
Section Location	**Case**	**Calculated Factor of Safety**	**Target Factor of Safety**
Fly Ash Pond West Embankment	Static Condition Normal River Stage	2.1	1.5
	Static Condition Major Flood Stage (447'MSL)	2.5	1.5
	Rapid Drawdown Major Flood Stage (447'MSL)	1.7	1.2
	Seismic Condition	1.3	1.0
Bottom Ash Pond West Embankment	Static Condition Normal River Stage	1.8	1.5
	Static Condition Major Flood Stage (447'MSL)	1.6	1.5
	Rapid Drawdown Major Flood Stage (447'MSL)	1.7	1.2
	Seismic Condition	1.3	1.0

The stability models for each section at the Fly Ash Pond and Bottom Ash Pond closures have calculated factors of safety greater than or equal to the recommended IDNR target factor of safety for the static and seismic conditions.

5.0 CLOSURE ACTIVITIES

Proposed closure activities include grading, installation of high performance high density polyethylene (HDPE) geomembrane, and establishment of surface water control features for the Fly Ash and Bottom Ash Ponds. Closure activities will be performed in accordance with the Closure Plans and Specifications. Quality control will be performed in accordance with the Construction Quality Assurance (CQA) Plan prepared for this project and will be documented by a professional engineer licensed in Illinois.

Refer to the Plans and Specifications completed for this project (CDG, 2016) for details on the closure system.

5.1 Grading. Ash and other material (i.e. embankment soils, bottom ash, and approved demolition debris) will be moved within and between the Fly Ash and Bottom Ash Ponds to achieve design grades. Embankment materials and bottom ash may be used to bring the subgrade to within one foot of design elevations. At least one foot of fly ash will be placed on top of the bottom ash to provide a good surface for ClosureTurf® installation. Ash will be placed at a maximum slope of 1V:10H (10 percent slope). Slopes are designed to promote surface runoff and reduce ponding. The final subgrade surface will be compacted and drum-rolled to provide a smooth surface prior to placement of the high performance HDPE system.

5.2 ClosureTurf®/HydroTurf® Installation. The ClosureTurf®/HydroTurf® system is a low permeability synthetic liner used to control storm water infiltration and limit exposure of the capped material to humans and vectors (i.e. animals). The design grades facilitate storm water runoff to the surface water management features outside the Fly Ash and Bottom Ash Ponds.

The ClosureTurf®/HydroTurf® is generally installed in the following manner (Refer to the CQA Plan for specific installation guidelines):

- The geomembrane component is installed per the manufacturer's requirements including the use of heat welding for seaming.
- The turf component is installed per the manufacturer's requirements including the use of a sewing machine for seaming.
- Sand or hydrobinder infill is placed and hydrated per the manufacturer's requirements.
- The perimeter of the geomembrane and turf components is secured by an anchor trench.

5.3 Surface Water Management. Surface water management features have been incorporated into the final cover design. Surface water features, such as ditches, will be formed in the subgrade to facilitate runoff. The ClosureTurf®/HydroTurf® will be placed over the berms and into ditches. Additional details are provided in the Plans and Specifications (CDG, 2016).

Surface water features are designed to handle runoff from a 20-year precipitation event without damage to the final cover and water ponding.

5.4 Construction Quality Assurance (CQA) Program. Refer to the CQA Plan (Geotechnology, 2016) for details on the project specific CQA program.

6.0 HYDROGEOLOGIC SITE INVESTIGATION

The Hydrogeologic Site Investigation includes a summary of geologic data, hydrogeologic data, and known impacts to the groundwater for the site. Boron and arsenic are typically the best indicator chemicals for coal combustion waste related impacts at the site. Please refer to the separate Hydrogeologic Site Investigation Report (Geotechnology, 2016) for detailed information.

7.0 GROUNDWATER

7.1 Groundwater Monitoring Program. Requirements for the groundwater monitoring program and associated quality assurance are found in the Groundwater Monitoring Plan (Geotechnology, 2016). Quarterly groundwater sampling of the groundwater monitoring system will occur for the first five years after the CQA acceptance report is submitted, and sampling frequencies may be reduced after that time frame. Monitoring data and trend analysis data will be maintained at the offices of Medina Valley Cogen, LLC until a post-closure completion report is accepted by the IEPA.

7.2 Groundwater Monitoring System. Nine monitoring wells (Groundwater Monitoring Program, Plate 2) have been installed in the vicinity of the Fly Ash and Bottom Ash Ponds. These monitoring wells are used for the groundwater monitoring system. Additional monitoring wells are not planned at this time. The monitoring well network will be evaluated two years after completion of the ash pond closures for effectiveness. One monitoring well (APW-1) will be sampled for background values, and eight monitoring wells will be sampled for groundwater assessment. Please refer to the separate Groundwater Monitoring Plan (Geotechnology, 2016) for additional information.

7.3 Groundwater Trend Analysis. Intrawell analysis will be used to assess groundwater trends over time. Please refer to the separate Groundwater Monitoring Plan (Geotechnology, 2016) for additional information.

7.4 Mitigation of Statistically Significant Trends. If statistically significant increasing trends are noted in the groundwater analysis, additional investigation into the cause of the increasing trends will be needed. Refer to the Groundwater Monitoring Plan (Geotechnology, 2016) for additional information.

8.0 TIME AND COST ESTIMATES

8.1 Time to Complete Closure. Completion of closure activities is dependent on weather and final approval of the closure plan by the IEPA. However, closure activities are anticipated to begin in 2016 and be completed in 2017.

8.2 Time to Reach Class I Groundwater Standards. Boron concentrations for the current ash pond configurations were modeled for 25 years to represent a scenario where the ash ponds were not closed. After 25 years, Monitoring Well APW-3 (the well with historically highest boron concentrations) stabilized at 16.9 mg/L of boron, which exceeds the Class I Groundwater standards. Monitoring Wells APW-2, APW-6, APW-7, and APW-8 also exceeded the Class I Groundwater standards at 25 years with no action.

After the dewatering and closure activities of the Fly Ash and Bottom Ash Ponds are complete, it will take approximately three years for boron concentrations to decrease below the Class I Groundwater standards for each well on site according to the model results.

Refer to the Hydrogeologic Site Investigation Report (Geotechnology, 2016) for more information regarding the groundwater modeling.

8.3 Remediation Time Frame. Once the ClosureTurf® caps for the Fly Ash and Bottom Ash Ponds are in place, precipitation will be diverted away from the ash ponds. Infiltration of precipitation into the ash ponds will be reduced or eliminated and further reductions of the concentrations of COCs are anticipated. Boron exhibited the highest concentration over the largest area and was used as the indicator contaminant for contaminant transport modeling. Based on the modeling results, the length of time required for the concentration of boron to decrease below the Class I Groundwater Standards is approximately three years. Additional contamination transport modeling information is in the Hydrogeologic Site Investigation Report (Geotechnology, 2016).

8.4 Cost of Closure. The cost for closure activities related to the closure of the Fly Ash and Bottom Ash Ponds as specified in the drawings and specifications is estimated to be $10,000,000.

8.5 Cost of Post-Closure Care. The cost for post-closure care activities related to the closure of the Fly Ash and Bottom Ash Ponds as specified in the Post-Closure Plan is estimated to be $20,000 annually while quarterly groundwater sampling is in progress.

9.0 REFERENCES

CDG, 2016. "Specifications and Construction Plans, Fly Ash and Bottom Ash Ponds Closure, Meredosia Power Station." CDG Engineers Architects Planners, Inc., St. Louis, Missouri, 2016

Geotechnology, Inc., Construction Quality Assurance Plan, Meredosia Power Station, Ameren, 2016.

Geotechnology, Inc., Groundwater Monitoring Plan, Meredosia Power Station, Ameren, 2016.

Geotechnology, Inc., Groundwater Management Zone Plan, Meredosia Power Station, Ameren, 2016.

Geotechnology, Inc., Post-Closure Plan, Meredosia Power Station, Ameren, 2016.

10.0 LICENSED PROFESSIONAL SIGNATURE/SEAL

I hereby affirm that the information and design documents contained in this closure plan are true and accurate to the best of my knowledge and professional opinion.

Rosanna M. Saindon, P.E., Ph.D.
Illinois Licensed Professional Engineer
Project Manager
Geotechnology, Inc.

LICENSED PROFESSIONAL ENGINEER
ROSANNA MARIE SAINDON
062.062289
8/15/2016
STATE OF ILLINOIS

NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

0 2,000 4,000

SCALE IN FEET

N

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 7-20-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.01	PLATE 1

NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.

LEGEND
Monitoring Well Location
Soil Boring Location
Slope Stability Analysis Cross Section

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 7-20-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

AERIAL PHOTOGRAPH OF SITE

Project Number J024917.01

PLATE 2

APPENDIX A

STABILITY ANALYSIS

APPENDIX A

STABILITY ANALYSIS

1.0 PREVIOUS SLOPE STABILITY STUDY

Geotechnology performed a subsurface exploration and global stability evaluation[2] for the west embankments of the Bottom Ash and Fly Ash Ponds at the subject site in January 2011. Ten borings designated as Borings B-1 through B-10 were drilled during the subsurface exploration. Boring locations are shown on Plate 2. Laboratory testing included moisture contents for cohesive samples and Atterberg limits on selected samples. Also, consolidated-undrained triaxial, unconfined compression and direct shear tests were performed on representative samples. Relevant data from this exploration are incorporated into this report. Copies of the boring logs are presented in Attachment A. Laboratory test results are included in Attachment B.

2.0 SLOPE STABILITY ANALYSIS

Slope stability analysis consists of comparing the driving forces within a cross-section of slope to the resisting forces and determining the factor of safety. Gravity forces tend to move the slope downwards (driving force), while resisting forces, derived from the soil shear strength, tend to keep the slope in place. When the driving force acting on the slope is greater than the resisting force, sliding can occur. The factor of safety of the slope is the ratio of the restraining force divided by the driving force. Generally, when the factor of safety is 1 or less, the slope is considered to be unstable. The accepted standard in local practice and consistent with the Illinois Department of Natural Resources (IDNR) dam safety requirement is a factor of safety of 1.5 for long term static stability of a slope, and 1.0 for pseudo-static conditions (seismic loading).

Slope stability analyses were performed for representative sections of the west embankments of the Bottom Ash and Fly Ash Ponds. We understand that the embankment slopes will remain as-is or will be graded to a slope of 1V:3H (Vertical:Horizontal) or flatter. The locations of the typical cross-sections of the embankments are represented by Sections B-B' and A-A', respectively, and are shown on Plate 2. Soil profile and properties used in the stability analysis were selected based on boring and laboratory test results reported in the 2011 Global Stability Evaluation report and Geotechnology's experience with similar materials. The soil properties used in the models are summarized in the following table:

---

[2] *Global Stability Evaluation, Meredosia Power Station, Bottom and Fly Ash Ponds, Meredosia, Illinois,* prepared for Ameren Energy Resources by Geotechnology Inc., Report No. J017150.01, and dated January 4, 2011.

2.1 Effective Stress Parameters

Material	Cohesion (psf)	Friction Angle (deg)	Density (pcf)
Embankment Fill	0	28	115
Silty Clay	50	29	115
Sand	0	39	120
Fly Ash	0	25	112
Bottom Ash	0	28	112

2.2 Total Stress Parameters

Material	Cohesion (psf)	Friction Angle (deg)
Embankment Fill	0	0
Silty Clay	500	14
Sand	0	0
Fly Ash	0	0
Bottom Ash	0	0

Geotechnology performed stability analysis for deep seated, global failure of the embankments. Representative cross-sections of the embankments are shown on the plates included in Appendix C. Since the embankments have been in place for 40 years or more, long-term stability of the embankments was analyzed (i.e. effective stress conditions). Both effective and total stress soil properties were used for the rapid drawdown analysis. Groundwater in the Bottom Ash Pond was varied between El 435[3] to 440 for our analyses. Groundwater in the Fly Ash Pond was assumed to be at El 450. For the rapid drawdown case it was assumed that the Illinois River will drain rapidly from its major flood stage of El 447.

A pseudo-static seismic analysis was performed on the embankment sections using a Peak Ground Acceleration (PGA) of 0.1g, which corresponds to a seismic event with a mean return time of 2,500 years. The PGA is based on data provided in Appendix 1 of the dam safety guidelines[4] published by the IDNR. The Morgenstern-Price procedure was used to compute factors of safety. The computer program SLOPE/W was used to perform the computations. The calculated factors of safety are given in the following table.

[3] All elevations herein refer to the mean sea level (msl) datum in feet.
[4] "Procedural Guidelines for Preparation of Technical Data to be included in Application for Permits for Construction and Maintenance of Dams" issued by Illinois Department of Natural Resources.

SLOPE STABILITY ANALYSIS RESULTS				
Analysis Condition	Calculated Factor of Safety		Target Factor of Safety[a]	Reference Plate No.
	Fly Ash Pond Section AA'	Bottom Ash Pond Section BB'		
Steady State Seepage Groundwater Elevation in Ash Pond as noted	2.1 (El 450)	1.8 (El 435)	1.5	1 and 5
Steady State Seepage at Major Flood Stage El 447 Groundwater Elevation in Ash Pond as noted	2.5 (El 450)	1.6 (El 440)	1.5	2 and 6
Rapid Drawdown from Major Flood Stage at El 447 Groundwater Elevation in Ash Pond as noted	1.7 (El 450)	1.7 (El 440)	1.2	3 and 7
Slope with Seismic Forces Mean Return Time 2,500 Years Groundwater Elevation in Ash Pond as noted	1.3 (El 450)	1.3 (El 435)	1.0	4 and 8

[a] "Procedural Guidelines for Preparation of Technical Data to be included in Application for Permits for Construction and Maintenance of Dams" issued by Illinois Department of Natural Resources.

IDNR recommends a minimum factor of safety of 1.5 for long-term stability. During an extreme event, such as an earthquake, a factor of safety of 1.0 or more is recommended. Based on the results of our analyses, the Bottom Ash and Fly Ash Pond embankment slopes have adequate factors of safety for global stability.

ATTACHMENT A

BORING LOGS AND
BORING LOG TERMS AND SYMBOLS

Surface Elevation: 449.0 | Completion Date: 10/21/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
0.5	FILL: brown, fine to coarse sand, trace clay lenses		
		6-16-10	SS1
		3-11-13-14	SS2
		5-7-9	SS3
		5-9-14	SS4
		4-4-4	SS5
14	FILL: black clay with sand		
17	Very soft, gray, interbedded SILT and CLAY with organics - ML/CL		
		0-0-1	SS6
22	Medium stiff, gray CLAY - (CH)		
		2-2-3	SS7
		92	ST8
		87 89	ST9
32	Loose, gray, clayey SAND with gravel - SP		
		1-4-4	SS10
37	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP		
		5-7-7	SS11

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

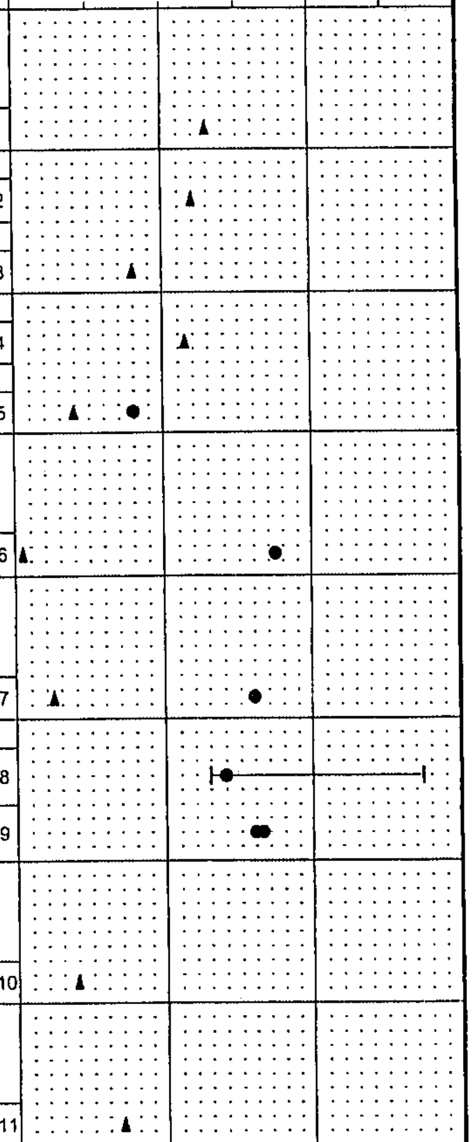
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148760.916' E: 2182703.077'

Drawn by: KA	Checked by:	App'vd. by:
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-1

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0536301.GPJ 12/13/10

Surface Elevation: 449.0 | Completion Date: 10/21/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*			
45			4-5-4	SS12
50			5-7-9	SS13
55			9-8-9	SS14
60			7-12-15	SS15
	Boring terminated at 60 feet			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148760.916' E: 2182703.077'

Drawn by: KA	Checked by: SK	App'vd. by: DML
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-1

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0538301.GPJ 12/13/10

Surface Elevation: 449.2 Completion Date: 10/21/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ● LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
1	FILL: brown, fine to coarse sand with black clay lenses		
		5-7-9	SS1
		6-10-8	SS2
		7-8-13	SS3
		5-5-9	SS4
		3-3-3	SS5
17	Black, clayey SAND, trace gravel - SP		
			ST6
22	Medium stiff, gray CLAY - CH		
		3-4-4	SS7
		3-3-3	SS8
32	Soft, gray, clayey SILT with sand and clay lenses - ML		
		2-1-1	SS9
37	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP		
		0-2-4	SS10

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 13.6 FEET AFTER 16 HOURS

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Hole collpased at 46 feet. Datum: IL State Plane Coordinates, West Zone. N: 1148689.546' E: 2182613.025'

Drawn by: KA	Checked by:	App'vd. by:
Date: 10/26/10	Date: 12/ /10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-2

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 449.2 Completion Date: 10/21/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*		3-6-6	SS11
45				
	Boring terminated at 46 feet.			
50				
55				
60				
65				
70				
75				

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 □ - SV; 0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL LL; 10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 13.6 FEET AFTER 16 HOURS ⊻

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Hole collpased at 46 feet. Datum: IL State Plane Coordinates, West Zone. N: 1148689.546' E: 2182613.025'

Drawn by: KA Date: 10/26/10 | Checked by: SL Date: 12/22/10 | App'vd. by: DW Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF LOG OF BORING: B-2

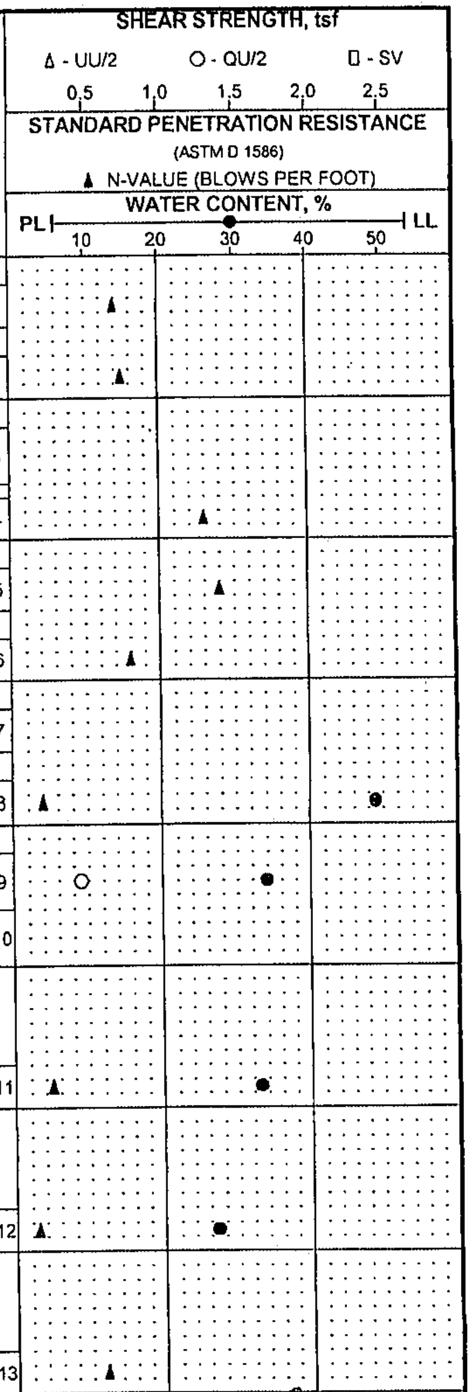
Project No. J017150.01

Surface Elevation: 449.1

Datum msl

Completion Date: 10/21/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Crushed rock		
	FILL: brown sand with black clay lenses	4-6-8	SS1
		5-6-9	SS2
5			ST3
		8-10-16	SS4
10		8-13-15	SS5
		6-8-8	SS6
15	FILL: black clay with sand, trace gravel		SS7
	Soft to medium stiff, gray CLAY - CH	2-2-2	SS8
20	with organics	86	ST9
			ST10
25			
		1-2-3	SS11
30	Soft, brown, clayey SILT with sand - ML		
		1-2-1	SS12
35	Medium dense, brown, fine to coarse SAND, trace gravel - SP	5-5-7	SS13



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148536.604' E: 2182554.305'

Drawn by: KA	Checked by: SL	App'vd. by: DWY
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-3

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/11/10

Surface Elevation: 449.1 Completion Date: 10/21/10

Datum msl

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢——●——⊣ LL

10 20 30 40 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*			
			6-7-7	SS14
45				
			6-7-9	SS15
50				
			5-8-9	SS16
55				
			8-8-13	SS17
60	Boring terminated at 60 feet.			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148536.604' E: 2182554.305'

Drawn by: KA	Checked by: [illegible]	App'vd. by: [illegible]
Date: 10/26/10	Date: 12/[illegible]/10	Date: 1/4/11

GEOTECHNOLOGY INC

FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

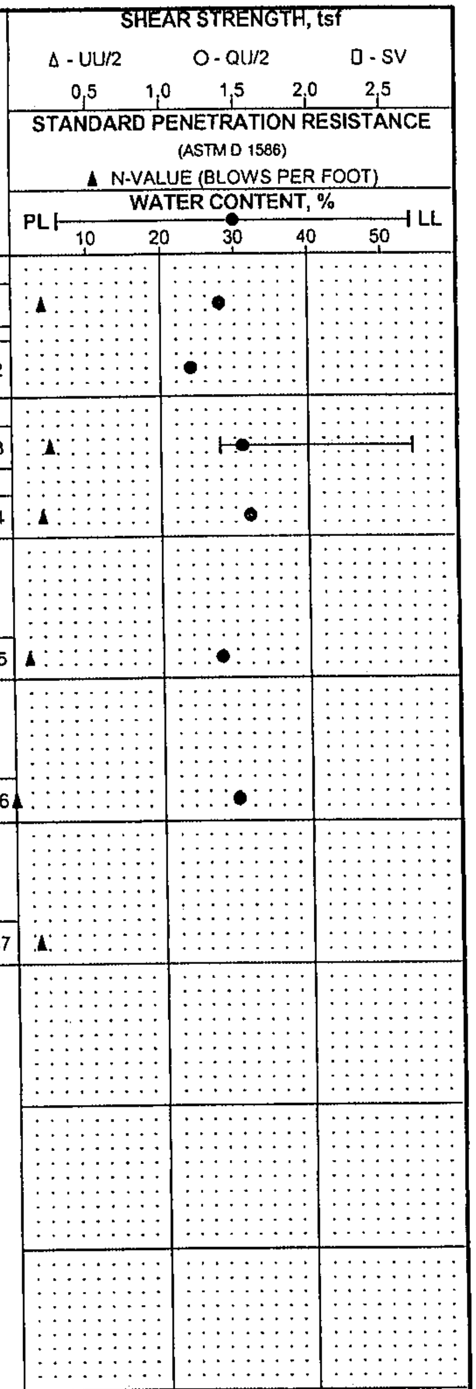
CONTINUATION OF LOG OF BORING: B-3

Project No. J017150.01

Surface Elevation: 431.6 Completion Date: 10/22/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft to medium stiff, brown and gray CLAY - (CH)		1-2-2	SS1
			*	ST2
			1-2-3	SS3
			0-2-2	SS4
12	Soft, gray, silty CLAY, trace sand - CL		0-1-1	SS5
17	Very soft, gray, sandy CLAY with silt - CL		0-0-0	SS6
22	Very loose, brown, fine to coarse SAND, trace gravel - SP		0-1-2	SS7
25	Boring terminated at 25 feet.			



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 19 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * Disturbed sample Datum: IL State Plane Coordinates, West Zone. N: 1148688.82' E: 2182505.605'

Drawn by: KA	Checked by: SLC	App'vd. by: DN
Date: 10/26/10	Date: 12/13/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-4

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 431.8 | Completion Date: 10/22/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray, silty CLAY - CL			
			2-2-3	SS1
			2-2-2	SS2
5	Medium stiff to very soft, brown and gray CLAY - CH			
			1-1-3	SS3
			89	ST4
10				
			0-0-0	SS5
15	Very soft, gray, silty CLAY with sand - CL			
			0-0-0	SS6
20				
	∇		0-0-0	SS7
25	Boring terminated at 25 feet.			
30				
35				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - TV

0.5 1.0 1.5 2.0 2.5

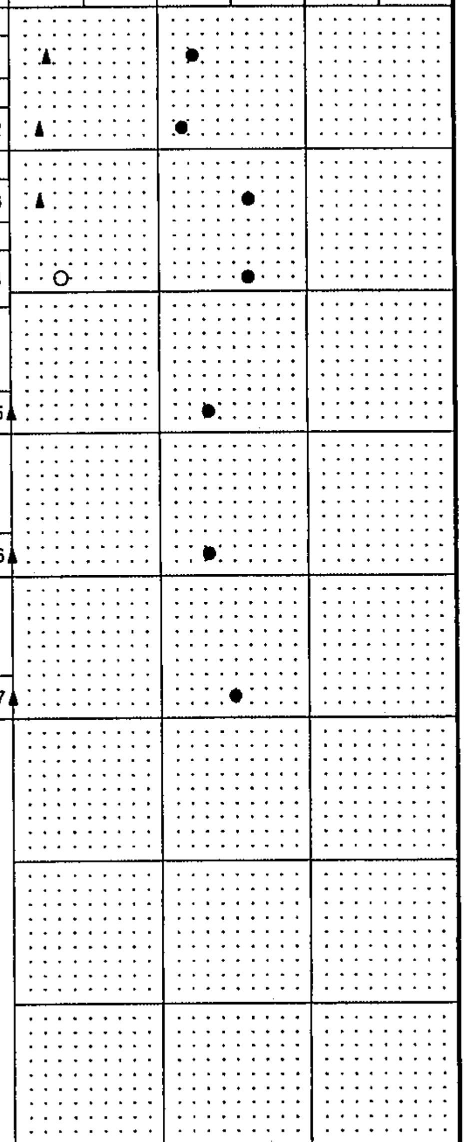
STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢——●——⊣ LL

10 20 30 40 50



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/21/10

GROUNDWATER DATA

ENCOUNTERED AT 23 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148661.88' E: 2182476.0360'

Drawn by: KA	Checked by: SK	App'vd. by: DW
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC

FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-5

Project No. J017150.01

Surface Elevation: 450.8 Completion Date: 10/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
	FILL: black clay with sand pockets	3-6-10	SS1
	FILL: brown, fine sand, trace clay	3-8-9	SS2
5		4-6-7	SS3
	FILL: black ash and sand		ST4
10			ST5
	FILL: brown, fine sand, trace gravel	6-7-13	SS6
15	Very stiff, gray, silty CLAY with sand - CL	0-5-15	SS7
20	Very loose, gray silty SAND - SM	0-0-0	SS8
25	Very soft to soft, gray, silty CLAY with clay and silt seams - (CL)	0-1-3	SS9
30		0-0-0	SS10
35		0-0-0	SS11

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ● LL

10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148066.896' E: 2182040.954'

Drawn by: KA	Checked by: SR	App'vd. by: DW
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-6

Project No. J017150.01

Surface Elevation: 450.8 Completion Date: 10/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf / STANDARD PENETRATION RESISTANCE / WATER CONTENT, %
	Very soft to soft, gray, silty CLAY with clay and silt seams - (CL) *(continued)*				
45			1-1-1	SS12	
	Dense, brown, fine to coarse SAND - SP		7-13-42	SS13	
50	Boring terminated at 50 feet.				
55					
60					
65					
70					
75					

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 □ - SV; 0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL ├──●──┤ LL; 10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148066.896' E: 2182040.954'

Drawn by: KA	Checked by: SH	App'vd. by: DW
Date: 10/26/10	Date: 12/7/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-6

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0633301.GPJ 12/13/10

Surface Elevation: 450.5 | Completion Date: 10/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Crushed rock		
	FILL: black clay, ash and sand	5-8-9	SS1
	FILL: brown, fine sand	2-6-6	SS2
5		4-6-9	SS3
	FILL: black sand and ash with clay lenses	3-6-5	SS4
10			SS5
		3-7-9	SS6
15			
	Medium stiff, brown, sandy CLAY - CL	6-4-3	SS7
20			
	Medium stiff to very soft, gray, silty CLAY with sand - CL	3-4-5	SS8
25		87 86	ST9
		95	ST10
30			
		1-0-0	SS11
35			
		*	ST12

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

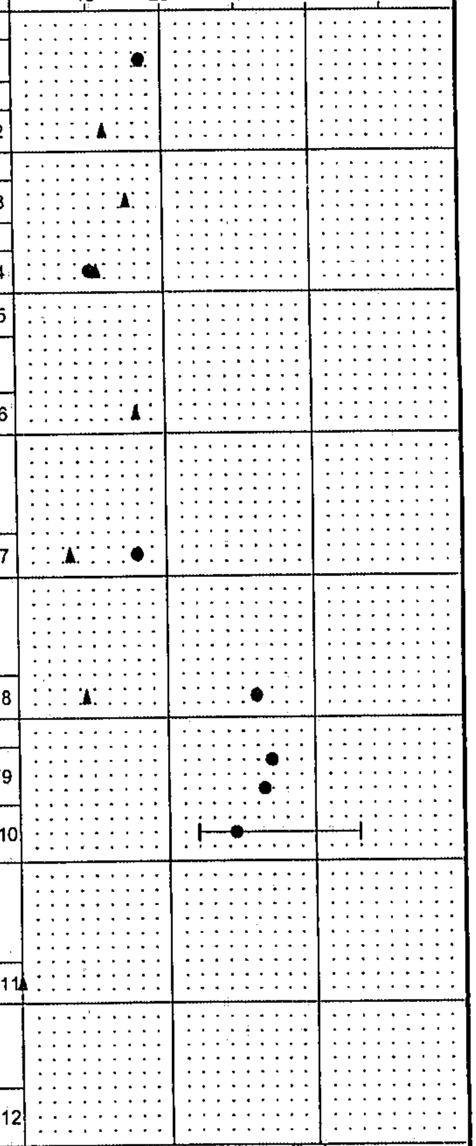
STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢ ● ⊣ LL

10 20 30 40 50



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * No recovery in samples SS11 and ST12 Datum: IL State Plane Coordinates, West Zone. N: 1147816.37' E: 2181875.293'

Drawn by: KA	Checked by: SK	App'vd. by: DAI
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-7

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 450.5 | Completion Date: 10/19/10
Datum msl

SHEAR STRENGTH, tsf
Δ - UU/2 O - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5
STANDARD PENETRATION RESISTANCE
(ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)
WATER CONTENT, %
PL ——— LL
10 20 30 40 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very soft, gray, silty CLAY with sand - CL *(continued)*			
	sandy			ST13
45				
	Medium dense to dense, brown, fine to medium coarse SAND - SP			
			5-8-10	SS14
50				
			7-9-14	SS15
55				
			13-17-19	SS16
60	Boring terminated at 60 feet.			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM 20 FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS: * No recovery in samples SS11 and ST12 Datum: IL State Plane Coordinates, West Zone. N: 1147816.37' E: 2181875.293'

Drawn by: KA	Checked by: [signature]	App'vd. by: [signature]
Date: 10/26/10	Date: 12/20/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-7

Project No. J017150.01

Surface Elevation: 451.1 Completion Date: 10/20/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ⊢—●—⊣ LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
	FILL: black clay with sand	5-6-10	SS1
	FILL: brown sand, trace to some clay	2-4-6	SS2
5		0-5-7	SS3
		4-8-12	SS4
10	FILL: black clay with sand	0-4-6	SS5
			ST6
15			
	FILL: gray, clayey sand with black clay lenses	2-4-6	SS7
20		4-3-3	SS8
	Medium stiff, black to gray CLAY - CH	2-3-4	SS9
25			
		0-2-3	SS10
30	Medium stiff to soft, gray clayey SILT with sand - ML	101	ST11
			SS12
35			
		0-0-2	SS13

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Drawn by: KA Date: 10/26/10 | Checked by: SK Date: 12/22/10 | App'vd. by: DW Date: 1/4/11

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 9.3 FEET AFTER 0.5 HOURS

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1147594.427' E: 2181738.149'

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-8

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0528301.GPJ 12/13/10

Surface Elevation: 451.1 Completion Date: 10/20/10
Datum msl

SHEAR STRENGTH, tsf
Δ - UU/2 O - QU/2 ◻ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL — LL
10 20 30 40 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Medium stiff to soft, gray clayey SILT with sand - ML *(continued)*			
	Dense to medium dense, brown, fine to coarse SAND with gravel - SP			
			13-16-16	SS14
45				
			7-9-11	SS15
50				
			5-7-9	SS16
55				
			10-13-14	SS17
60	Boring terminated at 60 feet.			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/1...

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 9.3 FEET AFTER 0.5 HOURS

DRILLING DATA

AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM 20 FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1147594.427' E: 2181738.149'

Drawn by: KA	Checked by: SK	App'vd. by: DM
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-8

Project No. J017150.01

Surface Elevation: 433.6 Completion Date: 10/25/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, black and gray CLAY - (CH)			
			2-3-4	SS1
			1-1-1	SS2
5				
				ST3
			86	ST4
10				
	Soft to very soft, gray, silty CLAY with silt seams and sand - CL			
			0-1-1	SS6
15				
			0-1-2	SS7
20				
			0-0-0	SS8
25	Boring terminated at 25 feet.			
30				
35				

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 □ - SV; 0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ├──●──┤ LL; 10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148133.361' E: 2182009.017'

Drawn by: KA	Checked by: SAC	App'vd. by: DMV
Date: 11/3/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-9

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 433.2 | Completion Date: 10/25/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray silty CLAY, trace sand and wood - CL		
		2-3-3	SS1
5		2-2-3	SS2
		0-2-3	SS3
10		0-1-2	SS4
	▽		
15		95	ST5
	Very loose to medium dense, gray, silty SAND with silty clay seams - SM		
20		0-1-1	SS6
	Wood	8-11-7	SS7
25	Boring terminated at 25 feet.		
30			
35			

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

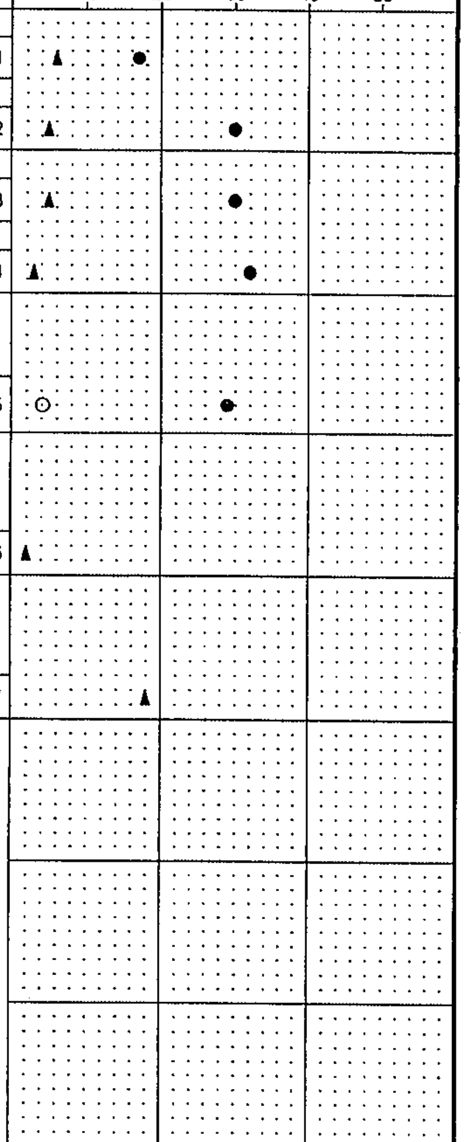
STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL LL

10 20 30 40 50



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 12 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148120.612' E: 2181976.582'

Drawn by: KA	Checked by: SH	App'vd. by: OW
Date: 11/3/10	Date: 12/2/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-10

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/1/10

BORING LOG: TERMS AND SYMBOLS

GENERAL NOTES

1. *Information on each boring log is a compilation of subsurface conditions based on soil or rock classifications obtained from the field as well as from laboratory testing of samples. The strata lines on the logs may be approximate or the transition between the strata may be gradual rather than distinct. Water level measurements refer only to those ob - served at the times and places indicated, and may vary with time, geologic condition or construction activity.*
2. *Relative composition and Unified Soil Classification designations are based on visual estimates and are approximate only. If laboratory tests were performed to classify the soil, the unified designation is show in parenthesis.*
3. *Value given in Unit Dry Weight/SPT Column is either a unit dry weight in pounds per cubic foot, if adjacent to a ST sample designation, or blows per 6-inch increment if adjacent to a SS sample designation.*

ABBREVIATIONS

UU/2 *Shear Strength from Unconsolidated – Undrained Triaxial Test (ASTM D2850)*
QU/2 *Shear Strength from Unconfined Compression Test (ASTM D2166)*
SV *Shear Strength from Field Vane (ASTM D2573)*
PL *Plastic Limit (ASTM D4318)*
LL *Liquid Limit (ASTM D4318)*

LEGEND

CS	Continuous Sampler
GB	Grab Sample Taken From Auger Cuttings Or Wash Water Return
NX 100/42	NX Rock Core with Percent Recovery/R.Q.D. Given In Adjacent Column
PST	Three Inch Diameter Piston Tube Sample
SS	Split Spoon Sample (Standard Penetration Test)
ST	Three Inch Diameter Shelby Tube Sample
*	Sample Not Recovered
SV	Field Vane Test

SPLIT – BARREL SAMPLER DRIVING RECORD

Blow Per Foot (N-Value)	*Description*
25	*25 blows drove sampler 12 inches after initial 6 inches of seating.*
75/10"	*75 blows drove sampler 10 inches after initial 6 inches of seating.*
50/S3"	*50 blows drove sampler 3 inches during initial 6 inch seating interval.*

NOTES: *1. To avoid damage to sampling tools, driving is limited to 50 blows during any six inch interval.*
2. N-Value (Blow Count) is the standard penetration resistance based on the total number of blows, using a 140-lb hammer with 30-inch free fall, required to drive a split spoon the last two of three, 6-inch drive increments. (Example: 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on grid plot and may be shown as 4/7/9 in Unit Dry Weight – SPT column.

RELATIVE COMPOSITION

Trace........................0-10 %
With/Some...............11-35 %
Soil modifier such....... > 35 %
As silty, clayey, sandy, etc.

DENSITY OF GRANULAR SOILS

Descriptive Term:	*N—Value*
Very Loose	*0 - 4*
Loose	*5 - 10*
Medium Dense	*11 - 30*
Dense	*31 - 50*
Very Dense	*> 50*

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength Tons Per Sq. Ft.	Field Test	Approximate N-Value Range
Very Soft	*less than 0.12*	*Thumb will penetrate soil more than 1"*	*0 - 1*
Soft	*13 to 0.25*	*Thumb will penetrate soil about 1"*	*2 - 4*
Medium Stiff	*0.26 to 0.50*	*Thumb will penetrate soil about ¼"*	*5 – 8*
Stiff	*0.51 to 1.00*	*Thumb hardly indents soil*	*9 – 15*
Very Stiff	*1.01 to 2.00*	*Thumb will not indent soil, but readily indented with thumbnail*	*16 – 30*
Hard	*greater than 2.00*	*Thumbnail will not indent soil*	*> 30*

SOIL GRAIN SIZE

U.S. STANDARD SIEVE

Sieve	12"	3"	¾"	4	10	40	200		
	BOULDERS	COBBLES	GRAVEL – COARSE	GRAVEL – FINE	SAND – COARSE	SAND – MEDIUM	SAND – FINE	SILT	CLAY
mm	300	76.2	19.1	4.76	2.00	0.42	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

SOIL STRUCTURE

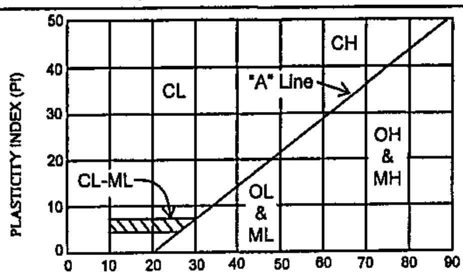
Calcareous *– Having appreciable quantities of carbonate.*
Fissured *– Containing shrinkage or relief cracks, often filled with sand or silt; usually more or less vertical.*
Slickensided *– Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the ease of breaking along those planes.*
Layer *– Inclusion greater than 3 inches thick.*
Seam *– Inclusion 1/8 inch to 3 inches thick extending through the sample*
Parting *– Inclusion less than 1/8 inch thick.*
Pocket *– Inclusion of material of different texture that is smaller than the diameter of the sample.*
Interlayered *– Soil samples composed of alternating layers of different soil types.*
Intermixed *– Soil samples composed of pockets of different soil types and a layered or laminated structure is not evident.*
Laminated *– Soil sample composed of alternating partings or seams of different soil type.*

GEOTECHNOLOGY
FROM THE GROUND UP

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	DESCRIPTION
Coarse-Grained Soils (More than 50% Larger than No 200 Sieve Size)	Gravel and Gravelly Soils	Clean Gravels Little or no Fines	GW	Well-Graded Gravel, Gravel-Sand Mixture
			GP	Poorly -Graded Gravel, Gravel-Sand Mixture
		Gravels with Appreciable Fines	GM	Silty Gravel, Gravel-Sand-Silt Mixture
			GC	Clayey-Gravel, Gravel-Sand-Clay Mixture
	Sand and Sandy Soils	Clean Sands Little or no Fines	SW	Well-Graded Sand, Gravelly Sand
			SP	Poorly Graded Sand, Gravelly Sand
		Sands with Appreciable Fines	SM	Silty Sand, Sand-Silt Mixture
			SC	Clayey Sand, Sand-Clay Mixture
Fine-Grained Soils (More than 50% Smaller than No 200 Sieve Size)	Silts and Clays	Liquid Limit Less Than 50	ML	Silt, Clayey Silt, Silty or Clayey Very Fine Sand, Slight Plasticity
			CL	Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity
			OL	Organic Silts, or Silty Clays of Low Plasticity
	Silts and Clays	Liquid Limit More Than 50	MH	Silt, Fine Sandy or Silt Soil with High Plasticity
			CH	Clay, High Plasticity
			OH	Organic Clay of Medium to High Plasticity
	Highly Organic Soils		PT	Peat, Humus, Swamp Soil

PLASTICITY CHART



RELATIVE PLASTICITY

Nonplastic	Cannot Roll Into Ball
Trace Plasticity	Barely Roll Into Ball
Medium Plastic	Can be Rolled Into Ball
Highly Plastic	No Rupture by Kneading

VISUAL DESCRIPTION CRITERIA*

TABLE 1: CRITERIA FOR DESCRIBING ANGULARITY OF COARSE-GRAINED PARTICLES

Description	***Criteria***
Angular	*Particles have sharp edges and relatively plane sides with unpolished surfaces*
Subangular	*Particles are similar to angular description but have rounded edges*
Subrounded	*Particles have nearly plane sides but have well-rounded corners and edges*
Rounded	*Particles have smoothly curved sides and no edges*

TABLE 2: CRITERIA FOR DESCRIBING PARTICLE SHAPE

Description	***Criteria***
Flat	*Particles with width/thickness X3*
Elongated	*Particles with length/width X3*
Flat and Elongated	*Particles meet criteria for both flat and elongated*

TABLE 3: CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	***Criteria***
Dry	*Absence of moisture, dusty, dry to the touch*
Moist	*Damp, but no visible water*
Wet	*Visible free water, usually soil is below the water table*

TABLE 4: CRITERIA FOR DESCRIBING REACTION WITH HCL

Description	***Criteria***
None	*No visible reaction*
Weak	*Some reaction, with bubbles forming slowly*
Strong	*Violent reaction, with bubbles forming rapidly*

TABLE 6: CRITERIA FOR DESCRIBING CEMENTATION

Description	***Criteria***
Weak	*Crumbles or breaks with handling or little finger pressure*
Moderate	*Crumbles or breaks with considerable finger pressure*
Strong	*Will not crumble or break with finger pressure*

*NOTES: 1. *Tables adapted from ASTM D2488 "Description and Identification of Soils" (Visual-Manual Procedure)*
2. *Tables 5, 7 and 11 incorporated into other information on this plate.*

TABLE 8: CRITERIA FOR DESCRIBING DRY STRENGTH

Description	***Criteria***
None	*The dry specimen crumbles into powder with mere pressure of handling*
Low	*The dry specimen crumbles into powder with some finger pressure*
Medium	*The dry specimen breaks into pieces or crumbles with considerable finger pressure*
High	*The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.*
Very High	*The dry specimen cannot be broken between the thumb and a hard surface*

TABLE 9: CRITERIA FOR DESCRIBING DILATANCY

Description	***Criteria***
None	*No visible change in the specimen*
Slow	*Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.*
Rapid	*Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.*

TABLE 10: CRITERIA FOR DESCRIBING TOUGHNESS

Description	***Criteria***
Low	*Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.*
Medium	*Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness*
High	*Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness*

TABLE 12: IDENTIFICATION OF INORGANIC FINE-GRAINED SOILS FROM MANUAL TESTS

Soil Symbol	***Dry Strength***	***Dilatancy***	***Toughness***
ML	*None to low*	*Slow to rapid*	*Low or thread cannot be formed*
CL	*Medium to high*	*None to slow*	*Medium*
MH	*Low to medium*	*None to slow*	*Low to medium*
CH	*High to very high*	*none*	*High*

ATTACHMENT B

LABORATORY TEST RESULTS

GEOTECHNOLOGY INC
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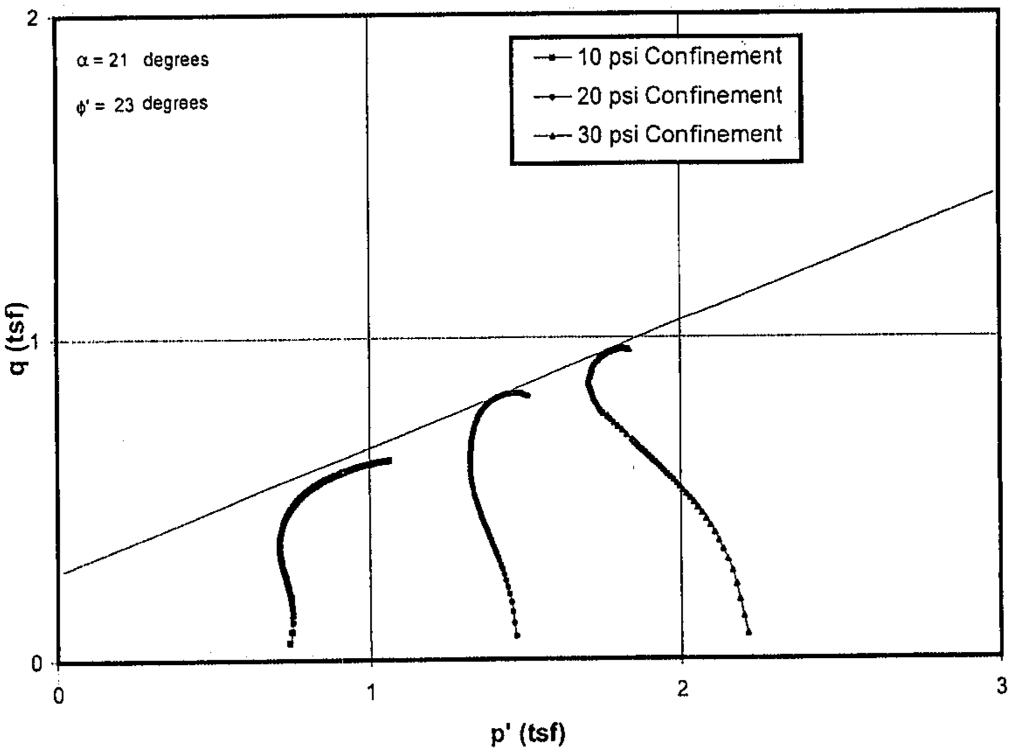
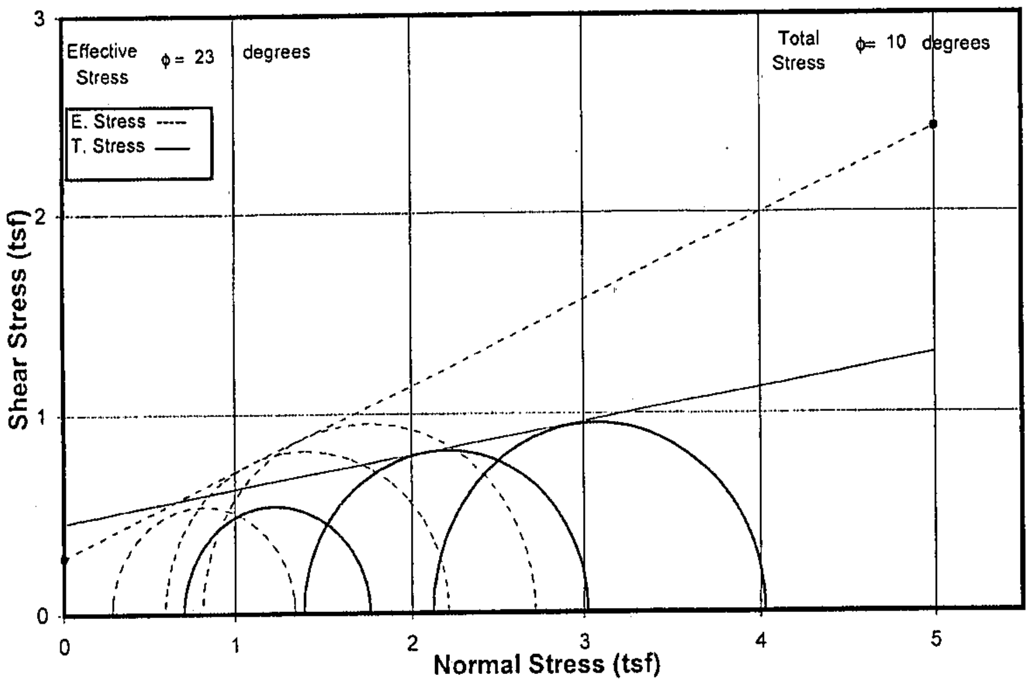
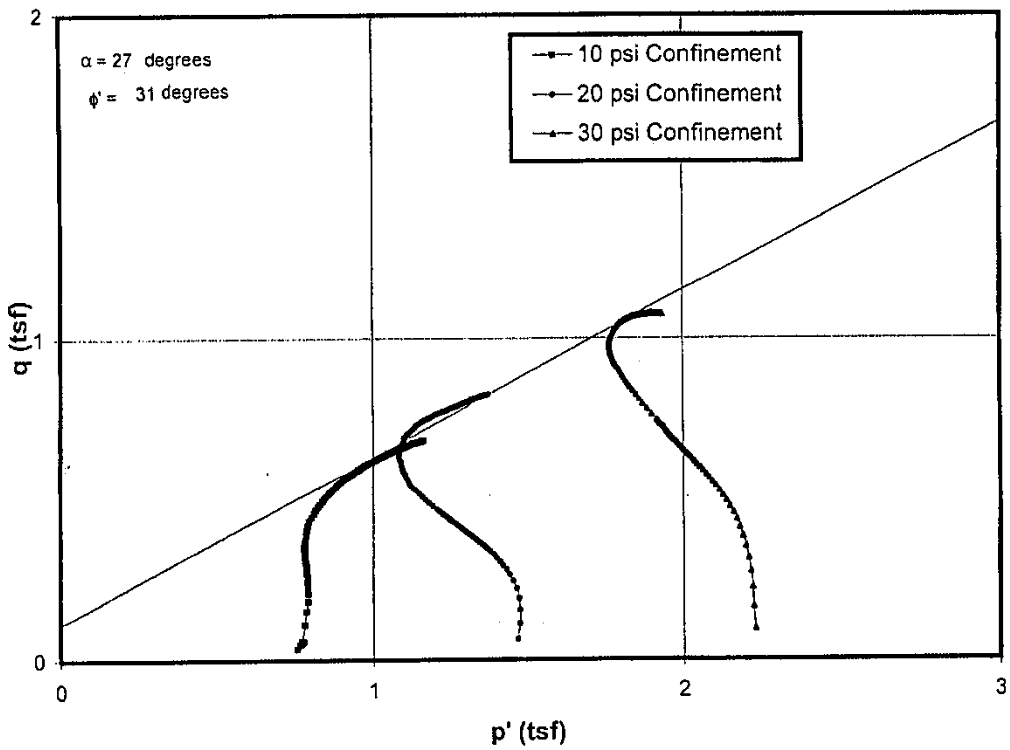
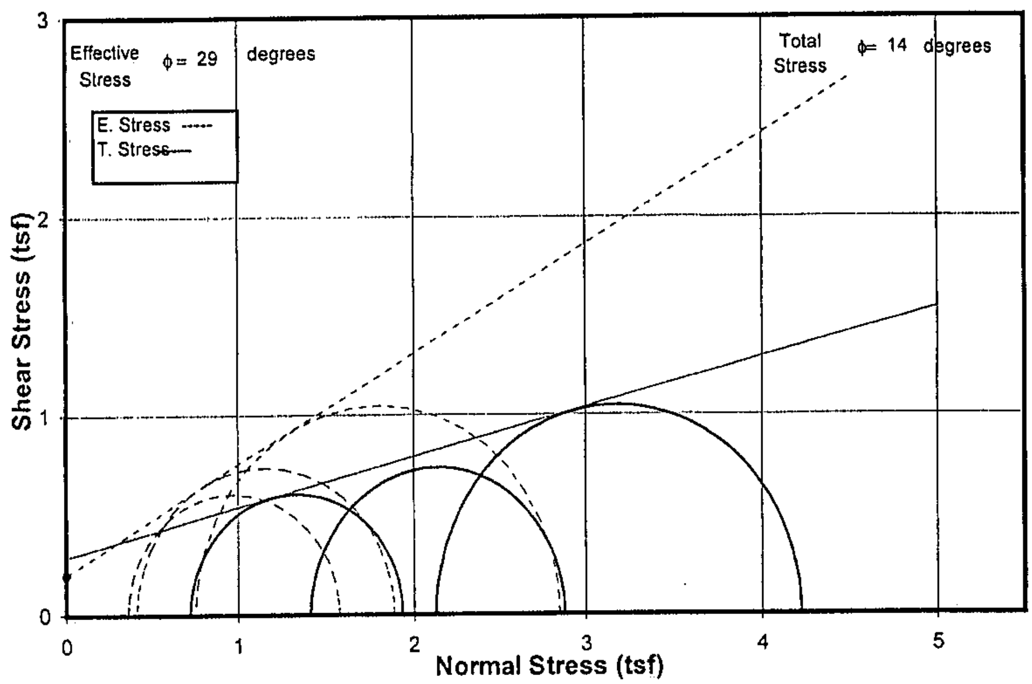




CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D 4767
Project No.: J017150.01
Boring: B-1
Sample: ST-8, ST-9, ST-9 - Depth: 26, 28, 28

GEOTECHNOLOGY INC
FROM THE GROUND UP





CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 4767

Project No.: J017150.01

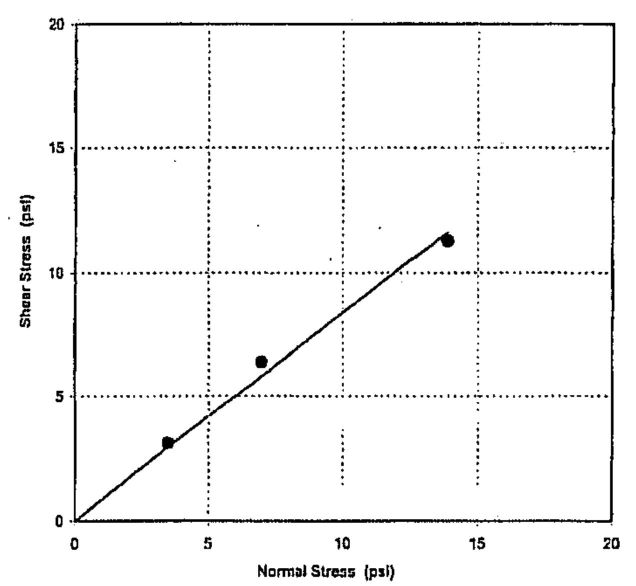
Boring: B-7

Sample: ST-10, ST-9, ST-9 - Depth: 28, 26, 26

DIRECT SHEAR TEST DATA

ASTM D 3080

Project Number:	J017150.01	Boring Number.:	B-1
Project Name:	Ameren-Meredosia	Sample Number:	SS-11, SS-12
Project Location:	--	Sample Depth (ft):	38.5' - 45.0'



Trial Number	Normal Stress (psi)	Shear Stress (psi)	Normal Stress (psf)	Shear Stress (psf)	ϕ (degrees)
1	3.5	3.1	500	445	39.9
2	6.9	6.4	1000	923	
3	13.9	11.3	2000	1626	

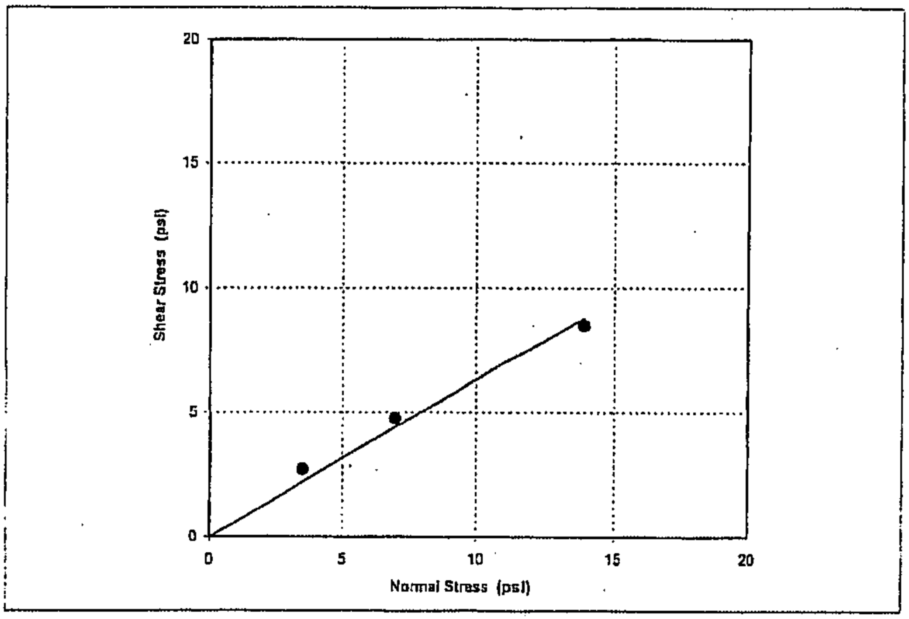
Atterberg Limits:		Standard Proctor Results:	
Liquid Limit:	--	Max. Dry Density:	N/A
Plastic Limit:	--	Opt. Moisture Content:	N/A
Plasticity Index:	NP		

Soil Classification: SAND, medium grained, brown, medium dense - (SP)

DIRECT SHEAR TEST DATA

ASTM D 3080

Project Number:	J017150.01	Boring Number.:	B-1
Project Name:	Ameren-Meredosia	Sample Number:	SS-2
Project Location:	–	Sample Depth (ft):	6.0' - 7.5'



Trial Number	Normal Stress (psi)	Shear Stress (psi)	Normal Stress (psf)	Shear Stress (psf)	ϕ (degrees)
1	3.5	2.7	500	389	32.3
2	6.9	4.7	1000	684	
3	13.9	8.5	2000	1218	

Atterberg Limits:

Liquid Limit: –

Plastic Limit: –

Plasticity Index: NP

Standard Proctor Results:

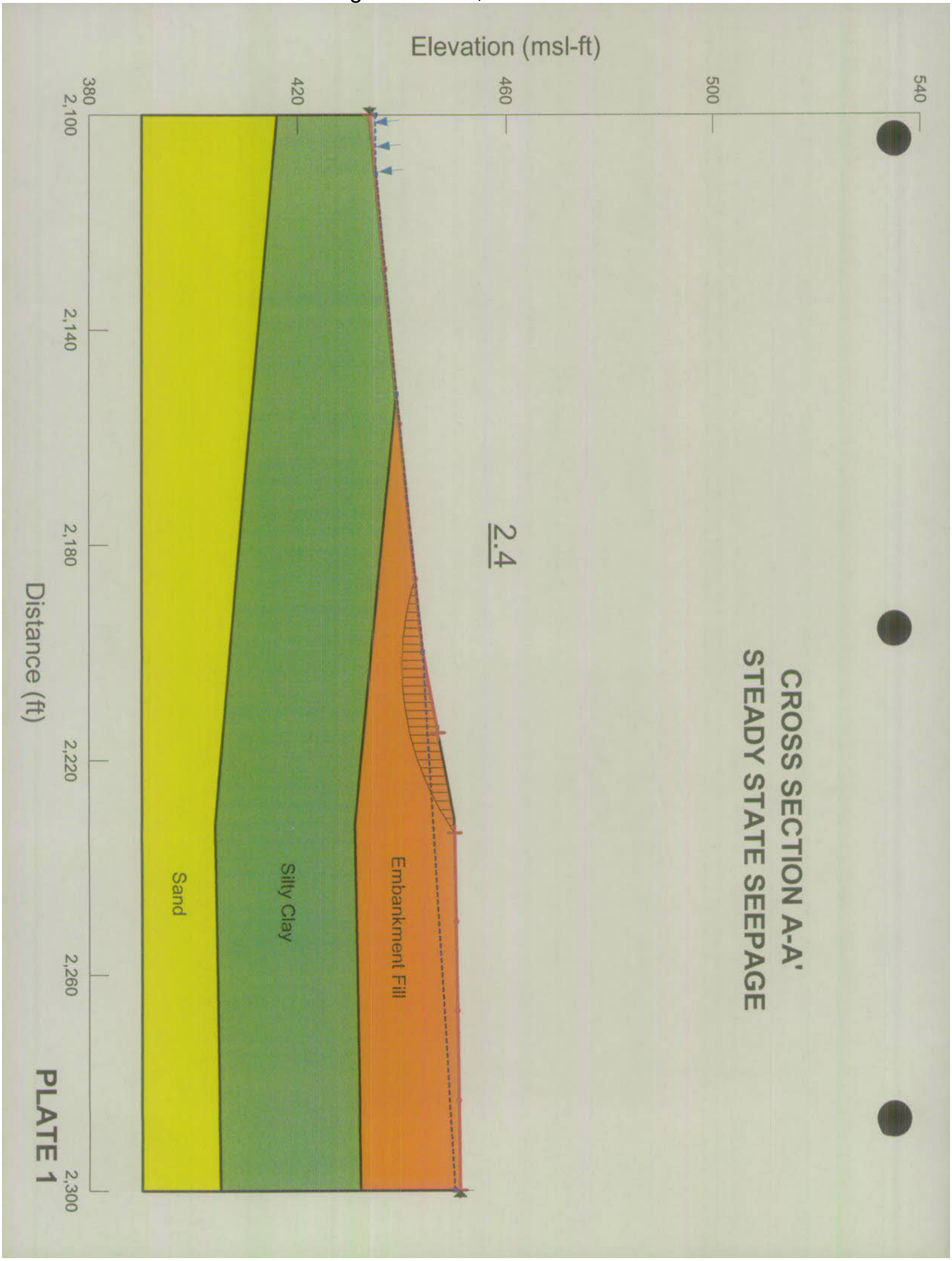
Max. Dry Density: N/A

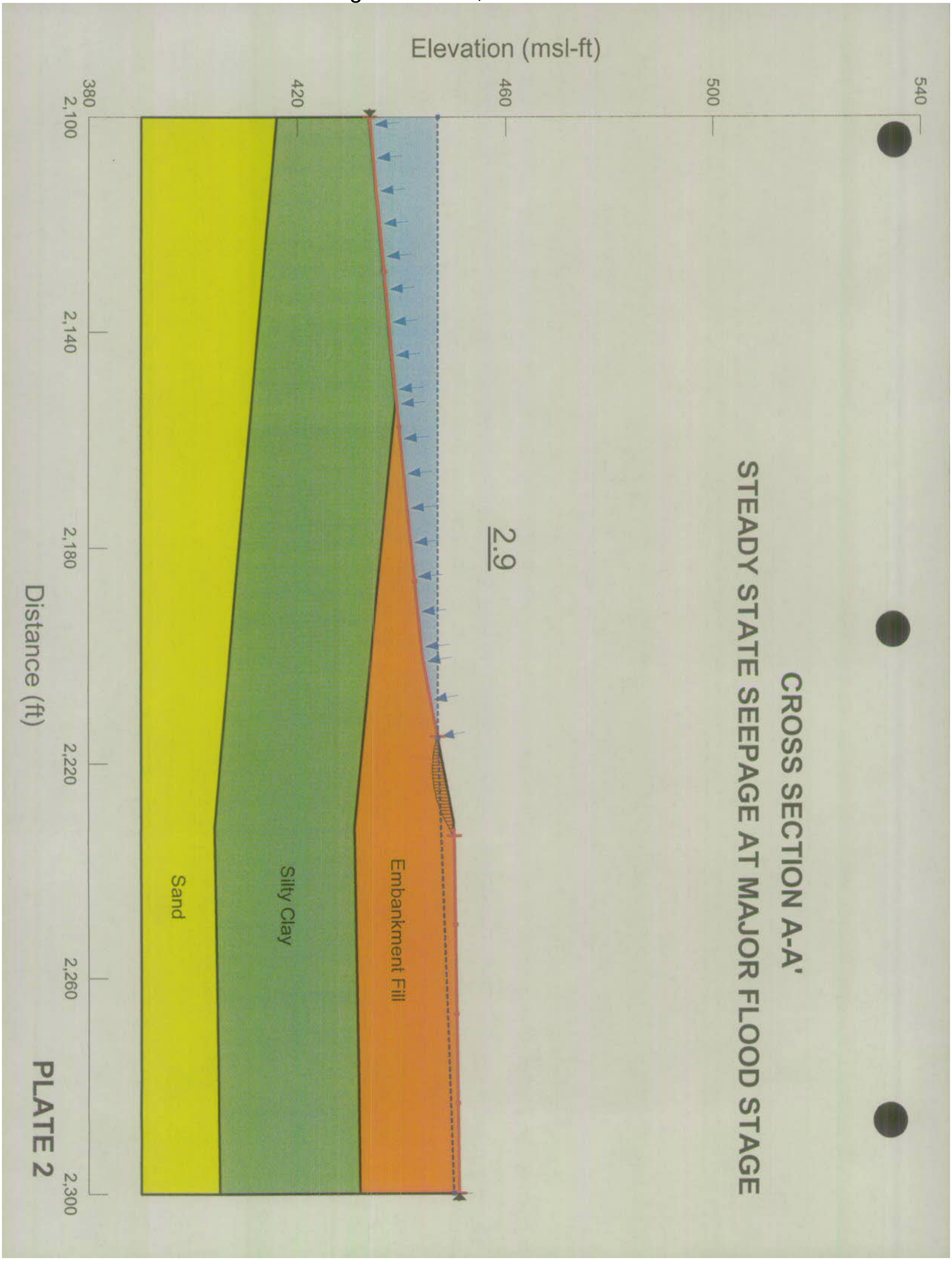
Opt. Moisture Content: N/A

Soil Classification: SAND, fine grained, brown, loose - (SP)

ATTACHMENT C

SLOPE STABILITY ANALYSIS RESULTS


CROSS SECTION A-A'
STEADY STATE SEEPAGE
Elevation (msl-ft)
380
420
460
500
540
Distance (ft)
2,100
2,140
2,180
2,220
2,260
2,300
2.4
Embankment Fill
Silty Clay
Sand
PLATE 1


CROSS SECTION A-A'
STEADY STATE SEEPAGE AT MAJOR FLOOD STAGE
2.9
Elevation (msl-ft)
380
420
460
500
540
Distance (ft)
2,100
2,140
2,180
2,220
2,260
2,300
Embankment Fill
Silty Clay
Sand
PLATE 2

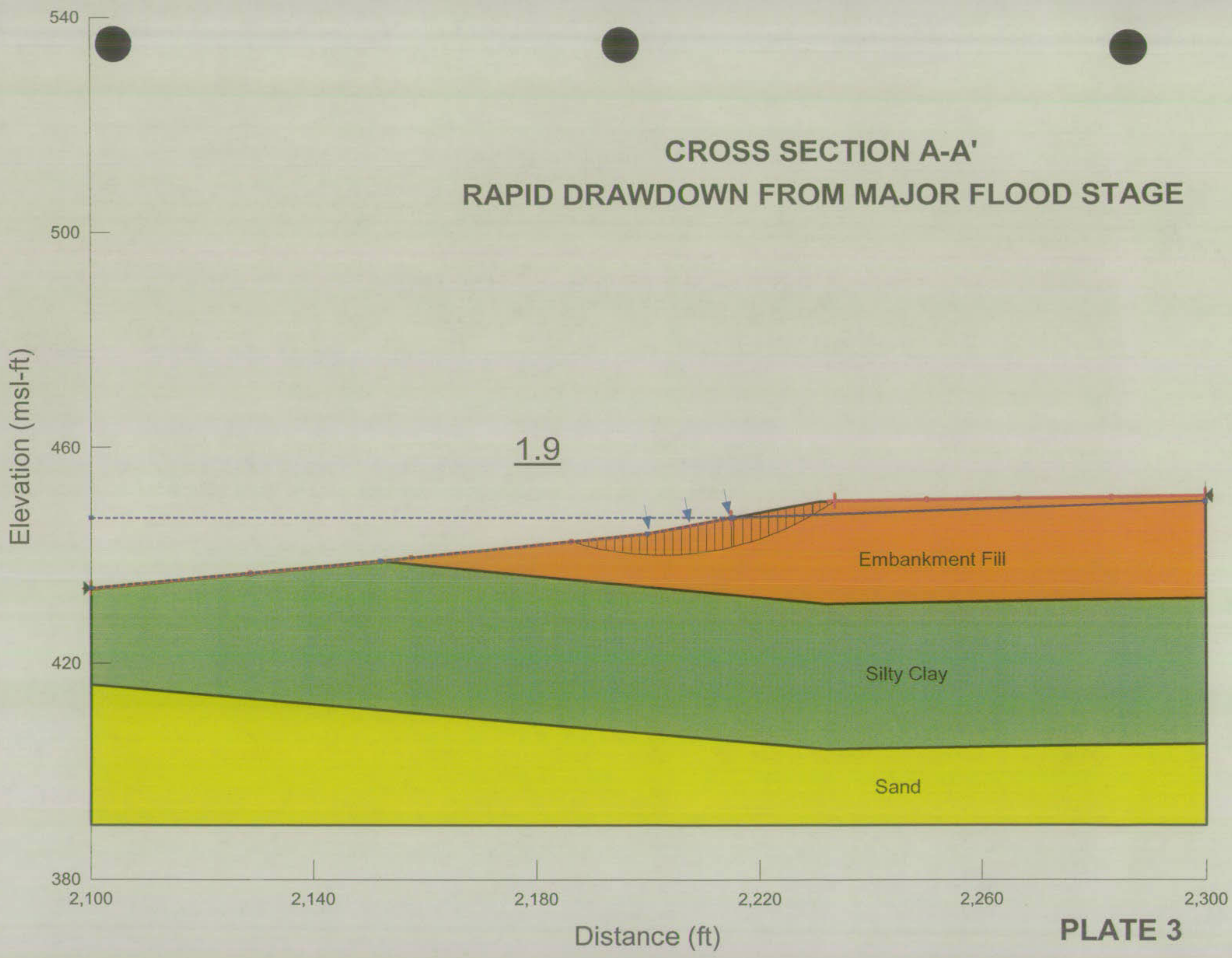
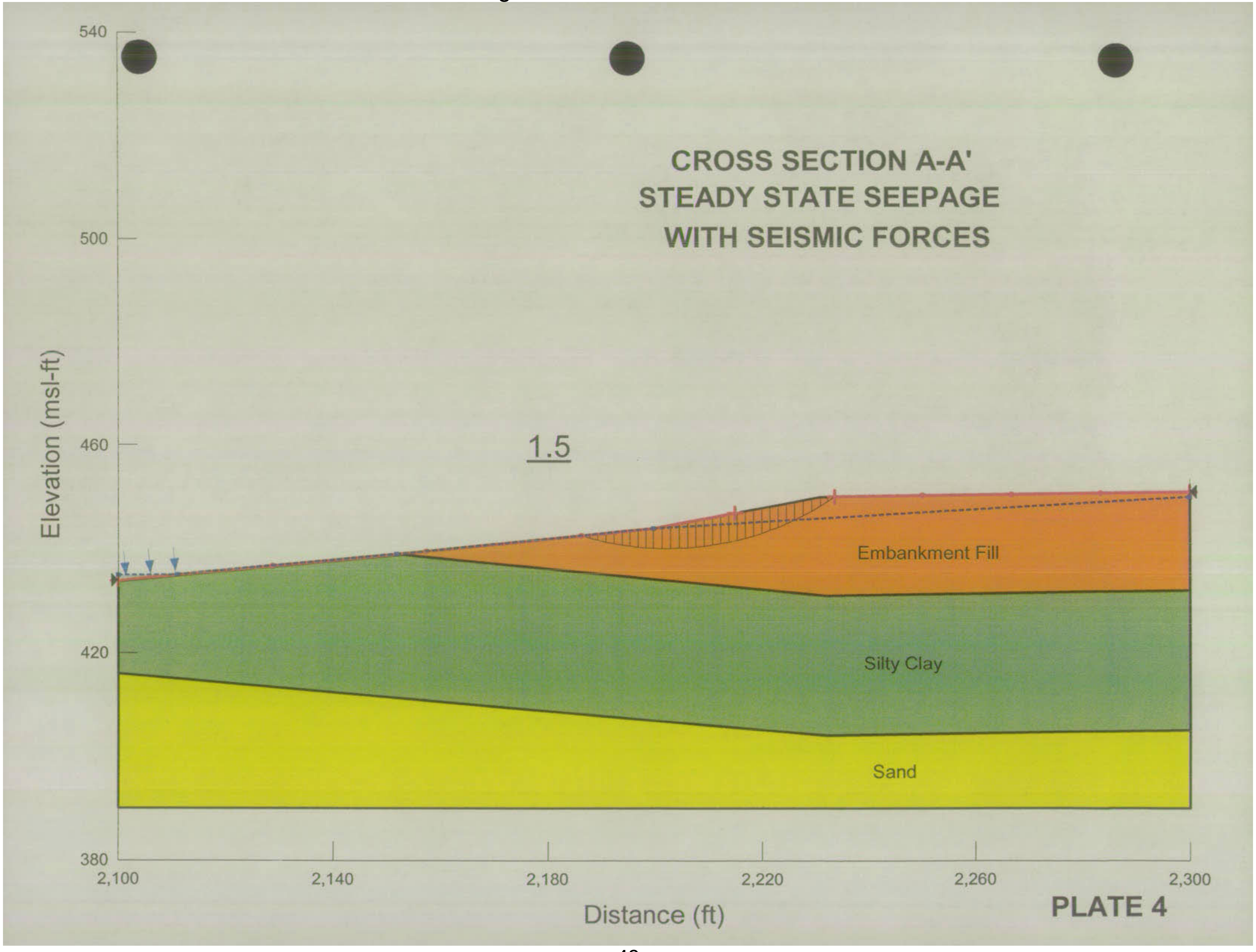

CROSS SECTION A-A'
RAPID DRAWDOWN FROM MAJOR FLOOD STAGE
Elevation (msl-ft)
540
500
460
420
380
1.9
Embankment Fill
Silty Clay
Sand
2,100
2,140
2,180
2,220
2,260
2,300
Distance (ft)

PLATE 3



CROSS SECTION A-A'
STEADY STATE SEEPAGE
WITH SEISMIC FORCES
1.5
Embankment Fill
Silty Clay
Sand
Elevation (msl-ft)
540
500
460
420
380
2,100
2,140
2,180
2,220
2,260
2,300
Distance (ft)

PLATE 4

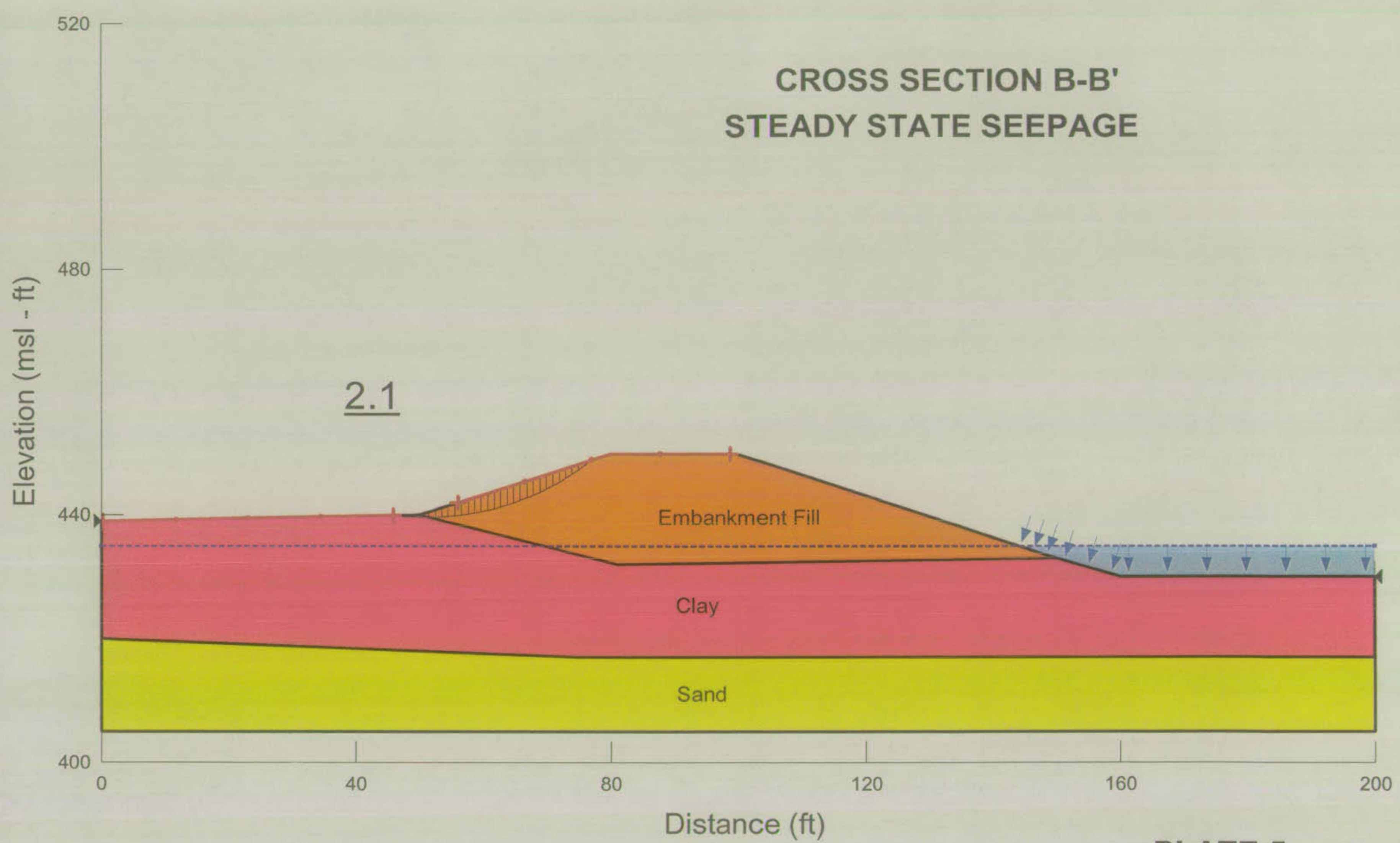

CROSS SECTION B-B'
STEADY STATE SEEPAGE
2.1
Embankment Fill
Clay
Sand
Elevation (msl - ft)
520
480
440
400
0
40
80
120
160
200
Distance (ft)

PLATE 5

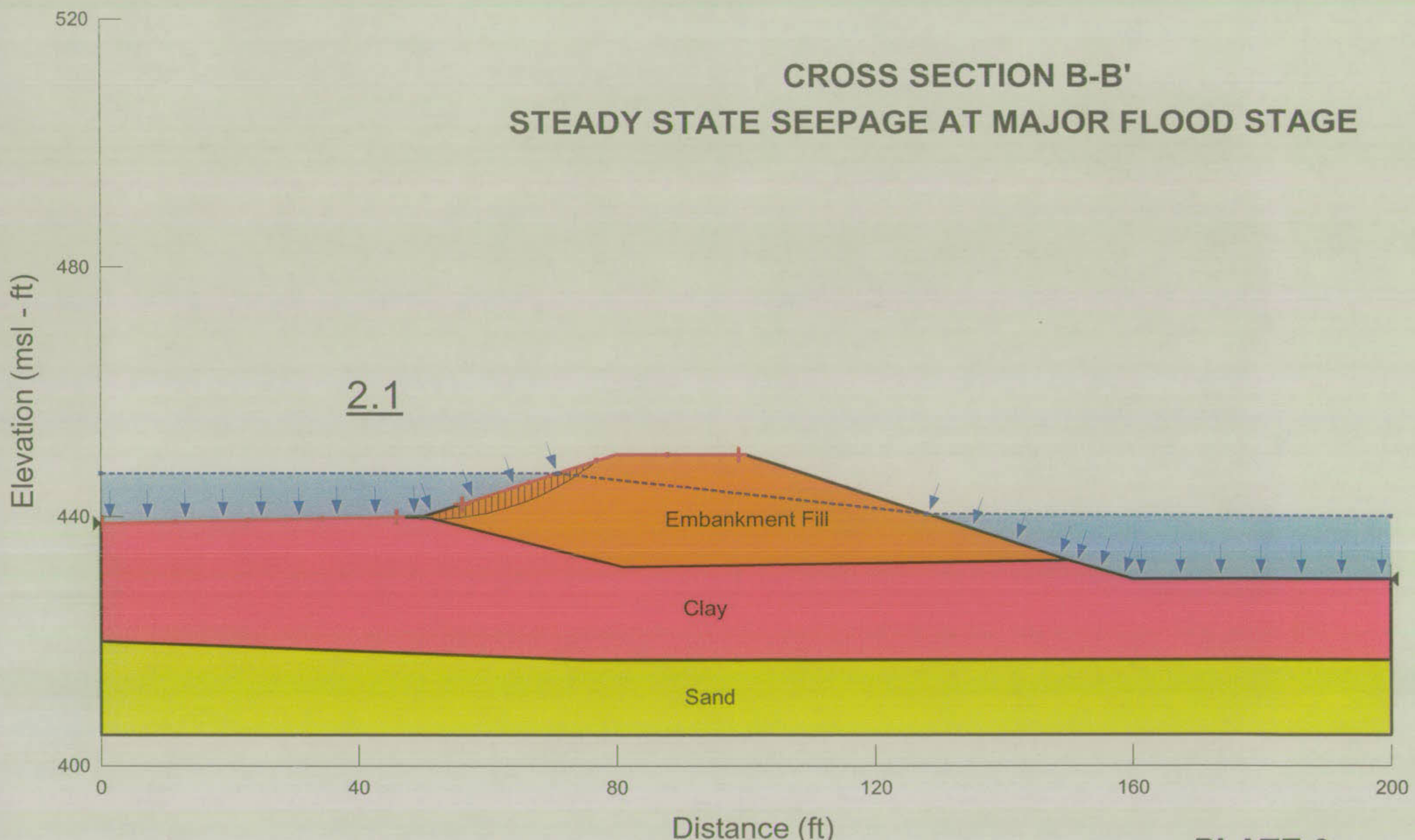

CROSS SECTION B-B'
STEADY STATE SEEPAGE AT MAJOR FLOOD STAGE
2.1
Embankment Fill
Clay
Sand
Elevation (msl - ft)
520
480
440
400
0
40
80
120
160
200
Distance (ft)

PLATE 6

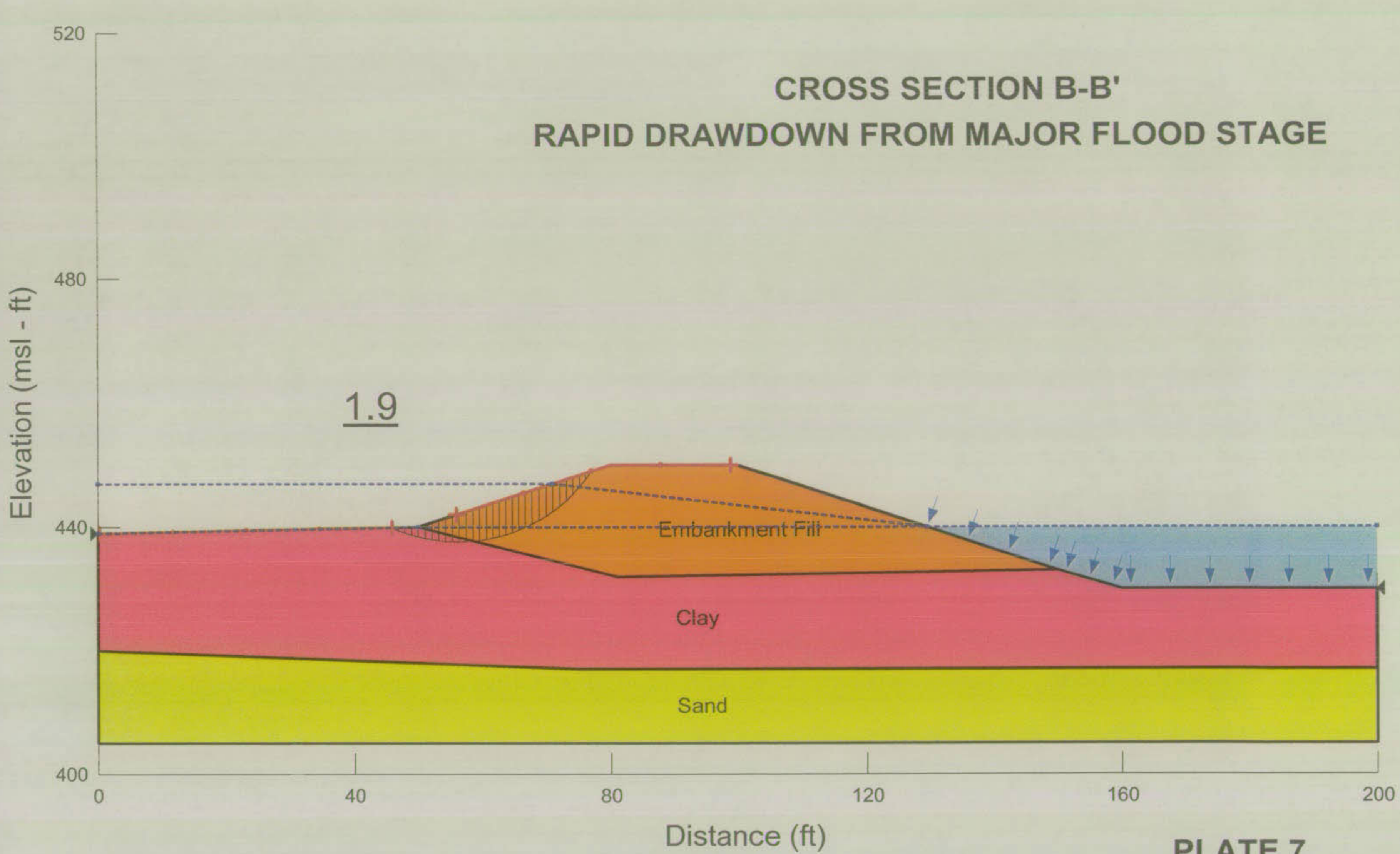
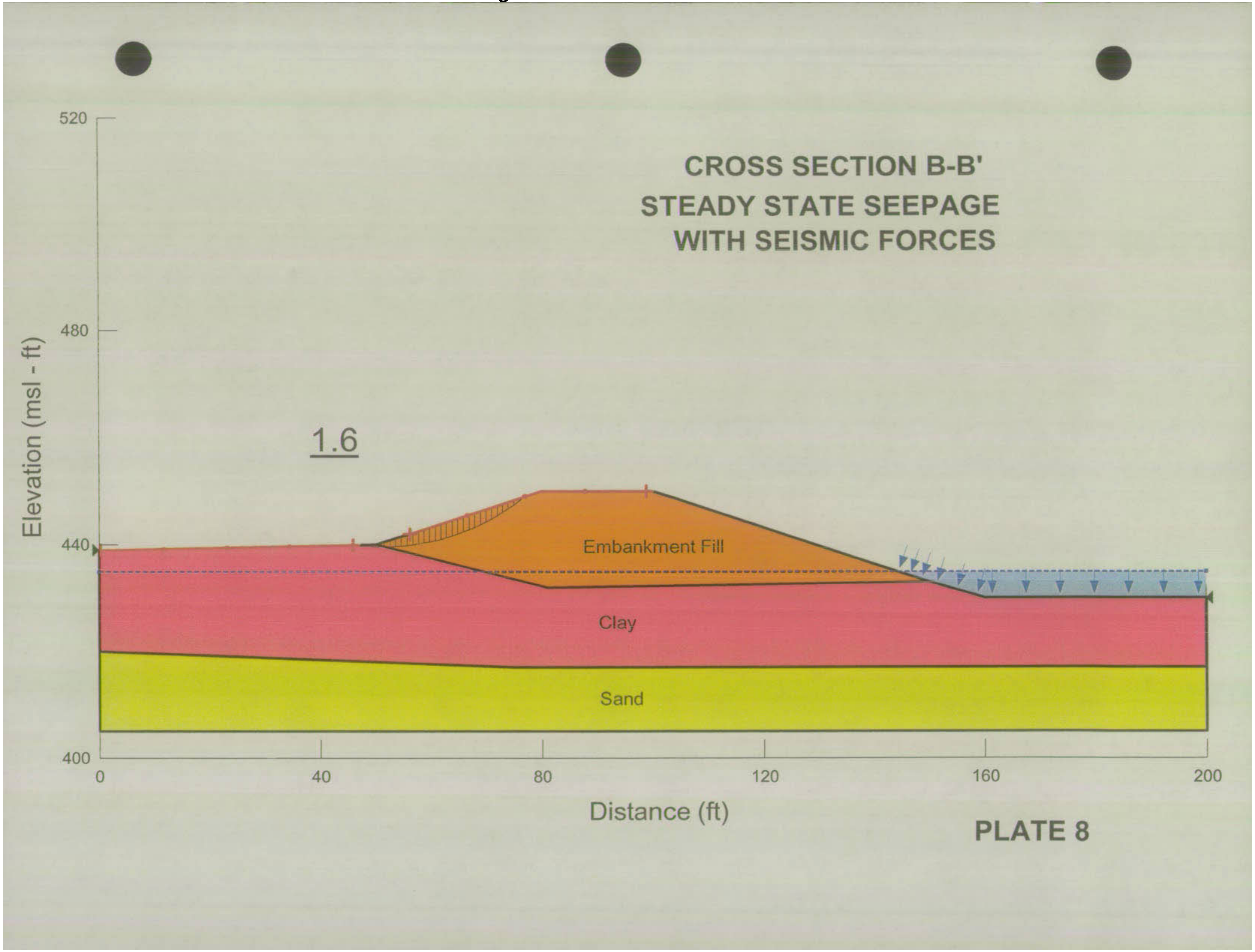

CROSS SECTION B-B'
RAPID DRAWDOWN FROM MAJOR FLOOD STAGE
1.9
Embankment Fill
Clay
Sand
Elevation (msl - ft)
520
480
440
400
0
40
80
120
160
200
Distance (ft)

PLATE 7


CROSS SECTION B-B'
STEADY STATE SEEPAGE
WITH SEISMIC FORCES
1.6
Embankment Fill
Clay
Sand
Elevation (msl - ft)
520
480
440
400
0
40
80
120
160
200
Distance (ft)
PLATE 8

ATTACHMENT A

HYDROGEOLOGIC ASSESSMENT REPORT
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 4, 2016

Dcl/J024917.01 Meredosia Hydro-Geo RF.doc

J024917.01

HYDROGEOLOGIC ASSESSMENT REPORT
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

TABLE OF CONTENTS

HYDROGEOLOGIC ASSESSMENT REPORT
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

TABLE OF CONTENTS
-continued-

TABLES

ILLUSTRATIONS

J024917.01

HYDROGEOLOGIC ASSESSMENT REPORT
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

TABLE OF CONTENTS
-continued-

APPENDICES

J024917.01

HYDROGEOLOGIC ASSESSMENT REPORT
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

AmerenEnergy Median Valley Cogen, LLC (Ameren) has retained Geotechnology, Inc. (Geotechnology) to provide design services for the closures of a fly ash pond and a bottom ash pond at their Meredosia, Illinois power station. We understand that the closure rules for the Meredosia ash ponds are similar to those defined for ash pond closures at Ameren's Hutsonville Power Station - Hutsonville, Illinois in January 2011 under Illinois Administrative Code (IAC) Title 35, Part 840, Subpart A: *Closure of Ash Pond D, Hutsonville Power Station.* These rules address the hydrogeologic site investigation, groundwater monitoring, groundwater collection and discharge, final slopes and stabilization, final cover system, closure plan, and post-closure maintenance and care.

The Meredosia Power Station in Morgan County, Illinois is owned by AmerenEnergy Medina Valley Cogen, LLC and operated by the Ameren Energy Generating Company from 1948 to 2011, when the power station was closed. The Meredosia Power Station has three coal combustion product impoundments including: the Bottom Ash Pond, the Fly Ash Pond and the Old Ash Pond. The Old Ash Pond was previously closed.

This document comprises the Hydrogeologic Assessment and includes a review and update of previous hydrogeologic assessment documents prepared by others for the Meredosia Power Station. Additionally, subsurface data collected from the October 2015 subsurface investigation and monitoring well installation activities are incorporated into this assessment. Hydrogeologic assessment data was compiled from previously presented information including the March 2013 Phase I Hydrogeological Assessment Report prepared by Natural Resource Technology Environmental Consultants (NRT)[1] and the November 2009 Site Characterization and Groundwater Monitoring Plan for CCP Impoundments prepared by Rapps Engineering and Applied Science (Rapps)[2].

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[1] *Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundments, Meredosia Power Station, Morgan County, Illinois;* prepared by Natural Resource Technology, Inc. for Ameren Energy Generating Company; Project No. 2124, dated March 19, 2013.

[2] *Site Characterization and Groundwater Monitoring Plan For CCP Impoundments, Ameren Energy Generating Company, Meredosia Power Station, Morgan County, Illinois;* prepared by Rapps Engineering and Applied Science for Ameren Services; dated November 2009.

2.0 PHYSICAL SETTING

The Meredosia Power Station is located at 800 South Washington Street, Meredosia, Illinois. The Fly Ash and Bottom Ash Ponds are located southwest of the former coal pile and plant facilities. The site location and topography are shown on Plate 1. An aerial photograph site plan showing existing structures, ash ponds, and monitoring well/boring locations is included as Plate 2. The Meredosia Power Station is located in the floodplain of the Illinois River which borders the site to the west.

The Meredosia Power Station ash ponds are located in the south half of Section 21 and the north half of Section 28, T.16N, R.13W. The Bottom Ash Pond was constructed in 1972 with a design surface area of 11 acres, a height of 24 feet, and a volume of approximately 90 acre-feet. The Fly Ash Pond was constructed in 1968 and has a design surface area of 44.8 acres, a height of 24 feet, and a volume of approximately 500 acre-feet.

3.0 REGIONAL GEOLOGY

The Meredosia Power Station is located near the western edge of the Springfield Plain Subsection of the Till Plains Section, Central Lowland Province, Interior Plains Physiographic Region. The Interior Plains Physiographic Region extends across the Laurentian craton of central North America. It is comprised of the Great Plains and Central Lowland Provinces. The Central Lowlands Province to the east formed from eroded sediments from the topographically-higher Great Plains Province to the west (Fenneman, 1922).

The Till Plains Section of the Central Lowland Province is subdivided into seven areas in Illinois. Four of the subdivisions are in Illinoian-aged drift (Willman et al., 1975). The Springfield Plain comprises the western half of the Illinoian-aged till plain. It is level to undulatory and exhibits relatively shallow drainages. The southern boundary is observed where the drift thins and the underlying bedrock control becomes prominent. It is characterized by smoothed features and glacial landforms. The Illinois River forms the northwestern border of the Springfield Plain.

<u>3.1 Bedrock Stratigraphy.</u> The Meredosia Power Station and surrounding areas within the Illinois River valley are underlain by Mississippian System bedrock of the Lower Valmeyeran Series which consists of the Meppen Limestone, Fern Glen formation, and the Burlington-Keokuk Limestone (Kolata, 2005). A bedrock geology map of the site and surrounding areas is included as Plate 3.

Willman et al. (1975) describe the Meppen Limestone as a tan or buff, very fine-grained dolomitic limestone or calcareous dolomite. The formation is slightly crinoidal and contains calcite geodes up to 2-inches in diameter. The maximum thickness of this formation is approximately 22 feet. The Fern Glen formation consists of calcareous shale, limestone, and dolomite. Dolomitic portions of the formation are partially argillaceous. The limestone portions of the formation contain nodules of greenish-gray chert. The thickness of the formation can range from approximately 50 to 100 feet. The Burlington formation of the Burlington-Keokuk Limestone is described as a "very pure, coarsely crystalline, crinoidal, light gray limestone in medium to thick beds." The Burlington formation also contains beds of fine-grained, brownish-gray, dolomitic limestone. The formation is approximately 100 to 150 feet thick in Illinois. The Keokuk formation of the Burlington-Keokuk Limestone is composed of beds of fossiliferous, crinoidal limestone interbedded with fine-grained limestone, argillaceous dolomite, and calcareous gray shale. The Keokuk formation is approximately 60 to 80 feet thick in Illinois.

3.2 Surficial Geology. The Meredosia Power Station is situated within the Illinois River valley. The overburden soils consist of channel and floodplain deposits of the Cahokia formation underlain by glacial outwash deposits belonging to the Henry formation. Fine-grained lacustrine deposits of the Equality formation are present in the subsurface, but are discontinuous. These formations occur throughout Illinois in valley bottoms and floodplains as channel deposits in present-day rivers and streams.

The Cahokia Alluvium consists mainly of poorly-sorted silt, clay, and silty sand, but locally contains lenses of sand and gravel. The upper part consists of overbank silt and clays. The lower portion consists of coarse-textured sand and lateral accretion deposits. The Cahokia formation may be up to 20 feet thick in the area of the Meredosia Power Station (Berg and Kempton, 1987).

The Henry formation consists of glacial sand and gravel outwash. The Henry formation is subdivided into three members that differ in lithology: the Batavia Member (outwash plains), the Mackinaw Member (valley trains), and the Wasco Member (ice-contact deposits) (Willman and Frye, 1970; Willman et al., 1975). Based on information from well logs, the thickness of the Henry formation ranges from 60 to 84 feet in the area of the Meredosia Power Station.

The Equality formation consists of bedded silt and clay deposits in glacial and post-glacial lakes. Gravel, sand, and organic deposits occur in lenses that intertongue with the Henry formation. In the area of the Meredosia Power Station, the Equality formation overlies the Henry formation and generally occurs as lenses or patches not exceeding 20 feet thick.

Geotechnology has conducted subsurface explorations of the overburden soils at the Meredosia Power Station. The subsurface exploration and laboratory testing efforts are discussed further in Section 4.0.

3.3 Surface Water. The major surface water body in the vicinity of the Meredosia Power Station is the Illinois River, which flows from the north-northeast to the south-southwest, and borders the west side of the site. The normal pool elevation of the Illinois River is approximately

421.0 feet[3]. Information from the U.S. Army Corps of Engineers indicates the Illinois River flood stage is 435.0 feet above mean sea level (MSL). The record high stage was 446.69 feet above MSL on May 26, 1943, and the record low stage was 418.40 feet above MSL on January 11, 1940.

Meredosia Lake is a backwater lake located north of the Village of Meredosia within the Illinois River valley and within the Meredosia National Wildlife Refuge. Meredosia Lake is approximately 1.5 miles north of the Meredosia Power Station. Smith Lake is located approximately 1-mile south of the Meredosia Power Station and is connected to Seaman's Pond. Westerly-flowing streams drain the uplands to the east of the Meredosia Power Station. Easterly-flowing streams and drainage channels drain the floodplain across the Illinois River to the west of the Meredosia Power Station.

3.4 Groundwater. Groundwater within and near the Illinois River valley is obtained from the sand and gravel deposits of the Henry formation and to a lesser extent from wells drilled into the Mississippian-age Burlington-Keokuk Limestone and Salem Limestone. A summary of the water supply wells identified within 1-mile of the Meredosia Power Station is presented in Table 1 below. The water supply well information is included as Appendix A. The approximate locations of the water supply wells are depicted on Plate 4.

TABLE 1 – WATER SUPPLY WELL SUMMARY

Owner	Wells	On/Off Site	Type	Status
CIPS*	42	On Site	Water Supply	Abandoned (except 4)
National Starch	15	Off Site	Water Supply	Unknown
Village of Meredosia	6	Off Site	Public Supply	In Use
IDOT	4	Off Site	Test Borings	Not Wells
W.R. Grace	2	Off Site	Water Supply	Unknown
T.A. Terminal	2	Off Site	Water Supply	Unknown
Illinois Road Contractors	1	Off Site	Water Supply	Unknown

*Central Illinois Public Service Company

The water supply wells were located using the Illinois State Geological Survey (ISGS) *Illinois Water Well* (ILWATER) *Internet Map Service,* the Illinois State Water Survey's *Domestic Wells Database*, the Illinois Environmental Protection Agency (IEPA) web-based Geographic Information System (GIS) files, Illinois Department of Health (IDPH) records, and Morgan County Health Department records.

[3] Elevations herein refer to the mean sea level datum in feet (msl-ft).

3.4.1 Private Water Supply Wells. Approximately 62 private water supply wells and 4 non-well test borings were identified within 1-mile of the Meredosia Power Station. Twenty of the private water supply wells are off-site. The status of the wells are unknown at this time, but are assumed to be in-use. The twenty off-site private water supply wells are up-gradient or cross-gradient from the site and are not anticipated to be impacted from the site. Groundwater sampling and testing results further support that the twenty off-site water supply wells are not expected to be impacted.

The other 42 private water supply wells are located at the Meredosia Power Station. According to site records, personnel interviews, and field reconnaissance, 38 of the on-site water supply wells have been abandoned. Two wells are no longer used, but have not been abandoned. One well is shut down and one currently supplies water to the restrooms/showers on the site. Once the former power plant is demolished and the ash pond closure activities are complete, these four supply wells will be abandoned. Additional water needs at the Meredosia Power Station are provided by the Village of Meredosia public water supply.

3.4.2 Public Water Supply Wells. According to the mapping sources referenced in Section 3.4.1, public water supply wells are not located within 1-mile of the Meredosia Power Station. The closest public water supply wells to the Meredosia Power Station belong to the Village of Meredosia. The six public water supply wells are situated approximately 1.2 miles to the north-northeast. Although the wells are beyond 1-mile from the facility, the locations are depicted on Plate 4 and the water supply well information is included in Appendix A for reference.

Per the IEPA database, two of the Village of Meredosia public water supply wells have a minimum setback of 400 feet and a second setback of 1,000 feet due to the Phase I Wellhead Protection Area (WHPA). A third Village of Meredosia public water supply well has a Phase II WHPA, which has an extended area of protection that includes the recharge area or geographic area surrounding the well that supplies potable water to a community.

3.4.3 Oil and Gas Wells. Oil and gas wells within a 1-mile radius of the Meredosia Power Station were identified using the Illinois State Geological Survey *Illinois Oil and Gas Resources* (ILOIL) *Internet Map Service*. ILOIL contained records for three wells within the search radius, but the status of the three wells was listed as dry, abandoned and plugged.

4.0 SUBSURFACE INVESTIGATION

4.1 Subsurface Investigations. From October 19 through October 26, 2010, Geotechnology advanced 15 borings at the Meredosia Power Station. Ten of the borings (B-1 through B-10) were drilled in support of a global stability evaluation, while the remaining five borings were completed as Monitoring Wells APW-1 through APW-5 in support of groundwater monitoring activities. The borings were drilled using a truck-mounted CME 550 rotary drill rig equipped with 4-1/4-inch hollow stem augers. The borings were drilled to depths ranging from 25 to 60 feet below land surface (bls). Standard Penetration Tests (SPT) were performed using an automatic hammer and split spoon sampler. The locations of the borings and monitoring wells are included on Plate 2.

From September 28 through October 1, 2015, Geotechnology advanced four additional borings at the site using a truck-mounted CME 550 rotary drill rig equipped with 4-1/4-inch hollow stem augers. The borings were drilled to depths ranging from 17 to 40 feet bls. SPTs were performed using an automatic hammer and split spoon sampler. Monitoring Wells APW-6 through APW-9 were installed in the borings in support of ongoing groundwater monitoring activities. Copies of the boring logs are included as Appendix B. The locations of the monitoring wells are included on Plate 2.

Monitoring Wells APW-6 through APW-9 were constructed using 10 feet of 2-inch-diameter 0.010-inch slotted PVC screen and riser to the surface. The monitoring wells were completed at the surface with above-ground steel covers set in a concrete pad. The monitoring wells were developed in accordance with industry practice and registered with the IDPH and the IEPA.

An engineer from Geotechnology provided technical direction during field exploration, observed drilling and sampling, assisted in obtaining samples and prepared descriptive logs of the material encountered. The boring logs represent conditions observed at the time of exploration.

Unless noted on the boring logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials may be gradual or may occur between recovered samples. The stratification given on the boring logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

4.2 Subsurface Conditions. Native soils consisting of brown and gray, very soft to medium stiff, silt and clay were encountered below the fill in Boring B-1 and Monitoring Well APW-9, and at the ground surface in Boring B-5. Native soils consisting of black, clayey sand with trace gravel were encountered below the fill in Boring B-2.

A stratum of very soft to medium stiff, brown, black, and gray clay with traces of sand and wood was encountered below the fill in Borings B-3 and B-8, below the native soils in Borings B-1, B-2, and B-5, and at the ground surface in Borings B-4, B-9, APW-2, APW-3, APW-4, and APW-7. This soil stratum ranged in thickness from approximately 8 to 17 feet bls.

The clay layer described above was underlain by a stratum of granular and cohesive alluvial soils (except for Boring APW-4). The granular alluvium generally consisted of loose, gray, clayey sand with gravel. The cohesive alluvium generally consisted of very soft to medium stiff, gray and brown, clayey silt, silty clay, and sandy clay. This soil stratum ranges in thickness from approximately 5 to 11 feet bls in borings where it is encountered.

Alluvium was encountered below the fill soils in Borings B-6 and B-7, and at the ground surface in Boring B-10 and Monitoring Wells APW-6 and APW-8. This stratum is interpreted as alluvium placed in a buried valley that had been cut down through the soil stratum described above. The granular portions of this alluvium infill generally consisted of very loose, gray, silty sand. The cohesive portions generally consisted of very soft to very stiff, gray, silty clay with sand and silt seams. This soil stratum was at least 28 feet thick where encountered.

The native soils described above are interpreted as belonging to the Cahokia Alluvium, and were underlain by sand deposits interpreted as belonging to the Henry formation. Generalized east-west and north-south subsurface profiles based on the soil boring data at the Meredosia Power Station are included on Plates 6 and 7, respectively. The plan-view of the subsurface profile orientations is included on Plate 5.

During the subsurface exploration activities, groundwater was observed in Borings B-3, B-4, B-5 and B-6 at depths ranging from approximately 18 to 39 feet bls. Groundwater was observed in Monitoring Wells APW-1 through APW-9 at depths ranging from 6 to 32 feet bls at the time of construction. Groundwater levels might not have stabilized before backfilling or well construction activities. Consequently, the indicated groundwater levels might not represent present or future levels. Groundwater levels could vary over time due to the effects of the Illinois River, seasonal variation in precipitation, or other factors not evident at the time of exploration.

5.0 SITE HYDROGEOLOGY

5.1 Groundwater Classification. The Illinois Class I groundwater standards are applicable to the Meredosia Power Station. The Illinois Class I groundwater is defined as groundwater that is capable of being potable. As stated in 35 IAC 620.410(a) and (d) the following parameters are required to be monitored with the exception of Radium 226 and 228:

- antimony,
- arsenic,
- barium,
- beryllium,
- boron,
- cadmium,
- chloride,
- chromium,
- cobalt,
- copper,
- cyanide,
- fluoride,
- iron,
- lead,
- manganese,
- mercury,
- nickel,
- nitrate as nitrogen,
- selenium,
- silver,
- sulfate,
- thallium,
- total dissolved solids,
- vanadium, and
- zinc.

5.2 Groundwater Monitoring. The groundwater monitoring network at the Meredosia Power Station consists of one up-gradient monitoring well (APW-1) and eight down-gradient monitoring wells (APW-2 through APW-9). The approximate locations of the monitoring wells are included on Plate 2. The monitoring wells are screened in the uppermost aquifer which generally consists of saturated, fine to coarse sand. The monitoring well depths range from 17 to 40 feet bls. Monitoring well construction diagrams from Monitoring Wells APW-1 through APW-9 are included in Appendix B. A total of 11 groundwater monitoring events have been conducted at the Meredosia Power Station since December 2010. The groundwater monitoring events have been conducted quarterly since the third quarter of 2015. Future groundwater monitoring events are anticipated to be conducted quarterly until trend analysis indicates less frequent monitoring is acceptable. A summary of the monitoring well gauging data is included as Table 2. A summary of the groundwater laboratory analytical results collected to date is included as Table 3.

5.3 Groundwater Flow. Based on the monitoring well gauging data in Table 2, the groundwater flow direction at the Meredosia Power Station is to the west-northwest toward the Illinois River. Groundwater flow direction may be influenced by the stage of the Illinois River. Groundwater elevation contour maps for the 10 groundwater monitoring events are included as

Plates 8 through 16. These events include a range of climate conditions including flood and dry timeframes. *Note: Only gauging events with data from at least five monitoring wells are included.*

<u>5.4 Groundwater Geochemistry.</u> A total of 11 groundwater sampling events have been conducted at the Meredosia Power Station since December 2010. The parameters analyzed include those listed in Section 5.1 in addition to field parameters pH, specific conductivity, and temperature. The analytical testing data are summarized in Table 3. The historical groundwater data collected prior to 2015 consists of dissolved parameter concentrations only. During the time these data were collected, laboratory analysis for dissolved concentrations was the applicable standard of care. The use of dissolved parameter concentration results in the statistical analysis for this Hydrogeologic Assessment report was the only historical data available for the site and was based on the precedent set by the Hutsonville Ash Pond D Closure which was approved by the IEPA. The recent three quarterly sampling events (3Q15, 4Q15, and 1Q16) were analyzed for both total and dissolved parameter concentrations. The purpose of the dual analysis was to allow historical data to be compared to current data and to prepare for future statistical analysis using total parameter concentrations. *Note: The historical data provided by others did not contain practical quantitation limits (PQLs) or method detection limits (MDLs). The PQLs and MDLs from the February 2016 groundwater sampling event were substituted for the missing data during statistical analysis.*

The analytical results were compared to the Illinois Class I groundwater standards. Historical concentrations of arsenic exceeded the Class I groundwater standard in Monitoring Wells APW-3 and APW-4. Currently, (as of February 2016) the arsenic concentration exceeded the Class I groundwater standard in APW-3 only. Concentrations of boron exceeded the Class I groundwater standard in Monitoring Wells APW-2, APW-3, APW-4, APW-6, APW-8, and APW-9. Currently, (as of February 2016) the boron concentration exceeded the Class I groundwater standard (2 ppm) in Monitoring Wells APW-2, APW-3, APW-8, and APW-9. Aerial photographs showing the boron concentration contours for September 2015, December 2015, and February 2016 are included as Plates 18 through 20, respectively. Concentrations of manganese exceeded the Class I groundwater standard in Monitoring Wells APW-2, APW-3, and APW-4. Historical concentrations of iron exceeded the Class I groundwater standards in Monitoring Wells APW-3 and APW-4, but the February 2016 results are below the Class I groundwater standard. A single event anomaly associated with flooding in February 2016 resulted in the concentration of sulfate in Monitoring Well APW-9 being above the Class I groundwater standard. The arsenic and manganese exceedances at each monitoring well for the February 2016 sampling event are included on Plate 21. Changes of oxidation/reduction (redox) potential in the subsurface due to fluctuations in pH make evaluation of manganese and iron concentrations unreliable at this facility. Comparison of manganese and iron to the respective Class I groundwater standard may be inappropriate for this site.

Box and whiskers plots of the exceedances, with the exception of sulfate, iron, and manganese are included as Appendix C. Statistical trend analysis plots for arsenic and boron are also included in Appendix C. Statistical trends are decreasing or not significant at a 98% confidence level. The analysis indicates that increasing trends may have been present while the Meredosia Power Station was in operation through 2011, but appear to be decreasing based on the three most recent quarterly monitoring data.

5.5 Contaminants of Concern. Boron is the contaminant of concern for the Meredosia Power Station and is also indicator parameters. Boron is widespread across the site and is generally considered a good indicator chemical for ash pond facilities in Illinois. Due to the elevated levels of boron above background levels in the groundwater near the ash ponds on site, boron will be a primary indicator parameter for the site during remedial actions and ash pond closure activities. Boron is relatively stable in the subsurface and is not prone to attenuation.

Other chemicals and water quality parameters such as iron, manganese, pH, and TDS can be affected by redox conditions in the subsurface and are therefore not reliable as indicator parameters at this site. The concentrations of other chemicals may naturally fluctuate through attenuation.

5.6 Groundwater Modeling.

Both a two-dimensional and three-dimensional transient groundwater flow and transport model was used to describe the site. The models were calibrated to match the groundwater elevation and concentration trends observed between 2009 and 2015. Prediction simulations were then performed for no action and for proposed ash pond closure activities. The existing conditions model was used to calibrate the hydrogeologic flow and transport conditions and to evaluate the need for the ponds to be closed. The proposed closure conditions model was created to evaluate the length of time for the boron concentrations to decrease to below the IEPA Class I Groundwater standards. Boron transport was chosen because it is an indicator contaminant for coal ash leachate, is mobile in groundwater, and impacts are the most widespread across the site.

5.6.1 HELP Model

In order to assess the drainage capabilities of the proposed fly ash and bottom ash pond closures, Geotechnology utilized the USEPA Hydrologic Evaluation of Landfill Performance (HELP) model to simulate conditions at the site. The version of software used was HELP 3.07 (November 1997). A description of inputs and output data is attached in Appendix D of this report. For the purposes of this evaluation, the proposed ash pond cap, ash, and soil cross-section has been divided into six layers.

Model parameters for the layers were the default values for each selected layer type as provided by the HELP software module, or were input by the user (for synthetic materials) with known or manufacturer provided parameters. The model was run without groundwater influx parameters.

The model indicates that steady state conditions (<0.05 inches of head on the sand layer) will be achieved within approximately six months of closure activities at the two ash ponds on site. The data obtained from the HELP model was used as input parameters for MODFLOW and MT3DMS.

5.6.2 MODFLOW and MT3DMS

MODFLOW was developed by the United States Geological Survey (USGS) to solve three-dimensional transient head distributions using finite difference approximations. The model inputs include soil properties, multiple layers, heterogeneities, variable thicknesses, variable gradients, flow boundaries, wells, and can define confined or unconfined flow systems. Assumptions of the program include that groundwater is governed by Darcy's law; the formation behaves as a continuous porous medium; flow is not affected by chemical, temperature, or density gradients; and hydraulic properties are constant within a grid cell.

MT3DMS was developed by the USGS and calculates concentration distributions for a single chemical as a function of time and location using a finite difference solution. Concentration is distributed over a three-dimensional, non-uniform, transient flow field. MT3DMS accounts for advection, diffusion, dispersion, sorption, and first order decay. Assumptions of the module include changes in the concentration field do not affect the flow field; concentrations of solutes do not interact with each other; chemical and hydraulic properties are constant within a cell; sorption is instantaneous and fully reversible; and decay is not reversible.

Flow and transport boundaries, soil properties, and river stage fluctuations were the same for the calibration and prediction scenarios. One prediction scenario was no action and the other included the proposed ash pond closures.

Boron concentrations for the current configuration were modeled for 25 years to represent a scenario where the ash ponds were not closed. After 25 years, monitoring well APW-3 (the well with historically highest boron concentrations) stabilized at 16.9 mg/L of boron, which exceeds the Class I Groundwater standards. APW-2, APW-6, APW-7, and APW-8 also exceeded the Class I Groundwater standards at 25 years with no action.

According to the model results, boron concentrations will be below the Class I Groundwater standards for each well on site within three years after dewatering and closure of the fly ash and bottom ash ponds.

Additional information on the MODFLOW and MT3DMS modeling and modeling results are provided in Appendix E.

5.6.3 Boron and Arsenic Loading to the Illinois River

Groundwater in the vicinity of the fly ash and bottom ash ponds discharges to the Illinois River. A mixing calculation was performed to conservatively estimate the boron and arsenic loading rates to the Illinois River. Calculations are provided in Appendix F.

The loading rate was calculated by multiplying the volume of groundwater flowing into the river by the concentration of boron and arsenic in groundwater.

Loading Rate (L) = Concentration (C) * Groundwater Discharge Volume (Q)

Where Q = Hydraulic Conductivity (K) * Hydraulic Gradient (I) * Area (A)

To be conservative, the highest single concentration in groundwater monitoring wells at the site was initially used in this calculation (Cmax). A second calculation was performed using the average of the four monitoring wells near the river (APW-2, APW-3, APW-4, and APW-9).

The monitoring wells were not tested for hydraulic conductivity; however, Gibbet al. (1979) published hydraulic conductivity values for wells along the Illinois waterway, which included a site-specific value of 1,200 gallons per day/square foot (gpd/ft2). Both a maximum and an average hydraulic gradient were used. The average hydraulic gradient was based on the ten groundwater gauging events. Two groundwater gauging events were not used because of flooding and inaccessibility of the wells. Removing flooding events provides a more conservative value. The cross sectional area was assumed to be over the entire thickness of the aquifer, and along the entire length of the Fly Ash Pond parallel to the river, plus 50 feet north and south of the pond.

The calculated loading rate was divided by: 1) the 7-day 10-year low flow (Q7,10); and 2) the mean of the average annual flow data at the Meredosia gaging station. This calculation estimates the incremental concentration increase (dB) in the river due to discharge from the Fly Ash Pond. Due to the size of the Illinois River, it is unlikely that boron and arsenic concentrations would initially be distributed across the entire width of the river. Therefore, an additional calculation was performed to determine the incremental concentration increase assuming that mixing occurred within 50 feet of the shoreline. This calculation was performed by multiplying dB by 750 feet/50 feet (750 feet being total river width and 50 feet being the assumed mixing width).

The result of the boron calculation is an incremental increase of 0.048 mg/L calculated using average concentration, average hydraulic gradient, and mean annual river discharge. This is near the reporting limit for boron as listed by the USEPA in method SW-846, 6010c and below the Class I Groundwater Standard. The result of the boron calculation; based on maximum concentration, maximum hydraulic gradient, and the Q7,10; is a conservative estimate of the increase in boron loading to the Illinois River. This result (1.92 mg/L) suggests that a measurable boron increase could occur near shore for worst case conditions at low flow. This value is below the IEPA Class I Groundwater standard.

Under typical conditions, arsenic will not have a measurable impact (incremental concentration increase of 0.0022 mg/L) on concentrations within the Illinois River. The calculations for arsenic suggest that it may be measurable in river water under worst case conditions (incremental increase of 0.0129 mg/L), assuming that it does not precipitate or sorb from solution prior to reaching the groundwater/surface water interface.

6.0 CONCLUSIONS

Although up to 11 groundwater monitoring events have been conducted at the Meredosia Power Station since December 2010, only three events have been conducted since the facility ceased operations in 2011. Therefore, statistical analysis of post-closure trends could not be performed. The groundwater analytical and statistical data indicates that the unlined ash ponds are a primary contributor to groundwater impacts based on the location of groundwater exceedances, the types of chemicals common to coals ash exceeding the applicable Class I groundwater standards, gradual reduction of groundwater impacts after plant closure, and contaminant transport modeling. The preliminary data suggests that a reduction in the concentrations of boron and arsenic has occurred since the facility ceased operations. The results of the groundwater modeling further supports this preliminary assessment in that once the ash ponds are capped and a Groundwater Management Zone is put into effect, the primary pathway (storm water infiltration) for contaminants to impact the groundwater at the site will not be complete. Groundwater modeling indicates that within four years of dewatering and closure, boron levels will be below the Class I Groundwater standards.

Additional groundwater monitoring events are planned to further assess the extent of the impacts of ash pond capping activities. Future monitoring events will be sampled for the parameters in accordance with the Meredosia Power Station Groundwater Monitoring Plan (GMP, 2016).

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8.0 LICENSED PROFESSIONAL SIGNATURE/SEAL

I hereby affirm that the information and design documents contained in this hydrogeologic assessment report are true and accurate to the best of my knowledge and professional opinion.

Rosanna M. Saindon, P.E., Ph.D.
Illinois Licensed Professional Engineer
Project Manager
Geotechnology, Inc.

LICENSED PROFESSIONAL ENGINEER
ROSANNA MARIE SAINDON
062.062289
8/4/2016
STATE OF ILLINOIS

TABLE 2

MONITORING WELL DATA SUMMARY
MEREDOSIA POWER STATION
MORGAN COUNTY, ILLINOIS

Well ID	Ground Surface Elevation	Bottom of Well Elevation	Screen Length (ft)	Top of Casing Elevation[1]	Groundwater Measurements		
					Date	Depth to Water (ft)	Groundwater Surface Elevation
APW-1	446.06	420.90	10.00	449.26	11/17/10	18.35	430.91
					12/13/10	19.15	430.11
					03/14/11	18.30	430.96
					06/24/11	10.80	438.46
					09/15/11	17.30	431.96
					10/28/11	19.60	429.66
					03/26/12	21.55	427.71
					06/18/12	21.34	427.92
					09/17/12	23.45	425.81
					08/25/15	12.10	437.16
					12/21/15	18.22	431.04
					02/18/16	13.54	435.72
APW-2	433.97	410.60	10.00	436.87	11/17/10	13.00	423.87
					12/13/10	13.14	423.73
					03/14/11	8.30	428.57
					09/15/11	12.65	424.22
					10/28/11	13.60	423.27
					03/26/12	13.27	423.60
					06/18/12	14.46	422.41
					09/17/12	15.59	421.28
					08/25/15	9.67	427.20
					12/21/15	9.05	427.82
					02/18/16	8.21	428.66
APW-3	433.35	410.30	10.00	436.28	11/17/10	13.52	422.76
					12/13/10	13.35	422.93
					03/14/11	5.70	430.58
					09/15/11	13.90	422.38
					10/28/11	14.60	421.68
					03/26/12	12.80	423.48
					06/18/12	13.95	422.33
					09/17/12	15.92	420.36
					08/25/15	11.10	425.18
					12/21/15	4.79	431.49
					02/18/16	8.74	427.54
APW-4	431.90	405.80	6.50	434.86	11/17/10	9.15	425.71
					12/13/10	9.25	425.61
					09/15/11	9.20	425.66
					10/28/11	10.00	424.86
					03/26/12	9.90	424.96
					06/18/12	10.95	423.91
					09/17/12	12.36	422.50
					08/25/15	6.13	428.73
					12/21/15	5.47	429.39
					02/18/16	4.92	429.94
APW-5	450.48	420.20	10.00	453.20	11/17/10	25.60	427.60
					12/13/10	25.40	427.80
					03/14/11	22.60	430.60
					06/24/11	14.70	438.50
					09/15/11	23.40	429.80
					10/28/11	24.50	428.70
					03/26/12	27.20	426.00
					06/18/12	27.30	425.90
					09/17/12	29.18	424.02
					08/25/15	18.55	434.65
					12/21/15	23.68	429.52
					02/18/16	19.42	433.78
APW-6	448.60	420.60	9.68	451.90	12/21/15	21.90	430.00
					02/18/16	18.35	433.55
APW-7	435.00	418.50	9.70	438.70	12/21/15	9.15	429.55
					02/18/16	6.95	431.75
APW-8	460.50	421.40	9.68	463.90	12/21/15	34.56	429.34
					02/18/16	31.60	432.30
APW-9	445.00	415.70	9.68	448.10	12/21/15	18.23	429.87
					02/18/16	17.76	430.34

[1]Elevations reported in feet above mean sea level.

TABLE 3

GROUNDWATER ANALYTICAL DATA SUMMARY
MEREDOSIA POWER STATION
MEREDOSIA, ILLINOIS

WELL ID	SAMPLE DATE	PARAMETER[1]													
		Antimony (d)	Antimony (t)	Arsenic (d)	Arsenic (t)	Barium (d)	Barium (t)	Beryllium (d)	Beryllium (t)	Boron (d)	Boron (t)	Cadmium (d)	Cadmium (t)	Chloride (d)	Chromium (d)
APW-1	12/13/2010	<0.006	NA	<0.004	NA	<0.05	NA	<0.004	NA	0.117	NA	<0.004	NA	1	<0.01
	3/24/2011	<0.003	NA	<0.001	NA	0.01	NA	<0.001	NA	0.13	NA	<0.001	NA	11	<0.004
	6/24/2011	<0.003	NA	<0.001	NA	0.01	NA	<0.001	NA	0.14	NA	<0.001	NA	5.6	<0.004
	9/15/2011	<0.003	NA	<0.001	NA	0.017	NA	<0.001	NA	0.1	NA	<0.001	NA	13	<0.004
	10/28/2011	<0.003	NA	<0.001	NA	0.019	NA	<0.001	NA	0.098	NA	<0.001	NA	6.8	<0.004
	3/26/2012	<0.003	NA	<0.001	NA	0.011	NA	<0.001	NA	0.11	NA	<0.001	NA	20	<0.004
	6/18/2012	<0.003	NA	<0.001	NA	0.02	NA	<0.001	NA	0.097	NA	<0.001	NA	45	<0.004
	9/17/2012	<0.003	NA	<0.001	NA	0.013	NA	<0.001	NA	0.055	NA	<0.001	NA	39	<0.004
	8/25/2015	<0.001	<0.001	<0.001	0.004	0.014	0.032	<0.0005	<0.0005	0.066	0.071	<0.002	<0.002	54	<0.005
	12/21/2015	<0.001	<0.001	<0.001	0.003	0.014	0.03	<0.0005	<0.0005	0.074	0.079	<0.002	<0.002	62	<0.005
	2/18/2016	<0.0010	0.0004	<0.0010	0.0012	0.0207	0.0276	<0.0005	<0.0005	0.0712	0.0705	<0.0020	<0.0020	80	<0.0050
APW-2	12/13/2010	<0.006	NA	0.004	NA	<0.05	NA	<0.004	NA	2.11	NA	<0.004	NA	33	<0.01
	3/24/2011	<0.003	NA	0.004	NA	0.055	NA	<0.001	NA	3.1	NA	<0.001	NA	50	<0.004
	9/15/2011	<0.003	NA	0.003	NA	0.042	NA	<0.001	NA	2.8	NA	<0.001	NA	41	<0.004
	10/28/2011	<0.003	NA	0.004	NA	0.045	NA	<0.001	NA	3.3	NA	<0.001	NA	42	<0.004
	3/26/2012	<0.003	NA	0.004	NA	0.046	NA	<0.001	NA	3.6	NA	<0.001	NA	47	<0.004
	6/18/2012	<0.003	NA	0.004	NA	0.051	NA	<0.001	NA	3.5	NA	<0.001	NA	50	<0.004
	9/17/2012	<0.003	NA	0.004	NA	0.048	NA	<0.001	NA	3.9	NA	<0.001	NA	44	<0.004
	8/25/2015	<0.001	<0.001	0.001	0.003	0.06	0.073	<0.0005	<0.0005	2.65	2.8	<0.002	<0.002	40	<0.005
	12/21/2015	<0.001	<0.001	0.002	0.003	0.074	0.092	<0.0005	<0.0005	2.61	2.61	<0.002	<0.002	26	<0.005
	2/18/2016	<0.0010	0.0007	0.0011	0.0014	0.0597	0.0654	<0.0005	<0.0005	2.66	2.88	<0.0020	<0.0020	30	<0.0050
APW-3	12/13/2010	<0.006	NA	0.148	NA	<0.05	NA	<0.004	NA	30.2	NA	<0.004	NA	54.5	<0.01
	3/24/2011	<0.003	NA	0.17	NA	0.05	NA	<0.001	NA	28	NA	0.001	NA	54	<0.004
	9/15/2011	<0.003	NA	0.21	NA	0.042	NA	<0.001	NA	32	NA	<0.001	NA	44	<0.004
	10/28/2011	<0.003	NA	0.22	NA	0.045	NA	0.001	NA	35	NA	<0.001	NA	47	<0.004
	3/26/2012	<0.003	NA	0.19	NA	0.048	NA	<0.001	NA	31	NA	0.001	NA	54	<0.004
	6/18/2012	<0.003	NA	0.31	NA	0.081	NA	<0.001	NA	46	NA	0.002	NA	49	<0.004
	9/17/2012	<0.003	NA	0.17	NA	0.11	NA	<0.001	NA	26	NA	0.001	NA	58	<0.004
	8/25/2015	<0.001	<0.001	0.216	0.225	0.072	0.082	<0.0005	<0.0005	25.3	27	<0.002	<0.002	27	<0.005
	12/21/2015	<0.001	<0.001	0.19	0.207	0.066	0.074	<0.0005	<0.0005	24.2	24.9	<0.002	<0.002	26	<0.005
	2/18/2016	<0.0010	0.0004	0.143	0.158	0.0605	0.0690	<0.0005	<0.0005	23.1	23.7	<0.0020	<0.0020	25	<0.0050
APW-4	12/13/2010	<0.006	NA	0.053	NA	0.067	NA	<0.004	NA	2.55	NA	<0.004	NA	41	<0.01
	9/15/2011	<0.003	NA	0.15	NA	0.085	NA	0.002	NA	4.5	NA	<0.001	NA	50	0.007
	10/28/2011	<0.003	NA	0.18	NA	0.095	NA	0.002	NA	6.3	NA	<0.001	NA	63	<0.004
	3/26/2012	<0.003	NA	0.029	NA	0.048	NA	<0.001	NA	3.9	NA	<0.001	NA	58	<0.004
	6/18/2012	<0.003	NA	0.033	NA	0.063	NA	<0.001	NA	4.8	NA	<0.001	NA	53	<0.004
	9/17/2012	<0.003	NA	0.036	NA	0.064	NA	<0.001	NA	4.9	NA	<0.001	NA	49	<0.004
	8/25/2015	<0.001	<0.001	0.03	0.032	0.053	0.063	<0.0005	<0.0005	1.81	1.89	<0.002	<0.002	33	<0.005
	12/21/2015	<0.001	<0.001	0.018	0.02	0.057	0.077	<0.0005	<0.0005	1.96	2.22	<0.002	<0.002	24	<0.005
	2/18/2016	<0.0010	0.0008	0.0086	0.0151	0.0706	0.176	<0.0005	0.0007	1.33	1.62	<0.0020	<0.0020	26	<0.0050
APW-5	12/13/2010	<0.006	NA	<0.004	NA	<0.05	NA	<0.004	NA	0.118	NA	<0.004	NA	3	<0.01
	3/24/2011	<0.003	NA	<0.001	NA	0.009	NA	<0.001	NA	0.17	NA	<0.001	NA	2.8	<0.004
	6/24/2011	<0.003	NA	<0.001	NA	0.01	NA	<0.001	NA	0.2	NA	<0.001	NA	2.6	<0.004
	9/15/2011	<0.003	NA	<0.001	NA	0.006	NA	<0.001	NA	0.35	NA	<0.001	NA	<1	<0.004
	10/28/2011	<0.003	NA	<0.001	NA	0.006	NA	<0.001	NA	0.31	NA	<0.001	NA	1	<0.004
	3/26/2012	<0.003	NA	0.001	NA	0.009	NA	<0.001	NA	0.3	NA	<0.001	NA	2.5	<0.004
	6/18/2012	<0.003	NA	0.001	NA	0.01	NA	<0.001	NA	0.41	NA	<0.001	NA	4.6	<0.004
	9/17/2012	<0.003	NA	<0.001	NA	0.009	NA	<0.001	NA	0.32	NA	<0.001	NA	2.9	<0.004
	8/25/2015	<0.001	0.001	<0.001	0.008	0.011	0.042	<0.0005	<0.0005	0.109	0.119	<0.002	<0.002	9	<0.005
	12/21/2015	<0.001	<0.001	<0.001	0.001	0.012	0.018	<0.0005	<0.0005	0.092	0.116	<0.002	<0.002	6	<0.005
	2/18/2016	0.0003	0.0006	0.0003	0.0010	0.0113	0.0151	<0.0005	<0.0005	0.118	0.165	<0.0020	<0.0020	9	<0.0050
APW-6	12/21/2015	<0.001	<0.001	<0.001	<0.001	0.015	0.018	<0.0005	<0.0005	0.246	0.271	<0.002	<0.002	6	<0.005
	2/18/2016	<0.0010	0.0005	0.0006	0.0008	0.0150	0.0167	<0.0005	<0.0005	0.412	0.444	<0.0020	<0.0020	6	<0.0050
APW-7	12/21/2015	<0.001	<0.001	<0.001	0.002	0.028	0.042	<0.0005	<0.0005	0.245	0.26	<0.002	<0.002	28	<0.005
	2/18/2016	<0.0010	0.0005	0.0003	0.0010	0.0202	0.0284	<0.0005	<0.0005	0.109	0.0986	<0.0020	<0.0020	30	<0.0050
APW-8	12/21/2015	<0.001	<0.001	0.001	0.002	0.083	0.09	<0.0005	<0.0005	10.8	11	<0.002	<0.002	13	0.01
	2/18/2016	0.0003	0.0006	0.0012	0.0013	0.0729	0.0788	<0.0005	<0.0005	10.3	11.1	<0.0020	<0.0020	12	0.0070
APW-9	12/21/2015	<0.001	0.001	<0.001	0.002	0.017	0.028	<0.0005	<0.0005	0.5	0.531	<0.002	<0.002	16	<0.005
	2/18/2016	0.0008	0.0013	0.0007	0.0012	0.0363	0.0425	<0.0005	<0.0005	4.42	5.12	<0.0020	<0.0020	19	<0.0050
Class I GW Standards		**0.006**	**NE**	**0.010**	**NE**	**2**	**NE**	**0.004**	**NE**	**2**	**NE**	**0.005**	**NE**	**200**	**0.1**

Results are reported as mg/L or parts per million (ppm)
Contents of table obtained from data provided by Ameren.
Concentration above Illinois Class I Groundwater Standards
NA = Not Analyzed
NE = Not Established
TDS = Total Dissolved Solids
(d) = dissolved concentration
(t) = total concentration

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TABLE 3

GROUNDWATER ANALYTICAL DATA SUMMARY
MEREDOSIA POWER STATION
MEREDOSIA, ILLINOIS

WELL ID	PARAMETER[1]														
	Chromium (t)	Cobalt (d)	Cobalt (t)	Copper (d)	Copper (t)	Cyanide	Fluoride (d)	Iron (t)	Iron (d)	Lead (d)	Lead (t)	Manganese (t)	Manganese (d)	Mercury (d)	Mercury (t)
APW-1	NA	<0.05	NA	<0.025	NA	<0.01	<0.1	NA	0.162	<0.005	NA	NA	<0.015	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	0.03	<0.001	NA	NA	0.008	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	<0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.26	NA	<0.01	<0.001	NA	NA	0.003	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.32	NA	<0.01	<0.001	NA	NA	0.005	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	<0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	0.009	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	<0.001	<0.0002	NA
	<0.005	<0.005	0.012	<0.005	0.008	<0.007	<0.1	5.67	0.1	<0.001	0.007	0.593	<0.003	<0.0002	<0.0002
	<0.005	<0.005	0.009	<0.005	0.006	<0.007	0.11	4.18	<0.02	<0.001	0.005	0.418	<0.003	<0.0002	<0.0002
	0.0022	<0.0050	0.0028	<0.0050	0.0016	<0.007	0.10	1.53	<0.0200	<0.0010	0.0020	0.170	<0.0030	<0.00020	<0.00020
APW-2	NA	<0.05	NA	<0.025	NA	<0.01	0.3	NA	<0.1	<0.005	NA	NA	0.931	<0.0002	NA
	NA	0.004	NA	<0.003	NA	<0.005	<0.25	NA	1.1	<0.001	NA	NA	0.48	<0.0002	NA
	NA	0.003	NA	<0.003	NA	<0.005	0.44	NA	0.37	<0.001	NA	NA	0.82	<0.0002	NA
	NA	0.002	NA	<0.003	NA	<0.005	0.46	NA	0.46	<0.001	NA	NA	0.79	<0.0002	NA
	NA	0.003	NA	<0.003	NA	<0.005	0.32	NA	0.15	<0.001	NA	NA	0.91	<0.0002	NA
	NA	0.003	NA	<0.003	NA	<0.005	0.27	NA	0.34	0.001	NA	NA	0.83	<0.0002	NA
	NA	0.003	NA	<0.003	NA	<0.005	0.3	NA	0.3	<0.001	NA	NA	0.96	<0.0002	NA
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.28	2.16	0.104	<0.001	0.001	1.09	0.989	<0.0002	<0.0002
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.29	1.9	0.024	<0.001	0.001	0.686	0.63	<0.0002	<0.0002
	<0.0050	<0.0050	<0.0050	<0.0050	0.0015	<0.007	0.31	0.297	0.018	<0.0010	0.0004	0.925	0.906	<0.00020	<0.00020
APW-3	NA	<0.05	NA	<0.025	NA	<0.01	0.25	NA	<0.1	<0.005	NA	NA	0.169	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.36	NA	0.65	<0.001	NA	NA	0.45	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.49	NA	0.41	<0.001	NA	NA	0.28	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.54	NA	0.33	<0.001	NA	NA	0.25	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.32	NA	0.48	<0.001	NA	NA	0.3	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.29	NA	0.39	0.001	NA	NA	0.46	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.29	NA	5.4	<0.001	NA	NA	1.2	<0.0002	NA
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.2	2.38	0.475	<0.001	0.001	0.492	0.432	<0.0002	<0.0002
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.23	1.93	1.38	<0.001	<0.001	0.635	0.586	<0.0002	<0.0002
	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.007	0.22	2.26	1.36	<0.0010	0.0006	0.669	0.632	<0.00020	<0.00020
APW-4	NA	<0.05	NA	<0.025	NA	<0.01	0.39	NA	<0.1	<0.005	NA	NA	3.1	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.73	NA	5.9	<0.001	NA	NA	3.4	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.79	NA	6.6	<0.001	NA	NA	5.4	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.47	NA	14	<0.001	NA	NA	2.8	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.45	NA	16	<0.001	NA	NA	3.3	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.45	NA	16	<0.001	NA	NA	2.9	<0.0002	NA
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.37	13.8	11.8	<0.001	<0.001	2.14	2.05	<0.0002	<0.0002
	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.41	18.4	14.1	<0.001	0.001	2.3	2.18	<0.0002	<0.0002
	0.0228	<0.0050	0.0079	<0.0050	0.0203	<0.007	0.30	27.5	2.16	<0.0010	0.0136	2.39	1.72	<0.00020	<0.00020
APW-5	NA	<0.05	NA	<0.025	NA	<0.01	0.13	NA	<0.1	<0.005	NA	NA	<0.015	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	0.012	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	0.012	<0.001	NA	NA	0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.31	NA	<0.01	<0.001	NA	NA	<0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	0.36	NA	<0.01	<0.001	NA	NA	<0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	0.001	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	0.04	<0.0002	NA
	NA	<0.002	NA	<0.003	NA	<0.005	<0.25	NA	<0.01	<0.001	NA	NA	0.002	<0.0002	NA
	0.009	<0.005	0.05	<0.005	0.023	<0.007	<0.1	11.2	<0.02	<0.001	0.018	2.13	0.004	<0.0002	<0.0002
	<0.005	<0.005	0.007	<0.005	<0.005	<0.007	<0.1	1.4	<0.02	<0.001	0.002	0.292	<0.003	<0.0002	<0.0002
	<0.0050	<0.0050	0.0035	<0.0050	0.0015	<0.007	0.08	0.886	<0.0200	<0.0010	0.0016	0.181	0.0009	<0.00020	<0.00020
APW-6	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.11	0.402	<0.02	<0.001	<0.001	0.04	0.01	<0.0002	<0.0002
	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.007	0.15	0.198	<0.0200	<0.0010	0.0003	0.0129	<0.0030	<0.00020	<0.00020
APW-7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.22	2.57	<0.02	<0.001	0.002	0.177	0.018	<0.0002	<0.0002
	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.007	0.21	1.32	<0.0200	<0.0010	0.0010	0.0549	0.0008	<0.00020	<0.00020
APW-8	0.013	<0.005	<0.005	<0.005	<0.005	<0.007	<0.1	0.809	<0.02	<0.001	0.001	0.116	<0.003	<0.0002	<0.0002
	0.0078	<0.0050	<0.0050	<0.0050	<0.0050	<0.007	0.23	0.0531	<0.0200	<0.0010	<0.0010	0.0052	<0.0030	<0.00020	<0.00020
APW-9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	0.59	1.26	<0.02	<0.001	0.002	0.175	0.008	<0.0002	<0.0002
	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.007	0.10	0.505	<0.0200	<0.0010	0.0007	0.0579	<0.0030	<0.00020	<0.00020
Class I GW Standards	**NE**	**1**	**NE**	**0.65**	**NE**	**0.2**	**4**	**NE**	**5**	**0.0075**	**NE**	**NE**	**0.15**	**0.002**	**NE**

Results are reported as mg/L or parts per million (ppm)
Contents of table obtained from data provided by Ameren.
Concentration above Illinois Class I Groundwater Standards
NA = Not Analyzed
NE = Not Established
TDS = Total Dissolved Solids
(d) = dissolved concentration
(t) = total concentration

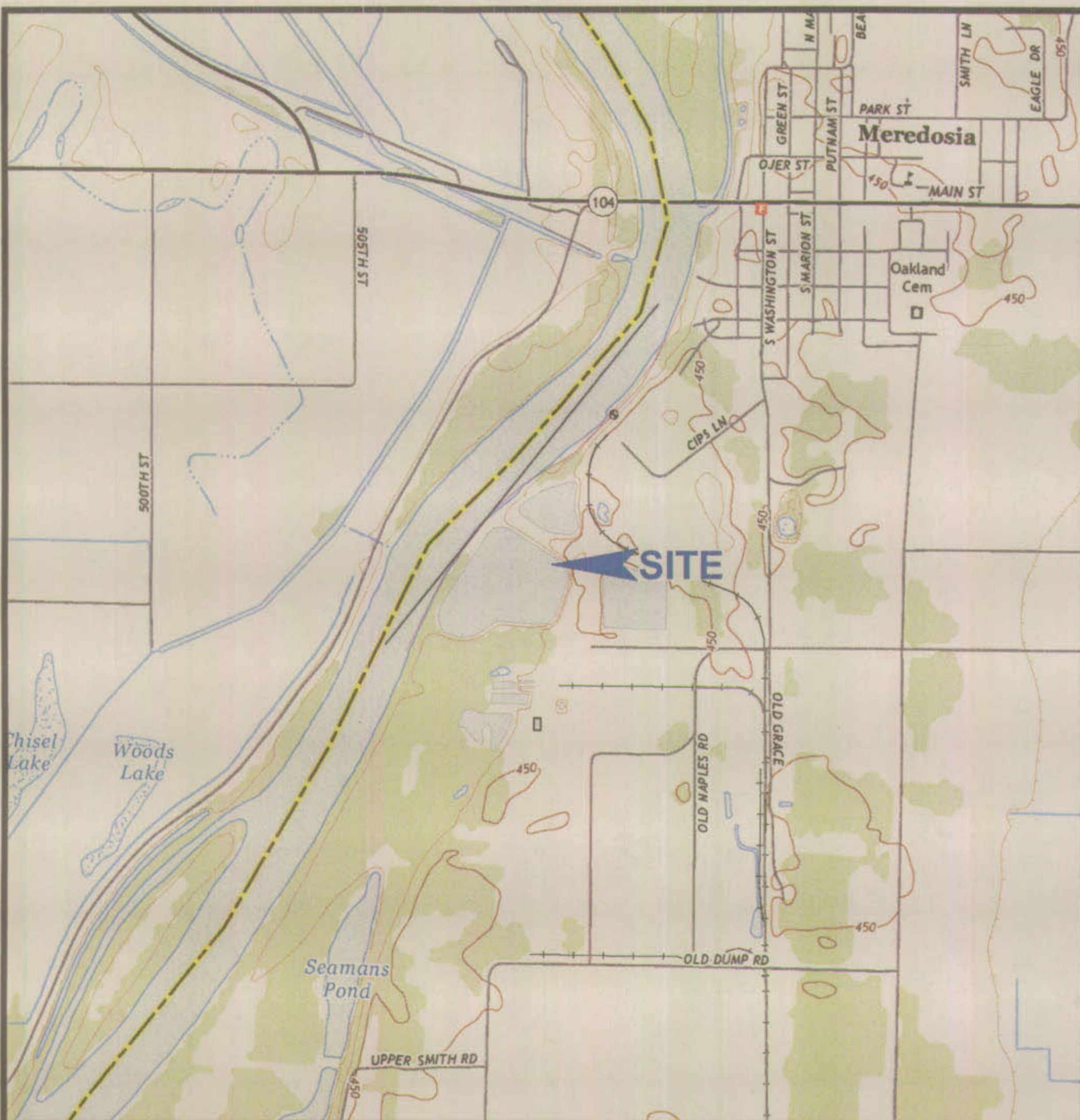
del J024917.01 Table 3 Analytical Data Summary.xlsx

TABLE 3

GROUNDWATER ANALYTICAL DATA SUMMARY
MEREDOSIA POWER STATION
MEREDOSIA, ILLINOIS

WELL ID	PARAMETER														
	Nickel (d)	Nickel (t)	Nitrate	Selenium (d)	Selenium (t)	Silver (d)	Silver (t)	Sulfate	TDS	Thallium (d)	Thallium (t)	Vanadium (d)	Vanadium (t)	Zinc (d)	Zinc (t)
APW-1	<0.04	NA	3.8	<0.01	NA	<0.005	NA	26.4	132	<0.002	NA	NA	NA	<0.02	NA
	<0.005	NA	3.9	0.002	NA	<0.005	NA	23	190	<0.001	NA	NA	NA	<0.006	NA
	0.014	NA	4.7	0.002	NA	<0.005	NA	33	140	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	1.7	0.002	NA	<0.005	NA	20	190	<0.001	NA	NA	NA	<0.006	NA
	0.005	NA	2.8	0.002	NA	<0.005	NA	24	150	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	5.7	0.001	NA	<0.005	NA	15	180	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	2.1	<0.001	NA	<0.005	NA	13	270	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	1.6	0.002	NA	<0.005	NA	12	280	<0.001	NA	NA	NA	<0.006	NA
	<0.005	0.021	3.94	<0.04	<0.04	<0.005	<0.005	12	226	<0.001	<0.001	<0.01	<0.01	<0.01	0.02
	<0.005	0.015	3.43	<0.04	<0.04	<0.005	<0.005	11	280	<0.001	<0.001	<0.01	<0.01	<0.01	0.015
	0.0030	0.0090	3.59	<0.0400	<0.0400	<0.0050	<0.0050	20	298	<0.0010	<0.0010	<0.0100	0.0025	<0.0100	0.0068
APW-2	<0.04	NA	0.4	<0.01	NA	<0.005	NA	28.2	368	<0.002	NA	NA	NA	<0.02	NA
	0.012	NA	<0.02	<0.001	NA	<0.005	NA	41	630	<0.001	NA	NA	NA	<0.006	NA
	0.007	NA	<0.02	<0.001	NA	<0.005	NA	<25	430	<0.001	NA	NA	NA	<0.006	NA
	0.006	NA	0.04	0.003	NA	<0.005	NA	14	440	<0.001	NA	NA	NA	<0.006	NA
	0.009	NA	0.07	0.001	NA	<0.005	NA	13	460	<0.001	NA	NA	NA	<0.006	NA
	0.011	NA	<0.02	0.004	NA	<0.005	NA	18	510	<0.001	NA	NA	NA	0.006	NA
	0.011	NA	<0.02	0.002	NA	<0.005	NA	15	520	<0.001	NA	NA	NA	<0.006	NA
	<0.005	0.007	<0.05	<0.04	<0.04	<0.005	<0.005	<10	488	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.005	0.005	<0.05	<0.04	<0.04	<0.005	<0.005	22	572	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	0.0058	0.0062	<0.050	<0.0400	<0.0400	<0.0050	<0.0050	19	494	<0.0010	<0.0010	0.0015	0.0017	<0.0100	0.0036
APW-3	<0.04	NA	0.49	<0.01	NA	<0.005	NA	284	660	<0.002	NA	NA	NA	<0.02	NA
	0.01	NA	<0.02	0.001	NA	<0.005	NA	310	750	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	<0.02	<0.001	NA	<0.005	NA	260	680	<0.001	NA	NA	NA	<0.006	NA
	0.006	NA	<0.02	0.002	NA	<0.005	NA	290	650	<0.001	NA	NA	NA	<0.006	NA
	0.006	NA	<0.02	<0.001	NA	<0.005	NA	270	710	<0.001	NA	NA	NA	<0.006	NA
	0.011	NA	<0.02	0.002	NA	<0.005	NA	300	770	0.001	NA	NA	NA	0.012	NA
	0.012	NA	<0.02	0.003	NA	<0.005	NA	300	970	<0.001	NA	NA	NA	<0.006	NA
	<0.005	<0.005	<0.05	<0.04	<0.04	<0.005	<0.005	177	670	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.005	<0.005	<0.05	<0.04	<0.04	<0.005	<0.005	235	738	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	<0.0050	<0.050	<0.0400	<0.0400	<0.0050	<0.0050	192	736	<0.0010	<0.0010	<0.0100	<0.0100	<0.0100	0.0028
APW-4	<0.04	NA	0.31	<0.01	NA	<0.005	NA	49.3	418	<0.002	NA	NA	NA	<0.02	NA
	0.019	NA	0.04	0.012	NA	<0.005	NA	53	470	<0.001	NA	NA	NA	<0.006	NA
	0.01	NA	0.29	0.013	NA	<0.005	NA	17	520	<0.001	NA	NA	NA	<0.006	NA
	0.006	NA	<0.02	0.015	NA	<0.005	NA	23	300	<0.001	NA	NA	NA	<0.006	NA
	0.009	NA	<0.02	0.021	NA	<0.005	NA	14	690	<0.001	NA	NA	NA	0.007	NA
	0.01	NA	<0.02	0.03	NA	<0.005	NA	24	360	<0.001	NA	NA	NA	<0.006	NA
	<0.005	<0.005	<0.05	<0.04	<0.04	<0.005	<0.005	<10	504	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.005	<0.005	<0.05	<0.04	<0.04	<0.005	<0.005	28	578	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	0.0033	0.0232	<0.050	<0.0400	<0.0400	<0.0050	<0.0050	66	462	<0.0010	<0.0010	<0.0100	0.0331	0.0024	0.0677
APW-5	<0.04	NA	1.7	<0.01	NA	<0.005	NA	6.1	138	<0.002	NA	NA	NA	<0.02	NA
	0.007	NA	1.9	<0.001	NA	<0.005	NA	17	230	<0.001	NA	NA	NA	<0.006	NA
	0.01	NA	1.4	0.002	NA	<0.005	NA	15	290	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	2	0.001	NA	<0.005	NA	9.5	180	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	1.9	0.004	NA	<0.005	NA	6.7	160	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	2	0.002	NA	<0.005	NA	14	250	<0.001	NA	NA	NA	<0.006	NA
	<0.005	NA	4.1	0.003	NA	<0.005	NA	15	280	<0.001	NA	NA	NA	<0.006	NA
	0.006	NA	2.6	0.002	NA	<0.005	NA	33	290	<0.001	NA	NA	NA	<0.006	NA
	<0.005	0.07	2.03	<0.04	<0.04	<0.005	<0.005	19	338	<0.001	<0.001	<0.01	0.017	<0.01	0.037
	<0.005	0.009	2.1	<0.04	<0.04	<0.005	<0.005	66	400	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	0.0077	1.85	<0.0400	<0.0400	<0.0050	<0.0050	36	340	<0.0010	<0.0010	<0.0100	0.0025	<0.0100	0.0048
APW-6	<0.005	<0.005	0.172	<0.04	<0.04	<0.005	<0.005	<10	354	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	0.002	0.730	<0.0400	<0.0400	<0.0050	<0.0050	12	296	<0.0010	<0.0010	<0.0100	<0.0100	<0.0100	0.0025
APW-7	<0.005	<0.005	1.09	<0.04	<0.04	<0.005	<0.005	17	384	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	0.0033	4.82	<0.0400	<0.0400	<0.0050	<0.0050	35	248	<0.0010	<0.0010	<0.0100	0.0033	<0.0100	0.0054
APW-8	<0.005	<0.005	5.73	0.126	0.135	<0.005	<0.005	473	994	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	<0.0050	5.29	0.102	0.118	<0.0050	<0.0050	338	786	<0.0010	<0.0010	<0.0100	<0.0100	<0.0100	<0.0100
APW-9	<0.005	0.005	3.25	<0.04	<0.04	<0.005	<0.005	265	716	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01
	<0.0050	0.0035	3.88	<0.0400	<0.0400	<0.0050	<0.0050	466	1,070	<0.0010	<0.0010	0.0028	0.0033	<0.0100	0.0030
Class I GW Standards	0.1	NE	10	0.05	NE	0.05	NE	400	1,200	NE	NE	0.049	NE	5	NE

Results are reported as mg/L or parts per million (ppm)
Contents of table obtained from data provided by Ameren.
Concentration above Illinois Class I Groundwater Standards
NA = Not Analyzed
NE = Not Established
TDS = Total Dissolved Solids
(d) = dissolved concentration
(t) = total concentration



NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

0 2,000 4,000

SCALE IN FEET

Drawn By: WAH	Ck'd By: [illegible]	App'vd By: Ams
Date: 5-9-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.01	PLATE 1

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.

LEGEND

- Monitoring Well Location
- Soil Boring Location

N

0 200 400 800
SCALE IN FEET

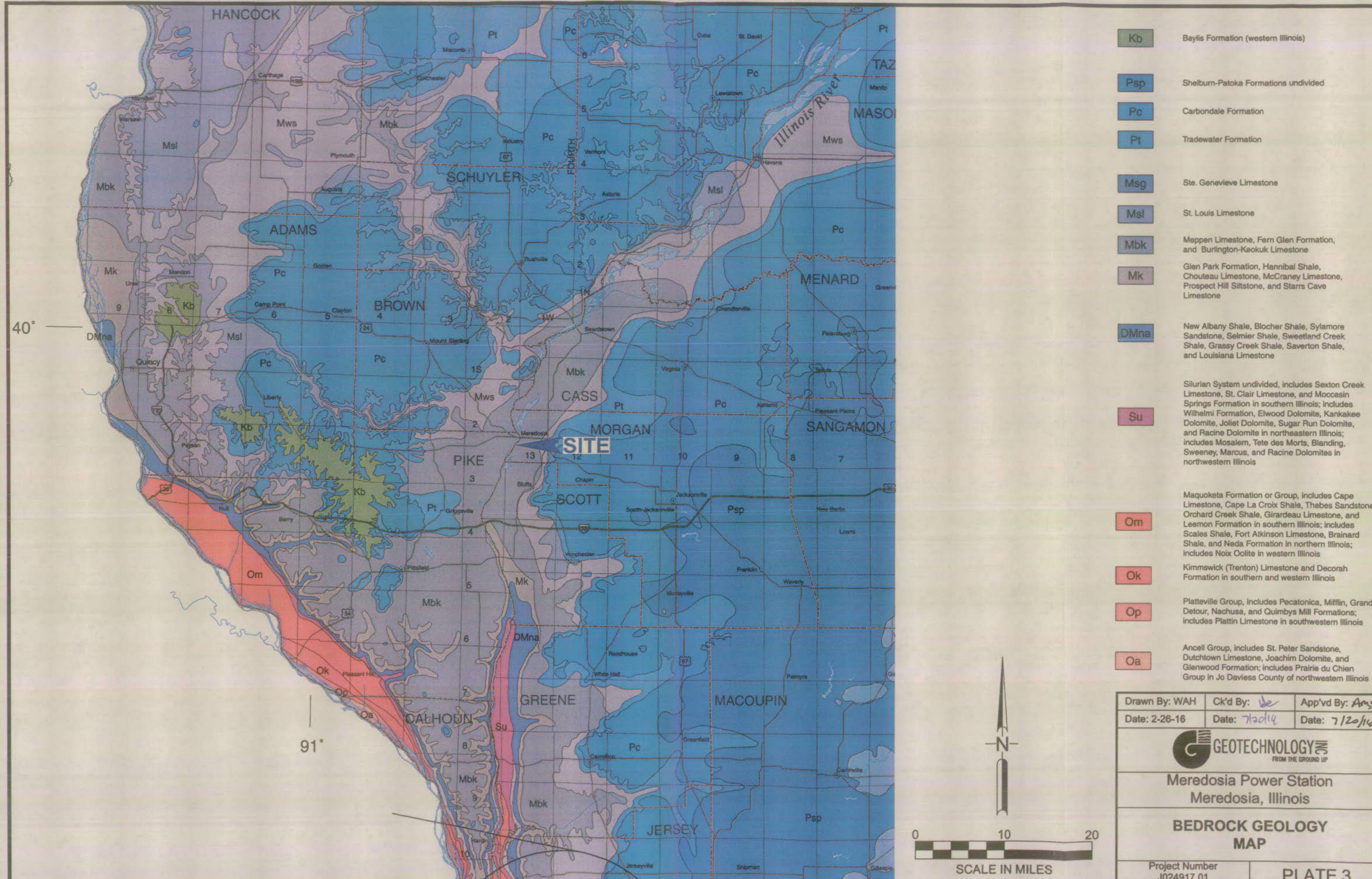
Drawn By: WAH	Ck'd By: [illegible]	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE PLAN AND
MONITORING WELL LOCATIONS

Project Number J024917.01	PLATE 2


HANCOCK
ADAMS
SCHUYLER
BROWN
PIKE
CASS
MORGAN
SCOTT
MENARD
SANGAMON
GREENE
MACOUPIN
CALHOUN
JERSEY
SITE
Illinois River
40°
91°
Kb Baylis Formation (western Illinois)
Psp Shelburn-Patoka Formations undivided
Pc Carbondale Formation
Pt Tradewater Formation
Msg Ste. Genevieve Limestone
Msl St. Louis Limestone
Mbk Meppen Limestone, Fern Glen Formation, and Burlington-Keokuk Limestone
Mk Glen Park Formation, Hannibal Shale, Chouteau Limestone, McCraney Limestone, Prospect Hill Siltstone, and Starrs Cave Limestone
DMna New Albany Shale, Blocher Shale, Sylamore Sandstone, Selmier Shale, Sweetland Creek Shale, Grassy Creek Shale, Saverton Shale, and Louisiana Limestone
Su Silurian System undivided, includes Sexton Creek Limestone, St. Clair Limestone, and Moccasin Springs Formation in southern Illinois; includes Wilhelmi Formation, Elwood Dolomite, Kankakee Dolomite, Joliet Dolomite, Sugar Run Dolomite, and Racine Dolomite in northeastern Illinois; includes Mosalem, Tete des Morts, Blanding, Sweeney, Marcus, and Racine Dolomites in northwestern Illinois
Om Maquoketa Formation or Group, includes Cape Limestone, Cape La Croix Shale, Thebes Sandstone, Orchard Creek Shale, Girardeau Limestone, and Leemon Formation in southern Illinois; includes Scales Shale, Fort Atkinson Limestone, Brainard Shale, and Neda Formation in northern Illinois; includes Noix Oolite in western Illinois
Ok Kimmswick (Trenton) Limestone and Decorah Formation in southern and western Illinois
Op Platteville Group, includes Pecatonica, Mifflin, Grand Detour, Nachusa, and Quimbys Mill Formations; includes Plattin Limestone in southwestern Illinois
Oa Ancell Group, includes St. Peter Sandstone, Dutchtown Limestone, Joachim Dolomite, and Glenwood Formation; includes Prairie du Chien Group in Jo Daviess County of northwestern Illinois
N
0 10 20
SCALE IN MILES
Drawn By: WAH
Date: 2-26-16
Ck'd By:
Date: 7/20/16
App'vd By: AMS
Date: 7/20/16
GEOTECHNOLOGY INC
FROM THE GROUND UP
Meredosia Power Station
Meredosia, Illinois
BEDROCK GEOLOGY MAP
Project Number J024917.01
PLATE 3

NOTES
1. Plan adapted from a July 22, 2012 aerial photograph courtesy of Google Earth.
2. Water well locations from Illinois State Geological Survey Prairie Research Institute.
3. See Appendix A for water well records.
4. Abandoned on-site water supply wells are not shown.

LEGEND
- Water Supply Wells
- On-Site Water Supply Wells to be Abandoned

N

0 600 1200 2400
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 4-21-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

POTABLE WATER WELL SEARCH RADIUS

Project Number J024917.01	PLATE 4

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- Soil Boring Location
- Subsurface Profile (See Plate 6 and 7 for Cross-Section A-A' and B-B', Respectively)

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: Ams
Date: 3-9-16	Date: 7/20/16	Date: 7/20/16

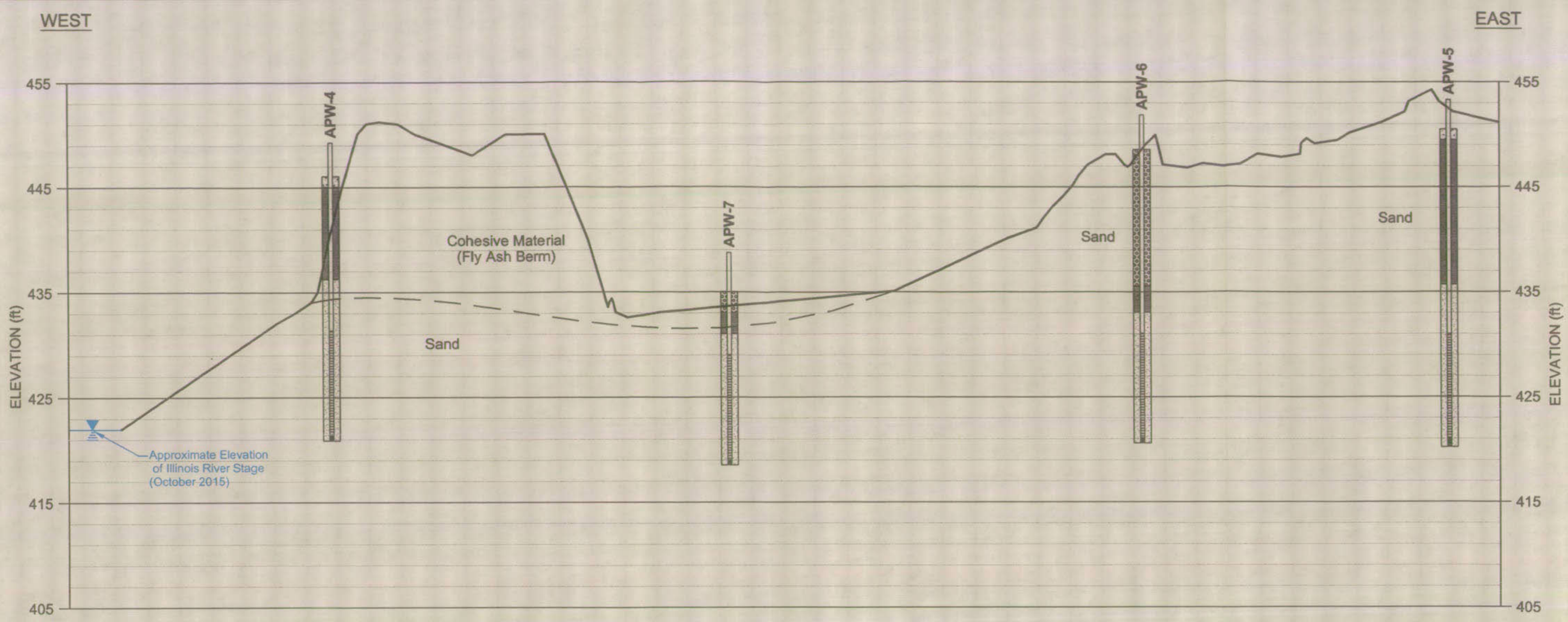
GEOTECHNOLOGY INC

FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SUBSURFACE PROFILE PLAN

Project Number J024917.01	PLATE 5



NOTES
1. See PLATE 5 for location of Subsurface Profile A-A'.

2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.

SCALE IN FEET
Horizontal 1" = 200'
Vertical 1" = 10'

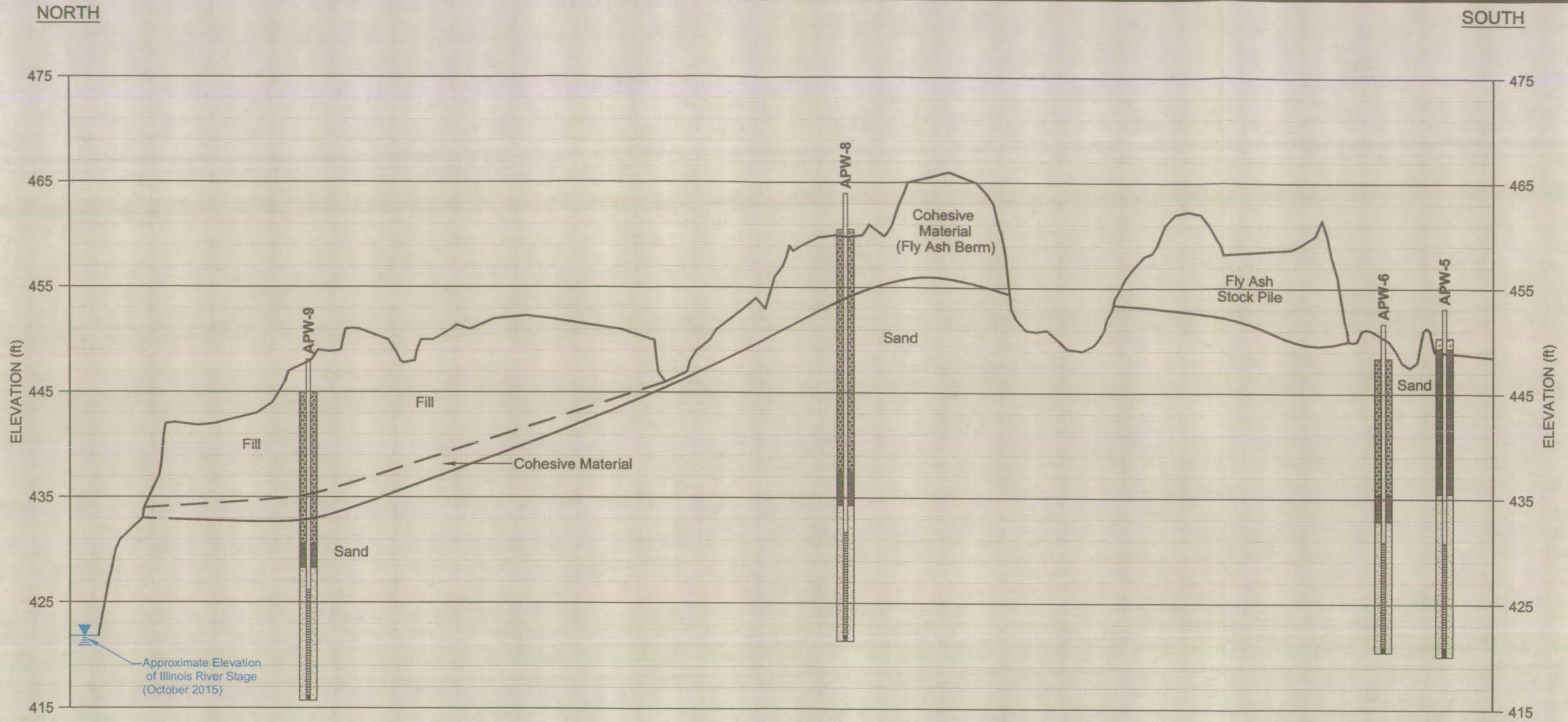
Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 3-9-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GENERALIZED SUBSURFACE PROFILE - SECTION A-A'

Project Number J024917.01 | PLATE 6



NOTES
1. See PLATE 5 for location of Subsurface Profile B-B'.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions at locations between borings may differ from the generalized profile shown here.

SCALE IN FEET
Horizontal 1" = 200'
Vertical 1" = 10'

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 3-7-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC. FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GENERALIZED SUBSURFACE PROFILE - SECTION B-B'

Project Number J024917.01

PLATE 7

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (November 17, 2010)
- —425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - NOVEMBER 2010

Project Number J024917.01	PLATE 8

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

Monitoring Well Location

(427.20) Groundwater Elevation at Well Location (December 13, 2010)

—425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/16/20

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - DECEMBER 2010

Project Number J024917.01	PLATE 9

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (September 15, 2011)
- —425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - SEPTEMBER 2011

Project Number J024917.01	PLATE 10

NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND
Monitoring Well Location
(427.20) Groundwater Elevation at Well Location (October 28, 2011)
—425— Groundwater Elevation Contour

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - OCTOBER 2011

Project Number J024917.01	PLATE 11

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (March 26, 2012)
- —425— Groundwater Elevation Contour

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - MARCH 2012

Project Number J024917.01 — PLATE 12

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (June 18, 2012)
- —425— Groundwater Elevation Contour

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By: [illegible]	App'vd By: [illegible]
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - JUNE 2012

Project Number J024917.01 | PLATE 13

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (September 17, 2012)
- —425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - SEPTEMBER 2012

Project Number J024917.01	PLATE 14

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (August 25, 2015)
- —425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - AUGUST 2015

Project Number J024917.01	PLATE 15

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

Monitoring Well Location
(427.20) Groundwater Elevation at Well Location (December 21, 2015)
—425— Groundwater Elevation Contour

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 3-9-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - DECEMBER 2015

Project Number J024917.01	PLATE 16

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (427.20) Groundwater Elevation at Well Location (February 18, 2016)
- —425— Groundwater Elevation Contour

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: [illegible]	App'vd By: AMS
Date: 5-18-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

GROUNDWATER ELEVATION CONTOURS - FEBRUARY 2016

Project Number J024917.01	PLATE 17

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (10.8) Boron Concentration in Groundwater, (mg/l - ppm) - August 25, 2015
- —10— Boron Concentration Isopleth, (mg/l - ppm)

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: [illegible]	App'vd By: AMS
Date: 4-21-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

BORON CONCENTRATION IN GROUNDWATER - AUGUST 2015

Project Number J024917.01	PLATE 18

NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND
Monitoring Well Location
(10.8) Boron Concentration in Groundwater, (mg/l - ppm) - December 21, 2015
—10— Boron Concentration Isopleth, (mg/l - ppm)

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 4-19-16	Date: 7/20/16	Date: 7/20/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

BORON CONCENTRATION IN GROUNDWATER - DECEMBER 2015

Project Number J024917.01

PLATE 19

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND

- Monitoring Well Location
- (10.3) Boron Concentration in Groundwater, (mg/l - ppm) - February 18, 2016
- —10— Boron Concentration Isopleth, (mg/l - ppm)

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: [signature]	App'vd By: AMS
Date: 4-21-16	Date: 7/20/16	Date: 7/20/16

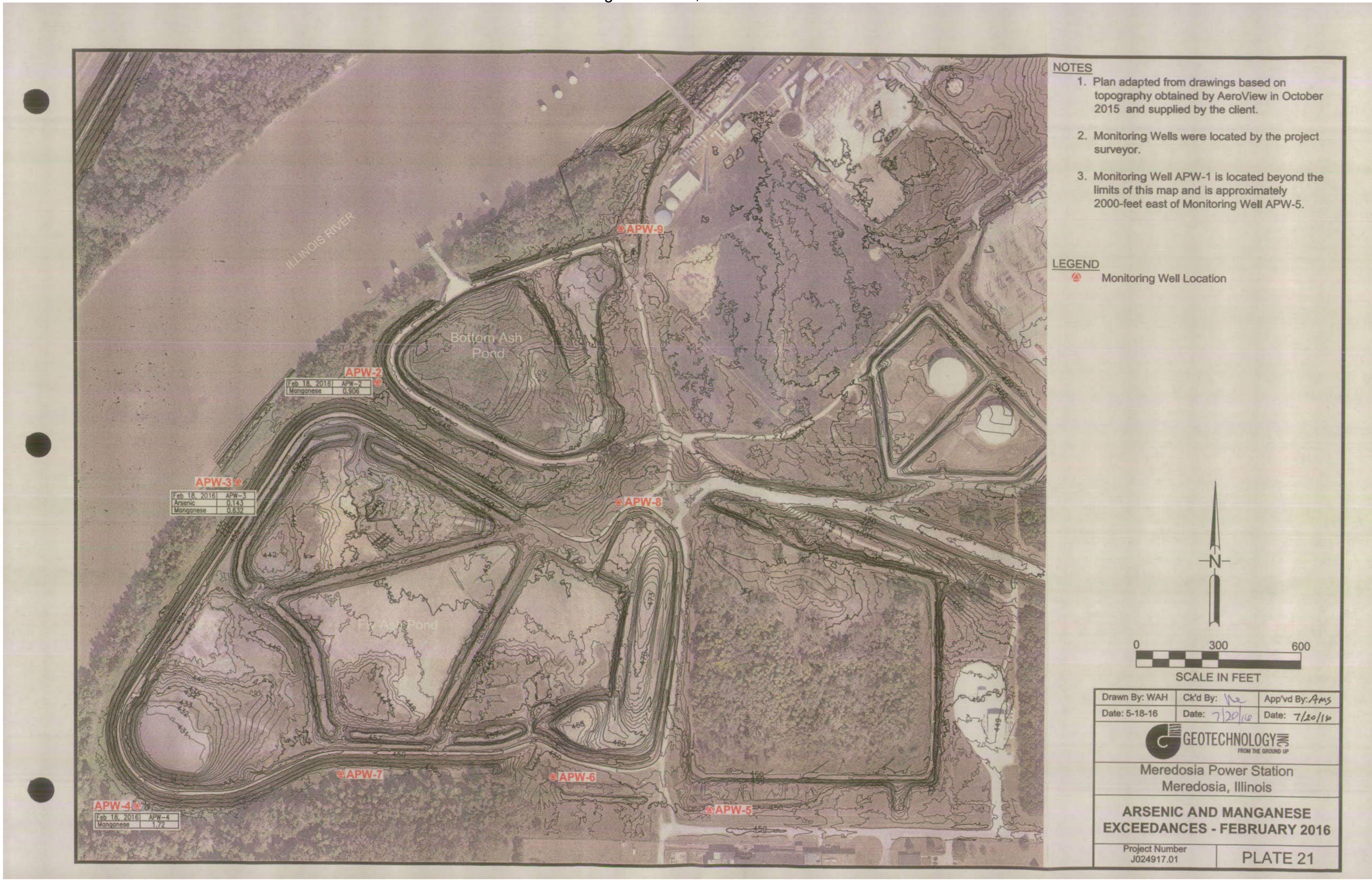
GEOTECHNOLOGY INC. FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

BORON CONCENTRATION IN GROUNDWATER - FEBRUARY 2016

Project Number J024917.01

PLATE 20


NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.
LEGEND
Monitoring Well Location
ILLINOIS RIVER
Bottom Ash Pond
Fly Ash Pond
APW-2
Feb 18, 2016 APW-2
Manganese 0.906
APW-3
Feb 18, 2016 APW-3
Arsenic 0.143
Manganese 0.832
APW-4
Feb 18, 2016 APW-4
Manganese 1.72
APW-5
APW-6
APW-7
APW-8
APW-9
N
0 300 600
SCALE IN FEET
Drawn By: WAH
Date: 5-18-16
Ck'd By:
Date: 7/20/16
App'vd By: AMS
Date: 7/20/16
GEOTECHNOLOGY INC
FROM THE GROUND UP
Meredosia Power Station
Meredosia, Illinois
ARSENIC AND MANGANESE EXCEEDANCES - FEBRUARY 2016
Project Number J024917.01
PLATE 21

APPENDIX A

POTABLE WATER WELL DATA

Page 1

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, fine; silt & pebbles	0	5
sand, medium grain	5	11
sand, medium grain	11	22
sand, medium; small pebbles	22	32
sand, medium; small pebbles	32	42
sand, medium; small pebbles	42	52
sand, medium; small pebbles	52	62
sand, coarse;medium gravel & rock	62	67
limestone, chert bands; core	67	77
limestone, chert bands; core	77	88
limestone, chert bands; core	88	94
limestone, chert bands; core	94	100
Total Depth		100

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co
DATE DRILLED January 1, 1941 **NO.** 27
ELEVATION 418CO **COUNTY NO.** 00561
LOCATION 460'N line, 20'W line of NW SE
LATITUDE 39.82506 **LONGITUDE** -90.567886
COUNTY Morgan **API** 121370056100 21 - 16N - 13W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
fine sand	0	25
medium sand fine gravel	25	40
fine sand	40	48
fine coarse sand & gravel	48	52
fine medium sand	52	65
fine pink sand,	65	81
coarse sand, gravel & small boulders	81	105
Total Depth		105

Static level 38' below casing top which is 0' above GL
Pumping level 40' when pumping at 503 gpm for 8 hours

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Central Ill.Public Service
DATE DRILLED December 1, 1960 **NO.** 4
ELEVATION 460GL **COUNTY NO.** 20656
LOCATION 2003'S line, 577'E line of section
LATITUDE 39.824389 **LONGITUDE** -90.565516
COUNTY Morgan **API** 121372065600 **21 - 16N - 13W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	3
sand, brown, medium grain	3	6
sand, brown, fine grain	6	10
sand, brown, coarse grain	10	15
sand, coarse; fine gravel	15	20
sand, brown, medium grain	20	30
sand, medium, small pebbles	30	40
sand, brown, medium grain	40	50
sand, brown, fine grain	50	60
sand, coarse; medium gravel	60	70
sand, brown, fine grain	70	80
sand, coarse; coarse gravel	80	83
limestone, 2 1/8" core	83	86
limestone, 2 1/8" core	86	91
limestone, crystallized bands, very hard	91	96
limestone, 2 1/8" core	96	100
Total Depth		100
Driller's Log filed		
Owner Address: ,		
Location source: Location from the driller		

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co
DATE DRILLED January 1, 1941 **NO.** 21
ELEVATION 433CO **COUNTY NO.** 00555
LOCATION 530'N 315'E SW/c NE SE
LATITUDE 39.824039 **LONGITUDE** -90.564817
COUNTY Morgan **API** 121370055500 **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, medium, light brown	0	3
sand, medium, clay content	3	6
sand, brown, medium grain	6	10
sand, medium, slight clay content	10	15
sand, brown, fine grain	15	20
sand, brown, fine grain	20	30
sand, coarse; fine gravel	30	40
sand, brown, fine grain	40	50
sand, coarse; fine gravel	50	60
sand, coarse; small gravel	60	70
sand, coarse; coarse gravel	70	80
sand, fine	80	90
sand, fine	90	98
boulders, small	98	99
sand, coarse; small gravel	99	100
Total Depth		**100**

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 NO. 20

ELEVATION 450CO COUNTY NO. 00554

LOCATION 485'N 350'E SW/c NE SE

LATITUDE 39.823913 LONGITUDE -90.564729

COUNTY Morgan API 121370055400 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
d, silty, brown	0	3
nd, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	30
sand, brown, medium grain	30	40
sand, brown, coarse grain, medium gravel	40	50
sand, coarse, small gravel	50	60
gravel, medium	60	70
gravel, medium	70	80
gravel, medium;sand, medium brown	80	90
medium gravel & sand, traces of lignite	90	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 11

ELEVATION 456CO **COUNTY NO.** 00545

LOCATION 420'N 405'E SW/c NE SE

LATITUDE 39.823732 **LONGITUDE** -90.564583

COUNTY Morgan **API** 121370054500 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, brown, medium grain	0	5
sand, brown, medium grain	5	7
sand, coarse; fine gravel	7	11
sand, coarse; fine gravel	11	16
sand, medium grain	16	26
sand, medium; medium gravel	26	36
sand, medium; medium gravel	36	46
sand, fine grain	46	56
sand, fine grain	56	66
sand, medium grain	66	76
sand, coarse; medium gravel	76	82
limestone	82	88
limestone	88	91
limestone, interbedded with flint	91	98
limestone	98	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 22

ELEVATION 434CO **COUNTY NO.** 00556

LOCATION 445'N 230'E SW/c NE SE

LATITUDE 39.823809 **LONGITUDE** -90.565185

COUNTY Morgan **API** 121370055600 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, fine grain	0	3
sand, fine grain	3	6
sand, fine grain	6	10
sand, fine grain	10	15
sand, fine grain	15	25
sand, medium, clay content	25	35
sand, coarse, small pebbles	35	45
sand, coarse, small pebbles	45	55
sand, fine grain	55	65
sand, fine grain	65	75
sand, medium grain	75	85
sand, coarse; fine gravel	85	92
sand, coarse; medium gravel (rock)	92	94
limestone (core)	94	100
Total Depth		100

Driller's Log filed
Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co.
DATE DRILLED January 1, 1941 **NO.** 19
ELEVATION 444CO **COUNTY NO.** 00553
LOCATION 400'N 270'E SW/c NE SE
LATITUDE 39.823683 **LONGITUDE** -90.56508
COUNTY Morgan **API** 121370055300 **21 - 16N - 13W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	30
sand, brown, medium grain	30	40
sand, coarse grain, small gravel	40	50
sand, coarse, grain, medium gravel	50	60
sand, coarse grain, small gravel	60	70
sand, coarse grain, small gravel	70	80
sand, coarse, grain, med gvl, tr lignite	80	90
sand, coarse grain, medium gravel	90	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 12

ELEVATION 457CO **COUNTY NO.** 00546

LOCATION 370'N 360'E SW/c NE SE

LATITUDE 39.823598 **LONGITUDE** -90.564781

COUNTY **Morgan** **API** **121370054600** **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
ilty sand	0	15
arse sand & gravel	15	30
medium sand & gravel	30	50
gravel, coarse sand	50	60
fine sand	60	67
sand & gravel	67	80
fine sand	80	85
gravel	85	106
rock at	106	106
Total Depth		106

Casing: 12" from -2' to 81'
20" from 0' to 30'

Water from sand & gravel at 0' to 0'.
Static level 27' below casing top which is 2' above GL
Pumping level 33' when pumping at 503 gpm for 24 hours

Driller's Log filed

Owner Address: ,
Location source: Location from permit

Permit Date: **Permit #:**

COMPANY owner
FARM CIPS Meredosia Unit 4
DATE DRILLED May 1, 1974 **NO.** 5
ELEVATION 455TM **COUNTY NO.** 20658
LOCATION 1700'S line, 300'E line of SE
LATITUDE 39.823541 **LONGITUDE** -90.564662
COUNTY **Morgan** **API 121372065800** **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, fine grain	0	3
sand, fine grain	3	6
sand, medium grain	6	10
sand, medium grain	10	15
sand, medium; fine gravel	15	25
sand, coarse; medium gravel	25	35
sand, fine grain	35	45
sand, fine grain	45	55
sand, medium; small gravel	55	65
sand, coarse; small gravel	65	75
sand, coarse; medium gravel	75	82
limestone	82	85
limestone	85	95
limestone	95	100
Total Depth		100

Driller's Log filed
Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co
DATE DRILLED January 1, 1941 **NO.** 23
ELEVATION 432CO **COUNTY NO.** 00557
LOCATION 380'N 160'E SW/c NE SE
LATITUDE 39.823633 **LONGITUDE** -90.565487
COUNTY Morgan **API** 121370055700 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, fine; little clay	0	3
sand, fine grain	3	6
sand, medium grain	6	10
sand, medium grain	10	15
sand, coarse; fine gravel	15	25
sand, coarse; fine gravel	25	35
sand, medium, small pebbles	35	45
sand, coarse; fine gravel	45	55
sand, fine grain	55	65
sand, fine grain	65	75
sand, medium, small pebbles	75	85
sand, coarse; coarse gravel	85	93
limestone core	93	97
limestone, chert bands, core	97	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co.

DATE DRILLED January 1, 1941 **NO.** 18

ELEVATION 443CO **COUNTY NO.** 00552

LOCATION 335'N 200'E SW/c NE SE

LATITUDE 39.823507 **LONGITUDE** -90.565381

COUNTY Morgan **API** 121370055200 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
fine to medium sand	0	24
medium sand & fine gravel	24	55
fine sand	55	68
sand & gravel	68	73
medium sand, gravel & boulders	73	78
total depth	78	109
Total Depth		109

Casing: 30" from 0' to 30'
10" from 4' to 84'

Pumping level 3' when pumping at 165 gpm for 1 hour

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Central Ill.Public Ser.
DATE DRILLED November 21, 1957 **NO.** 3
ELEVATION 460GL **COUNTY NO.** 20657
LOCATION 1643'S line, 473'E line of section
LATITUDE 39.823391 **LONGITUDE** -90.565304
COUNTY Morgan **API** 121372065700 21 - 16N - 13W

Page 1

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
nd, medium grain	0	3
d, brown, medium grain	3	10
sand, brown, medium grain	10	15
sand, medium grain, clay content	15	17
sand, brown, medium grain	17	20
sand, brown, medium grain	20	30
sand, coarse; small gravel	30	40
sand, coarse; small gravel	40	50
sand, coarse; medium gravel	50	60
sand, coarse; medium gravel	60	70
sand, medium grain	70	80
sand, medium grain	80	90
sand, medium grain; medium gravel	90	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co.

DATE DRILLED January 1, 1941 **NO.** 13

ELEVATION 456CO **COUNTY NO.** 00547

LOCATION 305'N 295'E SW/c NE SE

LATITUDE 39.823421 **LONGITUDE** -90.565065

COUNTY Morgan **API** 121370054700 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, silty, brown	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	25
Total Depth		**25**

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 **NO.** 10
ELEVATION 456CO **COUNTY NO.** 00544
LOCATION 255'N 350'E SW/c NE SE
LATITUDE 39.823282 **LONGITUDE** -90.564909
COUNTY Morgan **API** 121370054400 21 - 16N - 13W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
nd, silty, medium grain	0	1
sand, brown, medium grain	1	7
sand, brown, medium grain	7	10
sand, brown, slight clay content	10	13
sand, brown, slight clay content	13	19
sand, dark brown, medium grain	19	25
Total Depth		25
Driller's Log filed		

Permit Date: **Permit #:**

COMPANY C.I.P.S.
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 **NO.** 1
ELEVATION 454CO **COUNTY NO.** 00535
LOCATION 190'N 410'E SW/c NE SE
LATITUDE 39.823098 **LONGITUDE** -90.564749
COUNTY Morgan **API** 121370053500 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, medium grain	0	3
sand, medium grain	3	6
sand, medium grain	6	10
sand, medium grain	10	15
sand, fine grain	15	25
sand, medium; fine gravel	25	35
sand, fine grain	35	45
sand, fine grain	45	50
Total Depth		50

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 26

ELEVATION 423CO **COUNTY NO.** 00560

LOCATION 395'N 45'E SW/c NE SE

LATITUDE 39.823679 **LONGITUDE** -90.565885

COUNTY Morgan **API** 121370056000 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	30
sand, medium grain; small gravel	30	40
sand, medium grain; small gravel	40	50
sand, medium grain; small gravel	50	60
sand, medium grain; medium gravel	60	70
sand, medium grain; small gravel	70	80
sand, medium grain; small gravel	80	90
sand, medium grain; small gravel	90	100
Total Depth		**100**

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co.

DATE DRILLED January 1, 1941 **NO.** 14

ELEVATION 456CO **COUNTY NO.** 00548

LOCATION 240'N 230'E SW/c NE SE

LATITUDE 39.823245 **LONGITUDE** -90.565349

COUNTY Morgan **API** 121370054800 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, silty, brown	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain, small gravel	20	25
Total Depth		25

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 9

ELEVATION 456CO **COUNTY NO.** 00543

LOCATION 215'N 310'E SW/c NE SE

LATITUDE 39.823173 **LONGITUDE** -90.565083

COUNTY Morgan **API** 121370054300 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
nd, silty	0	2
and, brown, medium grain	2	5
sand, brown, medium grain	5	10
sand, brown, medium grain	10	14
sand,brown,medium grain,slight clay	14	15
sand, brown, medium grain	15	20
sand, brown, medium grain	20	25
Total Depth		25

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 2

ELEVATION 454CO **COUNTY NO.** 00536

LOCATION 150'N 370'E SW/c NE SE

LATITUDE 39.822992 **LONGITUDE** -90.564922

COUNTY Morgan **API** 121370053600 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, fine grain	0	3
sand, medium grain	3	6
sand, fine grain	6	10
sand, fine grain	10	15
sand, medium, small pebbles	15	25
sand, fine grain	25	35
sand, medium grain	35	45
sand, fine grain	45	55
sand, fine grain	55	65
sand, coarse; fine gravel	65	75
sand, coarse; medium gravel	75	81
limestone core	81	86
limestone with chert bands	86	89
limestone	89	91
limestone	91	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 24

ELEVATION 431CO **COUNTY NO.** 00558

LOCATION 310'N 95'E SW/c NE SE

LATITUDE 39.823442 **LONGITUDE** -90.565774

COUNTY Morgan **API** 121370055800 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, medium grain	0	3
sand, medium grain	3	10
sand, medium grain	10	20
sand, medium grain; small gravel	20	30
sand, medium grain	30	40
sand, coarse; large gravel	40	50
sand, coarse; large gravel	50	56
sand, fine	56	60
sand, fine; small gravel	60	70
sand, fine; small gravel	70	80
sand, coarse; coarse gravel	80	90
gravel, medium, clay content	90	95
limestone	95	96
limestone	96	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co.

DATE DRILLED January 1, 1941 **NO.** 17

ELEVATION 446CO **COUNTY NO.** 00551

LOCATION 270'N 135'E SW/c NE SE

LATITUDE 39.82333 **LONGITUDE** -90.565661

COUNTY Morgan **API** 121370055100 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, brown, medium grain	0	2
sand, brown, medium grain	2	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	25
Total Depth		25

Driller's Log filed
Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 **NO.** 8
ELEVATION 457CO **COUNTY NO.** 00542
LOCATION 175'N 270'E SW/c NE SE
LATITUDE 39.823063 **LONGITUDE** -90.565256
COUNTY Morgan **API** 121370054200 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, silty	0	3
sand, brown, medium grain	3	5
sand, brown, medium grain	5	10
sand, brown, medium grain	10	20
sand, brown, traces of fine gravel	20	25
Total Depth		25

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 **NO.** 3
ELEVATION 454CO **COUNTY NO.** 00537
LOCATION 105'N 330'E SW/c NE SE
LATITUDE 39.822869 **LONGITUDE** -90.5651
COUNTY Morgan **API** 121370053700 **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, brown	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	30
sand, medium grain; small gravel	30	40
sand, medium grain; small gravel	40	50
sand; small gravel	50	60
sand; coarse gravel	60	70
sand, fine grain; traces small gravel	70	80
sand, fine grain	80	90
sand, coarse	90	100
Total Depth		100

Driller's Log filed
Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co.
DATE DRILLED January 1, 1941 **NO.** 15
ELEVATION 454CO **COUNTY NO.** 00549
LOCATION 175'N 160'E SW/c NE SE
LATITUDE 39.823068 **LONGITUDE** -90.565647
COUNTY Morgan **API** 121370054900 21 - 16N - 13W

Page 1

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	3
sand, brown, medium grain	3	10
sand, brown, medium grain	10	20
sand, brown, medium grain	20	30
sand, medium coarse grain, small gravel	30	40
sand, medium coarse grain, small gravel	40	50
Total Depth		50

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 7

ELEVATION 456CO **COUNTY NO.** 00541

LOCATION 130'N 230'E SW/c NE SE

LATITUDE 39.822943 **LONGITUDE** -90.565434

COUNTY Morgan **API** 121370054100 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, silty,brown	0	1
sand, brown, medium grain	1	5
sand, brown, medium grain	5	10
sand,brown,medium grain,slight clay	10	10
sand, brown, medium grain	10	28
sand, medium gravel	28	30
sand, medium gravel, water showing	30	40
sand, medium gravel, water showing	40	50
Total Depth		50

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 NO. 4
ELEVATION 454CO COUNTY NO. 00538
LOCATION 65'N 290'E SW/c NE SE
LATITUDE 39.82276 LONGITUDE -90.565273
COUNTY Morgan API 121370053800 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	5
sand, brown, medium grain	5	10
sand, brown, medium grain	10	20
sand, light brown, medium grain	20	30
no record	30	31
sand, coarse; medium gravel	31	35
sand, coarse; medium gravel	35	40
sand, fine grain	40	50
sand, fine grain	50	60
gravel, small, pea size	60	70
sand, coarse; small gravel	70	80
sand, coarse; small gravel	80	86
limestone	86	92
limestone	92	95
limestone	95	100
Total Depth		**100**

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 25

ELEVATION 436CO **COUNTY NO.** 00559

LOCATION 245'N 25'E SW/c NE SE

LATITUDE 39.823266 **LONGITUDE** -90.566072

COUNTY Morgan **API** 121370055900 **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, brown, medium grain	0	4
clay, sandy	4	5
sand, brown, medium grain	5	10
sand, brown, medium grain	10	20
sand, medium; medium gravel	20	30
sand, medium; medium gravel	30	40
sand, coarse; medium gravel	40	50
sand, fine; coarse gravel	50	60
sand, fine	60	70
sand; medium gravel	70	80
sand, coarse; small gravel	80	90
sand, coarse; small gravel	90	93
sand, coarse; small gravel	93	95
limestone	95	96
limestone	96	100
Total Depth		100

Driller's Log filed
Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co.
DATE DRILLED January 1, 1941 **NO.** 16
ELEVATION 446CO **COUNTY NO.** 00550
LOCATION 190'N 80'E SW/c NE SE
LATITUDE 39.823113 **LONGITUDE** -90.565919
COUNTY Morgan **API** 121370055000 **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
nd, silty, brown	0	2
nd, brown, medium grain	2	10
sand, brown, medium grain	10	20
sand, brown, medium coarse grain	20	30
sand, brown, small gravel	30	40
sand, medium coarse, medium gravel	40	50
Total Depth		50

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service

DATE DRILLED January 1, 1941 **NO.** 6

ELEVATION 454CO **COUNTY NO.** 00540

LOCATION 85'N 190'E SW/c NE SE

LATITUDE 39.82282 **LONGITUDE** -90.565614

COUNTY Morgan **API** 121370054000 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand, silty, brown	0	3
sand, brown, medium grain	3	5
sand, brown, medium grain	5	10
sand, brown, slight clay content	10	15
sand, brown, medium grain	15	20
sand, brown, medium grain	20	29
sand, medium gravel, water showing	29	30
sand, medium grain, medium gravel	30	40
sand, medium grain, medium gravel	40	50
Total Depth		50

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service
DATE DRILLED January 1, 1941 **NO.** 5
ELEVATION 454CO **COUNTY NO.** 00539
LOCATION 25'N 250'E SW/c NE SE
LATITUDE 39.822653 **LONGITUDE** -90.565447
COUNTY Morgan **API** 121370053900 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
d, medium; silt & pebbles	0	5
and, medium; fine gravel	5	14
sand, medium; fine gravel	14	24
sand, fine grain	24	34
sand, fine grain	34	44
sand, fine grain	44	54
sand, coarse; small pebbles	54	64
sand, coarse; medium gravel	64	67
limestone (broken), core	67	77
limestone (broken), core	77	87
limestone (broken), core	87	100
Total Depth		100
Driller's Log filed Owner Address: , Location source: Location from the driller		

Permit Date: **Permit #:**

COMPANY owner
FARM Cen. Ill. Pub. Service Co
DATE DRILLED January 1, 1941 **NO.** 28
ELEVATION 417CO **COUNTY NO.** 00562
LOCATION 290'N 180'W SE/c NW SE
LATITUDE 39.823398 **LONGITUDE** -90.566769
COUNTY Morgan **API** 121370056200 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
silt, sandy, dark brown	0	3
silt, sandy, dark brown	3	6
sand, medium & silt	6	10
sand, fine, light brown	10	15
sand, medium; fine gravel	15	20
sand, coarse; coarse gravel	20	30
sand, fine; small stones	30	40
sand, fine	40	50
Total Depth		50

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 29

ELEVATION 429CO **COUNTY NO.** 00563

LOCATION 200'N 95'W SE/c NW SE

LATITUDE 39.823148 **LONGITUDE** -90.566536

COUNTY Morgan **API** 121370056300 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
[illegible]d, brown, slight clay content	0	3
[illegible]nd, brown, medium grain	3	10
sand, brown, medium grain	10	19
sand, course; medium gravel	19	20
sand, course; medium gravel	20	30
sand, coarse; small gravel	30	40
sand, coarse; medium gravel	40	50
sand, fine	50	60
sand, coarse	60	70
sand, coarse	70	80
sand, coarse	80	89
sand, coarse;small gvl w/tr of lignite	89	90
limestone	90	96
limestone	96	100
Total Depth		100

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 30

ELEVATION 442CO **COUNTY NO.** 00564

LOCATION 115'N 5'W SE/c NW SE

LATITUDE 39.822911 **LONGITUDE** -90.566281

COUNTY Morgan **API** 121370056400 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand fill	0	20
clay	20	30
coarse sand & gravel	30	104
rock at	104	104
Total Depth		**104**

Casing: 30" STEEL .312 from 0' to 30'
12" STEEL .375 from 0' to 79'

Screen: 25' of 12" diameter 6 slot

Size hole below casing: 38"

Water from alluvial at 30' to 102'.
Static level 25' below casing top which is 2' above GL

Driller's Log filed

Owner Address: Meredosia, IL

Location source: Platbook verified

Permit Date: September 8, 1977 **Permit #:** 66466

COMPANY Ruester, John T.

FARM Central Ill. Public Ser.Co.

DATE DRILLED April 25, 1978 **NO.** 6

ELEVATION 448GL **COUNTY NO.** 20758

LOCATION 100'S line, 50'W line of SW NE SE

LATITUDE 39.822865 **LONGITUDE** -90.566098

COUNTY **Morgan** **API** **121372075800** **21 - 16N - 13W**

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand, brown, medium grain	0	8
sand, medium, clay content	8	10
sand, brown, medium grain	10	15
sand, brown, medium grain	15	20
sand, brown, medium grain	20	30
sand & medium gravel	30	35
sand, coarse; medium gravel	35	40
sand, coarse; medium gravel	40	45
sand, coarse; fine gravel	45	50
Total Depth		50

Driller's Log filed

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM Cen. Ill. Pub. Service Co

DATE DRILLED January 1, 1941 **NO.** 31

ELEVATION 454CO **COUNTY NO.** 00565

LOCATION 40'N 70'E SW/c NE SE

LATITUDE 39.8227 **LONGITUDE** -90.566074

COUNTY Morgan **API** 121370056500 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
fine brown sand	0	30
coarse sand	30	50
medium sand	50	70
fine to medium sand	70	90
sand & gravel	90	105
rock at	105	105
Total Depth		105

Casing: 12" from -1' to 79'
30" from 0' to 31'

Water from sand & gravel at 0' to 0'.
Static level 32' below casing top which is 0' above GL
Pumping level 39' when pumping at 517 gpm for 22 hours

Driller's Log filed
Sample set # 58921 (0' - 103') Received: December 8, 1973

Owner Address: ,
Location source: Location from permit

Permit Date: **Permit #:**

COMPANY owner
FARM CIPS Meredosia Power Sta unit 4,#
DATE DRILLED August 30, 1973 **NO.** 5
ELEVATION 445TM **COUNTY NO.** 00639
LOCATION 1300'S line, 500'E line of SE
LATITUDE 39.822448 **LONGITUDE** -90.565551
COUNTY Morgan **API** 121370063900 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
crushed stone	0	1
silty sand	1	5
fine sand	5	20
fine to medium sand	20	25
fine to coarse sand	25	35
coarse sand	35	40
med. to coarse sand w/gravel	40	45
fine to medium sand	45	50
fine to coarse sand	50	70
fine to coarse sand w/gravel	70	75
silty, fine to medium sand	75	85
fine to coarse sand	85	95
medium to coarse sand	95	101
fine to coarse sand w/boulders	101	104
Total Depth		**104**

Sample set # 67974 (5' - 103') Received: July 1, 1994

Owner Address: Meredosia, IL
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Brotcke, Paul
FARM CIPS Power Station
DATE DRILLED June 21, 1994 **NO.** 7
ELEVATION 0 **COUNTY NO.** 21579
LOCATION SE NE SE
LATITUDE 39.823501 **LONGITUDE** -90.564221
COUNTY **Morgan** **API** **121372157900** **21 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Noncommunity - Public Water Well	Top	Bottom
fine-medium sand	0	24
medium sand & fine gravel	24	55
fine sand	55	68
sand & gravel	68	73
medium sand, gravel & boulders	73	78
Total Depth		78
Pumping level 0' when pumping at 165 gpm for 1 hour		

Permit Date: **Permit #:**

COMPANY
FARM CIPS
DATE DRILLED November 21, 1957 **NO.** 3
ELEVATION 460 **COUNTY NO.** 21982
LOCATION NW NE SE
LATITUDE 39.825368 **LONGITUDE** -90.564994
COUNTY Morgan **API** 121372198200 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Noncommunity - Public Water Well	Top	Bottom
[illegible]ne sand	0	25
[illegible]dium sand-fine gravel	25	40
fine sand	40	48
fine-coarse sand & gravel	48	52
fine-medium sand	52	65
fine pink sand	65	81
coarse sand, gravel & small boulders	81	105
Total Depth		105

Static level 38' below casing top which is 0' above GL
Pumping level 40' when pumping at 503 gpm for 8 hours

Permit Date: **Permit #:**

COMPANY
FARM CIPS
DATE DRILLED December 1, 1960 **NO.** 4
ELEVATION 460 **COUNTY NO.** 21981
LOCATION NE NE SE
LATITUDE 39.825356 **LONGITUDE** -90.563863
COUNTY Morgan **API** 121372198100 21 - 16N - 13W

 ILLINOIS STATE GEOLOGICAL SURVEY

Noncommunity - Public Water Well	Top	Bottom
fill sand	0	20
fine sand	20	40
medium sand	40	85
medium sand with gravel	85	104
rock at	104	104
Total Depth		104

Casing: 36" STEEL 166.35#/FT from -2' to 30'
16" STEEL 62.58#/FT from -2' to 79'

Screen: 25' of 16" diameter .05 slot

Grout: NEAT from 0 to 30.

Water from sand & gravel at 32' to 104'.
Static level 32' below casing top which is 2' above GL
Permanent pump installed at 75'
on July 11, 1994, with a capacity of 600 gpm

Owner Address: 800 S. Washington St. Meredosia, IL
Location source: Location from permit

Permit Date: June 9, 1994 **Permit #:**

COMPANY Brotcke Engineering
FARM Central IL Public Service C
DATE DRILLED June 21, 1994 NO. 7
ELEVATION 0 COUNTY NO. 21613
LOCATION SE NE SE
LATITUDE 39.823501 LONGITUDE -90.564221
COUNTY Morgan API 121372161300 21 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Noncommunity - Public Water Well	Top	Bottom
fill sand	0	20
fine sand	20	40
medium sand	40	85
medium sand w/ gravel	85	104
rock @	104	104
Total Depth		104

Casing: 36" STEEL from -2' to 30'
16" STEEL from -2' to 79'

Grout: NEAT from 0 to 30.

Water from sand & gravel at 32' to 104'.
Static level 32' below casing top which is 2' above GL
Permanent pump installed at 75'
on July 11, 1994, with a capacity of 600 gpm
Remarks: IEPA well #13700182

Owner Address: ,
Address of well: 800 Washington
Meredosia, IL
Location source: Location from the driller

Permit Date: June 9, 1994 **Permit #:**

COMPANY Brotcke Engineering
FARM CIPS
DATE DRILLED June 21, 1994 **NO.** 7
ELEVATION 0 **COUNTY NO.** 21980
LOCATION SE NE SE
LATITUDE 39.823501 **LONGITUDE** -90.564221
COUNTY Morgan **API** 121372198000 21 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand	0	40
medium to fine sand	40	70
sand & gravel	70	94
gravel & boulders	94	98
Total Depth		98

Casing: 12" STEEL CASING from 0' to 78'

Static level 25' below casing top which is 0' above GL

Pumping level 34' when pumping at 600 gpm for 15 hours

Owner Address: ,

Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner

FARM National Starch & Chem. Co

DATE DRILLED July 7, 1964 NO. 4

ELEVATION 435GL COUNTY NO. 20802

LOCATION 1669'N line, 1850'E line of NE

LATITUDE 39.814322 LONGITUDE -90.570968

COUNTY Morgan API 121372080200 28 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
s #31677	0	0
nd	0	20
sand & gravel	20	60
coarse sand & gravel	60	92
Total Depth		92

Casing: 12" ID from -2' to 72'
Water from at 70' to 90'.
Static level 25' below casing top which is 0' above GL
Pumping level 0' when pumping at 500 gpm for 0 hours

Remarks: see file for detail sample study
Driller's Log filed
Sample set # 31677 (0' - 92') Received: October 21, 1958

Owner Address: ,
Location source: Location from permit

Permit Date: September 9, 1958 **Permit #:**

COMPANY owner
FARM National Starch Prod.
DATE DRILLED October 1, 1958 **NO.** 2
ELEVATION 442GL **COUNTY NO.** 00147
LOCATION 310'N line, 1200'E line of NE
LATITUDE 39.818045 **LONGITUDE** -90.568641
COUNTY Morgan **API** 121370014700 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand	0	45
sand & gravel	45	90
Total Depth		90

Casing: 16" STEEL 3/8 WALL from -2' to 65'
Screen: 25' of 16" diameter .8 slot
Water from drift at 65' to 90'.

Owner Address: P.O. Box 197 Meredosia, IL
Location source: Location from permit

Permit Date: October 13, 1978 **Permit #:** 80737

COMPANY owner
FARM National Starch
DATE DRILLED October 24, 1978 **NO.** 11
ELEVATION 0 **COUNTY NO.** 20760
LOCATION 1408'N line, 855'E line of NE
LATITUDE 39.815 **LONGITUDE** -90.567407
COUNTY Morgan **API** 121372076000 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
sand	0	40
medium to fine sand	40	70
sand & gravel	70	94
gravel & boulders	94	98
Total Depth		98

Casing: 12" STEEL CASING from 0' to 78'

Static level 25' below casing top which is 0' above GL
Pumping level 34' when pumping at 600 gpm for 15 hours

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM National Starch & Chem. Co
DATE DRILLED July 7, 1964 NO. 4
ELEVATION 435GL COUNTY NO. 20802
LOCATION 1669'N line, 1850'E line of NE
LATITUDE 39.814322 LONGITUDE -90.570968
COUNTY Morgan API 121372080200 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Semi-Private Water Well	Top	Bottom
top soil	0	2
fine sand	2	17
medium-coarse sand	17	40
medium-coarse gravel	40	62
coarse sand at	62	62
Total Depth		62

Casing: 5" SS SCREEN from 0' to 4'
5" PLAIN CASING from 4' to 62'

Screen: 4' of 5" diameter .012 slot

Grout: BENTONITE from 4 to 25.

Permanent pump installed at 45'
on , with a capacity of 10 gpm

Owner Address: P.O. Box #500 Meredosia, IL

Address of well: Co. Rd. #1975N

Location source: Location from permit

Permit Date: July 16, 1993 **Permit #:**

COMPANY Dirks, Michael J.

FARM National Starch & Chemical Co.

DATE DRILLED July 26, 1993 NO.

ELEVATION 0 COUNTY NO. 21524

LOCATION NW SE NE

LATITUDE 39.814361 LONGITUDE -90.567035

COUNTY Morgan API 121372152400 28 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
Sand & gravel	0	89
Total Depth		89

Casing: 16" OD STEEL 3/8"WALL from 0' to 63'

Screen: 25' of 16" diameter .08 slot

Water from sand & gravel at 63' to 88'.

Static level 26' below casing top which is 2' above GL

Pumping level 33' when pumping at 600 gpm for 8 hours

Owner Address: Merdosia, IL

Location source: Location from permit

Permit Date: October 16, 1977 **Permit #:** 61809

COMPANY Miller, J.P. Artesian Well Co.

FARM Natl. Starch & Chem.

DATE DRILLED June 21, 1977 **NO.** 6A

ELEVATION 0 **COUNTY NO.** 20759

LOCATION 1889'N line, 871'E line of NE

LATITUDE 39.813672 **LONGITUDE** -90.567465

COUNTY Morgan **API** 121372075900 **28 - 16N - 13W**

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand	0	40
medium to fine sand	40	70
sand & gravel	70	94
gravel & boulders	94	98
Total Depth		98

Casing: 12" STEEL CASING from 0' to 78'
Static level 25' below casing top which is 0' above GL
Pumping level 34' when pumping at 600 gpm for 15 hours

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM National Starch & Chem. Co
DATE DRILLED July 7, 1964 NO. 4
ELEVATION 435GL COUNTY NO. 20802
LOCATION 1669'N line, 1850'E line of NE
LATITUDE 39.814322 LONGITUDE -90.570968
COUNTY Morgan API 121372080200 28 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
[illegible]e sand, not clean	0	18
Fine sand, clean	18	60
Total Depth		60

Casing: 16" STEEL 3/8" WALL from 0' to 49'
8" STEEL 25# from 0' to 52'
Screen: 10' of 8" diameter 40 slot
Water from aluvium at 0' to 62'.
Static level 20' below casing top which is 2' above GL
Pumping level 25' when pumping at 120 gpm for 2 hours

Driller's Log filed
Owner Address: Meredosia, IL
Location source: Location from permit

Permit Date: January 1, 1971 **Permit #:** 10077

COMPANY Diehl Pump and Supply Co.
FARM National Starch
DATE DRILLED January 1, 1971 **NO.** 2A
ELEVATION 0 **COUNTY NO.** 00629
LOCATION 2154'N line, 1108'E line of NE
LATITUDE 39.812952 **LONGITUDE** -90.568313
COUNTY Morgan **API** 121370062900 28 - 16N - 13W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Test Hole	Top	Bottom
drift- sand & gravel	0	96
Total Depth		96
Casing: 16" STEEL 62.58 LB. from 0' to 70'		
Screen: 25' of 16" diameter .08 slot		
Water from drift at 50' to 96'.		
Static level 17' below casing top which is 0' above GL		
Pumping level 24' when pumping at 800 gpm for 8 hours		
Remarks: see file for detail sample study		
Driller's Log filed		
Sample set # 58824 (0' - 95') Received: September 19, 1973		
Owner Address: Meredosia, IL		
Location source: Location from permit		

Permit Date: May 1, 1973 **Permit #:** 18880

COMPANY Miller, J.P. Artesian Well Co.
FARM National Starch & Chemical
DATE DRILLED May 1, 1973 **NO.** 9
ELEVATION 0 **COUNTY NO.** 00638
LOCATION 2600'N line, 1400'E line of NE
LATITUDE 39.811734 **LONGITUDE** -90.569358
COUNTY Morgan **API** 121370063800 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
#55587	0	0
sandy brown clay	0	20
sandy gravel	20	92
Total Depth		92

Casing: 24" STEEL 3/8" WALL from 0' to 50'
12" STEEL 3/8" WALL from 0' to 62'
Screen: 30' of 12" diameter 50 slot
Water from drift at 0' to 92'.
Static level 26' below casing top which is 0' above GL

Remarks: see file for detail sample study
Driller's Log filed
Sample set # 55587 (0' - 93') Received: October 1, 1968

Owner Address: Meredosia, IL
Location source: Location from permit

Permit Date: January 1, 1968 **Permit #:** NF 4615

COMPANY Diehl Pump and Supply Co.
FARM National Starch
DATE DRILLED August 31, 1968 **NO.** 8
ELEVATION 0 **COUNTY NO.** 00422
LOCATION 2150'N line, 1400'E line of NE
LATITUDE 39.812976 **LONGITUDE** -90.569359
COUNTY Morgan **API** 121370042200 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Non Potable Water Well	Top	Bottom
brown silty sand	0	5
fine sand	5	18
medium to large sand w/1" gravel	18	83
sand w/medium to large gravel	83	85
gravel	85	86
Total Depth		86

Casing: 24" STEEL 94.62#/FT from -2' to 51'
Screen: 15' of 24" diameter 100 slot
Grout: CEMENT from 0 to 20.

Size hole below casing: 42"

Water from sand & gravel at 0' to 0'.
Static level 18' below casing top which is 2' above GL
Pumping level 33' when pumping at 1500 gpm for 8 hours

Permanent pump installed at 65'
on September 17, 1996, with a capacity of 1500 gpm

Owner Address: PO Box 500 Meredosia, IL
Address of well: S. Washington St.
Meredosia, IL
Add'l loc. info: FALSE
Process water only
Location source: Location from permit

Permit Date: August 28, 1996 **Permit #:** 137-046

COMPANY Stollhans, Jeff
FARM National Starch & Chem. Co
DATE DRILLED September 13, 1996 **NO.** 16
ELEVATION 0 **COUNTY NO.** 21769
LOCATION SW SW NE
LATITUDE 39.812578 **LONGITUDE** -90.570974
COUNTY Morgan **API** 121372176900 **28 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
#55586	0	0
sandy brown clay	0	24
fine sand & gravel	24	69
medium sand & small gravel	69	96
Total Depth		96

Casing: 8" STEEL 3/8" WALL from 0' to 96'
Screen: 16' of 8" diameter 25 slot
Water from drift at 0' to 96'.
Static level 26' below casing top which is 0' above GL

Driller's Log filed
Sample set # 55586 (0' - 97') Received: October 1, 1968

Owner Address: Meredosia, IL
Location source: Location from permit

Permit Date: January 1, 1968 **Permit #:** NF 4614

COMPANY Diehl Pump and Supply Co.
FARM National Starch
DATE DRILLED August 31, 1968 **NO.** 7
ELEVATION 0 **COUNTY NO.** 00421
LOCATION 0'N 0'E SW/c NW SE NE
LATITUDE 39.813492 **LONGITUDE** -90.569044
COUNTY Morgan **API** 121370042100 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
ss #57364	0	0
sandy top soil	0	18
fine sand	18	45
fine sand, small gravel	45	55
fine sand	55	65
fine sand, small gravel	65	93
very large boulders	93	95
rock at	95	95
Total Depth		95

Casing: 26" 3/8 WALL from 0' to 63'
12" 48 POUND from 0' to 68'
Screen: 25' of 12" diameter 40 slot
Water from glacial drift at 0' to 95'.
Static level 25' below casing top which is 2' above GL
Pumping level 34' when pumping at 1000 gpm for 6 hours

Remarks: see file for detail sample study
Driller's Log filed
Sample set # 57364 (2' - 93') Received: February 4, 1971

Owner Address: Meredosia, IL
Location source: Location from permit

Permit Date: June 24, 1970 **Permit #:** 10077

COMPANY Diehl Pump and Supply Co.
FARM National Starch
DATE DRILLED December 18, 1970 **NO.** 8
ELEVATION 0 **COUNTY NO.** 00628
LOCATION 1800'N line, 625'E line of NE
LATITUDE 39.813907 **LONGITUDE** -90.566585
COUNTY Morgan **API** 121370062800 28 - 16N - 13W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Test Hole	Top	Bottom
#54997	0	0
sandy clay	0	21
fine sand, very little gravel	21	60
sand & gravel	60	90
Total Depth		90

Casing: 18" CASING STEEL 3/8" from 0' to 60'
12" STEEL WALL from 0' to 67'

Screen: 25' of 10" diameter 35 slot

Size hole below casing: 18"

Water from glacial drift at 0' to 0'.
Static level 27' below casing top which is 0' above GL
Pumping level 47' when pumping at 780 gpm for 3 hours

Driller's Log filed
Sample set # 54997 (50' - 91.5') Received: December 14, 1967

Owner Address: Meredosia, IL
Location source: Location from permit

Permit Date: January 1, 1967 **Permit #:** 3350

COMPANY Diehl Pump and Supply Co.
FARM National Starch
DATE DRILLED February 1, 1968 **NO.** 6
ELEVATION 0 **COUNTY NO.** 00396
LOCATION 1800'N line, 900'E line of NE
LATITUDE 39.81392 **LONGITUDE** -90.567569
COUNTY Morgan **API** 121370039600 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
ss #60435	0	0
sand	0	40
sand & fine gravel	40	90
rock at	90	90
Total Depth		90

Casing: 16" from -2' to 65'
Screen: 25' of 16" diameter slot
Static level 25' below casing top which is 0' above GL
Pumping level 38' when pumping at 1075 gpm for 2 hours

Sample set # 60435 (0' - 90') Received: August 30, 1976

Owner Address: ,
Location source: Location from permit

Permit Date: January 20, 1976 **Permit #:** 44276

COMPANY owner
FARM National Starch & Chem.Co
DATE DRILLED February 17, 1976 **NO.** 10
ELEVATION 0 **COUNTY NO.** 20682
LOCATION 1403'N line, 332'E line of NE
LATITUDE 39.81499 **LONGITUDE** -90.565535
COUNTY Morgan **API** 121372068200 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Industrial Water Well	Top	Bottom
[illegible]e brown sand	0	40
Fine light brown sand	40	55
medium to coarse brown sand & gravel	55	90
Total Depth		91

Casing: 16" BLACK 375 from -2' to 64'

Screen: 25' of 16" diameter .08 slot

Grout: CEMENT from 0 to 20.

Water from sand & gravel at 64' to 91'.
Static level 28' below casing top which is 2' above GL
Pumping level 36' when pumping at 800 gpm for 6 hours

Permanent pump installed at 50'
on November 10, 1988, with a capacity of 800 gpm

Owner Address: South Washington St. Meredosia, IL
Location source: Location from permit

Permit Date: September 23, 1988 **Permit #:** 006133

COMPANY Peterson, Steven R.
FARM National Starch-Chemical Co.
DATE DRILLED October 11, 1988 **NO.**
ELEVATION 0 **COUNTY NO.** 21398
LOCATION NE NE NE
LATITUDE 39.817955 **LONGITUDE** -90.565139
COUNTY Morgan **API** 121372139800 28 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Industrial Water Well	Top	Bottom
SS #67434 (0'-80.5')	0	0
fine reddish brown sand	0	15
fine-med lt brown to reddish brown sand	15	25
fine-medium light brown sand	25	30
med lt brn sand, some cobbles in samples	30	45
medium light brown sand	45	50
med lt brown sand, lignite in sample	50	55
medium to fine light brown sand	55	60
medium light brown sand	60	80
medium to fine light brown sand	80	81
Total Depth		81

Casing: 8" CARBON STEEL 24.7# from -2' to 58'
Screen: 20' of 8" diameter 60 slot
Grout: CONCRETE from 0 to 20.

Size hole below casing: 34"

Water from at 24' to 81'.
Static level 24' below casing top which is 2' above GL
Pumping level 26' when pumping at 0 gpm for 1 hour
Permanent pump installed at 50'
on March 8, 1991, with a capacity of 80 gpm
Sample set # 67434 (0' - 80.5') Received: April 17, 1981

Owner Address: S. Washington Meredosia, IL
Location source: Location from the driller

Permit Date: January 15, 1991 **Permit #:** 13736

COMPANY Skouby, Marion
FARM National Starch
DATE DRILLED February 13, 1991 **NO.**
ELEVATION 0 **COUNTY NO.** 21647
LOCATION SW NE NE
LATITUDE 39.816167 **LONGITUDE** -90.56688
COUNTY Morgan **API** 121372164700 28 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
ss #20134	0	0
sand	0	30
sand, coarse	30	40
Total Depth		40

Casing: 8" from 0' to 0'
Screen: 10' of " diameter 16 slot

Driller's Log filed
Sample set # 20134 (0' - 40') Received: January 1, 1950

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Meredosia, Village of
DATE DRILLED April 1, 1950 **NO.** 1
ELEVATION 455GL **COUNTY NO.** 00514
LOCATION 900'N line, 3000'E line of section
LATITUDE 39.831189 **LONGITUDE** -90.5543
COUNTY Morgan **API** 121370051400 22 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Municipal Water Supply	Top	Bottom
no record	0	84
Total Depth		84
Casing: 8" CASING from 0' to 70' 8" SCREEN from 70' to 84'		
Screen: 14' of 8" diameter 25 slot		
Water from coarse sand at 69' to 84'.		
Owner Address: ,		
Address of well: 120' NNE of WTP		

Permit Date: **Permit #:**

COMPANY Elmer W. Franke/Calhoun Drlg.
FARM Meredosia, Village
DATE DRILLED September 1, 1973 **NO.** 3
ELEVATION 0 **COUNTY NO.** 21944
LOCATION SE NE NW
LATITUDE 39.830881 **LONGITUDE** -90.554188
COUNTY Montgomery **API** 121352194400 22 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
Total Depth		88

Permit Date: **Permit #:** 37760

COMPANY
FARM Meredosia Village
DATE DRILLED **NO.** 4
ELEVATION 0 **COUNTY NO.** 20971
LOCATION 805'N line, 2950'E line of NE
LATITUDE 39.83145 **LONGITUDE** -90.554082
COUNTY Morgan **API** 121372097100 22 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
ss #20135	0	0
s,lgt brn,f,rndd,well srtd,drty,noncalc	0	5
s,lgt brn,f,rndd,well srtd,few calc grns	5	10
s,f,rndd,well srtd,few calc grns,clean	10	25
sand,light brown,fine/med,clean,noncalc	25	30
s,lgt brn,f/med,clean,few calc grns	30	35
sand,lgt brn,f/vy crd,clean,mly calc	35	40
Pleistocene	5	40
Total Depth		**40**

Casing: 8" from 0' to 0'
Screen: 10' of " diameter 16 slot

Remarks: see logbook for detail sample study
Driller's Log filed
Survey Sample Study filed
Sample set # 20135 (0' - 40') Received: January 1, 1950

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM Meredosia, Village of
DATE DRILLED April 1, 1950 **NO.** 2
ELEVATION 0 **COUNTY NO.** 00515
LOCATION 725'S 10'W NE/c NW
LATITUDE 39.831665 **LONGITUDE** -90.552929
COUNTY Morgan **API 121370051500** **22 - 16N - 13W**

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Municipal Water Supply	Top	Bottom
no record	0	25
sand & gravel	25	92
Total Depth		92

Casing: 10" CASING from -1' to 72'
10" SCREEN from 72' to 92'
Screen: 20' of 10" diameter slot
Water from sand & gravel at 25' to 92'.
Static level 27' below casing top which is 1' above GL
Pumping level 32' when pumping at 300 gpm for 3 hours

Owner Address: ,
Address of well: 200' NNW of WTP

Permit Date: **Permit #:**

COMPANY Albrecht Well Drilling Inc
FARM Meredosia, Village
DATE DRILLED September 2, 1980 **NO.** 5
ELEVATION 0 **COUNTY NO.** 21945
LOCATION 612'S line, 2425'E line of section
LATITUDE 39.820473 **LONGITUDE** -90.553748
COUNTY Montgomery **API** 121352194500 22 - 16N - 13W

ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
railroad embankment ballast stone, cinders, & silty clay loam fill drilled 5' to seat augers	0	5
brown silty clay loam moist (v. stiff)	5	8
brown silty clay loam moist (hard)	8	10
dark brown & grey silty clay loam moist (v. stiff)	10	13
dark brown & grey silty clay moist (v. stiff)	13	18
grey clay v. moist (stiff)	18	20
grey & brown clay v. moist (medium)	20	23
grey & brown clay v. moist (stiff)	23	25
grey & brown clay v. moist (medium)	25	28
grey & brown silty clay loam v. moist (stiff)	28	30
grey silty clay v. moist (stiff)	30	33
grey silty clay v. moist (medium)	33	35
grey clay loam wet (soft)	35	38
grey silty clay loam v. moist (soft)	38	40
grey sand (coarse) w/medium pebble gravel wet (v. loose)	40	43
grey sand (coarse) w/some small gravel wet medium	43	45
brown sand (medium) w/some small gravel wet (medium)	45	50
brown sand (medium) wet (medium)	50	53
brown sand (medium-coarse) w/some small gravel wet (medium)	53	55
brown sand (medium-coarse) w/some small gravel wet (dense)	55	58

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation
FARM FAS 2585 P-96-056-85
DATE DRILLED June 9, 1986 **NO.** 1(NW.Abut)
ELEVATION 438GL **COUNTY NO.** 21245
LOCATION 0'S 0'W NE/c SW SE NW
LATITUDE 39.833731 **LONGITUDE** -90.582965
COUNTY Pike **API** 121492124500 1 - 3S - 2W

ILLINOIS STATE GEOLOGICAL SURVEY

[illegible]wn sand (coarse) w/some small gravel [illegible] (medium)	58	60
brown sand (coarse) w/some medium pebble gravel wet (dense)	60	65
brown sand (medium-coarse) w/some fine pebble gravel wet (dense	65	70
brown sand (medium-coarse) w/some gravel wet (dense)	70	71.5
Total Depth		**71**

IL Dept. of Transportation FAS 2585 P-96-056-8 1(NW.Abut)

COUNTY Pike **API 121492124500** **1 - 3S - 2W**

ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
brown-brown & grey silty clay loam moist (stiff)	0	7
grey & brown silty clay loam v. moist (medium)	7	9
grey silty clay wet (medium)	9	12
grey silty clay wet (soft)	12	14
grey silty clay wet (medium)	14	17
grey silty clay wet (soft)	17	22
grey clay loam wet (soft)	22	27
grey sand (fine-medium) w/some clay bonding wet (v. loose)	27	29
grey sand (medium-coarse) w/some medium pebble gravel wet (medium)	29	39
grey sand (fine-medium) wet (medium)	39	44
grey sand (medium-coarse) w/some fine pebble gravel wet (medium)	44	49
grey sand (medium-coarse) w/some medium pebble gravel wet (medium)	49	57
grey sand (medium-coarse) w/some medium pebble gravel wet (dense)	57	60.5
Total Depth		60

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation
FARM FAS 2585 Illinois Route 99
DATE DRILLED June 19, 1986 **NO.** 2(SE.Abut)
ELEVATION 427GL **COUNTY NO.** 21246
LOCATION SW SE NW
LATITUDE 39.832804 **LONGITUDE** -90.584075
COUNTY Pike **API** 121492124600 1 - 3S - 2W

ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
concrete pavement & subbase material	0	3
dark grey silty clay loam moist (soft)	3	7
dark grey silty clay loam moist (stiff)	7	12
grey & brown silty clay moist (stiff)	12	14
grey sand (fine) wet (v. loose)	14	19
grey sand (fine) wet (loose)	19	22
grey sand (fine) wet (medium)	22	27
grey sand (medium) wet (medium)	27	37
grey sand (medium-coarse) w/some gravel wet (dense)	37	42
grey sand (medium) wet (medium)	42	54
grey sand (medium-coarse) w/some fine pebble gravel wet (dense)	54	59
grey sand (medium-coarse) w/some fine pebble gravel wet (medium)	59	64
grey sand (medium-coarse) w/some fine pebble gravel wet (dense)	64	67
standard 50 tsf bearing achieved. augered and additional 10' to check for possible limestone bedrock	67	70
grey sand w/some gravel throughout wet (medium-dense) from elev.365.7 to 354.7	70	78
Total Depth		78

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation
FARM FAP 745 Il. Rte. 104
DATE DRILLED June 3, 1986 **NO.** 2(W.Abut)
ELEVATION 433GL **COUNTY NO.** 21248
LOCATION 2640'N line, 2640'W line of section
LATITUDE 39.831966 **LONGITUDE** -90.579769
COUNTY Pike **API** 121492124800 1 - 3S - 2W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
concrete pavement & subbase material	0	2
brown sand (medium) moist (loose) w/some shells @ 9.5 - 10.5'	2	10.5
grey clay moist (medium)	10.5	14
grey clay moist (stiff)	14	17
grey silty clay v. moist (medium)	17	19
grey sand (fine) wet (loose)	19	22
grey sand (fine) wet (v. loose)	22	24
grey sand (fine) wet (loose)	24	27
grey sand (fine) wet (medium)	27	29
grey sand (fine) wet (loose)	29	31
grey sand (medium) wet (medium)	31	37
grey sand (fine-medium) wet (medium)	37	44
grey fine pebble gravel wet (medium)	44	49
grey gravel (fine-medium pebble) wet (medium)	49	54
brown sand (coarse) w/some gravel wet (dense)	54	59
grey sand (fine) wet (dense)	59	63.5
grey sand (fine) wet (medium)	63.5	65.5
Total Depth		65

Permit Date: Permit #:

COMPANY IL Dept. of Transportation
FARM FAP 745 Ill. RTE. 104
DATE DRILLED June 2, 1986 NO. 1 (E.Abut)
ELEVATION 436GL COUNTY NO. 21247
LOCATION
LATITUDE 39.831875 LONGITUDE -90.579775
COUNTY Pike API 121492124700 1 - 3S - 2W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Test Hole	Top	Bottom
#56380	0	0
ne sand	0	20
fine sand, small gravel	20	45
fine sand, coarse gravel	45	55
fine sand, small gravel	55	71
medium sand, small gravel	71	85
medium sand, large gravel	85	90
Total Depth		90

Casing: 24" 3/8 WALL from 0' to 60'
12" 52 LB. from 0' to 64'

Screen: 26' of 12" diameter 60 slot

Water from sand & gravel at 0' to 90'.

Static level 14' below casing top which is 2' above GL

Pumping level 32' when pumping at 1000 gpm for 8 hours

Remarks: see file for detail sample study

Driller's Log filed

Sample set # 56380 (0' - 90') Received: August 26, 1969

Owner Address: Meredosia, IL

Location source: Location from permit

Permit Date: June 29, 1969 **Permit #:** 06700

COMPANY Lorenz D A

FARM W.R. Grace Co.

DATE DRILLED September 11, 1969 **NO.** DL-3

ELEVATION 0 **COUNTY NO.** 00607

LOCATION NE NE NE

LATITUDE 39.817955 **LONGITUDE** -90.565139

COUNTY Morgan **API** 121370060700 28 - 16N - 13W

Page 1 ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
sand	0	36
sand & gravel	36	67
fine to medium gravel	67	91
Total Depth		91

Casing: 16" STEEL .375 from 3' to 66'
Screen: 25' of 16" diameter .08 slot
Water from drift at 66' to 91'.
Static level 12' below casing top which is 0' above GL
Pumping level 22' when pumping at 1000 gpm for 8 hours

Owner Address: P.O. Box 153 Meredosia, IL
Location source: Location from permit

Permit Date: May 11, 1979 **Permit #:** 85480

COMPANY Hakala, Richard L.
FARM Grace, W.R. & Co.
DATE DRILLED May 15, 1979 **NO.** 4
ELEVATION 0 **COUNTY NO.** 20770
LOCATION 1980'N line, 450'W line of NW
LATITUDE 39.813373 **LONGITUDE** -90.562736
COUNTY Morgan **API** 121372077000 27 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Industrial Water Well	Top	Bottom
fine to medium sand	0	40
medium to coarse sand	40	50
medium sand	50	62
coarse sand to fine gravel	62	73
medium to coarse sand	73	78
fine to medium sand with gravel	78	85
coarse sand & fine to medium gravel	85	90
medium sand to fine gravel	90	91
coarse sand, gravel & boulders	91	95
Total Depth		95

Casing: 24" STEEL from -2' to 65'
24" STAINLESS STL SCREEN from 65' to 94'
Screen: 29' of 24" diameter .05 slot
Grout: NEAT CEMENT from 0 to 20.
Grout: BENTONITE CHIPS from 20 to 27.
Grout: SILICA #2 NORTHERN from 27 to 94.

Water from sand & gravel at 16' to 94'.
Static level 16' below casing top which is 2' above GL
Pumping level 40' when pumping at 2503 gpm for 20 hours
Permanent pump installed at 60'
on January 25, 2011, with a capacity of 1850 gpm
Remarks: driller's est. well yield 3000 gpm
Sample set # 69973 (0' - 95') Received: January 9, 2012
Owner Address: ,
Address of well: 1994 Old Grace Road
Location source: Location from permit

Permit Date: **Permit #:**

COMPANY Water Well Solutions
FARM T.A. Terminal
DATE DRILLED November 23, 2011 **NO.** 6
ELEVATION **COUNTY NO.** 22134
LOCATION NW NW SW
LATITUDE 39.81073 **LONGITUDE** -90.563186
COUNTY Morgan **API** 121372213400 27 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Industrial Water Well	Top	Bottom
fine to medium sand	0	40
medium to coarse sand	40	50
medium sand	50	62
coarse sand to fine gravel	62	73
medium to coarse sand	73	78
fine to medium sand with gravel	78	85
coarse sand & fine to medium gravel	85	90
medium sand to fine gravel	90	91
coarse sand, gravel & flat boulders	91	95
Total Depth		100

Casing: 24" STEEL from -2' to 65'
24" STAINLESS STL SCREEN from 65' to 94'
Screen: 29' of 24" diameter .05 slot
Grout: NEAT CEMENT from 0 to 20.
Grout: BENTONITE CHIPS from 20 to 27.
Grout: SILICA #3 NORTHERN from 27 to 94.

Water from sand & gravel at 20' to 94'.
Static level 20' below casing top which is 2' above GL
Pumping level 43' when pumping at 2485 gpm for 24 hours
Permanent pump installed at 60'
on January 19, 2011, with a capacity of 1850 gpm
Remarks: driller's est. well yield 3000 gpm
Sample set # 69972 (0' - 100') Received: January 9, 2012
Owner Address: ,
Address of well: 1994 Old Grace Road
Location source: Location from permit

Permit Date: **Permit #:**

COMPANY Water Well Solutions
FARM T.A. Terminal
DATE DRILLED November 23, 2011 **NO.** 5
ELEVATION **COUNTY NO.** 22133
LOCATION NW NW SW
LATITUDE 39.81073 **LONGITUDE** -90.563186
COUNTY Morgan **API** 121372213300 27 - 16N - 13W

Page 1 **ILLINOIS STATE GEOLOGICAL SURVEY**

Water Well	Top	Bottom
nd fine	0	30
nd coarse	30	50
coarse sand and gravel	50	60
gravel small to large	60	73
Total Depth		73

Casing: 10" STEEL from 0' to 61'
" 12' SCREEN from 0' to 73'
Screen: 12' of 9.5" diameter 50 slot
Water from sand gravel at 61' to 73'.
Static level 4' below casing top which is 3' above GL
Pumping level 15' when pumping at 300 gpm for 2 hours

Owner Address: Box 328 Jacksonville, IL
Location source: Platbook verified

Permit Date: December 11, 1975 **Permit #:** 43710

COMPANY Chadwick, G. W.
FARM Ill. Road Contractors Inc.
DATE DRILLED December 20, 1975 **NO.**
ELEVATION 0 **COUNTY NO.** 20621
LOCATION SE SE NE
LATITUDE 39.832804 **LONGITUDE** -90.571759
COUNTY Pike **API** 121492062100 1 - 3S - 2W

APPDENDIX B

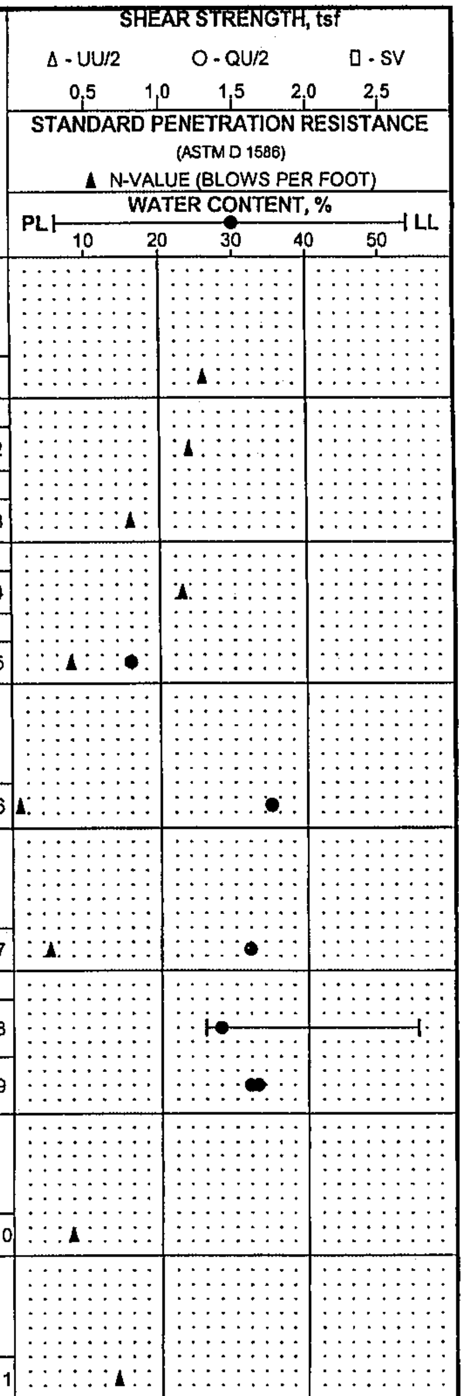
BORING LOGS

Surface Elevation: 449.0

Datum: msl

Completion Date: 10/21/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
	FILL: brown, fine to coarse sand, trace clay lenses	6-16-10	SS1
		3-11-13 -14	SS2
		5-7-9	SS3
		5-9-14	SS4
	FILL: black clay with sand	4-4-4	SS5
	Very soft, gray, interbedded SILT and CLAY with organics - ML/CL	0-0-1	SS6
	Medium stiff, gray CLAY - (CH)	2-2-3	SS7
		92	ST8
		87 89	ST9
	Loose, gray, clayey SAND with gravel - SP	1-4-4	SS10
	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP	5-7-7	SS11



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148760.916' E: 2182703.077'

Drawn by: KA	Checked by: [signature]	App'vd. by: [signature]
Date: 10/26/10	Date: 12/22/10	Date: 1/11/11

GEOTECHNOLOGY INC. FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-1

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 449.0 | Completion Date: 10/21/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ├──●──┤ LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*			
45			4-5-4	SS12
50			5-7-9	SS13
55			9-8-9	SS14
60			7-12-15	SS15
	Boring terminated at 60 feet			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148760.916' E: 2182703.077'

Drawn by: KA	Checked by: SK	App'vd. by: DM
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF LOG OF BORING: B-1

Project No. J017150.01

Surface Elevation: 449.2 Completion Date: 10/21/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586): ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL — LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
2	FILL: brown, fine to coarse sand with black clay lenses		
4		5-7-9	SS1
6.5		6-10-8	SS2
9		7-8-13	SS3
11.5		5-5-9	SS4
14		3-3-3	SS5
17	Black, clayey SAND, trace gravel - SP		
19			ST6
22	Medium stiff, gray CLAY - CH		
24		3-4-4	SS7
29		3-3-3	SS8
32	Soft, gray, clayey SILT with sand and clay lenses - ML		
34		2-1-1	SS9
37	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP		
39		0-2-4	SS10

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 13.6 FEET AFTER 16 HOURS ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Hole collpased at 46 feet. Datum: IL State Plane Coordinates, West Zone. N: 1148689.546' E: 2182613.025'

Drawn by: KA	Checked by: [illegible]	App'vd. by: [illegible]
Date: 10/26/10	Date: 12/[illegible]/10	Date: 1/4/11

GEOTECHNOLOGY INC — FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-2

Project No. J017150.01

Surface Elevation: 449.2 Datum msl	Completion Date: 10/21/10				SHEAR STRENGTH, tsf Δ - UU/2 O - QU/2 □ - SV 0.5 1.0 1.5 2.0 2.5 STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) WATER CONTENT, % PL LL 10 20 30 40 50
DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	
	Loose to medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*				
45			3-6-6	SS11	▲
	Boring terminated at 46 feet.				
50					
55					
60					
65					
70					
75					

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 13.6 FEET AFTER 16 HOURS ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Hole collpased at 46 feet. Datum: IL State Plane Coordinates, West Zone. N: 1148689.546' E: 2182613.025'

Drawn by: KA	Checked by: SK	App'vd. by: DN
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-2

Project No. J017150.01

Surface Elevation: 449.1 Completion Date: 10/21/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ● LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Crushed rock		
	FILL: brown sand with black clay lenses	4-6-8	SS1
		5-6-9	SS2
5			
			ST3
		8-10-16	SS4
10			
		8-13-15	SS5
		6-8-8	SS6
15	FILL: black clay with sand, trace gravel		
			SS7
	Soft to medium stiff, gray CLAY - CH	2-2-2	SS8
20	with organics		
		86	ST9
			ST10
25			
		1-2-3	SS11
30			
	Soft, brown, clayey SILT with sand - ML		
		1-2-1	SS12
35			
	Medium dense, brown, fine to coarse SAND, trace gravel - SP		
		5-5-7	SS13

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148536.604' E: 2182554.305'

Drawn by: KA	Checked by: SK	App'vd. by: DWY
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC. FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-3

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 449.1

Datum msl

Completion Date: 10/21/10

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

Δ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢ 10 20 30 40 50 ⊣ LL

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium dense, brown, fine to coarse SAND, trace gravel - SP *(continued)*			
45			6-7-7	SS14
50			6-7-9	SS15
55			5-8-9	SS16
60			8-8-13	SS17
60	Boring terminated at 60 feet.			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 15 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148536.604' E: 2182554.305'

Drawn by: KA	Checked by: [illegible]	App'vd. by: [illegible]
Date: 10/26/10	Date: 12/13/10	Date: 1/11/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF LOG OF BORING: B-3

Project No. J017150.01

Surface Elevation: 431.6 | Completion Date: 10/22/10

Datum msl

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL — LL (10, 20, 30, 40, 50)

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft to medium stiff, brown and gray CLAY - (CH)		
		1-2-2	SS1
		*	ST2
5		1-2-3	SS3
		0-2-2	SS4
12	Soft, gray, silty CLAY, trace sand - CL		
		0-1-1	SS5
17	Very soft, gray, sandy CLAY with silt - CL		
19	∇	0-0-0	SS6
22	Very loose, brown, fine to coarse SAND, trace gravel - SP		
		0-1-2	SS7
25	Boring terminated at 25 feet.		

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

ENCOUNTERED AT 19 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * Disturbed sample Datum: IL State Plane Coordinates, West Zone. N: 1148688.82' E: 2182505.605'

Drawn by: KA	Checked by: SLC	App'vd. by: DM
Date: 10/26/10	Date: 12/1/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

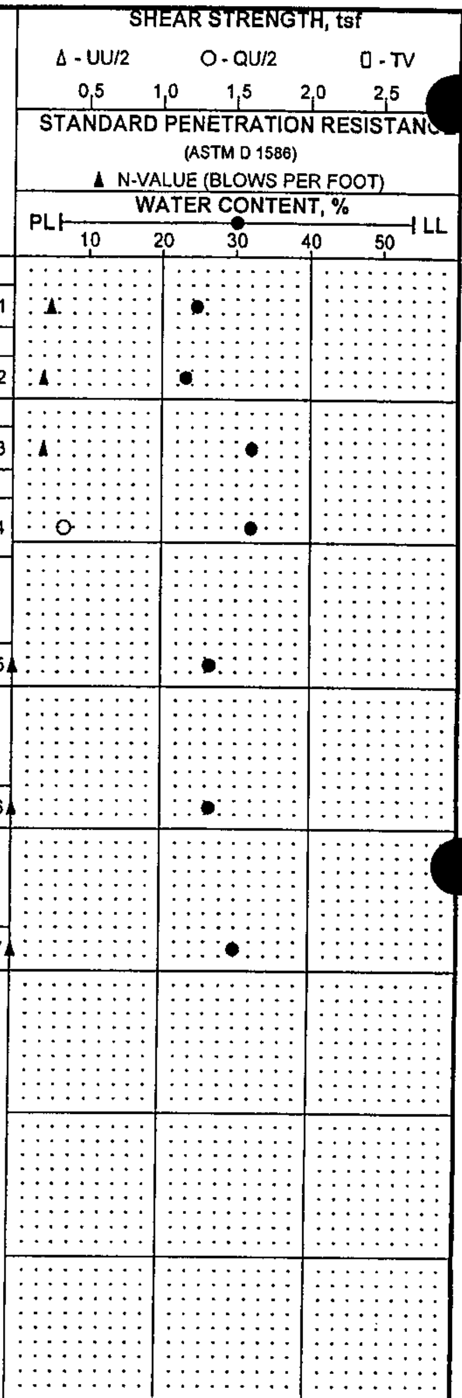
LOG OF BORING: B-4

Project No. J017150.01

Surface Elevation: 431.8 Completion Date: 10/22/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray, silty CLAY - CL		
		2-2-3	SS1
		2-2-2	SS2
5	Medium stiff to very soft, brown and gray CLAY - CH		
		1-1-3	SS3
10		89	ST4
15		0-0-0	SS5
18.5	Very soft, gray, silty CLAY with sand - CL		
20		0-0-0	SS6
25		0-0-0	SS7
25	Boring terminated at 25 feet.		



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 23 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148661.88' E: 2182476.0360'

Drawn by: KA	Checked by: SIC	App'vd. by: DW
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-5

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/21/10

Surface Elevation: 450.8 Completion Date: 10/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Crushed rock		
	FILL: black clay with sand pockets	3-6-10	SS1
	FILL: brown, fine sand, trace clay	3-8-9	SS2
5		4-6-7	SS3
	FILL: black ash and sand		ST4
10	FILL: brown, fine sand, trace gravel		ST5
15		6-7-13	SS6
	Very stiff, gray, silty CLAY with sand - CL	0-5-15	SS7
20	Very loose, gray silty SAND - SM		
		0-0-0	SS8
25	Very soft to soft, gray, silty CLAY with clay and silt seams - (CL)		
30		0-1-3	SS9
35		0-0-0	SS10
		0-0-0	SS11

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL LL

10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0636301.GPJ 12/13/10

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148066.896' E: 2182040.954'

Drawn by: KA	Checked by: SR	App'vd. by: DN
Date: 10/26/10	Date: 12/22/10	Date: 1/11/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-6

Project No. J017150.01

Surface Elevation: 450.8 Completion Date: 10/19/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf / STANDARD PENETRATION RESISTANCE / WATER CONTENT, %
	Very soft to soft, gray, silty CLAY with clay and silt seams - (CL) *(continued)*				
45			1-1-1	SS12	
	Dense, brown, fine to coarse SAND - SP				
50			7-13-42	SS13	
	Boring terminated at 50 feet.				
55					
60					
65					
70					
75					

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 □ - SV; 0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL ⊢—●—⊣ LL; 10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148066.896' E: 2182040.954'

Drawn by: KA	Checked by: SK	App'vd. by: DM
Date: 10/26/10	Date: 12/2/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-6

Project No. J017150.01

Surface Elevation: 450.5

Datum msl

Completion Date: 10/19/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Crushed rock			
	FILL: black clay, ash and sand		5-8-9	SS1
	FILL: brown, fine sand		2-6-6	SS2
5			4-6-9	SS3
	FILL: black sand and ash with clay lenses		3-6-5	SS4
10				SS5
			3-7-9	SS6
15				
	Medium stiff, brown, sandy CLAY - CL		6-4-3	SS7
20	Medium stiff to very soft, gray, silty CLAY with sand - CL			
			3-4-5	SS8
25			87 86	ST9
			95	ST10
30				
			1-0-0	SS11
35				
			*	ST12

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL ⊢—●—⊣ LL

10 20 30 40 50

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * No recovery in samples SS11 and ST12 Datum: IL State Plane Coordinates, West Zone. N: 1147816.37' E: 2181875.293'

Drawn by: KA	Checked by: SK	App'vd. by: DAL
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-7

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 450.5 | Completion Date: 10/19/10

Datum msl

SHEAR STRENGTH, tsf
Δ - UU/2 O - QU/2 □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL ├──●──┤ LL
10 20 30 40 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to very soft, gray, silty CLAY with sand - CL *(continued)*			
	sandy			ST13
45				
	Medium dense to dense, brown, fine to medium coarse SAND - SP			
50			5-8-10	SS14
55			7-9-14	SS15
60			13-17-19	SS16
	Boring terminated at 60 feet,			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM 20 FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS: * No recovery in samples SS11 and ST12 Datum: IL State Plane Coordinates, West Zone. N: 1147816.37' E: 2181875.293'

Drawn by: KA	Checked by: [illegible]	App'vd. by: DJM
Date: 10/26/10	Date: 12/30/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF
LOG OF BORING: B-7

Project No. J017150.01

Surface Elevation: 451.1 Completion Date: 10/20/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Crushed rock		
	FILL: black clay with sand	5-6-10	SS1
	FILL: brown sand, trace to some clay	2-4-6	SS2
5		0-5-7	SS3
		4-8-12	SS4
10	FILL: black clay with sand	0-4-6	SS5
			ST6
15	FILL: gray, clayey sand with black clay lenses	2-4-6	SS7
20		4-3-3	SS8
	Medium stiff, black to gray CLAY - CH	2-3-4	SS9
25			
		0-2-3	SS10
30	Medium stiff to soft, gray clayey SILT with sand - ML	101	ST11
			SS12
35		0-0-2	SS13

SHEAR STRENGTH, tsf: Δ - UU/2 O - QU/2 ▯ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, % PL ● LL (10, 20, 30, 40, 50)

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 9.3 FEET AFTER 0.5 HOURS

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1147594.427' E: 2181738.149'

Drawn by: KA	Checked by: SL	App'vd. by: DW
Date: 10/26/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-8

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 451.1 | Completion Date: 10/20/10

Datum msl

SHEAR STRENGTH, tsf
Δ - UU/2 | O - QU/2 | □ - SV
0.5 | 1.0 | 1.5 | 2.0 | 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL ├── ● ──┤ LL
10 | 20 | 30 | 40 | 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff to soft, gray clayey SILT with sand - ML *(continued)*			
	Dense to medium dense, brown, fine to coarse SAND with gravel - SP			
45			13-16-16	SS14
50			7-9-11	SS15
55			5-7-9	SS16
60			10-13-14	SS17
	Boring terminated at 60 feet.			
65				
70				
75				

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 9.3 FEET AFTER 0.5 HOURS

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1147594.427' E: 2181738.149'

Drawn by: KA	Checked by: SK	App'vd. by: DJW
Date: 10/28/10	Date: 12/22/10	Date: 1/4/11

GEOTECHNOLOGY INC — FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

CONTINUATION OF LOG OF BORING: B-8

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 433.6 | Completion Date: 10/25/10

Datum msl

SHEAR STRENGTH, tsf
Δ - UU/2 | O - QU/2 | □ - SV
0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE (ASTM D 1586)
▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %
PL ● LL
10 20 30 40 50

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, black and gray CLAY - (CH)		
		2-3-4	SS1
		1-1-1	SS2
			ST3
		86	ST4
12	Soft to very soft, gray, silty CLAY with silt seams and sand - CL		
		0-1-1	SS6
		0-1-2	SS7
		0-0-0	SS8
25	Boring terminated at 25 feet.		

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148133.361' E: 2182009.017'

Drawn by: KA | Checked by: SK | App'vd. by: DM
Date: 11/3/10 | Date: 12/22/10 | Date: 1/4/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-9

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 433.2

Datum msl

Completion Date: 10/25/10

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray silty CLAY, trace sand and wood - CL		
		2-3-3	SS1
		2-2-3	SS2
		0-2-3	SS3
		0-1-2	SS4
12	∇		
		95	ST5
17	Very loose to medium dense, gray, silty SAND with silty clay seams - SM		
		0-1-1	SS6
24	Wood	8-11-7	SS7
25	Boring terminated at 25 feet.		

SHEAR STRENGTH, tsf: Δ - UU/2, O - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANC (ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %: PL, LL (10, 20, 30, 40, 50)

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 12 FEET ∇

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: Datum: IL State Plane Coordinates, West Zone. N: 1148120.612' E: 2181976.582'

Drawn by: KA	Checked by: SH	App'vd. by: DMW
Date: 11/3/10	Date: 12/2/10	Date: 1/4/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

LOG OF BORING: B-10

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01GEO - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 446.06

Datum: msl

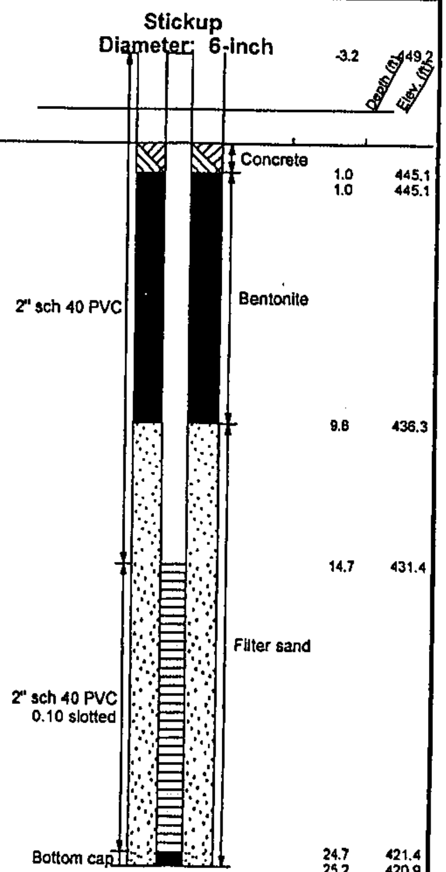
Completion Date: 10/26/10

Northing: 1147018.68

Easting: 2185605.2

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Loose, brown, fine SAND - SP			
			1-1-1	SS1
			2-2-1	SS2
5				
			2-4-4	SS3
			3-3-3	SS4
10				
	Loose, brown fine to coarse SAND, trace gravel - SP ▽			
			1-1-2	SS5
15				
			1-1-2	SS6
20				
	Loose, brown, fine SAND - SP			
			0-1-2	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 1/11/11

GROUNDWATER DATA

ENCOUNTERED AT 13 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

Surface Elevation: 433.97

Datum: msl

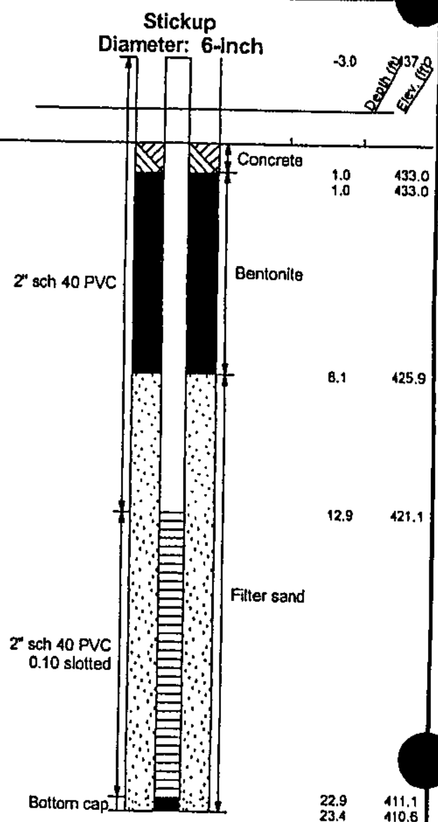
Completion Date: 10/25/10

Northing: 1148489.69

Easting: 2182485.19

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft to medium stiff, brown and gray CLAY, trace sand - CH			
			2-2-2	SS1
5			2-2-2	SS2
			2-2-4	SS3
10			0-2-3	SS4
15			2-2-3	SS5
	Soft, gray, silty CLAY with shells, trace to some sand - CL			
20			0-1-1	SS6
	Very loose, brown, fine to medium SAND - SP			
			0-0-1	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KSP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-2/MW-2

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 433.35

Datum msl

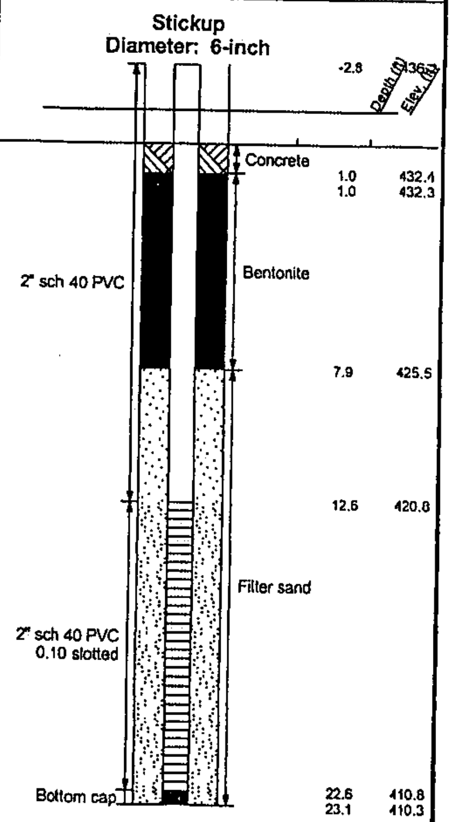
Completion Date: 10/25/10

Northing: 1148118.6

Easting: 2181973.76

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0–12	Medium stiff, brown and gray CLAY, trace sand and wood - CH		2-3-3	SS1
			2-2-3	SS2
			0-2-3	SS3
			0-1-2	SS4
12–17	Gray, silty CLAY, trace sand - CL		95	ST5
17–24	Soft, gray, silty SAND with shells and silty clay seams - SM		0-1-1	SS6
24–25	Wood		8-11-7	SS7
25	Boring terminated at 25 feet.			

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 12 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: MBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-3/B-10

Project No. J017150.01

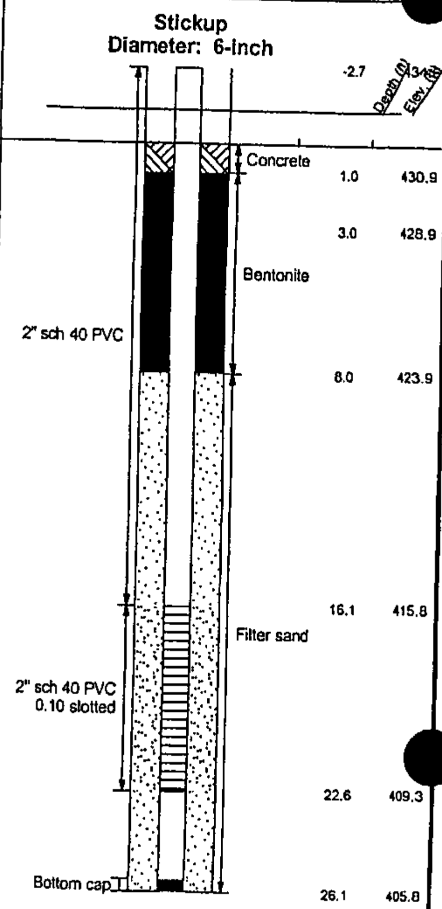
LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 431.90
Datum msl

Completion Date: 10/26/10
Northing: 1146935.94
Easting: 2181602.97

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray CLAY, trace sand and wood - CH			
			0-0-4	SS1
5			2-4-4	SS2
			1-1-1	SS3
10			1-1-2	SS4
11.5	Loose, brown, fine SAND - SP			
15			3-6-7	SS5
20			0-2-2	SS6
25			0-0-0	SS7
25	Boring terminated at 25 feet.			

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

GROUNDWATER DATA

ENCOUNTERED AT 11.5 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: ABP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

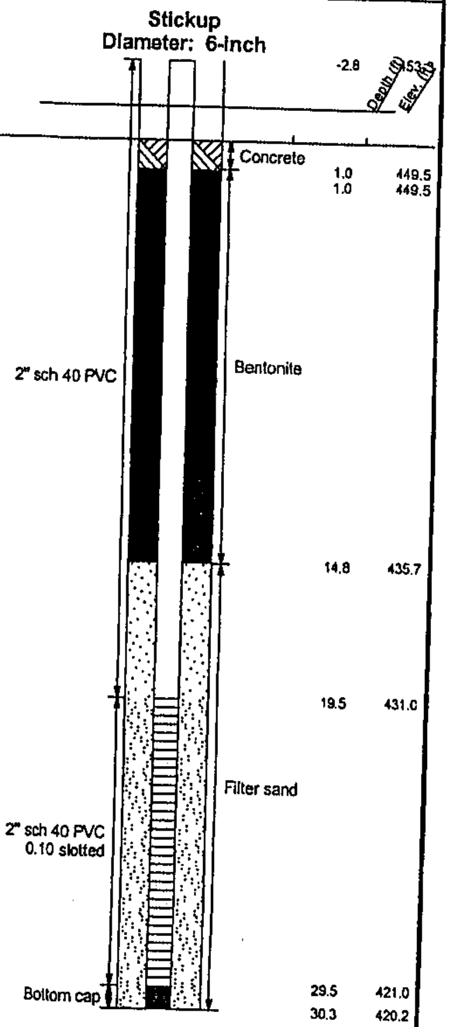
LOG OF BORING: APW-4

Project No. J017150.01

Surface Elevation: 450.48
Datum msl
Completion Date: 10/26/10
Northing: 1146922.64
Easting: 2183711.11

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Loose, brown, fine SAND - SP			
			3-3-3	SS1
5			2-2-2	SS2
			1-3-4	SS3
10			2-3-3	SS4
15			2-3-4	SS5
20	Loose, brown, fine to coarse SAND, trace to some gravel - SP		2-1-2	SS6
25			3-3-3	SS7
30	Boring terminated at 30 feet.		1-1-1	SS8
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 ... J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DJK	App'vd. by: RBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-5

Project No. J017150.01

Surface Elevation: 448.55

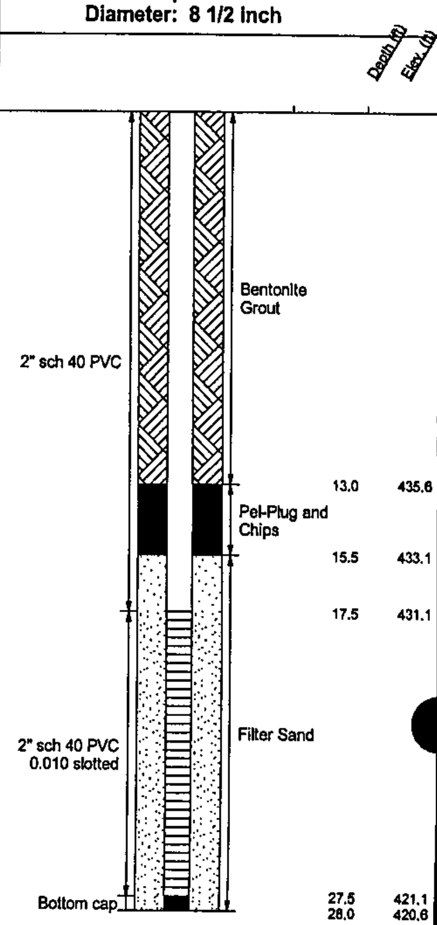
Datum: ____

Completion Date: 10/1/2015
Latitude: 39.815833
Longitude: -90.570556

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Brown, fine grained SAND - SP		0-3-4	SS1
			3-4-6	SS2
5			2-3-1	SS3
			2-2-2	SS4
			3-3-5	SS5
10			4-5-6	SS6
			1-3-3	SS7
15			1-2-3	SS8
17	Brown, medium grained SAND - SP ∇		4-6-7	SS9
20			4-3-4	SS10
			1-2-2	SS11
22	Blind drilled - heaving sands			
25				
28	Boring terminated at 28 feet.			
30				
35				

WELL DIAGRAM

Stickup = 3.3 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 18 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
SMP DRILLER SJK LOGGER
CME 550 DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by:	App'vd. by:
Date: 10/9/2015	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-6

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

Surface Elevation: 435.03

Datum: ______

Completion Date: 10/1/2015

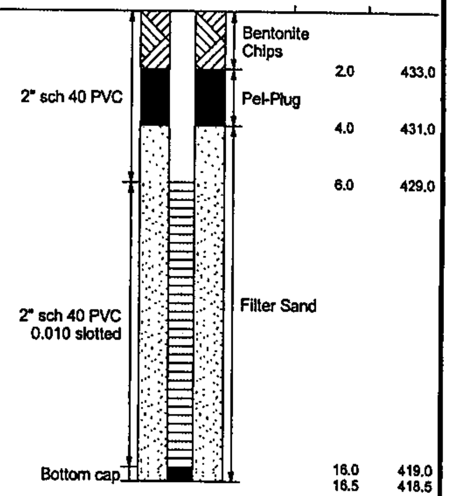
Latitude: 39.815833

Longitude: -90.573333

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Black, silty CLAY - CL		2-4-3	SS1
	Brown, silty CLAY - CL		2-3-4	SS2
5			1-2-1	SS3
	Brown, fine grained SAND - SP		1-1-1	SS4
			0-0-1	SS5
10	Blind drilled - heaving sands			
15				
	Boring terminated at 17 feet.			
20				
25				
30				
35				

WELL DIAGRAM

Stickup = 3.7 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 6 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by:	App'vd. by:
Date: 10/9/2015	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-7

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

Surface Elevation: 460.54

Datum: ______

Completion Date: 10/1/2015

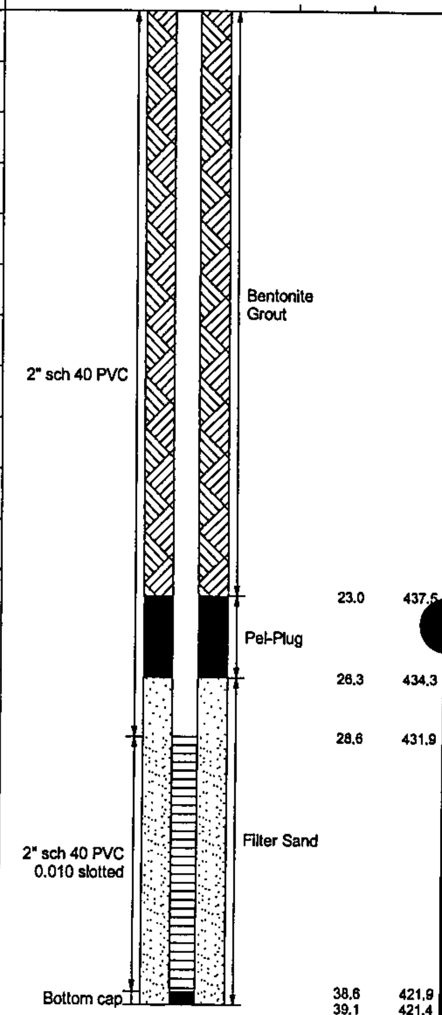
Latitude: 39.818611

Longitude: -90.5697222

WELL DIAGRAM

Stickup = 3.4 ft
Diameter: 8 1/2 inch

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Brown, fine grained, poorly graded SAND - SP		3-9-9	SS1
			7-11-12	SS2
5			3-4-5	SS3
			2-3-3	SS4
			2-3-4	SS5
10			2-3-5	SS6
			3-5-9	SS7
15			5-7-7	SS8
			5-7-8	SS9
			5-7-8	SS10
20			9-15-16	SS11
			7-12-13	SS12
25			8-13-14	SS13
			9-10-11	SS14
	Brown, medium grained, poorly graded SAND - SP		6-6-9	SS15
30	⊽		5-8-9	SS16
			4-5-6	SS17
35	Blind drilled - heaving sands			
40	Boring terminated at 40 feet.			



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 32 FEET ⊽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by:	App'vd. by:
Date: 10/9/2015	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-8

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

Surface Elevation: 444.97

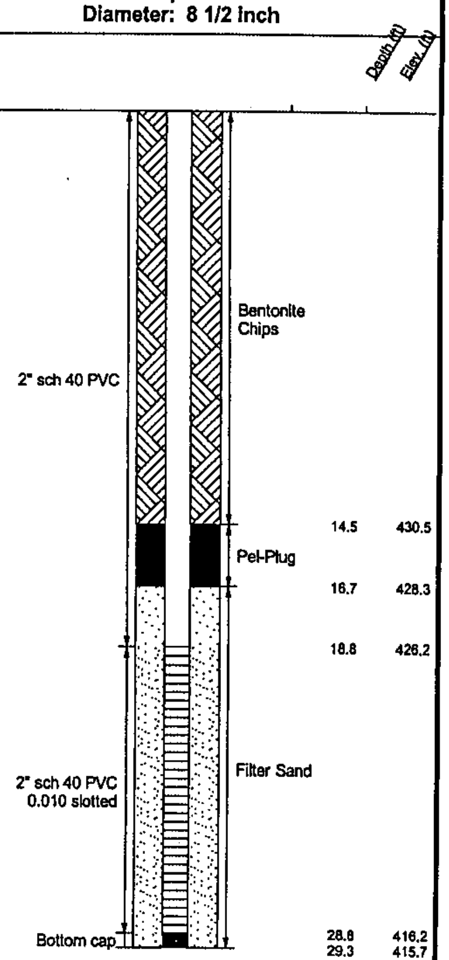
Datum: ______

Completion Date: 10/1/2015
Latitude: 39.821388
Longitude: -90.569722

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	FILL: black, silty sand with coal CCR		4-3-2	SS1
			2-3-3	SS2
5			3-8-8	SS3
			2-4-1	SS4
			2-3-10	SS5
10	Gray SILT - ML		4-3-2	SS6
	Brown, fine grained SAND - SP		5-6-5	SS7
15			3-4-3	SS8
			3-3-4	SS9
	Brown, medium grained SAND - SP		3-3-4	SS10
20	∇		1-2-1	SS11
			2-2-4	SS12
25	Blind drilled - heaving sands			
30	Boring terminated at 30 feet.			
35				

WELL DIAGRAM

Stickup = 3.1 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
SMP DRILLER SJK LOGGER
CME 550 DRILL RIG
HAMMER TYPE Auto

REMARKS:
CCR = Coal Combustion Residuals

Drawn by: AGB	Checked by:	App'vd. by:
Date: 10/9/2015	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

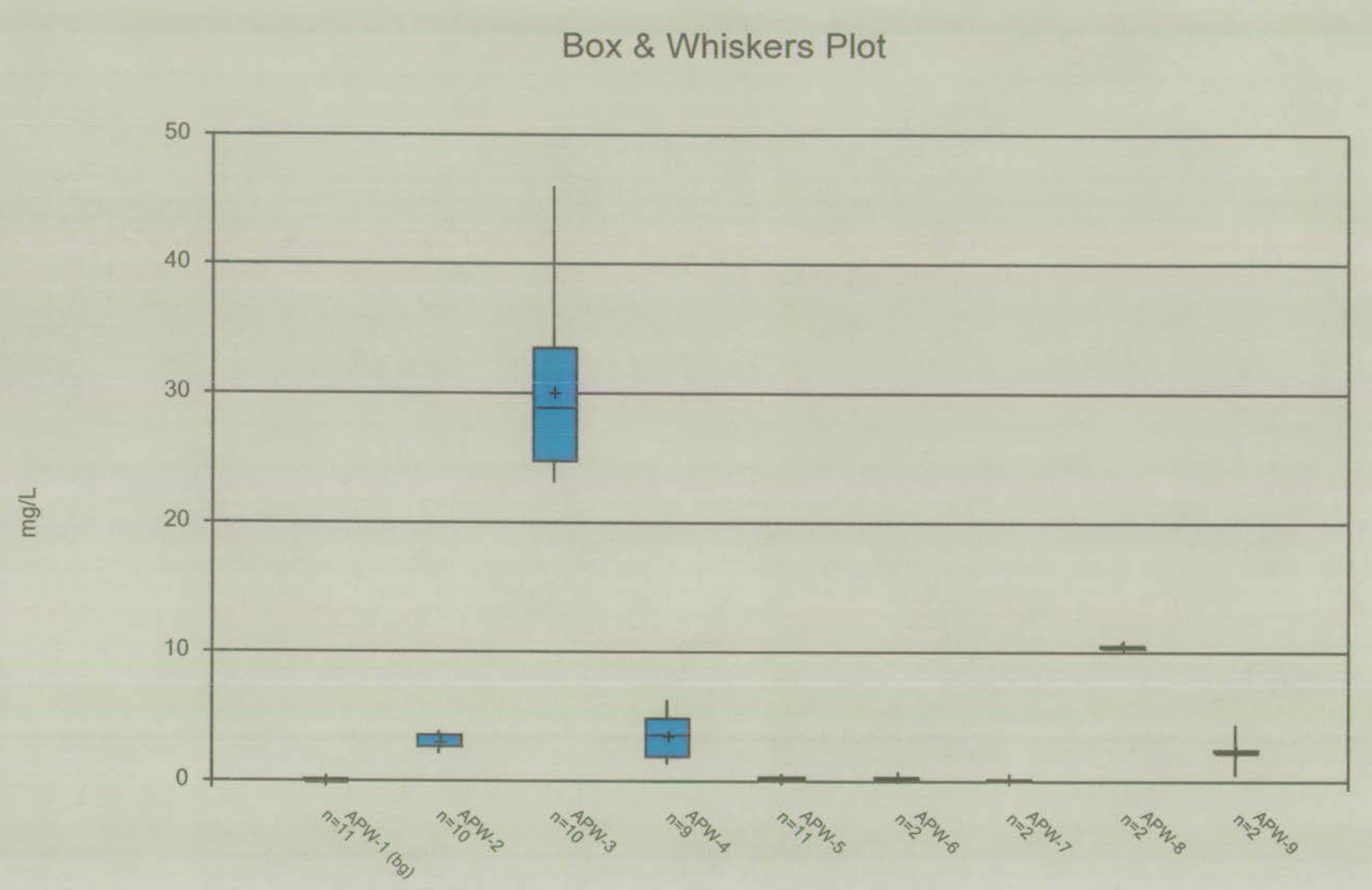
Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-9

Project No. J024917.01

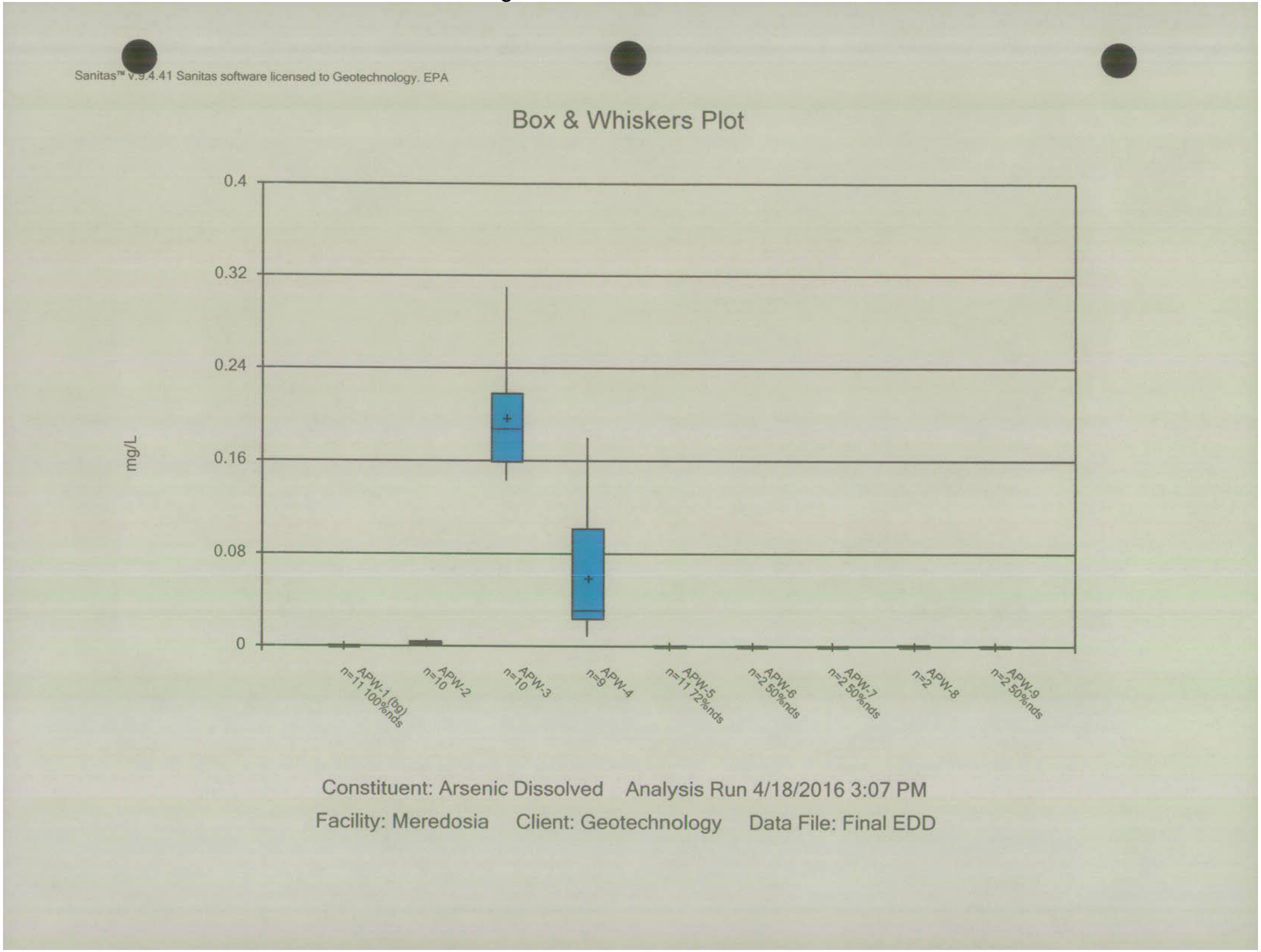
APPENDIX C

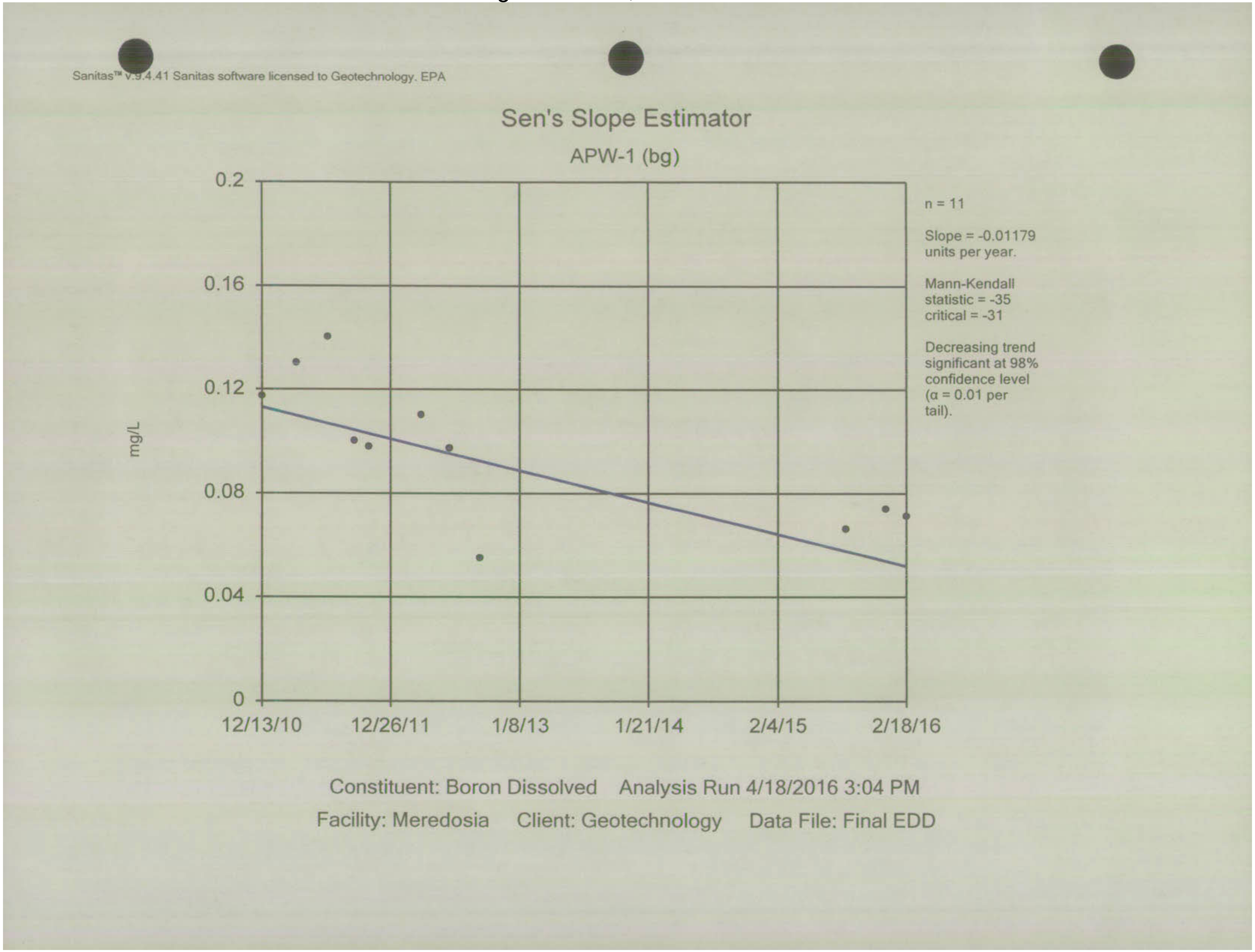
STATISTICAL ANALYSIS PLOTS

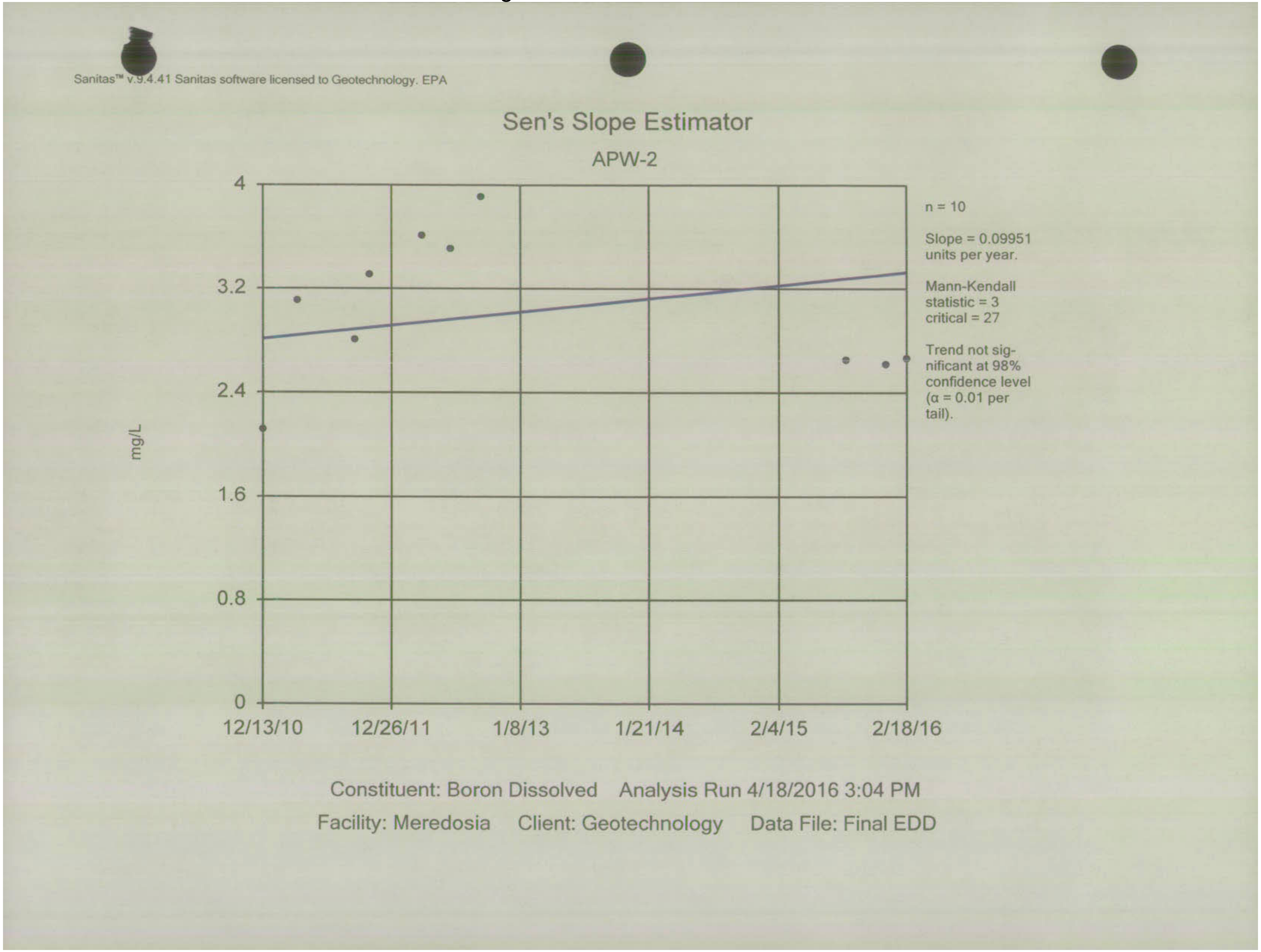


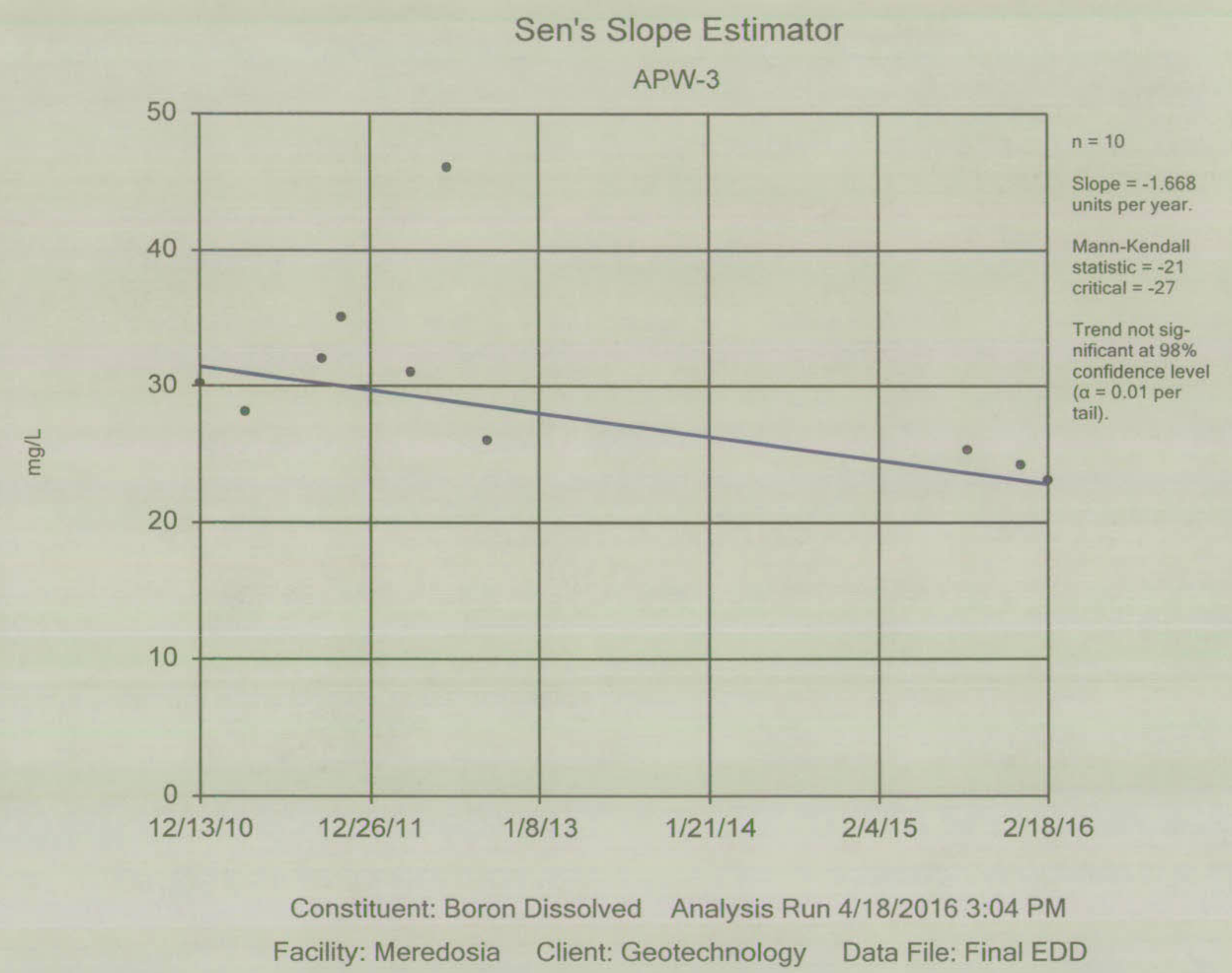
Constituent: Boron Dissolved Analysis Run 4/18/2016 3:06 PM

Facility: Meredosia Client: Geotechnology Data File: Final EDD

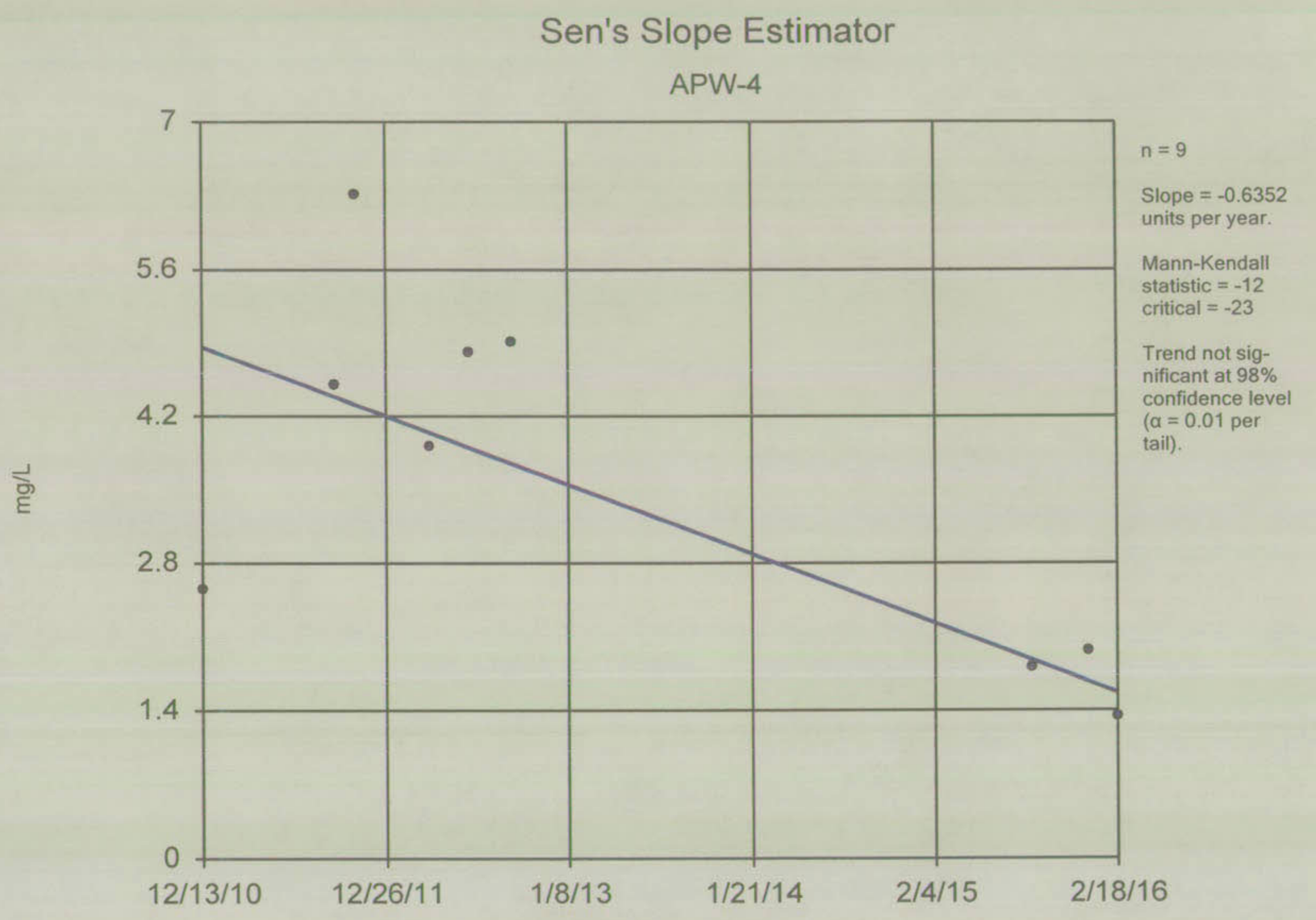

Sanitas™ v.9.4.41 Sanitas software licensed to Geotechnology. EPA
Box & Whiskers Plot
mg/L
0.4
0.32
0.24
0.16
0.08
0
APW-1 (bg) n=11 100%nds
APW-2 n=10
APW-3 n=10
APW-4 n=9
APW-5 n=11 72%nds
APW-6 n=2 50%nds
APW-7 n=2 50%nds
APW-8 n=2
APW-9 n=2 50%nds
Constituent: Arsenic Dissolved Analysis Run 4/18/2016 3:07 PM
Facility: Meredosia Client: Geotechnology Data File: Final EDD


Sanitas™ v.9.4.41 Sanitas software licensed to Geotechnology. EPA
Sen's Slope Estimator
APW-1 (bg)
0.2
0.16
0.12
0.08
0.04
0
mg/L
12/13/10
12/26/11
1/8/13
1/21/14
2/4/15
2/18/16
n = 11
Slope = -0.01179 units per year.
Mann-Kendall statistic = -35 critical = -31
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).
Constituent: Boron Dissolved Analysis Run 4/18/2016 3:04 PM
Facility: Meredosia Client: Geotechnology Data File: Final EDD


Sanitas™ v.9.4.41 Sanitas software licensed to Geotechnology. EPA
Sen's Slope Estimator
APW-2
mg/L
4
3.2
2.4
1.6
0.8
0
12/13/10
12/26/11
1/8/13
1/21/14
2/4/15
2/18/16
n = 10
Slope = 0.09951 units per year.
Mann-Kendall statistic = 3 critical = 27
Trend not significant at 98% confidence level (α = 0.01 per tail).
Constituent: Boron Dissolved Analysis Run 4/18/2016 3:04 PM
Facility: Meredosia Client: Geotechnology Data File: Final EDD

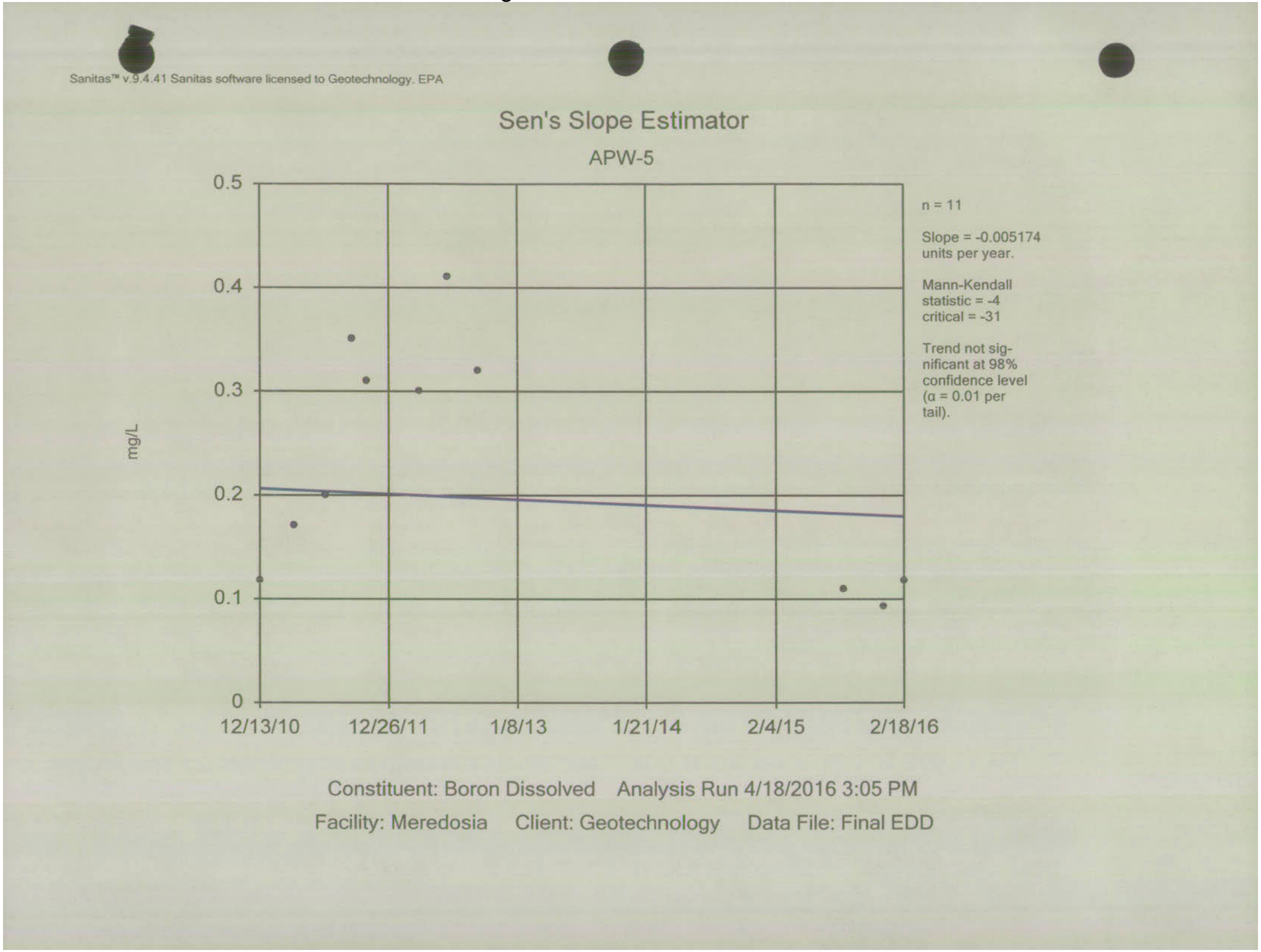


Sen's Slope Estimator
APW-3
mg/L
50
40
30
20
10
0
12/13/10
12/26/11
1/8/13
1/21/14
2/4/15
2/18/16
n = 10
Slope = -1.668 units per year.
Mann-Kendall statistic = -21 critical = -27
Trend not significant at 98% confidence level (α = 0.01 per tail).
Constituent: Boron Dissolved Analysis Run 4/18/2016 3:04 PM
Facility: Meredosia Client: Geotechnology Data File: Final EDD



Constituent: Boron Dissolved Analysis Run 4/18/2016 3:04 PM

Facility: Meredosia Client: Geotechnology Data File: Final EDD


Sanitas™ v.9.4.41 Sanitas software licensed to Geotechnology. EPA
Sen's Slope Estimator
APW-5
mg/L
0.5
0.4
0.3
0.2
0.1
0
12/13/10
12/26/11
1/8/13
1/21/14
2/4/15
2/18/16
n = 11
Slope = -0.005174 units per year.
Mann-Kendall statistic = -4 critical = -31
Trend not significant at 98% confidence level (α = 0.01 per tail).
Constituent: Boron Dissolved Analysis Run 4/18/2016 3:05 PM
Facility: Meredosia Client: Geotechnology Data File: Final EDD

APPENDIX D

HELP GROUNDWATER MODEL DATA

In order to assess the drainage capabilities of the proposed Meredosia Ash Pond, Geotechnology utilized the USEPA Hydrologic Evaluation of Landfill Performance (HELP) model to simulate conditions at the site. The version of software used was HELP 3.07 (1 November 1997). For the purposes of this evaluation, the ash pond designed cap has been divided into 6 layers as follows:

Layer 1 – Closure Turf (Geotextile/Turf Layer)
Layer 2 – Closure Turf Drainage Layer
Layer 3 – Membrane (50 mil HDPE)
Layer 4 – Fly Ash (at elevations above the piezometric surface of the pond, but 100% saturated to reflect conservative conditions at initial placement)
Layer 5 – Fly Ash (at elevations below the piezometric surface of the pond, at 100% saturation)
Layer 6 – Fine Silty Sand (conservative for the range of sands encountered)

Model parameters for the layers were the default values for each selected layer type as provided by the HELP software module, or were input by the user (for synthetic materials) with manufacturer provided parameters. Geotechnology utilized user-selected variables of 5 pinholes and 1 installation defect per each acre of membrane material as the modeled values, with a "good" initial installation quality. We assumed the Illinois River was at nominal stage and does not affect the drainage. During future flooding events, groundwater elevation may increase to the point where the lower levels of the ash are rewetted. In the case of a 100-year flood, it is not expected that the conditions in the ash will be as saturated as provided in this model due to the limited time of flooding and relatively low permeability of the ash compared to the underlying native sands.

inches

Geotechnology utilized a user-generated Soil Conservations Service (SCS) Curve Number of 95% and an evaporative zone depth of 0.8 feet for the model based on the site location. Evapotranspiration data were calculated using site latitude, an artificial vegetative surface, and a growing season from April 19 to October 10. Average wind speed at the site was chosen from the Springfield, Illinois National Oceanic and Atmospheric Administration (NOAA) Station, and humidity input was calculated from NOAA data provided for Meredosia, Illinois. Precipitation and temperature coefficients were selected from the HELP database-provided site (Columbia, Missouri) and adjusted for site latitude. The model was run without groundwater influx parameters. The model indicates that steady state conditions (<0.05 inches of head on the sand layer) will be achieved within approximately six months of closure activities at the two ash ponds on site.

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♀
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)               **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:      C:\HELP3\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP3\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\DATAMER2.D10
OUTPUT DATA FILE:             C:\HELP3\RBCA1.OUT


TIME:  11:49     DATE:   4/15/2016


******************************************************************************

     TITLE:  Meredosia

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =        0.60    INCHES
          POROSITY                     =        0.4170 VOL/VOL
          FIELD CAPACITY               =        0.0450 VOL/VOL
          WILTING POINT                =        0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT   =        0.0180 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                  LAYER  2
                                  --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
```

```
                          RBCA1
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =       0.20    INCHES
POROSITY                     =       0.8500 VOL/VOL
FIELD CAPACITY               =       0.0100 VOL/VOL
WILTING POINT                =       0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0050 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC
SLOPE                        =       4.00    PERCENT
DRAINAGE LENGTH              =     750.0     FEET


                         LAYER  3
                         --------

           TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =       0.05    INCHES
POROSITY                     =       0.0000 VOL/VOL
FIELD CAPACITY               =       0.0000 VOL/VOL
WILTING POINT                =       0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       5.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =       1.00    HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD


                         LAYER  4
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =     240.00    INCHES
POROSITY                     =       0.5410 VOL/VOL
FIELD CAPACITY               =       0.1870 VOL/VOL
WILTING POINT                =       0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC


                         LAYER  5
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =     264.00    INCHES
POROSITY                     =       0.5410 VOL/VOL
FIELD CAPACITY               =       0.1870 VOL/VOL
WILTING POINT                =       0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC


                         LAYER  6
                         --------
```

RBCA1

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 7

THICKNESS	=	480.00 INCHES
POROSITY	=	0.4730 VOL/VOL
FIELD CAPACITY	=	0.2220 VOL/VOL
WILTING POINT	=	0.1040 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4730 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.520000001000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	95.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	41.900	ACRES
EVAPORATIVE ZONE DEPTH	=	0.8	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.012	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	0.420	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.012	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	499.716	INCHES
TOTAL INITIAL WATER	=	499.716	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
MEREDOSIA IL

STATION LATITUDE	=	39.83 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	109
END OF GROWING SEASON (JULIAN DATE)	=	283
EVAPORATIVE ZONE DEPTH	=	0.8 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.40 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	73.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	67.70 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.80 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR COLUMBIA MISSOURI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.57	1.86	3.19	3.83	4.47	3.76
3.51	2.93	3.64	3.34	2.02	1.95

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR COLUMBIA MISSOURI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
27.50	32.50	41.70	54.80	64.10	72.90
77.60	76.00	68.40	57.10	43.50	32.90

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR COLUMBIA MISSOURI
AND STATION LATITUDE = 39.83 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.65	0.98	4.35	2.34	2.09	5.12
	1.99	2.71	2.91	5.84	0.59	3.18
RUNOFF	0.268	0.076	3.142	0.562	0.817	1.215
	0.076	0.413	1.655	4.155	0.135	2.372
EVAPOTRANSPIRATION	0.237	0.691	1.145	1.773	1.675	3.834
	1.966	2.312	1.253	1.680	0.453	0.559
LATERAL DRAINAGE COLLECTED	0.0001	0.0004	0.0023	0.0009	0.0006	0.0007
FROM LAYER 2	0.0001	0.0003	0.0004	0.0011	0.0003	0.0018
PERCOLATION/LEAKAGE THROUGH	0.0004	0.0021	0.0071	0.0039	0.0029	0.0032
LAYER 3	0.0007	0.0014	0.0017	0.0041	0.0013	0.0053
PERCOLATION/LEAKAGE THROUGH	54.4649	19.1717	12.2311	8.0304	6.2079	4.7599
LAYER 6	4.0537	3.4231	2.8656	2.5884	2.2323	2.0824

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.026	0.122	0.487	0.254	0.179	0.209
TOP OF LAYER 3	0.031	0.079	0.104	0.259	0.081	0.364
STD. DEVIATION OF DAILY	0.080	0.211	0.299	0.225	0.208	0.197
HEAD ON TOP OF LAYER 3	0.107	0.164	0.187	0.285	0.183	0.370
AVERAGE DAILY HEAD ON	4.633	0.242	0.140	0.095	0.071	0.056
TOP OF LAYER 6	0.046	0.039	0.034	0.029	0.026	0.024

STD. DEVIATION OF DAILY	22.615	0.047	0.019	0.009	0.005	0.003
HEAD ON TOP OF LAYER 6	0.002	0.002	0.001	0.001	0.001	0.001

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.75	4981177.000	100.00
RUNOFF	14.887	2264236.500	45.46
EVAPOTRANSPIRATION	17.579	2673680.250	53.68
DRAINAGE COLLECTED FROM LAYER 2	0.0089	1348.050	0.03
PERC./LEAKAGE THROUGH LAYER 3	0.033986	5169.242	0.10
AVG. HEAD ON TOP OF LAYER 3	0.1828		
PERC./LEAKAGE THROUGH LAYER 6	122.111244	18572754.000	372.86
AVG. HEAD ON TOP OF LAYER 6	0.4529		
CHANGE IN WATER STORAGE	-121.836	-18530826.000	-372.02
SOIL WATER AT START OF YEAR	499.716	76005376.000	
SOIL WATER AT END OF YEAR	377.881	57474548.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	-0.0001	-17.406	0.00

****

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.86	1.75	3.39	5.43	9.02	6.65
	3.39	1.19	0.84	5.12	1.57	0.67
RUNOFF	0.146	2.270	3.338	2.979	6.238	3.405
	1.386	0.404	0.179	4.267	0.565	0.319

RBCA1

EVAPOTRANSPIRATION	0.611	0.427	1.316	2.334	3.009	3.243
	1.703	1.084	0.350	1.151	0.628	0.490
LATERAL DRAINAGE COLLECTED	0.0007	0.0001	0.0005	0.0009	0.0012	0.0010
FROM LAYER 2	0.0005	0.0001	0.0016	0.0013	0.0007	0.0027
PERCOLATION/LEAKAGE THROUGH	0.0040	0.0024	0.0032	0.0042	0.0043	0.0035
LAYER 3	0.0020	0.0008	0.0047	0.0043	0.0028	0.0084
PERCOLATION/LEAKAGE THROUGH	1.8995	1.5731	1.6060	1.4391	1.3817	1.2485
LAYER 6	1.2092	1.1317	1.0323	1.0082	0.9299	0.9066

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.237	0.131	0.178	0.276	0.288	0.243
TOP OF LAYER 3	0.132	0.041	0.343	0.294	0.176	0.581
STD. DEVIATION OF DAILY	0.214	0.000	0.191	0.232	0.272	0.281
HEAD ON TOP OF LAYER 3	0.223	0.115	0.327	0.304	0.267	0.230
AVERAGE DAILY HEAD ON	0.022	0.020	0.018	0.017	0.016	0.015
TOP OF LAYER 6	0.014	0.013	0.012	0.011	0.011	0.010
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.88	6369823.000	100.00
RUNOFF	25.496	3877910.000	60.88
EVAPOTRANSPIRATION	16.345	2486056.250	39.03
DRAINAGE COLLECTED FROM LAYER 2	0.0114	1726.946	0.03
PERC./LEAKAGE THROUGH LAYER 3	0.044646	6790.513	0.11
AVG. HEAD ON TOP OF LAYER 3	0.2433		
PERC./LEAKAGE THROUGH LAYER 6	15.365823	2337095.750	36.69
AVG. HEAD ON TOP OF LAYER 6	0.0149		
CHANGE IN WATER STORAGE	-15.339	-2332968.000	-36.63
SOIL WATER AT START OF YEAR	377.881	57474548.000	
SOIL WATER AT END OF YEAR	362.542	55141580.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	1.886	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.74	2.95	1.91	2.30	1.25	3.82
	8.48	0.95	5.48	2.08	2.67	1.16
RUNOFF	2.459	2.121	0.531	1.093	0.696	1.824
	4.299	0.054	3.751	0.637	1.542	0.260
EVAPOTRANSPIRATION	0.096	0.889	1.304	1.204	0.768	2.022
	4.004	1.227	1.642	1.371	1.250	0.372
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.0001	0.0021	0.0009	0.0008	0.0010	0.0007
	0.0011	0.0001	0.0006	0.0008	0.0017	0.0003
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0027	0.0070	0.0036	0.0029	0.0031	0.0036
	0.0041	0.0006	0.0025	0.0036	0.0055	0.0023
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.8677	0.7468	0.7898	0.7322	0.7255	0.6688
	0.6678	0.6424	0.5990	0.5954	0.5543	0.5595

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.138	0.530	0.235	0.204	0.212	0.223
	0.259	0.030	0.162	0.227	0.377	0.134
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.030	0.237	0.258	0.253	0.320	0.194
	0.247	0.078	0.231	0.238	0.310	0.152
AVERAGE DAILY HEAD ON TOP OF LAYER 6	0.010	0.009	0.009	0.009	0.008	0.008
	0.008	0.007	0.007	0.007	0.007	0.006
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

RBCA1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.79	5443552.000	100.00
RUNOFF	19.266	2930366.500	53.83
EVAPOTRANSPIRATION	16.149	2456188.000	45.12
DRAINAGE COLLECTED FROM LAYER 2	0.0102	1553.305	0.03
PERC./LEAKAGE THROUGH LAYER 3	0.041437	6302.389	0.12
AVG. HEAD ON TOP OF LAYER 3	0.2274		
PERC./LEAKAGE THROUGH LAYER 6	8.149208	1239470.120	22.77
AVG. HEAD ON TOP OF LAYER 6	0.0079		
CHANGE IN WATER STORAGE	-7.785	-1184027.870	-21.75
SOIL WATER AT START OF YEAR	362.542	55141580.000	
SOIL WATER AT END OF YEAR	354.618	53936332.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.140	21218.414	0.39
ANNUAL WATER BUDGET BALANCE	0.0000	2.176	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.80	2.25	2.37	2.92	4.89	4.29
	2.02	4.10	3.72	1.07	2.94	2.40
RUNOFF	0.586	1.541	1.387	1.382	1.789	1.468
	0.137	1.452	1.793	0.022	1.683	1.930
EVAPOTRANSPIRATION	0.353	0.761	1.322	1.149	3.297	3.003
	1.881	2.388	1.942	0.917	1.206	0.461
LATERAL DRAINAGE COLLECTED	0.0001	0.0015	0.0019	0.0006	0.0013	0.0006
FROM LAYER 2	0.0002	0.0007	0.0010	0.0004	0.0020	0.0023
PERCOLATION/LEAKAGE THROUGH	0.0027	0.0056	0.0062	0.0024	0.0051	0.0027
LAYER 3	0.0012	0.0025	0.0038	0.0022	0.0068	0.0074
PERCOLATION/LEAKAGE THROUGH	0.5398	0.4892	0.5039	0.4772	0.4789	0.4493
LAYER 6	0.4517	0.4385	0.4116	0.4133	0.3914	0.3909

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.131	0.392	0.424	0.153	0.329	0.160
	0.064	0.163	0.257	0.141	0.477	0.498
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001	0.254	0.274	0.241	0.239	0.205
	0.145	0.231	0.237	0.168	0.217	0.303
AVERAGE DAILY HEAD ON TOP OF LAYER 6	0.006	0.006	0.006	0.006	0.005	0.005
	0.005	0.005	0.005	0.005	0.005	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.77	5136316.500	100.00
RUNOFF	15.170	2307287.750	44.92
EVAPOTRANSPIRATION	18.679	2840977.500	55.31
DRAINAGE COLLECTED FROM LAYER 2	0.0124	1883.304	0.04
PERC./LEAKAGE THROUGH LAYER 3	0.048741	7413.380	0.14
AVG. HEAD ON TOP OF LAYER 3	0.2659		
PERC./LEAKAGE THROUGH LAYER 6	5.435782	826766.250	16.10
AVG. HEAD ON TOP OF LAYER 6	0.0052		
CHANGE IN WATER STORAGE	-5.527	-840596.500	-16.37
SOIL WATER AT START OF YEAR	354.618	53936332.000	
SOIL WATER AT END OF YEAR	349.231	53116956.000	
SNOW WATER AT START OF YEAR	0.140	21218.414	0.41
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-1.668	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.31	0.76	4.61	6.11	2.96	7.06
	0.87	1.98	3.38	2.79	3.89	2.30
RUNOFF	0.116	0.531	2.830	3.019	0.715	4.162
	0.103	0.369	1.915	1.795	2.559	0.983
EVAPOTRANSPIRATION	0.194	0.281	1.802	3.116	2.530	2.893
	0.767	1.562	1.247	1.254	1.317	0.911
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.0001	0.0001	0.0016	0.0015	0.0009	0.0011
	0.0001	0.0003	0.0006	0.0008	0.0017	0.0007
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.0027	0.0025	0.0054	0.0056	0.0036	0.0040
	0.0006	0.0014	0.0023	0.0029	0.0056	0.0030
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.3862	0.3427	0.3694	0.3482	0.3489	0.3338
	0.3365	0.3309	0.3111	0.3122	0.2973	0.2996

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 3	0.131	0.143	0.364	0.385	0.230	0.267
	0.037	0.081	0.160	0.189	0.390	0.187
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 3	0.001	0.082	0.272	0.240	0.259	0.266
	0.108	0.155	0.236	0.259	0.290	0.240
AVERAGE DAILY HEAD ON TOP OF LAYER 6	0.004	0.004	0.004	0.004	0.004	0.004
	0.004	0.004	0.004	0.004	0.003	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.02	5630630.500	100.00
RUNOFF	19.098	2904761.000	51.59
EVAPOTRANSPIRATION	17.872	2718264.500	48.28
DRAINAGE COLLECTED FROM LAYER 2	0.0095	1444.178	0.03

PERC./LEAKAGE THROUGH LAYER 3	0.039613	6025.084	0.11
AVG. HEAD ON TOP OF LAYER 3	0.2135		
PERC./LEAKAGE THROUGH LAYER 6	4.016714	610930.187	10.85
AVG. HEAD ON TOP OF LAYER 6	0.0039		
CHANGE IN WATER STORAGE	-3.976	-604767.562	-10.74
SOIL WATER AT START OF YEAR	349.231	53116956.000	
SOIL WATER AT END OF YEAR	345.255	52512188.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-1.523	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.47 3.35	1.74 2.19	3.33 3.27	3.82 3.38	4.04 2.33	5.39 1.94
STD. DEVIATIONS	1.23 3.00	0.90 1.27	1.19 1.67	1.81 2.03	3.09 1.28	1.43 1.01
RUNOFF						
TOTALS	0.715 1.200	1.308 0.538	2.246 1.859	1.807 2.175	2.051 1.297	2.415 1.173
STD. DEVIATIONS	0.993 1.819	0.970 0.532	1.227 1.270	1.127 1.965	2.384 0.960	1.296 0.950
EVAPOTRANSPIRATION						
TOTALS	0.298 2.064	0.610 1.714	1.378 1.287	1.915 1.275	2.256 0.971	2.999 0.559
STD. DEVIATIONS	0.198 1.185	0.250 0.606	0.248 0.599	0.826 0.282	1.034 0.399	0.656 0.208
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.0002 0.0004	0.0008 0.0003	0.0014 0.0008	0.0010 0.0009	0.0010 0.0013	0.0008 0.0016

STD. DEVIATIONS	0.0003	0.0009	0.0007	0.0004	0.0003	0.0002
	0.0004	0.0002	0.0005	0.0003	0.0007	0.0010

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0025	0.0039	0.0051	0.0038	0.0038	0.0034
	0.0017	0.0013	0.0030	0.0034	0.0044	0.0053
STD. DEVIATIONS	0.0013	0.0022	0.0017	0.0012	0.0009	0.0005
	0.0014	0.0008	0.0012	0.0009	0.0023	0.0027

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	11.6316	4.4647	3.1000	2.2054	1.8286	1.4921
	1.3438	1.1933	1.0439	0.9835	0.8810	0.8478
STD. DEVIATIONS	23.9518	8.2352	5.1269	3.2834	2.4802	1.8604
	1.5515	1.2838	1.0552	0.9358	0.7930	0.7280

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.1323	0.2634	0.3375	0.2543	0.2476	0.2203
	0.1045	0.0789	0.2051	0.2219	0.3002	0.3528
STD. DEVIATIONS	0.0747	0.1867	0.1292	0.0871	0.0603	0.0400
	0.0953	0.0524	0.0948	0.0599	0.1649	0.1927

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.9350	0.0564	0.0354	0.0260	0.0208	0.0176
	0.0153	0.0136	0.0123	0.0112	0.0104	0.0097
STD. DEVIATIONS	2.0672	0.1042	0.0585	0.0387	0.0283	0.0219
	0.0177	0.0146	0.0124	0.0107	0.0093	0.0083

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.24 (3.567)	5512299.0	100.00
RUNOFF	18.783 (4.2906)	2856912.50	51.828
EVAPOTRANSPIRATION	17.325 (1.0653)	2635033.25	47.803
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.01046 (0.00142)	1591.157	0.02887
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.04168 (0.00553)	6340.122	0.11502

AVERAGE HEAD ON TOP OF LAYER 3	0.227 (	0.031)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	31.01575 (	51.11133)	4717403.000	85.57959
AVERAGE HEAD ON TOP OF LAYER 6	0.097 (	0.199)		
CHANGE IN WATER STORAGE	-30.892	(51.0256)	-4698637.00	-85.239

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	2.59	393931.219
RUNOFF	2.144	326045.4060
DRAINAGE COLLECTED FROM LAYER 2	0.00013	20.29407
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000370	56.22432
AVERAGE HEAD ON TOP OF LAYER 3	0.800	
MAXIMUM HEAD ON TOP OF LAYER 3	1.569	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	13.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 6	7.397256	1125100.62000
AVERAGE HEAD ON TOP OF LAYER 6	126.484	
SNOW WATER	2.25	342081.3750
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.5253
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0148

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	0.2646	0.4411
2	0.1556	0.7778
3	0.0000	0.0000
4	51.6723	0.2153
5	66.1214	0.2505
6	227.0400	0.4730
SNOW WATER	0.000	

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APPENDIX E

MODFLOW AND MT3DMS MODEL DATA

MODFLOW was developed by the United States Geological Survey (USGS) to solve three-dimensional transient head distributions using finite difference approximations. The user can input soil properties, multiple layers, heterogeneities, variable thicknesses, variable gradients, flow boundaries, wells, and can define confined or unconfined flow systems. Major assumptions of the program include that groundwater is governed by Darcy's law; the formation behaves as a continuous porous medium; flow is not affected by chemical, temperature, or density gradients; and hydraulic properties are constant within a grid cell.

MT3DMS calculates concentration distributions for a single chemical as a function of time and location using a finite difference solution. Concentration is distributed over a three-dimensional, non-uniform, transient flow field. MT3DMS accounts for advection, diffusion, dispersion, sorption, and first order decay. Major assumptions of the module include changes in the concentration field do not affect the flow field; concentrations of solutes do not interact with each other; chemical and hydraulic properties are constant within a cell; sorption is instantaneous and fully reversible; and decay is not reversible.

The current configuration was calibrated to groundwater elevation data collected between 2009 and 2015 in the MODFLOW program and the boron concentration data was used to calibrate the MT3DMS module. The prediction scenario includes the clean closure and capping of the two ash ponds.

Model Setup

A two layer grid with twelve objects was established with 100-foot grid spacing parallel and perpendicular to the primary flow direction. The grid size was decreased to a 50-foot grid in the vicinity of the ash ponds. Areas adjacent to the flow and transport boundaries, soil properties, and river stage fluctuations were the same for the calibration and prediction scenarios. The upgradient (east) edge of the model was a general head boundary to allow for flow reversals due to the Illinois River fluctuations. The bottom of the aquifer (estimated), north boundary, and south boundary was modeled as no-flow boundaries. The downgradient boundary was a river object to model the Illinois River. The top boundary (land surface) was a specified flux boundary condition to model rainfall infiltration and seepage through the ash ponds.

Simplifying assumptions were made for this model.

- boron instantaneously dissolves into water;
- leachate instantaneously migrates to the groundwater;
- leachate concentrations remain constant over time and the source is not depleted;
- the Illinois River has a consistent annual pattern; and
- the cap has an instantaneous effect on the percolation rate.

MODFLOW and MT3DMS Input Values

Layers

The top layer included the two ash pond objects and the topographic surface. This layer was between 2 and 42 feet thick depending on the location of the layer. The bottom layer represented the unconfined sand aquifer and was 50 feet thick.

Soil Parameters

Soil parameters were estimated using published values for the units as observed during drilling activities, from laboratory testing results, or defaults provided within the MODFLOW and MT3DMS program. Soil parameters were refined during model calibration using observed data.

Recharge

Water recharge rates were modeled using results from the HELP model for the proposed closure configuration. Rainfall and infiltration rates were applied across the site using average annual rainfall data from the City of Meredosia.

River Parameters

The Illinois River was represented by a head-dependent flux that required inputs for river stage, width, bed thickness, and bed hydraulic conductivity. River stage data was obtained from the river gauge located adjacent to the site (National Weather Service http://water.weather.gov/) from years 2009 to 2015. River stages were split into high stage (March to July) and low stage (August to February) for each year.

Source Concentration

The source concentration of boron in the Fly Ash and Bottom Ash Ponds was based on calibration results at the end of 25 years. The Fly Ash Pond boron concentration was modeled as a constant source of 25 mg/L. The Bottom Ash Pond boron concentration was modeled as a constant source of 3 mg/L. Boron and other contaminants dissolve slower into water from bottom ash instead of fly ash due to the higher temperatures that form bottom ash stabilizing the chemicals as solids (Cox 1978; Leaching of Boron from Coal Ash). Retardation and decay were not used to be conservative.

Model Results

Boron concentrations for the current configuration were modeled for 25 years to represent a scenario where the ash ponds were not closed. After 25 years, monitoring well APW-3 (the well with historically highest concentrations) stabilized at 16.9 mg/L of boron, which exceeds the Class I Groundwater standards. As shown in the table below, APW-2, APW-6, APW-7, and APW-8 also exceeded the Class I Groundwater standards at 25 years with no action.

Boron Concentration in Groundwater for the No Action Scenario at 25 Years

Well	Boron (mg/l)
APW-1	0.010
APW-2	10.2
APW-3	16.9
APW-4	0.330
APW-5	0.002
APW-6	7.60
APW-7	8.89
APW-8	12.9
APW-9	0.261

Yellow highlighting indicates a prediction exceeding the Class I Groundwater standard of 2 mg/l.

Within three years after dewatering and complete closure of the two ash ponds on site, boron modeling results indicate that boron will be below the Class I Groundwater standards for each well on the site. Boron concentrations at each of the monitoring wells after three years are shown in the table below.

Boron Concentration in Groundwater for the Ash Pond Closure Scenario at at 3 years after Closure and Dewatering

Well	Boron (mg/l)
APW-1	0.056
APW-2	0.124
APW-3	0.955
APW-4	0.011
APW-5	0.033
APW-6	0.067
APW-7	0.030
APW-8	1.17
APW-9	0.014

APPENDIX F

ILLINOIS RIVER LOADING DATA

Meredosia Power Plant J024917.01
Boron and Arsenic Loading in the Illinois River

L=C(Q)
Q=KIA

Cmax=highest single concentration
Cavg=mean concentration of APWs-2, 3, 4, and 9 (closest to river)
Q=groundwater discharge volume into river
K=hydraulic conductivity, from NRT value in report
Imax=maximum observed hydraulic gradient from all events
Iavg=mean hydraulic gradient from all events
A=cross section of aquifer, 52 feet thick x 2000 feet long
Q7,10=7-day, 10 year low flow, from IL Water Survey 1988 (most recent calculated value)
converted from cfs to gpd with factor of 1cfs = 646190.4 gpd
Qavg=average annual flow from 1936 to 1988, from USGS NWIS
converted from cfs to gpd with factor of 1cfs = 646190.4 gpd
Mixing Zone = 50 feet from shore, river is 750 feet wide

Boron Cmax=46	46
Arsenic Cmax=0.31	0.31
Boron Cavg=11.87	11.87
Arsenic Cavg=0.08	0.08
K=1,200 gpd/ft2	1200
Imax=11.98 feet	11.98
Iavg=6.72 feet	6.72
A=104,000 ft2	104,000
Qmax	1,495,104,000 gpd
Qavg	838,656,000 gpd

Boron Loading

Lmax	68,774,784,000		
Lavg	9,954,846,720		
(1) Q7,10	2,390,904,625 gpd		
(2) Qavg	13,818,782,542 gpd		
dB max (1)	28.76517251	div by 15 (750/50)	**1.917678 mg/L**
dB max (2)	4.976906163	div by 15 (750/50)	**0.331794 mg/L**
dB avg (1)	4.163631881	div by 15 (750/50)	**0.277575 mg/L**
dB avg (2)	0.720385221	div by 15 (750/50)	**0.048026 mg/L**

Arsenic Loading

Lmax	463,482,240		
Lavg	67,092,480		
(1) Q7,10	2,390,904,625 gpd		
(2) Qavg	13,818,782,542 gpd		
dB max (1)	0.19385225	div by 15 (750/50)	**0.012923 mg/L**
dB max (2)	0.03354002	div by 15 (750/50)	**0.002236 mg/L**
dB avg (1)	0.028061546	div by 15 (750/50)	**0.001871 mg/L**
dB avg (2)	0.004855166	div by 15 (750/50)	**0.000324 mg/L**

ATTACHMENT B

**GROUNDWATER MONITORING PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS**

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 5, 2016

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GROUNDWATER MONITORING PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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J024917.01

GROUNDWATER MONITORING PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

The following groundwater monitoring plan is provided for the AmerenEnergy Medina Valley Cogen, LLC Meredosia Power Station Fly Ash Pond and Bottom Ash Pond closure project for the purpose of evaluating the performance of the ash pond closure activities. This is done in general accordance with Title 35, Illinois Administrative Code (IAC), Part 840 even though the regulation does not directly apply to this facility. Groundwater will be monitored to evaluate closure and post-closure groundwater quality by conducting statistical trend analysis and assessing compliance with the applicable standards. The site location and topography are shown on Plate 1.

A Groundwater Management Zone (GMZ) is proposed for the site. The purpose of the GMZ will be to remediate groundwater to the level of the Class I groundwater standard. The method of remediation is the closure and capping of the ash ponds which will reduce or eliminate the current primary contaminate infiltration source (precipitation).

2.0 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program is based on the geology and hydrogeology information presented in the April 2016 Hydrogeologic Assessment Report. This Groundwater Monitoring Plan (GMP) provides groundwater monitoring and sampling procedures; parameter list and analytical methods; and assessment of groundwater quality data.

2.1 Monitoring Locations. Groundwater samples will be obtained from existing groundwater monitoring wells (APW-1 through APW-9). If additional wells are constructed in the future (see Section 2.2), the construction, sampling, and analysis methods described herein will apply to those monitoring wells. Monitoring wells have a well identification number with an "APW" identifier, followed by a 1-, 2-, or 3-place alpha-numeric designation. The approximate locations of the monitoring wells are included on Plate 2. The monitoring program generally follows 35 IAC 620 by satisfying the following standards for the monitoring system:

- The monitoring wells are sufficiently located to represent the quality of groundwater at the compliance point(s);
- The monitoring wells are located within the stratigraphic unit(s) that may serve as potential contaminant migration pathways;

- The groundwater monitoring wells are secure; and,
- Monitoring wells are installed to evaluate on-site and off-site groundwater quality.

2.2 Monitoring Well Installation. The current monitoring well network is comprised of five groundwater monitoring wells installed in October 2010 and four groundwater monitoring wells installed in October 2015. The nine groundwater monitoring wells are screened in the uppermost aquifer on the site.

The October 2015 groundwater monitoring wells were installed to better delineate groundwater impacts previously identified at the site. These wells were also installed to provide information on the effects of the ash pond closure activities on the groundwater. The monitoring well network data is included as Table 1 and includes the monitoring well identification numbers, screened intervals, and gradient designation. The groundwater monitoring wells were constructed in accordance with the Illinois Department of Public Health (IDPH) standards as cited in 77 IAC 920.170 and regulatory standards as cited in 35 IAC 620.505(a). As-built diagrams for the groundwater monitoring wells are included in Appendix A.

The current monitoring well network is adequate to design remedial activities, but is not adequate to fully delineate boron groundwater impacts and the future effects of the remedial activities (clean closure and capping) at the site. Installation of three additional monitoring wells is proposed: one to the southwest of the Fly Ash Pond; one to the east of the closed old ash pond, and one to the northeast of the Fly Ash Pond. The three proposed monitoring well locations are illustrated on Plate 3. These three locations will assist boron plume delineation to the southwest, east, and northeast of the ash ponds as well as provide information needed to evaluate the effect of remedial activities at the facility. It is anticipated that monitoring well installation will occur during the clean closure and capping activities on the site.

Monitoring wells will be maintained so representative groundwater samples may be collected. Items to observe during routine monitoring include: checking the concrete pad/seal for cracks, assessing the integrity of the protective casing, casing lock, seal of well cap, and integrity of the well riser. In the event a monitoring well is damaged, the well shall be repaired or replaced in accordance with regulatory requirements.

3.0 GROUNDWATER SAMPLING

3.1 Sampling Schedule. The initial sampling schedule for groundwater monitoring is provided in Table 2. Groundwater monitoring events are anticipated to be conducted quarterly until trend analysis indicates less frequent monitoring is acceptable.

Table 2 - Quarterly Groundwater Monitoring Schedule

Sampling Quarter	Report Due	Parameter List
1 – January-March	May 31	Per Section 3.2
2 – April-June	August 31	Per Section 3.2
3 – July-September	November 30	Per Section 3.2
4 – October-December	February 28	Per Section 3.2

Five years after approval of the CQA Acceptance Report, 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 the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring;
- Adequate data has been collected to characterize groundwater; and
- Concentrations of constituents monitored at the downgradient boundaries do not demonstrate statistically significant increasing trends that can be attributed to the former ash ponds.

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 when the IEPA approves the post-closure care completion report. This occurs after statistically significant increasing trends are not detected for five (5) consecutive years after changing to an annual monitoring frequency.

3.2 Parameter List. Routine sample collection will be conducted quarterly on the schedule outlined above, for the constituents listed below. Ameren may seek future reductions in the monitoring frequency and/or monitored parameters, consistent with criteria in the regulations, if approved, and found applicable to the closure of these ponds. Groundwater monitoring will continue until completion of the GMZ.

As stated in 35 IAC 620.410(a) and (d), the following laboratory analysis parameters are required to be monitored:

- Antimony,
- Arsenic,
- Barium,
- Beryllium,
- Boron,
- Cadmium,
- Chloride,
- Chromium,
- Cobalt,
- Copper,
- Cyanide,
- Fluoride,
- Iron,
- Lead,
- Manganese,
- Mercury,
- Nickel,
- Nitrate as nitrogen,
- Selenium,
- Silver,
- Sulfate,
- Thallium,
- Total dissolved solids,
- Vanadium, and
- Zinc.

Prior to 2015, groundwater samples were obtained and tested for dissolved constituents. Current regulatory preferences are to obtain and analyze groundwater samples for total constituents. Both dissolved and total parameters will be obtained for analytical testing for eight quarters after closure activities are completed or until there is enough statistical strength in the total analysis to warrant switching to total constituent analysis only. This provides information that is comparable to data obtained prior to the power station closing operations through the closure process.

Field monitoring parameters will include pH, specific conductance, groundwater surface elevation, well depth, temperature, depth to water, and elevation of measuring point.

3.3 Sampling Procedure. Groundwater samples shall be collected following the procedures presented in Appendix B, or equivalent methods developed by Ameren or its contractors.

4.0 SAMPLE ANALYSIS

Laboratory analysis and testing methods shall be in general accordance with those listed in the U.S. EPA publication Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition – Update V, amended October 2013 (U.S. EPA, 2013) or as superseded by future editions. The specific testing method used for analysis shall have Practical Quantitation Limit (PQL) values that are capable of assessing if regulatory and/or site groundwater standards are exceeded. Specific testing methods shall be referenced in the Laboratory Analysis Report.

The Quality Assurance/Quality Control (QA/QC) program at the laboratory should generally follow the requirements outlined in the U.S. EPA publication Test Methods for Evaluation Solid Waste, Physical/Chemical Methods, EPA/530/SW-846, 3rd Edition –Update V, amended January 2013 (U.S. EPA, 2013) and which may be periodically revised in the future. However, other published QA/QC methods may be utilized as part of laboratory policy provided the QA/QC methodologies generally follow those numerated above. A copy of the laboratory Quality Assurance Manual is included as Appendix C.

5.0 DATA EVALUATION

5.1 Groundwater Quality Standards. Pursuant to 35 IAC 620.450, the on-site groundwater quality requirements shall be the Class I Potable Resource Groundwater standard (35 IAC 620.410) with the exception of the areas under the GMZ. If upon completion of the post-closure care period the observed concentrations in the site groundwater still exceed a Class I standard, the on-site standard may be adjusted provided criteria are addressed to the satisfaction of the IEPA. If off-site groundwater impacts are detected, the groundwater quality requirements shall be the Class I Potable Resource Groundwater standard or a GMZ will be obtained for those areas during the timeframe of remedial activities.

5.2 Compliance Demonstration. Compliance will be evaluated against the appropriate groundwater standard. On-site groundwater shall be considered to be in compliance when no statistically significant increasing trend can be attributable to the Fly Ash Pond or the Bottom Ash Pond at the compliance boundary for five (5) consecutive years following the change to an annual monitoring frequency and with IEPA concurrence.

Compliance will be demonstrated by performing an annual trend analysis for each downgradient monitoring well for all of the monitored constituents listed in Section 3.2 that exceed the Class I groundwater standards. The analysis shall be performed on a minimum of eight (8) consecutive samples and use Sen's Estimate of Slope for compliance assessment. Generally, if analyses for a parameter show an increasing trend at a down-gradient well, a Mann-Kendall analysis must be performed at a 95% tolerance interval to assess whether the increasing trend is statistically significant. If a statistically significant increase is observed, three (3) alternative statistical methods may be applied:

1. Notification of statistically significant increasing trends and revision to the sampling frequency must be reported to the IEPA within 30 days of making the determinations.

2. If an investigation determines that the statistically significant increasing trend is due to a superseding cause then the IEPA will be notified in writing, stating the cause of the increasing trend and the rationale used in its determination.

3. If there is no superseding cause, and the monitoring frequency has been decreased to semi-annual or annual, then sampling must return to a quarterly frequency. If after four (4) consecutive quarters and no statistically significant increasing trend is observed, then sampling frequency can return to the previous frequency.

If a statistically significant increasing trend continues to be observed over two or more consecutive years and there is no superseding cause, a hydrogeologic investigation (and additional site investigation(s), if necessary) will be performed.

Based on the outcome of the additional activities, action must be taken to mitigate the statistically significant increasing trends that are causing, threatening or allowing exceedances of off-site groundwater quality standards. Any actions must be proposed as a modification to the post-closure care plan within 180 days after completion of the additional hydrogeologic and/or additional site investigations.

6.0 REFERENCES

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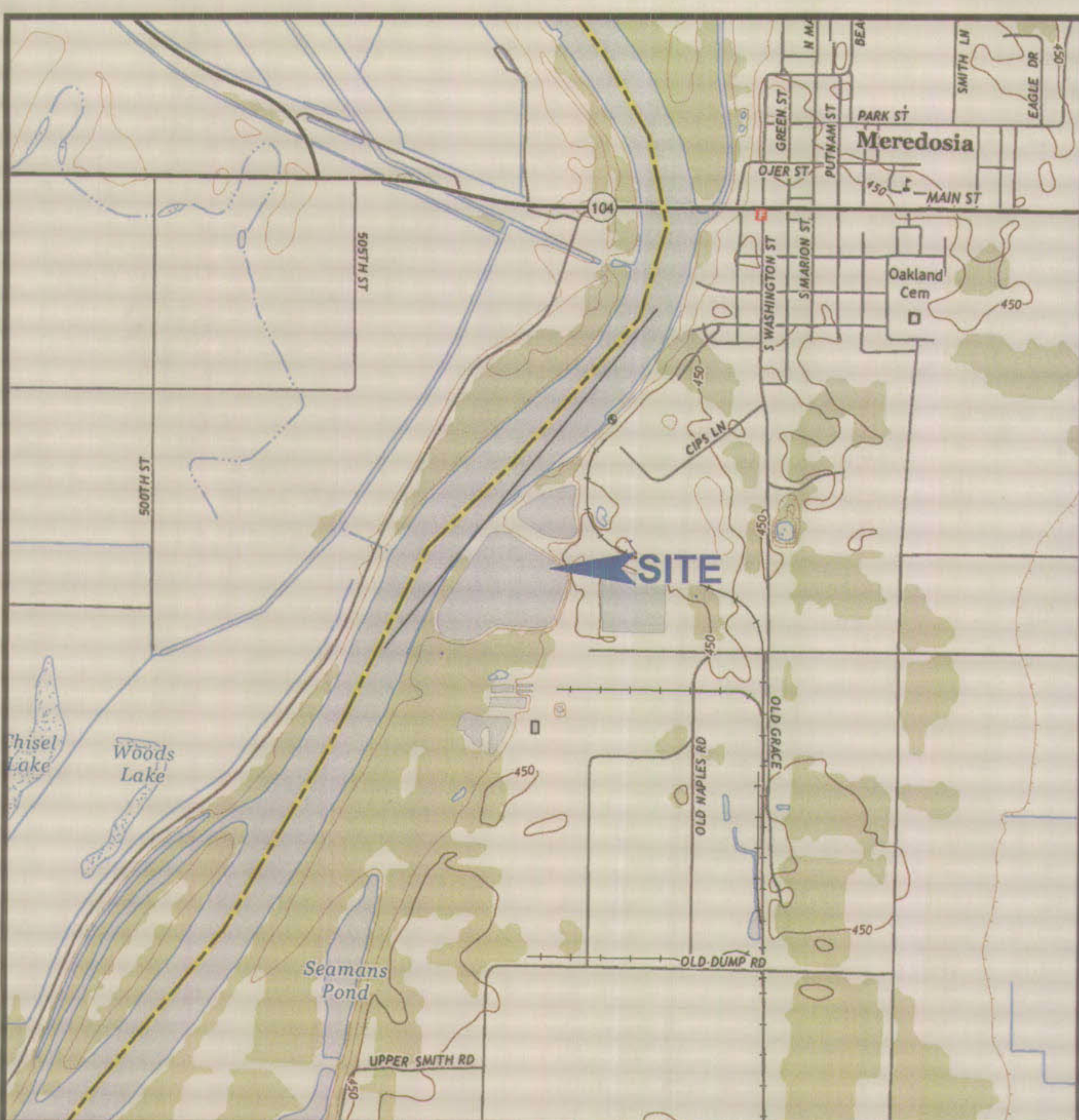
TABLE 1 J024917.01

GROUNDWATER MONITORING NETWORK SUMMARY
MEREDOSIA POWER STATION
MORGAN COUNTY, ILLINOIS

Well ID	Gradient	Ground Surface Elevation	Bottom of Well Elevation	Screen Length (ft)	Top of Casing Elevation[1]	Installation Completion Date
APW-1	Upgradient	446.06	420.90	10.00	449.26	10/26/2010
APW-2	Downgradient	433.97	410.60	10.00	436.87	10/25/2010
APW-3	Downgradient	433.35	410.30	10.00	436.28	10/25/2010
APW-4	Downgradient	431.90	405.80	6.50	434.86	10/26/2010
APW-5	Downgradient	450.48	420.20	10.00	453.20	10/26/2010
APW-6	Downgradient	448.60	420.60	10.00	451.90	10/1/2015
APW-7	Downgradient	435.00	418.50	10.00	438.70	10/1/2015
APW-8	Downgradient	460.50	421.40	10.00	463.90	10/1/2015
APW-9	Downgradient	445.00	415.70	10.00	448.10	10/1/2015

Elevations reported in feet above mean sea level.



NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

0 2,000 4,000

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: Ae	App'vd By: AMS
Date: 5-9-16	Date: 5/9/16	Date: 5/9/2016

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.01	PLATE 1

NOTES

1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring Wells were located by the project surveyor.

LEGEND

Monitoring Well Location
Property Boundary

N

0 200 400 800

SCALE IN FEET

Drawn By: WAH	Ck'd By: JYH	App'vd By: AMS
Date: 5-13-16	Date: 7-15-16	Date: 7/15/2016

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE PLAN AND MONITORING WELL LOCATIONS

Project Number J024917.01

PLATE 2

NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND
- Monitoring Well Location
- Proposed Monitoring Well Location
- Property Boundary

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By: AMS
Date: 5-9-16	Date: 5/9/16	Date: 5/9/2016

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

PROPOSED MONITORING WELL LOCATIONS

Project Number J024917.01	PLATE 3

APPENDIX A

BORING LOGS AND MONITORING WELL DIAGRAMS

Surface Elevation: 446.06

Datum msl

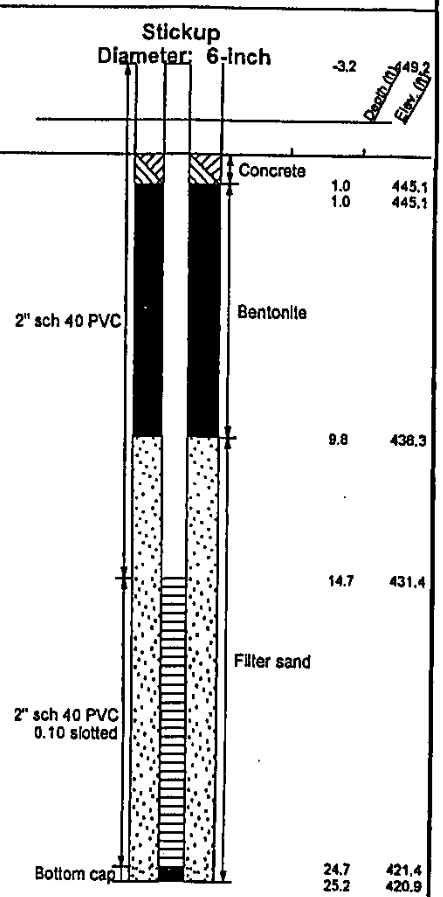
Completion Date: 10/26/10

Northing: 1147018.68

Easting: 2185605.2

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Loose, brown, fine SAND - SP			
			1-1-1	SS1
			2-2-1	SS2
5				
			2-4-4	SS3
			3-3-3	SS4
10				
	Loose, brown fine to coarse SAND, trace gravel - SP ▽			
			1-1-2	SS5
15				
			1-1-2	SS6
20				
	Loose, brown, fine SAND - SP			
			0-1-2	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 1/11/11

GROUNDWATER DATA

ENCOUNTERED AT 13 FEET ▽

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

Surface Elevation: 433.97

Datum msl

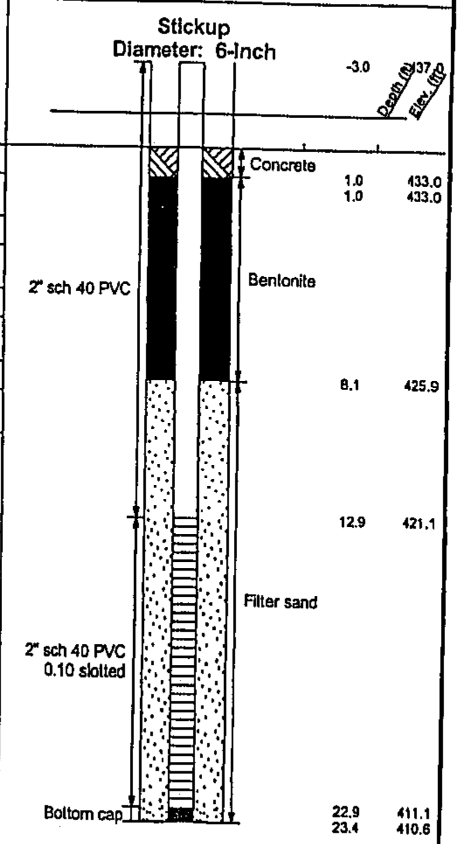
Completion Date: 10/25/10

Northing: 1148489.69

Easting: 2182485.19

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft to medium stiff, brown and gray CLAY, trace sand - CH			
			2-2-2	SS1
5			2-2-2	SS2
			2-2-4	SS3
10			0-2-3	SS4
15			2-2-3	SS5
	Soft, gray, silty CLAY with shells, trace to some sand - CL			
20			0-1-1	SS6
	Very loose, brown, fine to medium SAND - SP			
25			0-0-1	SS7
	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KGP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-2/MW-2

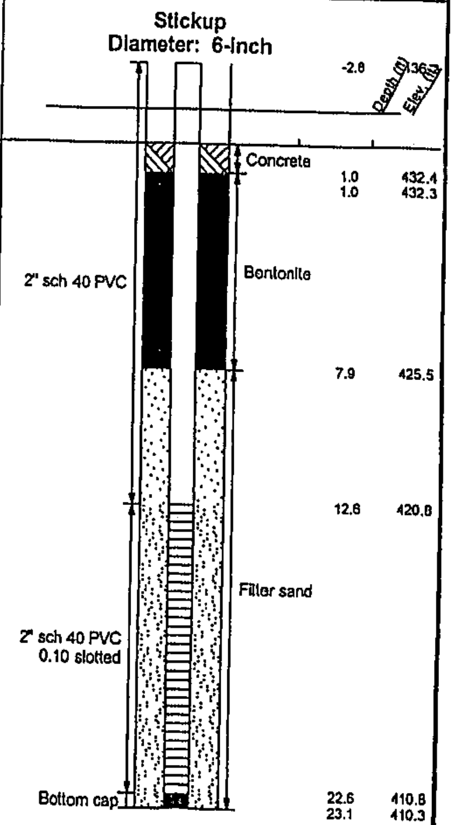
Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 433.35 | Datum: msl | Completion Date: 10/25/10 | Northing: 1148118.6 | Easting: 2181973.76

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff, brown and gray CLAY, trace sand and wood - CH			
			2-3-3	SS1
5			2-2-3	SS2
			0-2-3	SS3
10			0-1-2	SS4
12	Gray, silty CLAY, trace sand - CL			
15			95	ST5
17	Soft, gray, silty SAND with shells and silty clay seams - SM			
20			0-1-1	SS6
24	Wood			
25	Boring terminated at 25 feet.		8-11-7	SS7

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 12 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
MB DRILLER LAH LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-3/B-10

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 431.90

Datum msl

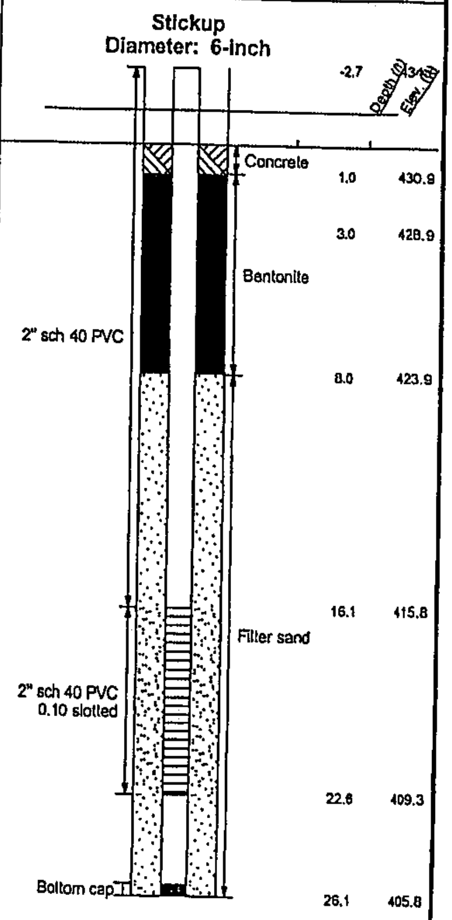
Completion Date: 10/26/10

Northing: 1146935.94

Easting: 2181602.97

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray CLAY, trace sand and wood - CH		
		0-0-4	SS1
		2-4-4	SS2
5			
		1-1-1	SS3
		1-1-2	SS4
10			
11.5	Loose, brown, fine SAND - SP		
		3-6-7	SS5
15			
		0-2-2	SS6
20			
		0-0-0	SS7
25	Boring terminated at 25 feet.		
30			
35			

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 11.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: ABP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 450.48

Datum msl

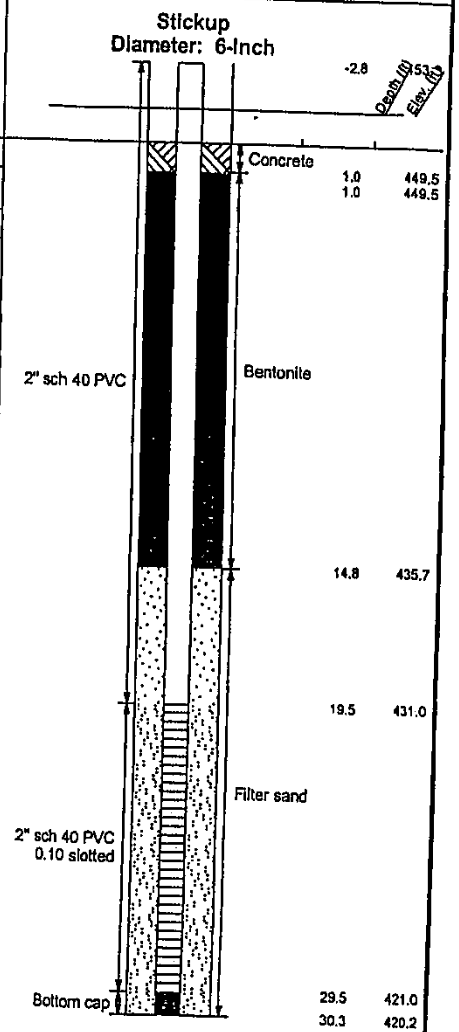
Completion Date: 10/26/10

Northing: 1146922.64

Easting: 2183711.11

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Loose, brown, fine SAND - SP			
			3-3-3	SS1
5			2-2-2	SS2
			1-3-4	SS3
10			2-3-3	SS4
15			2-3-4	SS5
20	Loose, brown, fine to coarse SAND, trace to some gravel - SP		2-1-2	SS6
25			3-3-3	SS7
30	Boring terminated at 30 feet.		1-1-1	SS8
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DJK	App'vd. by: RBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-5

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0538301.GPJ 12/22/10

Surface Elevation: 448.55

Datum: ______

Completion Date: 10/1/2015

Latitude: 39.815833

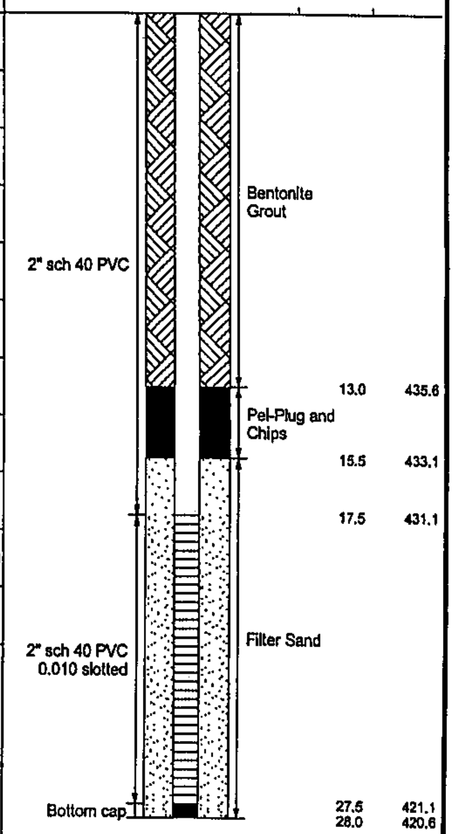
Longitude: -90.570556

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Brown, fine grained SAND - SP		0-3-4	SS1
			3-4-6	SS2
5			2-3-1	SS3
			2-2-2	SS4
			3-3-5	SS5
10			4-5-6	SS6
			1-3-3	SS7
15			1-2-3	SS8
			4-6-7	SS9
17	Brown, medium grained SAND - SP ▽		4-3-4	SS10
20			1-2-2	SS11
22	Blind drilled - heaving sands			
25				
28	Boring terminated at 28 feet.			
30				
35				

WELL DIAGRAM

Stickup = 3.3 ft

Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/16

GROUNDWATER DATA

ENCOUNTERED AT 18 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: [illegible]	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-6

Project No. J024917.01

Surface Elevation: 435.03

Datum: ______

Completion Date: 10/1/2015

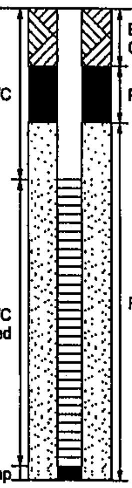
Latitude: 39.815833

Longitude: -90.573333

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0–2	Black, silty CLAY - CL		2-4-3	SS1
2–6	Brown, silty CLAY - CL		2-3-4	SS2
5			1-2-1	SS3
6–10	Brown, fine grained SAND - SP		1-1-1	SS4
			0-0-1	SS5
10–17	Blind drilled - heaving sands			
17	Boring terminated at 17 feet.			

WELL DIAGRAM

Stickup = 3.7 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 6 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: [illegible]	App'vd. by: AHS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-7

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

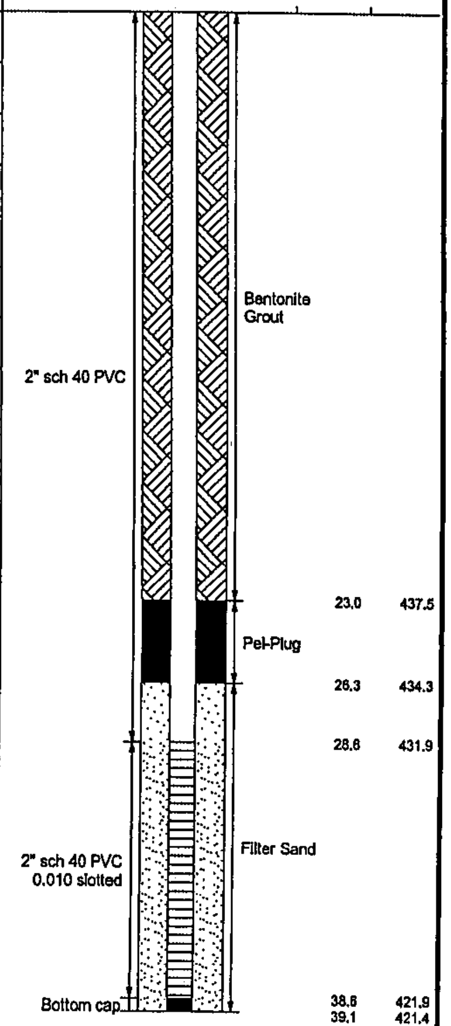
Surface Elevation: 460.54 Completion Date: 10/1/2015
Datum: Latitude: 39.818611
Longitude: -90.5697222

DESCRIPTION OF MATERIAL

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Brown, fine grained, poorly graded SAND - SP	3-9-9	SS1
		7-11-12	SS2
5		3-4-5	SS3
		2-3-3	SS4
		2-3-4	SS5
10		2-3-5	SS6
		3-5-9	SS7
15		5-7-7	SS8
		5-7-8	SS9
20		5-7-8	SS10
		9-15-16	SS11
		7-12-13	SS12
25		8-13-14	SS13
		9-10-11	SS14
	Brown, medium grained, poorly graded SAND - SP	6-6-9	SS15
30		5-8-9	SS16
	▽	4-5-6	SS17
35	Blind drilled - heaving sands		
40	Boring terminated at 40 feet.		

WELL DIAGRAM

Stickup = 3.4 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 32 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM __ FEET
SMP DRILLER SJK LOGGER
CME 550 DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: Vic	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-8

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

Surface Elevation: 444.97

Datum: ______

Completion Date: 10/1/2015

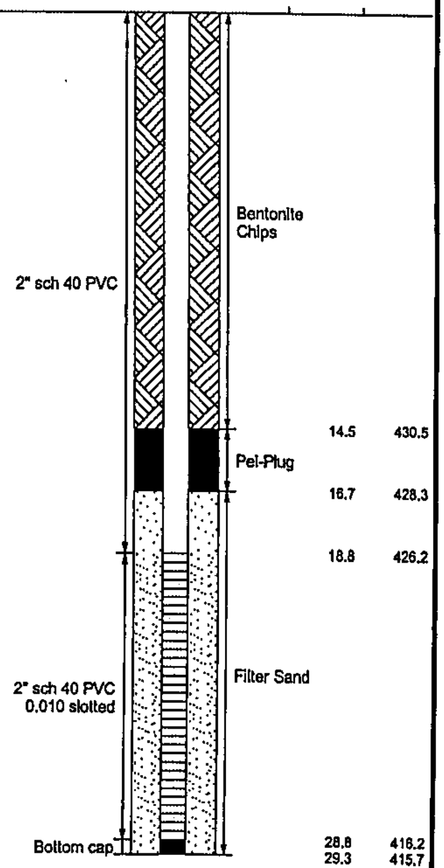
Latitude: 39.821388

Longitude: -90.569722

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: black, silty sand with coal CCR	4-3-2	SS1
		2-3-3	SS2
5		3-8-8	SS3
		2-4-1	SS4
		2-3-10	SS5
10	Gray SILT - ML	4-3-2	SS6
	Brown, fine grained SAND - SP	5-6-5	SS7
15		3-4-3	SS8
		3-3-4	SS9
	Brown, medium grained SAND - SP	3-3-4	SS10
20	∇	1-2-1	SS11
		2-2-4	SS12
25	Blind drilled - heaving sands		
30	Boring terminated at 30 feet.		
35			

WELL DIAGRAM

Stickup = 3.1 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:
CCR = Coal Combustion Residuals

Drawn by: AGB	Checked by: [illegible]	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-9

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/15

APPENDIX B

GROUNDWATER SAMPLING PROTOCOL

Appendix B – Groundwater Sampling Procedure

The following procedure shall be used in sampling groundwater at the site. This sampling procedure applies to the routine quarterly and/or modified semi-annual or annual sampling events. A groundwater sampling field data sheet, comparable to the example located in Exhibit B-1, may be used to document the sampling activities at each well. If site conditions at the time of sampling could influence the results, sampling should be postponed until a later date. However, under no circumstances shall the sampling deviate from the schedule in Section 3.1.

To ensure samples are identified and collected at the correct location, monitoring wells should be marked with the monitoring identification designated in the groundwater monitoring program. Brass monument tags with the well identification stamped into the metal shall be installed on each well.

Wells must have permanently marked reference points from which groundwater levels and well depths will be measured. Elevations of reference points must be established relative to the *North American Vertical Datum of 1929 or 1983*, whichever is available. All sampling points should use the same datum.

Upgradient wells should be sampled first to avoid cross contamination. In general, this procedure is intended to sample the least potentially contaminated monitoring point first, and subsequently sample all other monitoring points with increasing contamination potentials.

The three principal steps in collecting groundwater samples from monitoring wells are measuring static groundwater levels; evacuating or purging well bores and casings; and collecting and preserving samples. Each step must be performed consistently from well to well, and from one sampling event to the next if accurate data and representative samples are to be obtained.

General Procedures

The date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers shall be recorded on the groundwater sampling sheet for each well. The sampling equipment and containers should be stored so that contact with the ground surface is minimized.

All parts of sampling equipment coming in contact with groundwater must be thoroughly washed with a non-phosphate detergent and triple rinsed with deionized or distilled water before use. Decontamination shall be conducted initially upon arrival at the site and after each monitoring well has been sampled. Sampling equipment shall be calibrated in accordance to the manufacturer's specifications at the start of each day or as required by the manufacturer.

Water Level Gauging

Static elevations of groundwater should be measured prior to purging each well. Initially, depths to static groundwater levels should be measured from the specified reference point of each well during each sampling event in order to calculate the initial groundwater volume. Groundwater elevations in wells are obtained by subtracting measured depths to groundwater from the specified reference point elevation. Water levels at all monitoring wells should be collected on the same day to prevent time distortion of the water surface data.

Monitoring well depths should be measured as the distance from the reference point to the well bottom. Record these depths at each sampling event after low-flow purging. A decrease in well depth, from the known installed total depth, may indicate that sediments have been deposited in the well. If accumulated sediment obstructs approximately 10 percent of the screened interval length, then the well should be redeveloped.

The most common device used to measure well depth and groundwater level is an electronic water level meter. Electronic water level meters are battery-powered devices with a probe that is lowered into the well until an audible signal and/or light indicates contact with the water surface has been made.

The difference between installed total well depth and depth to static groundwater level is the stabilized height of the groundwater column in the well. Accumulated sediment is not subtracted when calculating the volume of groundwater in the well, resulting in a greater and more conservative estimate of purge volume. These measurements are used to determine the static well volume (in gallons) of groundwater for each well as follows:

1. In order to obtain the height (H) of the groundwater column, measure the well total depth (TD) and subtract the measured depth to static water level (MSD)

$$H = TD - MSD$$

2. Use the following formula to calculate the static well volume (in gallons) of groundwater:

$$V = 5.875 \times D^2 \times H$$

Where:
V = Well volume (gallons)
D = Inside well diameter (feet)
H = Height of groundwater column (feet)

Monitoring Well Purging – Pump Method

Low flow sampling methods will be used to obtain representative samples from the groundwater bearing zone being monitored in wells that demonstrate consistent and sufficient yields. A dedicated pumping device installed permanently in the well or a portable pumping device will be used to conduct low flow sampling. The pump intake must be near the middle of the well screen. Pumping flow rates must be less than natural recovery rate of the well generally less than 0.5 liters per minute. The goal is to minimize drawdown in the well. Drawdown is limited to less than 0.3 feet or 10% of the total water column. Continuous monitoring of water level and water quality indicator parameters for stabilization will be obtained during purging.

Indicator parameters for stabilization will begin to be obtained after one equivalent volume of tubing has been removed from the well. For this facility, the following parameters and stabilization requirements are:

- pH ± 0.05 S.U.
- temperature ± 0.5°F
- specific conductivity ± 5%
- dissolved oxygen ± 10% (optional)
- redox potential ± 10% (optional)
- turbidity ± 10% (optional)

Samples should be directly placed into the appropriate laboratory containers and handled according to the Sample Handling section and laboratory protocols. If a well is dry or exhibits slow recharge, the well will be allowed to recharge for a minimum of 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. The sampling conditions including dry well conditions shall be documented on the groundwater sampling field data sheet.

Monitoring Well Purging – Bailer Method

Bailers shall only be used for sample collection in the event of a non-functioning pump. Only new, disposable bailers with new string attached shall be used for sampling. Stabilization indicator parameter readings will be collected at each 0.5 gallon interval until stabilization is achieved in accordance with the Low Flow sampling method described above. Well volumes will be calculated in accordance with well gauging formulas described above.

Sample Collection Procedures

Sample handling and preservation techniques depend on the parameters to be analyzed. Groundwater samples should be collected, preserved and containerized in their order of sensitivity to volatilization (most sensitive to least sensitive). The purpose of sample preservation is to stabilize parameters of interest by retarding chemical or biological changes. Methods of preservation are generally limited to pH adjustment, chemical addition and cooling.

Samples requiring preservation should be preserved immediately upon collection or be placed in sealed containers with preservative added by the laboratory. Proper preservation will help ensure that samples are representative of groundwater.

Every sample must be cooled to 4° C (approximately 39° F) immediately after being containerized and preserved. Every sample must also be maintained at 4° C until analyzed. Laboratory protocol regarding appropriate containers, preservatives, and holding times should be followed.

Groundwater samples that are to be analyzed for total recoverable metals must not be field filtered. However, if dissolved metals analyses are required, then the samples must either be field filtered through a 0.45-micron filter immediately upon collection and prior to preservation and transport to a laboratory or filtered by the laboratory upon receipt.

Field measurements for the indicator parameters of pH, temperature and specific conductivity should be taken on a portion of the sample that has been placed in a separate clean container that will not be analyzed for any other parameters. This procedure avoids cross contamination from field instrument probes.

Sample Documentation and Transportation

Before samples are transported to the laboratory, a chain-of-custody record shall be provided. Chain-of-custody records document in a legally defensible manner the history of collection, transfer and transport of each sample. Every individual, who is responsible for the samples from the time of collection to the time they are received by a laboratory, must be documented in the Chain-of-Custody record. The Chain-of-Custody document records allow tracing the possession and handling of individual samples from the time of field collection through the time of laboratory analyses. The sample labels shall be completed in indelible ink and sample seals (if required) should be applied to each container prior to packing and shipment. Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

GEOTECHNOLOGY, INC. ENGINEERING AND ENVIRONMENTAL SERVICES ST LOUIS • COLLINSVILLE	GROUNDWATER SAMPLING FIELD DATA SHEET Project No:

WELL NUMBER		PROJECT:

Personnel ____________ Date ________ Weather ______________

WELL DATA

Depth to water (pre-purge):		Condition of Well	Yes	No
Depth to water (post-sample):		Is well easily accessible?		
Total drawdown (ft).		Is well clearly labeled?		
Total well depth (ft):		Is protective casing in good		
Water column (ft):		Is PVC casing in good condition?		
Casing diameter inches:		Is padlock present? Locked?		
Depth to top of screen (ft):		Any obstruction or kinks in well?		
Casing volume (liters):		Is concrete pad intact?		
Tubing volume (liters)		Weep hole adequately drain well		
Method of purging:		Does well have protective posts?		
Purge rate (liters/min):		Purge Equipment?		
Purging time:		Was flow through cell used?		
Vol. purged (liters):		Instruments calibrated?		

FIELD PARAMETERS

Purge vol (L)	Sample Time	pH (SU)	Temp (°C)	Dissolved Oxygen (mg/L)	Spec. Cond. (S/m)	Turbidity NTU	ORP mV

SAMPLE DATA

Sample Date	
Time:	
Pumping rate (liters/min):	
Sample appearance:	

Observations:	1 gallon = 3.8 liters Tubing volume 1/4 ID inch = 0.0094 liters/foot 2" well volume = 0.6 liters/foot

proj/Low Flow gwDATAsheets Rev 1211.xls

APPENDIX C

LABORATORY QUALITY ASSURANCE MANUAL

BOW REFERENCE SHEET --- SAME FACILITY

Facility Number:	**W1370300005**
Facility Name:	**Ameren Energy - Meredosia**
USEPA Number:	
File Category:	**06L – Groundwater Closure**

FOR ADDITIONAL INFORMATION ON THIS, SEE CATEGORY UNDER THIS SAME FILE HEADING:	**06L – Groundwater Closure** **(CD)**

DATE OF OTHER DOCUMENT		DESCRIPTION OF OTHER DOCUMENT:
08/22/2016		**Closure Plan – Fly Ash Pond and Bottom Ash Pond**
		CD: Teklab QA Manual

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

AUG 18 2017

REVIEWER: JKS

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ATTACHMENT C

GROUNDWATER MANAGEMENT ZONE PLAN
FLY ASH AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 15, 2016

Del/J024917.01 Meredosia GMZ RD.doc

J024917.01

GROUNDWATER MANAGEMENT ZONE PLAN
FLY ASH AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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J024917.01

GROUNDWATER MANAGEMENT ZONE PLAN
FLY ASH AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

The Meredosia Power Station in Morgan County, Illinois is owned by AmerenEnergy Medina Valley Cogen, LLC and operated by the Ameren Energy Generating Company from 1948 to 2011, when the power station was closed. The Meredosia Power Station has three coal combustion residual impoundments including: the Bottom Ash Pond, the Fly Ash Pond and the Old Ash Pond. The Old Ash Pond was previously closed. The ash ponds were reportedly constructed of native materials and do not have bottom liners.

The Bottom Ash Pond was constructed in 1972 with a current surface area of approximately 14.8 acres. The Bottom Ash Pond received low-volume wastewater, bottom ash and storm water runoff. The Fly Ash Pond was constructed in 1968 with a current surface area of approximately 44.8 acres. The Fly Ash Pond reportedly received fly ash, low-volume wastewater and storm water runoff.

This document comprises the plan to establish a Groundwater Management Zone (GMZ) for the Meredosia Power Station in accordance with 35 Illinois Administrative Code (IAC) Part 620.250. This GMZ plan includes Parts I, II, and III of the 35 IAC Part 620.250(a)(2) Illinois Bureau of Land Management Confirmation of Adequate Corrective Action forms which are included in Attachment 1. Some of the information contained in this plan was obtained from the April 2016 Hydrogeologic Assessment Report[1] and the Groundwater Monitoring Plan[2] (GMP). The four on-site water supply wells identified in the Hydrogeologic Assessment report will be abandoned during planned demolition activities that are scheduled to occur in 2016-2018. The four on-site water supply wells should not be considered when assessing the adequacy of this GMZ request.

---

[1] *Hydrogeologic Assessment Report, Fly Ash and Bottom Ash Ponds Meredosia Power Station, Meredosia, Illinois;* prepared for Ameren Energy Medina Valley Cogen, LLC; prepared by Geotechnology, Inc.; Report No. J024917.01, dated April 2016.

[2] *Groundwater Management Plan, Fly Ash and Bottom Ash Ponds Meredosia Power Station, Meredosia, Illinois;* prepared for Ameren Energy Medina Valley Cogen, LLC; prepared by Geotechnology, Inc.; Report No. J024917.01, dated April 2016.

Sections 2.0 through 6.0 below contain the text of the requirements specified in the Confirmation of Corrective Action forms in italics followed by the required information and/or response.

2.0 GENERAL FACILITY INFORMATION

a. Facility Name

The facility name is the Meredosia Power Station.

b. Facility Address

The facility address is 800 South Washington Street, Meredosia, Illinois 62665.

c. County in which facility is located

The facility is located in Morgan County, Illinois.

d. Illinois EPA, Bureau of Land, and USEPA Identification Numbers

The Illinois Bureau of Land identification number is 1370305002. The United States Environmental Protection Agency (USEPA) identification number is ILD065236226.

e. A general description of the type of industry, products manufactured, raw materials used, location and size of the facility, including SIC codes

The Meredosia Power Station was a coal-fired electricity-generating power plant. Coal was shipped by rail and barge to the facility, burned, and the CCR deposited on-site in storage ponds. The Bottom Ash Pond was constructed in 1972 with a current surface area of approximately 14.8 acres. The Bottom Ash Pond received low-volume wastewater, bottom ash and storm water runoff. The Fly Ash Pond was constructed in 1968 with a current surface area of approximately 44.8 acres. The Fly Ash Pond reportedly received fly ash, low-volume wastewater and storm water runoff. The SIC code for the facility is 4911.

f. An identification of special units (operating or closed) present at the facility for which the GMZ is proposed

The Bottom Ash Pond and the Fly Ash Pond are the units for which the GMZ is proposed. Due to their proximity and relative positioning on the site, the two ash ponds will be treated as a single unit for purposes of groundwater monitoring and this GMZ.

g. *A USGS topographic or county map showing the location of the site and a more detailed scaled map of the facility with each waste management unit identified in Item 2.0 (f) above. Map scale must be specific and the location of the facility must be provided with respect to Township, Section, and Range.*

A United States Geologic Survey (USGS) topographic map with the site location is attached in Plate 1. A scaled site plan of the facility including the surveyed area of the proposed aerial extent of the GMZ is included in Plate 2. The ash ponds are located in the south half of Section 21 and the north half of Section 28, Township 16 North, Range 13 West.

h. *A description of the geology and hydrogeology within the proposed GMZ and the surrounding area*

The following is a summary of the information provided in the Hydrogeologic Assessment Report.

The Meredosia Power Station is located near the western edge of the Springfield Plain Subsection of the Till Plains Section, Central Lowland Province, Interior Plains Physiographic Region. The Interior Plains Physiographic Region extends across the Laurentian craton of central North America. It is comprised of the Great Plains and Central Lowland Provinces. The Central Lowlands Province to the east formed from eroded sediments from the topographically-higher Great Plains Province to the west.

Bedrock Stratigraphy. The Meredosia Power Station and surrounding areas within the Illinois River valley are underlain by Mississippian System bedrock of the Lower Valmeyeran Series which consists of the Meppen Limestone, Fern Glen formation, and the Burlington-Keokuk Limestone (Kolata, 2005).

Willman et al. (1975) describe the Meppen Limestone as a tan or buff, very fine-grained dolomitic limestone or calcareous dolomite. The formation is slightly crinoidal and contains calcite geodes up to 2-inches in diameter. The maximum thickness of this formation is approximately 22 feet. The Fern Glen formation consists of calcareous shale, limestone, and dolomite. Dolomitic portions of the formation are partially argillaceous. The limestone portions of the formation contain nodules of greenish-gray chert. The thickness of the formation can range from approximately 50 to 100 feet. The Burlington formation of the Burlington-Keokuk Limestone is described as a "very pure, coarsely crystalline, crinoidal, light gray limestone in medium to thick beds." The Burlington formation also contains beds of fine-grained, brownish-gray, dolomitic limestone. The formation is approximately 100 to 150 feet thick in Illinois. The Keokuk formation of the Burlington-Keokuk Limestone is composed of beds of fossiliferous, crinoidal limestone interbedded with fine-grained limestone, argillaceous dolomite, and calcareous gray shale. The Keokuk formation is approximately 60 to 80 feet thick in Illinois.

Surficial Geology. The Meredosia Power Station is situated within the Illinois River valley. The overburden soils consist of channel and floodplain deposits of the Cahokia formation underlain by glacial outwash deposits belonging to the Henry formation. Fine-grained lacustrine deposits of the Equality formation are present in the subsurface, but are discontinuous. These formations occur throughout Illinois in valley bottoms and floodplains as channel deposits in present-day rivers and streams.

The Cahokia Alluvium consists mainly of poorly-sorted silt, clay, and silty sand, but locally contains lenses of sand and gravel. The upper part consists of overbank silt and clays. The lower portion consists of coarse-textured sand and lateral accretion deposits. The Cahokia formation may be up to 20 feet thick in the area of the Meredosia Power Station (Berg and Kempton, 1987).

The Henry formation consists of glacial sand and gravel outwash. The Henry formation is subdivided into three members that differ in lithology: the Batavia Member (outwash plains), the Mackinaw Member (valley trains), and the Wasco Member (ice-contact deposits) (Willman and Frye, 1970; Willman et al., 1975). Based on information from well logs, the thickness of the Henry formation ranges from 60 to 84 feet in the area of the Meredosia Power Station.

The Equality formation consists of bedded silt and clay deposits in glacial and post-glacial lakes. Gravel, sand, and organic deposits occur in lenses that intertongue with the Henry formation. In the area of the Meredosia Power Station, the Equality formation overlies the Henry formation and generally occurs as lenses or patches not exceeding 20 feet thick.

Subsurface Conditions. Geotechnology has conducted subsurface explorations of the overburden soils at the Meredosia Power Station. The subsurface exploration and laboratory testing efforts are discussed further in the Hydrogeologic Assessment Report and the following is a summary of the site conditions.

Native soils consisting of brown and gray, very soft to medium stiff, silt and clay were encountered below the fill in Boring B-1 and Monitoring Well APW-9, and at the ground surface in Boring B-5. Native soils consisting of black, clayey sand with trace gravel were encountered below the fill in Boring B-2.

A stratum of very soft to medium stiff, brown, black, and gray clay with traces of sand and wood was encountered below the fill in Borings B-3 and B-8, below the native soils in Borings B-1, B-2, and B-5, and at the ground surface in Borings B-4, B-9, APW-2, APW-3, APW-4, and APW-7. This soil stratum ranged in thickness from approximately 8 to 17 feet bls.

The clay layer described above was underlain by a stratum of granular and cohesive alluvial soils (except for Boring APW-4). The granular alluvium generally consisted of loose, gray, clayey sand with gravel. The cohesive alluvium generally consisted of very soft to medium stiff, gray and brown, clayey silt, silty clay, and sandy clay. This soil stratum ranges in thickness from approximately 5 to 11 feet bls in borings where it is encountered.

Alluvium was encountered below the fill soils in Borings B-6 and B-7, and at the ground surface in Boring B-10 and Monitoring Wells APW-6 and APW-8. This stratum is interpreted as alluvium placed in a buried valley that had been cut down through the soil stratum described above. The granular portions of this alluvium infill generally consisted of very loose, gray, silty sand. The cohesive portions generally consisted of very soft to very stiff, gray, silty clay with sand and silt seams. This soil stratum was at least 28 feet thick where encountered.

The native soils described above are interpreted as belonging to the Cahokia Alluvium, and were underlain by sand deposits interpreted as belonging to the Henry formation. Generalized east-west and north-south subsurface profiles based on the soil boring data at the Meredosia Power Station.

Surface Water. The major surface water body in the vicinity of the Meredosia Power Station is the Illinois River, which flows from the north-northeast to the south-southwest, and borders the west side of the site. The normal pool elevation of the Illinois River is approximately 421.0 feet[3]. Information from the U.S. Army Corps of Engineers indicates the Illinois River flood stage is 435.0 feet above mean sea level (MSL). The record high stage was 446.69 feet above MSL on May 26, 1943, and the record low stage was 418.40 feet above MSL on January 11, 1940.

Meredosia Lake is approximately 1.5 miles north of the Meredosia Power Station. Smith Lake is located approximately 1-mile south of the site. Westerly-flowing streams drain the uplands east of the site to the Illinois River located west of the site.

Groundwater Flow. Based on the monitoring well gauging data, the groundwater flow direction at the Meredosia Power Station is to the west-northwest toward the Illinois River. Groundwater flow direction may be influenced by the stage of the Illinois River.

i. Groundwater classification at the site

Groundwater at the site is classified as Class I Groundwater per 35 Illinois Administrative Code (IAC) Part 620.

[3] Elevations herein refer to the mean sea level datum in feet (msl-ft).

j. *A description of the circumstances under which the release from each waste management unit identified in Item 2.0 (f) above, to groundwater was identified*

Five groundwater wells were installed near the facility Fly Ash and Bottom Ash Ponds at the request of the IEPA in 2010. A release was detected during routine groundwater monitoring at the site.

3.0 RELEASE INFORMATION

a. *The chemical constituents released to groundwater*

The analytical results from 11 groundwater sampling and testing events were compared to the Illinois Class I groundwater standards. Boron, arsenic, iron, manganese, and sulfate were identified in at least one sampling event as exceeding the Class I groundwater standards. Changes of oxidation/reduction (redox) potential in the subsurface due to fluctuations in pH make evaluation of manganese and iron concentrations unreliable at this facility. Comparison of manganese and iron to the respective Class I groundwater standard may be inappropriate for this site.

The chemical constituents released to groundwater are described in detail in the Hydrogeologic Assessment Report. In summary, boron is the chemical constituents of concern due to the extent of impacts. These are consistent with typical CCR residual releases.

b. *Identification of the chemical constituents detected in groundwater that are above the applicable standard in 35 Ill. Adm. Code Part 620*

The analytical results from 11 groundwater sampling and testing events were compared to the Illinois Class I groundwater standards. As of the February 2016 sampling event, the boron concentration exceeded the Class I groundwater standard (2 ppm) in Monitoring Wells APW-2, APW-3, APW-8, and APW-9. As of the February 2016 sampling event, the arsenic concentration exceeded the Class I groundwater standard in Monitoring Well APW-3. Concentrations of manganese exceeded the Class I groundwater standard in Monitoring Wells APW-2, APW-3, and APW-4. Historical concentrations of iron exceeded the Class I groundwater standards in Monitoring Wells APW-3 and APW-4, but the February 2016 results are below the Class I groundwater standard. A single event anomaly associated with flooding in February 2016 resulted in the concentration of sulfate in Monitoring Well APW-9 being above the Class I groundwater standard. Changes of oxidation/reduction (redox) potential in the subsurface due to fluctuations in pH make evaluation of manganese and iron concentrations unreliable at this facility. Comparison of manganese and iron to the respective Class I groundwater standard may be inappropriate for this site.

c. *A description of how the site has been investigated to determine the source or sources of the release*

A detailed description of site investigation activities to date is included in the Hydrogeologic Assessment Report. A summary of the site investigation activities follows.

From October 19 through October 26, 2010, Geotechnology advanced 15 borings at the Meredosia Power Station. Ten of the borings (B-1 through B-10) were drilled in support of a global stability evaluation, while the remaining five borings were completed as Monitoring Wells APW-1 through APW-5 in support of groundwater monitoring activities. The borings were drilled to depths ranging from 25 to 60 feet below land surface (bls). Standard Penetration Tests (SPT) were performed using an automatic hammer and split spoon sampler.

From September 28 through October 1, 2015, Geotechnology advanced four additional borings at the site. The borings were drilled to depths ranging from 17 to 40 feet bls. SPTs were performed using an automatic hammer and split spoon sampler. Monitoring Wells APW-6 through APW-9 were installed in the borings in support of ongoing groundwater monitoring activities.

d. *A description of the groundwater monitoring network and groundwater sampling protocols in place at the facility*

Groundwater samples will be obtained from existing groundwater monitoring wells (APW-1 through APW-9). If additional wells are constructed in the future, the construction, sampling, and analysis methods described in the Groundwater Monitoring Plan will apply to those monitoring wells. Monitoring wells have a well identification number with an "APW" identifier, followed by a 1-, 2-, or 3-place alpha-numeric designation. The approximate locations of the monitoring wells are included on Plate 2. The monitoring program generally follows 35 IAC 620 by satisfying the following standards for the monitoring system:

- The monitoring wells are sufficiently located to represent the quality of groundwater at the compliance point(s);
- The monitoring wells are located within the stratigraphic unit(s) that may serve as potential contaminant migration pathways;
- The groundwater monitoring wells are secure; and,
- Monitoring wells are installed to evaluate on-site and off-site groundwater quality.

The groundwater sampling protocols are provided in Appendix B of the Groundwater Monitoring Plan and a copy has been provided in Appendix B of this plan.

e. *The schedule for monitoring of the groundwater*

Groundwater monitoring events are anticipated to be conducted quarterly until trend analysis indicates less frequent monitoring is acceptable.

Five years after approval of the CQA Acceptance Report, 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 the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring;
- Adequate data has been collected to characterize groundwater; and
- Concentrations of constituents monitored at the downgradient boundaries do not demonstrate statistically significant increasing trends that can be attributed to the former ash ponds.

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 when the IEPA approves the post-closure care completion report. This occurs after statistically significant increasing trends are not detected for five (5) consecutive years after changing to an annual monitoring frequency.

4.0 PROPOSED GMZ BOUNDARIES

The horizontal boundaries of the proposed GMZ are illustrated on Plate 2. The vertical component of the proposed GMZ will extend to 60 feet below the ground surface within the horizontal boundaries of the GMZ, concurrent with the bottom of the Henry Formation at the site.

5.0 APPROVED REMEDIAL ACTION INFORMATION

a. A description of the approved remedial action

The remedial action for the facility is the relocation and clean closing of the east ash storage pile, capping of the Fly Ash Pond, and the partial clean closure and capping of the Bottom Ash Pond. The Bottom Ash Pond will be closed by the removal of most coal combustion residuals (CCR) to the Fly Ash Pond. The remaining CCR under the roadway and pipeline will be capped in-place. Because the groundwater contamination is a result of leaching inorganics from the CCR, this will effectively remove the majority of the contamination source material from the Bottom Ash Pond, and protect the remaining material from storm water infiltration.

The Fly Ash Pond will be closed by the installation of a cap. A capped closure will redirect precipitation that may otherwise pass through the CCR. The capped closure will reduce further leaching of inorganics into the groundwater.

b. A description of how the approved remedial action has impacted the release

It is anticipated that the closure of the ash ponds will reduce the concentrations of contaminants below the Illinois Class I groundwater standards in approximately 3 years after dewatering and closure. This is based on the general reduction of chemicals in groundwater since the plant was closed and modeling of the cap system using the HELP model, MODFLOW and MT3DMS models, and river concentration calculations. The remedial action will occur concurrently with the implementation of this proposed GMZ.

c. A description of how the approved remedial action is operated and maintained

Subject to IEPA approval, the remedial action is the closure of the Bottom Ash Pond and the Fly Ash Pond. Proposed ash pond closure activities include reducing the aerial extent of the Fly Ash Pond to 41.9 acres, moving approximately 12.3 acres of the Bottom Ash Pond to the Fly Ash Pond, grading the ash for storm water runoff, installing ClosureTurf (meets the performance requirements of Subtitle D) cover over the 41.9 acres of the Fly Ash Pond and the 2.5 acres of Bottom Ash Pond that is being closed-in-place. These activities will address the source of the impacts by directing storm water away from the CCR and reduce future infiltration of impacted water into the groundwater.

d. A projected schedule for completion of remediation

The completion of remediation activities are anticipated to be performed during the 2016 and 2017 construction seasons. Groundwater monitoring will continue in accordance with the schedule described in Section 3.0(e).

e. *An identification of any and all permits obtained from the Illinois EPA for the remedial action*

An NPDES permit is pending renewal.

f. *A description of how groundwater at the facility will be monitored following the future completion of the remedy to ensure that the groundwater quality standards have been attained*

Groundwater will be monitored using the groundwater monitoring network of nine wells described in Section 3.0(d) in the GMP.

Compliance will be demonstrated by performing an annual trend analysis for each downgradient monitoring well for the monitored constituents listed in the Groundwater Monitoring Plan that exceed the Class I groundwater standards. The analysis shall be performed on a minimum of eight (8) consecutive samples and use Sen's Estimate of Slope for compliance assessment. Generally, if analyses for a parameter show an increasing trend at a down-gradient well, a Mann-Kendall analysis must be performed at a 95% tolerance interval to assess whether the increasing trend is statistically significant. If a statistically significant increase is observed, three (3) alternative statistical methods may be applied:

1. Notification of statistically significant increasing trends and revision to the sampling frequency must be reported to the IEPA within 30 days of making the determinations.

2. If an investigation determines that the statistically significant increasing trend is due to a superseding cause then the IEPA will be notified in writing, stating the cause of the increasing trend and the rationale used in its determination.

3. If there is no superseding cause, and the monitoring frequency has been decreased to semi-annual or annual, then sampling must return to a quarterly frequency. If after four (4) consecutive quarters and no statistically significant increasing trend is observed, then sampling frequency can return to the previous frequency.

If a statistically significant increasing trend continues to be observed over two or more consecutive years and there is no superseding cause, a hydrogeologic investigation (and additional site investigation(s), if necessary) will be performed.

g. *A discussion addressing the adequacy of the controls and management of the proposed GMZ at the site*

The controls and management of the GMZ are common practice in the industry and adequate to reduce the concentrations of contaminants below the Class I groundwater standards over time.

h. *Course of action for future activities and/or request for modification in regards to the proposed GMZ at the site*

Requests for future action or changes to the GMZ will be submitted in writing to the IEPA.

6.0 POINT OF COMPLIANCE

In any GMZ, the goal is remediation of the groundwater to the level of the standards applicable to that class of groundwater. This goal does not mean all groundwater within the GMZ must be returned to the groundwater standard. On the other hand, groundwater within the GMZ that is beyond the point of compliance as established under 35 Ill. Adm. Code part 620.505(a) is to be remediated to the level applicable to that groundwater class. However, groundwater contamination within the three-dimensional zone between the compliance point wells and the waste management unit could still exceed the applicable standards at completion of the corrective action. If this is the case, post-remediation monitoring may be necessary.

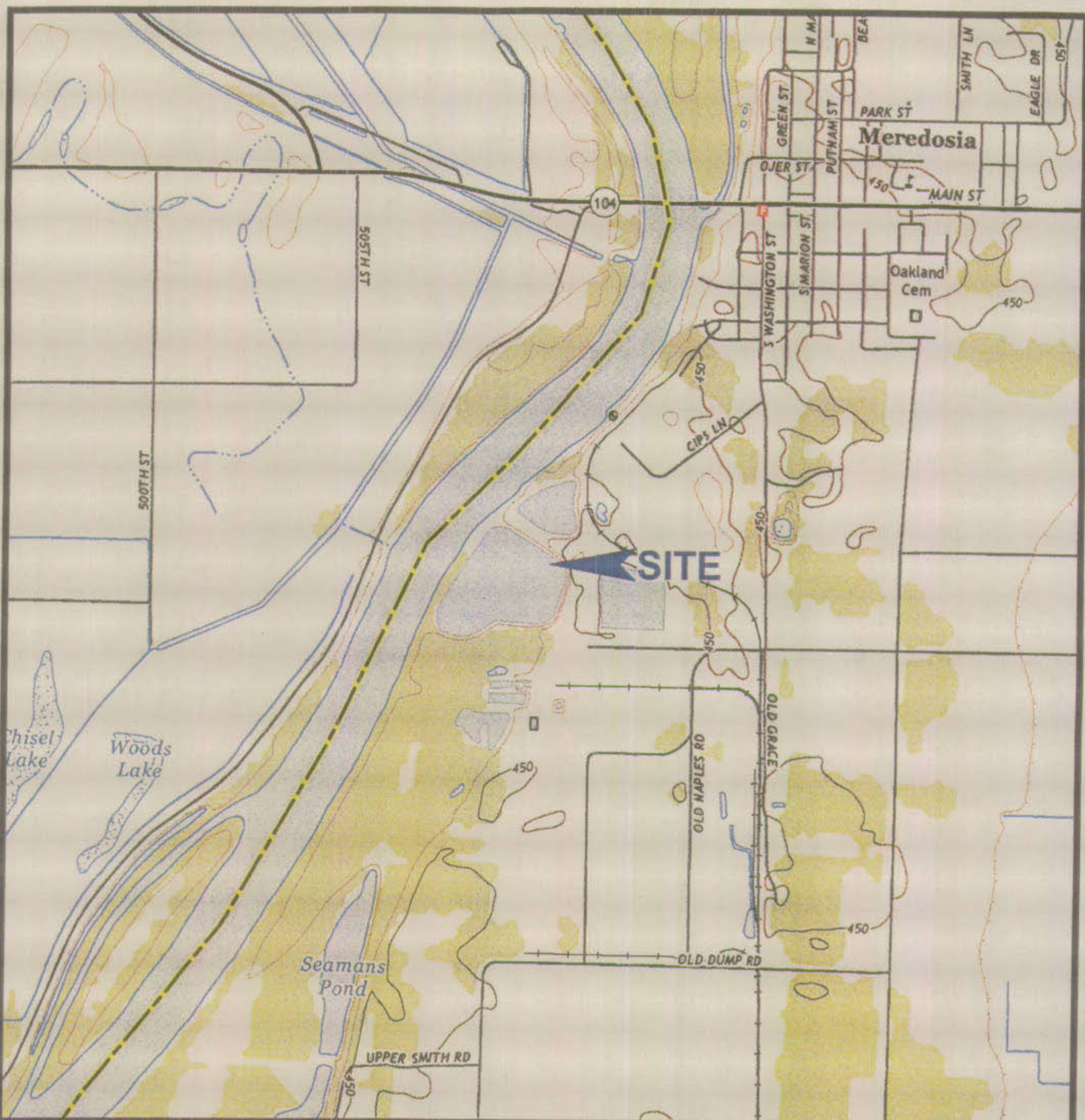
The point of compliance wells for the subject property will be APW-2 and APW-3. These wells are located adjacent to the Illinois River, and are located downgradient relative to the site. If remedial activities do not reduce the contaminant concentrations to levels below the Class I groundwater standards, a plan for post-remediation monitoring will be submitted to the IEPA.

7.0 LICENSED PROFESSIONAL SIGNATURE/SEAL

I hereby affirm that the information and design documents contained in this groundwater management zone plan are true and accurate to the best of my knowledge and professional opinion.

Rosanna M. Saindon, P.E., Ph.D.
Illinois Licensed Professional Engineer
Project Manager
Geotechnology, Inc.

LICENSED PROFESSIONAL ENGINEER
ROSANNA MARIE SAINDON
062.062289
8/15/2016
STATE OF ILLINOIS



NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

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SCALE IN FEET

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Drawn By: WAH	Ck'd By: [signature]	App'vd By: MSR
Date: 2-26-16	Date: 4/21/16	Date: 4/21/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.01

PLATE 1

P.O.B.
SOUTHEAST CORNER
NORTH 1/2, NORTHEAST
1/4, SEC. 28, T.16N.,
R.13W., 3RD P.M.
N1146800.74
E2184866.98

NOTE:
ALL BEARINGS AND COORDINATES ARE REFERENCED TO THE ILLINOIS STATE PLANE COORDINATE SYSTEM, NAD83, ILLINOIS WEST ZONE.
ALL DISTANCES ARE GROUND

N

0 300 600
GRAPHIC SCALE

LEGAL DESCRIPTION

Part of the Northwest Quarter (NW 1/4) of Section Twenty-seven (27), part of the Northeast Quarter (NE 1/4) of Section Twenty-eight (28), and part of the Southeast Quarter (SE 1/4) of Section Twenty-One (21), all in Township Sixteen (16) North, Range Thirteen (13) of the Third Principal Meridian, Morgan County, Illinois, being more particularly described as follows; Beginning at the Southeast corner of the North Half (N 1/2) of the Northeast Quarter (NE 1/4) of said Section Twenty-eight (28); thence South 89°11'27" East (all bearings referenced to the Illinois State Plane Coordinate System, NAD 83, Illinois West Zone), 874.74 feet; thence North 00°23'32" West 1297.08 feet; thence North 89°02'55" West 1418.74 feet; thence North 07°18'23" West, 487.01 feet; thence North 44°46'00" East, 391.08 feet; thence North 58°53'16" West, 1658.73 feet; thence South 54°18'23" West 924.04 feet; thence South 48°53'44" West, 478.06 feet; thence South 40°26'07" West, 882.11 feet; thence South 27°15'47" West 1552.69 feet; thence South 89°40'31" East, 1015.01 feet; thence South 89°44'19" East, 496.63 feet; thence South 89°43'05" East 2641.92 feet to the point of beginning, except the following described parcel:

Part of the Northeast Quarter of Section 28, Township 16 North, Range 13 West of the Third Principal Meridian, Morgan County, Illinois, being more particularly described as follows:

Commencing at the Northeast corner of Section 28 (Southwest corner Section 22), Township 16 North, Range 13 West of the Third Principal Meridian, Morgan County, Illinois; thence South 89° 02' 55" East (basis of bearing is the Illinois State Plane Coordinate System, NAD 83, Illinois West Zone) along the South line of said Section 22, a distance of 19.06 feet; thence South 48° 18' 27" West a distance of 29.52 feet; thence North 89° 02' 55" West a distance of 19.76 feet; thence South 00° 09' 41" West a distance of 449.00 feet to the true point of beginning;

Thence continuing South 00° 09' 41" West a distance of 780.26 feet to a point on the now vacated North R.O.W. line of T.R. 59; thence North 89° 43' 05" West a distance of 250.00 feet; thence North 00° 09' 41" East a distance of 780.26 feet; thence South 89° 43' 05" East a distance of 250.00 feet to the true point of beginning.

Excepted parcel containing 4.478 acres, more or less.

Said Groundwater Management Zone tract containing 211.94 acres, more or less.

PROFESSIONAL LAND SURVEYOR
KENNETH E. STURGEON
035-003518
JACKSONVILLE
ILLINOIS
STATE OF ILLINOIS

SURVEYORS STATEMENT

I, KENNETH E. STURGEON, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF ILLINOIS DO HEREBY STATE THAT THE PLAT AND DESCRIPTION SHOWN HEREON IS A TRUE AND CORRECT REPRESENTATION OF THE SURVEY MADE UNDER MY SUPERVISION.

Kenneth E. Sturgeon 8/15/16

KENNETH E. STURGEON
ILLINOIS PROFESSIONAL LAND SURVEYOR #3518
LICENSE EXPIRES 11/30/16

THIS PROFESSIONAL SERVICE CONFORMS TO THE CURRENT ILLINOIS MINIMUM STANDARDS FOR A BOUNDARY SURVEY.

B&A
BENTON & ASSOCIATES INC
Illinois Design Firm
Registration No. 184-000852

No.	Description	Date	Appr.

GROUND WATER MANAGEMENT ZONE
PLAT OF SURVEY
FOR
AMEREN, MEREDOSIA, ILLINOIS

BENTON & ASSOCIATES, INC.
1970 W. Lafayette Ave., Jacksonville IL 62650
(217) 245-4146 (217) 245-4149 Fax
Kirksville Missouri
Macomb Illinois
Macon Missouri

Date:	August 2016
Designed by:	K Sturgeon
Drawn by:	S. Weber
Reviewed by:	K Sturgeon
Approved by:	K Sturgeon

Job No. 12s3250

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Sheet 1 of 2

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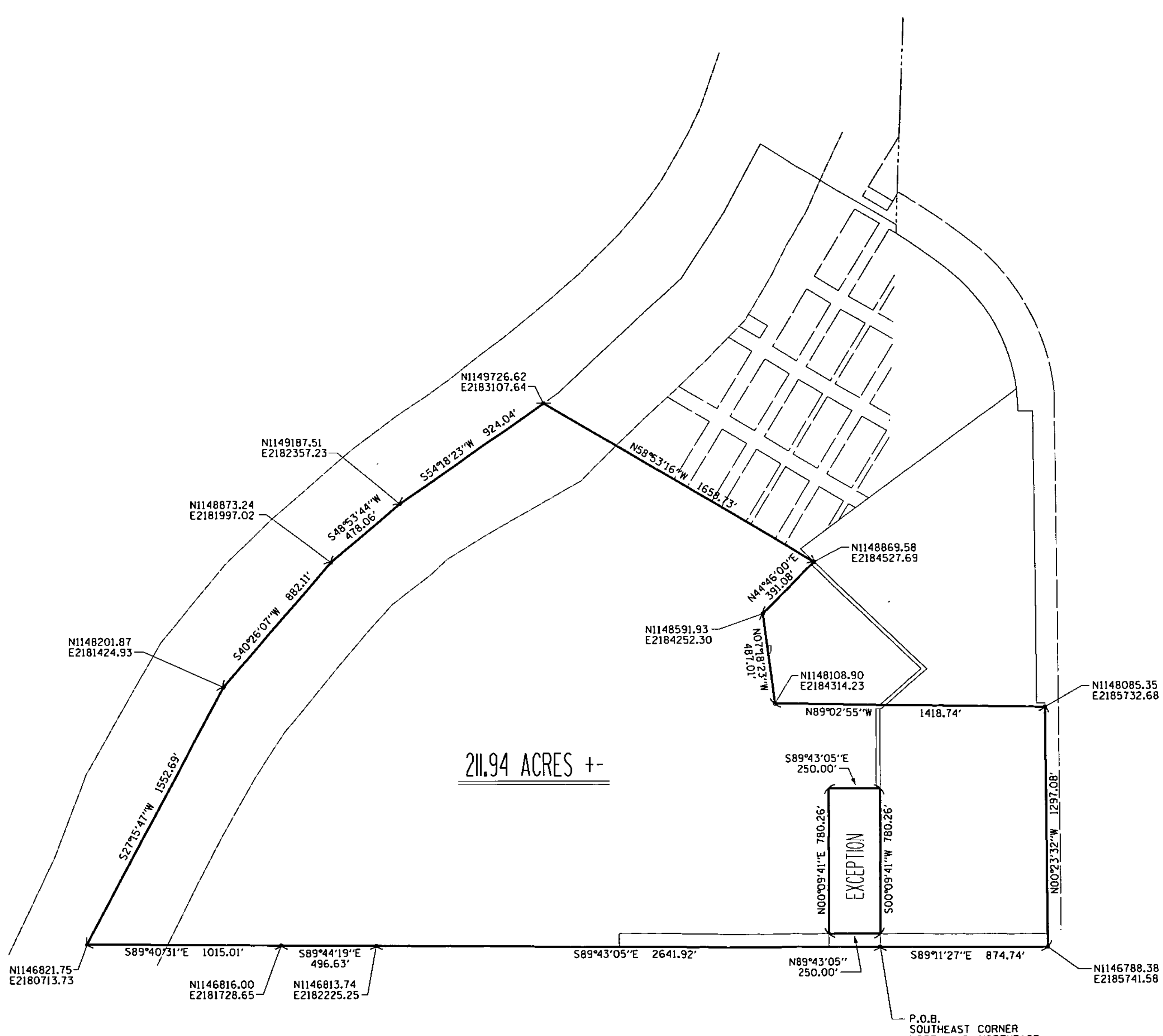

NOTE:
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ALL DISTANCES ARE GROUND

LEGAL DESCRIPTION

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B&A
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No. | Description | Date | Appr.

GROUND WATER MANAGEMENT ZONE
PLAT OF SURVEY
FOR
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1970 W. Lafayette Ave., Jacksonville IL 62650
(217) 245-4146 (217) 245-4149 Fax
Kirksville Missouri
Macomb Illinois
Macon Missouri

Date:	August 2016
Designed by:	K. Sturgeon
Drawn by:	S. Weber
Reviewed by:	K. Sturgeon
Approved by:	K. Sturgeon

Job No. 12s3250

X2

Sheet 1 of 2

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ATTACHMENT 1

CONFIRMATON OF CORRECTIVE ACTION FORM

Joint Committee on Administrative Rules

ADMINISTRATIVE CODE

TITLE 35: ENVIRONMENTAL PROTECTION
SUBTITLE F: PUBLIC WATER SUPPLIES
CHAPTER I: POLLUTION CONTROL BOARD
PART 620 GROUNDWATER QUALITY
SECTION 620.APPENDIX D CONFIRMATION OF AN ADEQUATE CORRECTIVE ACTION PURSUANT TO 35 ILL. ADM. CODE 620.250(A)(2)

Section 620.APPENDIX D Confirmation of an Adequate Corrective Action Pursuant to 35 Ill. Adm. Code 620.250(a)(2)

Pursuant to 35 Ill. Adm. Code 620.250(a) if an owner or operator provides a written confirmation to the Agency that an adequate corrective action, equivalent to a corrective action process approved by the Agency, is being undertaken in a timely and appropriate manner, then a groundwater management zone may be established as a three-dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site. This document provides the form in which the written confirmation is to be submitted to the Agency.

Note 1. Parts I and II are to be submitted to IEPA at the time that the facility claims the alternative groundwater standards. Part III is to be submitted at the completion of the site investigation. At the completion of the corrective process, a final report is to be filed which includes the confirmation statement included in Part IV.

Note 2. The issuance of a permit by IEPA's Division of Air Pollution Control or Water Pollution Control for a treatment system does not imply that the Agency has approved the corrective action process.

Note 3. If the facility is conducting a cleanup of a unit which is subject to the requirements of the Resource Conservation and Recovery Act (RCRA) or the 35 Ill. Adm. Code 731 regulations for Underground Storage Tanks, this confirmation process is not applicable and cannot be used.

Note 4. If the answers to any of these questions require explanation or clarification, provide such in an attachment to this document.

Part I. Facility Information

Facility Name Meredosia Power Station

Facility Address 800 South Washington Street; Meredosia, Illinois

County Morgan

Standard Industrial Code (SIC) 4911

1. Provide a general description of the type of industry, products manufactured, raw materials used, location and size of the facility. See Section 2.0(e.) of the GMZ Plan.

2. What specific units (operating or closed) are present at the facility which are or were used to manage waste, hazardous waste, hazardous substances or petroleum?

	YES	NO
Landfill		X
Surface Impoundment	X	
Land Treatment		X
Spray Irrigation		X
Waste Pile		X
Incinerator		X
Storage Tank (above ground)		X
Storage Tank (underground)		X
Container Storage Area		X
Injection Well		X
Water Treatment Units		X
Septic Tanks		X
French Drains		X
Transfer Station		X
Other Units (please describe)		

3. Provide an extract from a USGS topographic or county map showing the location of the site and a more detailed scaled map of the facility with each waste management unit identified in Question 2 or known/suspected source clearly identified. Map scale must be specified and the location of the facility must be provided with respect to Township, Range and Section. See Section 2.0(g.) of the GMZ Plan.

4. Has the facility ever conducted operations which involved the generation, manufacture, processing, transportation, treatment, storage or handling of "hazardous substances" as defined by the Illinois Environmental Protection Act? Yes ___No X If the answer to this question is "yes" generally describe these operations.

5. Has the facility generated, stored or treated hazardous waste as defined by the Resource Conservation and Recovery Act? Yes___ No X If the answer to this question is "yes" generally describe these operations.

6. Has the facility conducted operations which involved the processing, storage or handling of petroleum? Yes ___No X If the answer to this question is "yes" generally describe these operations.

7. Has the facility ever held any of the following permits?

a. Permits for any waste storage, waste treatment or waste disposal operation. Yes ___ No X If the answer to this question is "yes", identify the IEPA permit numbers.

b. Interim Status under the Resources Conservation and Recovery Act (filing of a RCRA Part A application). Yes ___ No X If the answer to this question is "yes", attach a copy of the last approved Part A application.

c. RCRA Part B Permits. Yes ___ No X If the answer to this question is "yes", identify the permit log number.

8. Has the facility ever conducted the closure of a RCRA hazardous waste management unit? Yes ___ No X

9. Have any of the following State or federal government actions taken place for a release at the facility?

a. Written notification regarding known, suspected or alleged contamination on or emanating from the property (e.g., a Notice pursuant to Section 4(q) of the Environment Protection Act)? Yes ___ No X If the to this question is "yes", identify the caption and date of issuance.

b. Consent Decree or Order under RCRA, CERCLA, EPAct Section 22.2 (State Superfund), or EPAct Section 21(f) (State RCRA). Yes ___ No X

c. If either of Items a or b were answered by checking "yes", is the notice, order or decree still in effect? Yes ___ No X

10. What groundwater classification will the facility be subject to at the completion of the remediation?

Class I X Class II ___ Class III ___ Class IV ___
If more than one Class applies, please explain.

11. Describe the circumstances which the release to groundwater was identified.
See Section 2.0(j.) of the GMZ Plan.

Based on my inquiry of those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true and accurate.

Facility Name	Signature of Owner/Operator
Location of Facility	Name of Owner/Operator
EPA Identification Number	Date

PART II: Release Information

1. Identify the chemical constituents release to the groundwater. Attach additional documents as necessary. See Section 3.0(a.) of GMZ Plan.

Chemical Description	Chemical Abstract No.
-	-
-	-
-	-

2. Describe how the site will be investigated to determine the source or sources of the release. See Section 3.0(c.) of the GMZ Plan.

3. Describe how groundwater will be monitored to determine the rate and extent of the release. See Section 3.0(d.) of the GMZ Plan.

4. Has the release been contained on-site at the facility? Yes

5. Describe the groundwater monitoring network and groundwater and soil sampling protocols in place at the facility. See Section 3.0(d.) of the GMZ Plan.

6. Provide the schedule for investigation and monitoring. See Section 3.0(e.) of the GMZ Plan.

7. Describe the laboratory quality assurance program utilized for the investigation. The laboratory quality assurance program is attached to this form.

8. Provide a summary of the results of available soil testing and groundwater monitoring associated with the release at the facility. The summary or results should provide the following information: dates of sampling; types of samples taken (soil or water); locations and depths of samples; sampling and analytical methods; analytical laboratories used; chemical constituents for which analyses were performed; analytical detection limits; and concentrations of chemical constituents in ppm (levels below detection should be identified as "ND"). A summary of the results of available groundwater testing data is included in Appendix B of the GMZ Plan.

Based on my inquiry of those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of knowledge and belief, true and accurate and confirm that the actions identified herein will be undertaken in accordance with the schedule set forth herein.

Facility Name	Signature of Owner/Operator
Location of Facility	Name of Owner/Operator
EPA Identification Number	Date

Part III: Remedy Selection Information

1. Describe the selected remedy. The ash ponds will be clean closed.

2. Describe other remedies which were considered and why they were rejected. Other remedies were not considered.

3. Will waste, contaminated soil or contaminated groundwater be removed from the site in the course of this remediation? Yes ___ No _X_ If the answer to this question is "yes", where will the contaminated material be taken?

4. Describe how the selected remedy will accomplish the maximum practical restoration of beneficial use of groundwater. See Section 5.0 of the GMZ Plan. 5a + C

5. Describe how the selected remedy will minimize any threat to public health or the environment. See Section 5.0 of the GMZ Plan. 5b add [illegible] @ 3yrs

6. Describe how the selected remedy will result in compliance with the applicable groundwater standards. See Section 5.0 of the GMZ Plan. 5b refer Attachment B

7. Provide a schedule for design, construction and operation of the remedy, including dates for the start and completion. See Section 5.0 of the GMZ Plan. 5d, table 9 [illegible] re time

8. Describe how the remedy will be operated and maintained. See Section 5.0 of the GMZ Plan. refer to Attachments D+E

9. Have any of the following permits been issued for the remediation?

   a. Construction or Operating permit from the Division of Water Pollution Control. Yes __ No ___ deferred after approval of plan

   b. Land treatment permit from the Division of Water Pollution Control. Yes ___ No ___ If the answer to this question is "yes", identify the permit number. deferred

   c. Construction or Operating permit from the Division of Air Pollution Control. Yes ___ No ___ If the answer to this question is "yes", identify the permit number. deferred

10. How will groundwater at the facility be monitored following completion of the remedy to ensure that the groundwater standards have been attained?
    See Appendix C of the GMZ Plan. refer to Attachment B

Based on my inquiry of those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true and accurate and confirm that the actions identified herein will be undertaken in accordance with the schedule set forth herein.

Facility Name	Signature of Owner/Operator
Location of Facility	Name of Owner/Operator
EPA Identification Number	Date

ATTACHMENT 2

GROUNDWATER SAMPLING PROCEDURES

Appendix B – Groundwater Sampling Procedure

The following procedure shall be used in sampling groundwater at the site. This sampling procedure applies to the routine quarterly and/or modified semi-annual or annual sampling events. A groundwater sampling field data sheet, comparable to the example located in Exhibit B-1, may be used to document the sampling activities at each well. If site conditions at the time of sampling could influence the results, sampling should be postponed until a later date. However, under no circumstances shall the sampling deviate from the schedule in Section 3.1.

To ensure samples are identified and collected at the correct location, monitoring wells should be marked with the monitoring identification designated in the groundwater monitoring program. Brass monument tags with the well identification stamped into the metal shall be installed on each well.

Wells must have permanently marked reference points from which groundwater levels and well depths will be measured. Elevations of reference points must be established relative to the *North American Vertical Datum of 1929 or 1983*, whichever is available. All sampling points should use the same datum.

Upgradient wells should be sampled first to avoid cross contamination. In general, this procedure is intended to sample the least potentially contaminated monitoring point first, and subsequently sample all other monitoring points with increasing contamination potentials.

The three principal steps in collecting groundwater samples from monitoring wells are measuring static groundwater levels; evacuating or purging well bores and casings; and collecting and preserving samples. Each step must be performed consistently from well to well, and from one sampling event to the next if accurate data and representative samples are to be obtained.

General Procedures

The date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers shall be recorded on the groundwater sampling sheet for each well. The sampling equipment and containers should be stored so that contact with the ground surface is minimized.

All parts of sampling equipment coming in contact with groundwater must be thoroughly washed with a non-phosphate detergent and triple rinsed with deionized or distilled water before use. Decontamination shall be conducted initially upon arrival at the site and after each monitoring well has been sampled. Sampling equipment shall be calibrated in accordance to the manufacturer's specifications at the start of each day or as required by the manufacturer.

Water Level Gauging

Static elevations of groundwater should be measured prior to purging each well. Initially, depths to static groundwater levels should be measured from the specified reference point of each well during each sampling event in order to calculate the initial groundwater volume. Groundwater elevations in wells are obtained by subtracting measured depths to groundwater from the specified reference point elevation. Water levels at all monitoring wells should be collected on the same day to prevent time distortion of the water surface data.

Monitoring well depths should be measured as the distance from the reference point to the well bottom. Record these depths at each sampling event after low-flow purging. A decrease in well depth, from the known installed total depth, may indicate that sediments have been deposited in the well. If accumulated sediment obstructs approximately 10 percent of the screened interval length, then the well should be redeveloped.

The most common device used to measure well depth and groundwater level is an electronic water level meter. Electronic water level meters are battery-powered devices with a probe that is lowered into the well until an audible signal and/or light indicates contact with the water surface has been made.

The difference between installed total well depth and depth to static groundwater level is the stabilized height of the groundwater column in the well. Accumulated sediment is not subtracted when calculating the volume of groundwater in the well, resulting in a greater and more conservative estimate of purge volume. These measurements are used to determine the static well volume (in gallons) of groundwater for each well as follows:

1. In order to obtain the height (H) of the groundwater column, measure the well total depth (TD) and subtract the measured depth to static water level (MSD)

$$H = TD - MSD$$

2. Use the following formula to calculate the static well volume (in gallons) of groundwater:

$$V = 5.875 \times D^2 \times H$$

Where:
V = Well volume (gallons)
D = Inside well diameter (feet)
H = Height of groundwater column (feet)

Monitoring Well Purging – Pump Method

Low flow sampling methods will be used to obtain representative samples from the groundwater bearing zone being monitored in wells that demonstrate consistent and sufficient yields. A dedicated pumping device installed permanently in the well or a portable pumping device will be used to conduct low flow sampling. The pump intake must be near the middle of the well screen. Pumping flow rates must be less than natural recovery rate of the well generally less than 0.5 liters per minute. The goal is to minimize drawdown in the well. Drawdown is limited to less than 0.3 feet or 10% of the total water column. Continuous monitoring of water level and water quality indicator parameters for stabilization will be obtained during purging.

Indicator parameters for stabilization will begin to be obtained after one equivalent volume of tubing has been removed from the well. For this facility, the following parameters and stabilization requirements are:

- pH ± 0.05 S.U.
- temperature ± 0.5°F
- specific conductivity ± 5%
- dissolved oxygen ± 10% (optional)
- redox potential ± 10% (optional)
- turbidity ± 10% (optional)

Samples should be directly placed into the appropriate laboratory containers and handled according to the Sample Handling section and laboratory protocols. If a well is dry or exhibits slow recharge, the well will be allowed to recharge for a minimum of 12 hours. Samples shall be collected until all sample containers have been filled or the well becomes dry. The sampling conditions including dry well conditions shall be documented on the groundwater sampling field data sheet.

Monitoring Well Purging – Bailer Method

Bailers shall only be used for sample collection in the event of a non-functioning pump. Only new, disposable bailers with new string attached shall be used for sampling. Stabilization indicator parameter readings will be collected at each 0.5 gallon interval until stabilization is achieved in accordance with the Low Flow sampling method described above. Well volumes will be calculated in accordance with well gauging formulas described above.

Sample Collection Procedures

Sample handling and preservation techniques depend on the parameters to be analyzed. Groundwater samples should be collected, preserved and containerized in their order of sensitivity to volatilization (most sensitive to least sensitive). The purpose of sample preservation is to stabilize parameters of interest by retarding chemical or biological changes. Methods of preservation are generally limited to pH adjustment, chemical addition and cooling.

Samples requiring preservation should be preserved immediately upon collection or be placed in sealed containers with preservative added by the laboratory. Proper preservation will help ensure that samples are representative of groundwater.

Every sample must be cooled to 4° C (approximately 39° F) immediately after being containerized and preserved. Every sample must also be maintained at 4° C until analyzed. Laboratory protocol regarding appropriate containers, preservatives, and holding times should be followed.

Groundwater samples that are to be analyzed for total recoverable metals must not be field filtered. However, if dissolved metals analyses are required, then the samples must either be field filtered through a 0.45-micron filter immediately upon collection and prior to preservation and transport to a laboratory or filtered by the laboratory upon receipt.

Field measurements for the indicator parameters of pH, temperature and specific conductivity should be taken on a portion of the sample that has been placed in a separate clean container that will not be analyzed for any other parameters. This procedure avoids cross contamination from field instrument probes.

Sample Documentation and Transportation

Before samples are transported to the laboratory, a chain-of-custody record shall be provided. Chain-of-custody records document in a legally defensible manner the history of collection, transfer and transport of each sample. Every individual, who is responsible for the samples from the time of collection to the time they are received by a laboratory, must be documented in the Chain-of-Custody record. The Chain-of-Custody document records allow tracing the possession and handling of individual samples from the time of field collection through the time of laboratory analyses. The sample labels shall be completed in indelible ink and sample seals (if required) should be applied to each container prior to packing and shipment. Samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests, or coolers. The samples should be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

ATTACHMENT 3

LABORATORY QUALITY ASSURANCE PROGRAM

BOW REFERENCE SHEET --- SAME FACILITY

Facility Number:	**W1370300005**
Facility Name:	**Ameren Energy - Meredosia**
USEPA Number:	
File Category:	**06L – Groundwater Closure**

FOR ADDITIONAL INFORMATION ON THIS, SEE CATEGORY UNDER THIS SAME FILE HEADING:	**06L – Groundwater Closure** **(CD)**

DATE OF OTHER DOCUMENT	DESCRIPTION OF OTHER DOCUMENT:
08/22/2016	**Closure Plan – Fly Ash Pond and Bottom Ash Pond**
	CD: Teklab QA Manual

IEPA-DIVISION OF RECORDS MANAGEMENT
RELEASABLE

AUG 18 2017

REVIEWER: JKS

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PaperLPC 258 REV. JUN-93

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ATTACHMENT D

POST-CLOSURE CARE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 4, 2016

Del/J024917.01 Meredosia Post Closure Care Plan RF.doc

J024917.01

POST-CLOSURE CARE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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POST-CLOSURE CARE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

This Post-Closure Care Plan for the AmerenEnergy Medina Valley Cogen, LLC, Meredosia Power Station Fly Ash and Bottom Ash Ponds Coal Combustion Waste Surface Impoundments (Meredosia) has been prepared in general accordance with the requirements of the site-specific rule in 35 Illinois Administrative Code (IAC) Part 840. Supporting documents are listed in Section 6.0 of this report and are being submitted concurrently with the Post-Closure Care Plan.

A written record of monitoring will be made and retained at the main office of the owner since the site is in the process of being decommissioned and demolished. This written record typically includes completed standard inspection forms and photographs. The inspector will assess the condition and need for repair of cover components, embankments, monitoring wells, and surface water control features.

2.0 SITE LAYOUT

The Meredosia Power Station is located at 800 South Washington Street, Meredosia, Illinois. The facility is currently being decommissioned and will be demolished. The Fly Ash and Bottom Ash Ponds are located southwest of the coal pile and plant facilities. The site location and topography are shown on Plate 1. The structures and ash ponds are shown on Plate 2.

3.0 POST-CLOSURE MAINTENANCE PROGRAM

The post-closure operation and maintenance program includes site inspections of surface disturbances, failures, adequacy of sand infill, storm water drainage channel maintenance, and repairs as required. This Post-Closure Plan applies the Fly Ash Pond, the Bottom Ash Berm, groundwater monitoring wells associated with the former ash ponds, and surface water drainage from the former ash ponds.

Site monitoring and repair records will be created and retained at the main office of the owner until the Illinois Environmental Protection Agency (IEPA) approves a certified Post-Closure Completion Report.

3.1 Frequency of Inspections

Quarterly site inspections of the Fly Ash Pond, the Bottom Ash Berm, and associated features will be performed for the first five (5) years after completion of closure activities and submittal of the Construction Quality Assurance (CQA) Acceptance Report. After the five year period, site inspections will be performed at the same rate as groundwater sampling (Groundwater Monitoring Plan, Geotechnology, 2016), with a minimum frequency of once per year. Site inspections will occur until the IEPA approves a Post-Closure Completion Report.

3.2 Erosion Control Maintenance

The embankments for both ash ponds will be capped with ClosureTurf® and HydroTurf®, which do not require vegetation. Ash pond embankments below the 100-year flood elevation will also have rip-rap protection. Some areas that are currently vegetated near the ash ponds may be impacted during construction activities. These areas will be regraded and vegetated.

3.3 Drainage Channel Maintenance

Drainage channels on the cover and along the ash pond embankments will be lined with HydroTurf®, which minimizes erosion and sedimentation issues. Drainage channels outside of the ash pond will be natural or rock-lined. Metal culverts will be installed under roads as needed. However, soil or sand at the connections from the HydroTurf® to the drainage channels outside the ash ponds may erode due to the sudden change in gradient at connections with other drainage ways. Repair of energy dissipaters at the connections or localized material infill may be required. The repair material will consist of material similar to the infill and will be capped with a liner material or vegetated.

Storm water from the cap will exit the surface water control system into existing waterways onsite. These waterways will be monitored and repaired as necessary to reduce pooling and erosion. Eroded areas will be infilled with material similar to that which was eroded and capped with like material or vegetated.

3.4 Final Cover Maintenance

The ash in the Fly Ash Pond and the Bottom Ash Pond has consolidated for a minimum of four years. The ClosureTurf® and HydroTurf® systems are not sensitive to settlement, but if post-closure cover settlement occurs, localized repairs to maintain the integrity of the cover may be needed.

3.5 Vegetative Repair and Mowing

Vegetation and mowing is not required on the capped areas due to the use of ClosureTurf® and HydroTurf® to cover the ash ponds instead of vegetative cover.

3.6 Miscellaneous Repairs

Minor repairs may be required to maintain the integrity and proper function of fencing, surface water drainage structures, monitoring points, and groundwater monitoring wells. Repairs will be made as warranted.

4.0 GROUNDWATER MONITORING SYSTEM

The groundwater monitoring well locations, system, maintenance program, and monitoring program are provided under a separate cover titled the Groundwater Monitoring Plan (Geotechnology, 2016). Groundwater trend statistical analysis and mitigation of statistically significant increasing trends are addressed in the Groundwater Monitoring Plan. Two years after the ash ponds have been closed, the groundwater monitoring network will be re-evaluated based on the changes in the groundwater impacts.

5.0 OPERATION AND MAINTENANCE PLAN FOR STRUCTURES AND DEVICES

Operation and maintenance plans for currently planned structures are addressed in the associated sections of this report and the referenced reports. Operation and maintenance plans for future structures, if needed, will be prepared at the time those structures are installed.

6.0 REFERENCES

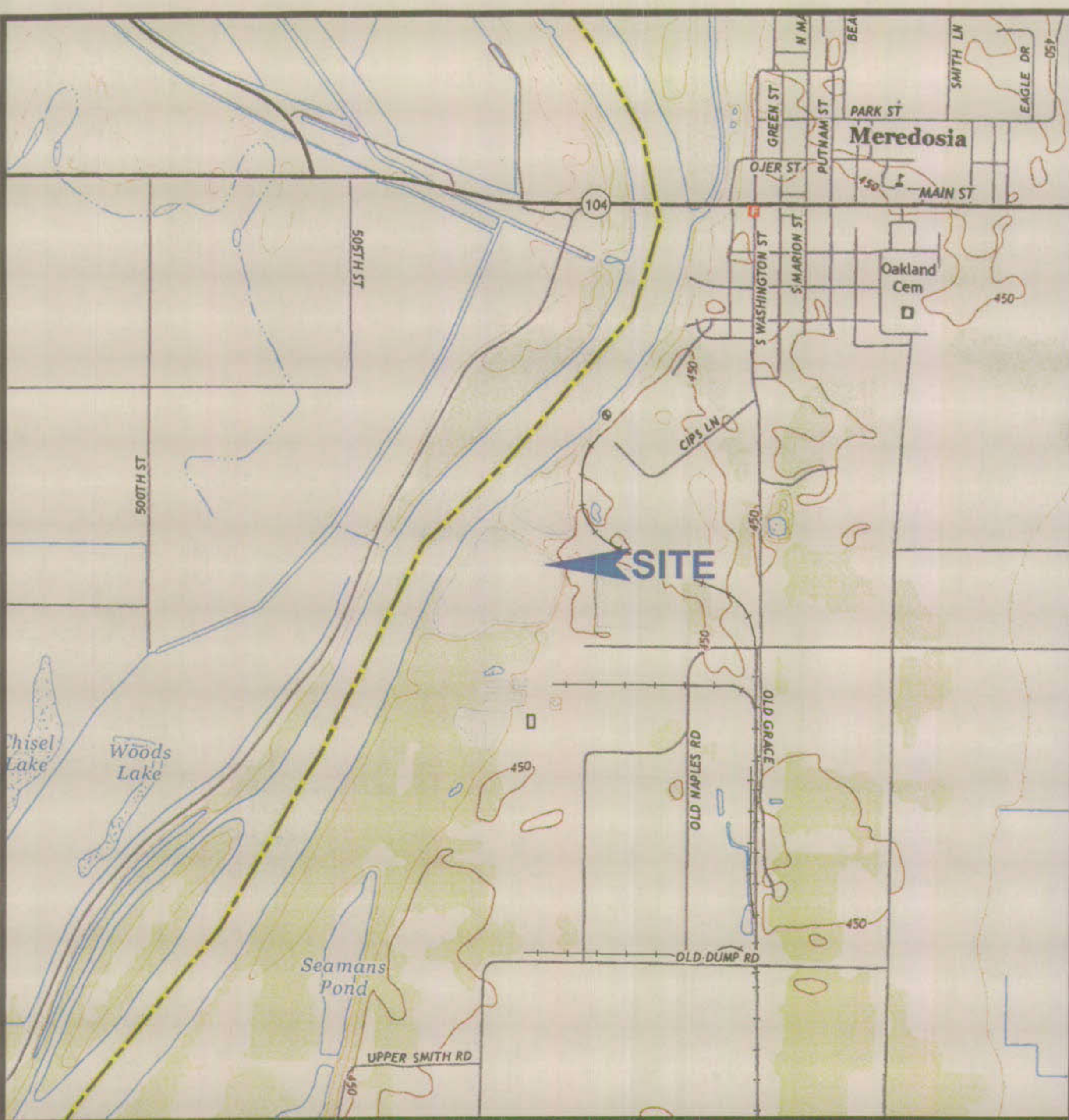
Geotechnology, 2016. "Groundwater Monitoring Plan, Fly Ash and Bottom Ash Ponds, Meredosia Power Station." Geotechnology, Inc., St. Louis, Missouri.

7.0 LICENSED PROFESSIONAL SIGNATURE/SEAL

I hereby affirm that the information contained in this Post-Closure Care Plan is true and accurate to the best of my knowledge and professional opinion.

Rosanna M. Saindon, P.E., Ph.D.
Illinois Licensed Professional Engineer
Project Manager
Geotechnology, Inc.

LICENSED PROFESSIONAL ENGINEER
ROSANNA MARIE SAINDON
062.062289
8/4/2016
STATE OF ILLINOIS



NOTES
1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

0 2,000 4,000
SCALE IN FEET

N

Drawn By: WAH	Ck'd By: AMS	App'vd By: DTK
Date: 2-26-16	Date: 7/1/16	Date: 7/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.01	PLATE 1

NOTES
1. Plan adapted from drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. Monitoring wells were located by the project surveyor.
3. Monitoring Well APW-1 is located beyond the limits of this map and is approximately 2000-feet east of Monitoring Well APW-5.

LEGEND
Monitoring Well Location

N

0 300 600
SCALE IN FEET

Drawn By: WAH	Ck'd By:	App'vd By:
Date: 5-26-16	Date: 7/1/16	Date: 7/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
Meredosia, Illinois

SITE PLAN AND MONITORING WELL LOCATIONS

Project Number J024917.01	PLATE 2

ATTACHMENT E

CONSTRUCTION QUALITY ASSURANCE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

Prepared for:

AMERENENERGY MEDINA VALLEY COGEN, LLC
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Project No. J024917.01

August 15, 2016

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CONSTRUCTION QUALITY ASSURANCE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

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CONSTRUCTION QUALITY ASSURANCE PLAN
FLY ASH POND AND BOTTOM ASH POND
MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, ILLINOIS

1.0 INTRODUCTION

Geotechnology, Inc. prepared this Construction Quality Assurance (CQA) plan for the Fly and Bottom Ash Ponds closure at the Meredosia Power Station in Meredosia, Morgan County, Illinois. The CQA Plan was prepared in general accordance with the Coal Combustion Waste (CCW) surface impoundment closure guidance of 35 Illinois Administrative Code (IAC) 840.146 entitled Site-Specific Closures of Coal Combustion Waste Surface Impoundments Subpart A: Closure of Ash Pond D, Hutsonville Power Station Construction Quality Assurance Program.

This CQA plan includes information related to responsible personnel, project activities, monitoring, sampling, and testing of the coal combustion residual (CCR) cap. The purpose of the CQA plan is to achieve a reasonable degree of certainty that the construction of the CCR surface impoundment cap achieves the specified design parameters.

The CQA Plan requires preparation of an acceptance report at the end of construction by the CQA Officer. The acceptance report includes CQA documentation and a certification by the CQA Officer that the CQA Plan for the facility was followed. This CQA Plan is intended to supplement the project plans and specifications. Where a conflict exists, the current approved CQA Plan will govern.

The testing methods, acceptance requirements, and testing frequencies that guide the implementation of this plan are listed in Table 1. Appendix A includes example testing and observation forms. Alternative forms approved by the Ameren Missouri (Ameren) Project Manager that include the same information are acceptable. Appendix B includes the Watershed Geosynthetics ClosureTurf® and HydroTurf® reference material.

2.0 PROJECT PERSONNEL RESPONSIBILITY AND AUTHORITY

The project organization chart (Figure 1) illustrates the project personnel involved in the Fly and Bottom Ash Ponds closure activities. Project personnel responsibility and authority are presented below.

2.1 Owner. AmerenEnergy Medina Valley Cogen, LLC (Owner) currently holds permits for National Pollutant Discharge Elimination System (NPDES) and operation of the Fly and Bottom Ash Ponds. The Owner has an agreement with Ameren Missouri (Ameren) to complete this work. Ameren will submit the project closure plan, construction plan, specifications, CQA plan, groundwater monitoring plan, and post-closure care plan to the Illinois Environmental Protection Agency (IEPA) and Illinois Department of Natural Resources (IDNR) for approval prior to construction.

The Ameren designated representative is the Ameren Project Manager. The Ameren Project Manager coordinates overall construction and acts as the Owner's primary point of contact with the General Contractor. The Ameren Project Manager coordinates all matters involving contract issues, including approving changes to the project plans and specifications.

2.2 Design Engineer. The Design Engineer is responsible for development of plans and specifications that fulfill the requirements of the Owner and regulatory agencies. The Design Engineer is responsible for:

- responding to the Contractor requests for information (RFIs) during construction;
- addressing identified conflicts in the project plans and specifications; and
- developing modifications to the plans and specifications that may be required to address changed field conditions, field cost savings, design improvements, or other necessary or desired modifications as approved by the Owner.

2.3 Site Supervisor. The Site Supervisor is the field representative for the Owner that observes contractor activities and reports to the Owner. The Site Supervisor is responsible for:

- maintaining records of Contractor personnel on-site, equipment on-site, and material deliveries, as provided by contractors and suppliers;
- recording closure activity progress in daily reports;
- obtaining photographs of closure activities;
- attending progress and/or deficiency meetings;
- developing and maintaining a submittal log;
- coordinating schedules with the Owner, General Contractor, and CQA Personnel;
- assisting the Owner by reviewing work orders and field changes;

- coordinating with the Owner, General Contractor, and CQA Personnel regarding Owner-approved additional work and/or field changes; and
- observing construction activities, and reporting to the Owner if discrepancies between the activities and the project plans and/or specifications occur.

2.4 CQA Personnel.

2.4.1 CQA Officer. Ameren will retain a CQA Officer for the project who will report directly to the Ameren Project Manager. The CQA Officer will be a Professional Engineer registered in the State of Illinois, who is a person other than the Owner or an employee of the Owner. The CQA Officer will supervise and be responsible for monitoring, testing, and other activities required in the CQA plan. The CQA Officer will also supervise firms who will perform the monitoring, testing, and sampling required by the CQA plan.

The CQA Officer will be present at the beginning of primary project tasks and at various times during construction. The time that the CQA Officer must be at the project site will depend on the construction methods used by the contractors. The CQA Officer will exercise professional judgment to be present at the project site as required to assume responsibility for the monitoring and testing performed by those persons under his/her direct supervision. The CQA Officer will have enough on-site staff (CQA Representatives) to adequately perform the quality assurance activities in the CQA Plan. If the CQA Officer cannot perform a required duty, a CQA Officer-In-Absentia, qualified for that portion of the work, may be designated by the CQA Officer.

The CQA Officer, with on-site support personnel as required, will provide observation of the monitoring, testing, and/or sampling of the following construction activities for the facility:

- placement and compaction of the subgrade to specified parameters;
- placement of final cover, including installation of the geosynthetics; and
- construction of surface water control features.

The CQA Officer will verify that the sampling, monitoring, and testing for the major elements of the construction are in compliance with the established design requirements before the next sequential item for construction is initiated. The elements of work requiring compliance verification include:

- the subgrade prior to placement of the ClosureTurf® and other geosynthetic materials; and

- the geomembrane components of the ClosureTurf® and HydroTurf® have completed and passed testing prior to installation of the geotextile/turf component.

The CQA Officer will review the monitoring, sampling, and testing completed for the work item to assess compliance with design requirements. The CQA Officer will also visually observe the work item before completing and signing the CQA Certification form (Appendix A). The contractor or installer for the subsequent construction activity will not be allowed to initiate work for the next task until the forms are completed and signed by the CQA Officer.

The completed and signed CQA Certification forms will be filed as project records in accordance with the provisions of Section 9.0.

2.4.2 Document Controller. The Document Controller files all CQA records related to the monitoring, sampling, and testing specified in the CQA Plan. In addition, the Document Controller will control the CQA Plan distribution so that current documents are being used by the CQA staff. The duties of the Document Controller may be performed by other members of the CQA team.

Requirements for control of the CQA Plan and for filing of the project records are discussed in Section 9.0.

2.5 Testing and Monitoring Firms. The CQA Officer will provide guidance to the testing and monitoring firms during quality assurance sampling, monitoring, and/or testing discussed in the CQA Plan. Limited monitoring and independent sampling and testing are required for the geosynthetic liner installation. Product suppliers and installers of geosynthetic materials are responsible for the sampling and testing required.

2.5.1 Soil Testing (Laboratory and Field). One or more soil testing firms qualified by the IDOT or IEPA (as appropriate) will be retained to perform the field and laboratory testing outlined in CQA Plan. Materials will be sampled by the testing firm or persons designated by the CQA Officer.

Each firm will provide proof of calibration to the CQA Officer for measuring and/or testing equipment used in the field or laboratory. Proof of calibration for commercial grade equipment, such as rulers and tape measures that provide adequate accuracy for the intended purpose is not required.

Field and laboratory forms proposed for data collection will be subject to review by Ameren prior to use. Incomplete or otherwise unacceptable forms will be modified by the testing firm to meet the intent of the CQA Plan.

2.5.2 Surveyor. One or more surveyors will survey specified elevations, slopes, and grades as required in the CQA Plan. The firm(s) selected will complete the work using or under the supervision of an Illinois Professional Land Surveyor.

Each surveyor will be required to provide proof of calibration to the CQA Officer for each surveying device that will be used. Proof of calibration for commercial grade equipment, such as rulers, tape measures or other devices that provide adequate accuracy for their intended purpose is not needed.

2.5.3 Geosynthetic Testing. A geosynthetic monitoring firm may be retained to perform quality assurance observations for geosynthetic monitoring, testing, and sampling performed by the suppliers and installers. Additional geosynthetic samples may be collected for independent testing.

The geosynthetic testing laboratory will be independent of both the manufacturer and the installer of the geosynthetics. The Ameren Project Manager and CQA Officer will review and approve the geosynthetic testing laboratory quality assurance (QA) plan prior to start of services.

Field and laboratory forms proposed for data collection will be subject to review by Ameren prior to use. Incomplete or otherwise unacceptable forms will be modified by the testing firm to meet the requirements of the CQA Plan.

2.6 Contractors, Suppliers, and Installers. The General Contractor is responsible for obtaining all necessary construction permits and the appropriate subcontractors, suppliers, and installers to complete the work in accordance with the contract. Acceptance of work by the CQA Officer does not relieve the General Contractor of obligations to furnish all work in accordance with the contract.

Contractors, subcontractors, suppliers, and installers are responsible for completing their portions of the work within specified schedules and in accordance with the requirements of the plans and specifications. The contractors, subcontractors, suppliers, and installers will accommodate the monitoring, sampling, and testing outlined in the CQA Plan. At least 7 days of notice is required to schedule CQA personnel and to review testing results.

The geosynthetic suppliers and installers will provide the quality assurance monitoring, sampling, and testing as required in the CQA Plan. The geosynthetic installers will be required to submit "certificates of acceptance" for certain items of work that precede their construction activities. The "certificates of acceptance" are discussed in Section 4.3.2.

3.0 PROJECT MEETINGS

Periodic meetings will be held to provide coordination among the involved personnel. Descriptions of pre-construction meetings, routine progress meetings and work deficiency meetings are presented in the following paragraphs.

3.1 Pre-Construction Meetings. Pre-construction meetings will occur before site grading and geosynthetic installations. The Ameren Project Manager, CQA Officer, Site Supervisor, General Contractor, and the appropriate subcontractors will attend.

At a minimum, project plans, specifications, and CQA items that will be discussed during the pre-construction meeting will include:

- protocols for monitoring, testing, and sampling;
- items of work requiring CQA Officer certification or installer acceptance before subsequent work items can be initiated (see Section 4.0); and
- established protocol for handling construction deficiencies, corrective measures, and retesting (see Section 6.0).

The General Contractor's Project Manager shall coordinate meeting times, provide an agenda, and provide meeting minutes as required in the Project Specifications. The meeting documentation review by attendees will occur before documents are filed as project records in accordance with Section 9.0.

3.2 Progress Meetings. The Ameren Project Manager or CQA Officer will schedule progress meetings to discuss on-going and up-coming construction activities. Attendees will include the Ameren Project Manager, CQA Officer, Site Supervisor, General Contractor, and appropriate subcontractors. At a minimum, topics regarding progress and the following CQA items will be reviewed:

- protocol for monitoring, testing, and sampling;
- items of work requiring CQA Officer certification or installer acceptance before subsequent work items can be initiated (see Section 4.0);
- established protocol for handling construction deficiencies, corrective measures, and retesting (see Section 6.0); and
- upcoming scheduled activities and appropriate personnel.

The General Contractor's Project Manager shall coordinate meeting times, provide an agenda, and provide meeting minutes as required in the Project Specifications. The meeting documentation review by attendees will occur before documents are filed as project records in accordance with Section 9.0.

3.3 Work Deficiency Meetings. The CQA Officer will require special meetings when a project issue or work deficiency is anticipated or encountered. Attendees will include the Ameren Project Manager, Site Supervisor, General Contractor, and appropriate subcontractors. The purpose of these meetings is to define and resolve the project issue or work deficiency in the following manner:

- define the project issue or work deficiency and its probable causes or influence on the project;
- discuss alternative actions to address the project issue or work deficiency;
- assign parties to implement the selected action;
- implement the selected action to resolve the project issue or work deficiency; and
- verify the implemented action has been effective through appropriate monitoring.

The General Contractor's Project Manager shall coordinate meeting times, provide an agenda, and provide meeting minutes as required in the Project Specifications. The meeting documentation review by attendees will occur before documents are filed as project records in accordance with Section 9.0.

4.0 SAMPLING AND TESTING REQUIREMENTS

4.1 Introduction. Prequalification and placement sampling and testing requirements for the various materials and construction activities are summarized in Table 1. Frequencies for the material placement testing listed in Table 1 are based on the volume of material used in construction and are recommended minimums. The CQA Officer will select the specific testing locations by exercising professional judgment. The testing and sampling locations will represent the construction activity.

The geosynthetic installers will be responsible for the required sampling for the Geosynthetic Prequalification and Placement Testing presented in Table 1. Independent laboratory testing will be coordinated through the CQA Officer.

Custody of samples and transfer from the sampling location to the testing facility will be established and documented through the use of a Chain of Custody Record. The sampling party will document sample description, date, time, material type, and testing method, then relinquish sample custody to the testing firm by signing and dating the form. The sampling party will retain a copy for their records. The samples will be shipped or delivered to the testing firm with the signed Chain of Custody Record.

The testing firm will document sample receipt by signing and dating the Chain of Custody Record. The testing firm will return the original signed Chain of Custody Record to the Document Controller with the corresponding test results. The Document Controller will retain the signed original Chain of Custody form as a project record in accordance with Section 9.0.

The sampling and testing results will be documented on a daily basis by each testing firm or installer providing the quality assurance activities. The original copies of the sampling and testing results will be provided to the CQA Officer.

4.2 Subgrade.

4.2.1 Fly Ash Pond Subgrade. The CQA Officer will direct the sample collection and laboratory testing for the standard Proctor test in accordance with the American Standard of Testing and Materials (ASTM) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (ASTM D698-12). The subgrade material will be coal combustion residuals, but embankment material and other fill material may be included. A separate standard Proctor test for each material type will be required. The CQA Officer will direct field moisture/density testing of the top one foot of subgrade in accordance with Table 1.

4.2.2 Bottom Ash Road Subgrade. The CQA Officer will direct the sample collection and laboratory testing for the standard Proctor test in accordance with the ASTM Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (ASTM D698-12). The subgrade material will be coal combustion residuals, but embankment material and other fill material may be included. A separate standard Proctor test for each material type will be required. The CQA Officer will direct field moisture/density testing of each 6-inch lift of subgrade in accordance with Table 1.

Since the berm will be widened to account for heavy vehicle traffic, lifts will be placed horizontally, compacted, tested, then graded. Additional material will be blended into the current berm to reduce the chance of slope failure.

4.2.3 Bottom Ash Pond Backfill. The CQA Officer will direct the sample collection and laboratory testing of backfill material for the Bottom Ash Pond. One pre-qualification sample will be required per source for testing in accordance with Table 1. One confirmation sample will be required per 20,000 cubic yards of backfill placed in the Bottom Ash Pond per source in accordance with Table 1. If non-virgin material is being used, full IEPA Tiered Approach to Corrective Action (TACO) contaminants of concern will be tested.

The CQA Officer will direct the sample collection and laboratory testing for the standard Proctor test in accordance with the ASTM Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (ASTM D698-12). The CQA Officer will direct field moisture/density testing of each 1-foot lift of subgrade in accordance with Table 1.

4.2.4 Subgrade Survey. The prepared subgrade will be surveyed on a 100-foot grid pattern and at breaks in grade. Prepared subgrade not within the control tolerance requirement of 0.0 to +0.4 feet of design grade (or as accepted by the CQA Officer and Ameren Project Manager) will be corrected. The maximum grade for the slopes is 10-percent. The surveyor will document the measured grades on "as-built" drawings furnished to the CQA Officer.

The CQA Officer will review the survey data for conformance to the requirements, and, if in agreement with design requirements, will provide approval for the work using the CQA Certification Form.

4.2.5 Post-Placement. Prior to placing geosynthetics, the entire subgrade will be proofrolled using a smooth drum roller. CQA Representatives will provide visual observation during proofrolling. Soft or pumping areas will be removed and replaced with acceptable material. Subgrade completion observation activities may include additional testing of subgrade material, observing subgrade surfaces, and additional surveys to measure elevations, slopes, and subgrade boundaries where discrepancies with the construction drawings are suspected.

4.3 ClosureTurf® and HydroTurf®. Where not otherwise specified, Geosythetic procedures shall be in accordance with the September 2015 Watershed Geosynthetics ClosureTurf® and HydroTurf® Installation Guidance Documents (Appendix B). Installers will be certified by Watershed Geosynthetics on both ClosureTurf® and HydroTurf® installation and CQA procedures. ClosureTurf® and HydroTurf® are composed of three main components:

1. The geomembrane liner component is 50-mil structured high-density polyethylene (HDPE) Agru Super Grip Net with the spikes placed on subgrade;

2. The synthetic turf component is made of woven polypropylene geotextiles tufted with polyethylene yarn; and

3. Infill is Sand (ClosureTurf®) or HydroBinder (HydroTurf®).

4.3.1 Manufacturer Guaranteed Properties for Geosynthetics. The manufacturer will submit documentation that the materials have been tested for the parameters listed in the manufacturers list of guaranteed properties. The test results, including identification of all individual geomembrane rolls tested will be submitted to the CQA Officer for review. The manufacturer will certify that all geomembrane rolls meet the manufacturer's guaranteed properties.

4.3.2 Prequalification Testing for Geosynthetics. The geosynthetic manufacturer will supply an inventory list of geomembrane rolls to the Owner's geosynthetics QA monitoring firm and/or CQA Officer, who will select geomembrane rolls to be prequalified for the type and frequency of prequalification testing in Table 1.

The geomembrane manufacturer will procure and submit samples from the designated prequalification geomembrane rolls to the independent geosynthetic laboratory for verification of selected manufacturer's guaranteed properties. Submitted samples will be 2 feet long by the entire width of the geomembrane roll. The machine direction, manufacturer's roll identification number, and date the sample was obtained will be marked on the sample by the geosynthetic laboratory prior to shipment.

Geomembrane prequalification testing shall be completed prior to delivery. If prequalification testing is not completed prior to delivery, the Contractor takes responsibility for any failed prequalification testing and the additional costs associated with having it delivered prior to acceptance.

4.3.3 Installer Certification of Placement Surface. The prepared subgrade surface shall be cleared of stones, sand, and similar materials that could damage the geosynthetics, cause clogging of drains or filters, or hamper seaming of geosynthetics. The geosynthetic installer accepts responsibility for inspecting the subgrade (on a daily basis) to verify unsuitable materials are not present within the prepared subgrade area to be covered each day. The geosynthetic installer will complete and sign the Installer Certificate of Acceptance form, which documents acceptance of the prepared subgrade for geosynthetic placement. The geosynthetic installer will provide the original signed document to the CQA Officer for signature of receipt.

Completed and signed forms will be filed as project records in accordance with the provisions in Section 9.0.

4.3.4 Placement Testing For Seam Overlap. The contractor and geosynthetic installer will arrange geomembrane sections to minimize field seams. A preliminary drawing illustrating the panel layout will be provided to the Ameren Project Manager and CQA Officer prior to placement for approval.

Seam overlaps will be field-measured by the geosynthetic installer to verify the requirements in Table 1 are met for the seams. Seam overlap will be "shingled" in the downslope direction. The CQA Officer will provide appropriate personnel to obtain independent measurements of a representative number of seam overlaps.

The geosynthetic installer will provide the CQA Officer with "as-built" drawings of the geomembrane installation showing the panels, seam locations, and destruct locations, at a minimum.

4.3.5 Trial Weld Seams. Trial weld sample seams will be required before membrane seams can be welded. Trial weld sample seams must be 3 feet long and 12 inches wide, with the seam centered lengthwise. Both wedge and extrusion welder are required to produce a trial weld sample seam at daily startup, immediately after any break, anytime the machine is turned off for more than 30 minutes, and anytime the machine is operating for more than five hours. If at any time the CQA Officer or approved representative believes that an operator or welding apparatus is not functioning properly, an additional trial seam must be produced and tested.

Trial weld sample seams will be tested in the field for peel and shear using a field tensiometer. Four 1-inch coupons will be required for testing: two to be tested for peel and two to be tested for shear. The requirements for field testing are located in Table 1 and Geosynthetics Research Institute (GRI) Test Method GM-19 Table 1(a) (Appendix B)

4.3.6 Placement Non-Destructive Testing. The geosynthetic installer will conduct non-destructive testing as seaming progresses (Table 1). Seams will be non-destructively tested over the full length using an air pressure test, vacuum test unit, spark test, or other method approved by the CQA Officer.

The CQA Officer will provide appropriate personnel to monitor non-destructive testing performed by the installer.

The geosynthetic installer will submit all non-destructive field testing results to the CQA Officer for filing as project records in accordance with Section 9.0.

Air Pressure Testing (For Double Fusion Seams Only)

Equipment

The air pressure test equipment includes:

- an air pump (manual or motor driven) equipped with pressure gauge, accurate to 1 pounds per square inch (psi), capable of generating and sustaining a pressure between 25 psi and 30 psi and mounted on a cushion to protect the geomembrane;
- a rubber hose with fittings and connections; and
- a sharp hollow needle, or other approved pressure feed device.

Procedure

The air pressure test procedure is as follows:

1. Seal both ends of the seam.
2. Insert a needle or other approved pressure feed device into the air channel created by the fusion weld.
3. Insert a protective cushion between the air pump and the geomembrane.
4. Pressurize the seam to between 25 psi and 30 psi. Close the valve and sustain the pressure for at least five minutes.
5. A pressure loss of 2 psi or less is a passing test.
6. A pressure loss of more than 2 psi is a failing test. Locate the faulty area, then repair and retest.
7. At the conclusion of the passing air pressure test, slit the opposite end of the seam and monitor the drop in pressure. This indicates that the entire seam was tested.
8. Remove needle or other approved pressure feed device and seal.

Vacuum Testing (Extruded Welds)

Equipment

The vacuum test equipment includes:

- a vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket on the bottom, a valve assembly, and a vacuum gauge;

- a vacuum tank and pump assembly equipped with a pressure controller and pipe connections or equipment capable of performing the same function;
- a rubber pressure or vacuum hose with fittings and connections;
- a bucket; and
- a soapy solution.

Procedure

The vacuum test procedure is as follows:

1. Energize the vacuum pump to approximately 5 psi.
2. Wet the extrusion weld area with the soapy solution.
3. Place the vacuum box over the wetted area.
4. Close the bleed valve and open the vacuum valve.
5. Check that a leak-tight seal is created.
6. Examine the geomembrane through the viewing window for the presence of soap bubbles for at least 10 seconds.
7. If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve. Move the box over the next adjoining area and repeat the procedures in steps 1 through 6.
8. Mark, repair, and retest areas where soap bubbles appear.

Spark Testing (Extrusion Welds at Penetrations)

Equipment

The spark test equipment includes:

- an electrically conductive tape or wire placed beneath the seam prior to welding;
- a hand-held holiday spark tester; and
- a conductive wand that generates a high voltage.

Procedure

The spark test procedure is as follows:

1. Place the electrically conductive tape or wire beneath the seam prior to welding.

2. A trial seam containing a non-welded segment shall be subject to a calibration test to ensure that such a defect will be identified under the planned machine settings and procedures (i.e., exposed wire will cause a spark to occur).
3. Upon completion of the weld, enable the spark tester and hold approximately 1 inch above the weld, moving slowly over the entire length of the weld in accordance with ASTM 6365.
4. If there is no spark, the weld is a passing test. A spark indicates a hole in the seam.
5. Mark, repair, and retest areas where sparks occur.
6. Care should be taken if flammable gases may be present in the area of testing.

4.3.7 Placement Destructive Testing. Destructive testing is used to evaluate seam strength. Destructive samples will be collected and field tested by the geosynthetic installer at randomly selected geomembrane locations as seaming work progresses at the direction of the CQA Representative. The remaining destructive sample will be sent to the independent geosynthetic testing laboratory for analysis.

The geosynthetic installer will submit results of destructive testing to the CQA Officer for filing as project records in accordance with Section 9.0.

Destructive samples will be collected within 24 hours of being chosen by the CQA Representative unless extenuating circumstances, previously approved by the Ameren Project Manager and CQA Officer, occur.

Location and Frequency

The CQA Representative shall select destructive testing locations based on:

1. Selected destructive testing will be at minimum frequency of one test location per 500 feet of seam length. This minimum frequency is the average taken throughout the entire area of placement and does not include retests.
2. A destructive test will be completed for each welding machine used per day.
3. A destructive test will be completed for individual repairs that are more than 150 feet long.

4. Additional test locations will be chosen during seaming at the CQA Representative's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.
5. All samples obtained for destructive testing will include a 12-inch by 12-inch sample provided to the Owner for archive storage.

Destructive Sampling Procedure

The destructive sampling procedure is as follows:

1. Assign a number and label each sample (12 inches by 48 inches with the seam centered lengthwise).
2. Collect the sample within 24 hours of being marked.
3. Record the sample location(s) on layout ("as-built") drawing.
4. Record the reason for taking the sample(s) at this location.
5. Repair the sample location(s) the same day.
6. Vacuum test each repair.

Field Testing

The geosynthetic installer shall use a tensiometer to field-test a minimum of four 1-inch wide strips from the samples: two for peel and two for shear. The geosynthetic installer shall log the date, time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperature, and pass or fail description. The requirements and frequency for field testing is located in Table 1 and GRI Test Method GM-19 Table 2(a) (Appendix B).

Quality Assurance Laboratory Testing.

Field testing prequalifies destructive samples for independent laboratory testing. The quality assurance laboratory shall be selected by the CQA Officer with approval from the Ameren Project Manager.

Laboratory testing will include five tests each of shear strength and peel adhesion. Laboratory testing methods will be in accordance with ASTM D 4437 "Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes". Acceptance will be based upon the criteria in GRI Test Method GM-19 Table 1(a) (Appendix B).

Procedures For Destructive Test Failure.

Failed destructive tests, in the field or quality assurance laboratory, will be remedied by either of the following options:

1. The geosynthetic installer may reconstruct the seam between two passed test locations; or
2. The geosynthetic installer may trace the welding path to an intermediate location at least 10 feet beyond the point of the failed test in each direction, and take a sample for an additional field test at each location. If these additional samples pass, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed.

Acceptable reconstructed seams must be bounded by two locations with passing laboratory destructive tests. In cases where the reconstructed seam exceeds 150 feet, an additional destructive sample of the repaired area shall be obtained. The geosynthetic installer shall document all actions taken regarding destructive test failures.

4.3.8 Manufacturer Guaranteed Properties for the Turf Component. The manufacturer will submit documentation that the materials have been tested for the parameters listed in the manufacturer's list of guaranteed properties. The test results including identification of all individual geomembrane rolls tested will be submitted to the CQA Officer for review. The manufacturer will certify that all geomembrane rolls meet the manufacturer's guaranteed properties.

4.3.9 Prequalification Testing for the Turf Component. The geomembrane manufacturer will supply an inventory list of turf rolls to the Owner's geosynthetics QA monitoring firm and/or CQA Officer, who will select geomembrane rolls to be prequalified for the type and frequency of prequalification testing in Table 1.

The geosynthetic manufacturer will procure and submit samples from the designated prequalification turf rolls to the independent geosynthetic laboratory for verification of selected manufacturer's guaranteed properties. Submitted samples will be 2 feet long by the entire width of the turf roll.

Turf prequalification testing shall be completed prior to delivery.

4.3.10 Field Monitoring of the Turf Component. The CQA Officer or designated representative will observe the turf as it is placed and sewn. Vehicles and equipment are not permitted on slopes exceeding 15 percent until the infill (sand for ClosureTurf® and pozzolanic mixture for HydroTurf®) is in place. In flatter slopes, all-terrain vehicles

(ATVs) and similar vehicles will be allowed prior to infill placement if the tire pressure is less than 5 psi. After infill placement, tire pressures should be limited on slopes to 35 psi or less.

Wrinkles will be smoothed out or removed to the extent possible prior to field seaming. Wrinkles that can fold over must be repaired either by cutting out excess material, or by allowing the liner to contract by temperature reduction. The CQA Officer or designated representative will observe geomembrane for wrinkles and notify the Contractor if wrinkles are being formed that may fold over or are above the vertical 4-inch maximum tolerance level on slopes, or above the 2-inch maximum tolerance level in ditches. The CQA Representative is then responsible for documenting corrective action to remove the wrinkles.

4.3.11 Sand Prequalification Testing for ClosureTurf®. One sand prequalification sample and testing results will be provided by the contractor to the CQA Officer at least one week prior to sand delivery on site. Laboratory testing will occur in accordance with the testing listed in Table 1.

4.3.12 Sand Conformance Testing for ClosureTurf®. Sand conformance samples will be obtained by the CQA Officer or designated representative. Laboratory testing will occur in accordance with the type and frequency of testing listed in Table 1.

During placement, the geosynthetics will be observed to verify that they are not damaged. The average thickness of the sand layer will be measured and recorded at the frequency listed in Table 1. Sand thickness will be measured with a digital caliper. A standard washer will be used as a plate for the point of entry into the sand infill for consistent depth control.

4.3.13 Hydrobinder Prequalification Testing for HydroTurf®. The cement-sand mixture will be a brand of Portland Cement conforming to ASTM C 150 (AASHTO M 85) and shall be Type I or Type II. The contractor will provide information to the CQA Officer on which mix will be used at least one week prior to delivery on site.

4.3.14 Hydrobinder Conformance Testing for HydroTurf®. The CQA Officer or Representative will observe that the hydrobinder infill is placed in a method that does not damage the underlying geosynthetics in dry conditions. After the mixture is worked into the turf, the average thickness of the layer will be measured and recorded at the frequency listed in Table 1. The mixture will be observed by a CQA Representative during hydration, which must occur the same day as infill placement.

4.4 Anchor Trench. The anchor trench shall be excavated in accordance with the project plans and specifications prior to geosynthetic placement in that area. The corners of the anchor trench shall be slightly rounded where the geosynthetic enters the trench to minimize sharp bends in the geosynthetic. Fill placed on the geosynthetic shall adhere to the same standards as the subgrade, and must be free of debris, rocks, sand, or other material which could damage the geosynthetic.

4.5 Surface Water Management System. The surveyor shall document the elevations and grades of the constructed berms and channels on an "as-built" drawing. The surveyor will provide this data to the CQA Officer. The CQA Officer shall check the information against the requirements and frequency provided in Table 1.

5.0 CORRECTIVE MEASURES

The CQA Officer will reject and require replacement of material that fails prequalification or material placement requirements (Table 1). The lateral and/or vertical extent of corrective measures will be based on the frequency of testing and CQA Officer's professional judgment.

6.0 DOCUMENTATION

6.1 Daily Reports. The CQA Officer, or designated representative, shall prepare and sign a daily report for each day that materials or placement of materials are being observed, sampled, or tested.

6.2 Weekly Summary Reports. The CQA Officer or designated representative shall prepare and sign a weekly summary report for each week that materials or placement of materials are being observed, sampled, or tested. The daily reports, test data, photographic records, and test results will be included in the weekly summary report. The weekly report will be filed by the Document Controller in accordance with Section 9.0.

6.3 Photographs. Photographs will be included in the weekly summary report to provide a visual record of work progress, testing activity, and construction work. The photographs shall include:

- general location, date and time of the photograph;
- description of the item photographed;
- direction of view (north, south, east, or west); and
- name of photographer.

7.0 ACCEPTANCE REPORT

The CQA Officer shall prepare and submit an acceptance report to the IEPA. The acceptance report shall contain:

- material testing results;
- geosynthetic quality assurance and an "as-built" drawing including panel placement, seams, destructive sample locations, and repairs;
- "as-built" drawings as specified herein;
- weekly summary reports;
- certification by the CQA Officer that the CQA Plan has been followed during construction; and
- signature of the CQA Officer.

8.0 CONSTRUCTION MANAGEMENT ACTIVITIES

8.1 Request For Information (RFI). The General Contractor or subcontractor may, after exercising due diligence to locate required information, request from the CQA Officer or Design Engineer clarification or interpretation of the contract documents. The General Contractor or subcontractor will initiate the RFI in a timely manner using the Request for Information form (Appendix A) in accordance with project specifications. RFIs will be filed as project records in accordance with Section 9.0.

8.2 Review of Contractor Submittals. The General Contractor will submit shop drawings, product data, and samples (Table 2) to the CQA Officer or Ameren Project Manager in accordance with the project specifications and the CQA Plan in a timely manner to reduce work delays. Copies of submittals and the log will be filed as project records in accordance with Section 9.0.

8.3 Field Change Order. The contractor shall prepare requests for Field Change Order (FCO) in accordance with the project specifications and submit the FCO requests to the Ameren Project Manager. Copies of the FCO and logs of authorized FCOs will be retained as project records in accordance with Section 9.0.

9.0 DOCUMENT CONTROL AND PROJECT RECORDS

9.1 CQA Plan. The CQA Officer shall control the preparation, issue, and revision of CQA Plan. The CQA Plan, including all changes, will be reviewed for adequacy and approved for release by the Ameren Project Manager. The Document Controller will issue current copies of the CQA Plan and maintain records associated with its preparation.

9.2 Project Records. The Document Controller shall maintain and protect documents during construction activities against damage, deterioration, and loss. Records will be readily identifiable and retrievable. Original CQA documents from the field and laboratories will be furnished to the Document Controller for filing and maintenance.

Project records will be made available to the Ameren Project Manager as requested during construction and, when requested, will be turned over to Ameren at completion of the construction contract. Ameren will retain the weekly summary reports provided by the CQA Officer until the completion of the post-closure care period and must make those reports available at reasonable times for viewing and photocopying by the IEPA.

Records include, but are not limited to, the following:

- CQA Plan;
- CQA Plan documentation;
- meeting minutes;
- weekly summary reports;
- daily reports;
- manufacturer's QA results and certifications;
- certificates of acceptance by geosynthetic installers;
- CQA certifications;
- certificates of calibration for monitoring, measuring and test equipment;
- "as-built" drawings;
- laboratory test results and chain of custody records;
- laboratory certifications of manufacturer's guaranteed properties for geosynthetics;
- Field Change Order requests;
- Log of Authorized Field Change Orders;
- shop drawing submittals;
- log of shop drawing submittals;
- RFI from contractor/installer;
- RFI responses; and
- acceptance reports.

TABLE 1
SUMMARY OF TESTING FREQUENCY
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Test	Test Frequency[1]	Specification Criteria	Responsible Party
FLY ASH POND SUBGRADE			
Standard Proctor	1 per 10,000 cubic yard (minimum 1 per material type)	ASTM D 1557	CQA Officer
Field Moisture/Density	5 per acre per 6-inch compacted lift, top 1 foot of subgrade (on approximately 100-foot grid)	>90% maximum dry density from appropriate standard Proctor	
Survey[2]	CQA survey locations provided in project specifications. In general, survey points include 100-foot spacing along grade breaks and 200-foot grid between slope breaks.	>2% and ≤10% grade, positive drainage, no sharp changes in slope	
BOTTOM ASH BERM/ROAD SUBGRADE			
Standard Proctor	1 per 10,000 cubic yard (minimum 1 per material type)	ASTM D 1557	CQA Officer
Field Moisture/Density	5 per acre per 6-inch compacted lift (on approximately 100-foot grid)	>90% maximum dry density from appropriate standard Proctor	
Survey[2]	CQA survey locations provided in project specifications. In general, survey points include 100-foot spacing along grade breaks and 200-foot grid between slope breaks.	>2% and ≤10% grade, positive drainage, no sharp changes in slope	
SURFACE WATER MANAGEMENT SYSTEM			
Survey[2]	CQA survey locations provided in project specifications. In general, survey points include inlets, outlets, grade breaks, and every 100 or 200 linear feet along channel (based on channel grade)	Field established for positive drainage	CQA Officer

Notes:

[1] Based on project plans, specifications, and CQA Plan.

[2] CQA survey locations are not intended to be sufficient for as-built surveys or construction staking. Electronic files of the design surface are available for use from Ameren Missouri.

[3] This is in addition to the manufacturer's internal QC testing to be provided to the CQA officer before delivery of the product.

[4] Sample 2 feet long by the full roll width.

[5] For Class 1 High Survivability.

TABLE 1 - CONTINUED
SUMMARY OF TESTING FREQUENCY
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Test	Test Frequency[1]	Specification Criteria	Responsible Party
BOTTOM ASH POND BACKFILL - PREQUALIFICATION			
Grain Size Analysis - ASTM C-33-03	1 per source	Sand or Gravel	Contractor
RCRA Metals and CCW Ions as TCLP: SW 846 1311 - Arsenic, Barium, Cadmium, Chromium, Lead, Silver, Selenium SW 846 7478 - Mercury SW 846 6010B - Boron SW 846 M4500-CLE - Chloride SW 846 9036 - Sulfate	1 per source (virgin material)	Below the Class I Groundwater Standards at Title 35 Illinois Administrative Code (IAC) 620.410(a).	
BTEX Constituents as TCLP: SW846 6260B - Benzene, Ethylbenzene, Toluene, Xylene	1 per source (virgin material)	Below the Class I Groundwater Standards at 35 IAC 620.410(b).	
pH - SW846 9045C	1 per source (virgin material)	Below the Class I Groundwater Standards at 35 IAC 620.410(e).	
IEPA TACO COCs	1 per source (non-virgin material)	Below the Class I Groundwater Standards at 35 IAC 620.410(e).	
BOTTOM ASH POND BACKFILL - MATERIAL PLACEMENT TESTING			
Standard Proctor	1 per 10,000 cubic yards (minimum 1 per material type)	ASTM D 1557	CQA Officer
Field Moisture/Density	5 per acre per 1-foot compacted lift (on approximately 100-foot grid)	>85% maximum dry density from appropriate standard Proctor	
Grain Size Analysis - ASTM C-33-03	1 per 20,000 cubic yards	Sand or Gravel	
RCRA Metals and CCW Ions as TCLP: SW 846 1311 - Arsenic, Barium, Cadmium, Chromium, Lead, Silver, Selenium SW 846 7478 - Mercury SW 846 6010B - Boron SW 846 M4500-CLE - Chloride SW 846 9036 - Sulfate	1 per 20,000 cubic yards	Below the Class I Groundwater Standards at Title 35 Illinois Administrative Code (IAC) 620.410(a).	
BTEX Constituents as TCLP: SW846 6260B - Benzene, Ethylbenzene, Toluene, Xylene	1 per 20,000 cubic yards	Below the Class I Groundwater Standards at 35 IAC 620.410(b).	
pH - SW846 9045C	1 per 20,000 cubic yards	Below the Class I Groundwater Standards at 35 IAC 620.410(e).	
Applied Sand Thickness	Approximately 100 foot grid intervals	Between 0.50 inches and 0.75 inches.	

Notes:

1 Based on project plans, specifications, and CQA Plan.

2 CQA survey locations are not intended to be sufficient for as-built surveys or construction staking. Electronic files of the design surface are available for use from Ameren Missouri.

3 This is in addition to the manufacturer's internal QC testing to be provided to the CQA officer before delivery of the product.

4 Sample 2 feet long by the full roll width.

5 For Class 1 High Survivability.

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TABLE 1 - CONTINUED
SUMMARY OF TESTING FREQUENCY
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Test	Test Frequency[1]	Specification Criteria	Responsible Party
50-MIL HDPE SUPERGRIPNET - PREQUALIFICATION[3]			
Density - ASTM D792	1 per 100,000 square feet per resin lot, with a minimum of 1 per resin lot.[4]	GRI Test Method GM13 (Appendix B)	The contractor and/or manufactuter shall provide samples to the independent laboratory chosen by the CQA officer for testing (testing cost to owner).
Carbon Black Content - ASTM D4218	1 per 100,000 square feet per resin lot, with a minimum of 1 per resin lot.[4]	GRI Test Method GM13 (Appendix B)	
Carbon Black Dispersion - ASTM D5596	1 per 100,000 square feet per resin lot, with a minimum of 1 per resin lot.[4]	GRI Test Method GM13 (Appendix B)	
Thickness - ASTM D5994	1 per 100,000 square feet per resin lot, with a minimum of 1 per resin lot.[4]	GRI Test Method GM13 (Appendix B)	
Tensile Strength and Elongation - ASTM D6693/Type IV Specimen	1 per 100,000 square feet per resin lot, with a minimum of 1 per resin lot.[4]	GRI Test Method GM13 (Appendix B)	
50-MIL HDPE SUPERGRIPNET - MATERIAL PLACEMENT TESTING			
Seam Overlap	All Seams	3-inch (Minimum)	Testing and sampling performed by installer. Destructive samples provided to CQA Officer for third party testing.
Wrinkle Height	All Panels	May Not Fold 4-inch (Maximum) on Slopes 2-inch (Maximum) on Ditches	
Non-Destructive Testing	All Seams	As per Section 4.4.4 of CQA Plan	
Destructive Testing	Minimum One Every 500 Feet (not including retesting)	As per Section 4.4.5 of CQA Plan	

Notes:

[1] Based on project plans, specifications, and CQA Plan.

[2] CQA survey locations are not intended to be sufficient for as-built surveys or construction staking. Electronic files of the design surface are available for use from Ameren Missouri.

[3] This is in addition to the manufacturer's internal QC testing to be provided to the CQA officer before delivery of the product.

[4] Sample 2 feet long by the full roll width.

[5] For Class 1 High Survivability.

TABLE 1 - CONTINUED
SUMMARY OF TESTING FREQUENCY
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Test	Test Frequency[1]	Specification Criteria	Responsible Party
GEOTEXTILE/TURF COMPONENT - PREQUALIFICATION[3]			
Total Product Weight	1 per 400,000 square feet.[4]	ClosureTurf Engineered Turf Component Product Datasheet	The contractor and/or manufactuter shall provide samples to the independent laboratory chosen by the CQA officer for testing (testing cost to owner).
Tensile Strength of Yarn - ASTM D2256	1 per 400,000 square feet.[4]	ClosureTurf Engineered Turf Component Product Datasheet	
Tensile Strength of Product - ASTM D4595	1 per 400,000 square feet.[4]	ClosureTurf Engineered Turf Component Product Datasheet	
Tensile Strength of Product - ASTM D4595	1 per 400,000 square feet.[4]	ClosureTurf Engineered Turf Component Product Datasheet	
Grab Tensile Strength - ASTM D4632	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
Trapezoid Tear Strength - ASTM D4533	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
CBR Puncture Strength - ASTM D6241	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
Permittivity - ASTM D4491	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
Apparent Opening Size - ASTM D4751	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
Ultraviolet Stability - ASTM D7238	1 per 400,000 square feet.[4]	GRI Test Method GT13(a)[5] (Appendix B)	
GEOTEXTILE/TURF COMPONENT - MATERIAL PLACEMENT TESTING			
Seam Overlap	All Seams	3-inch (Minimum)	Testing and sampling performed by installer. Destructive samples provided to CQA Officer for third party testing.
Wrinkle Height	All Panels	May Not Fold 4-inch (Maximum) on Slopes 2-inch (Maximum) on Ditches	

Notes:

[1] Based on project plans, specifications, and CQA Plan.

[2] CQA survey locations are not intended to be sufficient for as-built surveys or construction staking. Electronic files of the design surface are available for use from Ameren Missouri.

[3] This is in addition to the manufacturer's internal QC testing to be provided to the CQA officer before delivery of the product.

[4] Sample 2 feet long by the full roll width.

[5] For Class 1 High Survivability.

TABLE 1 - CONTINUED
SUMMARY OF TESTING FREQUENCY
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Test	Test Frequency[1]	Specification Criteria	Responsible Party
SAND INFILL - PREQUALIFICATION			
Grain Size Analysis - ASTM C-33-03	1 per sand source	Fine Aggegates	Contractor
RCRA Metals and CCW Ions as TCLP: SW 846 1311 - Arsenic, Barium, Cadmium, Chromium, Lead, Silver, Selenium SW 846 7478 - Mercury SW 846 6010B - Boron SW 846 M4500-CLE - Chloride SW 846 9036 - Sulfate	1 per sand source	Below the Class I Groundwater Standards at Title 35 Illinois Administrative Code (IAC) 620.410(a).	
BTEX Constituents as TCLP: SW846 6260B - Benzene, Ethylbenzene, Toluene, Xylene	1 per sand source	Below the Class I Groundwater Standards at 35 IAC 620.410(b).	
pH - SW846 9045C	1 per sand source	Below the Class I Groundwater Standards at 35 IAC 620.410(e).	
SAND INFILL - MATERIAL PLACEMENT TESTING			
Grain Size Analysis - ASTM C-33-03	1 per 5,000 cubic yards	Fine Aggegates	CQA Officer
RCRA Metals and CCW Ions as TCLP: SW 846 1311 - Arsenic, Barium, Cadmium, Chromium, Lead, Silver, Selenium SW 846 7478 - Mercury SW 846 6010B - Boron SW 846 M4500-CLE - Chloride SW 846 9036 - Sulfate	1 per 5,000 cubic yards	Below the Class I Groundwater Standards at Title 35 Illinois Administrative Code (IAC) 620.410(a).	
BTEX Constituents as TCLP: SW846 6260B - Benzene, Ethylbenzene, Toluene, Xylene	1 per 5,000 cubic yards	Below the Class I Groundwater Standards at 35 IAC 620.410(b).	
pH - SW846 9045C	1 per 5,000 cubic yards	Below the Class I Groundwater Standards at 35 IAC 620.410(e).	
Applied Sand Thickness	Approximately 100 foot grid intervals	Between 0.50 inches and 0.75 inches.	
ALTERNATE INFILL HYDROBINDER - PREQUALIFICATION			
Manufacturer's Certification	1 per source	Per Specifications	Contractor
ALTERNATE INFILL HYDROBINDER - MATERIAL PLACEMENT TESTING			
Verification that Material Used is the Same as Material Submitted	1 per source	Per Approved Submittal	CQA Officer
Applied Thickness	Approximately 100 foot grid intervals	Between 0.75 inches and 1.0 inches.	

Notes:

[1] Based on project plans, specifications, and CQA Plan.

[2] CQA survey locations are not intended to be sufficient for as-built surveys or construction staking. Electronic files of the design surface are available for use from Ameren Missouri.

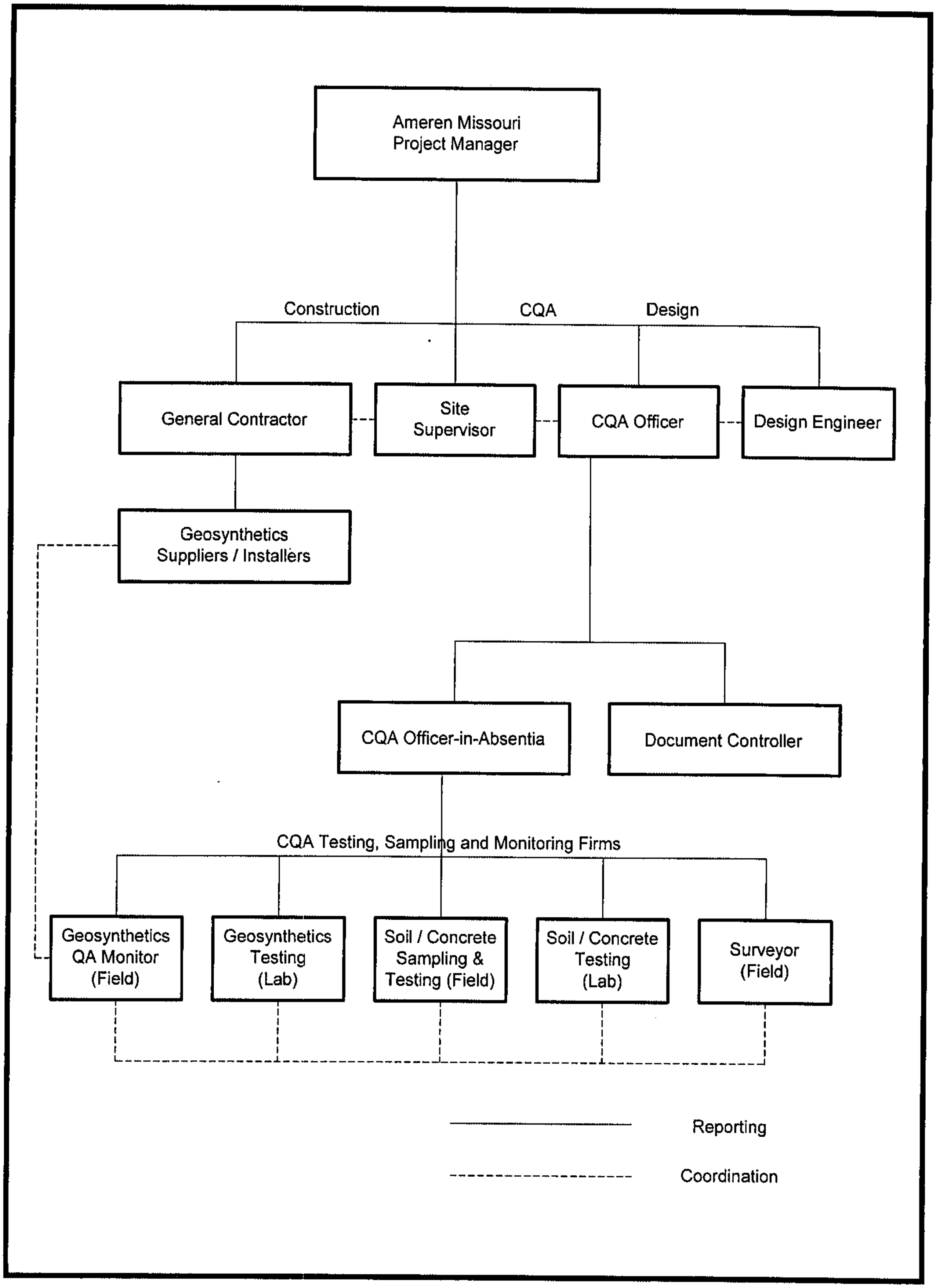
[3] This is in addition to the manufacturer's internal QC testing to be provided to the CQA officer before delivery of the product.

[4] Sample 2 feet long by the full roll width.

[5] For Class 1 High Survivability.

TABLE 2
SUMMARY OF CQA DOCUMENTATION
MEREDOSIA POWER STATION - FLY ASH AND BOTTOM ASH PONDS

Submittal	Responsible Party
Request for Information	General Contractor
Field Change Orders	General Contractor
Log of Authorized Field Change Orders	General Contractor
Shop Drawing Submittals	General Contractor
Calibration Forms	Soil Testing and Surveying Firms
Chain of Custody	Testing Firms
Laboratory Test Results	As appropriate
CQA Subgrade Certification Points	CQA Surveying Firm
"As-built" Surface Water Management System/Final Grade	General Contractor's Surveying Firm
Manufacturer's Guaranteed Properties for Geosynthetics	General Contractor's Geosynthetic Manufacturer
Geosynthetic Roll Inventory	General Contractor's Geosynthetic Manufacturer
Geosynthetic Manufacturer's Guarantee of Product	General Contractor's Geosynthetic Manufacturer
Alternate Fill - HydroBinder Manufacturer's Certification	General Contractor's Geosynthetic Installer
Certificates of Acceptance	General Contractor's Geosynthetic Installer
"As-built" Drawing of Exposed Geomembrane Installation	General Contractor's Geosynthetic Installer
Non-Destructive Field Testing Results	General Contractor's Geosynthetic Installer
Destructive Field Testing Results	General Contractor's Geosynthetic Installer
Meeting Summaries	General Contractor
Daily Reports	CQA Officer
Weekly Summary Reports	CQA Officer
Photographs	CQA Officer
CQA Certification Form	CQA Officer
CQA Acceptance Report	CQA Officer


Ameren Missouri
Project Manager
Construction
CQA
Design
General Contractor
Site
Supervisor
CQA Officer
Design Engineer
Geosynthetics
Suppliers / Installers
CQA Officer-in-Absentia
Document Controller
CQA Testing, Sampling and Monitoring Firms
Geosynthetics
QA Monitor
(Field)
Geosynthetics
Testing
(Lab)
Soil / Concrete
Sampling &
Testing (Field)
Soil / Concrete
Testing
(Lab)
Surveyor
(Field)
Reporting
Coordination

APPENDIX A

FORMS

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

REQUEST FOR INFORMATION

RFI #: ______________________ **DATE:** ______________________

FROM: ______________________ **TO:** ______________________

COMPANY: ______________________ **COMPANY:** ______________________

PHONE: ______________________ **PHONE:** ______________________

FAX: ______________________ **FAX:** ______________________

RE: ______________________

CHECK CATEGORY:

☐ Information not shown on contract documents:

☐ Interpretation of Requirements

☐ Conflict in Requirements

☐ Coordination Problem

☐ Other Category

Contract Drawing Reference: _____
Shop Drawing Reference: _____
Specification Reference: _____
Possible Cost Impact: _____
Possible Time Impact: _____

DESCRIPTION (Use Attached Sheets as Necessary) ______________________

CC: File

ATTACHMENTS: ☐ Yes ☐ No

RESPONSE

(Use Attached Sheets as Necessary)

DATE: ______________________ **RESPONSE BY:** ______________________

J024917.01 RFI Form

Chain of Custody Record

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

		Analysis and/or Method Requested
Client		
Address		
City, State, Zip Code		
Phone / Facsimile No.		
Client Project		
Location		
Sampler(s) / Phone	/	
Turnaround Time	Standard [ ] Rush [ ] Date Required:	
P.O. # or Invoice To		
Contact Person		

Sample Description	Sampling		Sample Type[1]	# of Containers								Remarks or Observations
	Date	Time										

(1) Sample Type: S = Soil; GM = Geomembrane; GT = Geotextile; GCL = Geosynthetic Clay Liner; DM = Drainage Media; O = Other

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment

Special Instructions:

Copies: CQA Officer, Testing Firm, and Sampler

Page ____ of ____

J024917.01 Chain of Custody Record.doc

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

DAILY INSPECTION REPORT

TESTING FIRM/INSTALLER: ______________________ **DATE:** __________

1. CONSTRUCTION ACTIVITIES AND LOCATIONS:

____

____

____

____

____

____

2. TYPE, LOCATION, AND PROCEDURES FOR INSPECTION/SAMPLING/TESTING::

____

____

____

____

3. TEST DATA

☐ **Attached** ☐ **None Taken**

4. PHOTOGRAPHIC RECORDS

☐ **Attached** ☐ **None Taken**

5. RESULTS OF ACTIVITY:

☐ **Pass** ☐ **Fail** ☐ **Corrective Actions Required** ☐ **See Attached Results**

☐ **See Explanatory Notes on Continuation Sheet** ☐ **Other:** ______________________

Prepared By: ______________________

____
Signature of CQA Officer or Designated Representative

Original Report/Attachments To: Document Controller

Copies to: ______________________

____

____

____

SHEET _____ **OF** _____

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

DAILY INSPECTION REPORT

ADDITIONAL NOTES: **DATE:** _____

SHEET _____ OF _____

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

WEEKLY SUMMARY REPORT

1. SUMMARY OF WEATHER CONDITIONS: **Date:** ______________

AM Conditions: ____

PM Conditions: ____

Weather Delays: ____

2. EQUIPMENT & PERSONNEL ON SITE:

Equipment: ____

Personnel: ____

Visitors: ____

3. CONSTRUCTION ACTIVITIES AND LOCATIONS:

____

____

____

____

____

4. SUMMARY OF MEETINGS HELD/ATTENDEES:

☐ **None** ☐ **See Sheet 2 of 2** ☐ **See Attached Meeting Minutes**

5. MATERIALS USED & TESTING OR INSPECTION RESULTS:

Materials Used: ☐ Stockpiled Soil ☐ GCL ☐ Geomembrane ☐ Geotextile ☐ Aggregate

☐ Off-Site Borrow Soil ☐ CCB Material ☐ HDPE Pipe ☐ Riprap

☐ Other: ____

Testing and/or Inspection Results: ☐ None ☐ See Attached Daily Inspection Reports

Calibration Records for Equipment: ☐ None ☐ See Attached

Prepared By: ______________________ ______________________
Signature of CQA Officer-in-Absentia (if applicable)

____

____
Signature of CQA Officer

Original Report/Attachments To: Document Controller

Copies to: ______________________

SHEET ____ **OF** ____

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

WEEKLY SUMMARY REPORT

ADDITIONAL NOTES: **Date:** ______________

SHEET _____ OF _____

Meredosia Power Station - Closure of Fly Ash and Bottom Ash Ponds

INSTALLER CERTIFICATE OF ACCEPTANCE

INSTALLER: ______________________________ **DATE :** __________

GEOSYNTHETIC MATERIAL: ______________________________

AREA ACCEPTED: ______________________________

____

____

____

INSTALLER: The undersigned authorized representative of the Installer certifies that he has visually inspected the substrate for the above referenced area and has found the surface to be acceptable for installation of the above referenced geosynthetic material on the date so noted.

The Installer shall be responsible for the integrity and suitability of the finished geosynthetic material from this date to completion of the installation.

CERTIFICATION OF ACCEPTANCE:

Signature of Installer's Authorized Representative: ______________________________

Printed Name of Installer's Authorized Representative: ______________________________

Title of Installer's Authorized Representative: ______________________________

Date: ______________________________

CERTIFICATE OF ACCEPTANCE RECEIVED BY CQA OFFICER:

Signature of CQA Officer-in-Absentia (if applicable): ______________________________

Printed Name of CQA Officer-in-Absentia: ______________________________

Date: ______________________________

Signature of CQA Officer: ______________________________

Printed Name of CQA Officer: ______________________________

Date: ______________________________

J024917.01 Installer Certification Form.doc

Meredosia Power Station- Closure of Fly Ash and Bottom Ash Ponds

CQA CERTIFICATION

The CQA certification as provided herein is based on a review of available inspection, testing and sampling results for the subject Work and is for the sole purpose of noting compliance of these results with established design parameters and taking no exceptions to initiation of next sequential Work. CQA certification by the Owner's Representative does not relieve the Contractor of its obligations to furnish all Work in accordance with the Contract.

---

1. LOCATION AND DESCRIPTION OF THE SUBJECT WORK:

____

____

____

____

____

2. CONTRACTOR COMPLETING THE SUBJECT WORK:

____

____

____

____

____

3. NEXT SEQUENTIAL WORK TO BEGIN:

____

____

____

____

____

____

By CQA Officer-in-Absentia: ______________________________ **Date:** ______________
(if applicable) (Signature)

By CQA Officer: ______________________________ **Date:** ______________
(Signature)

Distribution: Original To: Document Controller Copies To: ______________________________

J024917.01 CQA Certification Form.doc

APPENDIX B

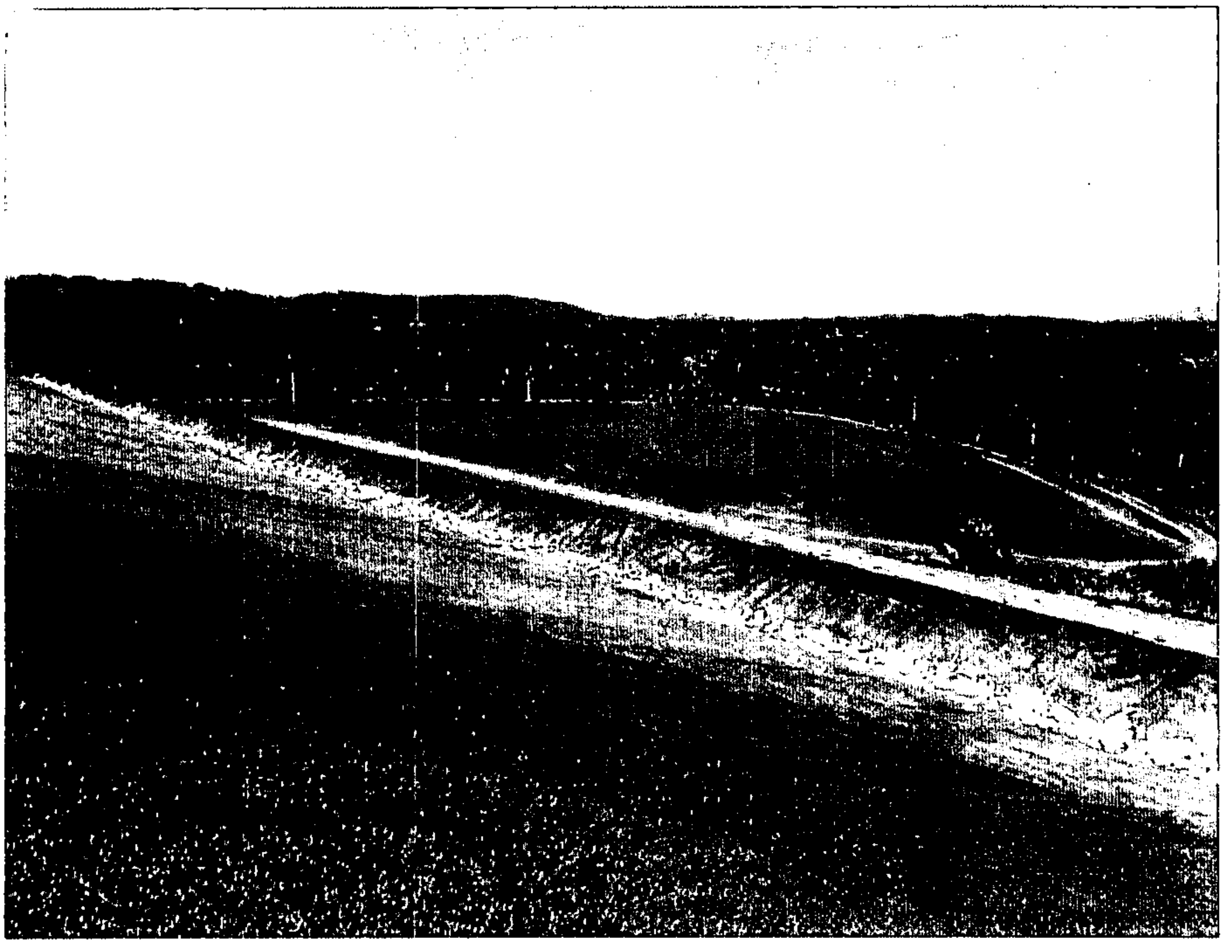
GEOSYNTHETIC TESTING STANDARDS

ClosureTurf®

Installation Guidelines Manual

May 2016

Before utilizing this document as an installation tool, Installer should download the latest version of the Installation Guidelines Manual from the website at www.watershedgeo.com.



WatershedGeo®
Unearthing Solutions

Table of Contents

1.0 Introduction

ClosureTurf® is a patented, 3 Component System* that serves as the final cover system on landfills. The 3 components of this unique system are:

Component 1 - An Agru Super Gripnet® LLDPE (or HDPE) geomembrane liner, or other liner approved for use by WatershedGeo.

Component 2 - An Engineered Turf

Component 3 - A sand infill (and/or alternatively, Hydrobinder®, or AmorFill™ -E infill)

*A Watershed Geosynthetics® patented (patent no. 8,585,322) gas collection system is a separate component to be utilized on sites that produce gas emissions. Malfunction Relief Valves are provided at one per acre of ClosureTurf® on landfills where gas emissions are expected.

1.1 Purpose and Scope

The ClosureTurf® Installation Guidelines document has been prepared to provide the Engineer / Contractor / Installer general guidance to the proper installation of the ClosureTurf® System. This document should be used in conjunction with the ClosureTurf® CSI (Construction Standards Institute) Specifications for the proper installation of the product.

2.0 Disclaimer

This manual is meant as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for site conditions and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

ClosureTurf® (US Patent No. 7,682,105, 8,585,322, 9,163,375 and 9,199, 287; Canadian Patent No. 2,663,170; and other Patents Pending) and trademark are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

3.0 Definitions

Whenever the terms listed below are used, the intent and meaning will be interpreted as indicated.

Acclimation

Physiological/thermal adjustment. Required in the geomembrane deployment process.

ArmorFill™

Armor-Fill™ Liquid Emulsion is a proprietary Polymer Emulsion product used to bind the ASTM-C33 sand infill component of the ClosureTurf® System.

ASTM

ASTM International, known until 2001 as the American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

ClosureTurf®

A patented 4 component system consisting of a Watershed Geosynthetics specific Gas Management System (if applicable), a Structured Geomembrane (LLDPE or HDPE), an Engineered Turf, and a specific grade of sand infill (or alternatively a HydroBinder® infill material).

Construction Quality Assurance (CQA)

Construction Quality Assurance includes but is not limited to observations and documentation of materials and workmanship necessary to show that a particular project is being constructed according to site-specific specifications and within regulatory guidelines.

Construction Quality Assurance (CQA) Personnel

Construction Quality Assurance (CQA) personnel are representatives of the Professional of Record (POR) who work under direct supervision of the POR. The CQA personnel are responsible for quality assurance monitoring, applicable conformance sampling and performing onsite tests and observations.

Construction Quality Assurance Professional of Record (POR)

The POR is an authorized representative of the Owner and has overall responsibility for CQA efforts and to confirm the project was constructed in general accordance with site-specific specifications approved by the regulatory authority and contract documents. The POR must be licensed as a Professional Engineer in the State the project is located and experienced in geosynthetics.

Construction Quality Control (CQC) Personnel

CQC Personnel are representatives of the Geosynthetics Installer who work under direct supervision of the Geosynthetics Installer. The Geosynthetics Installers' CQC Personnel are responsible for construction quality control, applicable conformance sampling and performing onsite tests and observations.

Contract Documents

Written, printed, or electronic matter that provides information or evidence that serves as an official record and are issued by the owner or operator. The documents include bidding requirements that include but are not limited to, contract forms, contract conditions, contract specifications, CQA plan, contract drawings, addenda, and contract modifications.

Contract Specifications

The requirements which are to be followed in the construction of the ClosureTurf® System. The standard specifications, supplemental specifications, special provisions, and all written or printed agreements and instructions that pertain to the method and manner of performing the work.

Contractor

One that agrees to furnish materials or perform services at a specified price, especially for construction work.

Design Engineer

An individual licensed to practice as a Professional Engineer or a Professional Service Firm that is responsible for the preparation of the project construction drawings and specifications.

Earthwork

A general engineering term relating to the relocation and utilization of soil during the process of construction.

Engineered Turf

A component of the ClosureTurf® System. A synthetic structured material consisting of one or more geotextiles tufted with polyethylene yarns that resemble grass blades.

Final Cover System Evaluation Report (FCSER)

Upon substantial completion of closure activities, the POR is responsible for the documentation of construction activities relating to the project, and any other inspections or verifications required by the regulatory authority. The FCSER will be signed and stamped by the POR and include documentation necessary for certification closure.

Fish Mouth

A semi-conical opening of the seam that is formed by an edge wrinkle in one sheet of the geomembrane component.

Geomembrane

A synthetic lining material that is a component of the ClosureTurf® System. Used as the primary barrier to infiltration and exfiltration of covered materials.

GSI

Geosynthetic Institute

475 Kedron Avenue

Folsom, PA 19033-1208 USA

TEL (610) 522-8440

FAX (610) 522-8441

HydroTurf®

A patented 3 component system consisting of a Structured Geomembrane Liner, a specialized Engineered Turf, and HydroBinder® infill material.

HydroBinder®

A proprietary pozzolanic infill utilized where higher surface water velocities may occur as well as in anchor trenches where specified.

Geosynthetics Contractor / Installer

The entity responsible for geosynthetic installation.

Independent Testing Laboratory

An organization, person, or company that tests products and materials, etc. according to agreed requirements. The entity shall be independent of ownership or control by the Owner or any party to the construction of the final cover or the manufacturer of the final cover products used. The entity shall also have proper legal authority where required to issue opinions and document the results of tests requested by the Owner.

Installation Supervisor

The person on-site who works for the Geosynthetics Installer and is in charge of the Geosynthetics Personnel and following the site specifications for the installation of the geosynthetics.

Manufacturing Quality Control (MQC)

A planned system of inspection and verification to ensure the quality of the final product.

Nonconformance

A deficiency in characteristics, documentation, or procedures that render the quality of an item or activity unacceptable or indeterminate. Examples of non-conformances include, but are not limited to, physical defects, test failures, and inadequate documentation.

Operator

The entity in control and responsible for the facility.

Owner

The entity that owns facility and land.

Owner's or Operators Representative

An official representative of the Owner or Operator responsible for planning, organizing, and controlling construction activities.

Panel

A general reference to a unit area of either the Structured Geomembrane (LLDPE or HDPE), or the Engineered Turf component of the ClosureTurf® System.

Quality Assurance

A planned and systematic pattern of procedures and documentation to ensure that items of work or services meet the requirements of the contract documents.

Quality Control

These actions provide a means to measure and regulate the characteristics of an item or service to comply with the requirements of the contract documents.

Relief Valve

A mechanical device used specifically to relieve gas buildup pressure underneath the ClosureTurf® system.

Representative Sample

(With respect to geomembrane destructive testing) - A random specimen of either the Structured Geomembrane (LLDPE or HDPE) or the Engineered Turf component consisting of 1 or more cut pieces (commonly referred to as coupons) from the same rectangular portion of material, oriented along a seam that is removed for field or laboratory testing purposes.

Ripple

Smaller in nature than a wrinkle. A result of thermal/or manufacturing that cannot be folded over.

Snapping

A manual method to an open ended seam to remove tenting as a result of the welding of the geomembrane seams.

Spike

A systematic design for interface friction located on the bottom of the Super Gripnet®.

Specimen

(With respect to geomembrane destructive testing) - A specimen is the individual test strip (sometimes called coupon) from a sample location. A sample location can consist of many specimens.

Studs

A systematic design for drainage located on the top side of the Super Gripnet®.

Surficial Collection Foot

A manufactured device utilized specifically for collection of gas beneath the Super Gripnet®.

Surficial Strip

A strip of Super Gripnet® used for gas conveyance below the ClosureTurf® system.

Tenting

A vertical ridge that is caused by wedge welding geomembrane.

Wrinkle

A portion of the geomembrane that does not lay relatively flat and is not a result of subgrade irregularity and which can be folded over.

4.0 Subgrade Preparation

Prior to ClosureTurf® system installation, the subgrade (e.g., protective cover soil) will be inspected. Observe the following:

- The protective cover soil is substantially free of surface irregularities and protrusions.
- The protective cover soil surface does not contain stones or other objects that could damage any of the ClosureTurf® components.
- The surface will be substantially smooth and free of foreign and organic material, sharp objects, particles or other deleterious material.

- Maximum particle size (e.g. rocks) will be specified by the by the design and contract specifications.
- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and other deleterious material.
- Construction stakes and hubs have been removed and the resultant holes have been backfilled.
- The geosynthetics contractor, POR or his representative, and the permittee or his representatives have certified in writing that the surface on which the ClosureTurf® System will be installed is acceptable.
- Final grades on the slopes as well as benches dimensions and grades conform to the design grades.
- Survey shots and as-built drawings will be carefully reviewed and evaluated to insure the surface grades will drain as intended in the design drawings.

5.0 Installation – Surficial Gas Management System

5.1 Minimum Requirements

The gas management plan will include at a minimum, the use of provided ClosureTurf® Malfunction Relief Valves, (See Figure 3) to meet the specific needs of the intended site. The minimum required gas emission venting device will be installed at a rate of at least one vent per acre of installed ClosureTurf® (See Figure 1). Watershed Geosynthetics LLC supplies the minimum number of Malfunction Relief Valves with delivery of the ClosureTurf® product.

5.2 Surficial Collection Design (Where Applicable)

While it should be noted that not all projects will incorporate a surficial collection design, the ClosureTurf® system serves as an effective tool for control of fugitive emissions and can be incorporated into a conventional gas collection system or in some cases as a standalone gas collection and control system. A ClosureTurf® surficial collection design will incorporate the use of surficial collection strips (See Figure 1) that provide high flow capacity (See Figure 2) and a larger radius of influence. The system design will also incorporate the surficial collection foot (See Figure 4) that serves as a wellhead base, geomembrane interface and gas conveyance path from the strips to the collection wellhead (not provided).

5.2.1 Surficial Strips (Where Applicable)

Surficial strips are to be placed prior to the placement of geomembrane. Surficial Strips may consist of SuperGripnet®, single sided geocomposite or other techniques that will allow for the proper flow of gas without causing ballooning. The placement of the strips will be determined by the design engineer and included in the gas management plan.

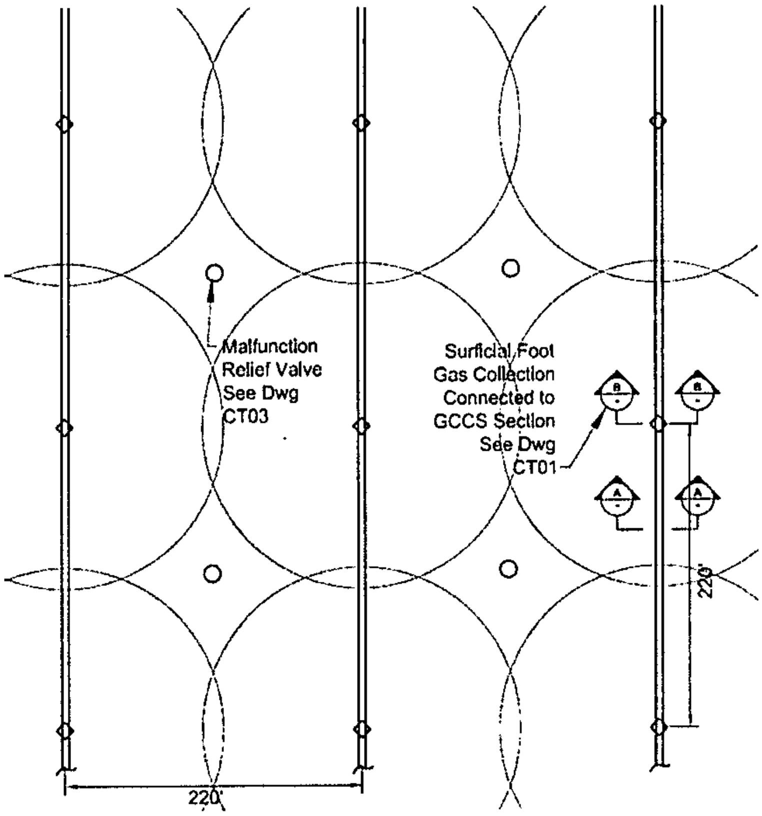


Figure 1: Typical Surficial Collection Strip Placement

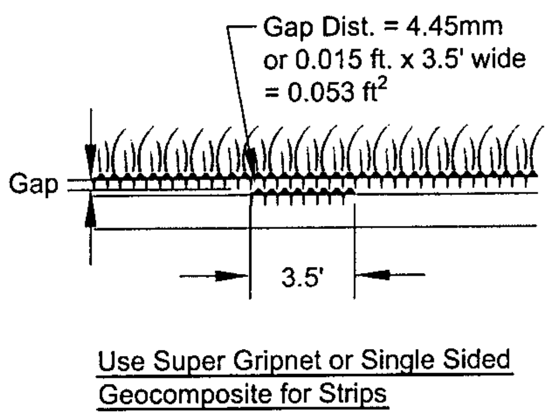


Figure 2: Effective Cross Sectional Area: Surficial Strips

5.2.2 ClosureTurf® Malfunction Relief Valve

The Malfunction Relief Valve is a mandatory component of the ClosureTurf® System. The primary purpose of this component is to provide for necessary release of pressure in the event the gas collection system malfunctions. The Malfunction Relief Valves will be placed at one per acre as indicated by the site's gas management plan and installed during construction of the ClosureTurf® system.

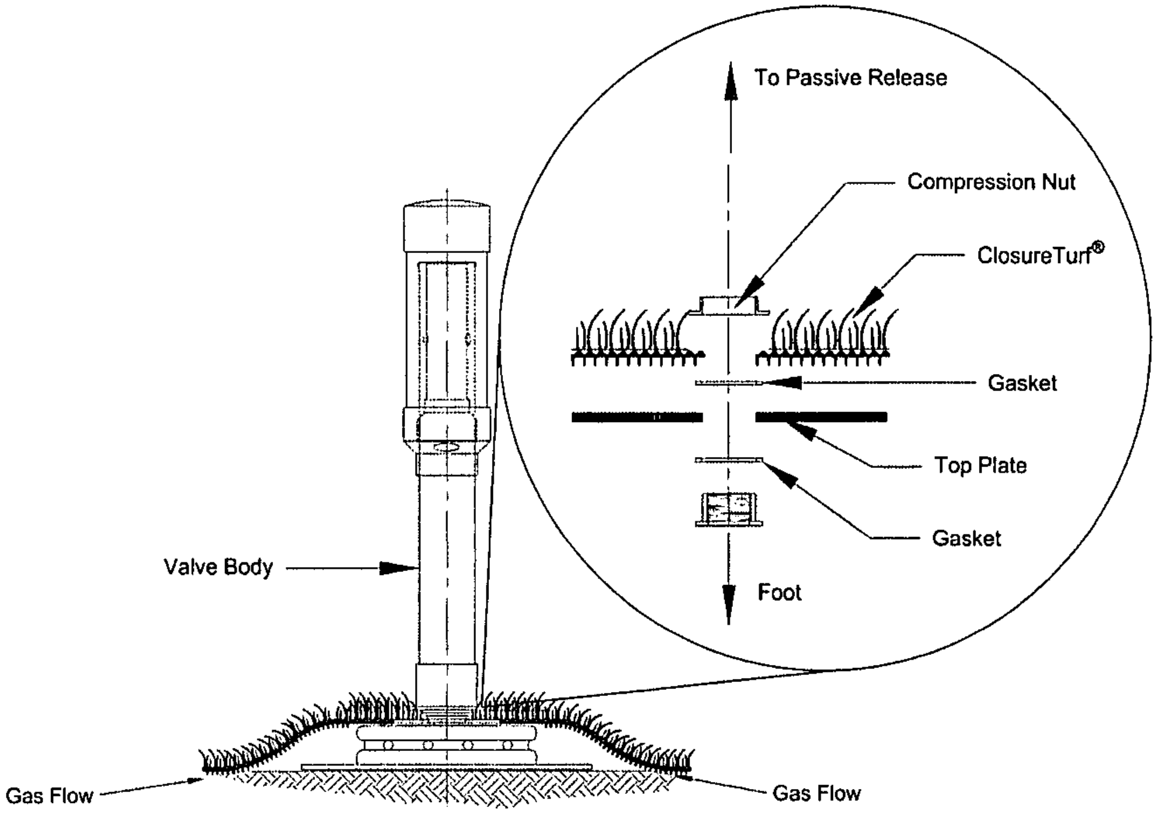


Figure 3: ClosureTurf® Malfunction Relief Valve (Patent Pending)

5.2.3 ClosureTurf® Collection Foot

This device is designed to be the interface between the surficial collection strips, the geomembrane and a gas collection wellhead (not provided). The unit allows vacuum to flow in from beneath the geomembrane and from the surficial collection strips to create a larger radius of influence for gas collection. Placement will be determined by the gas collection system design.

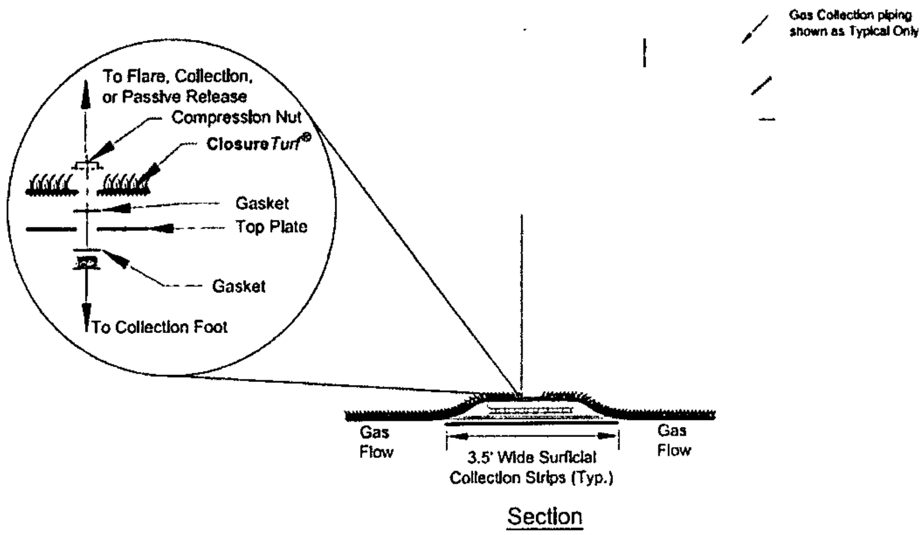


Figure 4: ClosureTurf® Surficial Collection Foot Connection to GCCS System

6.0 Installation - Geomembrane Liner

Installation of the Geomembrane Liner must be completed by a geosynthetics contractor approved by Watershed Geosynthetics. Qualification requirements for geosynthetics personnel are shown in WatershedGeo Installation Specification 01 73 19. Each component of the ClosureTurf® system will require specific testing and submittals before, during and after installation of the component. For information concerning submittals, see contract specifications. It is the responsibility of the contractor to ensure that each prior component installation has been approved by the POR before continuing with installation of the next ClosureTurf® component.

6.1 Delivery – Geomembrane Liner

Upon delivery of the geomembrane, observe that:

- The geomembrane is delivered in rolls and not folded. Any evidence of folding or other shipping damage is cause for rejection of the material.
- Equipment used to unload and store the rolls or pallets does not damage the geomembrane component.
- The geomembrane is stored in an acceptable location in accordance with the specifications and stacked no more than five rolls high.
- The geomembrane component is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.
- Manufacturing documentation required by the specifications has been received and reviewed for compliance with the technical specifications. This documentation will be included in the FCSER.
- The geosynthetics receipt log form has been completed for materials received.
- Geomembrane component that is damaged or has been rejected due to improper manufacturer documentation will be removed from the site or stored at a location separate from the accepted geomembrane component.

6.2 Installation - Panel Deployment and Field Seaming

ClosureTurf® installation requires some additional care and techniques beyond those of the typical geomembrane installation. General panel deployment techniques as well as special techniques are listed below.

General

- Observe that the geomembrane component is placed in direct and uniform contact with underlying protective cover soil or subgrade soil.
- Observe the sheet surface as it is deployed and record panel defects and repair of the defects (e.g. panel rejected, patch installed, etc.) on the repair sheet. Repairs must be made in accordance with the contract specifications and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane component during handling (See Section 6.4).
- Observe that the subgrade beneath the geomembrane component has not deteriorated since previous acceptance.
- Observe that there are no stones, construction debris, soil clogs or other deleterious items on the subgrade that could cause damage to the geomembrane component.
- The geomembrane component will not be deployed during inclement weather conditions as defined in the site specific specifications.
- Observe that people working on the geomembrane component do not smoke, wear boots/shoes that could damage the ClosureTurf® system components, or engage in activities that could damage the ClosureTurf® system components.
- Observe that the method used to deploy the sheet reduces wrinkles but does not cause bridging and that the sheets are anchored to prevent lifting or movement by the wind (geosynthetics contractor is responsible for any damage to or from windblown geomembrane).
- Observe that horizontal or cross seams on the side slopes are staggered so that long horizontal seams across the slope are not produced.
- The POR shall be responsible for approving the integrity of horizontal seams.

Acclimation and Adjustments

- The geomembrane component requires acclimation to ambient temperature after being deployed and before seaming operations begin.
- Acclimation time is dependent on the current weather conditions.
- By allowing the panels to acclimate, excessive wrinkling can be avoided.
- Final panel adjustments can be completed after the panel has properly acclimated to ambient temperature.
- After the panel has acclimated and before seaming operations begin, wrinkles will be worked toward the toe of slope.
- Once the above items are addressed, a final adjustment is required to pull the liner at the bottom of the slope.

Wedge Welding

- After proper acclimation and final adjustments/wrinkle removal, wedge welding may proceed.
- Wedge welding machines are a low profile machine with a vertical height (wedge height) not to exceed 3 inches, measured from flat surface to top of heating wedge.
- Wedge welding will be completed in accordance with the contract specifications.
- Sand bags will be applied as the wedge welding progresses to reduce tenting.

Snapping

- As a result of wedge welding, "ridges" or "tenting" of the seams may occur. A process called "snapping" must be employed to remove the excess slack caused by the welding process.
- Normally, this technique requires several people lined up along the open seam at the edge of the geomembrane and applying clamps to the edge. The panel is then "snapped" into positon and when applied properly, the excess slack is removed.
- The snapping technique will be applied while the welding seam is still warm.
- Previously applied sand bags along the wedge welded seam will reduce rebound tenting.

6.3 Anchor Trench Backfill

ClosureTurf® only relies on the anchor trenches to serve as a termination point. Top anchor trenches should be backfilled as quickly as practical after Engineered Turf Component is installed (prior to sand infill placement).

Vertical anchor trenches as well as anchor trenches along the toe will not be backfilled until sand infill of the engineered turf is in place. Anchor trench dimensions will be shown in the drawings.

Backfilling or sand bag loading the bottom and side anchor trenches should be considered and applied when cool temperatures are anticipated to assist with creep reduction.

6.4 Equipment on ClosureTurf® Geomembrane

Construction equipment on the ClosureTurf® geomembrane component will be limited to reduce the potential for geosynthetics damage. Observe/provide the following:

- Use power source generators capable of providing constant voltage to all required equipment under combined-line load.
- Secondary containment to catch spilled fuel under equipment where applicable.
- No equipment with tire or track pressures exceeding 5 psi will be allowed on the partially constructed ClosureTurf® system until after the completed installation of the sand infill component.
- No equipment will be left running and unattended over the constructed geomembrane component.
- Equipment operators shall check for sharp edges, embedded rocks, or other foreign materials stuck into or protruding from tires prior to operating equipment on the geomembrane component.
- Path driven on geomembrane component will be as straight as possible with no sharp turns, sudden stops or quick starts.

6.5 Wrinkles

Wrinkles occur during the geomembrane installation due to changes in geomembrane temperatures and deployment methods. The wrinkles may interfere with the installation of the engineered turf layer as well as the final appearance of the ClosureTurf® system. Observe that:

- Snapping procedures are followed.
- Wrinkles are repaired if they can be folded over as defined the morning after the seam is developed and the liner is in a cool state.

7.0 Installation – Engineered Turf

Qualification requirements for the personnel who the Engineered Turf component are shown in WatershedGeo Installation Specification 01 73 19.

7.1 Delivery – Engineered Turf

Box trucks will deliver 27 rolls per truck. Rolls will be strapped in groups of 9 allowing equipment (i.e. pick-up truck, skid steer) to pull the grouped rolls to the front of the truck. Rolls can be pulled directly to the ground or carpet stingers can move the rolls to a designated area. Observe the following:

Observe the following:

- The engineered turf is wrapped in rolls with protective covering.
- The rolls are not stacked more than 3 high.
- The rolls are not damaged during unloading.
- Protect the engineered turf from mud, soil, dirt, dust, debris, cutting, or impact forces.
- Each roll must be marked or tagged with proper identification.
- Rolls that have been rejected due to damage are be removed from the site or stored at a location separate from accepted rolls, designated by the Owner/Operator.
- Rolls that do not have proper manufacturer's documentation will be stored at a separate location until documentation has been received and approved.

7.2 Installation – Engineered Turf - Surface Preparation

Prior to installation of Engineered Turf, observe the following:

- ClosureTurf® geomembrane has been installed in accordance with the contract specifications.
- The geomembrane installation documentation has been completed and approved by the POR for areas were the Engineered Turf is to be installed.
- The supporting surface (i.e., the geomembrane) does not contain stones, debris, membrane grindings or large scraps left over from the installation process that could damage or impede surface water flow through the Engineered Turf.

7.2.1 Installation – Engineered Turf – Deployment & Field Seaming

During deployment of Engineered Turf, observe the following:

- Observe the turf as it is deployed.
- Verify that equipment used does not damage the turf or underlying geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that during deployment, the Engineered Turf filaments point upslope a majority of the time.
- Verify that the turf is anchored to prevent movement by the wind (the contractor is responsible for any damage resulting to or from windblown Engineered Turf).
- Verify that the turf remains free of contaminants such as soil, grease, fuel, etc.
- Observe that the turf is laid substantially smooth and substantially free of tension, stress, folds, wrinkles, or creases.
- Observe the deployment of the panels to insure proper flipping in order to expose the turf surface up after seaming operations. After the first panel of the project is deployed, deployment will be done on the adjacent turf panel to avoid damage.

7.2.1.1 Installation – Engineered Turf – Sewn Seam Method

- A single stitch prayer type seam is constructed using an American Newlong sewing machine or equivalent.
- The thread will be Polyester or equivalent.
- Sewing will occur between the 1st and 2nd row of tufts from the edge.

7.2.1.2 Installation – Engineered Turf – Fusion Seaming Method

- Engineered Turf fusion seaming device will be a DemTech VM20/4/A fusion welder only.
- Fusion seams require a minimum of 5 inches of overlap.
- Frayed or loose geotextile strands will be cut off or removed.
- Prior to starting the production fusion seaming, trial seams must be performed as outlined in Section 7.2.1.3 below.
- Demonstrate the preparation methods and equipment utilized for removal of the salvage from the outside edge of the rolls of turf (i.e. trimming & cutting devices).
- Mechanical trimming and cutting devices will be utilized for salvage trimming.
- Demonstrate and control the fraying of geotextile strands when performing the removal of salvage.
- Any damage that occurs due to production seaming will be repaired as outlined in WG Installation Guidance Documents.
- Any defects will be repaired as outlined in 7.2.2.

7.2.1.3 Installation – Engineered Turf – Fusion Seaming Method Trial Seam Requirements

1. Prior to turf component welding, CQA personnel shall observe and document the following:
    a. Turf welding apparatus are tested;
    b. at daily start-up; and
    c. immediately after any break; or

d. anytime the machine is turned off for more than 30 minutes.

2. Procedures:
   a. The turf trial weld will be completed under conditions similar to those under the panels that will be welded.

b. If at any time, the CQA Personnel believe that an operator or fusion welding apparatus is not functioning properly, a Field Trial Seam Test must be performed.

c. Any dispute concerning proper installation techniques or the proper function of fusion welding equipment will be resolved by the OWNER'S REPRESENTATIVE.

d. The trial weld must be allowed to cool to ambient temperature before seam snapping or panel adjustments are applied.

3. Trial Sample Test Results:

a. Trial weld samples must comply with "VISUAL PASSING CRITERIA" Visual passing criteria is verified when a manual peel/pull test is performed and the top turf panel tufts transfer to the bottom turf panel. The transfer of approx. 75% of the tufts constitutes a passing trial weld.

4. Field Seam Test Failure:

a. Less than approx.75% of the top turf panel tufts do not transfer to the bottom turf panel.

5. Additional Trial Sample Testing Requirements:

a. Two consecutive trial welds meet the visual passing criteria.

6. The trial weld sample must be a minimum of 3 feet long and 12 inches wide, with the seam centered lengthwise.

7. If a welding apparatus exceeds 5 hours in the second half of the day, another trial seam must be performed.

8. CQA documentation of trial seam procedures will include the following:

a. The names of the seaming personnel;

b. The name of the fusion seaming technician;

c. the welding apparatus number, time, date;

d. ambient air temperature; and

e. welding apparatus temperature & speed setting.

7.2.2 Installation – Engineered Turf Repairs and Tie-In Procedures

When Repairs and Tie-Ins to Engineered Turf occur, observe the following:

- Tie-In's to Engineered Turf will be completed by using a fusion seam.
- Seaming equipment for Engineered Turf will be a DemTech VM 20/4/A welder.
- A hand held heat gun should be used in smaller/concentrated areas.

7.2.3 Installation – Equipment on Engineered Turf

No equipment will be allowed on slopes exceeding 15% until Sand Infill is in place. On slopes less than 15%, such as top decks, ATV type vehicles will be allowed prior to infill placement if the rubber tire or track pressure is less than 5 psi. Post construction (full specified sand infill thickness) drivability tire pressures on slopes greater than 10% should be limited on the ClosureTurf® system to less than 35 psi.

Allowable rubber tire or track pressures on top decks may increase to as much as 120 psi as long as sustained traffic load is not expected.
In all phases of construction, equipment used on the ClosureTurf® product will not be allowed to change speed or direction in a manner that could displace or damage the ClosureTurf® system.
High traffic areas will require sand to be placed at the full height of the turf. ArmorFill may also be utilized in high traffic areas to reduce sand migration due to the increased sand thickness.

8.0 Installation - Sand Infill

This component of the ClosureTurf® system is a specialized mixture of sand infill that is placed between the tufts of the Engineered Turf component.

Observe that the following general requirements regarding Sand Infill are met:

- Sand Infill will meet ASTM C-33 specifications.
- Areas that are to receive sand infill must be inspected and accepted by the POR or CQA Personnel before placement of sand infill takes place.

8.1 Submittals and Testing - Sand Infill

See contract specifications for Sand Infill MQC Submittals and submittal/testing requirements regarding the Sand Infill.

8.2 Installation - Sand Infill Deployment

Observe that the following installation guidelines regarding the Sand Infill:

- Sand infill thickness will be verified at a frequency of 20 measurements per acre of final cover installed.
- The sand infill layer will be placed to a ½ inch minimum thickness not to exceed ¾ inch thick.
- The sand infill will be worked into Engineered Turf as infill between the synthetic yarn blades.
- No equipment will be allowed on slopes exceeding 15% until the sand infill is in place.
- Conveyor systems and/or Express Blowers are the preferred method to spread and place the sand infill.
- Contractor shall explain in detail in the pre-construction meeting the method of sand infill deployment to be used.
- The sand infill deployment method will be approved prior to installation of the sand infill.
- For slopes 3H: 1V or steeper the sand infill shall be placed using long reach conveyor belts or using water or air express blower methods that demonstrate achievable results.
- The sand infill placement will be done in front of the deployment equipment to improve the bearing capacity of the previously installed ClosureTurf® components.
- Sand infill placement cannot occur with snow or ice on the Engineered Turf component.
- Verify that underlying geosynthetics installations are not damaged during placement operations. Mark damaged geosynthetics and verify that damage is repaired.

The method for measuring the Sand Infill thickness will be performed utilizing a digital caliper with depth rod capabilities, or a POR approved alternate measuring device.

8.3 - Alternate Infill - ClosureTurf® with HydroBinder® Infill for Ditches and Downslope Channels

Alternate Infill - HydroBinder® is provided by Watershed Geosynthetics or approved supplier. When the ClosureTurf® system is installed and HydroBinder® infill is placed in lieu of sand infill, it creates a ditch/downslope lining armor that will allow high flow velocities to convey without damage or maintenance to the underlying ClosureTurf® components. Typical ClosureTurf® installation procedures are used for the first three ClosureTurf® components, and then the HydroBinder® infill is placed dry and hydrated after placement. Figure 4 shows a typical ClosureTurf® with HydroBinder® infilled ditch section.

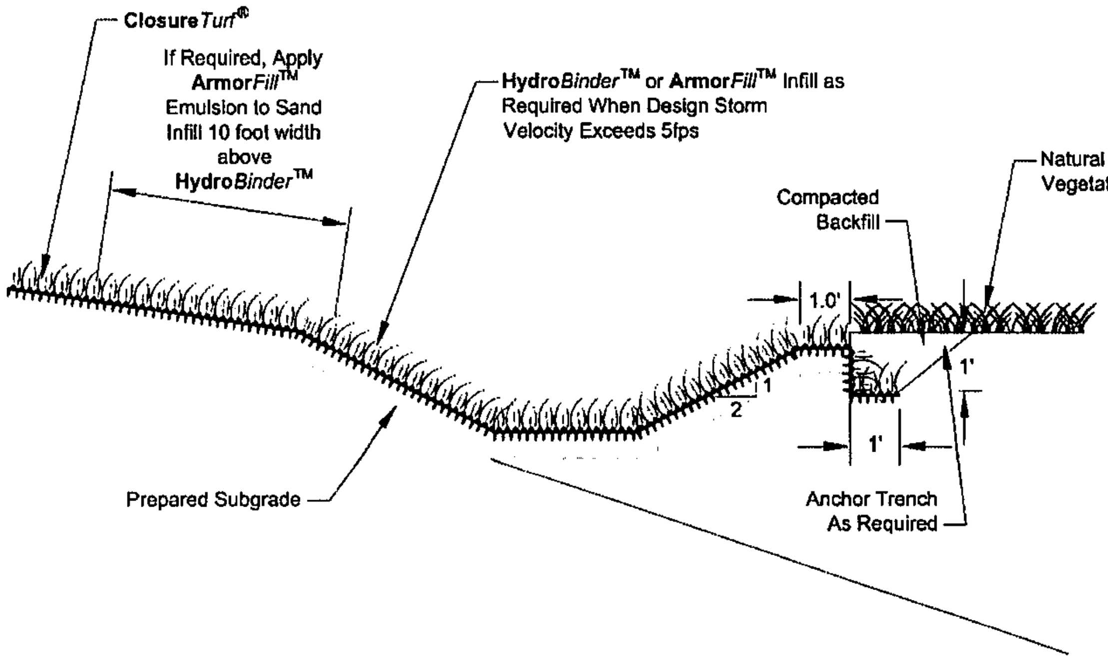


Figure 4: Typical ClosureTurf® with HydroBinder® Infilled Ditch Section

8.4.1 Installation – Alternate Infill - HydroBinder®

Verify the following regarding installation of HydroBinder® Infill:

- The HydroBinder® infill layer may be placed using any appropriate equipment capable of completing the work while meeting loading requirements specified herein.
- Manual hand spreading is acceptable when equipment isn't practical.
- Contractor / Installer will explain in detail in the pre-construction meeting the method of HydroBinder® infill deployment.
- Installation of HydroBinder® infill will only be performed by a Watershed Geosynthetics' licensed and approved installer using techniques and equipment approved by Watershed Geosynthetics.
- The HydroBinder® will be installed into the turf while it is in a dry state.
- The HydroBinder® will be worked into the tufts so the tufts are in an upright position.
- The HydroBinder® infill layer will be placed to a ¾ inch minimum thickness not to exceed 1 inch thick.

- Do not backfill anchor trenches until turf has been installed with HydroBinder® infill.
- The hydration process must occur the day of the HydroBinder® infill placement.
- The desired HydroBinder® infill thickness will be achieved prior to the hydration process.
- The cemented infill is hydrated thoroughly however care must be taken to avoid displacement of the non-hydrated infill.
- The objective is to soak the area to start the hydration process but not to inundate with water beyond saturation.
- Once hydration is completed as described, backfill and compaction of the vertical anchor trenches should take place.
- The HydroBinder® will be at minimum performance levels within 24 hours.

8.4.2 Installation – Alternate Infill - ArmorFill™

Verify the following regarding installation of ArmorFill™ Infill:

- Installation of ArmorFill™ will be completed by an installer certified by Watershed Geosynthetics.
- Apply ArmorFill™ under dry weather conditions and when precipitation is not expected for at least 24 hours after installation.
- Apply ArmorFill™ on a previously installed ClosureTurf® system that is free of leaves and other material that may inhibit the penetration of the ArmorFill™ into the sand component.
- Apply ArmorFill™ only after approval of the finished ClosureTurf® product installation.
- Verify ArmorFill™ and water mix ratio by logging volume mixed of each component.
- Verify that ArmorFill™ has saturated the sand by inserting a probe and displacing a 1 inch area of sand.
- Check saturation randomly at a rate of 20 probes per acre.
- Verify proper application rate by marking a known area and applying the proper volume to that area.
- Adjust delivery rate to match the delivery volume per area.
- Mix in a hydraulic conveyance system such as a water truck or portable tank.
- Utilize a small agitation pump to mix and recirculate the ArmorFill™ within the tank to impede separation of the mix.
- Place ½ of the water component in the tank, then add the full strength ArmorFill™ and complete the mix by then adding the other ½ of the water into the tank.
- ArmorFill™ application equipment will have a 2 inch diameter hose with a spray adjustment nozzle and cut off function in the nozzle head.
- Reduce the number of equipment set-ups required and take care with the application hose so as

previously applied ArmorFill™ is not displaced by dragging of the hose.

- Spray product evenly.
- Apply ArmorFill™ at a rate of approximately 2600 gallons of the mixed product per acre (Approx. 0.06 gallons per square foot)
- Do not apply ArmorFill™ in inclement weather or in freezing temperatures.
- At the completion of ArmorFill™ placement activities, clean the equipment thoroughly and purge the tank and hoses of the product.
- All waste product will be disposed of in accordance to site regulations
- Avoid unnecessary foot traffic on the applied product for 24 hours.
- No vehicle traffic is allowed on the applied product for 7 calendar days.

8.5 Installation – Coverage - ArmorFill™

For most applications, use a 6:1 mix ratio unless otherwise stated by the Engineer.

8.5.1 Installation – Coverage - HydroBinder®

Table 1

Approximate Coverage Area for HydroBinder™ Infill

Product	Bag Size	Yield (Cubic Feet)	Coverage in Sq. Ft. for 3/4 in. Thick[1]	Coverage in Sq. Ft. for 1 in. Thick[1]	Amount of Water to Mix per Bag (gal)	Amount of Water (gal) to Apply per Sq. Ft. (3/4 in. Thick)[1]	Amount of Water (gal) to Apply per Sq. Ft. (1 in. Thick)[1]
HydroBinder Infill	40 lbs.	0.3	4.8	3.6	0.6	0.12	0.16
	60 lbs.	0.45	7.2	5.4	0.9	0.12	0.16
	80 lbs.	0.6	9.6	7.2	1.2	0.12	0.16
	1 Cubic Yard (Super Sack)	27	432	324	55	0.13	0.17

[1] - Values are approximate

8.6 Post Installation - Maintenance and Monitoring

The ClosureTurf® System is designed to be a very low maintenance final cover. If maintenance issues or damage occurs to the ClosureTurf® System, please refer to the following guidelines.

8.6.1 Exposed Geotextiles

If the engineered turf backing becomes exposed, then the ASTM C-33 graded infill is to be placed and brushed into the exposed turf backing areas. WG suggested guidance is to evaluate the closure system at a frequency of no less than once every 5 years.

Additionally, UV resistant coating can be applied to the exposed area and sand immediately applied onto the coating material, this provides a flexible UV barrier for the underlying geotextiles. The UV coating product is manufactured by Quikrete, product number 8640 and Sakrete, product number 60205006, concrete sealants and can be purchased at most Lowes & Home Depot Home Improvement stores. ArmorFill™ can also be utilized for this purpose.

8.6.2 Damage to the Geomembrane or Engineered Turf Components

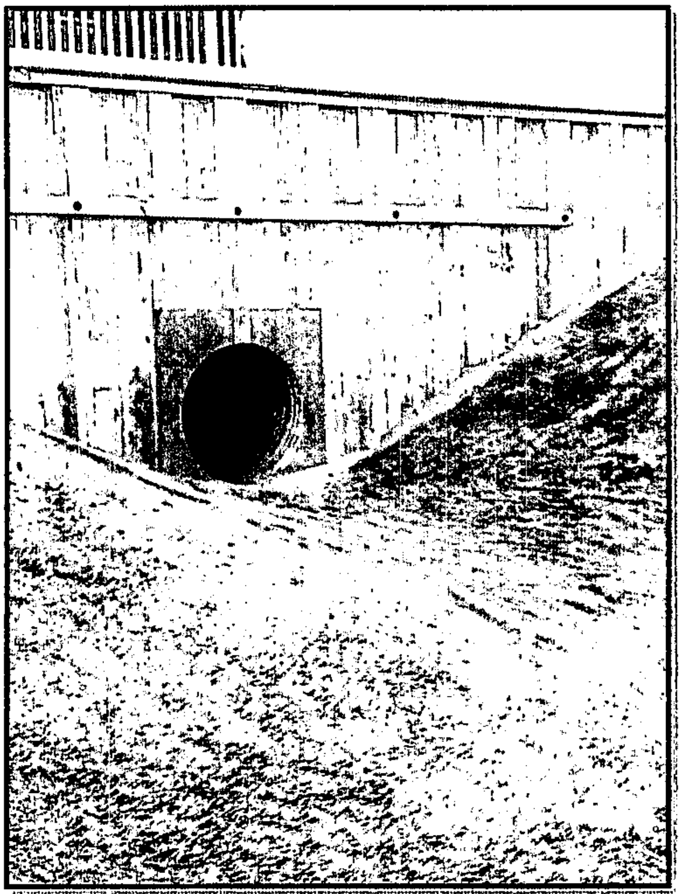
If damage occurs to the geomembrane or geotextile Components, call an approved ClosureTurf® installer for repairs. Contact WatershedGeo® at 770 777 0386 for a list of qualified installers.

HydroTurf®

INSTALLATION GUIDELINES MANUAL

March 2015, Revision 2.1

Before utilizing this document as an installation tool, Installer should download the latest version of the Installation Guidelines Manual from the website at www.watershedgeo.com.



WatershedGeo®
Unearthing Solutions

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1.0 Introduction

HydroTurf® Advanced Revetment Technology is a patented system which is used as a hardened armoring for protection against erosion from hydraulic forces. There are two HydroTurf® Systems. These systems are as follows:

HydroTurf® CS is shown in Figure 1. The components of this system are as follows:

- Structured LLDPE (or HDPE) Geomembrane Liner
- Engineered Synthetic Turf
- HydroBinder® Infill
- Penetrating Colloidal Concrete Treatment (PCCT) -Optional for Freeze / Thaw Protection

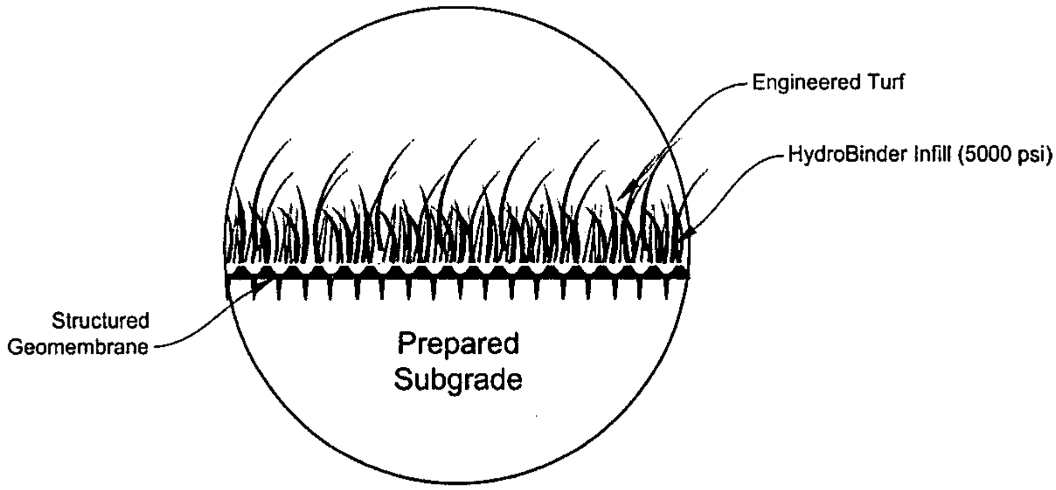

Figure 1 – Section of HydroTurf® CS

HydroTurf® Z is shown in Figure 2. The components of this system are as follows:

- Engineered Synthetic Turf with Integrated Polyethylene Backing
- HydroBinder® Infill
- Penetrating Colloidal Concrete Treatment (PCCT) -Optional for Freeze / Thaw Protection

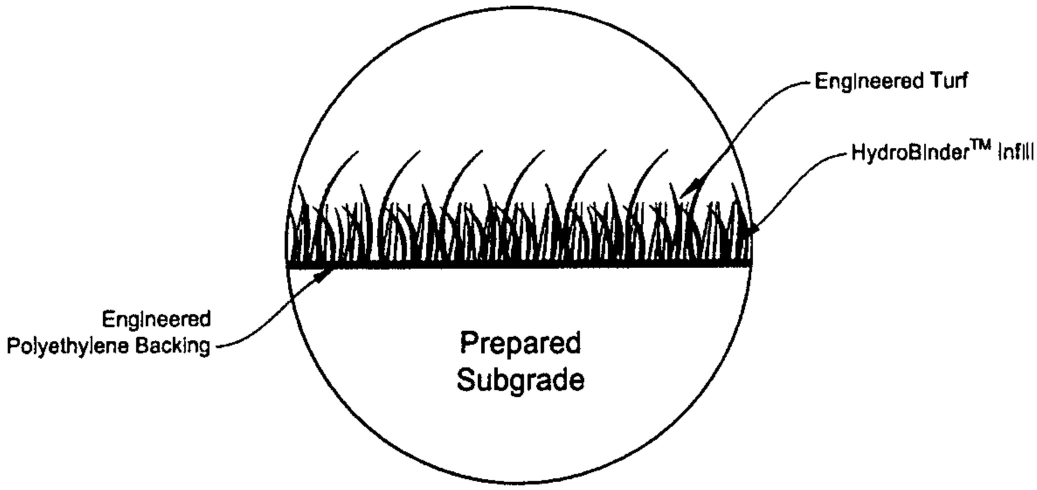

Figure 2 – Section of HydroTurf® Z

2.0 Limitations

This manual is meant as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for site conditions and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

HydroTurf® (US Patent Nos. 7,682,105, 8,585,322; Canadian Patent No. 2,663,170; and other Patents Pending) and registered trademark are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

3.0 Subgrade Preparation (HydroTurf® CS and Z)

Prior to HydroTurf® system installation, the soil subgrade shall be inspected by the Engineer and geosynthetics contractor. The following shall be observed:

- The soil subgrade shall be compacted to the requirements as specified by the engineer. The subgrade shall be firm and unyielding.
- The soil subgrade shall be smooth and uniform, and shall be substantially free of surface irregularities and protrusions.
- The soil surface shall be free of foreign and organic material, sharp objects, particles or other deleterious material, and shall not contain stones or other objects that could damage any of the HydroTurf® components.
- Maximum particle size (e.g. stones) shall be specified by the design and site-specific specifications.
- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and other deleterious material.
- Construction stakes and hubs have been removed and the resultant holes have been backfilled.
- Final grades on the slopes as well as benches dimensions and grades conform to the design grades.
- Survey shots and as-built drawings shall be carefully reviewed and evaluated to ensure the surface grades will drain as intended in the design drawings.

4.0 Structured Geomembrane Liner Component (HydroTurf® CS only)

Installation of the Structured Geomembrane LLDPE (or equivalent HDPE) Liner must be completed by an approved geosynthetics contractor who can demonstrate significant experience with installation of structured geomembranes. Each component of the HydroTurf® system will require specific testing and submittals before, during or after installation of the component. It is the responsibility of the contractor to ensure that each prior component installation has been approved by the owner's representative before continuing with installation of the next HydroTurf® component.

4.1 Geomembrane Panel Deployment

Engineer shall ensure that all Pre-Installation procedures have been followed before proceeding with deployment of geomembrane. As geomembrane component panel deployment proceeds, the Engineer and the Geosynthetics Contractor shall:

- Ensure the geomembrane component is placed in direct and uniform contact with underlying protective cover soil or subgrade soil.
- Observe the geomembrane surface as it is deployed and record panel defects and repair of the defects (e.g. panel rejected, patch installed, etc.) on the repair sheet. Repairs must be made in accordance with the technical specifications and located on a repair drawing.
- Support equipment is not allowed on the geomembrane component during handling.
- Confirm that the surface beneath the geomembrane component has not deteriorated since previous acceptance.
- Confirm that there are no stones, construction debris, soil clogs or other deleterious items on the subgrade that could cause damage to the geomembrane component.
- The geomembrane component shall not be dragged across a surface that could damage the material. If the geomembrane component is dragged across an unprotected surface, it must be inspected for scratches and repaired or rejected, as necessary.

- The geomembrane component shall not be deployed during inclement weather conditions as defined in the project specific specifications.
- Personnel working on the geomembrane component shall not smoke, wear boots/shoes that could damage the HydroTurf® system components, or engage in activities that could damage the HydroTurf® system components.
- The method used to deploy the geomembrane shall minimize ripples and eliminate wrinkles but does not cause bridging, and that the geomembrane is anchored to prevent lifting or movement by the wind (geosynthetics contractor is responsible for any damage to or from windblown geomembrane). A wrinkle is a portion of the geomembrane that does not lay relatively flat and is not the result of a subgrade irregularity. A wrinkle is large enough that it can be folded over. A ripple is the result of manufacturing or thermal expansion. It is smaller in nature than a wrinkle and cannot be folded over.
- Excess geomembrane materials should be walked-out or removed to the extent practical.
- The geosynthetics contractor shall apply tension techniques to pull out excess material / slack prior to seaming.
- The geomembrane component shall acclimate to the ambient temperature prior to welding. The ambient temperature is defined as the temperature of previously deployed and welded geomembrane panels.
- Additional acclimation time will be required when temperatures drop below 50 degrees Fahrenheit and when solar heating is reduced.
- The horizontal or cross seams on the side slopes shall be staggered so that long horizontal seams across the slope are not produced.

4.2 Geomembrane Field Seaming/Welding

Geomembrane field seaming and welding operations shall be performed as follows:

- Wedge welding machines shall be a low profile machine with a vertical height to not exceed 3 inches to the highest point of the wedge. Installer shall demonstrate that each wedge welding machine meets this requirement.
- The geosynthetics contractor shall have the number of welding apparatuses and spare parts necessary to perform the work.
- Equipment used for welding will not damage any HydroTurf® system components.
- The extrusion welding machine is purged prior to beginning a weld until the heat degraded extrudate is removed.
- The ambient temperature, measured 6 inches above the geomembrane surface, is between 35°F and 104°F, or geomembrane manufacturer's recommended temperature limits if they are more stringent.
- The contact surfaces of the sheets are clean, free of dust, grease, dirt, debris, and moisture prior to welding.
- The weld is substantially free of dust, soil / mud, rocks, and other debris.
- The seams are overlapped a minimum of 3 inches for extrusion and hot wedge welding, or in accordance with geomembrane manufacturer's recommendations, whichever is more stringent.
- Panels shall be overlapped (shingled) in the downgrade direction.
- No solvents or adhesives are present in the seam area.

- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being welded in accordance with the plans and site specific specifications.
- There is no obvious free moisture in the weld area.
- Observe that at the end of each day or installation segment, unseamed edges are anchored with sandbags or other approved anchoring device.
- Penetration anchors shall not be used to secure the geomembrane.
- Once two panels have been seamed together or at the approx. 1/3 seaming process a seam "snapping" process should be applied. This method is performed with manual labor by utilizing 3-4 technicians on the open side of the panel applying a pulling pressure to snap out the tented welded seam.
- The "snapping" requirement is important in that it allows the engineered turf component to lie more evenly over the geomembrane component.

4.3 Defects

Any portion of the geomembrane with a detected flaw, must be repaired in accordance with the project specifications (e.g., material requirements, installation, testing, etc.).

5.0 Engineered Turf Component (HydroTurf® CS and Z)

The installation of HydroTurf® engineered turf consists of the placement and seaming of the engineered turf component over the structured geomembrane liner (HydroTurf® CS) or over the soil subgrade (HydroTurf® Z).

Box trucks will deliver up to 27 rolls engineered turf per truck. Nine (9) rolls will be strapped together allowing equipment (i.e. pick-up truck, skid steer) to pull the strapped rolls to the front of the truck. Rolls can be moved to a designated area by using a carpet stinger or lifted by straps.

During unloading, the contractor and / or CQA personnel shall confirm that the following is practiced and performed:

- The engineered turf is wrapped in rolls with protective covering.
- The rolls are not stacked more than 3 high.
- The rolls are not damaged during unloading.
- Protect the engineered turf from damage (i.e., mud, soil, dirt, dust, debris, cutting, impact forces, etc.).
- Each roll must be marked or tagged with proper identification.
- Rolls that have been rejected due to damage are to be removed from the site or stored at a location separate from accepted rolls, designated by the Owner/Operator.

5.1 Surface Preparation (HydroTurf® CS)

Prior to installation of Engineered Turf, the following shall be completed:

- The geomembrane component of the HydroTurf® CS has been installed in accordance with the site specific specifications.
- The required geomembrane installation documentation has been completed and approved by the Engineer prior to installation of the Engineered Turf.
- The surface of the geomembrane does not contain soil / mud, stones, debris or large scraps left over from the installation process.

5.2 Engineered Turf Deployment (HydroTurf® CS and Z)

Engineered Turf shall be deployed as follows:

- Observe the engineered turf as it is deployed and record defects and disposition of the defects (panel rejected, patch installed, etc.). Repairs are to be made in accordance with the specifications.
- Equipment used shall not damage the engineered turf, underlying geomembrane or subgrade by handling, trafficking, leakage of hydrocarbons, or by other means.
- The panels shall be deployed from the top of the slope in a way that the leading edge of the roll stays at the top of the slope with the Engineered Turf filaments pointing upwards. Also, the turf has colored marker fibers (yellow) on one side of the roll. These colored fibers shall be lined up on the same side of every panel. This will ensure that the turf filaments are pointing in the same direction.
- The turf shall be ballasted to prevent movement by the wind or other means (the contractor is responsible for any resulting damage).
- The turf shall remain free of contaminants such as soil / mud, debris, grease, fuel, etc.
- The turf shall be laid smooth and substantially free of tension (but not loose), stress, folds, ripples / wrinkles, or creases. The geomembrane (for HydroTurf® CS) or the turf (for HydroTurf® Z) shall be in intimate contact with the underlying subgrade
- On slopes, the turf shall be secured with sandbag anchoring at the top of the slope and then rolled down the slope.

5.3 Engineered Turf Seaming

5.3.1 Sewing (HydroTurf® CS)

Seaming of the engineered turf component of HydroTurf® CS may be performed by sewing. This is described as follows:

- The panels shall be deployed to ensure proper flipping in order to expose the turf surface up after seaming (sewing) operations. After the first panel of the project is deployed, deployment shall be done on the adjacent turf panel to avoid damage.
- The panels shall be deployed in a manner to ensure that the turf filaments are pointing upslope and in the same direction as the adjacent panel.
- The adjacent panels are sewn together with a single stitch prayer type seam. This is constructed using a heavy-duty textile stitching machine (i.e., Nulong sewing machine or equivalent).

- The thread shall be 207 Polyester or equivalent.
- Sewing shall occur between the 1st and 2nd row of tuft stiches of the engineered turf in order to avoid exposure of the black geotextile backing after flipping the panel. Incorrect sewing, which creates "fishmouths" and / or exposed geotextile backing, shall be repaired.

5.3.2 Heat-Bond Welding (HydroTurf® Z)

Seaming of the engineered turf component of HydroTurf® Z may be performed by heat-bond welding. This is described as follows:

- Panels shall be deployed such that the seam overlaps are shingled with the flow of water. The panel on the up-flow / upstream side shall have the overlap placed on top of the down-flow / downstream panel.
- The panels shall be deployed in a manner to ensure that the turf filaments are pointing upslope and in the same direction as the adjacent panel.
- The DemTech 4-inch, single-wedge welder (Model No. VM-20/4/A Pro-Wedge Welder 120V, VM20 Outfitted with 100-KIT/4S/VC/A.2 Welding Kit, 4-in, 220V, S.S.) shall be used to heat-bond the seams for the engineered synthetic turf.
- Since the temperature and speed controls of the DemTech VM-20 machine are variable and can be increased / decreased depending on weather and environment conditions, the temperature and speed shall be confirmed with a trial seam. This trial seam shall be field tested. Trial seams shall be performed at the being of each day and during the day when the weather (i.e., temperature) conditions change.
- Field testing of this trial seam consists of the following:
  - Observe the weld and confirm that the geotextile backings are not melting. If they are melting, then the machine is too hot.
  - Observe and feel the welded seam in order to confirm that there is a stiff, inner core which is continuous along the weld.
  - Observe and confirm that the welds may not be pulled or peeled apart. If it can, there was not enough heat during the welding process. Pulled or peeled seams shall be re-seamed or patched with a cap.
  - All seams shall be continuous. These seams shall be verified by the installer that they are continuous by running their fingers along the seam. If there is any penetration of their fingers into the seam, the installer will need to use a hand-held Leister at the location of the penetration in the seam in order to weld it continuously. The seam will need to be re-inspected by the installer.
- Production field seams shall be performed in the same manner as trial seams. The field seams shall be inspected every hour at a minimum. This inspection of the field seams shall be the same as the inspection for the trial seams.
- Burnouts shall be patched.
- All seams not passing the visual inspection shall be repaired.
- After seaming operations, the edges of the synthetic turf panels shall be sufficiently anchored with sandbags in the top of slope perimeter anchor trenches unless otherwise noted on the construction drawings.

5.3.3 Repairs and Tie-Ins Procedures for Engineered Turf (HydroTurf® CS and Z)

When Repairs, caps and tie-ins of engineered turf are needed, the following shall be performed:

- Repairs to engineered turf shall be completed by using a heat-bonded seam.
- All tie-in seams along flatter slope (i.e. 15% or less) with length greater than 25 feet shall use the DemTech VM-20 single wedge welder (outfitted with the synthetic turf welding kit) so a continuous, consistent pressure is achieved throughout the seam.
- A hand-held heat gun (i.e. Leister) with a pressure wheel should be used in shorter or smaller concentrated areas (i.e., butt seams, caps or patches). The hand leister shall be immediately followed by a press wheel providing a constant pressure.
- Hand leistering shall be field tested with a trial seam to confirm proper seaming.
- The quality of these trial and field welds shall be confirmed by the following visual observations:
  - Observe the weld and confirm that the geotextile backings are not melting. If they are melting, then the machine is too hot.
  - Observe and feel the welded seam in order to confirm that there is a stiff, inner core which is continuous along the weld.
  - Observe and confirm that the welds may not be pulled or peeled apart. If it can, there was not enough heat during the welding process. Pulled or peeled seams shall be re-seamed or patched with a cap.
  - All hand-leistered seams shall be continuous. These seams shall be verified by the installer that they are continuous by running their fingers along the seam. If there is any penetration of their fingers into the seam, the installer will need to use a hand-held Leister at the location of the penetration in order to weld the seam continuously. The seam will need to be re-inspected by the installer.

5.4 Equipment on Engineered Turf (HydroTurf® CS and Z)

No equipment shall be allowed on slopes exceeding 15% until HydroBinder® Infill is in place. On flatter slopes, ATV type vehicles and / or rubber tracked skid steer machines will be allowed prior to infill placement if their ground pressure is less than 5 psi. Post construction and after 28 days of curing of the HydroBinder®, vehicle (ground) tire pressures should be limited on the HydroTurf® system to less than 35 psi. Driving should be limited to areas where the subgrade under the HydroTurf® is well-compacted, firm and unyielding.

6.0 HydroBinder® Infill (HydroTurf® CS and Z)

HydroBinder® Infill is a dry, high-strength cementitious mix. It is provided by Watershed Geosynthetics with the HydroTurf™ system. When the HydroTurf™ system is installed and HydroBinder® infill is placed, it creates a hardened revetment armoring that can resist the forces from high hydraulic flow velocities. The HydroBinder® infill is placed dry, groomed into the engineered synthetic turf and hydrated after placement.

6.1 Placement of HydroBinder™ Infill (HydroTurf™ CS and Z)

HydroBinder® Infill shall be placed as follows:

- HydroBinder® is delivered to the jobsite on pallets in either 3000# bulk bags (1 per pallet) or 80# bags (42 per pallet). It is delivered on a flatbed with 16 pallets (typical) per truckload.
- The HydroBinder® shall be installed into the turf while it is in a dry state.
- Prior to placing the HydroBinder®, the engineered turf shall be dry. If the turf is wet from rain or dew, the installer shall wait until it is dry. The installer may attempt to speed up the drying process by using a blower (i.e., leaf blower, industrial blower, etc.).
- HydroBinder™ shall not be installed in inclement, wet or rainy weather, or the threat of inclement weather. Also, the HydroBinder® shall not be installed in freezing temperatures.
- The HydroBinder® infill shall be placed at a minimum thickness of ¾-in. This thickness is achieved by placing approximately 6 to 7 lbs/sf of the dry HydroBinder® over the engineered turf.
- The infill is to be placed / spread using a manual drop spreader, top-dresser and/or drop spreader attached to low ground pressure equipment with adequate dust control.
- Manual hand spreading is acceptable when equipment is not practical.
- If weep holes are required for draining the internal drainage layer through the engineered turf (HydroTurf® CS), remove the HydroBinder® in the areas of the weep holes prior to hydration or block the weep hole locations prior to infilling. Blocks may consist of pipe, dowels, etc. Weep holes are typically ½ to ¾-in diameter and are located at the toe of slope on 2-ft centers.

6.2 Brushing of the HydroBinder™ Infill (HydroTurf® CS and Z)

The HydroBinder® infill will need to be worked into the tufted fibers of the engineered turf such that the turf fibers are in an upright position. This can be achieved as follows:

- The infill shall be worked into the tuft fibers so the tuft fibers are in an upright position with the infill at a measurable ¾ inch minimum depth. This is achieved with common mechanical turf broom, power broom, shop broom, yard rakes, or greens groomer rakes.
- Brushing should be performed in all four directions starting with the direction against the lay of the fibers. Multiple passes may be required.
- The HydroBinder® may need to be placed in 2 to 4 lifts with brushing in between lifts to effectively work the material into the tufts and achieve fibers that are upright.
- The engineered turf shall be visually inspected to confirm that the turf fibers are upright and that there are no trapped fibers.
- Thickness measurements of the HydroBinder® infill shall be taken using a caliper or equivalent device. Measurements shall be taken at a minimum frequency of 5 measurements per 1,000 sf (for smaller projects) or 20 per acre (for larger projects) of installed area.
- The desired HydroBinder® infill thickness shall be achieved prior to the hydration process.

6.3 Hydration of the HydroBinder® Infill (HydroTurf® CS and Z)

The HydroBinder® infill shall be hydrated in place as follows:

- The hydration process shall occur on the same day as the HydroBinder® infill placement.
- The infill shall be hydrated thoroughly with a light and consistent spray of water to avoid displacement of the non-hydrated infill. Estimated application rate is between 0.12 and 0.20 gallons per square foot of area.
- The installer shall not overhydrate the infill so that water begins to runoff and cause loss of cement infill during the process. The general objective is to soak the area to start the hydration process but not to inundate with water beyond saturation of the infill.
- Visual verification can be performed that the HydroBinder® infill has been fully hydrated, and not over hydrated. Visually observe that the top of the HydroBinder has a wet sheen (denoting saturation) but that water is not ponding on top. Also, excavate (with finger or small tool) into the HydroBinder® to confirm full hydration of the section has been achieved.
- To improve curing, the hydrated area may be covered with plastic sheeting.
- If freezing temperatures are expected during the night, the hydrated area should be covered with burlap and / or plastic sheeting.
- The HydroBinder® infill shall harden within 24 hours following hydration, and shall reach its maximum compressive strength at 28 days. If the HydroBinder has not hardened in 24 hours, it will need to be removed and replaced.
- Personnel access on the HydroTurf® shall be prohibited for 24-hr following the hydration of the HydroBinder®.
- Once hydration is completed and the HydroBinder® has set up, backfill and compaction of the anchor trenches may be performed.

6.4 Cold Weather Placement and Curing of the HydroBinder® Infill (HydroTurf® CS and Z)

Cold weather placement and curing techniques for HydroBinder® shall be consistent with industry standard techniques used for concrete and cement products. The following guidelines are suggested:

- Follow the procedures in American Concrete Institute (ACI) 306 – Guide to Cold Weather Concreting.
- ACI 306 defines cold weather as three consecutive days of the following:
  - Average daily temperature falls below 40 dg F; or
  - The air temperature does not rise above 50 deg F for more than half of a day in one 24 hour period.
- At the time of HydroBinder® placement, the subgrade and surface of the engineered turf shall be at a temperature of at least 36 deg F and rising.
- Ensure that frost or frozen surfaces are thawed with no standing water.
- If the temperature can fall below 32 °F within 24 hours of application, heated tarps and/or insulated blankets are required to maintain the temperature above 50 deg F.
- Heated tarps and/or insulated blankets are required to maintain the temperature above 50 deg F for a period of at least 7 days.

- Heated tarps may dry out the HydroBinder®. Do not allow it to dry out. You may need to add moisture and use impermeable covers.

The project design engineer and/or resident engineer shall provide technical specifications and guidance for cold weather concreting based upon your specific project particulars (i.e., geographical location, weather, and time of year), and the engineer should review and approve all proposed installation methods.

6.5 Penetrating Colloidal Concrete Treatment for the HydroBinder® Infill (Optional for HydroTurf® CS and Z)

Penetrating colloidal concrete treatment (PCCT) is an optional liquid application and treatment for the freeze / thaw protection of the HydroBinder® infill. It should be applied to the HydroBinder® when specified. The PCCT shall be applied as follows:

- PCCT shall ideally be stored in a location that is dry and between 35 °F to 100 °F (2 °C to 38 °C) ambient temperature. Optimal storage is at the middle of the temperature range. Protect the PCCT from freezing.
  - The following shall be followed when applying the PCCT:
    - The PCCT product and the HydroBinder® surface shall be at temperature of at least 36 deg F (2 deg C) and rising.
    - Do not apply on frozen substrate or when temperature can fall below 32 °F within 24 hours of application.
    - Ensure that frost or frozen surfaces are thawed with no standing water.
    - Areas of standing water shall be removed prior to application.
    - Do not apply unprotected during periods of high winds.
    - PCCT shall not be applied in inclement, wet or rainy weather, or the threat of inclement weather.
    - Do not apply when substrate is 90°F (32°C) or higher. If surface temperature is higher than 90°F (32°C) then pre-wetting with water is required. Be sure to remove any puddles before applying of SCP.
    - When hot temperature and direct sunlight conditions exist, apply a fine mist spray of water on the surface after application of PCCT.
  - Apply PCCT as soon as the HydroBinder® infill is hard enough to walk on without damage to the surface.
  - Use a 1,500-psi (10.5 MPa) airless sprayer set at a pressure that will not damage the surface [i.e., approximately 400 to 900 psi (2.5 to 6.5 MPa)].
  - Hold wand and spray the PCCT 6 inches (15 cm) from the surface of the HydroBinder® at a 90º angle.
  - PCCT must be applied using an overlapping spray pattern of 50% on the previous run.
  - Any area that absorbs product faster than 10 minutes will need to be reapplied until the product no longer absorbs faster than 15 minutes.
  - If PCCT has absorbed thoroughly in the majority of the area, but there is pooling in the low areas, use a broom to spread additional PCCT into the areas already penetrated. Do not allow PCCT to dry in pools. Remove excess PCCT with a damp mop. Apply at a rate of approximately 160 ft^2 per gallon of PCCT. If necessary, spray a second application of PCCT.

- For sloped applications, work from lowest to highest elevation. Very light and repeated spray passes should be made on the same area until the concrete surface no longer accepts PCCT. Move onto next area after achieving "point of rejection".

7.0 Backfilling of the Anchor Trenches (HydroTurf® CS and Z)

Backfilling of the anchor trenches for the HydroTurf® CS shall be performed as follows:

- The structured geomembrane component shall be in intimate contact with the anchor trench inside wall and bottom. Wrinkles, ripples, fish mouths, and/or bunching shall be removed and properly patched.
- The structured geomembrane shall not extend up the outside wall of the anchor trench. It shall be trimmed short of the outside wall and shall extend a minimum of ¾ of the width of the anchor trench.
- The engineered synthetic turf component shall be in intimate contact with the structured geomembrane. Wrinkles, ripples, fish mouths, and/or bunching shall be removed and properly patched.
- The engineered synthetic turf shall be trimmed so that it does not extend onto the bottom of the anchor trench. It shall be trimmed just short of the bottom and shall extend a minimum of ¾ of the depth of the anchor trench.
- During filling of the anchor trench with compacted soil or concrete backfill, the contractor shall maintain that the geomembrane is in intimate contact with the trench wall and bottom and that the engineered synthetic turf is in intimate contact with the structured geomembrane.
- Soil backfill shall be compacted in accordance with the specifications for engineered fill. Concrete backfill shall be vibrated in place in accordance with standard industry techniques.

Backfilling of the anchor trenches for the HydroTurf® Z shall be performed as follows:

- The engineered synthetic turf component shall be in intimate contact with the anchor trench inside wall and bottom. Wrinkles, ripples, fish mouths, and/or bunching shall be removed and properly patched.
- The engineered synthetic turf shall not extend up the outside wall of the anchor trench. It shall be trimmed short of the outside wall and shall extend a minimum of ¾ of the width of the anchor trench.
- During filling of the anchor trench with compacted soil or concrete backfill, the contractor shall maintain that the geomembrane is in intimate contact with the trench wall and bottom and that the engineered synthetic turf is in intimate contact with the structured geomembrane.
- Soil backfill shall be compacted in accordance with the specifications for engineered fill. Concrete backfill shall be vibrated in place in accordance with standard industry techniques.

ClosureTurf™
Brought to you by Agru America

50 mil SUPER GRIPNET®

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (min. avg.), mil (mm)	ASTM D5994	50 (1.25)	50 (1.25)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	45 (1.15)	45 (1.15)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
Friction Spike Height (min. avg.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.939 (max)	0.94 (min)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @ Yield (min. avg.), lb/in width (N/mm)	ASTM D6693, Type IV	N/A	110 (19.3)
Elongation @ Yield (min. avg.), % (GL=1.3in)	ASTM D6693, Type IV	N/A	13
Strength @ Break (min. avg.), lb/in width (N/mm)	ASTM D6693, Type IV	110 (19.3)	110 (19.3)
Elongation @ Break (min. avg.), % (GL=2.0in)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	30 (133)	33 (169)
Puncture Resistance (min. avg.), lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range in %)	ASTM D4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat. 3	
Stress Crack Resistance (Single Point NCTL), hours	ASTM 5397, Appendix	N/A	300
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥140	≥140
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16 kg	≤1.0	≤1.0
Oven Aging with HP OIT, (% retained after 90 days)	ASTM D5721 ASTM D5885, 150°C, 500 psi O_2	60	80
UV Resistance with HP OIT, (% retained after 1600 hours)	ASTM D7238 ASTM D5885, 150°C, 500 psi O2	20 hr. Cycle @ 75° C/4 hr. dark condensation @ 60° 35	50
2% Secant Modulus (max), lb/in (N/mm)	ASTM D5323	3,000 (520)	N/A
Axi-Symmetric Break Resistance Strain, % (min)	ASTM D5617	30	N/A

Agru America's geomembranes are certified to pass Low Temp. Brittleness via ASTM D746 (-80°C), and Dimensional Stability via ASTM D1204 (± 2% @ 100°C)

TURF COMPONENT

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	900 lb, (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb/ft min (MARV)
Rainfall Induced Erosion	ASTM D96459	< 0.45% Infill Loss 6 in/hr
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with maximum uplift of 0.12 lb/sf
DuraTurf™ Fiber UV Stability	ASTM G147	> 60% retained tensile strength at 100 years (projected)
Backing System UV Stability (Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs/ft retained tensile strength at 6500 hours (projected)
Steady State Hydraulic Overtopping (ClosureTurf™ with HydroBinder™)	ASTM D7277/D7276	5 ft overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf™ with HydroBinder™)	Colorado State University Wave Simulator	165,000 ft3/ft
Full Scale Wave Overtopping Test Wave Overtopping Discharge(ClosureTurf™ with HydroBinder™)	Colorado State University Wave Simulator	4.0 ft3/s/ft
Transmissivity w/ underlying structured geomembrane Normal stress 50 psf and 0.33 gradient (m2/sec)	ASTM D4716	2.5E -03m^2/sec., min.
Internal Friction of combined components	ASTM D5321	35°, min.
Sand Infill Gradation and Ballast	ASTM D6913	ASTM C-33 Fine Aggregates

SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg)	
	mil	mm	ft	m	ft	m	ft^2	m^2	lbs	kg
Super Gripnet	50	1.25	23	7	300	91.44	6900	640	2855	1300
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	840	381

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Revision Schedule on pg. 9

GRI GT13(a) – ASTM Version*

Standard Specification for

"Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate"

This specification was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers geotextile test methods properties for subsequent use as separation between subgrade soil and aggregate predominantly in pavement systems.

Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being "firm" as indicated by CBR values in ASTM D1883 higher than 3.0 (soaked) or 8.0 (unsoaked).

1.2 This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded, by the geotextile being manufactured.

1.3 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document. However, its general use is essentially as a recommended design document.

1.4 This specification is intended to assure both good quality and performance of fabrics used as geotextile separators but is possibly not adequate for the complete

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

specification in a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

1.5 This standard specification does not address installation practice. This item is addressed in the geosynthetics literature dealing with this particular application and under unique situations might require modifications, e.g., higher values and/or additional test properties.

2. Referenced Documents

2.1 ASTM Standards

D 1883	Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils
D 4354	Practice for Sampling of Geosynthetics for Testing
D 4533	Test Method for Trapezoidal Tearing Strength of Geotextiles
D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4759	Practice for Determining the Specification Conformance of Geosynthetics
D 4873	Guide for Identification, Storage and Handling of Geotextiles
D 5261	Test Method for Measuring Mass per Unit Area of Geotextiles
D 6241	Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe
D 7238	Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus

2.2 AASHTO Specification

M288-05 Geotextile Specification for Highway Applications

3. Definitions

3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For geotextiles, a formulation is defined as the exact percentages and types of resin(s), additives and/or carbon black.

3.2 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications [ref. EPA/600/R-93/182].

3.3 Minimum Average Roll Value (MARV) – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, "MARV" is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.

3.4 Minimum Value -- The lowest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.

3.5 Maximum Value -- The highest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.

3.6 Separation – The placement of a flexible porous geosynthetic between dissimilar materials so the integrity and functioning of both materials can remain intact or be improved.

Note 2: For separation of stone base courses overlying soil subgrades this primary function simultaneously prevents the stone from intruding down into the soil and the soil from pumping up into the stone.

4. Material Classification and Formulation

4.1 This specification covers geotextiles used as separation materials.

4.2 The polymer types are mainly polypropylene, but also polyester or polyethylene. Other polymers are also possible in this regard.

4.3 The type of geotextile style is not designated. However a distinction can be made based on the elongation criteria of 50%.

Note 3: It is assumed that nonwoven fabrics break at elongations higher than 50%. Woven fabrics always break at elongations significantly lower than 50%.

5. Specification Requirements

5.1 The geotextiles for use as separator shall conform to Tables 1or 2. Table 1 is given in English units and Table 2 is in SI (Metric) units. The conversion from English to SI units is "soft", i.e., rounded off to an approximate value. All test methods are based on ASTM Standards.

Note 4: The numeric relationships between this specification based on ASTM Test Methods and GRI –GT13(b) based on ISO Test Methods have been developed at the Geosynthetic Institute.

5.2 The required values for most properties in Tables 1 and 2 are to be minimum average roll values (MARV). The exceptions are AOS which is a maximum average roll value (MaxARV), and UV stability which is a minimum average value.

5.3 The required class is determined by the severity of installation conditions (i.e., size of equipment, condition of subgrade, thickness of covering lift, etc.). Table 3 gives guidance in this respect.

6. Workmanship and Appearance

6.1 The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.

6.2 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling, Testing, and Acceptance

7.1 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling shall be in accordance with the most current modification of ASTM Standard D 4354, using the section titled, "Procedure for Sampling for Purchaser's Specification Conformance Testing." In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D 4759 for more details regarding geotextile acceptance procedures.

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Shipment and Storage

9.1 Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

9.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

Note 5: The project specification shall be very explicit as to the maximum exposure time between the geotextile being removed from the wrapper and being backfilled with soil or covered with another geosynthetic.

9.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

10. Certification

10.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.

10.2 The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.

10.3 The manufacturer's certificate shall state that the finished geotextile meets the requirements of the specification as evaluated under the manufacturer's quality control program. A person having legal authority to bind the manufacturer shall attest to the certificate.

10.4 Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

English Units

Table 1(a) – Geotextile Properties Class 1 (High Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	315	203
Trapezoid Tear Strength	D 4533	lb	112	79
CBR Puncture Strength	D 6241	lb	630	440
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Table 1(b) – Geotextile Properties Class 2 (Moderate Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	248	158
Trapezoid Tear Strength	D 4533	lb	90	56
CBR Puncture Strength	D 6241	lb	500	320
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Table 1(c) – Geotextile Properties Class 3 (Low Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	180	113
Trapezoid Tear Strength	D 4533	lb	68	41
CBR Puncture Strength	D 6241	lb	380	230
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Notes:

(1) All values are minimum average roll values (MARV) except AOS which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.

(2) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

SI Metric Units

Table 2(a) – Geotextile Properties Class 1 (High Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1400	900
Trapezoid Tear Strength	D 4533	N	500	350
CBR Puncture Strength	D 6241	N	2800	2000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Table 2(b) – Geotextile Properties Class 2 (Moderate Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1100	700
Trapezoid Tear Strength	D 4533	N	400	250
CBR Puncture Strength	D 6241	N	2250	1400
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Table 2(c) – Geotextile Properties Class 3 (Low Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	800	500
Trapezoid Tear Strength	D 4533	N	300	180
CBR Puncture Strength	D 6241	N	1700	1000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	50	50

Notes:

(1) All values are minimum average roll values (MARV) except AOS which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.

(2) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

Table 3 - Required Degree of Survivability as a Function of Subgrade Conditions, Construction Equipment and Lift Thickness (Class 1, 2 and 3 Properties are Given in Table 1 and 2; Class 1 + Properties are Higher than Class 1 but Not Defined at this Time)

	Low ground-pressure equipment ≤ 25 kPa (3.6 psi)	Medium ground-pressure equipment > 25 to ≤ 50 kPa (>3.6 to ≤ 7.3 psi)	High ground-pressure equipment > 50 kPa (> 7.3 psi)
Subgrade has been cleared of all obstacles except grass, weeds, leaves, and fine wood debris. Surface is smooth and level so that any shallow depressions and humps do not exceed 450 mm (18 in.) in depth or height. All larger depressions are filled. Alternatively, a smooth working table may be placed.	Low (Class 3)	Moderate (Class 2)	High (Class 1)
Subgrade has been cleared of obstacles larger than small to moderate-sized tree limbs and rocks. Tree trunks and stumps should be removed or covered with a partial working table. Depressions and humps should not exceed 450 mm (18 in.) in depth or height. Larger depressions should be filled.	Moderate (Class 2)	High (Class 1)	Very High (Class 1+)
Minimal site preparation is required. Trees may be felled, delimbed, and left in place. Stumps should be cut to project not more than ± 150 mm (6 in.) above subgrade. Fabric may be draped directly over the tree trunks, stumps, large depressions and humps, holes, stream channels, and large boulders. Items should be removed only if placing the fabric and cover material over them will distort the finished road surface.	High (Class 1)	Very high (Class 1+)	Not recommended

*Recommendations are for 150 to 300 mm (6 to 12 in.) initial lift thickness. For other initial lift thicknesses:

- 300 to 450 mm (12 to 18 in.): reduce survivability requirement one level;
- 450 to 600 mm (18 to 24 in.): reduce survivability requirement two levels;
- > 600 mm (24 in.): reduce survivability requirement three levels

Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being "firm" as indicated by CBR values higher than 3.0 (soaked) or 8.0 (unsoaked).

Source: Modified after Christopher, Holtz, and DiMaggio

Adoption and Revision Schedule

GRI-GT13(a) – ASTM Version

"Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate"

Original:	March 10, 2004
Revision 1:	May 6, 2005: Editorial changes
Revision 2:	August 29, 2008: Editorial changes
Revision 3:	December 19, 2012: Changed ASTM D4355 to ASTM D7238 and editorial changes

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Revision 10: April 11, 2011
Revision schedule on pg. 11

GRI Test Method GM13*

Standard Specification for

"Test Methods, Test Properties and Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

values for test indicated, may be necessary under conditions of a particular application.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004	Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505	Test Method for Density of Plastics by the Density-Gradient Technique
D 1603	Test Method for Carbon Black in Olefin Plastics
D 3895	Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218	Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199	Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397	Procedure to Perform a Single Point Notched Constant Tensile Load – (SP-NCTL) Test: Appendix
D 5596	Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721	Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885	Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994	Test Method for Measuring the Core Thickness of Textured Geomembranes
D 6370	Standard Test Method for Rubber-Compositional Analysis by Thermogravimetry (TGA)
D 6693	Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
D 7466	Test Method for Measuring the Asperity Height of Textured Geomembranes

2.2 GRI Standards

GM10	Specification for the Stress Crack Resistance of Geomembrane Sheet
GM 11	Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 4: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 5: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet (see Note 6)
- Trouser Tear (see Note 7)

Note 6: The minimum average value of asperity height does not represent an expected value of interface shear strength. Shear strength associated with geomembranes is both site-specific and product-specific and should be determined by direct shear testing using ASTM D5321/ASTM D6243 as prescribed. This testing should be included in the particular site's CQA conformance testing protocol for the geosynthetic materials involved, or formally waived by the Design Engineer, with concurrence from the Owner prior to the deployment of the geosynthetic materials.

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 8: There is a GRI test currently included in this standard. Since this topic is not covered in ASTM standards, this is necessary. It is the following:

- UV Fluorescent Light Exposure

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 9: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.)	D5199	nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density mg/l (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties *(1)* (min. ave.)	D 6693 Type IV								20,000 lb
• yield strength		63 lb/in.	84 lb/in.	105 lb/in.	126 lb/in.	168 lb/in.	210 lb/in.	252 lb/in.	
• break strength		114 lb/in.	152 lb/in.	190 lb/in.	228 lb/in.	304 lb/in.	380 lb/in.	456 lb/in.	
• yield elongation		12%	12%	12%	12%	12%	12%	12%	
• break elongation		700%	700%	700%	700%	700%	700%	700%	
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	54 lb	72 lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 4218 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)*									200,000 lb
(a) Standard OIT	D 3895	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	
— or —									
(b) High Pressure OIT	D 5885	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	
Oven Aging at 85°C *(5), (6)*	D 5721								per each formulation
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	55%	55%	55%	55%	55%	55%	55%	
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80%	80%	80%	80%	80%	80%	80%	
UV Resistance *(7)*	GM 11								per each formulation
(a) Standard OIT (min. ave.)	D 3895	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 5885	50%	50%	50%	50%	50%	50%	50%	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness - mils (min. ave.) • lowest individual of 10 values	D5199	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	per roll
Density (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 20 kN/m 12% 700%	15 kN/m 27 kN/m 12% 700%	18 kN/m 33 kN/m 12% 700%	22 kN/m 40 kN/m 12% 700%	29 kN/m 53 kN/m 12% 700%	37 kN/m 67 kN/m 12% 700%	44 kN/m 80 kN/m 12% 700%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	240 N	320 N	400 N	480 N	640 N	800 N	960 N	20,000 kg
Stress Crack Resistance *(2)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM-10
Carbon Black Content - %	D 4218 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 3895 D 5885	N. R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	N.R. *(8)* 50%	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	D 7466	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	63 lb/in. 45 lb/in. 12% 100%	84 lb/in. 60 lb/in. 12% 100%	105 lb/in. 75 lb/in. 12% 100%	126 lb/in. 90 lb/in. 12% 100%	168 lb/in. 120 lb/in. 12% 100%	210 lb/in. 150 lb/in. 12% 100%	252 lb/in. 180 lb/in. 12% 100%	20,000 lb
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	45 lb	60 lb	75 lb	90 lb	120 lb	150 lb	180 lb	45,000 lb
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 4218 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	20,000 lb
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	45,000 lb
idative Induction Time (OIT) (min. ave.) *(7)* Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	200,000 lb
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils; also see Note 6.
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches
(4) P-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(5) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC UNITS)

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	D 7466	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	11 kN/m 8 kN/m 12% 100%	15 kN/m 10 kN/m 12% 100%	18 kN/m 13 kN/m 12% 100%	22 kN/m 16 kN/m 12% 100%	29 kN/m 21 kN/m 12% 100%	37 kN/m 26 kN/m 12% 100%	44 kN/m 32 kN/m 12% 100%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	200N	267 N	333 N	400 N	534 N	667 N	800 N	20,000 kg
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 4218 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	9,000 kg
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 0.18 mm, and lowest individual reading must be ≥ 0.13 mm; also see Note 6.
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(5) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Adoption and Revision Schedule
for
HDPE Specification per GRI-GM13

"Test Methods, Test Properties, Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

Adopted:	June 17, 1997
Revision 1:	November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.
Revision 2:	April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: "(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)" and to Note (4) in the property tables.
Revision 3:	June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.
Revision 4:	December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".
Revision 5:	May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.
Revision 6:	June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.
Revision 7:	February 20, 2006: Added Note 6 on Asperity Height clarification with respect to shear strength.
Revision 8:	Removed recommended warranty from specification.
Revision 9:	June 1, 2009: Replaced GRI-GM12 test for asperity height of textured geomembranes with ASTM D 7466.
Revision 10	April 11, 2011: Added alternative carbon black content test methods

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Original: February 28, 2002
Revision 8: February 12, 2015
Revision schedule is on pg. 13

GRI Test Method GM19*

Standard Specification for

**Seam Strength and Related Properties
of Thermally Bonded Polyolefin Geomembranes**

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification addresses the required seam strength and related properties of thermally bonded polyolefin geomembranes; in particular, high density polyethylene (HDPE), linear low density polyethylene both nonreinforced (LLDPE) and scrim reinforced (LLDPE-R) and flexible polypropylene both nonreinforced (fPP) and scrim reinforced (fPP-R).

1.2 Numeric values of seam strength and related properties are specified in both shear and peel modes.

Note 1: This specification does not address the test method details or specific testing procedures. It refers to the relevant ASTM test methods where applicable.

1.3 The thermal bonding methods focused upon are hot wedge (single and dual track) and extrusion fillet.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 5-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

Note 2: Other acceptable, but less frequently used, methods of seaming are hot air and ultrasonic methods. They are inferred as being a subcategory of hot wedge seaming.

1.4 This specification does not suggest a specific distance between destructive seam samples to be taken in the field, i.e., the sampling interval. A separate GRI Standard Practice is focused on this issue, see GRI-GM29.

1.5 This specification is only applicable to laboratory testing.

1.6 This specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards

D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

D7747 Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method

2.2 EPA Standards

EPA 600/2.88/052 (NTIS PB-89-129670)
Lining of Waste Containment and Other Containment Facilities

2.3 GRI Standards

GM13 Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

GM14 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

GM17 Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

GM18 Test Properties and Testing Frequency for Flexible Polypropylene (fPP and fPP-R) Geomembranes

GM20 Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using Control Charts

GM25 Test Property and Testing Frequency for Scrim Reinforced Linear Low Density Polyethylene Geomembranes

GM29 Practice for Field Integrity Evaluation of Geomembrane Seams (and Sheet) Using Destructive and Nondestructive Testing

3. Definition

3.1 Geomembrane, n – An essentially impermeable geosynthetic composed of one or more synthetic sheets used for the purpose of liquid, gas or solid containment.

3.2 Hot Wedge Seaming – A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a hot metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Seams of this type can be made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual hot wedge seams or double-track seams.

3.3 Hot Air Seaming – This seaming technique introduces high-temperature air or gas between two geomembrane surfaces to facilitate localized surface melting. Pressure is applied to the top or bottom geomembrane, forcing together the two surfaces to form a continuous bond.

3.4 Ultrasonic Seaming - A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a ultrasonically vibrated metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Some seams of this type are made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual-track seams or double-track seams.

3.5 Extrusion Fillet Seaming – This seaming technique involves extruding molten resin at the edge of an overlapped geomembrane on another to form a continuous bond. A depreciated method called "extrusion flat" seaming extrudes the molten resin between the two overlapped sheets. In all types of extrusion seaming the surfaces upon which the molten resin is applied must be suitably prepared, usually by a slight grinding or buffing.

4. Significance and Use

4.1 The various methods of field fabrication of seams in polyolefin geomembranes are covered in existing ASTM standards mentioned in the referenced document section. What is not covered in those documents is the numeric values of strength and related properties that the completed seam must meet, or exceed. This specification provides this information insofar as minimum, or maximum, property values are concerned when the field fabricated seams are sampled and laboratory tested in shear and peel. A separate GRI standard, GRI-GM29 (DRAFT), provides guidance as to the spacing that destructive samples should be taken in typical field installation projects.

5. Sample and Specimen Preparation

5.1 The spacing for taking field seam samples for destructive testing is provided in GRI-GM29 (DRAFT), a standard-of-practice. The process describes a progression from the most restrictive interval of 1 per 500 feet (1 per 150 m) to the complete use and reliance of the electrical leak location survey (ELLS) method. Intermediate between these extremes are variations depending upon the installers experience and performance.

5.2 The size of field seam samples is to be according to the referenced test method, e.g., ASTM D6392 or site-specific CQA plan.

5.3 The individual test specimens taken from the field seam samples are to be tested according to the referenced test method, i.e., ASTM D6392 for HDPE, LLDPE and fPP, and ASTM D751 (modified to a 150 mm + seam width gage length) for fPP-R. The specimens are to be conditioned prior to testing according to these same test methods and evaluated accordingly.

6. Assessment of Seam Test Results

6.1 HDPE seams – For HDPE seams (both smooth and textured), the strength of four out of five 1.0 inch (25 mm) wide strip specimens in shear should meet or exceed the values given in Tables 1(a) and 1(b). The fifth must meet or exceed 80% of the given values. In addition, five out five specimens should meet the shear percent elongation, calculated as follows, and exceed the values given in Tables 1(a) and 1(b):

$$E = \frac{L}{L_o}(100) \tag{1}$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original average length (usually 1.0 in. or 25 mm)

Note 3: The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For HDPE seams (both smooth and textured), the strength of four out of five 1.0 in. (25 mm) wide strip specimens tested in peel should meet or exceed the values given in Tables 1(a) and 1(b). The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Tables 1(a) and 1(b) for all five out of five specimens. The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \qquad (2)$$

where

S = separation (%)
A = average area of separation, or incursion (in^2 or mm^2)
A_0 = original bonding area (in^2 or mm^2)

Note 4: The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2
Exception: AD-WLD (unless strength is achieved)

Note 5: Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, five out of five specimens shall result in acceptable break patterns.

6.2 LLDPE seams – For LLDPE seams (smooth, textured and scrim reinforced), the strength of four out of five 1.0 in. (25 mm) wide strip specimens in shear should meet or exceed the values given in Tables 2(a) through 2(d). The fifth must meet or exceed 80% of the given values. Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips and the scrim reinforced specimens are 4.0 in. (100 mm) wide grab tests. In addition, the shear percent elongation, calculated as follows, should exceed the values given in Tables 2(a) through 2(d). All five out of five should meet the shear elongation requirement.

$$E = \frac{L}{L_o}(100) \qquad (1)$$

where
E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original average length (usually 1.0 in. or 25 mm)

Note 3 (Repeated): The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

Shear elongation is not relevant to scrim reinforced geomembranes and as such is listed as "not applicable" in Tables 2 (c) and (d).

For LLDPE seams (smooth, textured and scrim reinforced), the strength of four out of five 1.0 in. (25 mm) wide strip specimens tested in peel should meet or exceed the values given in Tables 2(a) through 2(d). The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Tables 2(a) through 2(d). All five out of five specimens shall meet the peel separation value. The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \qquad (2)$$

where

S = separation (%)
A = average depth of separation, or incursion (in.^{2} or mm^2)
A_0 = original bonding distance (in.^{2} or mm^2)

Note 4 (Repeated): The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2
Exception: AD-WLD (unless strength is achieved)

Note 5 (Repeated): Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, five out of five specimens shall result in acceptable break patterns.

6.3 fPP Seams – For fPP seams (both nonreinforced and scrim reinforced), the strength of four out of five specimens in <u>shear</u> should meet or exceed the values given in Tables 3(a) and 3(b). The fifth must meet or exceed 80% of the given values. Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips and the scrim reinforced specimens are 4.0 in. (100 mm) wide grab tests. In addition, the shear percent elongation on the unreinforced specimens, calculated as follows, should exceed the values given in Tables 3(a) and 3(b). All five out of five specimens should meet the shear elongation requirement.

$$E = \frac{L}{L_o}(100) \quad (1)$$

where
E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original gauge length (usually 1.0 in. or 25 mm)

Note 3 (Repeated): The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

Shear elongation is not relevant to scrim reinforced geomembranes and as such is listed as "not applicable" in Tables 3(a) and 3(b).

For fPP seams (both nonreinforced and scrim reinforced), the strength of four out of five specimens in <u>peel</u> should meet or exceed the values given in Tables 3(a) and 3(b). The fifth must meet or exceed 80% of the given values. Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips and the scrim reinforced specimens are grab tests. In addition, the peel percent separation (or incursion) should not exceed the values given in Tables 3(a) and 3(b). All five out of five specimens should meet the peel separation value. The values should be based on the proportion of area of separated bond to the area of the original bonding as follows.

$$S = \frac{A}{A_o}(100) \quad (2)$$

where

S = separation in (%)
A = average depth of separation, or incursion (in.^{2} or mm^2)
A_o = original bonding distance (in.^{2} or mm^2)

Note 4 (Repeated): The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2
Exception: AD-WLD (unless strength is achieved)

Note 5 (Repeated): Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, five out of five specimens shall result in acceptable break patterns.

7. Retest and Rejection

7.1 If the results of the testing of a sample do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the construction quality control or construction quality assurance plan for the particular site under construction.

8. Certification

8.1 Upon request of the construction quality assurance officer or certification engineer, an installer's certification that the geomembrane was installed and tested in accordance with this specification, together with a report of the test results, shall be furnished at the completion of the installation.

Table 1(a) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** High Density Polyethylene (HDPE) Geomembranes **(English Units)**

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams(1)							
shear strength(2), lb/in.	57	80	100	120	160	200	240
shear elongation at break(3), %	50	50	50	50	50	50	50
peel strength(2), lb/in.	45	60	76	91	121	151	181
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength(2), lb/in.	57	80	100	120	160	200	240
shear elongation at break(3), %	50	50	50	50	50	50	50
peel strength(2), lb/in.	39	52	65	78	104	130	156
peel separation, %	25	25	25	25	25	25	25

Notes for Tables 1(a) and 1(b):
1. Also for hot air and ultrasonic seaming methods
2. Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing

Table 1(b) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** High Density Polyethylene (HDPE) Geomembranes **(S.I. Units)**

Geomembrane Nominal Thickness	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams(1)							
shear strength(2), N/25 mm.	250	350	438	525	701	876	1050
shear elongation at break(3), %	50	50	50	50	50	50	50
peel strength(2), N/25 mm	197	263	333	398	530	661	793
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength(2), N/25 mm	250	350	438	525	701	876	1050
shear elongation at break(3), %	50	50	50	50	50	50	50
peel strength(2), N/25 mm	170	225	285	340	455	570	680
peel separation, %	25	25	25	25	25	25	25

Table 2(a) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** Linear Low Density Polyethylene (LLDPE) Geomembranes (English Units)

Geomembrane Nominal Thickness	20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams(1)								
shear strength(2), lb/in.	30	45	60	75	90	120	150	180
shear elongation(3), %	50	50	50	50	50	50	50	50
peel strength(2), lb/in.	25	38	50	63	75	100	125	150
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength(2), lb/in.	30	45	60	75	90	120	150	180
shear elongation(3), %	50	50	50	50	50	50	50	50
peel strength(2), lb/in.	22	34	44	57	66	88	114	136
peel separation, %	25	25	25	25	25	25	25	25

Notes for Tables 2(a) and 2(b):
1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing

Table 2(b) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** Linear Low Density Polyethylene (LLDPE) Geomembranes (S.I. Units)

Geomembrane Nominal Thickness	0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams(1)								
shear strength(2), N/25 mm	131	197	263	328	394	525	657	788
shear elongation(3), %	50	50	50	50	50	50	50	50
peel strength(2), N/25 mm	109	166	219	276	328	438	547	657
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength(2), N/25 mm	131	197	263	328	394	525	657	788
shear elongation(3), %	50	50	50	50	50	50	50	50
peel strength(2), N/25 mm	95	150	190	250	290	385	500	595
peel separation, %	25	25	25	25	25	25	25	25

Table 2(c) – Seam Strength and Related Properties of Thermally Bonded **Scrim Reinforced** Linear Low Density Polyethylene (LLDPE-R) Geomembranes (English Units)

Geomembrane Nominal Thickness	36 mil(4)	45 mil(4)
Hot Wedge Seams(1)		
shear strength(2), lb	200	200
shear elongation(3), %	n/a	n/a
peel strength(2), lb	20	20
peel separation, %	n/a	n/a
Extrusion Fillet Seams		
shear strength(2), lb	200	200
shear elongation(3), %	n/a	n/a
peel strength(2), lb	20	20
peel separation, %	n/a	n/a

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing
4. Values are based on grab tensile strength and elongation per D7747 for laboratory tested specimens

Table 2(d) – Seam Strength and Related Properties of Thermally Bonded **Scrim Reinforced** Linear Low Density Polyethylene (LLDPE-R) Geomembranes (S.I. Units)

Geomembrane Nominal Thickness	36 mil(4)	45 mil(4)
Hot Wedge Seams(1)		
shear strength(2), N	890	890
shear elongation(3), %	n/a	n/a
peel strength(2), N	90	90
peel separation, %	n/a	n/a
Extrusion Fillet Seams		
shear strength(2), N	890	890
shear elongation(3), %	n/a	n/a
peel strength(2), N	90	90
peel separation, %	n/a	n/a

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing
4. Values are based on grab tensile strength and elongation per D7747 for laboratory tested specimens

Table 3(a) – Seam Strength and Related Properties of Thermally Bonded **Nonreinforced and Scrim Reinforced** Flexible Polypropylene (fPP) Geomembranes (English Units)

Geomembrane Nominal Thickness	30 mil-NR	40 mil-NR	36 mil-R(4)	45 mil-R(4)
Hot Wedge Seams(1)				
shear strength(2), lb/in. (NR); lb (R)	25	30	200	200
shear elongation(3), %	50	50	n/a	n/a
peel strength(2), lb/in. (NR); lb (R)	20	25	20	20
peel separation, %	25	25	n/a	n/a
Extrusion Fillet Seams				
shear strength(2), lb/in. (NR); lb (R)	25	30	200	200
shear elongation(3), %	50	50	n/a	n/a
peel strength(2), lb/in. (NR); lb (R)	20	25	20	20
peel separation, %	25	25	n/a	n/a

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing
4. Values are based on grab tensile strength and elongation per D7747 for laboratory tested specimens

Table 3(b) – Seam Strength and Related Properties of Thermally Bonded **Nonreinforced and Scrim Reinforced** Flexible Polypropylene (fPP) Geomembranes (S.I. Units)

Geomembrane Nominal Thickness	0.75 mm-NR	1.0 mm-NR	0.91 mm-R(4)	1.14 mm-R(4)
Hot Wedge Seams(1)				
shear strength(2), N/25 mm (NR); N (R)	110	130	890	890
shear elongation(3), %	50	50	n/a	n/a
peel strength(2), N/25 mm (NR); N (R)	85	110	90	90
peel separation, %	25	25	n/a	n/a
Extrusion Fillet Seams				
shear strength(2), N/25 mm (NR); N (R)	110	130	890	890
shear elongation(3), %	50	50	n/a	n/a
peel strength(2), N/25 mm (NR); N (R)	85	110	90	90
peel separation, %	25	25	n/a	n/a

1. Also for hot air and ultrasonic seaming methods
2. Values listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values
3. Elongation measurements should be omitted for field testing
4. Values are based on grab tensile strength and elongation per D7747 for laboratory tested specimens

Adoption and Revision Schedule
for
Seam Specification per GRI-GM19

"Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes"

Adopted: February 18, 2002

Revision 1: May 15, 2003; Increased selected shear and peel test requirements, per the following:

Material	Test	Seam Type	Current GM19	Proposed GM19	Difference
HDPE	Shear	Hot Wedge	95% yield	95% yield	no change
		Extrusion	95% yield	95% yield	no change
	Peel	Hot Wedge	62% yield	72% yield	16% increase
		Extrusion	62% yield	62% yield	no change
LLDPE	Shear	Hot Wedge	1300 psi break	1500 psi break	15% increase
		Extrusion	1300 psi break	1500 psi break	15% increase
	Peel	Hot Wedge	1100 psi break	1250 psi break	14% increase
		Extrusion	1100 psi break	1100 psi break	no change

Revision 2: January 28, 2005; added Note 6 (in three locations) stating that incursion is measured on an area basis and not depth as in ASTM D6392.

Revision 3: June 4, 2010; Removed Note 6 on peel incursion since ASTM D6392 (2008) now uses area of incursion whereas previously they used linear length of incursion. Thus ASTM is now in agreement with GM19 in this regard.

Revision 4: November 15, 2010; Added Note 6 (in three locations) stating what separation-in-plane (SIP) is, and is not, and that it is acceptable if the required strength, shear elongation and peel separation criteria are met.

Revision 5: July 12, 2011; AD1 and AD2 breaks are now unacceptable even if strength is achieved.

Revision 6: October 3, 2011; Added LLDPE-R to the various geomembrane types, in particular, Tables 2(c) and 2(d) and made editorial changes.

Revision 7: November 3, 2013; clarified issues of 4 out of 5 passing strength and 5 out of 5 passing locus-of-break, shear elongation and peel separation.

Revision 8: February 12, 2015; upgraded standards and terminology

ATTACHMENT F

CONSTRUCTION SPECIFICATION
POS-SPEC-000167

FOR

MEREDOSIA ASH POND CLOSURES

AT

MEREDOSIA ENERGY CENTER

Technical Specifications and Drawings Prepared by:

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for

Ameren
MISSOURI

8/12/16

Rev	Date	Revisions	Originator	Reviewer	Approver
0	08-12-2016	Submittal to I-EPA	S. Hilderbrand	A. Saindon	M. Wagstaff

Project Manual for the Meredosia Ash Pond Closures
at Meredosia Energy Center

INDEX

SECTION 1A - SUPPLEMENTAL GENERAL CONDITIONS
FOR AMEREN MISSOURI POWER OPERATIONS

For General Conditions of Contract – Construction:

http://www.ameren.com/BusinessPartners/Suppliers/Documents/GCCconstruction.pdf

For Supplemental General Conditions of Contract:

http://www.ameren.com/BusinessPartners/Suppliers/Documents/SupplementalGCCs.pdf

In addition to the above Contract Conditions, the following requirements apply:

1.0 GENERAL

1.1 This section of the specification clarifies and supplements the Ameren General Conditions of Contract (GCC) and other Contract documents. Specific duties set forth herein do not constitute an exclusive list of requirements, but complement the Ameren GCC. In the event of a conflict between this specification and the Ameren GCC, this specification shall be controlling.

1.2 Contractor shall assure that all tiers of Subcontractors comply with all requirements of Contract documents.

1.3 For any work performed for Ameren Missouri Power Operations, Contractor agrees to comply with Ameren's Supplemental Terms and Conditions, commonly referred to as Section 1A-Supplemental General Conditions for Ameren Missouri Power Operations.

2.0 DEFINITIONS

2.1 Accident/Incident An incident is defined as a near miss, vehicle accident, or property damage to Company-owned/leased equipment or facilities. Refer to Occupational Safety and Health Administration (OSHA) 29CFR1904 for definitions of reportable incidents and injuries.

2.2 Asbestos Containing Material (ACM) Material that contains asbestos in concentration greater than 1% and must be handled according to Ameren procedures and Federal and State regulations.

2.3 Barricade A physical obstruction such as barricade tape, chains, cones, concrete barriers, fencing, or "A" frame type wood and/or metal structures intended to warn and limit access to a work area. Barricade tape alone cannot be used to protect certain hazards such as unattended floor openings or fall hazards.

2.4 Competent Person An individual, who is trained and certified in applicable standards, is capable of identifying workplace hazards relating to specific operations, performs inspections of industrial and construction jobsite equipment, and has authority to take corrective actions when needed.

2.5 Computer Based Training (CBT) Computer Based Training is used for safety and job work rules orientation of new employees before they are permitted unescorted access to Company property.

2.6 Confined Space An enclosed area that is not normally designed or intended for human occupancy, has a restricted entrance or exit by way of location or size, and can represent a risk for the health and safety of anyone who enters, due to atmospheric, engulfment, entrapment, mechanical, electrical, or any other recognized hazard. See OSHA 29CFR1910.146 and Power Operations Administrative Procedure AUE-ADM-2415.

2.7 Hot Work Work that will generate sparks, such as; cutting, grinding, welding, and brazing. A permit may be required for hot work that is hazardous due to location or other factors.

2.8 Corporate Safety Department Ameren's Corporate Safety Department sets standards for safety and health issues and monitors compliance with Ameren policies, as well as with Federal, State and Local regulations.

2.9 Extra Work is defined in Article 1 of the GCCs.

2.10 Extra Work Order (EWO) is defined in Article 1 of the GCCs.

2.11 Job Working Rules Rules of conduct for Contractors working at Ameren facilities that include various types of prohibited behavior: off-limit areas, driving and parking instructions, and safety information that may be specific for the plant, such as fire alarms and evacuation procedures.

2.12 Single Point of Contact (SPOC) is defined in Article 1 of the GCCs.

2.13 Specifications are defined in Article 1 of the GCCs.

2.14 Work is defined in Article 1 of the GCCs.

2.15 Worker's Protection Assurance (WPA) or Hold Card Procedure Ameren's equipment lock-out procedure that ensures equipment and systems are in a safe state prior to service or testing. Employees must have WPA training and adhere to WPA procedures. Contractor supervisors must have plant-specific training prior to starting jobs requiring WPA protection.

3.0 INTENT OF SPECIFICATIONS AND DRAWINGS

3.1 The Contract Documents shall be interpreted as being complementary, requiring a complete Project. Any requirement occurring in any one of the Contract Documents is as binding as though occurring in all Contract Documents. Generally, Specifications address quality, types of materials and Contract conditions, while Plans show placement, sizes, and fabrication details of materials. Reference Article 2.01 of the GCCs.

4.0 BENCH MARKS

4.1 Company will furnish one site bench mark with its assigned elevation. Contractor shall furnish field layouts and shall be responsible for the use of field dimensions and elevations. All such Work shall be subject to approval at the discretion of the SPOC.

5.0 DRAWINGS, DETAILS & INSTRUCTIONS PROVIDED BY CONTRACTOR

5.1 Contractor shall submit to the Company copies of shop drawings, equipment details; installation, operating, and maintenance instructions, wiring diagrams, parts lists, cable termination sign-off sheets, etc. Reference Article 3.02 of the GCCs.

5.1.1 These submittals shall cause no delay in the performance of work. The minimum turn-around time for design changes shall be incorporated on drawings and shall not delay the performance of work. As-built drawings shall be submitted in accordance with Company's schedule.

5.1.2 Contractor shall submit five (5) copies of the above information, four (4) of which Company will retain. One (1) copy will be returned.

5.1.3 In addition to the copies listed above, Contractor shall submit drawings electronically in an approved CAD format. Ameren typically uses Bentley Microstation V7 or V8 (.dgn files).

5.1.4 Company will review submittals for general design features. Contractor is responsible for dimensions, quantities, accuracy, fit, adequacy of details, and coordination with other trades. Contractor must request deviations from contract documents in writing and receive written approval from Company.

5.1.5 Contractor must request field changes in writing and receive written approval from Company. Contractor shall promptly submit as-built drawings to Company.

5.2 Professional Engineering (PE) License Seals

5.2.1 All design documentation meant for fabrication, permitting, erection, or construction such as design drawings, specifications, and calculations shall have a Professional Engineering (PE) seal applied, signed and dated by Contractor's registered professional engineer(s).

5.2.1.1 The license shall be current, valid, and in good standing for the appropriate state where the work is taking place.

5.2.2 Documents where seals are not required include review items (not to be constructed), sketches, samples, design control documents, operations manuals, vendor material design documents, engineered product drawings (not related to permitting) and other documents agreed upon in writing between Ameren and Contractor.

5.2.2.1 Contractor shall be responsible to contact the main Ameren contact up-front to clarify the requirements to seal any project specific documentation.

6.0 LABOR CONDITIONS

6.1 Contractor's Work shall be performed under the National Maintenance Agreement (NMA), unless an exception is agreed upon in writing by the Construction Project Lead or his management. Contractor must furnish a copy of the site extension approval(s) granted by the International Union(s). Site extension requests for the NMA may be filed online at www.nmapc.org.

6.2 There shall be no limit on the work output of any employee, and no restrictions on what tools or equipment may safely be used to increase productivity. There shall be no minimum, other than what may be required by safety regulations, on the number of employees assigned to any crew or to any service.

6.3 Featherbedding practices of any kind will not be tolerated.

6.4 Actual work hours will be agreed upon during pre-job conferences; lunch breaks will be an unpaid one-half hour. No additional organized breaks are allowed. There shall be no non-working stewards. If a steward is included in the labor force, the steward must be a qualified worker and shall exercise no supervisory functions.

6.5 Contractors must conform to Construction Users Round Table (CURT) Tripartite Initiative report, dated June 2004, with respect to absenteeism, excessive overtime and work disruptions.

6.6 Contractor employees must be rested and fit for duty when they report to the Company's site. Contractor employees must not work in excess of 16 consecutive hours without prior approval of Contractor's Superintendent and Company, and then only when additional steps have been taken to ensure worker safety.

6.7 Contractor shall provide break/lunch facilities at a location in close proximity to the majority of the Work such locations to be approved by the SPOC or other Ameren Management personnel.

6.8 There shall be no slowdowns, illegal strikes, or unauthorized work stoppages of any kind. Contractor understands that its work must be completed in a timely fashion notwithstanding the presence of a labor strike or any pickets at or around the job site.

6.9 In the event that Company's employees, another contractor's or subcontractor's employees or Contractor's employees engage in a strike or established pickets, Contractor is expected to continue to meet its obligations under the terms of the contract and/or obligations with Company. Any such picketing activity is not an excuse for non-performance or delay in completing the project

6.10 Medical services provided by Ameren: On specified projects, contractors are not to include costs within bids associated with the following medical services:

- Random and for-cause substance abuse (SA) testing,
- First-aid expenses that can be addressed by an onsite nurse, if an onsite nurse is provided.

7.0 CONTRACTOR MANAGEMENT REQUIREMENTS

7.1 Prior to mobilization, Contractor shall submit an organizational chart and resumes for the entire management team that will utilize, on or offsite, for the project.

7.2 Contractor shall adhere to the Job Working Rules (Appendix B).

7.3 Contractor supervisory employees who will be responsible for requesting and signing the WPA must receive site-specific training before working onsite. The SPOC will arrange for the required WPA supervisor training to be located at the Ameren POS Training Center training facility.

7.4 Contractor supervisor shall comply with the specific plant's WPA procedure which is included as Appendix A, Section 2 of this specification. WPA procedure provides details of program and outlines responsibilities for supervisors.

CAUTION: The presence of WPA process does not relieve workers of the responsibility to verify that equipment is actually de-energized or in the designated state. Instruct employees to walk down the job, check energy sources and isolation points such as: voltages, temperatures, pressures, etc. to confirm status.

7.5 Contractor Site Representative shall read, understand, and sign the Contractor Agreement of Understanding Form (Appendix A, Attachment A18), prior to beginning work onsite.

7.6 Contractor supervisors shall instruct employees to observe WPA rules and comply with WPA tags at all times.

7.7 Contractor shall participate in individual Construction Progress meetings. The meetings are typically held weekly, but the SPOC may specify another frequency during the course of the Contract.

7.8.1 A Contractor representative with sufficient authority to make binding work and schedule commitments shall attend these meetings.

7.8.2 The individual progress meeting will typically concentrate on safety and housekeeping, schedule and work progress, job related problems, and site coordination.

7.8.3 Contractor shall come to the progress meeting with an updated schedule showing actual progress and the critical path of the work. See Contractor Schedule Requirements (Appendix D) for additional schedule requirements.

7.8.4 Contractor shall take and distribute meeting minutes within two (2) working days of the meeting.

7.9 A Contractor representative with sufficient authority to make binding commitments may also be required to attend a weekly Outage Coordination Meeting.

7.10 Contractor personnel, Business agents, Vendor/Sales representatives, etc., shall use the entrance designated for their Contractor, park in the Construction parking lot, and be escorted onsite unless they have a Contractor badge. Construction badge holders may use Contractor entrance or Ameren employee entrance, and park in the Construction parking lot or main parking lot depending on purpose of visit.

8.0 DELIVERY AND STORAGE

8.1 Contractor shall be responsible for receiving, unloading, inspecting and hauling materials unless otherwise stated in the Contract documents.

8.2 Contractor and the name of the project must be indicated on materials delivered to the site.

8.3 Contractor shall provide facilities to store materials and equipment on the jobsite. The SPOC will designate storage locations that will not interfere with Company's personnel or operations.

8.4 Payment for material or equipment stored onsite will not be made to Contractor until the material or equipment is installed. Contractor may apply for early payment only if early delivery and storage of the material or equipment will benefit Ameren.

8.5 A carrier that is compliant with the Depart of Transportation's (DOT) Hazardous Materials Security Plan must be used for deliveries of hazardous materials to Ameren. For a list of approved carriers visit http://vics.keyship.net/Ameren. Fill out the required fields & check the HazMat option. A list of qualified carriers will populate. Any vehicle carrying hazardous materials onto Company facilities will be refused entry until proof of compliance is provided.

8.6 If materials are provided by Ameren, they will be stored by Ameren until Contractor is onsite. Contractor will be responsible for loss or damage after acceptance of equipment or material provided by Company. Contractor shall inventory and haul excess material retained by Company to designated Company storage location(s) after completion of Work.

8.7 Contractor shall restore construction storage areas to a reasonable condition that satisfies the SPOC.

8.8 Material Receipt

8.8.1 Contractor must resolve all issues with contractor-procured material.

8.8.2 Contractor must identify, inspect, test and store material to purchase order requirements.

8.8.3 Contractor must ensure all receiving quality documentation is supplied to Ameren's SPOC upon receipt.

8.8.4 Contractor must have a program in place to ensure receipted critical plant material and equipment is not relocated or improperly stored without proper authorization from Ameren's SPOC.

8.8.5 Contractor will be provided a list of critical materials and equipment during pre-construction meetings.

8.8.6 Contractor must handle, store, and identify Critical Material in accordance with the paragraph below:

Ameren
MISSOURI

Specification #000167
Sheet No. 1A - 6

MATERIAL HANDLING, STORAGE & IDENTIFICATION INSTRUCTIONS FOR CONTRACTORS

AUE-ADM-4203, Receiving Storage & Handling of Critical Materials

All Ameren purchased critical material received by a contractor or sub-contractor has specific requirements that must be met to comply with Ameren's Quality Management Program in accordance with AUE-ADM-4203. Contractor requirements contained in AUE-ADM-4203 are provided below. Contractors will be evaluated on their quality control and material management. A list of critical materials shall be provided to the contractor during Pre-Construction Meetings.

1) Notify Responsible Engineer (RE) of Ameren material received and the PO number. Ensure receiving documentation remains with the material until clear direction is provided by RE.

   NOTE: Steps 2-5 shall be directed by Responsible Engineer (RE)

2) Receiving documentation, number of containers, and intended storage location shall be taken to Storeroom personnel.
3) Storeroom shall create a Receipt Order (RO) number for traceability and provide identification labels for attachment to each container. Information will always include the RO tracking# and may include PO #, Job #, RE, PM, Storage Level, and intended location.
4) The RO number shall be clearly marked on all boxes, containers, equipment, and packing slip(s).
5) An Ameren Material Receipt Inspection Report (MRIR) shall be printed with the inspection requirements and shall be used to document inspection results. Contractors may perform additional inspections as directed by RE.
6) After successful acceptance, MRIR Inspector(s) shall sign the MRIR and each traceable barcode label; and shall attach labels to containers.
7) Hold tags shall be attached to any materials not accepted.

WARNING: **Contact Responsible Engineer or Ameren Designee immediately** if unidentified material is discovered, labels become unreadable, material needs to be relocated, or if material location or storage level differs from label.

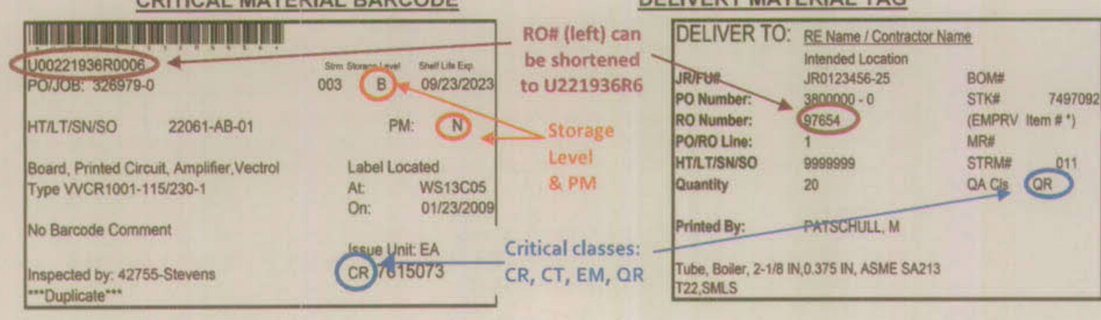
If during staging, prep work, etc., the material is repackaged or removed from labeled containers and the potential for identification or material loss exists, transfer the RO or barcode number, at a minimum, to the materials.

Storage Level B – Indoor storage. Temperatures controlled between 40°F and 140°F. This level includes the storeroom, turbine floor, or any other location inside the plant.

Storage Level C – Covered storage. Temperature control not required. These locations include secondary storerooms, covered parking areas, etc.

Storage Level D – Outside storage. Store in well drained areas in a manner allowing air circulation to minimize trapped water. Provide adequate protection from forces due to rain, wind and storms

CRITICAL MATERIAL BARCODE | **DELIVERY MATERIAL TAG**



9.0 **REMOVALS AND PREPARATORY WORK**

9.1 Contractor shall cooperate with the SPOC in scheduling removal work so there is no disruption to Company's personnel or operations.

9.2 Contractor shall provide protective enclosures, covers, water stops, etc. to prevent water or other weather-related damage to facilities during construction.

9.3 Before mobilizing tools, material and equipment, Contractor will install appropriate trash cans, cigarette butt receptacles, and dumpsters in designated areas.

9.4 Materials authorized to be removed become the property of Contractor, unless otherwise specified in the Contract documents, and shall be promptly removed from the worksite. An inventory of materials being removed must be submitted to the SPOC. If materials are retained, the SPOC will designate where materials shall be stored. Retained materials shall be neatly stored and protected from the elements.

9.5 Before mobilizing tools, material and equipment, Contractor shall install protection on both sides of all walkways in work area from top rail to toe board. This protection may include, but not limited to, orange fencing, plywood and sheet metal. However, openings in fencing shall be no larger than one inch square. Contractor shall install decking on open floor work areas, seal decking along edges and install toe boards, and install debris nets to further contain fallings objects. All wood subject to ignition sources shall have fire retardant cloth or tarps installed over the wood. Cloth shall be secured to avoid tripping hazards. All safety barriers shall be removed after the completion of the project.

9.6 For additional safety requirements to be performed prior to working on elevated platforms, walkways and scaffolds above 6 feet, refer to Safety Requirements for Working on Elevated Platforms (Appendix Y).

10.0 **CUTTING& PATCHING AND TEMPORARY BUILDINGS, ETC.**

10.1 Contractor shall do all cutting, fitting, or patching that may be necessary to make the several parts come together properly and fit to receive the Work of other Contractors and Subcontractors.

10.2 All temporary buildings/structures such as tool rooms, break rooms, lunch rooms, etc., shall be constructed with non-combustible materials.

11.0 **TEMPORARY HEAT**

11.1 Contractor shall provide temporary heat to protect Work materials against damage from dampness and cold to the satisfaction of the SPOC.

12.0 **QUALITY REQUIREMENTS**

12.1 The Quality Management System Manual, AUE-MAN-QMS-1001, provides the basis for the Ameren Missouri Power Operations Quality Management System (QMS) and provides the assurance that processes are in place to achieve our business objectives. The QMS performance standards and performance criteria provide requirements to achieve a controlled and systematic approach to quality management activities and promote continuous improvement. Contractors and Subcontractors can obtain a copy of the QMS from the Ameren Missouri Project Manager.

12.2 The Contractor's quality management program and supportive procedures are subject to Ameren review and audit. If a gap exists between the QMS, and the Contractor's quality management program and supportive procedures, the Contractor will be required to comply with the QMS.

12.3 Contractors and Subcontractors agree to comply with the applicable QMS requirements for the work scope included in this Ameren Missouri contract. The Contractor shall provide a copy of the Contractor's quality management program and supportive procedures with the bid submittal, if the Contractor is not on the Ameren Missouri 'Generation Approved Supplier List – Critical (GASLC)'.

12.4 The QMS Application Aid (QMS-AA) per Appendix Q contains the applicable QMS requirements in this Ameren Missouri contract. The Contractor shall complete and return the QMS-AA with the bid submittal, if the Contractor is not on the Ameren Missouri GASLC.

12.5 The Contractor shall upon award develop and provide to Ameren a 'Project-specific Quality Management Plan' which is compliant with the QMS-AA.

12.6 The Contractor's awarded work scope, including that of its Subcontractors, shall be performed to the requirements of the QMS-AA.

12.7 Ameren will be allowed to make quality inspections at Contractor's and Subcontractor's facilities at no cost to Ameren. Ameren will be allowed to view applicable Contractor's and Subcontractor's quality procedures and procedure generated records and documents.

12.8 Design Documents and Calculations:

12.8.1 Contractors and Sub Contractors shall meet the technical requirements included in Section 1D of this specification and the QMS-AA.

13.0 OWNER APPROVAL OF PROCEDURE

13.1 Ameren must consent to deviations from the procedures, methods and materials agreed to in the Contract. Reference Articles 2.01 and 4.01 of the GCCs.

13.2 Ameren reserves the right of approval over all procedures, methods, and materials to be employed by Contractor or its Subcontractors for this Work. Reference Articles 2.01 and 4.01 of the GCCs.

14.0 CONFIDENTIALITY

14.1 Contractor shall hold Ameren's Confidential Information confidential and shall not use or disclose to others during or subsequent to the performance of the Work (except as is necessary to perform the Work). Reference Article 9.02 of the GCCs.

14.2 Publication or advertising of information directly derived from Project or Work or data obtained in connection with services rendered under the Contract must first be approved in writing by Ameren (Ameren personnel need approval from Ameren Corporate Communications). Contractor shall not release any information for publication or advertising purposes relative to the material, equipment and/or services furnished under the Contract Documents without the prior written consent of Ameren. Ameren reserves the right to release all advertising or publicity concerning the Project or Work. Except as to signs required by building department regulations or any other governmental requirements, Contractor shall not display or permit any signs or advertisements to be displayed about the Project site nor publicize in any manner its performance of the Work without the express written permission of Ameren. Reference Article 9.02 of the GCC.

14.3 Contractor shall restrict the knowledge of all confidential information regarding the Work to as few as possible of its employees who are directly connected with performance of the Work and have a definite need for such knowledge. Upon request by Ameren's Representative, Contractor shall cause such persons or groups of persons involved in the Work on Contractor's behalf as Ameren may designate to sign individual secrecy agreements in a form satisfactory to Ameren. Reference Article 9.02 of the GCCs.

15.0 ACCOUNTING / INVOICING REQUIREMENTS / ACIP

15.1 Contractor shall furnish complete accounting information and cooperate with Ameren's accounting practices.

15.2 For Time and Material contracts prior to commencing work, Contractor shall furnish Company with a written estimate for Company approval. Once approved, Contractor shall promptly notify Company of any facts and circumstances that may adversely impact the estimate. Further, Contractor shall not exceed ninety percent (90%) of the time and materials estimate without Company approval. All overtime for Time and Material contracts shall be approved by Company in advance of working. Reference Articles 6 and 8 of the GCCs.

15.3 Company reserves the right not to honor charges associated with timesheets that are not provided daily.

15.4 Material invoices must be submitted as Work progresses. Total cost updates will be provided on a weekly basis.

15.5 If Work indicated or specified in Contract Documents is increased, Company may have Contractor perform Extra Work.

15.5.1 Contractor must obtain written approval from the SPOC prior to performing any Extra Work. Each Extra Work Order (EWO) shall be invoiced separately and shall reference the EWO number and Purchase Order (PO) number.

15.5.2 If work is performed on a time and material basis, then work shall be charged at the rates indicated on the Labor Rate Sheets in the Contract.

15.5.3 Ameren will pay Contractor the cost of extra work as follows:

NOTE:	Subcontractor labor and material charges shall be subject to the provisions of Items 15.5.3.1, 15.5.3.2 and 15.5.3.3 below.

15.5.3.1 Labor:

- Direct cost of payroll labor, including first line foreman, excluding job Superintendent and General Foreman
- Fringe benefits including welfare and pension
- Insurance
- Taxes including FICA, Federal, State and Local tax
- Overhead, including costs for home office, field office, consumables, and small tools with an original value under $1,200, as agreed by Company and Contractor at the award of Contract
- Profit, as agreed by Company and Contractor at the award of Contract

15.5.3.2 Material and third party rental equipment:

- Direct cost of material or rental equipment

Subcontractors:

- Direct cost of Subcontractor

Contractor-Owned Rental Equipment (excluding third party rental equipment):

- Contractor shall submit for approval an equipment rental rate schedule including all equipment, tools, and supplies required to perform the Work specified. These equipment rental rates will be used for extra work.

15.5.3.3 Ameren Coordinated Insurance Program (ACIP)

- If the project is part of the Ameren Coordinated Insurance Program (ACIP), all contractors of all tiers will be required to provide completed enrollment and monthly reporting forms for duration of their work on project. All prime contractors will be responsible for their subcontractors of all tiers with respect to compliance of enrollment and reporting requirements.
- If the project is part of the ACIP, contractors of all tiers must be enrolled and have a copy of ACIP certificate of insurance prior to mobilization onsite. Ameren will not allow non-enrolled contractors to access site prior to enrollment in ACIP.

END OF SECTION 1A

SECTION 1B – SUMMARY OF WORK

1.0 INTRODUCTION

1.1 Definitions

1.1.1 The term "Company" means the entity identified in the Company's Purchase Order, its agents, employees, representatives, successors, and assigns. The terms "Purchaser," "Owner," and "Buyer," if used in the Contract Documents, are considered synonymous and refer to the Company.

1.1.2 The term "Engineer" means the Engineer duly appointed to represent the Company as specified from time to time by the Company who may be employed by the Company or who may be employed by others.

1.1.3 The term "Contractor" means the entity identified in the Company's Purchase Order, and its agents, employees and authorized representatives undertaking the performance of the Work as defined in this Specification. The terms "vendor," "supplier," "manufacturer," or "fabricator" if used in the Contract Documents, are considered synonymous and refer to Contractor.

1.1.4 The term "Sub Contractor" means any individual, partnership, firm, corporation or business entity, other than an employee of Contractor, who contracts or agrees with Contractor (or another Sub Contractor or any tier thereof) to furnish any services, labor, materials or equipment for, or in connection with, the performance of the Work.

1.1.5 The term "Construction Project Lead" means the Company's representative as specified from time to time and located at job site.

1.2 Location

1.2.1 The Meredosia Energy Center is located at:

800 South Washington Street
Meredosia, IL 62665

1.2.2 This project is located at the Meredosia Energy Center in Morgan County, Illinois. The Bottom Ash Pond and the Fly Ash Pond are located on the western side of the site adjacent to the Illinois River. See figure on sheet 1B-7 for a location map showing the Bottom Ash Pond and the Fly Ash Pond.

1.3 Contacts

1.3.1 All commercial matters shall be directed to the Ameren purchasing agent designated on the Request for Proposal or listed on the purchase order.

1.3.2 All technical questions regarding this specification shall be directed to:

Ameren Energy Missouri
Michael Wagstaff, P.E.
3750 S. Lindbergh Blvd.
Sunset Hills, MO 63127

2.0 SUMMARY OF WORK

2.1 Project Objectives – The Project Objective is the closure of the Bottom Ash Pond and Fly Ash Pond at the Meredosia Energy Center. Material will be removed from the Bottom Ash Pond, including the southern berm and the top three feet of the northern berm, and will be placed in the larger Fly Ash Pond. Existing steam line piping, light poles, culverts, fencing and outfall structure associated with the Bottom Ash Pond will be demolished and removed in an approved manner. Electric power poles will be removed and relocated. All of these components are located either within the ash pond or along the berms.

2.2 The Closure documents for Ameren Energy Medina Valley Cogen's Meredosia Ash Pond Closures at Meredosia Energy Center has been prepared in accordance with the requirements of the site specific Rule in 35 Illinois Administrative Code Part 840, Subpart A. The following supporting documents will be submitted to the IEPA.

2.2.1 Closure Work Plan
2.2.2 Closure Plan
2.2.3 Hydrogeologic Report
2.2.4 Construction Quality Assurance Plan
2.2.5 Groundwater Monitoring Plan
2.2.6 Post-Closure Care Plan

2.3 Copies of the above documents, including IAC Part 840, Subpart A, are available upon request.

2.4 General Requirements

2.4.1 Contractor shall be responsible for furnishing all material (except those items of material specifically stated to be furnished by the Company), tools, equipment, labor, supervision and any other incidental items or services required to perform all of the work described herein.

2.4.2 Contractor shall be responsible for any and all engineering, drafting, field sketches, and field layout required for temporary supports, rigging, removals, and installation of all material.

2.4.3 Contractor shall be responsible for receiving, storage and security of all materials supplied by Contractor and material provided by Company. Contractor will be required to unload material in Construction Staging Area as shown on the plan (Sheet T-002) and/or designated by the Construction Project Lead. Contractor will also be required to obtain items, where specified, from the storeroom. Contractor is responsible for developing an inventory list of material received. Contractor shall provide adequate protection for equipment/material stored outside from forces due to rain, wind and storms. As an example, material such as precipitator collector plates – which would be subject to damage during a high wind event – would require Contractor to perform analysis of potential wind loading and create a detailed storage plan. For this example, Ameren shall review and provide approval of specific storage plan.

2.4.4 Contractor will be responsible for proper disposal of all demolition or surplus construction materials.

2.4.5 Contractor Design shall use the Design for Safety Guide (Appendix C).

2.4.6 Ameren **will not** provide a nurse and first aid trailer for Ameren and Contractor personnel.

2.5 Description of Work

2.5.1 The description of work, in general, includes but is not limited to:
- Installation and maintenance of a Stormwater Pollution Prevention Plan (SWPPP)
- Erosion control fences and blankets
- Clearing and Grubbing
- Removal of Improvements (Demolition)
- Excavation, Compaction and Grading of Ash
- Excavation, Compaction and Grading of Soil Materials
- Electric Poles relocated and dusk to dawn lights installed by local utility company
- Dust Control
- Installation of ClosureTurf™ and HydroTurf™
- Installation of Rip Rap and Energy Dissipators
- Installation of Crushed Stone Access Road
- Seeding and Mulching

2.5.2 Other Requirements:

- In order to facilitate procurement of a Construction Quality Assurance (CQA) contractor by a separate contract, a Level 2/3 construction schedule will be requested to be submitted by the apparent low bidder(s) within two weeks of receipt of bids. This schedule will be used as the basis for the CQA contractor whose scope is defined in the attached Construction Quality Assurance Plan and specifications. Please see "Appendix D - Contractor Schedule Requirements".
- A Construction Staging Area has been shown on the plans. This area shall be returned to original condition at the end of construction activities.

- Ameren's Construction Project Lead will have an office in the Ameren trailer. A meeting room for weekly team meetings is also available in this building.
- Contractor's trailer location (proposed) shall be located in the Staging Area as shown on the plan. See sheet T-002. This area shall be returned to original condition at the end of construction activities.
- Existing monitoring wells shall be protected with snow fences. In the event a monitoring well is impacted by construction activities the Owner shall be notified immediately.
- Contractor is responsible for keeping as-built plan markups during construction. All markups shall be provided to the Owner at substantial completion of the project.

3.0 COMPANY AND MANUFACTURER'S DRAWINGS

3.1 The following drawings are intended to indicate the scope of the work to be done and details necessary for the items of work set forth in this specification, and are part of this specification. These drawings in general are to scale, but figures shall always be followed and drawings are not to be scaled. Contractor shall make any requests for additional drawings in writing to the Engineer.

3.1.1 Drawings prepared by CDG Engineers, Inc. dated August 12, 2016, include the following:

T-001	TITLE SHEET
T-002	PLANT VICINITY MAP
T-003	GENERAL NOTES
C-101	SITE INDEX MAP
C-102	SITE PLAN
C-103	SITE PLAN
C-104	SITE PLAN
C-105	SITE PLAN
C-106	SITE PLAN
C-107	SITE PLAN
C-108	NOT USED
C-109	NOT USED
C-110	SITE PROFILE
C-111	PROFILES
C-301	DETAILS
C-302	DETAILS
C-303	DETAILS
C-304	DETAILS
C-305	DETAILS
C-601	DRAINAGE AREA MAP
C-602	SWPPP PLAN
C-603	SWPPP DETAILS

3.1.2 The following drawings are intended as references and will be on a cd/dvd prepared by Ameren and included in back of the project manual:

B-331-O-E	Plan Ash Storage Pond
B-332-O-D	Bottom Ash Storage Pond Details
B-333-O-C	Fly Ash Storage Pond Details
K-584-A	Rev. 1 Meredosia closed ash ponds
K-584-A	Rev. 2 Meredosia closed ash ponds

4.0 WORK, MATERIALS AND EQUIPMENT SUPPLIED BY COMPANY

4.1 Not applicable.

5.0 WORK, MATERIALS AND EQUIPMENT FURNISHED BY CONTRACTOR

5.1 All supervision, components, labor, materials, equipment, tools, and any incidental items described herein (except those specifically stated above) necessary to completely install each portion or component of the work shall be furnished by Contractor.

6.0 UTILITIES AND FACILITIES

6.1 Contractor shall supply sanitary facilities, drinking water and shower facilities (if needed) equipped with water heaters.

6.2 The Company will provide telephone, fax, computer, and power hook-up connections for Contractor supplied trailers.

6.3 Temporary lighting, wiring, plumbing, globes, guard lights, barricades or any other items required for protection, facility of work, local regulation, or by law for public protection shall be provided by Contractor.

6.4 The Company shall furnish one source of 480 volt, three phase electric power per major work area as directed by the Construction Project Lead. Contractor shall furnish the tie-in and any extensions required. Contractor shall not use the Company's 120-volt outlets, unless directed otherwise by the Construction Project Lead. Contractor shall provide 480/120-volt transformers as required.

6.4.1 Contractor shall provide with bid proposal a list of his estimated temporary (construction) power requirements.

6.5 Non-potable (construction) water will be provided by the Company for Contractor for the purposes of clean up/wash down. Potable water for drinking will be provided by the Contractor.

6.6 Construction Staging Area/Lay down areas for equipment and material will be designated as close to work site as possible. Areas for tool, office, and change house trailers will be designated as close to work site as possible. Contractor's lay down area will be as determined by the Construction Project Lead.

7.0 <u>RECORDING OF HISTORICAL DATA</u>

7.1 Contractor shall make revisions to plans and specifications (red lines) during the course of the work. Plans and specifications shall be turned over to the Owner at Substantial Completion of the project.

8.0 <u>CONTRACTOR'S FIELD SAFETY PROGRAM</u>

8.1 Contractor shall comply with the Safety and Housekeeping procedures stated in Safety and Contractor Requirements (Appendix A), Attachment A18 and Attachment A19.

8.2 The Company has computerized the WPA request process. All organizations working on plant site shall be required to use the WPA computers to request WPA tags to be hung. The Company will provide training to one or two individuals per organization with training to be located at the Ameren POS Training Center.

9.0 <u>TRANSFER OF INFORMATION (OSHA Safety Requirement)</u>

9.1 Ameren shall inform the Contractor of known characteristics and conditions as it relates to the safety of the work being performed on all equipment associated with generation of electricity. This will be accomplished before work begins, after the contract is awarded during Ameren's pre-construction meeting.

9.2 The transfer of information will be shared with the primary contractor awarded the work. That primary contractor will share the same information with any sub-contractors hired by the primary contractor.

9.3 If any unique and/or hazardous conditions exist which were not mentioned by Ameren, Contractors must inform Ameren of those conditions in a timely manner.

10.0 <u>PARTICIPATION IN COORDINATION ACTIVITIES</u>

10.1 Contractor shall provide a representative for and participate in coordination and information exchange activities with representatives of the Company and other contractors involved with the plant improvements, including the following activities:

10.1.1 Exchange of information necessary for the work specified herein to interface with other Contractors.

10.1.2 Participation in multi-contact coordination, construction, installation, and startup meetings. One construction meeting per week and one multi-contractor outage coordination meeting per week is anticipated during the majority of the outage. Initial shutdown and startup meetings are on a more frequent basis; often daily.

10.1.3 Participation in safety walk-down meetings. Safety meetings may occur bi-weekly. The Construction Project Lead will inform Contractor of meeting dates and times as necessary.

10.1.4 Contractor shall electronically track safety findings from safety walk-downs and document corrective actions taken.

10.2 Contractor shall provide daily schedule updates to the designated Company representative (Project Scheduler) for inclusion into the integrated outage schedule.

11.0 CONTRACTOR'S COST TRACKING PROGRAM

11.1 In addition to daily timesheets, Contractor shall furnish manpower and cost information to the Construction Project Lead for all "time & material" work on a weekly basis. Time & Material information is to be submitted on Contractor-supplied forms.

12.0 GENERAL INFORMATION

12.1 Upon completion, all work defined in this document shall be of a uniformly neat and workmanlike appearance. All costs of repair to meet this condition shall be to Contractor's account.

12.2 Contractor shall follow the manufacturer's or fabricator's guidelines and requirements for installation of all materials and equipment, except as modified by this Specification.

12.3 Contractor shall be aware that there may be other contractors onsite during the Work as described in this Specification as well as Company GCMS and Plant forces. Contractor shall coordinate his work to minimize interferences with the work of other contractors and/or crafts.

12.4 Contractor's employees shall park in designated parking areas only. Employees shall observe Ameren site requirements for driving and parking on-site. Employees are to report to the main entrance prior to proceeding to parking area.

12.5 Upon admittance into the Plant, Contractor (including each and every employee or sub-contractor's employees) shall be subjected to a computer based training (CBT) program that describes the Plant Construction Job Work Rules. These work rules are similar to those listed in Supplemental General Conditions Section 1A, Item 2.4. The training lasts approximately ¾ hour for the average worker. Employees cannot begin work until the training is completed.

12.6 Contractors must recognize the difference between special instrument air connections and service air connections and shall not use instrument air for their air supply needs.

12.7 Job Working Rules

Contractor must enforce the Ameren Job Working Rules (Appendix B) as well as the Contractor's own work rules. If the rules conflict, then the more restrictive rule applies.

Equipment skids supplied by the contractor shall have a P&ID diagram with equipment identifications, critical settings and pressure ratings identified. The skid pumps, blowers, motors, valves, instruments and other equipment shall have labels attached with the device number shown on the P&ID. The device numbers will be provided by Ameren and be compatible with plant equipment labels and numbering schemes.

13.0 EXTRA WORK ORDERS

13.1 Extra work will be authorized by an approved Extra Work Order (EWO). Contractor shall not start any additional work without written approval from the Company.

13.2 Extra work may be authorized on a lump sum firm price, time and materials (T&M), or a T&M-not-to-exceed basis. The Company will select the terms of the EWO.

13.2.1 Pricing for lump sum firm price and T&M-not-to-exceed work shall be based on the Engineering Inspection Report supplied by the Construction Project Lead.

13.2.2 The Company may accept or reject Contractor's proposal for any EWO. If an EWO proposal is rejected the Company may try to negotiate the price, reduce or cancel the work scope, or obtaining pricing from another contractor.

13.2.3 If Contractor's submitted EWO proposal is acceptable to the Company an approved EWO will be issued authorizing the work.

13.3 Invoices for all approved Extra Work Orders shall reference the purchase order number of the original contract, the EWO Number, and have a copy of the approved EWO attached.

END OF SECTION 1B

Ameren MISSOURI

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Meredosia Energy Center Location Map

SECTION 1C – INFORMATION REQUIRED FROM BIDDERS

1.0 **INFORMATION REQUIRED WITH BID PROPOSAL**

1.1 Proposed Construction Schedule

- Contractor shall attend a mandatory **Pre-Bid Conference** at the Meredosia Energy Center on ____________.
- Contractor shall submit a **Lump Sum Firm Price Bid Proposal** by ____________.
- Contractor shall submit **Level 3 Schedule** by ____________.
- Anticipated **Contract Award** for construction is ____________.
- **Contractor shall complete all work by** ____________.

1.2 Contractor shall submit the following items with the Bid Proposal:

- Pricing
- Project Schedule
- Preliminary Project Execution Plan
- Insurance Certification Statement
- Field Construction Safety Program
- Laydown and access requirements
- Diverse Supplier Business Plan
- Statement of Qualifications
- Contractor Safety & Health Data Form
- Bid Form

1.3 Pricing

1.3.1 Contractor to submit a Lump Sum Firm Price Bid Proposal

1.3.2 Contractor shall submit with bid proposal a schedule of time and material (T&M) rates as well as T&M rates for all planned subcontractors. The submitted schedules of T&M rates will be used for any additional work the Company may request or approve during the course of the specified work.

1.3.3 Break out cost for safety personnel per Safety and Contractor Requirements Appendix A, Item 4.2.

1.4 Project Schedule

1.4.1 A Level 2/3 Schedule shall be prepared.

1.5 Preliminary Project Execution Plan

1.5.1 Contractor shall submit with bid proposal a preliminary work plan describing how the project will be executed.

1.6 Insurance Certification Statement

1.6.1 Contractor shall submit acceptable Insurance Certification.

1.7 Field Construction Safety Program

1.7.1 Safety Program for Field Operations shall be submitted.

1.8 Laydown and Access requirements

1.8.1 A Staging Area is shown on the plans. (See sheet T-002) Contractor to address the adequacy of this area for their operations.

1.9 Diverse Supplier Business Plan

1.9.1 In order to support Ameren's policy on Supplier Diversity, Attachment A22 shall be filled out and submitted with bid. 2[nd] Tier Supplier shall be defined as work as set forth in bid proposal not being self-performed. Ameren does not certify Diverse Suppliers and relies upon third party certifying organization. Ameren recognizes certification from the National Minority Council (NMSDC) and its affiliate councils, the Women's Business Enterprise National Council (WBENC) and its affiliate councils, and Federal, State and Local government certifying agencies.

Note: editable versions of Attachment A22 with instructions and reporting guidelines will be sent out as part of bid package. Questions on filling out form will be directed towards Ameren Supplier Diversity professionals at (888) 256-1150 or at http://www.ameren.com/BusinessPartners/SupplierDiversity/Pages/SupplierDiversityHome.as.

1.10 Statement of Qualifications

1.11 Contractor Safety & Health Data Form

1.11.1 Contractor shall submit with bid proposal a completed Contractor Safety & Health Data Form (Appendix A, Attachment A9).

1.12 Bid Form

1.12.1 Contractor shall submit the Bid Form found in Appendix AA of this specification.

1.13 Exceptions

1.13.1 Any contract award resulting from this Specification will incorporate all provisions specified herein. It is understood that Contractor agrees to all provisions of Specification unless exceptions are specifically listed in bid proposal.

1.14 Quality

1.14.1 Copies of the Contractor's quality management program and supportive procedures.

2.0 INFORMATION REQUIRED AFTER CONTRACT AWARD

2.1 Schedule

2.1.1 Contractor shall submit a construction schedule as described in Contractor Schedule Requirements (Appendix D). Failure to provide a schedule may result in rejection of the bid.

2.1.2 Contractor shall provide continuous (daily) updates of his project work schedule beginning after he mobilized at jobsite and continuing through completion of work. Failure to provide a schedule may result in charges to Contractor.

2.2 Revised Project Execution Plan

2.2.1 Contractor shall submit after award of contract a detailed work plan describing how the project will be executed. Included in the work plan shall be items/details such as:

2.2.1.1 Method of construction of the dewatering system.

2.2.1.3 Location of Contractor's proposed borrow area.

2.2.1.4 Quality control plan

2.2.1.6 List of subcontractors

2.2.1.7 Site-specific safety plan. At a minimum, Attachment A21 – Site-Specific Safety Plan (SSSP), shall be filled out in its entirety. The SSSP shall be submitted to Ameren for review, comment and approval. Editable version of Attachment A21 is to be supplied after issuance of PO.

2.2.1.8 Site-specific demolition plan (may be incorporated into the Safety Plan)

2.3 Contractor Project Management

2.3.1 Contractor shall provide an organizational chart depicting names and roles of individuals involved with project from Project Manager to Foreman level.

2.3.2 Contractor shall provide necessary resources to provide scheduling information and updates as defined in Contractor Schedule Requirements (Appendix D).

2.3.3 Contractor shall provide a full time Project Manager onsite unless an exemption is provided in writing by the Managing Supervisor of Construction.

2.6 Contractor and subcontractors shall submit a Quality Plan which is in compliance with the Quality Requirement in Supplemental General Conditions Section 1A, Item 12, prior to start of work. .

2.7 Diverse Supplier 2nd Tier Report

2.7.1 In accordance with Item 1.6.1 above, Attachment A23 shall be filled out with actual spent cost and issued per timeline agreed upon between Contractor and Ameren. Typical timeline for reporting will be monthly.

Note: editable version of Attachment A23 with instructions and reporting guidelines will be sent out as part of Contract Award. Questions on filling out form will be directed toward Ameren Supplier Diversity professionals at (888) 256-1150 or at http://www.ameren.com/BusinessPartners/SupplierDiversity/Pages/SupplierDiversityHome.as.

END OF SECTION 1C

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:

1. Coordination drawings
2. Requests for Information (RFIs)
3. Project meetings

B. Related Requirements:

1. Section 01700 "Execution Requirements" for procedures for coordinating general installation and field-engineering services shall be followed, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. REQUEST FOR INFORMATION (RFI): An RFI is a request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: The Contractor will prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products,
2. Number and title of related Specification Section(s) covered by subcontract, and
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: The Contractor will coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Additionally, the Contractor shall coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation as indicated below.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. The Contractor shall prepare memoranda for distribution to each party involved that outlines special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: The Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule,
2. Preparation of the schedule of values,

3. Installation and removal of temporary facilities and controls,
4. Delivery and processing of submittals,
5. Progress meetings,
6. Preinstallation conferences,
7. Project closeout activities, and
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. General Coordination Drawings: The Contractor shall prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information should be drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to the Engineer indicating the proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, the Contractor shall prepare and submit an RFI in the form specified below:

1. All RFIs to be submitted by the Contractor; Engineer will not reply to RFIs submitted by subcontractors, vendors or suppliers.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in the Work or work of subcontractors.
3. Submit separate RFIs for each item requiring information or interpretation.

B. The Contractor will prepare RFIs on forms supplied by Owner.

C. The Content of the RFI should include a detailed, legible description of item needing information or interpretation and the following:

1. Project name,
2. Project number,
3. Date,
4. Name of Contractor,
5. Name of Engineer,
6. RFI number, numbered sequentially,
7. RFI subject,
8. Specification Section number and title and related paragraphs, as appropriate,
9. Drawing number and detail references, as appropriate,
10. Field dimensions and conditions, as appropriate,
11. Contractor's suggested resolution. (If Contractor's resolutions impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature, and
13. Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, coordination drawings, and other information necessary to adequately describe items needing interpretation.

D. Engineer's Action: The Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

a. Requests for approval of submittals,
b. Requests for approval of substitutions,
c. Requests for coordination information already indicated in the Contract Documents,
d. Requests for adjustments in the Contract Time or the Contract Sum,
e. Requests for interpretation of Engineer's actions on submittals, and
f. Incomplete RFIs or inaccurately prepared RFIs.

2. The Engineer's action may include a request for additional information, in which case Engineer's time for response will date from the time of receipt of additional information.

   a. If Contractor believes the RFI response warrants a change in the Contract Time or the Contract Sum, the Engineer must be notified in writing within 10 days of receipt of the RFI response.

E. RFI Log: The Contractor will prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. The log will be submitted monthly and will include the following:

1. Project name,
2. Name and address of Contractor,
3. Name and address of Engineer,
4. RFI number including RFIs that were dropped and not submitted,
5. RFI description,
6. Date the RFI was submitted, and
7. Date the Engineer's and Construction Manager's response was received.

F. On receipt of the Engineer's action, update the RFI log and immediately distribute the RFI response to the affected parties. Review the response and notify the Engineer within seven (7) days if Contractor disagrees with the response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: The Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify the Owner and Engineer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda and distribute the agenda to all invited attendees.
3. Minutes: The Entity responsible for conducting meeting will record significant discussions and agreements achieved. The meeting minutes will be distributed to everyone concerned, including the Owner, and Engineer, within three (3) days of the meeting.

B. Preconstruction Conference: The Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to the Owner and Engineer, but no later than 15 days after execution of the Contract.

1. Attendees: Authorized representatives of the Owner, Contractor and/or Contractor superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
2. Agenda: Items of significance will be discussed that could affect progress, and may include the following:

   a. Tentative construction schedule,
   b. Critical work sequencing and long-lead items,
   c. Designation of key personnel and their duties,
   d. Procedures for processing field decisions and Extra Work Orders,
   e. Procedures for RFIs,
   f. Procedures for testing and inspecting,
   g. Procedures for processing Applications for Payment,

h. Distribution of the Contract Documents,
i. Submittal procedures,
j. Preparation of record documents,
k. Use of the premises and existing building,
l. Work restrictions,
m. Working hours,
n. Owner occupancy requirements,
o. Responsibility for temporary facilities and controls,
p. Procedures for disruptions and shutdowns,
q. Construction waste management and recycling,
r. Parking availability,
s. Office, work, and storage areas,
t. Equipment deliveries and priorities,
u. First aid, and
v. Security,

3. Minutes: The Contractor will record and distribute meeting minutes.

C. Progress Meetings: The Contractor will conduct progress meetings at monthly intervals.

1. Attendees: In addition to representatives of the Owner, Contractor, and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. The Contractor shall review present and future needs of each entity present, including the following:

1) Interface requirements,
2) Sequence of operations,
3) Status of submittals,
4) Deliveries,
5) Access,
6) Site utilization,
7) Temporary facilities and controls,
8) Quality and work standards,
9) Status of correction of deficient items,
10) Field observations,
11) Status of RFIs,
12) Status of proposal requests,
13) Pending changes,
14) Status of Change Orders and Extra Work Orders,
15) Pending claims and disputes, and
16) Documentation of information for payment requests.

3. Minutes: The Contractor will record and distribute the meeting minutes to each party present and to the parties requiring information.

a. Schedule Updating: The Contractor's construction schedule will be revised after each progress meeting where revisions to the schedule have been made or recognized. The revised schedule will be issued concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01322 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs, and
2. Periodic construction photographs.

B. Related Requirements:

1. Section 01770 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: The Contractor shall submit key plan of Project site with notation of vantage points marked for location and direction of each photograph. Include same information as corresponding photographic documentation.

B. Digital Photographs: The Contractor shall submit unaltered, original, full-size image files as attachment to weekly reports.

1. Digital camera should have a minimum sensor resolution of 8 megapixels.
2. Identification: Provide the following information with each image description in the file metadata tag:

a. Name of Project,
b. Date photograph was taken, and
c. Description of vantage point, indicating location, and direction (by compass point).

C. Include date photograph was taken if not date stamped by camera.

D. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Unique sequential identifier keyed to accompanying key plan.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall have a camera on site at all times for Ameren's Construction Project Lead's use. Camera should have a date stamp feature and software to download photos to computer.

B. General: Photographs should be taken using the maximum range of depth of field, and in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. The Contractor shall maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: The Contractor shall submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: The date and time will be included in file name for each image.
2. Field Office Images: One set of images will be maintained accessible in the field office at Project site, available at all times for reference. The images should be identified in the same manner as those submitted to Engineer and Owner.

D. Preconstruction Photographs: Before commencement of excavation, commencement of selective demolition, and starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Special attention should be given to existing pipeline foundations that are to remain undisturbed.

E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Project Closeout Photographs: After construction has been completed, the Contractor shall document the condition of the existing oil pipeline foundations. The same vantage points should be utilized for the photographs.

G. Additional Photographs: The Engineer may request photographs in addition to periodic photographs specified.

1. Five (5) day notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:

   a. Immediate follow-up when on-site events result in construction damage or losses,
   b. Photographs to be taken at fabrication locations away from Project site,
   c. Substantial Completion of a major phase or component of the Work, or
   d. Extra record photographs at time of final acceptance.

END OF SECTION 01322

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SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: The Contractor shall submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.

1. The Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. The Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

B. Refer to Submittal Requirement chart at the end of this section for the submittal required for each section.

C. Coordination: The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

E. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer and Construction Manager.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Engineer.
d. Name of Contractor.
e. Name of subcontractor.
f. Name of supplier.
g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Engineer or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

a. Contractor to submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer and Construction Manager.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer and Construction Manager will return without review submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name and address of Engineer.
6) Name of Contractor.
7) Name of firm or entity that prepared submittal.
8) Names of subcontractor, manufacturer, and supplier.
9) Category and type of submittal.
10) Submittal purpose and description.
11) Specification Section number and title.
12) Specification paragraph number or drawing designation and generic name for each of multiple items.
13) Drawing number and detail references, as appropriate.
14) Indication of full or partial submittal.
15) Transmittal number, numbered consecutively.
16) Submittal and transmittal distribution record.

17) Remarks.
18) Signature of transmitter.

F. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06100.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:

   a. Project name.
   b. Date.
   c. Name and address of Engineer.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Names of subcontractor, manufacturer, and supplier.
   g. Category and type of submittal.
   h. Submittal purpose and description.
   i. Specification Section number and title.
   j. Specification paragraph number or drawing designation and generic name for each of multiple items.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Indication of full or partial submittal.
   o. Transmittal number, numbered consecutively.
   p. Submittal and transmittal distribution record.
   q. Other necessary identification.
   r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

G. Options: Identify options requiring selection by Engineer.

H. Deviations: Identify deviations from the Contract Documents on submittals.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's and Construction Manager's action stamp.

J. Distribution: The Contractor shall furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: The Contractor shall retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

   a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Engineer, through Construction Manager, will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Engineer and Construction Manager will not return copies.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Statement of compliance with specified referenced standards.
   d. Testing by recognized testing agency.
   e. Application of testing agency labels and seals.
   f. Notation of coordination requirements.
   g. Availability and delivery time information.

4. Submit Product Data before or concurrent with Samples.
5. Submit Product Data in the following format:

   a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 22 by 34 inches.
3. Submit Shop Drawings in the following format:

   a. PDF electronic file.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.

E. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Construction Quality Assurance Plan.

F. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01770 "Closeout Procedures."

G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

I. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

J. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

K. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

L. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

M. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Schedule of Tests and Inspections: Comply with requirements specified in Section 01400 "Quality Requirements."

O. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

P. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01770 "Closeout Procedures."

C. Approval Stamp: The Contractor shall stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

A. General: The Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: The Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01330

Section	Item	Catalog Cuts	Closeout	Coordination Drawings	Design Mixtures	Field Quality Control	Informational	Installer Certifications	Material Test Report	Product Certificates	Product Data	Sample Warranty	Samples	Source Quality Control	Shop Drawings & Design Calculations	Testing and Inspection Reports
01310	Subcontract List						X									
01322	Key Plan						X									
01322	Digital Photographs						X									
01500	Site Plan						X									
01500	Erosion & Sediment Control Compliance						X									
01500	Fire-Safety Program						X									
01700	Survey Certification						X									
01770	Contractor's List Incomplete Items		X													
01770	Certified List Incomplete Items		X													
01770	Certificates of Release		X													
01770	Inspection for Substantial Completion (min 10 days prior)		X													
01770	Final Completion		X													
01781	Record Drawings		X													
01781	Record Specifications		X													
01781	Record Product Data		X													
02060	Pre-demolition Photos or Video (before work begins)						X									
02060	Schedule of selective demolition						X									
02060	Flowable Fill				X					X						X
02200	Earthwork												X			X
02240	Dewatering plan						X									
02250	Site Drainage – Rock Blanket and Energy Dissipator										X					
02250	Geotextile Filter										X		X			
02511	Crushed Stone Paving												X			
02800	HDPE Geomembranes and Polypropylene Turf Grass		X			X		X	X	X		X	X	X	X	X
02821	Chain-Link Fences and Gates	X									X					
02936	Seeding and Mulching									X	X					
02950	Abandonment of Storm Sewer	X							X		X					

Ameren Energy Generating

SECTION 01356 - SWPPP DESIGN, INSTALLATION, MAINTENANCE AND REMOVAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. A Stormwater Pollution Prevention Plan (SWPPP) has been provided by Ameren. A copy of these plans have been provided, see drawings C-602 and C-603.

B. Refer to Appendix CC for the SWPPP report.

C. Implement, maintain and remove SWPPP. Maintenance of the SWPPP includes adjustments to the SWPPP as deemed necessary by Ameren and any adjustments necessary to control stormwater pollution.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all equipment and materials, suitable and in adequate quantity, required to accomplish the work as specified herein.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Contractor shall install and maintain SWPPP BMP's during construction as necessary to control and prevent pollution of stormwater runoff leaving the site. Adjust SWPPP as directed and as necessary to prevent stormwater pollution. At an appropriate time after project completion, and only after all disturbed areas are fully vegetated or otherwise protected from erosion in a permanent fashion, remove SWPPP BMPs.

B. Contractor to provide and maintain a proper washdown station.

C. All BMPs shall be inspected weekly by the Contractor and after rainfall events of 1 inch or more. Contractor inspections must be scheduled at least once per week and no later than 48 hours after a rainfall that causes stormwater runoff to occur on-site. A typed inspection report must be delivered to the Engineer after each Contractor inspection.

END OF SECTION 01356

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer or Construction Manager.

B. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

C. Construction Quality Assurance (CQA) contractor hired under separate contract by the owner to implement the Construction Quality Assurance Plan.

D. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

H. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

1.4 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Description of the Work and test and inspection method.
6. Identification of product and Specification Section.
7. Complete test or inspection data.
8. Test and inspection results and an interpretation of test results.
9. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
10. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
11. Name and signature of laboratory inspector.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

D. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

F. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.6 QUALITY CONTROL

A. Contractor Responsibilities: Check the CQA plan for responsibilities concerning all tests and inspections.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
2. Notify testing agencies and/or CQA Contractor at least three (3) working days in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

B. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. CQA Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer, through the Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01700 "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 1B "Summary of Work" for limitations on work restrictions and utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Engineer, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Engineer, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 1B "Summary of Work."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel.

D. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

F. Telephone Service: Owner will provide telephone, fax, and computer connections for Contractor supplied construction trailers.

1. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone.

3.3 SUPPORT FACILITIES INSTALLATION

A. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 02200 "Earthwork."

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Waste Disposal Facilities: Paper waster form construction office trailers and waste from installation of new materials to be hauled off by licensed trash haulers. No paper or cardboard waster to be left on site or buried in designated disposal area.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to the SWPPP.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

END OF SECTION 01500

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

   a. Form of Approval: As specified in Section 01330 "Submittal Procedures."
   b. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01330 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
3. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
4. Protect stored products from damage.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01770 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturers:

   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Correction of the Work.

B. Related Requirements:

1. Division 1 Section 01770 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by Illinois licensed land surveyor certifying that location and elevation of improvements comply with requirements.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in the State of Illinois and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 01310 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Owner or Engineer promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including grading, fill and topsoil placement, and utility slopes.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Contractor.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Survey Control Points: Survey Control points have been established for this project, but are not limited by the established list. Contractor may establish additional control points as deemed necessary during construction.

C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
2. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

3.7 PROGRESS CLEANING

A. Site: Maintain Project site free of waste materials and debris.

B. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

C. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and property adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

END OF SECTION 01700

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01781 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name where applicable.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Instruct Owner's personnel in maintenance of products.
3. Complete final cleaning requirements.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by SPOC that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Company requirements.
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in maintenance of products.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Engineer and Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Submit list of incomplete items in the following format:

a. PDF electronic file. Engineer, through Contractor, will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. Remove labels that are not permanent.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective materials, refinishing damaged surfaces. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

END OF SECTION 01770

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.

b. Final Submittal:

1) Submit record digital data files and three set(s) of record digital data file plots.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

D. Photographs of the oil pipeline foundations after construction.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as paper copy.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's and Construction Manager's reference during normal working hours.

END OF SECTION 01781

SECTION 02060 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes all items described in these specifications and as shown on Site Plan drawings C-101 through C-107.

B. Section Includes:

1. Demolition, removal, and disposal of selected site elements as indicated on drawings:
   a. Above grade steam line and foundations,
   b. Chain link fencing, including but not limited to the mesh, posts, supports, barbed wire, foundations, etc.
   c. Sluice piping and inflow structure at Bottom Ash Pond,
   d. Light poles and wiring around Bottom Ash Pond,
   e. Underground electric lines, boxes, panels, components and monitoring equipment on Berm of Fly Ash Pond,
   f. Other piping and miscellaneous items.
2. Salvage of existing items to be reused or recycled.
3. Temporary removal and replacement.
4. Removal and disposal of Outflow structure and pipe from Bottom Ash Pond.
5. Removal and disposal of Inflow structure, concrete vault structure and inlet pipe(s) from Bottom Ash Pond.
6. Removal and disposal of Outflow structure and plug outlet pipe with flowable fill in the Fly Ash Pond.
7. Removal of underground electric service and utility poles at dock and along north edge of Bottom Ash Pond.

1.2 DEFINITIONS

A. Demolish: Remove existing construction items and legally dispose of.

B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Pre-demolition Photographs or Video: Submit before Work begins.

B. Schedule of selective demolition activities with starting and ending dates for each activity.

C. Submittals shall be as outlined in Section 01330 Submittals.

1.5 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.6 SALVAGE

A. Contractor may salvage any materials within the scope of demolition, such as, metal piping, chain-link fencing, rock blanket, power poles, light poles, etc.

B. Salvage materials must be approved by Ameren personnel before leaving project site.

1.7 SUBMITTALS

A. Submit design mixture and testing certification of Flowable Fill.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

C. Flowable Fill: Density in place shall be 65 to 100 psi for non-air-entrained or conventionally air-entrained mixtures. Mixture to meet ASTM C403 standards. Provide mix design and specifications to engineers for review prior to beginning work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated electrical or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 01322 "Photographic Documentation."

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 1B "Summary of Work."

B. Existing Services/Systems To Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.

3. If systems are required to be removed, relocated, or abandoned, provide temporary systems that bypass area of selective demolition and that maintain continuity of systems to other parts of building.
4. Contractor to coordinate with local utility to remove and relocate the utility poles along the north side of the Bottom Ash Pond. New dusk to dawn lights and underground service to dock will be installed.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 01500 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to facilities to remain.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
2. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: All demolished materials from the site are to stay on-site and/or be disposed of in an approved manner.

1. Demolished materials remaining on-site shall be disposed of within the Fly Ash Pond as approved by Owner.
2. Do not allow demolished materials to accumulate on-site.
3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. The Contractor can salvage any materials within the scope of the demolition.

3.6 CLEANING

A. Clean adjacent areas, on-site or off-site, of debris caused by selective demolition operations. Return adjacent areas to condition existing before demolition operations began.

END OF SECTION 02060

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SECTION 02200 - EARTH WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Moving and shaping ash to the grading shown on the drawings.
2. Excavate the Bottom Ash Pond to elevation 424 and deposit into Fly Ash Pond and backfill with off-site borrow soil to elevation 430.
3. Excavating and shaping Eastern Fly Ash Stockpile area with off-site borrow soil as shown on drawings.
4. Moving, filling, and shaping of materials deposited into Fly Ash Pond.
5. Preparing subgrades for synthetic turf, turf, grasses and roadway.
6. Excavating and backfilling for synthetic turf, turfs, ditches and structures.
7. Excavating and backfilling for anchor trenches.
8. Shaping proposed ditches.
9. Scraping coal pile and removing approximately 18-24 inches and depositing into the Fly Ash Pond.
10. Hauling in and filling with off-site borrow soil.

1.2 DEFINITIONS

A. Ash Material: Consists of Coal Fines, Bottom Ash, Fly Ash, Ash/Soil/Rock mixture.

B. Backfill: Ash or Soil material used as fill.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Synthetic Turf: A synthetic grass system for closure of mine spoils and landfills; turf is a combination of polypropylene grass tufts underlain by impermeable HDPE geomembrane, i.e. "Closureturf™" or "Hydroturf™".

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

1.5 SUBMITTALS

A. Submit soil material samples as required by CQA Plan and as outlined in Section 01330 Submittals.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils:

1. General Fill: Soil Classification Groups CL, ML, GW, GP, GM, SC, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

2. Ash Pond Subgrade within 1 foot of design grade - Soil Classification Groups CL, ML, SC, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; no bottom ash; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

3. Bottom Ash Pond Backfill: Soil Classification Groups GW, GM, GP, GC, SC, SW, SP, SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

4. Access Road on Bottom Ash Berm: Bottom Ash Berm Widening under ClosureTurf™ shall be constructed with Bottom Ash Material only.

B. Unsatisfactory Soils:

1. Unsatisfactory soils also include satisfactory soils not maintained within 4 percent of optimum moisture content at time of compaction.

C. Sand Infill for ClosureTurf™: Natural or manufactured sand material, fine aggregate meeting grain size distribution ASTM C 33 and Specification No. 02800-2.4C.

D. Hydrobinder Infill for HydroTurf™: Proprietary blended material manufactured by Agru America or approved equivalent.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION OF BOTTOM ASH POND

A. Excavate to elevation 424.0 and deposit material into the Fly Ash Pond.

B. Backfill Bottom Ash Pond with approved materials.

3.4 REMOVAL OF MATERIAL FROM COAL PILE

A. Remove material from top 18" – 24" of Coal Pile.

B. Deposit material into Fly Ash Pond.

C. Grade Coal Pile to drain.

3.5 MOVING, FILLING, AND SHAPING FLY ASH POND

A. Deposit on-site Ash Materials into Fly Ash Pond.

B. Demolition items, as approved by Owner, shall be disposed of within the Fly Ash Pond.

1. Allow a minimum of 3 feet of Ash Material cover over demolition items to ensure HDPE Geomembrane is protected from possible punctures, etc.

C. Grade and shape Ash Material as shown on drawings

D. Encapsulate Fly Ash Pond with ClosureTurf™ product, see specification section 02800.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade with a loaded pneumatic-tired dump truck or equivalent to identify soft areas and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that is too wet to compact to specified dry unit weight.

3.9 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:

1. Under turf or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
2. For trench backfill, compact each layer of initial and final backfill soil material at 90 percent.
3. For crushed rock backfill, compact each layer of initial and final backfill material to 95 percent.

3.10 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away to prevent ponding. Finish subgrades to required elevations as shown on the drawings.

C. In order to accommodate a final balanced cut and fill, the Contractor may adjust the final grade elevations provided that the profile slopes of the ditches are not reduced less that the minimum slopes as shown on the drawings.

D. Any additional cut shall be distributed evenly throughout the grading area of the Fly Ash Pond so as to produce a balance. There shall be no haul-off of material from this site.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. All waste materials, including trash and debris will be disposed of off-site in an approved manner.

END OF SECTION 02200

SECTION 02230 - SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing site utilities.
6. Temporary erosion- and sedimentation-control measures.
7. Cleaning and shaping existing ditches.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property; cleared materials shall be disposed of on-site in the designated disposal area.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads and other adjacent occupied or used facilities during site-clearing operations.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other diggings unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 02200 "Earth Work."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.

C. Protect existing site improvements from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. Refer to Section 01356 for the SWPPP requirements for soil and sedimentation control.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.
3. Should any underground utilities be encountered, stop work immediately and notify SPOC.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Remove top 6 inches of topsoil. Store topsoil for later use.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other waste materials. Remove subsoil and non-subsoil materials including clay lumps, gravel and other objects more than 2 inches in diameter.

D. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including debris, and dispose of them in the designated on-site location.

END OF SECTION 02230

SECTION 02240 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes dewatering of the Ash Ponds and water disposal, which is Contractor's responsibility, if needed.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 FIELD CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.4 SUBMITTAL

A. Informational: Dewatering Plan

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

2.2 DEWATERING PLAN

A. The Contractor shall prepare a dewatering plan and submit it to Ameren. The plan must be approved by Ameren prior to implementation.

B. The Contractor shall dewater and monitor settlement of the ash as necessary in order to achieve final placement of the ash in accordance with the plans.

C. Geotechnical studies indicate known supersaturated and liquefiable materials on-site.

D. Dewatering well points within the Bottom Ash Pond need to be pumped and drained to a settling basin within the Fly Ash Pond prior to being discharged to the regulated NPDES Outfall 004 location in the Fly Ash Pond (shown on T-002).

E. There is a standing pond of water located at the southwest end of the Fly Ash Pond. This pond is equipped with an existing NPDES outflow structure. The structure is used to control the overflow elevation of the standing water. The Contractor may utilize this water for dust control during grading operations.

F. Water that is removed from Ash Ponds, from dewatering operations, must be discharged in an approved manner under the direction of Ameren personnel.

G. Water conditioning by Ameren personnel (Or contractor hired by Ameren) is available in order to balance pH and remove suspended solids (TSS).

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide temporary grading to facilitate dewatering and control of surface water.

B. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 02230 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 WATER DISPOSAL

A. Dispose of water removed from excavations in such a manner as:

1. Will not endanger portions of work under construction or completed.
2. Will cause no inconvenience to Owner or to others working near site.

B. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas.

C. Disposal water must be directed to the permitted site NPDES regulated discharge point for disposal. The southwest corner of the Fly Ash Pond shall be utilized to allow contaminants to settle out prior to discharge.

1. The Owner will have CQA personnel monitoring the discharge stream for contaminants in compliance with the site NPDES Permit. The Contractor shall allow time and access for testing the water prior to final discharge.
2. At no time shall dewatering be discharged to the Illinois River without going through the regulated NPDES Outfall 004 at the southwest corner of the Fly Ash Pond.

3.4 OPERATION

A. Operate system to control groundwater to permit excavation, installation of materials, and placement of fill materials on dry subgrades.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

3.5 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

END OF SECTION 02240

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SECTION 02250 – SITE DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Rock Blanket lining ditches and embankments,
2. Energy Dissipators, and
3. Geotextile Filter.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: Provide quarry name and material gradation prior to delivery. Provide manufacturer's certification for Geotextile Filter.

B. Product Sample: Geotextile Filter (18" x 18")

PART 2 - PRODUCTS

2.1 ROCK BLANKET

A. Rock Blanket shall meet the requirements of IDOT Specification Section 1005.01.

B. Material shall be stone, quarried from undisturbed consolidated deposits of rock reasonably free of shale. Ledges shall be sufficiently thick to produce the desired dimensions.

C. IDOT Gradation: RR-6, Equivalent Diameter of 24 inches.

2.2 ENERGY DISSIPATOR

A. Energy Dissipator shall meet the requirements of IDOT Specification Section 1005.01.

B. Material shall be stone, quarried from undisturbed consolidated deposits of rock reasonably free of shale. Ledges shall be sufficiently thick to produce the desired dimensions.

C. IDOT Gradation: RR-4, Equivalent Diameter of 15 inches.

2.3 GEOTEXTILE FILTER

A. Geotextile Filter Fabric shall meet IDOT spec. sect. 1080.03. Material shall be a nonwoven material not less than six (6) ft. wide, weighing no less than 8 oz./sq.yd.

PART 3 - EXECUTION

3.1 PREPARATION OF DITCH OR EMBANKMENT FOR GEOTEXTILE FILTER

A. Grade and compact to a relatively smooth surface free from sharp objects and large stones.

B. Unroll geotextile as smoothly as possible overlapping edges a minimum of 18 inches.

C. Staple or pin geotextile in place.

3.2 INSTALLATION OF ROCK BLANKET AND ENERGY DISSIPATORS

A. Place rock blanket/rip rap immediately after installing filter.

B. Install rock in one operation. Do not dump through chutes or use any method that causes segregation of stone sizes.

C. Be careful not to dislodge the underlying filter when placing the stones.

D. If fabric is damaged, remove rock blanket/energy dissipator and repair fabric by adding another layer, overlapping the damaged area by 12 inches.

E. Where rip rap is used for outlet protection, the rip rap should be placed before or in conjunction with the construction of the ditch so that it is in place when the channel begins to operate.

3.3 FIELD QUALITY CONTROL

A. Contractor to ensure a dense, well-graded mass of stone with a minimum of voids present.

END OF SECTION 02250

SECTION 02511 CRUSHED STONE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes Roadways and drives; IDOT CA6 limestone.
B. This Section includes the geotextile filter located under the crushed stone roadway.

1.2 RELATED WORK

A. Section 02200 - Earthwork.

1.3 REFERENCES

A. ASTM C136- Sieve Analysis of Fine and Coarse Aggregates.

B. American Association of State Highway and Transportation Officials (AASHTO) T27.

1.4 TESTS

A. Gradation of stone material will be performed in accordance with ASTM C136.

B. Gradation of stone material will be performed in accordance with AASHTO No. T2

1.3 SUBMITTALS

A. Product Data:

1. Aggregate source list: submit a list of proposed aggregate sources.

2. Shipping Tickets for granular material delivered to site.

B. Samples:

1. Submit one (1) sample per source for each aggregate for use on the project. Samples shall be at least 1 lb. and shall be obtained and shipped according to ASTM D75.

PART 2 PRODUCTS

2.1 MATERIALS

A. IDOT CA6. Limestone, clean, tough, and durable, free of thin and elongated pieces of soft and objectionable material, graded in accordance with ASTM C136. The aggregate shall be in accordance with the following gradation:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	95 +/- 5
1/2 inch	75 +/- 15
No.4	43 +/- 13
No. 16	25 +/- 15
No. 200	8 +/- 4

B. Water: Clean and free of injurious amounts of oil, acid, alkali, salt, organic matter, vegetable matter, or other deleterious substances.

C. Compacted subgrade as defined in section Earthwork 02200.

2.2 GEOTEXTILE FILTER

A. Geotextile Filter Fabric shall meet IDOT sec. 1080.03, it shall be a nonwoven material not less than 6 ft. wide, weighing no less than 8 oz/sq.yd.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify compacted subgrade is dry and ready to receive the work of this Section. Remove and replace or repair all soft or unstable areas to the satisfaction of the Construction Supervisor.

B. Verify gradients and elevations of sub-base are correct.

C. Beginning of installation means acceptance of existing condition

3.2 PREPARE 12" THICK SUBGRADE

A. Prepare subgrade as directed in section 02200 Earthwork.

3.3 INSTALLING GEOTEXTILE FILTER

A. Place the geotextile on the smooth and level subgrade. All depressions, humps, sharp objects, and large stones should be removed.

B. Fabric shall be laid out and stretched as flat as possible.

C. Overlap adjacent rolls a minimum of 18 inches or as specified by manufacturer.

D. Secure fabric with staples, pins, or other suitable methods. Fabric should be secured along the edges and then at overlapping portions.

3.4 PLACING IDOT CA6,

A. Spread the top layer of stone directly from trucks equipped with hydraulic hoists and adjustable tailgates, or with mechanical spreaders, or with spreader boxes to achieve a compacted thickness of 3 inches unless otherwise shown on the plans. If a mechanical spreader is not used, blade the material a sufficient number of times to form the required gradation. Spread stone to a uniform distribution of sizes throughout, remove any segregated areas, and replace with suitable materials.

B. Rolling shall be performed utilizing a self-propelled (10) ton roller.

C. Begin rolling at edges and progress gradually toward the center.

D. Uniformly overlap each preceding track and thoroughly cover the entire surface. A minimum of FOUR (4) complete passes with the roller is required in all areas accessible by the roller.

E. Check the stone for humps, hollows, or other irregularities. Loosen defective areas, remove surplus or add new material as required, re-roll, and treat as necessary to completely eliminate the defects

F. Where access restraints do not permit the use of the rolling equipment specified above, roll to levels specified above using appropriately sized mechanical rolling/vibrating-plate equipment.

3.5 COORDINATION

A. No paving work shall be done or paving materials placed until all excavation and backfill for all utilities and storm water drainage (under the roads and/or drives) is installed, inspected, and has been allowed to settle.

END OF SECTION 02511

SECTION 02800 – HDPE GEOMEMBRANES AND POLYPROPYLENE TURF GRASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes geosynthetic cover system for ash ponds.

B. Section also includes "batten" and/or "flashing" requirements for sealing penetrations in the geomembrane.

1.2 PERFORMANCE REQUIREMENTS

A. Provide geosynthetic cover system that prevents the passage of water.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for geomembrane liners. Show panel layout, seams, penetrations, perimeter anchorage, and methods of attachment and sealing to other construction (batten and flashing). Differentiate between factory and field seams and joints.

C. Samples: Refer to CQA Plan for sample requirements. These samples will be used as control samples for the type of seams to be installed.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.7 WARRANTY

A. Special Warranty: Specified form in which geomembrane manufacturer, geomembrane liner fabricator, and geomembrane liner Installer agree to repair or replace geomembrane liner that fails in material or workmanship or that deteriorates under conditions of normal weather within specified warranty period. Warranty does not include deterioration or failure of geomembrane liner due to exposure to harmful chemicals, gases or vapors, abnormal and severe weather phenomena, fire, earthquakes, floods, vandalism, or abuse by persons, animals, or equipment.

1. Failures include, but are not limited to, the following:

a. Leaks in geomembrane liner.
b. Defects in seams.
c. Cracks and holes in floating cover.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CLOSURETURF™

A. Basis of Design: The intent of the documents and specifications for the product is that the closure geosynthetic cover system shall be "ClosureTurf™" as manufactured by Agru America, Inc.

B. Manufacturers of similar types of material may be submitted for approval of the Engineer prior to bidding.

2.2 HYDROTURF™

A. Basis of Design: The intent of the documents and specifications for the product is that "HydroTurf™" as manufactured by Agru-America, Inc. be used for swales and drainage ways.

B. Manufacturers of similar types of material may be submitted for approval of the Engineer prior to bidding.

2.3 HDPE GEOMEMBRANE

A. Basis of Design: The intent of the documents and specifications for the geomembrane shall be "Super Grip Net Liner" as manufactured by Agru America, Inc.

B. Manufacturers of similar type of material may be submitted for approval by the Engineer prior to bidding.

2.4 MISCELLANEOUS MATERIALS

A. Provide types of adhesive primers, compounds, solvents, and tapes recommended in writing by geomembrane liner manufacturer.

B. Provide manufacturer's standard factory-fabricated assemblies for sealing penetrations. Include joint sealant recommended in writing by geomembrane liner manufacturer and compatible with geomembrane liner, containment conditions, and materials.

C. SAND INFIFLL COMPONENT of the ClosureTurf™ System will meet ASTM C 33; fine aggregate, natural or manufactured sand, gradation shown below:

ASTM C-33-03	
Sieve	Percent Passing
9.5 mm (3/8 in.)	100
4.75 mm (No. 4)	95 to100
2.36 mm (No. 8)	80 to 100
1.18 mm (No. 16)	50 to 85
600 µm (No. 30)	25 to 60
300 µm (No. 50)	5 to 30
150 µm (No. 100)	0 to 10

D. HydroTurf™ HYDROBINDER INFILL COMPONENT is a proprietary cementitious product used as the infill component of the HydroTurf™ system.

E. Cement: brand of Portland Cement, meeting ASTM C150 and will be Type I or Type II, one brand throughout the duration of the contract, conforming to ASTM C387 for high strength mortars, cementitious infill will have a minimum 28 day compressive strength of 5000psi.

2.5 FABRICATION

A. Fabricate geomembrane liner panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming.

2.6 SOURCE QUALITY CONTROL

A. See Construction Quality Assurance Plan.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per manufacturers recommended installation procedures.

B. Examine substrates, with Installer present, for compliance with requirements for soil compaction and grading; for subgrade free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and for other conditions affecting performance of geomembrane liner.

C. Examine perimeter anchor trench, where geomembrane liner will be secured, for substrate conditions indicated above and for correct location and configuration.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Provide temporary ballast, until edges are permanently secured, that does not damage geomembrane liner or substrate, to prevent uplift of geomembrane liner in areas with prevailing winds.

F. Prepare surfaces of construction penetrating through geomembrane liner according to geomembrane liner manufacturer's written instructions.

G. Place geomembrane liner over prepared surfaces to ensure minimum handling. Install according to Shop Drawings and in compliance with geomembrane liner manufacturer's written instructions. Begin placing geomembrane liner at Project's upwind direction and proceed downwind. Install geomembrane liner in a relaxed condition, free from stress and with minimum wrinkles, and in full contact with subgrade. Do not bridge over voids or low areas in the subgrade. Fit closely and seal around inlets, outlets, and other projections through geomembrane liner. Permanently secure edges.

H. Install battens and/or flashing on required footings and/or utility/power poles.

I. Field Seams: Comply with geomembrane liner manufacturer's written instructions.

J. Installation in Anchor Trench: Install geomembrane liner in trench according to manufacturer's written instructions. Backfill and compact to lock liner into trench.

K. Protect installed geomembrane liner according to manufacturer's written instructions. Repair or replace areas of geomembrane liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.

L. Before initial placement of turf cover, inspect seams and patched areas to ensure tight, continuously bonded installation. Repair damaged geomembrane and seams and re-inspect repaired work.

3.2 FIELD QUALITY CONTROL

A. See Construction Quality Assurance Plan.

END OF SECTION 02800

SECTION 02821 CHAIN-LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes chain-link fences and swing gates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each polymer-coated product and for each color and texture specified, in 6-inch lengths for components and on full-sized units for accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence and gate, from manufacturer.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: Seven (7) feet plus embedment length into the ground.

2. Steel Wire Fabric: Wire with a diameter of 9 gauge steel wire.

a. Mesh Size: 1 inch

b. Aluminum-Coated Fabric: ASTM A 491, Type II aluminum coating of 0.4 oz/sf

3. Selvage: Twisted top and knuckled bottom.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: Seven (7) feet.

2. Heavy Industrial Strength: Material, post shall be made of Allied SS-40 or Wheatland WT-40, sized as follows

a. Line Post: 2.375" OD

b. End, Corner and Pull Post: 4.00" OD

3. Horizontal Framework Members: Intermediate, top and bottom rails complying with ASTM F 1043.

4. Brace Rails: Comply with ASTM F 1043.

5. Metallic Coating for Steel Framing:

a. Type A zinc coating.

2.3 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type I, aluminum coated (aluminized).

2.4 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and double swing gate types.

1. Gate Fabric Height: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.

C. Frame Corner Construction: Assembled with corner fittings.

D. Hardware:

1. Hinges: 180-degree outward swing.

2. Latches for drive gates shall be Pioneer Latch Model No. 2507 as manufactured by Merchant Metals, Minneapolis, MN

2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Barbed Wire Arms: Pressed steel, with clips, slots, or other means for attaching strands of barbed wire, integral with post cap; for each post unless otherwise indicated, and as follows:

1. Provide line posts with arms that accommodate top rail or tension wire.

2. Provide corner arms at fence corner posts.

3. Type I, single slanted arm.

C. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./ sq. ft. zinc.

2.6 BARBED WIRE

A. Steel Barbed Wire: Shall be Copperweld Steel Co. "Alumoweld" Four Point Type Light Weight (three 0.080" diameter strands)

2.7 CEMENT

A. Ultimate strength of 3,000 psi at 28 days; 5.5 sack (minimum) of cement per cubic yard; 6.5 gallons per sack of cement; ¾" maximum aggregate size/ 3%-5% air entrainment; mixed per ASTM C94.

PART 3 EXECUTION

3.1 INSTALLATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 1 inch above grade; shape and smooth to shed water.

G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

H. Line Posts: Space line posts uniformly at 96 inches o.c.

I. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. No gap shall remain between the finish grade and the fence fabric itself. Install edge of fencing fabric into the proposed grades 4-6 inches.

K. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.

L. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

M. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 02821

SECTION 02936 - SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding and mulching.

1.2 DEFINITIONS

A. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

B. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.

1. Certification of each seed mixture for grass.

B. Product certificates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

1.7 SEEDING AND MULCHING LOCATIONS

A. Seeding and mulching shall occur in all areas within the limits of disturbance outside of ClosureTurf™ limits, rock blanket limits and energy dissipator limits. These areas include but not limited to:

1. Coal Pile
2. Bottom Ash Pond
3. Eastern Fly Ash Stockpile
4. Construction Staging Area

B. Contractor shall obtain approval from Owner prior to Seeding and Mulching.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
3. Full Sun:

   a. 50 percent Tall (fine blade) Fescue – 4 lbs/1000 sf
   b. 50 percent Perennial Rye – 4 lbs/1000 sf

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 - EXECUTION

3.1 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 4 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

E. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

END OF SECTION 02936

APPENDIX A – SAFETY AND CONTRACTOR REQUIREMENTS

1.0 GENERAL CONTRACTOR SAFETY REQUIREMENTS

Contractor and their employees are responsible for their safety.

1.1 Contractor General Requirements

1.1.1 Contractor supervision and personnel shall obtain site-specific training. This will include, but not be limited to:

- Workman's Protection Assurance (WPA) / Hold Tag Equipment Lock-out
- Hot Works
- Confined Spaces
- Commissioning WPA Procedure
- Other Safety Requirements listed in this specification

> Note: Contractor employees may be barred from Ameren property for failure to comply with WPA procedures. Contract may be terminated or Contractor may lose future work for failure to enforce WPA. See the following WPA Authorization Form (Attachment A5) for sign-on access to the Ameren automated WPA system at each plant site.

1.1.2 Contractor administers appropriate disciplinary action if their employees violate Job Working Rules.

1.1.3 Contractor must hold daily job briefings.

1.1.4 All rolling equipment must be inspected prior to use.

1.1.5 Ameren reserves the right to bar any individual from Company property.

1.2 Rules to Live By (RTLB)

Rules to Live By (RTLB) is focused on activities that have the potential to produce a fatality or serious injury. While there are many hazards that can produce serious injuries, the items listed below are so significant that a single violation warrants immediate intervention by the Contractor. Actions determined to be in violation of these rules may result in permanent barring from all Ameren facilities. Ameren may conduct an independent investigation as necessary.

- Fall Protection – Failure to use proper fall protection when there is a risk of a fall that is greater than 6 feet
- WPA (Lock Out / Tag Out) – Violation of a tag, lock or tag-out device that is used for employee and contractor protection.
- Electrical Safety – Failure to follow proper procedures and wear proper personal protective equipment when working on energized equipment.
- Confined Space Entry – Failure to evaluate confined space and perform air monitoring checks prior to entry.
- Rigging / Hoisting – Walking or working under a suspended load.
- Trenching and Shoring – Entering excavation greater than 5 feet deep that has not been properly sloped or shored.

1.2.1 It is the expectation that the Contractor will enforce our RTLB program and discipline the RTLB violators. All violators will be removed immediately from the site, after which the Contractor will be required to formally submit on their letterhead a detailed report on the incident, noting internal meeting(s), additional training that was conducted, and what will be done to prevent a recurrence, prior to return of the employee.

1.2.2 Violations of other safe work practices may result in permanent barring from all Ameren Facilities.

1.2.3 Contractors will be assessed $2,000 per RTLB violation that Ameren personnel find during project. Contractor is to donate assessment to a mutually agreed-upon charity.

1.3 Safe Work Practices

1.3.1 Hard hats with bill facing forward, safety shoes and foam-lined safety glasses with side shields or wrap-around safety glasses **must be worn at all times in all locations** past the Construction Gate. Safety shoes must be compliant with ANSI Z41-1999. Safety glasses must be compliant with ANSI Z87.1-2003 or equivalent.

1.3.2 Wear a hardhat, safety glasses, leather gloves, and a welding helmet when welding.

1.3.3 Wear foam-lined safety goggles over non-safety rated prescription eyewear.

1.3.4 Foam-lined safety glasses shall be worn at all times. Contractor employees who wear prescription safety eyewear shall also have the foam-lined feature.

1.3.5 Face shields must be worn over safety glasses when grinding, chipping, jack hammering, power sawing, handling hazardous chemicals, or performing other tasks that could result in face or eye injury.

1.3.6 Wear appropriate gloves to protect hands from cuts, burns, temperature extremes, chemicals, biological agents or other hazards.

1.3.7 Wear hearing protection when performing noisy work, such as jack-hammering, or where posted.

1.3.8 Hair must be cut or contained above shoulder length and must not interfere with protective headgear.

1.3.9 Shorts, shirts without sleeves or with sleeves rolled up above the shoulder are not permitted.

1.3.10 Gas bottles must be secured to prevent tipping. Gas bottles must be capped or have a regulator installed. Oxy/acetylene bottles must be separated by at least 20-foot or a 5-foot barrier with a one-hour fire rating while in storage.

1.3.11 During welding or "burning":

- Use temporary shielding to protect personnel beside, above and below the work; free falling of sparks below a cutter/welder's feet is not allowed.
- Contain slag, sparks, etc.
- Place weld rod stubs in containers after removal from stingers, and place all other trash in appropriate containers.

1.3.12 Safety harnesses are required when working on surfaces over six (6) feet high that do not have guardrails or other fall protection. Attach lanyards and lifelines to structural members capable of supporting the load requirement (5000 lbs. anchor point).

1.3.13 On portable articulating man lifts, fall arrest is required per manufacturer's specifications. Fall arrest is not required on scissor-type man lifts unless recommended by manufacturer. The lift must be secure and stable prior to use.

1.3.14 For overhead work, rolling scaffolds and mechanical lift platforms are preferred over ladders.

1.3.15 If straight or extension ladders must be used, one worker must hold the ladder until another worker has tied the top to a substantial anchor point. Prior to working above 6 feet off the straight or extension ladder, and leaning beyond the side rails of the ladder, the worker is to don fall protection harness with lifeline, using or establishing an anchor point overhead for clip attachment.

1.3.16 If a step ladder must be used when worker's feet are on or above the fifth rung, then top of ladder must be tied to a substantial anchor or a second worker must hold ladder. When working on step ladder adjacent to and above guard/handrail where there is risk of significant fall over the rail, worker is to don fall protection harness with lifeline, using or establishing an anchor point overhead for clip attachment.

1.3.17 Daily clean-up of the work area is required. Keep stairways and aisles clear at all times. Tie extension cords, welding leads, air hoses, etc., to middle rail of the handrail and/or route overhead.

1.3.18 Barricade at least 6 feet from hole or edge if grating or handrail sections are being removed or installed.

1.3.19 Barricade below lifting/hoisting activities, including both critical and non-critical lifts.

1.3.20 All electrical junction boxes, duct panels, etc., are to be kept closed whenever possible.

1.3.21 All fuel-powered equipment such as welders, generators, compressors and power tools must be used so that the engine exhaust does not present a hazard to personnel inside the building; if this is not possible, then the equipment must be exhausted outside of the facility. Equipment near doors must be positioned so the exhaust will not enter the facility when the doors are open. In areas where fuel-powered equipment is being used, verify that carbon monoxide levels are safe by using a direct reading instrument that is capable of monitoring for carbon monoxide.

1.3.22 Plant fire hose stations and fire hydrants shall NOT be used for routine work unless specifically authorized by the Plant.

1.3.23 If the plant allows Contractor employees to use elevators, observe the following rules:

- No equipment on elevators may extend through the roof access opening.
- Transport bulk materials in freight elevators and obey the posted weight limits.
- Only tools and materials that can be carried by hand are allowed on passenger elevators.
- Contractor shall coordinate with Site Contact before any plant elevator is used to transport asbestos.
- Construction elevator (when available) is the preferred transport system for asbestos.
- All asbestos shall be double bagged before transported.
- No plant personnel other than asbestos workers shall be on elevators when asbestos is transported.

1.3.24 Qualified electricians are required to wear fire-retardant (FR) PPE when working on exposed, energized circuits. FR PPE must meet arc flash labels and be appropriate for tasks being performed.

1.3.25 Reflective safety vests must be worn by all personnel who work on or near active highways, roads, or parking lots. Vests are also required for other work that places personnel near motor vehicles such as flaggers, riggers, survey crews, etc. ANSI/ISEA 107, Class III high-visibility reflective safety vests shall be worn for maximum visibility. Ameren may require vests on other projects.

1.3.26 Ground Fault Circuit Interrupters (GFCI) shall be used to protect all 120 VAC electrical equipment including electric hand tools & cord sets. Use of 480 VAC GFCI is required when working in wet locations.

1.3.27 Adding slugs within electrical devices requires written approval by Ameren representative. Equipment rated fuses and/or circuit breakers shall not be removed and replaced with ones of different set parameters without written approval by an Ameren representative

1.3.28 Contractor shall follow safety requirements for working on elevated platforms per Elevated Platform Safety Requirements (Appendix Y).

1.3.29 We want this to be a SAFE job. YOU CAN HELP. Report all unsafe acts and conditions to your Supervisor. Consult a Contractor or Ameren Supervisor if there are any questions about work rules or safety requirements.

1.4 Other Safety Requirements

1.4.1 If outages are required, the Contractor shall coordinate with the SPOC to obtain lock-outs and releases in accordance with the Plant's WPA/Hold Card procedures and operating practices. Equipment with a WPA/Hold Card tag shall never be serviced or removed.

1.4.2 Contractors shall comply with all OSHA requirements for work in permit-required confined spaces. Contractors shall obtain information from the SPOC on the location and other pertinent information regarding confined space entry. Any entry involving both Contractor and Ameren employees shall be coordinated through the SPOC. For reference, review Appendix Z for a representative list of identified confined spaces at Ameren Energy Centers. Appendix Z shall be used as a guide and not be considered a complete list.

1.4.3 Only qualified and authorized persons shall work on energized electrical equipment as per Ameren procedure AUE-ADM-5002, Energized Equipment Electrical Safety Program. If applicable to specified work scope, the SPOC will supply a copy of AUE-ADM-5002.

Contractor shall not work on energized equipment without the express, written consent of the SPOC. In no case shall Contractor work on or near (within reach of) energized equipment without the use of appropriate insulated tools to perform the work. Violators of this policy will be subject to disciplinary action, including a minimum $10,000 fine, and up to and including termination of employment.

1.4.4 All lifting/hoisting activities near overhead, high tension power lines must include awareness of and observance of the following safe working clearances:

Minimum Clearance Distance	
Voltage (kV)	**Clearance (feet)**
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45

1.4.5 Ameren must review contractor qualifications before contractor employees may work in areas with high voltage equipment (over 600 volts).

1.4.6 Contractor shall coordinate hot work, (i.e., welding, brazing, heating and cutting), with Company personnel to assure that Ameren safety requirements are met as outlined on Hot Work Permit (Attachment A8).

1.4.6.1 Hot Work Checklist/Permit must be utilized when performing hot work such as welding, cutting, grinding, or any other activity that produces sparks. Contractor may use their own forms or Ameren's but work shall be coordinated through the SPOC.

1.4.7 Plant equipment identified with a nuclear radiation symbol (as seen below) is NOT to be serviced by unauthorized personnel):

1.4.8 All equipment on the project shall be used in accordance with Federal, State, and Local S&H requirements in addition to the manufacturer's instructions and guidelines. Equipment shall not be modified in any way for use other than what the manufacturer intended.

1.4.8.1 Any alterations must be approved by the manufacturer in writing. Only trained and authorized persons shall operate machinery or equipment.

1.4.8.2 Use hand-held power tools only for their intended purpose. Do not use tools that are broken, have dull blades, dull bits, have damaged cords, or have damaged/missing guards. Hand-held power tool switches shall not be modified by any means to maintain power without constant trigger pressure. (Ref. OSHA 29CFR1910.243.

1.4.8.3 All Grinders guards/handles must remain on grinders at all times. If a guard or handle is required to be removed because of a tight work area, a permit must be completed and maintained at work location. See Grinder Plan (Attachment A6).

1.4.9 Ameren expects that all Electrical Contractors will follow the common work practice that a check of all wires being demoed is performed to ensure that all wires are dead and de-terminated before wrecking. If wires are found live, they will be de-energized and re-verification will be made prior to wires being terminated or cut.

1.4.10 Barricade Tape

NOTE: Do not rely on barricade tape and flags to prevent a fall that is more than 6 feet.

- **When attended, install barricade tape no less than 6 feet from opening.**
- **Use fall protection if personnel are working closer than 6 feet to the opening.**
- **When unattended, cover the floor opening with a temporary cover, or temporary handrails 42 inches in height that include a mid-rail and toe board. Temporary covers must be able to support at least twice the load to which they will be subjected (including people, equipment and/or vehicle traffic).**
- **Temporary covers must be secured when installed in such a way as to prevent accidental movement by wind, traffic, or employees.**

1.4.10.1 Barricade tape must be used to warn employees about a hazard or restrict employees' access to a hazardous area. Barricade tape must have an information tag listing the responsible person, date of erection, and purpose. Barricade signs shall indicate the Contractor, reason, and expiration date/time. Remove the barricade when work is completed. See Barricade Tag (Attachment A4).

1.4.10.2 Any employee may erect barricade tape. The person responsible for the barricade tape must remove it when the hazard no longer exists.

NOTE: Any time red barricade tape is to be used, the Contractor must inform the Construction Project Lead/SPOC, who in turn will notify the Shift Supervisor.

- **Red barricade tape** shall be used to warn personnel DO NOT ENTER dangerous areas. These areas may only be entered with authorization from the person who erected the barricade.
- **Yellow and magenta barricade tape** shall be used to warn personnel DO NOT ENTER an area because radiography is creating a radiation hazard.
- **Yellow barricade tape** shall be used to warn personnel of immediate hazards that have the potential to cause injury. Areas barricaded with yellow may be entered once the hazard is identified and can be avoided.
- **Green barricade tape** shall be used to warn personnel of possible exposure to hexavalant chromium. Respiratory protection is required in these areas.

Contractors are responsible for compliance with the OSHA Regulation on Hexavalant Chromium. "Regulated Areas" shall be clearly demarcated with **Green** barricade tape with a caution tag that clearly states the hazard in the work area (e.g., "Hex Chrome Exposure – Respiratory Protection Required"). In general, regulated areas shall be established a minimum distance from the activity as described below:

1. 5 Feet – Welding on boiler tubes, steam piping and other materials that contain 2.5% chromium or less
2. 10 Feet – Welding on Stainless steel and other materials that contain more than 2.5% chromium.
3. 20 Feet and/or Visible plume – Plasma arc cutting, air arc cutting, chamfer-trodes, cut-trodes and other processes lacking sufficient air monitoring data by Ameren for the protection of our employees.

Contractors are responsible for air monitoring as required for their employee protection and validation of engineering controls. The guidelines for barricading are based on employee exposures based on collection of data by Ameren. These distances are guidelines and may be increased or decreased based on air monitoring data. Air monitoring data for each job shall be furnished to the Industrial Hygienist in the Ameren Corporate Safety Department.

- A Nuclear Radiation Sign (see Item 1.4.7 above) is used to warn unauthorized personnel not to tamper with or remove instruments or equipment.
- Flashing yellow lights may be used with barricades.
- Other barricades may be used for roadwork and for other special situations.

1.4.10.3 When determining and setting overhead load path barricade boundaries, Contractors shall include within the boundary the potential for dropping load during load swing (failed load path). All elevations affected per this potential 'failed load path' shall be barricaded.

1.4.11 Incident/Accident Reporting

1.4.11.1 In the event of incident/injury to a Contractor or Subcontractor employee, the SPOC shall be notified ASAP and a written report provided no later than 24 hours after incident/injury.

1.4.11.1.1 This notification shall include a detailed description of the accident or injury, including the names of those involved. (Incident/Accident Investigation Report (Attachment A1)) and (Witness Statement (Attachment A2)) must be utilized to provide the required notification.

1.4.11.1.2 OSHA Recordable injuries and minor injuries requiring first aid must be recorded using the First Aid Register (Attachment A3), which must be forwarded to the SPOC.

1.4.11.1.3 On Ameren Coordinated Insurance Program (ACIP) projects, copies of all first reports of injury and supporting investigation information shall be faxed to the designated claims manager and ACIP broker (see Ameren Safety Supervisor for contact numbers).

1.4.11.2 **For any serious incident or injury:**

- **First — Notify the Plant Shift Supervisor or designee immediately.** The Shift Supervisor will make the Emergency call and implement appropriate Plant Emergency Response procedures.
- **Second — Provide First Aid for the injured** as required until professional Emergency Responders arrive.
- **Third — Secure the area** to ensure safety of other personnel.
- **Fourth — Notify the SPOC** via phone, PA, radio, or in person.

1.4.11.3 The accident scene must be secured for accident investigation. Equipment or material can only be moved to prevent further injury until a review of the accident is completed.

1.4.11.4 Follow up verbal messages to the SPOC with written notifications within 24 hours as directed in Item 1.4.11.1.

1.4.12 Imminent Danger Situations

1.4.12.1 Contractor must suspend work immediately upon discovery of any situation that may, in their opinion, reasonably be expected to cause serious physical harm, illness, death, or significant environmental or equipment damage.

1.4.12.2 S&H concern(s) must be corrected, to the satisfaction of the Contractor and Company, before work may resume.

1.4.12.3 Examples of "imminent danger" situations may include, but are not limited to the following:

- Falls from elevations
- Excavations not properly sloped or shored
- Radiation hazards

- Electrocution hazards
- Injury to the public
- Unsafe operation of vehicles, machinery or heavy equipment
- Improper or non-existent WPA/Hold Card equipment lockout
- Release of hazardous substances (OSHA 40CFR Part 302) into the environment in excess of the reportable quantity
- Release of asbestos outside of containment work areas

1.4.13 Abandoned Piping and Demolishing Abandoned Piping

Ameren expects all Contractors to follow the Guidelines for Abandoned Piping and Demolishing Abandoned Piping (Attachment A20) while performing work on piping and/or utilities which are considered to be abandoned or will be abandoned in place.

1.4.14 Excavations

1.4.14.1 Contractor shall non-destructive excavate all underground construction activities, unless given approval by the SPOC to do otherwise.

1.4.14.2 High Suction Vacuum Contractors working at the Ameren site must have a vacuum relief valve located within equipment, a vacuum break at the point of operation, along with equipment that is grounded while operating.

2.0 WORKERS PROTECTION ASSURANCE PROCEDURE FOR OUTSIDE CONTRACT OR CONSTRUCTION PERSONNEL

GENERAL

It is necessary to assure the safety of outside contract personnel and Ameren personnel throughout construction of new system equipment and/or modification of existing system equipment. The following is a brief outline of procedures, to guide outside contract personnel in dealing with Ameren operating authorities to obtain Worker's Protection Assurances (WPA).

2.1 Definition

2.1.1 Worker's Protection Assurance

WPA is the name given to the process used by Ameren to ensure the safety of those who work on generation, transmission and substation equipment.

2.1.1.1 Its primary purpose is to ensure the SAFETY of the worker.

2.1.1.2 The Ameren WPA system uses a series of Tags and a Sign-On procedure.

2.1.1.3 The reliability and integrity of the WPA process relies upon all persons on the plant site understanding and honoring the WPA Tags and Sign-On procedure.

2.1.1.4 WPA is the Operating Authority's assurance to the person obtaining Worker's Protection Assurance that (see Operating Authority below):

Either 1) The equipment covered by the Worker's Protection Assurance has been completely isolated from energy sources (see Out of Service below).

Or 2) The equipment is placed in a special status requested by the person receiving the Worker's Protection Assurance (see Local Control below).

2.1.2 Types of WPA Authorities

2.1.2.1 Custody Authority

2.1.2.1.2 Custody Authority is the person responsible for and "in charge" of all of the equipment in a system or power plant (usually the Plant Manager).

2.1.2.2 Jurisdictional Authority

2.1.2.2.1 Jurisdictional Authority is the individual or group of individuals responsible for the overall direction and coordination of Ameren system equipment.

2.1.2.2.2 Jurisdictional Authority of Plant Equipment (coal pile to turbine) is the Plant Operating Supervisor.

2.1.2.2.3 Jurisdictional Authority (generator to Electrical System) is the Transmission Dispatcher / Power Dispatcher.

2.1.2.3 Functional Authority

2.1.2.3.1 Functional Authority is the individual or group of individuals who perform or direct someone else to perform detailed operations, such as switching or valving.

2.1.2.3.2 Functional Authority of Most Plant Equipment (coal pile to turbine) is the Operating Supervisor.

2.1.2.3.3 Functional Authority (Electrical System) is the Transmission Dispatcher.

In a power plant, one person, the Operating Supervisor in the Control Room, approves and issues the WPA.

2.1.2.4 Functional Agents

2.1.2.4.1 One type of Functional Agent is the Unit Operating Engineer (UOE) who creates the documentation.

2.1.2.4.2 Another type of Functional Agent is the Plant Operating Engineer (POE) who performs the work and hangs the tags.

The Plant's UOE and POE always perform the above duties – never Contractor personnel.

2.1.3 WPA Isolation Point

2.1.3.1 A WPA Isolation Point may be any of the following energy-isolating devices:

- Switch
- Circuit Breaker
- Valve
- Coupling
- Drive Belt
- Chain

2.1.4 Boundary

2.1.4.1 A Boundary is a collection of energy-isolation devices that form a "zone of protection or control" around the equipment to be serviced.

- The status of equipment within a WPA Boundary can only be changed after the Holder has Signed-Off the WPA and the WPA tag(s) have been removed.

2.2 <u>Equipment Covered By Worker's Protection Assurance</u>

2.2.1 All system equipment under the jurisdiction of an Operating Authority must be covered by Worker's Protection Assurance when it is to be worked on or tested.

2.2.2 The only equipment that can be covered by Worker's Protection Assurance is equipment under an Operating Authority's jurisdiction.

2.2.2.1 Equipment connected to energy sources but not released to the jurisdiction of an Operating Authority can only be protected by Worker's Protection Assurance on the isolating device (or devices) between the energy source and the equipment.

In this case it is only possible for the Operating Authority to assure the person receiving Worker's Protection Assurance that the particular isolating device(s) connecting the new equipment to his/her energy sources is protected and he/she cannot assure the person receiving the Worker's Protection Assurance that the equipment is completely isolated. Therefore, it is better for all new equipment to be released to the jurisdiction of an Operating Authority as soon as possible.

2.3 <u>Description and Purpose of Tags</u>

2.3.1 General Notes

2.3.1.1 When you see a WPA tag on equipment, it is telling you to stay clear of the equipment and keep hands off (violating WPA tags will result in disciplinary action up to and including termination).

2.3.1.2 Only the Functional Authority of the equipment may order tags to be placed or removed.

2.3.1.3 Tags will ordinarily be executed and attached by an Operator or his agent.

2.3.1.4 Tags, record sheets and WPA sheets will have the equipment name, etc., along with the serial number of the WPA record.

2.3.2 Function Authority's Hold Off Tag

2.3.2.1 Definition

2.3.2.1.1 The Hold Off is an inviolable order of a Functional Authority that the disconnect device(s) which it is intended to cover must not be closed (or opened in the case of valves) under any circumstances unless definitely ordered or approved by the Functional Authority and then only if the Hold Off tag is first ordered removed.

2.3.2.2 Issued to

2.3.2.2.1 Only to the Functional Authority (never to a worker).

2.3.2.3 Usage

2.3.2.3.1 The Hold Off is an Operating Authority's tool which he may choose to use any time he feels it would contribute to a safer working environment.

2.3.2.3.2 To properly isolate equipment from all sources of normal energy and tag them with Hold Off tags so the Functional Authority may issue an Out of Service or Restraint to a supervisor or workman so work on designated equipment may proceed.

2.3.2.4 Equipment Status

2.3.2.4.1 Operator must obtain the approval of, or be acting under the orders of, his Functional Authority before changing the status of, or working on any equipment bearing a Hold Off tag.

2.3.3 Worker's Hold Off Tag

2.3.3.1 Definition

The Worker's Hold Off is the method by which the Holder of a Local Control isolates equipment he is working on under the Local Control.

2.3.3.2 Workers will create their own Worker's Hold Off tag by legibly signing a blank Power Plant Hold Off Tag. If the Holder of a Local Control wants to work on the equipment, it must first be isolated from its energy supplies. The Holder would open the breaker, close the valves, etc. to isolate the equipment. The Holder must then hang a Worker's Hold Off on top of the Local Control to ensure the breaker or valves remain in the de-energized position. A Worker's Hold Off tag when placed has the same meaning as a Functional Authority's Hold Off. The Holder would need to remove the Worker's Hold Off prior to closing the breaker or opening the valves and operating the equipment.

2.3.3.3 A Worker's Hold Off can only be placed over a Local Control Tag. It cannot be placed by itself.

EXAMPLE OF HOLD OFF TAG

EXAMPLE OF WORKER'S HOLD OFF TAG

Worker's Hold Off

Worker's Hold Off tag to be placed over plant-issued Local Control

2.4 <u>Types of Worker's Protection Assurances</u>

The following types of Worker's Protection Assurances are issued during construction at power plants:

2.4.1 Out of Service (Issued under Hold Off Tag)

2.4.1.1 Definition

- The Operating Authority's assurance that the equipment designated is properly isolated from all known energy sources and is appropriately tagged so that it will remain de-energized until the Out of Service is released.

2.4.1.2 Energy Status

- Isolated from all normal sources and emergency back-up energy sources.
- This does not relieve the person obtaining the protection of the responsibility of making prescribed tests or observations to assure himself that the equipment is safe

to work on. Points of isolation and points not to be changed are tagged, where possible, and those points cannot be changed while the Out of Service is in effect. However, equipment inside the zone of protection and not tagged, may be manually operated or tested, since it is in a de-energized state.

2.4.1.3 Usage

- Maintenance, including complete removal and disassembly.

2.4.1.4 Issued to

- Supervisors or Workers when authorized by Custody Authority.

2.4.1.5 Persons Covered

- Holder and anyone working directly for or with the Holder.

2.4.1.6 Physical Location of Holder

- Does not have to remain on Plant property.

2.4.1.7 Duration

- No time limitations. Remains in effect until equipment is ready to be restored to service.

2.4.1.8 Predominance

- Unlimited number of Out of Services may be issued on a single piece of equipment by various people for various reasons. Multiple tags may be required for isolation.

2.4.2 Restraint

2.4.2.1 Definition

- The Restraint, which is issued on the Functional Authority's Hold Off, is an assurance given by the Functional Authority to the person to whom it is issued that the equipment it covers has been properly isolated from its energy sources and that normal voltage will not be applied while the Restraint is in effect.

2.4.2.2 Energy Status

- Isolated from all normal sources and emergency back-up energy sources.

2.4.2.3 Usage

- The person to whom the Restraint is issued shall have control of the application of test energy in that his/her consent must be obtained before applying external energy of any magnitude, and he/she must be informed when the test is completed. Thus, the person shall be familiar with the status of the equipment at all times, and to this extent the person shall be responsible for seeing that other persons working on equipment with that person or under that person's specific direction are protected against the application of test energy.

- The operator of the high-energy source will direct test and connections required, following established standards or procedures or in special cases, specific instructions of the Functional Authority. The operator of the high-energy test source will communicate directly with the person who has the Restraint, but the operator may at no time apply energy until the Holder of the Restraint has given the operator permission to proceed.

2.4.2.4 Issued to

- Supervisors or Workers when authorized by Custody Authority. In cases where several workers will work on the equipment tested, a qualified worker or supervisor shall be designated to act coordinator on the job, and that person shall obtain the Restraint.

2.4.2.5 Persons Covered

- Holder and anyone working directly for and with the Holder.

2.4.2.6 Physical Location of Holder

- Must remain on Plant property and in control of the job. If the Holder leaves the site of the test, he/she must remain "on-call." The Holder shall not release the Restraint until all persons are removed from the equipment and informed of the intended release.

- The performance of maintenance will be permitted simultaneously with testing on equipment, provided that adequate safety can be maintained between the two jobs.

- If electrical testing is required, the procedures set forth in the System Operating Manual under Restraint, Item 207, will be followed.

2.4.2.7 Duration

- Released before Holder goes off duty for the day.

2.4.2.8 Predominance

- Only one Restraint and no other WPA.

2.4.3 Local Control

2.4.3.1 Definition

- An authority granted to a person (other than a regular operator) that permits him/her to operate or direct operation of equipment and gives him/her the assurance that no operations will be performed on the equipment unless requested or personally approved by him/her.

2.4.3.2 Energy Status

- May or may not be de-energized. This is why different tags are used. The Functional Authority's Hold Off is not in place for this type of WPA.

2.4.3.3 Usage

- Short duration maintenance or troubleshooting.

2.4.3.4 Issued to

- Supervisors or Workers when authorized by Custody Authority. Worker must give the reason for the request. Worker must specify if equipment is to be energized or isolated for him/her.

2.4.3.5 Persons Covered

- Holder and anyone working directly for or with the Holder.

2.4.3.6 Physical Location of Holder

- Must remain on Plant property and in direct control of the job since he/she is responsible for the safety of his/her workers.

2.4.3.7 Duration

- Released before Holder goes off duty. New equipment before acceptance has no time limit.

2.4.3.8 Predominance

- Only one Local Control and no other WPA.

EXAMPLE OF LOCAL CONTROL TAG

2.4.4 Clearance

2.4.4.1 Definition

- A Clearance is the assurance to Holder that system or equipment for which it is issued has been properly isolated from its normal energy sources (including any emergency back-up energy sources) and will remain isolated as long as Clearance is in effect.

2.4.4.2 Usage

- Used whenever it is necessary to completely isolate a system or piece of equipment from its normal energy sources (including any emergency back-up energy sources) to perform the desired work.

2.4.4.3 Issued to

- Supervisors or Workers when authorized by Custody Authority.

2.4.4.4 Persons Covered

- Holder and anyone working directly for or with the Holder.

2.4.4.5 Physical Location of Holder

- Must remain on Plant property and in direct control of the job since he/she is responsible for the safety of his/her workers.

2.4.4.6 Duration

- Released before Holder goes off duty.

2.4.4.7 Predominance

- None. An unlimited number of Clearances may be issued concurrently on a system or piece of equipment. Clearances may also be issued concurrently with Out of Services.

2.5 <u>Exception</u>

2.5.1 If a person holding Worker's Protection Assurance on a piece of equipment is not available and it is necessary because of plant or system emergency to place that piece of equipment in service, the Worker's Protection Assurance can be released to the Operating Authority by a person designated by the Holder of the Worker's Protection Assurance provided that:

2.5.1.1 Every attempt has been made to contact the holder of the Worker's Protection Assurance

<u>and</u>

2.5.1.2 A thorough examination by the person releasing the equipment reveals the equipment to be in proper operating order.

3.0 COMMISSIONING JURISDICTIONAL CONTROL AND EQUIPMENT TAGGING

3.1 <u>Commissioning Team Leader, Commissioning Engineer and Specialist</u>

3.1.1 Ensure the following, once a Construction Turnover Acceptance Form is signed by commissioning team leader:

- Any activities on the turned over system not authorized by a member of the Commissioning Team will promptly cease.
- Any Construction Cards within the boundaries of the turnover are promptly removed.

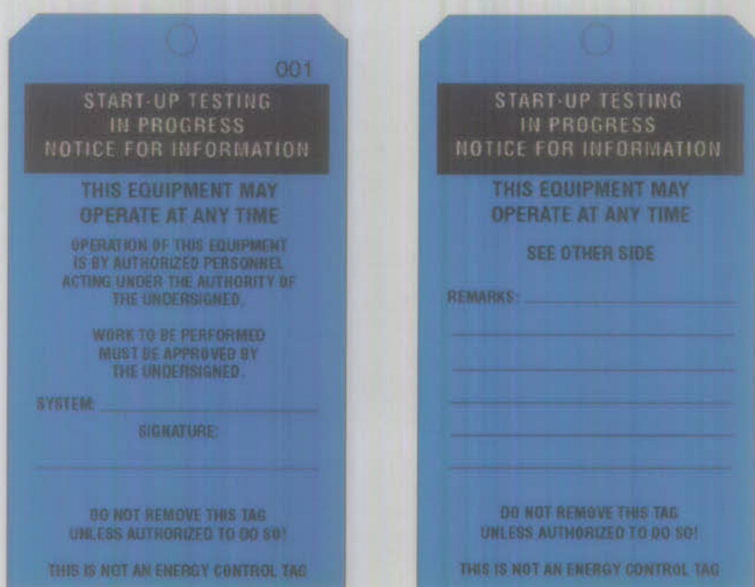
NOTE
Plant based WPA will be used if commissioning an existing system in the plant or if the new system is tied to existing plant systems. The sole WPA authority would be the control room.

3.1.2 Request "System Under Test" card or applicable WPA based on boundaries turned over to commissioning.

NOTE
In case the new system is independent of the existing plant. "System Under Test" card will be used and administered by commissioning.

3.1.3 Maintain AUE-FRM-ADM-2155-07, *System Under Test Card Log.*

3.1.4 In the event that a positive isolation device does not exist in a system being turned over, that system's boundary will be extended into the adjacent system to the first point of positive isolation.



4.0 SAFETY AND HEALTH

4.1 Contractor shall ensure worker and public safety during the course of this project.

4.1.1 Contractors must comply with all applicable Company, Federal, State, and Local health, safety and environmental regulations including, but not limited to, those concerning:

- <u>Safety & Contractor Requirements (Appendix A)</u> and <u>Job Working Rules (Appendix B)</u>
- Public and worker health and safety
- Public's "Right to Know"

- Fire safety
- Air and water quality
- Flammable materials storage
- Spill control, response and cleanup
- Hazardous and non-hazardous waste handling, identification and disposal

> NOTE: Ameren's policies and procedures applicable to Contractors are available on www.ameren.com under Business Partners Suppliers / Standard Contracts

4.1.2 Refer to Ameren's Contractor's Substance Abuse Policy AUE-07-01 (Attachment A15) for minimum substance abuse testing requirements.

4.2 Contractor must have a full-time company corporate Safety Director who oversees and maintains the site safety program and site safety person, unless waived by the Ameren Manager of Construction. This person must also be available for safety-related questions and concerns. A full-time company safety person must also be onsite for each shift for the entire duration of the project. The cost for the safety person shall be broken out in the bids. Resumés of the safety person who will be associated with the project must be submitted with the bid.

4.2.1 Ameren reserves the right to request the safety representative be removed from the project and be replaced with a more competent individual, if they are not fulfilling expectations.

4.3 With contract bid, Contractors shall submit:

- Contractor Safety & Health Data Form (Attachment A9) (unless specifically exempted from this provision by Company).
- Their company's S&H program manual

4.4 After award, Contractor shall submit:

- A project-specific S&H Action Plan, including an Emergency Response Action Plan that is in accordance with Ameren, Federal, State & Local requirements.
- At a minimum, Attachment A21 – Site-Specific Safety Plan (SSSP), shall be filled out in its entirety. The SSSP shall be submitted to Ameren for review, comment and approval. Editable version of Attachment A21 is to be supplied after issuance of PO.

4.5 At mobilization, Contractor shall:

- Appoint a competent onsite S&H representative who will coordinate Contractor S&H activities, hazardous material and waste handling. The S&H representative will work with Ameren personnel on S&H related issues, and implement S&H rules necessary for safe execution of the project.
- Supply to the SPOC the frequencies of all walkie-talkie 2-way radios they intend to use. Frequencies must be listed to four (4) decimal places. Authorization for Two-Way Radios (Attachment A14) must be submitted to the designated SPOC.

4.6 Contractor shall be responsible for tool inspection/maintenance in accordance with the requirements of OSHA standards and manufacturer's recommendations/instructions.

4.7 Handling of Materials and Waste

4.7.1 If project involves use or presence of chemicals or products that are regulated under Section 112 (r) of the Clean Air Act, Sections 302 & 304 of Emergency Planning & Community Right to Know Act, OSHA 29CFR1926.65 or 29CFR1910.120, then Contractor has the choice of adopting the plant's Health and Safety Plan (HSP) or developing a similar plan that is at least as protective and compliant

If Contractor is responsible for arranging to dispose of a hazardous or otherwise regulated waste where Ameren is identified as the generator of the waste, Company shall review, and approve or reject the waste disposal method and/or facility.

Contractor site personnel shall read and acknowledge by signature that they will comply with the applicable HSP.

Certification of individual training is required prior to hazardous waste operations as defined by OSHA 29CFR1910.120 or equivalent applicable state regulations.

4.7.2 Contractor shall identify as part of the bid, and be prepared to discuss upon award of Contract, the quantities, timetables and characterization, of wastes generated during project.

4.7.3 Contractor shall minimize amount of waste generated and shall discuss waste handling, manifest preparation, record keeping, and disposal with the SPOC in advance of these activities. Contractor should coordinate waste handling Vendors/Subcontractors with Company personnel.

4.7.4 Contractor shall handle, package, label and store wastes in accordance with Ameren, Federal, State and Local requirements.

4.7.5 Contractor shall remove such wastes from the premises in a timely manner for treatment, storage and/or disposal in full compliance with applicable laws, regulations and ordinances, including documentation requirements.

4.7.6 If Contractor is considered the sole generator of waste, then, such waste is sole responsibility of Contractor, and Ameren assumes no responsibility for Contractor's compliance with applicable regulations.

4.7.7 Contractor shall notify the SPOC before using chemical/material that could create noxious or toxic vapors/fumes.

4.7.8 For materials brought onto jobsite, Contractor shall make copies available (upon request) of the Safety Data Sheets (SDS) to the appropriate personnel on the worksite.

Contractor shall provide written notification to the SPOC of any material requiring an SDS that is brought onsite by Contractor in quantities in excess of that material's Superfund Amendments and Reauthorization Act (SARA) Threshold Planning Quantity. Such notification is required for SARA Tier II reporting purposes. Chemical of Interest Reporting (Appendix I) in this specification must be filled out and submitted to the SPOC.

4.7.9 Contractor shall ensure that hazardous chemicals or materials are properly contained, labeled and stored, and that employees are adequately trained to recognize, handle and use hazardous chemicals safely.

Small quantities (i.e., <10 gal.) of hazardous liquids, such as gasoline, diesel fuels or solvents, brought onto site shall be stored in properly labeled safety containers with flame arrestors and self-closing lids. All container labels must include contents information and display hazard symbols clearly on exterior of each container in accordance with NFPA 704M, OSHA 29CFR1910.1200 or other applicable standard.

4.8 Asbestos-Containing Material (ACM) and Lead

4.8.1 In structures built prior to 1981, thermal system insulation, sprayed-on surfacing, and vinyl or asbestos floor tile shall be presumed to be ACM.

- Non-ACM will be labeled as such or otherwise identified by the SPOC and communicated to Contractor.
- Areas containing abatement activities will have warning signs, be barricaded, and will have limited access.

4.8.2 Ameren S&H Management Instruction Asbestos Exposure Controls and Work Practices, ES-REG-203, specifies policies and procedures for contractors performing asbestos abatement work. Hardcopies may be requested from the SPOC.

Proposals for an ACM abatement project must designate:

- Scaffolding needs.
- Glove bag and containment areas, including remote decontamination areas. Remote decontamination areas require Ameren SPOC approval.
- Potable water and shower requirements and locations.
- Methods to protect scaffolding tubing from contamination after containment is removed.
- Methods to minimize non-ACM dust outside the containment areas.
- Methods to move ACM bags from containment areas to ACM receptacles.
- List of asbestos workers with copies of current training and state license.

4.8.3 Ameren S&H Lead Management Instruction, ES-REG-211, specifies policies and procedures for Contractors performing lead abatement work. Hardcopies may be requested from the SPOC.

4.9 Safety & Health Training Requirements

4.9.1 Documentation of OSHA training for Contractor craft workers and supervisors must be maintained onsite and made available to Ameren. Effective September 1, 2006, the minimum training standard is OSHA 10 for Contractor craft workers and OSHA 30 for Contractor supervisors.

4.9.2 Contractor will maintain documentation of S&H training on project and must provide requested documentation of training to Company. Contractor shall retain verification of satisfactory training for as long as required by law or six months after completion of contract, whichever is greater.

4.9.3 Job safety awareness meetings will be held with Company and applicable contractors on a frequency determined by Company. The meetings will address industrial safety issues from Contractor job safety reviews.

4.10 Safety & Health Surveys

4.10.1 The SPOC and Ameren S&H personnel will conduct periodic S&H surveys of the project. Any discrepancies will be reported to Contractor management for immediate correction.

4.10.2 These S&H surveys do not relieve Contractors of their responsibility to self-inspect their work and equipment and to conduct their work in a safe and environmentally compliant manner.

4.11 Reporting and Investigating Incidents/Accidents

4.11.1 Contractor shall make an immediate report by telephone to the SPOC of any accident involving injury, death, fire, spill, mishandling of oil, regulated/hazardous waste spill, or any other emergency.

4.11.2 In the event of an emergency, Company has authorized the Plant Shift Supervisor and the SPOC to act as emergency coordinators. Contractor shall proceed with appropriate emergency response measures as directed by Plant Shift Supervisor and the SPOC, and take full responsibility for clean-up and disposal of any wastes or materials.

4.11.3 Contractor shall indemnify Company for all related costs and liabilities.

4.11.4 Contractor shall submit a Monthly Contractor Accident Statistics Report (Attachment A10) by the second day of each month for the preceding month's activities.

4.11.5 Contractor shall investigate all types of events listed in above Item 1.4.11 Incident/Accident Reporting, whether they result in an injury or not, and provide the results of said investigation to Company. An accident investigation does not assign blame; it does determine how to eliminate similar accidents in the future. Company reserves the right to monitor Contractor's investigation, and Contractor shall provide the SPOC with all necessary information to all required Company personnel to perform this monitoring function.

4.11.6 Ameren reserves the right to investigate any accidents that occur on its property or in completing work being performed by a Contractor's employee whether they result in an injury or not. Ameren will conduct further investigations for accidental environmental releases or spills, etc.

4.11.7 A signed Witness Statement (Attachment A2) must be completed by each witness providing factual observations.

4.11.8 An Incident/Accident Investigation Report (Attachment A1) must be submitted to the SPOC within 24 hours to document the investigation. Accident facts, causes, and corrective action shall be documented and communicated to employees through S&H meetings.

4.12 Certifications, Inspections, and Permits

4.12.1 Operations may require a Company permit. Such activities may include but are not limited to: hot work, confined space/vessel entry, excavations, asbestos abatement, lead abatement, etc. Contractor shall determine from the SPOC if any of Contractor's activities require a Company permit or Contractor permit.

4.12.2 Some states and local authorities require permits for activities such as: excavations, heavy lifts, asbestos/lead abatement, air permits, water permits, hazardous waste generation, etc.

4.12.3 Contractors shall be responsible to secure and comply with these permits, unless the SPOC has delegated this to others in writing.

4.12.4 A third-party-certified Competent Person shall make a thorough annual inspection of cranes and powered hoisting equipment. Cranes shall be inspected and have deficiencies corrected prior to being put into service. Documentation of crane inspections must be maintained onsite by Contractor.

- Crane hooks shall be inspected by a Competent Person prior to use. Rigging shall be inspected by a Competent Person before each shift. Defective components shall be removed from service immediately. Anti-Two-Block devices, that automatically disengage crane hoist/boom functions when the hook or block approaches the jib or boom tip, shall be used on all cranes.
- All outriggers on mobile cranes must be fully extended and fully deployed when crane is used to lift or support a load.
- If, due to configuration or physical location, all outriggers cannot be fully deployed, calculations must be made from the "on-rubber" section of the load chart. A certified crane specialist must have written calculations and lift instructions reviewed by Ameren. The SPOC may make an exception for light-weight, lift-and-carry operations.

4.12.5 Operators of forklifts, boom lifts, buses, and other mobile equipment must be trained and certified on the operation of the specific equipment.

4.12.6 Operators of cranes must be trained and certified by National Commission for Certification of Crane Operators (CCO), or Operating Engineers Certification Program (OECP). Crane operators must be qualified on each crane type and rating they operate.

4.12.7 Operators of cranes are responsible for completing the Crane Maintenance Safety Checklist (Attachment A16).

4.12.8 Operators of cranes are responsible for providing documentation to Ameren SPOC of required OSHA crane inspections.

4.12.9 Cranes shall not be used to hoist employees without Ameren SPOC approval. Cranes should not be used to hoist personnel except where the Contractor can demonstrate that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairways, aerial lift, elevating platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions.

4.12.10 A Competent Person shall design and a Competent Person shall erect scaffolding. Only the authorized scaffolding erector can make changes to scaffolding.

4.12.11 A Competent Person must inspect and tag scaffolding prior to initial use, before each work shift, and after any event that could affect its structural integrity. Untagged scaffolds must not be used.

4.13 Critical Lifts

4.13.1 Critical Determination

Contractor shall submit a Critical Lift Plan for any critical lift. Ameren reserves the right to designate any lift as critical. A lift shall be designated as a critical lift if any one of the following conditions exists:

4.13.1.1 Lifting over 50 tons.

4.13.1.2 Lift exceeds 75% of the rated capacity of the crane.

4.13.1.3 Lift requires the use of more than one crane.

4.13.1.3.1 In no case shall a multiple crane lift be performed in excess of 75% of any one of the crane's individual load rated capacity at the planned radius.

4.13.1.4 Lifting a non-rigid object.

4.13.1.5 Lifting over equipment or material that could cause or result in a release of hazardous material to the environment.

4.13.1.6 The lifted item requires exceptional care in handling because it is being lifted above critical operating equipment or material and/or building structure.

4.13.1.7 The lifted item requires exceptional care in handling because of size, weight, close-tolerance installation, high susceptibility to damage or other unusual factor.

4.13.1.8 Lift performed in proximity of live electrical connections.

4.13.1.9 Lifting of personnel in baskets and/or personnel harnesses. This shall be conducted in accordance with OSHA Standard 29CFR 1926.1431.

4.13.1.10 Lifting of equipment by helicopter.

Any lifts proposed by the contractor that meet the above criteria or determined to be critical by the Project Engineer will be subject to a Critical Lift Plan. Examples of lifts that are generally considered critical are: boiler tube panels, feedwater heaters, conveyor systems, coolers and pump skids, turbines and generators.

4.13.2 Critical Lift Plan

Contractor shall provide a detailed lifting and rigging plan for all lifts identified as critical. All critical lifts will require a Professional Engineer's seal. Prior to executing lift, lift plans must be submitted to the Project Engineer, reviewed and accepted by a structural engineer in the POS Civil/Structural Group. Ameren will review submittals for general design features. Contractor is responsible for accuracy of calculations. Also prior to executing lift, any changes made in the field to the approved lift plan must be approved by the contractor's engineer and accepted by the Ameren POS Project and Structural engineers. A copy of the lift plan must be onsite during the lift and must have been reviewed with all personnel involved with the lift, including the Ameren Construction Supervisor. Ameren's Construction Supervisor shall be provided sufficient notice to allow him/her to witness the critical lift. A critical lift plan shall contain the following, as applicable:

4.13.2.1 Identify the items to be lifted.

4.13.2.2 Weight of the lifted item and total weight of the load (for mobile cranes, see the manufacturer's instructions regarding components and attachments that must be considered as part of the load).

4.13.2.3 Center of gravity location.

4.13.2.4 Documented step-by-step instructions.

4.13.2.5 Special precautions, if any (such as outrigger or track cribbing for mobile cranes).

4.13.2.6 Evaluation of hazards associated with the lift that include ground support, soil conditions, allowable soil bearing capacity, underground utilities that could be damaged or suddenly collapse, maximum permissible wind speed and any other physical obstruction.

4.13.2.7 A list of each piece of equipment (e.g., crane, hoist, fork truck), accessory, and rigging component (e.g., slings, shackles, spreader bars, yokes) to be used for the lift. (This list shall identify each piece of equipment by type and rated capacity).

4.13.2.8 Designated checkpoints, hold points and estimated instrument readings, as relevant, so that job progress can be checked against the plan.

4.13.2.9 Rigging sketch(es), which include the following:

4.13.2.9.1 Lift point identification

4.13.2.9.2 Method(s) of attachment

4.13.2.9.3 Load vectors

4.13.2.9.4 Sling angles

4.13.2.9.5 Accessories used

4.13.2.9.6 Other factors affecting the equipment capacity

4.13.2.9.7 Rated capacity of equipment in the configuration(s) in which it will be used. (For cranes, many factors affect rated capacity, including boom length, boom angle and work area.)

4.13.2.9.8 Percentage of the total weight of the lift to the rated capacity of the equipment in the configuration(s) in which it will be used (see above). Ameren best practices recommend limiting this percentage to less than 90% and shall not exceed 95%.

4.13.2.9.9 If rigging points are attached to existing structural steel, it is the responsibility of the contractor's engineer to confirm that the additional loads do not overstress the existing structure, and to design additional bracing/reinforcement if required. Supporting calculations sealed by a Missouri Professional Engineer shall be included with the critical lift plan.

4.13.2.10 A load-path sketch that shows the load path and height at key points in the job. (For lifts with mobile cranes, include the crane position(s) relative to the load and relative to surrounding obstructions.) Where appropriate, include floor-loading diagrams.

4.13.2.11 A sketch indicating lifting and travel speed limitations. (This may be noted on the load path sketch or on a separate sketch.)

4.13.2.12 A sign-off sheet to verify that all inspections/tests required by OSHA are current for all equipment and rigging.

4.13.2.13 The lift plan shall provide specific information for each lift when multiple items of varying weights and/or shapes are included in the lift plan unless an exception is approved by the Ameren structural engineer.

4.13.2.14 With their bid proposal, Contractors shall submit a normal weather lay-down plan for each onsite lattice crane, wherein contractors specifically outline the manner in which the crane will be stored in normal weather conditions.

4.13.2.15 With their bid proposal, Contractors shall submit a severe weather lay-down plan for each onsite lattice crane, wherein contractors specifically outline the manner in which the crane will be stored in severe weather conditions.

4.13.2.16 Before construction begins, the selected Contractor shall meet with Ameren representatives and shall outline the means and methods of the Contractor's crane execution plan for each lattice crane expected to be utilized onsite. Execution plan shall include specifics about transition from normal to severe weather crane lay-down plans and critical wind speed for crane position. Cranes shall not be allowed onsite until after the crane execution plan(s) have been reviewed and approved by Ameren representatives.

4.13.2.17 Crane loading shall typically be based on 2,000 pounds per square foot ground pressure, unless known ground conditions dictate/allow otherwise. Ameren representatives shall review and approve planned crane ground loading.

4.13.2.18 When determining and setting load path barricade boundaries, Contractors shall include within the boundary the potential for dropping load during load swing (failed load path). All elevations affected per this potential 'failed load path' shall be barricaded.

4.14 Respiratory Protection

4.14.2 Contractors must provide a copy of their Respiratory Protection Program to the SPOC before they use respirators. The program must comply current Ameren, Federal, State and local requirements including OSHA 29CFR1910.134. The program must properly address the following:

- Respirator selection
- Respirator training and required test fit procedures
- Respirator cleaning, sanitizing, inspection and maintenance
- Respirator user's medical clearance
- Chemical cartridge change-out schedule when applicable.

4.15 S&H Adherence Policy

4.15.2 **Action Level One** – The SPOC will issue a written Notice of S&H Non-Compliance (Attachment A11) and Warning Letter for S&H Non-Compliance (Attachment A12) to Contractor's management and site S&H representative if Contractor fails to comply with an applicable S&H standard.

4.15.3 **Action Level Two** – The SPOC will issue a Written Notice of Temporary Job Suspension (Attachment A13) to Contractor if S&H non-compliance is not corrected by Action Level One, or if Contractor repeatedly fails to comply with applicable S&H regulations. The appropriate Ameren Manager and Contractor's Division Manager, or equivalent, must meet and agree on corrective actions acceptable to Company before Work may resume. Actions may include, but are not limited to:

- Removal of certain Contractor personnel from project.
- Alteration of Contractor's job procedures.
- Having Ameren implement corrective action and backcharge Contractor.

Contractor shall not resume Work until Ameren accepts the proposed corrective actions. Ameren will retain meeting minutes documenting the agreement.

4.15.4 **Action Level Three** – Ameren Management may terminate the contract for cause, if **Action Level One** and **Action Level Two** do not result in Contractor's S&H compliance.

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ATTACHMENT A1

INCIDENT/ACCIDENT INVESTIGATION REPORT

Date of Accident: ________ Time of Accident: ________ Job Number: ________

Contractor Company Name: ________ Date of Investigation: ________

Location of Accident: ________

Did injury result? Yes/No,: ________ Involved Employee Name(s): ________
Involved Employee SS Number ________

Employee Job Classification or Skill: ________ Years In this Skill: ________ Years With Company: ________

Describe Type of Injury: ________

Body Part(s) Involved, If applicable: ________

Injury Classification per OSHA 29CFR1904: ________

Was property damaged? Yes/No ________ Describe damage/owner: ________

Is damaged property secured/maintained? Yes/No ________ Person Maintaining ________

Names of Witnesses/Co-workers (With Social Security No.): ________

Weather/Wind Conditions: ________

List/Describe personal Protective Equipment (PPE) in use by person exposed or injured.

____

Chemicals Involved:

Name(s) of Chemicals Encountered: ________

____

Form of Chemicals (Solids, Liquid, Dust, Mist Fume): ________

Describe Radiological Materials (if any): ________

Volume or Quantity Released: ________

Description of Accident: ________

____

____

____

(continued on next page)

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INCIDENT/ACCIDENT INVESTIGATION REPORT (continued)

Contributing Factors: ______________________________

What **Corrective Actions** Were Taken to Secure the Scene? ______________________________

Corrective Actions Being Taken to Prevent Recurrence:

Action Item:	List Responsible Person & Target Date for Implementation Name:	Date:

Job being performed at time of incident/accident: ______________________________

Was permit required for task being performed? Yes/No ________

If so, was permit issued? Yes/No ________ If yes, attach a copy of permit in effect at time of accident.

Indirect cause of accident: ________ ________ ________

Investigation Team Members:

Injured/Involved:	Name	Signature
Supervisor:	Name	Signature
Ameren SPOC	Name	Signature
S&H Representative	Name	Signature
Name (Others)	Title	Signature
Name (Others)	Title	Signature

Contractor Representative(s) Contacted: ______________________________

Ameren Representative(s) Contacted: ______________________________

*Attach additional sheets and supplemental data & information as necessary.

**Distribution: Original must be filed on-site; 1 copy must be sent promptly to the Corporate S&H Dept.
Must Notify: CCMI and Huntleigh McGehee

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ATTACHMENT A2

WITNESS STATEMENT

Name: ______________________ Title: ______________________

Social Security Number: ______________________ Date: __________ Time: __________

Temporary Address: ______________________ Phone: ______________________

____

Permanent Address: ______________________ Phone: ______________________

____

Location at Time of Accident: ____

Your statement shall include, to the best of your knowledge, detailed facts relative to the following five categories:

1. What happened just before, during, and just after the incident?
2. When did it happen?
3. Where did it happen?
4. Why do you think it happened?
5. Who was involved?

____
Signature

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ATTACHMENT A3

FIRST AID REGISTER

Company: ____________ Project Name /Number: ____________ Jobsite Location: ____________

Month /Year: ____________ Site Manager: ____________ Page: ______ of ______

Date	Time	Name	Supervisor/Foreman	Type of Injury, Body Part, and Brief Description of Accident	*Class

***Class** = Classification **FAV** = First Aid Visit **E1**= Doctor's Visit **REC** – OSHA Recordable **Other**:

ATTACHMENT A4

BARRICADE TAG

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ATTACHMENT A5

CONSTRUCTION WORKER'S PROTECTION ASSURANCE AUTHORIZATION

Date: ____________

Operating Supervisor: ______________________

The following person(s) has authorization to receive W.P.A.: ______________________

Project Name: ______________________

Company Name: ______________________

Company Address: ______________________

Name	Title	Office	Cell	Home	E-Mail

	Beginning		Ending	
	Date	Time	Date	Time
Expected Duration:				

Training is Required for Automated WPA System.

____
Plant Manager or Designee

(Designee: Admin. Supt., Operations Supt., Maintenance Supt., Planning/Scheduling, or Operations Supv. {Watch})

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ATTACHMENT A6

GRINDER SAFETY PLAN

Grinder Guard and Handle Removal PRE-PLAN

Date:	**Job #:**
Customer/Site:	**Location of Work/Unit:**
Description of Task:	**Equipment Identification:**

SCOPE OF WORK AND SCHEDULE (Please list complete description of task)

HAZARD ASSESSMENT TO DETERMINE ALTERNATE TOOL

procedures require a pre-plan whenever personnel remove the guard and handle on a grinder.

Reason:

- Grinding wheel cannot access point of work with guard and handle attached due to narrow gap for welding.

Alternate Methods to Removing Guard and/or Handle:

- Rotary file and die grinder?
- Conical grind stone and pole grinder?
- Other?

SAFETY PRECAUTIONS

- ☐ Cutting wheel CANNOT be used while guard and handle are detached.
- ☐ Grinder must be unplugged when removing guard and handle and when re-attaching.
- ☐ Guard and handle are only to be removed for this specific point of work. All other grinding in the work area must have safety devices attached.
- ☐ Pre-plan will only apply until the weld depth improves to allow for standard grinding operation, i.e. all safety devices attached.
- ☐ Wear face shield and sealed eyewear.
- ☐ Maintain control of grinder at all times, use two hands when operating the grinder.
- ☐ Keep hands/fingers clear of upper portion of the grinder near the wheel.
- ☐ Be aware of body positioning.

AFFECTED PERSONNEL INVOLVED IN WORK MUST READ AND SIGN THIS PRE-PLAN

PRE-PLAN REVIEW SIGN-IN

Employee Classification/Craft	Name (Print)	Signature	Date
1.			
2.			
3.			
4.			
Supervisor/Foreman			
Safety Representative			

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ATTACHMENT A7

CONTRACTOR REDUCTION IN FORCE REPORT

Contractor Name:	
Contractor Supervisor:	
Date Submitted:	
Time Submitted:	

Name of Employee (Please Print)	Badge #	Date of Reduction	Time of Reduction

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ATTACHMENT A8

POWER OPERATIONS HOT WORK CHECKLIST *(EXAMPLE)*

1. DESCRIPTION – JR# ____________________

Location ____________________ Elevation __________

Work to be done: Welding _____ Brazing _____ Open Flame Cutting / Heating _____

Equipment ____________________

NOTE: Before authorizing welding, cutting, heating, and brazing, this checklist must be completed.

2. PRE-WORK INSPECTION

Hot Work shall not be performed in the following situations:

a. In areas not authorized by Management.

b. In sprinklered buildings while such protection is impaired, unless authorized by Management.

c. In the presence of explosive atmospheres or explosive atmospheres that may develop inside unclean or improperly prepared tanks, pipes or equipment.

d. In areas near the storage of large quantities of exposed, readily ignitable materials.

Prior to welding, cutting heating, and brazing (W/C/H/B), you shall perform these basic precautions:

a. Move the object to be W/C/H/B to an area free of hazards.

b. If the object to be W/C/H/B cannot readily be moved, then you shall remove all movable fire hazards within the vicinity to a safe place.

c. If the object to be W/C/H/B cannot be moved and if all the fire hazards within 35 feet cannot be removed (including cable trays), then, immovable fire hazards shall be shielded and a fire watch provided.

IF THESE BASIC PRECAUTIONS ARE NOT FOLLOWED, WELDING, CUTTING HEATING AND BRAZING SHALL NOT BE PERFORMED. COMPLETE CHECK LIST.

3. ADDITIONAL FIRE WATCH PROVISIONS

N/A	YES	NO		
			a.	Can more than a minor fire develop?
			b.	Are combustible materials closer than 35-ft. to the point of operations?
			c.	Are combustible materials more than 35-ft. but easily ignitable by sparks?
			d.	Do wall or floor openings with a 35-ft. radius expose combustible materials in adjacent areas, including concealed spaces in walls or floors?
			e.	Are combustible materials adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are they likely to be ignited by conduction or radiation?

NOTE: If you answered yes to any of the above, a fire watch is required. Complete checklist. All of the following conditions must be met, if applicable.

(continued on next page)

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4. PRECAUTIONS

N/A	YES	NO		
			a.	A fire watch will be provided during and for 30 minutes following welding, cutting, heating and brazing.
			b.	The fire watch shall be supplied with a proper portable fire extinguisher in addition to installed operable plant equipment.
			c.	Cutting and welding equipment is in good condition.
			d.	Combustible materials are protected with covers, guards, or metal shields, or material is removed prior to start of work.
			e.	Nearby workers are suitably protected against heat, sparks, slag and flash.
			f.	Wall or floor openings are covered or enclosures provided. For elevated work, covers are suspended beneath to collect sparks or area below is free of combustibles.
			g.	Enclosed equipment is cleaned of all combustible material and purged of flammable vapors.
			h.	Ducts and /or conveyors are suitably protected or shutdown.
			i.	For work near walls, partitions, ceiling or roofs, proper precautions have been taken to prevent ignition of combustibles inside the barrier of adjacent areas.
			j.	For work on pipes or other metal in contact with combustible walls, partitions, ceilings, or roofs, precautions have been taken to prevent ignition by conduction of heat.
			k.	Other

PRE-WORK INSPECTION

Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________

POST-WORK INSPECTION

Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________
Supervisors Initials ________ Date ________ Time ________

DEFINITIONS

1. Combustible Material: Any material that, if in the form and under the conditions used, could ignite and burn.

2. Minor Fire: A fire which, if no action is taken to extinguish it, will self-extinguish (burn out), will not propagate (spread to other materials through the continuity of combustibles), and will not damage any permanent plant equipment.

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ATTACHMENT A9

CONTRACTOR SAFETY & HEALTH DATA FORM

1. S&H PERFORMANCE HISTORY

A. Interstate or Intrastate Worker's Compensation Experience Modification Rate (EMR), as shown on Workers Compensation Insurance Policy for three most recent years.

Year	EMR	*WH/CL

*If self-insured, provide employee Work Hours per Claim. (WH/CL)

THE FOLLOWING DATA FOR LAST THREE (3) YEARS FROM CONTRACTOR'S OSHA LOG

		Year		
B-1.	Employee hours worked			
B-2.	Fatalities (Column G of OSHA 300 log). Attach explanation for any fatalities.			
B-3.	Cases involving days away from work (Column H of the OSHA 300 Log)			
B-4.	Job transfer or restricted duty cases (Column J of OSHA 300 log)			
B-5.	Cases defined as other recordable cases (Column J of OSHA 300 Log)			
B-6.	Total # of cases for B-2, 3, 4 & 5 above.			
B-7.	"OSHA Incidence Rate" – Formula: $\frac{\text{Total Recordable Cases x 200,000}}{\text{Total \# of work hours.}}$			
B-8.	Citations by OSHA and/or other S&H regulatory agencies in past 3 years (provide details of each)			
C-1.	Motor vehicle accidents.			
C-2	Miles driven per year, total fleet.			

(continued on next page)

		Yes	No
2.	Do you have a written hazard communication program?	☐	☐
	Do you have a written S&H program?	☐	☐
	Do you have a written company substance abuse program?	☐	☐
	Do you have a written respiratory protection program?	☐	☐
3.	Do you have one or more full time:		
	A. Physicians	☐	☐
	B. S&H Professionals	☐	☐
	C. Industrial Hygienists	☐	☐
4.	Do you have a new employee orientation program?	☐	☐
	I it include the following?		
	A. Company S&H Policy	☐	☐
	B. Company S&H Rules	☐	☐
	C. S&H Meeting Attendance	☐	☐
	D. Company S&H Record	☐	☐
	E. Hazard Recognition	☐	☐
	F. Hazard Reporting	☐	☐
	G. Injury Reporting	☐	☐
	H. Personnel Protective Equipment	☐	☐
	I. Respiratory Protection	☐	☐
	J. Fire Protection	☐	☐
	K. Housekeeping	☐	☐
	L. Toxic Substances	☐	☐
	M. Electrical Safety	☐	☐
	N. Safety Harnesses and Lifelines	☐	☐
	O. First Aid	☐	☐
	P. Driving Safety	☐	☐
	Q. Lockout/Tagout	☐	☐
	R. Ladder/Stairway Safety	☐	☐
	S. Hearing Conservation	☐	☐
	T. Trenching and Excavation	☐	☐
	U. Asbestos Awareness	☐	☐
	V. Lead Awareness	☐	☐
5.	Do you have a training program for newly hired or promoted first line supervisors?	☐	☐
	I it include the following?		
	A. Hazard Recognition	☐	☐
	B. Safe Work Practices	☐	☐
	C. S&H Supervision	☐	☐
	D. New Employee Orientation	☐	☐
	E. Tailgate/Toolbox S&H Meetings	☐	☐
	F. First Aid Procedures	☐	☐
	G. Emergency Procedures	☐	☐
	H. Incident Reporting	☐	☐
	I. Accident Investigation	☐	☐

(continued on next page)

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6. How often do you hold periodic S&H meetings for your foremen/supervisors?

A. Weekly ☐ C. Bi-Weekly ☐

B. Monthly ☐ D. Less Often, As Needed ☐

7. Do you conduct field S&H inspection of work in progress? Yes ☐ No ☐

A. If yes, who conducts the inspection? ______________________

B. How often? ______________________

	Yes	No
8. Are accident reports circulated to your management?	☐	☐
9. Is S&H a (documented) weighted factor in evaluating the performance of:		
A. Foreman	☐	☐
B. Supervisor	☐	☐
C. Management	☐	☐
10. Does your firm hold "Toolbox S&H Meetings?	☐	☐

How often?

A. Weekly ☐

B. Bi-Weekly ☐

C. Monthly ☐

D. Less Often, As Needed ☐

11. List the most senior staff S&H professional at your company.

Name: ______________ Title: ______________ Phone: ______________

12. List the person to contact to discuss the details of the information contained in this document.

Name: ______________ Title: ______________ Phone: ______________

ATTACHMENT A10

MONTHLY CONTRACTOR ACCIDENT STATISTICS REPORT

Month: __________ Project Name: ______________________________

Contractor Name: ______________________________

Work hours for the month: __________ Work hours year-to-date: __________

Number of First Aid only cases: __________

Number of injuries & illnesses that received treatment by a physician: __________

Total number of OSHA Recordable injuries & illnesses for the month: __________

Number of restricted duty cases: __________ Number of lost time (days away) cases: __________

Number of motor vehicle accidents: __________ Number of miles driven: __________

Please list injuries and illnesses, which have occurred to employees of your company on the above project this month. Include accident cause, injury/illness suffered and current disposition of injured/ill employee (i.e., returned to work, still off work, awaiting surgery, etc.):

Person completing report: ____________________ Title: ____________________

Date: __________ Signature: ______________________________

Please submit this report to the SPOC on above project by the second business day of each month, for the preceding month's work activities.

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ATTACHMENT A11

NOTICE OF SAFETY & HEALTH NON-COMPLIANCE

To: ______________________ Site Representative for: ______________________

Your company has been found to be in non-compliance with one or more Federal, State, or Ameren S&H requirements as specified below. This S&H con-compliance must be corrected immediately for your company to meet the requirements of your contract.

Item # Item of non-compliance

Applicable S&H Requirement

Applicable S&H Requirement

Applicable S&H Requirement

Issued By: ______________________ ______________
Signature of the SPOC Date

Received By: ______________________ ______________
Signature of Representative Receiving Notice Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Plant Outage Manager

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ATTACHMENT A12

WARNING LETTER OF SAFETY & HEALTH NON-COMPLIANCE

Project Name and Number ______________________________

Your firm, ______________________________, has been found to be in violation of your contract by non-compliance with applicable Federal, State, or Ameren S&H requirements.

On ______________________________ , in accordance with the Ameren S&H Adherence Policy, your representative, ______________________ , was given a Notice of S&H Non-Compliance (copy attached). This notice specifies areas where your company does not comply with Federal, State, or Ameren S&H requirements, and requests that these items be corrected immediately. If they are not corrected, more stringent measures will be taken in accordance with Ameren S&H Adherence Policy.

Thank you for your prompt attention to this matter.

____
Signature of the SPOC

____
Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Plant Outage Manager

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ATTACHMENT A13

WRITTEN NOTICE OF TEMPORARY JOB SUSPENSION

Your company, ______________________________, while working on the ______________________________ project, has been notified of S&H performance deficiencies in accordance with Ameren's S&H Policy. Despite these written notifications requesting that immediate corrective action be taken to improve your S&H performance, improvement has not occurred.

Therefore, in accordance with Action Level Two of the Ameren S&H Adherence Policy, we are hereby notifying you that after securing your equipment, job activities on the project named above are to cease. Activities on this project may be resumed only after your company meets requirements set forth in the Ameren Adherence Policy.

Signature of the SPOC	Time	Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Plant Outage Manager

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ATTACHMENT A14
AUTHORIZATION FOR CONTRACTOR TWO-WAY RADIOS

AUTHORIZATION FOR CONTRACTOR TWO-WAY RADIOS (SAMPLE)

All frequencies must NOT fall between the two ranges of frequencies:

463.5500 to 463.5700 MHz (Plant-Specific)

464.5500 to 464.5700 MHz (Plant-Specific)

- When reporting the frequency, you must include digits four places past the decimal point (e.g., 123.4567).
- If a repeater is being used, you must report both transmit and receive frequencies.
- If no repeater is being used, receive and transmit frequencies will be the same.
- You must submit all frequencies to be used.

CONTRACTOR	
CONTRACTOR REPRESENTATIVE	Print Name
RADIO MANUFACTURER OR MAKE	
HOW MANY CHANNELS BEING USED?	
FCC License "Call Sign" e.g. WPUP269	

CHANNEL		RECEIVE FREQ (MHz)	TRANSMIT FREQ (MHz)
1			
2			
3			
4			
5			
6			
7			
8			

Ameren SPOC: ______________________ Contractor Rep: ______________________

Date: ________________ Date: ________________

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ATTACHMENT A15
CONTRACTOR'S SUBSTANCE ABUSE POLICY
Policy No. AUE-POL-000001, Rev. 0

1.0 INTRODUCTION

1.1 In an effort to provide a drug- and alcohol-free workplace, Ameren establishes the following policy for Contractors:

2.0 SCOPE

2.1 Working on an Ameren work site and being under the influence of drugs or alcohol creates safety risks for all personnel who work on our work sites.

2.2 The term Contractor refers to all non-Ameren personnel hired to perform a service for Ameren who will be on Ameren property and includes all Contractors, their subcontractors and all other non-Ameren persons who are employed by them with active badges for site access. Visitors and delivery drivers are excluded from these requirements.

2.3 This Policy supersedes GP-06-01, Contractor Substance Abuse Policy.

3.0 IMPLEMENTATION

3.1 Contractors shall establish and maintain a confidential drug and alcohol testing program for each of their employees assigned to work on Ameren property, which shall meet the following minimum requirements.

3.1.1 All employees of a Contractor who are assigned to an Ameren site shall be subject to Contractor's drug and alcohol testing program. Contractor's program shall prohibit employees from buying, selling, consuming, or distributing alcohol or drugs while working for Ameren or while on Ameren property. The program shall also prohibit Contractor employees from reporting to an Ameren site or being on Ameren property while under the influence of alcohol or drugs.

3.1.1.1 Contractor's program shall provide for drug testing for substances listed in Section 3.1.4 of this Policy under the following circumstances: pre-assignment testing; random testing; testing for reasonable cause based on observations by Ameren or Contractor supervisor; and testing after any accident or incident that involves injury to personnel or damage to property.

3.1.2 Contractor shall require pre-assignment drug testing, or will assure that each person who will be assigned to an Ameren location has been tested for drug use within the 120-day period immediately prior to the start of work on Ameren premises. Contractor shall provide written documentation from the testing authority to Ameren Construction Project Lead or Plant Station Point of Contact that its employees are either compliant or non-compliant with this Policy. Contractor employees, who are not in compliance with this Policy, will be subject to Section 3.1.6 of this Policy. To maintain confidentiality, Ameren will not accept actual test results. A previous random drug test or drug test conducted for another reason is sufficient to satisfy the pre-assignment testing requirement if test was conducted during the 120-day period prior to working on Ameren premises, and otherwise satisfies the drug testing requirement in Section 3.1.4 of this Policy. Contractor employees who have taken a pre-assignment drug test will be allowed to work pending test results for no more than 5 working days. Testing may be waived pending Ameren management approval for Contractor employees who are working less than 40 hours annually providing site labor.

3.1.2.1 In lieu of pre-assignment testing, Contractor may accept a certificate signed by Department of Health and Human Services (DHHS), Substance Abuse Mental Health Service Administration (SAMHSA) DHHS/SAMHSA-certified drug testing laboratory indicating the results of drug test performed within the 120-day period immediately prior to working on Ameren premises. Identification cards, which indicate employee's name and date of his/her most recent drug test, may also be accepted if they are traceable to the certification from the DHHS/SAMHSA -certified drug-testing laboratory, which performed the test, and are attested to by Contractor management.

3.1.3 Contractor shall provide site specific random substance abuse testing for each of its employees and its subcontractors' employees assigned to be on Ameren premises. The random testing shall be conducted at a frequency such that a minimum of one test is performed for hours up to the first 2,000 man-hours worked and one additional test for every 2,000 man-hours worked by Contractor, or any of its subcontractors, on Ameren premises. Contractor shall establish a random selection process to ensure that each individual will have an equal chance of being selected and tested each time a random test is scheduled. The random testing pool will include all crafts under the direction of the prime Contractor, including subcontractors. Employees selected for random testing shall not be informed of test until immediately prior to test and shall be accompanied to testing site by a responsible Contractor supervisor as soon as practical on the same day selected. Contractor shall notify Construction Project Lead or Plant Station Point of Contact of random selection results and an Ameren representative may exercise the option of being present during the selection process.

3.1.4 Samples used to comply with this policy shall be analyzed by a NIDA-certified laboratory or quick cup and/or instant cup method. Tests must screen at a minimum for the following substances and levels, however some labor consortium testing programs will be accepted for initial site access only pending Ameren approval. A confirmed positive drug testing will be considered a violation of this policy.

Substance	Initial Level	Confirmed Level
Amphetamines	500 ng/ml	250 ng/ml
Barbiturates	300 ng/ml	200 ng/ml
Benzodiazepines	300 ng/ml	200 ng/ml
Cocaine	150 ng/ml	100 ng/ml
Marijuana	50 ng/ml	15 ng/ml
Methadone	300 ng/ml	200 ng/ml
Opiates	300 ng/ml	150 ng/ml
Oxycodone	100 ng/ml	100 ng/ml
Propoxyphene	300 ng/ml	200 ng/ml
Methamphetamine	500mg/dl	250mg/dl

3.1.5 Contractor's program shall provide for alcohol testing under the following circumstances: random testing; testing for reasonable cause based on observations by Ameren or Contractor supervisor; and testing after any accident or incident that involves injury to personnel or damage to property. Pre-assignment alcohol testing shall not be required. A test result of .04% blood alcohol concentration or greater as indicated by a breathalyzer or similar test will be considered a violation of this Policy.

3.1.6 Individuals who fail a test, refuse to test or otherwise violate this Policy will be denied site access from all Ameren premises. In addition, Contractor shall notify the applicable consortium to remove employee from the active pool. A Contractor employee who is determined to have violated this policy will be denied site access for a period of one year. After a period of one year, if the individual can demonstrate successful completion of a required treatment program based on Contractor's consortium policy, the individual will be given a last-chance opportunity. However, site access will not be permitted unless the individual has a satisfactory return-to-duty drug test. If at any time an individual is found to have a second violation of this Policy, the individual will be permanently denied site access to all Ameren premises. Contractor shall document all non-compliance on a reduction force report and forward the report to Construction Project Lead or Plant Station Point of Contact. The reduction force report shall include the person's name, craft and reason stated "Non-Compliance with Ameren Substance Abuse Policy."

3.1.7 Contractors shall require all of their subcontractors to comply with all provisions of this Substance Abuse Policy. Failure of Contractor or any of its subcontractors to comply with the requirements of this Policy shall be grounds for removal from consideration for any future work and/or termination of the current contract at the discretion of Ameren. Ameren reserves the right to audit Contractor's drug and alcohol testing program at any time to verify compliance with this policy.

3.1.8 Ameren will not be responsible for any expense or loss of wages due to non-compliance with this Policy.

3.1.9 Ameren retains the right to change or modify this Policy at any time. Ameren also retains the right to waive this Policy for any Contractor that is badged as a visitor.

3.1.10 Any documents relating to this Policy will be maintained in confidence and will not be released without written authorization unless otherwise required by law.

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ATTACHMENT A16

CRANE MAINTENANCE SAFETY CHECKLIST

DATE: ______________ CRANE: ______________________________

JOB NUMBER/ LOCATION: ______________________________

TASK: ______________________________

☐ Has a Total Hazard Analysis (THA) been completed today? YES ☐ NO ☐

Comments: ______________________________

☐ Is access to work area established? YES ☐ NO ☐

Comments: ______________________________

☐ Is all safety equipment on hand and functioning properly? YES ☐ NO ☐

Comments: ______________________________

☐ Have lines of communication between operator and affected employee(s) been established (visual &/or verbal)?

Comments: ______________________________

☐ When servicing the crane (including crane lubrication), the operator must lower all loads to the ground, and move all controls to OFF. The engine MUST be stopped before the crane is serviced. The operator is to attach a WARNING sign to the engine start control to warn personnel that crane is being serviced and must not be started.

Comments: ______________________________

☐ Do not operate crane until all safety guards and covers are securely reinstalled and all maintenance equipment is removed.

Comments: ______________________________

☐ Before operator enters cab of crane, the affected employee(s) must be at a minimum safe distance of two feet from any moving parts.

Comments: ______________________________

Additional Comments: ______________________________

CREW SIGNATURES:

______________________ ______________________

______________________ ______________________

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ATTACHMENT A17
CONTRACTOR AGREEMENT OF UNDERSTANDING
(Form CONMGT0)

All Contractors and Subcontractors will be required to sign and submit this form prior to entering and/or starting work on any Ameren property.

- I have been informed of all expectations regarding Ameren Safety / Work rules and ZERO TOLERANCE policies and will immediately investigate and enforce all such rule and policy violations when they are reported or observed.
- I will cooperate to the fullest extent with any Ameren management or security person in investigating ZERO TOLERANCE policy violations.
- I am aware that Ameren plants contain asbestos, lead and flyash. Where necessary, I will abide by all Ameren, OSHA, State and Local policies, procedures and ordinances in all abatement, containment, waste-disposal, employee protection and reporting activities.
- I will obtain and promptly submit all of the required permits to the Ameren-designated Station Point of Contact (SPOC) prior to starting work.
- I will promptly forward all of the required submittals to the Ameren SPOC.
- I will not allow any employee to enter and / or start work on Ameren property before first conducting a Safety / Work Rules orientation and ensuring they have all required personal protective equipment.
- I will report all violations / actions taken to the Ameren SPOC, on form CONMGT1, each Friday before 9:00 AM.
- I will inform the Ameren SPOC of any sub-contractors in my employ and ensure that they are aware of and meet the conditions of this agreement before they enter and / or start work on Ameren property and will have them complete this Contractor Agreement of Understanding Form.
- Any employee found to have violated a ZERO TOLERANCE policy may be removed and barred immediately from Ameren property and will not be allowed to return to any Ameren property in the future.
- I understand that repeated violation of the Work / Safety rules or ZERO TOLERANCE policies may result in my company's removal from Ameren property.

Contractor Company (Print) ____

Contractor Representative (Print) ____

Representative's Signature ______________________________ Date ____________

ATTACHMENT A18
HOUSEKEEPING SCORECARD

PROJECT NAME: ______________________

CONTRACTOR NAME: ______________________

DATE: ______________

HOUSEKEEPING SCORECARD						
CATEGORY	RATING POOR				EXCELLENT	COMMENTS
General Cleanup	1	2	3	4	5	
Cords & Hoses (are out of the way)	1	2	3	4	5	
Barricades & Caution Tape (used & taken down appropriately)	1	2	3	4	5	
Other (e.g., material stored/staged appropriately, no tools on running equipment, no hazardous conditions, etc.)	1	2	3	4	5	
Total Housekeeping Score:						
Total Points (Total Housekeeping Score x 4) :						

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ATTACHMENT A19
SAFETY SCORECARD

SAFETY SCORECARD			
Notwithstanding the provisions below, a "work-related fatality" will result in maximum KPI reduction to the contractor regardless of any other safety criteria.			
KPI payment will be based on criteria that are equally weighted as follows:	Section 1	OSHA recordable rate	33⅓ %
	Section 2	"Rules to Live By" infraction	33⅓ %
	Section 3	Safety observation program	33⅓ %

SECTION 1	OSHA RECORDABLES		
OSHA rate is calculated by the following:		2 or more =	0%
		less than 2 =	100% of Section 1
Note: Review based on specific job criteria (i.e., duration of project). Ameren POS safety supervisor has final call on OSHA recordable determination.			

SECTION 2	"RULES TO LIVE BY" OBSERVATIONS		
		1 or more =	$2,000 penalized assessment per Appendix A
		less than 1 =	(add)
Note: Observations that are self-reported by contractor do not apply to this. Only observations by Owner or Owner's representative apply.			

SECTION 3	COMPLETED CARDS		
An agreed-upon safety observation card program will be developed as part of site safety process. Observations are based on number of fully completed, meaningful cards generated by contractor's employees and submitted to Ameren designated representative. These observation cards may show positive coaching as well as corrective coaching. Observation cards completed by Ameren will not be utilized KPI of this section.		< 70 cards =	(deduction)
		70 - 90 cards =	$0
		> 90 cards =	(add)

ATTACHMENT A20
GUIDELINE FOR ABANDONING PIPING AND DEMOLISHING ABANDONED PIPING

1.0 GENERAL GUIDELINE FOR PROPERLY ABANDONING AND/OR DEMOLISHING PIPING

The division of responsibility for the following actions to be decided at assignment of work:

1.1 A Competent Person shall pre-plan the job prior to the start of the work.

1.2 Determine pipe to be abandoned or demolished. Review P&ID's and piping isometrics to determine isolation points and material conveyed in piping.

1.3 If a JR is not already in EMPRV, Ameren Single Point of Contact (SPOC) shall create a JR in EMPRV.

1.4 Review WPA requirements with the Responsible Engineer listed on the JR. Ensure proper WPA is in place to isolate lines.

1.5 Conduct a pre-job briefing to discuss site specific safety plan and the following:

1.5.1 PPE required

- Chemical Protection
- Eye & Face Protection
- Foot Protection
- Hand Protection
- Head Protection
- Hearing Protection
- Respiratory Protection

1.5.2 Atmospheric conditions if working in enclosed spaces

1.5.3 WPA

1.6 Ensure proper WPA is in place to isolate lines. As part of WPA, drain lines and confirm all low spots have been drained.

1.7 Take special precautions to ensure environmental spills do not occur.

1.8 At extreme ends of pipe, remove at least a one foot section of pipe from equipment or process piping still in use to ensure complete isolation. Cap ends of process piping that will remain in service.

1.9 For piping that will be abandoned in place, permanently tag abandoned pipe in at least three locations (Steel or Brass tag wired to pipe). Tag shall indicate pipe to be "Abandoned in Place," applicable JR number, and material pipe conveyed.

1.10 For piping to be demolished, remove piping and dispose of properly.

1.11 Update P&ID's and piping isometrics as applicable.

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ATTACHMENT A21
SITE-SPECIFIC SAFETY PLAN (SSSP)

This plan shall be completed and reviewed with the Corporate Safety Department before work commences. Completed plans shall be maintained and kept on site with the project file.

Section 1: Company and Project Information	
Contractor Company:	
Contractor Address:	
Project Name:	
Project Address:	
Mobilization Date:	

Section 2: Contractor Info	**Name**	**Phone**	**Email**
Project Manager			
Superintendent			
Corporate Safety Representative			
General Foreman			
Site Safety Representative(s)			
Shifts working throughout project: 1st ☐ 2nd ☐ 3rd ☐	Maximum number of workers on site per shift: 1st 2nd 3rd	Number of safety representatives on site per shift: 1st 2nd 3rd	
Job Responsibilities:			
Titles:	Description of Job Duties		

Section 3: Site Emergency Information		
3.1	Identify the nearest medical facility (e.g., hospital, urgent care, occupational clinic etc.): Address: Phone # Note: Location and directions (including maps) to the nearest facility are required to be on this jobsite.	
3.2	List the local Fire & Rescue Squad Phone #	List the Police Phone #
3.3	Describe your emergency action plan for the project (e.g., response to fire, severe weather, etc.):	

Section 4: Company Safety Mission Statement

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Section 5: Scope of Work
Describe the activities your company will be performing while on this project. Ensure that all activities are referenced on the AHA of this plan, see Section 13.

Section 6: Subcontractor Information

Will subcontractor(s) be used on this project? ☐ Yes ☐ No

If yes, please provide the information below (add extra copies of this page as needed):

Note: All subcontractors are required to submit a Site Specific Safety Plan.

Subcontractor(s) Name:	Contact Person	Scope of Work	Phone	Email

Section 7: General Information	
7.1	Describe how you will secure your jobsite, equipment, and materials to protect public safety and to prevent theft.
7.2	Will there be persons onsite trained in First Aid and CPR? ☐ Yes ☐ No
7.3	Will there be ANSI Z308.1 compliant First Aid Kit(s) and Bloodborne Pathogens Kit(s) located in strategic areas on this project: ☐ Yes ☐ No
7.4	Will restrooms and wash facilities be brought on site? ☐ Yes ☐ No
7.5	How will housekeeping be managed? Describe the control measures to be used and how often they will be performed.
7.6	Do you have a map of the worksite location that includes roads, waterways, railways, bridges, etc.? ☐ Yes ☐ No *Please provide a copy of the map when submitting this document*

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Sections 8: Project Safety Management	
Owner shall have the authority to immediately stop contractor's work indefinitely for operations which, in the opinion of owner, constitute a safety concern. It is the responsibility of the contractor to adequately satisfy owner of any remediation necessary to provide a safe and healthful workplace. Contractor must have qualified and competent supervision at the site at all times to direct and observe the work.	
8.1	Do you require your supervision to successfully complete the OSHA 30-Hour for Construction Training?
8.2	Do you require your employees to successfully complete the OSHA 10-Hour Construction Training?
8.3	Outline the initial employee orientation on the job site:
8.4	Describe the process that you will use to verify that training within your scope of work has successfully been completed. *Note: Employee training records do not have to be submitted. Ameren reserves the right to review training records which must be readily available upon request.*
8.5	Describe your procedures for Contractor Event Reporting (CER) to Ameren.
8.6	Describe your Job Observation Process in detail:
8.7	Describe your Job Briefing Process in detail:
8.8	Will you have a Hazard Communication Program with a chemical inventory list and Safety Data Sheets (SDS) for chemicals used onsite? ☐ Yes ☐ No NOTE: Chemical inventory list must be onsite at the beginning of the work and Safety Data Sheets (SDS) shall be kept on file at the site by the contractor. SDSs must be available for the contractor and subcontractor employees' review and for review by the owner upon request.

Section 9: Rules To Live By Hazards and Controls	
9.1	Explain how you will communicate Ameren "Rules to Live By" to your employees on this project and describe the procedures you will follow when a violation occurs.
9.2	Explain your company's disciplinary action protocol as it relates to jobsite safety rules:

Section 10: Employee Engagement and Communication	
10.1	Identify steps your company is going to take to engage your workforce in safety:
10.2	Explain how your company is going to communicate safety information and expectations to your employees?

Section 11: Personal Protective Equipment (PPE)
List the minimum PPE required to access the job site:

Section 12: Safety and Health – Describe how hazards are controlled in the AHA for each 'Yes' answer (see Section 13):	
Will the work scope require any traffic or pedestrian disruptions?	☐ Yes ☐ No ☐ N/A
Will your work require you to penetrate into any surface at any depth?	☐ Yes ☐ No ☐ N/A
Will your work involve any excavations/trenches?	☐ Yes ☐ No ☐ N/A
Will the work scope require work at heights greater than 6 feet?	☐ Yes ☐ No ☐ N/A
Will wire rope guardrail systems be used on this project to protect workers from fall hazards and will an inspection program be implemented to verify safe installation/condition?	☐ Yes ☐ No ☐ N/A
Will the project involve electrical line construction, maintenance or repair activities?	☐ Yes ☐ No ☐ N/A
Will the project involve substation or switchyard construction, maintenance or repair activities?	☐ Yes ☐ No ☐ N/A
Will there be worksite obstructions that may create a hazard to workers such as railroads, bridges, power lines or waterways?	☐ Yes ☐ No ☐ N/A
Will the work scope involve the need to control hazardous energy sources?	☐ Yes ☐ No ☐ N/A
Will the project include work on pressurized vessels or pipes that may affect the integrity of the system such as welding, cutting, brazing, etc.?	☐ Yes ☐ No ☐ N/A
Will steel erection be part of the scope of this project?	☐ Yes ☐ No ☐ N/A

Section 12: Safety and Health – Describe how hazards are controlled in the AHA for each 'Yes' answer (see Section 13):			
Will there be potential impalement hazards such as protruding reinforcing steel (rebar)?	☐ Yes	☐ No	☐ N/A
Will any roofing be performed on this project?	☐ Yes	☐ No	☐ N/A
Will earthmoving or drilling equipment be used on this project?	☐ Yes	☐ No	☐ N/A
Will cranes, derricks, or other equipment be used on this project?	☐ Yes	☐ No	☐ N/A
Will a helicopter be used on this project?	☐ Yes	☐ No	☐ N/A
Will the work scope require the need for a critical lift plan that will include the safe rigging practices and prohibit work under suspended loads?	☐ Yes	☐ No	☐ N/A
Will hoists, elevators or conveyors be used on this project?	☐ Yes	☐ No	☐ N/A
Will employees be involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold system?	☐ Yes	☐ No	☐ N/A
Will the work scope include diving?	☐ Yes	☐ No	☐ N/A
Will the work scope require you to work in a confined space?	☐ Yes	☐ No	☐ N/A
Will welding, cutting, or brazing be performed on this worksite?	☐ Yes	☐ No	☐ N/A
Will the work involve the use of chemicals such as paints, solvents, adhesives, epoxy coatings, corrosives, fuels or other hazardous materials?	☐ Yes	☐ No	☐ N/A
Will lead based materials be used or disturbed on this project?	☐ Yes	☐ No	☐ N/A
Will asbestos containing materials be disturbed on this project?	☐ Yes	☐ No	☐ N/A
Will you be working in or generating a hazardous atmosphere?	☐ Yes	☐ No	☐ N/A
Will appreciable levels of dust be generated that will require control measures?	☐ Yes	☐ No	☐ N/A
Will abrasive blasting be performed on this project?	☐ Yes	☐ No	☐ N/A
Will the work scope involve any environmental hazards that generate flying debris, excessive noise levels, or any other air contaminants not mentioned above?	☐ Yes	☐ No	☐ N/A
Do you have a heat stress prevention program in place?	☐ Yes	☐ No	☐ N/A
Will radioactive materials/sources be used on this project?	☐ Yes	☐ No	☐ N/A
Will hazardous waste (e.g., lead, asbestos, contaminated soils) be generated and properly disposed of on this project?	☐ Yes	☐ No	☐ N/A

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Section 13: Risk Management

ANTICIPATED HAZARD ANALYSIS (AHA)

Use this form to identify activities that will occur on this project. List all potential hazards associated with that activity. Use the Risk Assessment Code table to determine the risk level of the activity/hazards. Lastly, list all of the controls that will be implemented to control those hazards. When a Job Hazard Analysis is needed, it must be performed, documented, and communicated to workers prior to the start of that activity, see footnote 2.

Contractor Name: ACME Contractor	Project Name/Number: 123456		Project Location: Anywhere, Missouri
	Date Prepared: 1/1/2014	Prepared By: ACME Manager	Reviewed By: John Doe

Risk Assessment Code (RAC) Color Ratings – *include color & numeric alpha characters for rating* Red =Extremely High Risk (Critical), e.g., Red IA Orange = High Risk (Serious), e.g., Orange 2B Yellow = Moderate Risk (Moderate), e.g., Yellow 3C Blue = Low Risk (Minor), e.g., Blue 3D Green = Extremely Low Risk (Negligible), e.g., Green 3E	PROBABILITY (how often the activity occurs)				
	Frequent (A) Occurs very often, known to happen regularly.	Likely (B) Occurs several times, a common occurrence.	Occasional (C) Occurs sporadically, but is not uncommon.	Seldom (D) Remotely possible, could occur at some time	Unlikely (E) Can assume it will not occur, but it is not impossible
Severity: Catastrophic (1) – Imminent and immediate danger of death or permanent disability to the public, employees or property.	Red (IA)	Red (IB)	Red (IC)	Orange (ID)	Yellow (IE)
Severity: Critical (2) – Permanent partial disability, hospitalized injury, temporary total disability.	Red (2A)	Orange (2B)	Orange (2C)	Yellow (2D)	Blue (2E)
Severity: Significant (3) – Reversible injury that would need ER care, reversible illness.	Orange (3A)	Yellow (3B)	Yellow (3C)	Blue (3D)	Green (3E)
Severity: Negligible (4) – First aid or minor medical treatment	Yellow (4A)	Blue (4B)	Blue (4C)	Green (4D)	Green (4E)

Activity Category	Potential Hazards	RAC Rating[1]	JHA Required[2]	Controls
Cutting on steam pipe located 15 ft. above ground	Explosion, thermal burns, fire, fall from heights, lacerations, flying debris	1B	Yes	1) Lockout equipment, bleed/cool/drain line, blow air through line 2) Use aerial lift with anchor point, full body harness, laynard 3) Hot work permit, firewatch, fire extinguisher, no combustibles within 35 ft. 4) PPE (safety glasses, faceshield, leather gloves, hardhat)

1 RAC Rating – Risk Assessment Code Rating. Use the Risk Assessment Matrix to list the color and numeric alpha code

2 JHA required if red or orange RAC color (See sample JHA; JHA is not required to be submitted with this plan)

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JOB HAZARD ANALYSIS (JHA) FORM

JOB HAZARD ANALYSIS	COMPANY NAME:	JOB:	DATE
	JOB TITLE OF WORKERS WHO DO THIS JOB:	ANALYSIS BY:	
LOCATION:	REQUIRED PERSONAL PROTECTIVE EQUIPMENT:		

Sequence of Basic Job Steps	Critical Task	Potential Accidents or Hazards	Recommended Safe Job Procedures
	☐		
	☐		
	☐		
	☐		
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	☐		
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	☐		
	☐		
	☐		

FOR AMEREN USE ONLY	
SAFETY HAZARDS CONTROL REVIEW OF CHECKLIST:	
DATE SUBMITTED:	
REVIEW STATUS: ☐ UNSATISFACTORY, RESUBMITTAL REQUIRED ☐ SATISFACTORY	
This plan is considered satisfactory if there are no comments below.	
AMEREN CORPORATE SAFETY REVIEW COMMENTS:	
Sections	**Comments**
Section 1:	
Section 2:	
Section 3:	
Section 4:	
Section 5:	
Section 6:	
Section 7:	
Section 8:	
Section 9:	
Section 10:	
Section 11:	
Section 12:	
Review Date:	
Resubmit Date:	
Approved Date:	
Ameren Project Manager and Date:	

ATTACHMENT A22
DIVERSE SUPPLIER BUSINESS PLAN

SUPPLIER / SUBCONTRACTOR BUSINESS PLAN

Note: Please list all diverse and non-diverse sub-contractors on supplier/sub-contractor business plan. Ameren will require bidders to track spend amounts when sub-contracts are awarded to Diverse Suppliers. If bidder is unable to award to Diverse Supplier indicate name of diverse supplier contacted and reason(s) why bidder was unable to award.

Please specify in the pull down below the % diverse supplier participation as part of the bid.

Enter % participation here					
Name of Sub-Contractor	Email	Business Classification of Diverse Sub-Contractor (Select from the Pull Down)	Type of Work/Services to be Provided by Sub-Contractor	Anticipated Value of Work ($) to be Performed	Reason(s) why unable to award to Diverse Sub-Contractor (Select from the Pull Down)
Please describe "Other" in this space:					

Pull-Downs:

0%	African American	Supplier awarded work
5%	Asian Pacific American	Supplier declined to bid
10%	Asian Sub-Continent American	Supplier not competitive-bid high
15%	Disabled Owned Business	Supplier not competitive-bid too low
20%	Hispanic American	Other (Please provide reason below)
25%	Hub Zone Business	
30%	Native American	
35%	Service Disabled Veteran Owned Business	
40%	Small Business	
45%	Veteran Owned Business	
50%	Woman Owned Business	
	Non-Diverse	

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ATTACHMENT A23
DIVERSE SUPPLIER 2ND TIER REPORT

2nd TIER PROGRAM - DIRECT EXPENDITURES

1st Tier Supplier: ____________ **Report Period:** ____________

In accordance with Ameren's Request for Proposal/Quotation, the definitions and codes contained herein and the resulting contract/purchase order between Ameren and the Supplier, Supplier shall complete columns 1 through 8, reporting its use of Minority Business Enterprises (MBEs) and (WBEs) in direct connection with goods and services provided under the terms and conditions of said contract/purchase order. Supplier shall also include the name of the Ameren business segment in which the work is being performed.

Use this report when MBE & WBE expenditures are directly attributable to fulfilling a specific contract. You must be able to trace the expenditure directly to the specified contract.

	(1) SUBCONTRACTOR	(2) BUSINESS SEGMENT	(3) CONTACT		(4) WORK		(6) 2ND TIER SPEND							(5)	(7)	(8)
	2nd Tier COMPANY NAME	AMEREN BUSINESS SEGMENT	NAME	PHONE	DESCRIPTION	MBE INDIRECT	AFRICAN AMERICAN	ASIAN PAC & SUB	HISPANIC	NATIVE AMERICAN	WBE	VETERAN	LGBT	TOTAL 2ND TIER	MONTHLY PAID by AMEREN	% OF MONTHLY DIVERSE SPENDING
1														$ -	$0	#DIV/0!
2														$ -	$0	#DIV/0!
3														$ -	$0	#DIV/0!
4														$ -	$0	#DIV/0!
5														$ -	$0	#DIV/0!
6														$ -	$0	#DIV/0!
7														$ -	$0	#DIV/0!
8														$ -	$0	#DIV/0!
9														$ -	$0	#DIV/0!
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11														$ -	$0	#DIV/0!
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21														$ -	$0	#DIV/0!
22														$ -	$0	#DIV/0!
23														$ -	$0	#DIV/0!
24														$ -	$0	#DIV/0!
25														$ -	$0	#DIV/0!
	TOTAL AMOUNT:						$ -	$ -	$ -	$ -	$ -	$ -		$ -	$0	#DIV/0!

______________ ______________ ______________ ______________
Name Phone Email Date

END OF APPENDIX A

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APPENDIX B – JOB WORKING RULES AND CONTRACT WORK LIMITATIONS
CONTRACTOR REQUIREMENTS - POWER PLANTS

1.0 JOB WORKING RULES

1.1 Contractor must enforce the Ameren Job Working Rules, included in this specification here as Appendix B, as well as the Contractor's own work rules. If the rules conflict, the more restrictive rule applies.

2.0 PLANT ACCESS, PARKING AND SECURITY

2.1 Contractor employees must enter the plant ***only*** at the entrance where their company name is posted. Security cameras monitor entrances to inform supervisors of violations.

2.2 The speed limit is 10-MPH unless otherwise posted.

2.3 Contractor personnel may not ride in the back of a truck on company property or to/from/between job sites unless properly seated with a seat belt.

2.4 Contractor employee vehicles must park in Construction Parking lot or in areas designated for Contractor use.

2.5 Contractor employees must enter and leave through the designated Construction gate.

2.6 Contractor employees must check in and out of project with their immediate Foreman or General Foreman.

2.7 Security will issue an identification badge to Contractor employees after site orientation training. Badges must be visible at all times while on the site.

2.8 If the site has an electronic badge reader, a green LED light indicates that arrival/departure times have been recorded and the gate is unlocked.

2.8.1 If a badge reader is not available, employees must sign the gate register when arriving or departing.

2.9 Lunch boxes, toolboxes, coolers and other containers are subject to inspection when entering or leaving Ameren premises.

2.10 An Ameren Material Pass (Form 5532NS) signed by the Ameren Station Point of Contact (SPOC) and a Contractor supervisor must be presented to Security when tools or materials are taken off site.

2.11 The Security Guards can:

- De-activate / activate a badge when changing plant locations
- Replace a damaged badge or lost badge
- Update the employee name, Contractor company, or craft.

2.12 Cameras and video recording devices are prohibited unless specifically authorized by Ameren management.

3.0 GENERAL REQUIREMENTS

3.1 The more restrictive rule will govern in the event of any conflict between Ameren and Contractor work rules.

3.2 All Contractor/Subcontractor employees must not leave their work areas during assigned work periods. Any reasonable break periods will be established by the Contractor/Subcontractor.

3.3 Only drink water from drinking fountains or lavatories, other outlets may contain river water.

3.4 Certain plant locations, including cafeterias, locker rooms, and washrooms, may be posted as OFF LIMITS to construction or Contractor personnel.

3.5 Written permission is required before using Ameren equipment or tools, except for public pay phones.

3.6 Radios or "boom boxes" are not allowed because they can disrupt communication and distract workers.

3.7 Ameren's Smoking Policy
In keeping with Ameren's corporate values, Ameren strives to provide a work environment that promotes and ensures the health and safety of all employees. Smoking presents known health risks to smokers and non-smokers alike. This policy applies to cigarette, pipe, and cigar smoke, as well as e-cigarettes.

3.7.1 Persons Affected
This policy applies to all Ameren employees, vendors, contractors, and visitors at any Ameren facility.

3.7.2 Policy
Smoking is prohibited in all Ameren buildings and any outside posted areas where hazards may exist. Smoking is prohibited within 25 feet from all entrances, exits, windows that open, and ventilation intakes that serve an enclosed area for all Ameren locations. Smoking is not permitted in a multi-occupant Company vehicle or while operating motorized equipment.

3.7.3 Enforcement
Any violation of this policy may result in the individual being removed or barred from Ameren property.

3.8 Daily cleanup of the work area is required. Ameren reserves the right to clean up Contractor's area if Contractor is not fulfilling their housekeeping requirements. Any and all costs associated with the cleanup will be deducted from Contractor's base contract.

4.0 EVACUATION

4.1 If there is an emergency, an evacuation announcement may be made over the plant's public address system. The evacuation assembly area shall be communicated during orientation training.

4.2 In the event of severe weather, an announcement to seek shelter may be made over the public address system. The location of the plant tornado shelter shall be communicated during orientation training.

4.3 To report an emergency, contact the Shift Supervisor immediately using the plant's public address system. Do not hang up. Wait for instructions.

5.0 WORKER'S PROTECTION ASSURANCE OR HOLD CARD PROCEDURE

WARNING: Violation of Workers Protection Assurance (WPA) procedures can cause serious equipment damage, personal injury or death.

When WPA is present, verify that equipment is actually de-energized or in the designated state. Always walk down the job, check voltages, temperatures, pressures, etc. to confirm status.

5.1 WPA is Ameren's procedure to tag equipment or systems that have been de-energized or put in a specified state, to allow for service or testing. The energy in a system may be electrical, mechanical, pneumatic, hydraulic, chemical, kinetic or nuclear.

5.2 All employees should receive site-specific WPA training including descriptions of the tags and their functions. Workers must sign on and off WPA protection as directed by their supervisor.

5.3 Contractor/Subcontractor employees shall observe all WPA rules and comply with WPA tags at all times. Never use an elevator that has a WPA card on the call button.

6.0 SUBSTANCE ABUSE

ATTENTION: Employees who refuse to take a drug test or have been found to be non-compliant will be escorted off-site immediately and may be subject to permanent barring from Ameren facilities.

6.1 Possession, and/or use of alcohol or drugs, is STRICTLY PROHIBITED.

6.1.1 Drugs, stimulants, "pep pills," tranquilizers, and similar substances are allowed only if prescribed by a doctor.

6.2 Ameren's Contractor's Substance Abuse Policy requires pre-employment and random drug testing of Contractor employees.

7.0 HARASSMENT AND WORKPLACE VIOLENCE POLICIES

7.1 Ameren Corporation has a zero-tolerance policy for behavior that is prohibited under Ameren's EEO & Anti-Harassment Policy and Ameren's Workplace Violence Policy Statement. These policies apply to Ameren employees and Contractor/Subcontractor employees.

7.2 Ameren intends that employees, contractors, customers, vendors, and visitors, never feel threatened, intimidated, harassed, offended or demeaned by any individual's actions, presence, conduct, or communication while they are on Ameren property.

7.3 The following behaviors and actions are **STRICTLY PROHIBITED** anywhere on Company property and may result in permanent barring from all Ameren facilities:

- Willful violation of safety rules or safe working practices
- Possession of unauthorized firearms, weapons or explosives and/or materials/components that could be used to make explosive devices
- Damaging, mutilating, or willful abuse of supplies, equipment & tools, vandalism of company property, or property of others
- Gambling or stealing
- Urinating in an undesignated area
- Harassment by anyone and in any form
    - Harassment includes, but is not limited to, unwelcome or unsolicited conduct or hostility based on or directed at a person or group because of race, color, religion, sex, national origin, ethnicity, age, disability, veteran status, pregnancy, marital status, sexual orientation or any other protected factor.
    - Conduct that may be considered offensive, hostile, demeaning, or derogatory, regardless of whether it is physical, verbal, or graphic in nature and whether it is done in person, or delivered via phone, fax, e-mail, text message, over a PA system, company mail, or by any other means.
    - Examples of Prohibited Physical Conduct:
        - → Bullying, wrestling, fighting, horseplay, or spitting on an individual,
        - → Sexual conduct such as rape, sexual battery, molestation, stalking, or attempts to commit such assaults, unwelcome touching, hugging, massaging, etc.
    - Examples of Prohibited Verbal Conduct:
        - → Threatening/intimidating someone (both explicit and implied),
        - → Verbal abuse, jokes, derogatory comments, references, or derogatory slurs of a sexual, racial, ethnic, or religious nature.
    - Examples of Prohibited Non-Verbal Conduct:
        - → Wearing of offensive clothing, hats, patches, etc.
        - → Displaying stickers, drawings, or posters that depict nooses, confederate "Rebel" flags, KKK paraphernalia, swastikas, or magazines, books, pictures or videotapes with sexual content.
        - → Drawing/displaying graffiti, specifically graffiti that is sexual, racial, or otherwise offensive, hostile, demeaning or derogatory to any individual/group or known to incite anger/violence.
        - → Using gestures that are obscene, or known to incite anger/violence.

7.4 Other behaviors and actions, not specifically set forth in this list, may violate Ameren zero tolerance policies.

8.0 WORKPLACE HAZARDS

8.1 Work near coal dust, fly ash, lime, or ferric/lead paint removal projects can create airborne contaminates. Do not use compressed air to clean surfaces or clothing. Use properly equipped vacuum, wet methods or other approved methods for cleaning.

8.2 All plants have asbestos-containing insulation and building materials (ACM). Treat all suspect materials as if they are asbestos.

8.3 Asbestos abatement projects may be in progress. Barricades will restrict access to areas with abatement projects. Only trained personnel using Personal Protection Equipment (PPE) may handle asbestos.

8.4 Personnel who are medically required to use syringes shall take them home, properly packaged for disposal. Only trained employees using PPE shall handle items contaminated with blood or other body fluids. Report any bloodborne related issues to the SPOC.

9.0 FOREIGN MATERIAL EXCLUSION (FME)

9.1 Foreign Material Exclusion protects critical plant components and systems, from contamination or damage. Systems such as feed water, condensate, steam, oil, and electrical controls and motors may suffer significant damage from foreign materials. See Foreign Material Exclusion Requirements (Appendix X) for additional requirements and details.

9.2 Foreign material contamination can come from sources such as:

- Welding and gas cutting debris,
- Metal chips, shavings and filings,
- Corrosion that produces flakes of metallic substances,
- Cleaning materials, such as shot from blasting, rags & lint,
- Forgotten tools or any material that falls out of worker's pockets,
- Water leaks/spills, cutting fluids, solvents, etc.

9.3 To prevent damage from foreign objects follow these work practices:

- Clean dirt, oil and fly ash from around covers, caps and other devices before opening.
- Remove welding electrodes, stubs and broken flux coating material from internal work areas in closed systems.
- Cover openings on turbines, generators, pumps, pipes, tubes, electrical cabinets/motors and other critical components during maintenance activities.
- Track tools, parts and materials allowed in an FME work area.
- Allow only materials necessary for the task into the work area; do not allow personal items such as jewelry or change.
- Secure all tools, safety glasses, badges, gloves and other loose items with lanyards, tape or other means.
- Catch clippings from cable ties, stripped wires, etc.
- Vacuum or wipe out electrical cabinets after repairs/modifications to remove moisture, metal chips, knockouts, clippings, etc.

I, the undersigned, have read the Job Working Rules. I have completed site orientation training and I understand:

- The Job Working Rules
- Site-specific instructions, including Worker's Protection Assurance procedures
- Safety requirements

I acknowledge that a violation of any of these provisions will be grounds for immediate removal from Ameren property and I may be subject to permanent barring from all Ameren facilities.

Date ______________________________

Employee Name (Print) ______________________________

Employee Signature ______________________________

Contractor ______________________________

END OF APPENDIX B

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APPENDIX C
DESIGN FOR SAFETY GUIDE

OBJECTIVE

Develop and maintain design guidelines to ensure engineering designs reduce safety risks for construction, operations, and maintenance of equipment and facilities.

These Guidelines reflect Ameren's commitment to incorporate safety into all designs. The designer of record is ultimately responsible for adherence to all governing Federal, State, and Local code requirements.

While attempts will be made to follow the recommendations in this guideline during the engineering phase there will be occasions where conditions and physical constraints may render some recommendations impractical or unattainable.

Several of the Design for Safety recommendations are subjective and can vary from plant to plant (i.e. serviceable access for equipment, pipe labeling, & color coding). Ameren Engineering and contracted consultants must engage plant stakeholders during the design phase to accommodate plant specific safety and operating requirements.

GENERAL FACILITY SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	General Arrangement layouts shall provide for adequate serviceable access for operation, maintenance, and replacement; i.e. personnel access, tool access, cart access, vertical lift access, fork truck access.
☐	☐	☐	Stairs shall not be used as access platforms. No valves, controls, equipment, etc., shall be positioned / designed to be accessed by personnel standing on stairs.
☐	☐	☐	Permanent, well identified and load rated fall protection tie-offs, shall be incorporated into the building structure at removable handrails and access hatchways.
☐	☐	☐	Self-closing swing gates are to be used instead of chains and clips at all personnel access openings for fall protection guarding where the elevated surface is used as a work platform or walkway.
☐	☐	☐	Non-slip "Mebac" ladder rung covers should be used on all fixed access ladders.

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YES	NO	N/A	
☐	☐	☐	All new handrails shall be fabricated utilizing 1 ½" diameter standard pipe rails and posts. Posts shall be spaced a maximum 6'-0 on centers. Rails shall include one (1) top rail (top of top rail shall be 42 inches above walking surface); **two (2) mid rails** *equally spaced to provide increased fall protection*; and a standard 4" high toeboard.
☐	☐	☐	OSHA required clearance to handrails on stairs (3") must be maintained. Structural bracing, electric conduit, or mechanical piping is not located within the required clearance space.
☐	☐	☐	No more than a 3" open gap is maintained between a walking surface and the side of a piece of equipment penetrating the walking surface.
☐	☐	☐	When practical, valves shall be located to allow for ergonomically correct operation.
☐	☐	☐	When practical, provide stairs rather than ladders to equipment, valves, etc. that requires routine access for operations and/or maintenance.
☐	☐	☐	Provide chain wheel operators for valves that cannot be accessed from a permanently installed ladder or platform.
☐	☐	☐	When possible, design stairs with lower angle of stairway rise (6½" R, 11" T). Stair landings are provided every 10 to 12 treads.
☐	☐	☐	When possible, no low mounted equipment, piping, ducting, conduit, etc. in travels paths. No "duck-unders". Use a minimum design head clearance of 7'-0".

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YES	NO	N/A	
☐	☐	☐	All 90 degree corners of structural steel members and plate trimmed / clipped where close to personnel access areas.
☐	☐	☐	Maintenance and replacement access considered when locating lighting fixtures (especially on stairways, over tops of equipment and high overhead locations).
☐	☐	☐	Underground utilities shall be designed and installed with warning and location indicators for future excavations in the areas of buried utilities.
☐	☐	☐	Underground utilities shall be designed and installed at shallowest depth possible (while maintaining freeze protection and surface surcharge loads) to minimize deep trenching hazards.
☐	☐	☐	Thermal protection guarding incorporated into design where required.
☐	☐	☐	Utilize above ground liquid containments or rigid structural underground containment. Avoid below grade lined pits.
☐	☐	☐	Incorporate seismic shut-off valves for gas service lines entering buildings and at meter locations. (Application mostly at non-power plant, off-site buildings / facilities).
☐	☐	☐	Walkways shall be clear of protruding obstructions and bump hazards. No valves, valve stems, valve handles, controls, equipment, etc. shall be positioned / designed within the normal walking path within personnel walkways. If not possible, paint or otherwise safeguard.

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YES	NO	N/A	
☐	☐	☐	Utilize yellow warning striping along edges of personnel walkways to guide / warn walking personnel of potential obstructions, ramps, bump hazards, grade / slope changes.
☐	☐	☐	Provide personnel access to all roofs for inspection and maintenance purposes.
☐	☐	☐	Provide permanent fall protection tie-offs that are well identified, load rated, and incorporated into the building structure on roofs where there are no parapets or guard railing. (Review the need for fall protection tie-offs on specific roof areas on a case-by-case basis).
☐	☐	☐	To eliminate the need for fall protection tie-offs, when practical building roof parapets should be designed high enough to meet OSHA fall protection guarding requirements.
☐	☐	☐	Where possible, roof mounted equipment shall not be designed and installed closer than 15' to open, unguarded edge of roof.
☐	☐	☐	Provide fall protection guarding at edge of roof (without parapet) where roof mounted equipment is installed closer than 15' to open edge of roof.
☐	☐	☐	Provide fall protection guarding on both sides of a fixed roof access ladder onto roofs with no parapet or guard railing.
☐	☐	☐	Provide fall protection guarding or tie-off point at all personnel access roof hatches.

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YES	NO	N/A	
☐	☐	☐	Provide fall protection guarding at roof mounted sky lights (many commercial skylights are available with security grills that will act as fall protection guarding).
☐	☐	☐	Design roof mounted equipment, ducting, and piping with adequate clearance for roof maintenance and replacement. Design clearances shall meet the NRCA recommendations for equipment to roof clearances.
☐	☐	☐	Provide service power for roof mounted equipment.
☐	☐	☐	Eliminate tripping hazards on roofs / floors. No low to roof / floor mounted electric conduits and drain pipes.
☐	☐	☐	Utilize safety balls on lightning protection air terminals. Eliminate impalement hazard of pointed air terminals on roofs.
☐	☐	☐	"Roof slippery when wet" signs shall be installed at all personnel access points onto roofs.
☐	☐	☐	Provide lighting on roofs in areas of personnel access for maintenance of equipment.
☐	☐	☐	Design mechanical / electrical equipment and components to be water tight for wash down cleaning.

YES	NO	N/A	
☐	☐	☐	Provide the proper quantity and type of fire extinguishers and hose stations.
☐	☐	☐	Provide proper washdown facilities (hose reels, supply pipes, drains) to allow facility cleaning.
☐	☐	☐	Assure proper safety signage is in place (chemicals, hearing protection, etc.).
☐	☐	☐	Assure roof drains are not placed where water will freeze and become a slipping hazard.
☐	☐	☐	Provide ice dams on sloped roofs above doorways and walkways to prevent and/or break up sliding ice.

COMMENTS TO GENERAL FACILITY SAFETY DESIGN:

ELECTRICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Walk down conduit and cable tray routes before installation to identify hazards such as tripping, head, thermal, chemical, etc.
☐	☐	☐	The location, cable tray material, and conduit shall be designed for the identified hazards for that specific location.
☐	☐	☐	Place electrical equipment in accessible locations.
☐	☐	☐	Electrical Room Egress: Provide at least two exit paths even if Code allows one exit for "un-occupied space". These spaces frequently become temporary Control Centers during construction, commissioning, and start-up.
☐	☐	☐	Cabinet/enclosures shall be designed to allow sufficient space for maintenance if maintenance to be performed inside the cabinet/enclosure.
☐	☐	☐	Provide sufficient space to allow for cabinet / enclosure access doors to fully open.
☐	☐	☐	Provide sufficient space for electrical equipment as defined by NEC in walkways, area between cabinets, etc. for forklifts, routine maintenance, etc.
☐	☐	☐	All control switches shall be accessible from outside of the cabinet.

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YES	NO	N/A	
☐	☐	☐	Provide the manufacturer's recommended spacing for equipment cooling.
☐	☐	☐	Obtain arc flash incident energy level and labels for any equipment rated 480V and higher or greater than 125KVA at 120VAC & above per NFPA 70E.
☐	☐	☐	Consider extra guarding of high voltages (Plexiglas) in electrical cabinets to reduce PPE requirements.
☐	☐	☐	Switchgear shall be specified to provide "Lock Out" capability.
☐	☐	☐	Equipment shall be designed for the ratings for which it will be subject to (i.e., maximum voltage, short circuit current, continuous current, ambient temperature, etc.).
☐	☐	☐	Equipment, cable, conduit, tray, etc. shall be labeled with the voltage level.
☐	☐	☐	Equipment shall be labeled with normal power feed and backup power feed (if applicable).
☐	☐	☐	Consider backup power feed for systems where failure of normal power feed would result in a hazardous event.

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YES	NO	N/A	
☐	☐	☐	Label all equipment with appropriate equipment description (if applicable).
☐	☐	☐	When possible, critical conduits shall be installed in a duct bank rather than direct buried.
☐	☐	☐	Control cabinets and wiring termination cabinets shall be accessible from platforms or at grade level. Ladders shall be avoided.
☐	☐	☐	Provide fall protection tie-off points at tops of transformers.

COMMENTS TO ELECTRICAL SAFETY DESIGN:

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MECHANICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Walking or climbing surfaces are sheltered or maintained in a manner to avoid slippery surfaces from rain or ice. (Review on a case-by-case basis).
☐	☐	☐	Emergency drainage systems are provided to direct flammable liquid leakage to a safe location.
☐	☐	☐	Provide eye wash stations at locations where liquids are sampled or "open fluids" are otherwise handled.
☐	☐	☐	Stairs, ladders, or ramps are provided at all locations where equipment design or maintenance actions require personnel to abruptly change elevation by more than 12 inches.
☐	☐	☐	Fixed ladders designed with a slope of 75 degrees or more where practical.
☐	☐	☐	Whenever practical, provide adequate access for maintenance personnel to all mechanical components, small-bore piping, ducts, valves, thermowells, flow meters and other appropriate instrumentation on piping runs and equipment units which require inspecting, testing, servicing, adjusting, greasing, removal, replacement, or repair.
☐	☐	☐	When practical, locate instruments, sample points, valves, etc. that require frequent readings, calibration, operation, etc. to allow for walk-up access.

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YES	NO	N/A	
☐	☐	☐	Specify equipment to include handling features that will aid in grasping, removing, and carrying equipment.
☐	☐	☐	Labeling and coding is provided for service and adjustment points to clearly identify the key aspects of the maintenance activity.
☐	☐	☐	Equipment and components shall be labeled with weights for lifting and removing for later maintenance or replacement. When modifying existing equipment, determine the weight of the existing equipment plus modifications and label or revise the existing labels accordingly. When possible, the label shall include references to the calculation, project, and/or drawing number.
☐	☐	☐	Provide lifting devices (lifting lugs, beams, monorail, etc.) for maintenance and replacement of equipment. Lifting devices shall be labeled with the rated lifting capacity.
☐	☐	☐	Provide Indicators for convenient and reliable determination of fluid levels.
☐	☐	☐	Drain fittings are provided to support fluid removal readily and safely.
☐	☐	☐	Ensure design basis application for failure modes on all positioned equipment. Example, loss of air, loss of DC, etc.
☐	☐	☐	Standardize parts, maintenance and adjustment points as much as possible. For example, use the same size and type of bolts to eliminate special wrenches/tools. Utilize common rigging points to minimize types of rigging connections, etc. If standardization is not possible, clearly differentiate specialized items with signs, markings, etc.

YES	NO	N/A	
☐	☐	☐	Minimize steam hazards, heat hazards, sharp corners, edges, and projections on equipment.
☐	☐	☐	Equipment should be placed on concrete housekeeping pads, especially where standing water might accumulate.
☐	☐	☐	Add equipment protection features to guard against hazards that cannot be removed or designed out of the system.
☐	☐	☐	Specify that equipment vendor technical manuals deal with one specific equipment model rather than with many different equipment models.
☐	☐	☐	Valves shall be provided with "Lock Out" devices.
☐	☐	☐	Provide adequate isolation valving and venting for WPA, maintenance, etc. on piping systems and equipment. Follow applicable code/standard section requirements.

COMMENTS TO MECHANICAL SAFETY DESIGN:

Ameren MISSOURI

Specification #000167
Sheet No. C - 13

CHEMICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Insure that bulk chemical tanks have separate containment areas. Containment areas shall be washable and have the ability to be drained.
☐	☐	☐	All materials used to construct storage tanks, containment, piping, etc. must be verified to be compatible for use with the chemicals used in each specific application.
☐	☐	☐	Lengths of chemical piping runs should be minimized. Chemical supply tanks and pumps should be designed to be as close to injection points as possible. Overhead chemical piping runs should be minimized. When used, labels shall be affixed to the floor beneath the piping with proper hazard communication. Chemical lines must be labeled a minimum of every 10 feet. All PVC/CPVC chemical piping must be protected from foot traffic.
☐	☐	☐	Chemical day tanks shall be properly sized to minimize the number of drums in the work area.
☐	☐	☐	Designate storage areas for each type of chemical, taking into account compatibility of each.
☐	☐	☐	Provide sufficient room for servicing instruments around bulk chemical storage tanks.
☐	☐	☐	Drains to sump shall be located around all chemical feed equipment. Local wash down water must be provided in chemical feed area. Include hose and hose reels for local wash down water.

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YES	NO	N/A	
☐	☐	☐	All laboratory areas must contain proper first-aid kit(s).
☐	☐	☐	Material for chemical spill control (pigs, pads, soda ash, etc.) shall be located in a designated area close to chemicals.
☐	☐	☐	Personal protective equipment shall be located in a designated area close to chemicals.
☐	☐	☐	Chemicals shall be transferred to equipment (mixing tanks or day tanks) in a way to minimize chances of contacting personnel and avoid manual dumping of bottles and drums.
☐	☐	☐	Chemical containers must be labeled with chemical names and HAZCOM placards.
☐	☐	☐	All safety showers shall be supplied with tepid water. Safety showers located outside shall also be covered and protected from the wind. Safety shower activation shall signal an alarm in the control room.
☐	☐	☐	All concrete and equipment exposed to chemicals shall be coated with an appropriate chemical-resistant coating.
☐	☐	☐	PA shall be located convenient to all chemical use areas, but beyond the area that could be engulfed by a chemical spill.

YES	NO	N/A	
☐	☐	☐	Operating and Maintenance personnel shall be isolated from all chemical pumps and feed systems by plastic screens or curtains.

COMMENTS TO CHEMICAL SAFETY DESIGN:

END OF APPENDIX C

APPENDIX D
STANDARD CONTRACTOR SCHEDULING REQUIREMENTS

1.0 PRE-BID/AWARD REQUIREMENTS

1.1 Contractor bids shall be rejected if they are not accompanied by a schedule. The scheduling tool shall be Primavera Enterprise (P6) unless otherwise authorized by Ameren Construction managing supervisor in writing.

1.2 Contractor's bid schedule shall reflect sufficient level of detail that effectively communicates the methodology of work/execution plan. The bid schedule shall be defined in compliance with the milestones, project constraints and deliverables required by Ameren.

1.3 Contractor shall indicate the calendar of their work schedule (days/week, shifts/day, hours/day) that is the basis for their schedule.

1.4 Contractor shall identify projected manpower required to execute project and shall also provide an assessment of labor availability based on prevailing market conditions.

1.5 Contractor shall identify the hierarchy of their project management team, including an organization chart of how they report to the Project Manager and how they report into the project management system.

1.6 The individual responsible for updating the Contractor's schedule shall be identified in the bid along with a personal resume.

1.7 Contractor's bid shall list any exceptions to the standard schedule requirements.

2.0 PRE-OUTAGE REQUIREMENTS AFTER AWARD

2.1 Contractor's point of contact for schedule submittals/updates will be the Ameren Project Scheduler. All schedule iterations and revisions shall be coordinated and approved through the Project Scheduler.

2.2 Contractor shall be required to organize the schedule according to requirements specified by Ameren's Project Scheduler, and shall include a work breakdown structure (WBS) that follows the provided sample schedule to facilitate schedule review and reporting.

2.2.1 Contractor shall develop their resource loaded schedule using Ameren's outage planning milestones within two weeks following contract award date. During this time frame, the Contractor and Project Scheduler will collaborate to develop a mutually acceptable schedule. Contractor's schedule will then be installed in the Ameren network to be used as the working schedule during pre-outage, outage execution and post outage.

2.2.2 Contractor is required to provide an onsite scheduler to provide updates to Ameren Project Scheduler for scheduling progress once installed in Ameren network.

2.2.3 Ameren will provide onsite network access to Contractor for scheduling review.

2.2.4 Ameren will make milestone to milestone ties, and other appropriate relationship ties between Contractor schedule and Ameren integrated outage schedule.

2.3 Contractor baseline shall be established after both Contractor and Project Scheduler mutually agree on schedule. This will be completed before the start of the outage. In accordance with outage planning milestones, the baseline schedule shall be compared to the actual schedule during the course of the outage.

3.0 OUTAGE EXECUTION/SUPPORT REQUIREMENTS

3.1 Contractor shall provide an onsite scheduler, unless otherwise authorized by Ameren, to provide updates to the Project Scheduler. Contractor scheduler will provide the following update information:

3.1.1 Activities worked on

3.1.2 Actual durations and resources used

3.1.3 Remaining durations

3.1.4 Percent complete

3.1.5 Expected finish dates

3.2 Contractor shall update/analyze the schedule daily. The schedule shall provide accurate reflection of progress throughout the outage. Schedule analysis should include risk management strategies to assure that outage milestones are achieved.

3.3 Contractor shall provide updates to Project Scheduler daily by 8:00 a.m. Several iterations of schedule edits/updates may be required before the Contractor's schedule may be scheduled with the integrated outage schedule. Ameren's Project Scheduler will analyze all schedules together with the integrated outage schedule and will post the updated integrated outage schedule to outage home page by 1:30 p.m.

3.4 Contractor will supply and develop activities, resources and associated project logic for added EWO work within one day of award of contract. Ameren will update Contractor with EWO work.

3.5 Ameren Project scheduler will inform the Contractor scheduler or single point of contact, Ameren engineering and responsible plant personnel of any high-risk activities that may impact the outage schedule and milestones on the Integrated Outage Schedule as required.

3.6 If Contractor progress is not meeting or will not meet the outage milestones, Ameren will require Contractor to participate in a re-evaluation of remaining work to ensure that milestone dates will be met for outage.

4.0 <u>POST-OUTAGE SCHEDULE REQUIREMENTS</u>

4.1 Contractor shall attend post-outage critique meetings that include a review of schedule performance.

END OF APPENDIX D

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APPENDIX E

SAFETY DATA SHEETS

CONTRACTOR AFFIDAVIT PURCHASE ORDER NO.

As the responsible party for the firm of ______________________________, I do here state that I have requested, received, read, understand, and will abide by and enforce the guidelines and conditions set forth in the Safety Data Sheets (SDS) provided by the product manufacturer for each hazardous chemical product delivered to and/or used in connection with the work specified in _________________________. I further state that I have the most current copy of the SDS for each hazardous chemical my firm has brought on site.

I further state that I am aware of, understand, and will fully implement the requirements of the OSHA Hazard Communication Standard (CFR 29, Part 1910.1200) and other workers' right-to-know laws.

I further state that I understand that Ameren maintains copies of SDS's on chemical substances at this facility. If any question arises regarding any chemicals to which employees may come into contact, an SDS on that chemical shall be reviewed. A copy of the SDS's is available from the Ameren SPOC.

I further state that I will maintain copies of the required SDS for each hazardous chemical used while on Ameren property; and will insure that the Safety Data Sheets are readily accessible during each work shift to employees when they are in their work areas.

I further state that the information contained within the SDS has been disseminated to all parties who have a right or need to know; and that all workers and other effected parties have received adequate and appropriate training in the hazards, handling, and use of hazardous chemicals.

____ ____________________

Contractor's Representative/Title Date

____

Notary Public Signature & Seal

END OF APPENDIX E

APPENDIX F
LEADED PAINT DISTURBANCE

NOT USED FOR THIS PROJECT

APPENDIX G
ASBESTOS REMOVAL

NOT USED FOR THIS PROJECT

APPENDIX H
FEDERAL ENERGY REGULATORY COMMISSION (FERC) STANDARDS OF CONDUCT

NOT USED FOR THIS PROJECT

APPENDIX I
CHEMICAL OF INTEREST REPORTING

NOT USED FOR THIS PROJECT

APPENDIX J
VENDOR DRAWING TRANSMITTAL/CAD REQUIREMENTS

NOT USED FOR THIS PROJECT

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APPENDIX K
PLANT ACCESS, PARKING & SECURITY

1.0 Plant Access, Parking and Security

1.1 Contractor employees, visitors and vendors must enter the plant *only* at the entrance where their company name is posted. Security cameras monitor entrances to inform supervisors of violations.

1.2 Security will direct contractor employees to work rules training the first time employees report to the site.

1.3 Employees must document their completion of site specific work rules training before they are allowed unescorted access to the site.

1.3.1 Computer Based Training (CBT) is typically used for work rules orientation and to document training.

1.3.2 Contractor employees must read and sign a hard-copy of the Job Working Rules if an orientation video or oral presentation is used for training.

1.3.3 If alternative training has been used due to a temporary CBT malfunction, then employees must take the CBT training when the system is restored.

1.4 Contractor's Employee Identification

1.4.1 Ameren Contractor ID badges containing the Contractor employee's name and Contractor ID number are issued when work rules training is completed.

1.4.2 Security will re-activate an existing badge if the employee has completed the site work rules orientation within the last 12 months.

1.4.3 Security will de-activate badges at the end of each job.

1.4.3.1 Contractor shall inform the Single Point of Contact (SPOC) when employees will complete their work on the site using the Reduction in Force Report (Attachment A7).

1.4.4 Daily gate logs will be used to validate invoices and may be provided to the Contractor upon request. If the plant has electronic badge readers, employee arrival and departure times are automatically recorded.

1.4.5 Contractor shall provide employees with hard hats of the same color. The hard hats must have Contractor's name or company logo on either the sides or the front of the hard hat.

1.4.6 Security will apply labels with the employee's first and last names to the front and back of each hard hat.

1.4.7 Contractor may provide a hard hat storage container at the Construction gate. PPE is required to access the site.

1.5 Contractor Access

1.5.1 Business agents, vendor/sales representatives, contractor executives and other contractor visitors shall park in the construction parking lot and be escorted on-site.

1.5.2 Consultant badge holders may park in either the construction parking lot or the Ameren employee parking lot visitor space, depending on the purpose of the visit.

1.5.3 A contractor employee who has completed CBT/Work Rules training may escort visitors and ensure Ameren work rules are followed.

1.5.4 Contractor visitors are issued a Visitor's badge and are required to wear a hard hat and safety glasses.

1.6 Vehicles Beyond the Security Gate

1.6.1 Only contractor work vehicles with an Ameren mirror tag are permitted beyond the security gate. Contractor can request a mirror tag for vehicles necessary to complete the Work by submitting an Authorization for Site Vehicle Pass form.

1.6.1.1 Vehicles must have Contractor name or Logo on each side and must have an insurance certificate verifying $1,000,000.00 minimum liability coverage.

1.6.1.2 Contractor work vehicles, commercial vehicles, or contract carrier vehicles without a mirror tag will be held at the gate until cleared by the SPOC.

1.6.2 Vehicle drivers and all passengers must swipe/sign-in at the construction gate.

1.6.3 Contractor vehicles leaving the plant will be inspected by Security.

1.6.3.1 Tools and materials being removed on Contractor vehicles must have an Ameren Material Pass (Form 5532NS) signed by the SPOC and a Contractor supervisor for Security to retain.

1.7 Use of Plant Facilities

Note: The policies are on Scholar, the Ameren intranet. Go to *Employee Center, Corporate Policies, Policies by Topic, Technology*.

1.7.1 Contractors who have Ameren computers, phones and fax machines are "Privileged Users" and must comply with the following policies.

- Electronic Mail Policy
- Facsimile Machine Usage Policy
- Information Resources Acceptable Use Policy
- Internet/Intranet Usage Policy
- System Access Control Policy
- Wireless Communication Policy

1.7.2 Work areas must be restored to a condition that is approved by the SPOC.

END OF APPENDIX K

APPENDIX L
CYBER SECURITY

NOT USED FOR THIS PROJECT

APPENDIX M
HAULING HEAVY EQUIPMENT

NOT USED FOR THIS PROJECT

APPENDIX N
PIPE AND FITTINGS: APPROVED MANUFACTURER LIST

NOT USED FOR THIS PROJECT

APPENDIX Q
QUALITY MANAGEMENT OVERSIGHT APPLICATION AID

NOT USED FOR THIS PROJECT

APPENDIX R
RADIOGRAPHY SAFETY REQUIREMENTS

NOT USED FOR THIS PROJECT

APPENDIX W
WELDING AND NDE

NOT USED FOR THIS PROJECT

APPENDIX X
FOREIGN MATERIAL EXCLUSION REQUIREMENTS

NOT USED FOR THIS PROJECT

APPENDIX Z
CONFINED SPACE LOCATIONS

NOT USED FOR THIS PROJECT

APPENDIX AA

BID FORM

MEREDOSIA ASH POND CLOSURES

AT

MEREDOSIA ENERGY CENTER
MORGAN COUNTY, ILLINOIS

FOR

AMEREN ENERGY MEDINA VALLEY COGEN, LLC
800 South Washington Street
Meredosia, IL 62665

DATE ________________, 2016

BIDDER

FIRM ____

ADDRESS ____

CITY ____________________ STATE ____________________ ZIP ____________

TELEPHONE NO (with AREA CODE) ______________________________________

BASE BID

The scope of **BASE BID** shall include all work included in the Plans and Specification as outlined on this bid form.

Having examined all Bidding Documents, including the Request for Quotation, and Plans and Specification prepared by Geotechnology, Inc. and CDG Engineers, Inc. for the project entitled above dated 04-29-2016 and having visited the site and examined all conditions affecting work, the undersigned proposes to furnish all labor, materials, equipment, and appliances required by said work for a Stipulated Sum of:

BASE BID:

____ DOLLARS (______)

For purposes of progress payment submittals only, this base bid can be divided as follows:

Ash Pond Closure	Quantity	Unit	Total Cost
Mobilization/Demobilization	1.0	LS	$
Erosion and Sediment Control Measures	1.0	LS	$
Surface Water Management	1.0	LS	$
Clearing and Grubbing	1.0	LS	$
Removal of Improvements	1.0	LS	$
Earthwork (Ash)	427,216	CY	$
Earthwork (Borrow)	167,076	CY	$
Earthwork Misc. Grading (Ditches, Swales, etc)	5,943	CY	$
ClosureTurf™	42.8	AC	$
HydroTurf™	3.4	AC	$
Energy Dissipators	317.0	CY	$
Remove and Re-use Existing Rock Blanket	3,386.0	CY	$
Rock Blanket	1,145.0	CY	$
Dewatering	1.0	LS	$
Aggregate Access Road (6" thick)	156	CY	$
Aggregate Access Road (24" thick)	2873	CY	$
Seeding and Mulching	33.0	AC	$
Chain Link Fence	995.0	LF	$
30' Wide Gate	1.0	EA	$
Other / Misc.	1.0	LS	$
Utility Allowance (Local Utility)	1.0	AL	$ 60,000
		TOTAL	$

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Specification #000167
Sheet No. AA - 3

SUBCONTRACTOR INFORMATION

The Contractor shall list all Subcontractors that he proposes to use.

SUBCONTRACTOR: ______________________________

ADDRESS: ______________________________

CITY ______________ STATE ______________ ZIP __________

WORK: ______________________________

SUBCONTRACT AMOUNT: $ ______________________________

SUBCONTRACTOR: ______________________________

ADDRESS: ______________________________

CITY ______________ STATE ______________ ZIP __________

WORK: ______________________________

SUBCONTRACT AMOUNT: $ ______________________________

SUBCONTRACTOR: ______________________________

ADDRESS: ______________________________

CITY ______________ STATE ______________ ZIP __________

WORK: ______________________________

SUBCONTRACT AMOUNT: $ ______________________________

LABOR AND EQUIPMENT RATES FOR TIME AND MATERIAL WORK

Provide on the following pages labor and equipment rates for miscellaneous work on Ameren Energy Medina Valley Cogen, LLC property at the Meredosia Energy Center as directed by the Owner.

Use of equipment included on the Small Tools Reference List shall be considered incidental to the labor and equipment rates provided.

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Specification #000167
Sheet No. AA - 4

TIME AND MATERIAL LABOR RATES

EXPIRE ________________

	S.T.	T.H.	D.T.
Carpenter/Millwright			
Apprentice			
Journeyman			
Foreman			
General Foreman			
Laborer			
Apprentice			
Journeyman			
Foreman			
General Foreman			
Cement Mason			
Apprentice			
Journeyman			
Foreman			
General Foreman			
Ironworker (Rebar)			
Apprentice			
Journeyman			
Foreman			
General Foreman			
Operator			
Apprentice			
Journeyman			
Foreman			
General Foreman			
Ironworker (Structural)			
Apprentice			
Journeyman			
Foreman			
General Foreman			

Material Mark-up	
Subcontractor Mark-up	
Equipment Mark-up	

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Specification #000167
Sheet No. AA - 5

BARE EQUIPMENT RATES

EXPIRE ___________

	Daily	Weekly	Monthly
Compactors/Tampers			
Compactor (Plate Tamper)			
Compactor (Jumping Jack)			
Concrete Breaking & Drilling			
Jack Hammer (60-90#)			
Chipping Hammer			
Hel Dog			
Rock Drills (45# & Over)			
1 - 1/2" Hammer Drill			
Concrete Placing Equipment			
Concrete Bucket (1CY)			
Concrete Bucket (2CY)			
Concrete Buggy (Power)			
Concrete Power Trowel (36")			
Concrete Vibrator			
Concrete Vibrator High Cycle			
Concrete Vibrators Air			
Concrete Saws			
Concrete Chain Saw			
Hand Held Cut-Off-Saw			
K40 Hand Held Air Saw			
K50 Walk Behind Air Saw			
14" Walk Behind			
36" Walk Behind			
Drills - Electric			
Core Drill			
Magnetic Drill			
Engineering and Alignment Equipment			
Engineers Level (Including Rod)			
EL-1 Electronic Level (Rotating)			
Level (Self Leveling)			
Transit			
Laser Alignment			
Generators			
Electric Generator Up To 3500 Watts			
Hi-Cycle 3500 Watt Generator			

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Specification #000167
Sheet No. AA - 6

	Daily	Weekly	Monthly
Heavy Equipment			
Bobcat			
Gehl GX35 Hoe or equivalent			
John Deere 650G Dozer or equivalent			
Cat 426 Backhoe (4WD)(416B) or equivalent			
Ford 655A Backhoe or equivalent			
Long-Arm Crawler Excavator			
Backhoe Mounted Hydraulic Breaker			
Backhoe Mounted Auger			
Backhoe Mounted Compactor			
Track Skid Steer			
Gradall/Lull/Lift			
Trackhoe			
Flatbed Truck			
Pick-up			
Hoists			
Air Tugger			
Electric Chain Hoist			
3 Ton Chain Hoist			
Miscellaneous Equipment			
Light Plant			
Gang Box (Security Box)			
Port-a-Power			
Radio			
Radio Repeater			
Pumps			
Pump with 20' suction & 50' discharge			
3" Gas			
4" Gas			
6" Gas			
Pump Only			
3" Gas			
4" Gas			
6" Gas			
2" Submersible			
3" Submersible			
4" Submersible			
Safety			
Breathing Air Equipment			
Tripod Safety Hoist			

	Daily	Weekly	Monthly
Shoring			
Shoring 11' -6 x 8" Panel (Krings)			
Shoring 14" Beams (Each)			
Trailers			
Large (Office)			
Small (Office)			
Work or Change Trailer			
Welders			
110 Wire Feed Welders			
Gas Welder			
Electric Welder			

Additional Equipment Required to Complete the Work

Ameren MISSOURI

Specification #000167
Sheet No. AA - 8

FIRM: ______________________________

ADDRESS: ______________________________

CITY ______________ STATE ______________ ZIP __________

TELEPHONE NO. (with AREA CODE) ______________________________

AUTHORIZED SIGNATURE: ______________________________

TITLE: ______________________________

DATE: ______________________________

ATTACHMENT G

SEE LARGE FORMAT MAP OR PLAN SHEET

DOCUMENT DESCRIPTION:

Tie #:	Batch # W0060l2
Document ID #:	2833912
Site #:	W137 030 0005
Site Name:	Ameren Energy - Meredosia
Cat #:	06L
Document Date:	08/15/2016
Permit #:	
Log #:	
Keyword:	
Comment:	

	Type or Description of Plan/Drawing	SEE COLOR	Date of Plan	Figure/Diagram
1.	Plant Vicinity Map	Y	8/12/16	T-002
2.	Title Sheet	Y	8/12/16	T-001
3.	Site Index Map	Y	8/12/16	C-101
4.	General Notes	N	8/12/16	T-003
5.	Site Plan	Y	8/12/16	C-102
6.	Site Plan	Y	8/12/16	C-103
7.	Site Plan	Y	8/12/16	C-104
8.	Site Plan	Y	8/12/16	C-105
9.				

IL 532-2702
LPC 602 5/2008

SEE LARGE FORMAT MAP OR PLAN SHEET

DOCUMENT DESCRIPTION:

Tie #:	Batch #W006012
Document ID #:	283391[illegible]
Site #:	W1370300005
Site Name:	Ameren Energy - Meredosia
Cat #:	06L
Document Date:	8/15/16
Permit #:	
Log #:	
Keyword:	
Comment:	

	Type or Description of Plan/Drawing	SEE COLOR	Date of Plan	Figure/Diagram
1.	Site Plan	Y	08/12/16	C-106
2.	Site Plan	Y	8/12/16	C-107
3.	Site Profile	N	8/12/16	C-110
4.	Profiles	N	8/12/16	C-111
5.	Details	Y	8/12/16	C-301
6.	Details	Y	8/12/16	C-302
7.	Details	Y	8/12/16	C-303
8.	Details	Y	8/12/16	C-304
9.				

IL 532-2702
LPC 602 5/2008

SEE LARGE FORMAT MAP OR PLAN SHEET

DOCUMENT DESCRIPTION:

Tie #:	Batch # W006012
Document ID #:	2833912
Site #:	W1370300005
Site Name:	Ameren Energy - Meredosia
Cat #:	06L
Document Date:	8/15/16
Permit #:	
Log #:	
Keyword:	
Comment:	

	Type or Description of Plan/Drawing	SEE COLOR	Date of Plan	Figure/Diagram
1.	Details	N	8/12/16	C-305
2.	Drainage Area Map	Y	8/12/16	C-601
3.	SWPPP Plan	Y	8/12/16	C-602
4.	SWPPP Details	N	8/12/16	C-603
5.				
6.				
7.				
8.				
9.				

IL 532-2702
LPC 602 5/2008

W1370308005
06L

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR ALEC MESSINA, DIRECTOR

March 8, 2017

Mr. Mike Bollinger, Principal Environmental Scientist
Ameren Services
1901 Chouteau Avenue
P.O. Box 66149, MC 602
St. Louis, Missouri 63166-6149

Dear Mr. Bollinger;

This transmittal responds to the AmerenEnergy Medina Valley Cogen, LLC (Ameren) supplemental data and responses received at the Illinois Environmental Protection Agency ("Agency") headquarters, dated February 6, 2017, which amends the "Closure Plan: Fly Ash Pond and Bottom Ash Pond, Meredosia Power Station". The Agency has reviewed the additional data and responses Ameren provided, and finds that the document adequately addresses the Agency's comments dated November 1, 2016.

The Agency notes that Ameren has committed to submitting a signed groundwater management zone ("GMZ") application upon the Agency's approval of the Meredosia Station Closure Plan which includes the initial plan dated August 15, 2016 as modified by the supplemental information dated February 6, 2017. The Agency hereby approves the Closure Plan for the Meredosia Station. The Agency will acknowledge approval of the signed GMZ application under separate cover.

Thank you for your attention to these matters. If you have any questions or concerns, please contact Lynn Dunaway of my staff or me at the letterhead address or 217/785-4787.

Sincerely,

William E. Buscher

William E. Buscher, P.G.
Supervisor, Hydogeology and Compliance Unit
Groundwater Section
Division of Public Water Supplies
Bureau of Water

CC: Lynn Dunaway
Darin LeCrone
Records

4302 N. Main St., Rockford, IL 61103 (815)987-7760
595 S. State, Elgin, IL 60123 (847)608-3131
2125 S. First St., Champaign, IL 61820 (217)278-5800
2009 Mall St., Collinsville, IL 62234 (618)346-5120
9511 Harrison St., Des Plaines, IL 60016 (847)294-4000
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2309 W. Main St., Suite 116, Marion, IL 62959 (618)993-7200
100 W. Randolph, Suite 10-300, Chicago, IL 60601

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Development and Resource Center

W1370300005-5

January 31, 2019

IL0000116

Bill Buscher
Groundwater Protection
Division of Water Pollution Control
Illinois Environmental Protection Agency
PO Box 19276
Springfield, IL 62794-9276

RE: Medina Valley Cogen, LLC
Meredosia Energy Center
Ash Pond Closures

Mr. Buscher,

I am pleased to inform you that Medina Valley Cogen, LLC has completed closure of the inactive Fly Ash and Bottom Ash Ponds at Meredosia Power Station. The closure project was deemed substantially complete December 5, 2018 in accordance with the Closure Plan approved by IEPA on March 8, 2017.

Enclosed are two copies of the Construction Quality Assurance (CQA) Report and Certification dated January 18, 2019, as required by Title 35, Part 840, Subpart A, Section 840.134. Please note that the Post-Closure Care Plan was submitted previously and approved by IEPA as part of the Closure Plan.

In accordance with Section 840.144, Annual Reports are due no later than March 28 of each year during the closure and throughout the post-closure care period. Ameren plans to submit an annual report containing groundwater monitoring data and any closure or post-closure activities after December 5, 2018.

If you have any questions or comments regarding this submittal, please contact me at (314) 957-3202 or at mwagstaff@ameren.com.

Sincerely,

Michael J. Wagstaff

Michael J. Wagstaff, P.E.
Consulting Engineer
On behalf of Medina Valley Cogen, LLC

Encl.

cc: D. E. Harley, w/o enclosure
M. Frerking, w/o enclosure
C. Henderson, w/o enclosure
S. B. Knowles, w/o enclosure
C. Giesmann, w/o enclosure
M. Kohlbusch, w/ enclosure (2)

W137030005
06L

GEOTECHNOLOGY INC
FROM THE GROUND UP

CONSTRUCTION QUALITY ASSURANCE REPORT
CLOSURE OF THE BOTTOM ASH POND AND FLY ASH POND

MEREDOSIA POWER STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, MORGAN COUNTY, ILLINOIS

Prepared for:

AMEREN ENERGY RESOURCES
ST. LOUIS, MISSOURI

Prepared by:

GEOTECHNOLOGY, INC.
ST. LOUIS, MISSOURI

Date:

JANUARY 18, 2019

Geotechnology Project No.:

J024917.04

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

St. Louis, MO | Erlanger, KY | Memphis, TN | Overland Park, KS | Cincinnati, OH | Fairview Heights, IL
Lexington, KY | Dayton, OH | Oxford, MS | Jonesboro, AR

GEOTECHNOLOGY INC
FROM THE GROUND UP

January 18, 2019

Mr. Mike Wagstaff, P.E.
Ameren Energy Resources
3700 South Lindbergh Boulevard
St. Louis, Missouri

RE: Construction Quality Assurance Report
Closure of the Bottom Ash Pond and Fly Ash Pond
Meredosia Power Station
800 South Washington Street
Meredosia, Morgan County, Illinois
Geotechnology Project Number: J024917.04

Dear Mr. Wagstaff:

Attached is the Construction Quality Assurance report for the referenced site. This report is documentation of the activities associated with the closure of the Bottom Ash Pond and the Fly Ash Pond at the Meredosia Power Station in Meredosia, Morgan County, Illinois performed through December 5, 2018. Site activities ceased on December 5, 2018 after reaching substantial completion. Final punch-list activities will be performed after the conclusion of winter weather and will be summarized in an addendum letter.

If you have any questions or comments regarding the attached information, please contact the undersigned at (314) 997-7440.

Very truly yours,

GEOTECHNOLOGY, INC.

Anna M. Saindon, P.E., Ph.D.
Project Manager

JYG/AMS/JAW:jyg/jsj

11816 Lackland Road, Suite 150 | St. Louis, Missouri 63146
(314) 997-7440 | Fax: (314) 997-2067 | geotechnology.com

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PLATES

APPENDICES

1.0 PROJECT BACKGROUND

Geotechnology, Inc. prepared this Construction Quality Assurance (CQA) report for the Bottom Ash Pond and Fly Ash Pond closure at the Meredosia Power Station in Meredosia, Morgan County, Illinois. The CQA report was prepared in general accordance with the Coal Combustion Residual (CCR) surface impoundment closure guidance of 35 Illinois Administrative Code (IAC) 840.146 entitled Site-Specific Closures of Coal Combustion Waste Surface Impoundments Subpart A: Closure of Ash Pond D, Hutsonville Power Station Construction Quality Assurance Program.

The Meredosia Power Station is located in the floodplain east of the Illinois River, south of Meredosia in Morgan County, Illinois, which is located in west-central Illinois. The Meredosia Power Station ash ponds are located in the south half of Section 21 and the north half of Section 28, T.16N, R.13W. The plant generated electricity from 1948 until February 2012. A third ash pond referred to as the "Old Ash Pond" was previously closed, and will not be further discussed in this report. The Bottom Ash Pond and Fly Ash Pond were constructed of native materials. A site overview with key feature locations is provided on Figure 1.

The Bottom Ash Pond was constructed in 1972 with a design surface area of 11 acres, a height of 24 feet and a volume of approximately 90 acre-feet. The Bottom Ash Pond reportedly received low-volume wastewater, bottom ash, and storm water runoff. The site operates under NPDES Permit IL0000116 Outfall 003 for the Bottom Ash Pond.

The Fly Ash Pond was constructed in 1968. The Fly Ash Pond has a surface area of 34 acres, a height of 24 feet and a volume of approximately 500 acre-feet. The Fly Ash Pond reportedly received fly ash, low-volume wastewater, and storm water runoff. The site operates under NPDES Permit IL0000116 Outfall 004 for the Fly Ash Pond. A Fly Ash Stockpile formerly located southeast of the Fly Ash Pond was clean closed as part of closure activities.

Clean closure activities for the Bottom Ash Pond generally consisted of CCR material removal, backfill to design grade with soil fill, construction of surface water control structures, and vegetation. A berm with CCR materials was closed-in-place in order to provide access to a river dock on the site. Closure activities for the berm generally consisted of placement, grading, and compaction of bottom ash and soil fill to design grade and installation of a ClosureTurf system consisting of 40-mil high density polyethylene (HDPE) MicroSpike geomembrane, a synthetic turf geotextile, and sand infill. ArmorFill was placed in the sand infill.

Closure activities for the Fly Ash Pond included placement of CCR materials excavated from the Bottom Ash Pond and the Fly Ash Stockpile, grading and compacting the subgrade to design slopes, construction of surface water control structures, and installation of a ClosureTurf system consisting of 40-mil MicroSpike HDPE geomembrane, a synthetic turf geotextile, and sand infill. ArmorFill will be placed in the sand infill in the stormwater ditches at the perimeter of the Fly Ash Pond in the spring of 2019.

2.0 CLEAN CLOSURE ACTIVITIES

2.1 CCR Removal Activities

CCR was removed from the Bottom Ash Pond and the Fly Ash Stockpile to facilitate clean closure of these areas. The berm in the Bottom Ash Pond was excluded from clean closure activities and is discussed later in this report. CCR removal at the Bottom Ash Pond began on March 12, 2018 and concluded on May 23, 2018. CCR removal at the Fly Ash Stockpile began on June 12, 2018 and concluded on July 11, 2018. A CQA representative periodically observed the CCR removal activities to assess the extent of CCR removal. CCR removed from the Bottom Ash Pond and the Fly Ash Stockpile was placed in the Fly Ash Pond. The CQA Certifications by the CQA Officer are provided in Appendix B. After CCR removal and CQA Officer approval, the areas were brought to final grade, stormwater controls were installed, and the areas were vegetated.

2.2 Coal Pile

The Coal Pile was used to store coal for use at the power plant during operation. The excess coal stored in the Coal Pile after the power plant operation ceased was removed prior to the beginning of this project. Residual coal spoils were present in the coal yard after removal activities were performed. Approximately two feet of soil and residual coal spoils were removed from the Coal Pile and a runoff area southwest of the Coal Pile. The residual coal materials and mixed soils were placed in the Fly Ash Pond. The CQA Certifications by the CQA Officer are provided in Appendix B.

2.3 Survey of Final Grade

The finished grade of the Bottom Ash Pond, the Coal Pile, and the Fly Ash Stockpile was surveyed by a licensed surveyor for a final as-built drawing. The results of the survey are illustrated and summarized on Figure 2.

2.4 Surface Water Management

Surface water management structures in the Bottom Ash Pond, the Coal Pile, and the Fly Ash Stockpile, including ditches and outfalls, were built in accordance with the design and approved modifications thereof.

2.5 Vegetation

After the Bottom Ash Pond, the Coal Pile, and the Fly Ash Stockpile were brought to final grade, they were fertilized and seeded using synthetic mats and straw to establish vegetation.

3.0 SUBGRADE PREPARATION

Subgrade preparation at the Bottom Ash Pond Berm began on June 5, 2018 and was completed on June 29, 2018. Subgrade preparation at the Fly Ash Pond began on May 7, 2018 and was completed on August 14, 2018.

Subgrade preparation activities at the Bottom Ash Pond Berm generally consisted of placement and compaction of fill soils in approximately 12-inch lifts, performing compaction testing, and surveying the final subgrade elevations.

Subgrade preparation activities at the Fly Ash Pond generally consisted of placing CCR material excavated from the Bottom Ash Pond and the Fly Ash Stockpile, placing residual coal spoils and mixed soils from the Coal Pile, grading the CCR materials placed in the Fly Ash Pond, compacting the top 12-inches of subgrade material, performing compaction testing, and surveying the final subgrade elevations. In addition, the prepared subgrade was visually assessed by the CQA Officer to observe that the surface was relatively smooth and free of deleterious materials (i.e. jagged, irregularly-shaped protrusions) that could damage the geomembrane.

3.1 Laboratory Testing

Two soil fill bulk samples and four CCR bulk samples were collected and submitted to the Geotechnology soil laboratory for standard Proctor moisture-density relationship testing. The laboratory testing results are summarized and presented in Appendix C.

One pre-qualification sample was collected of off-site backfill soils to be used as backfill in the Bottom Ash Pond (outside the berm area) and in the Fly Ash Stockpile. Additional conformance samples were collected for every 25,000 cubic yards of backfill brought onto the site. The laboratory testing results are summarized and presented in Appendix C.

3.2 Subgrade Compaction

Moisture/density tests were performed on each 12-inch lift of soil fill placed at the Bottom Ash Pond Berm and on the upper 12 inches of the Fly Ash Pond subgrade. The moisture/density results were compared to the standard Proctor moisture-density relationship laboratory testing data to assess the compaction. The project specifications require the subgrade to be compacted to 90 percent of the maximum standard Proctor dry density. Areas of failed moisture/density tests were re-compacted and re-tested as needed. Based on the laboratory and field testing results, the subgrade was compacted in general conformance with the CQA plan. The field tests are summarized in Table 1 (Bottom Ash Pond Berm) and Table 2 (Fly Ash Pond), and field reports with results are provided in Appendix C.

In addition to moisture/density testing, the Fly Ash Pond and the Bottom Ash Pond Berm subgrade were proof rolled using an 84-inch Sakai smooth drum roller under the observation of a CQA Representative to visually confirm firmness and stability of fill prior to placement of HDPE geomembrane.

Compaction of backfill materials at the Bottom Ash Pond (outside of the berm area) was performed using an 84-inch Sakai smooth drum roller. A proof roll of each lift using the smooth drum roller was used to confirm compaction of the Bottom Ash Pond backfill materials.

3.3 Survey of Final Grade

The finished grade of the Fly Ash Pond was surveyed by a licensed surveyor prior to installation of the geomembrane. The results of the survey are illustrated and summarized on Figure 2.

4.0 HDPE GEOMEMBRANE

40-mil HDPE MicroSpike geomembrane placement at the Bottom Ash Pond Berm began on August 6, 2018 and was completed on August 16, 2018.

40-mil HDPE MicroSpike geomembrane placement at the Fly Ash Pond began on August 17, 2018 and was completed on October 30, 2018.

Site activities ceased on December 5, 2018 after reaching substantial completion. Final punch-list activities will be performed after the conclusion of winter weather and will be summarized in an addendum letter.

Final punch-list activities are not required at the Bottom Ash Pond Berm. Final punch-list activities at the Fly Ash Pond include minor repair to the HDPE geomembrane.

4.1 Prequalification Testing

The geomembrane manufacturer, Agru America, Inc., supplied an inventory list of the 40-mil HDPE MicroSpike geomembrane rolls to the owner and the CQA Officer. The geomembrane manufacturer submitted samples from the prequalification rolls to an independent geosynthetics laboratory for verification of selected manufacturer's guaranteed properties (presented in Appendix D). On each geomembrane roll selected for sampling, a 2-foot long sample was collected along the entire width of the roll.

In addition, the manufacturer submitted documentation that the materials supplied were tested for the parameters listed in the manufacturers list of guaranteed properties at the required testing frequency. The results of the testing, including identification of tested rolls, were submitted to the CQA Officer for review. The manufacturer certified that all tested rolls met the manufacturer's guaranteed properties in accordance with the specified testing frequency rate (Appendix D).

Geomembrane prequalification testing was completed prior to delivery. Copies of the testing results are provided in Appendix D.

4.2 Installer Certification of Placement Surface

The geomembrane installer's inspection and acceptance of the prepared subgrade surface as suitable for the geomembrane installation is documented through Certificates of Acceptance (Appendix F). Certificates of Acceptance were provided to the CQA Officer each day for the area covered by geomembrane that day.

4.3 Seam Overlap Testing

The geomembrane installer arranged the geomembrane panels in an orientation to reduce the number of field seams. Within the geomembrane footprint, seam overlaps were field measured by the geomembrane installer to verify that the required 3 inches of overlap was met for each seam. Seam overlaps were generally "shingled" in the direction of the downslope. The CQA Officer and field representatives made independent measurements of the seam overlaps for additional verification.

4.4 Non-Destructive Testing

The geomembrane installer performed non-destructive testing of seams at the frequency specified in the CQA Plan. The seams were non-destructively tested over the full-length using a vacuum test unit, air pressure test, or other methods (i.e., spark testing for geomembrane boots around penetrations for pipeline supports and electric pole guy wires) approved by the CQA Officer. Vacuum testing and air pressure testing procedures are presented in Sections 4.4.1 and 4.4.2. Testing was completed as the seaming progressed. The CQA Officer and field representatives observed the non-destructive testing performed by the geomembrane installer. The geomembrane installer submitted all non-destructive field-testing results to the CQA Officer (Appendix D).

4.4.1 Air Pressure Testing (Double Fusion Welds)

Double fusion welders were typically used to fuse two panels of geomembrane together. Air pressure testing procedures for double fusion welds follow.

The air pressure test equipment included:

- Air pump (manual or motor driven) or air compressor equipped with pressure gauge capable of generating and sustaining a pressure of 25 to 30 pounds per square inch (psi) and mounted on a cushion to protect the geomembrane,
- Rubber hose with fittings and connections, and
- Sharp hollow needle with pressure gauge.

The air pressure test procedure was as follows:

1. Both ends of the seam to be tested were sealed.
2. A needle was inserted into the tunnel created by the fusion weld.
3. A protective cushion was inserted between the air pump and the geomembrane.
4. The air pump was energized to a pressure between 25 psi and 30 psi. The valve was closed, and the pressure was sustained for a minimum of five minutes.
5. If loss of pressure exceeded 3 psi or did not stabilize, the leaking area was located, then repaired and retested until passing test results were obtained.

6. At the conclusion of a passing air pressure test, the opposite end of the seam was slit and the subsequent drop in pressure was observed. Our observation of the pressure drop indicated that the seam passed.
7. The needle was removed. An extrusion-welded repair is required at each air test penetration.

4.4.2 Vacuum Testing (Extrusion Welds)

Extrusion welds were typically used for repairs and protrusions through the geomembrane. Vacuum testing procedures for extrusion welds follow.

The vacuum test equipment included:

- Vacuum box assembly consisting of a rigid housing with a transparent viewing window, soft neoprene gasket attached to the bottom, port hole or valve assembly and a vacuum gauge;
- Vacuum tank and pump assembly equipped with a pressure controller and pipe connections;
- Rubber pressure or vacuum hose with fittings and connections;
- Bucket; and
- Soapy solution.

The vacuum test procedure was as follows:

1. The vacuum pump was energized and tank pressure was adjusted to approximately 10 inches of mercury.
2. A strip of geomembrane approximately 12 inches wide by 48 inches long (an area larger than the coverage of the vacuum box) was wetted with the soapy solution.
3. The box was placed over the wetted area.
4. The bleed valve was closed and the vacuum valve opened.
5. A leak tight seal was verified.
6. The geomembrane was observed for at least ten seconds through the viewing window for the presence of soap bubbles.
7. When bubbles were not observed after 10 seconds, the vacuum valve was closed, and the bleed valve opened. The box was moved to the next adjoining area, and the process was repeated.
8. All areas where soap bubbles appeared were marked, repaired, and retested until passing test results were obtained.

4.4.3 Spark Testing (Extrusion Welds at Penetrations)

The spark test equipment included:

- An electrically conductive tape or wire placed beneath the seam prior to welding;
- A hand-held holiday spark tester; and
- A conductive wand that generates a high voltage.

The spark test procedure was as follows:

1. Note: Care should be taken if flammable gases may be present in the area of testing.
2. Place the electrically conductive tape or wire beneath the seam prior to welding.
3. A trial seam containing a con-welded segment shall be subject to a visual calibration test to ensure that such a defect will be identified under the planned machine settings and procedures (i.e., exposed wire will cause a spark to occur).
4. Upon completion of the weld, enable the spark tester and hold approximately 1 inch above the weld, moving slowly over the entire length of the weld in accordance with ASTM 6365.
5. A spark indicates a hole in the seam. If there is no spark, the weld has a passing test.
6. Mark, repair, and retest areas where sparks occur.

4.5 Destructive Testing

Destructive seam tests were performed at randomly selected geomembrane locations as seaming work progressed. The purpose of the destructive seam tests was to evaluate seam strength. The CQA Officer or field representatives observed the field destructive testing performed by the geomembrane installer.

The geomembrane installer submitted the results of the field destructive testing to the CQA Officer. An independent laboratory selected by the CQA Officer performed the destructive seam tests, consisting of peel and shear strength testing. The destructive seam testing results (field-testing and independent testing) are presented in Appendix D.

4.5.1 Testing Location and Frequency

The CQA Officer or field representative selected the destructive test locations where seam samples were removed for testing at a minimum frequency of one sample per 500 feet of seaming. This minimum frequency is the average taken throughout the entire area of placement and does not include retests. In addition, the CQA Officer or field representative could select additional destructive seam sample locations at their discretion. Destructive seam test locations include random seam testing and areas of possible defects (excess crystallinity, contamination, offset welds, equipment malfunction).

4.5.2 Sampling Procedures

Destructive seam samples were obtained as the seaming progressed. This method was used to facilitate approval of the destructive testing results prior to covering the geomembrane with the next layer of the closure construction. The CQA Officer or field representative assigned a number to each destructive seam sample and marked the location and seaming information on each collected sample. The destructive seam sample location was recorded on an as-built drawing. The locations of the destructive seam samples were repaired in accordance with the CQA Plan. The repairs were subsequently vacuum tested.

4.5.3 Field Testing

The geomembrane installer used a tensiometer to test four 1-inch wide strips from each sample identified for destructive testing. In accordance with the CQA Plan, the field destructive tests consisted of two samples for peel adhesion and two samples for shear strength. Upon successful field-testing, the remaining destructive seam samples were qualified to be submitted for independent laboratory testing.

4.5.4 Laboratory Testing

Samples that passed the prequalifying field tests were submitted to the independent testing laboratory. Ten specimens from each destructive seam sample were tested: five specimens were tested for shear strength and five specimens were tested for peel adhesion. Laboratory testing was in accordance with "Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods" (ASTM D 6392). Acceptance was based on the criteria outlined in the Geosynthetic Research Institute (GRI) standard GRI GM19 as provided in the CQA Plan.

4.5.5 Procedures for Failed Destructive Tests

If a destructive sample did not pass either a field or a laboratory test, the geomembrane installer had two options to remediate the failure. The geomembrane installer could reconstruct and repair the seam between any two passed test locations completed by the same technician on the same day. Alternatively, the geomembrane installer could trace the welding path to an intermediate location at least 10 feet from the failed test in either direction and take additional destructive seam samples. The additional samples were then field-tested prior to sending to the independent laboratory for testing as previously described. If the additional samples passed, then the seam was reconstructed between the two passing samples. If the additional samples failed, then the process was repeated to establish the zone in which the seam should be reconstructed.

Reconstructed seams were bounded by two locations with passing laboratory destructive tests. In cases that exceeded 150 feet of reconstructed seam, a destructive sample was taken from the zone in the reconstructed area. The geomembrane installer documented the actions taken in conjunction with destructive test failures (Appendix D).

5.0 SYNTHETIC TURF GEOTEXTILE

Synthetic turf geotextile placement at the Bottom Ash Pond Berm began on August 14, 2018 and was completed on August 16, 2018.

Synthetic turf geotextile placement at the Fly Ash Pond began on August 17, 2018 and was completed on November 22, 2018.

Site activities ceased on December 5, 2018 after reaching substantial completion. Final punch-list activities will be performed after the conclusion of winter weather and will be summarized in a Final Construction Quality Assurance Report.

Final punch-list activities are not required at the Bottom Ash Pond Berm. Final punch-list activities at the Fly Ash Pond include minor repair of synthetic turf geotextile.

5.1 Prequalification Testing

The geomembrane manufacturer, Agru America, Inc., supplied an inventory list of the synthetic turf geotextile rolls to the owner and the CQA Officer. The synthetic turf geotextile manufacturer submitted samples from the roll list to an independent geosynthetics laboratory for verification of selected manufacturer's guaranteed properties (presented in Appendix E). On each synthetic turf geotextile roll selected for sampling, a 2-foot long sample was collected along the entire width of the roll.

In addition, the manufacturer submitted documentation that the materials supplied were tested for the parameters listed in the manufacturers list of guaranteed properties at the required testing frequency. The results of the testing, including identification of tested rolls, were submitted to the CQA Officer for review. The manufacturer certified that all tested rolls met the manufacturer's guaranteed properties in accordance with the specified testing frequency rate (Appendix E).

Synthetic turf geotextile prequalification testing was completed prior to delivery. Copies of the testing results are provided in Appendix E.

5.2 Field Installation Monitoring

The CQA Officer or designated representative observed the synthetic turf geotextile as it was placed and welded. The placed synthetic turf geotextile was observed for wrinkles that could fold over and, if observed, required repairs were performed in these areas. The synthetic turf geotextile welds were observed for locations where the surface synthetic turf was melted and, if observed, required repairs were performed in these areas.

6.0 SAND INFILL AND ARMORFILL

Sand infill placement at the Bottom Ash Pond Berm occurred on October 15-16, 2018. ArmorFill placement at the Bottom Ash Pond Berm occurred on October 17, 2018.

Sand infill placement at the Fly Ash Pond began on September 12, 2018 and was substantially completed on November 30, 2018.

One prequalification test and one conformance test were performed for the sand used as synthetic turf geotextile infill. The analytical testing results are provided and summarized in Appendix C.

The sand was spread and brushed into place on the synthetic turf geotextile with a thickness between 0.50 and 0.75 inch. The CQA Officer or designated representative measured the thickness of the sand using a caliper on an approximately 100-foot grid.

Site activities ceased on December 5, 2018 after reaching substantial completion. Final punch-list activities will be performed after the conclusion of winter weather and will be summarized in an addendum letter.

Final punch-list activities are not required at the Bottom Ash Pond Berm.

At the Fly Ash Pond, cold temperatures and wet weather prevented effective sand placement and brushing near the conclusion of site activities for winter weather. Final punch-list activities at the Fly Ash Pond include final brushing and thickness testing of sand on the eastern portion and the perimeter ditch of the Fly Ash Pond, as well as placement, brushing, and testing at HDPE geomembrane repair locations.

7.0 SURFACE WATER MANAGEMENT

Surface water control structures generally included ditch and outlet structures at the Fly Ash Pond perimeter, two outfalls from the site to the Illinois River, and other piping/rip-rap placements on the site. A final as-built survey was performed.

A copy of the surface water management structure survey data is provided on Figure 2. Additional information on the field observations are provided in Appendix A.

8.0 SIGNATURE

As Construction Quality Assurance (CQA) Officer for the construction of the closure of the Fly Ash Pond and the Bottom Ash Pond (from February 9, 2018 to December 5, 2018), located at the Ameren Energy Resources, Meredosia Power Station in Meredosia, Illinois, I am familiar with the plans and specifications, and the CQA Plan as prepared and approved for the project. Based on my observations and the observations of the Construction Quality Assurance Officers-In-Absentia (Steve Graham, Jessie Goodwin, Kyle Henson, and Alyssa Okom), it is my professional opinion that the construction was completed as described in this Report. CQA certification by the owner's representative does not relieve the contractor of their obligations to furnish all work in accordance with the contract.

Rosanna M. Saindon, P.E., Ph.D.
Illinois Licensed Professional Engineer
Project Manager
Geotechnology, Inc.

LICENSED PROFESSIONAL ENGINEER
ROSANNA MARIE SAINDON
062.062289
1/18/19
STATE OF ILLINOIS

NOTES
1. Ground surface contours and aerial photograph provided by David Mason & Associates, Inc. on November 30, 2018.

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: JYG	App'vd By: AMS
Date: 1-16-19	Date: 1-17-19	Date: 1-17-19

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station
800 South Washington Street
Meredosia, Illinois

SITE OVERVIEW

Project Number
J024917.04

FIGURE 1

NOTES

1. Ground surface contours and aerial photograph provided by David Mason & Associates, Inc. on November 30, 2018.
2. Elevations reference to NAVD88.
3. Contour interval is 1 foot.

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: JYG	App'vd By: AMS
Date: 1-16-19	Date: 1-17-19	Date: 1-17-19

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station
800 South Washington Street
Meredosia, Illinois

FINAL AS-BUILT SURVEY

Project Number J024917.04	FIGURE 2

BOW REFERENCE SHEET (CD) --- SAME FACILITY

Site Number:	W1370300005
Facility Name:	Ameren Energy Medina Valley Cogen LLC
File Category:	06L / Groundwater Closure Reports
Document Date:	02/06/2019

FOR ADDITIONAL INFORMATION ON THIS, SEE CATEGORY UNDER THIS SAME FILE HEADING:	**06L Groundwater Closure Reports** **(CD)**

DATE OF OTHER DOCUMENT		DESCRIPTION OF OTHER DOCUMENT:
02/06/2019		CD – 01/18/2019
		CQA Report
		Closure of the Bottom Ash Pond & Fly Ash Pond
		Meredosia Power Station
		PDF files of appendices & other information
		J024917.04

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LPC 258 REV. JUN-93

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EXHIBIT 2

Intended for
AmerenEnergy Medina Valley CoGen, LLC

Date
March 31, 2020

Project No.
72974

2019 ANNUAL REPORT

MEREDOSIA POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL REPORT
MEREDOSIA POWER STATION

Project name	**Meredosia Power Station**
Project no.	**72974**
Recipient	**AmerenEnergy Medina Valley CoGen, LLC**
Document type	**2019 Annual Report**
Revision	**0**
Date	**March 31, 2020**
Prepared by	**Rachel A. Banoff, EIT**
Checked by	**Sarah L. Meyer**
Approved by	**A. Frances Ackerman, PE**

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Rachel A. Banoff, EIT
Environmental Engineering

A. Frances Ackerman, PE
Senior Managing Engineer

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TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

Ameren	AmerenEnergy Medina Valley Cogen, LLC
Class I Groundwater Standard	Groundwater Quality Standards for Class I: Potable Resource Groundwater (35 IAC 620.410)
GMZ	Groundwater management zone
HDPE	High-density polyethylene
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
Meredosia	Meredosia Power Station
mg/L	milligrams per liter
TDS	total dissolved solids

1. INTRODUCTION

1.1 Background

This 2019 Annual Report has been prepared for AmerenEnergy Medina Valley Cogen, LLC (Ameren) for the Meredosia Power Station (Meredosia, Figure 1-1). Ameren completed closure activities for the Fly Ash Pond and Bottom Ash Pond in accordance with the site-specific closure requirements of Title 35 of the Illinois Administrative Code (IAC) Section 840 in December 2018. Closure activities, which included grading, placement of a high-density polyethylene (HDPE) geomembrane covered with ClosureTurf®/ArmorFill® synthetic turf, and construction of surface water control structures, began in March 2018 and were substantially completed as of December 5, 2018. This is the third annual report for Meredosia since groundwater monitoring was restarted in 2017. Seven rounds of pre-closure groundwater data and four rounds of post-closure data have been collected between June 2017 and December 2019 to satisfy requirements of the Groundwater Monitoring Plan, dated December 14, 2016 (Geotechnology, Inc).

The Groundwater Monitoring Plan, in accordance with 35 IAC 840.114 and 35 IAC 840.116, outlines groundwater monitoring and sampling procedures, establishes the parameters and methods to be used for analyzing the groundwater samples, and describes evaluation methods to assess post-closure groundwater quality and trends to demonstrate compliance with the applicable groundwater standards. The Groundwater Monitoring Program Schedule is provided in Table 1-1.

The current groundwater monitoring network comprises 12 monitoring wells, including five installed in October 2010 (APW-1 through APW-5), four installed in October 2015 (APW-6 through APW-9), and three installed in August 2018 (APW-10 through APW-12). From 2010 to 2012, monitoring wells APW-1 through APW-5 were sampled. Beginning in June 2017 and in accordance with the Groundwater Monitoring Plan, groundwater sampling was restarted and conducted quarterly at monitoring wells APW-1 through APW-9. Beginning in September 2018 and in accordance with the Groundwater Monitoring Plan, monitoring wells APW-10, APW-11, and APW-12 were incorporated into the well network and were sampled quarterly along with wells APW-1 through APW-9. The monitoring wells were installed to define the lateral extent of impacts on site, as well as to assist in future groundwater monitoring of remedial actions. Monitoring well boring and construction logs are included in Appendix A. Locations of all monitoring wells are shown on Figure 1-2. Monitoring well locations, installation dates, construction information, and the groundwater zone they monitor are provided in Table 1-2. Boring logs and construction forms are included in Appendix A. Field and laboratory parameters for evaluating groundwater quality are shown in Table 1-3.

In conjunction with Ameren’s request for approval of the Closure Plan, Ameren submitted a Groundwater Management Zone Plan, Fly Ash Bottom Ash Pond, Meredosia Power Station (Geotechnology, Inc., December 2016) and a request to establish the groundwater management zone (GMZ) pursuant to 35 IAC 620.250(a)(2): Ash Ponds Closure, Groundwater Management Zone Application, dated October 17, 2017, which was approved by the Illinois Environmental Protection Agency (IEPA) on November 1, 2017.

This annual report includes the following elements:

- Monitoring well boring and installation logs for the 12 currently installed wells, APW-1 through APW-12 (Appendix A)
- A summary of post-closure groundwater monitoring data collected on January 29, 2019; June 4, 2019; August 26, 2019; and December 9, 2019, including data tables (Appendix B)
- Recent Site Inspection Forms (Appendix C)

1.2 Demonstration of Compliance

Compliance will be based on attainment of post-closure groundwater quality that meets the Class I Groundwater Standards, as set forth in 35 IAC 620.410. Groundwater shall be in compliance when concentrations are below the Class I Groundwater Standards and there are no statistically significant increasing trends at the compliance boundary. The trend analysis shall be performed on a minimum of eight consecutive post-closure groundwater samples and use Sen's Estimate of Slope for assessing concentration trends.

Ameren completed closure of the inactive Fly Ash and Bottom Ash Ponds at Meredosia Power Station and the closure project was deemed substantially complete December 5, 2018 in accordance with the Closure Plan (Ameren letter to IEPA dated January 31, 2019). As of the 2019 Annual Report, there are only four rounds of post-closure groundwater data available. Statistical analysis to demonstrate compliance will begin when eight rounds of post-closure data are available. It is anticipated that eight rounds of post-closure data will be available for analysis in the 2020 Annual Report.

2. DATA ANALYSIS

2.1 Groundwater Flow

The groundwater elevation contours for each quarterly sampling event shown on Figures 2-1 through 2-4 are based on groundwater measurements collected in 2019 and illustrate groundwater flow. During normal flow conditions, groundwater flow in the upper (shallow) zone is generally northwest and west towards the Illinois River, consistent with past evaluations (Figure 2-1, Figure 2-3 and Figure 2-4). In June 2019, groundwater elevation data was not collected from wells located near the west property boundary (APW-2, APW-3, APW-4, APW-7, APW-9, and APW-12) due to flooding (Figure 2-2). During June 2019 flood conditions, groundwater flow in the southeast corner of Meredosia flowed from APW-11 toward APW-1 in a southeasterly direction, away from the Illinois River.

Consistent with observations during January and December 2018, a minor groundwater inflection was seen at APW-2 during the January and December sampling events in 2019 (Figure 3-1). Groundwater elevation differences between well APW-2 and wells APW-9 and APW-3 ranged from 0.83 to 2.18 feet. APW-2 is screened predominantly in clay while the surrounding wells, including APW-3 and APW-9, are screened mostly in sand, making it likely that APW-2 is slower to react to changes in river elevation.

2.2 Summary of Analytical Data

This annual report presents four rounds of post-closure data collected on January 29, 2019; June 4, 2019; August 26, 2019; and December 9, 2019. Wells APW-2, APW-3, APW-4, APW-7, APW-9, and APW-12 were not sampled during the second quarter sampling event of 2019 due to flooding in the area. Note that total dissolved solids (TDS) was resampled on December 20, 2019 for the fourth quarter sampling event because the original samples were analyzed two days past hold time. All field and laboratory analytical results are tabulated in Appendix B.

As discussed in Section 1.2, and according to the Groundwater Monitoring Plan, eight samples are required to conduct trend analyses for compliance. Since only four rounds of post-closure data are currently available, and an additional four rounds of data are scheduled for collection in 2020, trend analysis will begin in the 2020 Annual Report. According to the Post-Closure Care Plan (Geotechnology, Inc., 2018), two years after the ash ponds have been closed, the groundwater monitoring network will be re-evaluated based on the changes in the groundwater impacts (December 2020).

2.3 Site Inspection

The Post-Closure Maintenance Program requires quarterly inspection for the first five years after closure. After five years, the inspection frequency can be reduced to semi-annually provided that semi-annual groundwater monitoring has been approved by IEPA. After five years of semiannual monitoring, the inspection frequency can be reduced to annually pending approval of annual groundwater monitoring. Discontinuance of site inspections will occur after IEPA approval of the certified Post-Closure Care Report.

Site inspections include assessment of the condition and need for repair of final cover and vegetation, as wells as fencing, monitoring points, and surface water control features. Following completion of closure activities in December 2018, the initial inspection occurred in December 2018 and quarterly inspections were done in 2019. The inspection reports from 2019 are included in Appendix D. Based on these reports, all the components of the closure turf are in good condition.

3. CONCLUSIONS

This annual report presents four rounds of post-closure data. The Groundwater Monitoring Plan requires eight consecutive rounds of post-closure data to be collected before statistical analysis of trends can be made for compliance. Once eight rounds of post-closure data have been collected, statistical analysis will be run using all eight samples and used to determine compliance. It is anticipated that eight rounds of post-closure data will be available for analysis in the 2020 Annual Report. No action, other than submittal of this report, is required per Section 5.2 of the Groundwater Monitoring Plan (Compliance Determination).

4. REFERENCES

Geotechnology, Inc., 2016. *Groundwater Monitoring Plan, Fly Ash Pond and Bottom Ash Pond, Meredosia Power Station*. December 14, 2016.

Geotechnology, Inc., 2016. *Groundwater Management Zone Plan, Fly Ash Bottom Ash Pond, Meredosia Power Station, 800 South Washington Street, Meredosia, Illinois*. December 22, 2016.

Geotechnology, Inc., 2018. *Post-Closure Care Plan, Meredosia Power Station*. March 12, 2018.

Illinois Environmental Protection Agency (IEPA), 1991. *Groundwater Quality Standards for Class I: Potable Resource Groundwater*, Title 35 of the Illinois Administrative Code Part 620: Groundwater Quality, amended 2013.

TABLES

Table 1-1. Groundwater Monitoring Program Schedule
2019 Annual Report
Meredosia Power Station - Fly Ash Pond and Bottom Ash Pond

Frequency	Duration	Sampling Quarter
Quarterly	Begins: June 2017	January- March (1) April - June (2) July - September (3) October - December (4)
	Ends: After successful completion of the post-closure activities required and approval of the Illinois EPA; or Acceptance of reduced frequency by IEPA based on successful demonstration under Semi-Annual or Annual Frequency	
Semi-Annual or Annual	Begins: Upon demonstration that monitoring effectiveness will not be compromised by reduced frequency, adequate data has been collected to characterize groundwater, and concentration of constituents monitored at downgradient boundaries do not demonstrate statistically significant increasing trends that can be attributed to the former ash ponds	April - June (2) October - December (4)
	Ends: After successful completion of the post-closure activities required and approval of the Illinois EPA	

[O: YD/SJC, C: YD/SJC]

Table 1-2. Groundwater Monitoring System Wells
2019 Annual Report
Meredosia Power Station - Fly Ash Pond and Bottom Ash Pond

Monitoring Well Number	Installation Date	Surface Elevation (ft, MSL)	TOC Elevation (ft, MSL)	Top of Screen Elev (ft)	Bottom of Screen Elevation (ft)	Total Well Depth (ft, BGS)	Objective	Position	Monitoring Zone
APW-1	10/26/2010	446.1	449.26	431.4	421.4	24.7	Compliance	Upgradient	Uppermost Aquifer
APW-2	10/25/2010	434.0	436.87	421.1	411.1	22.9	Compliance	Downgradient	Uppermost Aquifer
APW-3	10/25/2010	433.4	436.28	420.8	410.8	22.6	Compliance	Downgradient	Uppermost Aquifer
APW-4	10/26/2010	431.9	434.86	415.8	409.3	26.1	Compliance	Downgradient	Uppermost Aquifer
APW-5	10/26/2010	450.5	453.20	431.0	421.0	29.5	Compliance	Upgradient	Uppermost Aquifer
APW-6	10/1/2015	448.6	451.90	431.1	421.1	28.0	Compliance	Midgradient	Uppermost Aquifer
APW-7	10/1/2015	435.0	438.7	429.0	419.0	16.5	Compliance	Midgradient	Uppermost Aquifer
APW-8	10/1/2015	460.5	463.9	431.9	421.9	39.1	Compliance	Midgradient	Uppermost Aquifer
APW-9	10/1/2015	445.0	448.1	426.2	416.2	29.3	Compliance	Downgradient	Uppermost Aquifer
APW-10	8/20/2018	454.1	457.5	424.9	414.9	39.4	Compliance	Midgradient	Uppermost Aquifer
APW-11	8/22/2018	461.9	465.4	427.64	417.64	44.45	Compliance	Upgradient	Uppermost Aquifer
APW-12	8/21/2018	431.9	435.5	422.1	412.1	20.04	Compliance	Downgradient	Uppermost Aquifer

[U: RSD 3/12/2020, C: RAB 3/13/2020]

Notes:

TOC = top of casing (i.e. top of riser pipe)

MSL = mean sea level

BGS = below ground surface

ft = feet

Table 1-3. Groundwater Monitoring Program Parameters
2019 Annual Report
Meredosia Power Station - Fly Ash Pond and Bottom Ash Pond

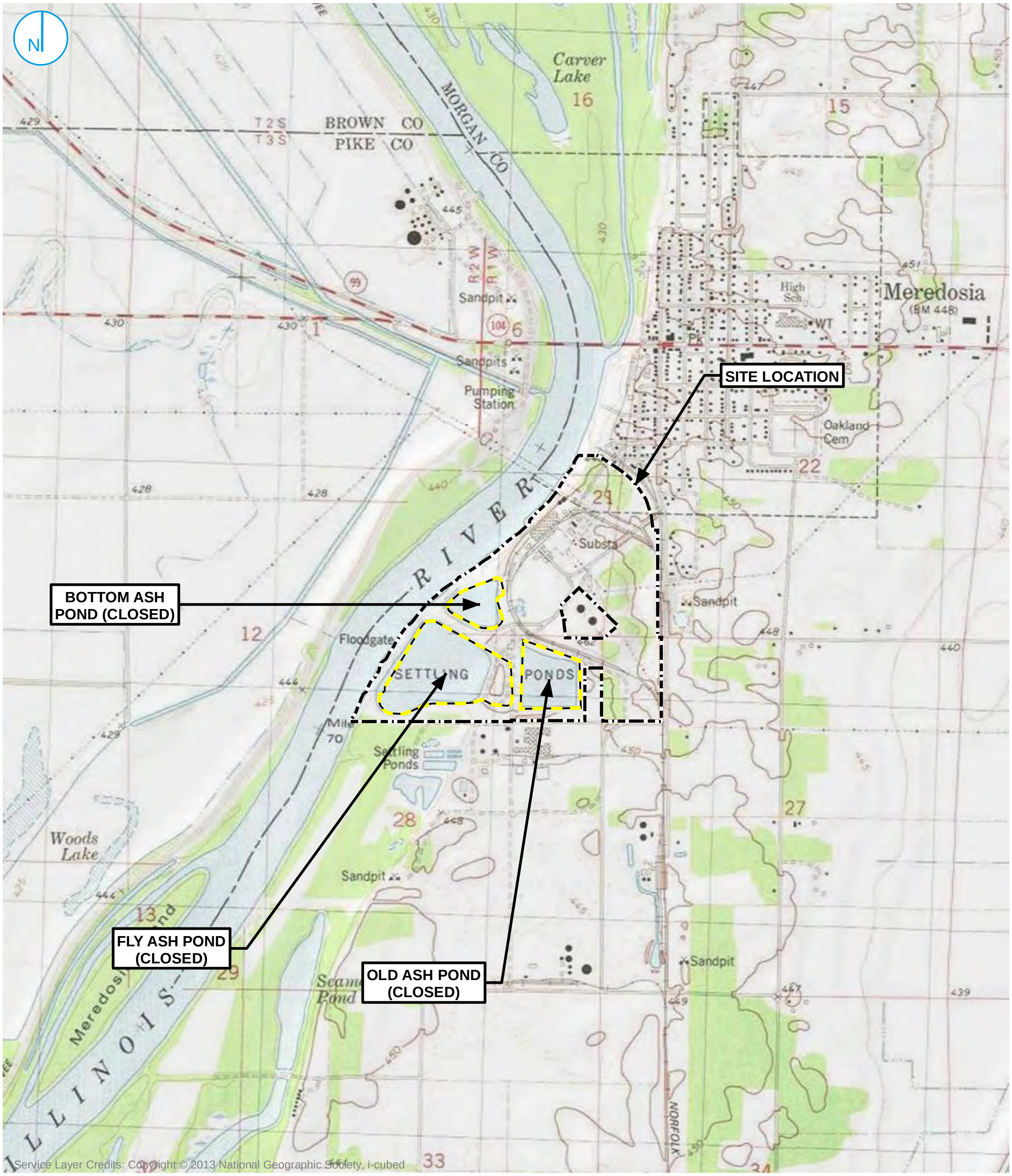
Field Parameters	STORET Code	
pH[2]	00400	
Specific Conductance[2]	00094	
Temperature (Fahrenheit)	00011	
Depth to Water (from TOC)	72109	
Elevation of GW Surface[2]	71993	
Depth of Well (BGS)[2]	72008	
Elevation of Measuring Point	72110	
Laboratory Parameters[1]	**STORET Code-Diss**	**STORET Code-Total**
Boron[2]	01020	01022
Iron[2]	01046	01045
Manganese[2]	01056	01055
Sulfate[2]	00946	- -
Total Dissolved Solids (TDS)[2]	70300	- -
Antimony	01095	01097
Arsenic	01000	01002
Barium	01005	01007
Beryllium	01010	01012
Cadmium	01025	01027
Chloride	00941	- -
Chromium	01030	01034
Cobalt	01035	01037
Copper	01040	01042
Cyanide	- -	00720
Fluoride	00950	- -
Lead	01049	01051
Mercury	71890	71900
Nickel	01065	01067
Nitrate as N	00613	- -
Nitrite as N	00618	- -
Selenium	01145	01147
Silver	01075	01077
Thallium	01057	01059
Vanadium	01085	01087
Zinc	01090	01092

[O: YD/SJC, C: YD/SJC]

Notes:
[1] Reported as dissolved (filtered) concentrations.
[2] Mandatory monitoring parameter per 35 IAC 840.114(a).
BGS: Below Ground Surface
TOC: Top of Casing

FIGURES

Y:\Mapping\Projects\6\67815\mxd\2020\Figure 1-1_Site Location Map.mxd



DATED: 2/14/2020 | DESIGNER: STOLZSD

KEY MAP

Map Scale: 1:1:24,000;
Map Center: 90°34'10"W 39°49'15"N

APPROXIMATE PROPERTY BOUNDARY

LIMITS OF CCP MANAGEMENT

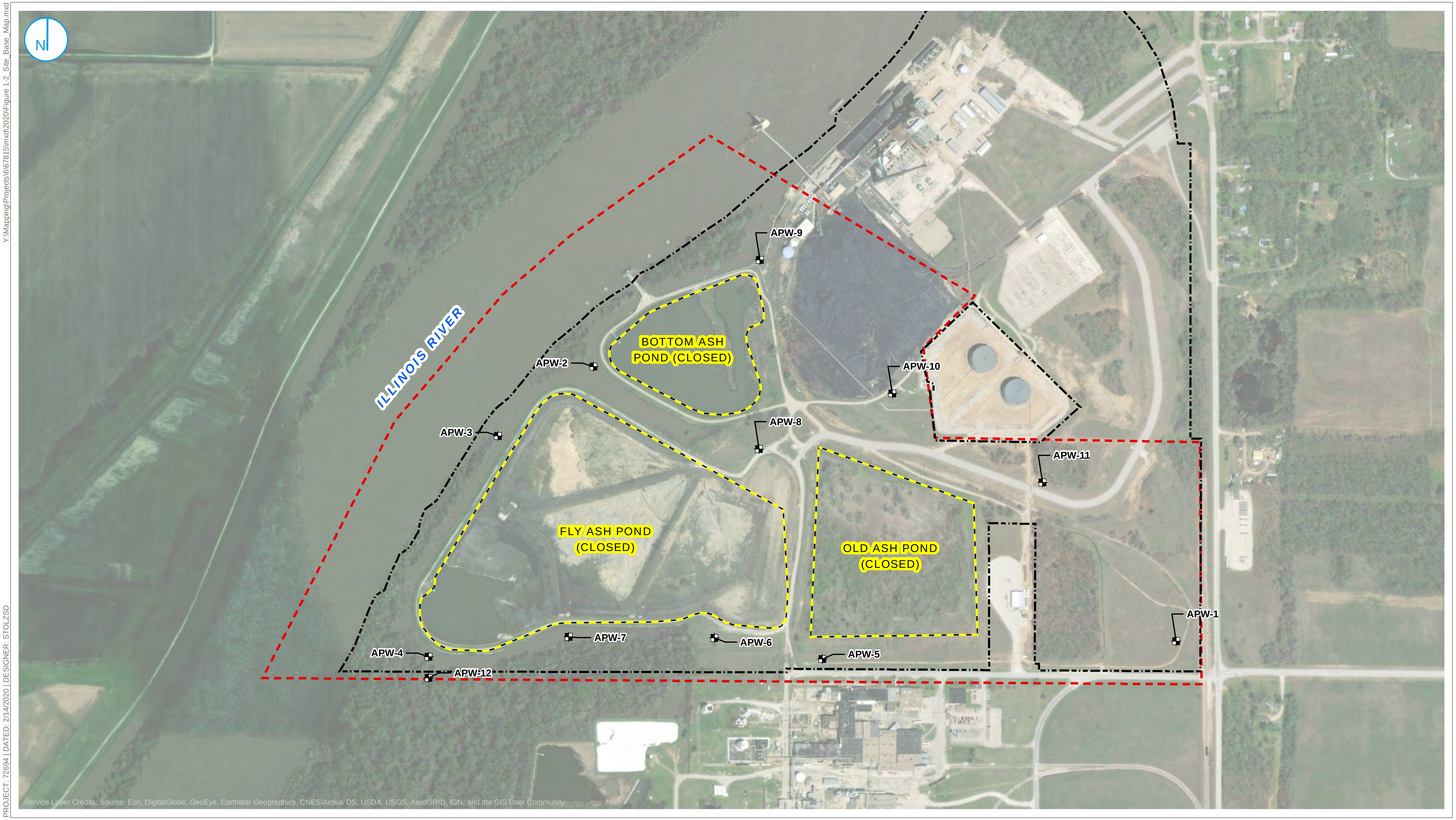
0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA POWER STATION
MORGAN COUNTY, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



MONITORING WELL LOCATION
APPROXIMATE PROPERTY BOUNDARY
LIMITS OF CCP MANAGEMENT
APPROXIMATE GROUNDWATER MONITORING ZONE

0 240 480 Feet

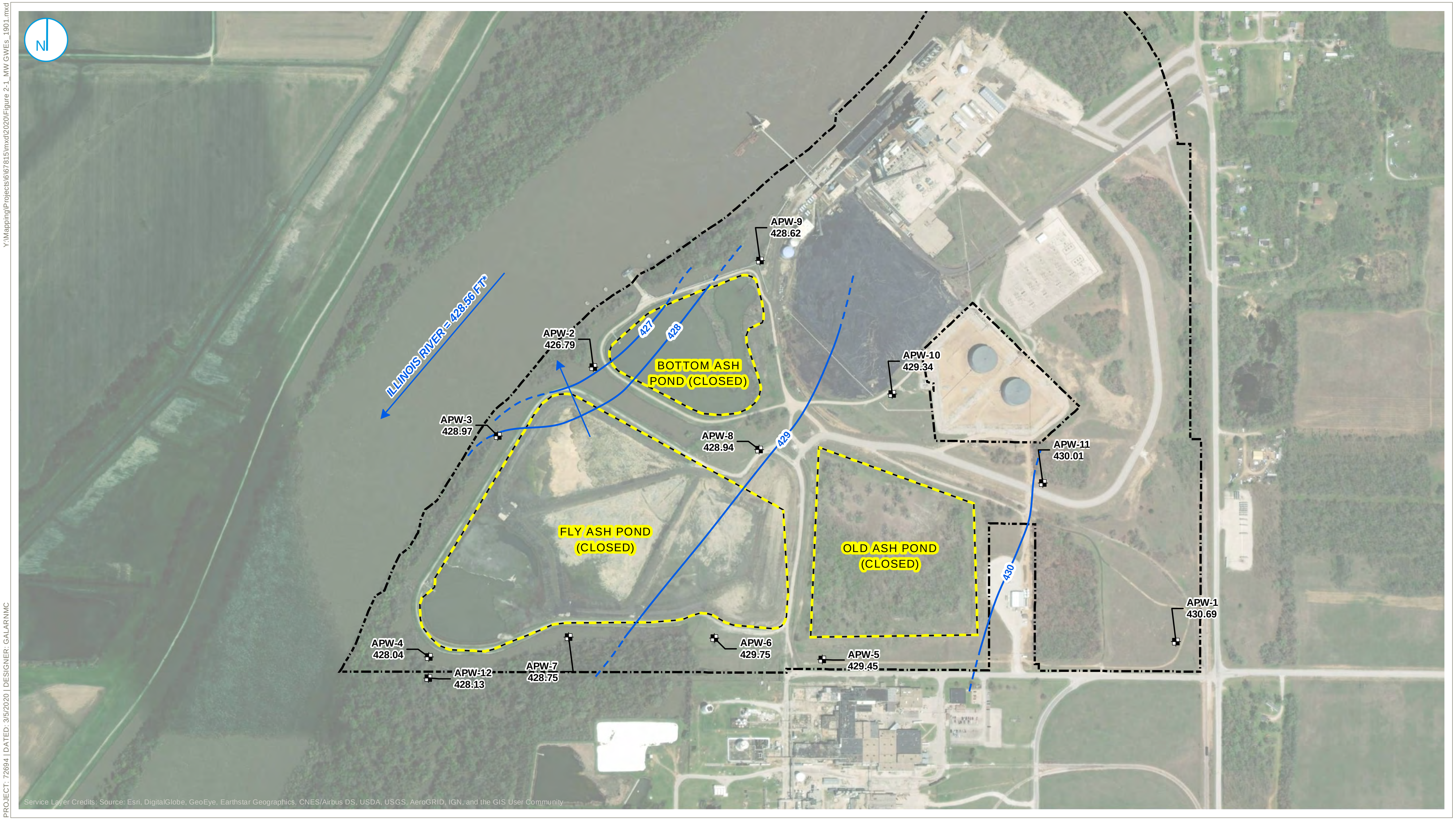
SITE BASE MAP

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA POWER STATION
MORGAN COUNTY, ILLINOIS

FIGURE 1-2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

Y:\Mapping\Projects\61\67815\mxd\2020\Figure 2-1_MW GWEs_1901.mxd



PROJECT: 72694 | DATED: 3/5/2020 | DESIGNER: GALARNMC

MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FT INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

0 240 480 Feet

APPROXIMATE PROPERTY BOUNDARY

LIMITS OF CCP MANAGEMENT

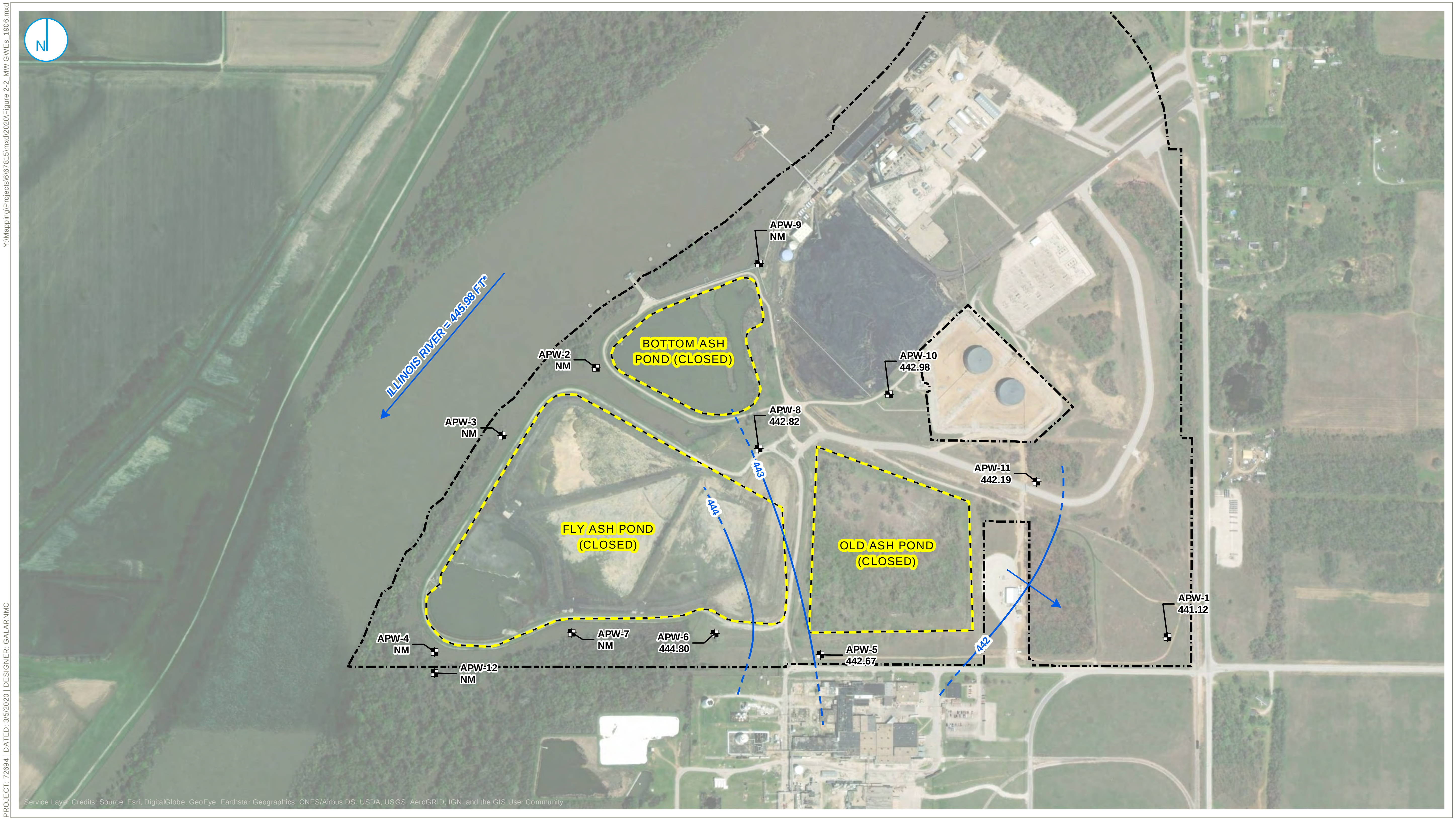
*River Elevation obtained from United States Geological Survey 05585500 Meredosia, IL gaging station. The elevation was reported in NGVD29 and then converted to NAVD88 at the time of this drawing.

GROUNDWATER ELEVATIONS - JANUARY 29, 2019

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA
POWER STATION
MORGAN COUNTY, ILLINOIS

FIGURE 2-1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FT INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

APPROXIMATE PROPERTY BOUNDARY
LIMITS OF CCP MANAGEMENT

*River Elevation obtained from United States Geological Survey 05585500 Meredosia, IL gaging station. The elevation was reported in NGVD29 and then converted to NAVD88 at the time of this drawing.
NM = Not Measured, surrounding area flooded

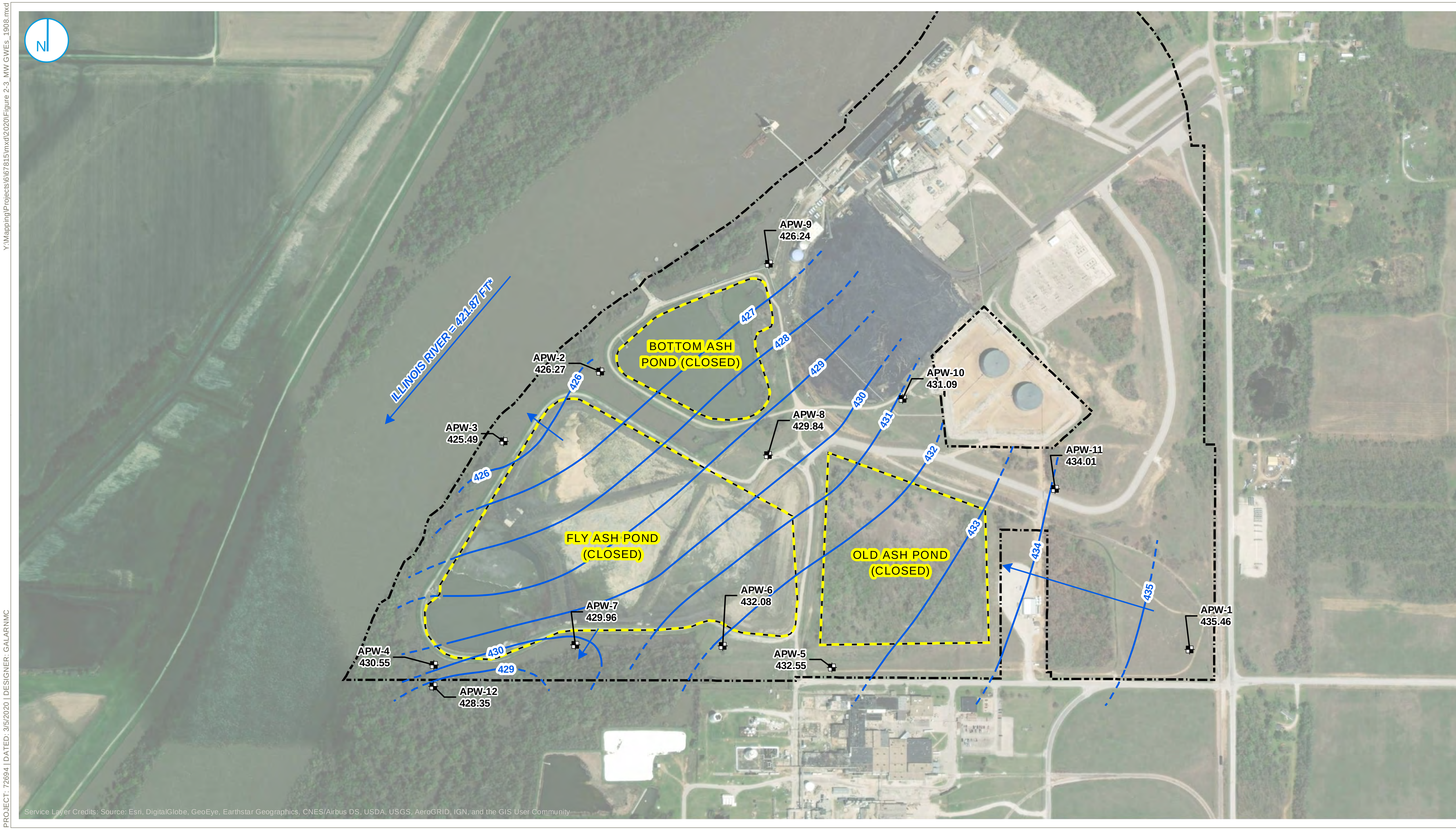
0 240 480 Feet

GROUNDWATER ELEVATIONS - JUNE 4, 2019

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA POWER STATION
MORGAN COUNTY, ILLINOIS

FIGURE 2-2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



Y:\Mapping\Projects\6\67815\mxd\2020\Figure 2-3_MW GWEs_1908.mxd

PROJECT: 72694 | DATED: 3/5/2020 | DESIGNER: GALARNMC

MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FT INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

APPROXIMATE PROPERTY BOUNDARY

LIMITS OF CCP MANAGEMENT

*River Elevation obtained from United States Geological Survey 05585500 Meredosia, IL gaging station. The elevation was reported in NGVD29 and then converted to NAVD88 at the time of this drawing.

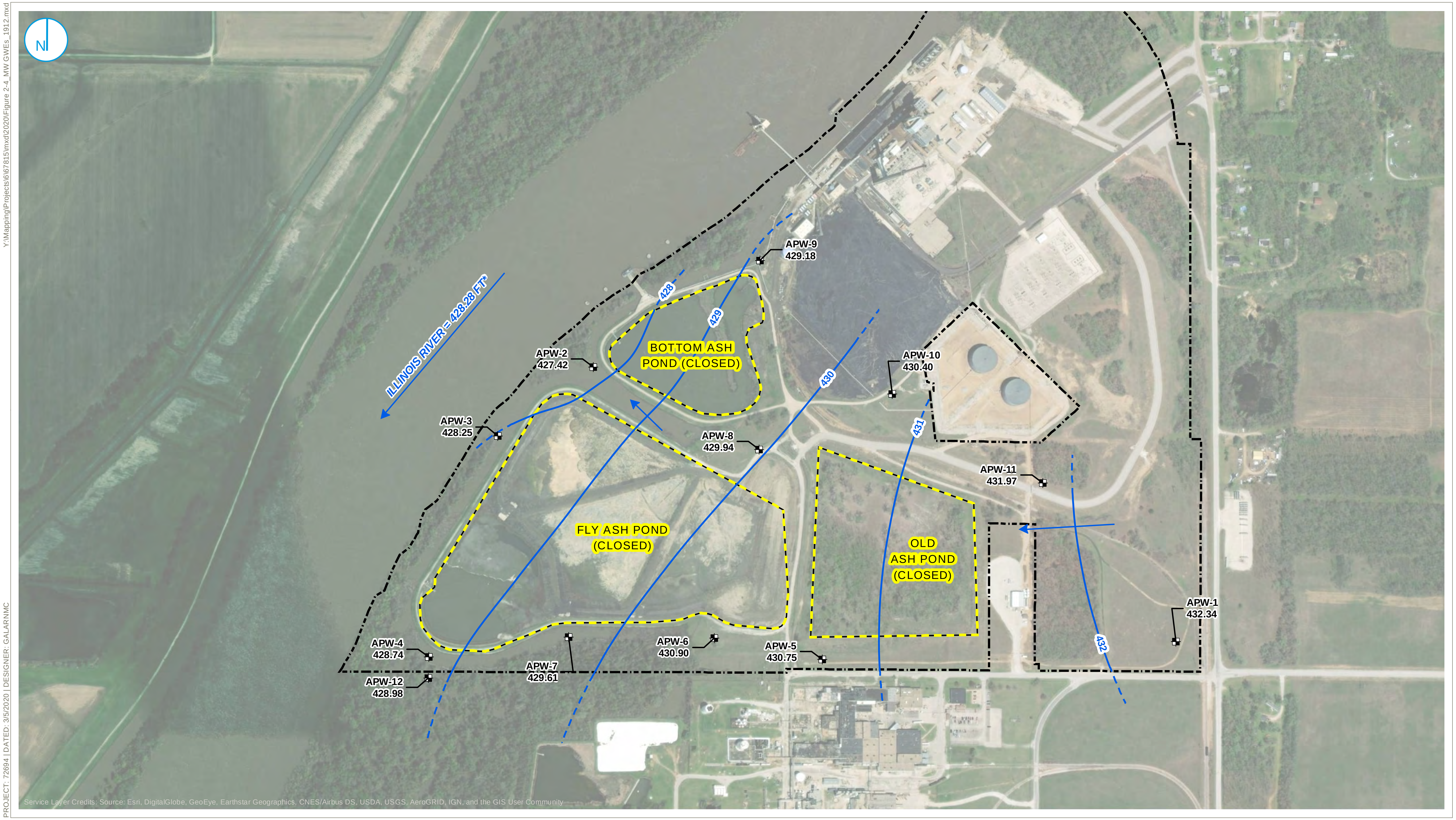
0 240 480 Feet

GROUNDWATER ELEVATIONS - AUGUST 26-27, 2019

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA
POWER STATION
MORGAN COUNTY, ILLINOIS

FIGURE 2-3

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



Y:\Mapping\Projects\6\67815\mxd\2020\Figure 2-4_MW GWEs_1912.mxd

PROJECT: 72694 | DATED: 3/5/2020 | DESIGNER: GALARNMC

MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (1-FT INTERVAL, NAVD88)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

0 240 480 Feet

APPROXIMATE PROPERTY BOUNDARY

LIMITS OF CCP MANAGEMENT

*River Elevation obtained from United States Geological Survey 05585500 Meredosia, IL gaging station. The elevation was reported in NGVD29 and then converted to NAVD88 at the time of this drawing.

GROUNDWATER ELEVATIONS - DECEMBER 9, 2019

2019 ANNUAL REPORT
AMEREN ENERGY RESOURCES MEREDOSIA
POWER STATION
MORGAN COUNTY, ILLINOIS

FIGURE 2-4

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

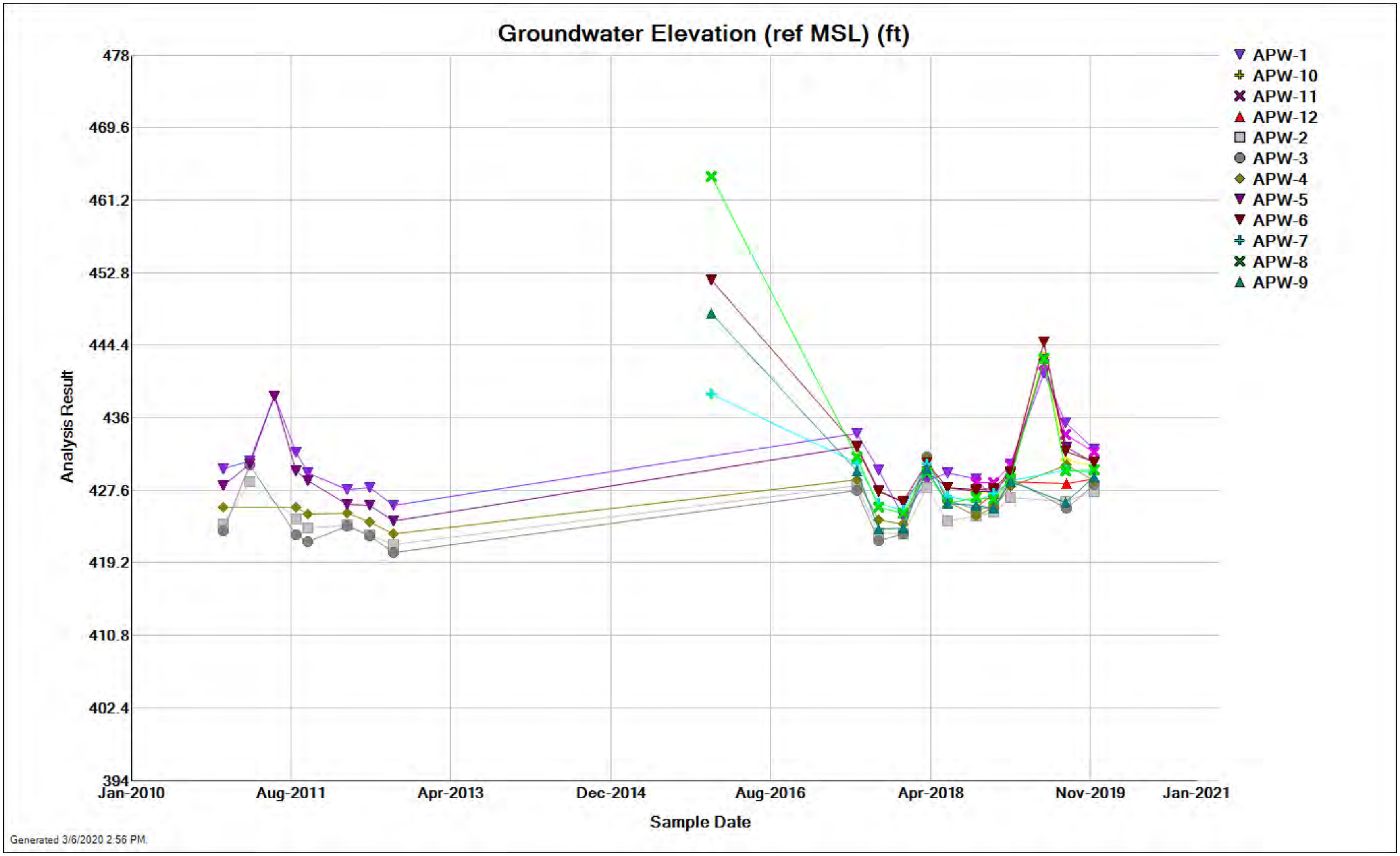


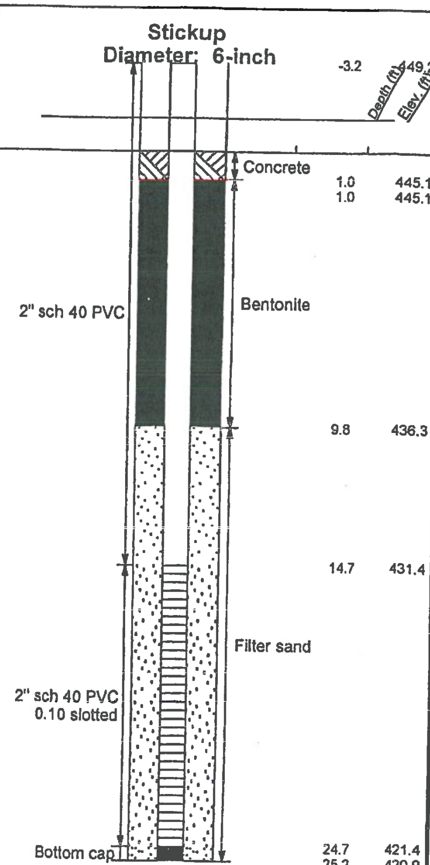
Figure 3-1. Groundwater elevation

APPENDIX A
MONITORING WELL BORING AND CONSTRUCTION LOGS

Surface Elevation: 446.06 | Datum msl | Completion Date: 10/26/10 | Northing: 1147018.68 | Easting: 2185605.2

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Loose, brown, fine SAND - SP			
			1-1-1	SS1
			2-2-1	SS2
5				
			2-4-4	SS3
			3-3-3	SS4
10				
	Loose, brown fine to coarse SAND, trace gravel - SP			
			1-1-2	SS5
15				
			1-1-2	SS6
20				
	Loose, brown, fine SAND - SP			
			0-1-2	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 13 FEET ∇

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 1/11/11

Surface Elevation: 433.97

Datum msl

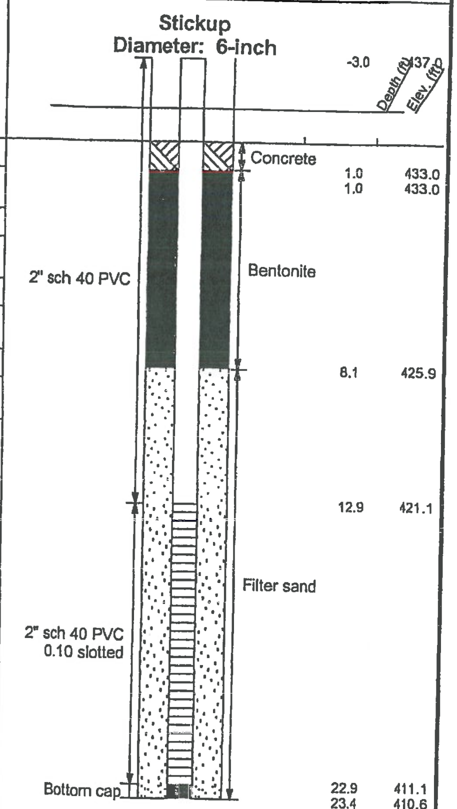
Completion Date: 10/25/10

Northing: 1148489.69

Easting: 2182485.19

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Soft to medium stiff, brown and gray CLAY, trace sand - CH			
			2-2-2	SS1
			2-2-2	SS2
5				
			2-2-4	SS3
			0-2-3	SS4
10				
			2-2-3	SS5
15				
17	Soft, gray, silty CLAY with shells, trace to some sand - CL			
			0-1-1	SS6
20				
22	Very loose, brown, fine to medium SAND - SP			
			0-0-1	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: KJP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC

FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-2/MW-2

Project No. J017150.01

Surface Elevation: 433.35

Datum msl

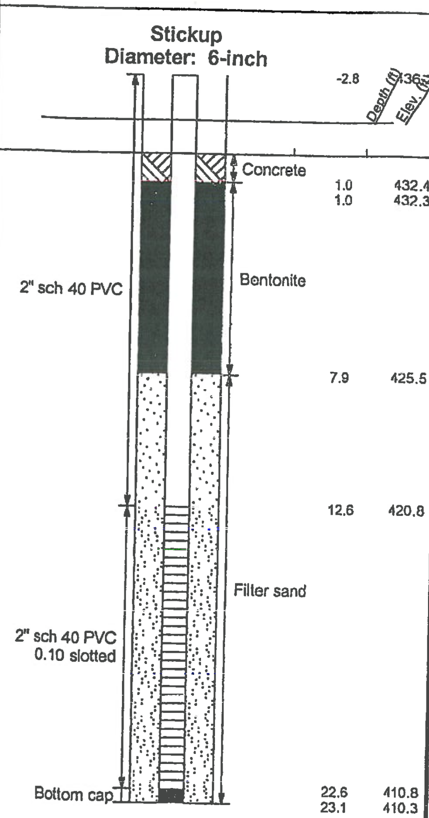
Completion Date: 10/25/10

Northing: 1148118.6

Easting: 2181973.76

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium stiff, brown and gray CLAY, trace sand and wood - CH		2-3-3	SS1
5			2-2-3	SS2
			0-2-3	SS3
10			0-1-2	SS4
	Gray, silty CLAY, trace sand - CL			
15			95	ST5
	Soft, gray, silty SAND with shells and silty clay seams - SM			
20			0-1-1	SS6
	Wood		8-11-7	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 12 FEET ∇

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: MBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-3/B-10

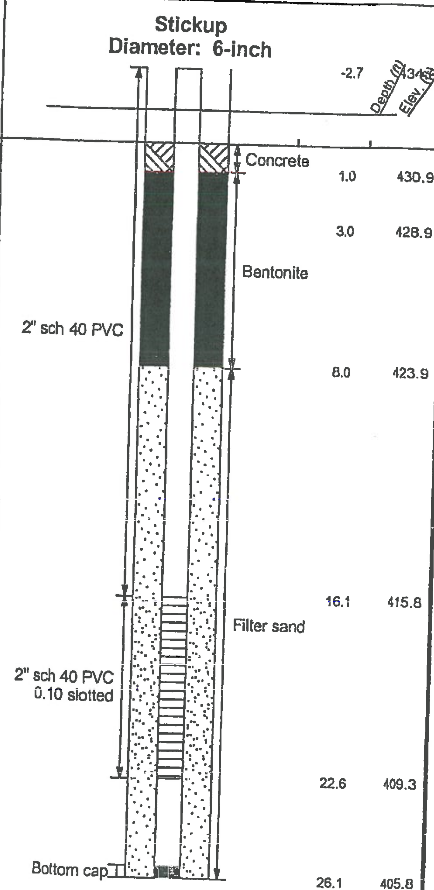
Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 431.90	Completion Date: 10/26/10
Datum msl	Northing: 1146935.94
	Easting: 2181602.97

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Medium stiff to soft, brown and gray CLAY, trace sand and wood - CH			
			0-0-4	SS1
5			2-4-4	SS2
			1-1-1	SS3
10			1-1-2	SS4
11.5	Loose, brown, fine SAND - SP			
15			3-6-7	SS5
20			0-2-2	SS6
25			0-0-0	SS7
25	Boring terminated at 25 feet.			
30				
35				

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 11.5 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DK	App'vd. by: ABP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 450.48

Datum msl

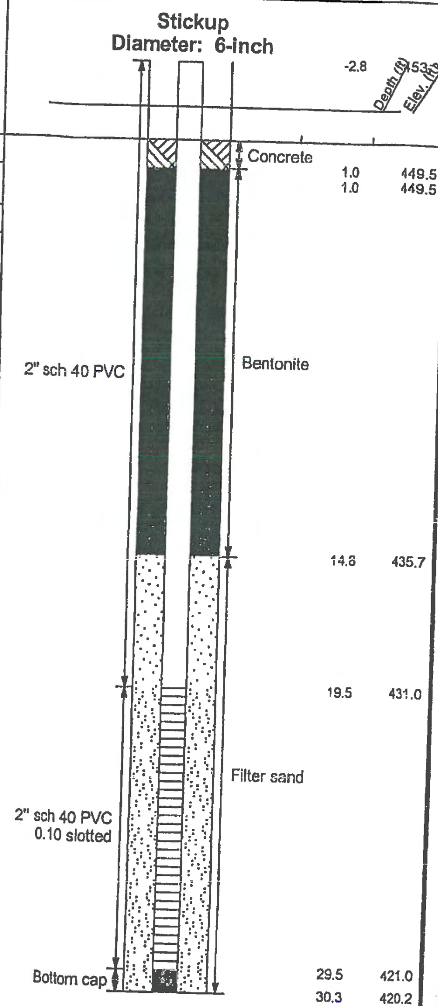
Completion Date: 10/26/10

Northing: 1146922.64

Easting: 2183711.11

Depth in Feet	Description of Material	Graphic Log	Dry Unit Weight (pcf) / SPT Blow Counts / Core Recovery/RQD	Samples
0	Loose, brown, fine SAND - SP			
			3-3-3	SS1
			2-2-2	SS2
			1-3-4	SS3
			2-3-3	SS4
			2-3-4	SS5
20	Loose, brown, fine to coarse SAND, trace to some gravel - SP		2-1-2	SS6
			3-3-3	SS7
30	Boring terminated at 30 feet.		1-1-1	SS8

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 19.5 FEET ∇

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

MB DRILLER LAH LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KA	Checked by: DTK	App'vd. by: TBP
Date: 11/3/10	Date: 2-17-11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Generating Facility
Meredosia, Illinois

LOG OF BORING: APW-5

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - MEREDOSIA.GPJ GTINC 0638301.GPJ 12/22/10

Surface Elevation: 448.55

Datum: ______

Completion Date: 10/1/2015

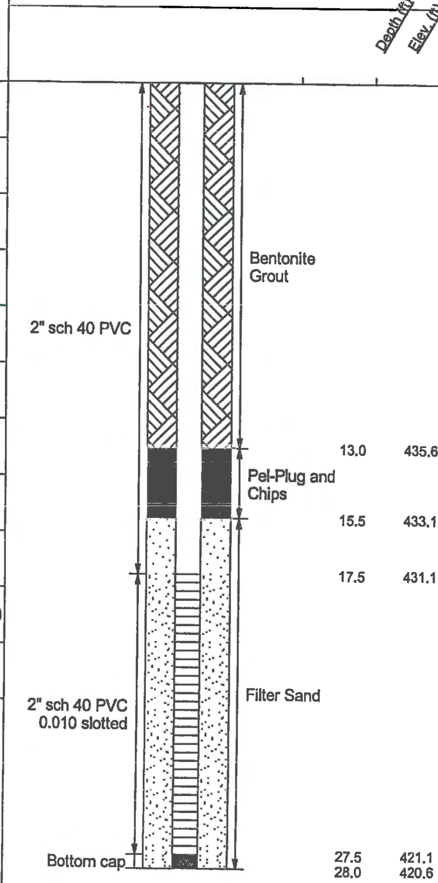
Latitude: 39.815833

Longitude: -90.570556

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Brown, fine grained SAND - SP		0-3-4	SS1
			3-4-6	SS2
5			2-3-1	SS3
			2-2-2	SS4
10			3-3-5	SS5
			4-5-6	SS6
			1-3-3	SS7
15			1-2-3	SS8
	Brown, medium grained SAND - SP ∇		4-6-7	SS9
20			4-3-4	SS10
			1-2-2	SS11
	Blind drilled - heaving sands			
25				
	Boring terminated at 28 feet.			
30				
35				

WELL DIAGRAM

Stickup = 3.3 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 18 FEET ∇

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: [initials]	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-6

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/16

Surface Elevation: 435.03

Datum: ______

Completion Date: 10/1/2015

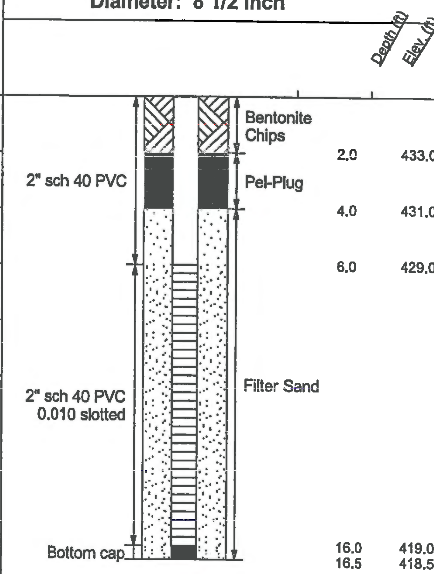
Latitude: 39.815833

Longitude: -90.573333

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Black, silty CLAY - CL	▨	2-4-3	SS1
	Brown, silty CLAY - CL	▨	2-3-4	SS2
5		▨	1-2-1	SS3
	Brown, fine grained SAND - SP	░	1-1-1	SS4
		░	0-0-1	SS5
10	Blind drilled - heaving sands			
15				
	Boring terminated at 17 feet.			
20				
25				
30				
35				

WELL DIAGRAM

Stickup = 3.7 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/16

GROUNDWATER DATA

ENCOUNTERED AT 6 FEET ⊻

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: [illegible]	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-7

Project No. J024917.01

Surface Elevation: 460.54

Datum: ________

Completion Date: 10/1/2015

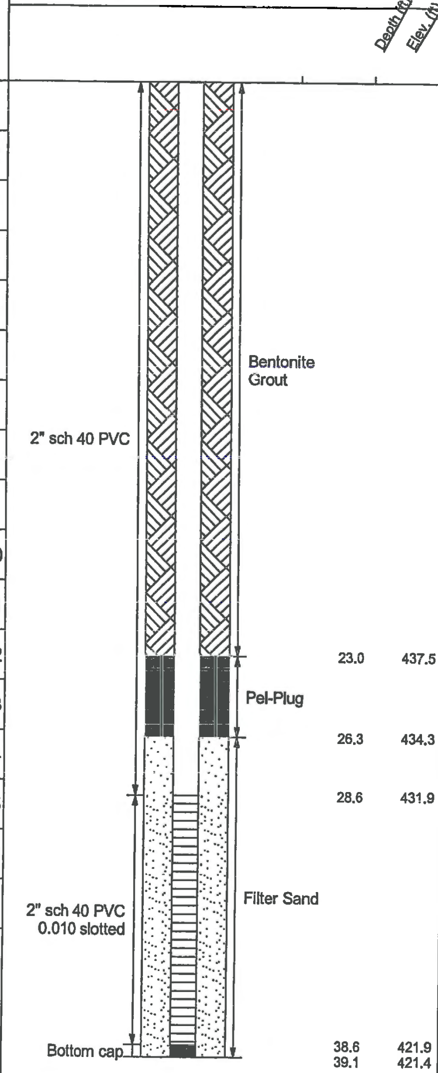
Latitude: 39.818611

Longitude: -90.5697222

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Brown, fine grained, poorly graded SAND - SP		3-9-9	SS1
			7-11-12	SS2
5			3-4-5	SS3
			2-3-3	SS4
			2-3-4	SS5
10			2-3-5	SS6
			3-5-9	SS7
15			5-7-7	SS8
			5-7-8	SS9
			5-7-8	SS10
20			9-15-16	SS11
			7-12-13	SS12
25			8-13-14	SS13
			9-10-11	SS14
	Brown, medium grained, poorly graded SAND - SP		6-6-9	SS15
30			5-8-9	SS16
		⊽	4-5-6	SS17
35	Blind drilled - heaving sands			
40	Boring terminated at 40 feet.			

WELL DIAGRAM

Stickup = 3.4 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 32 FEET ⊽

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM ___ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: [illegible]	App'vd. by: [illegible]
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-8

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/16

Surface Elevation: 444.97

Datum: ______

Completion Date: 10/1/2015

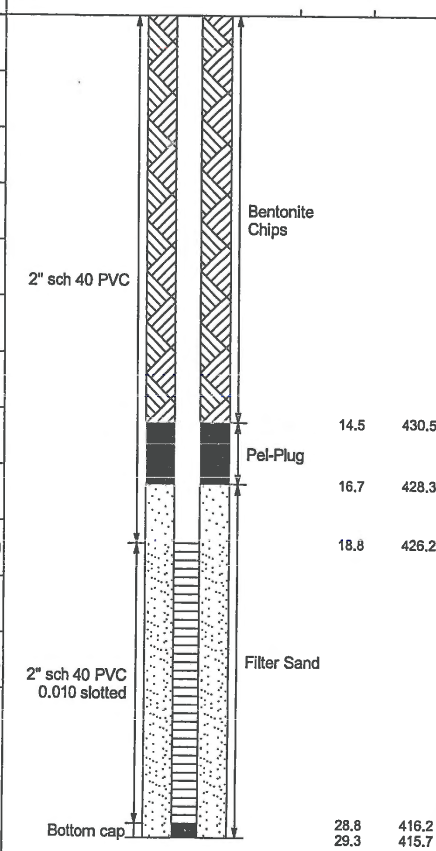
Latitude: 39.821388

Longitude: -90.569722

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	FILL: black, silty sand with coal CCR	4-3-2	SS1
		2-3-3	SS2
5		3-8-8	SS3
		2-4-1	SS4
		2-3-10	SS5
10	Gray SILT - ML	4-3-2	SS6
	Brown, fine grained SAND - SP	5-6-5	SS7
15		3-4-3	SS8
		3-3-4	SS9
	Brown, medium grained SAND - SP	3-3-4	SS10
20	▽	1-2-1	SS11
		2-2-4	SS12
25	Blind drilled - heaving sands		
30	Boring terminated at 30 feet.		
35			

WELL DIAGRAM

Stickup = 3.1 ft
Diameter: 8 1/2 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 20 FEET ▽

DRILLING DATA

__ AUGER 4 1/4" HOLLOW STEM

WASHBORING FROM __ FEET

SMP DRILLER SJK LOGGER

CME 550 DRILL RIG

HAMMER TYPE Auto

REMARKS:
CCR = Coal Combustion Residuals

Drawn by: AGB	Checked by: [illegible]	App'vd. by: AMS
Date: 10/9/2015	Date: 8/5/16	Date: 8/5/16

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Plant
Ameren Missouri

LOG OF BORING: APW-9

Project No. J024917.01

LOG OF BORING 2002 WL J024917.01 - MEREDOSIA WELL.GPJ 00 CLONE ME.GPJ 12/29/16

Surface Elevation: 454.1
Datum: NAVD88

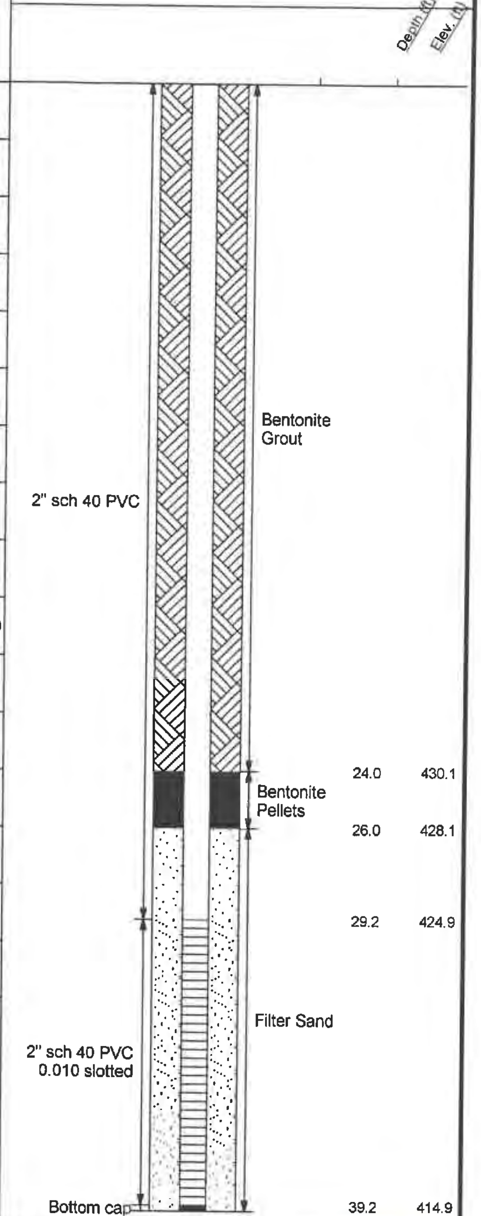
Completion Date: 8/20/18
Northing: 1148344.9
Easting: 2184086

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	FILL: coal residuals		
	Brown, fine SAND - SP	2-4-3-3	SS1
		4-5-4-4	SS2
5		3-2-2-1	SS3
	Brown, clayey SAND - SC		
	Brown, fine SAND - SP	2-3-3-4	SS4
		2-3-3-3	SS5
10		2-2-3-3	SS6
		2-5-7-7	SS7
15	Gray, brown, FAT CLAY - CH	3-5-5-5	SS8
	Brown, fine to medium SAND - SP	1-2-3-3	SS9
		2-3-3-3	SS10
20		2-2-3-2	SS11
		3-6-6-4	SS12
25		5-7-8-10	SS13
	Medium to coarse SAND - SW	7-10-7-6	SS14
		5-6-7-5	SS15
30		4-6-9-10	SS16
35			
	Boring terminated at 38.5 feet.		

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

WELL DIAGRAM

Aboveground = 3.35 feet
Diameter: 8 inch



GROUNDWATER DATA

ENCOUNTERED AT 27.5 FEET ▽
AT 28.11 FEET AFTER 360 HOURS ▼

DRILLING DATA

4 1/4" HOLLOW STEM FROM 0 TO 38.5 FEET
WASHBORING FROM __ FEET
TPD DRILLER JYG LOGGER
CME 55LC DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: JYG	App'vd. by: AMS
Date: 12/28/18	Date: 1-7-2019	Date: 1/7/2019

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station

LOG OF BORING: APW-10

Project No. J024917.05

2014 ENVIRO LOG N/E J024917.05 - MEREDOSIA.GPJ 00 CLONE ME.GPJ 1/7/19

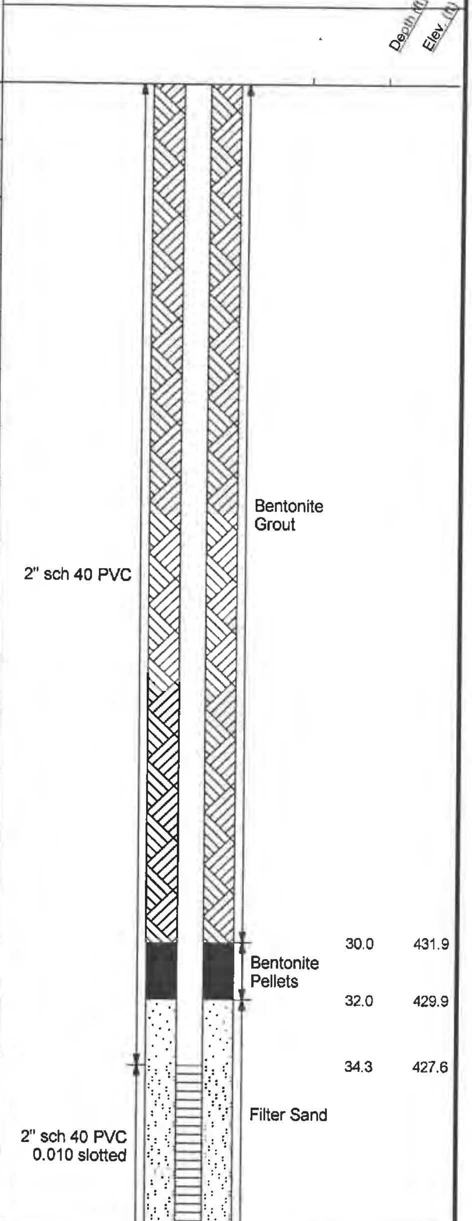
Surface Elevation: 461.89
Datum: NAVD88

Completion Date: 8/22/18
Northing: 1147868
Easting: 2184891

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Brown, fine SAND - SP		1-2-4-4	SS1
			2-2-2-2	SS2
5			2-2-3-3	SS3
			1-2-3-3	SS4
			1-2-4-2	SS5
10			1-2-4-3	SS6
			2-2-2-2	SS7
15			2-2-3-3	SS8
			2-2-3-5	SS9
			5-4-5-6	SS10
20			4-6-6-4	SS11
	light gray, lean clay seam		2-4-7-11	SS12
25			10-12-14 -12	SS13
			7-9-9-9	SS14
			2-4-2-5	SS15
30			2-4-8-6	SS16
			3-6-6-6	SS17
35	Brown, medium to coarse SAND, trace gravel - SW		3-5-6-8	SS18
			2-4-6-8	SS19

WELL DIAGRAM

Aboveground = 3.50 feet
Diameter: 8 inch



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 34 FEET ▽
AT 34.58 FEET AFTER 360 HOURS ▼

DRILLING DATA

4 1/4" HOLLOW STEM FROM 0 TO 44 FEET
WASHBORING FROM __ FEET
TPD DRILLER JYG LOGGER
CME 55LC DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: JYG	App'vd. by: AMS
Date: 12/28/18	Date: 1-7-2019	Date: 1/7/2019

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station

LOG OF BORING: APW-11

Project No. J024917.05

2014 ENVIRO LOG N/E J024917.05 - MEREDOSIA.GPJ 00 CLONE ME.GPJ 1/7/19

Surface Elevation: 461.89	Completion Date: 8/22/18				WELL DIAGRAM
Datum: NAVD88	Northing: 1147868 / Easting: 2184891				Aboveground = 3.50 feet Diameter: 8 inch
DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	Depth (ft) / Elev. (ft)
	Brown, medium to coarse SAND, trace gravel - SW *(continued)*				2" sch 40 PVC 0.010 slotted; Filter Sand
45	Boring terminated at 44 feet.				Bottom cap 44.3 417.6; 44.5 417.4
50					
55					
60					
65					
70					
75					

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

2014 ENVIRO LOG N/E J024917.05 - MEREDOSIA.GPJ 00 CLONE ME.GPJ 1/7/19

GROUNDWATER DATA

ENCOUNTERED AT 34 FEET ▽

AT 34.58 FEET AFTER 360 HOURS ▼

DRILLING DATA

4 1/4" HOLLOW STEM FROM 0 TO 44 FEET

WASHBORING FROM __ FEET

TPD DRILLER JYG LOGGER

CME 55LC DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: JYG	App'vd. by: AMS
Date: 12/28/18	Date: 1-7-2019	Date: 1/7/2019

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Power Station

CONTINUATION OF LOG OF BORING: APW-11

Project No. J024917.05

Surface Elevation: 431.94

Datum: NAVD88

Completion Date: 8/21/18

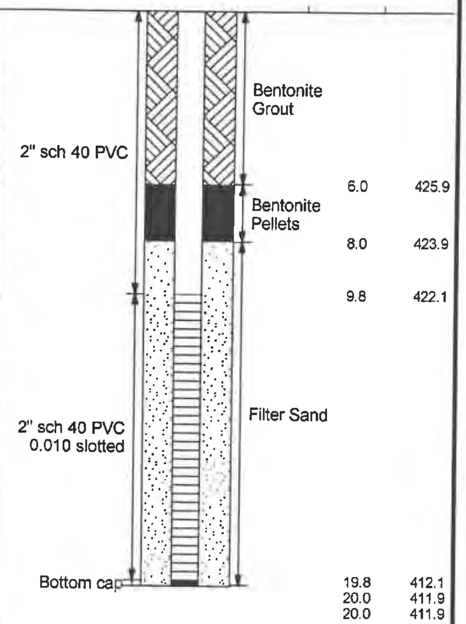
Northing: 1146822.6

Easting: 2181602

WELL DIAGRAM

Aboveground = 3.62 feet
Diameter: 8 inch

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
0	Dark brown. LEAN CLAY - CL		1-1-4-3	SS1
			2-2-2-2	SS2
5			3-3-4-4	SS3
7	Brown, clayey SAND - SC		3-2-1-2	SS4
8	Brown, fine SAND - SP		1-1-3-2	SS5
10	Brown, medium SAND - SW		1-1-2-1	SS6
			1-1-2-2	SS7
15			1-0-1-1	SS8
20	Boring terminated at 20 feet.			



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 8 FEET ∇

AT 7.71 FEET AFTER 360 HOURS ▼

DRILLING DATA

4 1/4" HOLLOW STEM FROM 0 TO 20 FEET

WASHBORING FROM __ FEET

TPD DRILLER JYG LOGGER

CME 55LC DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: AGB	Checked by: JYG	App'vd. by: AMS
Date: 12/28/18	Date: 1-7-2019	Date: 1/7/2019

GEOTECHNOLOGY INC FROM THE GROUND UP

Meredosia Power Station

LOG OF BORING: APW-12

Project No. J024917.05

2014 ENVIRO LOG N/E J024917.05 - MEREDOSIA.GPJ 00 CLONE ME.GPJ 1/7/19

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station, Meredosia, Illinois Well #: APW-6

State Plane Coordinate: X ____ Y ____ (or) Latitude: 39° 48' 57" Longitude: -90° 34' 14" Borehole #: APW-6

Surveyed by: Gateway Land Services, Inc. IL Registration #: ______

Drilling Contractor: Geotechnology, Inc. Driller: Steven Parker, Geotechnology, Inc.

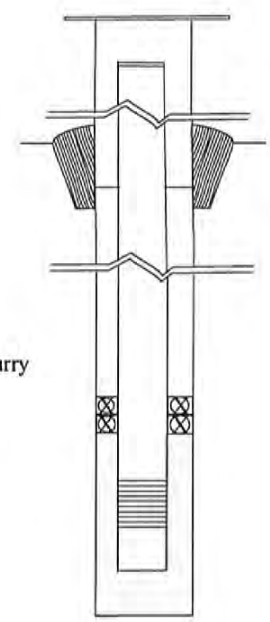
Consulting Firm: Geotechnology, Inc. Geologist: Stephanie Kline-Tissi, Geotechnology, Inc.

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): N/A

Logged By: Stephanie Kline-Tissi, Geotechnology, Inc. Date Started: Oct. 1, 2015 Date Finished: Oct. 1, 2015

Report Form Completed By: ______ Date: December 29, 2015

ANNULAR SPACE DETAILS



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	452.3	3.7	Top of Protective Casing
	451.9	3.3	Top of Riser Pipe
Type of Surface Seal: Concrete	448.6	0.0	Ground Surface
Type of Annular Sealant: Bentonite Grout	448.6	0.0	Top of Annular Sealant
Installation Method: Tremmie Setting Time: 72 Hours	____	____	Static Water Level (After Completion)
Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)	435.6	13.0	Top of Seal
Installation Method: Tremmie	433.1	15.5	Top of Sand Pack
Setting Time: 72 Hours	431.1	17.5	Top of Screen
Type of Sand Pack: Silica	421.1	27.5	Bottom of Screen
Grain Size: 0.010 (Sieve Size)	420.6	28.0	Bottom of Well
Installation Method: Tremmie	420.6	28.0	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Backfill Material: N/A (if applicable)

Installation Method: N/A

WELL CONSTRUCTION MATERIAL
(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.5"
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	20.6
Bottom of Screen to End Cap (feet)	0.5
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	20.6
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well**: Steel Casing Mechanically Driven No

e. Hole Diameter (in.) 8.5 to (ft.) 28 ; (in.) ___ to (ft.) ___ ; (in.) ___ to (ft.) ___

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
Bentonite Grout	3		13	0	13
Pel-Plug	1.5		15.5	13	15.5

g. Well Finished within Unconsolidated Materials

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Silica	0.010 Unimum	28	15.5

2. Well Use: Monitoring Well Disinfected? No

3. Date Well Completed: Oct 1, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ **9.** Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

13. Property Owner: Medina Valley Cogen LLC Well # APW-6

14. Driller: Steven Parker License # ______

15. Name of Drilling Company : Geotechnology, Inc. **16.** Permit Number: ______

Date Issued: ______ **17.** Date Drilling Started Oct 1, 2015

18. Well Site Address: 800 SOUTH WASHINGTON STREET

19. Township Name: ______ Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Moran b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 39 Minutes 48 Seconds 57 N

Lon: Degrees -90 Minutes 34 Seconds 14 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	PVC, threaded	28	0

23. Is the well screened? Yes

If yes	Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
	2	10	0.01	28	18

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground ______

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Brown, fine-grained SAND - SP	0	17
Brown, medium-grained SAND - SP	17	22
Blind drilled - heaving sands	22	28

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # ______
Licensed Water Well Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IL 482-0126
Revised 6/09

IMPORTANCE NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is Mandatory. This form has been approved by the Forms Management Center.

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: ____________ County: Morgan

Site Name: Meredosia Power Station, Meredosia, Illinois Well #: APW-7

State Plane Coordinate: X ____ Y ____ (or) Latitude: 39° 48' 57" Longitude: -90° 34' 24" Borehole #: APW-7

Surveyed by: Gateway Land Services, Inc. IL Registration #: ____________

Drilling Contractor: Geotechnology, Inc. Driller: Steven Parker, Geotechnology, Inc.

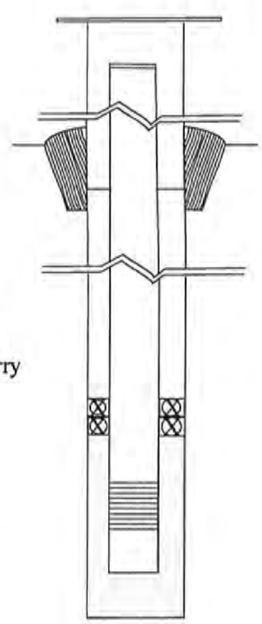
Consulting Firm: Geotechnology, Inc. Geologist: Stephanie Kline-Tissi, Geotechnology, Inc.

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): N/A

Logged By: Stephanie Kline-Tissi, Geotechnology, Inc. Date Started: Oct. 1, 2015 Date Finished: Oct. 1, 2015

Report Form Completed By: Anna Saindon, Geotechnology, Inc. Date: December 29, 2015

ANNULAR SPACE DETAILS



Elevations (MSL)*	Depths (BGS)	(.01ft.)
439.1	4.1	Top of Protective Casing
438.7	3.7	Top of Riser Pipe
435	0.0	Ground Surface
435	0.0	Top of Annular Sealant
		Static Water Level (After Completion)
433	2.0	Top of Seal
431	4.0	Top of Sand Pack
429	6.0	Top of Screen
419	16.0	Bottom of Screen
418.5	16.5	Bottom of Well
418.5	16.5	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Installation Method: Gravity

Setting Time: 72 Hours

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Tremmie

Setting Time: 72 Hours

Type of Sand Pack: Silica

Grain Size: 0.010 (Sieve Size)

Installation Method: Tremmie

Type of Backfill Material: N/A (if applicable)

Installation Method: N/A

CASING MEASURMENTS

Diameter of Borehole (inches)	8.5"
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	9.7
Bottom of Screen to End Cap (feet)	0.5
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	9.7
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL
(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

Well Completion Form (revised 02/06/02)

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ____ Depth (ft.) ____

b. **Bored Well**: Casing Diameter (in.) ____ Buried Slab? ____

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ____

d. **Drilled Well**: Steel Casing Mechanically Driven No

e. Hole Diameter (in.) 8.5 to (ft.) 16.5 ; (in.) ____ to (ft.) ____ ; (in.) ____ to (ft.) ____

f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
Bentonite Grout	3		2	0	
Pel-Plug	1		4	2	4

g. Well Finished within Unconsolidated Materials

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Silica	0.010 Unimum	16.5	14

2. Well Use: Monitoring Well Disinfected? No

3. Date Well Completed: Oct 1, 2015 Driller's Estimated Well Yield (gpm): ____

4. Date Permanent Pump Installed: ____ Set at Depth (ft.): ____

5. Pump Capacity (gpm): ____

6. Pitless Adapter Model and Manufacturer: ____ Attachment to Casing: ____

7. Well Cap Type & Manufacturer: ____

8. Pressure Tank Working Cycle (gals.): ____ Captive Air? ____ **9.** Pump System Disinfected: ____

10. Name of Pump Company ____

11. Pump Installer: ____ License # ____

12. ____ Date ____
Licensed Pump Installation Contractor Signature

13. Property Owner: Medina Valley Cogen LLC Well # APW-7

14. Driller: Steven Parker License # ____

15. Name of Drilling Company : Geotechnology, Inc. **16.** Permit Number: ____

Date Issued: ____ **17.** Date Drilling Started Oct 1, 2015

18. Well Site Address: 800 SOUTH WASHINGTON STREET

19. Township Name: ____ Land I.D. # ____

20. Subdivision Name: ____ Lot # ____

21. Location: a. County Moran b. Site Elevation ____ ft. (above msl)

c. Township: ____ Range: ____ Section: ____

d. ____ Quarter of the ____ Quarter of the ____ Quarter

e. GPS: Lat: Degrees 39 Minutes 48 Seconds 57 N
Lon: Degrees -90 Minutes 34 Seconds 14 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	PVC, threaded	16.5	0

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	16.5	6.5

24. Water from ____ at a depth of (ft.) ____ To (ft.) ____

a. Static water level (ft.) below top of casing ____ which is (in.) above ground ____

b. pumping level is (ft.) ____ pumping (gpm) ____ for (hours) ____

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Black, silty CLAY - CL	0	2
Brown, silty CLAY - CL	2	6
Brown, fine-grained SAND - SP	6	10
Blind drilled - heaving sands	10	16.5

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

____ License # ____
Licensed Water Well Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IMPORTANCE NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is Mandatory. This form has been approved by the Forms Management Center.

IL 482-0126
Revised 6/09

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station, Meredosia, Illinois — Well #: APW-8

State Plane Coordinate: X ____ Y ____ (or) Latitude: 39° 49' 07" Longitude: -90° 34' 11" — Borehole #: APW-8

Surveyed by: Gateway Land Services, Inc. — IL Registration #: ______

Drilling Contractor: Geotechnology, Inc. — Driller: Steven Parker, Geotechnology, Inc.

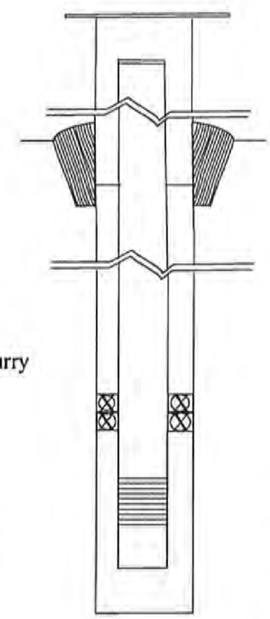
Consulting Firm: Geotechnology, Inc. — Geologist: Stephanie Kline-Tissi, Geotechnology, Inc.

Drilling Method: Hollow Stem Auger — Drilling Fluid (Type): N/A

Logged By: Stephanie Kline-Tissi, Geotechnology, Inc. — Date Started: Oct. 1, 2015 Date Finished: Oct. 1, 2015

Report Form Completed By: Anna Saindon, Geotechnology, Inc. — Date: December 29, 2015

ANNULAR SPACE DETAILS



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	464.4	3.9	Top of Protective Casing
	463.9	3.4	Top of Riser Pipe
Type of Surface Seal: Concrete	460.5	0.0	Ground Surface
Type of Annular Sealant: Bentonite Grout	460.5	0.0	Top of Annular Sealant
Installation Method: Tremmie; Setting Time: 72 Hours			Static Water Level (After Completion)
Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)	437.5	23	Top of Seal
Installation Method: Tremmie	434.3	26.3	Top of Sand Pack
Setting Time: 72 Hours	431.9	28.6	Top of Screen
Type of Sand Pack: Silica	421.9	38.6	Bottom of Screen
Grain Size: 0.010 (Sieve Size)	421.4	39.1	Bottom of Well
Installation Method: Tremmie	421.4	39.1	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Backfill Material: N/A (if applicable)

Installation Method: N/A

WELL CONSTRUCTION MATERIAL
(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.5"
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	32.7
Bottom of Screen to End Cap (feet)	0.5
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	32.7
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well

a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______

b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______

c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______

d. **Drilled Well**: Steel Casing Mechanically Driven No

e. Hole Diameter (in.) 8.5 to (ft.) 39.1 ; (in.) ___ to (ft.) ___ ; (in.) ___ to (ft.) ___

f.

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
Bentonite Grout	3		23	0	23
Pel-Plug	1		26.3	23	26.3

g. Well Finished within Unconsolidated Materials

h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Silica	0.010 Unimum	39.1	23

2. Well Use: Monitoring Well Disinfected? No

3. Date Well Completed: Oct 1, 2015 Driller's Estimated Well Yield (gpm): ______

4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______

5. Pump Capacity (gpm): ______

6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______

7. Well Cap Type & Manufacturer: ______

8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ **9.** Pump System Disinfected: ______

10. Name of Pump Company ______

11. Pump Installer: ______ License # ______

12. ______ Date ______
Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IL 482-0126
Revised 6/09

IMPORTANCE NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is Mandatory. This form has been approved by the Forms Management Center.

13. Property Owner: Medina Valley Cogen LLC Well # APW-8

14. Driller: Steven Parker License # ______

15. Name of Drilling Company : Geotechnology, Inc. **16.** Permit Number: ______

Date Issued: ______ **17.** Date Drilling Started Oct 1, 2015

18. Well Site Address: 800 SOUTH WASHINGTON STREET

19. Township Name: ______ Land I.D. # ______

20. Subdivision Name: ______ Lot # ______

21. Location: a. County Moran b. Site Elevation ______ ft. (above msl)

c. Township: ______ Range: ______ Section: ______

d. ______ Quarter of the ______ Quarter of the ______ Quarter

e. GPS: Lat: Degrees 39 Minutes 48 Seconds 57 N
Lon: Degrees -90 Minutes 34 Seconds 14 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	PVC, threaded	39.1	0

23. Is the well screened? Yes

If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	39.1	29.1

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______

a. Static water level (ft.) below top of casing ______ which is (in.) above ground ______

b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______

25.

Earth Materials Passed Through	From (ft.)	To (ft.)
Brown, fine-grained, poorly graded SAND -SP	0	23
Brown, medium-grained, poorly graded - SP	23	34
Blind drilled - heaving sands	34	39.1

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # ______
Licensed Water Well Contractor Signature

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station, Meredosia, Illinois Well #: APW-9

State Plane Coordinate: X ____ Y ____ (or) Latitude: 39° 49' 17" Longitude: -90° 34' 11" Borehole #: APW-9

Surveyed by: Gateway Land Services, Inc. IL Registration #: ______

Drilling Contractor: Geotechnology, Inc. Driller: Steven Parker, Geotechnology, Inc.

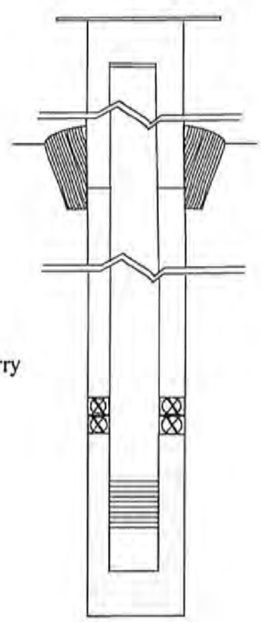
Consulting Firm: Geotechnology, Inc. Geologist: Stephanie Kline-Tissi, Geotechnology, Inc.

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): N/A

Logged By: Stephanie Kline-Tissi, Geotechnology, Inc. Date Started: Oct. 1, 2015 Date Finished: Oct. 1, 2015

Report Form Completed By: Anna Saindon, Geotechnology, Inc. Date: December 29, 2015

ANNULAR SPACE DETAILS



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	448.6	3.6	Top of Protective Casing
	448.1	3.1	Top of Riser Pipe
Type of Surface Seal: Concrete	445.0	0.0	Ground Surface
Type of Annular Sealant: Bentonite Chips	445.0	0.0	Top of Annular Sealant
Installation Method: Tremmie			Static Water Level (After Completion)
Setting Time: 72 Hours			
Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)	430.5	14.5	Top of Seal
Installation Method: Tremmie	428.3	16.7	Top of Sand Pack
Setting Time: 72 Hours	426.2	18.8	Top of Screen
Type of Sand Pack: Silica	416.2	28.8	Bottom of Screen
Grain Size: 0.010 (Sieve Size)	415.7	29.3	Bottom of Well
Installation Method: Tremmie	415.7	29.3	Bottom of Borehole

* Referenced to a National Geodetic Datum

Type of Backfill Material: N/A (if applicable)

Installation Method: N/A

WELL CONSTRUCTION MATERIAL
(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.5"
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	22.1
Bottom of Screen to End Cap (feet)	0.5
Screen Length (1st slot to last slot) (feet)	9.68
Total Length of Casing (feet)	22.1
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

State of Illinois
Department of Public Health

WATER WELL CONSTRUCTION REPORT

Complete within 30 days of well completion and send to the appropriate Health Department

Print Form

1. Type of Well
   a. **Driven Well**: Casing Diameter (in.) ______ Depth (ft.) ______
   b. **Bored Well**: Casing Diameter (in.) ______ Buried Slab? ______
   c. **Drilled Well**: PVC Casing Formation Packer Set at Depth of (ft.) ______
   d. **Drilled Well**: Steel Casing Mechanically Driven No
   e. Hole Diameter (in.) 8.5 to (ft.) 39.1 ; (in.) ___ to (ft.) ___ ; (in.) ___ to (ft.) ___
   f. Type of Grout

Type of Grout	# of bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)
Bentonite Grout	3		14.5	0	14.5
Pel-Plug	1		16.7	14.5	16.7

   g. Well Finished within Unconsolidated Materials
   h.

Kind of Gravel/Sand Pack	Grain Size/Supplier #	From (ft.)	To (ft.)
Silica	0.010 Unimum	29.3	16.7

2. Well Use: Monitoring Well Disinfected? No
3. Date Well Completed: Oct 1, 2015 Driller's Estimated Well Yield (gpm): ______
4. Date Permanent Pump Installed: ______ Set at Depth (ft.): ______
5. Pump Capacity (gpm): ______
6. Pitless Adapter Model and Manufacturer: ______ Attachment to Casing: ______
7. Well Cap Type & Manufacturer: ______
8. Pressure Tank Working Cycle (gals.): ______ Captive Air? ______ 9. Pump System Disinfected: ______
10. Name of Pump Company ______
11. Pump Installer: ______ License # ______
12. ______ Date ______
    Licensed Pump Installation Contractor Signature

Illinois Department of Public Health
Division of Environmental Health
525 West Jefferson Street
Springfield, IL 62761

IL 482-0126
Revised 6/09

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13. Property Owner: Medina Valley Cogen LLC Well # APW-9
14. Driller: Steven Parker License # ______
15. Name of Drilling Company : Geotechnology, Inc. 16. Permit Number: ______
    Date Issued: ______ 17. Date Drilling Started Oct 1, 2015
18. Well Site Address: 800 SOUTH WASHINGTON STREET
19. Township Name: ______ Land I.D. # ______
20. Subdivision Name: ______ Lot # ______
21. Location: a. County Moran b. Site Elevation ______ ft. (above msl)
    c. Township: ______ Range: ______ Section: ______
    d. ______ Quarter of the ______ Quarter of the ______ Quarter
    e. GPS: Lat: Degrees 39 Minutes 48 Seconds 57 N
    Lon: Degrees -90 Minutes 34 Seconds 14 W

Survey use only

22. Casing and Liner Information

Diameter (in.)	Material, Joint Type	From (ft.)	To (ft.)
2	PVC, threaded	29.3	0

23. Is the well screened? Yes If yes

Diameter (in.)	Length (ft.)	Slot Size (in.)	From (ft.)	To (ft.)
2	10	0.01	29.3	19.3

24. Water from ______ at a depth of (ft.) ______ To (ft.) ______
    a. Static water level (ft.) below top of casing ______ which is (in.) above ground ______
    b. pumping level is (ft.) ______ pumping (gpm) ______ for (hours) ______
25.

Earth Materials Passed Through	From (ft.)	To (ft.)
FILL: black, silty sand with coal CCR	0	10
Gray SILT - ML	10	12.7
Brown, fine-grained SAND - SP	12.7	18
Brown, medium-grained SAND - SP	18	24
Blind drilled - heaving sands	24	29.3

(Attach 2nd page, if necessary) (If DRY HOLE, fill out log & indicate how hole was sealed)

______ License # ______
Licensed Water Well Contractor Signature

Illinois Environmental Protection Agency

Well Completion Report

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station Well #: APW-10

State Plane Coordinate: X 2184086.395 Y 1148344.943 (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ " Borehole #: ______

Surveyed by: David Mason & Associates IL Registration #: ______

Drilling Contractor: Geotechnology, Inc. Driller: Thomas Dwyer

Consulting Firm: Geotechnology, Inc. Geologist: Anna Saindon

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Jessie Goodwin Date Started: 8/20/2018 Date Finished: 8/20/2018

Report Form Completed By: Jessie Goodwin Date: 12/26/2018

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Grout Slurry

Installation Method: Tremie

Setting Time: N/A

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Gravity

Setting Time: N/A

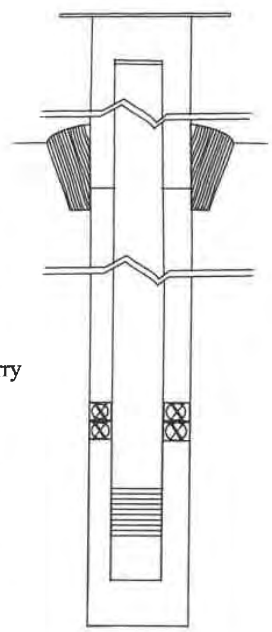
Type of Sand Pack: Silica

Grain Size: 10-20 Mesh (Sieve Size)

Installation Method: Gravity

Type of Backfill Material: N/A (if applicable)

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(.01ft.)
457.93	-3.83	Top of Protective Casing
457.45	-3.35	Top of Riser Pipe
454.10	0.00	Ground Surface
453.60	0.50	Top of Annular Sealant
425.99	28.11	Static Water Level (After Completion)
430.10	24.00	Top of Seal
428.10	26.00	Top of Sand Pack
424.90	29.20	Top of Screen
414.90	39.20	Bottom of Screen
414.70	39.40	Bottom of Well
414.70	39.40	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8
ID of Riser Pipe (inches)	2.0
Protective Casing Length (feet)	5.0
Riser Pipe Length (feet)	32.55
Bottom of Screen to End Cap (feet)	0.40
Screen Length (1st slot to last slot) (feet)	10.0
Total Length of Casing (feet)	42.75
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station Well #: APW-11

State Plane Coordinate: X 2184890.914 Y 1147868.023 (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ " Borehole #: ______

Surveyed by: David Mason & Associates

IL Registration #: ______

Drilling Contractor: Geotechnology, Inc.

Driller: Thomas Dwyer

Consulting Firm: Geotechnology, Inc.

Geologist: Anna Saindon

Drilling Method: Hollow Stem Auger

Drilling Fluid (Type): None

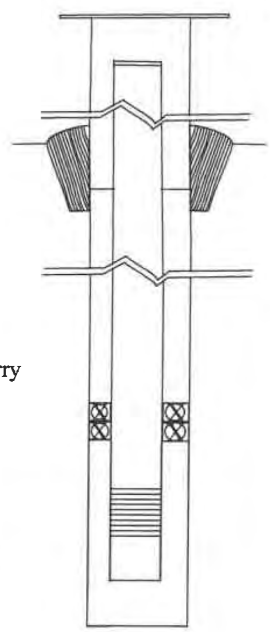
Logged By: Jessie Goodwin

Date Started: 8/22/2018 Date Finished: 8/22/2018

Report Form Completed By: Jessie Goodwin

Date: 12/26/2018

ANNULAR SPACE DETAILS



Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Grout Slurry

Installation Method: Tremie

Setting Time: N/A

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Gravity

Setting Time: N/A

Type of Sand Pack: Silica

Grain Size: 10-20 Mesh (Sieve Size)

Installation Method: Gravity

Type of Backfill Material: N/A (if applicable)

Installation Method: ______

Elevations (MSL)*	Depths (BGS)	(.01ft.)
465.94	-4.05	Top of Protective Casing
465.40	-3.51	Top of Riser Pipe
461.89	0.00	Ground Surface
461.39	0.50	Top of Annular Sealant
427.31	34.58	Static Water Level (After Completion)
431.89	30.00	Top of Seal
429.89	32.00	Top of Sand Pack
427.64	34.25	Top of Screen
417.64	44.25	Bottom of Screen
417.44	44.45	Bottom of Well
417.44	44.45	Bottom of Borehole

* Referenced to a National Geodetic Datum

CASING MEASURMENTS

Diameter of Borehole (inches)	8
ID of Riser Pipe (inches)	2.0
Protective Casing Length (feet)	5.0
Riser Pipe Length (feet)	37.76
Bottom of Screen to End Cap (feet)	0.40
Screen Length (1st slot to last slot) (feet)	10.0
Total Length of Casing (feet)	47.96
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

Well Completion Form (revised 02/06/02)

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: ______ County: Morgan

Site Name: Meredosia Power Station Well #: APW-12

State Plane Coordinate: X 2181601.52 Y 1146822.618 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___" Borehole #: ______

Surveyed by: David Mason & Associates IL Registration #: ______

Drilling Contractor: Geotechnology, Inc. Driller: Thomas Dwyer

Consulting Firm: Geotechnology, Inc. Geologist: Anna Saindon

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Jessie Goodwin Date Started: 8/21/2018 Date Finished: 8/21/2018

Report Form Completed By: Jessie Goodwin Date: 12/26/2018

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Grout Slurry

Installation Method: Tremie

Setting Time: N/A

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Gravity

Setting Time: N/A

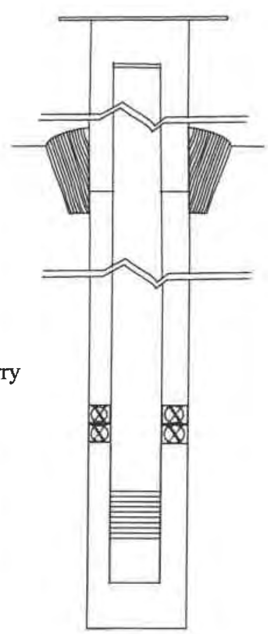
Type of Sand Pack: Silica

Grain Size: 10-20 Mesh (Sieve Size)

Installation Method: Gravity

Type of Backfill Material: N/A (if applicable)

Installation Method: ______



Elevations (MSL)*	Depths (BGS)	(.01ft.)
436.02	-4.08	Top of Protective Casing
435.52	-3.58	Top of Riser Pipe
431.94	0.00	Ground Surface
431.44	0.50	Top of Annular Sealant
424.23	7.71	Static Water Level (After Completion)
425.94	6.00	Top of Seal
493.94	8.00	Top of Sand Pack
422.10	9.84	Top of Screen
412.10	19.84	Bottom of Screen
411.90	20.04	Bottom of Well
411.90	20.04	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8
ID of Riser Pipe (inches)	2.0
Protective Casing Length (feet)	5.0
Riser Pipe Length (feet)	13.42
Bottom of Screen to End Cap (feet)	0.40
Screen Length (1st slot to last slot) (feet)	10.0
Total Length of Casing (feet)	23.62
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

APPENDIX B
2019 GROUNDWATER MONITORING RESULTS

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-1

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	0.0019	<0.0010	0.0011	0.0010	
B, diss, mg/L	0.0730	0.0486	0.0559	0.0679	
B, tot, mg/L	0.0787	0.0644	0.0629	0.0692	
Ba, diss, mg/L	0.0120	0.0142	0.0122	0.0075	
Ba, tot, mg/L	0.0221	0.0171	0.0181	0.0125	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	28.0	26.0	27.0	11.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.15	0.16	0.14	0.18	
Fe, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	2.3600	0.8820	1.3000	1.3000	
GW Elv, ft	430.69	441.12	435.46	432.34	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	<0.0070	<0.0070	<0.0070	
Mn, tot, mg/L	0.2010	0.0884	0.1050	0.0947	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	0.0081	<0.0050	0.0058	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	4.060	4.150	3.340	3.890	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	0.0030	0.0011	0.0015	0.0015	
pH (field), STD	6.86	6.87	6.63	7.04	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-1

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	13	17	11	15	
Spec. Cond. (field), micromho	326	378	326	248	
TDS, mg/L	202	200	168		130
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	0.0162	
Zn, tot, mg/L	0.0100	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-2

	1/29/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	0.0036	0.0032	
As, tot, mg/L	0.0026	0.0036	0.0042	
B, diss, mg/L	1.9100	2.2100	2.0200	
B, tot, mg/L	2.1100	2.2600	2.1500	
Ba, diss, mg/L	0.0626	0.0574	0.0552	
Ba, tot, mg/L	0.0902	0.0659	0.0631	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	19.0	25.0	20.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.24	0.26	0.26	
Fe, diss, mg/L	0.7400	0.3400	0.1180	
Fe, tot, mg/L	3.4100	1.0700	0.8540	
GW Elv, ft	426.79	426.27	427.42	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	0.2700	0.5090	0.3700	
Mn, tot, mg/L	0.5000	0.5120	0.4080	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	<0.050	0.077	<0.050	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	
pH (field), STD	6.66	6.95	6.85	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-2

	1/29/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	49	26	24	
Spec. Cond. (field), micromho	866	904	815	
TDS, mg/L	542	526		508
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-3

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	0.1900	0.2040	0.1850	
As, tot, mg/L	0.2150	0.2310	0.2310	
B, diss, mg/L	19.5000	14.9000	15.8000	
B, tot, mg/L	21.4000	15.4000	16.6000	
Ba, diss, mg/L	0.0686	0.0764	0.0370	
Ba, tot, mg/L	0.0847	0.0978	0.0845	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	20.0	29.0	28.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.23	0.21	0.20	
Fe, diss, mg/L	1.9800	2.6200	<0.0400	
Fe, tot, mg/L	2.7500	3.8500	3.2500	
GW Elv, ft	428.97	425.49	428.25	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	0.6990	0.6130	0.7040	
Mn, tot, mg/L	0.7620	0.6910	0.7830	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	<0.050	<0.050	<0.050	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	
pH (field), STD	7.41	7.51	7.45	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-3

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	141	68	65	
Spec. Cond. (field), micromho	993	949	985	
TDS, mg/L	716	598		604
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-4

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	0.0203	0.0265	0.0128	
As, tot, mg/L	0.0198	0.0278	0.0187	
B, diss, mg/L	1.4700	1.0200	1.1300	
B, tot, mg/L	1.6100	0.9950	1.2700	
Ba, diss, mg/L	0.0432	0.0382	0.0202	
Ba, tot, mg/L	0.0502	0.0612	0.0496	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	23.0	42.0	36.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.40	0.44	0.43	
Fe, diss, mg/L	11.3000	9.4800	4.9300	
Fe, tot, mg/L	12.4000	14.7000	11.4000	
GW Elv, ft	428.04	430.55	428.74	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	2.1200	1.4300	1.8000	
Mn, tot, mg/L	2.2800	1.6100	1.9400	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	0.0051	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	<0.050	<0.050	<0.050	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	0.0022	<0.0010	
pH (field), STD	6.82	6.91	6.89	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-4

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	37	20	27	
Spec. Cond. (field), micromho	869	746	816	
TDS, mg/L	558	402		468
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	0.0132	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-5

	1/29/2019	6/4/2019	8/27/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
B, diss, mg/L	0.1060	0.0912	0.0897	0.0856	
B, tot, mg/L	0.1190	0.1070	0.0950	0.0893	
Ba, diss, mg/L	0.0091	0.0108	0.0066	0.0079	
Ba, tot, mg/L	0.0109	0.0118	0.0075	0.0090	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	8.0	22.0	5.0	<5.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	<0.10	0.12	0.10	0.11	
Fe, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	0.2730	0.2140	0.1600	0.2610	
GW Elv, ft	429.45	442.67	432.55	430.75	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	<0.0070	<0.0070	<0.0070	
Mn, tot, mg/L	0.0336	0.0312	0.0202	0.0259	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	2.290	1.070	1.580	1.870	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
pH (field), STD	7.20	7.19	7.17	7.41	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-5

	1/29/2019	6/4/2019	8/27/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	70	25	19	48	
Spec. Cond. (field), micromho	535	707	454	513	
TDS, mg/L	330	382	224		282
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-6

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
B, diss, mg/L	0.5280	0.5500	1.0600	1.4000	
B, tot, mg/L	0.5680	0.5510	1.1100	1.4300	
Ba, diss, mg/L	0.0157	0.0198	0.0188	0.0152	
Ba, tot, mg/L	0.0179	0.0211	0.0214	0.0162	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	8.0	25.0	8.0	8.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.15	0.17	0.13	0.15	
Fe, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	0.0735	0.3100	0.0744	0.1520	
GW Elv, ft	429.75	444.80	432.08	430.90	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	<0.0070	<0.0070	<0.0070	
Mn, tot, mg/L	<0.0070	0.0220	<0.0070	0.0071	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	0.442	0.824	0.184	2.130	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
pH (field), STD	7.09	7.13	7.05	7.27	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-6

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	23	15	24	15	
Spec. Cond. (field), micromho	568	729	650	557	
TDS, mg/L	356	398	354		256
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-7

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	<0.0010	<0.0010	<0.0010	
B, diss, mg/L	0.2540	0.1330	0.1680	
B, tot, mg/L	0.2950	0.1400	0.1780	
Ba, diss, mg/L	0.0295	0.0373	0.0337	
Ba, tot, mg/L	0.0343	0.0405	0.0356	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	40.0	39.0	39.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.20	0.31	0.24	
Fe, diss, mg/L	<0.0400	0.0486	<0.0400	
Fe, tot, mg/L	0.2490	0.0982	0.0540	
GW Elv, ft	428.75	429.96	429.61	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	0.1130	0.0730	
Mn, tot, mg/L	0.0098	0.1240	0.1010	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	4.400	<0.050	0.055	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	
pH (field), STD	6.75	7.08	7.01	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-7

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	41	24	17	
Spec. Cond. (field), micromho	779	641	694	
TDS, mg/L	464	330		370
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-8

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	0.0013	0.0012	0.0012	0.0013	
As, tot, mg/L	0.0015	0.0015	0.0018	0.0301	
B, diss, mg/L	7.9400	7.5300	6.7600	7.6300	
B, tot, mg/L	8.6100	7.7200	7.1200	8.0200	
Ba, diss, mg/L	0.0692	0.0662	0.0696	0.0629	
Ba, tot, mg/L	0.0753	0.0680	0.0784	0.1850	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	0.0009	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	<5.0	5.0	10.0	18.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	0.0771	
Cr, diss, mg/L	0.0126	0.0117	0.0085	0.0117	
Cr, tot, mg/L	0.0142	0.0124	0.0102	0.0438	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	0.0815	
F, diss, mg/L	0.11	0.15	0.15	0.19	
Fe, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	0.1420	0.1350	0.9010	41.7000	
GW Elv, ft	428.94	442.82	429.84	429.94	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	<0.0070	<0.0070	<0.0070	
Mn, tot, mg/L	0.0151	0.0140	0.0556	2.7100	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	0.1200	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	3.860	3.890	4.070	5.390	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	0.0016	0.0484	
pH (field), STD	7.23	7.36	7.36	7.56	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-8

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	0.0011	0.0057	
Se, diss, mg/L	0.0809	0.0524	0.0616	0.0839	
Se, tot, mg/L	0.0822	0.0517	0.0672	0.0815	
SO4, diss, mg/L	304	249	367	389	
Spec. Cond. (field), micromho	888	891	1110	1140	
TDS, mg/L	678	600	766		760
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	0.0522	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	0.1450	

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2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-9

	1/29/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	0.0012	0.0012	0.0013	
As, tot, mg/L	0.0018	0.0015	0.0017	
B, diss, mg/L	0.6460	1.3000	1.2600	
B, tot, mg/L	0.6680	1.3400	1.3600	
Ba, diss, mg/L	0.0190	0.0348	0.0339	
Ba, tot, mg/L	0.0224	0.0371	0.0380	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	22.0	19.0	43.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	0.0052	
Co, tot, mg/L	<0.0050	<0.0050	0.0068	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.31	0.22	0.24	
Fe, diss, mg/L	<0.0400	0.0565	<0.0400	
Fe, tot, mg/L	0.3320	0.3590	0.4460	
GW Elv, ft	428.62	426.24	429.18	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	0.0080	<0.0070	
Mn, tot, mg/L	0.0316	0.0291	0.0378	
Ni, diss, mg/L	<0.0050	<0.0050	0.0119	
Ni, tot, mg/L	<0.0050	0.0059	0.0138	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	2.580	3.970	3.140	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	
pH (field), STD	7.02	6.79	7.00	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-9

	1/29/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	229	468	600	
Spec. Cond. (field), micromho	988	1520	1520	
TDS, mg/L	722	1130		1330
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-10

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	0.0019	0.0014	0.0015	0.0016	
As, tot, mg/L	0.0036	0.0023	0.0025	0.0025	
B, diss, mg/L	1.1000	1.0200	0.8210	0.8190	
B, tot, mg/L	1.2000	1.0400	0.8890	0.8790	
Ba, diss, mg/L	0.0217	0.0189	0.0158	0.0156	
Ba, tot, mg/L	0.0261	0.0221	0.0199	0.0200	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	<5.0	<5.0	<5.0	<5.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	0.0063	<0.0050	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	<0.10	<0.10	<0.10	<0.10	
Fe, diss, mg/L	0.5350	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	2.1500	1.0600	1.0400	1.0700	
GW Elv, ft	429.79	442.98	431.09	430.40	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	0.0452	<0.0070	<0.0070	<0.0070	
Mn, tot, mg/L	0.1640	0.0985	0.0773	0.0722	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	0.0067	<0.0050	<0.0050	<0.0050	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	4.300	3.030	2.500	3.800	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	0.0028	0.0018	0.0013	0.0013	
pH (field), STD	7.44	7.55	7.61	7.74	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

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2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-10

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	63	58	46	49	
Spec. Cond. (field), micromho	482	539	479	445	
TDS, mg/L	336	304	256		264
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	

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2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-11

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	0.0012	0.0010	0.0011	0.0371	
B, diss, mg/L	2.0600	0.4960	1.8800	2.6600	
B, tot, mg/L	2.3000	0.5270	2.0600	2.9000	
Ba, diss, mg/L	0.0147	0.0130	0.0132	0.0115	
Ba, tot, mg/L	0.0181	0.0147	0.0161	0.0970	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	0.0014	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	<5.0	<5.0	<5.0	<5.0	
CN, total, mg/L	<0.005	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	<0.0050	<0.0050	<0.0050	0.0860	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	0.0465	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	0.1070	
F, diss, mg/L	<0.10	0.13	<0.10	<0.10	
Fe, diss, mg/L	<0.0400	0.1440	<0.0400	<0.0400	
Fe, tot, mg/L	0.6330	0.5680	0.8710	56.8000	
GW Elv, ft	430.55	442.19	434.01	431.97	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	<0.0070	0.0900	<0.0070	<0.0070	
Mn, tot, mg/L	0.0572	0.2260	0.1820	3.6900	
Ni, diss, mg/L	<0.0050	<0.0050	<0.0050	<0.0050	
Ni, tot, mg/L	<0.0050	<0.0050	<0.0050	0.1520	
NO2, diss, mg/L	<0.05	<0.05	<0.05	<0.05	
NO3, diss, mg/L	3.140	1.870	2.590	2.470	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	<0.0010	<0.0010	<0.0010	0.0605	
pH (field), STD	7.37	7.50	7.42	7.48	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	<0.0010	

March 30, 2020
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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-11

	1/29/2019	6/4/2019	8/26/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	0.0026	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	74	19	48	80	
Spec. Cond. (field), micromho	558	412	568	622	
TDS, mg/L	362	238	304		406
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	0.0790	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	0.1890	

Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-12

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Ag, diss, mg/L	<0.007	<0.007	<0.007	
Ag, tot, mg/L	<0.007	<0.007	<0.007	
As, diss, mg/L	<0.0010	<0.0010	<0.0010	
As, tot, mg/L	0.0029	0.0013	0.0011	
B, diss, mg/L	0.2410	0.1370	0.1310	
B, tot, mg/L	0.2540	0.1610	0.1270	
Ba, diss, mg/L	0.2460	0.1190	0.1680	
Ba, tot, mg/L	0.2850	0.1210	0.1840	
Be, diss, mg/L	<0.0005	<0.0005	<0.0005	
Be, tot, mg/L	<0.0005	<0.0005	<0.0005	
Cd, diss, mg/L	<0.0020	<0.0020	<0.0020	
Cd,tot, mg/L	<0.0020	<0.0020	<0.0020	
Cl, diss, mg/L	75.0	39.0	44.0	
CN, total, mg/L	<0.005	<0.005	<0.005	
Co, diss, mg/L	<0.0050	<0.0050	<0.0050	
Co, tot, mg/L	0.0054	<0.0050	<0.0050	
Cr, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cr, tot, mg/L	<0.0050	<0.0050	<0.0050	
Cu, diss, mg/L	<0.0050	<0.0050	<0.0050	
Cu, tot, mg/L	<0.0050	<0.0050	<0.0050	
F, diss, mg/L	0.25	0.40	0.33	
Fe, diss, mg/L	<0.0400	<0.0400	<0.0400	
Fe, tot, mg/L	2.2000	0.7910	0.6220	
GW Elv, ft	428.61	428.35	428.98	
Hg, diss, mg/L	<0.0002	<0.0002	<0.0002	
Hg, tot, mg/L	<0.0002	<0.0002	<0.0002	
Mn, diss, mg/L	1.1200	1.0000	1.1800	
Mn, tot, mg/L	1.3800	1.1100	1.3500	
Ni, diss, mg/L	<0.0050	0.0058	0.0085	
Ni, tot, mg/L	0.0129	0.0086	0.0099	
NO2, diss, mg/L	<0.05	<0.05	<0.05	
NO3, diss, mg/L	5.500	<0.050	0.107	
Pb, diss, mg/L	<0.0010	<0.0010	<0.0010	
Pb, tot, mg/L	0.0023	<0.0010	<0.0010	
pH (field), STD	6.73	7.02	7.00	
Sb, diss, mg/L	<0.0010	<0.0010	<0.0010	

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Meredosia Power Station
2019 Groundwater Monitoring Results

Date Range: 01/01/2019 to 12/31/2019
Well: APW-12

	1/29/2019	8/27/2019	12/9/2019	12/20/2019
Sb, tot, mg/L	<0.0010	<0.0010	<0.0010	
Se, diss, mg/L	<0.0400	<0.0400	<0.0400	
Se, tot, mg/L	<0.0400	<0.0400	<0.0400	
SO4, diss, mg/L	96	25	70	
Spec. Cond. (field), micromho	1138	640	853	
TDS, mg/L	730	326		516
Tl, diss, mg/L	<0.0020	<0.0020	<0.0020	
Tl, tot, mg/L	<0.0020	<0.0020	<0.0020	
V, diss, mg/L	<0.0100	<0.0100	<0.0100	
V, tot, mg/L	<0.0100	<0.0100	<0.0100	
Zn, diss, mg/L	<0.0100	<0.0100	<0.0100	
Zn, tot, mg/L	<0.0100	<0.0100	<0.0100	

APPENDIX C
SITE INSPECTION REPORTS

Inspection Form for Closed Ponds at Ameren Facilities

Projcet Name: Quarterly Ash Pond Cap Inspection

Location: Meredosia Power Plant

System Description: Fly Ash Pond
Bottom Ash Embankment

Engineer/Inspectors: Mike Wagstaff

Owner Representative: n/a

Inspection Date: 3/29/2019
Temperature: 40's
Weather: cloudy

River Level at Meredosia: 436.3'
Gage 0' = 418.00' MSL
Bottom Ash Pond bottom is at 430.00' MSL

Overall System Rating: **Acceptable**

System Rating Codes

Acceptable System: Nearly all items or components are rated as GC or NE.

Minimally Acceptable System: One or more items are rated as MM or one or more items are rated as IM or EC and an engineering determination concludes that the IM or EC items would not prevent the system from performing as intended.

Unacceptable System: One or more items are rated as IM or EC and would prevent the system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

Condition Codes

EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Supervising Engineer, Dam Safety; i.e. pool draw down, work stoppage, or plant stoppage.

IM = Item needing Immediate Maintenance to restore or ensure its safety or integrity. Remediation should be completed within an appropriate timeframe as determined by the Supervising Engineer, Dam Safety.

MM = Item needing Minor Maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled.

OB = Condition requires regular Observation to ensure that the condition does not become worse.

GC = Good Condition.

NE = No Evidence of a problem.

NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Fly Ash Pond Cap - ClosureTurf
Quarterly Site Inspection Checksheet

Date	3/29/2019
Inspector	Mike Wagstaff
Temperature	40's
Weather	cloudy

	Item	Condition Code *	Comments
Closure Cap	**Drainage Ditch/ArmorFill**	**GC**	ArmorFill has not yet been applied to ditches. This work will be done Spring of 2019.
	Sand on Cap	**GC**	Sand has been applied to 100% of cap and swept into turf for 80% of cap. Remaining sweeping will be done in Spring 2019.
	ClosureTurf	**GC**	No damage or degradation evident.
	Riprap Outlet Flumes	**GC**	No vegetation in riprap outlet flumes.
	Other	**--**	
Embankment	**Riprap**	**GC**	Riprap placed during cap construction and is in good condition.
	Vegetation in riprap	**GC**	No weeds in riprap.
	Vegetation at Toe	**GC**	Vegetation has been mowed a minimum of 20' from berm toe.
	Debris/Logs	**GC**	All debris/logs were removed from the berm during closure construction.
	Erosion	**GC**	None.
	Other	**--**	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Bottom Ash Embankment - ClosureTurf
Quarterly Site Inspection Checksheet

Date	3/29/2019
Inspector	Mike Wagstaff
Temperature	40's
Weather	cloudy

	Item	Condition Code *	Comments
Roadway	**Gravel Road**	**GC**	Roadway gravel is compacted and smooth.
	Drainage	**GC**	No drainage problems at this time.
	Other	**GC**	No issues.
Embankment	**Vegetation at Toe**	**GC**	Vegetation has been mowed a minimum of 20' from berm toe.
	ClosureTurf	**GC**	Turf in excellent condition. No signs of wear or damage.
	ArmorFill	**GC**	ArmorFill has been applied and is in good condtion.
	Riprap at Toe	**GC**	No vegetation in riprap.
	Riprap Outlet Flumes	**GC**	Flume at northeast end of berm is in good condition.
	Other	**--**	
Remaining Basin	**Side Slopes**	**GC**	Sedimentation logs are in place, site has been seeded and mulched.
	Bottom	**GC**	Seed has germinated and started growing prior to winter weather.
	Outlet Riprap	**GC**	No weeds in riprap.
	Toe Riprap	**GC**	No weeds in riprap.
	Other	**--**	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Fly Ash Pond Cap – Northeast Corner looking northwest

Fly Ash Pond Cap – Northeast corner looking northwest

Fly Ash Pond Cap – East side looking south

Bottom Ash Pond embankment – East face looking south

Bottom Ash Pond Embankment – north berm looking east

Bottom Ash Pond Embankment – Roadway looking south

Bottom Ash Pond Embankment – West berm looking south

Bottom Ash Pond Embankment – South berm looking south

Fly Ash Pond Cap – Southeast corner looking west

Fly Ash Pond Embankment – South central side looking west

Fly Ash Pond Cap – Southwest corner looking west

Bottom Ash Pond Cap – West side looking north

Fly Ash Pond Cap – North side looking east

View of Bottom Ash Pond Embankment from Fly Ash Pond Cap

View of Bottom Ash Pond East Embankment from Fly Ash Pond Cap

Inspection Form for Closed Ponds at Ameren Facilities

Projcet Name: Quarterly Ash Pond Cap Inspection

Location: Meredosia Power Plant

System Description: Fly Ash Pond
Bottom Ash Embankment

Engineer/Inspectors: Mike Wagstaff

Owner Representative: n/a

Inspection Date: 04/17/2019
Temperature: 60's
Weather: cloudy

River Level at Meredosia: 434.5'
Gage 0' = 418.00' MSL
Bottom Ash Pond bottom is at 430.00' MSL

Overall System Rating: **Acceptable**

System Rating Codes

Acceptable System: Nearly all items or components are rated as GC or NE.

Minimally Acceptable System: One or more items are rated as MM or one or more items are rated as IM or EC and an engineering determination concludes that the IM or EC items would not prevent the system from performing as intended.

Unacceptable System: One or more items are rated as IM or EC and would prevent the system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

Condition Codes

EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Supervising Engineer, Dam Safety; i.e. pool draw down, work stoppage, or plant stoppage.

IM = Item needing Immediate Maintenance to restore or ensure its safety or integrity. Remediation should be completed within an appropriate timeframe as determined by the Supervising Engineer, Dam Safety.

MM = Item needing Minor Maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled.

OB = Condition requires regular Observation to ensure that the condition does not become worse.

GC = Good Condition.

NE = No Evidence of a problem.

NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Fly Ash Pond Cap - ClosureTurf
Quarterly Site Inspection Checksheet

Date	04/17/2019
Inspector	Mike Wagstaff
Temperature	60's
Weather	cloudy

	Item	Condition Code *	Comments
Closure Cap	**Drainage Ditch/ArmorFill**	**GC**	ArmorFill has not yet been applied to ditches.
	Sand on Cap	**GC**	Sand has been applied to 100% of cap and swept into turf for 80% of cap. Remaining sweeping will be done after floodwater recedes.
	ClosureTurf	**GC**	No damage or degradation evident.
	Riprap Outlet Flumes	**GC**	Portion of flume that is visible is in good condiiton.
	Other	**--**	
Embankment	**Riprap**	**GC**	Visible riprap is in good condition.
	Vegetation in riprap	**GC**	No weeds in upper portion of riprap.
	Vegetation at Toe	**NI**	Toe underwater.
	Debris/Logs	**NI**	Flooded.
	Erosion	**GC**	Half of berm underwater.
	Other	**--**	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Bottom Ash Embankment - ClosureTurf
Quarterly Site Inspection Checksheet

Date	04/17/2019
Inspector	Mike Wagstaff
Temperature	60's
Weather	cloudy

	Item	Condition Code *	Comments
Roadway	**Gravel Road**	**GC**	Roadway gravel is compacted and smooth.
	Drainage	**GC**	No drainage problems at this time.
	Other	**GC**	No issues.
Embankment	**Vegetation at Toe**	**NI**	Toe is underwater.
	ClosureTurf	**GC**	Visible turf is in good condition.
	ArmorFill	**GC**	Half of the berm is currently covered in floodwater.
	Riprap at Toe	**NI**	Toe is underwater..
	Riprap Outlet Flumes	**GC**	Visible flume is in good condition.
	Other	--	
Remaining Basin	**Side Slopes**	**GC**	Visible sedimentation logs are in good condition. BAP wetland area is currently flooded.
	Bottom	**NI**	Flooded.
	Outlet Riprap	**NI**	Flooded.
	Toe Riprap	**NI**	Flooded..
	Other	--	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Fly Ash Pond Cap – Looking northwest

Fly Ash Pond Cap – South embankment looking east

Fly Ash Pond Cap – Southeast side looking west

Bottom Ash Pond embankment – East face looking northwest

Bottom Ash Pond Embankment – southwest corner of berm looking north

Fly Ash Pond Outlet – Southwest outfall looking west

East Stockpile Area – Looking north

Bottom Ash Pond Embankment – Looking northwest

Fly Ash Pond Cap – Southeast corner looking northwest

Inspection Form for Closed Ponds at Ameren Facilities

Projcet Name: Quarterly Ash Pond Cap Inspection

Location: Meredosia Power Plant

System Description: Fly Ash Pond
Bottom Ash Embankment

Engineer/Inspectors: Mike Wagstaff

Owner Representative: n/a

Inspection Date: 08/28/2019
Temperature: 80's
Weather: sunny

River Level at Meredosia: 424.5'
Gage 0' = 418.00' MSL
Bottom Ash Pond bottom is at 430.00' MSL

Overall System Rating: **Acceptable**

System Rating Codes

Acceptable System: Nearly all items or components are rated as GC or NE.

Minimally Acceptable System: One or more items are rated as MM or one or more items are rated as IM or EC and an engineering determination concludes that the IM or EC items would not prevent the system from performing as intended.

Unacceptable System: One or more items are rated as IM or EC and would prevent the system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

Condition Codes

EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Supervising Engineer, Dam Safety; i.e. pool draw down, work stoppage, or plant stoppage.

IM = Item needing Immediate Maintenance to restore or ensure its safety or integrity. Remediation should be completed within an appropriate timeframe as determined by the Supervising Engineer, Dam Safety.

MM = Item needing Minor Maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled.

OB = Condition requires regular Observation to ensure that the condition does not become worse.

GC = Good Condition.

NE = No Evidence of a problem.

NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Fly Ash Pond Cap - ClosureTurf
Quarterly Site Inspection Checksheet

Date	08/28/2019
Inspector	Mike Wagstaff
Temperature	80's
Weather	sunny

	Item	Condition Code *	Comments
Closure Cap	**Drainage Ditch/ArmorFill**	**GC**	ArmorFill in good condition in ditches.
	Sand on Cap	**GC**	Sand is in good condition.
	ClosureTurf	**GC**	No damage or degradation evident.
	Riprap Outlet Flumes	**MM**	Flumes are in good condiiton. Weeds require spraying.
	Other	**--**	
Embankment	**Riprap**	**GC**	Riprap is in good condition.
	Vegetation in riprap	**MM**	Weeds in riprap should be sprayed.
	Vegetation at Toe	**MM**	Mowing required.
	Debris/Logs	**MM**	Some debris on embankment and at toe of embankment.
	Erosion	**GC**	Erosion not evident.
	Other	**--**	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Bottom Ash Embankment - ClosureTurf
Quarterly Site Inspection Checksheet

Date	08/28/2019
Inspector	Mike Wagstaff
Temperature	80's
Weather	sunny

	Item	Condition Code *	Comments
Roadway	**Gravel Road**	**GC**	Roadway gravel is compacted and smooth.
	Drainage	**GC**	No drainage problems at this time.
	Other	**GC**	No issues.
Embankment	**Vegetation at Toe**	**MM**	Mowing required.
	ClosureTurf	**MM**	Turf is in good condition. Sand requires re-sweeping.
	ArmorFill	**MM**	Binder has washed out of the sand. Maintenance required.
	Riprap at Toe	**MM**	Riprap at toes has minor vegetation. Spraying required.
	Riprap Outlet Flumes	**GC**	Flumes are in good condition.
	Other	**--**	
Remaining Basin	**Side Slopes**	**GC**	Sedimentation logs are in good condition. Vegetation trying to get established.
	Bottom	**MM**	Vegetaion is re-establishing in bottom of basin.
	Outlet Riprap	**MM**	Weeds need to be sprayed.
	Toe Riprap	**MM**	Riprap in good condition, Weeds need to be sprayed.
	Other	**--**	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Fly Ash Pond Cap – East side looking north

Fly Ash Pond Cap West embankment looking north

Fly Ash Pond Cap – Southwest outfall looking south

Bottom Ash Pond embankment – East face looking northwest

Bottom Ash Pond Embankment – West berm looking north

Bottom Ash Pond Embankment – East berm looking Southeast

Bottom Ash Embankment – East berm looking north

Bottom Ash Pond Embankment – South end of berm looking east

Bottom Ash Embankment – Southwest end looking north at oil unloading facility

Inspection Form for Closed Ponds at Ameren Facilities

Projcet Name: Quarterly Ash Pond Cap Inspection

Location: Meredosia Power Plant

System Description: Fly Ash Pond
Bottom Ash Embankment

Engineer/Inspectors: Mike Wagstaff

Owner Representative: n/a

Inspection Date: 11/20/2019
Temperature: 35-50
Weather: sunny

River Level at Meredosia: 429.5'
Gage 0' = 418.00' MSL
Bottom Ash Pond bottom is at 430.00' MSL

Overall System Rating: **Acceptable**

System Rating Codes

Acceptable System: Nearly all items or components are rated as GC or NE.

Minimally Acceptable System: One or more items are rated as MM or one or more items are rated as IM or EC and an engineering determination concludes that the IM or EC items would not prevent the system from performing as intended.

Unacceptable System: One or more items are rated as IM or EC and would prevent the system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

Condition Codes

EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Supervising Engineer, Dam Safety; i.e. pool draw down, work stoppage, or plant stoppage.

IM = Item needing Immediate Maintenance to restore or ensure its safety or integrity. Remediation should be completed within an appropriate timeframe as determined by the Supervising Engineer, Dam Safety.

MM = Item needing Minor Maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled.

OB = Condition requires regular Observation to ensure that the condition does not become worse.

GC = Good Condition.

NE = No Evidence of a problem.

NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Fly Ash Pond Cap - ClosureTurf
Quarterly Site Inspection Checksheet

Date	11/20/2019
Inspector	Mike Wagstaff
Temperature	35-50
Weather	sunny

	Item	Condition Code *	Comments
Closure Cap	Drainage Ditch/ArmorFill	GC	ArmorFill in good condition in ditches.
	Sand on Cap	GC	Sand is in good condition.
	ClosureTurf	GC	No damage or degradation evident.
	Riprap Outlet Flumes	MM	Flumes are in good condiiton. Weeds require spraying.
	Other	--	
Embankment	Riprap	GC	Riprap is in good condition.
	Vegetation in riprap	MM	Weeds in riprap should be sprayed.
	Vegetation at Toe	MM	Mowing required. Logs have floated onto the vegetated area at toe of berm, so mower could not access.
	Debris/Logs	MM	Some debris on embankment and at toe of embankment. This needs to be removed in Spring of 2020.
	Erosion	GC	Erosion not evident.
	Other	--	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

Meredosia Power Station
Bottom Ash Embankment - ClosureTurf
Quarterly Site Inspection Checksheet

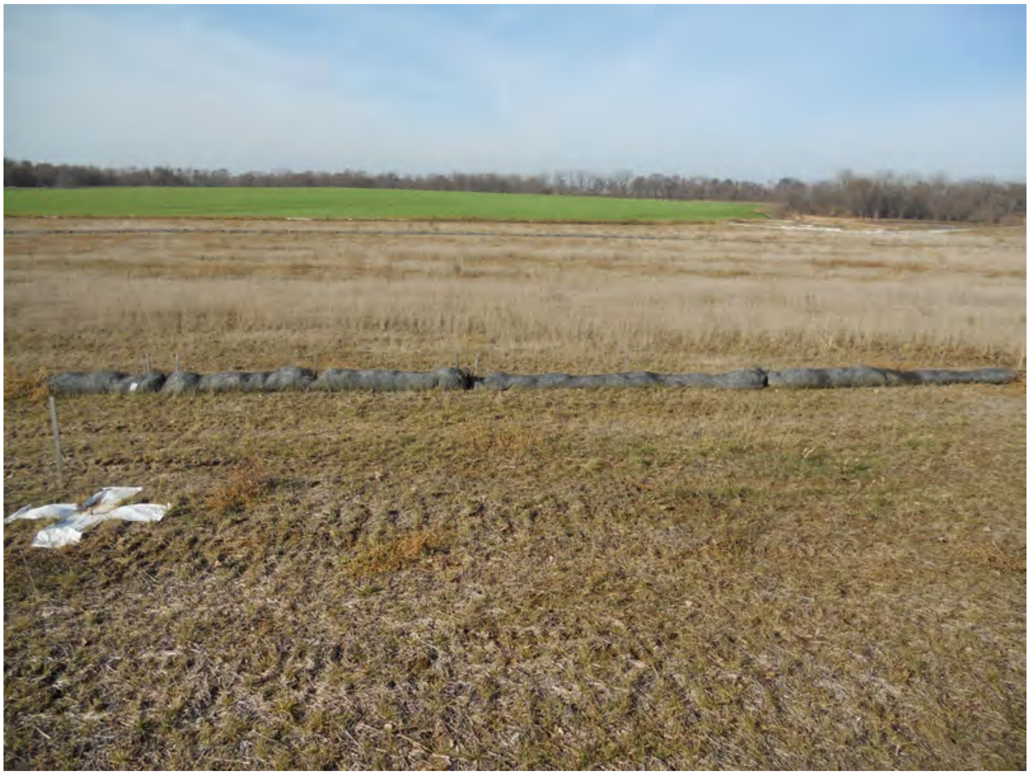
Date	11/20/2019
Inspector	Mike Wagstaff
Temperature	35-50
Weather	sunny

	Item	Condition Code *	Comments
Roadway	Gravel Road	GC	Roadway gravel is compacted and smooth.
	Drainage	GC	No drainage problems at this time.
	Other	GC	No issues.
Embankment	Vegetation at Toe	GC	Vegetation at toe looks good.
	ClosureTurf	GC	Turf is in good condition. Sand has been re-swept and Polyurethane is being applied today.
	ArmorFill	GC	Binder has washed out of the sand. Polyurethane is being applied today.
	Riprap at Toe	GC	Riprap at toe looks good.
	Riprap Outlet Flumes	GC	Flumes are in good condition.
	Other	--	
Remaining Basin	Side Slopes	GC	Sedimentation logs are in good condition. Vegetation trying to get established.
	Bottom	MM	Vegetaion is re-establishing in bottom of basin.
	Outlet Riprap	GC	Riprap looks good.
	Toe Riprap	GC	Riprap in good condition,
	Other	--	

Condition Codes

IM = Item needing Immediate Maintenance. Remediation should be completed within 1 month.
MM = Item needing Minor Maintenance and/or repairs within the year.
OB = Condition requires regular observation to ensure that the condition does not become worse.
GC = Good Condition. Working properly.
NE = No Evidence of a problem.
NI = Not Inspected. Reason should be stated in comment

East Stockpile Area – Standing on Road, looking Northwest



East Stockpile Area – Standing on Road, looking Southwest

Fly Ash Pond Cap - South embankment looking west

Fly Ash Pond Cap - south outlet looking south

Fly Ash Pond Cap - South embankment looking west

Fly Ash Pond Cap – south embankment looking west

Fly Ash Pond Cap - West embankment looking north

Fly Ash Pond Cap - West embankment looking south

Fly Ash Pond Cap – Northwest outlet looking northeast

Fly Ash Pond Cap – Northwest outfall looking north

Fly Ash Pond Cap – North embankment looking northeast

Fly Ash Pond Cap – North berm looking east

Fly Ash Pond Cap – Eastern side looking South

Bottom Ash Embankment – East berm looking south during Polyurethane application

Bottom Ash Pond Embankment – East face of berm looking Southwest

Bottom Ash Embankment – West face of berm looking south towards oil unloading facility

Bottom Ash Embankment – West face of berm looking north

EXHIBIT 3

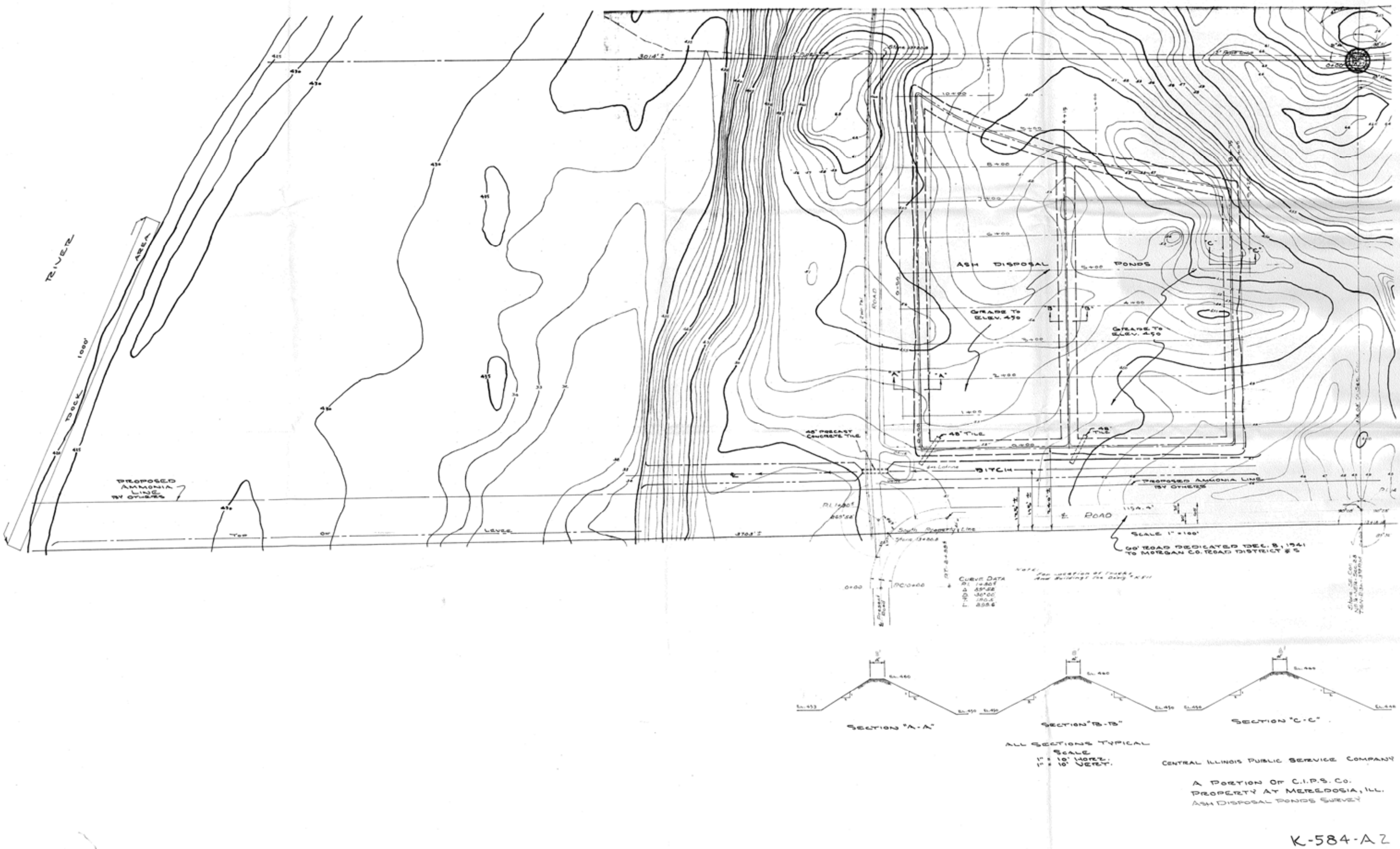

ILLINOIS
RIVER
DOCK AREA
1000'
PROPOSED AMMONIA LINE BY OTHERS
TOP OF LEVEE
ASH DISPOSAL PONDS
GRADE TO ELEV. 450
GRADE TO ELEV. 450
48" PRECAST CONCRETE TILE
48" TILE
DITCH
PROPOSED AMMONIA LINE BY OTHERS
℄ ROAD
SCALE 1" = 100'
60' ROAD DEDICATED DEC. 8, 1941 TO MORGAN CO. ROAD DISTRICT # 5
SECTION "A-A"
SECTION "B-B"
SECTION "C-C"
ALL SECTIONS TYPICAL
SCALE
1" = 10' HORZ.
1" = 10' VERT.
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY
A PORTION OF C.I.P.S. CO.
PROPERTY AT MEREDOSIA, ILL.
ASH DISPOSAL PONDS SURVEY
K-584-A2

EXHIBIT 4

COAL ASH IMPOUNDMENT
SITE ASSESSMENT FINAL REPORT

Meredosia Power Station
Ameren Energy Generating Company
Meredosia, Illinois

Prepared by:

KLEINFELDER
Bright People. Right Solutions.

611 Corporate Circle, Suite C
Golden, CO 80401

KLEINFELDER PROJECT NUMBER 112618-7

May 10, 2011

I acknowledge that the management units referenced herein:

- Fly Ash Pond
- Bottom Ash Pond

Were assessed on August 10, 2010

Signature: Brian T. Havens Date: 5/10/11

Brian T. Havens, P.E.
Lead Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
BRIAN T. HAVENS
062-061468
STATE OF ILLINOIS

Background information taken from the U. S. Environmental Protection Agency's (EPA's) website:

> "Following the December 22, 2008 dike failure at the TVA/Kingston, Tennessee coal combustion waste (CCW) ash pond dredging cell that resulted in a spill of over 1 billion gallons of coal ash slurry, covered more than 300 acres and impacted residences and infrastructure, the EPA is embarking on an initiative to prevent the catastrophic failure from occurring at other such facilities located at electric utilities in an effort to protect lives and property from the consequences of a impoundment or impoundment failure of the improper release of impounded slurry."

As part of the EPA's effort to protect lives and the environment from a disaster similar to that experienced in 2008, Kleinfelder was contracted to perform a site assessment at the Meredosia Power Generating Station that is owned and operated by Ameren Energy. This report summarizes the observations and findings of the site assessment that occurred on August 10, 2010.

The coal combustion waste impoundments observed during the site assessment included:

- Fly Ash Pond – Commissioned in 1968
- Bottom Ash Pond – Commissioned in 1972

Preliminary observations made during the site assessment are documented on the Site Assessment Checklist presented in Appendix A. A copy of this checklist was transmitted to the EPA following the field walk-through. A more detailed discussion of the observations is presented in Section 4, "Site Observations".

The fly ash and bottom ash pond impoundments are not regulated by any state agency and therefore do not currently have a designated hazard rating. Due to the potential environmental and economic impacts that a failure at either of these impoundments would present by breaching the south banks into the Illinois River, it is recommended a hazard classification of "Significant" be assigned to both impoundments.

Overall, the site is reasonably well maintained and operated with a few areas of concern as discussed in Section 6, "Recommendations".

On the date of this site assessment, there appeared to be no immediate threat to the safety of the impoundment embankments. No assurance can be made regarding the impoundments condition after this date. Subsequent adverse weather and other factors may affect the condition.

A brief summary of the Priority 1 and 2 Recommendations is given below. A more detailed discussion is provided in Section 6, "Recommendations".

Priority 1 Recommendations

1. Prepare an Emergency Action Plan (EAP) for the facility.
2. Perform a hydrologic and hydraulic study.
3. Establish a seepage and groundwater monitoring program.
4. Perform embankment and structural stability analyses.
5. Perform video assessments of culvert piping.
6. Control vegetation on the upstream and downstream slopes. Remove the trees from the embankment including the large tree at the overflow outlet discharge point.

Priority 2 Recommendations

1. Repair erosion of embankment.
2. Review the condition of riprap at the downstream toe of the bottom ash embankment and upgrade the riprap, if needed, to meet typical requirements for riprap size and placement.
3. Maintain a log of maintenance and other activities at the fly ash impoundments and supporting facilities.
4. Develop an Operation and Maintenance (O&M) manual for the impoundments and the facility.

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List of Figures

List of Appendices

SECTION 1 – INTRODUCTION

1.1 General

This report has been prepared for the United States Environmental Protection Agency (EPA) to document findings and observations from a site assessment at the Meredosia Power Station on August 10, 2010.

The following sections present a summary of data collection activities, site information, performance history of the facility's impoundment ponds, a summary of site observations, and recommendations resulting from the site investigation.

1.2 Project Location

The Meredosia Power Generating Station is located on the eastern bank of the Illinois River approximately one mile south of Meredosia, Illinois as shown in Figure 1. The town of Meredosia is located in Morgan County at approximately 39^{o}49'48'' N and 90^{o}33'30'' W. In general, the town of Meredosia is a rural agricultural community with the town population hovering around 1,000 people.

1.3 Site Documentation

Ameren Energy provided the following documents during the time of this inspection to aid in the review of the impoundments:

- Ameren, Impoundment Safety Program for Non-Illinois Department of Natural Resources (IDNR) Regulated Facilities, AER-DSP-004, April 3, 2009
- Ameren, Annual Engineering Inspection Report, July, 31, 2009
- Ameren, Flood Control Works Inspection Report, March 18, 2008
- Hanson Engineers, Capacity Survey and Stability Analysis Fly Ash Impoundment, Meredosia Power Station, June 13, 1991
- Sargent and Lundy, Design Drawings B-331 thru B-334, 1971
- Hanson Engineers, Utility Site Plan Drawing, 1980
- The CECO Corporation, Weir Box Design Drawing, 1971

SECTION 2 – SITE ASSESSMENT

2.1 Attendees

The site assessment was performed on August 10, 2010 by Brian Havens, P.E. and Matt Gardella, E.I.T. of Kleinfelder. Other persons present during the site assessment included:

- Paul Pike – Ameren Energy
- Michael Wagstaff – Ameren Energy
- Michael Long – Ameren Energy
- Joe Schnelten – Ameren Energy
- Mitch White – Ameren Energy
- Craig Dufficy – United States Environmental Protection Agency

2.2 Impoundments Inspected

Impoundments and associated structures that were observed during the site assessment included:

- Fly Ash Pond – Commissioned in 1968
- Bottom Ash Pond – Commissioned in 1972

Observations from the site assessment are documented on the Site Assessment Evaluation Checklists presented in Appendix A. A summary of observations from the site assessment is presented in Section 4.

2.3 Weather During Assessment

During the assessment of the Meredosia Power Station impoundments, the weather was sunny and clear with high humidity. Temperatures ranged from 95^{o} to 100^{o} F, and wind ranged from 0 to 5 miles per hour (mph).

3.1 Site Information and History

The Meredosia Power Generating Station is a coal fired facility that has been in operation since 1948. The facility currently sluices Bottom Ash and Fly Ash, by-products of coal fired energy generation, into two separate impoundments. These impoundments are referred to as the "Bottom Ash Pond" and the "Fly Ash Pond". An aerial image of these impoundments can be seen in Figure 2. These ponds act as settling basins for the bottom and fly ash prior to the water being treated and released back into the Illinois River. Disposal of the fly ash and bottom ash currently differ at the site. The bottom ash residual is removed from the Bottom Ash Pond, dried on site, and then sold to various organizations for beneficial use such as the topping of roadways. The fly ash residual is allowed to dry, then is removed, and is disposed of in offsite landfills. Beneficial use of the fly ash is not currently economically feasible at the Meredosia site, but could possibly hold potential in the future depending on local construction projects and their need for concrete admixtures.

The Bottom Ash Pond is a combination earthen embankment and incised impoundment. Sluice pipes transporting bottom ash from power generating operations outlet at the northeastern corner of the pond. From here the bottom ash slurry is directed through a settling channel into a larger portion of the pond. This channel is approximately 500 feet long and is separated from the main pond by a peninsula composed of dried and compacted bottom ash jutting out from the main embankment of the pond. The intention of this settling channel is to allow additional time for suspended solids to drop out of suspension before entering the main body of the Bottom Ash Pond where they are harder to collect and remove for drying. Both the settling channel and main portion of the pond are considered to be components of the larger Bottom Ash Pond.

Another key component of the Bottom Ash Pond is the pond's outlet works structure. The outlet works of the Bottom Ash Pond are located near the northwestern embankment and are accessible by a 75 foot long catwalk that extends from the crest of the embankment toward the center of the pond. The outlet works consist of a weir box with adjustable intake levels that leads to a 12 inch vitrified clay pipe. This clay pipe extends to the northwest and outlets in the Illinois River.

The Bottom Ash Pond has an emergency spillway consisting of a 12" corrugated metal pipe extending through the crest of the embankment on the north side of the impoundment.

The Fly Ash Pond is a combination earthen embankment and incised impoundment, and is divided into 4 cells by compacted bottom ash/fly ash dikes. One of these cells is a "clarifying" or "polishing" pond (Cell 4) and is used as a final settling pond before discharging water from the pond to the Illinois River. The other 3 cells that make up the Fly Ash Pond alternate impounding fly ash slurry. This is done so that a cell can be dried and the fly ash solids excavated and disposed of, before impounding more fly ash while another cell is dried and cleared. Equalization pipes and spillways cut in the internal dikes exist between all of the cells so that one cell is not allowed to overtop while the adjacent cell remains dry in extreme circumstances.

The Fly Ash Pond's outlet structure is very similar to the Bottom Ash Pond's outlet structure. The outlet works of the Fly Ash Pond are located near the western embankment of Cell 4 and are accessible by a 75 foot long catwalk that extends from the crest of the embankment toward the center of the pond. The outlet works consist of a weir box with adjustable intake levels that leads to a 12 inch vitrified clay pipe. This clay pipe extends to the northwest and outlets in the Illinois River.

The Fly Ash Pond does not have an emergency spillway that we are aware of.

Prior to the current operational layout at the Meredosia Power Generating Station, there had been an additional fly ash impoundment with two cells as well as a bottom ash impoundment at the site. The old fly ash pond was located immediately east of the current Fly Ash Pond, and the old bottom ash pond was located somewhere to the north of the current Bottom Ash Pond. The old fly ash impoundment was decommissioned and capped sometime in the 1970's but an exact date is unknown. The old bottom ash impoundment was decommissioned and capped sometime before the old fly ash impoundment, but an exact date is unknown.

In reviewing the response letter to the EPA's section 104(e) request for information, shown in Appendix C, it was noted that previously there had been a release of impounded water at the Meredosia Power Generating Station. Specifically, Ameren Energy reported that they released a small amount of water (less than 500 gallons) from the fly ash pond to the land in late December 2006. In response, they modified the pond and developed internal procedures to prevent a recurrence of the situation. They are not aware of any other spills or unpermitted releases of coal combustion by-products from their surface impoundments to surface water or to the land.

3.2 Pertinent Data

A. GENERAL

1. Name .... Meredosia Power Generating Station
2. State .... Illinois
3. County .... Morgan
4. Latitude .... 39° 49' 02'' North
5. Longitude .... 90° 34' 20'' West
6. River used for operations .... Illinois River
7. Year Constructed 1948
8. Modifications .... None to current impoundments
9. Current Hazard Classification .... None
10. Proposed Hazard Classification .... Significant
11. Size .... Unregulated Currently – Small Impoundment[2]

B. IMPOUNDMENTS

BOTTOM ASH POND

1. Type .... Earthen – Diked/Incised Combination
2. Crest Elevation .... ±450[1]
3. Crest Length .... Approximately 3,000 ft
4. Crest Width .... 8 ft
5. Impoundment Height .... App. 20 ft
6. Upstream Slope 3H:1V
7. Downstream Slope 3H:1V
8. Volume of Stored Ash.......... 139 acre-feet

FLY ASH POND

1. Type .... Earthen – Diked/Incised Combination
2. Crest Elevation .... ±452[1]
3. Crest Length .... Approx. 5,000 ft
4. Crest Width .... 8 ft
5. Impoundment Height .... App. 20 ft
6. Upstream Slope 3H:1V
7. Downstream Slope 3H:1V
8. Volume of Stored Ash.......... 650 acre-feet

C. DRAINAGE BASIN

1. Area of Drainage Basin .... Unknown
2. Downstream Description: .... Discharges directly into the Illinois River

D. RESERVOIR INLET

BOTTOM ASH POND

1. Reservoir Inlet .... Multiple inlet sluice pipes from the generating station

FLY ASH POND

1. Reservoir Inlet .... Multiple inlet sluice pipes from the generating station

E. RESERVOIR

BOTTOM ASH POND

1. Reservoir Capacity .... Normal Storage is approximately 186 acre-feet

FLY ASH POND

2. Reservoir Capacity .... Normal Storage is approximately 620 acre-feet

F. PRIMARY SPILLWAY

BOTTOM ASH POND

1. Description .... Outlet works with conduit per Section G below

FLY ASH POND

1. Description .... Outlet works with conduit per Section G below

G. OUTLET WORKS

BOTTOM ASH POND

1. Description .... Rectangular weir box with adjustable V-notch weir connected to 12" VCP
2. Location .... Near northwest embankment app. 75' into the center of the pond

3. Intake Structure .... Weir box with adjustable V-notch weir
   a. Intake Invert Elevation .... Adjustable
4. Discharge Conduit .... Vitrified Clay Pipe
   a. Length .... 150 ft
   b. Diameter .... 12 inches
5. Outlet Structure .... Gate valve at weir box
   a. Outlet Invert Elevation .... 425.3[1]
   b. Energy Dissipation .... Concrete slab with surrounding riprap[3]
6. Discharge Channel .... ~20' x 20' bay that empties directly into the Illinois River
7. Discharge Capacity with Water Surface at Top of Impoundment .... Unknown

FLY ASH POND

1. Description .... Rectangular weir box with adjustable V-notch weir connected to 12" VCP
2. Location .... Near west embankment app. 75' into the center of the pond
3. Intake Structure .... Weir box with adjustable V-notch weir
   a. Intake Invert Elevation .... Adjustable
4. Discharge Conduit .... Vitrified Clay Pipe
   a. Length .... 150 ft
   b. Diameter .... 12 inches
5. Outlet Structure .... Gate valve at weir box
   a. Outlet Invert Elevation .... 427.3[1]
   b. Energy Dissipation .... Concrete slab with surrounding riprap[3]
6. Discharge Channel .... ~20' x 30' bay that empties directly into the Illinois River
7. Discharge Capacity with Water Surface at Top of Impoundment .... Unknown

H. MANAGEMENT

1. Owner .... Ameren Energy
2. Purpose .... Coal Fired Energy Generation

Notes:
1. All elevations in feet based on original construction drawings by Sargent and Lundy Engineers
2. Impoundment is unregulated; size is based on Illinois Department of Natural Resources Administrative Code for Impoundment Safety
3. Structure was inundated during the time of inspection and was not able to be inspected

3.3 Regional Geology and Seismicity

The plant site is situated in the Illinois River Valley. As such, the subsurface conditions are expected to include Quaternary alluvial deposits overlying sedimentary bedrock. Based on the available data, it is uncertain whether the regional glacial deposits are present at the plant site between the alluvium and the bedrock.

Based on our review of historical soil borings and information from the Web Soil Survey, it appears that the upper alluvial deposits at the site include combinations of silty clay, clayey silt, silty sand and clayey sand. Based on our review of data published by the United States Geological Survey (USGS), the sedimentary rock formations in Morgan County include shale, sandstone and limestone.

The plant site is situated in a Seismic Zone 1 area. We have noted that the New Madrid Fault has a documented history of seismic activity, but is located more than 200 miles south of the plant site.

3.4 Hydrology and Hydraulics

Both the Bottom Ash and Fly Ash Ponds are designed and situated in such a manner that the watershed drainage contributing to the stored volume of the ponds is minimal and most likely limited to pumping operations and storm water that falls within the impoundments themselves. However, the exact extents of the watershed cannot be determined without a current topographic survey of the surrounding area and of the impoundments themselves.

During the assessment, documents such as hydrologic studies, hydraulic design calculations and assumptions, and impoundment break analyses were not available for our review. As a result, the design inflow, design freeboard and other important components of the impoundment designs are unknown at this time. The project plans do identify that the Bottom Ash Pond was designed to store up to 300,000 cubic yards of ash and the Fly Ash Pond was designed to store up to 1,000,000 cubic yards of ash.

3.5 Geotechnical Considerations

Regarding stability of the embankment slopes, we have reviewed a report dated May 17, 1991 by Hanson Engineers Incorporated. This study was apparently completed at a time when Central Illinois Public Service Company (now Ameren Energy) was considering raising the pool elevation in the Fly Ash impoundment. The study included stability analyses under the condition of a higher pool elevation at Elevation 449, but did not document stability of the impoundments in their present configuration (pool at Elevation 447). It appears that the pool elevation (and embankment elevation) were not raised following this study. We understand that embankment stability analyses are currently being completed for both impoundments by another consultant retained by Ameren Energy.

Regarding seepage, we understand that seepage at various locations along the downstream embankment of the Fly Ash pond has been witnessed by Ameren Energy and Hanson Professional Services at various times including 1991, 2008, 2009 and other intervening years. The seepage noted by Hanson Engineers in 2008 was at a low rate and appeared to be clear and free of transported or piped soils.

3.6 Structural Considerations

According to the inspection conducted in July, 2009, a fractured cross brace was noted in the middle support of the catwalk at the bottom ash pond. The assessment conducted in 2010 by Kleinfelder shows that the same fractured cross member is not repaired (see Photo 14 in Appendix B). The catwalk bridge access portion appears to be in satisfactory condition and the superstructure appears to be intact with minor corrosion. The catwalk substructure concrete foundations appear to be in satisfactory condition as well with little to no concrete spalling or scaling.

The 6' X 6' reinforced concrete weir box appears to be in satisfactory condition. A sluice gate within the weir box controls flows in and out of the fly ash pond. The weir box is approximately 30 feet high and connects with the catwalk mentioned above. Due to the water level at the time of inspection, we were not able to observe the foundation condition of the weir box.

The bottom ash pond inlet pipe appears to be supported on wood supports. The supports appeared to be weathered, although not to the point of structural failure. Due to the age of the facility, a structural engineering evaluation is merited to determine the condition of the supports.

Documentation of the structural portions of the impoundments under seismic loading was not available for our review. Although the plant site is located in a zone of relatively low risk for damaging seismic activity, evaluation of the structural components of the impoundments under applicable seismic loading conditions merits consideration.

3.7 Performance Evaluations

There have been no previous federal or state assessments of the Meredosia Power Generating Station's Bottom Ash or Fly Ash impoundments. Based on observations by Ameren Energy in their annual assessments, weekly assessments and other documents and accounts, there have been no major incidents involving the Bottom Ash or Fly Ash Ponds. Currently Ameren Energy's local plant personnel perform weekly assessments of the impoundments and their associated structures. Ameren Energy also performs annual assessments of the Meredosia impoundments, similar to this assessment, via their Impoundment Safety and Environmental personnel. In addition, Ameren Energy retained Hanson Professional Services, Inc. to make a site assessment and provide recommendations on January 11, 2008.

3.8 Hazard Classification

The Meredosia Power Generating Station's two impoundments are not regulated by any state agency and therefore do not currently have a designated hazard rating. However, the Fly Ash and Bottom Ash ponds were rated by Ameren Energy's internal impoundment safety organization as being Significant Hazard and Low Hazard impoundments respectively. However, due to the potential environmental and economic impacts that a failure at either of these impoundments would present, it is recommended that a hazard classification of "significant" be assigned to both impoundments. A "High Hazard" rating was not assigned to the impoundments, as it is not expected that a loss of life situation would be likely in the event of a failure. A loss of life situation is not expected as the Bottom Ash and Fly Ash Ponds sit immediately adjacent to the Illinois River without any homes, recreational facilities, businesses, roads or other structures immediately downstream of the impoundments. However, a hazard classification analysis is needed to determine the hazard classification of the impoundments.

3.9 Site Access

We were required to seek permission from Ameren Energy to gain access to the plant site. After arriving at the site and meeting with representatives of Ameren Energy, we were escorted by facility personnel to assess the impoundments. The impoundments can be accessed by standard car during normal weather conditions via gravel-surfaced roadways on the Meredosia Power Generating Station property.

The impoundment embankments, toes and outlet works (portions not inundated at the time of inspection) of both the Bottom Ash and Fly Ash Pond were observed during the August 10, 2010 site assessment. General observations of these features are presented below; more specific observations of the site and facilities are documented in the Site assessment Evaluation Checklist provided in Appendix A.

4.1 Bottom Ash Pond

4.1.1 Upstream Slope

Overall, the upstream slope of the impoundment was in fair condition. Photos 1, 6 and 23 in Appendix B show the conditions of the upstream slope. Specific observations include:

- The upstream slope was laid back at approximately 1.5H:1V, based on visual observations. This varies from the construction documents provided by Ameren, probably due to the build-up of bottom ash on the embankment. However, it is possible that cleanout operation at the Bottom Ash Pond could have cut into the embankment and steepened it over time.
- Minor erosion rills, less than 6 inches deep, were noted on some of the upstream slopes.
- Grasses and woody bushes were observed on the upstream slope for the majority of the impoundment.
- Mowing/Vegetation control had not been completed on the majority of the upstream slope.

4.1.2 Crest

Overall, the crest of the impoundment was in satisfactory condition. Photos 1 through 3 show the condition of the crest. Specific observations include:

- The impoundment crest is a gravel road.
- Sparse grasses and bushes were observed on the crest.
- No major depressions or rutting was noted on the impoundment crest.
- Transecting the crest with minimal cover are two Fly Ash sluice lines. Photo 24 in Appendix B shows these sluice lines.
- A chain link fence is located around the majority of the Bottom Ash Pond at the crest.
- Multiple light poles penetrate the crest of the levee. These light poles can be seen in Appendix B photos 23 and 28.
- Minor erosion was noted on crest in multiple locations. This erosion was typically less than six inches in depth and typically appeared on the edges of the crest where grade breaks occurred when transitioning to embankment slopes.

- Foundations for the pipeline that runs along the crest of northern embankment penetrate the crest in multiple locations.

4.1.3 Downstream Slope

Overall, the downstream slope was in fair to poor condition. Photos 7, 8 , 9, 18 and 20 show the conditions of the downstream slope. Specific observations include:

- There was slope protection on the downstream slope adjacent to the Illinois River. It was comprised of riprap that ranged greatly in size. Riprap armoring was sparse in some areas of the downstream slope.
- Minor erosion rills, less than 6 inches deep, were noted on some of the downstream slope.
- Grasses, woody bushes and large mature trees were observed on the downstream slope and at the toe of the embankment for the majority of the impoundment.
- Driven sheet pile used to form an access to the oil delivery area intersects the downstream slope of the Bottom Ash Pond as shown in Photos 12 and 13.

4.1.4 Downstream Toe Areas

The toe areas of the embankment were in fair to poor condition. See photos 15 and 17 for the condition of these areas. Key features and observations of these areas include:

- The toe areas were almost impassible in certain locations due to mud. The Illinois River had been up against the downstream bank of the impoundment and had just recently receded.
- The toe area had sparse grasses, some bushes, and multiple large mature trees.

4.1.5 Outlet Works

The outlet works of the Bottom Ash pond consist of a weir box located at the northwestern corner of the impoundment, approximately 75 feet toward the center of the pond. The weir box is accessible via a metal catwalk. The weir box has stop logs and a v-notch weir that can adjust the height of intake for the outlet structure. A sluice gate separates the weir box from a 12 inch vitrified clay pipe leading to the discharge location on the Illinois River. Operation of this sluice gate in flood conditions is possible by one person without any mechanized equipment. According to Ameren Energy personnel and the provided documents, the discharge location of the outlet pipe has a concrete slab to protect against slope erosion during discharge. However, this slab could not be observed during the assessment as it was inundated.

- The discharge location of the outlet pipe was not able to be observed as it was inundated at the time of assessment

- One cross brace of the catwalk used to access the weir box has rusted through.
- No video monitoring of the clay pipe was available at the time of assessment
- Overall, the outlet works system appears to be functioning as intended at this time.

4.1.6 Impoundment Inlet

Inflow into the Bottom Ash Pond is via metal piping on the northeastern corner of the impoundment, as well as storm water runoff that flows naturally into the pond. The inlet pipe can be seen in photo 4 of Appendix B. From this inlet location the ash and water slurry then flows through an interior settling channel and into the larger storage pool of the impoundment. The inlet pipe appears to be in satisfactory condition.

4.2 Fly Ash Pond

4.2.1 Upstream Slope

Overall, the upstream slope of the impoundment was in satisfactory condition. Photo 32 in Appendix B shows the conditions of the upstream slope. Specific observations include:

- The upstream slope was laid back at approximately 3H:1V
- Mowing had not been completed on the majority of the upstream slope.
- Grasses, bushes and woody debris were observed on the slope.

4.2.2 Crest

Overall, the crest of the impoundment was in satisfactory condition. Photos 29 and 31 show the condition of the crest. Specific observations include:

- The impoundment crest is a gravel road.
- Sparse grasses and bushes were observed on the crest.
- No major depressions or rutting was noted on the impoundment crest.
- Minor erosion was noted on crest in multiple locations. This erosion was typically less than six inches in depth and typically appeared on the edges of the crest where grade breaks occurred when transitioning to embankment slopes.

4.2.3 Downstream Slope

Overall, the downstream slope was in fair condition. Photos 30 and 31 show the conditions of the downstream slope. Specific observations include:

- Grasses, woody bushes and large mature trees were observed on the downstream slope and at the toe of the embankment for a large portion of the impoundment.

- There was slope protection on the majority of the slope for the Fly Ash Pond. Typically it consisted of large riprap that was typically vegetated.
- Typically the embankment was well maintained with recent mowing operations

4.2.4 Toe Areas

The toe areas of the embankment were in fair to poor condition. See photos 30 and 33 for the condition of these areas. Key features and observations of these areas include:

- The toe areas were in almost impassible in certain locations due to mud. The Illinois River had been up against the downstream bank of the impoundment and had just recently receded.
- The toe area had multiple locations where large mature trees still remained along with recently felled trees that had not been removed from the toe and slope of the impoundment

4.2.5 Outlet Works

The outlet works of the Fly Ash Pond are almost identical to that of the Bottom Ash Pond. The outlet works intake weir box is located in cell 4 near the western embankment, approximately 75 feet toward the center of the pond. The weir box is accessible via a metal catwalk. The weir box has stop logs and a v-notch weir that can adjust the height of intake for the outlet structure. A sluice gate separates the weir box from a 12 inch vitrified clay pipe leading to the discharge location on the Illinois River. Operation of this sluice gate in flood conditions is possible by one person without any mechanized equipment. According to Ameren Energy personnel and the provided design drawings, the discharge location of the outlet pipe has a concrete slab to protect against slope erosion during discharge. However, this slab could not be observed during the assessment as it was inundated.

- The discharge location of the outlet pipe was not able to be observed as it was inundated at the time of assessment
- No video monitoring of the clay pipe was available at the time of assessment
- Overall, the outlet works system appears to be functioning as intended at this time.

4.2.6 Impoundment Inlet

Inflow into the Fly Ash Pond is via multiple inlet pipes on the northeastern corner of the impoundment in cell 1, as well as storm water runoff that flows naturally into the pond. From this inlet location the ash and water slurry then flows through a series of pipes to fill either cell 2 or 3 (depending on which cell is being cleaned out) and then into cell 4 which contains the outlet works for the impoundment. The inlet pipe and pipes connecting all of the cells appear to be in functional condition.

4.3 Other

Internal dikes of the Fly Ash Pond cells appear to be laid back at approximately a 2.5H:1V slope. Surface erosion up to 12 inches in depth can be seen along the crest and slope of the majority of the internal dikes. Sparse vegetation can be observed on the slopes of the dikes, but provides little or no protection against surface erosion. Currently there are two known piezometers in the dikes that consist mainly of fly ash and bottom ash. However, these piezometers are not monitored with any specific frequency.

We inquired if Ameren Energy had developed an Emergency Action Plan (EAP) related to a potential failure of the impoundments. We understand that an EAP has not been developed for the site.

We also inquired if Ameren Energy had developed an Operation and Maintenance (O&M) Manual for the Meredosia Power Generating Station bottom ash and fly ash impoundments. We understand that an O&M Manual has also not been developed for the site. The above referenced EAP should be part of this O&M Manual, but should be capable of being a stand-alone document.

5.1 Analysis and Conclusions

Our analysis is summarized in three general considerations that are presented as follows:

Safety of the Impoundments including Maintenance and Methods of Operation

We understand that the impoundments have a history of safe performance. However, the future performance of these impoundments will depend on a variety of factors that may change over time, including surface water hydrology, changes in groundwater levels, changes in embankment integrity, etc. In light of this situation, we have noted several items as follows that present some concern in this regard:

- Large mature trees exist on the toe and slopes of both the Bottom Ash Pond and Fly Ash Pond and stumps remain in some areas where trees were recently cut down. These stumps can decompose over time and eventually create preferential paths for uncontrolled seepage
- An Emergency Action Plan (EAP) is not currently in place at the site to mitigate damage in the event of an emergency related to failure of the impoundment(s)
- Analyses of the slope stability for the embankments are not currently available for our review. However, we understand that these analyses are in the process of being developed.
- Documentation of the impoundment capacity under potential hydrologic and hydraulic loading is not currently available for review.
- We understand that an Operation and Maintenance (O&M) Manual is not currently in place for the site. Developing an O&M manual which includes a section that discusses the safety inspection and monitoring program would be recommended to standardize safety inspection and monitoring practice.

Changes in Design or Operation of the Impoundments following Initial Construction

We are not aware of significant changes in the design or operation of the impoundments that have been implemented. We reviewed a 1991 study for raising the pool level in the Fly Ash Pond, but we believe that this concept was never implemented.

Adequacy of Program for Monitoring Performance of the Impoundments

The present monitoring program primarily involves visual inspections by plant personnel and by the Ameren Energy Dam Safety Group. These visual inspections seem to be adequate to address issues such as surface erosion and general condition of the impoundments. However, a more detailed monitoring program is recommended to be established to quantify various important factors associated with embankment stability. Those factors include, but are not limited to seepage quantities through the embankment, the amount of sediments carried by the seepage water, and the fluctuation of ground water levels.

5.2 Summary Statement

I acknowledge that the management unit(s) referenced herein was personally inspected by me and found to be in the following condition:

FAIR

Signature: Brian T. Havens Date: 5/10/11

Brian T. Havens, P.E.
Lead Geotechnical Engineer

6.1 Definitions

Priority 1 Recommendation: Priority 1 Recommendations involve the correction of severe deficiencies where action is required to ensure the structural safety, operational integrity of a facility, and that may threaten the safety of the impoundment.

Priority 2 Recommendation: Priority 2 Recommendations where action is needed or required to prevent or reduce further damage or impair operation and/or improve or enhance the O&M of the facility, that do not appear to threaten the safety of the impoundment.

Based on observations during the site assessment, it is recommended that the following actions be taken at the Meredosia Power Generating Station.

6.2 Priority 1 Recommendations

1. **Prepare an emergency action plan (EAP) for the facility by 8/2/2011.** An EAP should be prepared for the Fly Ash and Bottom Ash Ponds as well as any other pertinent features related to the impoundments. The EAP should be reviewed by the EPA.
2. **Perform a hydrologic and hydraulic study by 8/1/2011.** This study should be performed to determine if the existing ponds are capable of impounding the appropriate inflow design flood without overtopping of the impoundments. At a minimum, documentation required for this evaluation will include a current topographic survey of the site and surrounding drainage basin, basin characteristics (surface runoff/infiltration condition) and sufficient hydrologic data to determine the design storm event. The results of this evaluation should be reviewed by the EPA.
3. **Establish seepage and ground water monitoring program by 8/1/2011**. As discussed in Section, 3.5, seepage water at various locations along the downstream embankment of the Fly Ash pond was observed. The presence of seepage water at the downstream embankment raises serious questions regarding the integrity and the stability of the embankment. Therefore, a detailed monitoring program should be established to quantify various important factors including seepage quantities through the embankment, the amount of sediments carried by the seepage water, and the fluctuation of ground water levels. The results of this evaluation should be reviewed by the EPA.

4. **Perform embankment and structure stability analyses by 8/1/2011.** The slopes of the Bottom Ash Pond were steep, appearing to be 1H:1V in some cases, and their stabilities are is unknown. Due to the lack of documented engineering design analysis, new stability analyses of both impoundments should be performed. The analyses should incorporate seepage monitoring data and include

evaluation of the embankments and the structures under seismic loading scenarios. According to Ameren, we understand that this task is currently being completed by another consultant retained by Ameren Energy. The results of this evaluation should be reviewed by the EPA.

5. **Perform video assessments of culvert piping by 8/1/2011.** Culvert piping used for the outlet works of the impoundments is vitrified clay pipe. As this pipe is either past or nearing the end of its life expectancy, a video assessment should be performed of all culvert piping to determine its effectiveness and if remedial actions are necessary.
6. **Control vegetation on the upstream and downstream slopes. Remove the trees and stumps from the embankment including the large tree at the overflow outlet discharge point by 8/1/2011.** Refer to FEMA Manual 534 (Impact of plants on Earthen Impoundments) for guidance on vegetation removal. This manual is available on the FEMA website.

6.3 Priority 2 Recommendations

1. **Repair erosion of embankment.** Minor surface erosion was noted at both the Bottom Ash Pond and Fly Ash Pond. Areas where erosion has occurred should be filled in and re-dressed with appropriate fill in order to prevent erosion from cutting further into the embankments.
2. **Review the condition of riprap at the downstream toe of the bottom ash embankment and upgrade the riprap, if needed, to meet typical requirements for riprap size and placement by 12/1/2011.**
3. **Maintain a log of maintenance and other activities at the fly ash impoundments and supporting facilities.** We believe that this log will provide continuity during periods of staff change.
4. **Develop an Operation and Maintenance (O&M) manual for the impoundments and the facility by 8/1/2011.** The O&M manual should include at least the following three key elements:
   - Procedures needed for operation and maintenance of the impoundments during typical operating conditions
   - Procedures for monitoring performance of the impoundments, including visible changes such as surface erosion, settlement and sloughing; internal embankment changes such as erosion due to uncontrolled seepage; and fluctuations in groundwater level
   - The EAP

For the EPA Ash Pond Assessment program, the following glossary of terms shall be used for classification unless otherwise noted.

Hazard Potential Rating

"Hazard potential" means the possible adverse incremental consequences that result from the release of water or stored contents due to the failure of the impoundment or reservoir or the misoperation of the impoundment, reservoir, or appurtenances. The hazard potential classification of a impoundment or reservoir shall not reflect in any way on the current condition of the impoundment or reservoir and its appurtenant works, including the impoundment's or reservoir's safety, structural integrity, or flood routing capacity. These classifications are as described below:

1. **Low Hazard Potential**

   "Low hazard" means a impoundment's or reservoir's failure will result in no probable loss of human life and low economic loss or environmental loss, or both. Economic losses are principally limited to the owner's property.

2. **Significant Hazard Potential**

   "Significant hazard" means a impoundment's or reservoir's failure will result in no probable loss of human life but can cause major economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification impoundments or reservoirs are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

3. **High Hazard Potential**

   "High hazard" means a impoundment's or reservoir's failure will result in probable loss of human life.

Size Classification

In accordance with the Illinois Department of Natural Resources (IDNR) Administrative Code for Impoundment Safety, "Part 3702 - Construction and Maintenance of Impoundments" dated January 13, 1987, a impoundment system is classified by size based on its height and potential storage capacity. Size classification is determined by which category (storage or height) is greatest (produces the larger size classification).

Category	Storage (acre-feet)	Height (feet)
Small	<1,000	<40
Intermediate	≥ 1,000 to <50,000	≥ 40 to <100
Large	≥ 50,000	≥ 100

Overall Classification of Impoundment

In a system similar to the New Jersey Department of Environmental Protection Impoundment Safety Guidelines for the Inspection of Existing Impoundments (January 2008), when the following terms are capitalized they denote and shall be used to describe the overall classification of the impoundment as follows:

SATISFACTORY - No existing or potential impoundment safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR – Acceptable performance is expected* under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

POOR - A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable impoundment safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential impoundment safety deficiencies.

UNSATISFACTORY – Considered unsafe. A impoundment safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

*the term expected is to be defined as likely

Condition Rating Criteria

In a system similar to the U.S. Department of Interior, Safety Evaluation of Existing Impoundments (SEED 1995), the terms satisfactory, fair, poor, and unsatisfactory are used in a general sense when describing the structural condition and the operational adequacy of the equipment for a impoundment or reservoir and its appurtenant works during the visual assessment. In addition the term unknown may be utilized as applicable.

Satisfactory – Expected to fulfill intended function.

Fair – Expected to fulfill intended function, but maintenance or other actions are recommended.

Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.

Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.

Unknown – Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

Recommendation Listing

Recommendations shall be written concisely and identify the specific actions to be taken. The first word in the recommendation should be an action word (i.e. "Prepare", "Perform", or "Submit"). The recommendations shall be prioritized and numbered to provide easy reference. Impoundment Safety recommendations shall be grouped, listed or categorized similar to the U.S. Department of Interior, Reclamation Manual - Directives and Standards - Review/Examination Program for High- and Significant-Hazard Impoundments (July, 1998 FAC 01-07) as follows:

Priority 1 Recommendations: Priority 1 Recommendations involve the correction of severe deficiencies where action is required to ensure the structural safety, operational integrity of a facility, and that may threaten the safety of the impoundment.

Priority 2 Recommendations: Priority 2 Recommendations where action is needed or required to prevent or reduce further damage or impair operation and/or improve or enhance the O&M of the facility, that do not appear to threaten the safety of the impoundment.

SECTION 8 – LIMITATIONS

The scope of this work is for a preliminary screening for the EPA and plant owner/operator of the visible performance and apparent stability of the impoundment embankments based only on the observable surface features and information provided by the owner/operator. Other features below the ground surface may exist or may be obscured by vegetation, water, debris, or other features that could not be identified and reported. This site assessment and report were performed without the benefit of any soil drilling, sampling, or testing of the subsurface materials, calculations of capacities, quantities, or stability, or any other engineering analyses. The purpose of this assessment is to provide information to the EPA and the plant owner/operator about recommended actions and/or studies that need to be performed to document the stability and safety of the impoundments.

This work was performed by qualified personnel in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession, practicing in the same locality, under similar conditions, and at the date the services are provided. Kleinfelder's conclusions, opinions, and recommendations are based on a limited number of observations. It is possible that conditions could vary between or beyond the observations made. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided. Kleinfelder makes no warranty or guaranty of future embankment stability or safety.

This report may be used only by the client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance but in no event later than one (1) year from the date of the report.

The information, included on graphic representations in this report, has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, expressed or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. These documents are not intended for use as a land survey product nor are they designed or intended as a construction design document. The use or misuse of the information contained on these graphic representations is at the sole risk of the party using or misusing the information.

Recommendations contained in this report are based on preliminary field observations without the benefit of subsurface explorations, laboratory tests, or detailed knowledge of the existing construction. If the scope of the proposed recommendations changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed and the conclusions of this report are modified or approved in writing by Kleinfelder. Kleinfelder cannot be responsible for interpretation by others of this report or the conditions encountered in the field.

Ameren, *Annual Engineering Inspection Report*, July, 31, 2009.

Ameren, *Flood Control Works Inspection Report*, March 18, 2008.

Ameren, Impoundment Safety Program for Non-Illinois Department of Natural Resources (IDNR) Regulated Facilities, AER-DSP-004, April 3, 2009.

Hanson Engineers, *Capacity Survey and Stability Analysis Fly Ash Impoundment*, Meredosia Power Station, June 13, 1991.

Hanson Engineers, Utility Site Plan Drawing, 1980.

Illinois Department of Natural Resources (IDNR), *Construction and Maintenance of Impoundments*, Part 3702 – Administrative Code for Impoundment Safety, January 13, 1987.

New Jersey Department of Environmental Protection, *Impoundment Safety Guidelines for the Inspection of Existing Impoundments,* January 2008.

Sargent and Lundy, Design Drawings B-331 thru B-334, 1971.

The CECO Corporation, Weir Box Design Drawing, 1971.

US Department of Agriculture (USDA)/ Natural Resources Conservation Service (NRCS), “Web Soil Survey”, http://websoilsurvey.nrcs.usda.gov

US Department of Interior, *Directives and Standards – Review/Examination Program for High and Significant Hazard Impoundments*, Reclamation Manual, July 1998.

US Department of the Interior, *Safety and Evaluation of Existing Impoundments (SEED)*, 1995.

Appendix A

Site assessment Evaluation Checklists

Appendix B

Site assessment Photographs

Appendix C

Response Letter to the EPA's Request for Information

AERIAL IMAGE

NTS

IMAGE SOURCE: GOOGLE EARTH PRO - IMAGE DATE 08/19/10

KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	PROJECT NO. 112618 DATE: 08/19/10 DRAWN BY: MAG CHECKED BY: BDH FILE NAME:	**LOCATION OF CRITICAL INFRASTRUCTURE** MEREDOSIA POWER GENERATING STATION 800 SOUTH WASHINGTON STREET MEREDOSIA, IL 62665	FIGURE **1**

10 Sep 2010, 2:19pm, MGardella

U:\MGardella\ASH PONDS\Reports\Meredosia Report\

AERIAL IMAGE
NTS

IMAGE SOURCE: GOOGLE EARTH PRO - IMAGE DATE 08/19/10

KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	PROJECT NO. 112618 DATE: 08/19/10 DRAWN BY: MAG CHECKED BY: BDH FILE NAME:	**MEREDOSIA POWER STATION AERIAL MAP** MEREDOSIA POWER GENERATING STATION 800 SOUTH WASHINGTON STREET MEREDOSIA, IL 62665	FIGURE **2**

10 Sep 2010, 2:22pm, MGardella

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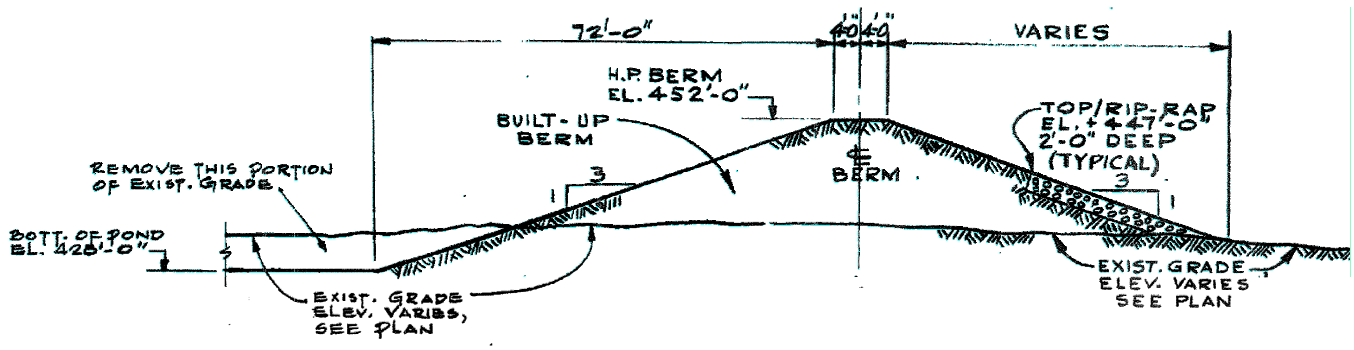
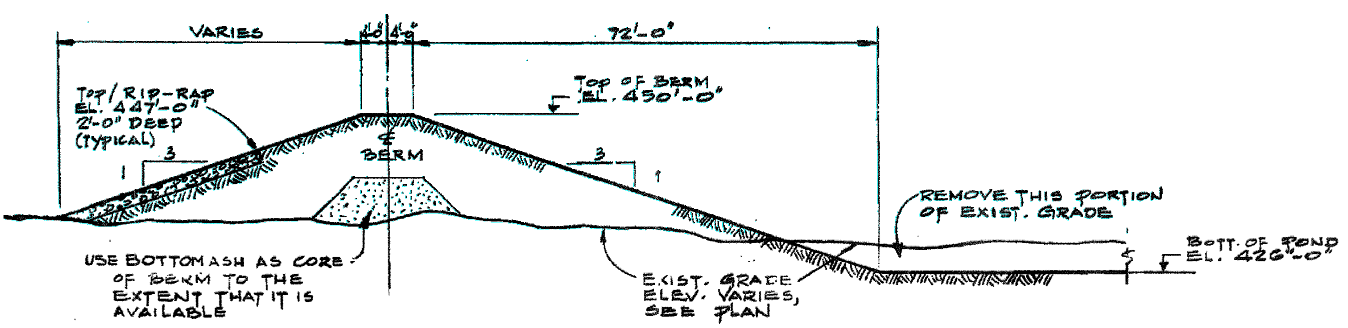


TYPICAL EMBANKMENT SECTION - FLY ASH POND

NTS



TYPICAL EMBANKMENT SECTION - BOTTOM ASH POND

NTS

IMAGE SOURCE: SARGENT AND LUNDY - ASH POND STORAGE PLAN DRAWING B-331 DATED 02/02/72

KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	PROJECT NO. 112618 DATE: 08/19/10 DRAWN BY: MAG CHECKED BY: BDH FILE NAME:	**TYPICAL CROSS SECTION BOTTOM AND FLY ASH PONDS** MEREDOSIA POWER GENERATING STATION 800 SOUTH WASHINGTON STREET MEREDOSIA, IL 62665	FIGURE **3**

18 Apr 2011, 4:55pm, MGardella

W:\112618 EPA Ash Pond Inspections\Task 7 - Meredosia\Meredosia Report\

ATTACHED IMAGES:
ATTACHED XREFS:
Den-L:\2008\95399
CAD FILE: W:\112618 EPA Ash Pond Inspections\Task 7 - Meredosia\Meredosia Report\ LAYOUT: General (2)

IMAGE SOURCE: GOOGLE EARTH PRO - IMAGE DATE 08/19/10

FIGURE 4	1 of 1 sheets	SCALE: NTS	DATE: 08/18/10	CHECKED BY: B. HAVENS	DRAWN BY: M. GARDELLA	DESIGNED BY: N/A	**LOCATIONS OF SITE ASSESSMENT PHOTOS FLY ASH POND** MEREDOSIA POWER GENERATING STATION 800 SOUTH WASHINGTON STREET MEREDOSIA, IL 62665	KLEINFELDER Bright People. Right Solutions. 611 Corporate Circle, Suite C Golden, Colorado 80401 PH. 303-237-6601 FAX. 303-237-6602 www.kleinfelder.com	PROJ. NO. 112618 ACAD FILE: Meredosia Figure 4.dwg

NO.	REVISION	BY	DATE
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PLOTTED: 18 Apr 2011, 4:51pm, MGardella

ATTACHED IMAGES:
ATTACHED XREFS:
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CAD FILE: W:\112618 EPA Ash Pond Inspections\Task 7 - Meredosia\Meredosia Report\ LAYOUT: General (2)

PROJECT	5
SCALE	NTS
DATE	08/18/10
CHECKED BY	B. HAVENS
DRAWN BY	M. GARDELLA
DESIGNED BY	N/A
SHEET	1 of 1 sheets

LOCATIONS OF SITE ASSESSMENT PHOTOS BOTTOM ASH POND

MEREDOSIA POWER GENERATING STATION
800 SOUTH WASHINGTON STREET
MEREDOSIA, IL 62665

KLEINFELDER
Bright People. Right Solutions.
611 Corporate Circle, Suite C
Golden, Colorado 80401
PH. 303-237-6601 FAX. 303-237-6602
www.kleinfelder.com

PROJ. NO. 112618
ACAD FILE: Meredosia Figure 5.dwg

NO.	REVISION	BY	DATE
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2	-	---	---
3	-	---	---
4	-	---	---
5	-	---	---

PLOTTED: 18 Apr 2011, 4:48pm, MGardella

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: MEREDOSIA POWER STATION | Date: 08-10-10

Unit Name: BOTTOM ASH POND | Operator's Name: AMEREN ENERGY

Unit I.D.: | Hazard Potential Classification: High Significant Low

Inspector's Name: BRIAN HAVENS, MATT GARDELLA

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

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	WEEKLY WITH ANNUAL REVIEW		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	441.8 ±		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	VARIES (STOP LOGS) OUTLET PIPE@ 426		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	450'		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A PLANS FOR M. WELLS + PIEZOS		Is water exiting outlet flowing clear?	UNKNOWN	N/A
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	UNKNOWN	N/A	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue #	Comments
8	ON DRAWINGS + OTHER INFORMATION PROVIDED CLEARING AND GRUBBING OPERATIONS ARE NOT CALLED OUT EXCEPT IN NOTES REFERENCING SPECIFICATIONS THAT ARE UNACCOUNTED FOR AND SUBSEQUENTLY UNAVAILIBLE FOR REVIEW.
9	TREES ON EMBANKMENT SLOPES + TOES RANGE FROM LESS THAN 1" TO ~18"
20	OUTLET LOCATIONS FOR THE BOTTOM ASH POND WAS SUBMERGED DURING TIME OF INSPECTION + OUTFLOW/COLOR COULD NOT BE DETERMINED
23.	WATER HAS BEEN AGAINST THE TOE RECENTLY WITH THE RAISED ILLINOIS RIVER LEVEL. HOWEVER, IT WAS RECEDED AT THE TIME OF INSPECTION

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # IL 0000116-003 INSPECTOR BRIAN HAVENS, MATT GARDEZCA
Date 08-10-10

Impoundment Name BOTTOM ASH POND
Impoundment Company AMEREN ENERGY
EPA Region V
State Agency (Field Office) Addresss 5415 N. UNIVERSITY
PEORIA, IL 61614
Name of Impoundment BOTTOM ASH POND
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ____

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

IMPOUNDMENT FUNCTION: SETTLING POND FOR BOTTOM ASH

Nearest Downstream Town : Name NAPLES, IL
Distance from the impoundment APPROXIMATELY 5 MILES
Impoundment
Location: Longitude W 90 Degrees 34 Minutes 16 Seconds
Latitude N 39 Degrees 49 Minutes 12 Seconds
State ILLINOIS County MORGAN

Does a state agency regulate this impoundment? YES ____ NO X (DAM SAFETY NOT MONITORED ONLY DISCHARGE)

If So Which State Agency? ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (DISCHARGE ONLY)

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

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

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

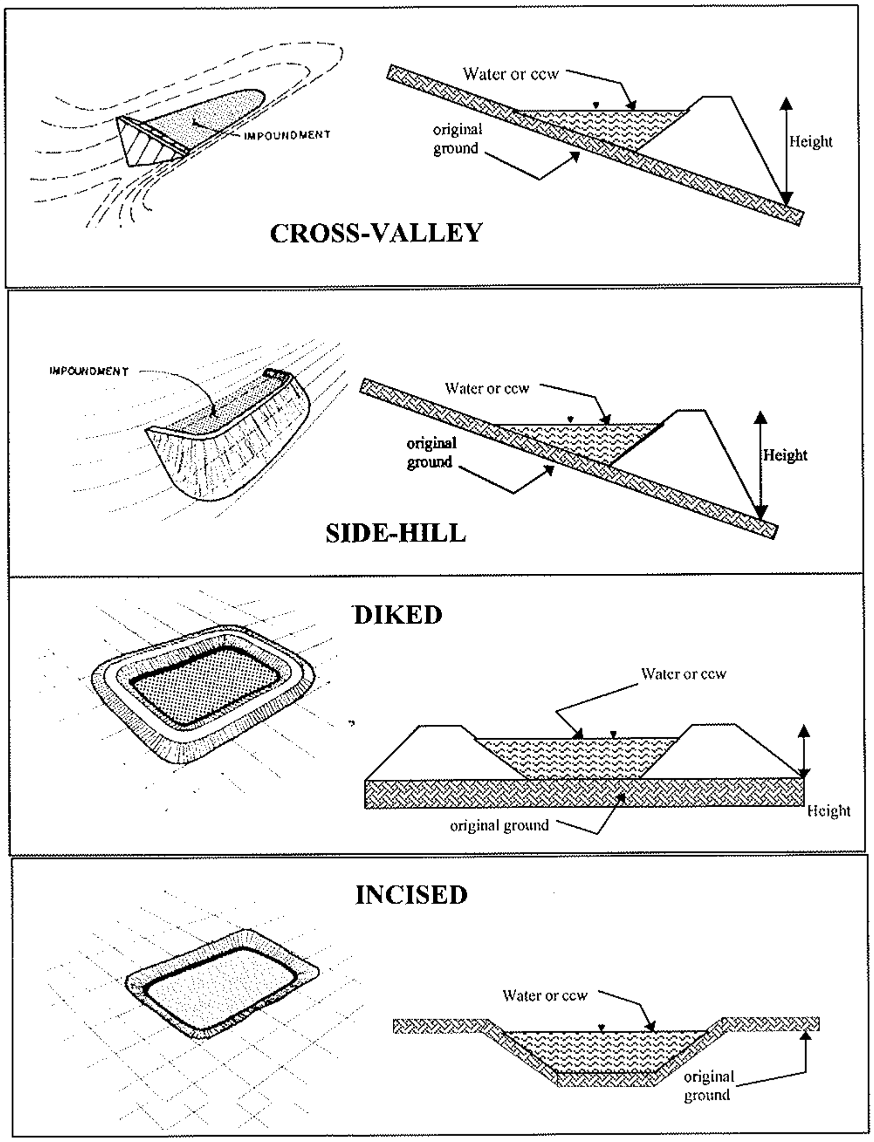
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

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

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

THE BOTTOM ASH POND SITS IMMEDIATLEY ADJACENT TO THE ILLINOIS RIVER. IN THE EVENT OF AN EMBANKMENT FAILURE AT THIS LOCATION BOTTOM ASH SLURRY WOULD ENTER THE ILLINOIS RIVER ALMOST IMMEDIATLEY. THIS COULD RESULT IN LARGE ENVIRONMENTAL DAMAGES AS WELL AS ECONOMIC LOSS AS THIS IS A NAVIGABLE WATERWAY USED FOR COMMERCE. LOSS OF LIFE WOULD NOT BE EXPECTED AS THERE ARE NO STRUCTURES OR FACILITIES BETWEEN THE BOTTOM ASH POND AND THE ILLINOIS RIVER. ALSO, NO SIGNIFICANT STRUCTURES SEEM TO APPEAR UNTIL 5 MILES DOWNSTREAM OF THE IMPOUNDMENT NEAR THE TOWN OF NAPLES.

CONFIGURATION:



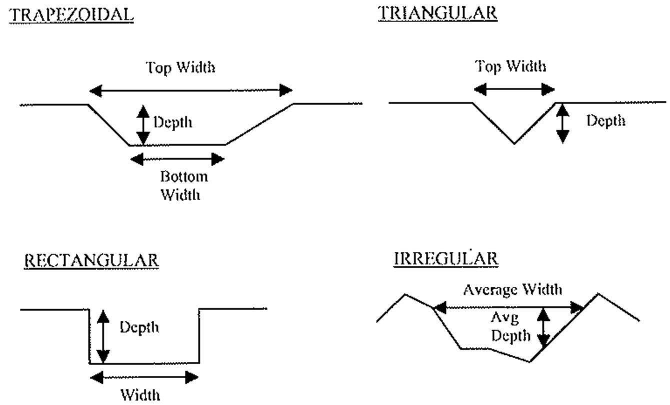
_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height 450 feet   Embankment Material BOTTOM ASH CORE + EARTH EMBANKMEN
Pool Area ~ 22 acres   Liner N/A
Current Freeboard ~ 8.2' MA feet   Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

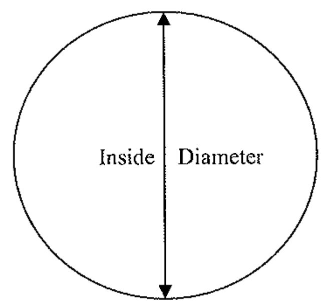
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



X **Outlet**

12" inside diameter



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

Is water flowing through the outlet? YES X NO _____

_____ **No Outlet**

X **Other Type of Outlet** (specify) WEIR BOX (TRIANGULAR) CONNECTED TO 12"VCP

The Impoundment was Designed By SARGENT + LUNDY ENGINEERS

Has there ever been a failure at this site? YES __________ NO ___X_____

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO __X____

If So When? ______________________________

IF So Please Describe: ______________________________

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO __X____

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

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: MEREDOSIA POWER STATION	Date: 08-10-10
Unit Name: FLY ASH POND	Operator's Name: AMEREN ENERGY
Unit I.D.:	Hazard Potential Classification: High Significant Low
Inspector's Name: BRIAN HAVENS, MATT GARDELLA	

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

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	WEEKLY W/ ANNUAL REVIEW		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	~447.0'		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	VARIES (STOP LOGS) OUTLET PIPE@ 428		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	~450.9'		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A PLANS FOR PIEZOS	FOR & M.WELLS	Is water exiting outlet flowing clear?	UNKNOWN N/A	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	UNKNOWN N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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

Inspection Issue #	Comments
8	ON PROVIDED DRAWINGS & OTHER INFORMATION CLEARING AND GRUBBING INFORMATION IS NOT CALLED OUT EXCEPT IN NOTES REFERENCING SPECIFICATIONS THAT ARE UNAVAILIBLE FOR REVIEW.
9	TREES ON EMBANKMENT SLOPES AND TOES RANGE FROM LESS THAN 1" TO ≈ 12"
20	OUTLET LOCATION SUBMERGED DURING TIME OF INSPECTION & OUTFALL COLOR COULD NOT BE DETERMINED.
23	WATER WAS PRESENT AT THE TOE OF EMBANKMENT FROM ELEVATED LEVELS OF THE ILLINOIS RIVER & HIGH PRECIPITATION IN THE AREA

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IL 0000116-004 INSPECTOR BRIAN HAVENS, MATT GARDELLA
Date 08-10-10

Impoundment Name FLY ASH POND
Impoundment Company AMEREN ENERGY
EPA Region V
State Agency (Field Office) Addresss 5415 N. UNIVERSITY
PEORIA, IL 61614
Name of Impoundment FLY ASH POND
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

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

IMPOUNDMENT FUNCTION: SETTLING POND FOR FLY ASH

Nearest Downstream Town : Name NAPLES, IL
Distance from the impoundment APPROXIMATELY 5 MILES
Impoundment
Location: Longitude W 90 Degrees 34 Minutes 20 Seconds
Latitude N 39 Degrees 49 Minutes 2 Seconds
State ILLINOIS County MORGAN

Does a state agency regulate this impoundment? YES ______ NO X (DAM SAFETY NOT MONITORED, ONLY DISCHARGE)

If So Which State Agency? ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (DISCHARGE ONLY)

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

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

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

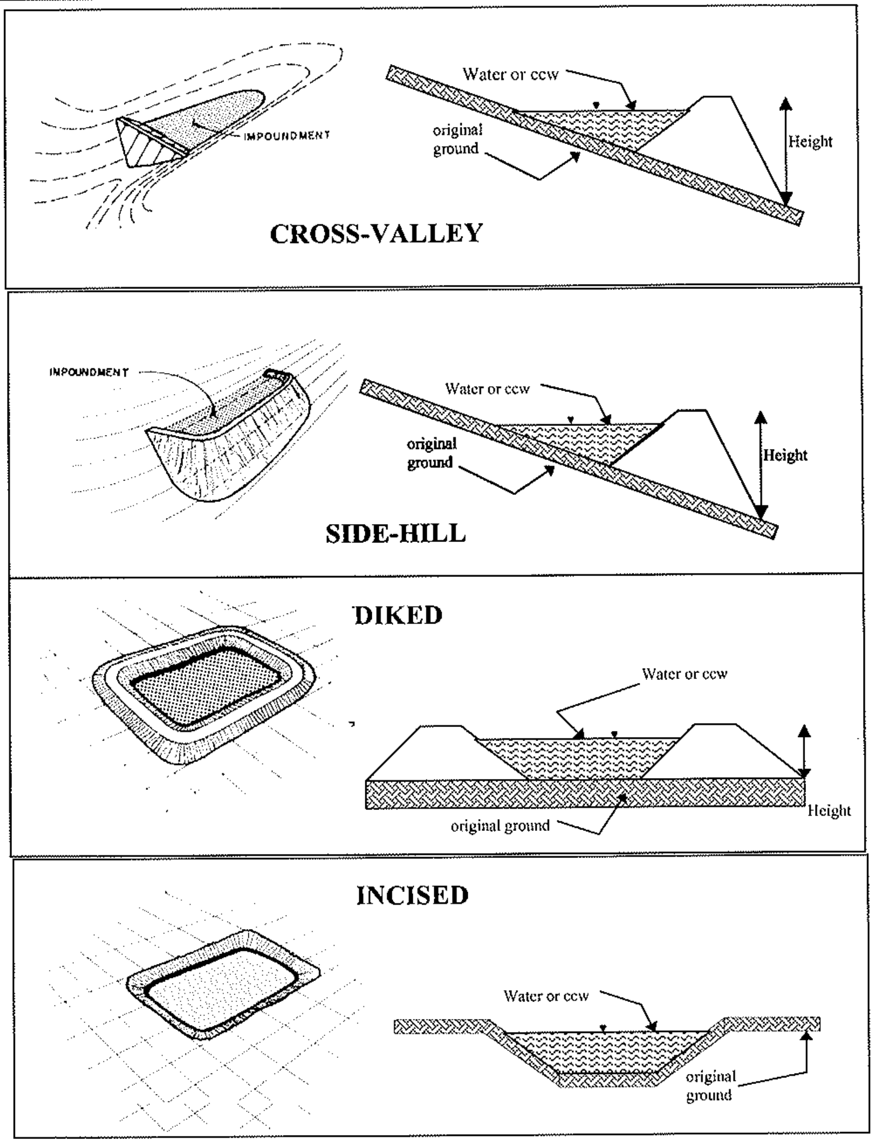
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.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

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

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

THE FLY ASH POND IS LOCATED ADJACENT TO THE ILLINOIS RIVER. IN THE EVENT OF AN EMBANKMENT FAILURE AT THE FLY ASH POND, FLY ASH SLURRY WOULD ENTER THE ILLINOIS RIVER ALMOST IMMEDIATLEY. IF THIS WERE TO OCCUR IT COULD RESULT IN LARGE ENVIRONMENTAL DAMAGES AS WELL AS ECONOMIC LOSSES, AS THE ILLINOIS RIVER IS A NAVIGABLE WATERWAY USED FOR COMMERCE. LOSS OF LIFE WOULD NOT BE EXPECTED AS NO RESIDENCES, STRUCTURES OR FACILITIES EXIST BETWEEN THE FLY ASH POND AND THE ILLINOIS RIVER. ALSO, NO SIGNIFICANT STRUCTURES SEEM TO APPEAR UNTIL 5 MILES DOWN STREAM OF THE FLY ASH NEAR THE TOWN OF NAPLES.

CONFIGURATION:



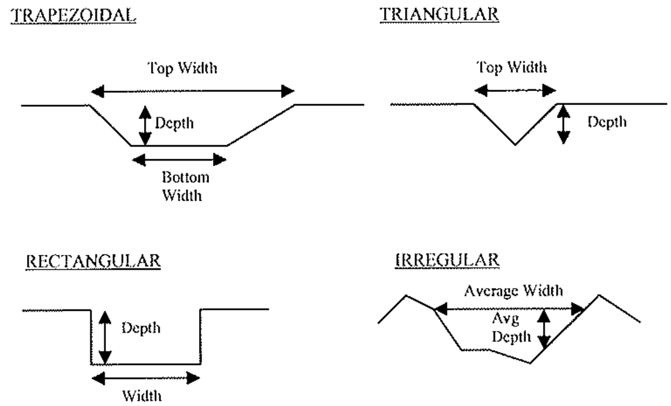
_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_X_ Combination Incised/Diked

Embankment Height 450.9 - 452 feet | Embankment Material COMPACTED EARTH FILL
Pool Area ~77 acres | Liner N/A
Current Freeboard 3.9' - 5' feet | Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

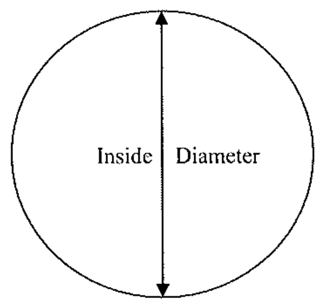
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

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



x **Outlet**

12" inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
x other (specify) VITRIFIED CLAY PIPE (VCP)

Is water flowing through the outlet? YES X NO _______

_____ **No Outlet**

X **Other Type of Outlet** (specify) WEIR BOX CONNECTED TO VCP (12")

The Impoundment was Designed By SARGENT + LUNDY ENGINEERS

Has there ever been a failure at this site? YES __________ NO ___X______

If So When? ____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO __x__

If So When? ______________________________

IF So Please Describe: ______________________________

2 LOCATIONS OF MINOR POSSIBLE SEEPAGE NOTED IN PAST INSPECTION REPORT. NO DOCUMENTATION OR KNOWLEDGE OF SIGNIFICANT SEEPAGE.

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

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

If so Please Describe : ____________________

Appendix B

Site Visit Photographs

Photo 1 – Bottom Ash Pond Embankment Looking Southwest (Note Pipeline, Foundations and Fence)

Photo 2 – Minor Surface Erosion of Bottom Ash Pond Crest (Note Typical Crest Condition and Pipeline)

Photo 3 – Minor Surface Erosion of Crest and Downstream Slope of the Bottom Ash Pond (Typical)

Photo 4 – Bottom Ash Pond Inlet Piping (Note Coal Stockpile in Background)

Photo 5 – Bottom Ash Pond Inlet Piping

Photo 6 – Settling Channel of Bottom Ash Pond near Inlet

Photo 7 – Riprap and Mature Trees on the Downstream Slope of the Bottom Ash Pond (Typical)

Photo 8 – Riprap on Downstream Slope of Bottom Ash Pond (Typical)

Photo 9 – Undersized Riprap on Downstream Embankment of the Bottom Ash Pond

Photo 10 – Emergency Spillway Pipe for the Bottom Ash Pond

Photo 11 – Emergency Spillway Pipe for the Bottom Ash Pond without any Noticeable Obstructions

Photo 12 – North Side of the Oil Delivery Sheet Pile Platform (Note Penetration into Embankment)

Photo 13 – South Side of the Oil Delivery Sheet Pile Platform (Note Penetration into Embankment)

Photo 14 – Outlet Works for the Bottom Ash Pond (Note Broken Support of Walkway)

Photo 15 – Bottom Ash Pond Outlet Piping Outfall (Submerged)

Photo 16 – Bottom Ash Pond Outlet Pipe Discharge Bay (Note Illinois River in Background)

Photo 17 – Debris Pile and Heavy Vegetation at the Downstream Toe of the Bottom Ash Pond (Typical)

Photo 18 – Vegetated Riprap on the Bottom Ash Pond Southwest Embankment

Photo 19 – Area between the Fly Ash and Bottom Ash Impoundments Looking Northwest

Photo 20 – Riprap on Downstream Slope of Bottom Ash Pond (Note Fence at Crest)

Photo 21 – Area between the Fly Ash and Bottom Ash Impoundments Looking Southeast

Photo 22 – General Photo of Bottom Ash Pond Looking Northeast

Photo 23 – Upstream Slope of the Bottom Ash Pond (Note Steep Slopes and Light Pole Penetrations)

Photo 24 – Sluice Pipe Penetrations through Crest of Bottom Ash Pond Embankment

Photo 25 – General Bottom Ash Pond Photograph (Note Bottom Ash Stockpile and Settling Channel)

Photo 26 – General Photograph of the Bottom Ash Pond (Note Settling Channel and Main Pond)

Photo 27 – Stockpile of Bottom Ash Recovered from the Bottom Ash Pond

Photo 28 – Typical Crest Condition of the Bottom Ash Pond (Note Light Pole Penetrations in Crest)

Photo 29 – Typical Embankment of Fly Ash Pond (Note Fly Ash Cell Divider Embankment to Left in Photo)

Photo 30 – Vegetation on the Downstream Slope and Toe of the Fly Ash Pond

Photo 31 – Fly Ash Pond Embankment (Note Riprap and Felled Tree Debris near Toe)

Photo 32 – Fly Ash Pond Outlet Works

Photo 33 – Fly Ash Pond Outlet Works Pipe Outfall (Submerged)

Photo 34 – Flooded Timber and Felled Tree Debris at the Toe of the Fly Ash Pond

Photo 35 – Mowed Woody Vegetation on Downstream Slope of Fly Ash Pond (Note Intact Root System)

Photo 36 – Fly Ash Pond Culvert Pipe between cells 1 and 4 (Note Emergency Spillway Cut)

Appendix C

Response Letter to the EPA's Request for Information

Ameren Services

Environmental Services
314.554.2388 (Phone)
314.554.4182 (Facsimile)
ppike@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149

March 26, 2009

Mr. Richard Kinch
US Environmental Protection Agency (53306P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Ameren

RE: Request for Information under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

This letter and attachments are AmerenEnergy Generating and AmerenEnergy Resources Companies' response to the United States Environmental Protection Agency's request for information relating to the surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals.

AmerenEnergy Generating and AmerenEnergy Resources Companies have received requests for information about their five coal-fired power stations in Illinois. Although most of our surface impoundments are not considered to be dams by State or Federal regulations, we are subject to State and Federal NPDES regulations and have had Agency personnel inspect these units. We are providing a full and complete response to each separate request for information set forth in your Enclosure A (attached) with responses corresponding to numbering in your questions. If you have any further questions please feel free to contact Paul Pike at (314) 554-2388.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared 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, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Sincerely,

Michael L. Menne
Vice President – Environmental Services

Enclosure A

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion residues or by-products, but still contain free liquids. .

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

2. What year was each management unit commissioned and expanded? ;

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste-management unit(s) under the supervision of a Professional Engineer?

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this. Enclosure.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

10. Please identify all current legal owner(s) and operator(s) at the facility.

AmerenEnergy Generating Company Response

Meredosia Power Station
800 W. Washington
Meredosia, Illinois 62665

1. Coal-combustion by-product surface impoundments at this Station are not classified as dams by State or Federal regulatory agencies so they have not been rated.

2. See table below.

Management Unit	Year Commissioned or Expanded
Fly Ash Pond	1968
Bottom Ash Pond	1972

3. See table below.

Management Unit	Materials Contained in Unit*
Fly Ash Pond	1
Bottom Ash Pond	2

*Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other.

Other types of materials that are temporarily or permanently contained in the unit(s) include, but are not limited to residual wastes remaining following treatment of wastewater from these systems: primary water treatment; boiler water make-up treatment; laboratory and sampling streams; boiler blowdown; floor drains; coal pile run off; house service water systems; and pyrites.

4. The management units at this facility were designed by a Professional Engineer. The construction of the management units were done under the supervision of a Professional Engineer. And, inspection and monitoring of the safety of the waste management units is under the supervision of a Professional Engineer.

5. The most recent annual internal professional engineering inspection of the management units occurred in 2009. Since these management units are not classified by regulation as dams the evaluation only included a visual inspection of the units. AmerenEnergy Resources Company has formed a Dam Safety Group consisting of civil engineers who oversee the

implementation of the company Dam Safety Program and this Group is supervised by a licensed Professional Engineer. The Dam Safety Program requires routine, annual and special inspection of the ash ponds and employees performing these inspections receive dam safety training. If maintenance issues are identified in these visual inspections, then corrective actions are taken by either plant employees or contractors to remedy the issue and final acceptance of the work is reviewed and evaluated by Dam Safety Group personnel.

6. No State, or Federal regulatory official has inspected or evaluated the safety (structural integrity) of the management unit(s), and we are not aware of a planned state or federal inspection or evaluation in the future.

7. Not applicable, see response to Question 6.

8. See table below.

Management Unit	**Surface Area (Acres)**	**Total Storage Capacity (Acre-ft)**	**Volume of Stored Ash (Acre-ft)**	**Maximum Height of Unit (ft.)**
Fly Ash Pond	186	700	650	24
Bottom Ash Pond	34	186	139	24

The volume measurement includes area excavated below natural surface level and was determined in 2007.

9. Assuming that brief history means incident(s) which could have occurred in the last ten (10) years, we are only aware of one instance when there was a release from our surface impoundments to the land. The incident occurred in late December, 2006, when we released a small amount of water (less than 500 gallons) from the fly ash pond to the land. In response, we modified the pond and developed internal procedures to prevent a recurrence of the situation. We are not aware of any other spills or unpermitted releases of coal-combustion by-products from our surface impoundments to surface water or to the land.

10. The current legal owner and operator at the facility is AmerenEnergy Generating Company.

EXHIBIT 5

GEOTECHNOLOGY INC
FROM THE GROUND UP

September 20, 2017

Mr. Paul Mauer
Illinois Department of Natural Resources
Office of Water Resources
One Natural Resources Way, 2nd Floor
Springfield, Illinois 62702-1271

Re: Permit Status Change Request
Fly Ash Pond and Closed Ash Pond
Meredosia Power Station
Meredosia, Illinois
Geotechnology, Inc. Project No. J024917.03

Dear Mr. Mauer:

Geotechnology, Inc. (Geotechnology), on behalf of Ameren Missouri, is requesting a permit change status at the referenced site to de-classify the embankments at the Fly Ash Pond and Closed Ash Pond as abandoned dams. A liquefaction analysis performed by Geotechnology is included as an attachment and summarized herein with additional information as discussed in our April 21, 2017 phone call.

The energy center site consists of the decommissioned Meredosia Power Station in Meredosia, Illinois. The Closed Ash Pond does not have an engineered bottom liner and has a soil cap of unknown thickness. The Fly Ash Pond does not have an engineered bottom liner and is scheduled be graded and capped in 2017-2018 construction seasons. The designed cap utilizes ClosureTurf, which is a geosynthetic system that meets the Subtitle D technical requirements and has been tentatively approved by the IEPA for installation.

The embankments at the capped Fly Ash Pond and Closed Ash Pond are currently not Illinois Department of Natural Resources – Office of Water Resources (IDNR) permitted dams. Upon modification of the dams, they would fall under the jurisdiction of IDNR. Based on conversations with IDNR, the following guidelines[1] summarize required documentation for consideration to abandoned a dams:

[1] GUIDELINES FOR PREPARATION OF APPLICATIONS FOR PERMITS FROM: *Illinois Department of Natural Resources, Office of Water Resources, Illinois Department of Natural Resources, Office of Mines and Minerals;* AND FOR REVIEW AND APPROVAL FROM: *United States Department of Labor, Mine Safety and Health Administration, Illinois Environmental Protection Agency;* FOR THE DESIGN, CONSTRUCTION MAINTENANCE AND INSPECTION OF DAMS AND IMPOUNDMENTS AT UNDERGROUND AND SURFACE COAL MINES IN ILLINOIS; *July 2004*

1. Classify the existing condition of the impounded material with respect to its fluid nature;

2. Analyze the liquefaction potential of the impounded material and the related stability of the containing dam;

3. Design the final surface configuration for the impoundment to preclude the potential for re-saturation of the impounded material, especially from any surface water impounding characteristics and the erosion potential of the surface material; and

4. Establish a follow-up inspection schedule to ensure the proposed plans have been effective and include record drawings of any closure modifications.

Each of these IDNR requested items are addressed below:

1. Geotechnology performed liquefaction analysis of the impounded material within Fly Ash Pond and Closed Ash Pond. The complete report is attached for your reference.

   In summary, six – approximately 25 feet deep cone penetration test (CPT) soundings were performed in the Closed Ash Pond and eight- approximately 25 feet CPT soundings were performed in the Fly Ash Pond. Direct push samples from the impounded ash were collected to a depth of approximately 24 feet in the Closed Ash Pond and approximately 24 feet in the Fly Ash Pond.

   The CPT data indicates interbedded layers of material that respond to CPT advancement similar to clay, silty clay, silty sand, and sand in the Fly Ash Pond and interbedded layers of sand and silty sand in the Closed Ash Pond. The interbedded nature of the CPT data interpretation is to be expected in an uncontrolled waste product such as fly ash. The laboratory testing indicates the sampled material in the Fly Ash Pond was fine grained in nature having approximately 98 and 99 percent passing the #200 sieve. The sampled material in the Closed Ash Pond indicates the material is coarser in nature with approximately 4 percent passing the #200 sieve.

   Geotechnology analyzed the CPT data for liquefaction potential and dynamic (post liquefaction) settlement utilizing a design PGA of 0.08g and an earthquake magnitude of 7.5. The analysis incorporated the results of the laboratory tests to refine the fines content within the soundings.

   Based on the liquefaction results there were not potentially liquefiable layers identified within the impounded ash.

2. See response for item 1 for the analysis of the liquefaction potential of the impounded material.

   The stability of the embankments for the Fly Ash Pond was analyzed by Geotechnology prior to the design of the ash pond capping project and approved by the IEPA in 2017 as a stable configuration that does not allow ponding of storm water. The Closed Ash Pond was reported closed with a soil cap in the 1970s.

3. The final surface configuration for the impoundments were designed to prevent re-saturation of the impounded material by using a cap system. The Closed Ash Pond uses a soil cap that is graded to drain to a storm water collection system. The Fly Ash Pond cap system is a ClosureTurf cap which includes a HDPE geomembrane (supergripnet), geotextile, turf, sand infill, and a storm water collection system. This cap system is scheduled to be constructed in 2018. Surface grades were designed to prevent ponding of storm water and reduce erosion potential of the surface material. The Fly Ash Pond design was submitted and approved by the IEPA in 2017.

4. As part of the ash pond closure process, a post-closure plan was prepared that includes an inspection schedule of the ash pond caps and the storm water collection systems. The post-closure plan was submitted and approved by the IEPA in 2017.

Based on this additional information, Geotechnology requests, on behalf of Ameren Missouri, that the embankments at Fly Ash Pond and Closed Ash Pond be de-classified and removed from regulatory jurisdiction.

* * * * * *

The following reports are made part of and complete this letter:

Geotechnical Exploration, Meredosia Fly Ash Pond and Closed Ash Pond, Liquefaction Analysis, Meredosia, Illinois, dated June 29, 2017

* * * * * *

If you have any questions or require additional information, please contact the undersigned at (314) 997-7440.

Very truly yours,

GEOTECHNOLOGY, INC.

Anna M Saindon, P.E., R.G., Ph.D.
Project Manager

AMS/MSR:ams/jsj/ccg

APPENDIX A

LIQUEFACTION ANALYSIS REPORT

GEOTECHNOLOGY INC
FROM THE GROUND UP

GEOTECHNICAL EXPLORATION
MEREDOSIA FLY ASH POND AND CLOSED ASH POND
LIQUEFACTION ANALYSIS
MEREDOSIA, ILLINOIS

Prepared for:

AMEREN MISSOURI
St. Louis, Missouri

Prepared by:

GEOTECHNOLOGY, INC.
St. Louis, Missouri

Geotechnology Project No. J024917.03

September 20, 2017

St. Louis, MO
Fairview Heights, IL
Overland Park, KS
Memphis, TN
geotechnology.com

QUALITY. INTEGRITY. PARTNERSHIP. OPPORTUNITY. RESPONSIVENESS. SAFETY

GEOTECHNOLOGY INC
FROM THE GROUND UP

September 20, 2017 J019896.07

Mr. Mike Wagstaff
Ameren Missouri
11149 Lindbergh Business Court
St. Louis, Missouri 63123

GEOTECHNICAL EXPLORATION
MEREDOSIA FLY AND CLOSED ASH PONDS
LIQUEFACTION ANALYSIS
HUTSONVILLE, ILLINOIS

Dear Mr. Wagstaff:

The report includes our understanding of the project, site conditions, conclusions and/or recommendations, and support data as listed in the Table of Contents.

It has been our pleasure to provide geotechnical services to you, and we would welcome the opportunity to provide other services during the course of the project. Please contact us if you need further information or clarification about this document.

Very truly yours,

GEOTECHNOLOGY, INC.

Brian J. Sanders, P.E.*
Senior Engineer

Craig K. Kaibel, P.E.
Geotechnical Manager

BJS/CKK/AMS:bjs/ccg

Copies submitted: (2) + pdf

LICENSED PROFESSIONAL ENGINEER
CRAIG K KAIBEL
062-061432
9/20/2017
STATE OF ILLINOIS

* Licensed in Missouri

GEOTECHNICAL EXPLORATION
MEREDOSIA FLY ASH POND AND CLOSED ASH POND
LIQUEFACTION ANALYSIS
MEREDOSIA, ILLINOIS

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LIQUEFACTION ANALYSIS
MEREDOSIA, ILLINOIS

SECTION I – PROJECT INFORMATION

AUTHORIZATION

Our services were authorized by the issuance of Ameren Energy PO 793018, dated June 6, 2017 to Geotechnology, Inc.

PURPOSE AND SCOPE OF SERVICES

The purpose of our services was to evaluate the liquefaction potential of the impounded material in the Fly Ash Pond and the Closed Ash Pond at the Meredosia Site. Briefly, services consisted of site reconnaissance, performing fourteen Cone Penetrometer Test (CPT) soundings, two direct push borings, engineering analyses, and preparation of this report. Important information prepared by The Geoprofessional Business Association (GBA) for studies of this type is presented in Appendix A for your review.

PROJECT AND SITE DESCRIPTION

The project site is at the decommissioned Meredosia Power Station in Meredosia, Illinois. Ameren is proposing to declassify the Fly Ash Pond and the Closed Ash Pond in accordance with guidelines issued by the Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR). We understand that the Closed Ash Pond does not have a bottom liner and has a soil cap of unknown thickness. The Fly Ash Pond does not have a bottom liner and is scheduled be graded and capped in 2018 construction seasons. The designed cap utilizes ClosureTurf, which is a geosynthetic system that meets the Subtitle D technical requirements and has been approved by the IEPA for installation.

SECTION II - FIELD EXPLORATION AND LABORATORY TESTING

Geotechnology performed fourteen seismic CPT soundings, designated as C-01 through C-08 (Fly Ash Pond) and O-01 through O-06 (Closed Ash Pond). The CPT sounding locations were selected and located in the field by a representative from Geotechnology. The CPT soundings were advanced by Geotechnology, using a 20-ton, track-mounted Vertek direct-push rig. The soundings were advanced to termination depths of approximately 25 feet below land surface (bls) in both the Fly Ash Pond and the Closed Ash Pond. Direct push samples from the impounded ash were collected to a depth of approximately 24 feet in each pond.

Geotechnology performed CPT testing in general accordance with ASTM D5778. The data were collected using a 15-square-centimeter end area, tri-axial geophone, seismic piezometric cone with a saturated, porous filter ring at the u_2 pore pressure location (i.e., behind the tip). The cone was advanced to the predetermined termination depth or cone refusal at a rate of approximately 20 +/- 5 millimeters per second. The cone resistance, sleeve friction, pore pressure, shear strength, normalized soil behavior type (SBTn), and standard penetration test (SPT) N60 values are presented in Appendix B. Seismic cone penetration tests (SCPT) were performed in each sounding at approximately 3-foot depth intervals to collect shear wave velocity data. Shear wave velocity measurements versus depth at these locations are presented in Appendix C. The fines content was determined on select direct push samples using the percent passing the #200 sieve test and the results are included in Appendix D.

An engineer from Geotechnology observed the CPT data collection process. Unless noted on the CPT logs, the lines designating the changes between various strata represent approximate boundaries. The stratification given on the CPT logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without Geotechnology's written approval.

The CPT soundings and related information depict subsurface conditions only at the specific locations and times where the soundings were conducted. The passage of time could result in changes in conditions, interpreted to exist, at the locations where CPT was conducted.

SECTION III – SUBSURFACE CONDITIONS

STRATIGRAPHY

We understand the stratigraphy within the ash ponds consists of fly ash to depths of approximately 25 feet in the Fly Ash Pond and approximately 25 feet in the Closed Ash Pond. The CPT data indicates interbedded layers of material that respond to CPT advancement similar to clay, silty clay, silty sand, and sand in the Fly Ash Pond and interbedded layers of sand and silty sand in the Closed Ash Pond. The interbedded nature of the CPT data interpretation is to be expected in an uncontrolled waste product such as fly ash. The laboratory testing indicates the sampled material in the Fly Ash Pond was fine grained in nature having approximately 98 and 99 percent passing the #200 sieve. The sampled material in the Closed Ash Pond indicates the material is coarser in nature with approximately 4 percent passing the #200 sieve.

GROUNDWATER

We understand that the groundwater within the ash ponds is typically perched in nature. Based on the CPT data, groundwater (i.e.,hydrostatic pressure) in the Fly Ash Pond appears to range from depths of approximately 15 to 17 feet below the ground surface. In the Closed Ash Pond, the groundwater (i.e., hydrostatic pressure) appears to range from depths of approximately 26 to 29 feet below the ground surface. Groundwater levels might vary over time due to the effects of seasonal variation in precipitation, recharge, stage of the Illinois River, or other factors not evident at the time of exploration.

SECTION IV – LIQUEFACTION ANALYSIS

Geotechnology analyzed the CPT data for liquefaction potential and dynamic (post-liquefaction) settlement using the CLiq software. CLiq utilizes the analysis method published by Idriss and Boulanger in 2008 and updated in 2014. Based on ASCE 7-10, a design PGA of 0.08g and an earthquake magnitude of 7.5 where used in this analysis. The analysis incorporated the results of the laboratory tests to refine the fines content within the soundings. Based on the liquefaction analysis, it does not appear that the ash ponds have potentially liquefiable layers, i.e. where the calculated factor of safety (F.O.S) is less than 1.0, under the analyzed seismic loading. Liquefaction analysis results for each CPT sounding to the depths pushed are presented in Appendix E.

Geotechnology, Inc. performed seismic and static stability analysis of the embankments and impounded ash. This stability analysis was submitted to the Illinois Department of Natural Resources (IDNR) and approved in 2017. The Closed Ash Pond was reported closed with a soil cap in the 1970s.

Liquefaction Potential Index (LPI[1]) indices are all less than 0, which indicates a **very low risk of liquefaction**. LPI attempts to predict the potential of liquefaction to cause damage to surface features and provide a measure of the severity of liquefaction and has a scale of 0 to 20. *For reference an LPI of 0 indicates a very low liquefaction risk and a LPI of less than 5 indicates a low risk of liquefaction*.

The fluidity of the impounded material was also considered. The elevated or perched groundwater conditions suggest that some level of saturation of the impounded material is possible, especially if the Illinois River is at flood stage. The fines content determined from laboratory testing indicates the impounded material will behave similarly to silts and clays. As such, when saturated, the impounded material would potentially be less fluid than a similarly placed sand material.

SECTION V – CONCLUSIONS

Based on the results of the liquefaction analysis and the seismic and static stability analysis performed by Geotechnology, Inc., it is Geotechnology's opinion that there is a very low risk of surface manifestation of liquefaction or damage to the Fly Ash Pond and Closed Ash Pond embankments during a seismic event.

---

[1] David Kun Li, C Hsein Juang, Ronald D. Andrus, *Liquefaction Potential Index: A Critical Assessment Using Probability Concept* Journal of GeoEngineering, Vol.1, No.1, August 2006, pp. 11-24,

SECTION VI - LIMITATIONS OF REPORT

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

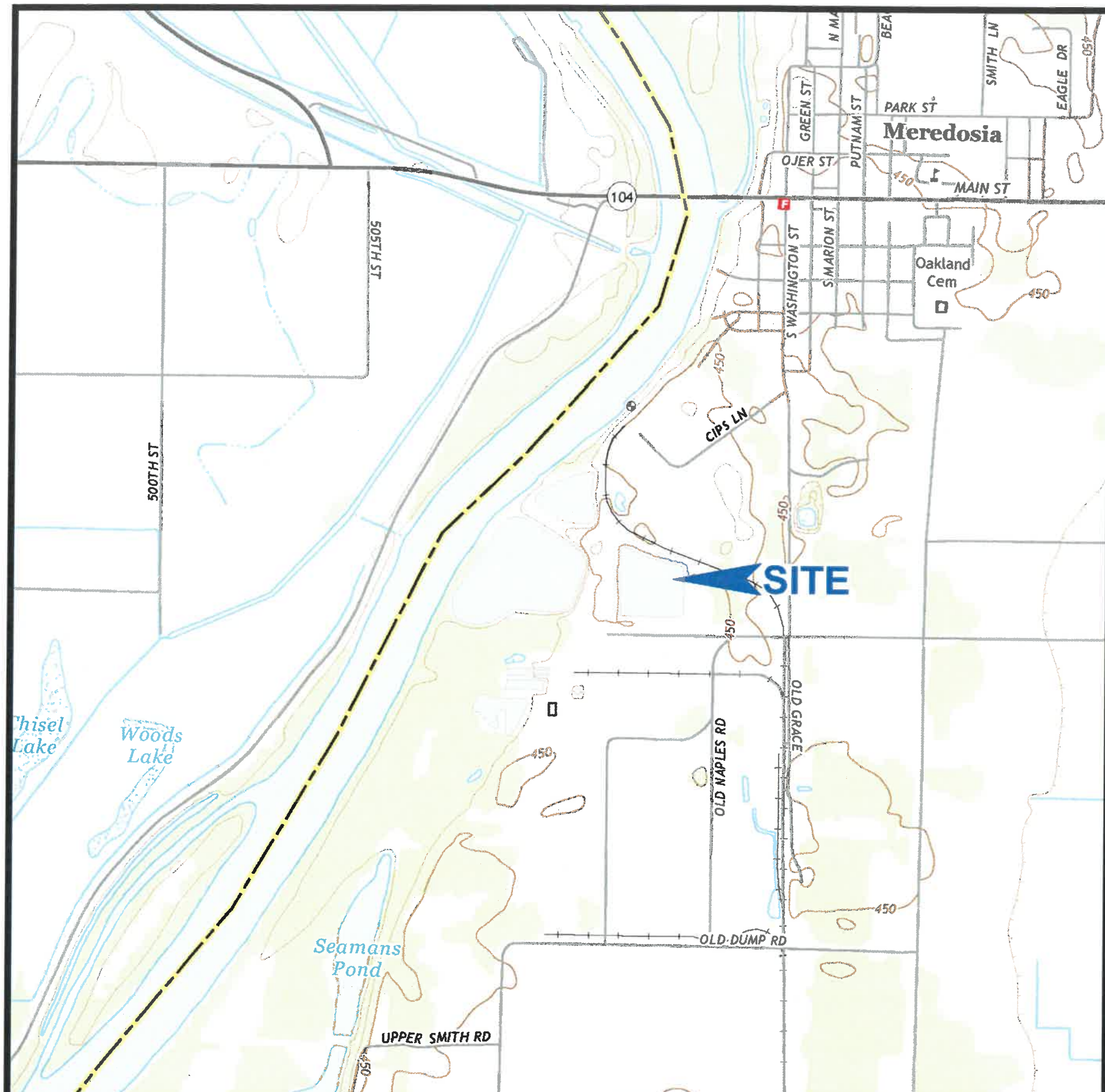
Our scope of service for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope of service did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the subsurface exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions may vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a substantial lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report.–Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that may be evaluated further during earthwork and foundation construction. Geotechnology should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

"Important Information about This Geotechnical-Engineering Report" published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA) is included as Appendix A. That document discusses some other limitations, as well as ways to manage risk associated with subsurface conditions.



NOTES

1. Plan adapted from a 7.5 minute U.S.G.S. map for Meredosia, Illinois quadrangle, last revised in 2015.

0 2,000 4,000
SCALE IN FEET

Drawn By: WAH	Ck'd By: BSS	App'vd By: CKK
Date: 6-27-17	Date: 9-20-17	Date: 9-20-17

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Ash Pond
Liquefaction Analysis
Meredosia, Illinois

SITE LOCATION AND TOPOGRAPHY

Project Number J024917.03

PLATE 1

N

NOTES

1. Plan adapted from an August 23, 2015 aerial photograph courtesy of Google Earth and drawings based on topography obtained by AeroView in October 2015 and supplied by the client.
2. CPT soundings were located in the field with reference to existing site features and are shown approximate only.

LEGEND

● CPT Sounding Location

N

0 300 600

SCALE IN FEET

Drawn By: WAH	Ck'd By: BJS	App'vd By: CKK
Date: 6-27-17	Date: 9-20-17	Date: 9-20-17

GEOTECHNOLOGY INC
FROM THE GROUND UP

Meredosia Ash Pond
Liquefaction Analysis
Meredosia, Illinois

AERIAL PHOTOGRAPH OF SITE AND CPT SOUNDING LOCATIONS

Project Number J024917.03

PLATE 2

APPENDIX A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL-ENGINEERING REPORT

Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

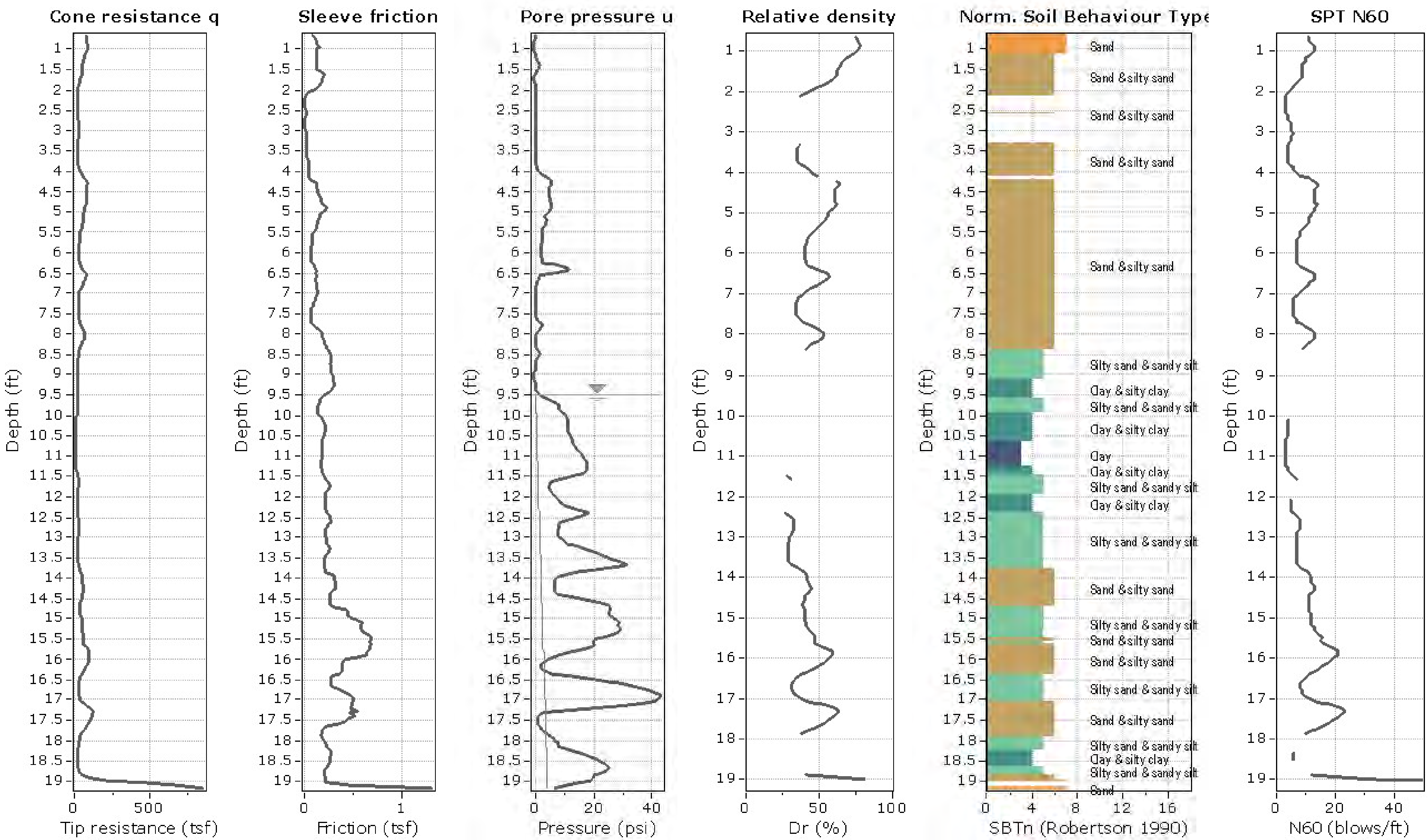
APPENDIX B

CPT SOUNDING LOGS, INTERPRETATIONS, AND ESTIMATIONS

Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: Meridosia Ash Pond
Location: Meridosia, IL

C01
Total depth: 19.17 ft, Date: 6/20/2017
Coords: lat 39.81785° lon -90.57078°
Cone Type: 15cm2
Cone Operator: DWJ

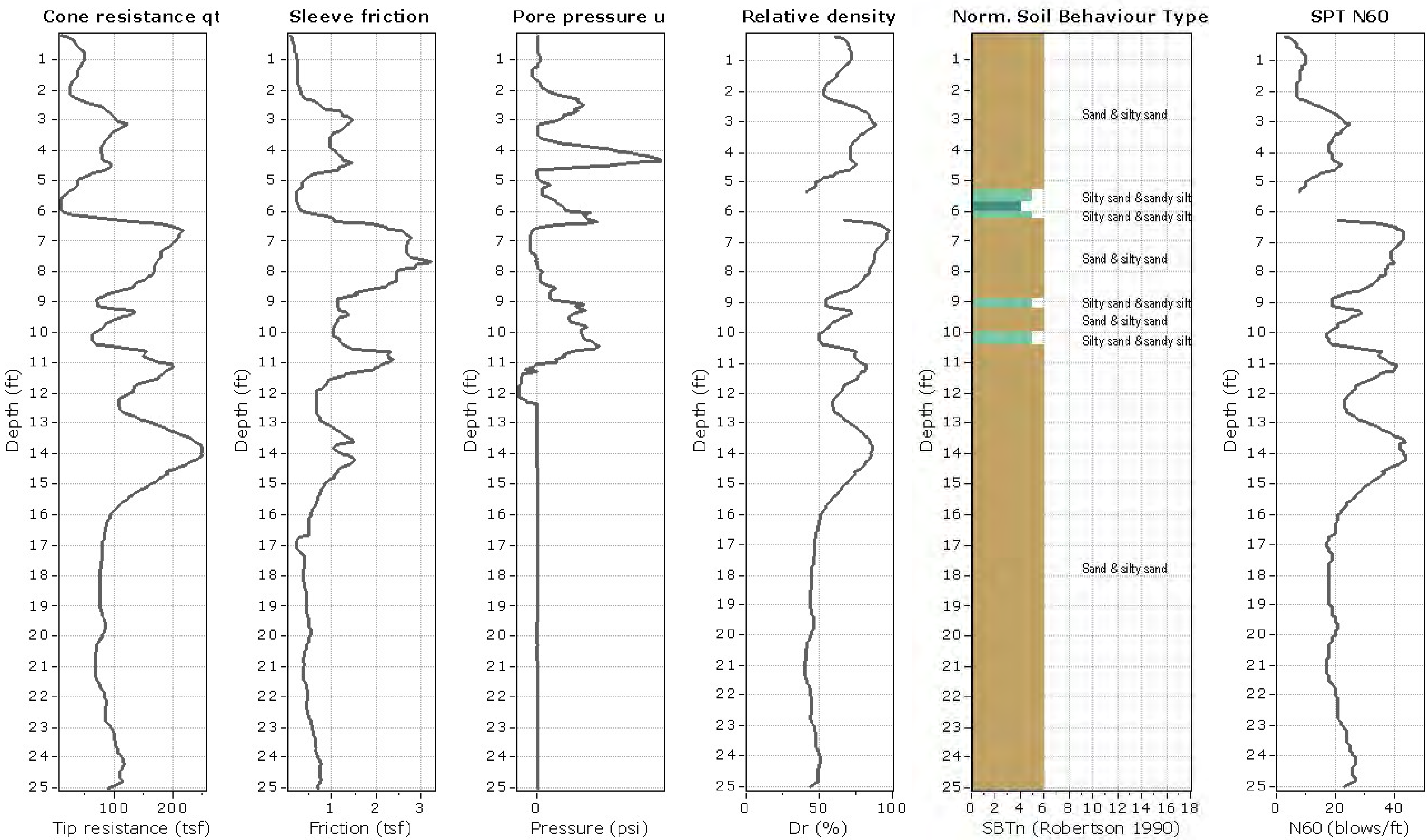


Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C02

Total depth: 25.02 ft, Date: 6/6/2017
Coords: lat 39.816763° lon -90.569358°
Cone Type: 15cm2
Cone Operator: DWJ

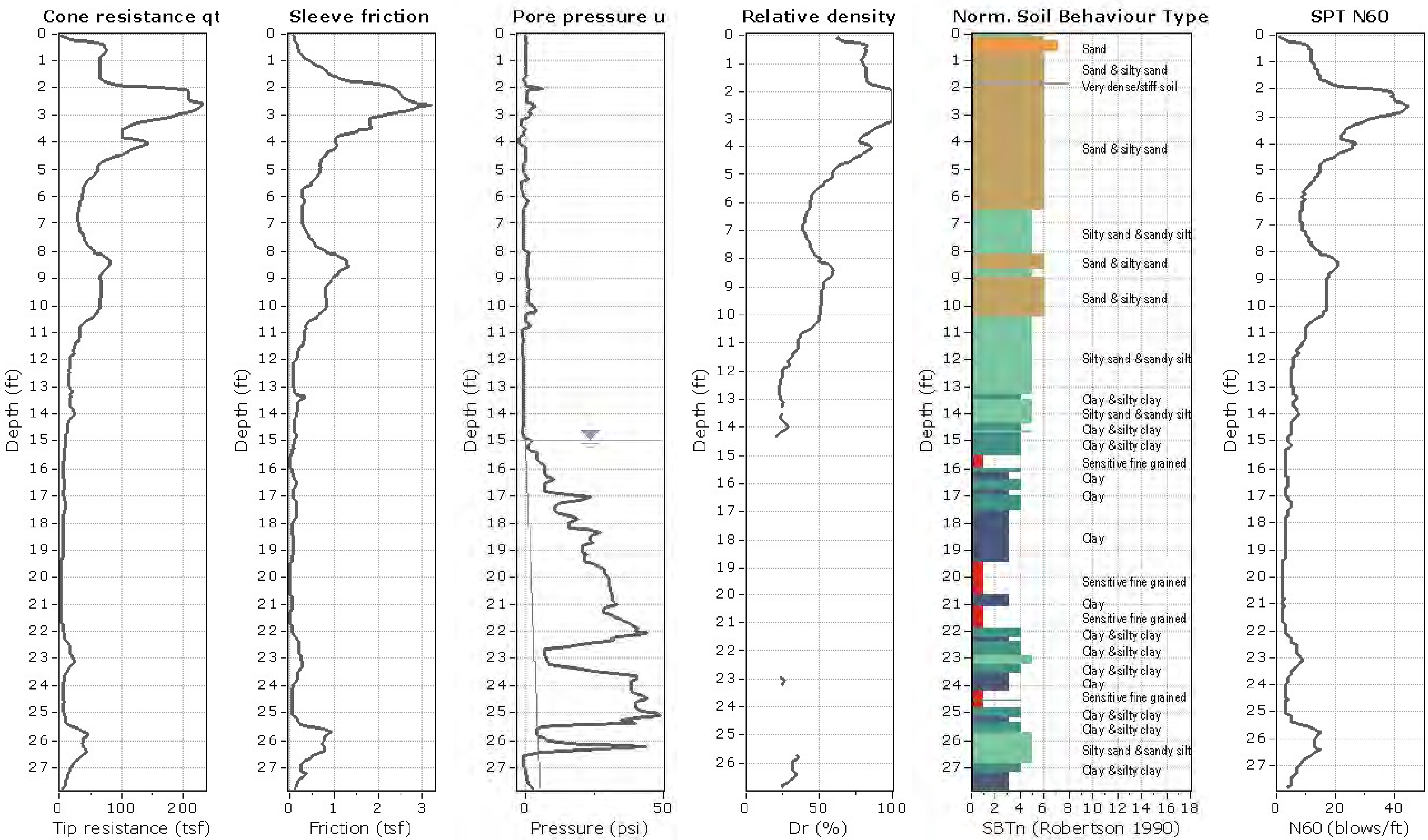
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

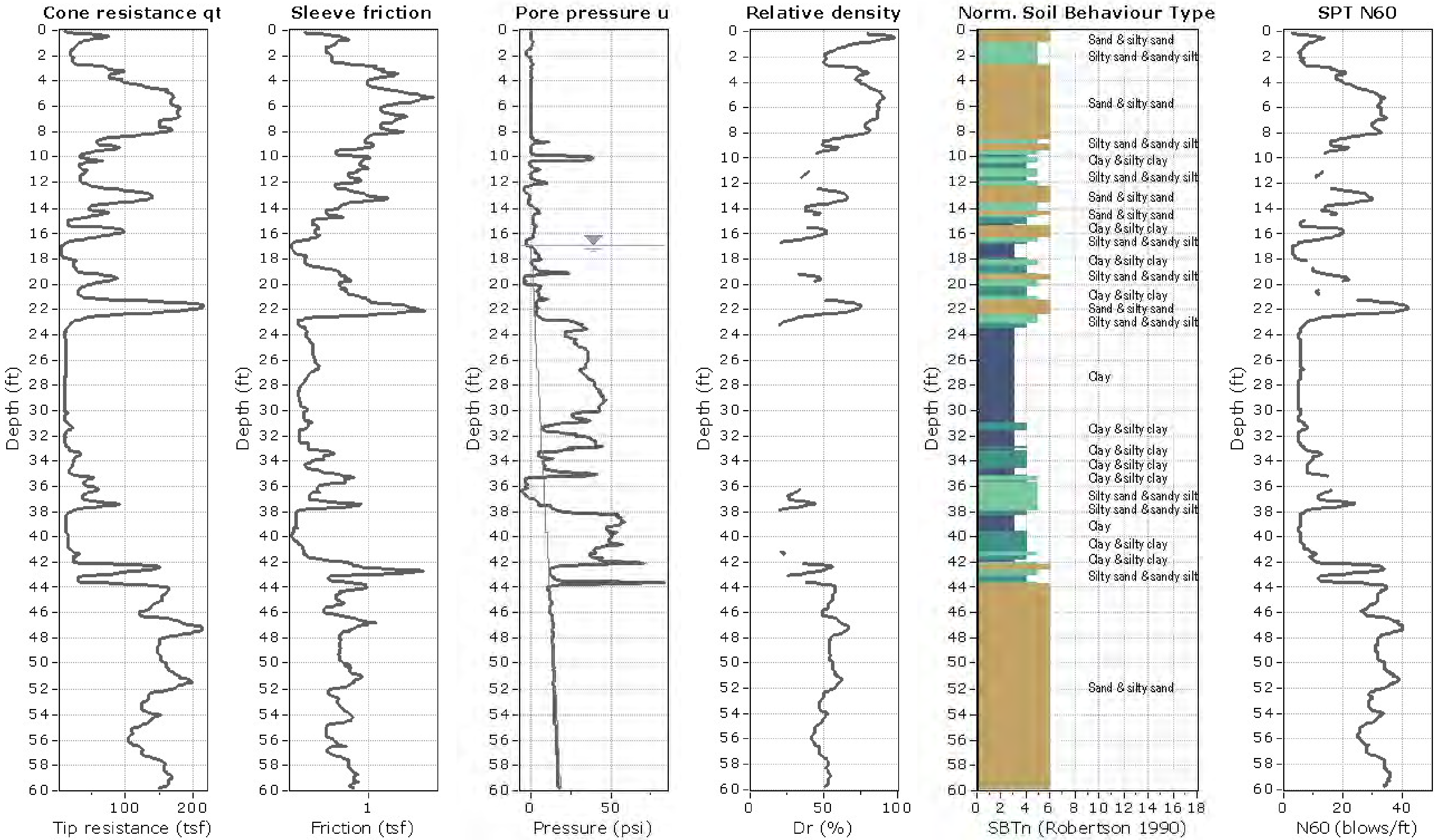
C03
Total depth: 27.76 ft, Date: 6/6/2017
Coords: lat 39.816228° lon -90.572783°
Cone Type: 15cm2
Cone Operator: DWJ



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C04
Total depth: 59.80 ft, Date: 6/6/2017
Coords: lat 39.816732° lon -90.57602°
Cone Type: 15cm2
Cone Operator: DWJ

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

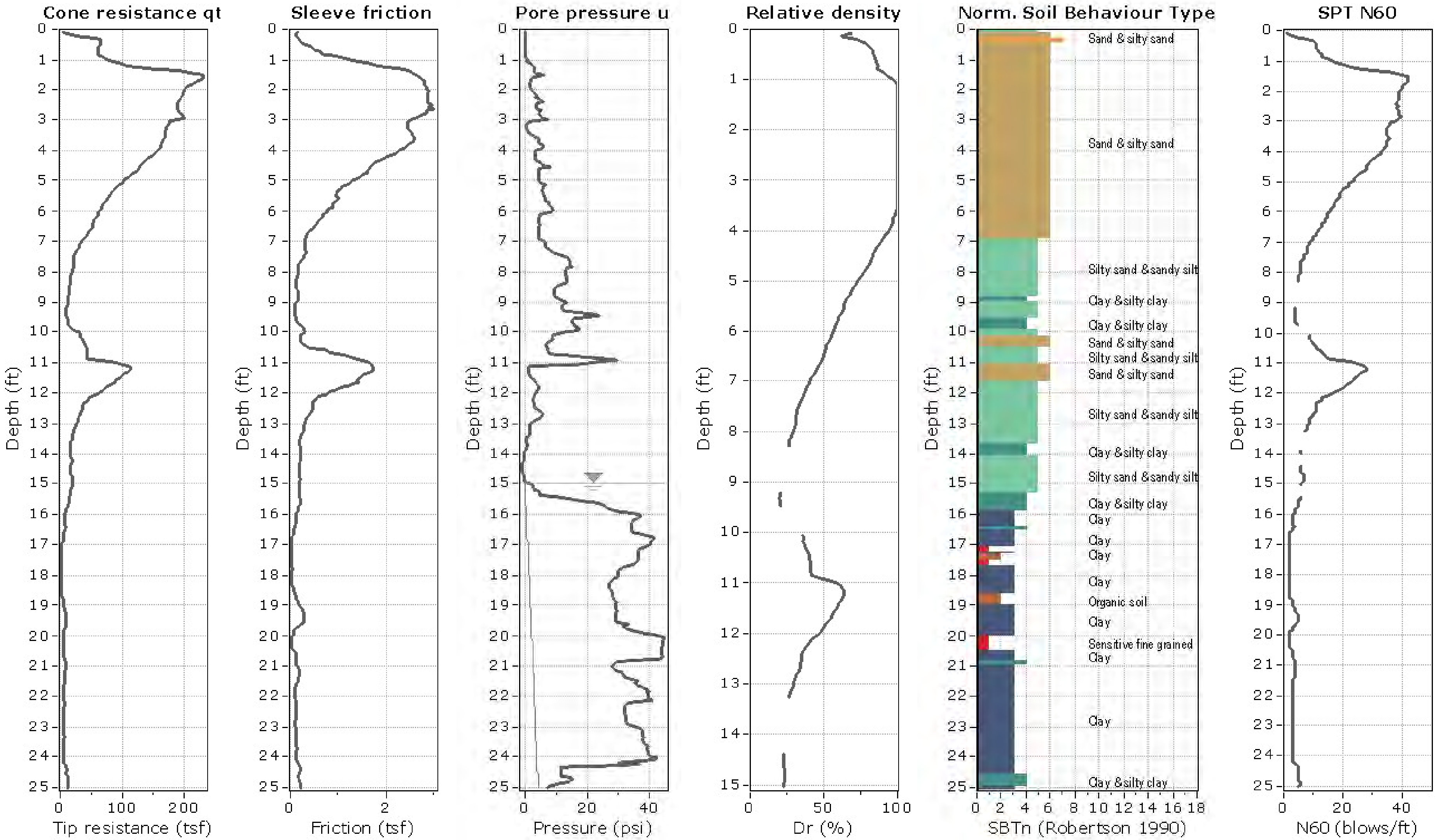


Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C05

Total depth: 25.02 ft, Date: 6/6/2017
Coords: lat 39.81905° lon -90.573843°
Cone Type: 15cm2
Cone Operator: DWJ

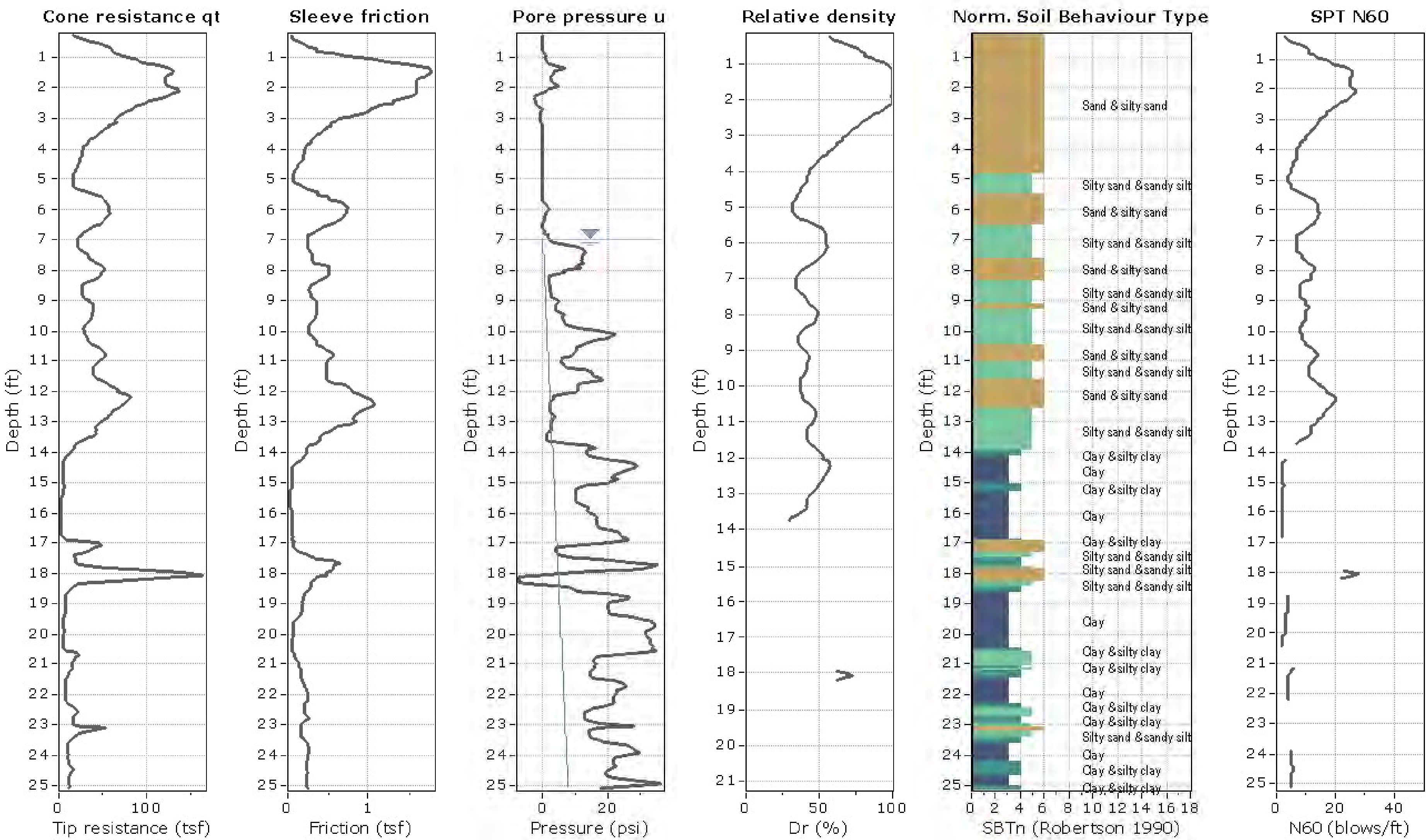
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C06
Total depth: 25.08 ft, Date: 6/6/2017
Coords: lat 39.817665° lon -90.574332°
Cone Type: 15cm2
Cone Operator: DWJ

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

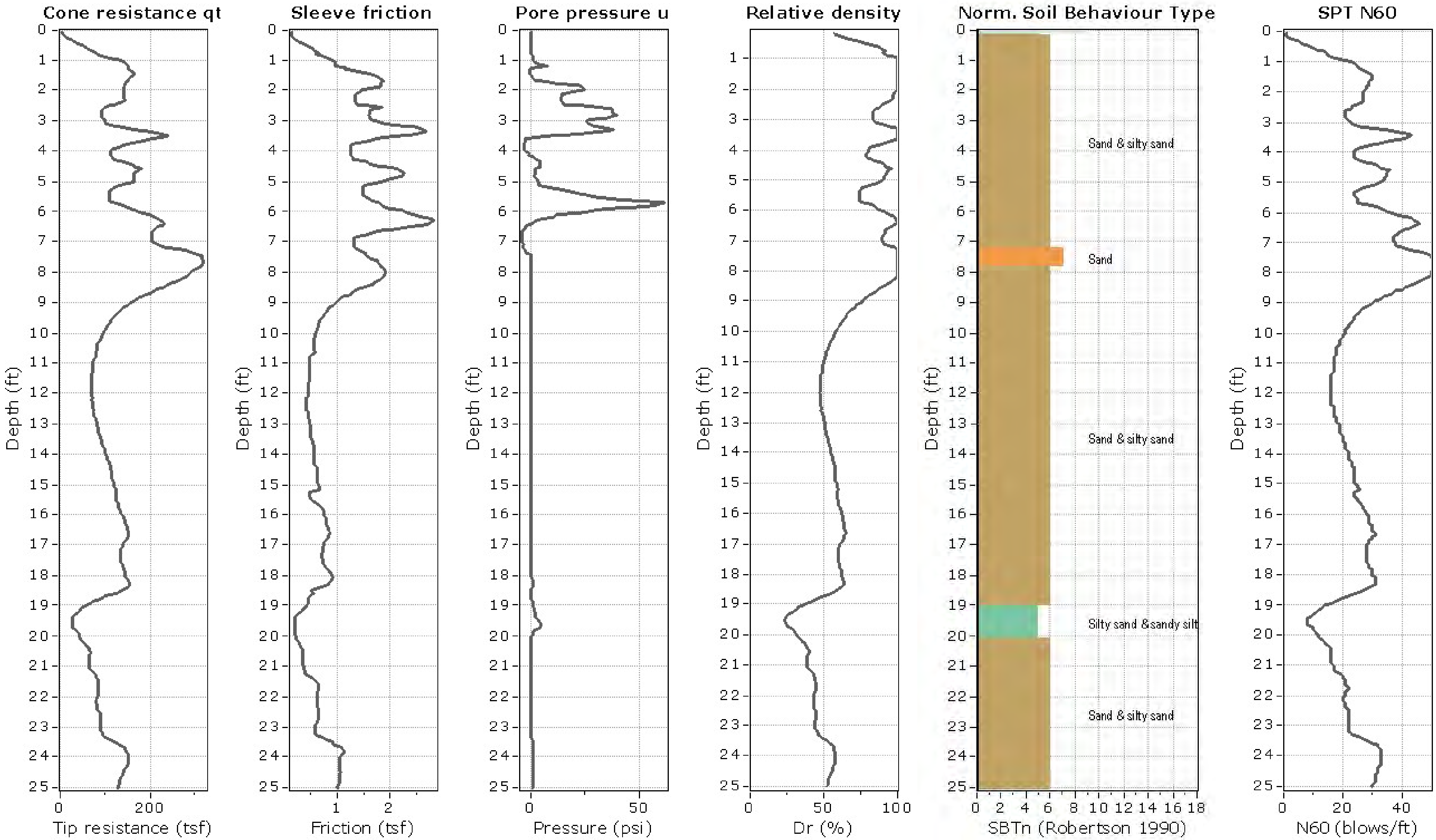


Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C07

Total depth: 25.01 ft, Date: 6/6/2017
Coords: lat 39.818095° lon -90.569087°
Cone Type: 15cm2
Cone Operator: DWJ

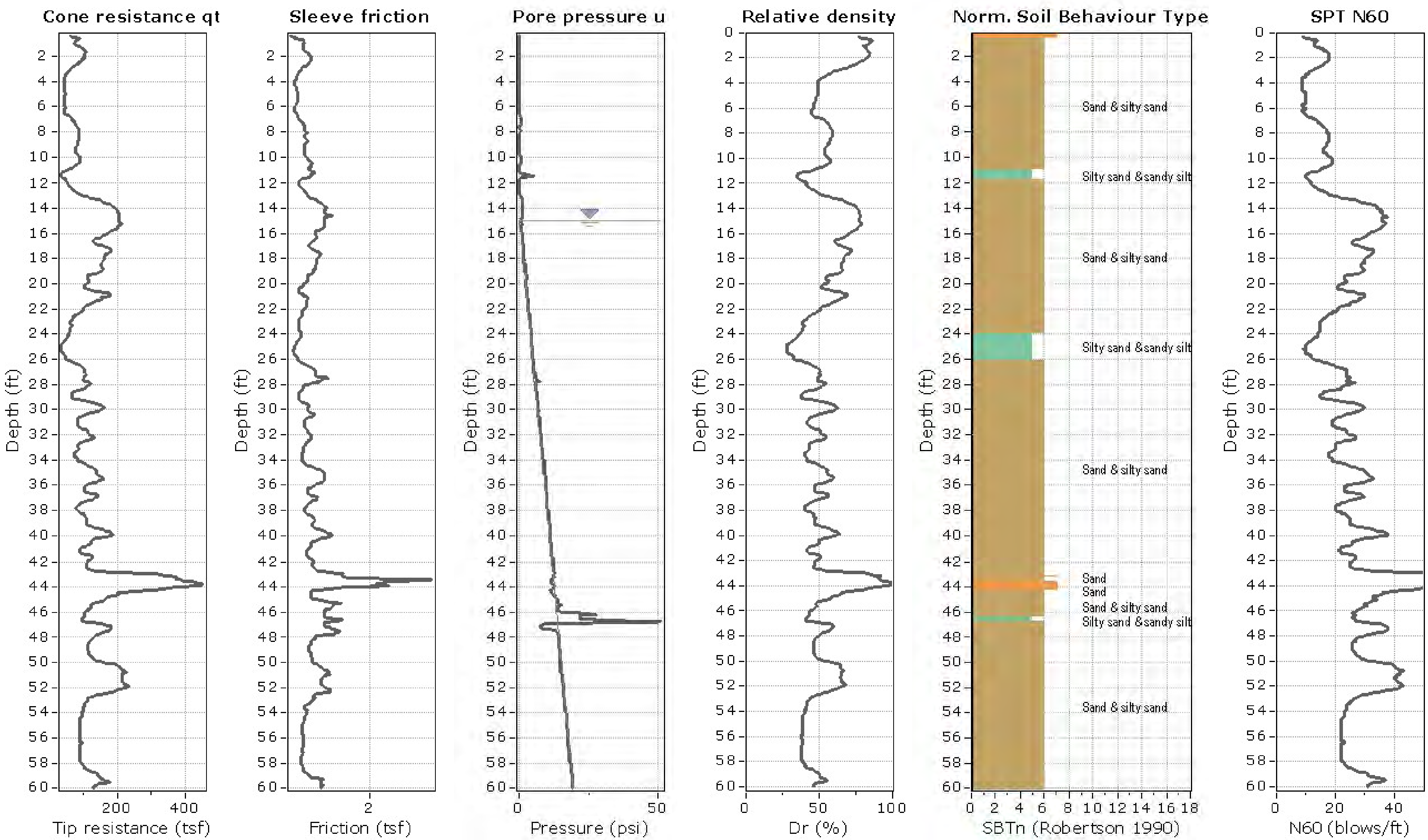
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

C08
Total depth: 59.99 ft, Date: 6/6/2017
Coords: lat 39.815977° lon -90.576365°
Cone Type: 15cm2
Cone Operator: DWJ

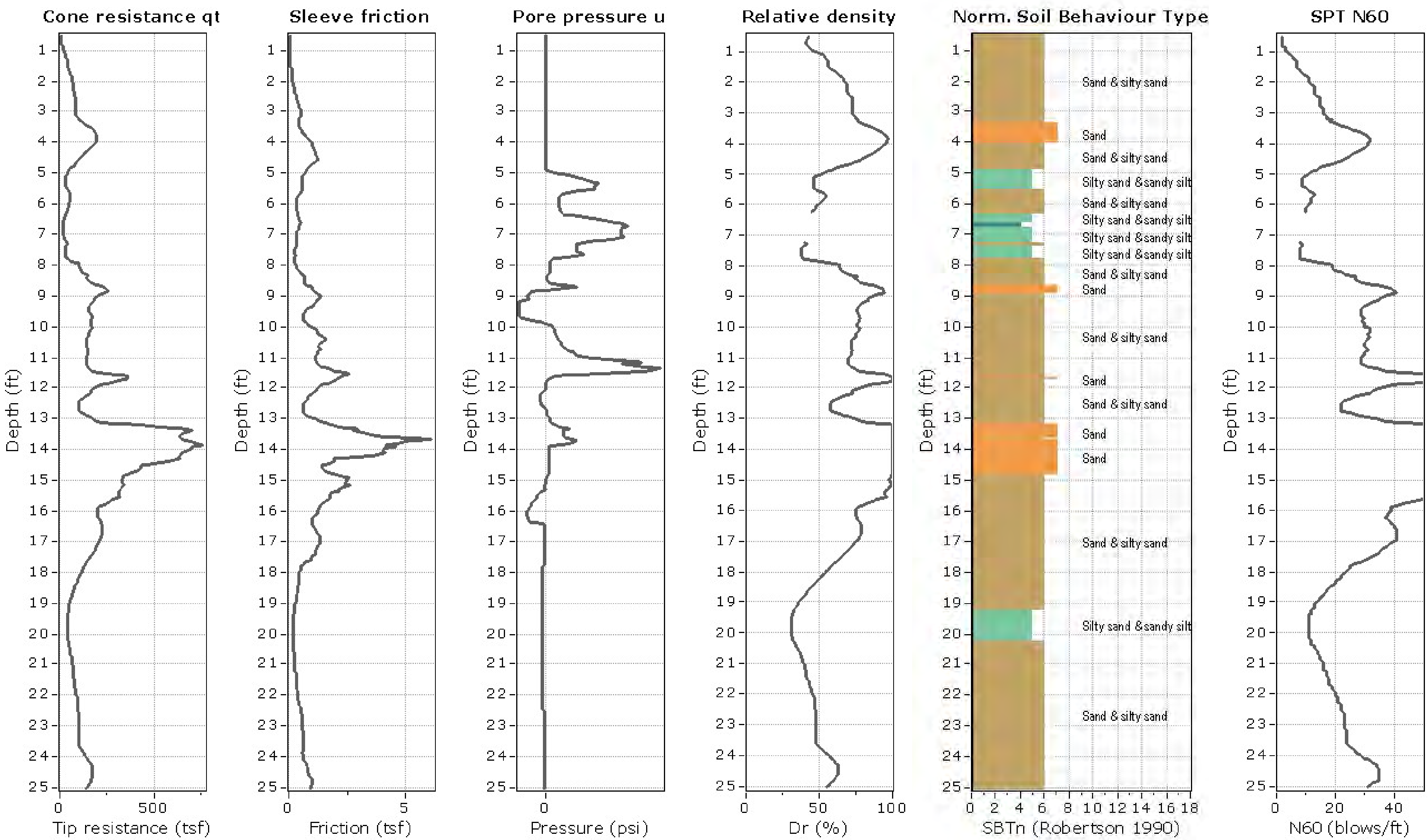
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

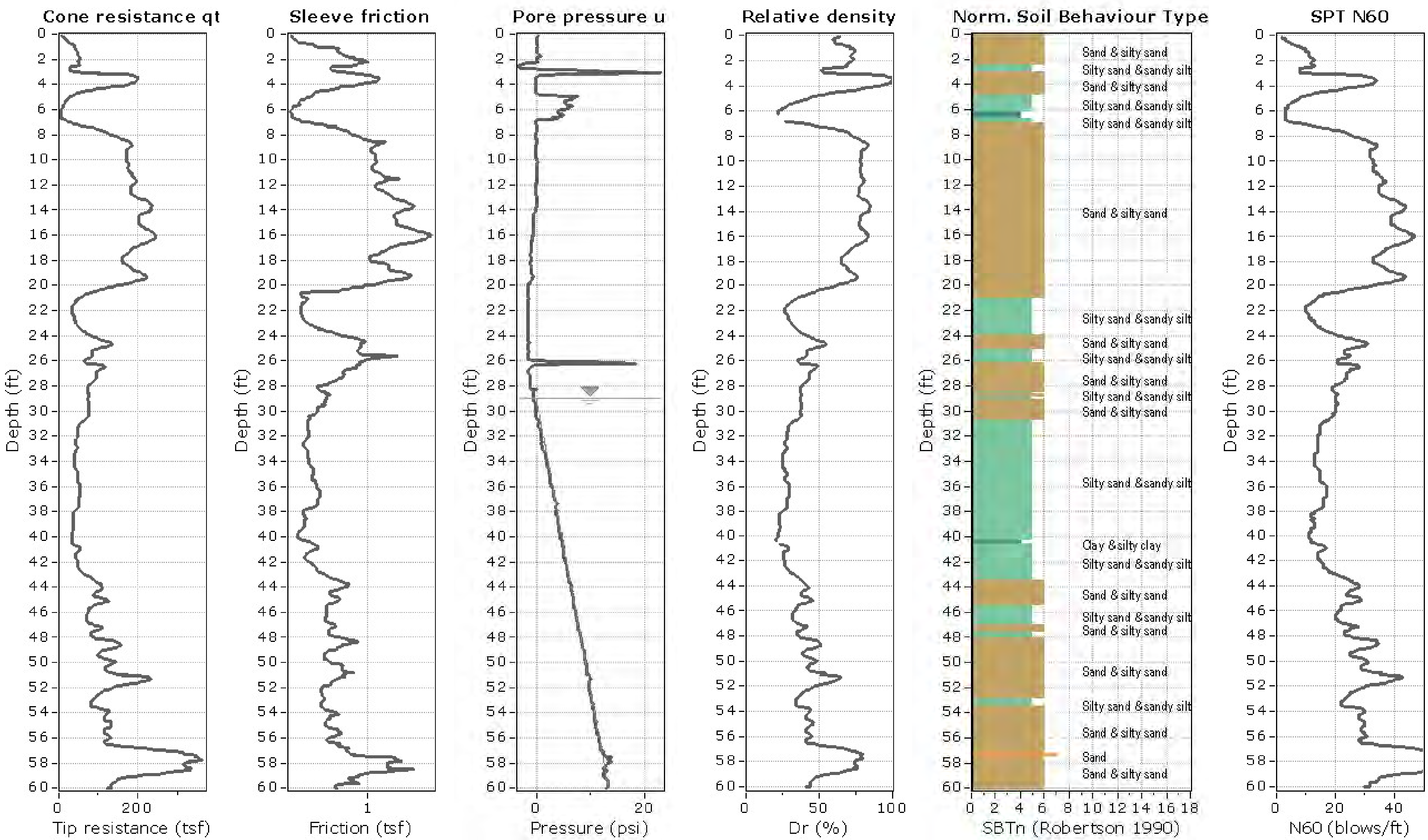
O01
Total depth: 25.02 ft, Date: 6/6/2017
Coords: lat 39.818205° lon -90.56809°
Cone Type: 15cm2
Cone Operator: DWJ



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

O02
Total depth: 60.05 ft, Date: 6/6/2017
Coords: lat 39.817595° lon -90.565527°
Cone Type: 15cm2
Cone Operator: DWJ

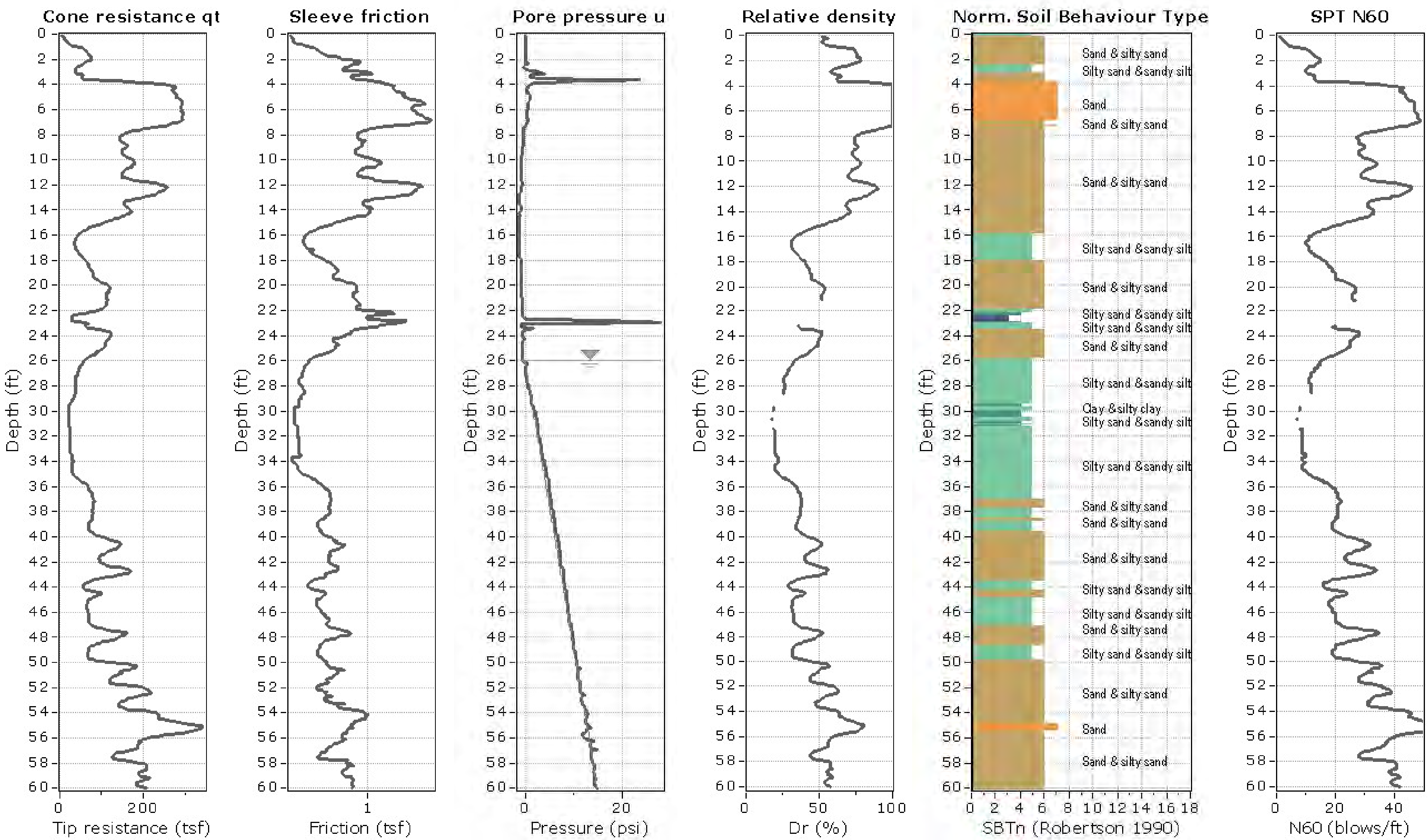


Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

O03

Total depth: 59.99 ft, Date: 6/6/2017
Coords: lat 39.815937° lon -90566513°
Cone Type: 15cm2
Cone Operator: DWJ

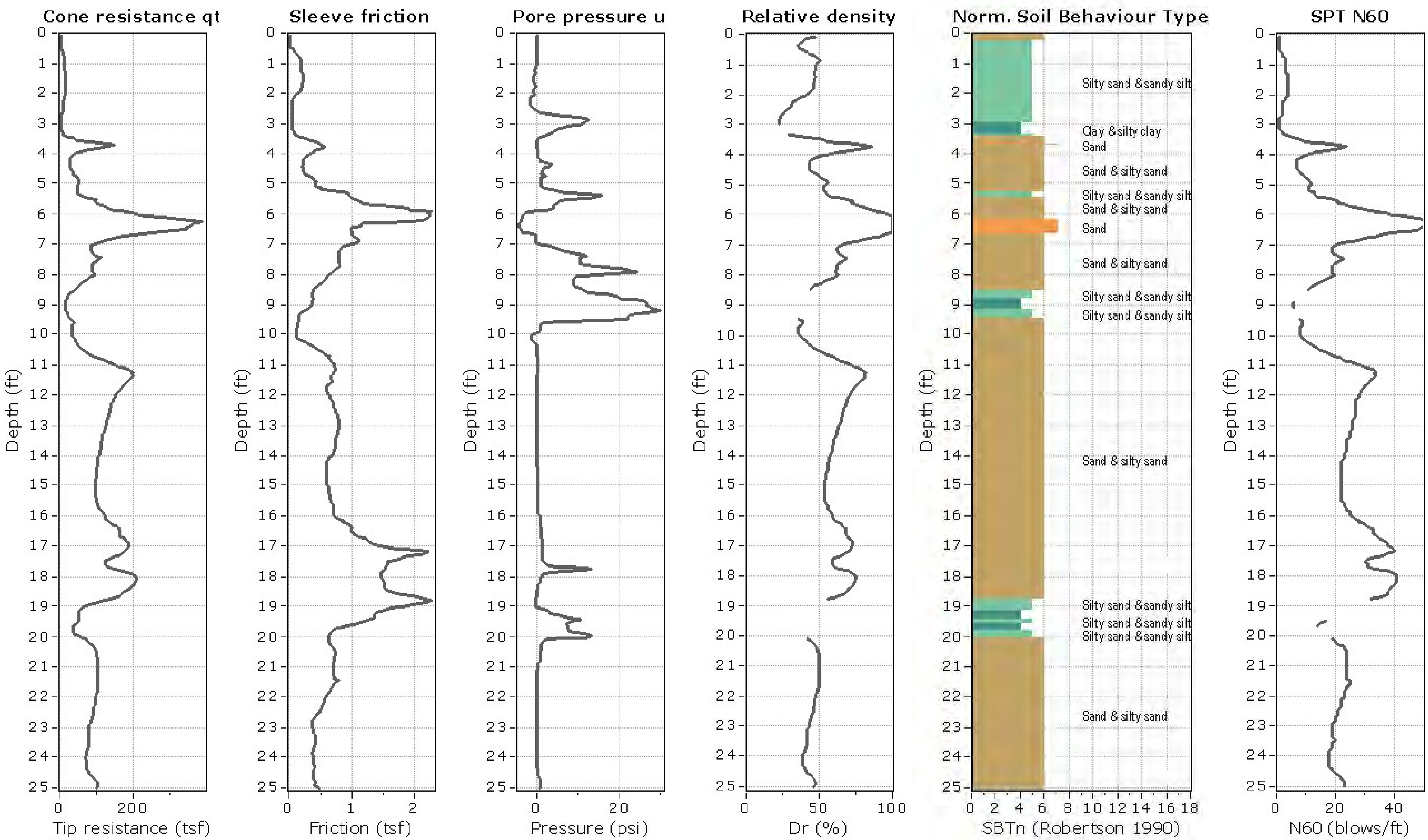
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

O04
Total depth: 25.02 ft, Date: 6/6/2017
Coords: lat 39.81632° lon -90.568385°
Cone Type: 15cm2
Cone Operator: DWJ



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

Project: Meridosia Ash Pond
Location: Meridosia, IL

O05
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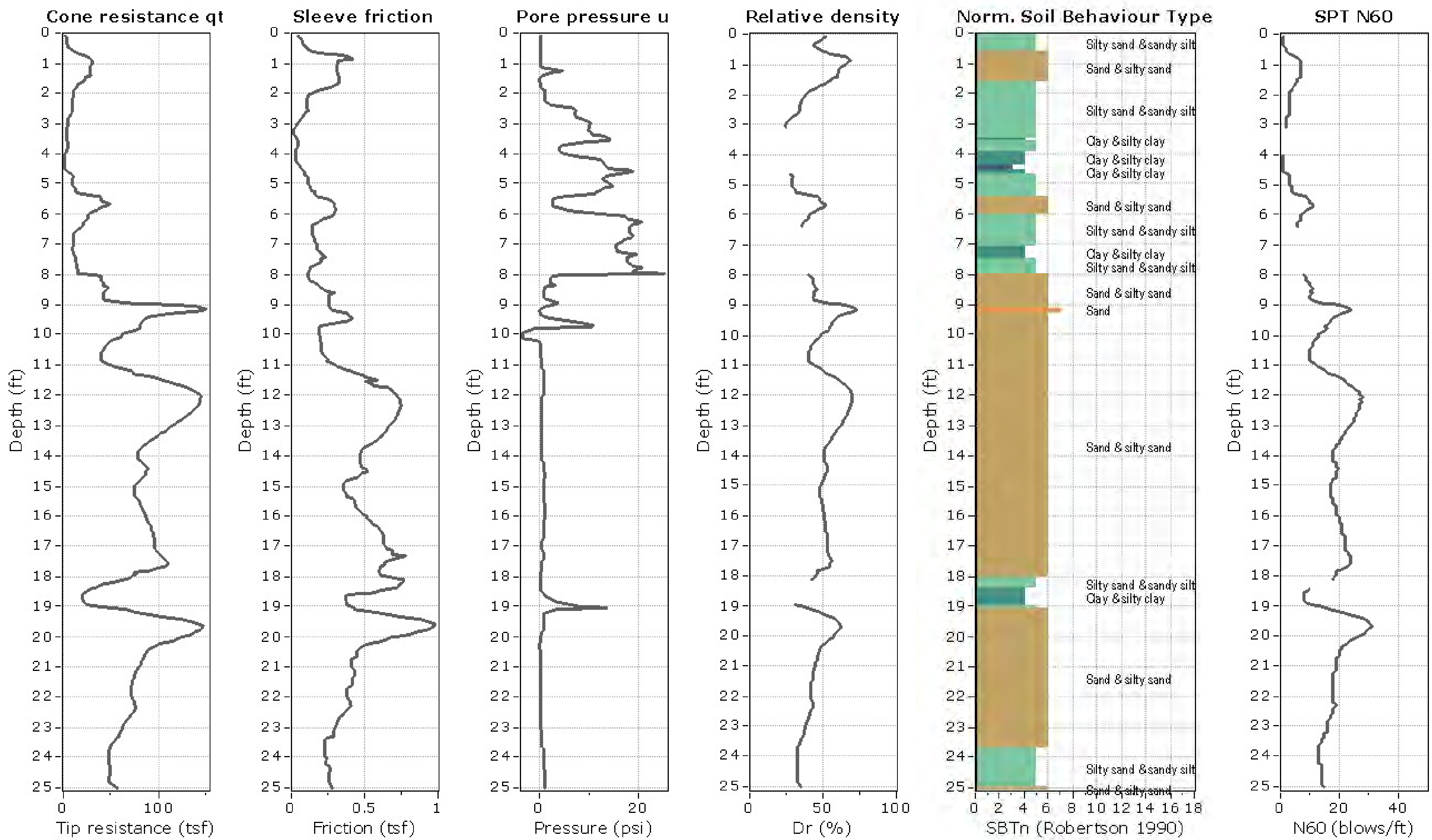
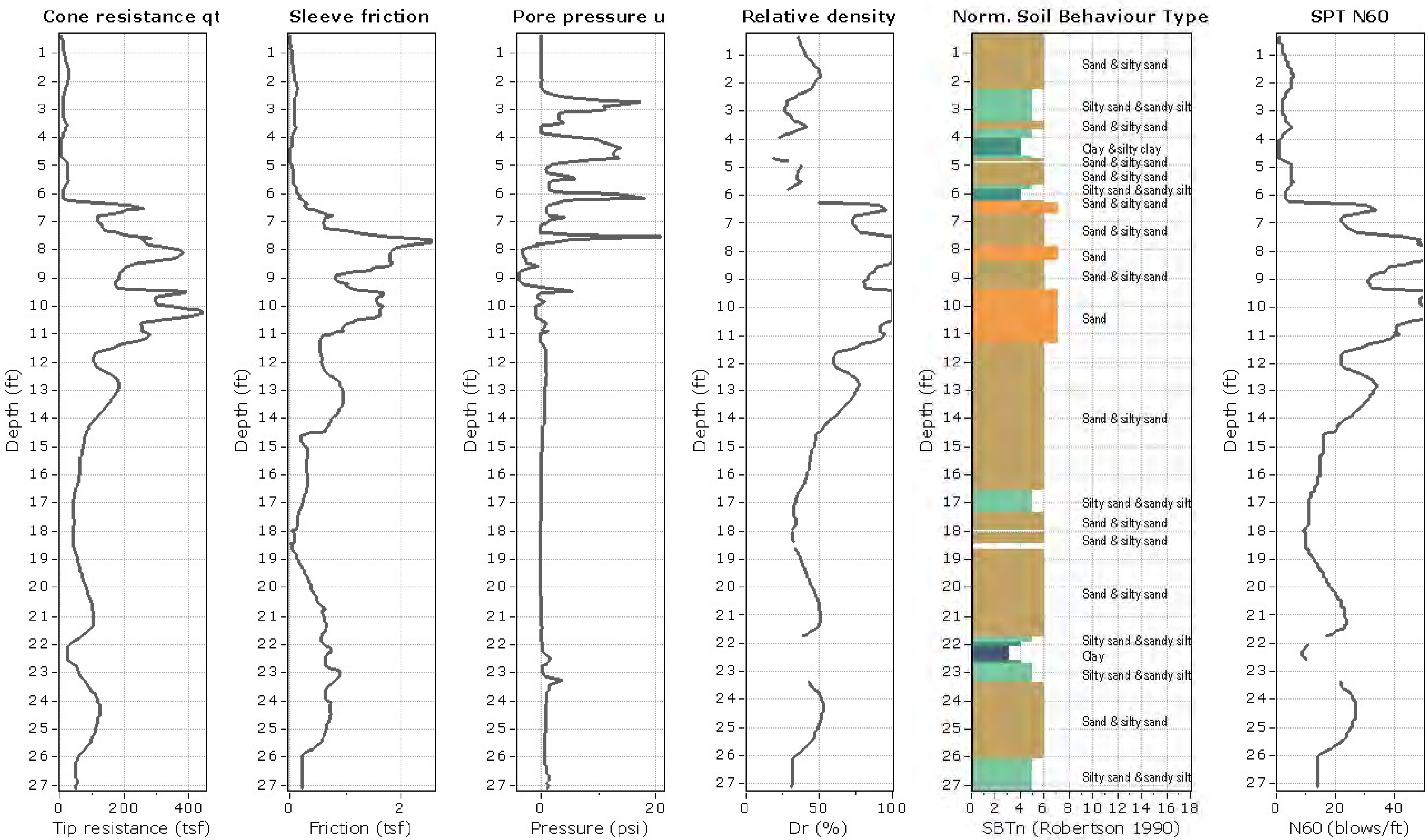
Coords: lat 39.816532° lon -90.582468°
Cone Type: 15cm2
Cone Operator: DWJ



Geotechnology, Inc
11816 Lackland Road
St. Louis, Missouri
http://www.geotechnology.com

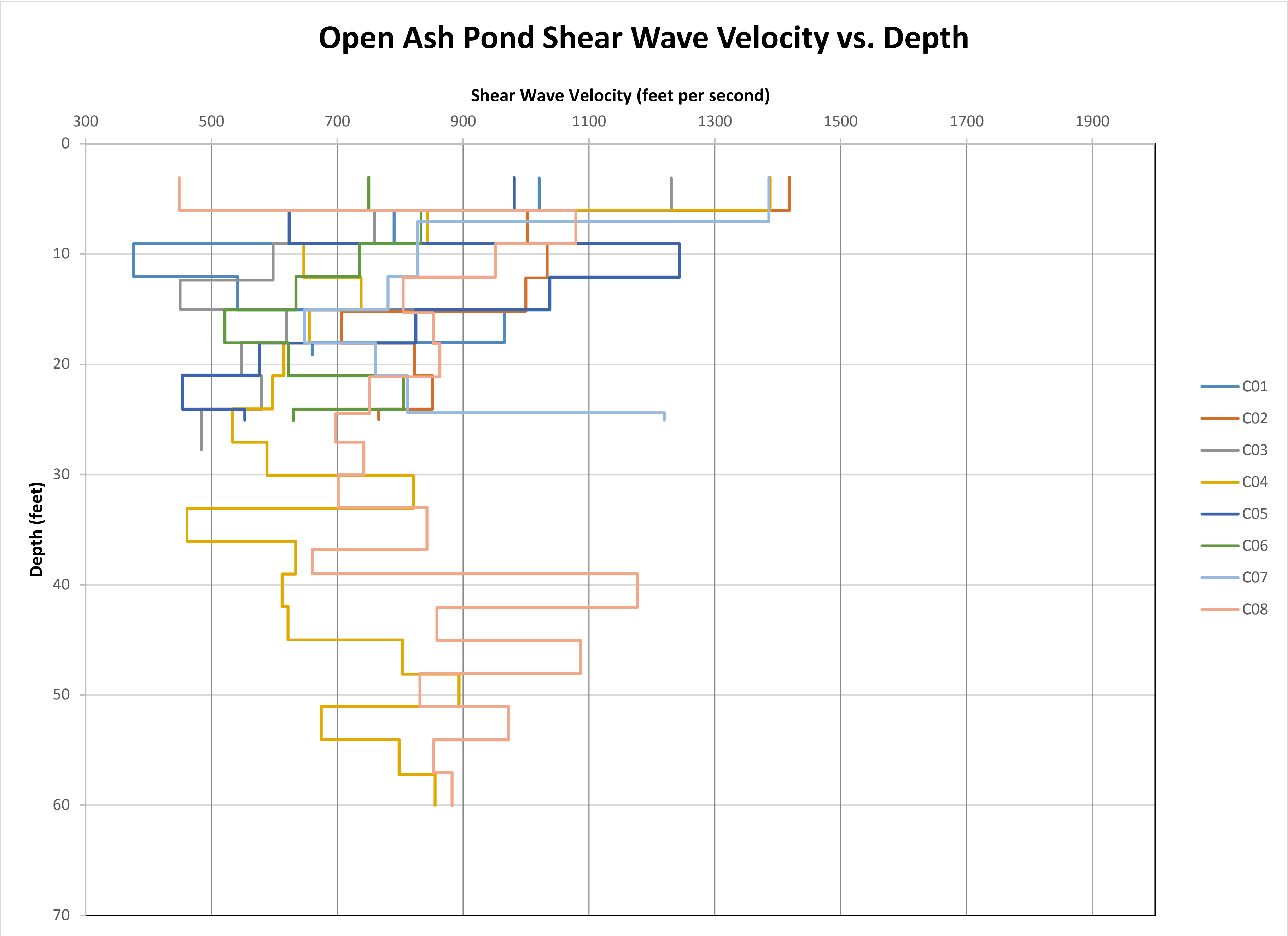
Project: **Meridosia Ash Pond**
Location: **Meridosia, IL**

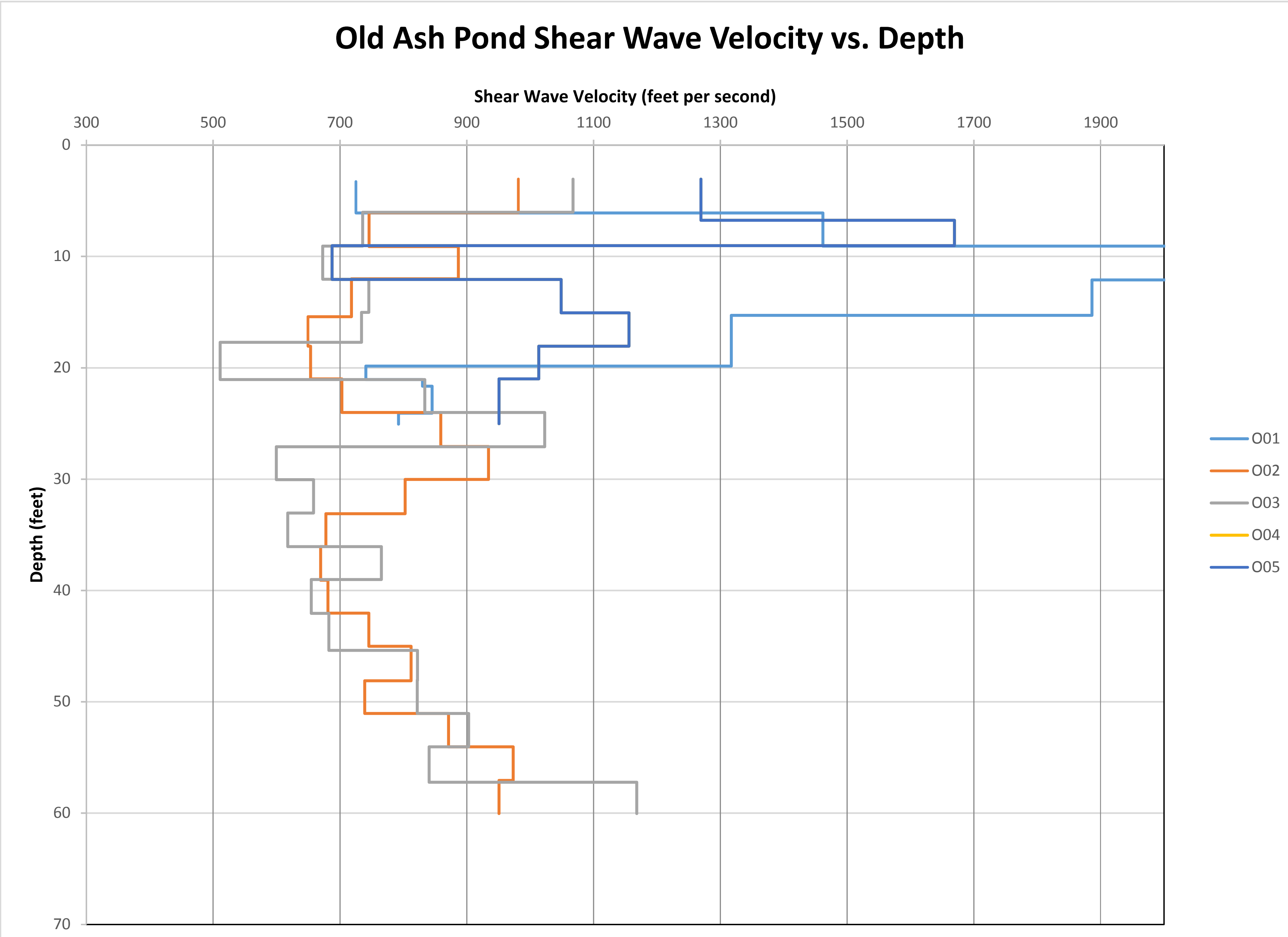
O06
Total depth: 27.13 ft, Date: 6/6/2017
Coords: lat 39.800462° lon -90.56739°
Cone Type: 15cm2
Cone Operator: DWJ



APPENDIX C

SHEAR WAVE VELOCITY RESULTS


Open Ash Pond Shear Wave Velocity vs. Depth
Shear Wave Velocity (feet per second)
300
500
700
900
1100
1300
1500
1700
1900
Depth (feet)
0
10
20
30
40
50
60
70
C01
C02
C03
C04
C05
C06
C07
C08


Old Ash Pond Shear Wave Velocity vs. Depth
Shear Wave Velocity (feet per second)
300
500
700
900
1100
1300
1500
1700
1900
0
10
20
30
40
50
60
70
Depth (feet)
O01
O02
O03
O04
O05

APPENDIX D

LABORATORY TEST RESULTS

PERCENT FINES (ASTM D 1140)

GEOTECHNOLOGY INC
FROM THE GROUND UP

DATE June 16, 2017	PROJECT NAME Meridosia Ash Pond Liquefaction Analysis	PROJECT NO.: J024917.03

Balance Used: BA- 17 Oven Used: OV- 9

Test Method: [x] Method A [ ] Method B Soaking length (min.) ____

Dry Mass determined: [ ] Directly [ ] From water content of Spec.

Boring No.	Sample No.	Depth (ft)	Sieve No. Used SV-200-	Visual Identification (Color, Group Name & Symbol)	Tare Number / Tare Mass (g)	Initial Dry Mass of Soil (g)	Dry Mass of Soil after Washing & Shaking over 75 µm Sieve (g)	% Passing 75 µm Sieve (%)
005A		12-16			KS-9 / 110.74	118.19	113.78	3.7
005A		20-24			KS-13 / 110.92	123.57	118.68	4.0
C01A		8-12			KS-10 / 115.05	78.54	1.38	98.2
C01A		16-20			KS-12 / 110.89	107.75	0.85	99.2

REMARKS

Tested By: AT Date: 06/16/17

Calculated By: AB Date: 06/19/17

Checked By: EG Date: 06/19/17

APPENDIX E

LIQUEFACTION ANALYSIS RESULTS

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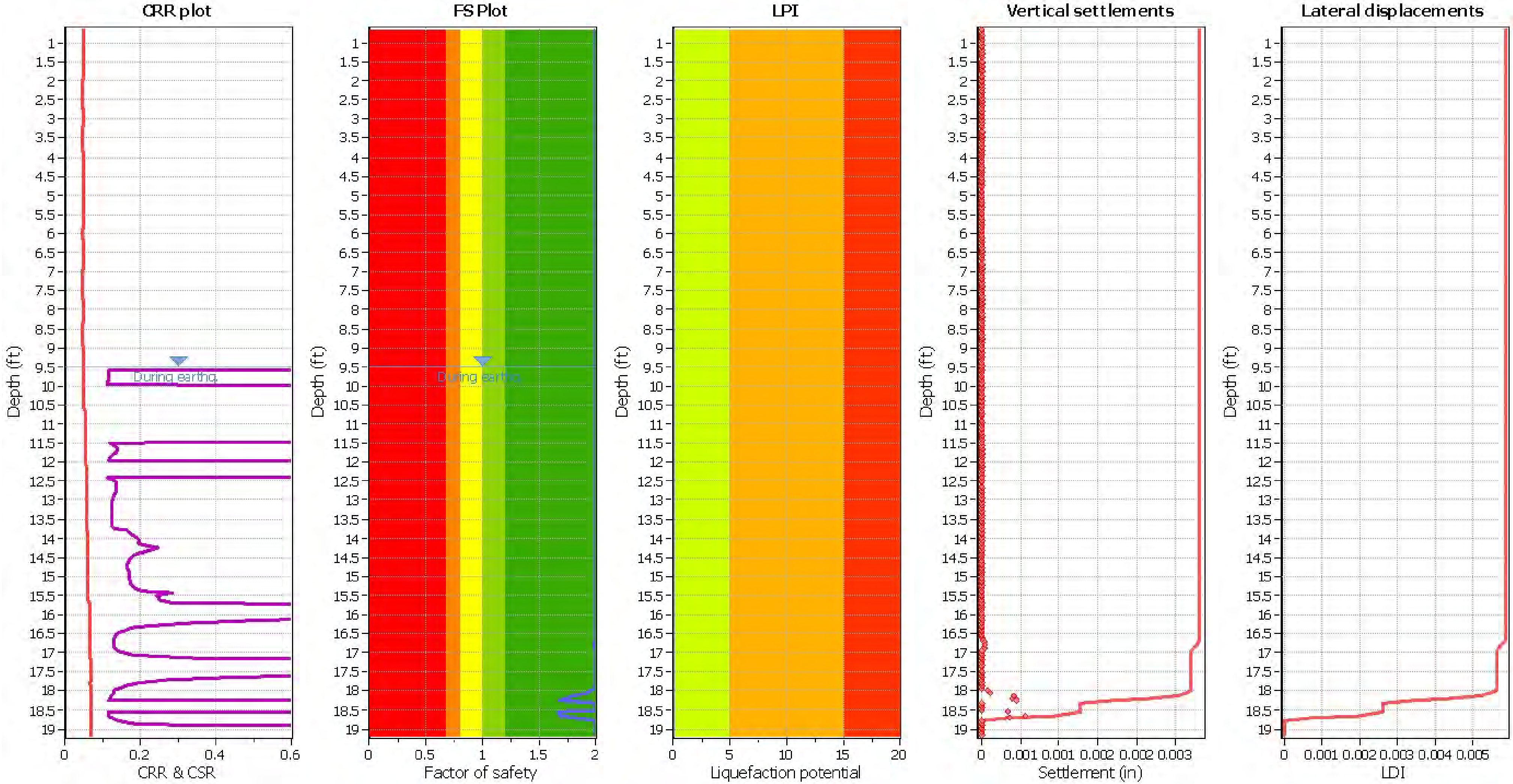
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	9.50 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	9.50 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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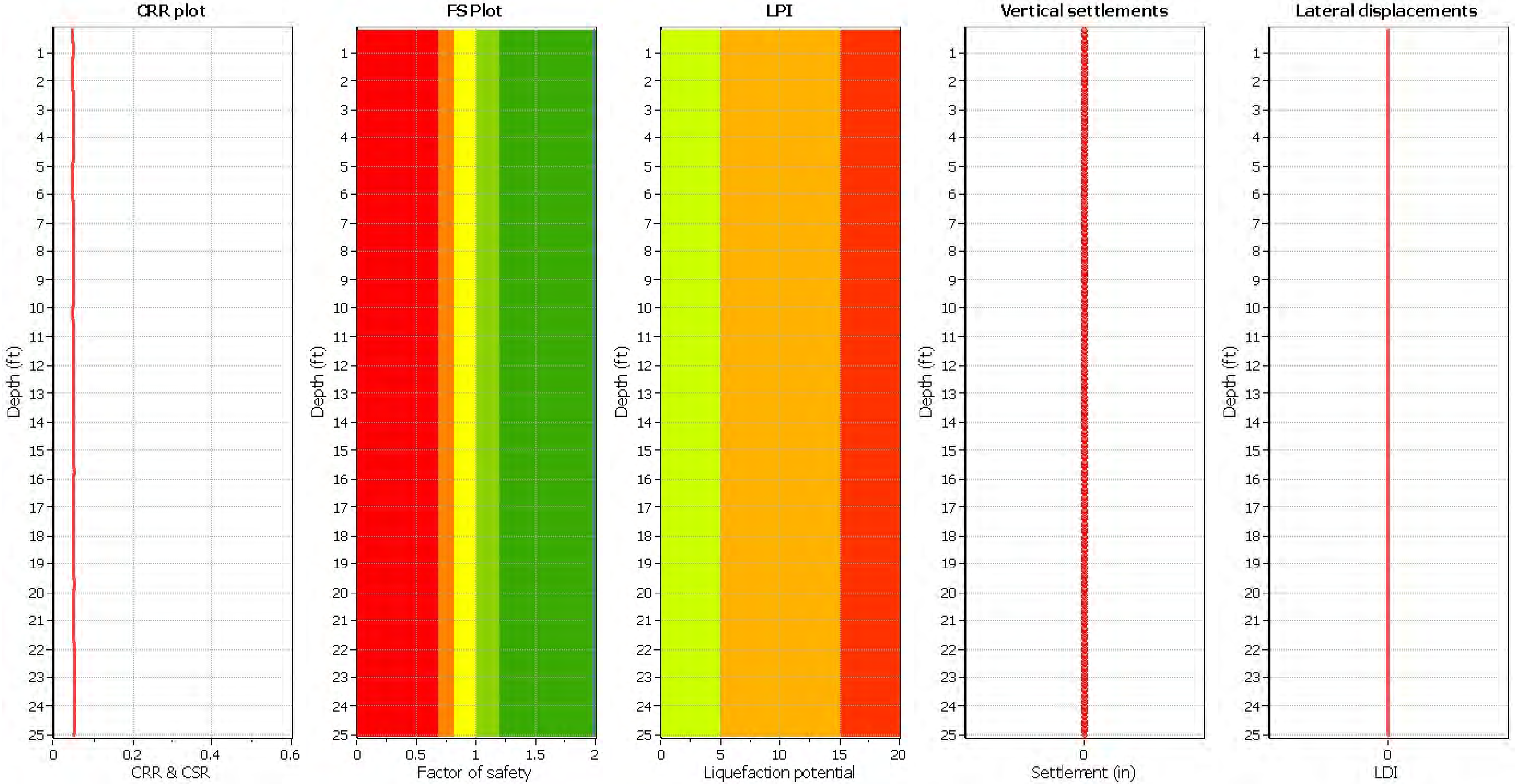
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	30.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	30.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

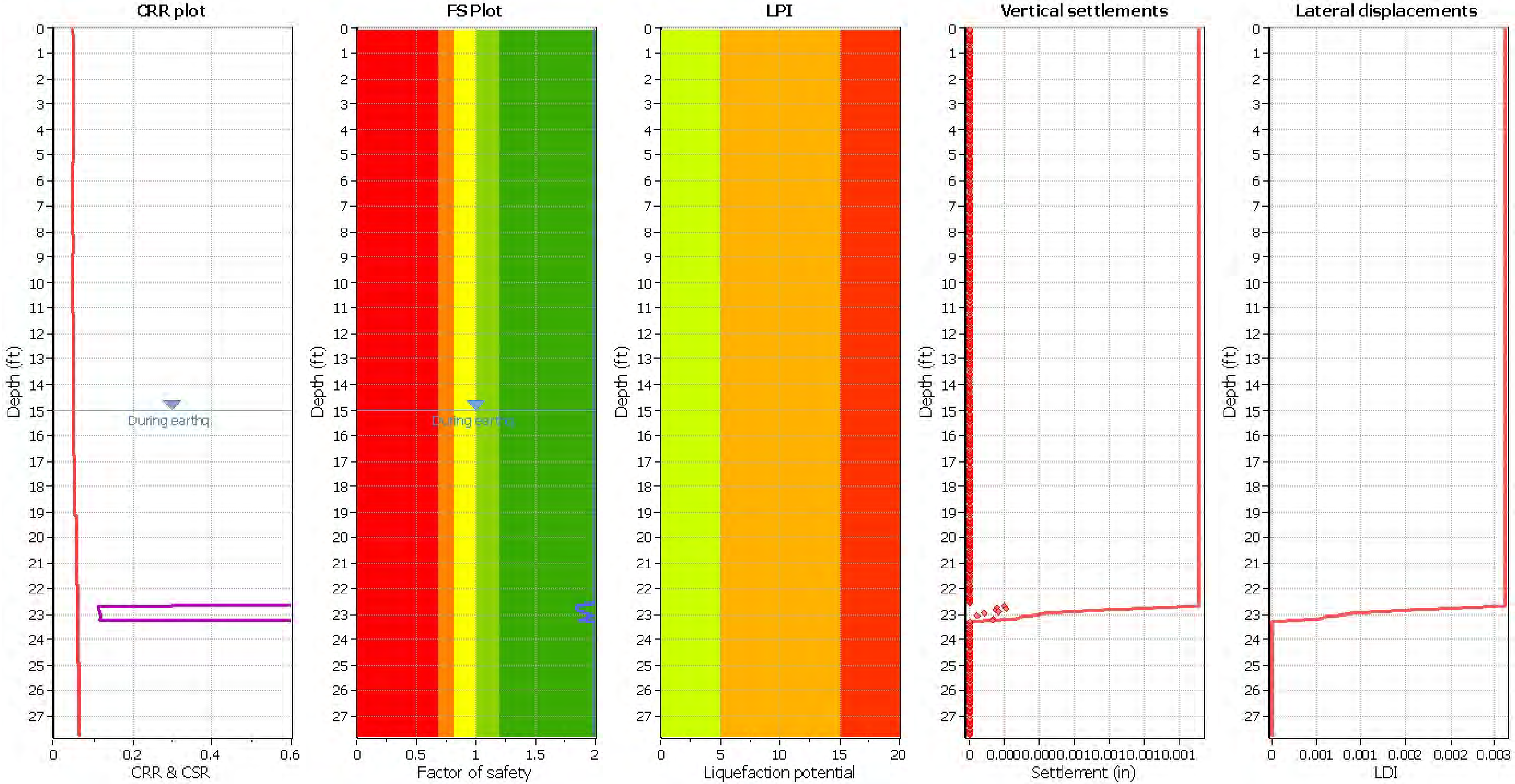
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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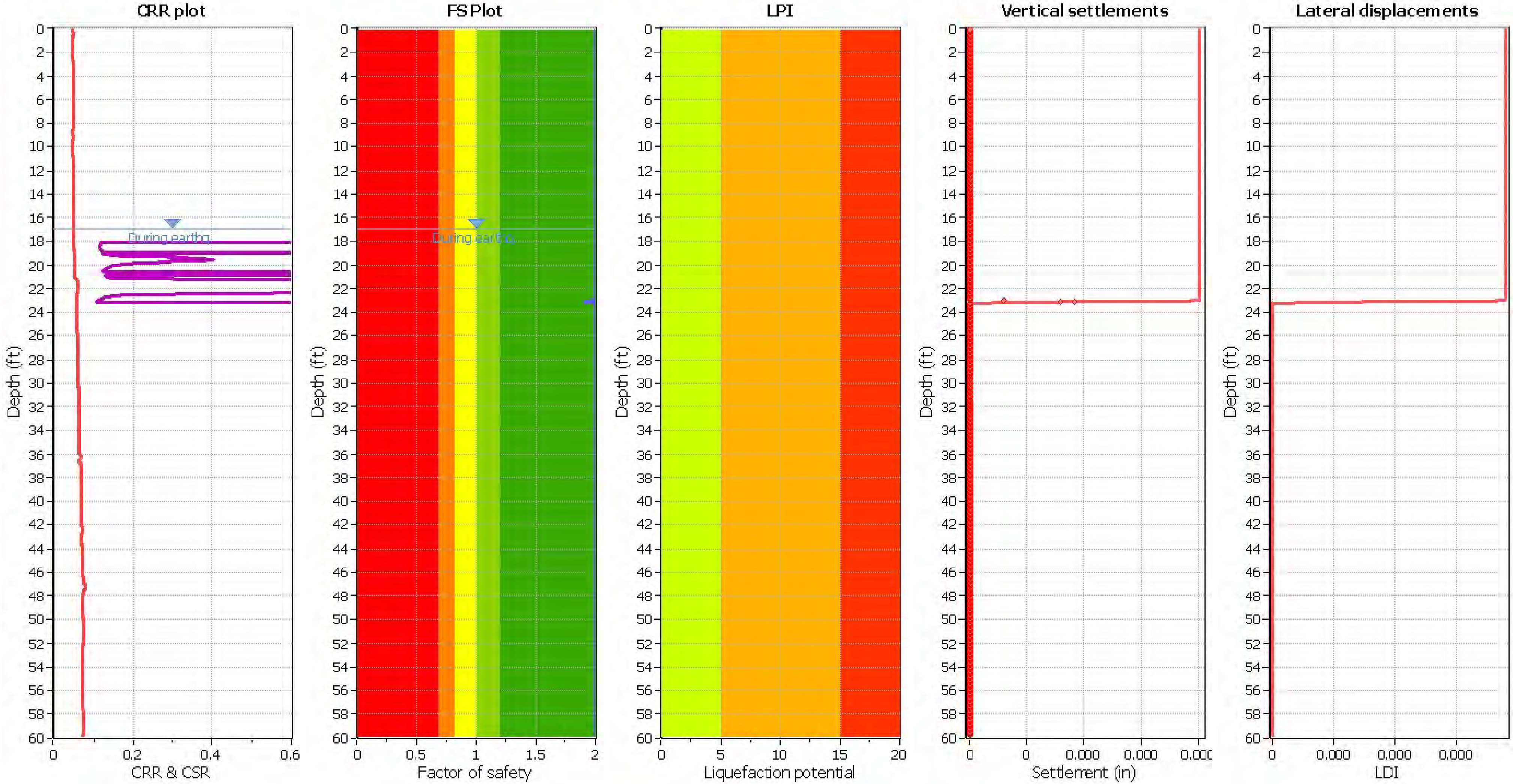
CPT name: C04

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	17.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	17.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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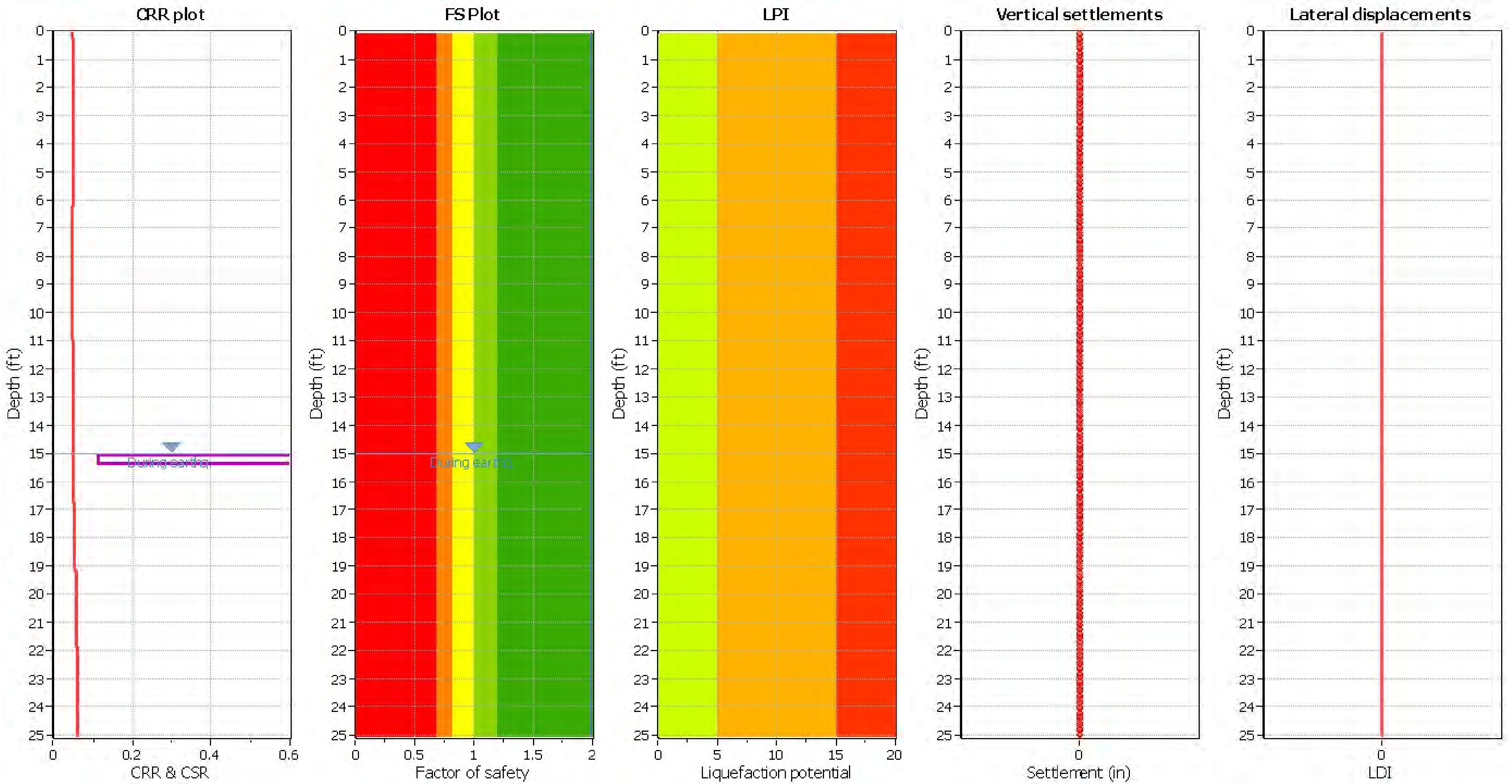
CPT name: C05

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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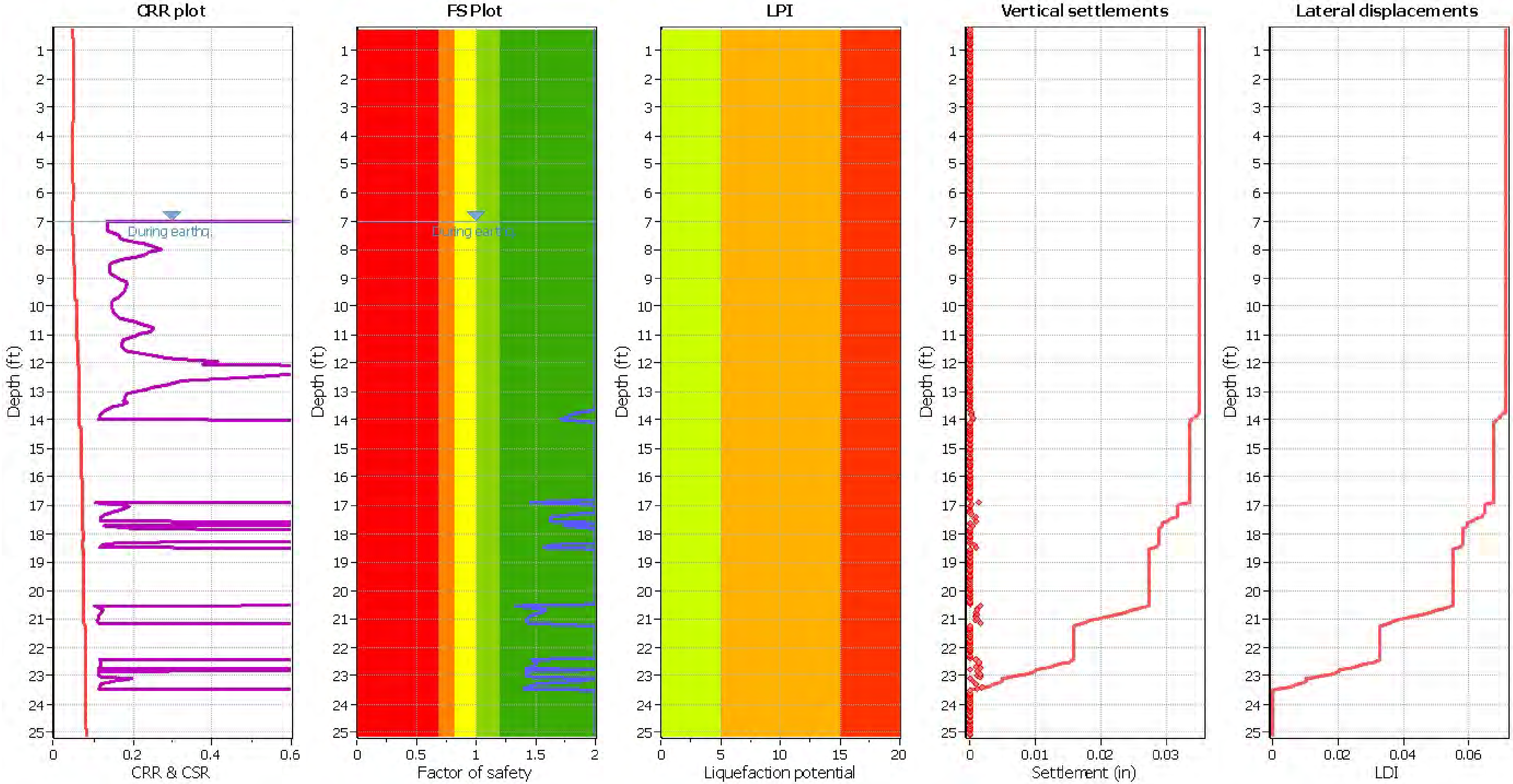
CPT name: C06

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)
Fines correction method:	B&I (2014)
Points to test:	Based on Ic value
Earthquake magnitude M_w:	7.70
Peak ground acceleration:	0.08
Depth to water table (insitu):	7.00 ft
Depth to GWT (erthq.):	7.00 ft
Average results interval:	3
Ic cut-off value:	2.60
Unit weight calculation:	Based on SBT
Use fill:	No
Fill height:	N/A
Fill weight:	N/A
Transition detect. applied:	No
K_σ applied:	Yes
Clay like behavior applied:	Sands only
Limit depth applied:	Yes
Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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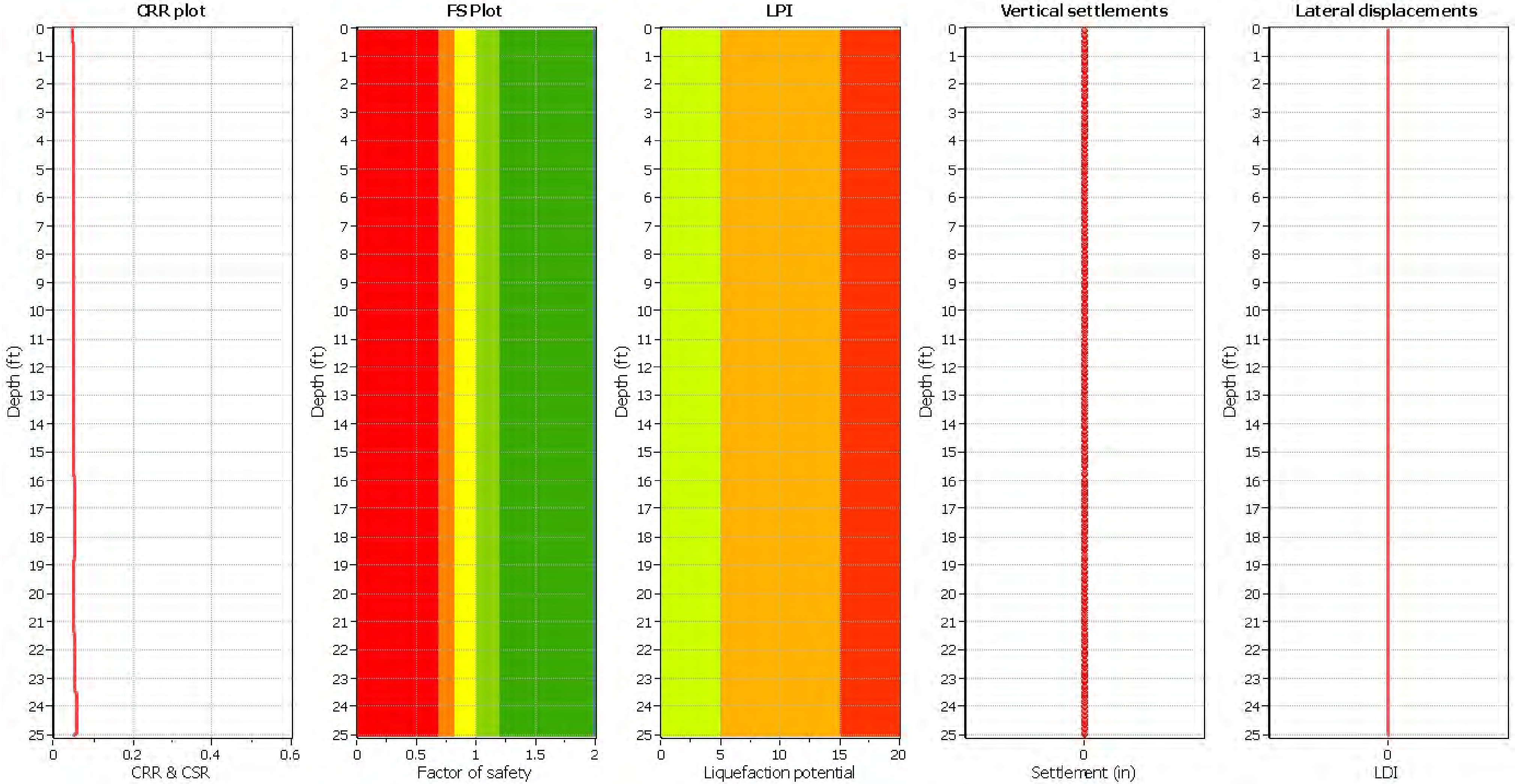
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	50.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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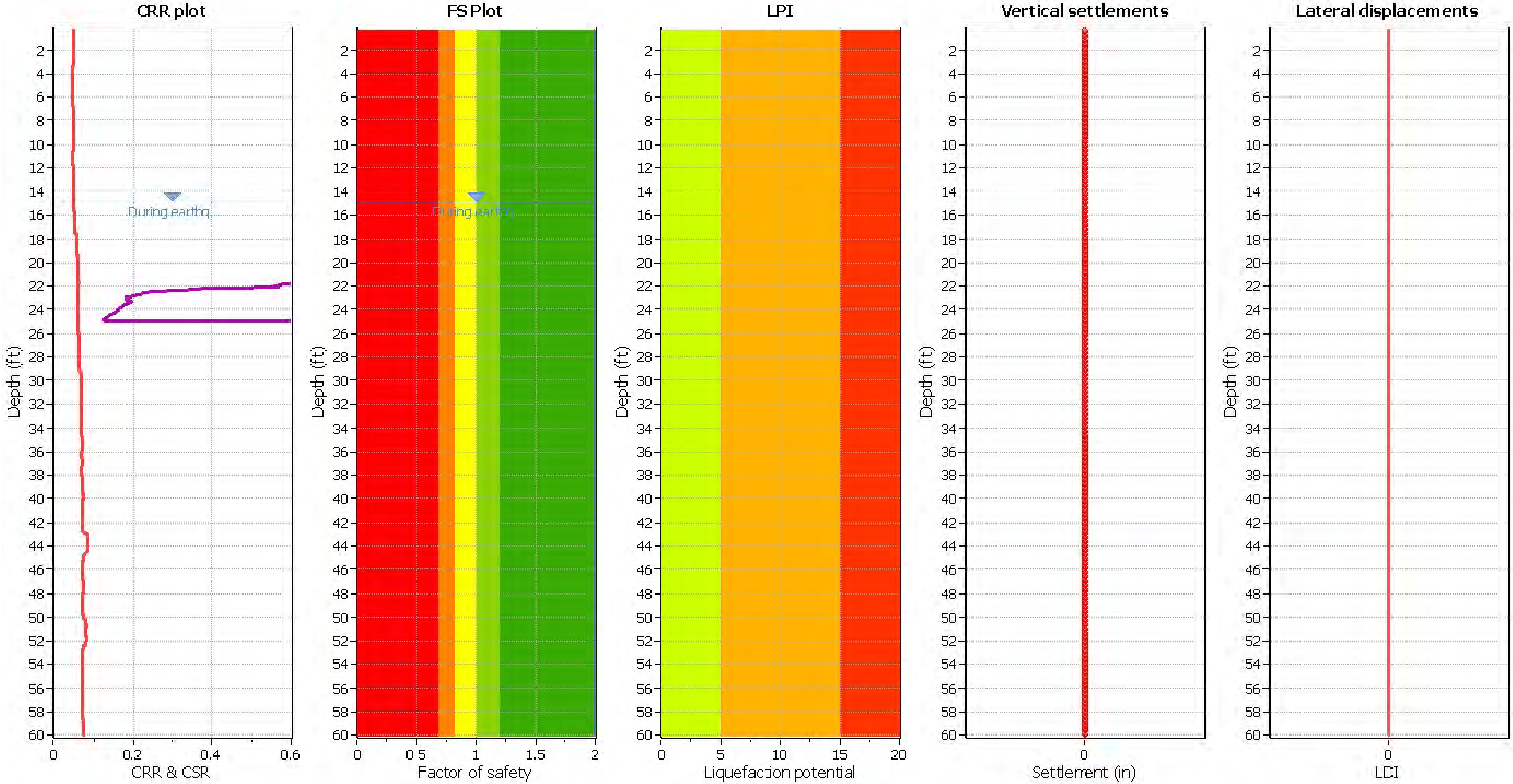
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	15.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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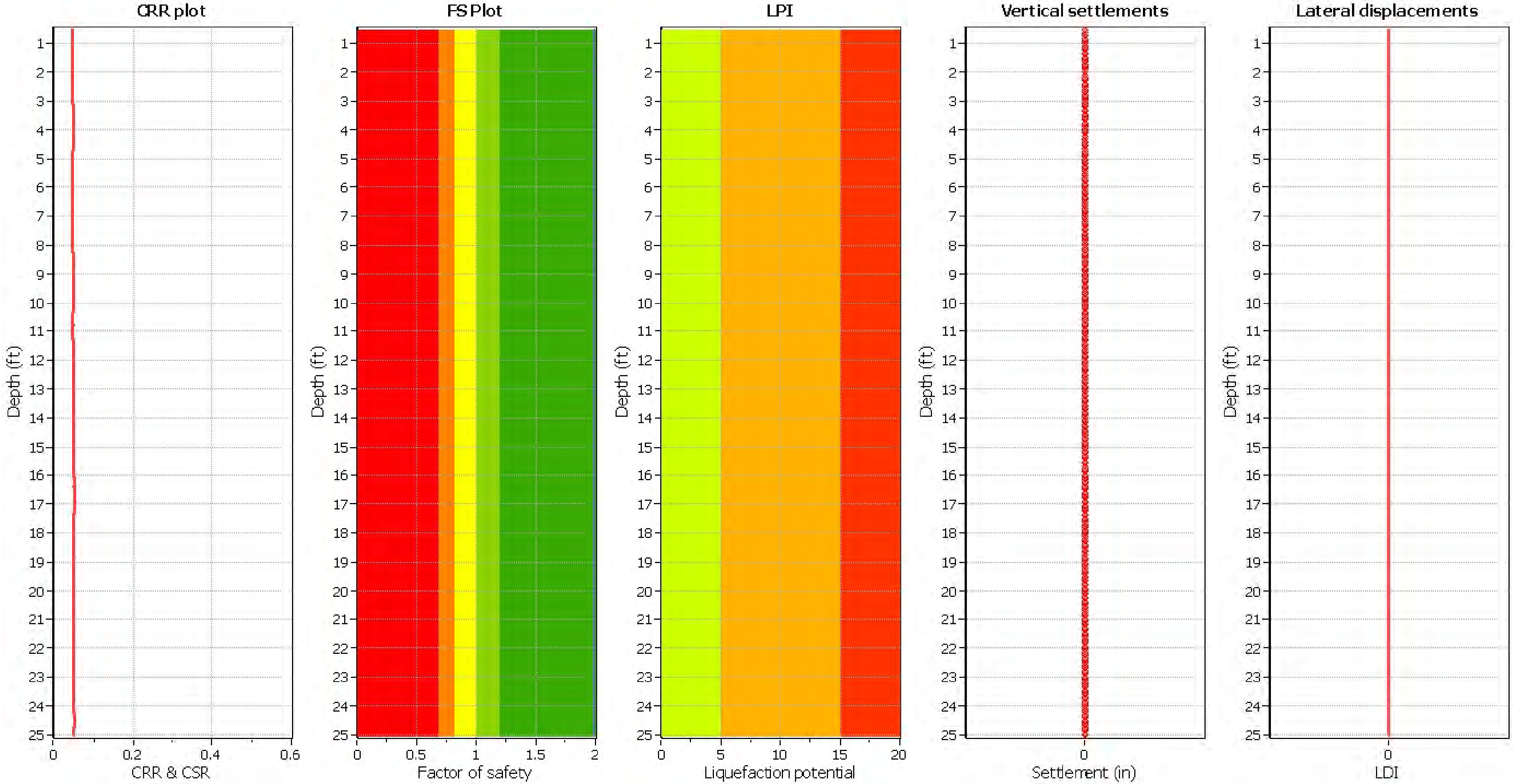
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	50.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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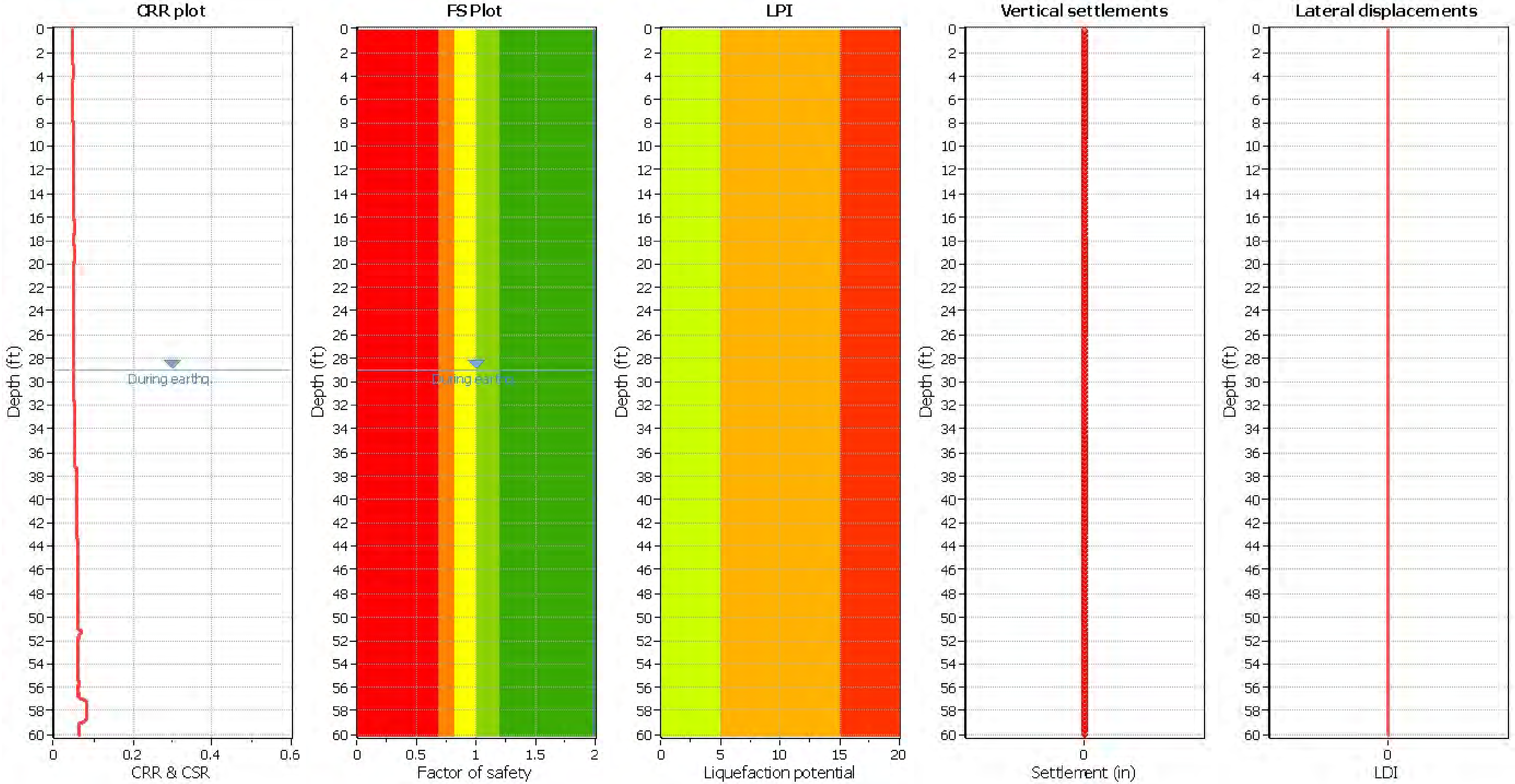
CPT name: O02

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	29.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	29.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
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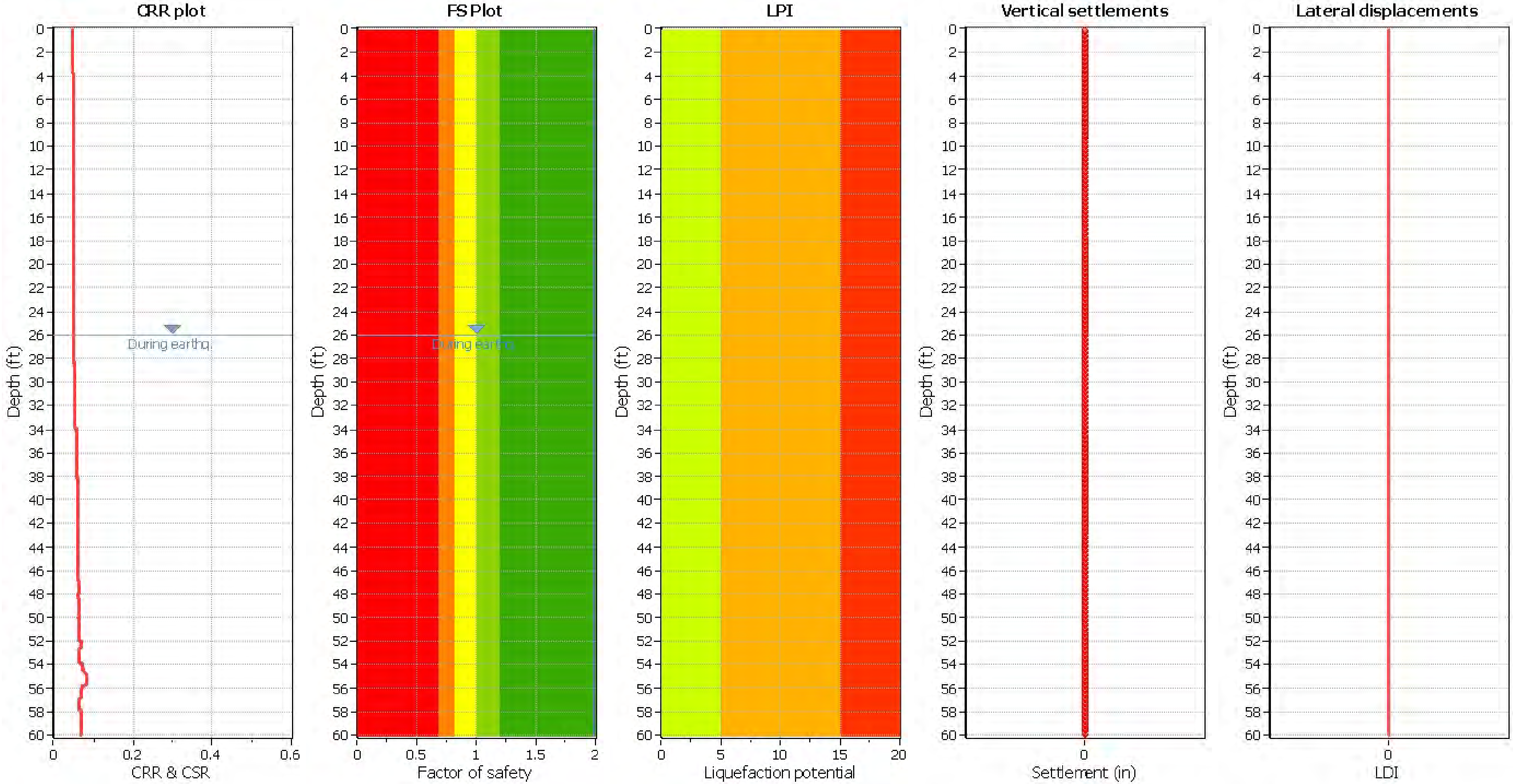
CPT name: O03

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	26.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	26.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

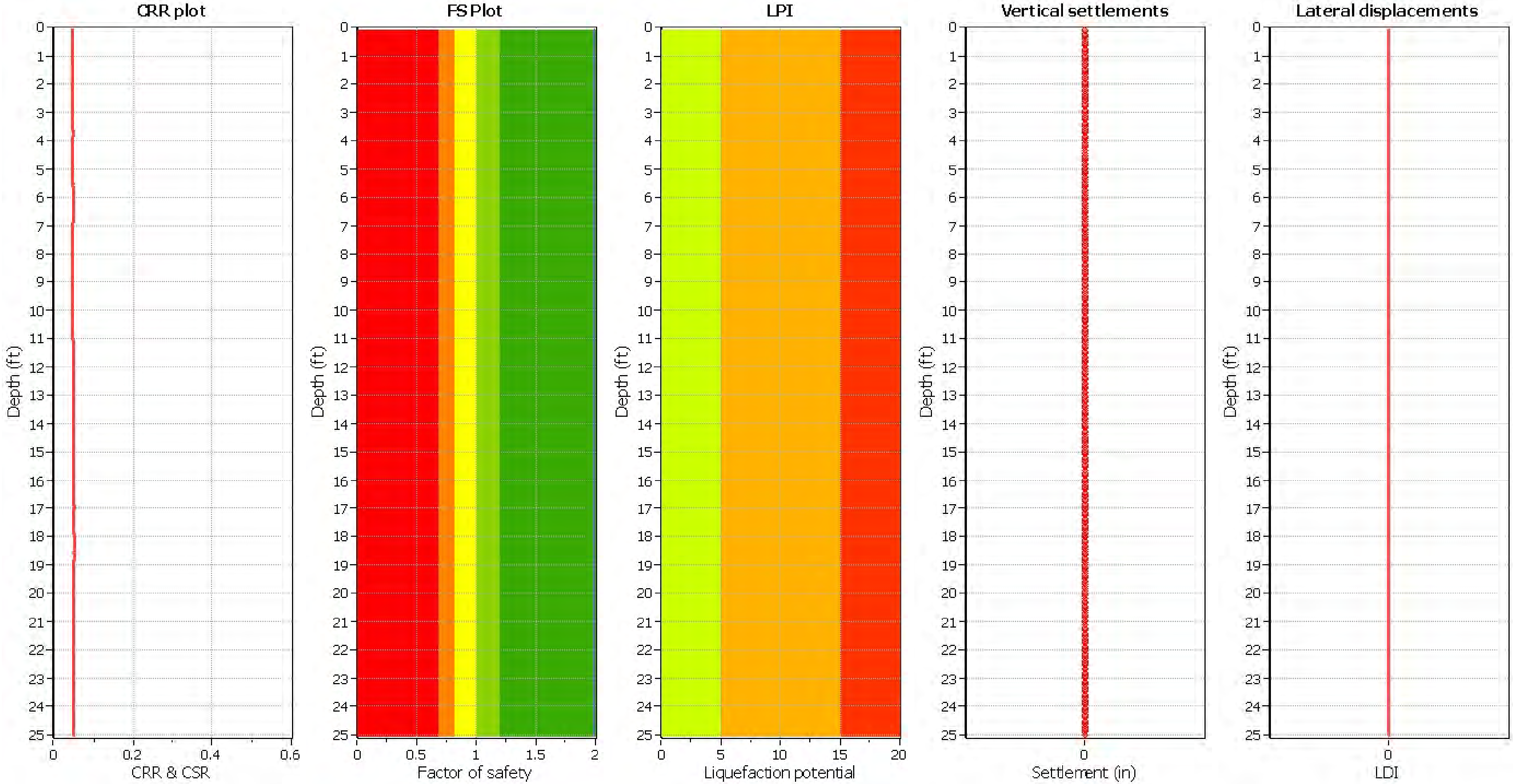
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

 CPT name: O04

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	50.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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LPI color scheme

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- High risk
- Low risk

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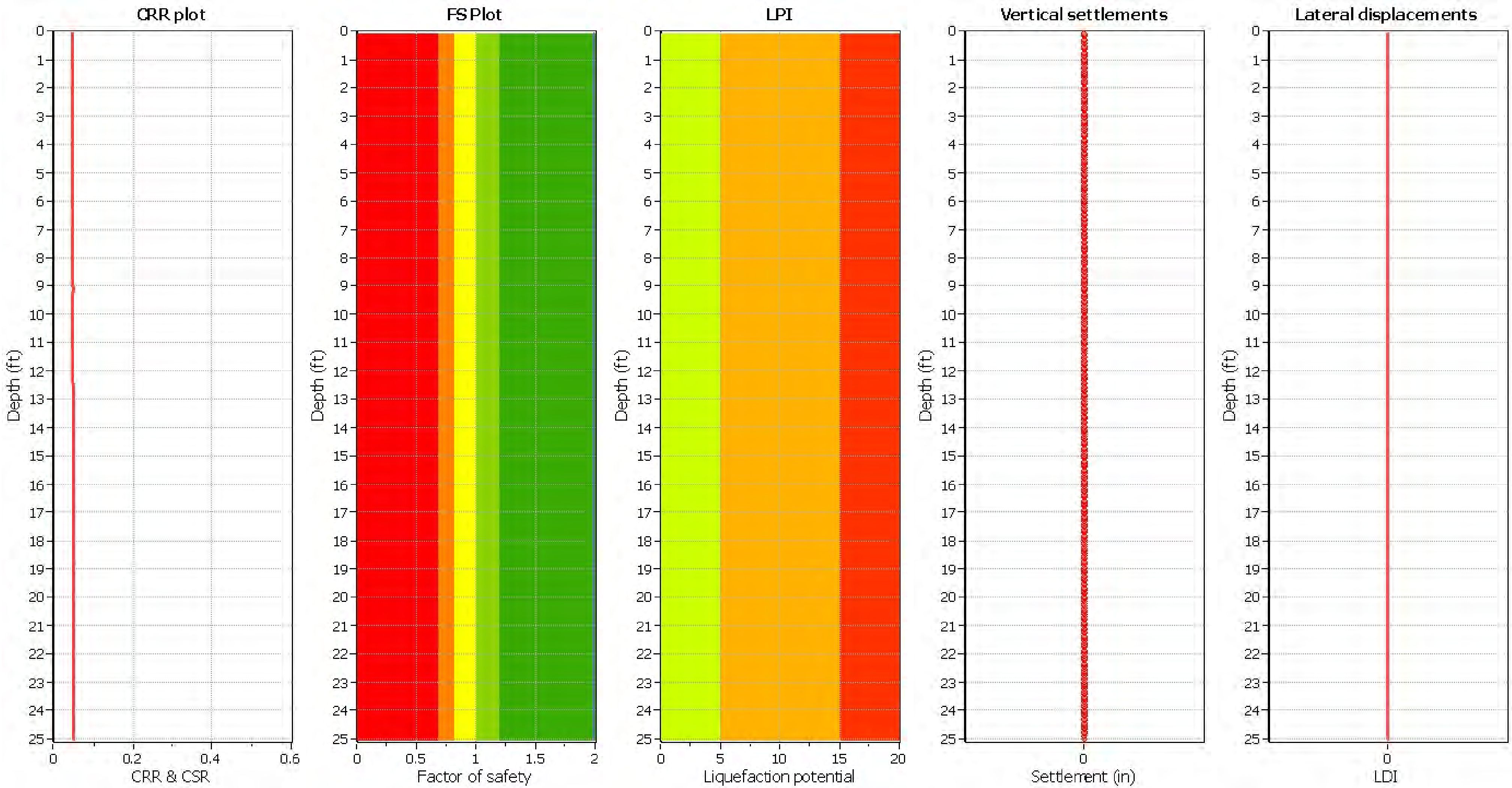
CPT name: O05

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	50.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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LPI color scheme

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- High risk
- Low risk

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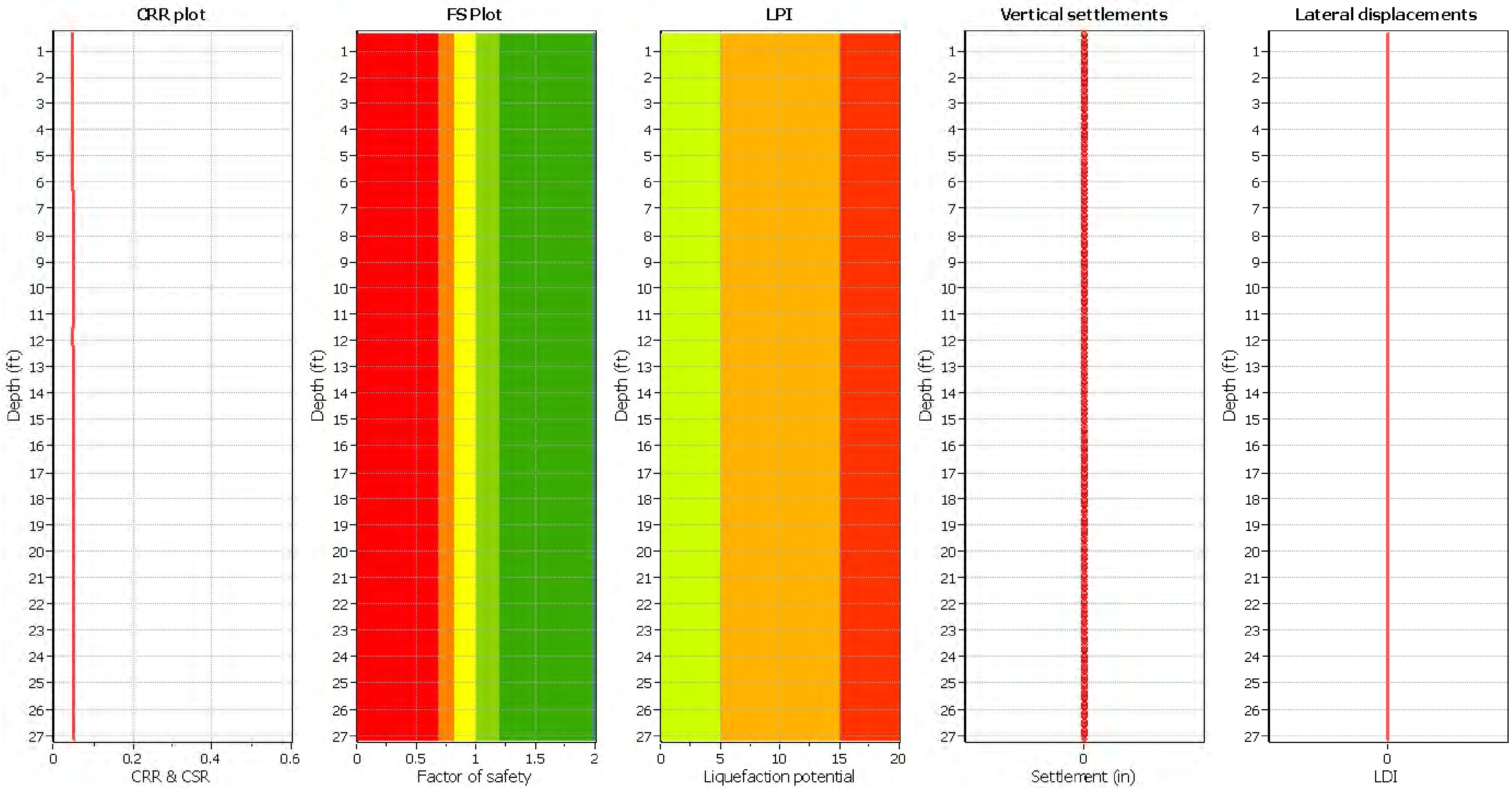
Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	50.00 ft	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.08	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	50.00 ft	Fill height:	N/A	Limit depth:	25.00 ft

F.S. color scheme

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LPI color scheme

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- High risk
- Low risk