REPORT
2023012434

# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNIT SCPD
# 40 CFR PART 257
# ST. CHARLES COUNTY, MISSOURI

Prepared for

Ameren MISSOURI

Prepared by

REITZ & JENS, INC.
CONSULTING ENGINEERS

October 2024

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# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNITS
# 40 CFR PART 257
# ST. CHARLES COUNTY, MISSOURI

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# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNITS
# ST. CHARLES COUNTY, MISSOURI

## 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. The SEC is located within the floodplain of the Mississippi and Missouri Rivers and has one active CCR surface impoundment that is approximately 40-acres in size. The CCR surface impoundment, designated as Cell 2 (SCPD), is used for managing coal combustion residuals (CCR). SCPA, SCPB and SCPC no longer receive CCRs, have been dewatered, and are closed. SCPD is currently receiving CCRs. Decant water in SCPD discharges into the Recycle Pond where pumps recirculate the water back to the power plant. Cell 2 is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. A map showing the location of the surface impoundment and the Recycle Pond is attached as Figure 1.

### 1.1 Purpose

The purpose of this report is to document evaluations and assessments completed for the Ameren Missouri Sioux Energy Center active CCR Units as required by select sections within 40 CFR Part 257, the final rule to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Specifically, Reitz & Jens completed assessments and evaluations as required by:

A. §257.73(c)(1), History of Construction
B. §257.74(a)(2), Periodic Hazard Potential Classification
C. §257.74(d)(1), Periodic Structural Stability Assessment
D. §257.74(e)(1), Periodic Safety Factor Assessment
E. §257.82, Initial Hydrologic and Hydraulic Capacity Requirements, and
F. §257.83(b), Inspection Requirements for CCR Surface Impoundments

The evaluations and assessments required by §257.73(c)(1) are discussed in the body of this report. The evaluations and assessments required by the remaining applicable sections of 40 CFR Part 257 are contained in the Appendices.

# 2.0 SIOUX ENERGY CENTER CCR UNITS

## 2.1 Owner and Operator

The CCR Units at the Sioux Energy Center (SEC) are owned and operated by Ameren Missouri. The SEC plant personnel have the primary responsibility for CCR unit operation. The SEC is located at 8501 North State Route 94, West Alton, Missouri 63386. The Ameren Missouri Dam Safety Group performs CCR unit inspections and reviews all updates to the Operations and Maintenance (O&M) Manual. A copy of the most recent O&M manual is included in Appendix A. The Ameren Missouri Dam Safety Group is located at 11149 Lindberg Business Court, St. Louis, Missouri 63127.

## 2.2 CCR Unit Location

The CCR Units are located as identified on the most recent USGS 7.5-minute Elsah, IL topographic quadrangle map in Township 48N, and Range 6E of the 5$^{th}$ Principal Meridian. A partial plot of the USGS topographic quadrangle map showing the location of the SEC is attached as Figure 2.

## 2.3 CCR Unit Identification and Purpose

There is one surface impoundment and the Recycle Pond at the SEC. The surface impoundment is used to store CCR. The Recycle Pond collects decant water from SCPD, which is recirculated back to the power plant. The name of the unit, type of impounded CCR, and operational status are listed in Table 1.

**Table 1 – Sioux Energy Center CCR Units**

| CCR Unit | CCR Type | Operational Status |
|---|---|---|
| **Cell 2 (SCPD)** | Gypsum | **Active** |

## 2.4 CCR Unit Watershed

The Sioux Energy Center is located along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River. According to the current Flood Insurance Rate Map, the regulatory 100-year flood elevation at the site is about el. 437 to 438. SCPD is mapped within the 100-year floodplain. The Mississippi River is immediately to the north of the SEC and the Missouri River is about 1 mile to the south of the SEC. Poeling Lake, which connects to the Mississippi River, is located immediately to the west of the closed SCPA and SCPB. The Mississippi River has a watershed area of approximately 170,000 square miles at the site and the Missouri River has a watershed area of approximately 500,000 square miles at their confluence. The SCPD does not receive rainfall run-off from areas outside of the CCR Unit.

## 2.5 Geomorphology and Foundation Geology

The geology at the Sioux Energy Center consists of natural alluvium, approximately 100 to 120 feet thick, deposited by the Mississippi and Missouri Rivers and sedimentary rocks of the Paleozoic era.

The alluvium consists of four somewhat distinct, sometimes discontinuous, coarse- to fine-grained deposits. The lower unit of considerable thickness once comprised the active channel for either or both bounding rivers and are called "channel deposits". This unit contains primarily fine to coarse sands with occasional silt interlaying and fine gravel fragments.

As river floodplains developed beyond the active channels, additional deposits of medium to fine sand occurred along the banks of the active channels. They also formed within the floodplain areas due to hydraulic variations within the active channels. They periodically diverted or retarded intermittent active channel flow and are thus termed "natural levee deposits".

The upper or near-surface unit contains primarily silts and clays, often intermixed or interbedded with fine to medium sands. The intermediate sandy unit is typically interlayered, whereas the upper more fine-grained unit is typically interbedded. The predominate particle or grain size reflects the water velocity at the time of settling and deposition. More coarse-grained soils "settle out" at faster water velocities; the upper fine-grained materials "settle out" in a low-flow to stagnant water environment. These interlayered and interbedded deposits of varying lithologies, are more recent deposits, and are termed "floodplain deposits". They may also contain remnants of decomposing root fibers indicating a period of exposure when surface vegetation thrived.

The upper-most alluvial unit are flood basin deposits. The typical thickness of the upper or near-surface unit is about 5 to 10 feet. This unit typically comprises very fine-grained clays with some silt intermixture.

Sedimentary bedrock lithology of the region consists of limestones, dolomites, sandstones and shales. The bedrock is of the Carboniferous Period and Mississippian System. The lowest unit is the Osagean Series, Burlington-Keokuk limestone formation, which is commonly the combination of the Burlington formation and the overlying Keokuk formation. Total thickness of the formation may range from 150 to 250 feet while consisting of a white to light buff, coarsely crystalline limestone with some chert sparsely intermixed throughout. The overlying Meramecian Series, Warsaw formation consists of fine- to coarse-crystalline limestone with chert, dolomite and shale intermixed throughout. This formation is typically 40 to 50 feet thick and is differentiated from the underlying Burlington-Keokuk limestone by the inclusion of often dark to black and sometimes fissured shale. The upper-most bedrock unit is the Meramecian Series, Salem formation with similar lithology to the underlying Warsaw formation. This formation is about 40 to 60 feet thick containing a buff limestone with dolomitic limestone, dolomite and shale.

Groundwater levels at the Sioux Energy Center closely follow the stage of the adjacent Mississippi River, and to a lesser extent the stage of the Missouri Rivers. The direction of groundwater flow is generally southward from the Mississippi River to the Missouri River.

## 2.6 Surveillance, Maintenance and Repair of the CCR Units

The Sioux UWL Cells 1, 2 & 4A and Recycle Pond O&M manual outline objectives, responsibilities, and procedures for Ameren personnel who are responsible for the management of the Sioux CCR units. The embankments of the CCR units are visually inspected weekly by Ameren plant operations staff. Ameren Missouri Dam Safety Group personnel perform annual inspections and periodic inspections or assessments with plant operations staff. In addition, the Ameren Missouri Dam Safety Group may conduct unannounced safety inspections. Descriptions of each type of inspection or assessment are included in the following sections. Checklists used during inspection of the CCR Units are included in the attached O&M manuals in Appendix A.

### 2.6.1 Surveillance

#### 2.6.1.1 Weekly Inspections

Weekly inspections are conducted by plant staff or support staff familiar with the ponds/ash pond embankments. The weekly inspections consist of visually inspecting the crest and slopes of each ash pond embankment to identify new or changed conditions. Checklists are completed and are made available to the Dam Safety Group for review.

#### 2.6.1.2 Annual Inspection

These inspections are conducted annually by the plant staff and the Ameren Missouri Dam Safety Group staff. The annual inspection is a detailed visual inspection of the ash pond embankment crest, interior and exterior slopes, downstream toe area, inlet/outlet works, and appurtenant structures.

An inspection report is to be prepared by the Ameren Missouri Dam Safety Group staff that includes a description of the observations of the visual inspection, photographs of the facilities taken during the inspection, and a written evaluation of the results. A record of maintenance activities for the ash pond embankments is also kept current by the Ameren Missouri Dam Safety Group.

### 2.6.1.3 Periodic Structural Stability Assessments

The Periodic Structural Stability Assessments are conducted every 5 years by the Ameren Missouri Dam Safety Group staff to document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein in general accordance with 40 CFR Part §257.73(d)(1).

Ameren Missouri Dam Safety Group staff will prepare a periodic structural stability assessment report which at a minimum will document whether the CCR unit has been designed, constructed, operated, and maintained with:

i. Stable foundations and abutments;
ii. Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;
iii. Dikes (embankments) mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;
iv. Vegetated slopes of dikes and surrounding areas not to exceed a height of 6 inches above the slope of the dike, except for slopes which have an alternate form of slope protection;
v. A single spillway or a combination of spillways designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the design flood event. The spillways must be either of non-erodible construction and designed to carry sustained flows; or earth or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected;
vi. Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure;
vii. For CCR units with downstream slopes which can be inundated by the pool level of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

If a deficiency or a release is identified during the periodic assessment, Ameren Missouri will remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

### 2.6.1.4 Periodic Hazard Potential Classification

Ameren Missouri Dam Safety Group staff will update the hazard potential classification every 5 years in general accordance with 40 CFR Part §257.74(a)(2). Ameren Missouri Dam Safety Group staff will prepare documentation of the hazard potential classification of each CCR unit as either high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment, and the basis for each hazard potential classification. Ameren Missouri Dam Safety Group staff will prepare and maintain a written Emergency Action Plan if it is determined that a CCR unit is either a high hazard potential surface impoundment or a significant hazard surface impoundment.

#### 2.6.1.5 Periodic Safety Factor Assessment

Ameren Missouri Dam Safety Group staff will conduct periodic safety factor assessments every 5 years in general accordance with 40 CFR Part §257.73(e)(1). The periodic safety factor assessments will be conducted for each CCR unit and will document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in §257.73(e)(1) for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments will be supported by appropriate engineering calculations.

#### 2.6.1.6 Periodic Inflow Design Flood Control System Plan

Ameren Missouri Dam Safety Group staff will prepare an inflow design flood control system plan every 5 years in general accordance with 40 CFR Part §257.82. The plan will document how the inflow design flood control system has been designed, constructed, operated and maintained to adequately manage flow into the CCR surface impoundment during and following the peak discharge of the inflow design flood. The inflow design flood is the probable maximum flood for a high hazard potential CCR surface impoundment, the 1000-year flood for a significant hazard potential CCR surface impoundment, the 100-year flood for a low hazard potential CCR surface impoundment, and the 25-year flood for an incised surface impoundment.

#### 2.6.1.7 Special Inspections

Special inspections are conducted when extreme events which may impact stability (seismic activity, severe flooding, etc.) occur. Special inspections are like the annual inspection but may be focused on a particular area. If conditions are discovered during a weekly or annual inspection which create concern for the SEC plant, personnel, or surrounding properties, a special inspection will be conducted. Responsibility for performance of special inspections will be evaluated based on the severity of the event and potential damage.

#### 2.6.1.8 Unannounced Inspections

The Ameren Missouri Chief Dam Safety Engineer (CDSE) may conduct unannounced inspections at the site as deemed appropriate. The inspection may include a visual inspection of the facility, a review of the inspection documentation, and interviews with plant personnel to review their understanding of the required inspection procedures.

#### 2.6.1.9 Inspection Findings

Observations made during the inspections are rated with a condition code as shown in the following Table 2. The timeliness of response to deficiencies observed depends on the severity of the condition.

### Table 2 - Ameren Missouri Dam Safety Inspection Condition Codes

| Condition Code | Description |
|---|---|
| **EC** | Emergency Condition. A serious dam safety condition exists that need immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; pool draw down, emergency repairs, work stoppage, plant stoppage. |
| **IM** | Item needing immediate maintenance to restore or ensure its safety and integrity. Remediation should be complete within 1 month or as required. |
| **MM** | Minor Maintenance. 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 and potential future minor maintenance. |
| **GC** | Good Condition. |
| **NO** | No observation possible. |
| **NI** | Not Inspected. State reason in comment column. |

### 2.6.2 Maintenance and Repair of the CCR Units

The O&M manual requires that timely repairs must be made after problem areas are identified. The plant engineer is to specify the work to be completed using Ameren's Work Control Process and provide direction to correct items noted in the operation and maintenance, and engineering inspections. The work request by the plant engineer will be reviewed with the Dam Safety Group to ensure proper emphasis has been placed on the request. The O&M manual specifies the minimum maintenance activities and requires that maintenance activities be documented. The O&M manual further specifies that no alterations or repairs to structural elements should be made without the approval of the Chief Dam Safety Engineer.

# 3.0 SCPD (CELL 2)

## 3.1 History of Construction

The SCPD was brought online in 2022. The CCR Unit was constructed in two parts, consisting of two connected cells, labeled “Interim” and “Primary”. The Interim and Primary cells are separated by a lined embankment but connected with a spillway through the embankment. The Interim cell was completed in 2022, and the Primary cell was completed in 2023. As-built drawings are presented in Appendix A. The Flue Gas Desulfurization (FGD) system produces gypsum as a byproduct. The FGD gypsum slurry is pumped to SCPD where it is managed for long-term or permanent storage. The SCPD does not receive any additional stormwater run-off outside its bounded area. The gypsum slurry discharges into the cell at the approximate midpoint of the west embankment. The gypsum settles out into SCPD and the decant water flows into the Recycle Pond through a set of triple box culverts. SCPD and the Recycle Pond are separated by an embankment. Triple box culverts connect SCPD with the Recycle Pond, and the culverts control the normal water level in SCPD to el. 441.1. SCPD also has two emergency spillways on the north side of the impoundment. The bottom and side slopes of SCPD are lined with 80-mil HDPE liner, which was constructed over 24 inches of compacted, impervious clay. The SCPD embankment upstream and downstream slopes have a steepness of 3H to 1V and the crest elevation is approximately 446 feet.

A summary of pertinent data for SCPD is summarized in Table 3.

**Table 3 - SCPD (Cell 2)**

| CCR Unit | Maximum Pond Area (acres) | Maximum Dam Height (feet) | Minimum Crest Width (feet) | Length (feet) | Upstream Slope Steepness (H:V) | Downstream Slope Steepness (H:V) |
|---|---|---|---|---|---|---|
| SCPD (Cell 2) | 40.3 | 24.0 | 12 | 5,283 | 3:1 | 3:1 |

## 3.2 Modifications to Embankment Geometry and Operation

There have been no modifications to the SCPD embankment geometry since the original construction of the impoundment in 2023.

## 3.3 Foundation and Abutment Geology

Geotechnical investigations in 2005 for SCPD document the impoundment foundation material and are presented in Appendix A. The uppermost stratum is generally clays and silty clays with scattered seams and layers of low plastic silt, underlain by silts. The thickness of these fine-grain deposits ranged from 0 to 24 feet, but generally between about 5 to 10 feet. Clay soils are almost all high plastic. The fine-grain soils are firm to stiff, with undrained cohesive shear strengths of 500 psf to over 2000 psf.

The upper fine-grain soils are underlain by sandy silts, silty fine sands, and fine sands, generally to a depth of 30 feet. These upper sandy soils are generally loose to medium-dense. The upper sandy soils are underlain by fine to coarse, poorly graded sands and well-graded sands, with some silty sands and gravelly sands at greater depths. Limestone bedrock is at a depth of about 115 feet. The lower sands generally ranged from medium dense to very dense, increasing in density with increasing depth.

## 3.4 Embankment Material

Embankment fill consists of compacted layers of clay and silt with varying amounts of sand. Fill material was compacted to a minimum of 95% of the maximum dry unit weight determined from the Standard Proctor Moisture-Density Test (ASTM D698). Fill placement was monitored, and moisture-density tests were obtained during construction. The upstream and downstream slopes have a steepness of 3H to 1V. The crest elevation of the embankment for SCPD is approximately elevation 446 feet.

The bottom of SCPD and the upstream slopes are covered with 2 feet of compacted clay liner that has a maximum hydraulic conductivity of $1 \times 10^{-7}$ cm/sec. Clay for the liner was obtained on site. The compaction criteria for the clay liner were developed using the "Daniel Method." Fill placement was monitored and moisture-density tests were obtained during construction.

## 3.5 Operating Pool Surface Elevations

The normal operating pool level for SCPD is elevation 441.1 feet. Assuming there is no flow from the triple box culvert spillway, the maximum surcharge pool elevation during the 100-year, 24-hour storm in SCPD is 442.0 feet. An area-capacity curve for SCPD is shown in Figure 3.

## 3.6 CCR Unit Outlet Works

The principal spillway for SCPD is a set of three box culverts. Each box culvert has a width of 6 feet and height of 3 feet. The flowline of the box culverts is at elevation 441 feet. The box culverts discharge into the Recycle Pond. The spillway construction drawings are presented in Appendix A.

SCPD also has two broad crested weir emergency spillway located near the northeast corner of the impoundment. The spillway is lined with concrete. The spillway invert elevation is at 445.0 feet. At the invert elevation the spillway has a width of 12 feet, and the sides are tapered up to the top of the embankment elevation over a distance of 12 feet. A typical cross-section of the emergency spillway is shown in the construction drawings presented in Appendix A.

Summarized in Table 4 are pertinent data for the SCPD outlet works.

**Table 4 – SCPD (Cell 2) Outlet Works**

| CCR Unit | Description | Type | Upstream Invert Elevation (feet) | Downstream Invert Elevation (feet) |
|---|---|---|---|---|
| **SCPD (Cell 2)** | Principal Spillway | Triple box culverts | 441.0 | 440.5 |
| **SCPD (Cell 2) - Primary** | Emergency Spillway | Broad Crested Weir | 445.0 | NA |
| **SCPD (Cell 2) - Interim** | Emergency Spillway | Broad Crested Weir | 445.0 | NA |

## 3.7 Impounded CCR

SCPD impounds gypsum and the estimated volume and depth as of October 2023 are shown in Table 5.

**Table 5 – SCPD (Cell 2) CCR**

| CCR Unit | Est. Volume of CCR (CY) | Approximate Bottom Elev. of CCR Unit (feet) | Est. Maximum CCR Elev. (feet) | Est. Average Depth of CCR (feet) | Est. Maximum Depth of CCR (feet) |
|---|---|---|---|---|---|
| **SCPD (Cell 2 – Gypsum)** | 54,500 | 432 | 441.1 | 1.0 | 8.1 |

Typical wet FGD gypsum is characterized by a moderately low hydraulic conductivity. The angle of internal friction ($\phi$) for gypsum is typically assumed to be about 40 to 42 degrees.

## 3.8 Instrumentation

There is no staff gage in SCPD. Given the large capacity of the box culverts, the water level within the pond is nearly constant at the invert of the culverts. The water level in the Recycle Pond is continuously monitored by Plant operation personnel using level sensors installed at the east end of the Recycling Pond.

## 3.9 Structural Instability

There are no records of structural instability for SCPD.

# 4.0 HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

**40 CFR Part 257**
**Hazard Potential Classification Assessments for CCR Surface Impoundments**
**§257.74(a)(2)**

The Hazard Potential Classification Assessment was conducted for active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center. The CCR surface impoundment is low hazard potential because failure of the impoundment is not expected to cause a loss of human life, and the economic, environmental and lifeline losses are expected to be low and generally limited to the owner. The hazard potential classification was completed in general accordance with Federal Guidelines for Dam Safety: Hazard Potential Classification for Dams by the Federal Emergency Management Agency (January 2004).

| CCR Unit | Hazard Potential Classification |
|---|---|
| **SCPD (Cell 2 – Gypsum)** | Low |

Refer to Appendix B for the Hazard Potential Classification report. The subsequent assessment of the hazard potential must be conducted within 5 years of this assessment.

**Engineer's Seal**


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Date: October 31, 2024

# 5.0 STRUCTURAL STABILITY ASSESSMENT

**40 CFR Part 257**
**Structural Stability Assessment for CCR Surface Impoundments §257.74(d)**

The Structural Stability Assessment was conducted for the active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center. The structural stability assessment was completed in general accordance with 40 CFR Part §257.73(d). Assessment of all three CCR Units found no structural stability deficiencies, no significant issues with the current operations and maintenance, and that the design and construction are adequate, however some corrective measures were recommended.

| Requirement | SCPD (Cell 2 – Gypsum) |
|---|---|
| **Initial periodic assessment was completed in general accordance with the requirements of 40 CFR Part §257.73(d)** | Yes |

Refer to Appendix C for the Structural Stability Assessment report. The subsequent Periodic Structural Stability Assessment must be conducted within 5 years of this assessment.

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# 6.0 SAFETY FACTOR ASSESSMENT

**40 CFR Part 257**
**Safety Factor Assessment for CCR Surface Impoundments §257.74(e)**

The Safety Factor Assessment was conducted for the active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center. The Safety Factor Assessment shows that the critical cross section for this Unit meet or exceed the minimum factors of safety specified in 40 CFR Part §257.74(e) as summarized below.

| Requirement | SCPD |
|---|---|
| The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50. | ≥1.50 |
| The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40. | ≥1.40 |
| The calculated seismic factor of safety must equal or exceed 1.00. | ≥1.00 |
| The calculated liquefaction factor of safety must equal or exceed 1.20. | ≥1.20 |

Refer to Appendix D for the Safety Factor Assessment report. The subsequent Periodic Safety Factor Assessment must be conducted within 5 years of this assessment.

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# 7.0 HYDROLOGIC AND HYDRAULIC CAPACITY REQUIREMENTS

**40 CFR Part 257**
**Initial Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundment §257.82**

The inflow design flood control system plan was completed for the active CCR surface impoundment SCPD (Cell 2) at the Sioux Energy Center. The initial inflow design flood control system plan was completed in general accordance with 40 CFR Part §257(e)(1) using the 100-year design flood for low hazard potential CCR surface impoundments.

| Requirement | Requirement | SCPD (Cell 2) |
|---|---|---|
| The initial inflow design flood control system plan meets the requirements of 40 CFR Part §257.82 | Yes | Yes |

Refer to Appendix E for the Inflow Design Flood Control System Plan report. The owner or operator must prepare periodic inflow design flood control system plans every five years, or whenever there is a change in conditions that would substantially affect the plan.

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Date: October 31, 2024

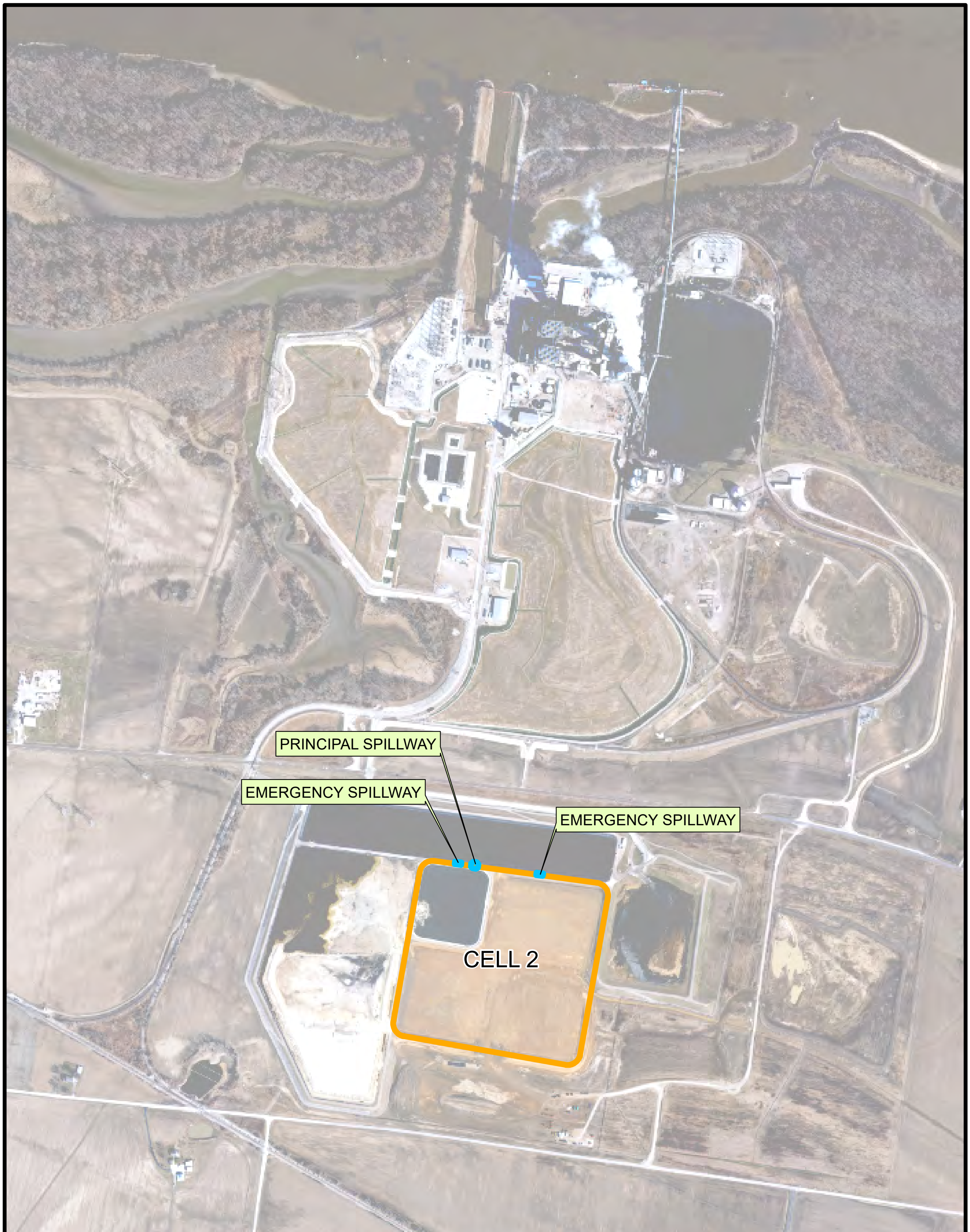
# 8.0 CLOSURE

The preceding history of construction is regarded as a living document. If there is a significant change to any information or there are periodic updates, Ameren must update the relevant information and place it in the facility's operating record.

# 9.0 REFERENCES

Ameren Missouri. (2024). "Operation and Maintenance Manual for Cells 1,2 & 4A and Recycle Pond, Sioux Energy Center Utility Waste Landfill, St. Charles County, Missouri." Power Operations Services, St. Louis, Missouri.

Environmental Protection Agency. (2015). "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule." 40 CFR Parts 257 and 261., Vol. 80, No. 74.




Legend

Embankment

Spillway

N

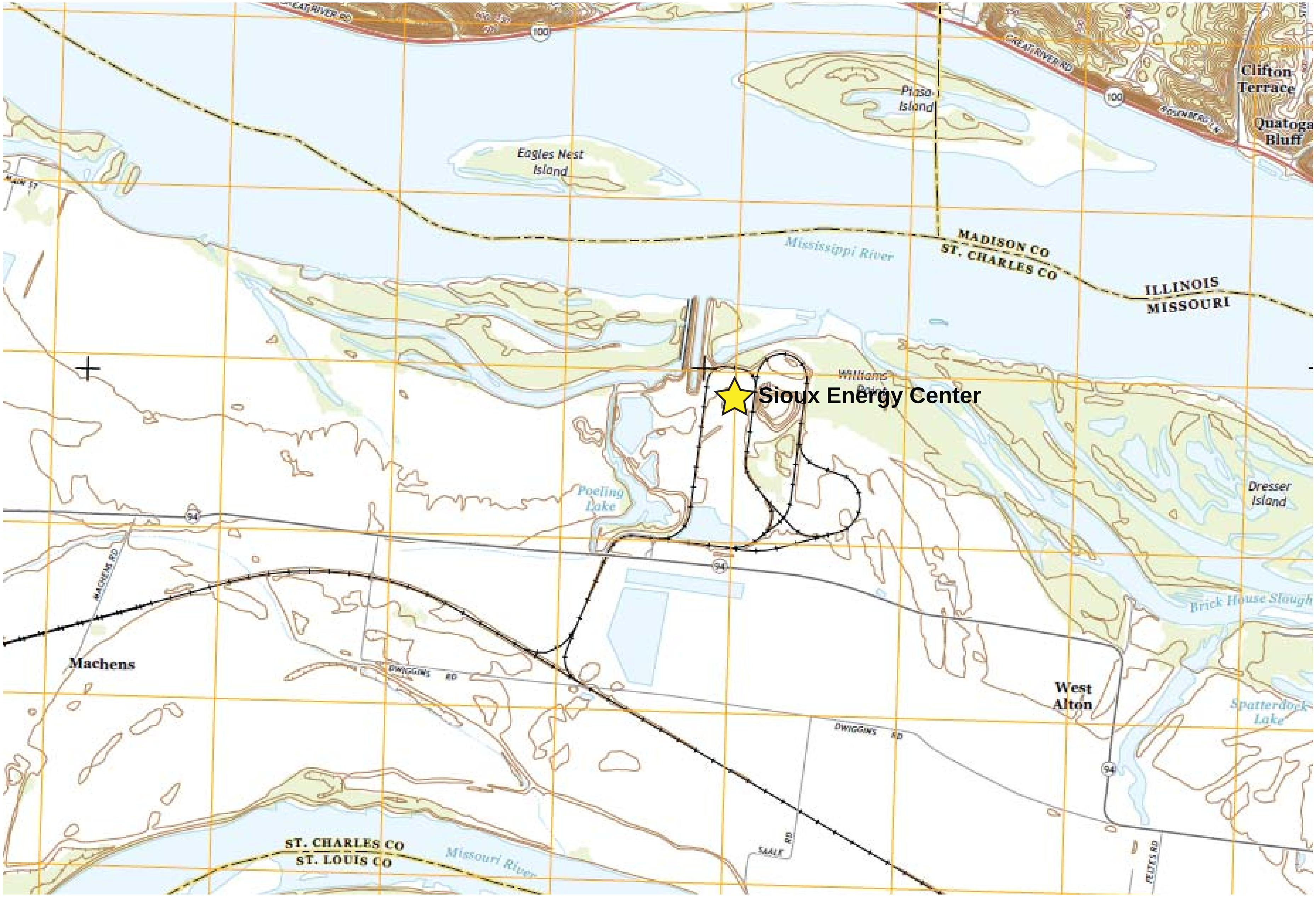
0 500 1,000 Feet

AMEREN MISSOURI
SIOUX ENERGY CENTER
ACTIVE CCR SURFACE IMPOUNDMENT
FIGURE 1

Ameren MISSOURI

REITZ & JENS, INC. CONSULTING ENGINEERS

Document Path: \\server01\projects\Amerenue\20230124341\dwg\Figure 1 CCR Reports\gis\AMRN-SIOUX-FIGURE 1.mxd




Ameren Missouri
Sioux Energy Center
CCR Unit Evaluation
USGS 7.5 minute quadrangle map

REITZ & JENS, INC.

Figure 2

SCPD AREA-CAPACITY CURVE

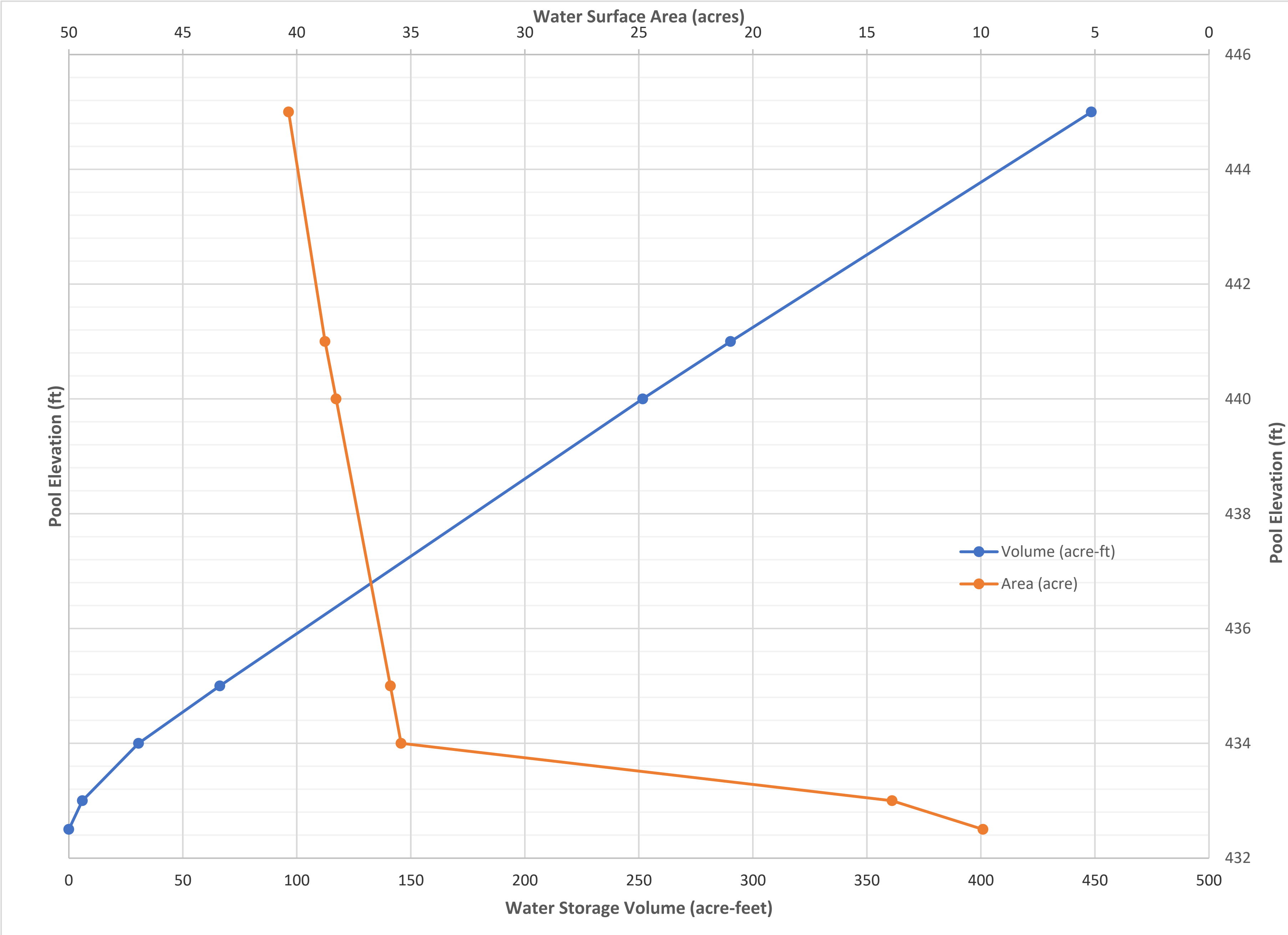



FIGURE 3

# APPENDIX A

OPERATION AND MAINTENANCE MANUAL FOR CELLS 1 & 4A AND RECYCLE POND

SCPD AS-BUILT DRAWINGS

AMEREN MISSOURI SIOUX ENERGY CENTER CONSTRUCTION PERMIT MODIFICATION FOR PERMITTED UTILITY WASTE LANDFILL (PERMIT NO. 0918301), ST. CHARLES COUNTY, MISSOURI, REVISED GEOTECHNICAL ENGINEERING REPORT, JANUARY 24, 2020

REITZ & JENS, INC.
CONSULTING ENGINEERS

GREDELL Engineering Resources, Inc.
ENVIRONMENTAL ENGINEERING LAND - AIR – WATER

**Project Engineering Team**

# Operation and Maintenance Manual for Cells 1 & 4A and Recycle Pond
## Sioux Energy Center Utility Waste Landfill
## St. Charles County, Missouri

*Prepared for:*

Ameren
MISSOURI

**Ameren Missouri**
**Power Operations Services**
**3700 South Lindbergh Blvd.**
**St. Louis, Missouri 63127**

April 2011 (Revised October 2015)

# Ameren Missouri Sioux Energy Center Utility Waste Landfill
# Cells 1 & 4A and Recycle Pond
# Operation and Maintenance Manual

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# ABBREVIATIONS

BFE............... Base Flood Elevation, from FEMA Flood Insurance Study maps
CCPs............. Coal combustion products (fly ash, bottom ash, and boiler slag)
CDSE............ Ameren Missouri Chief Dam Safety Engineer
CPA............... Construction Permit Application
CY................. Cubic yard(s)
DRSP............ MDNR Dam and Reservoir Safety Program (as in MDNR-DRSP)
DSI................ Detailed Site Investigation, part of the MDNR permitting process
DSP............... Ameren Missouri's Dam Safety Program (DSP 003)
EIP................ Ameren Emergency Implementing Procedures
EPA............... Environmental Protection Agency
FEMA............ Federal Emergency Management Agency
FS................. Factor of Safety
HDPE............ High density polyethylene
MDNR........... Missouri Department of Natural Resources
O&M............. Operation and maintenance
PSI................ Preliminary Site Investigation
SCC.............. St. Charles County
SWMC........... Soil Waste Management Code for St. Charles County
SWMP........... MDNR Solid Waste Management Program (as in MDNR-SWMP)
UWL.............. Utility waste landfill
WFGD........... Wet flue gas desulfurization
WFP.............. Waste Facility Plan, required by St. Charles County

# Ameren Missouri Sioux Energy Center Utility Waste Landfill Cells 1 & 4A and Recycle Pond Operation and Maintenance Manual

# 1.0 INTRODUCTION

## 1.1 GENERAL DESCRIPTION OF UTILITY WASTE LANDFILL

The Ameren Missouri Sioux Energy Center ("Plant") Utility Waste Landfill (UWL) site is located in unincorporated St. Charles County within a tract of land totaling 398 acres, of which 183.5 acres are permitted for use as the active disposal area. The UWL site is adjacent to the Plant, located south of State Highway 94 and north of Dwiggins Road. The active disposal area will be divided into multiple disposal cells. A general plan of the UWL is shown in Figure 1. Cell 1, the Recycle Pond, and associated facilities were constructed between 2008 and 2010. Cell 4A was constructed in 2012 and 2013. A plan of Cell 1, Cell 4A and the Recycle Pond is shown in Figure 2. The remaining acreage includes area for future cells, soil-borrow areas, access roads, flood protection berms, buffer area, slurry pipes, and haul roads. Ameren leases as much of the unused acreage as possible for crop farming.

The UWL has been approved by the Missouri Department of Natural Resources (MDNR) to allow permanent disposal of both wet flue gas desulfurization (WFGD) gypsum using wet "gypsum stack" methods, and dry disposal of coal combustion products (CCPs) produced by the Sioux Energy Center. The purpose of the Cell 1 and future Cells 2 and 3 is storage of gypsum from the WFGD system. Cells 4 through 7 will store moisture-conditioned (i.e. "dry") CCPs. Only the western half of Cell 4 (Cell 4A) has been constructed. The purpose of a future individual cell may change before it is designed and constructed.

Only CCPs generated by Ameren Missouri's Sioux Energy Center will be accepted at the UWL. The total CCP volume estimated to be available at the site is 21,123,000 CY when all cells have been constructed. This equates to an estimated 20,532,000 tons of landfill capacity. Based on historical production and assumptions for future CCP generation, the calculated life expectancy of the landfill is approximately 48 years, reaching capacity in 2058.

## 1.2 SCOPE OF O&M MANUAL

This Operations and Maintenance (O&M) Manual is only for: Cell 1, Cell 4A, and the Recycle Pond <u>outside the Reclaim Water Pump House and associated Electrical Equipment Building</u>. This Manual does NOT include the operation and maintenance of the piping, mechanical or electrical systems that are located in the Plant; between the Plant and the Pump House; nor associated with the Pump House and the Electrical Building at the Recycle Pond.

Safety requirements and procedures are not included in this Manual. <u>Ameren Missouri and Sioux Energy Center health and safety rules and procedures must be followed</u>. In particular, working on or near the inside slopes of Cell 1 and the Recycle Pond requires special precautions, such as the use of floatation vests and a life line. The high density polyethylene (HDPE) liner is very slippery when wet.

The effective timeframe of this O&M Manual began with start-up of the WFGD system in November 2010 until Ring Drain B will be installed. Ring Drain B will be required when enough gypsum solids have accumulated in Cell 1 for continued wet stack operation, which is at about el. 441 to 443. Based on an average monthly production rate of 7,000 to 9,000 tons of gypsum, Ring Drain B will not be required until 2020 to 2021 if gypsum stacking operations are performed. Plant operational, maintenance and construction activities required for the UWL beyond the installation of Ring Drain B in Cell 1 will need to be addressed at that time.

CCPs will be placed in Cell 4A as a construction contract periodically. Therefore, the daily operational procedures for the dry cell are not included in this O&M Manual. These procedures are stated in the St. Charles County Waste Facility Plan and the Construction Permit Application (CPA).

Because the effective timeframe of this O&M Manual spans several years, modifications made to processes or associated documents may necessitate revision and modification to this O&M Manual.

## 1.3 AMEREN DAM SAFETY PROGRAM

This operation, maintenance and inspection program for the Sioux UWL Cell 1 and Recycle Pond shall be in compliance with the current Ameren Missouri Procedure AUE-ADM-5103, “Dam Safety Program for Ameren Missouri Non-Hydroelectric Facilities.” The Dam Safety Program does not apply to Cell 4A or the other dry CCP cells.

## 1.4 OVERVIEW OF UWL

The Utility Waste Landfill (UWL) is being constructed in phases (or cells) that will be designed and permitted to accept either gypsum or CCPs. The initial phase was the construction of Cell 1 and Recycle Pond, which are located within a 183.5-acre permit boundary within the 398 acre tract. The footprint of Cell 1 covers approximately 37.5 acres, and the Recycle Pond footprint is approximately 19.6 acres. Cell 1 was designed for wet gypsum stacking operation. Additional disposal capacity for both gypsum and CCPs will be created by adding additional disposal cells with prior regulatory approval. At this time, Cells 1, 2 and 3 will hold WFGD gypsum, and will total 96.9 acres. Cells 4 through 7 will hold CCPs and will total 86.6 acres. Cell 4A has been constructed with a footprint of about 15 acres. Preliminary approval for adding future cells has been obtained from both the Missouri Department of Natural Resources (MDNR) and St. Charles County. The present MDNR permit does not allow reclamation activities.

The existing topography of the site is very flat. The site is a part of the 100-year floodplain of the Mississippi and Missouri Rivers, but not in the floodway. There are two topographic ridges, each less than 3 feet high, and one shallow drainage feature that cross the site north of Dwiggins Road in a general east-west direction. The shallow drainage feature lies between the two ridges. The entire UWL site is protected from flooding on the Mississippi River by the L-15 agricultural levee system up to about el. 433, which is the 20-year flood event on the Mississippi River (i.e. on average would occur once in every 20 years). The 50-year flood event on the Mississippi River is el 435. The 100-year flood event on the Mississippi River is el. 438.7 (i.e. BFE). The railroad embankment protects the site from the 100-year flood event on the Missouri River. The site itself generally drains from northwest to southeast. The Ameren spur railroad embankment to the west as well as roads on the north and south generally block surface water from flowing onto the UWL site.

A typical cross-section of a perimeter berm for Cell 1 and the Recycle Pond is shown in Figure 3. The top of the perimeter berms is at el. 446. A cross-section of the perimeter soil berms for Cell 4A (north, west and south berms) is shown in Figure 4. A cross-section of the east temporary CCP berm of Cell 4A is also shown in Figure 4. The interior floor and side slopes of Cells 1 and 4A and the Recycle Pond are lined with HDPE liner over 24 inches of high plastic clay. The HDPE and the compacted clay are collectively referred to as the "composite liner." The HDPE liner is held at the top of the interior slope by a 24-inch wide by 24-inch deep anchor trench. **IT IS CRITICAL THAT THE HDPE LINER IS NOT CUT, TORN OR PUNCTURED AT ANY POINT**. The HDPE liner must always be protected from damage. (The interior slope of the CCP berm does not have a HDPE liner.) The exterior of the western and southern Cell 1 and Recycle Pond perimeter berms are armored with riprap for flood protection in the remote event of a breach of the railroad embankment such as occurred in 1993.

Access to the UWL is limited to authorized Ameren personnel and contractors. Emergency vehicle access from the Sioux Energy Center to the UWL can be provided during a flood event via Highway 94 across from the Sioux Energy Center employee entrance. Access around the UWL is provided by gravel maintenance roads on the top of the perimeter berms and around the exterior toe of the perimeter berms. Another entrance was constructed to allow access via Highway 94 directly across from the Sioux Energy Center contractor's entrance. The entrance and associated haul road allows for CCP transportation from the Energy Center to the UWL.

Cells 1 and 4A and the Recycle Pond are surrounded by a seven-foot high security fence topped with barbed wire. Locked gates are located on the north side of the UWL at the entrance roads to control access to the disposal area. Ameren Sioux Energy Center security staff is on duty 24 hours per day and will provide additional security to the UWL through routine site monitoring.

### 1.4.1 Cell 1

The WFGD scrubber system installed at the Sioux Energy Center will reduce sulfur dioxide ($SO_2$) emissions. The by-product is gypsum (as found in wallboard), which is transported to the UWL as a slurry containing about 15% to 20% solids. Gypsum stored in the Gypsum Transfer Tank at the Plant is pumped from one of two gypsum transfer pumps located in the Plant's Gypsum Transfer Building through three underground HDPE pipelines. The piping connects the UWL system with the WFGD system at the Reclaim Water Pump House. These lines include gypsum transfer, reclaim water return, and a common spare that can be utilized for either gypsum transfer or reclaim water system. The pipelines cross under Highway 94 and enter through the north wall of the Pump House (shown in Figure 2).

The gypsum slurry is piped to Cell 1 through either one of two buried HDPE pipelines that run from the south wall of the Pump House, down the centers of the east embankment and the south embankment of the Recycle Pond, and down the center of the east embankment of Cell 1. The pipes discharge into Cell 1 at the approximate midpoint of the east embankment (Sta.

34+40) at an invert elevation of 442.67. There are 7 pairs of cleanouts in manholes – one set for each slurry pipeline – located at about 300-foot spacing (see Figure 2).

The gypsum slurry discharges into Cell 1, where the gypsum settles out and the “decant” water flows into the Recycle Pond. The water will normally flow by gravity through the triple box culverts (“Influent Structure”) near the northwest corner of Cell 1, or it may be pumped or siphoned out of Cell 1 into the Recycle Pond. The flow line of the box culverts is at about el. 441 which controls the maximum water level in Cell 1.

Cell 1 is designed with two ring drains that are a key component to the long-term stability of the UWL during gypsum stacking operations. The positions of the two ring drains are illustrated in Figure C-1 in Appendix C. These ring drains are not critical to the stability or operation of Cell 1 until gypsum stacking operations reached above about el. 451. The outer ring drain is designated “Ring Drain A” and was installed on top of the HDPE liner at the bottom of Cell 1. Four outlet drain pipes have been installed for Ring Drain A as shown in Figure 2. As the height of the gypsum stack increases, the lower gypsum is compressed, forcing the water out. Some of this water will be forced through the ring drains and up and out of the outlet pipes, which will discharge into a future perimeter ditch formed in the gypsum (see Figure C-1). The outlet pipes discharge at el. 443.0. So the height of the gypsum will have to be 3 to 5 feet above the discharge of the outlet pipes, or at about el. 446 to 448, before water will flow from the outlet pipes. Therefore, Ring Drain A and its associated outlet pipes are not expected to function during the effective timeframe of this O&M Manual. Ring Drain B is not currently installed, but is designed to be installed at approximate el. 440 when the gypsum in Cell 1 has accumulated to about el. 441 to el. 443, at which point a stable working surface can be established (see Section 1.2). Ring Drain B consists of 6-inch diameter slotted pipe enclosed by drainage gravel blanket. The gravel blanket is 12 feet wide and 18 inches thick, and is wrapped with a filter fabric. The total length of Ring Drain B is about 3600 feet.

The available volume for gypsum in Cell 1 up to el. 441 is 856,000 CY. Gypsum stacking operations will be required shortly after the gypsum fills Cell 1 up to about el. 441 to 442, which is expected to be in the 2020 to 2021 timeframe. Gypsum stacking operations are presented in Appendix C. Gypsum stacking in Cell 1 may not be allowable depending on the outcome of pending regulations. Should regulations allow stacking, the available volume of gypsum in Cell 1 is about 2.8 million CY to a maximum elevation of 485 feet. Permitting and construction of Cell 2 will need to be complete and ready for operation by the time this elevation is reached in Cell 1 and possibly sooner depending on regulations.

The sump, located at the approximate center of the north end of Cell 1, is designed to allow a submersible pump to be installed at a later date near the bottom of Cell 1 to help drain Cell 1. For example, this might be done to repair a leak in the liner.

### 1.4.2 Recycle Pond

The landfill is designed as a no-discharge water management system. The excess slurry water and rainfall within the perimeter berms is collected in the Recycle Pond and pumped back to the WFGD system as reclaim water. The water in the Recycle Pond normally will flow through the box culverts in the southwest corner to the east end, where two 48-inch diameter HDPE pump intakes manholes (“Effluent Structures”) are located on the bottom of the Recycle Pond. The tops of the manholes are at el. 426.5, and the bases are at el. 422. Water will flow through the tops of the manholes. If the water in the Recycle Pond is drawn down below el. 426.5 under special circumstances, then there are holes in the side of both manholes which will allow water to flow into the manholes down to el. 425.

These pump intakes are connected to 2 reclaim pumps in the Pump House through 2 double-wall HDPE intake pipes that enter the west side of the Pump House. The flowline of the intake pipes is at el. 423 at the pump intake manholes. The pipes go through the west wall of the pump house at el. 426 and el. 427 (centerline). The pump intakes and exposed piping are held in place by a gravel blanket that also protects the HDPE liner during future maintenance activities. The pump intakes have mesh screens covering their open tops that are designed to keep large objects and debris out of the reclaim pumps in the Pump House.

The water levels within the Recycle Pond are continuously monitored by the Plant operation personnel. A series of redundant level sensors are installed at the east end of the Recycle Pond to allow continuous monitoring. These sensors are housed in five 4-inch diameter HDPE pipes that are installed on top of the HDPE liner on the slope of the east embankment (see detail in Figure 2). The three long pipes house pressure transducers which are continuously read water level sensors, while the two shorter pipes house water level probes with redundancy for the “high” and “high-high” water level alarms. The HDPE pipes housing the level sensors are anchored to the HDPE liner by HDPE “anchors” boxes that are filled with gravel and are welded to the HDPE liner.

A recirculation pipe exits the west side of the Pump House, just below the top of the east embankment, and discharges into the southeast end of the Recycle Pond. The Pump House also has a sump pit to remove water that may accumulate in the Pump House. The water is returned to the Recycle Pond through a buried pipe that exits the south side of the Pump House and also discharges into the southeast corner of the Recycle Pond.

There are two (2) Emergency Spillways located in the west perimeter embankment: one for the Recycle Pond and one for Cell 1. These spillways are a regulatory requirement of the Dam Construction Permit, to provide a controlled discharge in the unlikely event that the water levels in either the Recycle Pond or Cell 1 are close to overtopping the perimeter embankments. THE EMERGENCY SPILLWAYS ARE NEVER INTENDED TO BE USED UNDER NORMAL OPERATING CONDITIONS. Discharge of water from the Recycle Pond or Cell 1 into the area outside of the perimeter embankments is not allowed under existing State and County environmental permits.

### 1.4.3 Cell 4A

Cell 4A is designed for the storage of CCPs from the Sioux Energy Center. As noted previously, Cell 4A is the western one-half of the whole future Cell 4, that is when the eastern Cell 4B is constructed (see Figure 1). The design capacity of Cell 4A is 990,000 CY up to el.

514 (i.e. el. 515 minus 1 foot of soil cover). Cell 4B would have to be permitted and constructed so that it is operational before the CCPs in Cell 4A reach el. 514.

The east berm of Cell 4A is a “temporary interior” berm and was constructed with compacted CCPs from the ash pond at the Sioux Energy Center. Cell 4A has a blanket leachate collection system over the bottom and interior side slopes, and under the east CCP berm. Leachate is free water that drains to the bottom of the cell, either from water squeezed out of the CCPs by compression of its own weight or precipitation percolating through the CCP fill. The blanket leachate collection system is a geo-composite that consists of an expanded HDPE mesh topped with a non-woven filter fabric. The geo-composite drains to a central north-south leachate collection pipe, which conveys the leachate to a sump located at the north berm of Cell 4A. The entire geo-composite is covered with 12 inches of clean sand, to protect the geo-composite and to act as a filter to keep fly ash out of the leachate collection system.

A submersible leachate sump pump (EPG SurePump Model WSDPTSL 15-6) is located at the bottom of the sump in an 18-inch HDPE pipe that runs up the interior slope to the leachate sump pump vault (see Figure 2). The north-south leachate collection pipe also extends up the interior slope to the vault, and has a cleanout. The leachate sump pump can be pulled up the sloping 18-inch pipe with a cable and pulley for maintenance. The controls for the leachate sump pump are located within a control panel (PG PumpMaster Series L925PT) mounted outside of the vault. The leachate sump pump is equipped with a pressure sensor and operates automatically to control the fluid pressure or “head” in the leachate collection system. Per MDNR-SWMP regulations, no more than one foot of water can remain on the HDPE liner outside of the sump area. The leachate sump pump discharges through a flexible hose, which connects inside the vault to a buried 6-inch HDPE pipe that runs along the top of the north berm over to the discharge structure in the Recycle Pond. Power to operate the leachate sump pump comes from the Reclaim Water Electric Equipment Building. The leachate pump and alarm settings are discussed later in Section 2.4.1 and in the O&M manual for the leachate pump system.

Cell 4A was initially filled with CCPs from the active Sioux ash pond north of Hwy. 94 as soon as the cell was completed and authorization was received from MDNR-SWMP and revised operating license from St. Charles County. The initial filling of Cell 4A was required to provide ballast (weight) to counter hydrostatic uplift on the bottom liner in the event of a significant flood. A plan and profile of the initial filling with CCPs is shown in Figure 9A. The top of the CCP fill has an “intermediate” soil cover because CCPs will not be placed within Cell 4A for more than 60 days, in accordance with MDNR-SWMP regulations. Precipitation that collects in Cell 4A must be pumped to the Recycle Pond, to try to minimize the volume that percolates through the CCP fill and becomes leachate that must be removed by the leachate collection system. The surface of the intermediate cover is shaped to drain to a sump located below the storm water channel at the west side of Cell 4A. An electric submersible sump pump (Zoeller Model MX292) pumps the collected storm water up to a buried discharge pipe which drains by gravity into the Recycle Pond (see Figures 2 and 9B). The storm water pump is designed to be readily relocated as CCPs are added to Cell 4A. Power for the storm water pump comes from the Reclaim Water Electric Equipment Building. The storm water pump is equipped with automatic controls and a moisture sensor indicator panel mounted on the pipe bollard with the power source (see Figure 9B). The storm water pump settings are discussed later in Section 2.4.2 and in the O&M manual for the storm water pump.

Currently, CCP ballast has been placed to elevations of 433 feet at the berms to 437 feet at the center of Cell 4A. An intermediate soil cover has been placed over the CCPs to elevations of 435 to 438 feet. The construction ramp was left in place to facilitate future CCP placement and also covered with the soil cover. When the CCPs in Cell 4A reach el. 483, then an intermediate storm water collection berm with "let-down" storm water channels will be constructed. The volume of CCPs in Cell 4A up to el. 483 is 850,000 CY.

There is one Emergency Spillway located in the west perimeter embankment to provide a controlled discharge into the Recycle Pond in the unlikely event that stormwater pump cannot maintain operations to prevent overtopping the perimeter embankments. THE EMERGENCY SPILLWAY IS NEVER INTENDED TO BE USED UNDER NORMAL OPERATING CONDITIONS. Discharge of water from Cell 4A into the area outside of the perimeter embankments is not allowed under existing State and County environmental permits.

## 1.5 STATE AND LOCAL PERMITS

The following State and County permits and licenses have been obtained in order to construct and operate the UWL:

1) Missouri Department of Natural Resources (MDNR) Solid Waste Disposal Area Operating Permit No. 0918301, dated July 30, 2010.

2) MDNR Solid Waste Disposal Area Construction Permit No. 0918301, dated March 28, 2008. The "Groundwater Monitoring Program" is incorporated into this Permit.

3) MDNR Dam and Reservoir Safety Council Construction Permit C-426 (MO40160), dated April 1, 2008, with a memorandum of understanding. This permit has to be renewed annually.

4) St. Charles County Solid Waste Operating License #04303, dated November 1, 2013, revised December 10, 2013. This license must be renewed annually by October 31.

5) MDNR Solid Waste Management Program Authorization to Operate (ATO) Cell 4A, dated December 6, 2013.

6) MDNR issued Water Pollution Control Construction Permit #22-7667 for the Recycle Pond on August 5, 2008.

7) Wastewater discharges from the Sioux Energy Center are authorized by NPDES Permit MO-0000353. This includes the Recycle Pond. Reissuance of this permit is currently pending with MDNR.

These permits and licenses contain specific requirements which must be followed and are provided in Appendix D for reference. The pertinent current requirements are summarized in

Section 6 and throughout this O&M Manual. However, nothing in this Manual may modify or supersede the requirements in the actual permits and licenses. The renewal or modification of these documents may impact the contents of this O&M Manual and may require revision of this Manual.

# 2.0 OPERATIONS

State operating permits and the St. Charles County operating license list Ameren Missouri as the operator of the UWL. This O&M Manual has been prepared based on Plant personnel conducting the day-to-day operations. Day-to-day activities of the UWL may be subcontracted to a qualified contractor in the future. If so, that may require revision to this O&M Manual, as well as notification and revision of one or more of the State permits or the County license.

## 2.1 PERSONNEL

When the UWL is being operated daily, that is receiving CCP from the Sioux Energy Center rather than periodically under a construction contract, then the landfill manager and at least one other employee of the landfill will be Certified Solid Waste Technicians, in accordance with the approved CPA, Section 4.8.3. The other employee who is a Certified Solid Waste Technician will be qualified to serve the role of landfill manager during the manager's absence. However, until the UWL has daily operations, these certifications are not required. The St. Charles County Solid Waste Facility License does require that the personnel performing the weekly and special inspections must be trained to do these inspections (see Section 3.0 of Embankment Inspections).

## 2.2 EQUIPMENT

A preventative maintenance program will be implemented for the landfill equipment to minimize equipment failure and maximize equipment life. The landfill will have redundant pieces of equipment for use in most emergency situations. Each piece of equipment will be equipped with a fire extinguisher. See the St. Charles County Waste Facility Plan for a list of primary equipment and maintenance requirements.

## 2.3 ROUTINE GYPSUM MANAGEMENT

The water level in Cell 1 must be maintained at el. 441 feet from about December 1 through about March 31 each year to provide freeze protection for the clay liner until a minimum of 2 feet of gypsum can be spread on the sides of Cell 1 for freeze protection. The volume of water in Cell 1 will gradually be reduced as gypsum solids accumulate. Since the beginning of operations, gypsum slurry has been discharged into Cell 1 through the ends of the buried slurry pipes at about the middle of the east side as shown in Figure 5. The gypsum sediment is forming a "beach" below the discharges that will be above the water surface. The beach expands outward as more gypsum is pumped into Cell 1. Once the beach extends more than half way across Cell 1, as illustrated in Figure 6, flexible overland pipes will need to be installed around the perimeter of Cell 1 to continue discharging into Cell 1 at the south end. The overland pipes, as illustrated in Figure 7, should be 10-inch HDPE SDR-17. The discharge ends of the buried slurry pipes have bolted HDPE flanges to connect overland pipes. The overland pipes may be placed on the slope;

however the pipes may NOT be anchored by any means that would puncture the HDPE liner. Bags filled with gypsum or fly ash (not sand) may be placed on the slope to hold the pipes.

### 2.3.1 Siphoning

It will be necessary or desirable at times to lower the water level within Cell 1 to about el. 438 to optimize the distribution of the gypsum. This time is from about April 1 to the end of November. This must be done by pumping or with a siphon. A minimum head differential of 3 to 4 feet between the Cell 1 and the Recycle Pond is needed for the siphon to work. The difference in head between the cell and the pond will provide sufficient head differential to operate a siphon to lower the water level in Cell 1 below el. 441. Reclaim water will be transported from Cell 1 to the Recycle Pond either by gravity through the triple box culverts or by a siphon using an 8-inch (or larger) siphon line. The siphon line may be run through the box culvert to keep the road on the top of the embankment clear. As soon as sufficient water accumulates in the Recycle Pond, it will be pumped back to the Plant for reuse so that the water level in the Recycle Pond is maintained within the range of el. 432 to el. 435 during normal operation.

### 2.3.2 Berm and Rim Ditch Construction

After the discharge point is relocated as shown in Figure 7, it will become necessary to begin construction of the perimeter gypsum berm and rim ditch. The beginning of the construction is illustrated in Figures 6, 7 and 8. The water level in Cell 1 must be 3 feet or more below the working surface of the gypsum beach to support light earthmoving equipment. As discussed in the previous section, the water level may be lowered below el. 441 by pumping or siphoning during the appropriate time of the year. Once the perimeter gypsum berm and rim ditch have been constructed around the southern half of the Cell 1 (Figure 8), then the gypsum slurry will be carried in the rim ditch.

### 2.3.3 Gypsum Stacking Operations

When stacking will be required above the perimeter berm elevation of 441, gypsum management should follow the operational guidelines presented in Appendix C.

## 2.4 ROUTINE DRY CELL MANAGEMENT

CCPs will continue to be managed within the existing ash ponds at Sioux Energy Center for the foreseeable future. When necessary due to space constraints within the ash ponds, Ameren will issue a construction contract to haul stockpiled CCPs from Sioux to Cell 4A. The CCPs must be sufficiently dry to pass the Paint Filter Liquids Test (USEPA Method 9095B) prior to transportation. Basically, this requires that there is no “free water” when transporting the CCPs to Cell 4A. A characteristic of the fly ash at the Sioux is that it retains water, which does not drain out of stockpiled fly ash. The CCPs should be conditioned to a moisture content low enough to pass the Paint Filter Test and to get the fly ash sufficiently dry to transport to the cell.

The first step in adding CCPs to Cell 4A will be to remove the intermediate soil cover. The plan is for the contractor to stockpile and reuse the soil for the intermediate cover on the new CCP fill. The truck ramp constructed in Cell 4A during the initial CCP ballast placement was left in place to facilitate future CCP placement. The gravel haul road from the contractor's entrance to the main entrance of the UWL may require regular maintenance to handle the heavy truck traffic during the hauling of CCPs to Cell 4A. After completion of hauling, the haul road and any other areas along the haul route should be restored if damage, such as rutting, occurs during hauling operations.

A bulldozer, tracked loader or other suitable type of earth moving equipment will be used to spread and compact the CCPs on the working face. The slope of the working face should not be steeper than 33% and the CCPs should be compacted in lifts no greater than 2 feet in thickness and to an average dry unit weight of 68 pounds per cubic foot (pcf). Generally, the disposal cells will be filled in a total vertical lift of 8 to 10 feet in height, with the waste confined to the smallest practicable area and compacted to the smallest practicable volume. The slope of the final landfill exterior side slopes of the dry disposal area will not exceed 25% slope (4 horz. to1 vert.). The vertical lifts will be staggered to promote storm water runoff with minimal erosion and to provide easy truck access and traffic flow while maintaining an orderly sequence of fill within the active portion of the lined cell. The CCPs may require additional conditioning to obtain a moisture content ranging from 30 to 40% for optimal compaction and for dust control. The operator will add moisture to the CCPs deposited at the active working face by spraying water directly onto the waste. If necessary, moisture content will be lowered by aerating the CCPs by disking or grading the CCPs on the working face. The compaction of the CCPs must be sufficient such that construction equipment will be able to run on top of the fill during placement of the new CCPs.

Refer to the plans in the CPA and the Waste Facility Plan for details about the design of the CCP fill, perimeter storm water collection ditch, and let down structures.

### 2.4.1 Leachate Collection System

MDNR-SWMP regulations require that the maximum water pressure on the HDPE liner below the CCP fill shall not exceed 1 foot of water (62.4 $lbs/ft^2$ or 0.43 psi). Therefore, the leachate collection sump pump must be capable of removing the leachate from the sump to keep the pressure in the leachate collection blanket below the CCP fill to less than 12 inches. The pressure transducer that controls the leachate sump pump is located at the center of the end. When the leachate sump pump is set in the bottom of the 18-inch pipe, the center of the pressure transducer is 13.3 inches above the bottom of the sump and 29.6 inches below the leachate collection geo-composite at the edge of the sump. Therefore, the control on the leachate sump pump should be set to turn the pump on when the pressure reaches 41.5 inches. The pump control should be set to turn the pump off when the pressure drops to 17 inches. The controls have two alarms, which are sent to the Control Room: the pump tripped/loss of power alarm, and the high level alarm. The high level alarm is set to 54 inches to indicate an excess head of 12 inches on the HDPE liner in the vicinity of the sump. The current settings on the controls are shown in Table 1.

The control panel for the leachate collection sump pump is located next to the sump pump vault. The control panel has a pump run light, a digital pressure readout, and elapsed run time readout for the pump, and a high level light. An exterior red alarm light on top of the control panel will also turn on with the high level alarm. See the EPG Companies Operations & Maintenance Manual for more details about the leachate collection sump pump system.

Table 1 – Setting of Operating Levels on Cell 4A Leachate Collection Pump

| Parameter | Meter Reading inches | Operation |
|---|---|---|
| Pr Hi | 41.5 | Turns pump on |
| Pr Lo | 17 | Turns pump off |
| AL Hi | 54 | Turns high level light on |
| Hy Hi | 1.0 | Turns high level light off when drops below AL Hi |
| AL H2 | 143 | Turns pump off (Greater value indicates probable failure of level sensor) |
| Hy H2 | | Not used |

The Plant receives only two alarms on the main alarm screen. The two alarms are: 1) the pump tripped/loss of power alarm, and 2) the high level alarm (AL Hi in Table 1). If the pump tripped/loss of power alarm is received, then maintenance personnel should be sent to Cell 4A to review the control panel, to investigate the cause and to determine the appropriate action. The alarm indicates one of two scenarios: 1) The pump has not been operating and water has steadily accumulated in the sump to an elevation above the high alarm setting (troubleshooting of the pump is required), or 2) The pump is running but cannot keep up with the amount of water entering the sump (no action is required as long as the pump continues to run and the water level drops below the high alarm setting). It is permissible for the leachate in the collection system to exceed 12 inches for up to several days, for example if a heavy rain has increased infiltration into the leachate collection system from ponded water on the surface. If the high level alarm stays on more than 48 hours, or if it occurs several times in a week, then Ameren Environmental Services should be notified.

### 2.4.2 Storm Water Pump

Storm water that collects in Cell 4A must be pumped into the Recycle Pond. The storm water channel is only an “emergency spillway” to prevent the overtopping of the perimeter berms. The storm water pump is intended to be relocated as needed during placement of CCP fill, but it must remain in the vicinity of the buried storm water discharge pipe into the Recycle Pond (see Figure 2). The pump is sized for approximately 100 GPM at a total dynamic head (TDH) of 18 feet. At that rate, the pump will require about 7-1/2 days to remove a 25-year, 1-hour rainfall in Cell 4A (2.63 inches). There may be considerable infiltration of ponded storm water into the leachate collection system during the initial years when the thickness of the CCPs is less than design. If the leachate collection sump pump runs excessively, then adding a second storm water pump should be evaluated to shorten the time required to pump out the storm water.

## 2.5 ROUTINE OPERATION OF THE RECYCLE POND

Reclaim water will normally discharge from Cell 1 into the Recycle Pond by gravity through the triple box culverts. A minimum elevation of 428 feet is required at all times to maintain proper ballast on the HPDE liner, with the exception of short durations for repair or maintenance of the pump intake structures. **The water level in the Recycle Pond will require a minimum**

**elevation of 430 feet to provide submergence for the reclaim pump intakes**. The water level in the Recycle Pond should be maintained between el. 432 and el. 435 during December 1 through about March 31 each year to provide freeze protection for the clay liner.

Special consideration of Recycle Pond management (i.e. leaving enough storage volume) should consider major boiler outages, forecasted heavy storms, or dual unit outages when the water level in the Recycle Pond is maintained above el. 435. Surge capacity is required in the Recycle Pond to accommodate all precipitation runoff from the entire area of Cell 1, Cell 4A, and the Recycle Pond. Instrumentation to continuously monitor the level of the Recycle Pond is housed in 4-inch diameter, perforated HDPE pipes. The following instrumentation set points have been established:

Table 2 – Recycle Pond Water Level Set Points

| Elevation (ft) | Description | Notes |
|---|---|---|
| 428 | Low Level | Auto Stop Reclaim Water Pumps; Minimum Elevation of water |
| 430 | Low | Start Permit - Reclaim Water Pumps |
| 432 | Low Level Alarm | |
| 435 | High with Check light and Alarm | Design Storm Water Capacity |
| 443 | High Alarm | |
| 443.5 | High High Alarm | |

Additional details of the operation of the UWL are presented in Section 4.0 of the CPA, and are reproduced in Appendix D of the St. Charles County Waste Facility Plan.

# 3.0 EMBANKMENT INSPECTIONS

This operation, maintenance and inspection program for the Sioux UWL Cell 1, Recycle Pond, and Cell 4A shall be in compliance with the current Ameren Missouri Procedure AUE-ADM-5103 “Dam Safety Program for Ameren Missouri Non-Hydroelectric Facilities” and the permits and licenses listed in Section 1.5.

Cell 1 and the Recycle Pond are listed in AUE-ADM-5103, Section 1.2.1.5 as “Gypsum Stack and Recycle Pond Dam.” Section 2.3 defines the policies, objectives and expectations of Ameren Missouri’s Dam Safety Program. Section 3.0 defines the duties and responsibilities of the Chief Dam Safety Engineer (CDSE), the Dam Safety Group Staff, and operations personnel.

Section 4.4 defines four types of dam safety inspections: routine, annual, special, and unannounced. These inspections also apply to Cell 4A. The inspections for Cells 1 and 4A and the Recycle Pond shall be: Weekly (“routine” in the AUE-ADM-5103), Special Incident, and Annual. The Dam Safety Group may still perform unannounced inspections.

All inspections (with the exception of initial emergency or urgent Special Incident inspections) must be done during daylight hours.

All inspections shall be done by qualified person or persons. The St. Charles County Solid Waste Facility License stipulates that a "qualified" person shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation.

## 3.1 DESCRIPTIONS OF CERTAIN ANOMALIES

The following terms used in describing certain anomalies associated with embankment maintenance and inspection are provided as background information.

"Slough" – appears in a slope as a relatively shallow spherical depression with a mound of disturbed material at the bottom of the depression. A slough may occur anywhere on a slope. A slough in the riprap may be very difficult to see. If the soil in the slough and below the slough is dry, then the slough should be noted and repaired as soon as possible. If the soil is wet in the slough or below the slough or there is seepage from the slough, then the Dam Safety Group and the Shift Supervisor at the Plant should be notified immediately.

"Deep Slide" – is a large movement of soil that may involve one-third or more of the slope. A slide is characterized by a nearly vertical "scarp" or exposed embankment material at the top of the slide, and a large mound of disturbed soil at the base of the slide. The lateral extent of the slide may appear circular. The Dam Safety Group and the Shift Supervisor at the Plant should be notified immediately if a slide is found, particularly if water is seeping from the disturbed area.

"Surface Slide" – is a very shallow slide, where the surface sod, riprap or soil has moved down the slope. There may be visible cracking, but no depression or scarp. A shallow slide should be noted and repaired as soon as possible.

"Seepage" – may be visible water running out of the base or face of a slope or it may be evident as a very wet, spongy area of soil. Water will be draining out of the base of a slope for some time after rain or snow. This is particularly true at the base of the riprap slope because a large quantity of rain or snow is collected in the spaces between riprap stone. Seepage at the base should be watched and reported if it occurs during dry weather, or continues for several days after a rain or a week after a snow.

"Boil" – is evident as seepage from a hole in the face of a slope or several hundred feet beyond the base of a slope. At the Sioux UWL, a boil may occur beyond the crushed rock perimeter road. There may be a mound of soil around the hole of the boil. The seepage water may be clear or may be muddy. A boil should be reported immediately to the Plant Shift Supervisor and the Dam Safety Group.

"Burrow" – any damage from animal intrusions, whether rutting, digging dens or tunnels or searching for food.

"Woody Vegetation" – includes shrubs, trees, dense ground cover, or any plant with a stiff, "woody" stem. Woody vegetation may interfere with mowing of the grass cover, or hide animal burrows or erosion.

## 3.2 WEEKLY INSPECTIONS

The Weekly Inspection shall consist primarily of traveling the upper and lower service roads of Cells 1 and 4A and Recycle Pond embankments, to look for visible evidence of potential problems, and with stops to check certain features. The form for Weekly Inspections is in Appendix A.

1) Inspect for erosion, sloughing, sliding, boils, seepage or animal burrows, in particular after the adjacent fields have been harvested.

2) Look at the grass cover on all embankments for bare spots or woody vegetation during the appropriate seasons. Record the locations of any bare spots.

3) Record the level of the water in the Recycle Pond, Cell 1, and Cell 4A (if any). Verify the elevation of the water in the Recycle Pond corresponds to the elevation indicated scrubber system logic and operator screen. If the difference between the visual level and the level indicated by the instrumentation is more than 12 inches, then the instrumentation will need to be recalibrated. Check that the level of the Recycle Pond is between el. 430 and 443. If the water level is lower than el. 430 or higher than el. 443, immediate action is required by the Plant Shift Supervisor.

4) Inspect for water spraying or running out of the manholes for the gypsum supply pipes between the Pump House and Cell 1. If so, notify the Plant Shift Supervisor immediately.

5) Check whether the level of the water in either the Cell 1 or the Recycle Pond is less than 2 feet below the crest of the emergency spillways (el. 445). If so, notify the Plant Shift Supervisor immediately.

6) Inspect for unevenness, depressions or cracking in the top of the embankment or the box culverts. A settlement of 0.2-foot or more should be reported.

7) Inspect for holes in the perimeter security fence (including barbed wire), vandalism, and whether the main entrance gate and the emergency entrance gate are locked.

8) Check that the gypsum slurry is flowing unobstructed from the discharge pipes.

9) Estimate visually and record the vertical distance between the flowline of the discharge pipes and the sedimented gypsum. It is not necessary to measure the distance. **Do not walk out on the HDPE liner without suitable safety equipment and procedures.**

10) Inspect the transducer level housing and controls for signs of damage due to power outages, water damage, animal burrows, debris damage or other deterioration. Make certain that the HDPE anchor blocks holding the instrumentation pipes are full of gravel.

11) Check the crushed rock perimeter roads, tops of embankments and ramps for evidence of erosion or vehicle tire rutting. Record the locations of erosion or rutting.

12) Look for deterioration, unevenness or cracks in the concrete blankets around the drain outlets and the sump outlet, and for erosion around the blankets and pipes.

13) Look for signs of stress or tears in the HDPE liners above water in the Recycle Pond.

14) Look for signs of stress or tears in the HDPE liners above water in Cell 1.

15) Look for exposed HDPE liner and geo-composite in Cell 4A, and for evidence of stress or tears.

16) Inspect for deterioration, unevenness, cracking, erosion or separation of the precast concrete blocks in the Recycle Pond below the triple box culverts. Check for debris or sediment that may be blocking the culverts.

17) Inspect for deterioration, unevenness, cracking, erosion or separation of the precast concrete blocks in the southeast corner of the Recycle Pond below the discharge pipes.

18) Inspect for deterioration, unevenness, cracking, settlement, erosion or separation of the precast concrete blocks in the Recycle Pond emergency spillway. Check for animal burrows. Check for debris or sediment that may block the spillway.

19) Inspect for deterioration, unevenness, cracking, settlement, erosion or separation of the precast concrete blocks in the Cell 1 emergency spillway. Check for animal burrows beneath the blocks. Check for debris or sediment that may block the spillway.

20) Inspect the HDPE recirculation pipe for leaks, and if pipe is frozen.

21) Inspect the Pump House sump discharge pipe, and if the pipe is frozen.

22) Inspect the Storm Water Channel between Cell 4A and the Recycle Pond for displacement or cracking.

23) Inspect the Cell 4A Storm Water Pump and Discharge Pipe.

24) Inspect the Leachate Collection Sump Pump Vault for displacement or leaking leachate.

25) Inspect the controls of the Leachate Collection Sump Pump and record the number of elapsed hours of operation.

26) Check for exposed CCPs on the exterior face of the CCP berm.

The Weekly Inspection form should be completed in the field while performing the inspection. If no anomalies or problems are noted, file with the records of the UWL as noted in Section 6.0. If an anomaly or problem is noted, indicate the location(s) on the Inspection Plan and attached it to the report, and email or FAX copies to the appropriate persons listed in Section 6.1.

Schedule the maintenance of the protective grass cover on the side slopes of the embankments in accordance with the recommendations in Appendix B. Mowing should be scheduled no more than 2 weeks prior to the Annual Inspection.

## 3.3 SPECIAL INCIDENT INSPECTION

An inspection shall be completed immediately following any of the following special incidents:

1) Within 48 hours prior to the start-up/commissioning of gypsum production.
2) Following periods of ice on the Recycle Pond and Cell 1 occurring between December 15 through March 31 of each year; inspect for damage to HDPE liners.
3) Brush fire inside the perimeter security fence.
4) Heavy rain of more than 2 inches in 24 hours.
5) A Mississippi or Missouri River flood event that inundates the exterior slopes of the embankments.
6) An earthquake with a magnitude (Mw) of 5.0 or greater.

The Special Incident Inspection is the same as the Weekly Inspection, and may be substituted for the normal Weekly Inspection if the timing coincides. If a Special Incident Inspection occurs during non-daylight hours, the inspection must be repeated during daylight hours the following day. The Special Incident Inspection form is provided in Appendix A. The completed Special Incident Inspection form is to be emailed or faxed immediately to the appropriate persons listed in Section 6.1.

A survey (horizontal and vertical) should be done of the tops of all the berms as described in Section 6.3.2 following an earthquake with a magnitude (Mw) of 5.0 or greater.

## 3.4 ANNUAL INSPECTION

The Annual Inspection shall be completed by a Professional Engineer registered in Missouri with a background in civil or geotechnical engineering. It should be done with a team of 2 qualified people or more. The St. Charles County Solid Waste Facility License stipulates that a “qualified” person shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation. The Annual Inspection shall consist of a detailed inspection of all of the embankments and appurtenances by walking both the tops and toes of the embankments. The Annual Inspection may be done in conjunction with the regular Weekly Inspection.

The registered Professional Engineer shall complete and seal the Annual Inspection report. The Annual Inspection report shall include as a minimum:

1) Completed Weekly Inspection form
2) Results of elevation survey if performed, comparing results with previous surveys

3) General assessment of the UWL and features as outlined in Section 1.4.3.

4) List of specific corrective actions and repairs, specifying the urgency of each

5) Photos of features and any items to be repaired or corrected

6) The Annual Inspection report shall be distributed to the persons and agencies listed in Section 6.0.

# 4.0 MAINTENANCE ACTIVITIES

Maintenance activities include procedures for routine maintenance and procedures for specific incident maintenance. Routine maintenance includes regularly scheduled activities and unscheduled activities that are to be completed, as required. A required routine maintenance procedure is groundwater sampling for chemical monitoring. Groundwater sampling is not included in the scope of this O&M Manual.

## 4.1 ROUTINE MAINTENANCE PROCEDURES

4.1.1 Maintain the grassy vegetation and riprap on the external slopes of the Cells 1 and 4A and the Recycle Pond perimeter embankments.

a) If animal burrows are found, fill burrows with compacted silty clay and take measures to eliminate animals from area. A reference on repairs and preventative measures is the FEMA “Technical Manual of Dam Owners: Impacts of Animals on Earthen Dams,” FEMA 473, September 2005.

b) Immediately repair erosion.

c) Evidence of sloughing, sliding or seepage may be indicating a larger problem. Immediately send inspection report to the CDSE or designated Dam Safety Staff for evaluation. Repair as indicated by Dam Safety.

d) Bare spots should be re-seeded and mulched with the appropriate native grasses seed mixture as given in Appendix B.

e) Mow protective grass cover and treat with fertilizer or herbicide as outlined in Appendix B.

4.1.2 Maintain the unpaved on-site road system.

a) Unpaved perimeter road system on top and bottom of the Cells 1 and 4A and Recycle Pond berms.

i. Regrade to correct vehicle tire rutting.

ii. Place additional gravel as necessary for all-weather travel and to fill erosion. Coarser crushed rock, such as 2-inch minus, may be used to fill deep gullies. Cap the coarse rock with 1-inch minus for a travel surface.

b) Unpaved ramps connecting upper and lower perimeter road system.

i. Regrade to correct vehicle tire rutting and/or erosion.

ii. Place additional gravel as necessary for all-weather travel and to fill erosion. See above note about using coarser crushed rock.

4.1.3 Maintain perimeter security fencing and access gates as needed. Backfill animal burrows. Maintain all facility signs required by State and County environmental permits; clean, repair, update or replace, as necessary.

a) UWL –Solid Waste Entrance Sign (one sign satisfies both State and County requirements).

b) Recycle Pond – Wastewater Treatment Facility Sign.

4.1.4 Maintain the emergency spillways as needed to maintain discharge flowline at el. 445.0. Replace broken blocks, reset blocks and fill voids with fine gravel ("Meramec Sand").

4.1.5 Maintain the grouted precast concrete revetment blocks below the triple box culverts and below the discharge pipes in the Recycle Pond.

a) Inspect articulated blocks on top and sides of berm for displacement or deterioration.

b) Inspect for general signs of significant or differential settlement (greater than 1 to 2 inches).

c) Place additional grout as needed to fill voids or stop settlement.

4.1.6 Maintain erosion control mats (concrete mat forms) at the ring drain pipe outlets (four) and sump pipe (one) in Cell 1.

a) Repair erosion of fly-ash on the slopes under and around the discharge pipes. Fly ash may be replaced with "sand" bags filled with fly ash or dry bags of concrete mix. DO NOT USE SANDBAGS.

b) Repair pipe movement or differential settlement as directed by the Dam Safety Staff.

c) Repair concrete erosion control mats for degradation and deterioration.

4.1.7 Whenever the water level in the Recycle Pond is lowered below the top of the intakes (Effluent Structures), inspect the pump intake manholes, cover screens and drilled holes in the sides of the intakes for clogging and debris. Inspect gravel ballast covering the pipes inside the Recycle Pond between the pump intakes and the HDPE liner penetration in the east slope for signs of movement or displacement. Maintain the inlet manhole cover screens and drilled inlet holes for the two pump intakes.

a) Clean as necessary.

b) Replace gravel ballast covering the pipes inside the Recycle Pond between the pump intakes and the HDPE liner penetration as needed.

c) Maintain the integrity of the screens on the recirculation pipe and pump house sump outlet pipe to prevent animal access to the pipe.

4.1.8 Maintain the water level transducers per the manufacturer's specifications and operations manual.

a) Reset the elevations of the transducers as needed to maintain the water level within the required limits.

b) Maintain the condition of the pipe anchors for integrity and function.

4.1.9 Maintain blind flanges on slurry pipe clean outs. The top plates of the clean outs tend to loosen in freezing weather and must be checked for leaks whenever a gypsum slurry pipeline is going to be used after a period of inactivity.

4.1.10 Replace the vent filter and water vapor trap on the Leachate Collection Sump Pump (see Bulletin 0690C of EPG Companies Operations and Maintenance Manual for Leachate Sump Pump.

## 4.2 SPECIAL INCIDENT MAINTENANCE PROCEDURES

Perform maintenance in response to a Special Incident Inspection due to one the following events:

4.2.1 After each heavy rain event of more than 3 inches in 24 hours. Arrange for timely repairs. Do not discharge any water outside of Cells 1 or 4A or the Recycle Pond unless approved by Ameren Environmental Services.

4.2.2 If a flood inundates the perimeter berm exterior slopes. Document and arrange to make timely repairs as necessary. Monitor, contain and test as appropriate any floodwaters accumulated on site in any depressions for appropriate management in compliance with applicable laws and regulations. Do not discharge any water from Cells 1 or 4A or the Recycle Pond unless approved by Ameren Environmental Services.

4.2.3 During extended heat/drought. Monitor water elevation levels in Cell 1 and the Recycle Pond to maintain a minimum water level in the Recycle Pond of el. 430 when recycle pumps are operating or el. 428 for brief periods when the pumps are not in operation.

4.2.4 Vandalism, vehicle or equipment damage. Systems that could be damaged include: the security fencing; access gates; roads; composite liner containment systems; slurry piping system; water recirculation piping system; riprap protection of the outer berms; the transducer level controls system; groundwater monitoring wells; and other facility appurtenances.

a) Notify the appropriate Plant personnel, Plant security authorities, and Ameren Dam Safety. Ameren Dam Safety may notify County, State and Federal agencies as necessary of the vandalism and damage.

b) Document the cause and extent of damage and arrange for timely repairs along with appropriate documentation of repairs as necessary to restore the damaged systems.

c) Develop and implement preventive measures and methods to avoid or minimize the potential for a reoccurrence of the event.

4.2.5 In preparation for use of a slurry pipe after an extended period without flow, inspect the integrity of the slurry pipe clean-out blind flange seals. Check the tightness of the bolts. Periods of freeze-thaw tend to loosen the bolts. After the pipe is on line, check the cleanout manholes for leakage. If possible, remove the lids of the manholes so that the cleanouts can be inspected for spraying or leaking for the first day shift after the pipe is on line. Place cones, orange barrels or other barricade around each open manhole for safety.

4.2.6 A seismic event of magnitude 5.0 or greater:

a) Notify the appropriate Plant personnel, Plant security authorities, local authorities, and Ameren Dam Safety. Ameren Dam Safety may notify County, State and Federal agencies as necessary of the observed damage.

b) Document the cause and extent of damage and arrange for timely repairs, along with appropriate documentation of repairs as necessary to restore the damaged systems.

c) Ameren Dam Safety will have a survey of the tops of all berms done (see Section 6.3.2).

4.2.7 Settlement of the Top of Perimeter Berms: notify Ameren Dam Safety. A survey of the top of the perimeter berm(s) may be required, and construction may be necessary to maintain the required flood level protection (el. 446).

# 5.0 EMERGENCY ACTION PLANS

In an emergency situation, the approved procedures outlined in Ameren Missouri's "Emergency Implementing Procedures" (EIP) must be followed. This Section provides information to supplement the EIP in the event of an emergency situation unique to the UWL, but is not a substitute for the Ameren Missouri EIP.

## 5.1 BREACH OF EMBANKMENT

Design features intended to prevent a breach of the embankments have been incorporated in Cell 1, Cell 4A, and the Recycle Pond. Emergency spillways located on the west embankments of both Cell 1 and the Recycle Pond are designed to accommodate discharges in an emergency situation to prevent the topping of the embankments. The spillway between Cell 4A and the

Recycle Pond is intended to convey storm water to prevent overtopping of the berms, but this is not an emergency situation that requires action. Perimeter berms are lined with clay, are vegetated and have a layer of riprap to prevent erosion damage. In the event of a breach of embankment, the appropriate officials and authorities must be notified immediately in accordance with the Ameren Missouri Sioux EIP.

## 5.2 DISCHARGE THROUGH EMERGENCY SPILLWAY

Discharge of water from the Recycle Pond or Cell 1 into the area outside of the embankments is not permitted. Water is never to be pumped from either the Recycle Pond or Cell 1 or Cell 4A and discharged outside of the embankments. In the event of a discharge, the appropriate officials and authorities must be notified in accordance with the Ameren Missouri EIP. In addition, the MDNR "National Pollutant Discharge Elimination System Standard Conditions" require the following reporting actions:

1) Provide MDNR with the following information in writing within five (5) days of becoming aware of such conditions:

   a) Description of the discharge and cause of noncompliance, and

   b) The period of noncompliance, including exact dates and times; or if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the discharge.

2) <u>Twenty-four hour reporting</u>. Ameren Missouri must report any noncompliance which may endanger health or the environment. Information shall be provided orally with 24 hours from the time that Ameren becomes aware of the circumstances. A written submission shall also be provided with five (5) days of the time that Ameren becomes aware of the circumstances. MDNR may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

## 5.3 FLOODING SURROUNDING EMBANKMENTS

A flood condition surrounding the UWL could impose a hydrostatic uplift pressure on the bottom of the composite liners in Cells 1 and 4A and the Recycle Pond. To maintain a factor of safety against upward displacement and rupture of the liner, **the levels of the water and gypsum slurry in the Recycle Pond and Cell 1 must always be no more than 2.5 feet below the level of the flood water surrounding the UWL.**

Should flooding in the area of the UWL occur, the appropriate officials and authorities should be notified in accordance with Ameren Missouri Sioux Energy Center EIP.

Following Cell 4A construction, approximately 196,000 cubic yards of CCP and temporary soil cover were placed to fill the cell up to el. 435 to 438 as ballast on the composite liner and for freeze protection of the underlying clay. At this elevation, the composite liner is safe from excess hydrostatic uplift for a flood event with an elevation of 441 feet. Once the CCP and temporary soil cover in Cell 4A is at or above el. 438.2, then the composite liner is safe from excess hydrostatic uplift for a flood event up to el. 445 (the elevation of the spillways).

Until the level of CCP in Cell 4A is at or above el. 438.2, water will have to be pumped into Cell 4A if a flood event is expected to exceed el. 441. Such an event will flood the fields surrounding the UWL and Hwy. 94. The following table states the water level that is required in Cell 4A for various flood levels surrounding the UWL, and the estimated volume of water that is needed in Cell 4A. This is based upon the current level of CCP and temporary soil cover.

| Anticipated Flood Elev. Surrounding UWL | Required Elev. of Water in Cell 4A | Estimated Volume of Water gallons. | Estimated Duration of Pumping at 720 GPM |
|---|---|---|---|
| 441 to 442 | 436.7 | 2,564,000 | 2.5 days |
| 442 to 443 | 437.8 | 5,273,000 | 5.1 days |
| 443 to 444 | 438.9 | 8,958,000 | 8.6 days |
| 444 to 445 | 440.0 | 13,032,000 | 12.6 days |

Two gasoline 7.1 HP engine Dayton semi-trash pumps (Model 11G236) with hoses are stored in the Sioux Energy Center storeroom dedicated for flood protection of Cell 4A. The maximum suction lift for this pump is 26 feet. The flow rate for 10 feet of head is 363 GPM. The pumps shall be positioned on the perimeter berm of Cell 4A. Water may be pumped from the Recycle Pond if the flow into the Recycle Pond is sufficient to maintain the required water level in the Pond; otherwise, water may be pumped from the flooded field surrounding Cell 4A.

If a flood exceeding el. 441 is anticipated, then the following procedures shall be followed:

1. Turn off the storm water pump and effluent pump in Cell 4A.
2. Set up the 2 designated flood pumps and begin pumping water into Cell 4A **with sufficient time to pump the minimum required volume of water prior to the anticipated flood level.** Rainfall in Cell 4A may significantly decrease the required volume of water to be pumped. Also, the storm water pump in Cell 4A may be repositioned to pump water from the Recycle Pond into Cell 4A.
3. Monitor the operation of the pumps and the water level in Cell 4A at least hourly, 24 hours a day, 7 days a week, until the required water level in Cell 4A is reached or the flood event is over.
4. All water pumped into Cell 4A must be pumped into the Recycle Pond; no water that may have been in contact with CCPs may be discharged outside of Cell 4A.

## 5.4 FIRE, MEDICAL OR OTHER

Fire extinguishers shall be located on all landfill equipment (not necessarily contractor’s haul trucks to and from the site). Communication equipment used at the UWL during operations will consist of two-way radios. Two-way radios will be assigned to personnel - not to equipment. This ensures all staff has communication equipment on their person at all times and provides direct access to the Sioux Energy Center Control Room. Table 3 in Section 5.5 is a list of agencies, individuals and telephone numbers for emergency contact.

## 5.5 CONTACTS

Table 3 – Important Contacts

| | |
|---|---|
| **Sioux Energy Center & UWL** | |
| Operating Supervisor (including after Hours): | Ameren Missouri Sioux Energy Center |
| | 8501 N. State Route 94 |
| | West Alton, MO 63386 |
| | (314) 992-6233 |
| Sioux – Engineering | (314) 992-6207 |
| | |
| **Ameren Missouri Dam Safety Staff** | |
| After Hours | (314) 957-3406 |
| During Normal Hours | (314) 210-4356 |
| | |
| **Missouri Highway Patrol, Troop C** | |
| Emergency: | 9-1-1 |
| Non-Emergency: | (314) 340-4000 |
| | |
| **St. Charles County Sheriff** | |
| Emergency: | 9-1-1 |
| Non-Emergency: | (636) 949-3005 |
| | |
| **Alton, IL Police Department** | |
| Emergency: | 9-1-1 |
| Non-Emergency: | (618) 463-3505 |
| | |
| **Hospital** | |
| Emergency Room (Ambulance Service): | 9-1-1 |
| Non-Emergency: | Alton Memorial Hospital |
| | 1 Memorial Drive |
| | Alton, Illinois 62002 |
| | (618) 463-7311 |
| | |
| **West Alton Fire Department** | |
| Emergency: | 9-1-1 |
| Non-Emergency: | (636) 899-1122 |
| | |
| **St. Charles County Government** | |
| Department of Community Health & the Environment | 9-1-1 |
| | (636) 949-1800 |

# 6.0 PERMIT REQUIREMENTS, RECORD KEEPING AND DISTRIBUTION

## 6.1 INTERNAL AMEREN COMMUNICATIONS

Written reports shall be prepared to document all inspections and maintenance performed during the effective timeframe of this O&M Manual. A copy of each report must be sent to the appropriate persons listed in this Section. Ameren Dam Safety staff and the Chief Dam Safety Engineer (CDSE) are responsible for sending reports to County and State agencies as required by the various permits and licenses, except in an emergency (see Section 5.0).

The appropriate records, as dictated by the State and County, must be kept on site and available upon request to State and local officials during operating hours. Records will be stored at the Sioux Energy Center. The designated person responsible for record keeping is Brett Novotny.

Records associated with the requirements of this O&M Manual include those generated from the various inspections outlined in Section 3.0. These records must be kept together in a binder or file and stored on site. Table 4 outlines the anticipated internal distribution of inspection reports:

Table 4 – Internal Distribution of Inspection Reports

| | | PLANT SHIFT SUPERVISOR | PLANT OPERATIONS | PLANT ENGINEERING | DAM SAFETY GROUP | POWER OPERATIONS SERVICES | UWL File |
|---|---|---|---|---|---|---|---|
| WEEKLY INSPECTION | Emergency Condition | Call | Email | Email | Call | Email | X |
| | Problem or Anomaly | | | X | X | X | X |
| | No problems | | | | | | X |
| SPECIAL INCIDENT | Emergency Condition | Call | Email | Email | Call | Email | X |
| | Recycle Pond Level | Call | Email | | | X | X |
| | Flooding | | X | X | Email | | X |
| | Routine | | | X | X | X | X |
| ANNUAL | Emergency Condition | Call | Email | Email | Call | Email | X |
| | Routine | | | X | X | X | X |

Missouri and St. Charles County also have specific recordkeeping requirements. The St. Charles County Solid Waste Management Code (SWMC) and the Solid Waste Facility License outline record keeping requirements for St. Charles County Department of Community Health & the Environment. The recordkeeping requirements of the State and County are discussed in further detail below and in Table 5.

Table 5 – Division of Responsibility

| Task | Frequency | Responsible Group | Section |
|---|---|---|---|
| MDNR-SWMP Reporting | even years by July 30, within 60 days | Environmental Services | 6.4.2 |
| MDNR dam construction permit | annual by April 1 | Dam Safety | 6.4 |
| St. Charles County operating license | annual by November 1 | Environmental Services | 6.5 |
| St. Charles County annual reporting | annual by November 1, within 30 days | Environmental Services | 6.4.1 |
| St. Charles County quantities of CCP received | quarterly | Environmental Services | 6.5.1 |
| Non-Compliance/Incident Reporting | verbal: within 24 hrs<br>written: within 15 days | Sioux Energy Center | 6.3.1, 6.5.1 |
| Emergency Spillway Discharge | within 5 days | Sioux Energy Center | 6.3.1, 6.5.1 |
| Flood Events | as needed | Sioux Energy Center | 3.3, 6.3.1, 6.5.1 |
| Groundwater Monitoring | quarterly | Environmental Services | 6.2.1 |
| Weekly Inspections | weekly | Sioux Energy Center | 3.2 |
| Annual Inspections | annually | Dam Safety | 3.4, 6.3.1 |
| Special Inspections | as needed | Sioux Energy Center | 3.3 |
| Inspection follow-ups | as needed | Sioux Energy Center | |
| Mowing | twice per year | Sioux Energy Center | Appendix B |
| Weed Control | twice per year | Sioux Energy Center | Appendix B |
| Fertilizing | as needed | Sioux Energy Center | Appendix B |
| Re-Seeding | as needed (September) | Sioux Energy Center | Appendix B |
| Record Keeping | - | Sioux Energy Center | 6 |

## 6.2 MDNR SOLID WASTE CONSTRUCTION PERMIT

The UWL development process began with the MDNR with a “Request of Preliminary Site Approval” in May 2005 and later a St. Charles County Request for Zoning Special Use Permit in March 2006. Following the preliminary site approval by MDNR, a detailed site investigation (DSI) was conducted at the site and a detailed report published of the findings. St. Charles County has rezoned the site, granted a conditional use permit and approved the site development plan. An application for construction permit was filed with MDNR on February 7, 2007. The MDNR issued Construction Permit Number 0918301 for the UWL in March 28, 2008. The following Permit Conditions are taken from pages 2 through 8 of the Solid Waste Construction Permit No. O918301:

1) All reports, plans, and data required to satisfy these general conditions shall be prepared or approved by a Professional Engineer registered in the state of Missouri.

2) Written approval from MDNR Solid Waste Management Program (SWMP) must be obtained prior to making any operational or design changes that are not in the permit.

3) State and County environmental permits require detection monitoring of groundwater quality in the vicinity of the UWL on a regular schedule. Sixteen (16) groundwater monitoring wells are installed around the perimeter of the UWL for this purpose. All sixteen (16) wells are located outside of the perimeter security fencing. The approximate locations of the groundwater monitoring wells are shown in Figure 1. Detection monitoring is required at all monitoring wells. The minimum sampling frequency required by 10 CSR 80-11.010 is twice yearly during the months of May and November. Details of the groundwater detection monitoring are stated in the Solid Waste Permit (included in Appendix D) and Appendix S – Revised 9-07 of Construction Permit Application. The groundwater monitoring, sampling, testing and chemical analyses are beyond the scope of this O&M Manual and will be managed by others.

## 6.3 MDNR SOLID WASTE OPERATING PERMIT

The MDNR Solid Waste Disposal Area Operating Permit (No. O918301) requires that any facility design elements that need to be changed or that may affect future construction or operation activities must be submitted and approved by MDNR prior to beginning construction. Also, any design or operational changes, complete construction specifications, construction procedures, and construction grade drawings must be submitted and approved prior to implementation. Should the O&M manual be followed, additional modifications to this permit will not be required; however, this permit should be reviewed prior to any change in operations.

### 6.3.1 MDNR-SWMP Recordkeeping Requirements

Record- keeping requirements for MDNR are provided in 10 CSR 80-11.010(17)(C)1. Records shall be maintained at Sioux Energy Center. Records five (5) years old or older may be stored at an alternate site if approved by MDNR; such stored records must be made available at the landfill upon request of MDNR personnel. Records must cover at least the following:

1) Major operational problems, complaints or difficulties;
2) Any demonstration, certification, finding, monitoring, testing or analytical data required under sections (4) and (9) of 10 CSR 80-11.010;
3) Dust and litter control efforts;
4) Quantitative measurements of the waste handled and an estimate of the air space left at the facility (see Section 6.3.3);
5) Any cost estimates and financial assurance documentation required under 10 CSR 80-2.030(4);
6) Inspection records and training procedures as required under subsection (3)(B) of 10 CSR 80-11.010;
7) Records associated with future corrective measures as required under section (10) of 10 CSR 80-11.010 (11); and

8) A detailed report of the origin of all waste received (refer to Section 6.5.1).

### 6.3.2 UWL Survey Requirements

An elevation survey of the tops of the perimeter berms of both Cells 1 and 4A and the Recycle Pond shall be done in conjunction with the Annual Inspection in certain years:

1) When a survey of Cells 1 and 4A is required for the MDNR-SWMP, which is every 2 years (CSR 80-11.010 (17)(D)) to measure the remaining air space. At present, MDNR-SWMP will waive performing a survey. (A letter will be issued form MDNR-SWMP documenting this agreement.)

2) Prior to the stacking of gypsum above the top of the perimeter berm (el. 446).

3) When the level of the stacked gypsum reaches 5 feet above the perimeter berm, or el. 451.

4) When CCPs in dry cells reach 10 feet above the perimeter berm, or el. 456.

The survey should be done at approximately 100-foot centers and at appurtenances (box culverts, cleanouts, sump and outlet drains, etc.). The elevation survey shall be completed to an accuracy of 0.01 foot. Elevations shall be tied to the permanent benchmarks established for the UWL (see Sheet 2 of the record drawings). The survey shall be done by a competent survey team.

### 6.3.3 Biennial Airspace Estimate

Every even-numbered year after the date of the permit issuance and prior to January 31, Ameren Missouri must submit to MDNR-SWMP an estimate of the air space (i.e. CCP volume) remaining in the UWL. The required topographic survey for this estimate is presently waived (see Section 6.3.2) by MDNR-SWMP. A copy of the estimate is also to be sent to SCC (see "Waste Facility Plan for St. Charles County", 3.36(f) in Appendix D.

## 6.4 MDNR DAM AND RESERVOIR SAFETY DAM CONSTRUCTION PERMIT

Neither Cell 1 nor the Recycle Pond is a regulated dam in Missouri during the period of this O&M Manual and under current Missouri regulations because they are less than 35 feet high. However, since Cell 1 and the rest of the UWL are designed to be 100 feet high to allow for future gypsum stacking operations, Cell 1 is considered a regulated dam that is under construction while in operation. The MDNR Dam & Reservoir Safety Program (DRSP) issued Construction Permit C-426 (No. MO40160), of which Cell 1 is a part. The Recycle Pond is not included in the Construction Permit except where Cell 1 and the Recycle Pond have a common embankment. Cell 4A and the future dry cells are not included in the Dam Construction Permit.

The anniversary date of the Dam Construction Permit is April 1 and is valid for one (1) year. **Ameren Missouri must submit an application letter for an extension of the Dam Construction Permit each year prior to April 1 until the construction of the UWL is finished**, that is until the entire UWL ceases to receive gypsum or CCP and is closed. When the UWL is closed, then Ameren Missouri must submit an application for a Dam Safety Permit to the MDNR-DRSP.

No changes shall be made in the construction of the dam which adversely affects the dam with regard to its integrity or to the environment, public safety, life or property. If any modifications to the plans or specifications are necessary, then the application letter for the extension must request approval of the modifications.

If at any time during construction or operation, immediate alterations to the approved plans and specifications are required to adequately protect the integrity of the UWL, the environment or public health, safety or welfare, then the alterations may be started, but Ameren Missouri shall promptly notify the Chief Engineer of MDNR-DRSP of such requirements. If the alterations are to remain as permanent project features, then the plans and specifications must be revised as soon as practical and must be submitted to the Dam and Reservoir Safety Council for approval. Such alteration shall be discontinued if disapproved by the Council, upon notice of such disapproval.

The annual application letter for the extension of the Dam Construction Permit must state the progress of “construction” and that there have been no significant modifications to the approved set of plans and specifications to date, if that is true. The application letter for the annual extension must be sealed by a Professional Engineer registered in Missouri. If a topographic survey of Cell 1 has been done for the MDNR-SWMP, then include the survey in the annual application letter, but it is not required. The first change to the approved drawings will likely be when the height of the gypsum is above el. 446. See the “Memorandum of Understanding” in Appendix D.

If any modifications to the plans or specifications are necessary, then the application letter for the extension must detail the changes, the reasons for the changes and the impact on the dam safety criteria. If changes to the plans or specifications are necessary, then the changes should be submitted informally to the MDNR-DRSP prior to the anniversary date of the Construction Permit, so that the MDNR-DRSP can advise Ameren Missouri whether the changes are significant enough to require a modification to the Construction Permit.

The Construction Permit also states that, “Based upon conditions existing at the time of issuing this permit, the Downstream Environmental Zone is Class II.” The UWL is considered an “industrial water detention dam or reservoir” (10 CSR 22-2.030(3)) with a Downstream Environmental Class II (10 CSR 22-2.040). The downstream environment zone is the area downstream, which is generally to the east of the UWL, which would be inundated by a breach of the dam. Inundation is defined as water, 2 feet or more deep, over the general level of the submerged ground outside of the stream channel, which is poorly defined for the UWL. Downstream Environmental Class II is defined as containing 1 to 9 permanent dwellings, or 1 or more campgrounds with permanent water, sewer and electrical services, or 1 or more industrial buildings. If future development to the east or downstream of the UWL were to cause the Downstream Environmental Class to become Class I, then modifications would have to be made to the Dam Construction Permit and possibly to the design of the UWL. Class I is defined as 10 or more permanent dwellings or any public building.

## 6.5 ST. CHARLES COUNTY SOLID WASTE OPERATING LICENSE

The St. Charles County Solid Waste Operating License No. O4303 has many requirements. A copy of the license is included in Appendix D and should be read carefully. Not included in Appendix D is the "Waste Facility Plan for St. Charles County." A copy of the Waste Facility Plan (WFP) must be kept at the Plant and should be read carefully. The main points pertaining to routine operations are briefly summarized in this Section.

1) Permitted hours to receive slurry waste are 24 hours per day, 7 days per week. Routine operating hours in the UWL are 6:00 AM to 5:30 PM.

2) Permitted Maximum Tonnage is 30,000 Tons per Month

3) Maximum Permitted Traffic Volume is 1000 Vehicles per Month.

4) A complete copy of this License and incorporated documents shall be kept at the disposal site, as identified by the Division Director (License Condition 8c).

5) Solid wastes that are permitted for disposal in the UWL are fly ash, bottom ash, boiler slag, and gypsum (License Condition 8d).

6) Ameren Missouri is prohibited from placing in the landfill the following wastes (License Condition 9):

   a. Other than in Cell 1 and 4, any liquid waste material that is determined to contain free liquids as defined by Method 9095 (Paint Filter Liquids Test), as described in Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (EPA Pub. No. SW-846);

   b. Hazardous waste, as defined by State and Federal Regulations;

   c. PCB waste, as defined by State and Federal Regulations; and

   d. Waste not identified in License Condition 8(d).

7) The St. Charles County Division of Environmental Health and Protection, or an authorized representative, must be allowed to enter the facility during the permitted hours of operation, or where records must be kept under the conditions of this License, upon the presentation of credentials or other documents as may be required by law (License Condition 12). The representatives must have access to and copy at reasonable times any records that must be kept under conditions of this License. Also, they may inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this License. They may sample, photograph, or monitor at reasonable times, for the purposes of assuring License compliance or as otherwise authorized, any substances, locations, or parameters at any location subject to the License.

8) Cells 1 and 4A and the Recycle Pond shall be examined at intervals not exceeding 7 days and all instruments shall be monitored. Cells 1 and 4A and the Recycle Pond shall be inspected annually by a registered Professional Engineer to assure that the design,

operation, and maintenance of the surface impoundment is in accordance with generally accepted engineering standards and such findings has been placed in the operating record. (License Condition 12) If a potential hazardous condition develops, then Ameren shall immediately take actions to eliminate the condition and to notify potentially affected persons and State and local first responders.

**The St. Charles County Solid Waste Operating License must be renewed annually for each year beginning with each anniversary date of the issuance of license (Condition 12).** The requirements for the annual application for renewal and other reporting requirements are summarized in Section 6.5.2.

### 6.5.1 St. Charles County Recordkeeping Requirements

The recordkeeping requirements for the St. Charles County (SCC) Department of Community Health & the Environment requires Ameren Missouri to maintain the following records at the site in accordance to SCC SWMC 240.1150(36):

1) Major problems and complaints regarding operation of the UWL;
2) All environmental media sampling/testing data;
3) In the event of documented exceedance of applicable standards established by MDNR for any monitoring system;
4) Records of vector control efforts;
5) Records of dust and litter control efforts;
6) A copy of the SCC SWMC supplied by the division; and
7) Records of quantity of waste handled. Quantities are to be reported quarterly. Such records shall be made contemporaneously with the matters recorded.

In addition, all incident reports shall be maintained at Sioux Energy Center. Ameren Missouri must report any noncompliance, imminent or existing hazard from a release of waste or hazardous constituents, or from a fire or explosion at the UWL, which may endanger human health or the environments, in accordance with SCC SWMC 240.1150 and as provided in the Waste Facility Plan. Such information must be reported by telephone to (636) 949-1800 within 24 hours from the time Ameren Missouri becomes aware of the circumstances. A written report must be submitted within 15 days of the incident and shall include the following:

1) Name and title of person making report;
2) Date, time and type of incident;
3) Name and quantity of material(s) involved;
4) A complete description of the occurrence and its cause;
5) The extent of injuries, if any;

6) An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable;

7) Estimated quantity and disposition of recovered material that resulted from the incident; and

8) Actions taken by the Plant in response to the incident.

Ameren Missouri must also maintain a complete copy of this the Solid Waste Facility License and incorporated documents, which, at a minimum, include the following documents listed in the SCC license under Condition 10:

1) Detailed Geologic and Hydrologic Site Investigation Report for AmerenUE Sioux Power Plant, Proposed Utility Waste Disposal Area St. Charles County, Missouri, 9/20/2007.

2) AmerenUE Sioux Power Plant Construction Permit Application for a Proposed Utility Waste Landfill, St. Charles County, Missouri, 9/20/2007.

3) Plan sheets numbered Sheet 1 of 33 through Sheet 33 of 33, titled, Ameren UE Sioux Power Plant Utility Waste Landfill, Construction Permit Number 0918301, St. Charles County, Missouri, Proposed Dry Disposal Area Permit Modification," dated June 2010, final revision August 2011, approved by Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc.

4) MDNR Solid Waste Disposal Area Construction Permit #0918301, dated March 28, 2008.

5) Sioux Power Plant Utility Waste Landfill, Construction Permit No. 0918301, Permit Modification – Cell 1 Ring Drains, St. Charles County, Missouri, November 2009, Revised January 2010.

6) AmerenUE Sioux Power Plant Utility Waste Landfill, Proposed Construction Permit Modification, Construction Permit Number 0918301, St. Charles County, Missouri, 6/1/2010.

7) Solid Waste Facility License, Ameren Missouri Sioux Power Plant Utility Waste Landfill, Facility NO. 04303, dated November 1, 2010.

8) AmerenUE Sioux Power Plant Utility Waste Landfill Proposed Construction Permit Modification, Construction Permit Number 0918301 revised February 2012.

9) Waste Facility Plan for St. Charles County, Sioux Energy Center UWL, Revised November 2013.

In addition, a copy of the annual renewal application, including the required report, shall be kept at Sioux Energy Center at all times.

### 6.5.2 St. Charles County Annual Report

The annual report must contain the information required in Section 240.820 (Ord. No 01-06§§1-8,5-30-01). Ameren Missouri must apply to renew the Solid Waste Facility License annually at least 30 days prior to each anniversary date of the initial license (November 01 of each year). The requirements for the renewal application are set forth in the schedule in subsection (2) of section 240.810 of the SCC SWMC, which are listed below. The application shall be addressed and delivered to the SCC Division Director and shall request that a renewal license be issued for a period of one (1) year.

1) Any changes in the waste facility plan which must be made to reflect actual usage or conditions.

2) Total incoming waste tonnage received.

3) Summary of all environmental monitoring data for all media compiled during the previous period with interpretation of trends using suitable modeling presentation.

4) Quantities of leachate collected, processed, treated and disposed or dissipated. (Ordinance includes landfill gases, which the UWL will have none.)

5) Equipment replaced or changed or anticipated to be replaced or changed.

6) A report describing the infrastructures which have been put in place including as-built construction plans and records.

7) If the facility is still under construction, a written report detailing conformance with the schedule contained in the Waste Facility Plan.

## 6.6 ST. CHARLES COUNTY WASTE FACILITY PLAN

A waste facility plan for the Sioux UWL was prepared and submitted to St. Charles County. It was approved for the Solid Waste Operating License. Most of the contents are contained in the other documents. The main points are briefly summarized in this Section.

1) Section 2.10(d): Daily cover is not required. If necessary, internal roads will be watered to minimize fugitive dust emissions.

2) Section 2.10(h)(ii): The gypsum stack will not have fire hazards, odors, litter, and decomposition gases typically associated with municipal solid waste landfills. Mosquitoes are the only possible vector anticipated. Should mosquitoes become a problem, then a mosquito eradication program will be implemented.

3) Section 2.10(h)(iv): Any areas of the side slopes that have settled, are severely eroded, or on which previously planted vegetation did not survive will be recovered, re-graded or reseeded as necessary to maintain side slope cover and integrity.

4) Section 2.14 of the Waste Facility Plan pertains to closure, which is beyond the scope of this O&M Manual.

5) Section 2.18: The Sioux Energy Center has existing Emergency Implementing Procedures (EIP) for emergencies and natural disasters which shall be followed for the Sioux Energy Center UWL.

6) Section 2.19: The Sioux Energy Center has a Safe Work Rules Handbook which covers general safety guidelines, task specific safety procedures, and Ameren's Corporate Safety & Health Policy. The Safe Work Rules Handbook shall be followed for the Sioux Energy Center UWL.

7) Section 3.25: A preventative maintenance program will be implemented for the landfill equipment. The landfill will have redundant equipment for use in most emergency situations.

8) Section 3.36 lists the documents and records that shall be kept on site.

9) Sections 3.38 and 3.39 specify the sign that shall be displayed at the entrance to the UWL.

## 7.0 REFERENCE DOCUMENTS

The following is a list of Ameren documents pertinent to the operation and maintenance of the UWL that are current as of May 2014. Some of these documents are subject to internal or regulatory changes over time.

1) Report "Sioux Power Plant Utility Waste Landfill, Construction Permit No. 0918301, Cell 1 Operating Permit Requirements Report, St. Charles County, Missouri," dated February 2010, Revised July 9, 2010.

2) Plan Sheets 1 through 33 titled, "Ameren UE Sioux Power Plant Utility Waste Landfill, Construction Permit Number 0918301, St. Charles County, Missouri, Proposed Dry Disposal Area Permit Modification," dated June 2010, final revision August 2011.

3) Report titled, "Ameren Missouri Sioux Power Plant Utility Waste Landfill, Proposed Construction Permit Modification, Construction Permit No. 0918301, St. Charles County, Missouri," dated June 2010, with final revision dated February 2012 and Addendum dated January 2014.

4) Ardaman & Associates, Inc. report titled, "Operation Plan, Gypsum Management Facility, Ameren Sioux Power Station," dated 2008, revised April 19, 2009.

5) Ameren Missouri Procedure AUE-ADM-5103 titled "Dam Safety Program for Ameren Missouri Non-Hydroelectric Facilities," latest revision.

6) Ameren Missouri Sioux Energy Center Emergency Implementing Procedures, latest revision.

7) Ameren Missouri Sioux Energy Center Utility Waste Landfill, Waste Facility Plan, St. Charles County, Missouri, revised November 2013 (SX-PLN-000158)

8) EPG Companies Operations and Maintenance Manual for Leachate Sump Pump (EPG Job #13-11136).

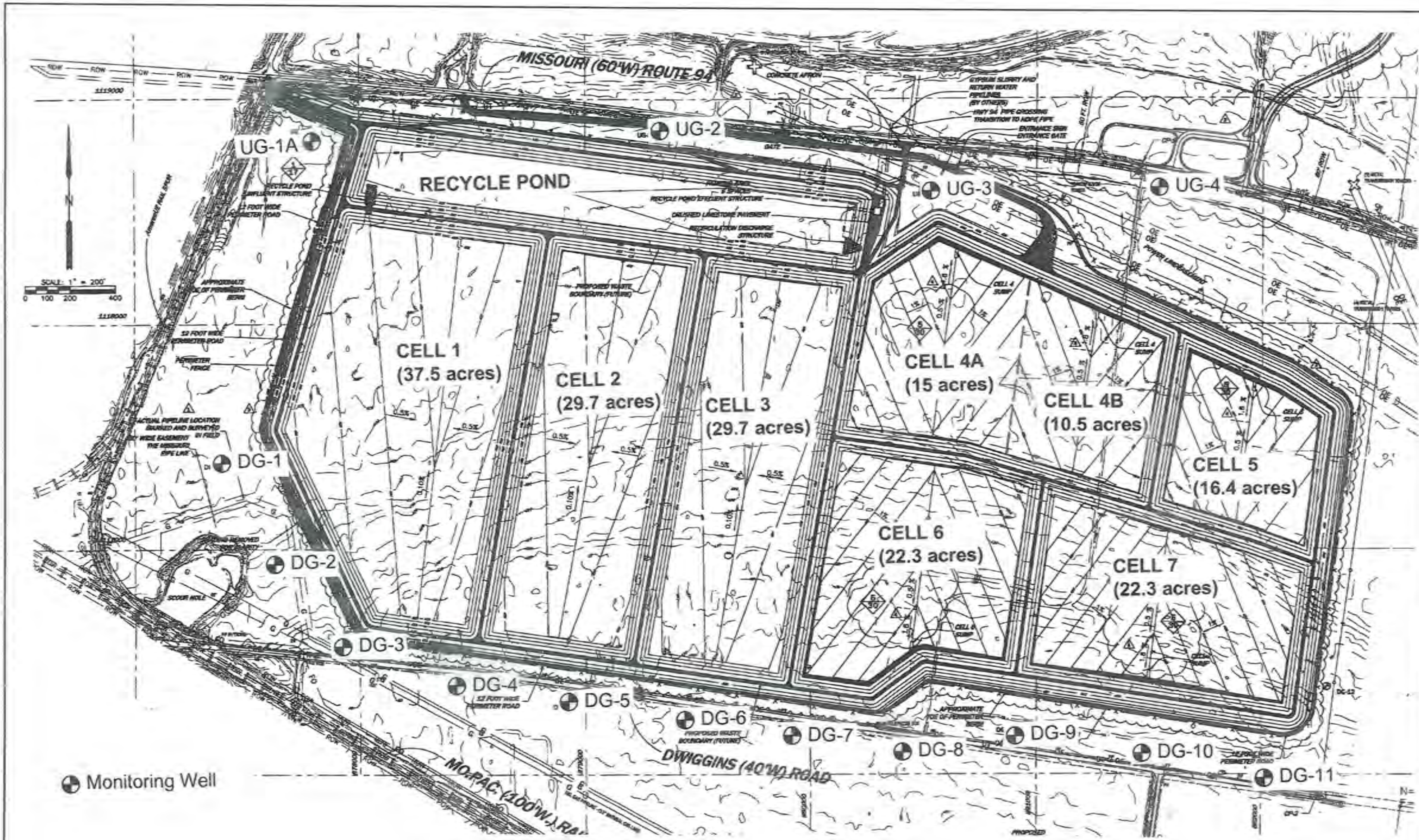
9) Zoeller Pump Company Owner's Manual for Zoeller Hazardous Environment Pumps.

10) Power Operations Safe Work Rules Handbook.

11) Design Basis Document “Sioux Common – Utility Waste Landfill” SX-DB-GPS-000004.

12) Design Change Package “Wet Flue Gas Desulfurization (WFGD) System Retrofit” SX-10-DCN-1600.

13) Design Change Package “Utility Waste Landfill – Cell 4” SX-2013-DC-0004.

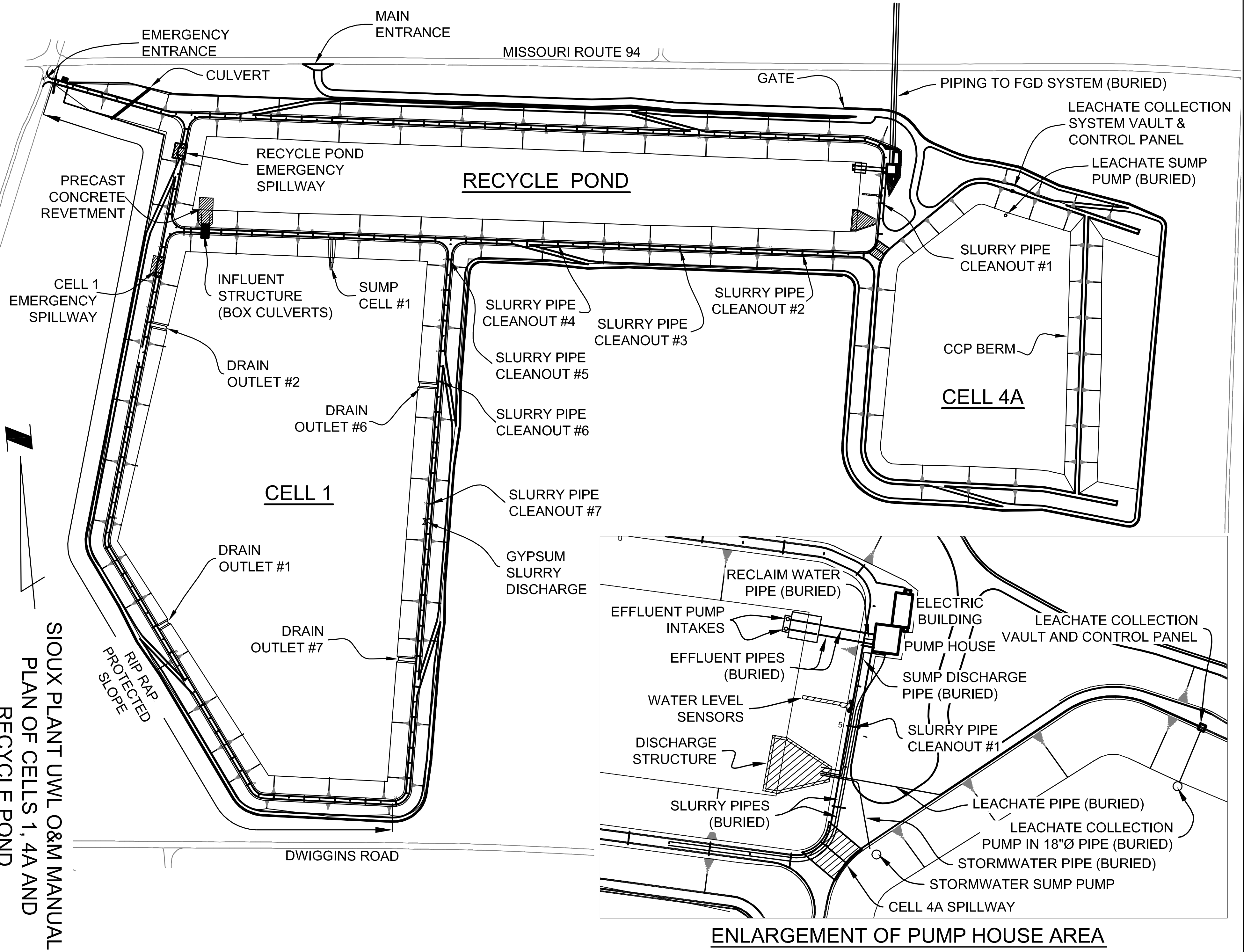



Note: reproduced from Sheet 5 of Modified Construction Permit Application.

Reitz & Jens, Inc.

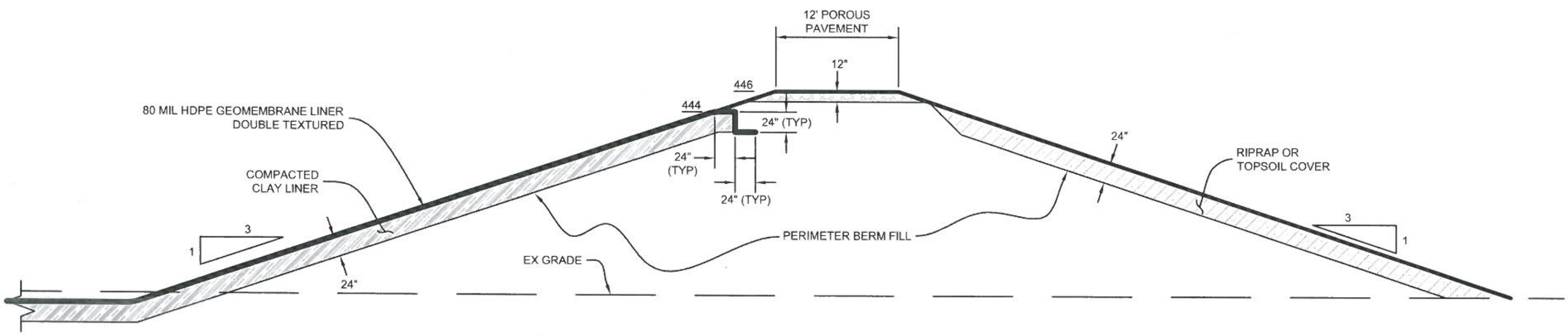
Ameren Sioux Energy Center UWL
GENERAL PLAN OF
UTILITY WASTE LANDFILL

Figure 1




SIOUX PLANT UWL O&M MANUAL
PLAN OF CELLS 1, 4A AND
RECYCLE POND

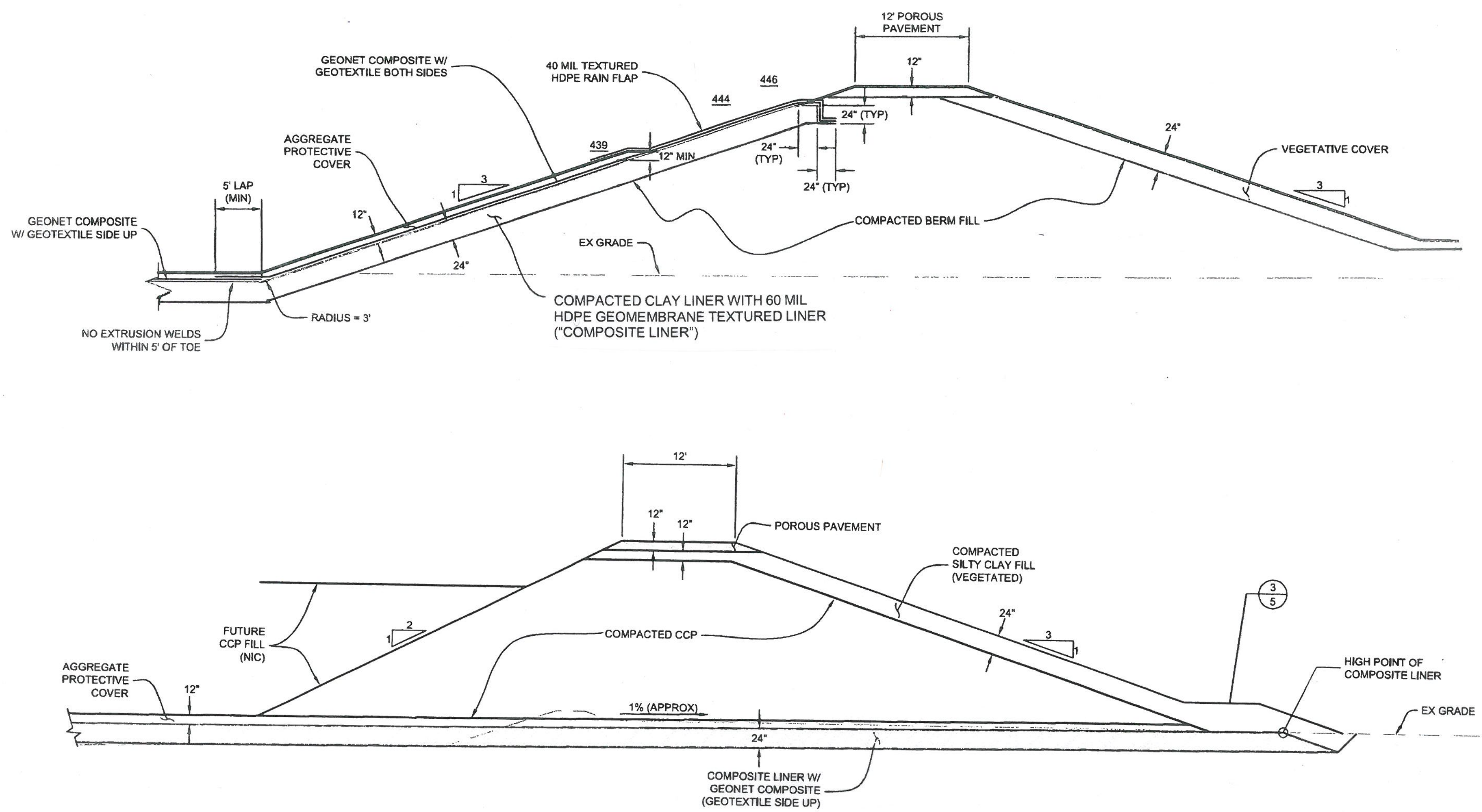
Figure 2




Ameren Sioux Energy Center UWL
TYPICAL CROSS-SECTION OF CELL 1 AND
RECYCLE POND PERIMETER BERM

REITZ & JENS, INC.

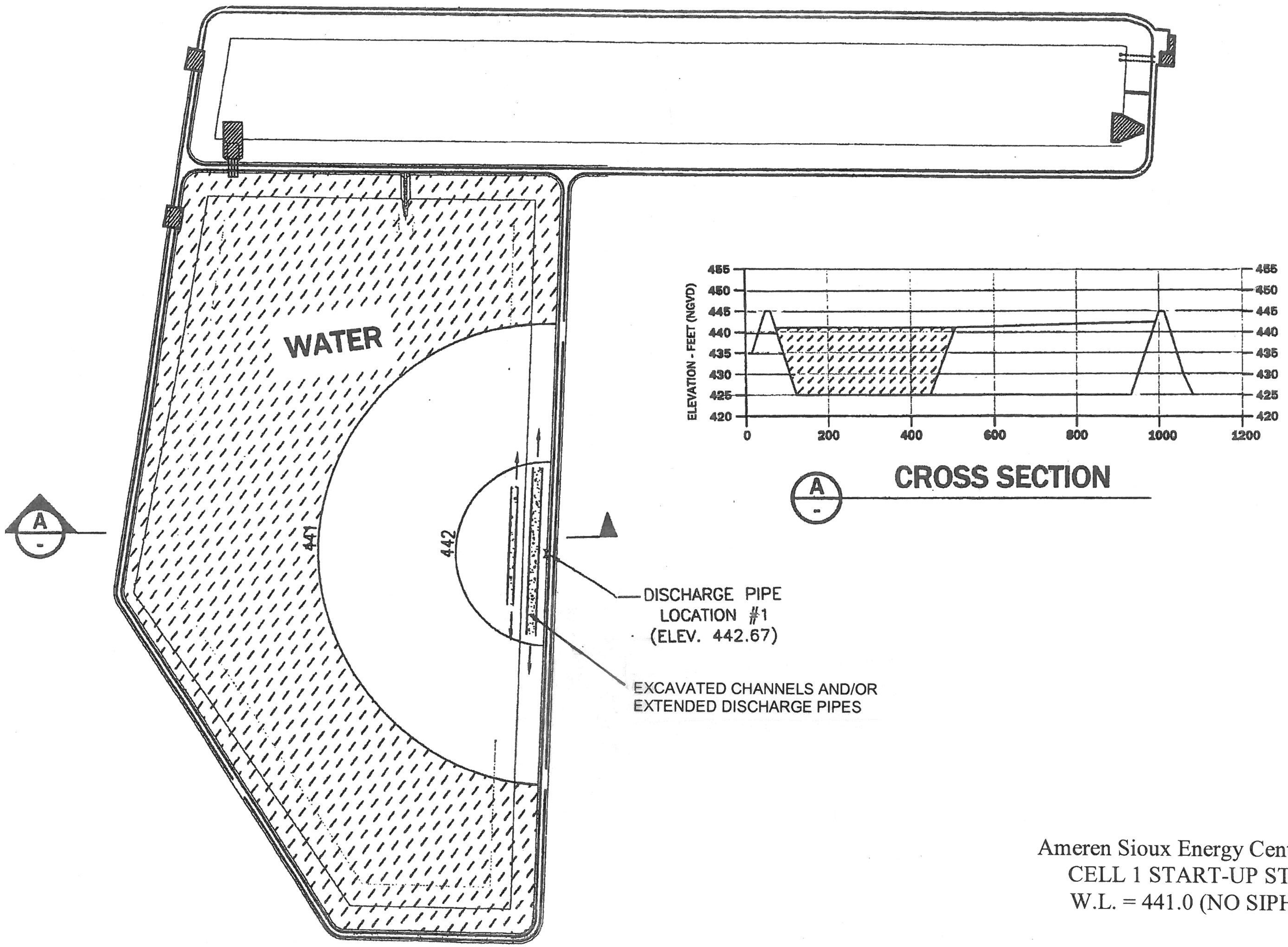
Figure 3




Ameren Sioux Energy Center UWL
TYPICAL CROSS-SECTION OF CELL 4A
SOIL PERIMETER BERM AND CCP BERM

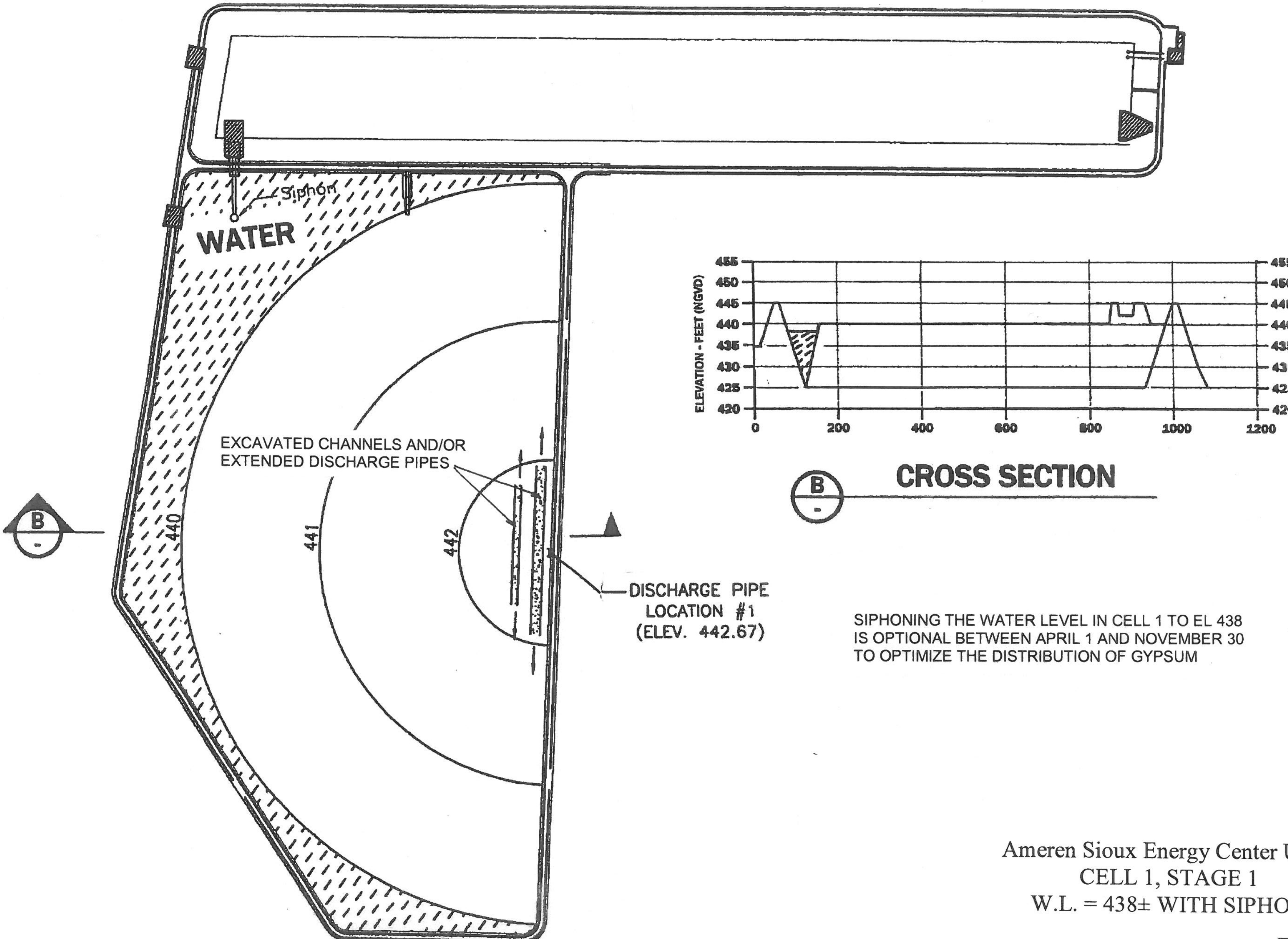
REITZ & JENS, INC.

Figure 4



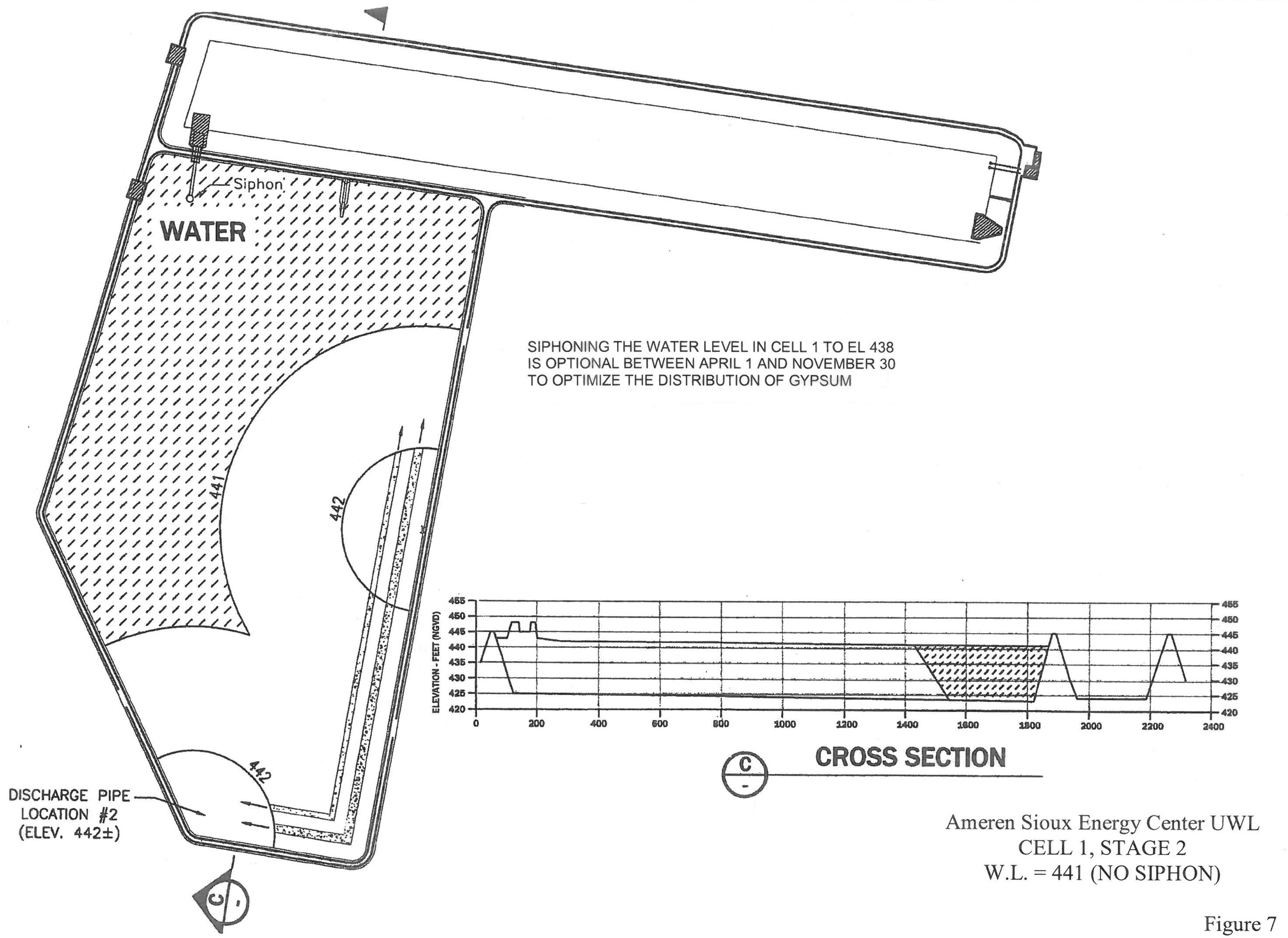

Ameren Sioux Energy Center UWL
CELL 1 START-UP STAGE
W.L. = 441.0 (NO SIPHON)

Figure 5



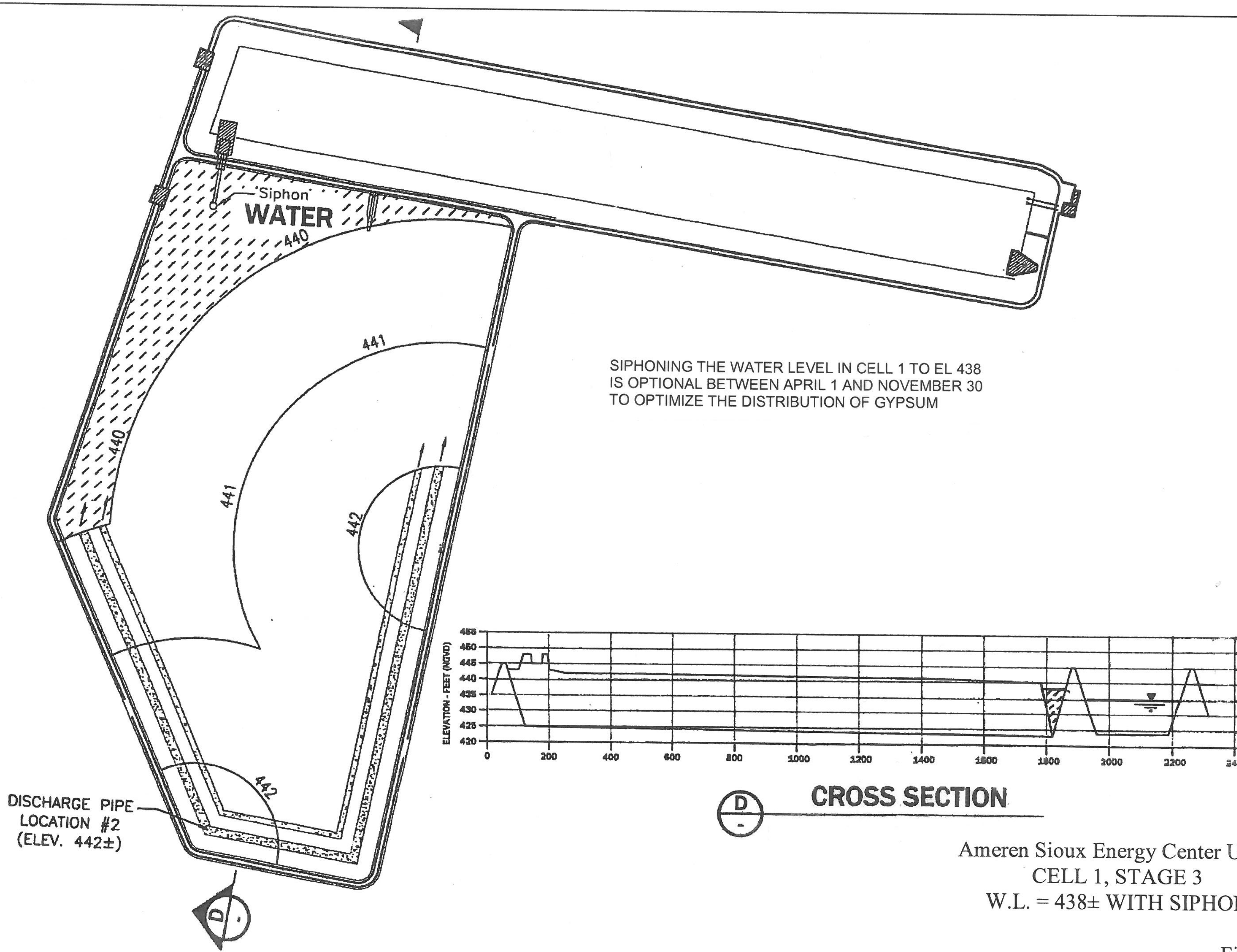

Ameren Sioux Energy Center UWL
CELL 1, STAGE 1
W.L. = 438± WITH SIPHON

Figure 6



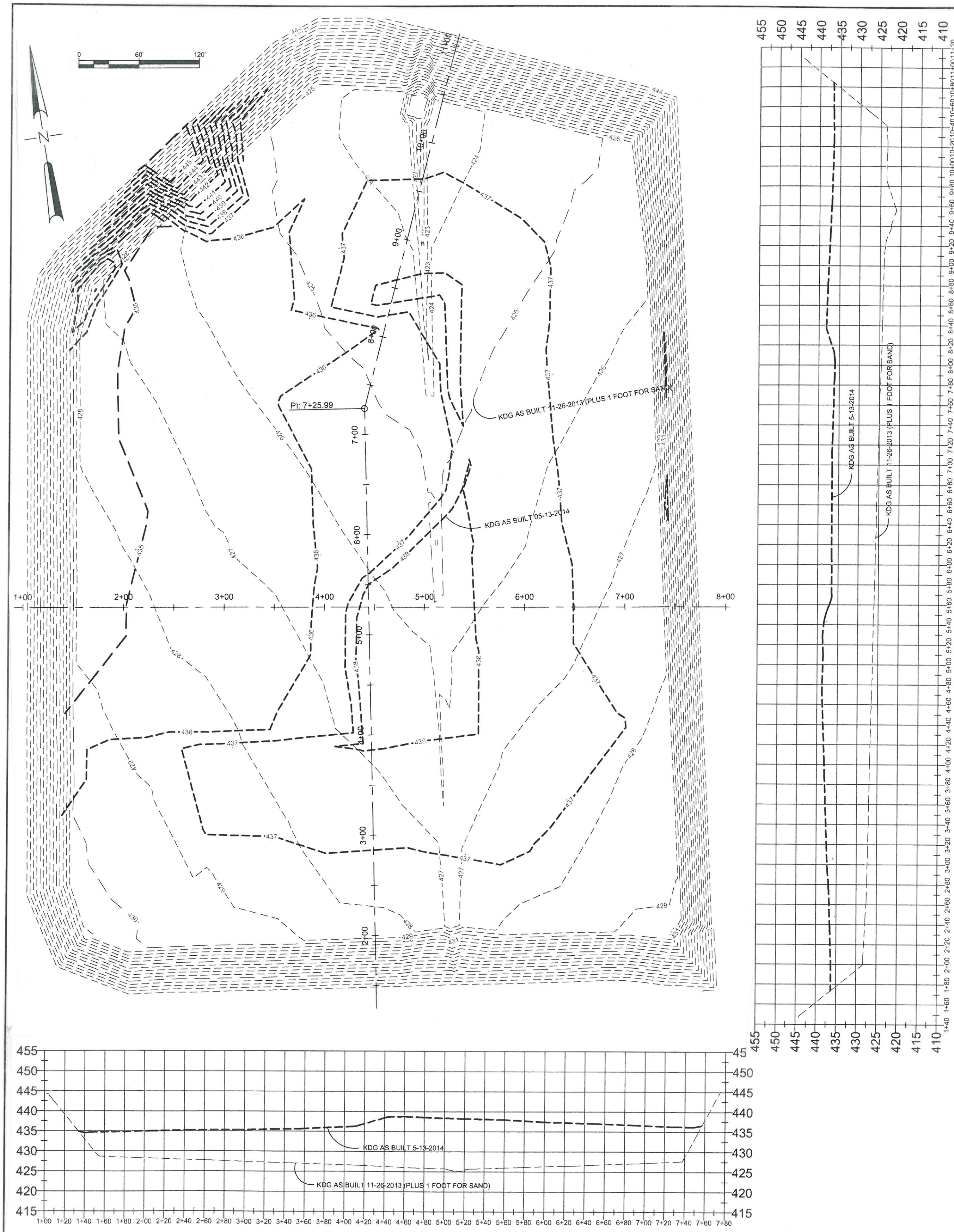

Ameren Sioux Energy Center UWL
CELL 1, STAGE 2
W.L. = 441 (NO SIPHON)

Figure 7




Ameren Sioux Energy Center UWL
CELL 1, STAGE 3
W.L. = 438± WITH SIPHON

Figure 8

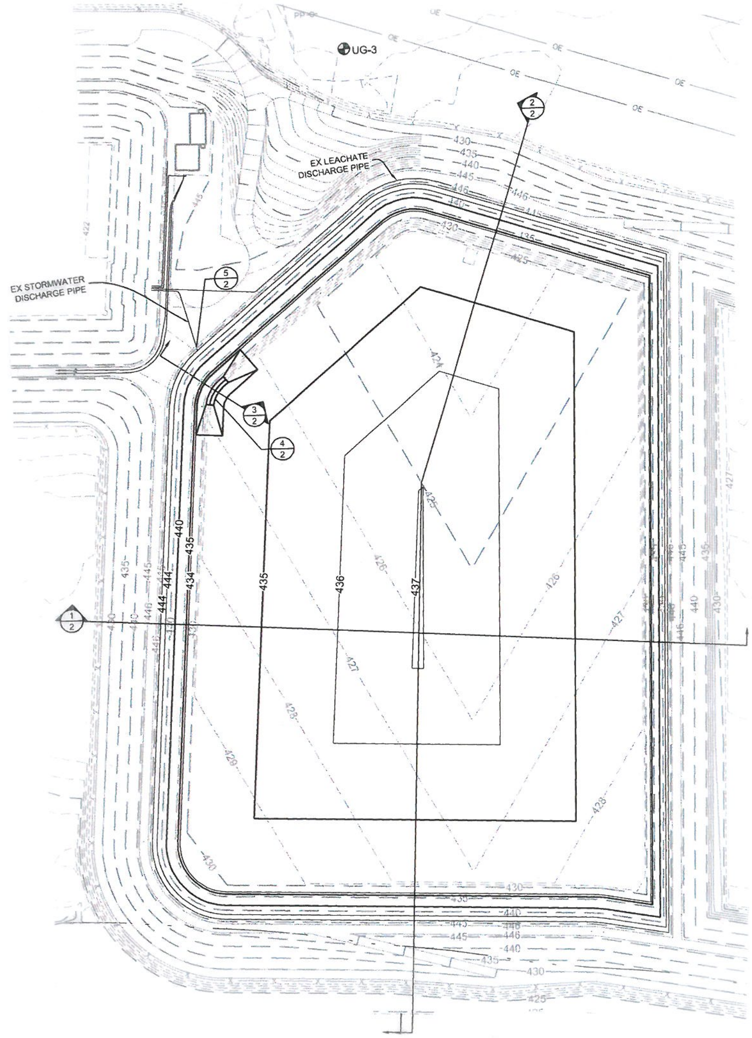


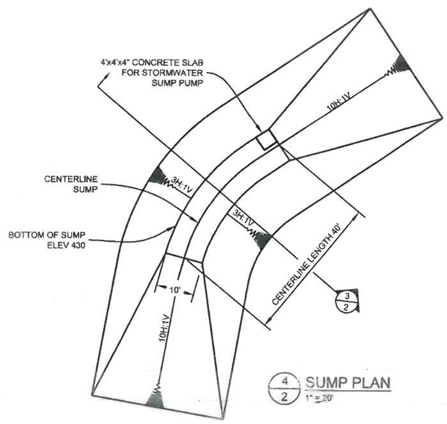

Note: Initial CCP fill placed to ballast composite line against hydrostatic uplift caused by flooding and for freeze protection. Figure based upon as-built survey of CCP and temporary soil cap by K*d*G, dated 5/13/2014.

Ameren Sioux Energy Center UWL
INITIAL FILLING OF CELL 4A

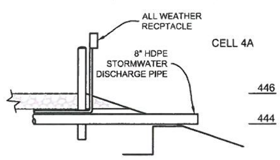
REITZ & JENS, INC.

Figure 9A

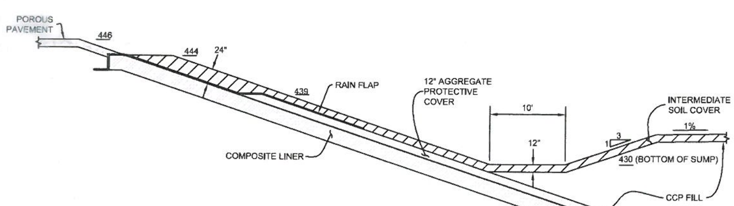



4/2 SUMP PLAN
1" = 20'




5/2 EXISTING STORMWATER DISCHARGE PIPE AND ELECTRICAL CONNECTIONS
1" = 5'




3/2 SUMP SECTION
1" = 10'

Note: reproduced from Dwg. 8430-Y-168643
"Cell 4A – Phase 3, Sheet 2 of 2, Initial CCP Fill."

Ameren Sioux Energy Center UWL
LOCATION OF STORM WATER SUMP AND PUMP DETAILS

REITZ & JENS, INC.

Figure 9B

Ameren Missouri Sioux Energy Center UWL
Cells 1 & 4A and Recycle Pond O&M Manual

# APPENDIX A

# INSPECTION FORMS

# APPENDIX A – INSPECTION FORMS

## LIST OF CONTENTS

# Sioux UWL Cells 1 & 4A and Recycle Pond
## WEEKLY INSPECTION REPORT

| | |
|---|---|
| Recycle Pond Level By Visual Reading of Instrumentation Pipes | |
| Recycle Pond Level Reading through DCS | |
| Cell 1 Level | |
| Elapsed Hours on Cell 4A Leachate Pump | |

| | |
|---|---|
| Date & Time | |
| Inspector(s) | |
| Weather | |
| Temperature | |

| | Item | Condition Code * | Comments |
|---|---|---|---|
| RECYCLE POND | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Recycle Pond between el. 428 and 443 | | |
| | Settlement, depression or crack in embankment | | |
| | Gravel Ballast Covering Pump Intake Pipes (when visible) | | |
| | Damage to transducer level controls or pipes | | |
| | Unevenness, movement of triple box culverts | | |
| | HDPE Recirculation Pipe (leaking or frozen) | | |
| | Pump House Sump Discharge Pipe (leaking or frozen) | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| | HDPE Liner | | |
| | Precast Concrete Revetment below Box Culverts | | |
| | Precast Concrete Revetment below Discharge Pipes | | |
| | Emergency Spillway | | |
| | Imminent discharge thru emergency spillway | | |
| CELL 1 | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Settlement, depression or crack in embankment | | |
| | Emergency Spillway | | |
| | Imminent discharge thru emergency spillway | | |
| | Gypsum slurry flowing unobstructed | | |
| | Slurry spraying or running out of cleanouts | | |
| | Height from discharge pipe flowline to gypsum level | | Visual Estimate, inches: |

## Sioux UWL Cells 1 & 4A and Recycle Pond



## WEEKLY INSPECTION REPORT

| Date & Time | |
|---|---|

| | Item | Condition Code * | Comments |
|---|---|---|---|
| CELL 1 (cont.) | HDPE Liner | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| | Sump Outlet & Concrete Pad | | |
| | Drain Outlets & Concrete Pads | | |
| | Movement of riprap | | |
| CELL 4A | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Settlement, depression or crack in embankment | | |
| | Storm Water Channel | | |
| | Storm Water Pump & Discharge Pipe | | |
| | Standing water in Cell | | |
| | Leachate Collection Sump Pump Vault | | |
| | Leachate Collection Pump, Controls & Discharge | | |
| | HDPE Liner | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| OTHER | Holes or breaks in perimeter fence, vandalism | | |
| | Main and emergency gates locked | | |

Drive slowly around tops of embankments looking for visible signs of present or developing major problems. Indicate location(s) of problems or anomalies on inspection plan - sign, date and attach sheet to report.

If a problem is noted, email or FAX report to appropriate persons. If emergency condition is noted, immediately contact the Shift Operations Supervisor and Chief Dam Safety Engineer.

### Condition Codes

| |
|---|
| EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; pool draw down, work stoppage, plant stoppage. |
| IM = Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within 1 month. |
| 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. |

Attach Inspection Form (plan) with Additional Observations or Comments on Back

## Sioux UWL Cells 1 & 4A and Recycle Pond



SPECIAL INCIDENT INSPECTION REPORT

| | |
|---|---|
| Recycle Pond Level By Visual Reading of Instrumentation Pipes | |
| Recycle Pond Level Reading through DCS | |
| Cell 1 Level | |
| Elapsed Hours on Cell 4A Leachate Pump | |

| | |
|---|---|
| Date & Time | |
| Inspector(s) | |
| Weather | |
| Temperature | |

DATE, TIME AND TYPE OF INCIDENT:

| | Item | Condition Code * | Comments |
|---|---|---|---|
| RECYCLE POND | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Recycle Pond between el. 428 and 443 | | |
| | Settlement, depression or crack in embankment | | |
| | Effluent Pump Intake Structures (when visible) | | |
| | Gravel Ballast Covering Pump Intake Pipes (when visible) | | |
| | Damage to transducer level controls or pipes | | |
| | Unevenness, movement of triple box culverts | | |
| | HDPE Recirculation Pipe (leaking or frozen) | | |
| | Pump House Sump Discharge Pipe (leaking or frozen) | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| | HDPE Liner | | |
| | Precast Concrete Revetment below Box Culverts | | |
| | Precast Concrete Revetment below Discharge Pipes | | |
| | Emergency Spillway | | |
| | Imminent discharge thru emergency spillway | | |
| CELL 1 | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Settlement, depression or crack in embankment | | |
| | Emergency Spillway | | |
| | Imminent discharge thru emergency spillway | | |
| | Gypsum slurry flowing unobstructed | | |
| | Slurry spraying or running out of cleanouts | | |

**Sioux UWL Cells 1 & 4A and Recycle Pond**

SPECIAL INCIDENT INSPECTION REPORT

| Date | |
|---|---|

| | Item | Condition Code * | Comments |
|---|---|---|---|
| CELL 1 (cont.) | Height from discharge pipe flowline to gypsum level | | Visual Estimate, inches: |
| | HDPE Liner | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| | Sump Outlet & Concrete Pad | | |
| | Drain Outlets & Concrete Pads | | |
| | Movement of riprap | | |
| CELL 4A | Erosion, sloughing, sliding, boils, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Settlement, depression or crack in embankment | | |
| | Storm Water Channel | | |
| | Storm Water Pump & Discharge Pipe | | |
| | Standing water in Cell | | |
| | Leachate Collection Sump Pump Vault | | |
| | Leachate Collection Pump, Controls & Discharge | | |
| | HDPE Liner | | |
| | Erosion or rutting gravel top & perimeter roads and ramps | | |
| OTHER | Holes or breaks in perimeter fence, vandalism | | |
| | Main and emergency gates locked | | |

Drive slowly around tops of embankments looking for visible signs of present or developing major problems. Indicate location(s) of problems or anomalies on inspection plan - sign, date and attach sheet to report.

If a problem is noted, email or FAX report to appropriate persons. If emergency condition is noted, immediately contact the Shift Operations Supervisor and Chief Dam Safety Engineer.

If an emergency situation requires an immediate Special Inspection during poor visibility (such as at night) then a second Special Inspection must be completed in daylight as soon as possible.

**Condition Codes**

| |
|---|
| EC = Emergency Condition. A serious dam safety condition exists that needs immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; pool draw down, work stoppage, plant stoppage. |
| IM = Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within 1 month. |
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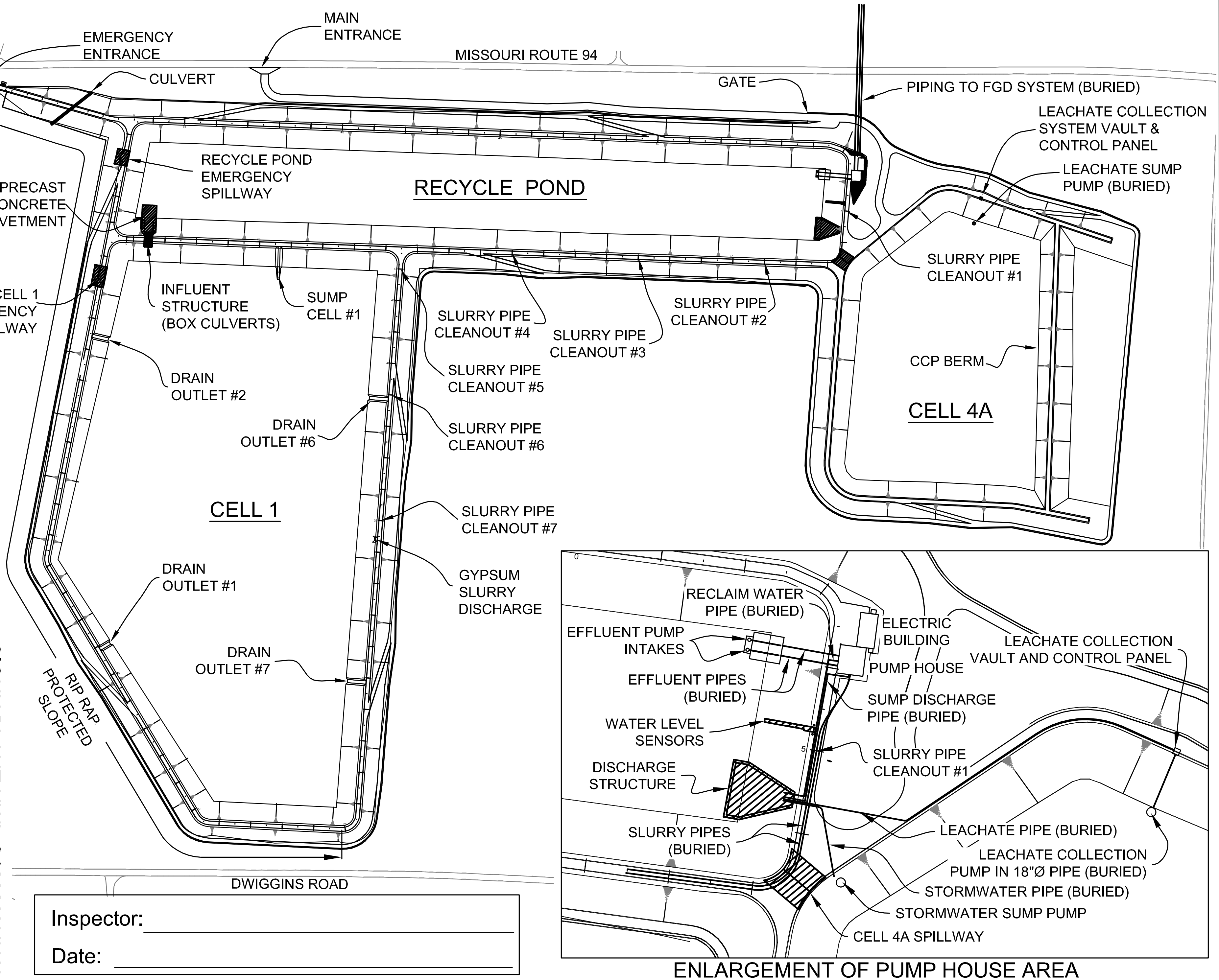
| OB = Condition requires regular observation to ensure that the condition does not become worse. |
| GC = Good Condition. |
| NE = No evidence of a problem. |
| NI = Not Inspected. Reason should be stated in comment. |

ATTACH INSPECTION FORM (PLAN) AND **NOTE ACTIONS TAKEN ON BACK OF FORM**




Inspector: ____________________

Date: ____________________

SIOUX PLANT UWL O&M MANUAL
PLAN OF CELLS 1, 4A AND
RECYCLE POND
INSPECTION FORM

Ameren Missouri Sioux Energy Center UWL
Cells 1 & 4A and Recycle Pond O&M Manual

# APPENDIX B

# MAINTENANCE OF PROTECTIVE GRASS COVER

# Appendix B
# MAINTENANCE OF PROTECTIVE GRASS COVER

## 1.0 ROUTINE MAINTENANCE

1.1 The embankment slopes were planted by broadcast seeding native grasses. The seed was a mixture of VNS annual ryegrass (temporary cover crop), Soft Red Winter wheat (temporary cover crop), 30% Canadian wild rye (native), and 30% "Cave-in-Rock" switchgrass (native). The wheat and annual rye start turning brown in June or early summer, but will reseed and begin growing again in the fall. The wild rye and switchgrass are perennial native warm season grasses that begin growing in late spring. It typically will take 2 to 3 years to establish the permanent native grass cover.

1.2 If additional wheat or rye cover is needed, it should be sown in September and will start to grow in October. If additional perennial switchgrass is needed, it should be broadcast seeded in early February or drilled by early spring so that it will grow over the summer.

1.3 The grasses should be mowed, to 6 to 8 inches high, twice per year, or a controlled burn once per year between mid-February and April 15. If a controlled burn is used, the burning should be from the top of embankment down, to have a slower and more controlled burn. A permit will be needed from St. Charles County to manage the native grasses by burning.

1.4 Riprap areas should be sprayed with an herbicide once in the spring and once in the fall of each year to eliminate the growth of woody vegetation. Embankment mowing should be supplemented by periodic use of herbicides to prevent the growth of woody plants on the embankments and within the perimeter fence of the UWL. The U.S. EPA bans the use of the herbicide 2,4,5-T in parks and recreational areas, and the use of Silvex (2,4,5-TP) around water. Herbicides shall not be used that contain 2,4,5-T or 2,4,5-TP, such as ESTERON 2,4,5 by DOW Chemical. Approved herbicides include 2,4-D or 2,4-DP, such as RTU or GARLON by DOW Chemical, WEEDONE 170 or WEEDONE 2,4-DP by Union Carbide, or a 1% to 2% solution of ROUNDUP.

1.5 Woody plants should be entirely removed from the slopes of the embankments, including the root ball. The void left from removal of the root ball should be backfilled with compacted silty clay or low plastic clay, and the disturbed area should be reseeded.

## 2.0 RESEEDING

2.1 PRODUCTS

2.1.1 Commercial fertilizer of 0-20-20 grade shall be provided and applied to the permanent seeding sites, so that not more than 2.0 pounds of phosphorus ($P_2O_5$) per 1000 sq.ft. and 2.0 pounds of potassium ($K_2O$) per 1000 sq.ft. are applied. The fertilizer shall be nitrogen (N) free. No nitrogen shall be applied at time of seeding. The fertilizer shall be uniform in composition, free flowing and suitable for application with available equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, fully labeled or otherwise designated in accordance with the applicable State fertilizer laws, and bearing the name, trade name or trademark, and warranty of the producer.

2.1.2 Permanent seed mixture should be as follows. All grass seed will meet minimum of 98% purity and 85% germination.

| Kinds of Seed | Pounds Pure Live Seed per Acre |
|---|---|
| Switchgrass (Blackwell or Cave-in-Rock) (*Panicum virgatum*) | 15 lbs. |
| Wild Rye (*Elymus canadensis*) | 15 lbs. |
| Annual Ryegrass (*Lolium multiflorum*) | 20 lbs. |
| Oats or Wheat | 30 lbs. |
| Total Pounds Pure Live Seed/Acre | 80 lbs. |

2.1.3 Mulch should be mature prairie hay, or if prairie hay is not available, straw of cereal grain such as oats or wheat. Materials containing objectionable weed seeds or other species detrimental to the planting should not be used.

2.2 APPLICATION - Permanent seeding sites should be tilled to an average depth of 3 to 5 inches, and fertilizer may be applied up to 10 days before seeding, or at the time of seeding, or up to 5 days after seeding. Seeding may be done by drilling or by broadcasting. Hay or straw mulch should be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading with either a mechanical anchor, such as a V-type-wheel land packer or a scallop-disk land packer designed to force mulch into the soil surface, or mulch may be glued to the ground surface using biodegradable glue.

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Cells 1 & 4A and Recycle Pond O&M Manual

# APPENDIX C

# GYPSUM STACKING OPERATIONS

# Appendix C
# GYPSUM STACKING OPERATIONS

## C.1 BEGINNING GYPSUM STACKING

The initial filling of Cell 1 is described in Section 2.3. Settled gypsum will gradually create a plain of material within Cell 1 that slopes gently away from the embankment (the "gypsum beach"), as shown in Figure 5. The bottom of the gypsum slurry discharge pipes is at el. 442.67. The gypsum beach cannot exceed about el. 442 without having to either change the discharge location or begin excavating the gypsum to construct the first dikes.

The concept of gypsum stacking is illustrated in Figure C-1. Two dikes will be made with gypsum from Cell 1: the exterior or outer dike, and the interior or inner dike. The channel between the perimeter berm of Cell 1 and the outer dike forms the perimeter ditch which returns water to the triple box culverts once the outer ditch is completed around all of Cell 1. The excavated channel between the outer dike and the inner dike forms the "rim ditch" which carries the gypsum slurry around the Cell 1. A cut is made through the inner dike at selected locations to distribute the gypsum slurry. The coarser gypsum particles settle in the rim ditch, where it is easier to excavate the gypsum with trackhoes to build the outer and inner dikes. The fine particles of gypsum settle in the center "sedimentation area" which is always under water.

Because the water level during the winter will be at el. 441, the gypsum beach on the eastern side of Cell 1 will reach an el. of 441 or higher during the first winter. As the water level is lowered during the spring, the beach on the east side of Cell 1 will dewater making it easier to begin construction of the inner and outer dikes in this area. Construction of the initial rim ditch will allow slurry to continue to be discharged from this location and redirect the slurry flow to the north and south along the east side of Cell 1, increasing the overall size of the beach.

After April 1 during normal operations, the water level in Cell 1 can be lowered to el. 438± to optimize the natural beach formation (Figure 6). This will continue until December 15, at which time the water level in Cell 1 will be raised to el. 441. When the gypsum beach extends more than one-half the distance across Cell 1, and while the water level is lowered to el. 438±, the ends of the slurry discharge pipes should be moved to the south end of Cell 1 (Discharge Location #2, Figure 7). HDPE pipe must be added to the ends of the gypsum slurry pipes at Location #1, and the pipe extension aligned along the inner edge of the embankment to the south end of Cell 1. The exact piping alignment and the final location of Discharge Location #2 will require field configuration.

After April 1, the water level in Cell 1 can again be lowered to el. 438± to optimize the natural beach formation (Figure 8). Construction of the initial rim ditches and exterior and interior dikes (Figures C-1 and C-2) will continue until they extend along the south perimeter of Cell 1 and halfway north on both the east and west perimeter of Cell 1. The construction of dikes and ditches is further detailed in the following section.

## C.2 GYPSUM DIKES AND SEDIMENTATION POND CONSTRUCTION

Construction of the rim ditch should begin after the beach at the east and south sides of Cell 1 reach el. 441 and the water level in the south end of the impoundment is lowered to el. 438±. The rim ditch is constructed by building two elevated roads on the gypsum beach beginning at the middle of the east berm and proceeding both clockwise and counterclockwise around the perimeter of the stack as shown in Figure C-2. Access to the beach will be provided by carefully pushing fill soil or fly ash outward from the crest of the earthen perimeter berm out onto the beach. The thickness of the fill will need to be at least 18 inches thick above the HDPE liner to avoid damage to the liner and will need to be at least 36 inches thick above the gypsum beach. After the access pad has been constructed far enough out onto the beach to allow excavation of the gypsum without damaging the liner, the access road can be completed using gypsum excavated from the beach. The details of constructing the access road and establishing the rim ditch are illustrated in Figure C-2. Note that the rim ditch is advanced by pushing the windrowed gypsum off of the two roadways out onto the beach in approximately 20-ft long segments.

Gypsum excavated from the beach is expected to be soft and saturated and must be windrowed and allowed to drain before it can be spread and compacted to form the roadway. Typically, gypsum drains sufficiently in 24 hours to allow spreading and compacting. Caution should be used to prevent equipment from getting stuck in the gypsum until the specific drainage characteristics of the gypsum produced at the Plant are determined. Sufficient compaction can be achieved by tracking with a low pressure D-6 dozer. Depending on the reach of the excavator, the rim ditch can advance about 20 feet per day in each direction.

The rim ditch should be refilled each day to provide gypsum for raising the roadway as the excavator retreats from the most recently placed windrow. The height of the interior dike when the initial rim ditch is completed should be at least 3 feet above the beach. The outer slope of the outer rim ditch should be graded to a slope of 3 horz. to 1 vert. (3H:1V). The gypsum interior and exterior dikes should be initially raised in lift increments of about 1.5 to 2 feet. A minimum freeboard of 3 feet should be maintained between the slurry level in the rim ditch and the crest of the perimeter embankment. The gypsum exterior dike should always be maintained at a slightly higher elevation (1 foot minimum) than the interior dike of the rim ditch to prevent accidental overflow of gypsum slurry down the stack slope in the event the rim ditch becomes blocked.

The exterior and interior dike crests should be moved inward each lift as needed to maintain the design slope of 3H:1V. The slopes can be graded with a smooth-edged excavator bucket, e.g., a finish or cleanup bucket. Under no circumstances should the slopes of the stack be graded using a toothed excavator bucket.

At an advance rate of 20 feet per day, it will take about 2 months for the rim ditch to reach the midpoint of the impoundment as illustrated in Figure 8. During this period, the beach and the water level in the ponded area will have increased in elevation by about two feet. During this same period, a 2-ft thick gypsum protective cover should be placed on top of the HDPE liner on interior of the earthen perimeter embankment. The gypsum for the cover can be excavated from the rim ditch.
Once the rim ditch is constructed around the east, south and west perimeter of the south half of Cell 1, the rim ditch must be extended across the middle of the impoundment. While construction is

completed, gypsum will be discharged intermittently into the north compartment as shown in Figure C-3. Clarified water will continue to be discharged using the siphon from northwest corner of Cell 1 in order to maintain the water level about 9 feet below the crest of the earthen perimeter dike. It is estimated that it will take about one month to construct the divider dike across the middle of the impoundment.

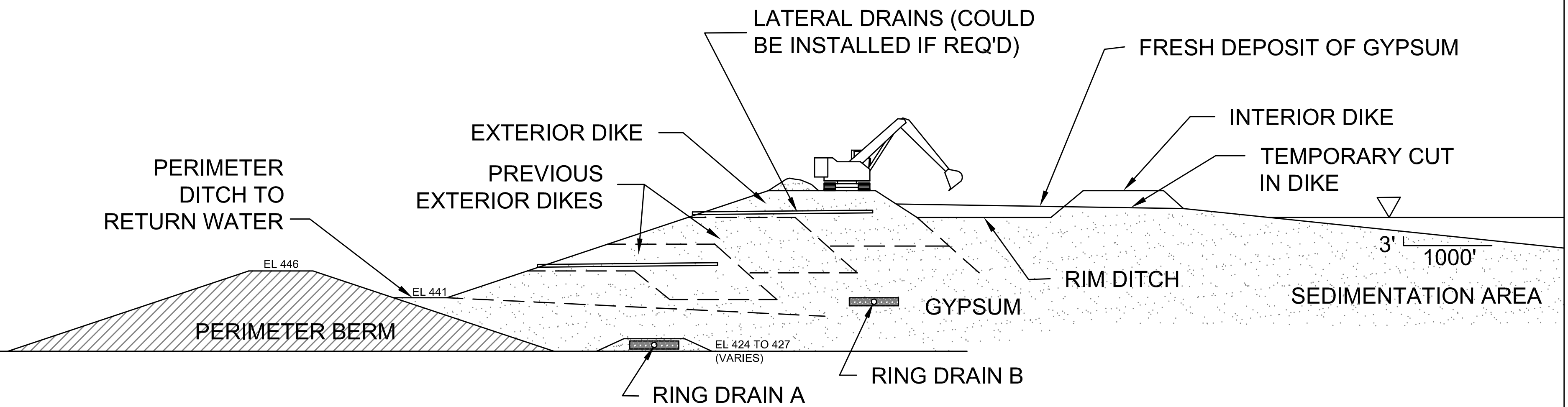
When the rim ditch around the south sedimentation pond is finished, gypsum will be introduced into the north compartment at both the southeast and southwest corners. When the rim ditch is extended into the north sedimentation pond, the rim ditch needs to be raised by discharging gypsum slurry into the sedimentation pond at both the southeast and southwest corners. Water will be decanted from the south sedimentation pond through a cut in the north inner dike near the northwest corner of the south sedimentation pond as shown in Figure C-3. The rim ditch on the east side of Cell 1 will be approximately 2 feet higher than the rim ditch on the west side of Cell 1 so that the clarified water from the south compartment can flow along the rim ditch into the north sedimentation pond as shown in Figure C-3.

At some time before the rim ditch in the north compartment reaches the location of the siphon line, the siphon line needs to be extended to the south as shown in Figure C-4. This will allow the rim ditch to be completed along the entire length of the north perimeter embankment. The 2-ft thick gypsum protective cover placed against the liner on the earthen perimeter dike of the southern compartment should also be completed during this time.

When the surface area of the water at the northwest corner of the south sedimentation pond becomes too small to effectively settle the gypsum, the cut through the inner dike at the northwest corner should be relocated to the middle of the inner dike where the bottom elevation of the rim ditch is 1.5 to 2 feet higher than at the northwest corner so that the south sedimentation pond can be raised by about 1.5 feet. The northwest corner of the south sedimentation pond, which is the lowest point in the pond before the cut is relocated, can be raised by blocking the south rim ditch as shown in Figure C-5 and directing gypsum slurry into the west part of the south sedimentation pond through a cut in the west inner dike.

Construction of the rim ditch for the north sedimentation pond will proceed as shown in Figure C-5 until the rim ditch is complete. When the rim ditch at the northwest corner of the north sedimentation pond, which is the lowest point in the entire Cell 1, reaches el. 440, an emergency decant structure should be installed near the northeast corner of the Phase I north compartment as shown in Figures C-6 and C-7.

The total volume of gypsum required to completely form the inner and outer dikes of the rim ditch around the entire stack impoundment, as illustrated in Figure C-8, is estimated at approximately 96,000 cubic yards. After Cell 1 has been divided into 2 operating subcells, then construction of Ring Drain B can begin.




Note: after Ardaman & Associates' report on wet gypsum stack method.

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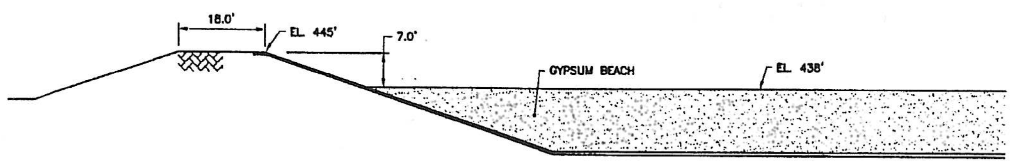
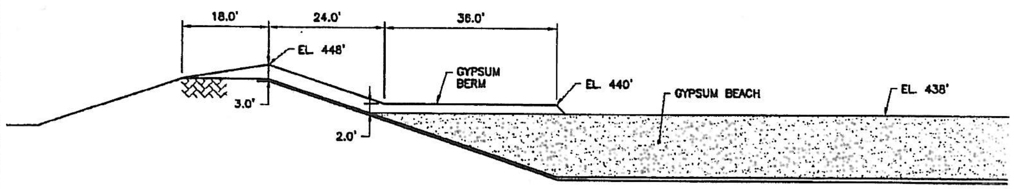
COMPONENTS OF WET
GYPSUM STACKING OPERATION

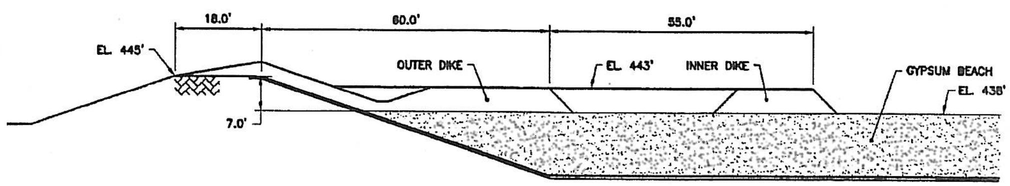
Figure C-1



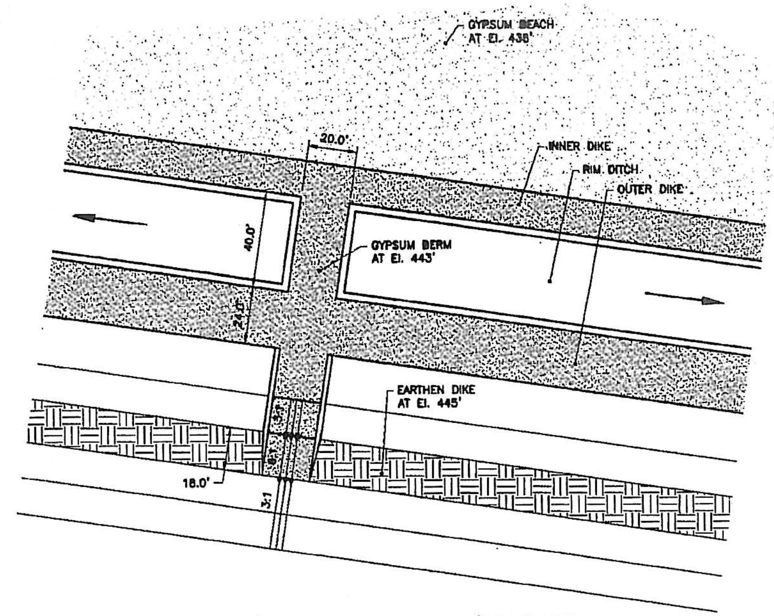

STEP 1 DISCHARGE GYPSUM TO RAISE THE GYPSUM BEACH TO 7 FEET BELOW THE CREST OF THE EARTHEN DIKE ALONG THE SOUTH WALL OF THE SETTLING COMPARTMENT




STEP 2 BUILD A 20 FOOT WIDE, 36 FOOT LONG WORK BENCH INTO THE COMPARTMENT USING FLY ASH OR GYPSUM AT THE LOCATION SHOWN IN FIGURE 2




STEP 3 CAREFULLY DIG GYPSUM FROM THE BEACH TO RAISE AND EXTEND THE WORK BENCH. EXTEND INNER AND OUTER DIKE FROM WORK BENCH AS SHOWN IN FIG 2.




PLAN VIEW OF THE INITIATION OF GYPSUM DIKE CONSTRUCTION

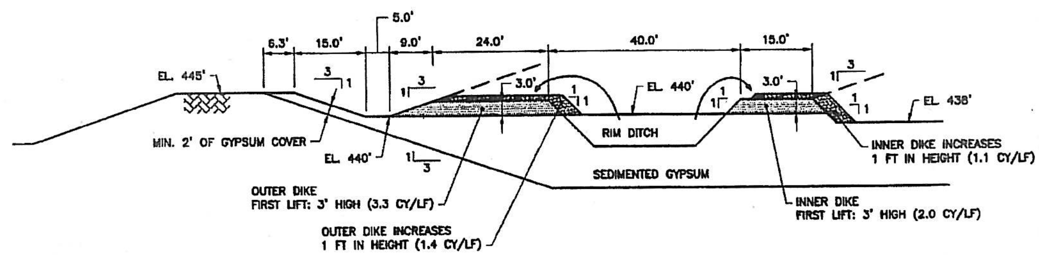
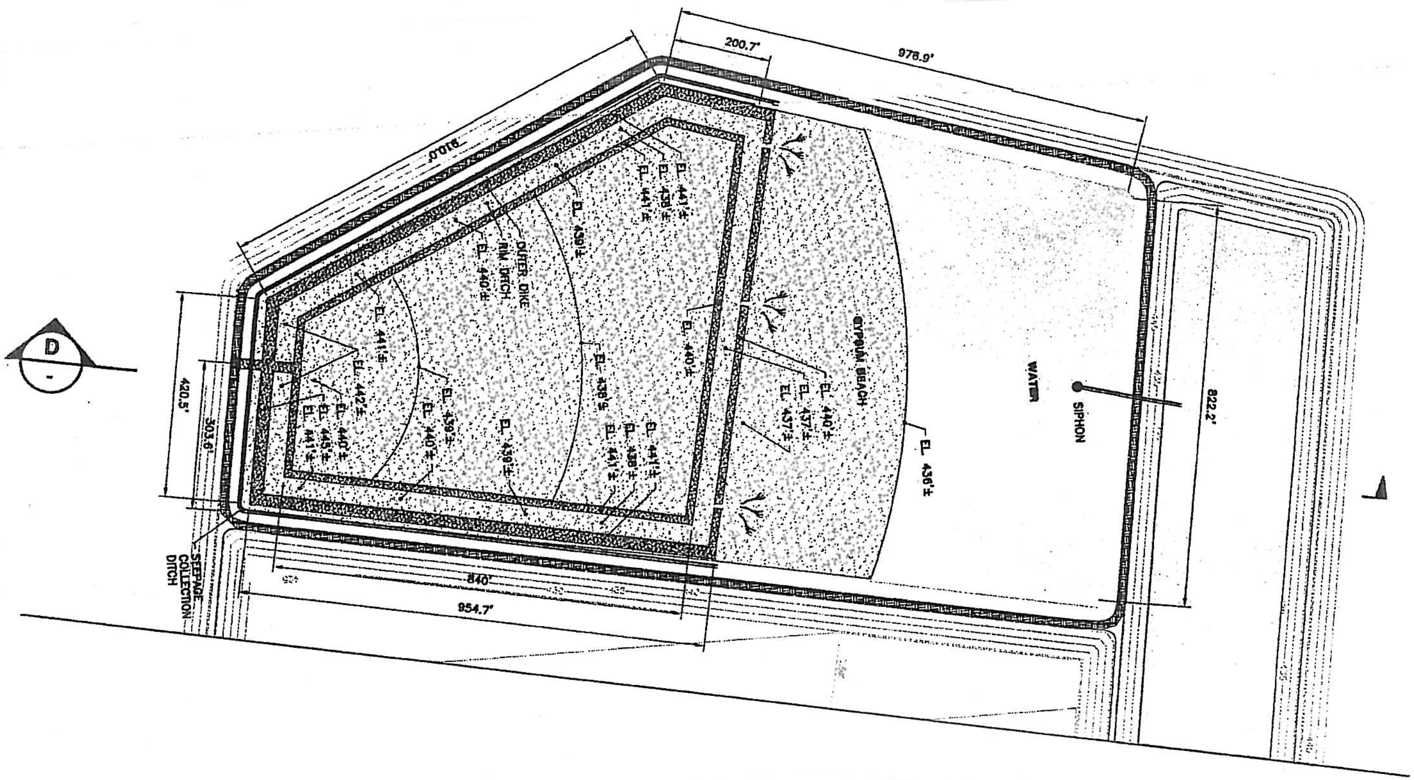


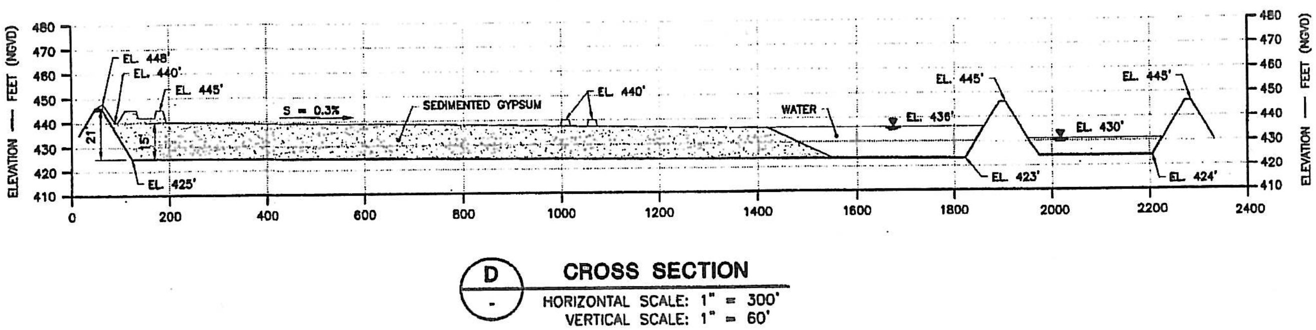

ILLUSTRATION OF INNER AND OUTER DIKE CONSTRUCTION

Sioux Plant UWL O&M Manual
CONSTRUCTION OF INNER AND OUTER GYPSUM DIKES

Figure C-2

Note: figure based on report by Ardaman & Associates, 2008. (Ref. 4 in Section 1.6)



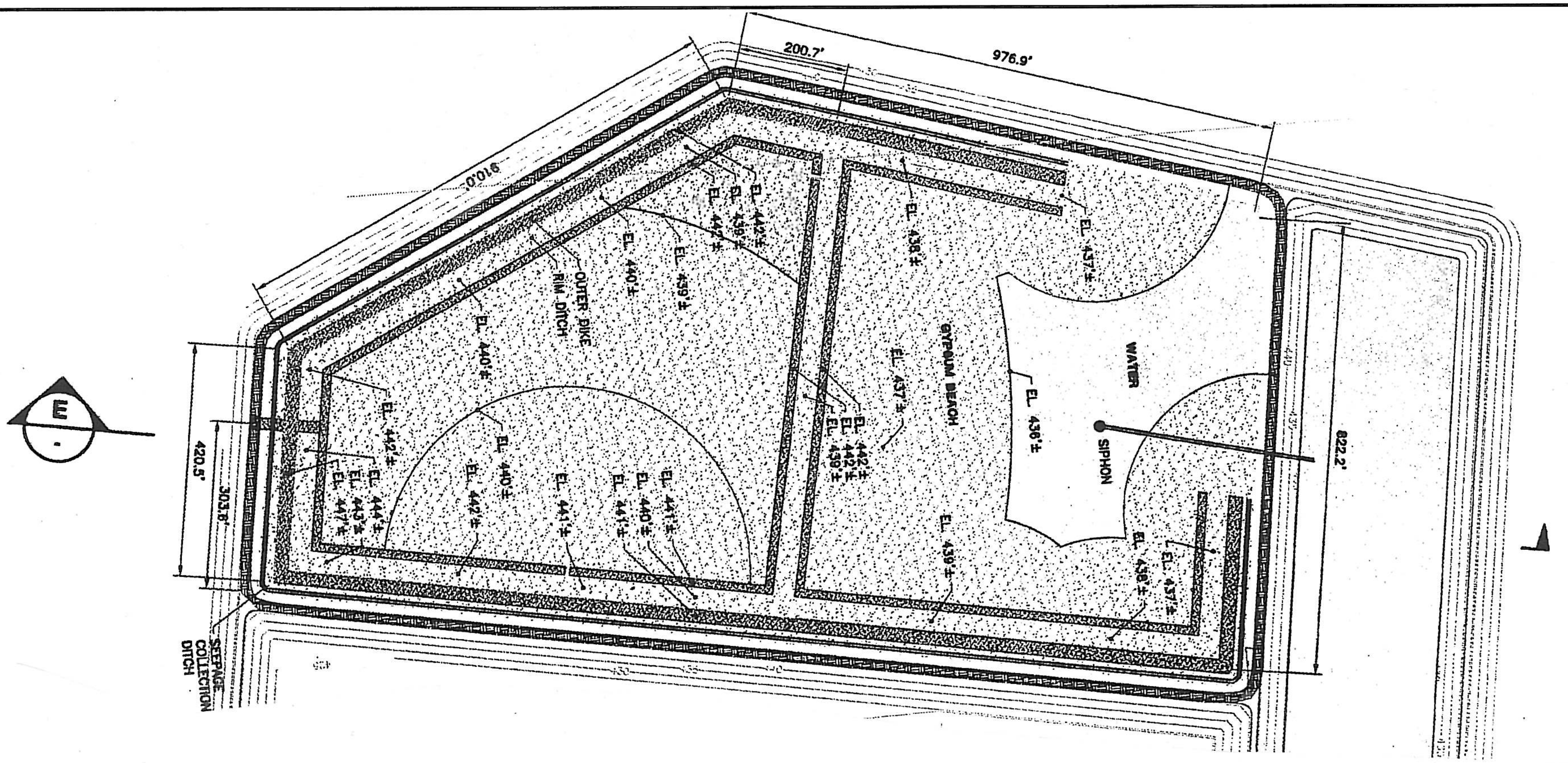



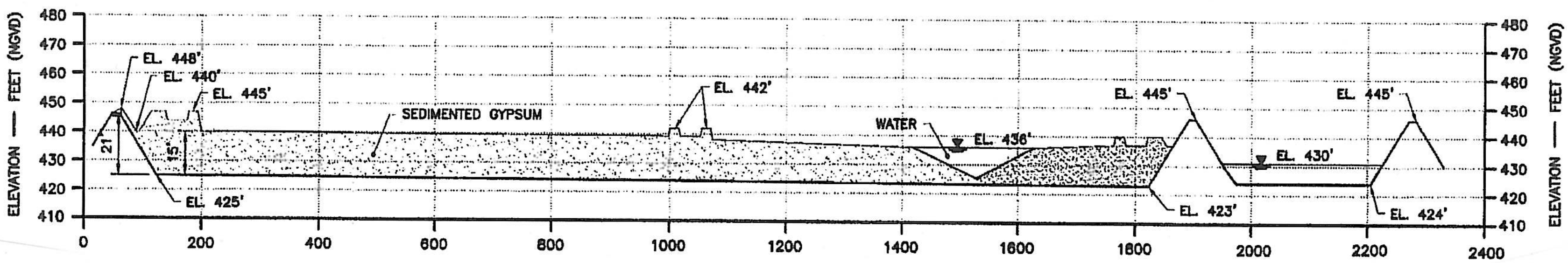

CROSS SECTION
HORIZONTAL SCALE: 1" = 300'
VERTICAL SCALE: 1" = 60'

Sioux Plant UWL O&M Manual
END OF STAGE 4

Figure C-3

Note: figure based on report by
Ardaman & Associates, 2008.
(Ref. 4 in Section 1.6)




E

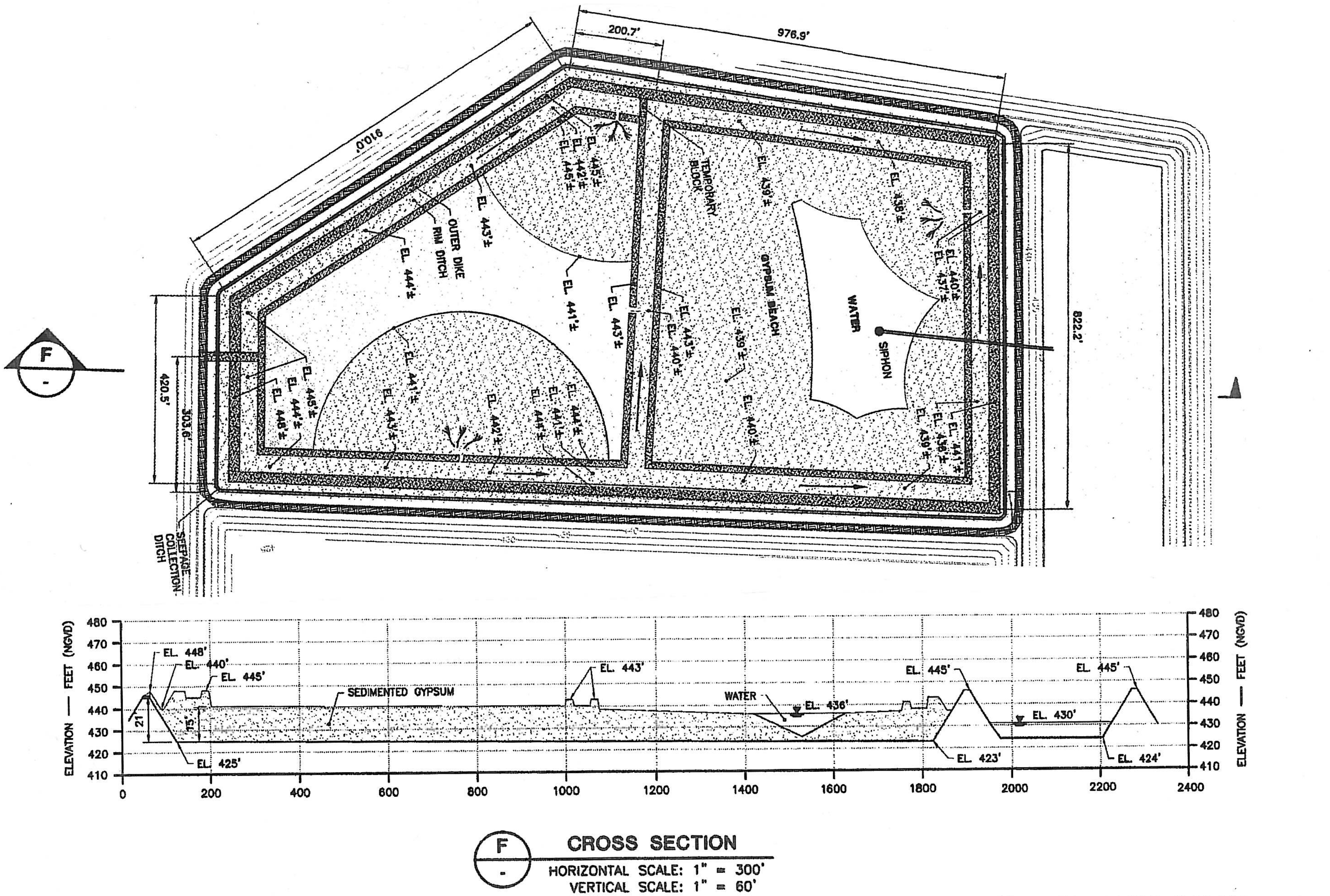
**CROSS SECTION**

HORIZONTAL SCALE: 1" = 300'
VERTICAL SCALE: 1" = 60'

Sioux Plant UWL O&M Manual
STAGE 5

Note: figure based on report by Ardaman & Associates, 2008. (Ref. 4 in Section 1.6)

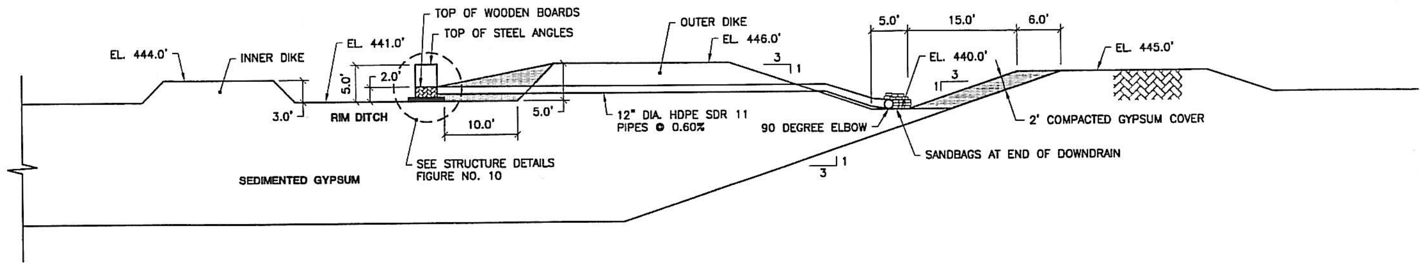
Figure C-4




Note: figure based on report by
Ardaman & Associates, 2008.
(Ref. 4 in Section 1.6)

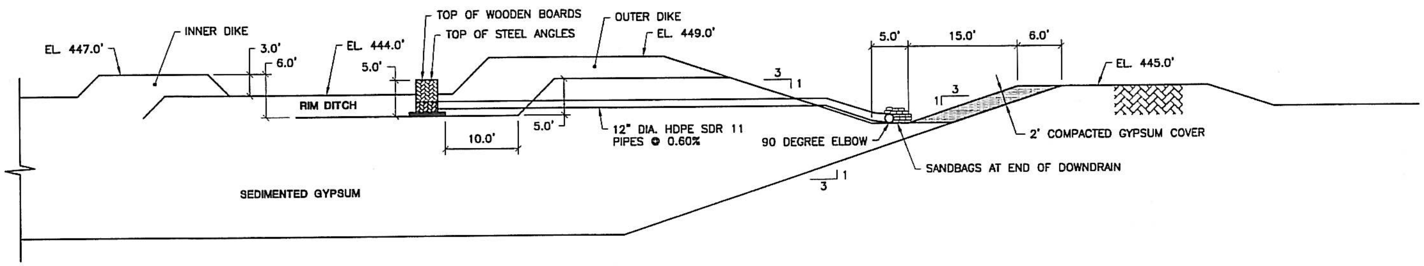
Sioux Plant UWL O&M Manual
STAGE 6

Figure C-5

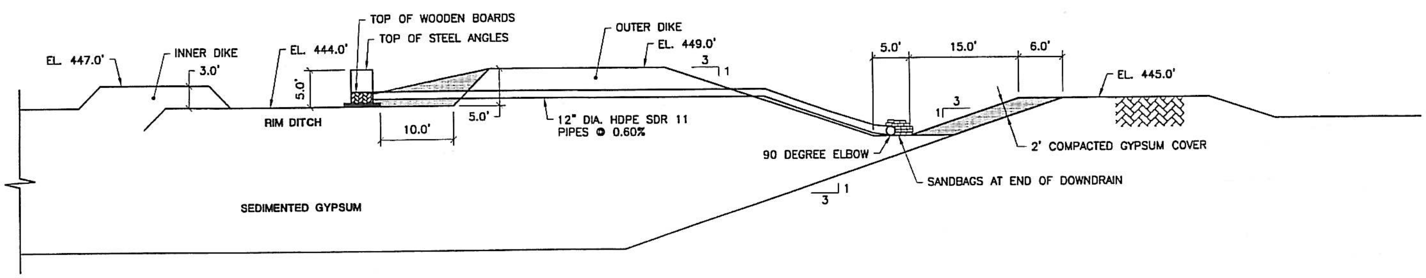



1-1
9

**STEP 1 BUILD A BERM 10 FT INTO RIM DITCH TO PLACE DECANT RISER; EXCAVATE THROUGH OUTER DIKE TO BURY DECANT PIPE.**




**STEP 2 ADD FLASH BOARDS TO DECANT RISER TO KEEP SLURRY IN RIM DITCH 2 FT BELOW TOP OF FLASH BOARDS**

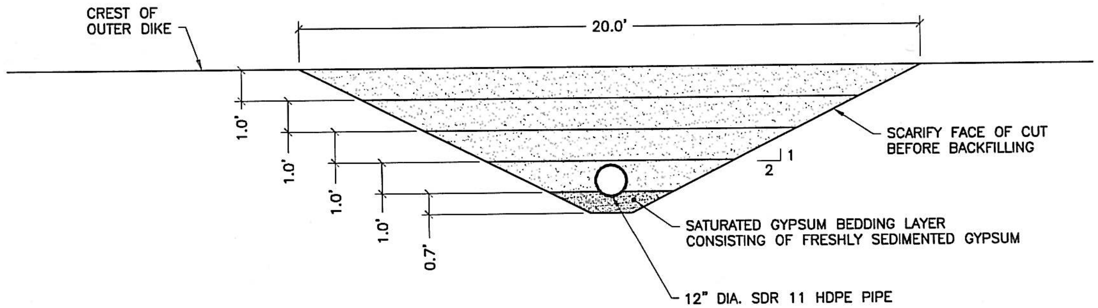



**STEP 3 AFTER RIM DITCH RISES 3 FT, DIG DECANT RISER AND PIPE OUT AND REINSTALL THEM IN A NEARBY LOCATION (ABOUT 50 FT AWAY)**

Note: figure based on report by Ardaman & Associates, 2008. (Ref. 4 in Section 1.6)

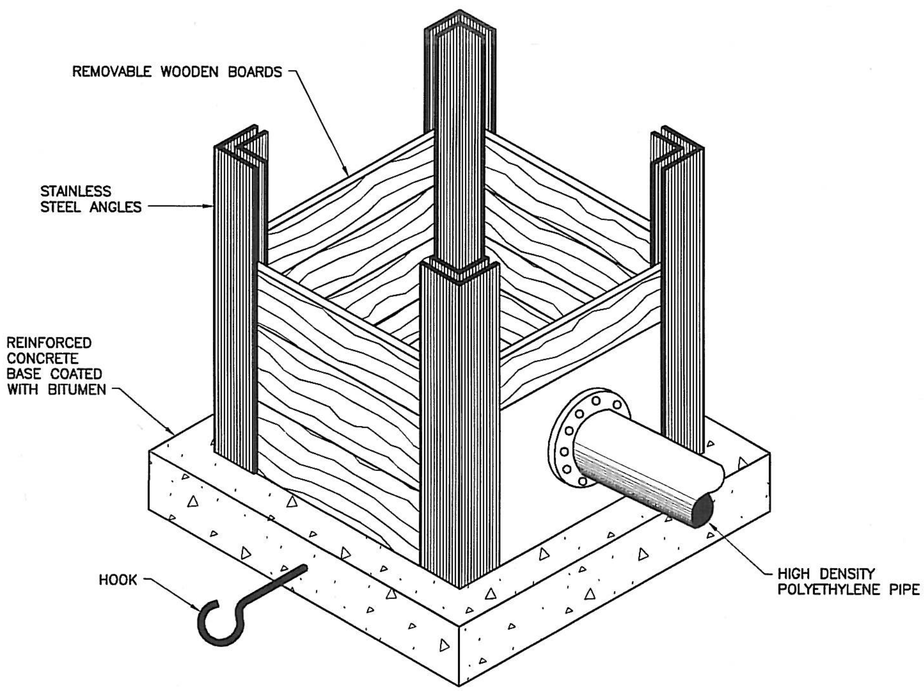
Sioux Plant UWL O&M Manual
DECANT STRUCTURE INSTALLATION

Figure C-6




AA' / 10 **DECANT PIPE THROUGH OUTER DIKE**

(N.T.S.)




NOTE:

1. PLACE 8-in LIFT OF WET TO VERY WET GYPSUM AT BOTTOM OF EXCAVATION PRIOR TO INSTALLING PIPE;
2. PUSH PIPE INTO FRESHLY PLACED GYPSUM TO ENSURE INTIMITE CONTACT BETWEEN GYPSUM AND LOWER 1/3 PIPE;
3. HOLD PIPE DOWN WITH PILES OF WET GYPSUM SPACED EVENLY ALONG CENTERLINE OF PIPE;
4. PLACE AND TAMP WET TO VERY WET GYPSUM AROUND REMAINING CUT IN 12-INCH LIFTS, SCARIFYING BETWEEN LIFTS IF NECESSARY;
5. DO NOT DRIVE CONSTRUCTION EQUIPMENTS ACROSS BACKFILLED CUT OR USE THE RIM DITCH FOR AT LEAST 48 HOURS AFTER THE CUT HAS BEEN BACKFILLED;
6. BACKFILL EXCAVATION AT PREVIOUS DECANT STRUCTURE LOCATION BY TAMPING WET OR VERY WET GYPSUM IN 12-INCH LIFTS, SCARIFYING BETWEEN LIFTS AS NECESSARY;
7. PRIOR TO BACKFILLING A CUT, THE EXPOSED GYPSUM SURFACE SHALL BE SCARIFIED TO BREAK UP AND REMOVE ANY DRY OR CEMENTED SURFACE CRUST, IF PRESENT.

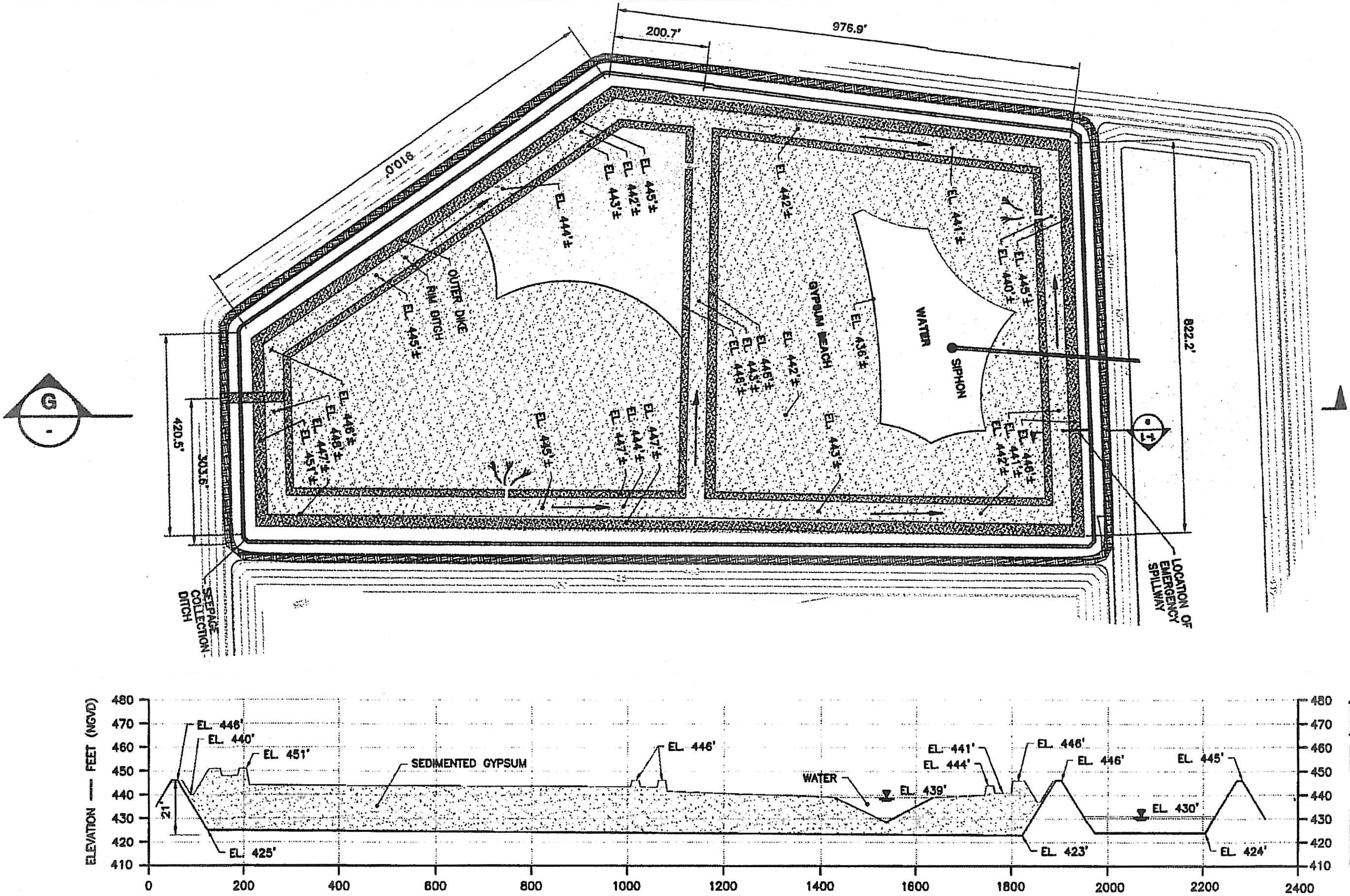
- / 10 **MOVABLE OVERFLOW-TYPE DECANT STRUCTURE DETAIL**

(N.T.S.)

Note: figure based on report by Ardaman & Associates, 2008. (Ref. 4 in Section 1.6)

Sioux Plant UWL O&M Manual
DETAILS OF DECANT STRUCTURE

Figure C-7




G
-
**CROSS SECTION**
HORIZONTAL SCALE: 1" = 300'
VERTICAL SCALE: 1" = 60'

Sioux Plant UWL O&M Manual
STAGE 7

Note: figure based on report by Ardaman & Associates, 2008. (Ref. 4 in Section 1.6)

Figure C-8

Ameren Missouri Sioux Energy Center UWL
Cells 1 & 4A and Recycle Pond O&M Manual

# APPENDIX D

# STATE AND LOCAL PERMITS

# APPENDIX D – STATE AND LOCAL PERMITS

# LIST OF CONTENTS

The following State and County permits and licenses have been obtained in order to construct and operate the UWL:

1. Missouri Department of Natural Resources (MDNR) Solid Waste Disposal Area Operating Permit No. 0918301, dated July 30, 2010.

2. MDNR Solid Waste Disposal Area Construction Permit No. 0918301, dated March 28, 2008.

3. Groundwater Monitoring Program incorporated into this Construction Permit.

4. MDNR Dam and Reservoir Safety Council Construction Permit C-426 (MO40160), dated April 1, 2008, amended April 8, 2010.

5. Letter of agreement by MDNR-DRSP, received February 16, 2011, of the Memorandum of Understanding dated August 5, 2008.

6. MDNR Dam and Reservoir Safety Council Construction Permit C-426 (MO40160), dated April 1, 2008, amended February 11, 2014.

7. St. Charles County Solid Waste Facility Operating License #04303 including Cell 4A, dated December 10, 2013.

8. St. Charles County Solid Waste Facility Operating License #04303, dated October 31, 2013.

9. MDNR Solid Waste Management Program Approval of Modified CPA, February 8, 2013.

10. MDNR Solid Waste Management Program Authorization to Operate (ATO) Cell 4A, December 6, 2013.

11. MDNR Solid Waste Management Program Approval of Initial Filling of Cell 4A with Conditions, dated April 6, 2015.

12. MDNR Solid Waste Management Program Modification of Permit No. 0918301 to incorporate the October 2015 Flood Protection Plan, dated October 28, 2015.

13. MDNR-SWMP “Biennial Airspace Estimate” Form

# Missouri
# Department of Natural Resources

## Solid Waste Disposal Area Operating Permit

**Permit Number 0918301**

**AmerenUE Sioux Power Plant Utility Waste Landfill**

**AmerenUE**

**St. Charles County**

Director, Solid Waste Management Program

Date: JUL 30 2010

STATE OF MISSOURI

Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director

DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

JUL 30 2010

CERTIFIED MAIL # 7007-0710-0002-2053-9726
RETURN RECEIPT REQUESTED

Mr. Michael Menne
Ameren UE
One Ameren Plaza
1901 Choteau Avenue
St. Louis, MO 63103

RE: AmerenUE Sioux Power Plant Utility Waste Landfill, Utility Waste Disposal Area Construction Permit Number 0918301, St. Charles County

Dear Mr. Menne:

A request for an Operating Permit has been filed with the Missouri Department of Natural Resources' (Department) Solid Waste Management Program (SWMP) for AmerenUE Sioux Power Plant Utility Waste Landfill, Construction Permit Number 0918301.

Whereas, the permittee has demonstrated compliance with the requirements of 10 CSR 80-2.020(2)(B) to the Department's satisfaction; an Operating Permit is hereby granted for Cell 1, as shown on drawing 2 of the plan sheets titled "Construction of Cell 1 and Recycle Pond". This Operating Permit is hereby made an official part of Solid Waste Disposal Area Construction Permit Number 0918301.

The following documents are hereby approved and incorporated into Permit Number 0918301.

**DOCUMENTS:**

1. A letter dated July 15, 2010, from Mr. Paul Pike, Environmental Science Executive of Ameren Services. This document includes a response to the July 1, 2010, comment letter from the Solid Waste Management Program.

2. A letter dated May 27, 2010, to Ms. Charlene Fitch, Solid Waste Management Program, from Mr. Paul Pike, Ameren Services, and received on June 1, 2010, requesting the Operating Permit.

3. "Cell 1 Operating Permit Requirements Report", dated February 2010 and received February 26, 2010, prepared by Ben Moore, P.E. of GREDELL Engineering Resources, Inc.

4. "Cell 1 Final CQA Report", dated January 20, 2010, and received February 20, 2010, prepared by Jeffrey Fouse, P.E. of Reitz & Jens, Inc. Consulting Engineers to be included with the final CQA report prepared by Ben Moore, P.E. of GREDELL Engineering Resources, Inc. This document also includes a set of plan sheets dated May 18, 2009, revised November 2, 2009, titled "Construction of Cell 1 and Recycle Pond", prepared and stamped by Jeffrey Fouse, P.E. of Reitz & Jens, Inc. Consulting Engineers.

5. "Cell 1 HDPE Geomembrane Liner CQA Report", dated February 2010 and received February 19, 2010, prepared by Ben Moore, P.E. of GREDELL Engineering Resources, Inc.

6. "Cell 1 Clay Liner Report", dated October 21, 2009, revised December 4, 2009, and received on December 10, 2009, prepared by Jeffrey Fouse, P.E. of Reitz & Jens, Inc. Consulting Engineers to be included with the Final CQA Report prepared by Ben Moore, P.E. of GREDELL Engineering Resources, Inc.

7. "Ardaman & Associates Cell 1 Reports Volumes 1 and 2", dated October 2009 and received on November 17, 2009, prepared by Thomas Ingra, P.E. of Ardaman & Associates, Inc. and compiled by GREDELL Engineering Resources, Inc.

The following conditions are an integral part of this approval. Compliance with these conditions shall, in part, determine compliance with Permit Number 0918301.

**CONDITIONS:**

1. A request for Authorization to Operate must be submitted for approval at least sixty (60) days prior to moving into future cells.

2. Any facility design elements that you need to change or that may affect future construction or operation activities must be submitted and approved prior to beginning construction. Also, any design or operational changes, complete construction specifications, construction procedures, and construction grade drawings must be submitted and approved prior to implementation.

3. All silt fences must be inspected monthly or during a storm event, whichever is more frequent.

This approval is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does it supersede any local permitting and/or zoning requirements.

The Department reserves the right to revoke, suspend, or modify this approval and/or Permit Number 0918301 if the permit holder fails to maintain the facility in compliance with the state's Solid Waste Management Law, with the terms and conditions of the permit, or the approved engineering plans and specifications.

If you are adversely affected by this decision, you may appeal to have the matter heard by the Director of the Missouri Department of Natural Resources. To appeal, you must file a petition within thirty (30) days of the date that this decision was mailed or the date it was delivered, whatever date is earlier.

We appreciate your efforts towards environmentally sound solid waste management practices. If you have any comments or questions concerning this letter, please contact Ms. Charlene Fitch or Ms. Katherine Huxol of my staff at (573) 751-5401, or P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANGEMENT PROGRAM

David J. Lamb
Director

DJL:khl

c: Senator Tom Dempsey, Missouri Senate
Representative Kenny Biermann, Missouri House of Representatives
The Honorable Steve Ehlmann, County Executive, St. Charles County Government
Ben Moore, P.E., GREDELL Engineering Resources, Inc.
Mr. Mark N. Templeton, Director, Department of Natural Resources
Ms. Crystal Lovett-Tibbs, Legislative Liaison, Department of Natural Resources
Mr. Chris Nagel, Chief, Enforcement Section, Solid Waste Management Program
Mr. Rob Morrison, Chief, Permits Section, Water Protection Program
Mr. Eric Gramlich, Solid Waste Management Program
St. Louis Regional Office

STATE OF MISSOURI
Matt Blunt, Governor • Doyle Childers, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

MAR 2 8 2008

CERTIFIED MAIL #: 7007-0710-0002-2053-3168
RETURN RECEIPT REQUESTED

Mr. Paul R. Pike, Strategic Analyst
Ameren UE Sioux Utility Waste Landfill
1901 Chouteau Avenue
St. Louis, MO 63166-1419

RE: Ameren UE Sioux Power Plant Utility Waste Landfill, Solid Waste Disposal Area Construction Permit Number 0918301, St. Charles County

Dear Mr. Pike:

An application for a construction permit to construct the above-referenced solid waste disposal area was filed with the Missouri Department of Natural Resources on March 28, 2007. The application was subsequently revised in response to the Department of Natural Resources' Solid Waste Management Program's (SWMP) comments, and the revisions were submitted on September 21, 2007. The application was filed by Gredell Engineering Resources, Inc. for review and approval. The application, prepared by Thomas R. Gredell, P.E., includes engineering plans, specifications, operating procedures, and subsequent correspondence or amendments for the subject disposal area. The application was reviewed for compliance with the Missouri Solid Waste Management Law (Sections 260.200 to 260.345, RSMo), and the Missouri Solid Waste Management Regulations.

In accordance with Section 260.205.5(7), RSMo, the department hereby approves the application as provided in the enclosed "Ameren UE Sioux Power Plant Utility Waste Landfill, Solid Waste Disposal Area Construction Permit Number 0918301" issued to Ameren UE, as owner/operator, to construct a solid waste disposal area as of the date of this letter. The disposal area is located adjacent to the Ameren UE Sioux Power Plant, south of State Highway 94, approximately two miles east of the town of Portage Des Sioux, and adjoining the City of West Alton, in St. Charles County, Missouri. The general legal description is as follows: Township 48 North, Range 6 East. The Latitude is North 38 Degrees, 54 minutes, and the Longitude is West 90 degrees, 18 minutes. This permit applies only to that tract of land consisting of approximately 398 acres as described by the engineering plans, specifications, and operating procedures submitted to the department. The disposal area contains approximately 183.5 acres divided into two phases to be used for waste disposal. The remaining area is to be utilized for utility waste landfill-related design features such as borrow area, all-weather access roads, buffer zone, leachate collection and removal system, and storm water diversion structures.

The department may review this permit after the date of issuance and notify the permit holder as necessary to assure the landfill continues to comply with the currently applicable requirements and provisions of the Missouri Solid Waste Management Law and rules adopted thereunder. Approval of the application and issuance of this permit is given with the explicit understanding that the disposal area will be developed and operated in compliance with the approved plans, specifications, operating procedures, the conditions of the permit, the Missouri Solid Waste Management Regulations, and the Missouri Solid Waste Management Law. This permit is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for any other regulatory requirements. This permit is not to be construed as compliance with any existing local ordinances or zoning requirements.

As the holder of this permit, you are required to comply with all applicable environmental laws and regulations enforced by the department. These environmental requirements are administered by the department's Air Pollution Control Program, Water Protection Program, Land Reclamation Program, Hazardous Waste Program and SWMP. In addition, you are required to comply with all applicable environmental laws administered by the government of St. Charles County, Missouri. Noncompliance with these environmental laws and regulations may, in certain circumstances, result in the suspension or revocation of this permit and may subject the permit holder to civil and criminal liability.

The Missouri Department of Natural Resources is committed to reducing, reusing and recycling all materials that might otherwise become waste. We believe reducing the amount of waste going into landfills has a multitude of economic as well as environmental benefits for Missouri citizens and businesses. Accordingly, we strongly encourage you to utilize and support materials recycling and reuse programs and techniques that reduce the amount of waste going into the landfill and make efficient use of our precious natural resources.

If you are aggrieved by this decision, you may be entitled to seek further administrative or judicial review pursuant to Section 260.235 or Section 536.150 of the Missouri Revised Statutes. Any appeal of the decision should be filed with the Director within 30 days of notice of the decision.

The department reserves the right to revoke, suspend, or modify Permit Number 0198301 if the permit holder fails to maintain the facility in compliance with the state's Solid Waste Management Law and regulations, the terms and conditions of the permit, and the approved engineering plans and specifications.

I appreciate your cooperation. If you have any questions, please contact Charlene Fitch, P.E., of the department's SWMP at (573) 751-5401 or P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

Daniel R Schuette

Daniel R. Schuette
Director

DRS:szl

Enclosure

c: The Honorable Tom Dempsey, Missouri Senate
The Honorable Vicki Schneider, Missouri House of Representatives
Mr. Steve Ehlmann, St. Charles County Executive
Mr. Mike Duvall, St. Charles County Government
Thomas R. Gredell, P.E., Gredell Engineering Resources, Inc.
Mr. David Berger, St. Louis-Jefferson Solid Waste Management District
Mr. James Alexander, Dam Safety Program, Division of Geology and Survey
Mr. Mike Alesandrini, Ombudsman, St. Louis Regional Office
St . Louis Regional Office

**MISSOURI DEPARTMENT OF NATURAL RESOURCES**
**SOLID WASTE PERMIT**

**Ameren UE Sioux Utility Waste Landfill**
Solid Waste Disposal Area Construction Permit Number 0918301
St. Charles County, Missouri

**Issue Date:** MAR 2 8 2008

## FACILITY DESCRIPTION

This facility is a utility waste landfill located adjacent to the Ameren UE Sioux Power Plant, south of State Highway 94, approximately two miles east of the town of Portage Des Sioux, and adjoining the City of West Alton, in St. Charles County, Missouri. The general legal description is as follows: Township 48 North, Range 6 East. The Latitude is North 38 Degrees, 54 minutes, and the Longitude is West 90 degrees, 18 minutes. This permit applies only to that tract of land consisting of approximately 398 acres as described by the engineering plans, specifications, and operating procedures submitted to the department. The disposal area contains approximately 183.5 acres divided into two phases to be used for waste disposal. The remainder is to be utilized for utility waste landfill-related design features such as borrow area, all-weather access roads, buffer zone, leachate collection and removal system, and storm water diversion structures.

## PERMIT DOCUMENTS

These documents are incorporated by this reference into Permit Number 0918301:

1. A letter dated February 6, 2007, to Mr. Jim Bell, Chief of Engineering, from Mr. Paul R. Pike, Strategic Analyst of Ameren UE, received February 8, 2007, requesting the Construction Permit.

2. Ameren UE Sioux Power Plant, Construction Permit Application for a Proposed Utility Waste Landfill, St. Charles County, Missouri, prepared by Ameren UE, first received February 8, 2007, deemed completed on March 28, 2007, last revised September 21, 2007. The Construction Permit Application form designates Ameren UE as the owner and operator of the landfill and Gredell Engineering Resources, Inc. as the engineering firm. Thomas R. Gredell, P.E., is the certifying professional engineer registered in Missouri.

3. Detailed Geologic and Hydrologic Site Investigation Report for Ameren UE Sioux Power Plant, Proposed Utility Waste Disposal Area, St. Charles County, Missouri, Volume I and II, prepared by Daniel E. Klockow, P.E., R.G., Gredell Engineering Resources, Inc., received February 8, 2007.

4. Engineering drawings numbered Sheet 1 of 22 through Sheet 22 of 22, titled, Ameren UE Sioux Power Plant, Proposed Utility Waste Landfill, St. Charles County, Missouri, September 2007, prepared by Reitz and Jens, Inc. and Gredell Engineering Resources, Inc., dated March 28, 2007, revised September 21, 2007. Thomas R. Gredell, P.E., is the certifying professional engineer registered in Missouri.

5. A letter dated September 20, 2007, to Jim Bell, Chief of Engineering, from Paul R. Pike, Strategic Analyst of Ameren UE, received September 21, 2007, in response to the SWMP's comment letter dated June 28, 2007.

6. A letter dated November 29, 2007, to Charlene Fitch, P.E., Solid Waste Management Program (SWMP), from Thomas R. Gredell, P.E., Gredell Engineering Resources, Inc., received December 3, 2007, responding to MDNR's verbal comments on October 23, 2007.

7. A letter dated February 20, 2008, to Jim Bell, SWMP, from Steven Lauer, of the St. Charles County Commission, received February 25, 2008, confirming the Ameren UE Sioux Power Plant Utility Waste Landfill is in compliance with local zoning in St. Charles County.

**GENERAL CONDITIONS**

The following general conditions are an integral part of Permit Number 0918301. Compliance with these general conditions shall, in part, determine compliance with the permit. All reports, plans, and data required to satisfy these general conditions shall be prepared or approved by a professional engineer registered in the state of Missouri.

1. Operation and Design

   Any change in the operation and/or design of this facility other than that which has been described in the application and approved in this permit is a modification of the permit, and prior written approval shall be obtained in advance of the permittee making that change.

2. Easement, Notice and Covenant

   The owner and the department shall execute:

   A. An easement to allow the department, its agents or its contractors, to enter the premises to complete work specified in the closure plan, monitor or maintain the site, or take remedial action during the post-closure period; and

   B. A notice and covenant indicating that the property has been permitted as a solid waste disposal area and prohibiting use of the land in any manner which interferes with the closure and post-closure plan filed with the department.

   To satisfy these requirements, the Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) has prepared a standard document titled Agreement for Easement, Notice and Covenant Running with the Land. This document is available electronically for your use. At least two (2) copies of the original document shall be submitted to the department's SWMP for approval and signature within thirty (30) days of the date of this permit.

3. Borehole Abandonment

All exploratory boreholes, abandoned monitoring wells and abandoned piezometers shall be plugged in accordance with 10 CSR 23-3.110, "Permanent Abandonment of Wells" and 10 CSR 23-4.080, "Plugging of Monitoring Wells," or an alternate method approved by the department. Proof of proper abandonment of boreholes and piezometers within each cell boundary shall be submitted to the department's SWMP for approval prior to requesting an operating permit for each subsequent cell.

4. Groundwater Monitoring

A. Groundwater monitoring shall be required per the following documents, which are hereby incorporated by reference into solid waste Permit Number 0918301:

1. "Groundwater Sampling and Analysis Plan" Appendix S-REVISED 9-07, of the Construction Permit Application (including all tables, figures and appendices included in Appendix S-REVISED 9-07); and

2. The enclosed document titled GROUNDWATER MONITORING PROGRAM, Ameren UE, Permit Number 0918301 dated MAR 2 8 2008, which is hereby incorporated by reference into solid waste Permit Number 0918301.

B. Before an operating permit will be granted, the construction of all groundwater monitoring wells shall be approved by the department. Two (2) copies of the geologist's boring logs and as-built drawings showing the well construction for any new monitoring wells, as well as two (2) copies of plan sheets that show the as-built locations of these wells, shall be submitted to the department's SWMP.

5. Liner and Final Cover

A. All borrow material used for liner and cover construction shall be from a previously sampled and approved borrow area.

B. The top surface of each lift of the compacted clay soil liner and final cover shall be scarified prior to placement of an over-lying lift of liner soil.

C. The top surface of the final lift of the compacted clay liner shall be smooth drum rolled prior to flexible membrane liner placement to ensure intimate contact between the compacted clay liner and the flexible membrane liner.

D. The soils to be used for liner and cover construction shall be periodically tested and analyzed to ensure they meet the requirements as described in the engineering report.

The compaction of the soil liner and final cover shall be confirmed via the following Quality Assurance/Quality Control (QA/QC) procedures. All QA/QC data results shall be submitted to the department's SWMP as follows:

1. On every 5,000 cubic yards of soil to be applied, perform laboratory tests of grain size, soil classification, Atterberg limits, permeability, and density/moisture testing (Standard or Modified Proctor).

2. Whenever soil conditions change, perform laboratory analysis on at least one representative sample for every 5,000 cubic yards of material used for construction.

3. All laboratory analysis on soil shall be performed prior to initial placement of soil.

4. Nuclear gauge field density and moisture tests (ASTM D2922-81) shall be performed on each lift of the soil liner and final cover. Testing shall be performed at a maximum horizontal spacing of one hundred (100) foot centers, offset fifty (50) feet, for each lift of the liner. Any portion of the liner and final cover which fails to meet the minimum compaction specification shall be removed, recompacted and retested.

5. A moisture/density calibration adjustment shall be performed at the start of each construction phase, when the soil used for liner/cover construction changes, when you change instruments, or every 12 months, which ever occurs first. Calibration adjustment procedures are covered in Annex A1, paragraph Al.3 of ASTM D 3017-88.

6. Elevations of the bottom and top of the landfill compacted soil liner and final cover shall be checked at a maximum horizontal spacing of one hundred (100) foot centers.

E. Installation of the flexible membrane liner and cover shall be performed in accordance with the QA/QC measures specified in the approved engineering report, and with the manufacturer's recommendations.

F. Please supply the department's SWMP with QA/QC data and results on the composite liner's geosynthetic components for each phase and conduct both nondestructive and destructive testing on the geomembrane.

G. The permittee shall provide seven (7) days advance notice of the following activities to the department's SWMP:

1. Test pad construction;

2. Subgrade excavation;

3. Placement of the soil component of the liner system, including final surface preparation;

4. Placement of the geosynthetic components of the liner system; and

5. Placement of the leachate collection system and its protective layer.

6. Placement of the final cover system.

The department's SWMP reserves the right to inspect and approve or disapprove any of the above-mentioned activities during the construction of the landfill.

6. Construction Quality Assurance Plan and Test Pad

A. The department may require you to revise the Construction Quality Assurance (CQA) Plan included in Appendix P-REVISED 9-07 of the approved engineering report following completion of the test pad. All construction and testing methods determined to be necessary during test pad construction shall be incorporated into the CQA plan at that time. The department must review and approve the revised CQA plan prior to construction of the liner system for the first landfill phase or cell.

B. Determination of soil placement criteria and construction of a test pad are required for each soil type proposed for use in liner construction. The department reserves the right to require test pads for future phases.

C. In addition to the testing outlined in the approved engineering report, a minimum of five (5) uniformly spaced nuclear moisture/density tests, per ASTM D 3017 and ASTM D 2922, shall be performed on each lift of the test pad.

D. At a minimum, the following information shall be included in each test pad report.

1. A detailed discussion explaining how each soil type was identified and characterized to determine the acceptable placement range. The discussion shall also take into account the soil testing performed during the detailed site investigation. This discussion shall include, at a minimum, a comparison of the following soil properties:

   a) Grain Size
   b) Atterbergs
   c) USCS soil classification
   d) Optimum moisture content
   e) Maximum dry density

f) Color
g) Texture

2. For each soil type, one plot showing the Proctor curves using symbology indicating which Proctor points passed the hydraulic conductivity criteria and which failed.

3. For each soil type, one plot showing the field moisture/density test results compared with the Proctor curves and the moisture and density pass/fail criteria.

4. A map showing soil sample locations and depths. All laboratory test reports shall be clearly correlated to sample locations.

5. A detailed discussion of the successful and unsuccessful construction techniques used, including:

   a) Methods of moisture conditioning
   b) Methods of surface preparation for each lift
   c) Depth of penetration of the compactor feet

6. A discussion of the amount of compactive effort applied to each lift of compacted soil based on the type and weight of equipment used, the number of passes, and the lift thicknesses.

7. A detailed discussion of how each soil type was identified in the field in order to correlate it to the proper soil placement range.

8. Documentation that all required calibration procedures specified by ASTM D 2922 and ASTM D 3417 (nuclear density and moisture testing) were performed before/during test pad construction.

9. A description of the methods used for subgrade preparation.

10. Copies of all field notes taken during test pad construction.

7. <u>Operating Permit</u>

When requesting the Operating Permit for the initial cell, three (3) copies of a written report shall be submitted containing all QA/QC data/results, as-built drawings, drawing(s) showing details of inter-phase berms, and a certification by a professional engineer who is registered in the state of Missouri stating that the landfill cell was constructed as per the department-approved engineering design plans and specifications. The certification shall be signed, or sealed, and dated by both the permittee and a professional engineer registered in the state of Missouri. The report and certification shall be approved by the department's SWMP before the Operating Permit for the initial cell will be granted.

If an application for the Operating Permit for the initial cell of the solid waste disposal area is not received by the department within sixty (60) months of issuance of the Construction Permit, the applicant, prior to submittal of an Operating Permit Application, shall hold a public awareness and community involvement session, solicit comments, and respond to the comments; submit to the department for approval any necessary changes to the design and operation of the facility so as to be in compliance with currently applicable law and rules; and submit to the department an updated violation history disclosure statement.

8. Authorization to Operate

When requesting Authorization to Operate for all subsequent cells, two (2) copies of a written report shall be submitted containing all QA/QC data/results, as-built drawings, drawing(s) showing details of inter-phase berms and the tie-in of liner elements to previously constructed phases, and a Missouri registered professional engineer's certification that each was constructed as per the department-approved engineering design plans and specifications. The certification shall be signed, or sealed, and dated by both the permittee and the Missouri registered professional engineer. The report and certification must be approved by the department's SWMP before Authorization to Operate for that cell will be issued. Additionally, the closure FAI for the subsequent cells must be submitted and approved.

9. Surface Water Control

Before an Operating Permit will be issued, the permittee shall provide correspondence to the department showing that all applicable permits and design approvals have been acquired from the Missouri Department of Natural Resources' Water Protection Program (WPP). As related to design approvals, the department's WPP may need to issue a Construction Permit for each sedimentation pond.

10. Air Pollution Control

Before an Operating Permit will be issued, the permittee shall provide correspondence to the department showing that all applicable permits and design approvals have been acquired from the Missouri Department of Natural Resources' Air Pollution Control Program.

11. Dam Safety

Before an Operating Permit will be issued, the permittee shall provide correspondence to the department showing that all applicable permits and design approvals have been acquired from the Missouri Department of Natural Resources' Water Resources Center, Dam & Reservoir Safety.

12. Statistical Evaluation of Groundwater Data

A. The department's SWMP shall be notified and allowed to review any changes in the statistical evaluation as they occur.

B. The permittee shall notify the department's SWMP of any statistical deviations in the groundwater data as they occur.

C. A minimum of four (4) rounds of groundwater monitoring data must be collected prior to filling.

D. Ameren UE has agreed to collect quarterly samples until there are 12 sets of samples.

**SITE SPECIFIC CONDITIONS**

A. In the future, should Ameren decide to reclaim the gypsum by-product from the permitted waste area, the department's SWMP must approve the reclamation plan prior to disturbance of the permitted area.

B. The Missouri Department of Transportation (MoDOT) must approve the design and related parameters regarding the proposed waste transport system (sluicing the waste over State Highway 94). A copy of the official MoDOT approval must be provided prior to the issuance of an operating permit.

C. A stockpiling plan for liner quality soil will be developed by the landfill construction contractor and/or geo-tech engineer. Once this plan is developed, please provide a copy to the department.

D. The wet gypsum stacking method of filling is approved; should Ameren UE wish to accept other coal combustion by-product wastes, a permit modification must be submitted.

**DISPOSAL AREA DESCRIPTION**

The types of waste to be accepted shall consist of coal combustion by-products including but not limited to fly ash, coal wastes, boiler slag and flue gas desulfurization wastes (gypsum).
The area fill method of utility waste landfill operation shall be utilized. The excavation depths and solid waste fill locations shall be completed as shown on the approved engineering plans and specifications. Upon completion of the disposal area, the final cover shall be graded, limed, fertilized as necessary, and seeded with grasses to control erosion. Continued maintenance of the

area shall be provided in accordance with the approved post-closure plan. All fencing, gates, equipment maintenance buildings, all-weather access roads, signs, surface-water control devices, leachate treatment facilities, operating equipment, standby equipment, and other necessary appurtenances shall be provided as per the approved plans, specifications, and operating procedures. The plans, specifications, and operating procedures described above have been examined as to engineering features of design which might affect the operation of the solid waste disposal area as a utility waste landfill.

**MODIFICATION AND TERMINATION OF PERMIT**

The department reserves the right to revoke, suspend, or modify Permit Number 0918301 if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and regulations, the terms and conditions of the permit, or the approved engineering plans and specifications.

MAR 2 8 2008

Date of Permit

Daniel R. Schuette, Director
DIVISION OF ENVIRONMENTAL QUALITY

GROUNDWATER MONITORING PROGRAM
Ameren UE, Sioux Utility Waste Landfill
Permit Number 0918301
Date MAR 2 8 2008

## A. INCORPORATED DOCUMENTS

The following documents are incorporated by this reference into the Groundwater Monitoring Program of Permit Number 0918301:

1. "Groundwater Sampling and Analysis Plan" Appendix S, of the Ameren UE Sioux Power Plant, Construction Permit Application, prepared by Gredell Engineering Resources, Inc., first received March 28, 2007, last revised September 21, 2007. The Construction Permit Application designates Ameren UE as the owner and operator of the landfill, and Gredell Engineering Resources, Inc., as the engineering firm. Thomas R. Gredell, P. E. is the certifying professional engineer registered in Missouri.

2. Engineering drawing Figure 2, "Monitoring Well Location Map" received September 21, 2007.

## B. MONITORING WELLS

The groundwater monitoring network of the Ameren UE Sioux Utility Waste Landfill shall consist of 16 monitoring wells. This monitoring system will be used to monitor groundwater flowing beneath the landfill. UG-1, UG-2, UG-3 and UG-4 will be background (upgradient) monitoring wells. DG-1, DG-2, DG-3, DG-4, DG-5, DG-6, DG-7, DG-8, DG-9, DG-10, DG-11, and DG-12 will be compliance (downgradient) monitoring wells.

The Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) and the Division of Geology and Land Survey (DGLS) shall review any changes in direction of groundwater flow from potentiometric surface maps; and as waste filling progresses in the landfill. The department's SWMP shall review all groundwater monitoring data to evaluate statistical determinations.

The existing and new (to be installed) monitoring wells listed in Table I are those for which Ameren UE Sioux Utility Waste Landfill is responsible for reporting bailing, purging, sampling, and field observations, and to provide representative sampling parameter analyses from the Sioux Utility Waste Landfill. For consistency in designations, the department's SWMP will use the monitoring point designations as shown in Table I. These designations shall appear on subsequent electronic submissions of groundwater data and groundwater monitoring reports. These monitoring designations shall be referenced in future correspondence associated with this permit.

**Table I**

| COMPLIANCE SUBJECT TO CHANGE BY THE SWMP AND DGLS | MONITORING WELL LOCATIONS | MONITORING WELL DESIGNATIONS |
|---|---|---|
| Upgradient | **Monitoring well** UG-1 located at approximately N1118957, E877795. | UG-1 |
| Upgradient | **Monitoring well** UG-2 located at approximately N1118859, E879319. | UG-2 |
| Upgradient | **Monitoring well** UG-3 located at approximately N1118609, E880519. | UG-3 |
| Upgradient | **Monitoring well** UG-4 located at approximately N1118616, E881530. | UG-4 |
| Compliance | **Monitoring well** DG-1 located at approximately N1117387, E877384. | DG-1 |
| Compliance | **Monitoring well** DG-2 located at approximately N1116940, E877618. | DG-2 |
| Compliance | **Monitoring well** DG-3 located at approximately N1116572, E877920. | DG-3 |
| Compliance | **Monitoring well** DG-4 located at approximately N1116403, E878421. | DG-4 |
| Compliance | **Monitoring well** DG-5 located at approximately N1116330, E878919. | DG-5 |
| Compliance | **Monitoring well** DG-6 located at approximately N1116257, E879418. | DG-6 |
| Compliance | **Monitoring well** DG-7 located at approximately N1116185, E879912. | DG-7 |
| Compliance | **Monitoring well** DG-8 located at approximately N1116114, E880398. | DG-8 |

| COMPLIANCE SUBJECT TO CHANGE BY THE SWMP AND DGLS | MONITORING WELL LOCATIONS | MONITORING WELL DESIGNATIONS |
|---|---|---|
| Compliance | **Monitoring well** DG-9 located at approximately N1116162, E880902. | DG-9 |
| Compliance | **Monitoring well** DG-10 located at approximately N1116080, E881456. | DG-10 |
| Compliance | **Monitoring well** DG-11 located at approximately N1115995, E882006. | DG-11 |
| Compliance | **Monitoring well** DG-12 located at approximately N1116386, E882290. | DG-12 |

For each monitoring event, prepurging water level elevations from all piezometers and monitoring wells shall be recorded and the data electronically submitted to the department's SWMP with the other groundwater sampling data. Piezometers within the landfill footprint shall be maintained and monitored as long as possible before landfill construction reaches their location. Piezometers within the landfill foot print shall be properly abandoned.

The department's DGLS shall be notified prior to mobilization of any drilling so that on-site technical assistance can be provided to the driller and site manager.

Any field investigations shall include a descriptive log as noted in the guidance document entitled, APPENDIX 1, GUIDANCE FOR CONDUCTING AND REPORTING DETAILED GEOLOGIC AND HYDROLOGIC INVESTIGATIONS AT A PROPOSED SOLID WASTE DISPOSAL AREA. At the time of construction of any new monitoring well, full details concerning the drilling procedures and development shall be reported to the department's SWMP and the department's DLGS before the department will grant approval for each well. The information and data submitted to the department's SWMP and the department's DGLS shall include, but not be limited to the following:

1. Depth and lithologic description of all water bearing or saturated zones encountered during drilling;

2. Descriptions of all geologic materials encountered and sampled during drilling, including: lithology, mineralogy, texture, grain-size, color, fossil occurrence, percent sample recovery, and primary/secondary porosity features;

3. Changes in porosity and degrees of saturation of all geologic materials encountered, (e.g., dry, damp, moist, wet, and/or saturated) including their associated depths from the ground surface;

4. Water level depths measured from the ground surface immediately following daily final drilling activity and measured preceding any subsequent drilling activity;

5. Complete records of drilling fluid volumes, including any lost fluid volumes and depths at which they are lost;

6. Complete records of recovered (lost) fluids prior to installation and development of well;

7. A description of all sources and chemical analyses of potable water used in drilling or boring, analyzing for the same chemical parameters as specified in the enclosed groundwater parameters to establish baseline groundwater quality;

8. Complete details or method(s) of drilling, including starting and ending times, depth and location of any drilling equipment refusals;

9. Measurements of drilling rate, including pressure gauges or weights on bit read during drilling and coring;

10. Measurements of soil sampling advance (e.g., loads on the sampling device as specified by the weight or number of blow counts to sample and/or refusal);

11. Complete details of well development, including starting and ending times;

12. Appearance of well fluids before, during, and after development;

13. Records of indicator parameters monitored throughout development;

14. Initial and final water levels immediately prior and immediately after development;

15. Initial well bore fluid volume (gallons);

16. Initial depth of well prior to development, in feet, from a specified point;

17. Total depth of well immediately after development from a specified point;

18. Total volume (gallons) evacuated during development;

19. Complete copies of all field notes;

20. Complete copies of monitoring well construction summaries having north and east location survey coordinates;

21. Complete copies of monitoring well boring logs having detailed soil and lithologic graphics/descriptions; and

22. Complete copies of the Monitoring Well Certification Record.

Existing or new wells improperly constructed, or screened to monitor improper or inadequate zones shall be abandoned as per 10 CSR 23-4.

All wells shall be constructed in accordance with Missouri Department of Natural Resources' Well Construction Codes, 10 CSR 23-1 through 6.

As per monitoring well construction standards cited above, each well borehole shall be at least four (4) inches larger than the outside diameter of the casing used.

Well construction (including locking cap security casing) shall be completed the same day the well casing is installed.

No wells shall be located in swales, drainage ditches, or any place where water can accumulate around the well.

Suggested monitoring well locations are based on hydrogeologic and topographic information, and do not take into account the location of any man-made alterations to the site. Alternate locations may be required if conflicts arise with the suggested locations.

## C. SAMPLING FREQUENCY/PARAMETERS

1. Baseline and Background Sampling

   Prior to filling in a phase/cell, baseline sampling shall start with at least four (4) quarters of independent samples as described in 10 CSR 80-3.010(11)(C)3 for all new monitoring wells designated in this document. A minimum of eight (8) independent samples shall be taken over the first eight (8) quarters after the date of development of any new monitoring well. Each of these baseline samples shall be analyzed for the groundwater monitoring parameters contained in the enclosed list titled Groundwater Monitoring Parameters. During baseline sampling, compliance monitoring wells shall be sampled during the first, second, third, and fourth quarters of a year for the parameters contained in the enclosed lists.

   Subsequent to the first eight (8) quarters of baseline monitoring the background database for each monitoring well will be updated with detection monitoring data as described in Appendix S, "Groundwater Sampling and Analysis Plan".

2. Detection Monitoring

   After the previously described eight (8) quarters of baseline sampling have been completed, all monitoring wells shall be sampled semi-annually for the parameters contained in the enclosed list entitled Groundwater Monitoring Parameters.
   All sampling results shall be submitted electronically to the department's SWMP within ninety (90) days from the date the sample is obtained.

3. Assessment Monitoring

   Permittee shall follow the procedures outlined in 10 CSR 80-11.010(11)(C)6 as a response to statistical analysis of significant difference in groundwater sampling results.

## D. GROUNDWATER MONITORING PROGRAM

Statistical analyses of groundwater data or additional hydrogeologic characterization through subsurface sampling and testing could alter the interpretation of previous hydrogeologic investigations. Approval of this Groundwater Monitoring Program does not preclude it from any future revision.

## E. **INQUIRIES**

All inquiries concerning these reporting procedures and/or any discussion of possible deviations from these reporting procedures shall first be directed to the department's SWMP at (573) 751-5401 for consideration by the department.

## GROUNDWATER MONITORING PARAMETERS

**Inorganic and Other Parameters**

Arsenic (As, µg/l)
Aluminum (Al, µg/l)
Antimony (Sb, µg/l)
Barium (Ba, µg/l))
Beryllium (Be, mg/l)
Boron (B, µg/l)
Cadmium (Cd, µg/l)
Calcium (Ca, mg/l)
Chemical Oxygen Demand (COD, mg/l)
Chlorides (Cl, mg/l)
Chromium (Cr, µg/l)
Cobalt (Co, ug/l)
Copper (Cu, ug/l)
Fluoride (Fl, mg/l)
Hardness (calculated, mg/l)
Iron (Fe, µg/l)
Lead (Pb, µg/l)
Magnesium (Mg, mg/l)
Manganese (Mn, µg/l)
Mercury (Hg, µg/l)
Nickel (Ni, mg/l)
pH (s.u.)
Selenium (Se, µg/l)
Silver (Ag, µg/l)
Sodium (Na, mg/l
Specific Conductance(Conductivity at 25° C,mhos/cm)
Sulfate ($SO_4$, mg/l)
Thallium (Tl, µg/l)
Total Dissolved Solids (TDS, mg/l)
Total Organic Carbon (TOC, mg/l)
Total Organic Halogens (TOX, mg/l)
Zinc (Zn, µg/l)
Groundwater Elevation (This is the only parameter for a piezometer.)

*ALL METALS ARE TOTAL - DO NOT FIELD FILTER SAMPLES*
**ALL FIELD OBSERVATIONS SHOULD BE REPORTED IN THE ELECTRONIC FORMAT DESCRIBED BY THE DEPARTMENT.**

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

April 8, 2010

Ameren UE
C/O Mr. Thomas L. Hollenkamp, P.E., S.E.
P.O. Box 66149, MC F-604
St. Louis, Missouri 63166-6149

RE: Sioux Power Plant Utility Waste Landfill (MO40160) St. Charles County

Dear Mr. Hollenkamp,

In response to your request to extend the expiration date of Construction Permit C-426 for the Sioux Power Plant Utility Waste Landfill, I have amended the permit to expire on April 01, 2011 and have enclosed a copy for your use. A copy of the amended permit is also being sent to Mr. Jeff Fouse, the engineer of record.

If you have any questions, please feel free to contact me.

Sincerely,

WATER RESOURCES CENTER

Robert A. Clay, P.E.
Chief Engineer
Dam & Reservoir Safety Program

RAC/clb

enclosures

c: Reitz & Jens
C/O Mr. Jeff Fouse, P.E.
1055 Corporate Square Drive
St. Louis, Missouri 63132

# STATE OF MISSOURI
# DEPARTMENT OF NATURAL RESOURCES
# DAM AND RESERVOIR SAFETY COUNCIL

## CONSTRUCTION PERMIT

Pursuant to Chapters 236.400 through 236.500 of the Revised Statutes of Missouri and the rules established by the Dam and Reservoir Safety Council, and on the basis of statements and information contained in the permit application, letters, maps, plans, specifications and reports prepared by Jeffrey L. Fouse, E-21043, hereafter known as the permittee's engineer, for the Sioux Power Plant Utility Waste Landfill, St. Charles County, all of which are made a part hereof by reference, **PERMISSION IS HEREBY GRANTED TO** Ameren UE, hereafter known as the permittee, whose address for the purpose of notices and other communications pertaining to this permit is C/O Mr. Tom Hollenkamp, One Ameren Plaza, 1901 Chouteau Avenue, P.O. Box 66149, St. Louis, Missouri 63166, which address is subject to change by written notice from the permittee, **TO CONSTRUCT A DAM** having a maximum crest elevation of 446.0 ft. The embankment will create two impoundments, a recycle pond and a waste containment cell. Each impoundment will have an open channel principal spillway with a control elevation of 445.00 feet. The dam is located in U.S. Survey 1838, Township 48 North, Range 06 East, and assigned the identification number of MO 40160, and approximate UTM Coordinates of 4,309,475 meters North and 734,822 meters East, Zone 15. This permit is subject to the following provisions:

## GENERAL PROVISIONS:

1. No liability shall be imposed upon or incurred by the State of Missouri and/or the Dam and Reservoir Safety Council, or any of their officers, agents, employees and members, officially or personally, on account of the granting hereof or on account of any damage to any person or property resulting from any act or omission of the permittee or any of its agents, employees, or contractors or closed corporations of successors or assigns relating to any matter hereunder. This permit shall not be construed as estopping or limiting any legal claim or right of action of the state against the permittee, its agents, employees or contractors for any damages or injury resulting from any such act or omission by them or for violation of or failure to comply with the provisions of the permit or applicable provisions of law.

2. The permittee shall comply with all Federal, State, and local laws and regulations, and shall obtain such other permits as may be required.

3. In all cases where the doing by the permittee of anything authorized by this permit shall involve the taking, using, or damaging of any property rights or interest of any other person or persons, or of any publicly owned lands or improvements thereon or interests therein, it is the sole responsibility of the permittee, before proceeding therewith, to obtain the written consent of all persons, agencies, or authorities concerned, and to acquire all property rights, and interests necessary therefor, including flood easements or permissions for all properties which may be inundated by the dam on a temporary or permanent basis in the upstream impoundment area below the top of dam elevation.

4. The permittee shall notify the Dam and Reservoir Safety Council in writing upon the sale or other transfer of interest in said dam or reservoir.

5. Based on conditions existing at the time of issuing this permit, the Downstream Environment Zone is Class II.

## SPECIAL PROVISIONS:

1. Construction work authorized under this permit shall be completed on or before April 1, 2011, unless extended in writing by the Dam and Reservoir Safety Council or the Chief Engineer of the Dam and Reservoir Safety Program.

2. No changes shall be made in the construction of the dam which adversely affect the dam or reservoir with regard to its integrity or to the environment, public safety, life or property.

3. If the permittee finds at any time during construction or operation that, in order to adequately protect the integrity of the dam, the environment or public health, safety or welfare, immediate alterations to the approved plans and specifications are required, the alterations may be started, but the permittee shall promptly notify the Chief Engineer of such requirements. If the alterations are to remain as permanent project features, the permittee shall, as soon as practicable, revise the plans and specifications and submit the revisions to the Dam and Reservoir Safety Council for approval. Such alteration shall be discontinued if disapproved by the Council, upon notice of such disapproval.

4. The permittee shall immediately notify in writing, the Chief Engineer of any unforeseen conditions discovered during construction that may adversely affect the structural stability of the dam.

5. The permittee, in cooperation with the permittee's engineer, shall be responsible for providing adequate controls on construction activities, compliance with plans and specifications authorized herein and verification of design, construction, and operating assumptions.

6. The permittee shall, as soon as practicable following construction, cover or protect all exposed soil resulting from the construction by placing riprap, sod and/or seed on banks and slopes of said construction for the prevention of soil erosion.

7. Within two (2) weeks of completion of the work authorized under this permit, the owner shall notify the Chief Engineer in writing that construction was completed in accordance with the approved plans and specifications. As-built plans and drawings shall be submitted if significant changes were made during construction.

8. Undertaking or initiating any work or part thereof authorized herein by the permittee constitutes acceptance of the permit and all its terms and conditions.

Executed at Rolla, Missouri on this 1st day of April, 2008. Amended April 8, 2010

**DAM AND RESERVOIR SAFETY COUNCIL**

By: [signature]
Chief Engineer
Dam and Reservoir Safety Program

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

Ameren Corporation
c/o Mr. Thomas L. Hollenkamp, P.E.,S.E.
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149, MC F-604
Saint Louis, Missouri 63166-6149

RECEIVED
FEB 16 2011

RE: Utility Waste Landfill MO40160 St. Charles County

Dear Tom:

In early December, Paul Simon and I met Matt Frerking at the Sioux Power Plant project to observe the progress of construction. One of the topics discussed is how we intend to manage the permitting for the structure. This project is projected to take up to 60 years to complete to the final configuration. Thus far, the starter dike for one of three proposed cells has been completed.

After reviewing the history of the project, I propose that we use the memorandum of understanding prepared by Ameren and submitted to us on August 5, 2008 as a guideline for amending the permit to allow future phases of construction.. This will allow us to review and approve the project at key intermediate stages of construction. I have enclosed a copy of that memorandum for your convenience. The landfill can continue to operate under the current construction permit, with extensions as needed, until the next phase of construction begins. The current construction permit will then be amended to allow additional phases. Amendments must be applied for in the same manner as the initial permit.

If you have any questions, please contact me. I can be reached at 573/368-2177 or via email at bob.clay@dnr.mo.gov.

Sincerely,
WATER RESOURCES CENTER

Robert A. Clay, P.E.
Chief Engineer
Dam and Reservoir Safety Program

RAC/rac

Recycled Paper

AmerenUE

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149, MC F-604
Saint Louis, Missouri 63166-6149

August 5, 2008

RECEIVED
AUG 1 2 2008 WRC

Mr. James Alexander, P.E.
Missouri Department of Natural Resources
Geological Survey and Resource Assessment Division
Dam and Reservoir Safety Program
P.O. Box 250
Rolla, Missouri 65402

**RE: AmerenUE Sioux Power Plant Utility Waste Landfill**
**Construction Permit C-426**
**MO40160, St. Charles County, Missouri**

Ameren UE

Dear Mr. Alexander:

Matthew Frerking, Carl Rezsonya and I appreciated meeting with you and Robert Clay on May 7, 2008, to discuss the construction permit that was issued on April 1, 2008, for the AmerenUE Sioux Power Plant Utility Waste Landfill (UWL). Ameren requested this meeting primarily to discuss the Special Provision No. 1 which states that the construction work authorized under this permit shall be completed on or before April 1, 2009, unless extended in writing by the Dam and Reservoir Safety Council or the Chief Engineer of the Dam and Reservoir Safety Program (D&RSP). We understand that the D&RSP only issues construction permits with a duration of one year. Since the construction and operation of the UWL may take up to 60 years, it is important for Ameren to have an understanding with the D&RSP that transcends all of the people currently involved with the project, as much as possible.

Attached is a summary statement of the principle points that we discussed in our meeting on May 7. Please review this summary to be certain that it accurately states the requirements under applicable Missouri regulations and D&RSP's position regarding the ongoing construction permit process for the UWL. We appreciate your corrections or additions to this summary, if any, because we would like this statement to become a "Memorandum of Understanding" between D&RSP and Ameren of the construction permit process for the Sioux Plant UWL.

Please contact either Matthew Frerking (314) 957-3426 or me at (314) 957-3406 if you want to discuss any questions or comments that you have. Thank you, again, for your time.

Sincerely,

Matt Frerking
For

Thomas L. Hollenkamp, P.E., S.E.
Chief Dam Safety Engineer

# MEMORANDUM OF UNDERSTANDING
# PERTAINING TO THE
# AMEREN UE SIOUX POWER PLANT UTILITY WASTE LANDFILL
# ST. CHARLES COUNTY (MO40160)
# JULY 2008

1. AmerenUE is constructing an Utility Waste Landfill (UWL) for the coal combustion byproducts from the Sioux Power Plant on its property south of Hwy. 94 in St. Charles County, Missouri. Construction Permit No. 0918301 was issued by the Missouri Department of Natural Resources Solid Waste Management Program (SWMP) for the UWL based on the construction permit application by AmerenUE, first received by SWMP on February 8, 2007, deemed completed on March 28, 2007, and last revised September 21, 2007.

2. Reitz & Jens, Inc. (Permittee's Engineer) submitted to Missouri Department of Natural Resources Dam & Reservoir Safety Program (D&RSP) on behalf of AmerenUE (Permittee) an engineering report and a set of preliminary drawings for the UWL. The engineering report and drawings, dated May 10, 2007, described the entire UWL project which eventually will consist of six cells and a recycle pond. The UWL will be constructed in phases. The design life of the UWL is up to 60 years. The D&RSP approved the concept of the UWL in a letter dated July 2, 2007.

3. Reitz & Jens submitted construction drawings and specifications for Cell 1 and the Recycle Pond to the D&RSP on February 14, 2008. The drawings showed the construction of the perimeter berms for Cell 1 and the Recycle Pond up to el. 446, and other appurtenances. The D&RSP issued Construction Permit No. M040160 for Cell 1 and the Recycle Pond on April 1, 2008.

4. The construction phase of the UWL will last until the UWL is closed in accordance with the requirements of the MDNR-SWMP. After the UWL is closed, Ameren will apply to the D&RSP for a dam operating permit.

5. The construction permit issued by D&RSP must be extended each year. The first extension is due before April 1, 2009. If there is no significant deviation from the latest approved construction drawings and specifications, then D&RSP only requires a letter from AmerenUE requesting the extension and a letter sealed by a registered Professional Engineer certifying that the construction to date has been in accordance with the approved construction drawings and specifications. The extension will be issued by D&RSP upon receipt of AmerenUE's request accompanied by the certification. If a survey of the completed construction is available, then D&RSP would like a copy of the survey, but it is not required.

6. When AmerenUE wants to proceed to the next phase of construction beyond the latest approved construction drawings and specifications, such as to construct the next planned cell or to raise the height of the gypsum stack, then AmerenUE will submit the revised construction drawings and specifications to D&RSP for approval prior to implementing the next phase.

7. The first significant change to the current construction drawings will be when the height of the gypsum stack in Cell 1 will rise above el. 446.

8. An engineering report will not be required if modifications to the construction drawings and specifications are within the scope of the approved engineering report for the UWL project dated May 10, 2007. The modified construction drawings will have a recent survey of the completed construction. The D&RSP will issue a modified construction permit upon approval of the modified construction documents if the modifications are within the scope of the original plans and engineering report for the overall UWL project.

STATE OF MISSOURI

Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director

# DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

February 11, 2014

Ameren UE
C/O Mr. Thomas L. Hollenkamp, P.E., S.E.
P.O. Box 66149, MC F-604
St. Louis, Missouri 63166-6149

RE: Sioux Power Plant Utility Waste Landfill (MO40160) St. Charles County

Dear Mr. Hollenkamp,

In response to your request to extend the expiration date of Construction Permit C-426 for the Sioux Power Plant Utility Waste Landfill, I have amended the permit to expire on April 01, 2015 and have enclosed a copy for your use. A copy of the amended permit is also being sent to Mr. Jeff Greer, the engineer of record.

If you have any questions, please feel free to contact me.

Sincerely,

**DEPARTMENT OF NATURAL RESOURCES**

Robert A. Clay

Robert A. Clay, P.E.
Chief Engineer
Dam & Reservoir Safety Program

RAC/clb

enclosures

c: Mr. Jeff Greer, P.E.
3700 Lindberg Blvd.
Sunset Hills, Missouri 63127

# STATE OF MISSOURI
# DEPARTMENT OF NATURAL RESOURCES
# DAM AND RESERVOIR SAFETY COUNCIL

## CONSTRUCTION PERMIT

Pursuant to Chapters 236.400 through 236.500 of the Revised Statutes of Missouri and the rules established by the Dam and Reservoir Safety Council, and on the basis of statements and information contained in the permit application, letters, maps, plans, specifications and reports prepared by Jeffrey L. Fouse, E-21043, hereafter known as the permittee's engineer, for the Sioux Power Plant Utility Waste Landfill, St. Charles County, all of which are made a part hereof by reference, **PERMISSION IS HEREBY GRANTED TO** Ameren UE, hereafter known as the permittee, whose address for the purpose of notices and other communications pertaining to this permit is C/O Mr. Tom Hollenkamp, One Ameren Plaza, 1901 Chouteau Avenue, P.O. Box 66149, St. Louis, Missouri 63166, which address is subject to change by written notice from the permittee, **TO CONSTRUCT A DAM** having a maximum crest elevation of 446.0 ft. The embankment will create two impoundments, a recycle pond and a waste containment cell. Each impoundment will have an open channel principal spillway with a control elevation of 445.00 feet. The dam is located in U.S. Survey 1838, Township 48 North, Range 06 East, and assigned the identification number of MO 40160, and approximate UTM Coordinates of 4,309,475 meters North and 734,822 meters East, Zone 15. This permit is subject to the following provisions:

## GENERAL PROVISIONS:

1. No liability shall be imposed upon or incurred by the State of Missouri and/or the Dam and Reservoir Safety Council, or any of their officers, agents, employees and members, officially or personally, on account of the granting hereof or on account of any damage to any person or property resulting from any act or omission of the permittee or any of its agents, employees, or contractors or closed corporations of successors or assigns relating to any matter hereunder. This permit shall not be construed as estopping or limiting any legal claim or right of action of the state against the permittee, its agents, employees or contractors for any damages or injury resulting from any such act or omission by them or for violation of or failure to comply with the provisions of the permit or applicable provisions of law.

2. The permittee shall comply with all Federal, State, and local laws and regulations, and shall obtain such other permits as may be required.

3. In all cases where the doing by the permittee of anything authorized by this permit shall involve the taking, using, or damaging of any property rights or interest of any other person or persons, or of any publicly owned lands or improvements thereon or interests therein, it is the sole responsibility of the permittee, before proceeding therewith, to obtain the written consent of all persons, agencies, or authorities concerned, and to acquire all property rights, and interests necessary therefor, including flood easements or permissions for all properties which may be inundated by the dam on a temporary or permanent basis in the upstream impoundment area below the top of dam elevation.

4. The permittee shall notify the Dam and Reservoir Safety Council in writing upon the sale or other transfer of interest in said dam or reservoir.

5. Based on conditions existing at the time of issuing this permit, the Downstream Environment Zone is Class II.

## SPECIAL PROVISIONS:

1. Construction work authorized under this permit shall be completed on or before April 1, 2015, unless extended in writing by the Dam and Reservoir Safety Council or the Chief Engineer of the Dam and Reservoir Safety Program.

2. No changes shall be made in the construction of the dam which adversely affect the dam or reservoir with regard to its integrity or to the environment, public safety, life or property.

3. If the permittee finds at any time during construction or operation that, in order to adequately protect the integrity of the dam, the environment or public health, safety or welfare, immediate alterations to the approved plans and specifications are required, the alterations may be started, but the permittee shall promptly notify the Chief Engineer of such requirements. If the alterations are to remain as permanent project features, the permittee shall, as soon as practicable, revise the plans and specifications and submit the revisions to the Dam and Reservoir Safety Council for approval. Such alteration shall be discontinued if disapproved by the Council, upon notice of such disapproval.

4. The permittee shall immediately notify in writing, the Chief Engineer of any unforeseen conditions discovered during construction that may adversely affect the structural stability of the dam.

5. The permittee, in cooperation with the permittee's engineer, shall be responsible for providing adequate controls on construction activities, compliance with plans and specifications authorized herein and verification of design, construction, and operating assumptions.

6. The permittee shall, as soon as practicable following construction, cover or protect all exposed soil resulting from the construction by placing riprap, sod and/or seed on banks and slopes of said construction for the prevention of soil erosion.

7. Within two (2) weeks of completion of the work authorized under this permit, the owner shall notify the Chief Engineer in writing that construction was completed in accordance with the approved plans and specifications. As-built plans and drawings shall be submitted if significant changes were made during construction.

8. Undertaking or initiating any work or part thereof authorized herein by the permittee constitutes acceptance of the permit and all its terms and conditions.

Executed at Rolla, Missouri on this 1st day of April, 2008. Amended February 11, 2014

**DAM AND RESERVOIR SAFETY COUNCIL**

By: [signature]
Chief Engineer
Dam and Reservoir Safety Program

ST. CHARLES COUNTY
COMMUNITY HEALTH
& THE ENVIRONMENT

Division of Environmental Health and Protection

Tuesday, December 10, 2013

**Certified Mail No. 7003 2260 0005 1076 6250**
**RETURN RECEIPT REQUESTED**

Mr. Michael Menne
Ameren Missouri
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, MO 63166-6149

**RE: Revised Waste Facility Plan and Operation of Cell 4A- Ameren Missouri Sioux Power Plant Utility Waste Landfill**

Mr. Menne:

The St. Charles County Department of Community Health and the Environment received a request for approval of the revised Waste Facility Plan (WFP) to operate the Sioux Plant Utility Waste Landfill (UWL) dated October 14, 2013 in a letter from Mr. Paul Pike of Ameren Missouri to Mr. Ryan Tilley of St. Charles County Government.

The St. Charles County Department of Community Health and the Environment has issued a conditional Solid Waste Facility License (SWFL) for operation of Cell 1 on October 31, 2013. This conditional license did not include the operation of Cell 4A until it could subsequently be approved by the Director.

Whereas, the licensee has demonstrated compliance with the requirements and request of the Division Director and the *St. Charles County Solid Waste Management Code* (SCC SWMC) to the division's satisfaction; the November 2013 revised WFP has been approved and the Solid Waste Facility License previously issued on November 1, 2013 is hereby enacted to include disposal of SCC approved waste into the western half of Cell 4 (Cell 4A).

This approval to operate shall not be construed as compliance with any federal, state, or local law other than that of the SCC SWMC; nor shall this be construed as a waiver for any other regulatory requirement. This approval is not to be construed as compliance with any existing local ordinances other than that of SCC SWMC; nor does it supersede any local laws including permitting and/or zoning requirements.

The Division Director reserves the right to suspend, revoke, or modify the license and approval based on any of the following criteria:

1. Failure to comply with the provisions of the WFP;
2. Failure to comply with the provisions of the SCC SWMC;

3. Failure to operate the facility in a manner consistent with the public health and welfare and the health and welfare of persons operating and/or using the facility, or in a manner deemed not to be protective of the environment.

The division is committed to working together with the community as a partner to achieve excellence in environmental health and protection within St. Charles County. I appreciate the opportunity to address your questions and further this partnership.

If the Environmental Health and Protection Division can be of any more assistance, please feel free to contact me at (636) 949-7406 or via email at **rtilley@sccmo.org.**

Respectfully,

Ryan Tilley

Ryan Tilley, REHS
Director, Division of Environmental Health and Protection

Cc: Charlene Fitch, P.E., Missouri Dept. of Natural Resources

ST. CHARLES COUNTY
COMMUNITY HEALTH
& THE ENVIRONMENT

Division of Environmental Health and Protection

Thursday, October 31, 2013

**Certified Mail No. 7003 2260 0005 1076 6748**
**RETURN RECEIPT REQUESTED**

Mr. Michael Menne
Ameren Missouri
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, MO 63166-6149

**RE: Solid Waste Facility License Renewal- Ameren Missouri Sioux Power Plant Utility Waste Landfill**

Mr. Menne:

The St. Charles County Department of Community Health and the Environment received a request that a renewal license be issued to operate the Sioux Plant Utility Waste Landfill (UWL) on October 24, 2013 in a letter from Mr. Paul Pike of Ameren Missouri to Mr. Ryan Tilley of St. Charles County Government.

Whereas, the licensee has demonstrated compliance with the requirements and request of the Division Director and the *Solid Waste Management Code of St. Charles County* (SCC SWMC) to the division's satisfaction; a renewal operating license will be granted. The renewal is hereby granted for Cell 1, as shown on drawing 7 of 22 in appendix G of the WFP for St. Charles County.

Before operation of Cell 4 and the revised WFP may be granted final approval, the division must complete the review of the WFP and allow additional time for Ameren to complete any revisions deemed necessary by the director. In addition, DNR must issue an operating permit approving Cell 4 before we will approve of the revised WFP and operation of Cell 4. In the future, applications must be delivered to the Division Director at least (30) days prior to each anniversary date as required in section 240.810 of the SCC SWMC.

The attached license includes the provisional approval to operate Cell 4 utilizing the revised WFP contingent upon their formal approval by the appropriate agencies. Any necessary exceedance of the conditional license for permitted maximum monthly tonnage or permitted monthly traffic volume will require at least seven (7) days' notice to the division.

The license issued shall be for a fixed number of years equal to the estimated operating life of the facility as contained in the approved WFP. Notwithstanding the issuance of a license for a fixed number of years, the WFP and the license must be reviewed annually subject to the provisions of Section 240.810 et seq., and the modifications requested by the operator in the annual application may include a request that the term of the license be changed.

The operating license may be suspended or revoked, following a hearing before the Division Director, based on any of the following criteria:

1. Failure to comply with the provisions of the WFP;
2. Failure to comply with the provisions of the SCC SWMC;
3. Failure to operate the facility in a manner consistent with the public health and welfare and the health and welfare of persons operating and/or using the facility, or in a manner deemed not to be protective of the environment.

The division is committed to working together with the community as a partner to achieve excellence in environmental health and protection within St. Charles County. **I appreciate the opportunity to address your questions and further this partnership.**

If the Environmental Health and Protection Division can be of any more assistance, please feel free to contact me at (636) 949-7406 or via email at rtilley@sccmo.org. If you have trouble reaching me, our office assistant Suzanne Lovasco, can be contacted at 636-949-1800.

Respectfully,

Ryan Tilley

Ryan Tilley, REHS
Director, Division of Environmental Health and Protection

cc:
The Honorable Steve Ehlmann, County Executive, St. Charles County Government SEhlmann@sccmo.org
Ms. Julie Eckstein, Director, Community Health and the Environment, St. Charles County Government JEckstein@sccmo.org
Ms. Joann Leykam, County Administrator, St. Charles County Government JLeykam@sccmo.org
Mr. Harold Ellis, County Counselor, St. Charles County Government HEllis@sccmo.org
Mr. Wayne Anthony, Director, Community Development, St. Charles County Government WAnthony@sccmo.org
Ms. Dorothy E. Franklin, Regional Director, St. Louis Regional Office, MO DNR dorothy.franklin@dnr.mo.gov
Ms. Charlene Fitch, P.E. Engineering Section Chief, SWMP, MO DNR charlene.fitch@dnr.mo.gov
Mr. Paul Pike, Environmental Science Executive, Ameren Missouri PPike@ameren.com

ST. CHARLES COUNTY
COMMUNITY HEALTH & THE ENVIRONMENT

# SOLID WASTE FACILITY LICENSE

1650 Boone's Lick Road • St. Charles, MO • 63301 • 636-949-1800 • http://health.sccmo.org/health

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. Facility Number** | 0 | 4 | 3 | 0 | 3 | **2. State Permit No.** | 0 | 9 | 1 | 8 | 3 | 0 | 1 |

| | |
|---|---|
| **3. Name and Street Address of Facility** | AMEREN MISSOURI SIOUX POWER PLANT UTILITY WASTE LANDFILL<br>SOUTHSIDE OF HWY 94 NORTH, EAST OF DWIGGINS ROAD<br>UNINCORPORATED |
| **4. Name and Mailing Address of Operator** | MICHAEL L. MENNE, VICE-PRESIDENT, ENVIRONMENTAL SERVICES<br>AMEREN MISSOURI<br>ONE AMEREN PLAZA, 1901 CHOUTEAU AVENUE<br>ST. LOUIS, MO 63103 |
| **5. Name and Mailing Address of Owner** | MICHAEL L. MENNE, VICE-PRESIDENT, ENVIRONMENTAL SERVICES<br>AMEREN MISSOURI<br>ONE AMEREN PLAZA, 1901 CHOUTEAU AVENUE<br>ST. LOUIS, MO 63103 |

## 6. Specifications:

**Upon a significant change in design or operation from that described herein, this permit is subject to revocation or suspension. The attached permit findings and conditions are integral parts of this permit and supersede the conditions of any previously issued solid waste facility permit.**

### a. Permitted Operations:

- [X] Solid Waste Disposal Site
- [ ] Composting Facility (Green Material)
- [ ] Transfer/Processing Facility (MRF)
- [ ] Other:

### b. Permitted Hours of Operations:

Receipt of Refuse/Waste* 0000 to 0000 ***24 hours per day, 7 days per week**

Ancillary Operations/Facility Operating Hours 0600 to 1730

### c. Permitted Maximum Tonnage: **30,000** Tons per month

### d. Permitted Traffic Volume: **≤ 1000** Vehicles per month

### e. Key Design Parameters (Detailed parameters see facility *Waste Facility Plan*):

| | Total | Disposal | Transfer/Processing | Composting | Transformation |
|---|---|---|---|---|---|
| Permitted Area (in acres) | **398.04** | **183.5** | N/A | N/A | N/A |
| Design Capacity (cu. Yards) | | **21,900,000** | N/A | N/A | N/A |
| Max. Elevation (Ft. MSL) | | **525** | | | |
| Max. Depth (Ft. MSL) | | **100** | | | |
| Estimated Closure Year | | **2068** | | | |

## 7. Legal Description of Facility:

The Ameren Missouri Sioux Power Plant Utility Waste Landfill (UWL) site is located south of State Highway 94, adjacent to the power plant, in unincorporated St. Charles County, in the southeastern part of Township 48 North, Range 6 East. The site is approximately two (2) miles east of the town of Portage des Sioux, and twelve (12) miles west-northwest of the confluence of the Mississippi and Missouri Rivers. The UWL is proposed within a tract of land totaling 398.04 acres, of which 183.5 acres are proposed for use as the active disposal area. The remaining acreage includes a proposed 19.6 acre wastewater recycle pond (permitted separately by the Water Pollution Control Program), soil borrow areas for soil liner and final cover as needed, access roads, flood protection berms and buffer area.

# SOLID WASTE FACILITY LICENSE

| Facility Number | 0 | 4 | 3 | 0 | 3 | State Permit No. | 0 | 9 | 1 | 8 | 3 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 8. Findings:

a. DEFINITIONS
Unless the context otherwise requires, the words used in the License have meanings ascribed to them in Solid Waste Management Code of St. Charles County, Missouri (SCC SWMC) (Ord. No. 01-061 sections--8, 5-30-01)
b. LICENSE ACTIONS
**This license is for operation(s) of Cell 1 until the Division Director authorizes it's extension to include Cell 4.** This License is based upon the information submitted in the application for a solid waste facility permit and the *Waste Facility Plan for St. Charles County* , April 2010 (WFP), and as approved by the St. Charles County, Department of Community Health and the Environment, Division of Environmental Health and Protection (Division or LEA). The License may be modified by the Division for cause in accordance with SCC SWMC sections 240.750, 240.810, or if there is a change in the statutes or regulations upon which the issuance of the License is based, or if modification is otherwise necessary to protect public health and safety and safeguarding environmental health and protection. If the disposal site does not remain in compliance with the applicable statutes and regulations, this license may be revoked or suspended when written notice is given by the Division. The filing of a request by the Licensee for a License modification or termination, or a notification of planned changes or anticipated noncompliance, does not stay any License condition. The Licensee shall inform the Division of any deviation from or change in operations as presented in the WFP, which may affect the Licensee's ability to comply with applicable regulations or conditions of the License. This License may be transferred to a subsequent owner or operator only if the Division approves the transfer based on documentation of financial responsibility provided by the new owner or operator.

This license may include the operation of Cell 4 under the guidance of the revised WFP once the Division Director has agreed to extend the license to Cell 4 and once the director has approved the revised WFP. The director will not agree to such terms until DNR has completed its review and granted approval for operation.

c. AVAILABILITY OF LICENSE DOCUMENTS
The Licensee shall keep at the disposal site a complete copy of this License and incorporated documents, as identified by the Division Director.
d. SOLID WASTES PERMITTED FOR DISPOSAL
i. Industrial Wastes: **Fly Ash & Bottom Ash**
ii. Special Wastes: **Boiler Slag & Gypsum**

## 9. Prohibitions:

The Licensee is prohibited from placing in the landfill the following wastes:
i. Other than in Cell 1 and Cell 4, any liquid waste material that is determined to contain free liquids as defined by Method 9095 (Paint Filter Liquids Test), as described in *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (EPA Pub. No. SW-846);*
ii. Hazardous waste, as defined by State and Federal Regulations;
iii. PCB waste, as defined by State and Federal Regulations; and
iv. Waste not identified in License Condition 8(d).

## 10. The following documents describe and/or restrict the operation of this facility:

| | Date | | Date |
|---|---|---|---|
| Detailed Geologic and Hydrologic Site Investigation Report for Ameren UE Sioux Power Plant, Proposed Utility Waste Disposal Area St. Charles County, Missouri (DSI) | 9/20/07 | AmerenUE Sioux Power Plant Utility Waste Landfill Proposed Construction Permit Modification Construction Permit Number 0918301 St. Charles County, Missouri | 06/2010 |
| AmerenUE Sioux Power Plant Construction Permit Application for a Proposed Utility Waste Landfill, St. Charles County, Missouri (CPA) | 9/20/07 | Missouri DNR Solid Waste Disposal Area Operating Permit Permit Number 0918301 AmerenUE Sioux Power Plant Utility Waste Landfill | 07/2010 |
| Ameren UE Sioux Power Plant, Proposed Utility Waste Landfill, St. Charles County, Missouri (Plans) | 9/20/07 | AmerenUE Sioux Power Plant Utility Waste Landfill Proposed Construction Permit Modification Construction Permit Number 0918301 St. Charles County, Missouri (Revised) | 02/2012 |
| Missouri DNR Solid Waste Disposal Area Construction Permit No. 0918301 | 3/28/08 | Revised Waste Facility Plan | 10/2013 |

# SOLID WASTE FACILITY LICENSE

| Facility Number | 0 | 4 | 3 | 0 | 3 | State Permit No. | 0 | 9 | 1 | 8 | 3 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**10. The following documents describe and/or restrict the operation of this facility: (continued)**

| | | | |
|---|---|---|---|
| Sioux Power Plant Utility Waste Landfill Construction Permit No. 0918301, Permit Modification - Cell 1 Ring Drains | 11/2009 | License Renewal Application Package for Ameren Missouri Sioux Utility Waste Landfill | 10/2013 |
| Waste Facility Plan for St. Charles County | 4/2010 | | |

**11. Self Monitoring:**

The owner/operator shall submit the results of all self monitoring programs to the Local Enforcement Agency (LEA), St. Charles County Department of Community Health and the Environment within 30 days of the end of the reporting period (*for example, 1st quarter = January - March, the report is due by April 30, etc.. Information required on an annual basis shall be submitted with the 4th quarter monitoring report, unless otherwise stated.)*

| | Program | Reporting Frequency |
|---|---|---|
| a). | The Licensee shall submit to the Division a report of the solid waste received at the site. The report must be submitted in a format approved by the Division. | **Quarterly** |
| b). | Financial Assurance Reporting: The Licensee Shall:<br>i. Notify the Division of any adjustments made to the estimates for the amounts of closure and post-closure care in accordance with SCC SWMC; and<br>ii. The Licensee shall submit the closure and post-closure cost estimates adjusted for inflation. | **Annually** |
| c). | Groundwater monitoring reports | **Quarterly** |
| d). | The Licensee shall submit to the Division a report of the surface impoundment inspections at the site. The report must be submitted in a format approved by the Division. | **Annually** |

**12. Local Enforcement Agency (LEA) Conditions:**

1. The operator shall comply with all Federal and State Minimum Standards for solid waste handling and disposal.

2. The Licensee shall keep at the disposal site a complete copy of this License and incorporated documents, as identified in Section 10.

3. The Licensee shall furnish to the Division, any relevant information which the Division may request in order to determine compliance with this License or to determine whether cause exists for modifying, revoking and reissuing, or terminating this License. The Licensee shall also furnish to the Division, upon request, copies of records as a requirement of this License. This shall be done in a reasonable timeframe within a mutually agreeable and negotiated deadline.

4. Licensee shall furnish to St. Charles County Government, Department of Community Development, any relevant information which the Department may request in order to determine compliance with county rules, laws, regulations and/or codes. This shall be done in a reasonable timeframe within a mutually agreeable and negotiated deadline.

5. Licensee shall not operate Cell 4 or implement the revised WFP until subsequently approved by the Division Director.

# SOLID WASTE FACILITY LICENSE

| Facility Number | 0 | 4 | 3 | 0 | 3 | State Permit No. | 0 | 9 | 1 | 8 | 3 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**12. Local Enforcement Agency (LEA) Conditions: (continued)**

6. In accordance with SCC SWMC section 240.1150, the Licensee shall report incidents to the Division as provided in the *Waste Facility Plan for St. Charles County,* April 2010 (WFP) or October 2013. In addition, the Licensee shall report any noncompliance, imminent or existing hazard from a release of waste or hazardous constituents, or from a fire or explosion at the facility, which may endanger human health or the environment. Such information shall be reported by telephone to (636) 949-1800 within twenty-four (24) hours from the time the Licensee becomes aware of the circumstances. A written report shall be submitted within fifteen (15) days of the incident and shall include the following:
   1. Name and title of person making report;
   2. Date, time, and type of incident;
   3. Name and quantity of material(s) involved;
   4. A complete description of the occurrence and its cause;
   5. The extent of injuries, if any;
   6. An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable;
   7. Estimated quantity and disposition of recovered material that resulted from the incident; and
   8. Actions taken by the Licensee in response to the incident.

7. The Licensee shall give advance notice to the Division Director of any planned changes in the permitted facility or activity, which may result in noncompliance with License requirements.

8. The Licensee shall allow the Division of Environmental Health and Protection, or an authorized representative, upon the presentation of credentials or other documents as may be required by law to:
   1. Enter at reasonable times (any time during the permitted hours of operation found in 6b) upon the Licensee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this License; and
   2. Have access to and copy, at reasonable times, any records that must be kept under conditions of this License; and
   3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this License; and
   4. Sample, photograph, or monitor at reasonable times, for the purposes of assuring License compliance or as otherwise authorized, any substances, locations, or parameters at any location subject to the License.

9. The Licensee shall: Follow and document a program for quality assurance and quality control for the construction of the facility.

10. The Licensee shall notify the Division in writing within sixty (60) days following the commencement of construction of a new cell.

11. The Licensee shall maintain the following records at the site in accordance to SCC SWMC section 240.1150(36):
   1. Major problems and complaints regarding operation of the landfill;
   2. All environmental media sampling/testing data;
   3. In the event of documented exceedence of applicable standards established by Missouri Department of Natural Resources for any monitoring system;
   4. Records of vector control efforts;
   5. Records of dust and litter control efforts;
   6. A copy of the SCC SWMC supplied by the division; and
   7. Records of quantity of waste handled. Such records shall be made contemporaneously with the matters recorded.

12. Despite the approval of the WFP and the issuance of a license for the construction and operation of facility, the licensee shall apply to renew such license annually for each year beginning with each anniversary date of the issuance of license. The renewal application as set forth in the schedule in subsection (2) of section 240.810 of the SCC SWMC shall be addressed and delivered to the Division Director at least thirty (30) days prior to each anniversary date of the initial license and shall contain:
   1. A request that a renewal license be issued for a period of one (1) year, and
   2. A report containing the information required in Section 240.820. (Ord. No 01-061 sections 1--8, 5-30-01)

# SOLID WASTE FACILITY LICENSE

| Facility Number | 0 | 4 | 3 | 0 | 3 | State Permit No. | 0 | 9 | 1 | 8 | 3 | 0 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**12. Local Enforcement Agency (LEA) Conditions: (continued)**

13. Surface Impoundment Inspection(s) Requirements:
1. All existing UWL surface impoundments shall be examined as follows:
a. At intervals not exceeding 7 days for appearances of structural weakness and other hazardous conditions;
b. At intervals not exceeding 7 days all instruments shall be monitored;
c. All inspections required by sections (1)(a) and (1)(b) above shall be performed by a qualified person as defined in (5) of this section, designated by the Licensee;
d. All existing UWL surface impoundments shall be inspected annually by a registered professional engineer to assure that the design, operation, and maintenance of the surface impoundment is in accordance with generally accepted engineering standards. The Licensee must notify the Division Director that a registered professional engineer has found that the design, operation, and maintenance of the surface impoundment is in accordance with generally accepted engineering standards and such findings has been placed in the operating record.
2. When a potentially hazardous condition develops, the Licensee shall immediately:
a. Take action to eliminate the potentially hazardous condition;
b. Notify potentially affected persons and state and local first responders;
c. Direct a qualified person to monitor all instruments and examine the structure at least once every eight hours, or more often as required by an authorized representative of the state.
3. After each inspection and instrumentation monitoring referred to in sections (1) and (2), each qualified person who conducted all or any part of the inspection or instrumentation monitoring shall promptly record the results of such inspection or instrumentation monitoring in a book which shall be available in the operation record and such qualified person shall also report the results of the inspection or monitoring to the Division Director as required in Section 11, Self Monitoring of this License. A report of each inspection and instrumentation monitoring shall also be available for public review if requested.
4. All inspection and instrumentation monitoring reports recorded in accordance with section (3) shall include a report of the action taken to abate hazardous conditions and shall be promptly signed by the person designated by the Licensee as responsible for health and safety at the UWL.
5. The qualified person or persons referred to in 12(1)(c) of this section shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation.
6. The Licensee must record and retain at the site in an operating record, all records, reports, studies or other documentation required to demonstrate sections (1) - (5).

14. All reports, notifications, or other submissions which are required by this License shall be submitted to:

**Division of Environmental Health and Protection**
Department of Community Health and the Environment
St. Charles County Government
1650 Boones Lick Road
St. Charles, MO 63301

**License issued:** 11 / 01 / 13

**License expires:** 10 / 31 / 14

**Signature of Approving Officer**

Ryan Tilley

**Ryan Tilley, REHS**
**Director, Division of Environmental Health and Protection**

Public Health
Prevent. Promote. Protect.

**Signature of Health Officer**

Julia M. Eckstein

**Julie Eckstein**
**Director, Department of Community Health and the Environment**

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

FEB 08 2013

Mr. Paul Pike
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149
St. Louis, MO 63166-6149

RE: Ameren Missouri Sioux Power Plant Utility Waste Landfill Dry Cell Permit Modification, Permit Number 0918301, St. Charles County

Dear Mr. Pike:

This letter is in response to the report and accompanying plan sheets titled, "Ameren UE Sioux Power Plant, Utility Waste Landfill, Proposed Construction Permit Modification," dated June 2010, revised March 2011, August 2011, November 2011, and February 2012, last received February 17, 2012. This report is signed and sealed by Thomas R. Gredell, P.E. of Gredell Engineering Resources, Inc. In the report the facility is requesting to modify the Ameren Missouri Sioux Power Plant Utility Waste Landfill permit in order to implement dry disposal of CCPs in 86.6 acres (cells 4, 5, 6, and 7) of the 183.5 acre permitted landfill. The Missouri Department of Natural Resources' (Department) Solid Waste Management Program has reviewed this report and plan sheets and hereby approves this modification request.

The following condition is an integral part of this approval. Compliance with this condition shall determine compliance with Permit Number 0918301:

**CONDITION:**

The Split Sampling Contract is in the process of being reviewed and agreed upon and must be executed once complete.

The following documents are hereby incorporated into permit number 0918301:

**DOCUMENTS:**

1. A report titled, "AmerenUE Sioux Power Plant, Utility Waste Landfill, Proposed Construction Permit Modification, Construction Permit Number 0918301, St. Charles County, Missouri" dated June 2010, received June 25, 2010, signed and sealed by Thomas R. Gredell, P.E. of Gredell Engineering Resources, Inc.

2. A letter dated April 8, 2011, received April 13, 2011, written in response to the October 7, 2010, comment letter. The following were revised:

    a. Report Covers
    b. Title Page, Table of Contents, and Text
    c. CD of the report
    d. Appendix K
    e. Appendix M
    f. Appendix N
    g. Appendix O
    h. Appendix P
    i. Appendix R
    j. Appendix T
    k. Appendix AA
    l. Plan Sheets 2 through 25, 28, and 33

3. A letter dated August 24, 2011, received August 25, 2011, written in response to the June 24, 2011, comment letter. The following were revised:

    a. Report Covers
    b. Title Page, Table of Contents, and Text
    c. CD of the report
    d. Appendices Cover
    e. Appendix K
    f. Appendix M
    g. Appendix N
    h. Appendix O
    i. Appendix P
    j. Plan Sheets 1, 26, 29, 30, 31, and 32

4. A letter dated November 17, 2011, received November 18, 2011, written in response to the October 18, 2011, comment letter. The submittal includes the "Ameren Missouri Sioux Plant Dry Cell Demonstration: Base of UWL Liner in Intermittent Contact with Groundwater" report dated November 2011, received November 18, 2011, prepared by Reitz & Jens, Inc. Consulting Engineers and Gredell Engineering Resources, Inc. and signed and sealed by Thomas R. Gredell, P.E. of Gredell Engineering Resources, Inc. The following were revised with this submittal:

    a. Report Covers
    b. Title Page, Table of Contents, and Text
    c. CD of the report
    d. Appendices Cover
    e. Appendix K

f. Appendix M
g. Appendix O
h. Appendix P

5. A letter dated February 17, 2012, received February 17, 2012, written in response to a January 18, 2012, e-mail. The following were revised with this submittal:

    a. Report Covers
    b. Title Page, Table of Contents, and Text (3-38, 3-39, 4-23, 4-24)
    c. CD of the report
    d. Appendices Cover
    e. Appendix P
    f. Plan Sheet 27

This approval is not to be construed as compliance with any existing federal or state laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does it supersede any local permitting and/or zoning requirements.

The Department reserves the right to revoke, suspend, or modify this approval and/or Permit Number 0918301 after due notice, if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and rules, the terms and conditions of the permit, and approved engineering plans and specifications.

If you have any comments or questions, please contact Ms. Katherine Huxol at (573) 526-3940 or at P.O. Box 176, Jefferson City, Missouri 65102-0176, or at katherine.huxol@dnr.mo.gov.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S. Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:khl

c: Thomas Gredell, P.E., Gredell Engineering Resources, Inc.
Mr. Ryan Tilley, Director, St. Charles County Government
St. Louis Regional Office

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

DEC 06 2013

Mr. Paul Pike
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149
St. Louis, MO 63166-6149

RE: Cell 4A Construction Quality Assurance (CQA) Report for Ameren Missouri Sioux Energy Center Utility Waste Landfill, Permit Number 0918301, St. Charles County

Dear Mr. Pike:

This letter is in response to the letter dated November 14, 2013, and received November 14, 2013, requesting approval to operate the western half of Cell 4 (Cell 4A) of the Ameren Missouri Sioux Energy Center Utility Waste Landfill. The documentation of the construction of Cell 4A was presented in the Cell 4A Construction Quality Assurance (CQA) Reports submitted in four parts in which the last report is dated November 14, 2013, and was received on November 14, 2013, and was submitted on your behalf by Reitz & Jens, Inc. Consulting Engineers. Cell 4A is approximately 15 acres and has been modified from a Gypsum landfill to implement dry disposal of coal combustion products (CCP's). The Missouri Department of Natural Resources' (Department) Solid Waste Management Program (SWMP) approved the modification from a Gypsum landfill to a dry disposal landfill on February 8, 2013, with the condition that a Split Sampling Contract be executed. A letter dated November 26, 2013, and two copies of the signed Groundwater Sampling Agreement were received December 2, 2013, to satisfy the February 8, 2013, condition.

The SWMP has reviewed these submittals. Whereas the permittee has demonstrated compliance with requirements of 10 CSR 80-2.020(4)(C) to the Department's satisfaction, the authorization to operate (ATO) is hereby granted. This ATO is hereby made an official part of Permit Number 0918301.

The following documents are hereby approved and incorporated into Permit Number 0918301:

**DOCUMENTS:**

1. A report titled, "Cell 4A Construction Quality Assurance (CQA) Report, Part 1 – Summary of Lab Test Data on Clay Liner," dated September 9, 2013, received September 20, 2013, signed and sealed by Jeffrey Lynn Fouse, P.E. of Reitz & Jens, Inc.

2. A report titled, "Cell 4A Construction Quality Assurance (CQA) Report, Part 2 – Perimeter Berms and Clay Liner," dated September 27, 2013, received October 1, 2013, signed and sealed by Jeffrey Lynn Fouse, P.E. of Reitz & Jens, Inc.

3. A report titled, "Cell 4A Construction Quality Assurance (CQA) Report, Part 3 – HDPE Geomembrane and Leachate Collection System," dated October 14, 2013, received October 15, 2013, signed and sealed by Jeff Bertel, P.E. of Reitz & Jens, Inc.

4. A report titled, "Cell 4A Construction Quality Assurance (CQA) Report, Part 4 – CCP Berm and Appurtenances," dated November 14, 2013, received November 14, 2013, signed and sealed by Jeff Bertel, P.E. of Reitz & Jens, Inc.

5. A letter dated November 14, 2013, received November 14, 2013, signed by Mr. Paul Pike, Environmental Science Executive of Ameren requesting authorization to operate Cell 4A of the Ameren Missouri Sioux Energy Center Utility Waste Landfill.

6. A memorandum dated November 8, 2013, received November 14, 2013, responding to comments concerning "Cell 4A Construction Quality Assurance (CQA) Report, Part 3, HDPE Geomembrane and Leachate Collection System".

7. A report dated November 27, 2013, received on December 2, 2013, titled, "Cell 4A Construction Quality Assurance (CQA) Report, Response to MDNR-SWMP Comments," signed and sealed by Jeff Bertel, P.E. of Reitz & Jens, Inc.

The following conditions are an integral part of this approval. Compliance with these conditions shall, in part, determine compliance with Permit Number 0918301:

**CONDITIONS:**

1. On page 18 of the Construction Quality Assurance Plan in Appendix P of the report titled, "Ameren Missouri Sioux Power Plant, Utility Waste Landfill, Proposed Construction Permit Modification" revised February 2012, approved February 8, 2013, the destructive testing specifications for the geomembrane are listed. These specifications do not match the construction specifications stated in the response to comment 17. Within 45 days of the date of this letter please evaluate the geomembrane destructive test specifications and determine if the specification used for Cell 4A is adequate and indicate what specifications will be used for future cells. We typically accept the Geosynthetic Research Institute (GRI) GM19 as the industry standard reference in geomembrane seaming. If you want to use standards that do not match these standards, you would need to provide justification.

2. Within 45 days of the date of this letter, please provide an update to the construction quality assurance plan for this facility which specifies updated compaction specifications for both the perimeter berms and the CCP berms for use in future cells.

3. Within 45 days of the date of this letter please provide evidence that the exterior of the perimeter berms for Cell 4A were constructed at a 3:1 slope.

This ATO shall not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does it supersede any local permitting and/or zoning requirements.

The Department reserves the right to revoke, suspend, or modify this approval and/or Permit Number 0918301 after due notice, if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and regulations, the terms and conditions of the permit, and approved engineering plans and specifications.

If you have any comments or questions, please contact Mr. Tom Roscetti at (573) 526-3940, or at P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:khl

c: Jeff Bertel, P.E., Reitz & Jens, Inc. Consulting Engineers
Jeffrey Fouse, P.E., Reitz & Jens, Inc. Consulting Engineers
Mr. Ryan Tilley, St. Charles County Division of Environmental Health and Protection
St. Louis Regional Office via Electronic Shared File

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

APR 06 2015

Mr. Paul Pike
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149
St. Louis, MO 63166-6149

RE: Cell 4A Initial Ash Placement, Ameren Missouri Sioux Power Plant Utility Waste Landfill, Permit Number 0918301, St. Charles County

Dear Mr. Pike:

This letter is in response to a letter from you, dated November 21, 2014, with an attached report from Reitz and Jens, Inc. The submittal is a response to a comment letter from the Solid Waste Management Program (SWMP), dated August 4, 2014, on the initial filling of Cell 4A. The initial filling was described in a report, dated May 29, 2014, also from Reitz and Jens, Inc. Both of these documents also address slope stability using updated material properties.

Based on our review of the submitted information, the SWMP is satisfied with both the initial report and the follow-up. However, the SWMP does have concerns; please note the conditions listed below.

The following conditions are an integral part of this approval. Compliance with these conditions shall, in part, determine compliance with Permit Number 0918301.

**CONDITIONS:**

1. During the October 1, 2014, on-site meeting between representatives of Ameren, Reitz and Jens, and the SWMP, it was agreed that Ameren would provide a flooding plan for Cell 4A, which would counteract hydrostatic uplift on the landfill liner should a 100-year flood occur before additional waste is added to the cell. This was to increase the safety factor and therefore provide additional assurance that uplift could not occur. This was not included in the November 2014 response. We would expect such a plan to address, at a minimum:

   - Pump sizing and availability
   - Pumping rates necessary
   - Minimum depth of water necessary
   - The triggering event to start pumping water into the cell

   Please provide this within 120 days of the date of this letter.

2. The November 2014 Reitz and Jens report (Document 2 below) states that the coal combustion waste was placed in thick lifts because it was too wet to spread in thin lifts. If, in the future, waste is to be placed in thicker lifts than the currently approved 2 foot lifts, please submit a request to modify the permit.

The following documents were reviewed and are incorporated by reference into Permit Number 0918301.

**DOCUMENTS:**

1. A report titled "Cell 4A Construction Quality Assurance (CQA) Summary Report for Phase 3 – Initial Filling", dated May 29, 2014, and prepared by Reitz and Jens, Inc.

2. A letter from Mr. Paul Pike of Ameren Missouri, dated November 21, 2014, and attached report from Reitz and Jens, Inc. titled "Response to MDNR-SWMP Cell 4A Authorization to Operate Follow-up and Initial Ash Placement", and dated August 4, 2014.

This approval is not to be construed as compliance with any existing federal or state environmental laws other than the Missouri Solid Waste Management Law; nor should this be construed as a waiver for any other regulatory requirements. This approval is not to be construed as compliance with any existing local permitting or zoning ordinances; nor does it supersede any local permitting and/or zoning requirements.

The department reserves the right to revoke, suspend, or modify this approval and/or Permit Number 0918301 if the permit holder fails to maintain the facility in compliance with the Missouri Solid Waste Management Law and rules, the terms and conditions of the permit, and the approved engineering plans and specifications.

We appreciate your continued efforts toward environmentally sound solid waste management practices. Should you have any questions, please contact Thomas Roscetti, P.E. of my staff at (573) 526-3940 or P.O. Box 176, Jefferson City, MO 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S. Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:trl

c: Jeffrey Fouse, P.E., Reitz and Jens
Mr. Larry Lehman, Chief, Compliance/Enforcement Section, SWMP
St. Louis Regional Office via Electronic Shared File

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

OCT 28 2015

Mr. Paul Pike
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
P.O. Box 66149
St. Louis, MO 63166-6149

RE: Flood Protection Plan for Cell 4A, Ameren Missouri Sioux Power Plant Utility Waste Landfill, Permit Number 0918301, St. Charles County

Dear Mr. Pike:

This letter is in response to a letter from you, dated August 3, 2015, which responds to Condition 1 of the Solid Waste Management Program (SWMP) letter of April 6, 2015, approving the information previously submitted on the initial filling of Cell 4A. Attached to your letter was a flood protection plan for Cell 4A, submitted in the form of Section 5.3 of a document titled "Cell 1 and 4A and Recycle Pond Operations & Maintenance". The flood protection plan discusses the procedures to be taken to counteract hydrostatic uplift on the landfill liner if the flood elevation is expected to be at the 100 year level. In addition, we have received a letter dated October 19, 2015, from Jeffrey Fouse, P.E. of Reitz and Jens, Inc., which discusses the moisture holding capability of the utility waste. Attached to Mr. Fouse' letter is a revised flood protection plan (revised date October 2015).

We have reviewed the documents submitted and believe they fulfill the condition of the April 6, 2015, letter. In addition, we hereby modify Permit Number 0918301 to incorporate the October 2015 flood protection plan.

If you have any questions, please contact Thomas Roscetti, P.E. of my staff at (573) 526-3940 or at P.O. Box 176, Jefferson City, MO 65102-0176.

Sincerely,

SOLID WASTE MANAGEMENT PROGRAM

Charlene S. Fitch

Charlene S. Fitch, P.E.
Chief, Engineering Section

CSF:trl

c: Jeffrey Fouse, P.E., Reitz and Jens, Inc.
Mr. Larry Lehman, Chief, Compliance/Enforcement Section, SWMP
St. Louis Regional Office via Electronic Shared File

# Biennial Airspace Estimate

Date ____________

Facility Name ____________________________________________

Permit Number ________ Total size of permitted area __________ acres

Date of current topographic survey __________

Date of previous topographic survey __________

Airspace filled during this reporting period __________ cubic yards

Total permitted airspace __________ cubic yards

Total airspace filled as of date of current survey __________ cubic yards

Remaining disposal airspace __________ cubic yards

Note: Airspace refers to the landfill volume above the leachate collection system (or protective layer if one exists), and below the final cover. It includes waste, daily cover, and intermediate cover.

Remarks ______________________________________________________________

# Sioux Energy Center - Utility Waste Landfill - Cell 2

St. Charles County
Community Development Department
Approval

Development Review Director ____________________

Date ____________________

Comments: ____________________

This approval is based upon conformity with the regulations embodied in the Unified Development Ordinance, and all standards contained or referenced therein, and does not relieve the engineer of responsibility for mathematical or design errors.

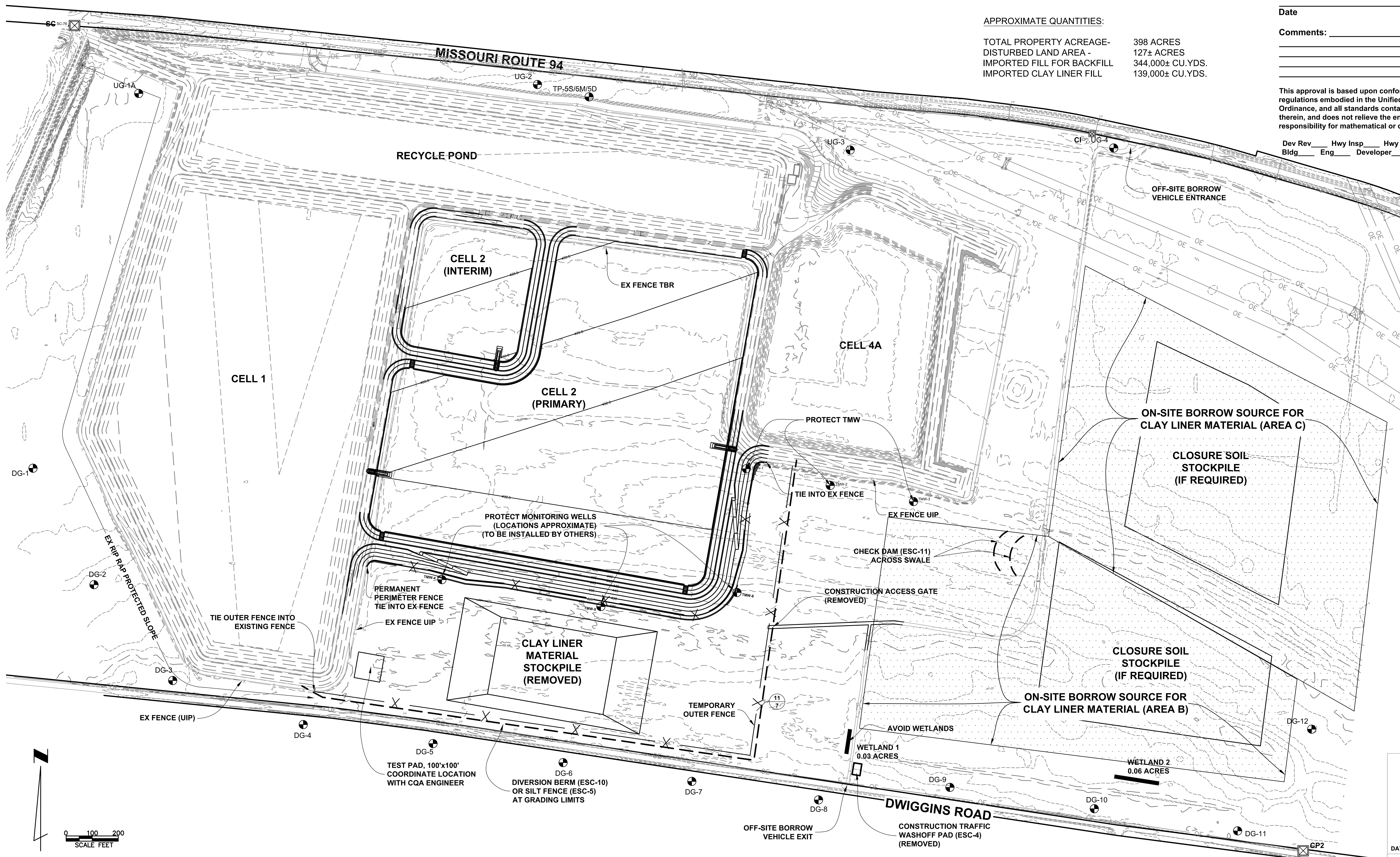
Dev Rev____ Hwy Insp____ Hwy SUP____ P&Z____
Bldg____ Eng____ Developer____ Contractor____

## LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING OVERHEAD ELECTRIC
- EXISTING TRANSMISSION TOWER
- EXISTING NATURAL GAS
- EXISTING STORM PIPE
- EXISTING STORM INLET
- EXISTING INLET DESIGNATOR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED TACK-ON BERM
- PROPOSED STORM PIPE
- PROPOSED STORM MANHOLE
- PROPOSED DOME INLET
- PROPOSED MANHOLE DESIGNATOR
- PROPOSED INLET DESIGNATOR
- EXISTING FENCE
- LAYOUT CONTROL POINT
- CONTROL POINT DESIGNATOR
- MONITORING WELL (DO NOT DISTURB)
- CONTROL POINT
- ALIGNMENT/CENTERLINE
- DIVERSION BERM OR SILT FENCE

APPROXIMATE QUANTITIES:

| | |
|---|---|
| TOTAL PROPERTY ACREAGE- | 398 ACRES |
| DISTURBED LAND AREA - | 127± ACRES |
| IMPORTED FILL FOR BACKFILL | 344,000± CU.YDS. |
| IMPORTED CLAY LINER FILL | 139,000± CU.YDS. |




DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

**KEY TO ABBREVIATIONS**

APPRX - APPROXIMATE
BLDG --- Building
CL ------- CenterLine
CMP ---- Corrugated Metal Pipe
CONC -- Concrete
ELEV --- Elevation
ESC ----- Erosion & Sediment Control
EX ------- Existing
FL ------- FlowLine
FT ------- Foot
FTG ---- Footing
GI ------- Grate Inlet
IN ------- Inch
L -------- Length of Curve
MAX --- Maximum
MH ----- ManHole
MIN ---- Minimum
NIC ---- Not In Contract
NTS --- Not to Scale
PC ----- Point of Curvature
PI ------ Point of Intersection
PT ----- Point of Tangency
R ------- Radius
RCP --- Reinforced Concrete Pipe
RR ----- Railroad
SAN --- Sanitary
STA --- Station
STM --- Storm
TBA --- To Be Abandoned
TBAF - To Be Abandoned and Filled
TBM -- Temporary Bench Mark
TBR --- To Be Removed
TBRR - To Be Removed and Replaced
TMW --- Temporary Monitoring Well
TYP ---- Typical
UIP ----- Use In Place
W/ ----- With

| BM | NORTHING | EASTING | ELEVATION (NAVD) | DESCRIPTION |
|---|---|---|---|---|
| SC-76 | 1119087.33 | 877543.26 | 438.32 | MO GEODETIC SURVEY BM |
| CP-1 | 1118671.98 | 881447.03 | 426.29 | IRON ROD W/CAP IN CONCRETE |
| CP-2 | 1115919.13 | 882257.95 | 426.26 | IRON ROD W/CAP IN CONCRETE |
| CP-3 | 1113921.00 | 881880.22 | 428.94 | IRON ROD W/CAP IN CONCRETE |
| CP-4 | 1117281.70 | 876152.34 | 433.63 | IRON ROD W/CAP IN CONCRETE |

ALL ELEVATIONS SHOWN WERE ESTABLISHED IN NAVD88 USING THE MISSOURI GEODETIC REFERENCE SYSTEM BENMARK SC-76 IMMEDIATELY SOUTH OF I-94 AND WEST OF THE AMEREN RAIL SPUR. TO COVERT THE NAVD88 ELEVATIONS SHOWN TO NGVD29(USGS) ADD 0.23 FEET.

**Index of Sheets**



THE ENGINEER WHOSE SIGNATURE AND PERSONAL SEAL APPEAR HEREON ASSUMES RESPONSIBILITY ONLY FOR WHAT APPEARS ON THIS PAGE AND DISCLAIMS (PURSUANT TO SECTION 327.411 RSMO) ANY RESPONSIBILITY FOR ALL OTHER PLANS, SPECIFICATIONS, ESTIMATES, REPORTS OR OTHER DOCUMENTS OR INSTRUMENTS NOT SEALED BY THE UNDERSIGNED ENGINEER RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE PROJECT TO WHICH THIS PAGE REFERS.


REITZ & JENS, INC.
CONSULTING ENGINEERS
1055 Corporate Square Drive
St. Louis, Missouri 63132
314.993.4132
Missouri Professional Engineering Corporation License No. 000215


PARTIALLY SUPERSEDED ---------------- REV---- DATE --/--/----

SUPERSEDES ---------------- REV---- DATE --/--/----

**CONSTRUCTION**

| MARK UP DRAWING NO. | REV. |
|---|---|
| | |

NOTICE OF LIMITED RESPONSIBILITY

THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

| | |
|---|---|
| SCALE | 1" = 200' |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

**SIOUX ENERGY CENTER**
**UTILITY WASTE LANDFILL - CELL 2**

**COVER**

SITE: SIOUX ENERGY CENTER

DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRAFTING DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

Ameren MISSOURI

DRAWING NO.
SX-DWG-PROP-00026-001

REVISION NO. 004

## GENERAL CONSTRUCTION NOTES:

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. Any discrepancy between the Drawings and the Specifications shall be immediately brought to the attention of the Owner and CQA Engineer for resolution.

2. Contractor shall be solely and completely responsible for the conditions of the job site, including safety of all persons and property during performance of the Work. This requirement will apply continuously and not be limited to normal working hours.

3. Field verify all dimensions before construction. Do not scale drawings; follow dimensions shown. All construction points shall be provided by the Contractor.

4. Underground facilities, structures and utilities have been plotted from available surveys and records; therefore, their locations must be considered approximate only. There may be others, the existence of which is at present not known. Verification of the locations of underground utilities, shown or not shown, shall be the responsibility of the Contractor. Contractor shall make suitable and timely requests to all utility owners, pipeline owners, or other parties affected to have all necessary adjustments of public or private utilities, pipelines or other appurtenances within, or adjacent to, the limits of construction as soon as practical or possible. Any discrepancy between the size, depth, quantity, or location of underground improvements shown on the Drawings and those located in the field shall be immediately brought to the attention of the Owner and CQA Engineer.

5. Contractor shall notify the Chief Inspector of the St. Charles County Highway Department and Missouri Department of Transportation a minimum of 24 hours prior to beginning any construction within the right-of-ways.

6. The proposed temporary construction access shown on the Drawings is on a private road of the Owner. If Contractor wants a temporary construction entrance off of Dwiggins Road, then the Contractor shall obtain a new special use permit from St. Charles County with permission of Owner.

7. Demolition: Demolition shall include the removal of the perimeter fence around the east berm of Cell 1, the south berm of the Recycle Pond, and a portion of Cell 4A as shown on the Drawings. Demolition of the fence shall not start until the temporary construction fence is in place and accepted by the Owner and meet perimeter security requirements. CONTRACTOR SHALL MAINTAIN CONTROL OF ACCESS TO THE UWL THROUGHOUT THE CONSTRUCTION AND MAINTAIN SITE SECURITY REQUIREMENTS THROUGHOUT THIS PROJECT.

8. Storm Water Pollution Prevention Plan (SWPPP): Install and maintain silt fences, dikes, swales, temporary access with wash-down facilities, and other erosion control devices in accordance with Section 02625 and as required for the St. Charles County and Missouri Department of Natural Resources (MDNR) Land Disturbance Permit.

9. Grades shown on the Drawings are final grades. Contractor shall grade all surfaces to appropriate subgrade to receive designated cover (clay, HDPE geomembrane, crushed stone pavement, vegetative cover or other). Elevations are based upon Missouri State Plane and NGVD88 datums. All finished grades shall be within the tolerances specified in Section 02200.

10. Conditions shown on the Drawings represent conditions surveyed in 2019 or previously. Existing elevations and grades may have changed since the survey due to erosion or sedimentation.

11. GPS System: furnish, install, calibrate and maintain a geographic positioning system (GPS) on site to control earthwork operations, locate field tests, and for periodic topographic surveys. Two (2) GPS's must be provided to the CQA Engineer for their sole use during construction of the berms, clay liner and HDPE liner. The GPS's provided to the CQA Engineer MUST have the ability to store and display waypoints taken during testing. Horizontal accuracy must be 1 foot or less. Vertical accuracy must be 0.1 foot or less.

12. Stockpile Clay Liner Material: Contractor shall import and stockpile the minimum volume of clay liner material to construct Cell 2 as shown on the Drawings. All clay liner material in the stockpile shall be blended, moisture conditioned as required, and compacted in accordance with Section 02210. The imported clay liner material must be tested and qualified by the CQA Engineer prior to transport of the material to the site. Contractor shall transport the clay liner material to the site, place it in the designated stockpile area, blend, and moisture condition as required, and compact in accordance with Section 02210. Contractor shall have Registered Surveyor survey the stockpile and calculate the volume of stockpiled clay liner material. Owner may have an independent survey done to verify.

13. Contractor shall prevent damage to crops outside of the area of Work as a direct or indirect result of his construction activities. All damages, delays and expenses associated with damage or the prevention of damage to existing facilities, roadways and crops outside of the area of Work shall be the responsibility of the Contractor and shall not be reimbursed by the Owner. CELL 1, RECYCLE POND AND CELL 4A SHALL REMAIN IN OPERATION DURING THE DURATION OF THIS CONSTRUCTION.

14. Contractor shall continuously maintain all paved roadways free of CCP, mud or tracked materials during site operations. Contractor shall use equipment specifically designed for street cleaning and approved by the Ameren Construction Supervisor.

15. General soil fill material for construction of the perimeter berms, subgrade fill and backfill shall be free of rock larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, or other deleterious matter. Soil materials shall be mixed to produce a homogeneous fill. Sand and sediment shall be mixed with clayey soil so that there are no pockets of relatively higher permeability. Materials obtained from off-site shall be in accordance with Section 02210. Contractor shall submit samples of off-site materials to the CQA Engineer in accordance with Division 1, Section 4.6.2. Contractor shall be responsible for obtaining all necessary permits associated with the borrow site(s) and hauling material to the site.

16. Effluent Structure: Furnish and install the Effluent Structure from Cell 2 (Interim) to the Recycle Pond as specified in the Contract Documents. Cell 1 and the Recycle Pond shall remain in operation throughout this construction and following.

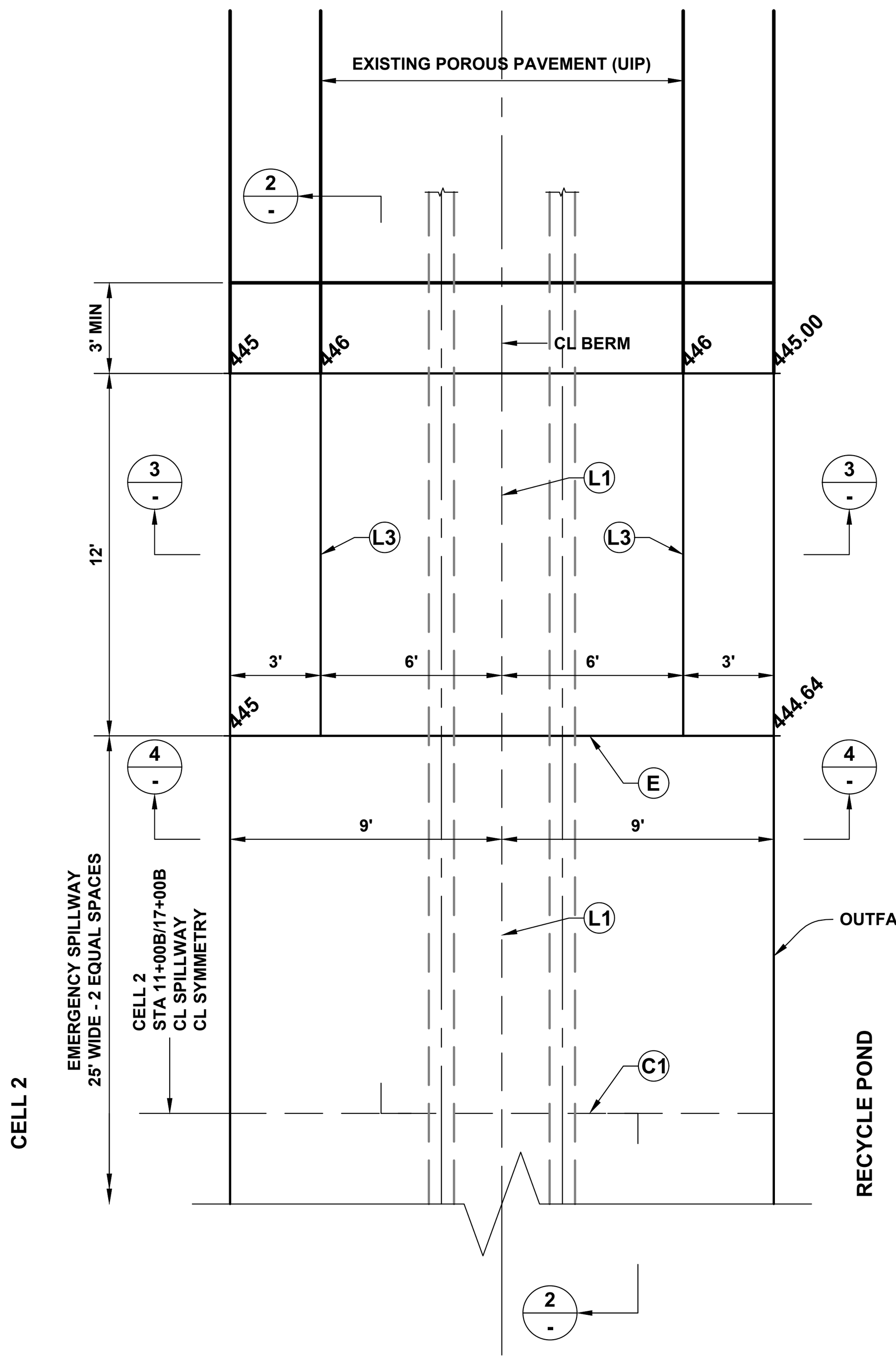
17. Interim Cell 2 shall be constructed first with the Interim/Primary Spillway and Closure in the east Interim berm (Sheet 3). After Cell 2 (Primary) in placed in operation, the Contractor shall remove the temporary fill from the Interim/Primary Spillway and Closure.

18. Gypsum Slurry Supply Pipe: Modification of the existing gypsum slurry supply pipes shall be coordinated with the Plant operations. A new discharge from the east gypsum slurry supply pipe into Cell 2 (Interim) shall be provided as specified in the Contract Documents. The existing discharge of the east gypsum slurry supply pipe into Cell 1 shall be relocated into Cell 2 (Primary) as specified in the Contract Documents and shall be plugged until Cell 2 (Primary) is operational. The existing discharge of the west gypsum slurry supply pipe into Cell 1 shall be relocated into Cell 2 (Primary) after Cell 2 (Primary) is operational.

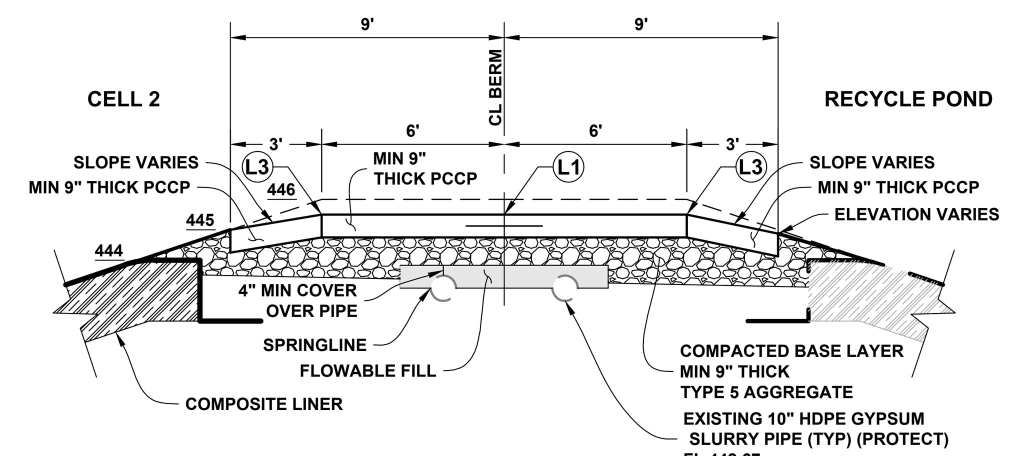
19. The approximate locations of the existing monitoring wells are shown on the Drawings. CONTRACTOR SHALL PROTECT MONITORING WELLS AS REQUIRED TO PREVENT DAMAGE. Damaged monitoring wells will be replaced by the Owner at the Contractor's expense. The top of TMW-1 shall be raised (by others).

20. Three new permanent monitoring wells are to be installed south of the south berm. These monitoring wells with protection are to be installed by others under contract with Owner during construction of Cell 2. CONTRACTOR SHALL AVOID MONITORING WELLS AS REQUIRED TO PREVENT DAMAGE. Damaged monitoring wells will be replaced by the Owner at the Contractor's expense.

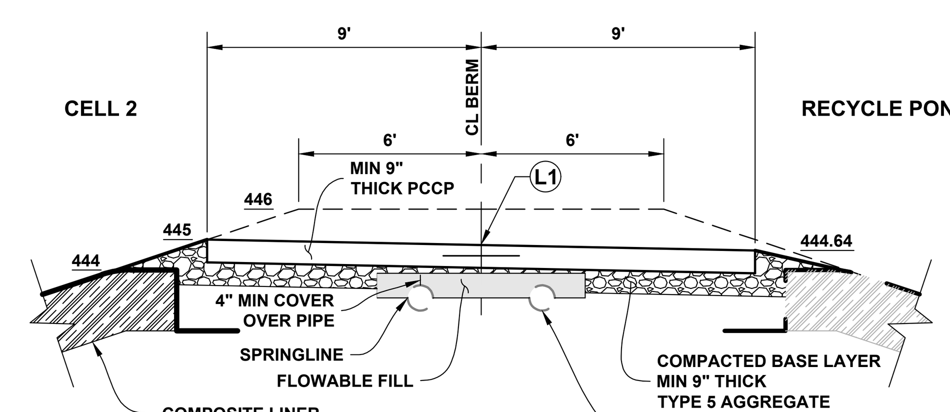
21. Contractor shall maintain one set of marked plans showing all changes and "as-built" information.



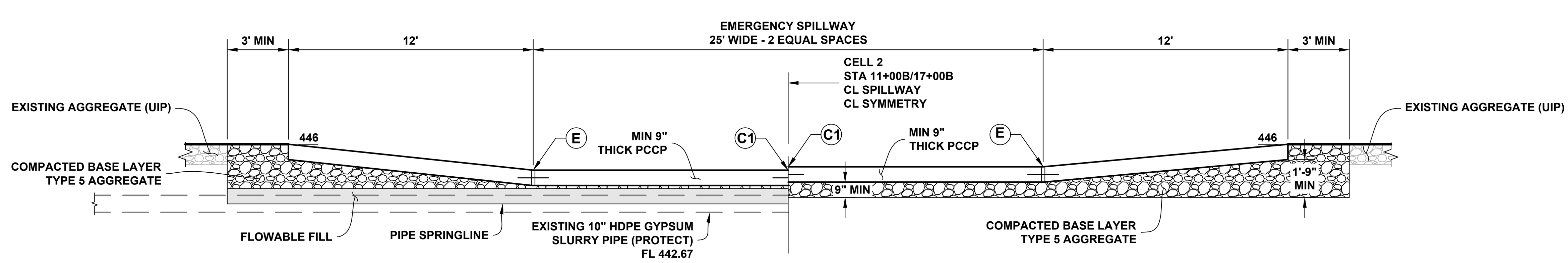

**1 - EMERGENCY SPILLWAY - PART PLAN STA 11+00B AND STA 17+00B**
SCALE: 1" = 5'



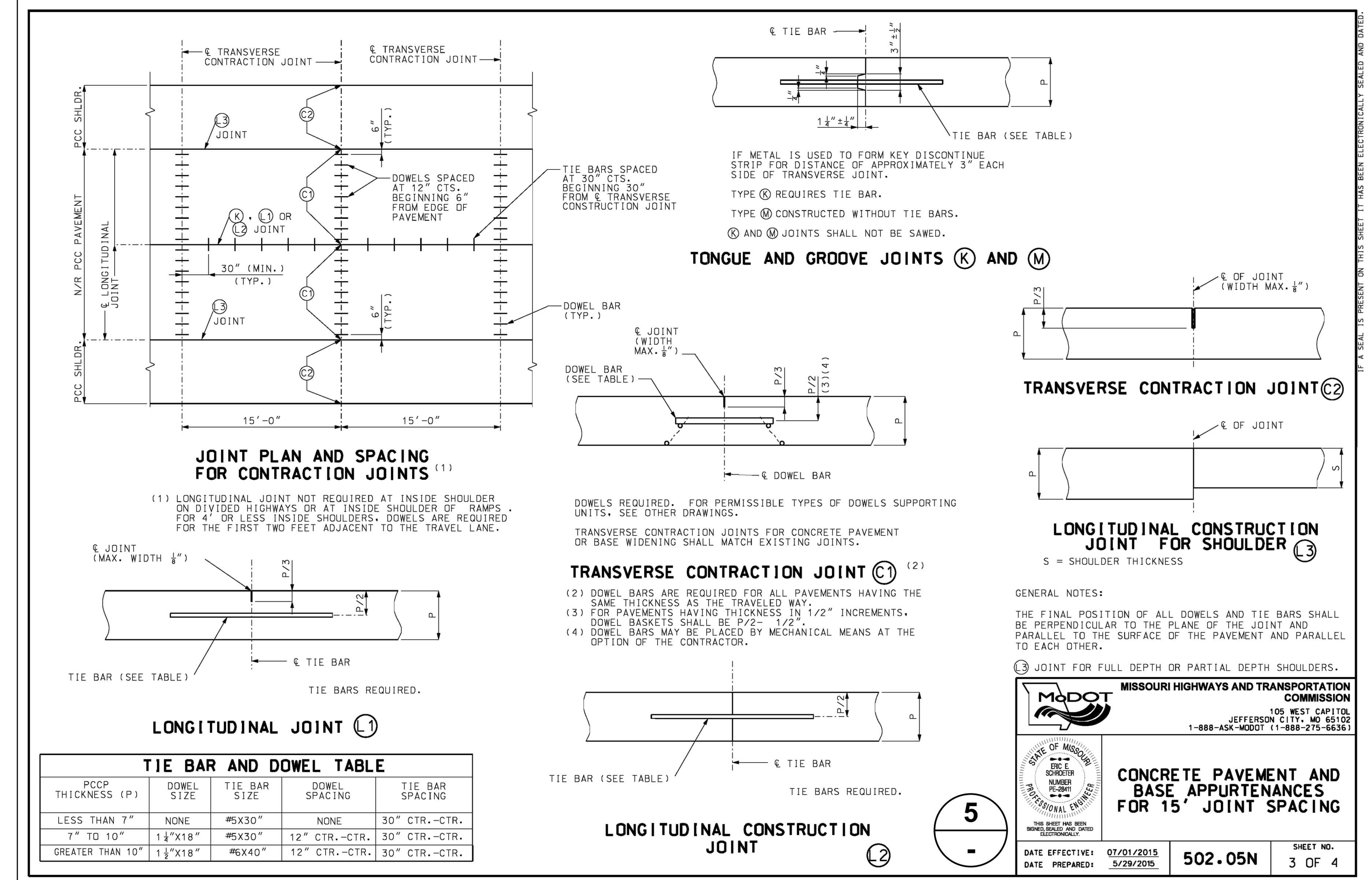

**3 - EMERGENCY SPILLWAY SECTION THROUGH SIDE SLOPE**
SCALE: 1" = 5'



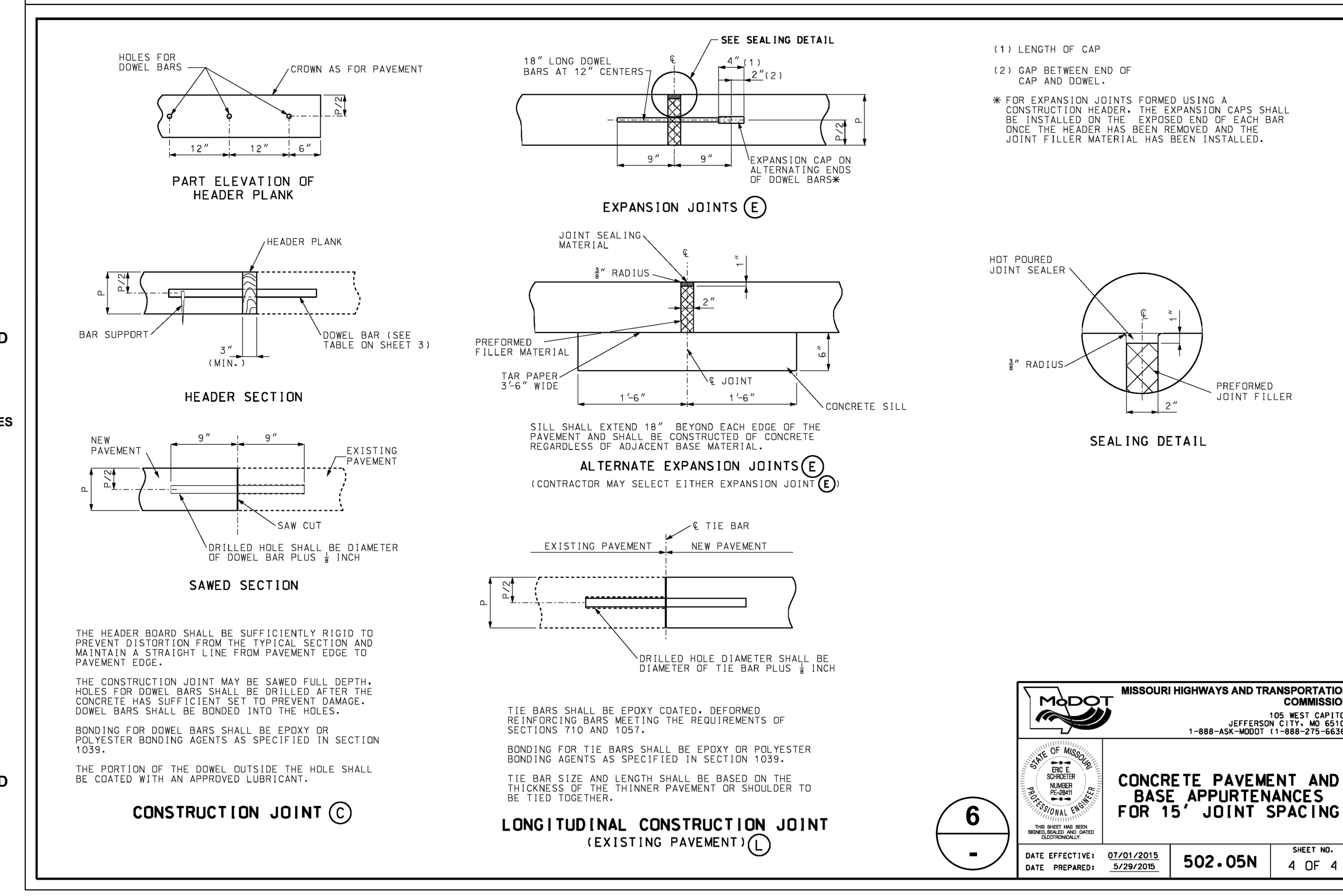

**4 - EMERGENCY SPILLWAY SECTION THROUGH SPILLWAY**
SCALE: 1" = 5'




**2 - EMERGENCY SPILLWAY LONGITUDINAL SECTION**
SCALE: 1" = 5'




**5 -**




**6 -**

### EMERGENCY SPILLWAY NOTES:

1. Emergency spillway shall be unreinforced Portland cement concrete pavement (PCCP).
2. Concrete shall have a minimum 28-day compressive strength of 4,500 psi.
3. Reinforcing steel to be ASTM A615, grade 60. Reinforcing steel shall have a minimum of 2" concrete cover, unless otherwise noted.

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

THE ENGINEER WHOSE SIGNATURE AND PERSONAL SEAL APPEAR HEREON ASSUMES RESPONSIBILITY ONLY FOR WHAT APPEARS ON THIS PAGE AND DISCLAIMS (PURSUANT TO SECTION 327.411 RSMO) ANY RESPONSIBILITY FOR ALL OTHER PLANS, SPECIFICATIONS, ESTIMATES, REPORTS OR OTHER DOCUMENTS OR INSTRUMENTS NOT SEALED BY THE UNDERSIGNED ENGINEER RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE PROJECT TO WHICH THIS PAGE REFERS.

REITZ & JENS, INC.
CONSULTING ENGINEERS
1055 Corporate Square Drive
St. Louis, Missouri 63132
314.993.4132
Missouri Professional Engineering Corporation License No. 000215

PARTIALLY SUPERSEDED ---------- REV.--- DATE --/--/----

**AS BUILT**

MARK UP DRAWING NO. | REV.

NOTICE OF LIMITED RESPONSIBILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

| | |
|---|---|
| SCALE | NA |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

SUPERSEDES ---------- REV.--- DATE --/--/----

**SIOUX ENERGY CENTER**
**UTILITY WASTE LANDFILL - CELL 2**
**NOTES AND GENERAL DETAILS**

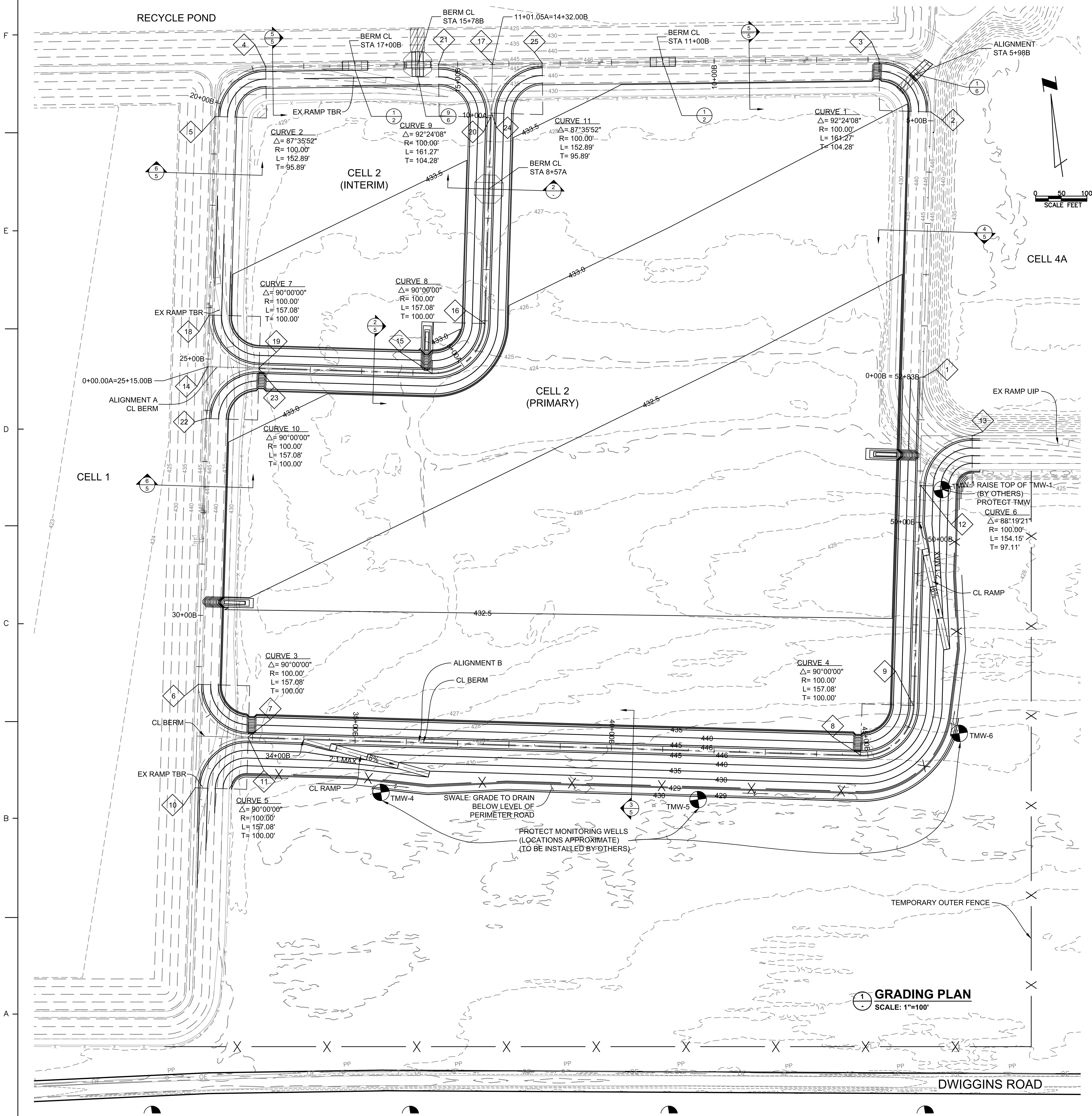
SITE: SIOUX ENERGY CENTER

DRAWING RECORD

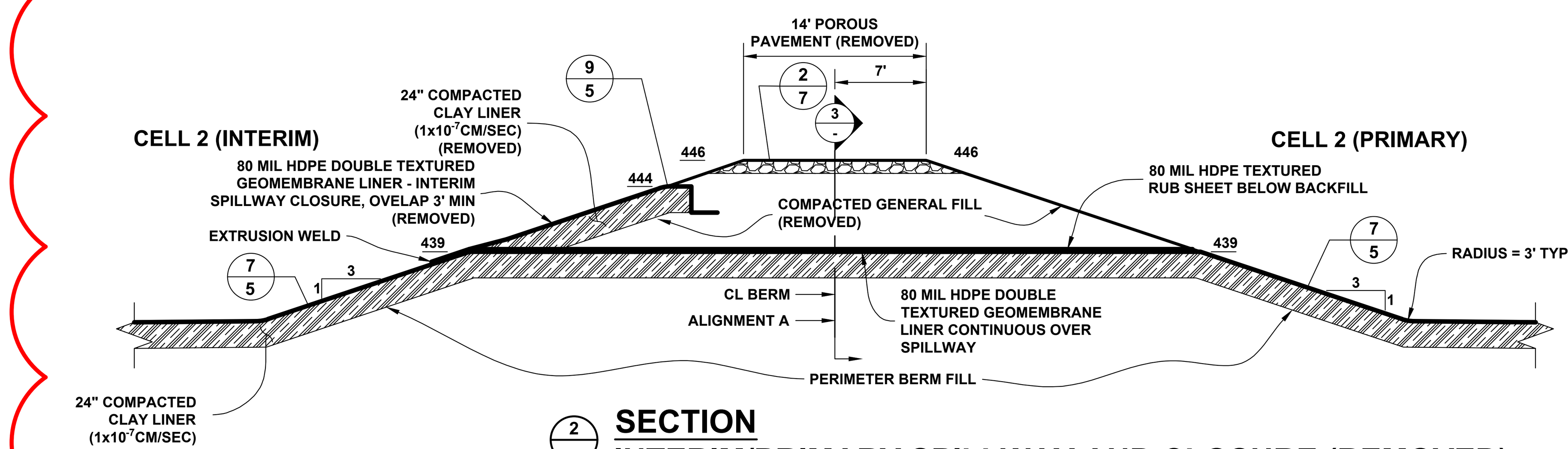
| REV. | DATE | PROJECT NO. | DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

Ameren MISSOURI

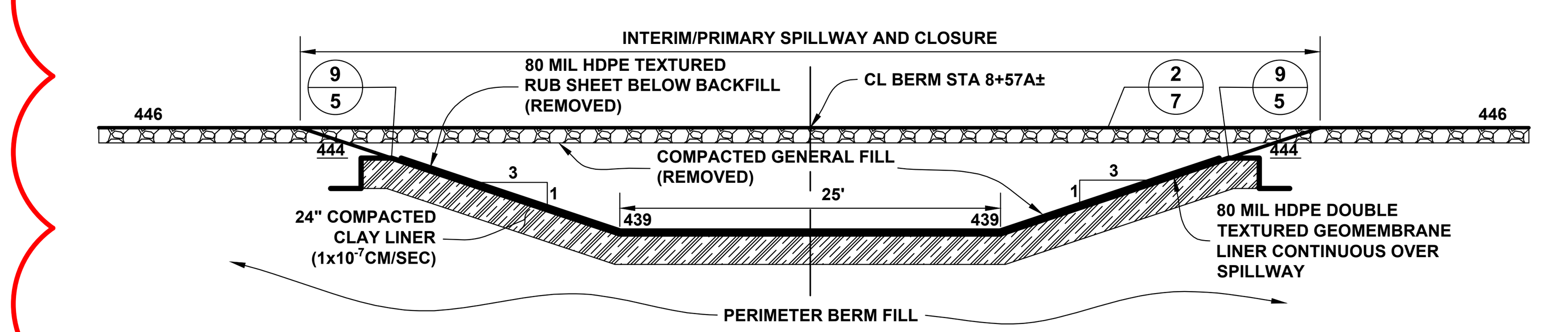
DRAWING NO. SX-DWG-PROP-00026-002
REVISION NO. 004




GRADING PLAN
SCALE: 1"=100'




SECTION
INTERIM/PRIMARY SPILLWAY AND CLOSURE (REMOVED)
CL BERM STA 8+57A±
SCALE: 1"=10'




PROFILE
INTERIM/PRIMARY SPILLWAY AND CLOSURE
SCALE: 1"=10'

INTERIM/PRIMARY SPILLWAY NOTES:
1. SPILLWAY SHALL BE BACKFILLED WITH COMPACTED GENERAL FILL. INTERIM SPILLWAY CLOSURE SHALL CONSIST OF COMPOSITE LINER OVERLAPPING THE ADJACENT LINER AND ANCHORED AT ELEVATION 444.
2. FUTURE REMOVAL OF SPILLWAY CLOSURE: LOWER WATER LEVEL IN INTERIM CELL 2, REMOVE SPILLWAY CLOSURE LINER AND BACKFILL BEFORE PRIMARY CELL 2 WATER LEVEL REACHES ELEVATION 438.

| LAYOUT | | | |
|---|---|---|---|
| CONTROL POINT # | COORDINATES N | COORDINATES E | DESCRIPTION |
| 1 | 1117607.40 | 880116.15 | STA 0+00.00B AND CL BERM |
| 2 | 1118116.89 | 880206.27 | STA 5+17.40B AND CL BERM, PC CURVE 1 |
| 3 | 1118233.42 | 880121.08 | STA 6+78.67B AND CL BERM, PT CURVE 1 |
| 4 | 1118392.11 | 878936.34 | STA 18+73.98B AND CL BERM, PC CURVE 2 |
| 5 | 1118310.42 | 878824.60 | STA 20+26.87B AND CL BERM, PT CURVE 2 |
| 6 | 1117219.78 | 878631.67 | STA 31+34.43B AND CL BERM, PC CURVE 3 |
| 7 | 1117103.89 | 878712.72 | STA 32+91.51B AND 1' LT OF CL BERM, PT CURVE 3 |
| 8 | 1116895.87 | 879888.73 | STA 44+85.78B AND 1' LT OF CL BERM, PC CURVE 4 |
| 9 | 1116976.92 | 880004.62 | STA 46+42.86B AND 1' LT OF CL BERM, PT CURVE 4 |
| 10 | 1117020.87 | 878596.49 | CL CELL 1 BERM, PC CURVE 5 |
| 11 | 1117101.93 | 878712.38 | STA 32+91.51B AND 1' RT OF CL BERM, PT CURVE 5 |
| 12 | 1117398.93 | 880081.30 | STA 50+71.77B AND 1' RT OF CL BERM, PC CURVE 6 |
| 13 | 1117480.45 | 880194.30 | CL CELL 4A BERM, PT CURVE 6 |
| 14 | 1117829.75 | 878739.57 | STA 0+00.00A CL BERM = STA 25+15.00B CL BERM |
| 15 | 1117753.56 | 879170.29 | STA 4+37.40A AND CL BERM, PC CURVE 8 |
| 16 | 1117834.61 | 879286.18 | STA 5+94.48A AND CL BERM, PT CURVE 8 |
| 17 | 1118333.43 | 879374.42 | STA 11+01.05A CL BERM = STA 14+32.00B CL BERM |
| 18 | 1117929.21 | 878757.16 | STA 24+14.00B AND CL BERM, PC CURVE 7 |
| 19 | 1117813.32 | 878838.22 | STA 1+00.00A AND 1' LT OF CL BERM, PT CURVE 7 |
| 20 | 1118230.88 | 879355.26 | STA 9+96.73A AND 1' LT OF CL BERM, PC CURVE 9 |
| 21 | 1118347.41 | 879270.06 | STA 15+37.28B AND CL BERM, PT CURVE 9 |
| 22 | 1117730.29 | 878721.98 | STA 26+16.00B AND CL BERM, PC CURVE 10 |
| 23 | 1117811.35 | 878837.87 | STA 1+00.00A AND 1' RT OF CL BERM, PT CURVE 10 |
| 24 | 1118238.88 | 879358.70 | STA 10+05.20A AND 1' RT OF CL BERM, PC CURVE 11 |
| 25 | 1118320.57 | 879470.45 | STA 13+35.11B AND CL BERM, PT CURVE 11 |

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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St. Louis, Missouri 63132
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Missouri Professional Engineering Corporation
License No. 000215

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SUPERSEDES ---------------------------- REV---- DATE --/--/----

# AS BUILT

| MARK UP DRAWING NO. | REV. |
|---|---|
| | |

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| | |
|---|---|
| SCALE | VARIES |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

## SIOUX ENERGY CENTER
## UTILITY WASTE LANDFILL - CELL 2

## GRADING PLAN

SITE: SIOUX ENERGY CENTER

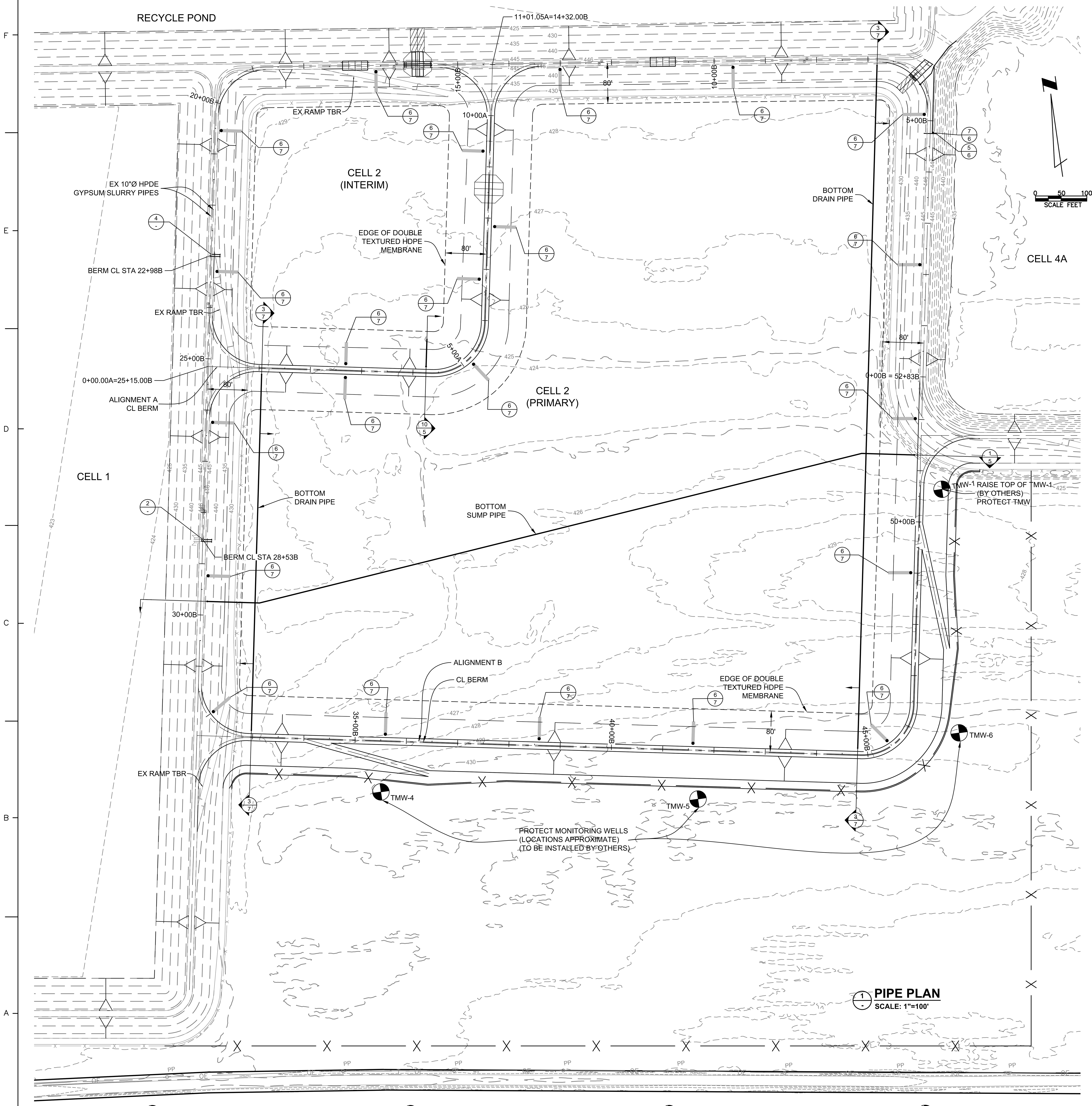
DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRAFTING DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | 25773 | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

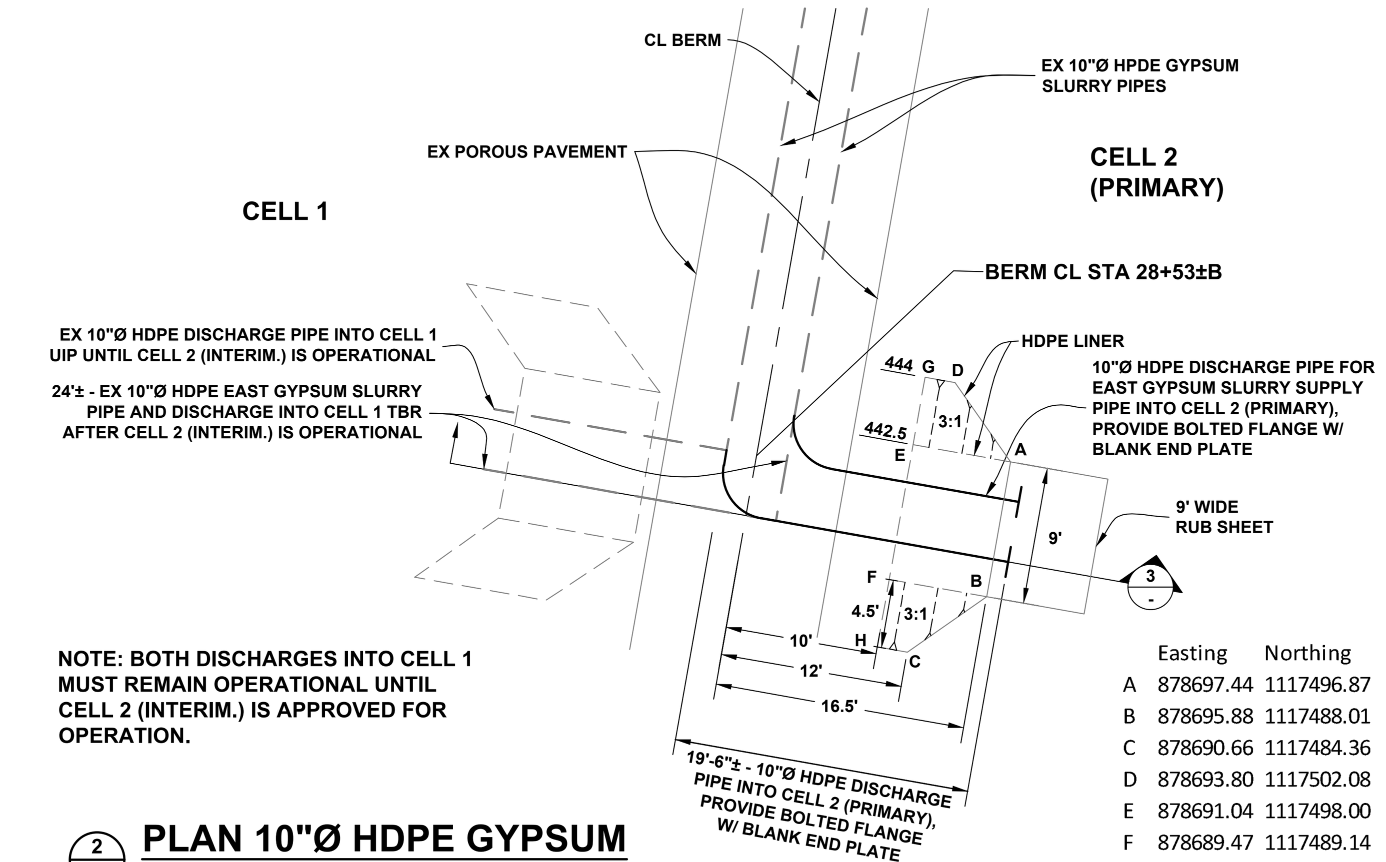
Ameren
MISSOURI

DRAWING NO.
SX-DWG-PROP-00026-003

REVISION NO. 004



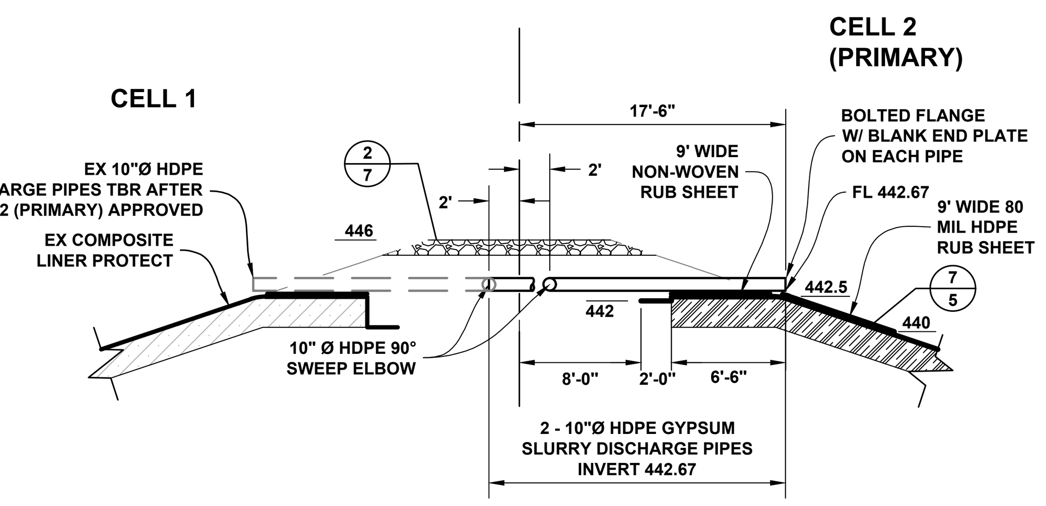

1 PIPE PLAN
SCALE: 1"=100'



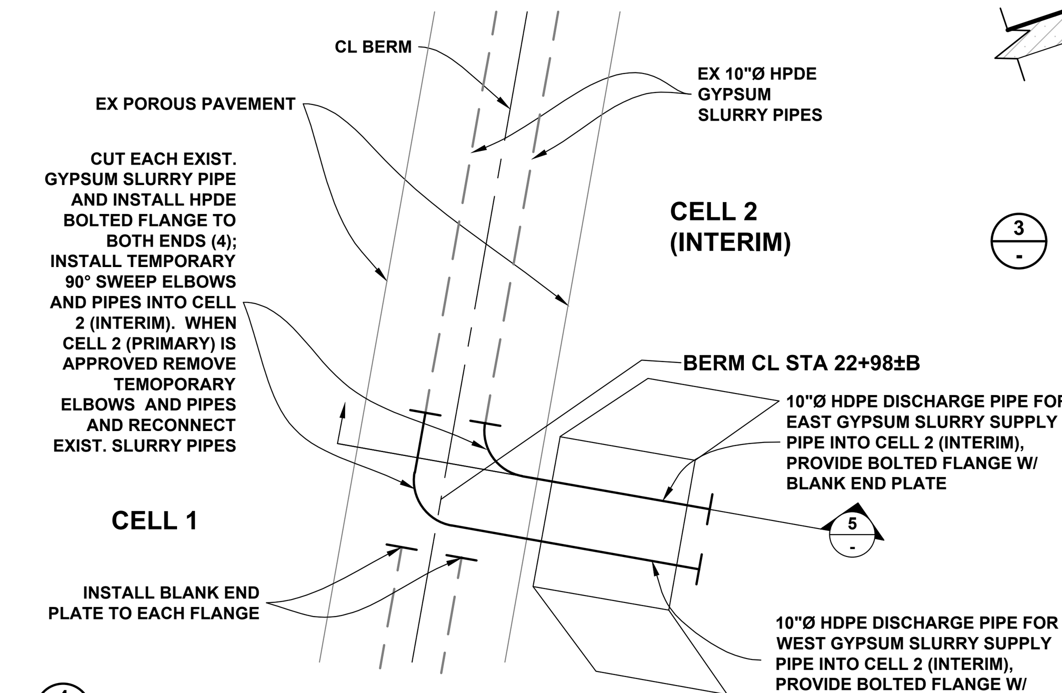

NOTE: BOTH DISCHARGES INTO CELL 1 MUST REMAIN OPERATIONAL UNTIL CELL 2 (INTERIM.) IS APPROVED FOR OPERATION.

| | Easting | Northing |
|---|---|---|
| A | 878697.44 | 1117496.87 |
| B | 878695.88 | 1117488.01 |
| C | 878690.66 | 1117484.36 |
| D | 878693.80 | 1117502.08 |
| E | 878691.04 | 1117498.00 |
| F | 878689.47 | 1117489.14 |
| G | 878691.83 | 1117502.43 |
| H | 878688.69 | 1117484.71 |

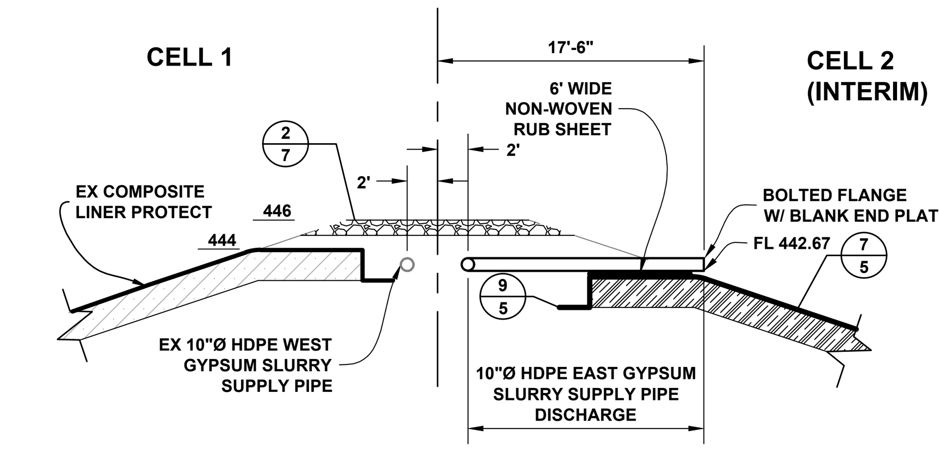
2 PLAN 10"Ø HDPE GYPSUM SLURRY PIPES TO CELL 2 (PRIMARY)
SCALE: 1"=10'




3 PARTIAL PROFILE 10"Ø HDPE GYPSUM SLURRY PIPE
SCALE: 1"=10'




4 PLAN 10"Ø HDPE GYPSUM SLURRY PIPES TO CELL 2 (INTERIM)
SCALE: 1"=10'




5 PARTIAL PROFILE 10"Ø HDPE EAST GYPSUM SLURRY PIPE
SCALE: 1"=10'

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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| | |
|---|---|
| SCALE | VARIES |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

SIOUX ENERGY CENTER
UTILITY WASTE LANDFILL - CELL 2

PIPE PLAN

SUPERSEDES ---------------- REV--- DATE --/--/----

DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

SITE: SIOUX ENERGY CENTER

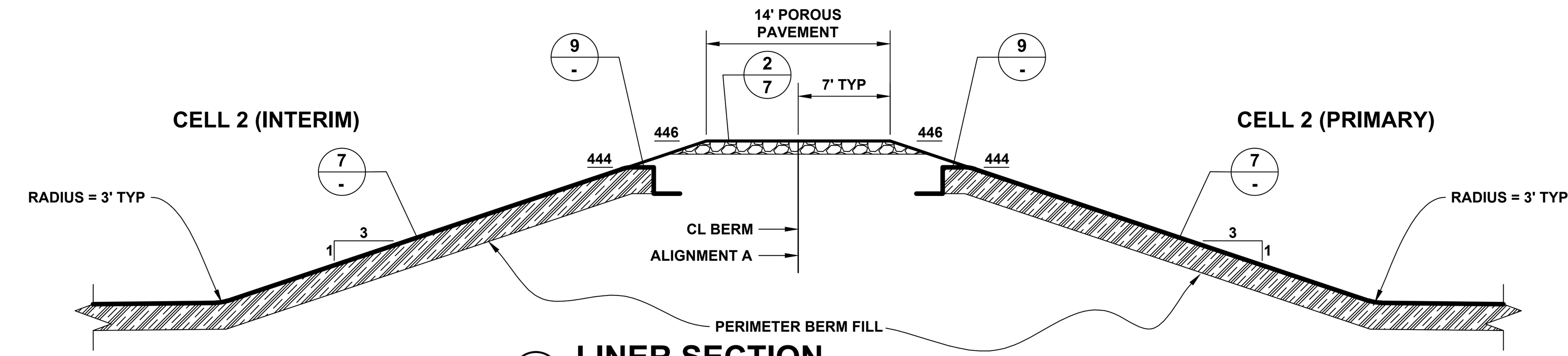
Ameren MISSOURI

DRAWING NO. SX-DWG-PROP-00026-004

REVISION NO. 004

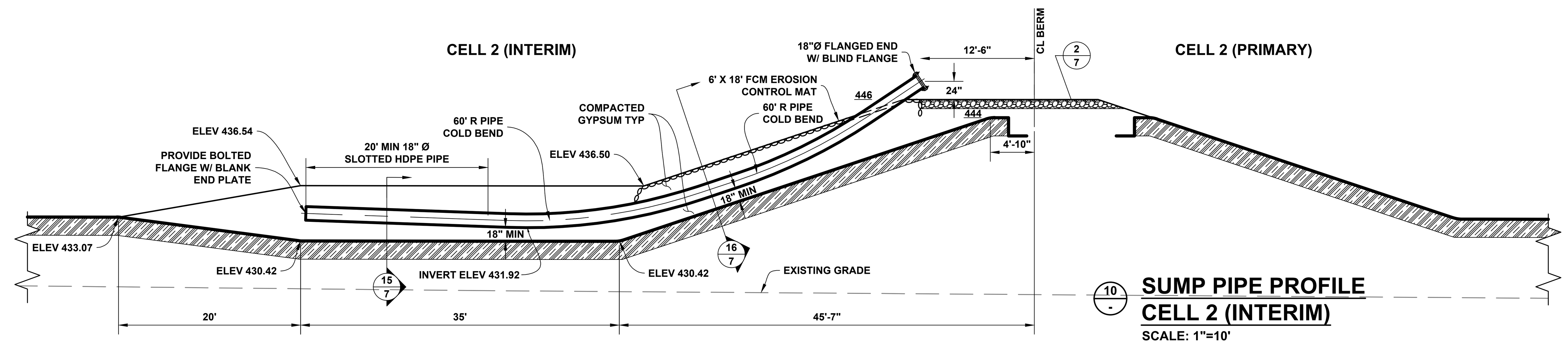

## SUMP PIPE PROFILE CELL 2 (PRIMARY)

SCALE: 1"=10'



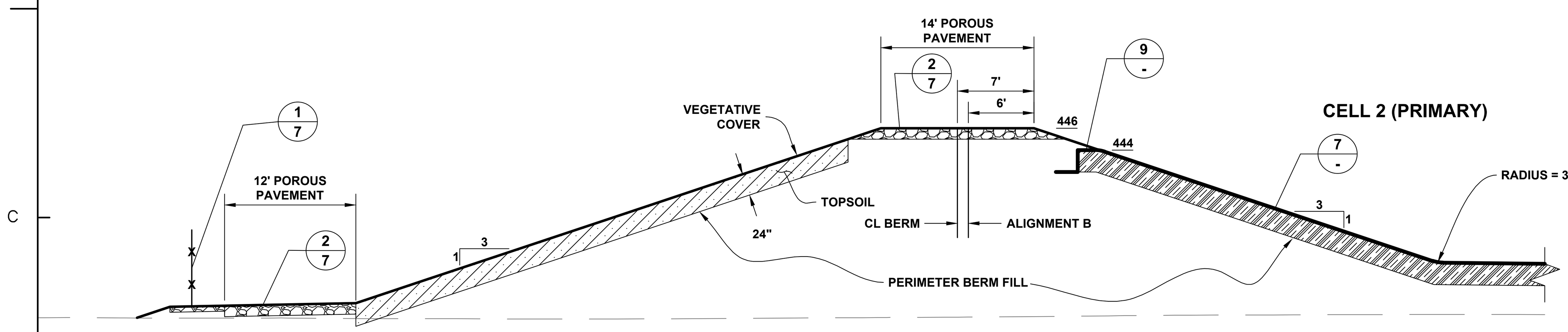

## LINER SECTION CL BERM STA 0+00A± TO 11+01A±

SCALE: 1"=10'



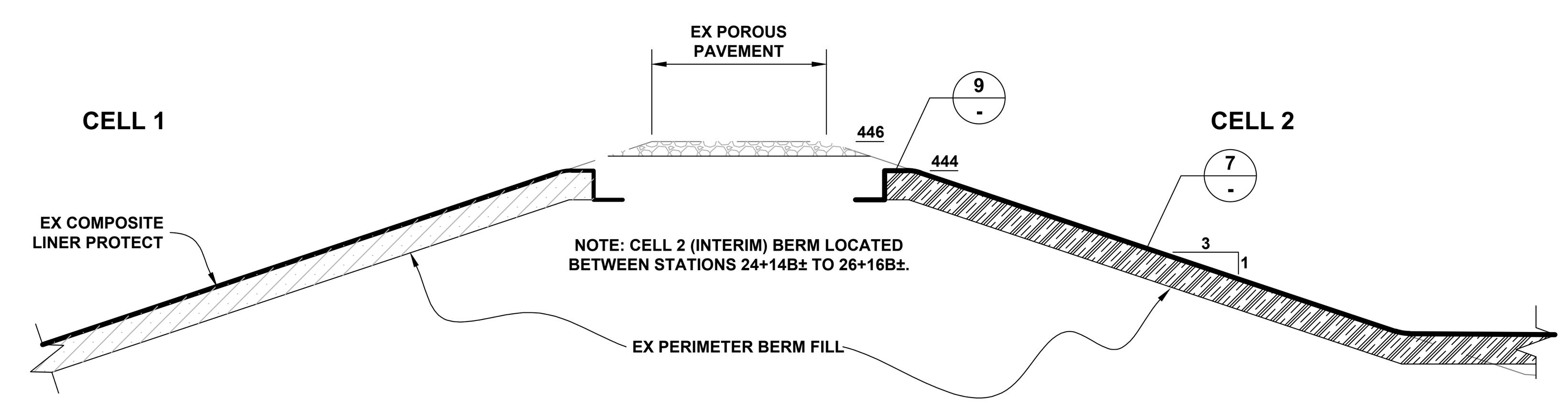

## SUMP PIPE PROFILE CELL 2 (INTERIM)

SCALE: 1"=10'



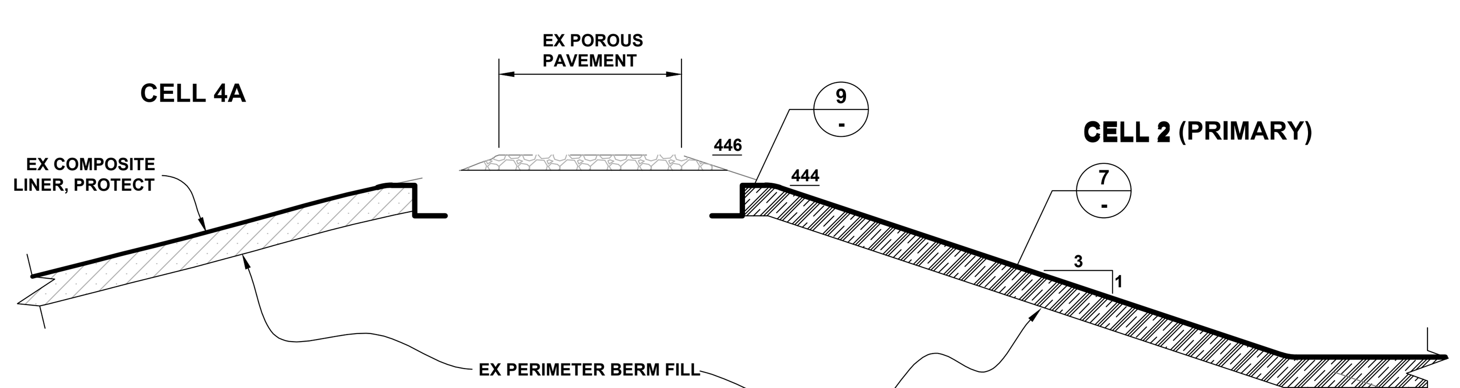

## LINER SECTION CL BERM STA 31+50B± TO 51+50B±

SCALE: 1"=10'



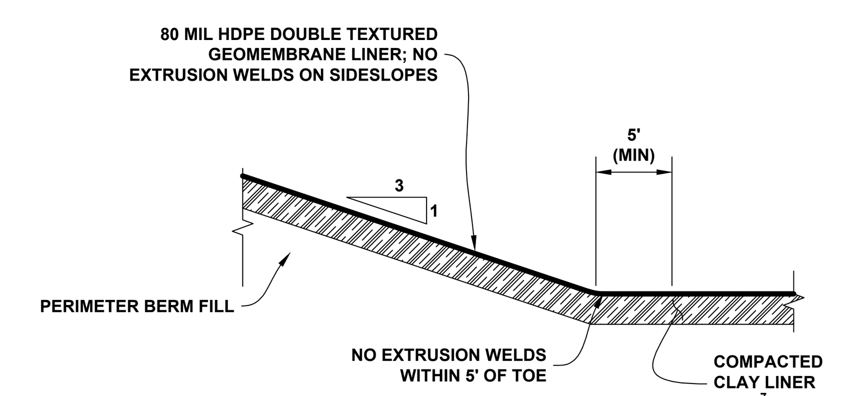

## LINER SECTION CL BERM STA 19+50B± TO 31+50B±

SCALE: 1"=10'




## LINER SECTION CL BERM STA 0+00B TO 5+98B± CL BERM STA 51+50B± TO 52+83B

SCALE: 1"=10'




## TRANSITION LINER

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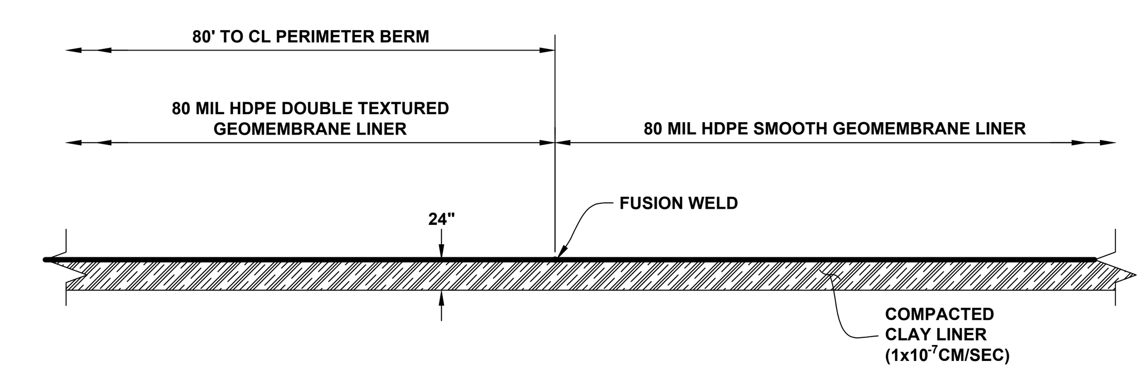
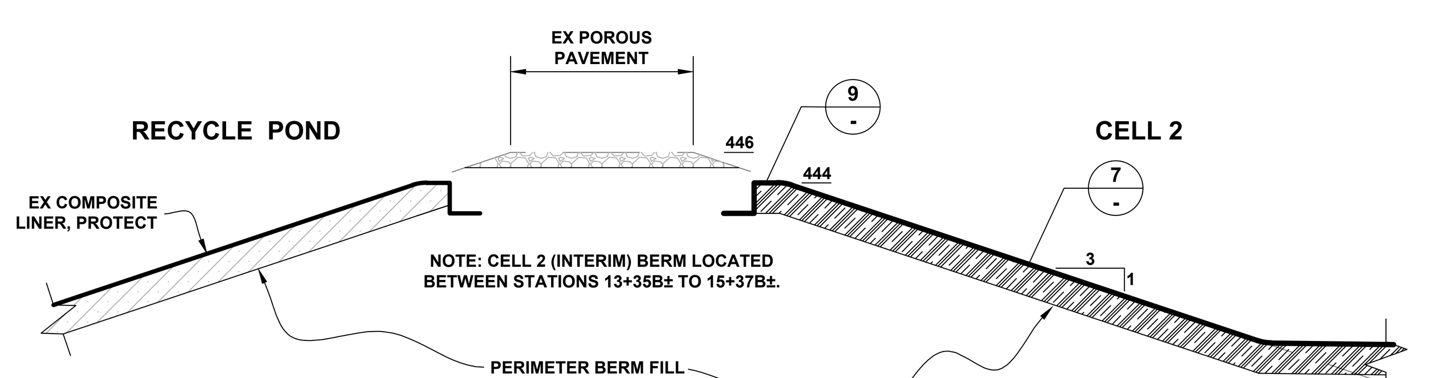


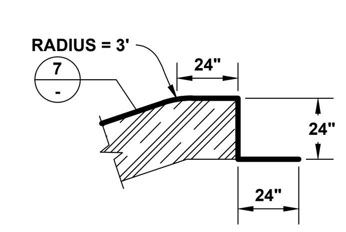

## COMPOSITE LINER

NO SCALE




## LINER SECTION CL BERM STA 5+98B± TO 19+50B±

SCALE: 1"=10'




## ANCHOR TRENCH

NO SCALE

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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| | |
|---|---|
| SCALE | 1" = 10' |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

SIOUX ENERGY CENTER
UTILITY WASTE LANDFILL - CELL 2

PROFILE AND TYPICAL SECTIONS

SITE: SIOUX ENERGY CENTER

SUPERSEDES ---------------- REV--- DATE --/--/----

DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

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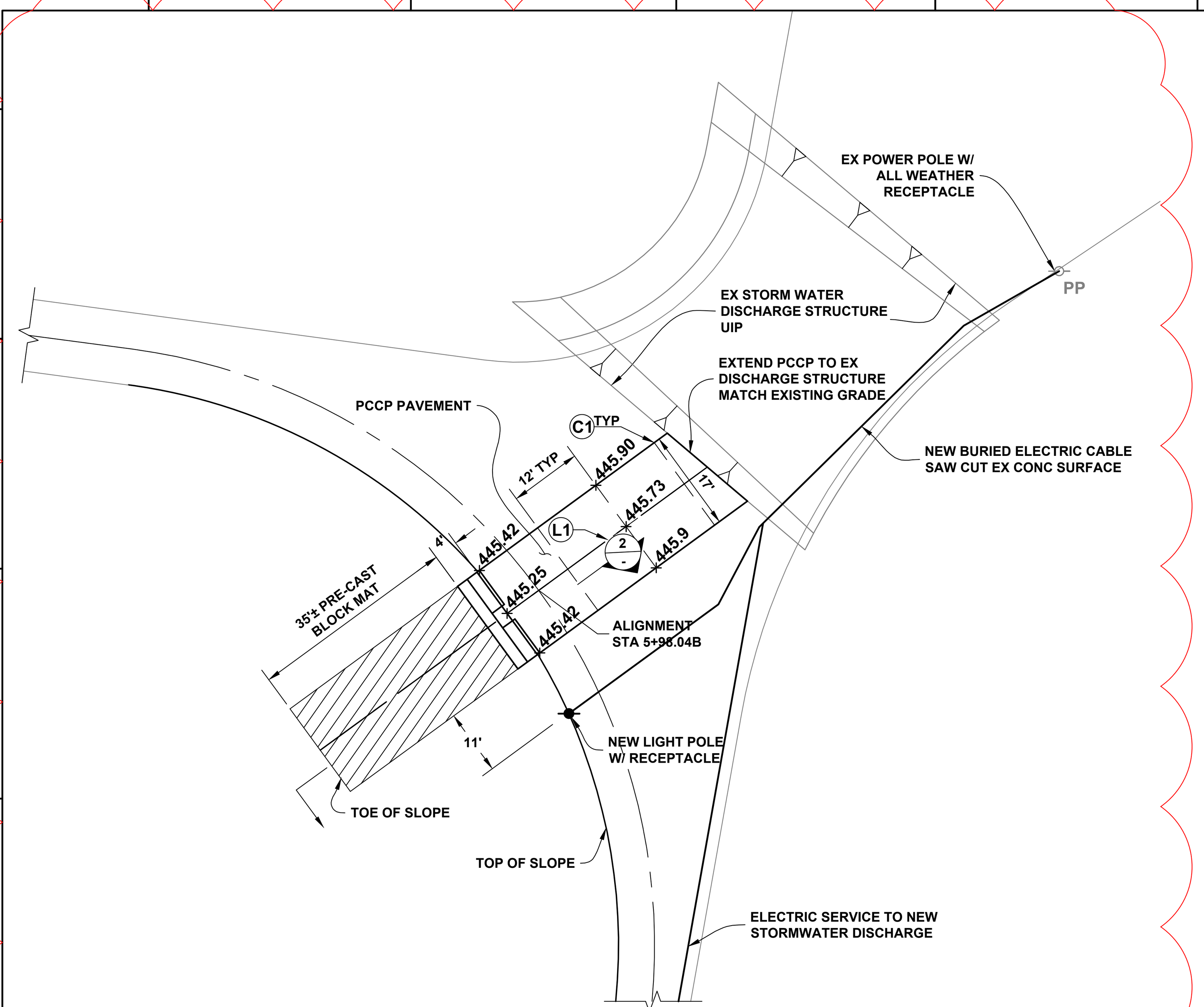
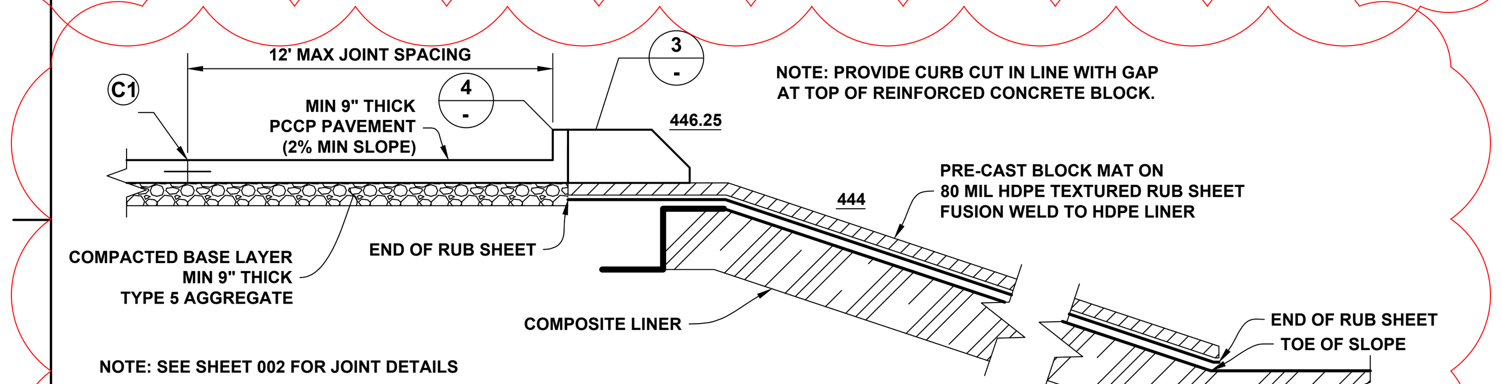
DRAWING NO. SX-DWG-PROP-00026-005

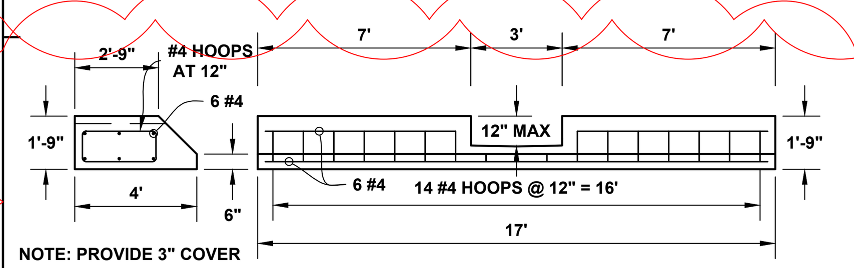
REVISION NO. 004



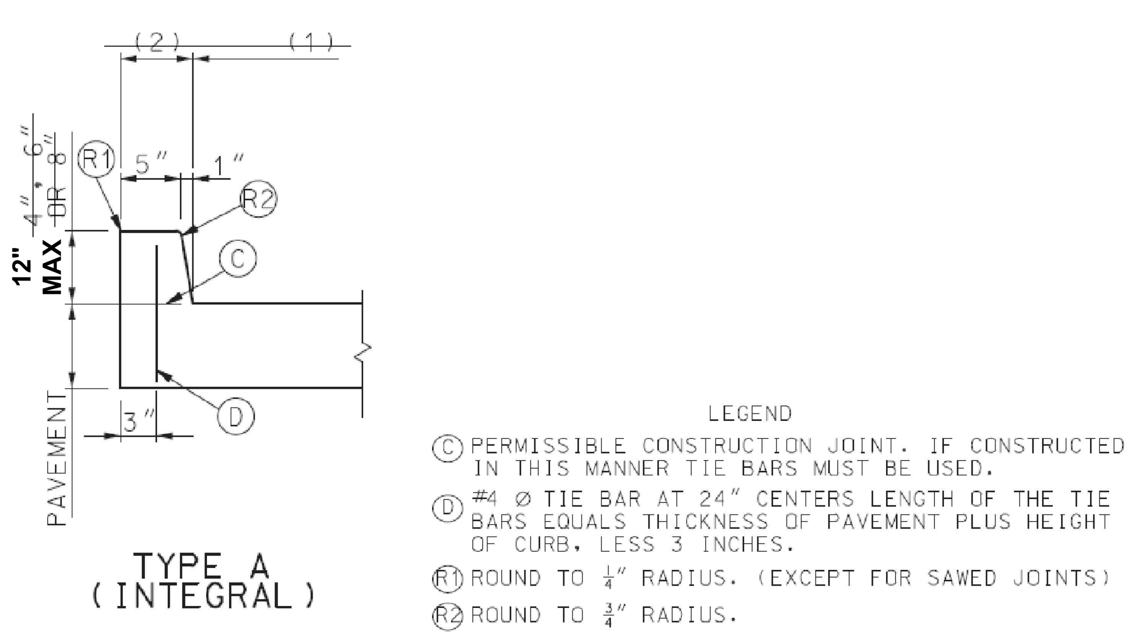

1 **OFF LOADING STATION PLAN**
SCALE: 1"=20'



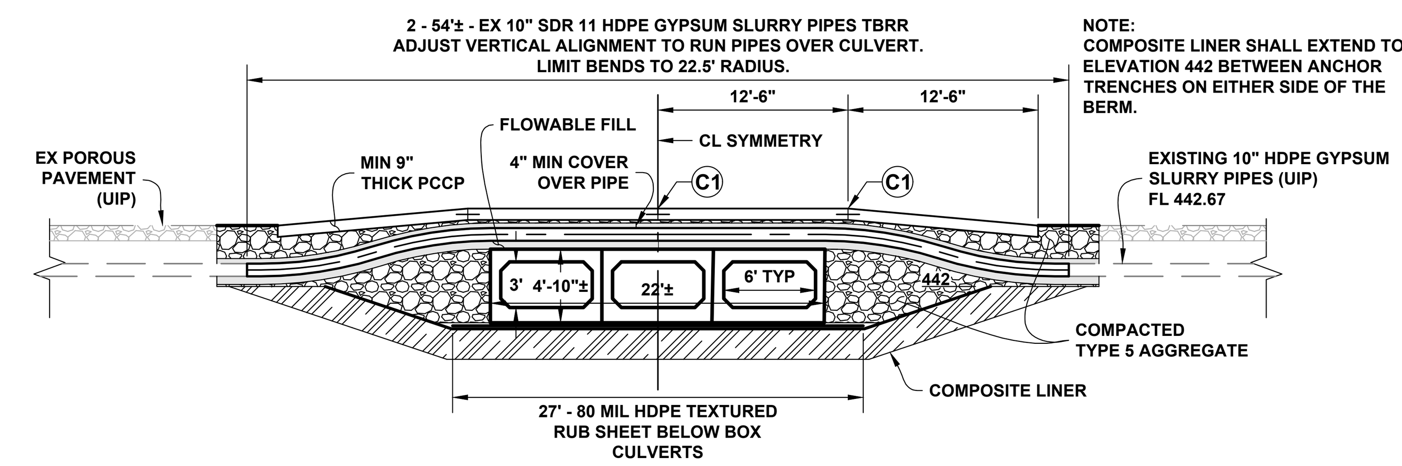

2 **OFF LOADING STATION SECTION**
SCALE: 1"=5'



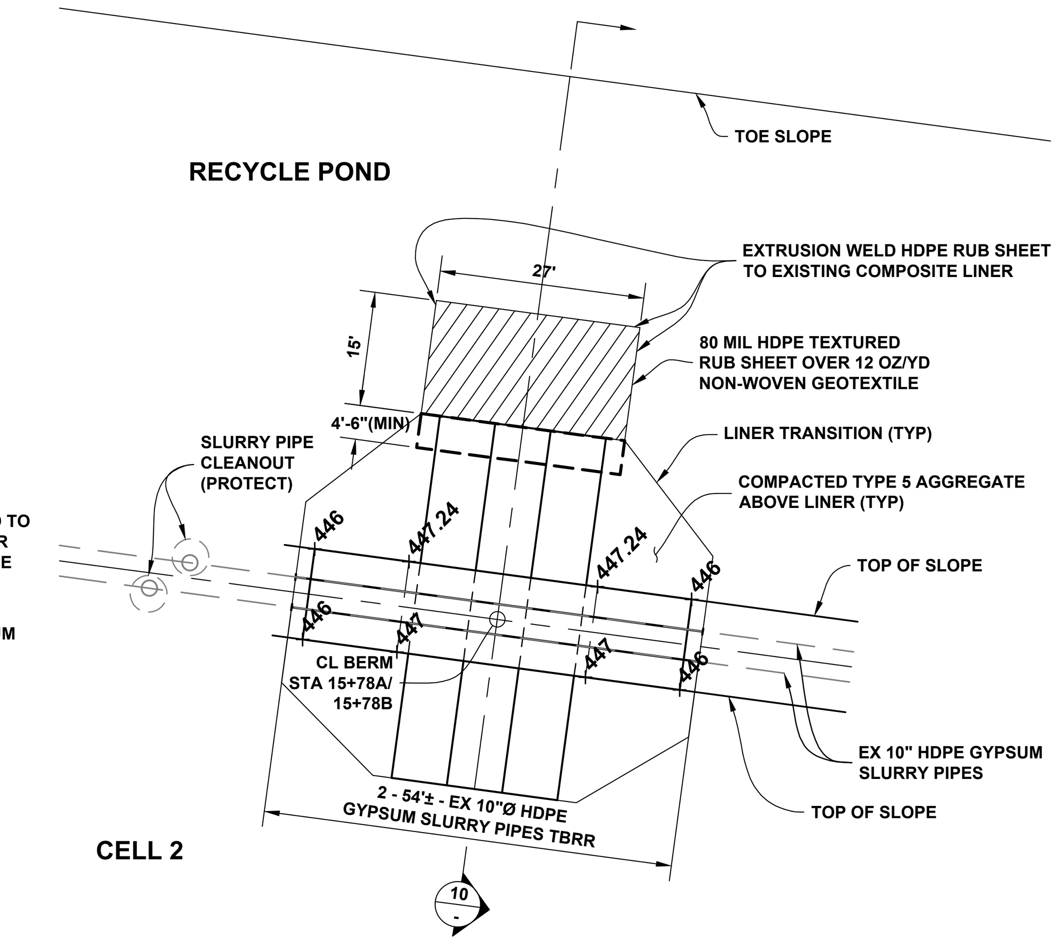

3 **OFF LOADING STATION REINFORCED CONCRETE BLOCK**
SCALE: 1"=5'



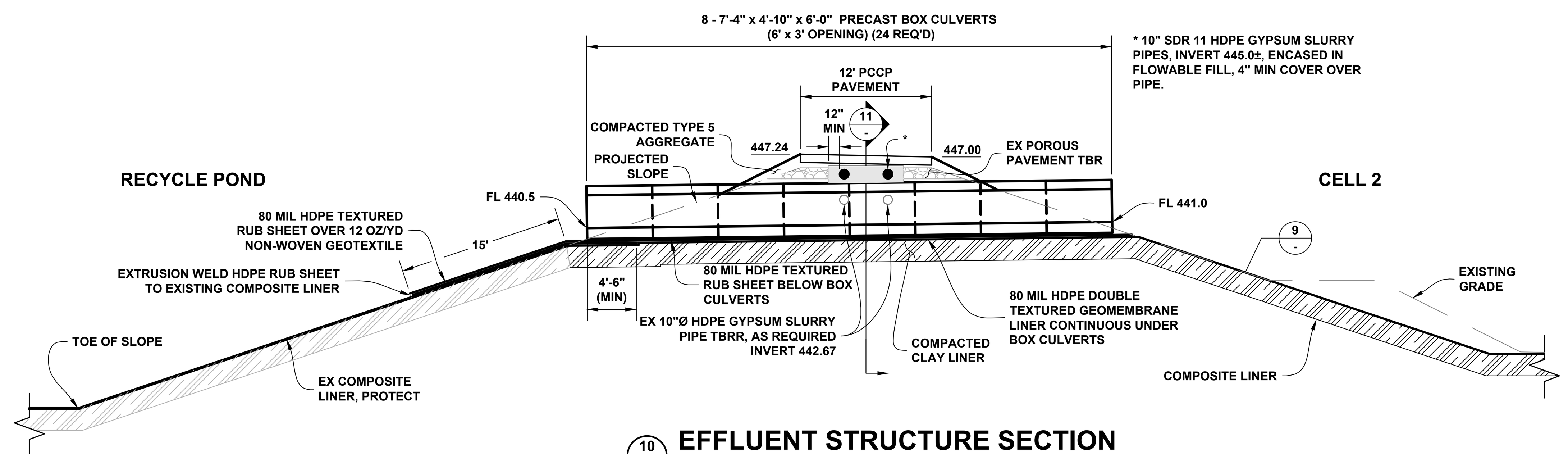

4 **INTEGRAL CURB**
NTS



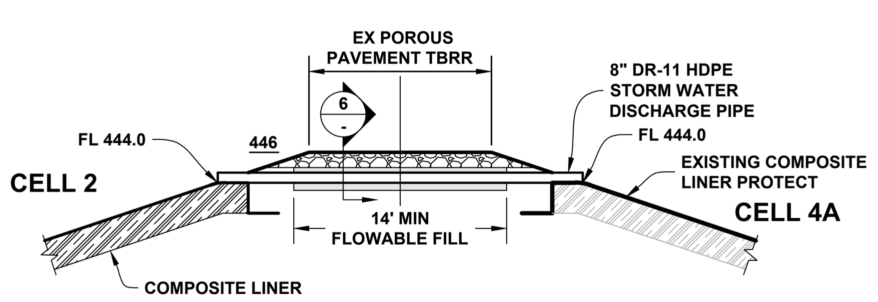

11 **EFFLUENT STRUCTURE SECTION**
SCALE: 1"=10'



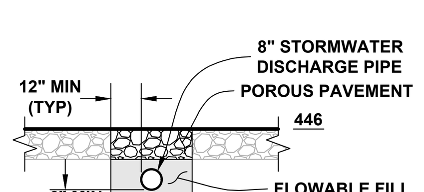

9 **EFFLUENT STRUCTURE PLAN**
SCALE: 1"=20'



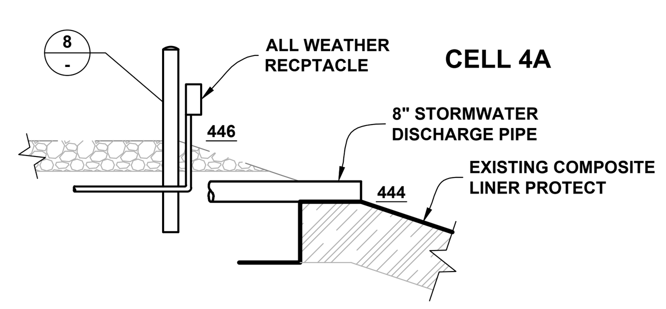

10 **EFFLUENT STRUCTURE SECTION**
SCALE: 1"=10'



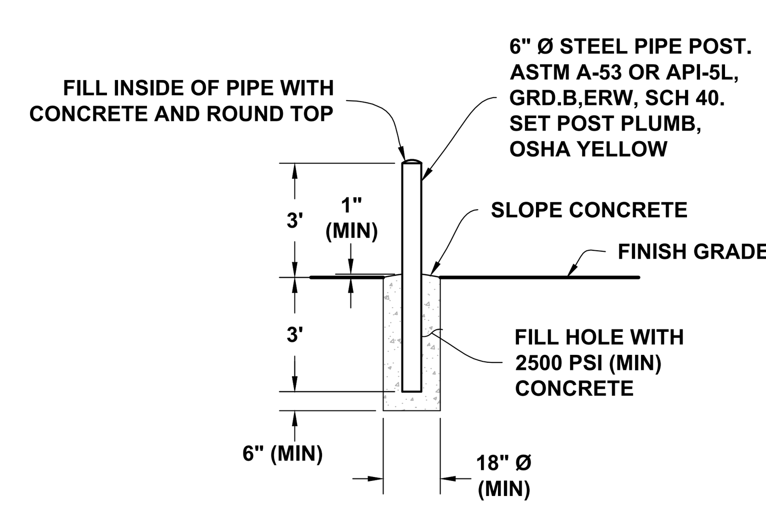

5 **STORMWATER DISCHARGE PROFILE**
SCALE: 1"=10'




6 **STORMWATER DISCHARGE SECTION**
1" = 5'




7 **STORMWATER DISCHARGE ELECTRIC SERVICE**
NTS




8 **PIPE BOLLARD**
NTS

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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| | |
|---|---|
| SCALE | VARIES |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

SUPERSEDES ---------- REV---- DATE --/--/----

# SIOUX ENERGY CENTER
# UTILITY WASTE LANDFILL - CELL 2
# GENERAL
# DETAILS

SITE: SIOUX ENERGY CENTER

DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
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| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

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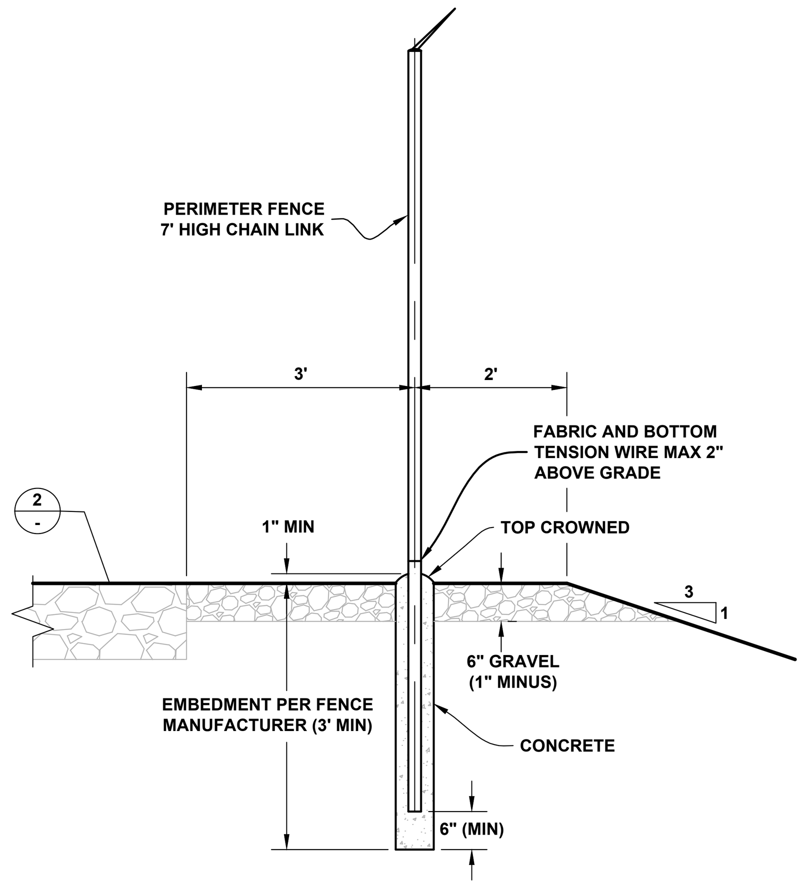
DRAWING NO.
SX-DWG-PROP-00026-006
REVISION NO. 004




## 1 PERMANENT PERIMETER FENCE TYPICAL INSTALLATION SECTION
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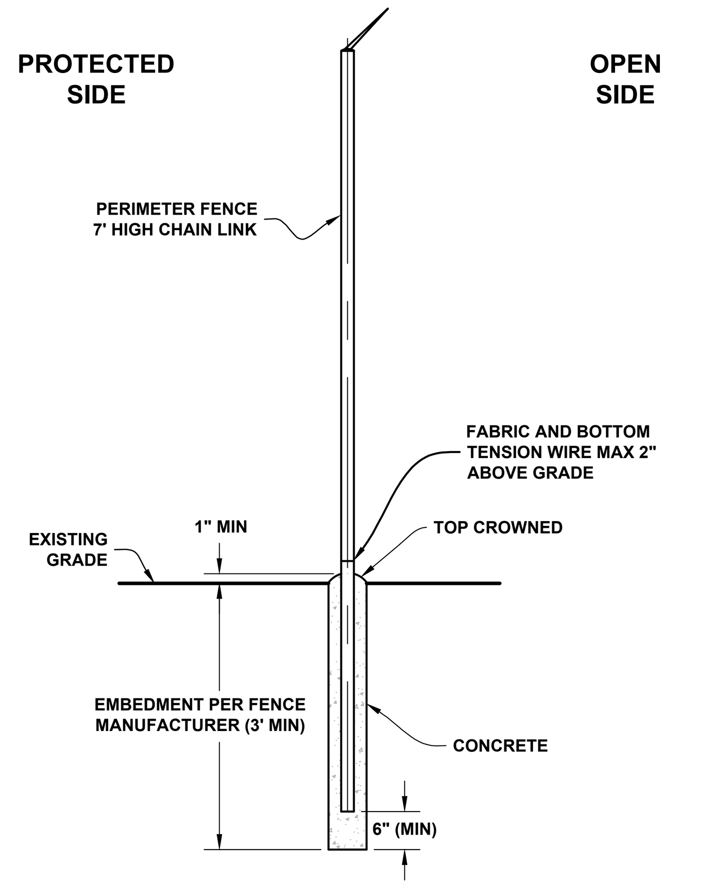


## 11 TEMPORARY OUTER FENCE TYPICAL INSTALLATION SECTION
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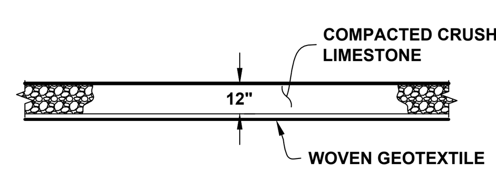


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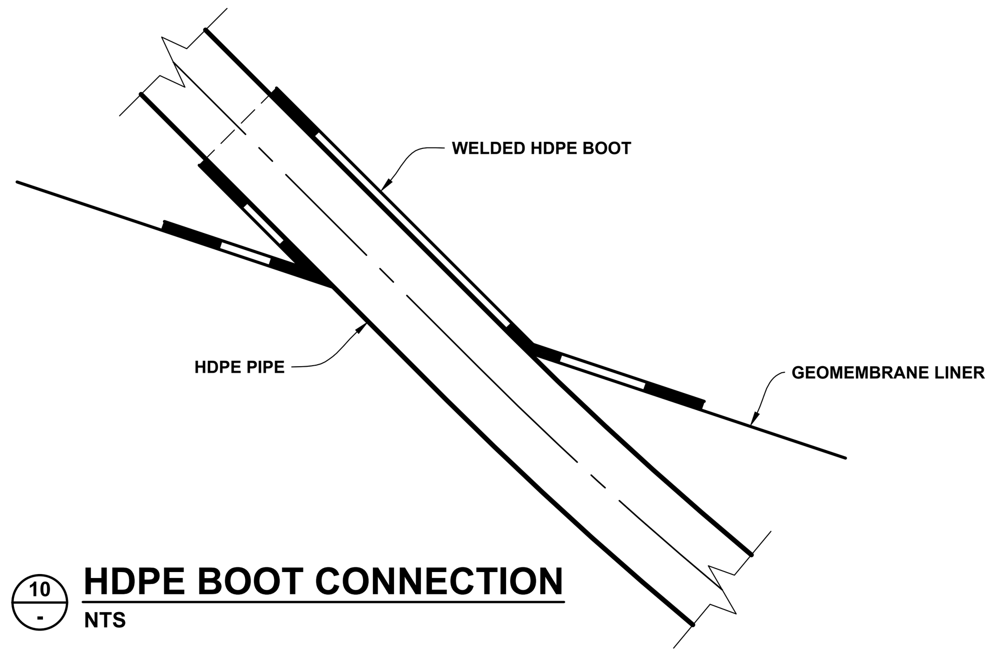


## 10 HDPE BOOT CONNECTION
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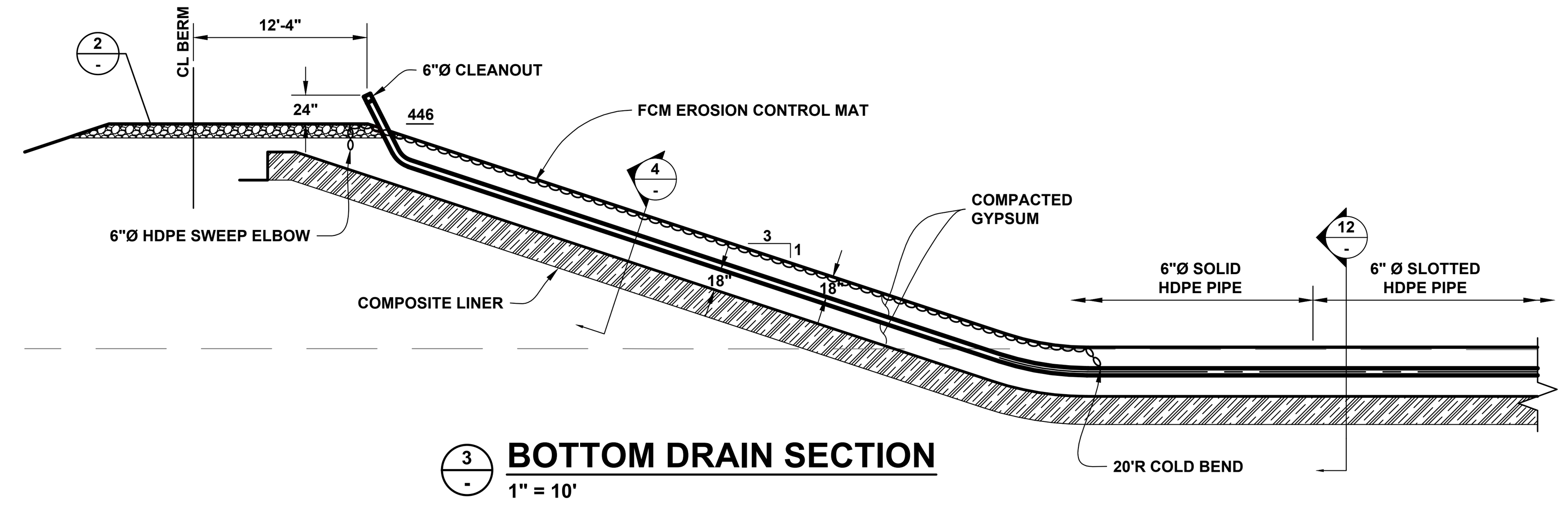
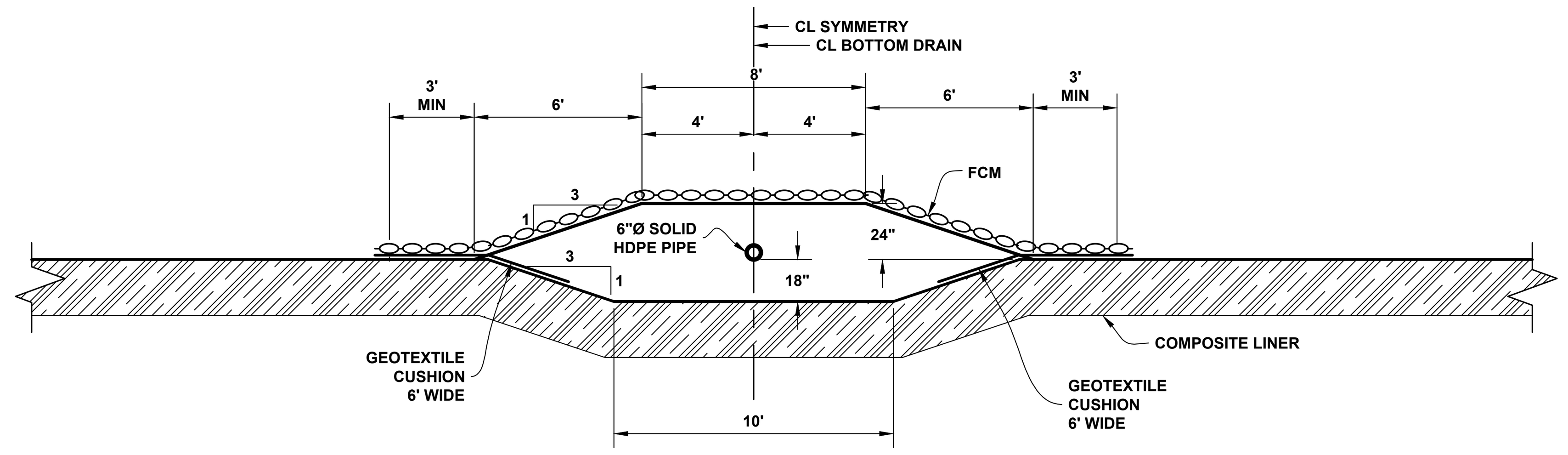
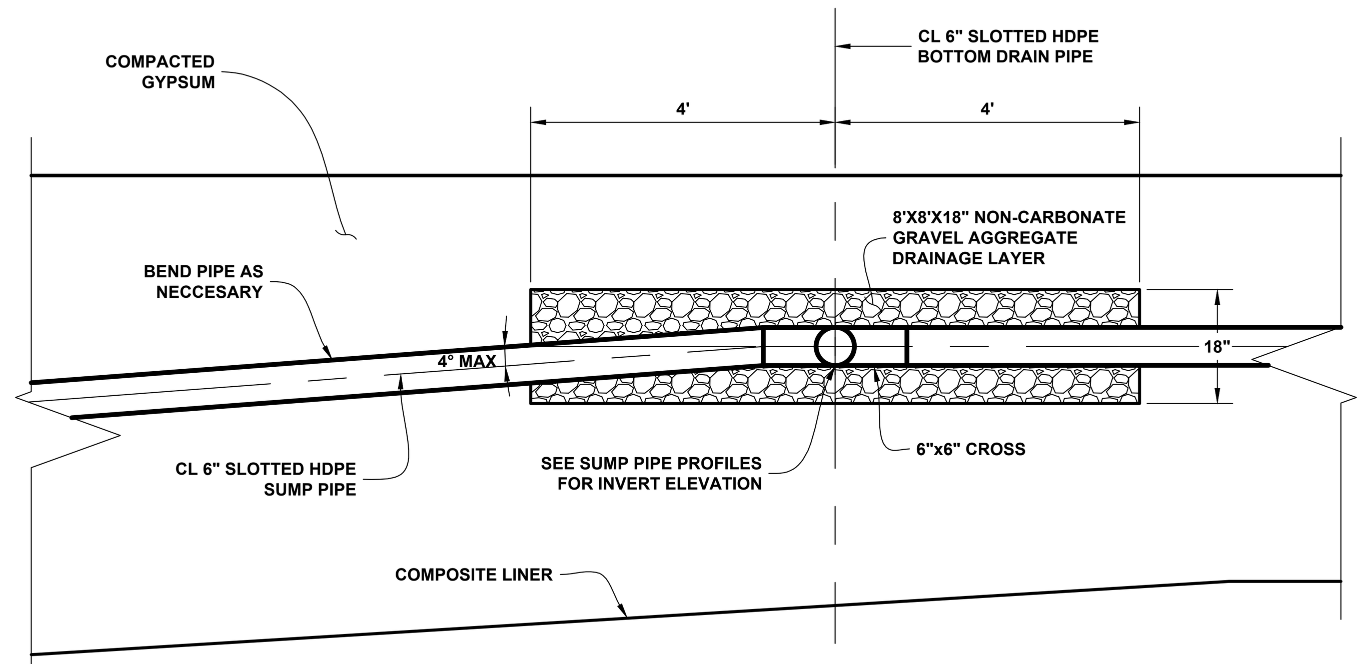


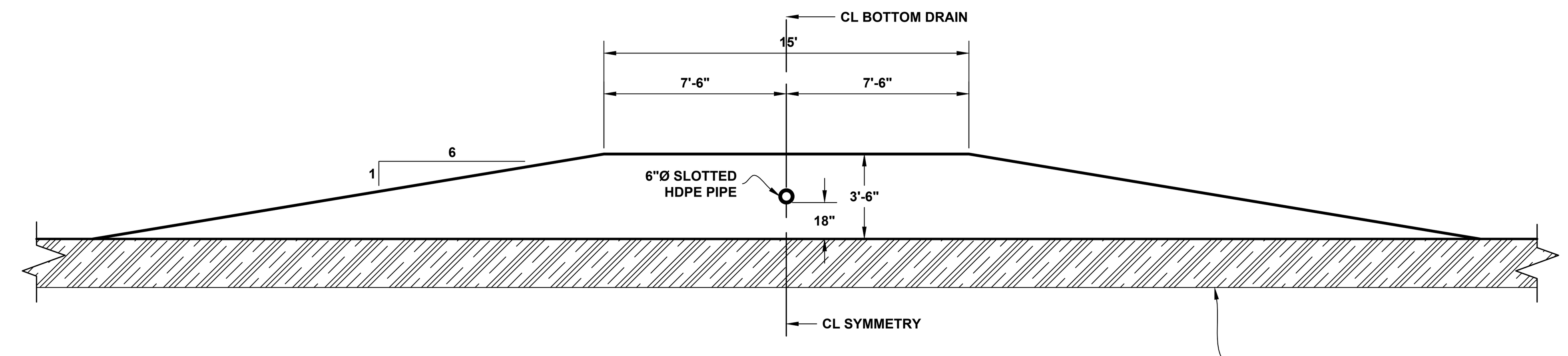

## 3 BOTTOM DRAIN SECTION
1" = 10'



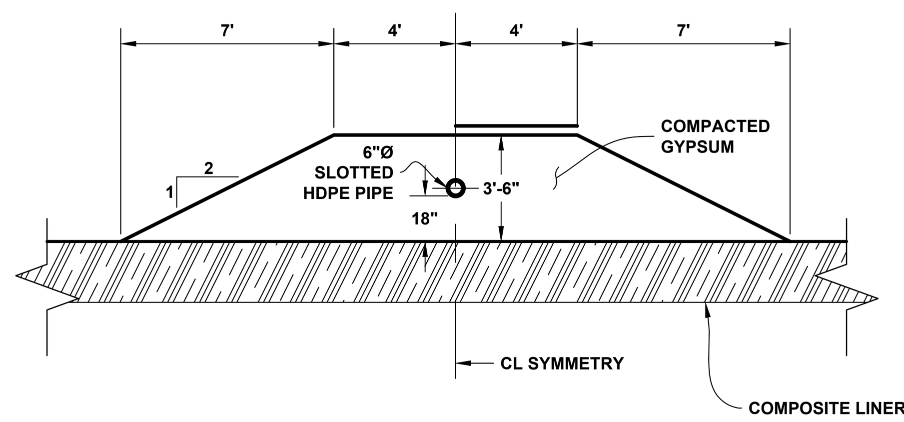

## 4 BOTTOM DRAIN SECTION ON 3:1 SLOPE
1" = 5'




## 5 SUMP AND BOTTOM DRAIN CONNECTION
1" = 2'




## 12 BOTTOM DRAIN SECTION
1" = 5'




## 14 SUMP PIPE SECTION
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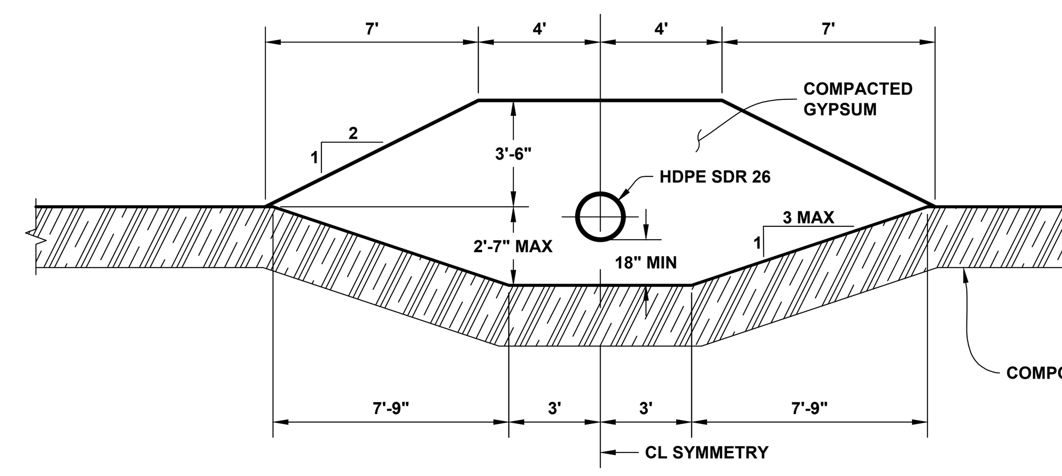


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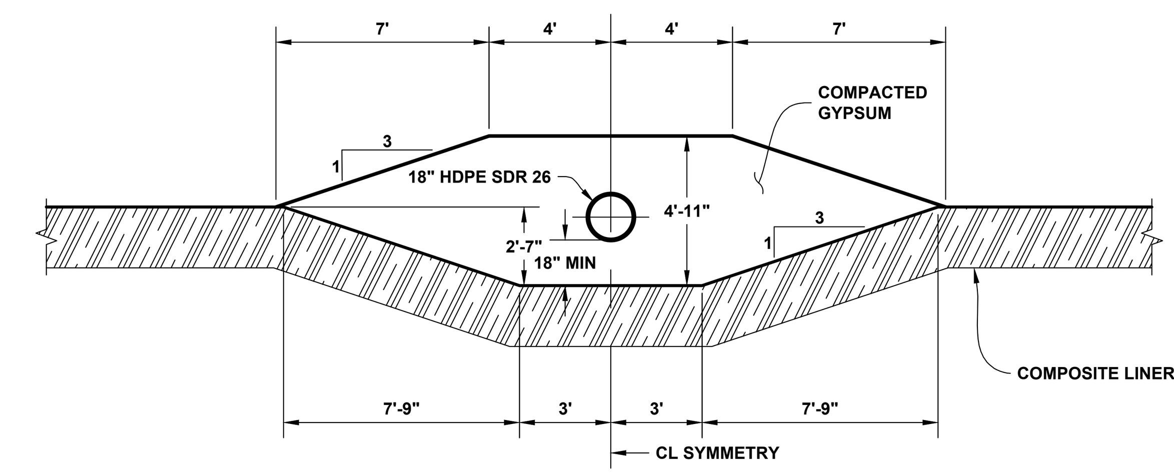


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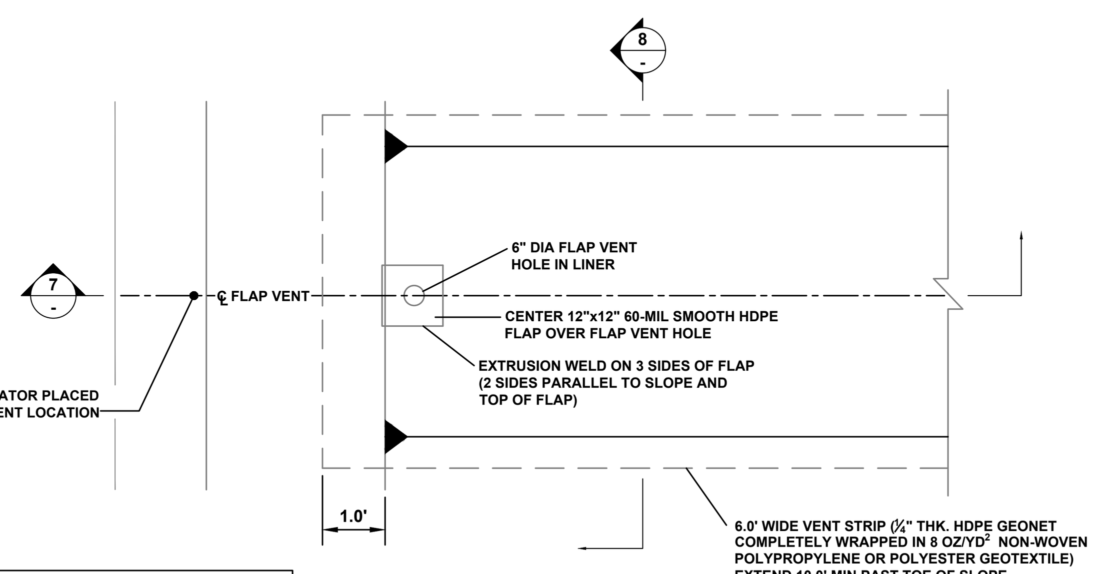
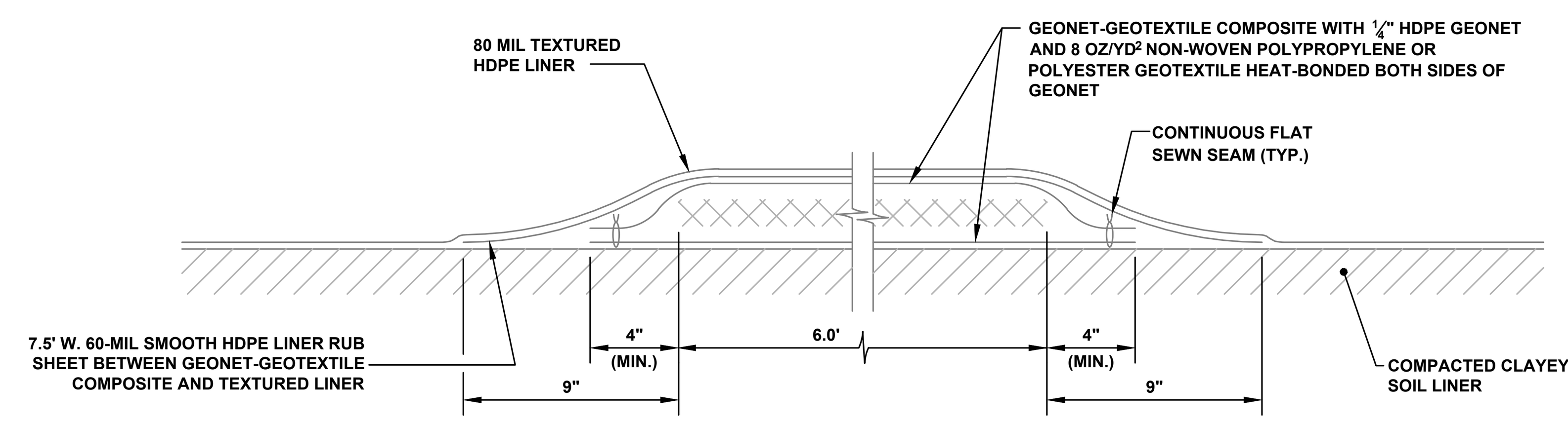



NOTE: TEMPORARY FLAP VENTS TO BE SEALED BY EXTRUSION WELDING OPEN SIDE OF FLAP PRIOR TO PLACING GYPSUM COVER ON LINER ON INSIDE SLOPE OF DIKE

## 6 AIR VENT PLAN
NTS




## 8 AIR VENT SECTION
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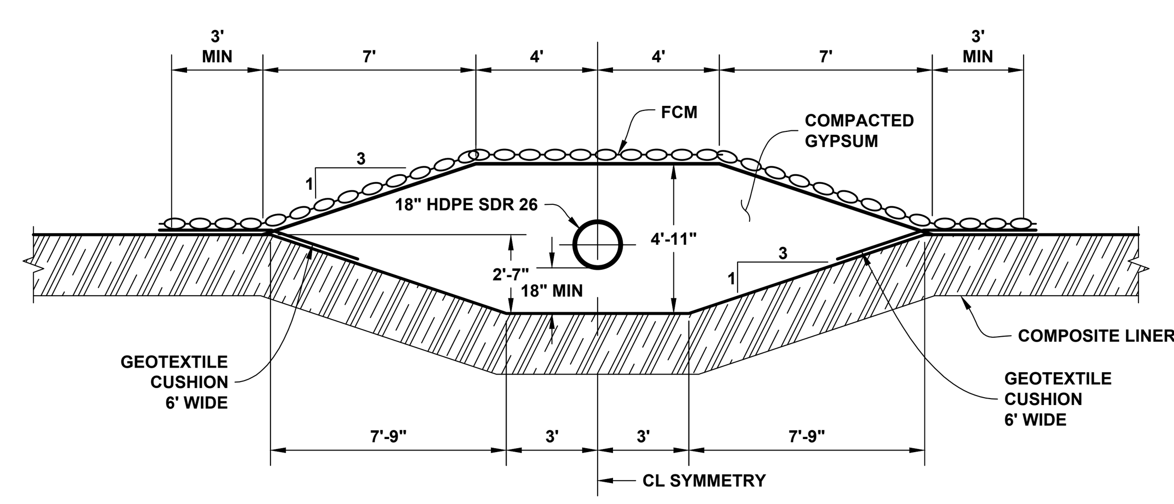


## 17 SUMP PIPE SECTION ON 3:1 SLOPE
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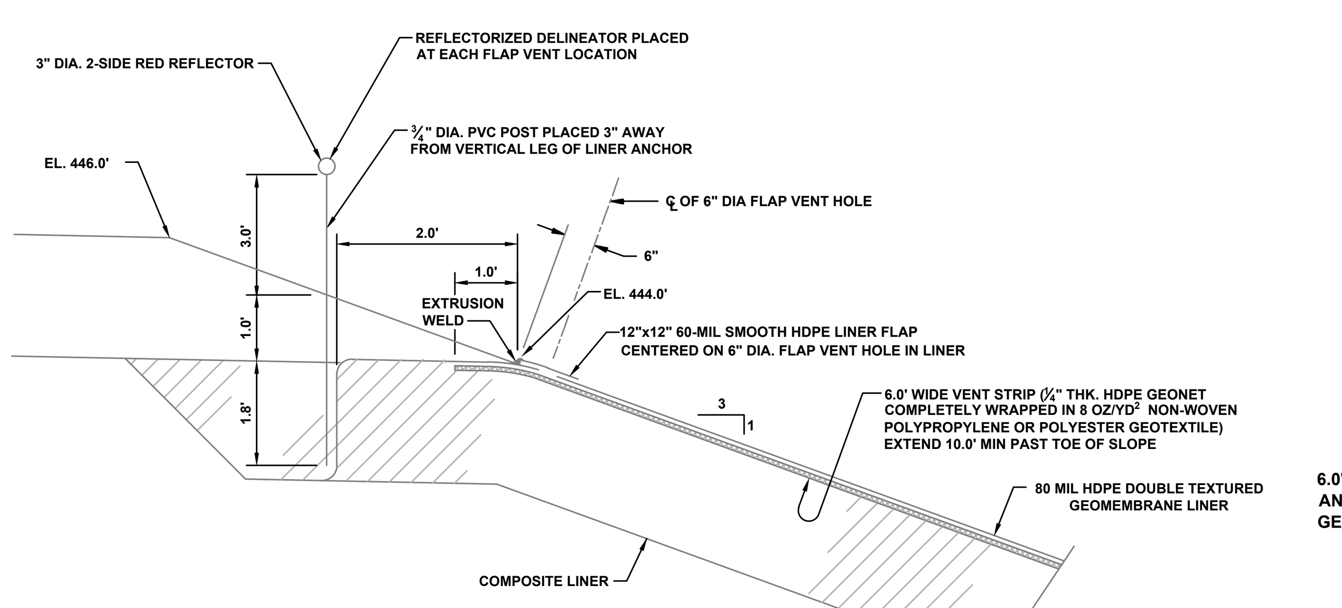


## 7 AIR VENT SECTION
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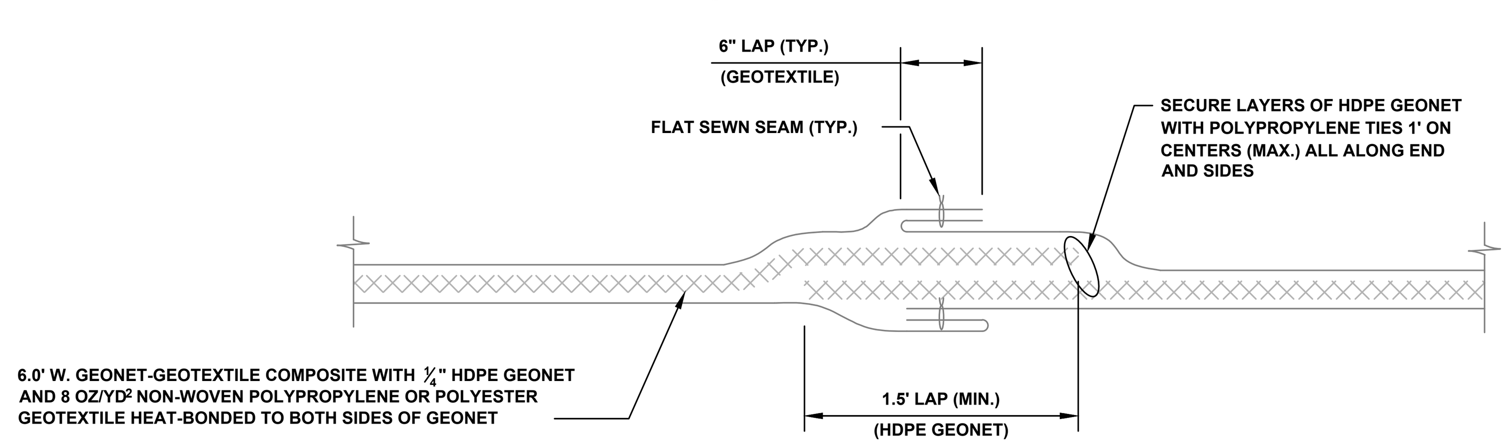


## 9 AIR VENT END TO END CONNECTION
NTS

## 13 RESERVED (NO DETAIL)

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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314.993.4132
Missouri Professional Engineering Corporation
License No. 000215

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| | |
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| SCALE | VARIES |
| UNIT NO. | NOT APPLICABLE |
| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

SIOUX ENERGY CENTER
UTILITY WASTE LANDFILL - CELL 2
GENERAL
DETAILS

SITE: SIOUX ENERGY CENTER

DRAWING RECORD

| REV. | DATE | PROJECT NO. | DRFTR | CHK'D | SUPV | ENGR | DESCRIPTION |
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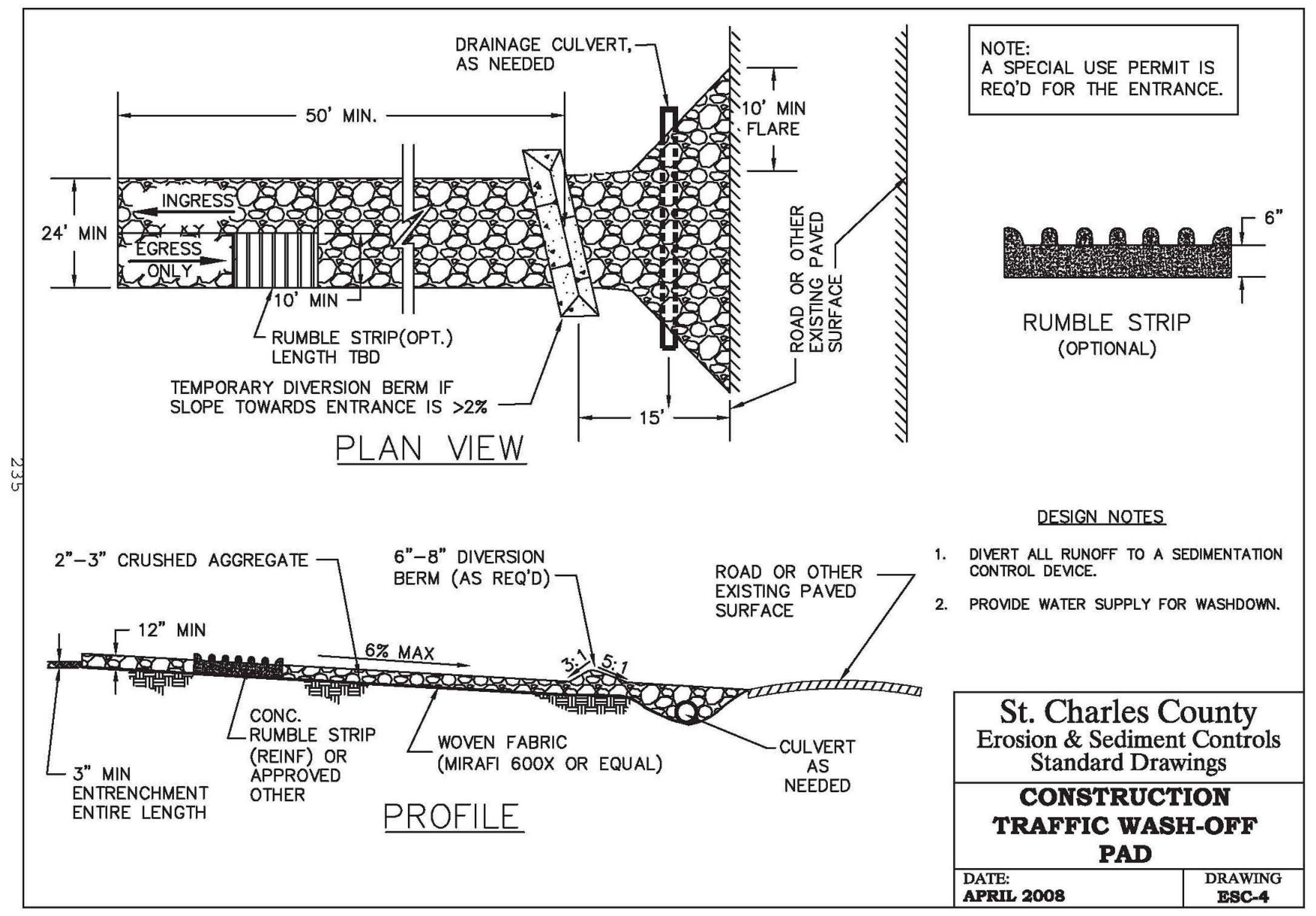
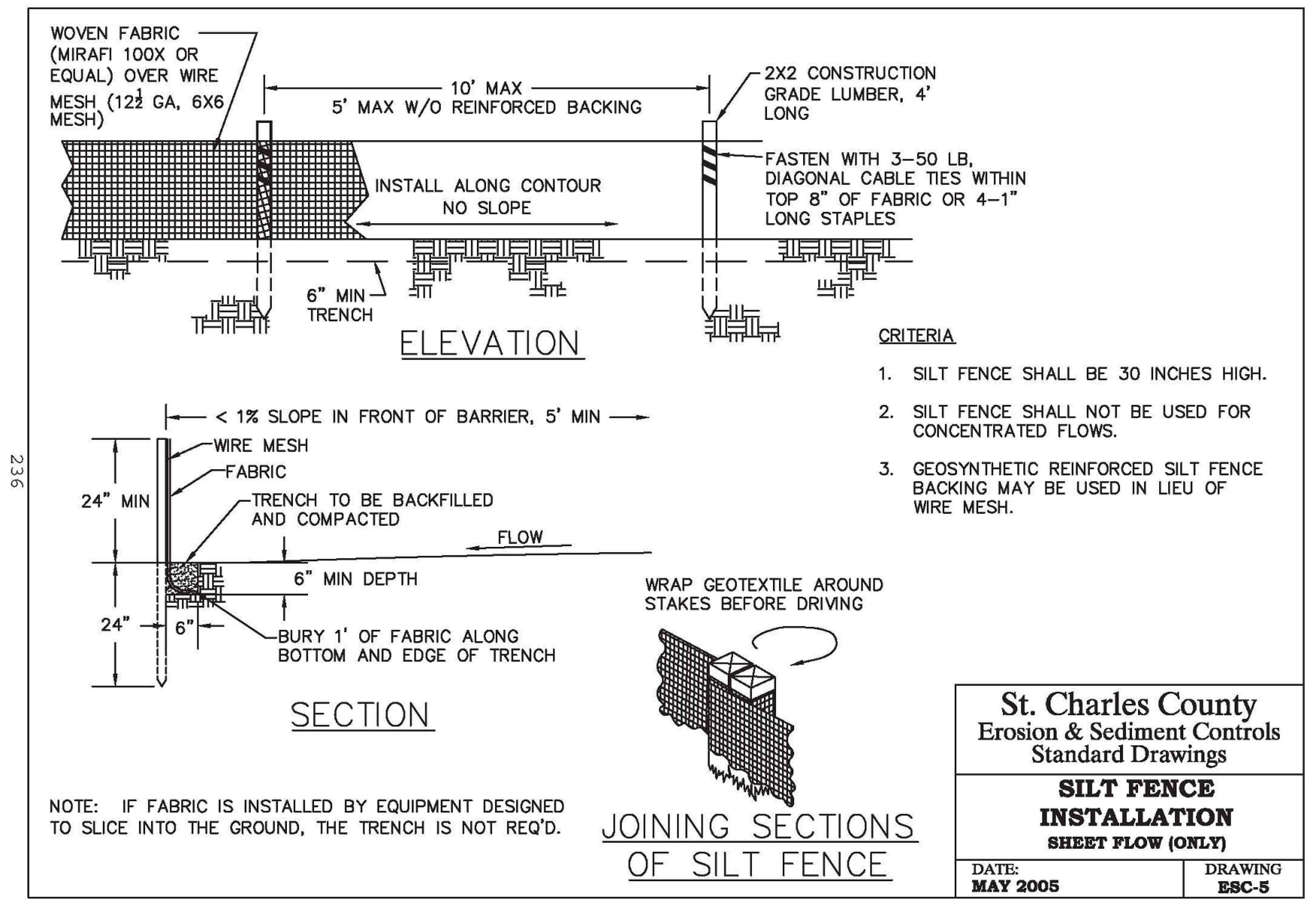
| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

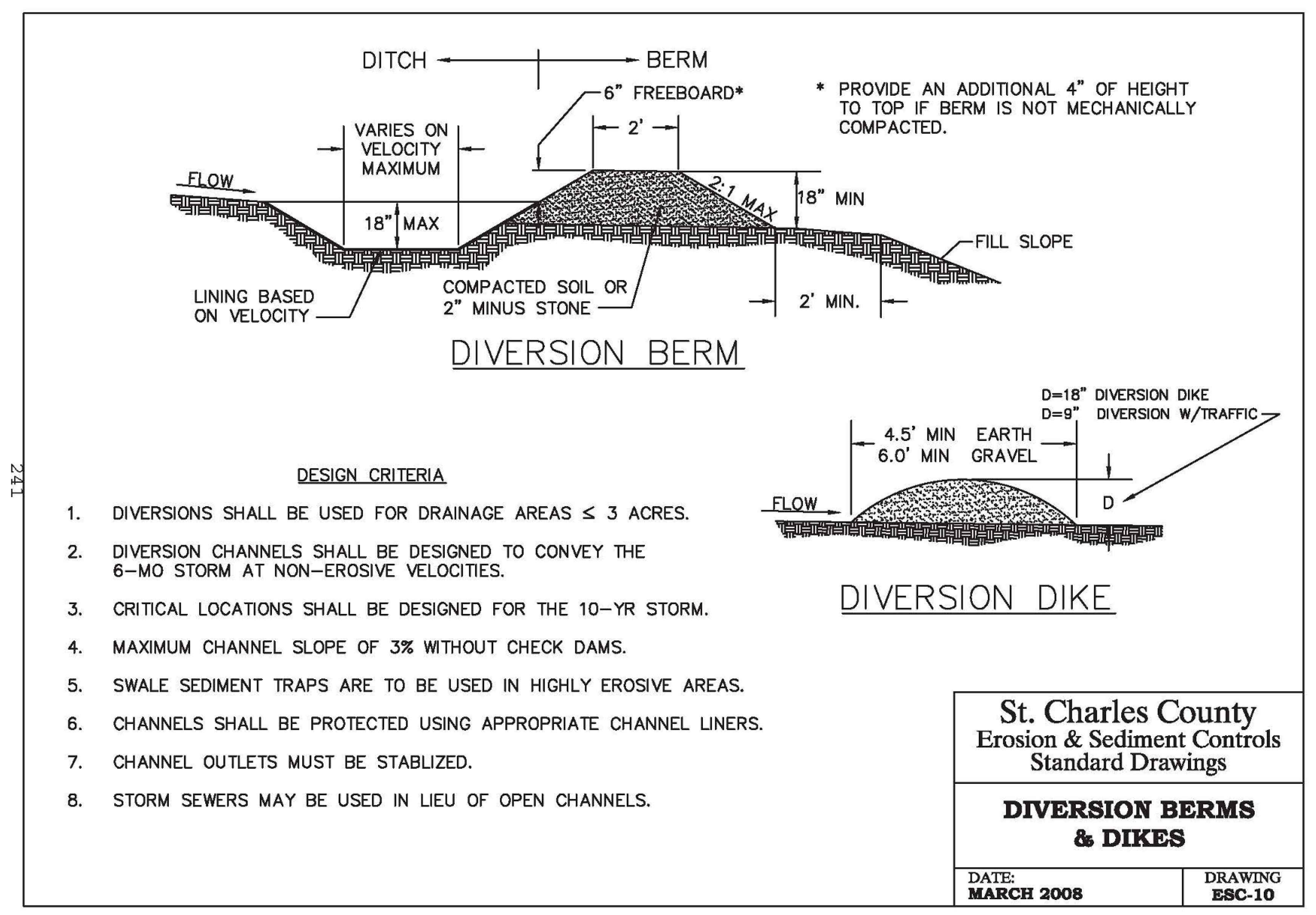
Ameren MISSOURI

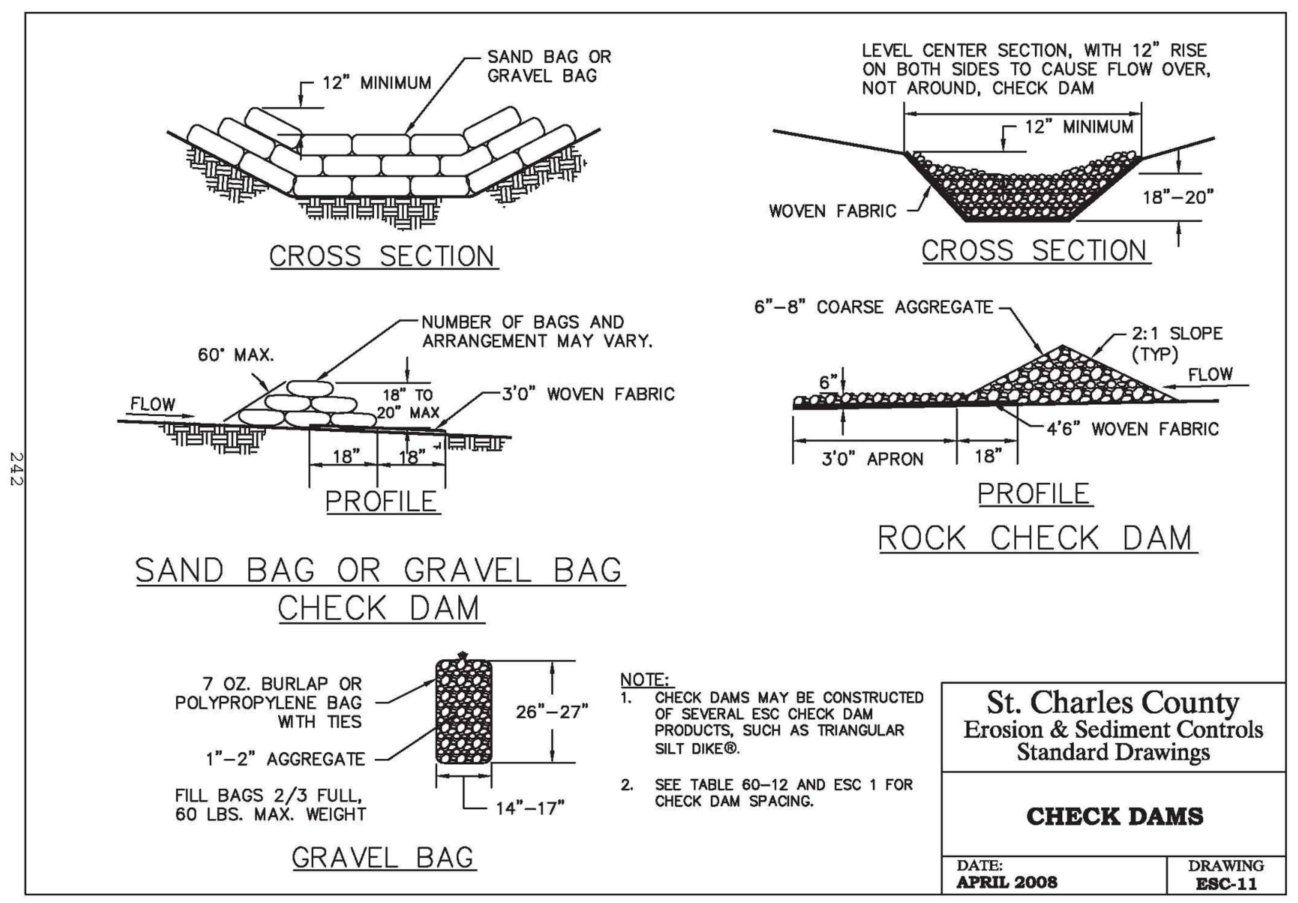
DRAWING NO. SX-DWG-PROP-00026-007

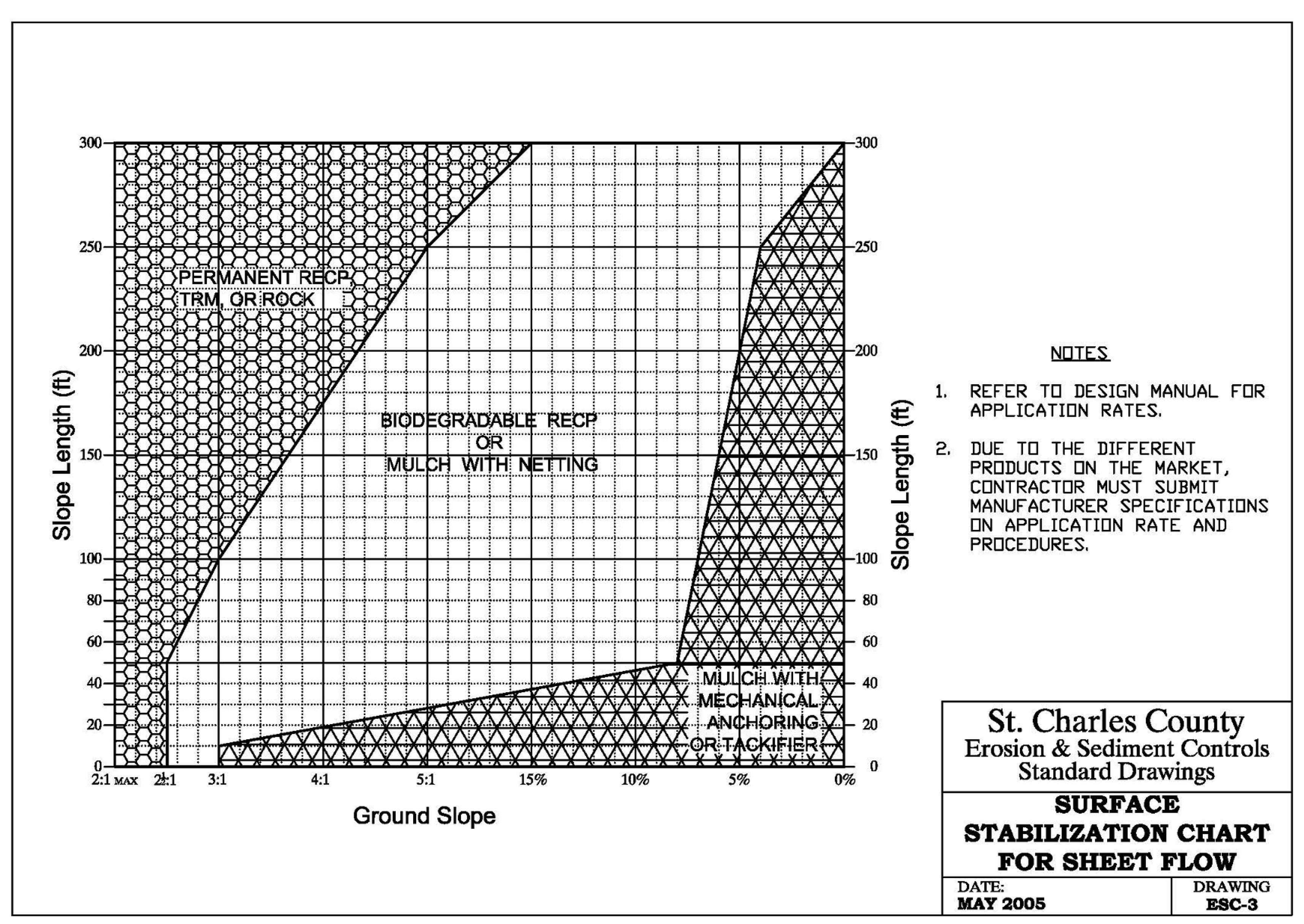
REVISION NO. 004




## GRADING SEDIMENT & EROSION CONTROL NOTES

1) Sediment and erosion control shall not be limited to the measures shown on the plans. The contractor, with the approval of the County inspector, shall utilize best management practices to prevent sediment from entering adjacent properties, roadways, storm sewers, and drainageways.

2) All filled places under proposed storm and sanitary sewer lines and/or paved areas including trench backfills within and off the road right-of-way shall be compacted to 90 percent of maximum density as determined by the "Modified AASHTO T-180 Compaction Test" (ASTM D-1557). All tests shall be verified by a Soils Engineer concurrent with grading and backfilling operations.

3) All filled places in proposed and existing St. Charles County roads (highways) shall be compacted from the bottom of the fill up to 90 percent maximum density as determined by the "Modified AASHTO T-180 Compaction Test" (ASTM D-1557). Paved areas in cuts shall meet the same compaction requirements. All tests shall be verified by a Soils Engineer concurrent with grading operations.

4) All trucking operations shall follow the approved trucking haul route. Concrete trucks shall have proper washouts, as approved by the County inspector. County and state roads shall be cleaned and kept clear of mud, sediment, and any other debris at all times throughout construction.

5) All on-site trash, litter, discarded building materials, other construction site wastes, and debris, either existing or from construction, must be removed and properly disposed of off-site. Debris and foundation material from any existing on-site building or structure which is scheduled to be razed for this development must be properly disposed of off-site.

6) Contractor shall provide sufficient temporary toilet facilities to serve the number of workers on the site.

7) Contractor shall provide the County Inspector information concerning storage and handling of all hazardous and toxic substances brought onto the site. The Contractor will adhere to applicable federal and state regulations concerning storage and dispensers, spill prevention control, and countermeasure plans for clean-up.

8) Any wells and/or springs which may exist on this property should be located and sealed in a manner acceptable to the St. Charles County Highway Department and the Building Code Enforcement Division of the Community Development Department.

9) Imported soils for backfill and clay liner will be obtained from the Central Stone Company's Ft. Belle Quarry in St. Louis County. The imported soil haul route will be from Ft. Belle Quarry along Highway 67 north to Highway 94 west entering the Ameren property at an existing crushed rock entrance off of Highway 94. Once on Ameren property the trucks will access the construction site along an existing gravel road. Empty trucks will leave the site at an existing entrance onto Dwiggins Road traveling east to Highway 94 ultimately returning to the Quarry. The existing gravel road and entrances onto Highway 94 and Dwiggins on Ameren Property will be improved with additional crushed rock and maintained to handle the truck traffic and a Construction Traffic Washoff Pad (ESC-4) will be added at the Dwiggins exit.

10) All construction vehicles and equipment will enter Ameren property from the existing entrance off Highway 94 and exit the site at the existing entrance onto Dwiggins Road.

11) When grading operations are completed or suspended for more than 30 days, permanent grass must be established at sufficient density to provide erosion control on the site. Between permanent grass seeding periods, temporary cover shall be provided according to the St. Charles County Director of the Division of Development Review. Temporary siltation control measures (structural) shall be maintained until vegetative cover is established at a sufficient density to provide erosion control on the site.

12) The following submittals are required prior to temporary and permanent seeding:

1. Seeding date
2. Seed mixture(s) and rate(s), supplier, purity percentage
3. Mulching material(s) and application rate(s)
4. Mowing height and schedule

Seeded areas shall be re-fertilized 4 weeks after initial seeding. All areas identified as bare and sparse (less than 30% ground cover) during the inspection shall be re-seeded and mulched. Grass shall not be cut until 4 inches of growth occurs.

13) The St. Charles County Erosion Control Inspector of the Community Development Department shall be notified a minimum of 48 hours prior to the commencement of clearing, grading, and/or prior to the commencement of construction to arrange for an inspection of the site.

14) Refer to Ameren's "Stormwater Pollution Prevention Plan for the Sioux Energy Center - Cell 2 Construction" and "Construction Specification SX-SPEC-000455 for the Utility Waste Landfill Cell 2" for additional details and requirements.

DATE: 12/27/2023
Jeffery Lynn Fouse
Professional Engineer
License No.: E-21043

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REITZ & JENS, INC.
CONSULTING ENGINEERS
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St. Louis, Missouri 63132
314.993.4132
Missouri Professional Engineering Corporation
License No. 000215

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| DWG. SIZE | 24x36 |
| SUB CLASS | 02010 |

**SIOUX ENERGY CENTER**
**UTILITY WASTE LANDFILL - CELL 2**
**SWPPP NOTES & DETAILS**
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SUPERSEDES ---------- REV.--- DATE --/--/----

DRAWING RECORD

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| 000 | 05/08/2020 | 25773 | mrf | phr | jlf | jlf | Issued for Bid |
| 001 | 12/15/2021 | 25773 | mjw | jlf | jlf | jlf | Issued for Rebid |
| 002 | 02/15/2022 | 25773 | mjw | jlf | jlf | jlf | Conformed Drawings |
| 003 | 05/24/2023 | 25773 | jbv | jlf | jlf | jlf | Conformed Drawings |
| 004 | 12/15/2023 | 25773 | jdb | jlf | jlf | jlf | As Built |

SITE: SIOUX ENERGY CENTER

Ameren MISSOURI

DRAWING NO. SX-DWG-PROP-00026-008

REVISION NO. 004

REPORT
2019012439

# AMEREN MISSOURI SIOUX ENERGY CENTER CONSTRUCTION PERMIT MODIFICATION FOR PERMITTED UTILITY WASTE LANDFILL (PERMIT NO. 0918301) ST. CHARLES COUNTY, MISSOURI

## REVISED GEOTECHNICAL ENGINEERING REPORT

Prepared for

Ameren
MISSOURI

Prepared by

Reitz & Jens, Inc.
CONSULTING ENGINEERS

STATE OF MISSOURI
JEFFREY LYNN FOUSE
NUMBER E-21043
REGISTERED PROFESSIONAL ENGINEER
1/24/2020

January 24, 2020

The Professional whose signature and personal seal appear hereon assumes responsibility only for what appears in the attached report and disclaims (pursuant to Section 327.411 RSMo) any responsibility for all other plans, estimates, specifications, reports, or other documents or instruments not sealed by the undersigned Professional relating to or intended to be used for any part or parts of the project to which this report refers.

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**CONSTRUCTION PERMIT MODIFICATION FOR**
**PERMITTED UTILITY WASTE LANDFILL**
**SOLID WASTE DISPOSAL AREA (PERMIT NUMBER 0918301)**
**ST. CHARLES COUNTY, MISSOURI**

**REVISED GEOTECHNICAL ENGINEERING REPORT**

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**CONSTRUCTION PERMIT MODIFICATION FOR**
**PERMITTED UTILITY WASTE LANDFILL**
**SOLID WASTE DISPOSAL AREA (PERMIT NUMBER 0918301)**
**ST. CHARLES COUNTY, MISSOURI**

**REVISED GEOTECHNICAL ENGINEERING REPORT**

# 1.0 HISTORY OF GEOTECHNICAL INVESTIGATION

## 1.1 Previous Revisions and Amendments

Reitz & Jens, Inc. (R&J) completed a geotechnical investigation for the design of the Utility Waste Landfill (UWL) for the Ameren Missouri Sioux Energy Center (SEC), located on Hwy. 94 in St. Charles County, Missouri. R&J was part of a design team for the UWL that included Gredell Engineering Resources, Inc. (GER) and Ardaman & Associates, Inc. (A&A). The principal component of the waste in the original UWL was gypsum, to be deposited in six wet stacks or cells. The gypsum is the by-product of the wet flue gas desulphurization (WFGD) scrubbers installed at the SEC. R&J's scope of work included: 1) field boring and laboratory testing programs to characterize the geotechnical engineering properties of the subsurface soils strata, 2) global stability analyses of the gypsum stack and the perimeter berm, 3) settlement analyses of the consolidation of the foundation soils, 4) liquefaction analyses of the foundation soils, 5) design of the perimeter berm, and 6) recommendations for the earthwork construction of the UWL. Because the wet gypsum stacks were to exceed 35 feet, the UWL was permitted as an industrial dam by the Missouri Department of Natural Resources – Dam and Reservoir Safety Program (MDNR-DRSP). Part of R&J's scope was compliance with the MDNR-DRSP regulations. The design of the gypsum stack – including the internal stability, drainage, liner, and operation – was the responsibility of A&A and was covered in a separate report. This geotechnical report pertains to R&J's scope of work. The original Geotechnical Report was included as Appendix K of the Construction Permit Application (CPA) submitted to the MDNR – Solid Waste Management Program (MDNR-SWMP) on January 29, 2007, and revised in September 2007. Construction Permit No. 0918301 was issued on March 28, 2008. Cell 1 and the Recycle Pond were constructed in 2008 and 2009, and began operation in 2010.

A modification to the original CPA was first submitted in June 2010 to change future gypsum Cells 4, 5 and 6 to be reconfigured as Cells 4, 5, 6 and 7 for the storage of dry Coal Combustion Residuals (CCRs) from the SEC. R&J's Geotechnical Report was revised accordingly in February 2011, August 2011, November 2011, and finally amended in August 2014. The August 2014 amendment has been incorporated into this revised Geotechnical Report. The modified Construction Permit No. 0918301 was approved in February 2013.

Construction of the western half of Cell 4 (designated "Cell 4A") was completed in November 2013. The third phase of the construction of Cell 4A was the initial filling with CCR (fly ash) to resist potential hydrostatic uplift on the bottom liner due to flooding. R&J submitted a Construction Quality Assurance (CQA) Summary Report for Phase 3 on May 29, 2014. This report included the results of additional laboratory testing on the fly ash placed in Cell 4A and additional slope stability analyses in response to questions from MDNR-SWMP during Phase 3. Also, this report included calculations of the resistance to hydrostatic uplift in response to questions from MDNR-SWMP. These findings have been incorporated into this revised Geotechnical Report.

## 1.2 Summary of Revisions for 2020 CPM

The Amended 2014 Geotechnical Report has been revised in accordance with the proposed changes to the SEC UWL, specifically: 1) the gypsum cells will not be wet stacked but will be closed with the gypsum left in place; 2) wet gypsum Cells 2 and 3 will be combined to form a single Cell 2; 3) an "aquiclude" geomembrane will be constructed below the composite liners in the new cells to comply with the EPA CCR Rule; and 4) the permanent caps for closure of the wet gypsum Cells 1 and 2 and dry CCR Cells 4, 5, 6 and 7 will include a HDPE membrane on the top and side slopes to comply with the EPA CCR Rule. The overall footprint of the UWL will not be changed. Also, the approved height of the dry CCR cells will not be changed (top el. 525).

The wet gypsum cells will not exceed a height of 35 feet. Therefore, no portion of the UWL will require regulation by the MDNR-DRSP. Cell 1 was built under MDNR-DRSP Construction Permit C-426 (MO40160), which had to be renewed annually as Cell 1 would be "under construction" until it was closed. This permit is no longer required. The gypsum in Cell 1 was never "wet stacked" above the perimeter berm. The configuration of the closed Cell 1 as described in the 2020 CPM is analyzed for slope stability and settlement herein. The original Geotechnical Report addressed dam safety requirements – dam type and downstream environmental class, seismic analyses, precipitation and spillway capacity, and operations and maintenance. Because the gypsum cells are no longer regulated by the MDNR-DRSP, these sections have been removed except for the seismic analyses. The seismic analyses have been significantly revised as explained in Section 5.

### 1.2.1 Field Investigation

No additional geotechnical field investigation was required because the UWL will occupy the same footprint. The geotechnical investigation for the UWL was completed in two phases: Phase 1 for the Detailed Site Investigation, and Phase 2 for the construction permit application. The description of the geotechnical investigation from the original approved CPM is included herein.

### 1.2.2 Laboratory Testing

No additional laboratory testing of soils was completed for this revision. Additional laboratory testing on CCR (fly ash) was performed previously for the modification to the CPM in 2011 for the addition of the dry cells. Also, additional laboratory testing on CCR from Cell 4A was performed in response to questions from MDNR-SWMP on the Phase 3 CQA Report for Cell 4A. These additional tests are included in this revised report, as explained in Section 3.3.

### 1.2.3 Seismic Risk Assessment and Analyses

The original seismic analyses for the Sioux UWL was based upon the criterion established in the MDNR-DRSP regulations. The required design criterion for an industrial water retention dam over 50 feet high and a Class II downstream environment was 0.5 PMA or 0.10g. Because Ameren will not be wet-stacking the gypsum in Cells 1 and 2, the UWL will no longer be regulated by the MDNR-DRSP. Therefore, the seismic design criterion has been revised to comply with the EPA 2015 CCR Rule. The seismic acceleration was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground

Acceleration (PGA) for the geometric Maximum Credible Earthquake ($MCE_G$) with a 2% probability of exceedance in 50 years. The basis for the seismic analyses is presented in Section 5. The potential for liquefaction of the subsurface soil strata were analyzed for the revised PGA and are presented in Section 6.0.

### 1.2.4 Slope Stability Analyses

The stability of the side slopes of the perimeter berms and the CCR fill at six sections were analyzed which had varying geometries and subsurface soil profiles. Each section was analyzed for the short-term (end of construction) geometry and for the completed cell, and using the short-term and long-term shear strength properties as appropriate. The seismic loading conditions were also analyzed, as well as the post-seismic condition with liquefaction occurring in the subsurface soil strata where indicated by the liquefaction analyses. Potential sliding block failures along the interface with the composite liner and aquiclude and the stability of the final cover were also analyzed. All of these analyses demonstrate that the proposed design meets or exceeds the minimum factors of safety for slope stability in accordance with the MDNR-SWMP regulations, the *Draft Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities* by MDNR-SWMP and Dr. Timothy Stark, and the EPA CCR Rule. Because the factors of safety against slope failure under the design seismic event were all greater than 1.0 for the various sections, the potential lateral displacement would be minor. The potential lateral displacements due to the seismic load were not estimated.

### 1.2.5 Settlement Analyses

The consolidation of the subsurface soils and the resulting settlement of the final UWL was estimated using the data from the boring logs and data from Cone Penetrometer Test (CPT) soundings for the Sioux Energy Center. The analyses were done using the SETTLE3D. These results demonstrate that the composite liner will not be subjected to damaging strains due to settlement. Also, the top of the perimeter berms will not settle below the 100-year flood level. The estimated settlement was used for design of the leachate collection system for the dry cells. Potential settlement due to liquefaction was also considered.

### 1.2.6 Impacts Due to Flooding

Because the site of the UWL is located in a floodplain, the Missouri solid waste regulations require that the design of the UWL prevent damage to the composite liner that could result from hydrostatic uplift during the 100-year flood. This requirement is satisfied by the initial operation of the UWL, during which sufficient process water will be placed in the wet cells or CCR fill will be placed in each dry cell to resist the hydrostatic uplift. The design of the perimeter berms prevents flood water from contacting the CCR in the cells. Another potential consequence of flooding would be erosion of the west perimeter berm and a portion of the south perimeter berm for Cell 1 should there be a breach of the BNSF Railroad embankment to the south of the UWL such as occurred in 1993. Riprap erosion protection has been designed for such an occurrence.

### 1.3 Summary Conclusion

Other findings and recommendations in this Geotechnical Report pertain to the bearing capacity of subsurface soils, earthwork construction procedures, soil material requirements, and quality assurance. Our professional engineering judgment is that the Sioux Energy Center UWL design and operating procedures described in this report are in accordance with generally accepted engineering practice, utilizing conservative assumptions where necessary, and therefore meet or exceed all of the requirements of the Missouri Soil Waste Management Law and Regulations, MDNR-SWMP engineering guidelines, and the EPA CCR Rule.

## 2.0 GEOTECHNICAL INVESTIGATIONS

No additional geotechnical field investigation was required because the UWL will occupy the same footprint. Therefore, the following Section 2 has not changed. The geotechnical investigation for the UWL was completed in two phases: Phase 1 for the Detailed Site Investigation, and Phase 2 for the construction permit application.

### 2.1 Detailed Site Investigation (DSI)

The field investigation for the DSI consisted of 57 geologic test holes (PZ-1 through PZ-57), in which PVC standpipe piezometers were installed, and 57 geotechnical borings (B-58 through B-114). The locations of these test holes and borings are shown in Figure 1. Fifty of these borings, B-58 through B-107, were located along the proposed alignment of the perimeter berm at that time (Fall 2005). The borings were alternately staggered approximately 50 feet on either side of the proposed centerline of the berm to provide a broader coverage, and were spaced approximately 250 feet apart. Seven other borings were made on the inside and outside of the proposed berm, to provide cross-sections of the subsurface conditions for stability analyses and settlement calculations.

All but three of the borings were made to a minimum depth of 30 feet. Three borings (B-58, B-75 and B-113) were extended to auger refusal, primarily to obtain N-values from the Standard Penetration Test (SPT) for seismic site classification and liquefaction analyses. The shallow borings were extended beyond the minimum depth of 30 feet to a depth where the following two criteria were met: 1) the uncorrected N-value from the Standard Penetration Test (SPT) was a minimum of 12 blows/foot, and 2) the last 15 feet of soil was classified as sand or gravel (Unified Soil Classifications of SW, SP, SM, GW,GP, GP-SP). The actual depths of the shallow borings were all 31 to 31.5 feet; that is, the two criteria were met at the planned minimum depth. The three deep borings were extended to drilling or sampler refusal on bedrock. The final depths of the deep borings were: 114.15 feet in B-58, 115.5 feet in B-75, and 114.85 feet in B-113.

Details of the Phase 1 geotechnical investigation and the individual boring logs are included in Appendix 7 of the report "Detailed Geologic and Hydrologic Site Investigation Report for AmerenUE Sioux Power Plant Proposed Utility Waste Disposal Area, St. Charles County, Missouri," Volume 2, August 2006.

### 2.2 Phase 2 Investigation

Geotechnical samples were not taken from the geologic test holes. The Phase 1 geotechnical borings were limited to the proposed alignment of the perimeter berm. Additional samples were needed throughout the area of the UWL to quantify the soils on site that would be suitable for construction of the liner and final cover. Also, the potential borrow area south of Dwiggins Road and north of the right-of-ways for the buried petroleum pipelines ("South Borrow"), and the area between Ameren's railroad spur into the Sioux Plant and the proposed western edge of the UWL ("West Borrow"), had to be investigated. Therefore, a second field investigation was done over four days between October 17 through 24, 2006.

The Phase 2 investigation consisted of 90 test holes (TH-115 through TH-205, without TH-179), the approximate locations of which are shown in Figure 1. These tests holes were located between the geologic test holes to maximize coverage of the UWL area. Each test hole was "continuously" sampled using hydraulically-pushed 3-inch O.D. Shelby tubes. Each Shelby tube was pushed 24 inches, beginning at the ground surface. The test hole was cleaned with a 4-inch diameter continuous-flight auger after each sample was taken. The sampling was continued to approximately el. 420. The elevation at the ground surface was estimated from the topographic survey by Kuhlmann Design Group (K*d*G). The field work was directed by R&J's geotechnical engineer. All Shelby tubes were sealed with plastic caps and duct tape, and taken to R&J's lab.

## 3.0 LABORATORY TESTING

No additional laboratory testing was performed on soils for this revision. Additional laboratory testing on CCR (fly ash) was previously performed as explained in Section 3.3. The other portions of Section 3.0 have not been changed from the previous Appendix K.

### 3.1 Classification of Phase 2 Test Holes

All of the Phase 2 Shelby tube samples were extruded in R&J's lab. The soil samples were classified and logged by a senior soils technician in general accordance with ASTM D2487-00 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" and D2488-00 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." The samples were sorted into five groups based upon the visual soil classification: 1) high plastic clay, 2) low plastic clay, 3) borderline silty clay or clayey silt, 4) non-plastic silt, and 5) sand. The non-plastic silt and sand were discarded because these soils would not be suitable for the liner or final cover. Moisture content and dry unit weight were measured on selected samples, to develop shrinkage factors for construction. The results of the classification of the samples are presented in the table in Appendix A.

### 3.2 Tests on Natural Soil Deposits

The general purpose of the Phase 1 testing program was to obtain soil properties for the determination of: bearing capacity, short-term and long-term slope stability, seepage characteristics of the top stratum fine-grain soils and the underlying sand strata, grain-size analyses for liquefaction potential, settlement characteristics, and soil classifications for the potential use of soils for fill materials. The procedures for assigning lab tests and the results are presented in Appendix 8 of the above-referenced DSI report. Grain-size analyses (ASTM D422) were performed on selected cohesionless samples (Unified Soil Classifications of SW, SP, SM, GW, GP, GP-SP). If the percentage of fines (passing #200 U.S. sieve) was greater than 25%, then a hydrometer analysis would have been performed on the fine-grain portion of the sample. A total of 186 grain-size analyses were performed. No hydrometer analyses were run.

Unconsolidated-undrained (U-U) triaxial shear strength tests (ASTM D2850) were performed on selected Shelby tube samples from each major cohesive soil stratum. The U-U tests were performed at the estimated confining pressure of the sample in the field conditions, to measure the *in situ* shear strength of the soil. Twenty-six U-U tests were performed.

Series of consolidated-undrained (C-U) triaxial shear strength tests (ASTM D3080) were performed on each major cohesive soil stratum and at intervals around the proposed perimeter berm. The tests were performed with the measurement of internal pore water pressures so that the effective strength properties of the soil could be determined. Ten series of C-U tests were performed.

Four one-dimensional consolidation tests (ASTM D2435) were performed on selected relatively undisturbed Shelby tube samples from each major cohesive soil stratum beneath the UWL.

Six flexible-wall hydraulic conductivity tests (ASTM D5084) were performed on selected relatively undisturbed Shelby tube samples of the upper clays.

The results of the triaxial shear strength tests, consolidation tests and hydraulic conductivity tests are summarized in Table 1.

### 3.3 Tests on CCR from Sioux Plant

It was originally planned that ash from the Sioux Plant will be used for construction of at least a portion of the perimeter berm and possibly some interior dikes. R&J performed a study in 2002 of the geotechnical engineering properties of the ash stored in the pond at Sioux Plant for the construction of a railroad loop expansion at the plant. A description of the study and the results are reproduced in Appendix 2.

Two series of consolidated-undrained (CU) triaxial compression tests with pore pressure measurements were run on samples of the fly ash from the Sioux Plant, to obtain the effective cohesion (c') and effective internal friction angle ($\phi$') for new stability analyses. A bulk sample of the fly ash was obtained from the fly ash that Kolb Construction hauled into Cell 1 for the construction of the ring drain and access roads. Cylindrical test specimens of the fly ash were formed in two ways: Sample 1 was formed in a mold with as little compaction as possible so as to form a specimen that still could be prepared for testing; Sample 2 was compacted in a mold to 100% of the maximum dry unit weight ($\gamma_d$) based on the standard Proctor Moisture-Density tests performed on the fly ash for construction of the ring drain in Cell 1. The $\gamma_d$ of Sample 1 was 64.1 lbs/ft$^3$ (pcf). This represents the condition of the fly ash if it is placed in the dry cell with minimal compaction. In practice, some compaction of the fly ash will be necessary for the dozers,

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Table 1: Geotechnical Properties of Samples from Phase 1 Borings

| | | | | | | | | Undrained Shear Strength Properties | | Effective Shear Strength Properties | | Consolidation Properties | | | Hydraulic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boring No. | Sample No. | Sample Depth | USCS Class. | Moisture Content % | Dry Unit Weight pcf | Liquid Limit % | Plasticity Index % | Cohesion c, psf | Friction Angle, $\phi$ | Cohesion c', psf | Friction Angle, $\phi'$ | Pc psf | Recomp. Index Cs | Comp. Index Cc | Conduct. k cm/sec |
| B-58 | ST-2 | 4 | CH | 34 | 85.2 | 71 | 62 | | | | | | | | 5.0E-08 |
| B-59 | ST-3 | 6.5 | CH | 30.9 | 82.4 | 74 | 51 | 640 | 0 | | | | | | |
| B-61 | ST-1 | 4 | CH | 33.4 | 84.2 | | | 1370 | 0 | | | | | | |
| B-62 | ST-2 | 4 | CH | 30 | 88.4 | | | 2090 | 0 | | | | | | |
| B-64 | ST-2 | 4 | CH | 32.2 | 85.4 | 84 | 61 | 2300 | 0 | | | | | | |
| B-66 | ST-1 | 1.5 | CH | 33.4 | 87.5 | 86 | 61 | 1780 | 0 | | | | | | |
| B-66 | ST-2 | 6.5 | CL | 32.9 | 87.6 | | | 960 | 0 | | | | | | |
| B-70 | ST-2 | 4 | CH | 43 | 77.3 | 99 | 70 | 470 | 14.5 | 330 | 24.4 | | | | |
| B-70 | ST-4 | 9 | CH | 35.2 | 84.4 | | | 1120 | 0 | | | | | | 2.3E-06 |
| B-71 | ST-2 | 4 | CH | 37.9 | 80.6 | | | 1360 | 0 | | | | | | |
| B-72 | ST-2 | 4 | CH | 37.9 | 80.9 | | | 410 | 15.0 | 350 | 24.6 | | | | |
| B-73 | ST-3 | 6 | SM | 21.2 | 83.3 | 29 | 2 | | | | | 2940 | 0.01 | 0.18 | |
| B-76 | ST-1 | 1 | CH | 39.7 | 79.5 | | | 540 | 9.3 | 480 | 14.7 | | | | |
| B-76 | ST-4 | 8.5 | CL | 23.2 | 76.7 | 31 | 8 | | | | | 4260 | 0.01 | 0.11 | |
| B-77 | ST-2 | 4 | CH | 28 | 91.6 | | | 2330 | 0 | | | | | | |
| B-77 | ST-4 | 9 | CL-ML | 32.7 | 85.9 | | | 880 | 0 | | | | | | |
| B-81 | ST-3 | 6.5 | CH | 35.6 | 86.8 | 64 | 43 | 750 | 13.7 | 340 | 27.4 | | | | |
| B-82 | ST-1 | 1.5 | CH | 35.3 | 86.3 | | | 2050 | 0 | | | | | | |
| B-83 | ST-2 | 4 | CH | 35.5 | 84.9 | | | 1760 | 0 | | | | | | |
| B-84 | ST-1 | 1.5 | CH | 36.8 | 84.4 | | | 2790 | 0 | | | | | | |
| B-85 | ST-2 | 4 | CL | 40.6 | 79.5 | 48 | 23 | 1050 | 0 | | | | | | 6.6E-05 |
| B-86 | ST-1 | 1.5 | CH | 42.3 | 79.1 | | | | | | | | | | 5.0E-09 |
| B-87 | ST-2 | 4 | CH | 36.1 | 84.7 | 89 | 62 | 1560 | 0 | | | | | | |
| B-88 | ST-1 | 1.5 | CH | 31.9 | 88.4 | 75 | 24 | 360 | 20.6 | 300 | 39.8 | | | | |
| B-90 | ST-2 | 4 | CL | 36.4 | 81.4 | | | 1610 | 0 | | | | | | |
| B-91 | ST-1 | 1.5 | CH | 30.6 | 87.4 | | | 970 | 0 | | | | | | |
| B-96 | ST-2 | 4 | ML | 17.2 | 80.3 | 31 | 3 | 1740 | 0 | | | | | | |
| B-99 | ST-3 | 6.5 | ML | 27.8 | 89.8 | | | 130 | 41.2 | 360 | 34.4 | | | | |
| B-100 | ST-1 | 1 | CH | 27.9 | 92.4 | 60 | 32 | | | | | | | | 6.8E-08 |
| B-101 | ST-1 | 1.5 | CH | 33.9 | 86.3 | 59 | 38 | | | | | | | | 4.7E-08 |
| B-101 | ST-2 | 4 | ML | 11 | 88.9 | | | 4250 | 0 | | | | | | |
| B-103 | ST-2 | 4 | CH | 33.8 | 73.4 | 75 | 49 | 1480 | 0 | | | | | | |
| B-103 | ST-2 | 5.25 | CL-ML | 26.6 | 89.2 | | | 1190 | 0 | | | | | | |
| B-104 | ST-1 | 1.5 | CH | 32.6 | 86.9 | | | 1250 | 0 | | | | | | |
| B-105 | ST-2 | 4 | CH | 30.5 | 90.6 | 87 | 61 | 3112 | 0 | | | | | | |
| B-105 | ST-5 | 11 | CL-ML | 32.4 | 86.4 | | | 1450 | 0 | | | | | | |
| B-106 | ST-2 | 4 | CH | 26.8 | 95 | 88 | 63 | 3760 | 0 | | | | | | |
| B-109 | ST-2 | 4 | CH | 42.2 | 80.7 | | | 1410 | 0 | | | | | | |
| B-109 | ST-2 | 4 | CL-ML | 26.6 | 93 | | | 2410 | 0 | | | | | | |
| B-110 | ST-1 | 1.5 | CH | 26.5 | 92.4 | | | 1300 | 0 | | | | | | |
| B-111 | ST-2 | 3.5 | CH | 37 | 78.7 | 94 | 54 | | | | | 5100 | 0.07 | 0.36 | |
| B-112 | ST-1 | 1.5 | CH | 33.6 | 88.3 | 91 | 66 | 1780 | 0 | | | 3560 | 0.08 | 0.31 | |
| B-113 | ST-1 | 1.5 | CL | 28.9 | 91.7 | 42 | 16 | 820 | 10.0 | 420 | 25.0 | | | | |

trucks and other vehicles to traverse the dry cell. The $\gamma_d$ of Sample 2 was 78.9 pcf at a moisture content of 35.2%. The results of the two series of CU triaxial tests are presented in Appendix 2.1. Sample 1 had a ϕ' of 19.4° and a c' of 200 psf. Sample 2 had a ϕ' of 35.7° and a c' of 280 psf. A series of direct shear tests was also performed on a lightly-compacted sample of fly ash on a textured HDPE liner. The results are presented in Appendix 2.1. The interface friction angle measured 34.8˚.

Our CQA Report for Phase 2 of the construction of Cell 4A reported the field density testing of the perimeter soil berms and the CCR berm. The compaction criterion stated in Appendix K of the modified Construction Permit Application (CPM) was based upon standard Proctor moisture-density tests performed on CCR samples at the time of our analyses. However, the properties of the CCR are variable. We found after construction of the CCR berm began that the maximum dry unit weight of 79 pcf was greater than could be achieved with the CCR that had been excavated from the pond and stockpiled. This is explained in our response to Comment 22 in "Cell 4A Construction Quality Assurance (CQA) Report, Response to MDNR-SWMP Comments" dated November 27, 2013. Based on previous tests and additional standard Proctor tests on new samples of the CCR, the maximum dry unit weight for ponded CCR was changed to 68 pcf. The criterion was established to achieve the desired engineering properties of the perimeter CCR berms. The actual average moist unit weight of the compacted CCR in the temporary east berm of Cell 4A is 104.8 pcf.

In response to questions from MDNR-SWMP regarding the compaction of the CCR berm, and to develop a better understanding of the shear strength of ash placed at a dry unit weight less than initially specified, we molded a specimen of the CCR to a density of approximately 57.5 pcf for a consolidated-undrained (CU) triaxial compression test (ASTM D4767). The dry unit weight of the specimen was much less than that achieved in the field for either the CCR fill or the CCR berm. Therefore, the shear strength properties of the test specimen are less than that of the *in situ* CCR fill and CCR berm. The effective angle of internal friction (ϕ') obtained from the triaxial compression test was 27º. A plot of the CU test results is presented in Appendix 2.2 from our Phase 3 CQA report for Cell 4A. The assumed shear strength properties of the CCR fill for design was ϕ' = 19º and effective cohesion (c') of 200 psf.

## 3.4 Tests on Composite Samples

### 3.4.1 Formation of Composite Samples

The retained soil samples from the Phase 2 borings were designated as high plastic clay ("CH"), low plastic clay ("CL"), and borderline very silty clay and clayey silt ("MCL"), based on the initial visual classification. In order to maintain the aerial location of each class of soil sample, the 90 Phase 2 borings were divided between 11 sections. The plan of the sections ("A" through "K") is shown in Appendix 1. The samples with the same classification and in the same section were combined to form 11 composite samples of each of the three classes of soil. Atterberg liquid and plastic limits tests were performed on each of the three soil types from each section. These results are shown in Table 2. Grain-size analyses (sieve and hydrometer) were also performed on each sample. The results of the gain-size analyses are included in Appendix 3. Many of the samples that were visually classified as CL were actually high plastic, that is the samples had a liquid limit equal to 50% or higher. Based on the soil classifications and Atterberg limits, soil samples from several sections were combined to reduce the number of tests, resulting in 10 composite samples. These composite samples, Nos. 1 through 10, are listed in Table 2.

Atterberg liquid and plastic limits and standard Proctor moisture-density tests (ASTM D698) were performed on each of the 10 composite samples. The results of the Atterberg limit tests are presented in Table 3. A representative bulk sample of the upper silty sands and sandy silts was obtained, to mix with a composite clay sample for a hydraulic conductivity test. A standard Proctor was also performed on the sandy silt. The maximum dry unit weights ($\gamma_d$) and optimum moisture contents from the standard Proctor tests are shown in Table 3 and the test results are included in Appendix 4.

### 3.4.2 Hydraulic Conductivity Tests

Five test points were molded for each standard Proctor test. One of the compacted specimens from each of the 10 composite samples and the sandy silt was selected for a hydraulic conductivity test (ASTM D5084). The sample that was selected had a $\gamma_d$ about equal to 95% of the maximum $\gamma_d$ and compacted at a moisture content that was 0 to 4% above the optimum. Each selected compacted specimen was trimmed from the standard Proctor mold to have a diameter of 2 inches and a length of 3 to 4 inches. Because the specimen was trimmed from the center of the mold, the specimen had an initial $\gamma_d$ that was greater than 95% of the maximum $\gamma_d$. The initial $\gamma_d$ and moisture content of each specimen is shown in Table 3. Each specimen was placed in a triaxial cell with a flexible membrane and was then saturated under 70 psi pressure. Multiple pressure increment tests were performed to verify that the specimen was saturated. Then, the specimen was consolidated under a differential pressure of 5 psi. After consolidation, a differential pressure between the top of the sample and the bottom of the sample was applied to create a pressure gradient in accordance with the ASTM procedure. The results of the hydraulic conductivity tests are presented in Table 3 and the data and results are included in Appendix 5.

### 3.4.3 Triaxial Shear Strength Tests

Following the hydraulic conductivity test, the cell was broken down to apply side drains to the specimen, and then the triaxial cell was reassembled to run a consolidated-undrained (C-U) triaxial shear strength test with pore pressure measurements (ASTM D4767). The results of the C-U tests are included in Appendix 6.

## 4.0 DESCRIPTION OF SOILS

### 4.1 General Stratigraphy

The site of the UWL is located in the flood plains of the Mississippi River and the Missouri River, although now the embankment for the BNSF railroad track effectively separates the site from the Missouri River. Deposition of soils in a flood plain of a river is dependent on the velocity of the water – as the flood waters slow the larger size particles are deposited first, and then the finer particles. The velocities of the water vary over the flood plain and with each flood as the topography changes. Therefore, soil deposits in a flood plain ("alluvial" deposits) vary greatly both with depth and in horizontal extent. The borings and test holes in the site reveal a typical alluvial stratigraphy.

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## Table 2  Summary of Classifications of Phase 2 Samples

| Composite Group # | R&J ID # | Composite Sample Number | % Passing #200 Sieve | % Silt | % Clay | LL | PL | PI |
|---|---|---|---|---|---|---|---|---|
| 1 | H-1 | H-CH | 96.9 | 16.4 | 80.5 | 80 | 21 | 59 |
| | E-1 | E-CH | 99.3 | 12.5 | 86.8 | 82 | 28 | 54 |
| 2 | G-1 | G-CH | 93.4 | 25.2 | 68.2 | 69 | 21 | 48 |
| | D-1 | D-CH | 99.2 | 19.7 | 79.5 | 76 | 31 | 45 |
| | F-1 | F-CH | 98.7 | 23.7 | 75.0 | 72 | 28 | 44 |
| | B-1 | B-CH | 99.0 | 25.1 | 73.9 | 71 | 27 | 44 |
| 3 | A-1 | A-CH | 98.7 | 19.4 | 79.3 | 69 | 26 | 43 |
| | E-2 | E-CL | 99.0 | 19.7 | 79.3 | 67 | 24 | 43 |
| | C-1 | C-CH | 99.0 | 27.1 | 71.9 | 62 | 20 | 42 |
| 4 | C-2 | C-CL | 97.9 | 36.9 | 61.0 | 52 | 19 | 33 |
| | D-2 | D-CL | 98.9 | 36.0 | 62.9 | 59 | 27 | 32 |
| | A-2 | A-CL | 97.9 | 38.2 | 59.7 | 52 | 21 | 31 |
| | G-2 | G-CL | 92.3 | 43.5 | 48.8 | 47 | 18 | 29 |
| | E-3 | E-MCL | 96.3 | 48.1 | 48.2 | 46 | 19 | 27 |
| 5 | H-2 | H-CL | 95.6 | 51.7 | 43.9 | 43 | 21 | 22 |
| | C-3 | C-MCL | 93.5 | 49.8 | 43.7 | 40 | 20 | 20 |
| | A-3 | A-MCL | 90.7 | 47.7 | 43.0 | 39 | 19 | 20 |
| | B-2 | B-CL | 90.0 | 49.7 | 40.3 | 41 | 22 | 19 |
| 6 | D-3 | D-MCL | 94.8 | 51.3 | 43.5 | 40 | 23 | 17 |
| | B-3 | B-MCL | 97.2 | 58.5 | 38.7 | 39 | 22 | 17 |
| | F-2 | F-CL | 85.3 | 41.5 | 43.8 | 39 | 22 | 17 |
| 7 | G-3 | G-MCL | 96.7 | 61.1 | 35.6 | 37 | 21 | 16 |
| | H-3 | H-MCL | 93.2 | 56.8 | 36.4 | 36 | 22 | 14 |
| | F-3 | F-MCL | 83.2 | 52.3 | 30.9 | 33 | 20 | 13 |
| 8 | J-1 | J-CH | 99.3 | 18.2 | 81.1 | 70 | 22 | 48 |
| | K-1 | K-CH | 99.3 | 17.5 | 81.8 | 75 | 29 | 46 |
| 9 | K-2 | K-CL | 98.1 | 30.8 | 67.3 | 60 | 22 | 38 |
| | I-1 | I-CH | 99.3 | 29.0 | 70.3 | 61 | 24 | 37 |
| | I-2 | I-CL | 98.0 | 32.7 | 65.3 | 55 | 20 | 35 |
| | J-2 | J-CL | 98.2 | 32.2 | 66.0 | 53 | 20 | 33 |
| 10 | I-3 | I-MCL | 95.7 | 42.7 | 53.0 | 44 | 19 | 25 |
| | K-3 | K-MCL | 95.8 | 51.0 | 44.8 | 37 | 22 | 15 |
| | J-3 | J-MCL | 95.5 | 58.1 | 37.4 | 34 | 21 | 13 |

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## Table 3: Summary of Geotechnical Properties of Phase 2 Composite Samples

| | | | | Standard Proctor, ASTM D698 | | Permeability Sample | | | Shear Strength Properties | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Composite # | USCS Classification | Liquid Limit | Plastic Index | Maximum Dry Density, pcf | Optimum Moisture Content | Initial Dry Density, pcf | Initial Moisture Content | Hydraulic Conductivity k, cm/sec | Undrained Cohesion, c, psf | Undrained Friction Angle, ϕ | Effective Cohesion, c', psf | Effective Friction Angle, ϕ' |
| 1 | CH | 85 | 62 | 89.9 | 27.9% | 90.7 | 29.3% | 1.5E-09 | 500 | 14.8° | 600 | 20.9° |
| 2 | CH | 77 | 53 | 93.2 | 25.5% | 93.7 | 27.1% | 2.2E-09 | | | | |
| 3 | CH | 74 | 52 | 93.0 | 26.3% | 92.7 | 28.2% | 1.9E-09 | | | | |
| 4 | CH | 54 | 34 | 100.4 | 21.7% | 100.5 | 23.8% | 3.0E-09 | | | | |
| 5 | CL | 42 | 22 | 102.5 | 19.6% | 103.7 | 20.6% | 2.7E-08 | | | | |
| 6 | CL | 40 | 18 | 101.7 | 20.2% | 94.2 | 26.5% | 1.7E-08 | | | | |
| 7 | CL | 36 | 14 | 101.7 | 19.5% | 96.1 | 25.0% | 2.3E-07 | 160 | 19.4° | 200 | 26.9° |
| 8 | CH | 80 | 58 | 90.6 | 26.5% | 91.3 | 27.8% | 3.6E-09 | | | | |
| 9 | CH | 61 | 41 | 96.9 | 23.2% | 95.2 | 26.5% | 2.8E-09 | | | | |
| 10 | CL | 42 | 25 | 101.6 | 19.4% | 99.2 | 22.3% | 1.6E-08 | | | | |
| 70% Composite #7 plus 30% fine Sandy SILT | CL | 30 | 23 | 102.3 | 18.0% | 98.1 | 23.6% | 4.5E-07 | 130 | 21.3° | 100 | 29.7° |
| Fine Sandy SILT | ML | | | 99.6 | 16.9% | 99.7 | 19.1% | 2.5E-05 | | | | |

The generalized logs from the geotechnical borings around the perimeter berm are illustrated in the profiles in Figures 2 through 4. The surface soils are generally clays and silty clays with scattered seams and layers of low plastic silt, underlain by silts. The thicknesses of these fine-grain deposits ranged from 0 to 24 feet, but generally between about 5 to 10 feet. The large number of Atterberg liquid limit (LL) and plastic limit (PL) tests performed on the Phase 2 test holes reveal that the clay soils are almost all high plastic (with a LL $\geq$ 50%). The LL measured on samples from the Phase 1 geotechnical borings ranged from 2% to 77% and averaged 44%. The LL measured on the samples from the Phase 2 test holes similarly ranged from 33% to 80%. The Plasticity Indices (PI) from the Phase 1 geotechnical borings ranged from 27% to 100% and averaged 70%. The PI of samples from the Phase 2 test holes ranged from 13% to 59%. The fine-grain soils are firm to stiff, with undrained cohesive shear strengths of 500 psf to over 2000 psf.

The upper fine-grain soils are underlain by sandy silts, silty fine sands, and fine sands, generally to a depth of 30 feet. These upper sandy soils are generally loose to medium-dense. The upper sandy soils are underlain by fine to coarse, poorly-graded sands (SP) and well-graded sands (SW), with some silty sands (SM) and gravelly sands at greater depths. Limestone bedrock is at a depth of about 115 feet. These lower sands generally ranged from medium dense to very dense, increasing in density with increasing depth.

## 4.2 Materials for Bottom Liner

Soils for the bottom composite liner must have the following properties from 10 CSR 80-11.01(10):

- Have particles with 30% or more passing a #200 U.S. sieve
- Have a liquid limit $\geq$ 20%
- Have a plasticity index $\geq$ 10%
- USCS Soil Classification of CL, CH or SC

The results on the Phase 2 soil samples presented in Table 2 show that all of the soils tested meet these criteria for use in the liner.

The report on the design of the gypsum stack previously submitted to SWMP by GER and A&A stated that the compacted soils for the liner will have a maximum hydraulic conductivity (K) of $1x10^{-7}$ cm/sec. The measured K for composite samples #1 through #6 from the main area of the UWL, and samples #8 through #10 from the south borrow area, all met or exceeded this criterion. The only composite sample that had a greater K ($2.3x10^{-7}$ cm/sec) was the low plastic clay (#7). The mixture of low plastic clay and 30% by weight sandy silt had a K of $4.5x10^{-7}$ cm/sec. Therefore, the low plastic clay, or a mixture with up to 30% sandy silt, meets the requirement for the final cover, which is a K of $1x10^{-5}$ cm/sec or less.

The descriptions of the Phase 2 soil samples presented in Appendix 2 show that both the suitable and unsuitable soils have the same range of colors, from dark gray or brown, to medium gray or brown, except that the light tan soils are generally non-plastic silts or sands that are not suitable. The soils will have to be segregated in the field on the basis of plasticity – that is, soils with a LL of 40% or greater will be suitable for the liner. All of the soils be suitable for the final cover, although cohesive soils are recommended rather than non-plastic silts or sands.

The surface plowed zone, varying from 0 to 15 inches deep, contains roots and decaying organic matter from the agricultural use. The surface soils containing organic matter should be excluded from the materials to be used in the liner. Where corn has been planted, the top soil may contain an abundance of root balls; this material should not be used for fill. The soils containing fine roots and organic matter may be used for surface vegetative covers and for construction of the perimeter berm.

### 4.3 Materials for Aquiclude Soil Protection and Final Cover

After the Aquiclude Geomembrane has been placed, tested and surveyed, a 12-inch thick layer of silty clay or clayey silt will be placed and semi-compacted by tracking with a small wheeled compactor or a low-ground pressure tracked dozer. The soil used will not contain rocks or any objects which might damage the geomembrane. The type of equipment will be selected based upon the Test Pad. The protective soil layer will be compacted such that there will be no rutting or displacement by the compaction equipment for the compacted clay of the bottom composite liner. The semi-compacted soil protection layer will have an approximate unit weight of 120 lbs./$ft^3$ and a minimum interactive friction angle of 15˚ with the aquiclude membrane as assumed for the stability analyses. Laboratory testing will be required to verify these properties once the soils and membrane are proposed.

Similarly, the soil for the final cover will be silty clay or clayey silt. The final cover will be placed and semi-compacted similar to the aquiclude soil protection layer. The soil used will not contain rocks or any objects which might damage the geomembrane. The semi-compacted soil layer will have an approximate unit weight of 120 lbs./ft3 and a minimum interactive friction angle of 20.5˚ with the HDPE membrane for the final cover as assumed for the stability analyses. Laboratory testing will be required to verify these properties once the soils and membrane are proposed.

### 4.4 Materials for Berm Construction

The other excavated materials, silty clays, clayey silts, sandy clays and clayey sands will be suitable for the construction of the perimeter berm, interior dikes and other fills. Cohesionless, permeable soils (poorly-graded sands, fine sands and gravels) should not be used for perimeter berms because these soils are erodible and may permit the build-up of hydrostatic pressures below the interior composite liner. The properties of the compacted berm soils will have a minimum undrained cohesive strength ($s_u$) of 800 psf, and a minimum effective cohesion (c’) of 10 psf and a minimum effective internal friction angle (ϕ’) of 30˚. Laboratory testing will be required to verify these properties.

## 5.0 SEISMIC ANALYSES

The original seismic analyses for the Sioux UWL was based upon the criterion established in the MDNR-DRSP regulations. The Probable Maximum Acceleration (PMA) of bedrock was defined as 20% of gravity (0.20g) for St. Charles county. The required design criterion for an industrial water retention dam over 50 feet high and a Class II downstream environment was 0.5 PMA or 0.10g. Because Ameren will not be wet-stacking the gypsum in Cells 1 and 2, the UWL will no longer be regulated by the MDNR-DRSP. Therefore, the seismic design criterion has been revised to comply with the EPA 2015 CCR Rule.

Typical cross-sections were analyzed for slope stability using a pseudo-static horizontal acceleration as a body force on the soil and CCR masses to calculate the minimum factors of safety for a design seismic event. The seismic acceleration was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground Acceleration (PGA) for the geometric Maximum Credible Earthquake ($MCE_G$) with a 2% probability of exceedance in 50 years. A portion of the 2014 map which includes the SEC is reproduced in Figure 5. The PGA is 0.187g. This PGA must be adjusted to account for the soil profile at the site. This adjustment was based upon the ASCE7-10 code. The adjustment ($F_{PGA}$) from Table 11.8-1 for Seismic Site Class E is 1.434. Therefore, the adjusted Peak Ground Acceleration for the site effects ($PGA_M$) is equal to $F_{PGA}$ x PGA = 0.268g. This $PGA_M$ was used for liquefaction analyses.

A seismic coefficient of 0.5 was applied to the $PGA_M$ to determine the pseudo-static horizontal acceleration for stability analyses. This is consistent with the Mine Safety and Health Administration (MSHA) 2009 *Engineering and Design Manual for Coal Refuse Disposal Facilities*, in particular Chapter 7, "Seismic Design: Stability and Deformation Analyses." The manual cites research by Hynes-Griffen and Franklin (1984) which found that for a seismic coefficient of 0.5 the probable deformations would be less than 3 feet for a factor of safety of 1.0. Therefore, the pseudo-static horizontal acceleration of 0.134g was used for stability analyses.

## 6.0 LIQUEFACTION ANALYSES

Each of the geotechnical borings within the UWL was analyzed for liquefaction potential. The potential of liquefaction in the sands and silty sands was estimated using the analysis developed by H. Bolton Seed and others (H. Bolton Seed, et al, 1985). Liquefaction is the loss of shear strength during an earthquake due to the build-up of pore pressures and the corresponding decrease in effective stress (σ'). Liquefaction generally occurs in loose to medium-dense clean sands or silty sands below the ground water table. The analysis uses corrected N-values, $(N_1)_{60}$, from the SPT to estimate the cyclic stress ratio (CSR) that will cause liquefaction. The CSR is compared to the applied stress ratio (ASR) from the design seismic acceleration. N-values are corrected for a number of factors, such as the type of SPT hammer, the length and size of the drill rods, the diameter of the hole, etc. in accordance with ASTM D6066. The factor of safety (FS) against liquefaction is equal to the ratio of (CSR/ASR). A FS $\leq$ 1.0 is considered a high risk of liquefaction; 1.0 < FS $\leq$ 1.28 is considered a moderate risk of liquefaction, and FS > 1.28 is considered a low risk. The liquefaction analyses are included in Appendix 7 and are summarized in Table 4. The studies of liquefaction show that it does not occur below 50 feet. Therefore, the result of the analyses shown in the tables in Appendix 7 is shown as "n.a." for not applicable.

The maximum acceleration for the analyses is 0.268g. The moment magnitude ($M_w$) of the earthquake was assumed to be 7.5 which is the peak from the New Madrid Seismic Zone. The depth of the ground water table is critical in the liquefaction analyses. The elevation of the ground water table during the year of monitoring for the DSI varied between about 411 and 417. The water table was assumed to be at el. 417 for these analyses, because the probability of a flood occurring simultaneous with the design earthquake was assumed to be low. The onset of liquefaction decreases with increasing vertical effective stress. Therefore, the risk of liquefaction will decrease as the CCR height increases. Table 4 summarizes the results of the liquefaction analyses at locations where analyses determined there is greater than a low risk of liquefaction; the risk of liquefaction at the other locations of the Phase 1 geotechnical borings was low.

Ameren Missouri Sioux Energy Center Utility Waste Landfill
Table 4 - Summary of Results of Liquefaction Analyses

| Boring No. | Depth(s) Where Liquefaction Occurs, feet | Risk With Existing Ground Surface | Risk Under 30 Feet of CCR | Risk Under 40 Feet of CCR |
|---|---|---|---|---|
| B-58 | 18.5, 29, 36, 49 | High | High | Low |
| B-59 | 24, 29 | High | Low | Low |
| B-60 | 15, 19, 24 | High | High | Low |
| B-61 | 19, 24, 29 | High | High | High |
| B-62 | 19, 29 | High | High | Low |
| B-63 | 10, 29 | High | High | High |
| B-64 | 14 | High | High | High |
| B-65 | 24, 29 | High | High | Low |
| B-66 | 10, 19, 24, 29 | High | High | High |
| B-67 | | High | Low | Low |
| B-68 | | Moderate | Low | Low |
| B-69 | 19, 29 | High | High | Low |
| B-70 | 29 | High | Low | Low |
| B-71 | 24 | High | High | High |
| B-72 | 29 | High | Low | Low |
| B-73 | 14, 19, 24, 29 | High | High | Low |
| B-74 | | Moderate | Moderate | Low |
| B-75 | 19, 39, 49 | High | High | Low |
| B-76 | 15, 20, 25, 29 | High | High | Low |
| B-77 | 25, 30 | High | Moderate | Low |
| B-78 | 20, 25, 30 | High | High | Low |
| B-79 | 20, 30 | High | High | Low |
| B-80 | 25, 30 | High | Moderate | Low |
| B-81 | 10 | High | High | High |
| B-82 | 15, 20, 30 | High | High | Moderate |
| B-83 | 19, 29 | High | High | Low |
| B-84 | 14, 19, 24 | High | High | Low |
| B-85 | 19, 24 | High | High | Low |
| B-86 | 19, 29 | High | High | Moderate |
| B-87 | 14, 24 | High | High | Low |
| B-88 | 14, 19 | High | High | Low |
| B-89 | 29 | High | Low | Low |
| B-90 | 14 | High | High | Low |
| B-91 | 19 | High | High | Low |
| B-92 | | Low | Low | Low |
| B-93 | 19, 24 | High | High | Low |
| B-94 | | Low | Low | Low |
| B-95 | 19, 24, 29 | High | High | Low |
| B-96 | 24, 29 | High | Moderate | Low |
| B-97 | 24, 29 | High | Moderate | Low |
| B-98 | 24, 29 | High | Moderate | Low |
| B-99 | | Moderate | Low | Low |
| B-100 | 29 | High | Moderate | Low |
| B-101 | 14, 19, 29 | High | High | Low |
| B-102 | 19 | High | High | Low |
| B-103 | 14, 24, 29 | High | High | Low |
| B-104 | | Moderate | Moderate | Low |
| B-105 | 19 | High | High | Low |
| B-106 | 29 | High | Low | Low |
| B-107 | 24 | High | Moderate | Low |
| B-108 | 24, 29 | High | Moderate | Low |
| B-109 | 29 | High | Low | Low |
| B-110 | 19, 24, 29 | High | High | Low |
| B-111 | 29 | High | High | Low |
| B-112 | 24, 29 | High | Moderate | Low |
| B-113 | 14, 24, 44 | High | High | Low |
| B-114 | 19, 29 | High | High | Low |

A high risk of liquefaction is pervasive on the site at the natural ground surface, as shown in Table 4. The risk of liquefaction will be beyond the perimeter berms where the existing vertical effective stress will not be increased by the placement of CCR in the cells. The liquefiable strata are the silty sand or poorly-graded sand below the upper cohesive soils and silts. The potential consequences of liquefaction are loss of shear strength and settlement. The loss of shear strength would impact the stability of slopes, and therefore is addressed under that section of this report. Potential settlement due to liquefaction may occur beneath the cells and under the perimeter berms at least until the level of the CCR exceeds about 40 feet. The magnitude of the settlement due to liquefaction is estimated using the empirical relationship between volumetric strain, ASR and $(N_1)_{60}$ developed by Tokimatsu and Seed (1987), which is reproduced in Figure 6. The estimated settlements are shown in the following table:

Table 5 – Estimate of Settlement Due to Liquefaction

| | | **Liquefaction Settlement (in)** | | |
|---|---|---|---|---|
| **Boring** | **Section** | **Outside of the UWL (in)** | **Under Berm and 20' of Ash** | **Under 30' of Ash** |
| B-108 | A | 4.8 | 4.3 | - |
| B-61 | B | 3.8 | 3.1 | - |
| B-110 | C | 4.7 | 4.3 | 1.8 |
| B-84 | D | 3.9 | 3.5 | 0.9 |
| B-113 | E | 3.2 | 1.9 | - |
| B-95 | F | 7.8 | 6.7 | - |

The maximum estimated settlement due to liquefaction is about 7 inches in the vicinity of Boring B-95 either outside the cells or beneath 20 feet or less of CCR, but averages about 4 inches. Below about 30 feet of CCR, the estimated settlement due to liquefaction is about 2 inches or less. Tokimatsu and Seed estimate that the predicted strain is accurate to $\pm$25%, so an estimated settlement of 5 inches is probably reasonable. So, the risk of damage to the composite liner and final cover due to liquefaction is minimal.

The data from the borings were analyzed to determine the PGA above which the potential for liquefaction is "moderate" to "high" for $M_w$ between 5 and 7.5. For the natural ground surface outside of the UWL, the minimum PGA for the potential occurrence of liquefaction is 0.04g to 0.06g. Under the berms or 20 feet of CCR, the minimum PGA for the potential occurrence of liquefaction is the same. Ameren should complete a topographic survey of the tops of the perimeter berms following a seismic event with a PGA of 0.04g or greater to determine where there may be settlement that would make the top of the berm less than the design flood event. Also, there may be some subsidence of the outside of the perimeter berms which would need to be addressed.

# 7.0 CONSTRUCTION RECOMMENDATIONS

## 7.1 Field Classification of Soils

The field classification of soils will require full-time observation and testing by experience soils technicians due to the variability of the strata. If the soils from on site are used, then the results of the laboratory testing that are summarized in the report may be used. If soils are imported from offsite, then laboratory testing of those imported fill soils will have to be performed to verify that the shear strength properties and other properties of the compacted fills will meet or exceed the parameters used in analyses. Since such laboratory testing will take some time, it would be best if the fill soils are stockpiled on site prior to construction.

As stated previously, the top soil with organic matter must be stripped for use in fills other than the liner or stockpiled on site. Based on the Phase 2 borings, the depth of stripping to remove organics and surface non-plastic soil will vary from 0 to 1.4 feet, and may average about 0.6 feet. The compacted composite samples of fine-grain soils all had suitable permeabilities for use in the bottom composite liner (less than $1 \times 10^{-7}$ cm/sec), except Sample 7 which was composed of the silty soils ("MCL") from Areas F, G and H (see Figure 8-0). These silty soils had fine sand contents up to 17%, clay contents less than 36%, and a liquid limit (LL) of 36%. Clays and silty clays with a liquid limit (LL) of 40% or greater may be used as liner material. The low plastic clay and silty clay, containing up to 30% silt or sandy silt, will be suitable for the final cover. The soils will have to be segregated on the basis of plasticity.

The natural moisture content of the clayey soils measured in the Phase 1 and Phase 2 borings ranged from about 24% to 43%, and averaged about 33%. The optimum moisture contents ranged from about 20% to 28%. So, these soils will have to be partially dried prior to placement. Soils may be dried by spreading the loose soil in lifts about 8 inches thick, and discing the soil using multiple passes.

Clays and silty clays that will be used for constructing the clay component of the bottom liner will be segregated and stockpiled prior to construction of the test pad or liner to provide sufficient time to test the homogeneity of the stockpile and to develop compaction criteria. The initial segregation soils for the liner will be based on ASTM D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." This procedure will enable an experienced soils technician to segregate soils as they are excavated based on plasticity. Specifically, three simple hand procedures are used to describe the plasticity of the soil: dry strength, dilatancy and toughness. If a sample has low to medium strength upon drying, rapid dilatancy and low toughness, then the soil probably would not be suitable for the liner and therefore will be stockpiled separately. Also, if the soil has more than a trace of sand, then it also will be stockpiled separately.

The soils technician and construction superintendent will delineate an area of soil to be excavated that is suitable for liner material based on the plasticity of the exposed surface. Scrapers will load the soil cutting no more than 6 inches deep. The newly exposed surface will be evaluated and the limits of the area will be changed, if necessary, to separate unsuitable soil. In this way, the classification of the soils going to the stockpile of liner material can be controlled sufficiently.

The high plasticity clay probably will come out of the scrapers in “slabs.” A disc will be run over the newly-deposited material to break up the large pieces. A dozer will grade the newly-deposited material to form a loose lift about 12 inches thick. Then, a large soil stabilizer, such as a Caterpillar SS250 will make a pass over the newly-deposited material. A soil stabilizer is used to excavate the surface up to 18 inches deep, pulverize the high plastic clay, thoroughly mix a stabilizing chemical such as lime or fly ash with the soil, and redeposit a blended, homogeneous mix. The newly-deposited soil will be blended with the previous lift by limiting the thickness to 12 inches and cutting up to 18 inches deep. Bag samples will be collected randomly from each lift in the stockpile for subsequent testing in the lab, to verify the homogeneity of the stockpile.

## 7.2 Compaction Criteria

Bag samples from the stockpile of liner material will be tested for grain-size distribution (i.e. hydrometer test), and liquid and plastic limits. If any volume of the stockpile differs significantly in these index properties, then that volume can be delineated, and separate compaction criteria can be developed for that material, or it can be rejected as liner material. Compaction criteria for the blended liner material in the stockpile will be developed using the “Daniel Method.” Daniel and Benson (1990) have determined that compaction criterion as a percentage of the maximum dry unit weight alone is not sufficient to assure the required minimum hydraulic conductivity. They recommend performing a series of compaction tests and hydraulic conductivity tests on each soil type to determine the acceptable “window” of dry density and moisture content that will meet the hydraulic conductivity requirements.

The stability of the perimeter berm requires higher shear strength than for the liner, etc. Therefore, the compaction of the materials in the perimeter berm should be an average of 100% of the maximum dry unit weight determined by the standard Proctor moister-density test, with no tests less than 95% of the same maximum dry unit weight. The moisture content at the time of compaction should be at optimum or a maximum of 4% above optimum.

Fill supporting structures, such as the pump building, should be compacted to the same criterion for the perimeter berm. There are no limits on the moisture content at the time of compaction for fills outside of the perimeter berm except as necessary to achieve the required dry unit weight.

Fills should be placed in horizontal lifts not exceeding 8 inches in thickness and compacted by uniform coverage with a suitable compactor. Cohesive fill should be compacted using a heavy tapered-foot compactor, with or without vibration. The final lift of cohesive fill should be compacted by a smooth-drum roller. Cohesionless fill, such as the silty sand or fly ash, should be compacted by a heavy vibratory compactor.

## 7.3 Quality Assurance

### 7.3.1 Test Pad

The plasticity indices of the bottom liner materials exceed 30%. Therefore, a test pad is required prior to construction to test the materials to be used for the liner, and the construction methods. The test pad must be large enough to accommodate the actual construction methods and equipment that will be used for the actual construction of the liner. The test pad should include a section on a 3(h)-to-1(v) slope to test the construction of the aquiclude membrane and protective soil layer on the interior berm slopes. This may be completed at the existing perimeter berm for Cell 1 or Cell 4A. The compaction criteria previously developed for the liner material will be used to construct the test pad. The geotechnical engineer is required to take undisturbed samples of the fill to measure the density and hydraulic conductivity. Bulk samples of the fill material must be taken to perform LL and PI tests and standard Proctor tests. Also, a minimum of two test pits are required to examine the interface between lifts of materials, to verify bonding of the lifts. A field permeability test is also required. A test pad is not necessary for the fill to be placed in other areas, such as the perimeter berm.

The proposed plastic membrane aquiclude will be placed on the suitable subgrade and then 12 inches of protective soil cover will be placed and lightly compacted on the membrane. Where the aquiclude membrane is on the floor of the cell, the protective soil cover may be a sand. However, sand is not acceptable on the 3(h)-to-1(v) side slope of the perimeter berm. A low plastic silty or sandy clay would be preferred.

### 7.3.2 QA During Construction

The successful completion of the test pad will verify the acceptable construction methods for the dual liner and the proposed high plastic clay for the composite liner. Field density tests must be made of each lift of fill during compaction. If this is accomplished using a nuclear density gauge, then the gauge must be checked regularly by taking undisturbed drive tube samples and measuring the dry unit weight and moisture content by laboratory tests. This is particularly true for the high plastic clays. MDNR-SWMP rules also require taking bulk samples of the fill material used in the liner, to perform LL and PI tests, standard Proctor tests, and a hydraulic conductivity tests for every 5000 cubic yards of liner placed.

Following the completion of the protective soil layer, the membrane installation subcontractor will perform a non-destructive survey of the aquiclude geomembrane to demonstrate that there are no leaks in the geomembrane. This survey may be a "spark" test or an electrical conductivity test or other method approved by the CQA Engineer. The same survey method may be used for the Test Pad.

## 8.0 STABILITY ANALYSES

Seven sets of slope stability analyses were performed on the proposed UWL profile. Generalized soil profiles were developed for widely-spaced sections, A through F, the locations of which are shown in Figure 8-0. The soil properties for the natural cohesive soils were estimated from the triaxial shear strength tests performed for the Phase 1 geotechnical investigation. The internal friction angle and unit weight of sands were estimated from the corrected N-values using standard empirical relationships. The soil properties of compacted fills were estimated from tests on compacted samples. The soil properties used in the slope stability analyses are shown on the profiles Appendix 8. The stability analyses were completed based upon the design with the geomembrane aquiclude. If the design of the dry cells is changed to include the base fill below the bottom liner instead of the aquiclude, then the stability analyses will have to be recalculated for the permit modification based upon the properties of the soils used for the base fill.

The slope stability analyses were performed using the computer program SLIDE 18. This program uses the Spencer method, which resolves the static forces on each vertical slice of soil profile along randomly generated failure surfaces. Two methods are used. The first method is to assume circular failure surfaces. A grid of possible centers for the circular failure surface is specified, as well as the possible bottom elevation of the failure surface. The program searches for the minimum factor of safety (FS) against slope failure for each center point in the grid by incrementally varying the radius of the failure surface. The plotted results from the program show the minimum FS, the center and radius of the failure surface with the minimum FS. The output of the program also plots contours of equal FS within the grid of possible center points. The second method is based upon a multi-linear failure surface. This method is used where there is a plane of weak shear strengths, such as along a composite liner or dual liner. The analyses are the same, that is searching for a configuration of a multi-linear failure surface which results in a minimum factor of safety. All of the results are presented graphically in Appendix 8. Stability analyses were performed at each section for initial and final stages of construction, and using short-term (undrained) properties and long-term properties as appropriate. Stability analyses were also performed for the pseudo-seismic loading, and the post-seismic static conditions were liquefaction exist in the natural soil strata below the groundwater table where there is a high risk. The results of the stability analyses are presented in the following Table 6.

Table 6 – Summary of Results of Stability Analyses

| | End of Initial Construction (Short-Term) | Completed, Full Cell Global Stability | Seismic (0.131g) Completed, Full Cell | Post-Seismic With Liquefied Strata |
|---|---|---|---|---|
| Required Min. FS | 1.4 | 1.5 | 1.0 | 1.0 |
| A) West Berm Cell 1 | 1.81 | 1.86 | 1.46 | 1.87 |
| B) North Brem Cell 2 | 2.46 | 1.83 | 2.06 | 1.88 |
| C) North Berms, Cells 4 & 5 | 2.94 | 1.85 | 1.15 | 1.33 |
| Temporary East Berm, Cell 4A | | 1.64 | 1.05 | |
| D) South Berms, Cells 6 & 7 | 2.68 | 1.71 | 1.03 | 1.83 |
| E) South Berm, Cell 2 | 1.80 | 1.84 | 1.47 | 1.74 |
| F) Southwest Berm, Cell 1 | 1.80 | 1.86 | 1.27 | 1.07 |

## 8.1 Stability of Perimeter Berm

The short-term stability of the perimeter berm was analyzed at each of the six sections using undrained shear strengths for the compacted clay of the berm. The berm may be constructed of clays, ash or non-plastic silts and sands. For the short-term stability analyses, a cohesive shear strength of 800 psf was used, assuming the berm is built entirely of high plasticity clay. This is not likely, but is the worst case for short-term stability. The height of the CCR was assumed to be el. 441 for the short-term stability analyses. The minimum FS ranged from 1.80 to 2.94, which exceed the required minimum of 1.4. The stability analyses for the Recycle Pond (Section B-B) were run with the pond at the lowest operating level (el. 435). When the Recycle Pond is drained after the UWL is closed, then the FS for the stability of the berm will be about 1.8 similar to the other berms.

## 8.2 Global Stability of Full Cells

The global stability of the full cells – gypsum and dry CCR – were analyzed using drained-strength properties. An internal friction angle, ϕ', of 30° was assumed for the perimeter berms because of the various materials which may be used. The average saturated weight of the gypsum was assumed to be 110 pcf based upon information from A&A. The average ϕ of the gypsum was assumed to be 41°, also based on the recommendation from A&A. As summarized in Table 6, the FS varied from 1.64 to 1.86, which meet or exceeds the minimum required FS of 1.5.

The slope stability of the temporary east berm of Cell 4A, which was built with fly ash, was analyzed for the Addendum to the CPM that was submitted in February 2011 based upon new shear strength tests (see Appendix 2.1). The long-term FS was 1.64. The slope stability of the east berm was re-analyzed for the Phase 3 CQA report of Cell 4A based upon new properties of the fly ash placed in Cell 4A (see Appendix 2.2). The long-term FS was 1.73.

## 8.3 Seismic Slope Stability

Global stability analyses were also performed of the full cells for a seismic event using a pseudo-static horizontal acceleration of 0.134g. The FS for the various sections ranged from 1.03 to 2.06, which meets or exceeds the required FS of 1.0. The temporary east berm of Cell 4A was also re-analyzed for a pseudo-static horizontal acceleration of 0.134g and a full cell. The minimum FS is 1.05 (see Figure 8-13). This is conservative because Cell 4B should be built before Cell 4A is filled to capacity so that this condition will not occur.

## 8.4 Post-Seismic Event with Liquefaction

At the locations where the liquefaction analyses indicated a high potential for liquefaction in a stratum, a residual cohesive shear strength was input for the liquefied soil stratum. The residual cohesive shear strength was estimated from the empirical relationship recommended by H. Bolton Seed (1987). This relationship is reproduced in Figure 7. Both the global stability of the full cell and the stability of the perimeter berm were analyzed using the post-liquefied shear strength of the subject soil stratum and no applied horizontal acceleration in accordance with the draft technical guidance document from SWMP and Stark (1998). The FS for this condition ranged from 1.07 to 1.88, which meets or exceeds the required FS of 1.0.

## 8.5 Stability of the Final Cover

The final cover of each cell will consist of a double-textured HDPE geomembrane on top of the CCR, followed a non-woven geotextile and then 24 inches of soil cover. The first 18 inches of soil cover will consist of compacted silty clay or sandy clay, covered with 6 inches of semi-compacted vegetative soil cover. The initial slope of the sides of the gypsum stack will be 4(h)-to-1(h). The stability of the final cover was analyzed. The calculations are included in Appendix 8. The factor of safety against sliding of the cover is the minimum desired of 1.5 for the silty clay with properties given in Section 4.3. As stated in Section 4.3, these properties will be verified by laboratory testing with the proposed soil and HDPE geomembrane.

# 9.0 SETTLEMENT ANALYSES

## 9.1 Estimated Settlements

Settlement analyses were completed using the computer program SETTLE3D. Six subsurface profiles were developed from borings within the project area. These are depicted graphically in Appendix 10. The settlement values were calculated assuming that all cells had been filled to an average elevation of 520 ft. Consolidation coefficients ($C_C$ and $C_R$) for cohesive materials were obtained from load increment consolidation tests run on representative undisturbed samples from the Phase 1 borings. The stress-strain modulus ($E_S$) for granular materials was estimated using cone penetration test (CPT) data obtained from the WFGD project at the Sioux Energy Center. $E_S$ is approximately 3 times the measured CPT $q_c$-value of resistance (Bowles, 1997). It was assumed that using the CPT data for the proposed UWL site was valid because a plot of standard penetration test (SPT) N-values shows similar stratigraphy for both sites, and N-values obtained at the UWL are generally larger than those at the plant. A plot of the N-values for the Sioux Energy Center and at the UWL site is shown in Figure 8. The CPT data are almost continuous with depth and are more reliable than SPT data. Therefore, the CPT data should provide a better estimate of the $E_S$ for the granular materials. A comparison of the variation in computed Es with depth based on the corrected N-values and the CPT data is shown in Figure 9.

The estimated settlements were calculated for the full load of the cells assuming that all of the loads from the berms and the full cells are placed simultaneously. The pattern of the loading stress is depicted graphically from the SETTLE3D input in Appendix 10. This is conservative with regard to the consequences of settlement (deformations of the berms and strains on the HDPE membranes) because the settlement resulting from the construction of the existing berms, the filling of Cell 1, and the filling of Cell 4A have already occurred. The estimated settlements are depicted graphically in the plan in Appendix 10. The maximum total settlement occurs in the northwest corner of Cell 4A, and is about 22 inches.

The estimated settlements under the full cells on an east-west centerline section are plotted in Figure 10 (Section H-H in Figure 8-0). The maximum settlement along this section occurs in Cell 4A and is about 20 inches. The estimated settlements in the dry cells range from about 20 inches to 14.5 inches on the east side of Cell 5. The estimated settlements in Cells 1 and 2 vary with the height of the gypsum from about 5.5 inches to 8 inches. The estimated settlements at the berms between cells is about 6 inches except for the east berm of Cell 5 which is about 4.5 inches. The maximum differential settlement occurs along the west slope of Cell 4A, which is about 15 inches (20 inches minus 5 inches at the west berm).

The estimated settlements in a north-south section through the full dry CCR Cells 7 and 4B (Section I-I in Figure 8-0) are plotted in Figure 11. The estimated settlement in the interior of the full cells vary from about 14 inches to 18.2 inches.

The estimated settlements in a north-south section through the full Cell 2 are plotted in Figure 12 (Section G-G in Figure 8-0). The estimated settlement in the interior of the full cells vary from about 4.5 inches to 18.5 inches.

The consolidation of the foundation soils may result in up to 6 inches of settlement at the top of the perimeter beam when the CCR reaches the full height and extent. This will be a slow process, so the settlement will occur over a number of years. The top of the perimeter berm will be at el. 446, which is 7 feet above the 100-year flood level, and 5 feet above the 1993 flood level. Therefore, the estimated settlement will not reduce the top of the perimeter berm to below the flood levels. Monuments should be set in the top of the perimeter berm at about 300-foot centers, and the settlement of the top of the berm should be measured as the cells are filled. The measured settlement may be used to adjust the model for the estimated settlements. Also, if Ameren wants to maintain the top of the perimeter berm at el. 446, then it may be necessary in the future to build out the exterior toe of the berm in order to raise the top.

### 9.2 Strain of HDPE Liner

The estimated settlements will occur over long distances, such that the differential settlement will be small, at a slope of about 1%. The liner will undergo differential settlement 0.9 feet between the crest of the perimeter berm to the inside toe of the berm (a horizontal distance of 69 feet), and 15 inches from the inside toe of the berm to a point below the crest of the Cell 4A (over 190 feet). The increase in lengths of the slopes after full settlement has occurred compared to the initial lengths will be 0.007% and 0.004%, respectively. A strain of less than 1% is acceptable, because the yield strength of most HDPE liners occurs at more than 12%. Therefore, the strain in the HDPE liner resulting from the estimated differential settlements are acceptable.

### 9.3 Slopes of Leachate Collection Pipes

The design slope of the buried leachate collection pipes in the dry cells must be a minimum of 0.5%. The settlement under the central portion of the cells will be relatively uniform. There will be some differential settlement of the pipes from top of the 4(h)-to-1(v) side slope to the sump at the toe of the perimeter berm. The estimated differential settlement on the west side of Cell 4A is about 14.2 inches or a change in the slope of the pipe of about 0.3%. The estimated differential settlement on the north side of Cell 4B is about 11 inches or a change in the slope of the pipe of about 0.3%. Therefore, the constructed slope of the leachate collections pipes from the top of the 4(h)-to-1(v) side slope to the sump should be 0.8%, or preferably 1.0%, to maintain a slope of 0.5% after settlement.

## 10.0 BEARING CAPACITY

The only structure at the UWL will be the pump house at the Recycle Pond. The pump house will be founded on compacted fill, with the grade at el. 446. Therefore, the bearing capacity of the natural soils is not a concern. The bearing capacity of the natural high plastic clay, which would be the lowest of the natural soils, was analyzed using undrained shear strength of 800 psf, and using drained strength properties. The net allowable bearing pressure for the natural high plastic clay is 2500 psf for continuous or strip footings and 3000 psf for square footings. These values are for the undrained strength and a factor of safety of 2.0.

Using the drained strength properties and a factor of safety of 3.0, the net allowable bearing pressure for the natural high plastic clay is 2500 psf for strip footings and 3000 psf for square footings up to 10 feet in plan. A factor of safety of 3.0 is used for the drained or long-term case to control settlement. The allowable bearing capacity of shallow footings in compacted fill will also be the lowest where the high plastic clay is used; for example, box culverts over the compacted clay liner. Using the drained strength properties of the compacted sample and a factor of safety of 3.0, the net allowable bearing pressure for the natural high plastic clay is 5000 psf for strip footings and 6500 psf for square footings up to 10 feet in plan. The bearing capacity calculations are included in Appendix 8.

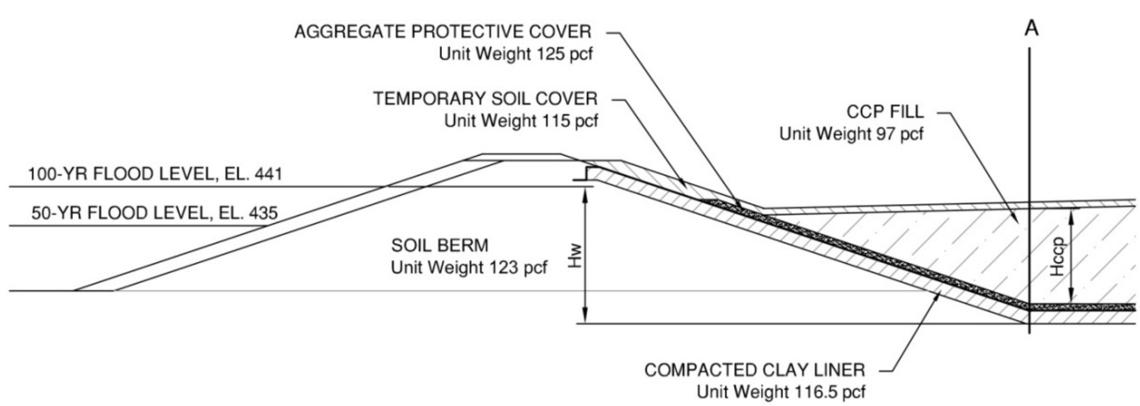
The bearing capacity of the natural soils below the perimeter berms and cells was analyzed using the SLIDE model as shown in Figure 8-28. The profile at Section F-F was selected as the worst case. The ultimate bearing capacity for the natural subgrade (consisting of primarily clayey silts, silty clays and sands, is 50,000 psf. This is applicable to the outside toe of the perimeter berms. This type of slope failure is included in the global slope stability analyses of the various sections in Appendix 8.

## 11.0 HYDROSTATIC PRESSURES

### 11.1 Liner

A flood condition surrounding the UWL would impose a hydrostatic uplift pressure on the bottom of the composite liner. This uplift pressure is initially only resisted by the weight of the composite liner, specifically the clay. To maintain a factor of safety of 1.5 against upward displacement and rupture of the liner, the 2 feet of clay can resist an upward pressure equal to about 2.5 feet of water. Therefore, the level of the water in the Recycle Pond and wet disposal cell must initially be no more than 2.5 feet below the level of the flood water surrounding the UWL.

The calculation of the FS against excess hydrostatic pressure (i.e. uplift) on the bottom liner in a dry cell during a flood is illustrated in the following diagram:




The Factor of Safety against uplift ($FS_{uplift}$) should be calculated at the lowest point which is the inside toe of the exterior soil berm (Point A in above section.)

$$FS_{uplift} = \frac{\text{Weight of Materials Above Bottom of the Aquiclude}}{\text{Hydrostatic Uplift Pressure}}$$

where the weight of materials is the sum of the weight of CCR fill, weight of temporary soil cover, 2 feet of compacted clay liner, the protective soil cover on the aquiclude membrane where present, and the weight of water in the cell, if any. The average or assumed moist unit weight of each material is shown in the above section.

The hydrostatic uplift pressure is the difference in elevation between the flood level and the level of the aquiclude (Hw) multiplied by the unit weight of water (62.4 PCF). For a dry cell where an aquiclude is present, the $FS_{uplift}$ is calculated by:

At Point A: $$FS_{uplift} = \frac{\text{Hccp x 97 PCF}+(2\text{ ft})(115\text{ PCF})+(1\text{ ft})(125\text{ PCF})+(3\text{ ft})(115\text{ PCF})}{\text{Hw x 62.4 PCF}} = \frac{\text{Hccp x 97 PCF}+700\text{ PSF}}{\text{Hw x 62.4 PCF}}$$

For example, if the aquiclude is at el. 426, then $H_W$ for the design flood is (441 – 426) = 15 feet of water. For a $FS_{uplift}$ = 1.1, the height of CCR in the cell must be 3.4 feet or at el. 433.4 to the top of the CCR. The construction for each new dry cell must require the initial filling of the dry cell as soon as it is operational with CCR to achieve the minimum $FS_{uplift}$ of 1.1.

### 11.2 Perimeter Berm

The perimeter berm will act as a flood protection levee to separate the UWL from potential flood water. Therefore, the perimeter berm will be designed in accordance with standard practice for flood protection levees. The recommended soil for the construction of the perimeter berms is presented in Section 4.4.

## 12.0 EROSION PROTECTION

The embankments for the BNSF railroad track and Ameren Missouri's spur track isolate the UWL from the flow of flood waters. Flood water surrounding the UWL will be backwater from the Mississippi River downstream, and therefore will have little flow that could cause erosion of the perimeter berm.

During the flood of 1993, the BNSF embankment separated the higher flood level of the Missouri River from the Mississippi River. Eventually, this differential hydrostatic pressure caused a failure at a weak point in the embankment, creating the scour hole shown in Figure 1. The existing elevation contours indicate that the flow from the scour hole extended across the site of the UWL and extended downstream to the southeast. If this event happened in the future, the UWL would block the flow from the scour hole. Such a failure would not necessarily occur at the same location, but this would be the most likely location even if the scour hole were filled. The surrounding topography and the UWL would create constrictions to the flow at Sections X and Y shown in Figure 8-0. The constrictions would increase the flow of the water and may cause erosion of the perimeter berm at these locations. Also, the reach of the perimeter berm facing the scour hole would be subject to the impact of the flow from the scour hole.

To analyze this emergency condition, several assumptions were made:

- a breach 160 feet wide occurs at the location of the scour hole, a repeat of the 1993 failure
- water on the Mississippi side ponds to el. 430.
- the water level on the Missouri River side is at el. 439.

- essentially all of the flow from the breach will flow through the south constriction (at Section Y).

The estimated flow from the breach is 9800 cu. ft/sec. The impact velocity on the southwest reach of the perimeter berm is 6.5 fps. The velocity of the flow through the south constriction is about 4 fps on the side of the berm. The calculations of the velocity of flow from the breach and the design of a riprap layer on the perimeter berm are included in Appendix 11. The riprap layer should be a minimum of 15 inches thick. The riprap should be sound limestone, ranging in size from 4 to 9 inches. The riprap layer should be placed on a 6-inch thick bedding layer of 2-inch minus crushed rock. The riprap should extend up to el. 439 on the perimeter berm. The riprap should extend from a point on the southern berm opposite the east boundary of Cell 1, to a point on the northern berm opposite the same east boundary of Cell 1. The profile of the riprap layer is shown in Figure 13.

## 13.0 REFERENCES

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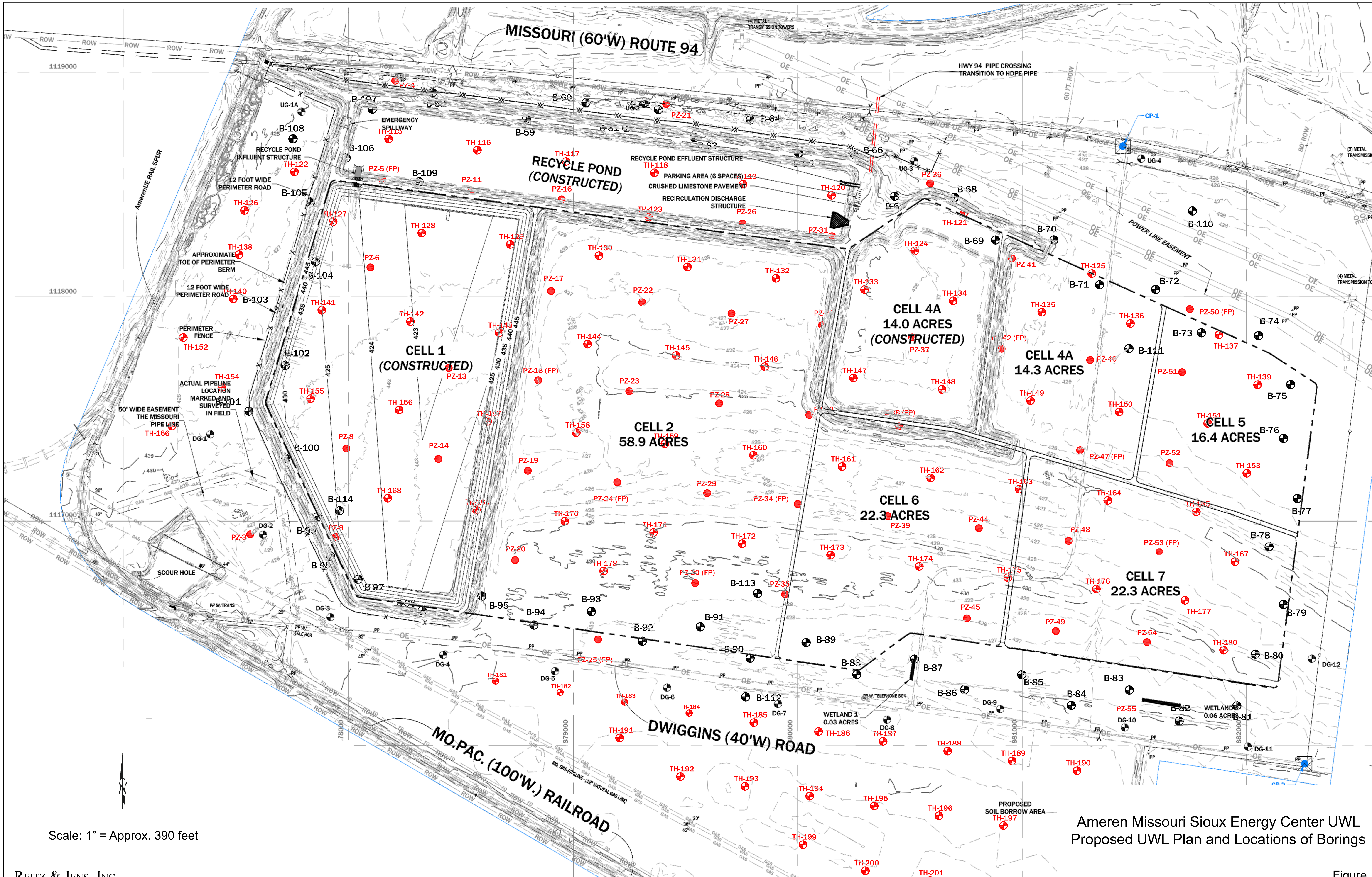
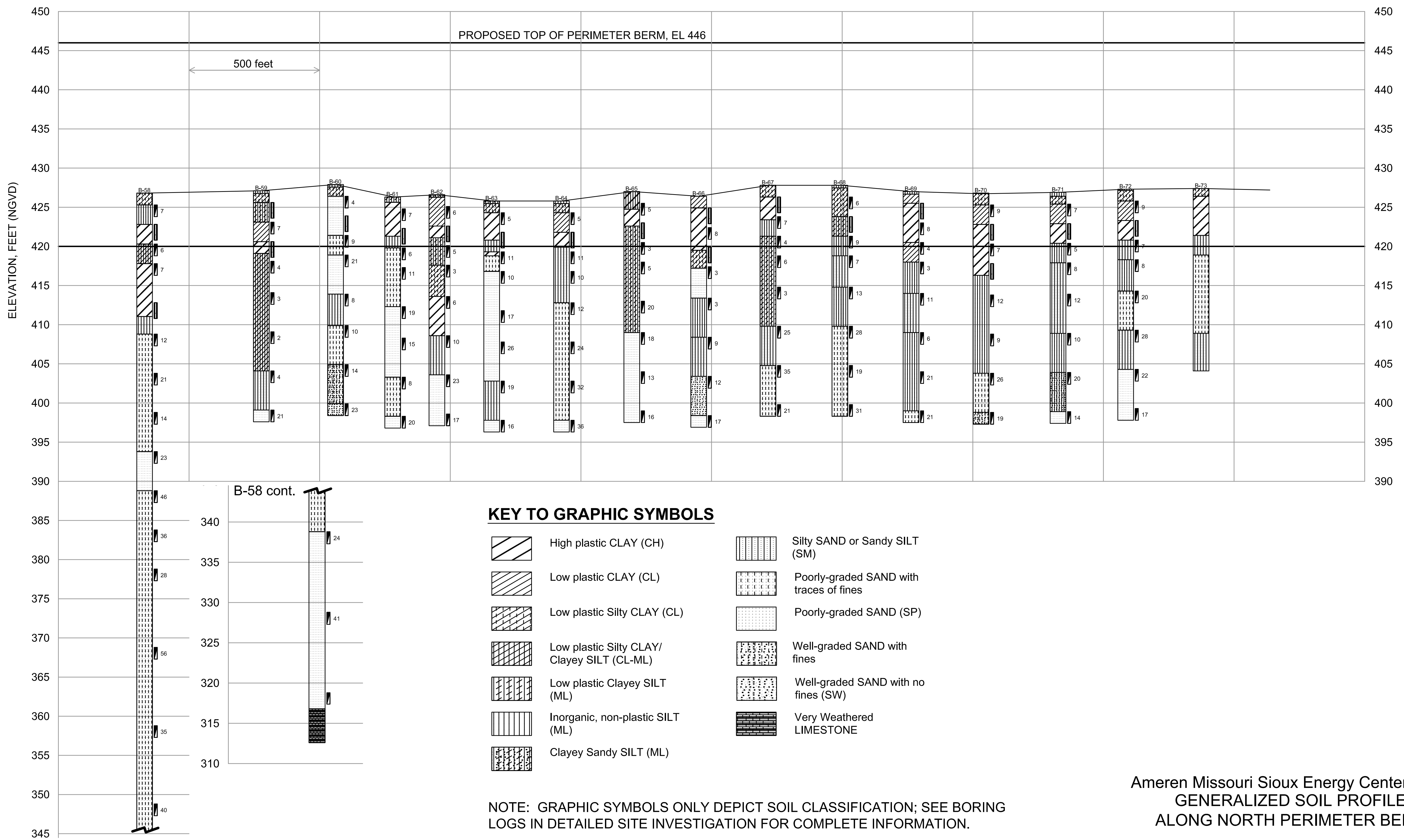



Ameren Missouri Sioux Energy Center UWL
Proposed UWL Plan and Locations of Borings

REITZ & JENS, INC.

Figure 1

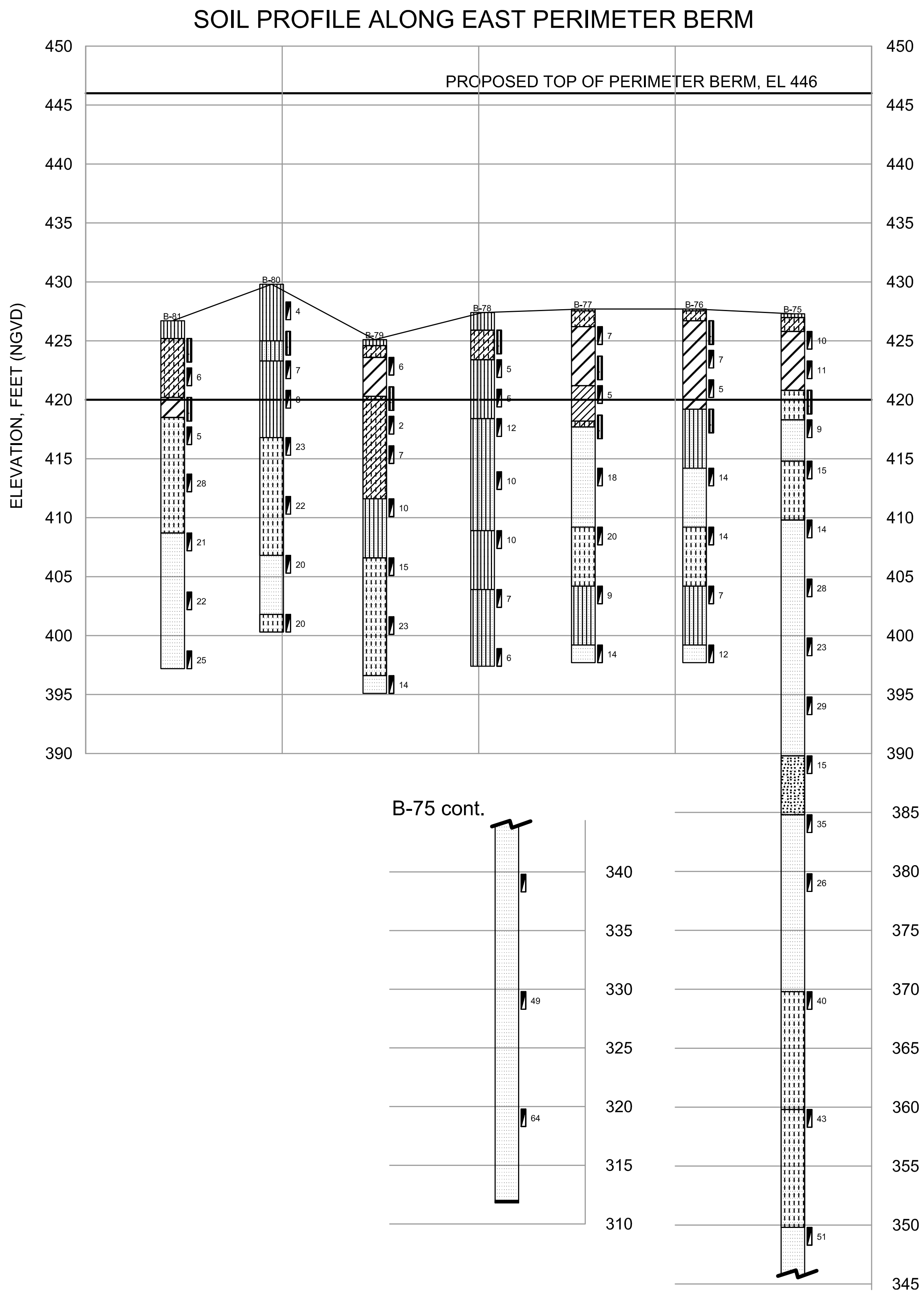


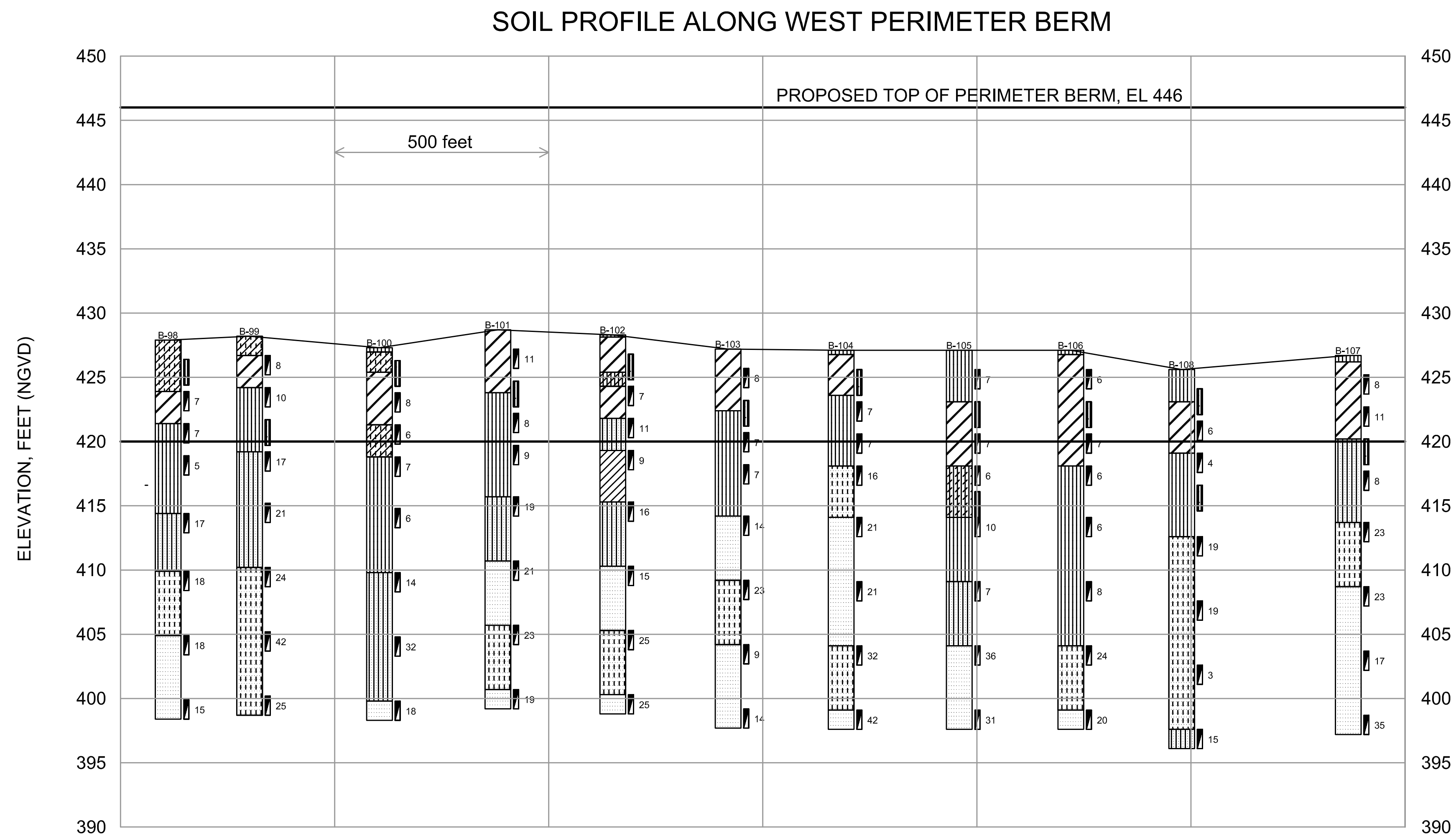

NOTE: GRAPHIC SYMBOLS ONLY DEPICT SOIL CLASSIFICATION; SEE BORING LOGS IN DETAILED SITE INVESTIGATION FOR COMPLETE INFORMATION.

Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILE
ALONG NORTH PERIMETER BERM

REITZ & JENS, INC.

Figure 2

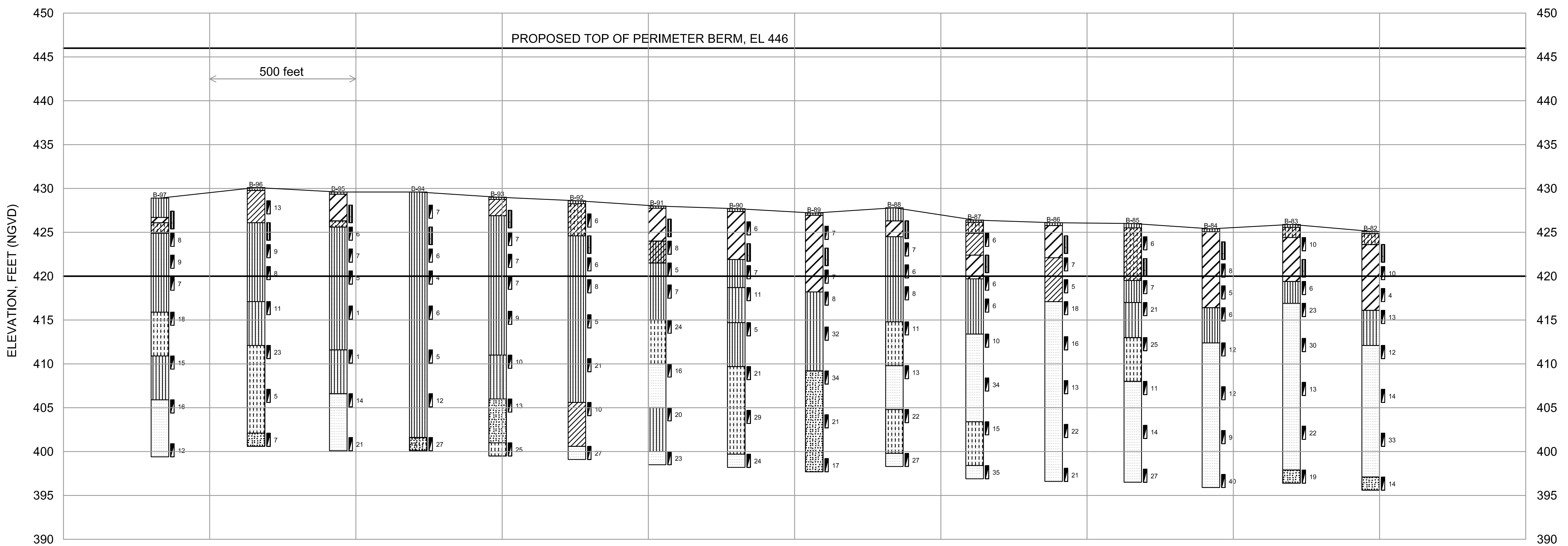



Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILES
ALONG EAST & WEST PERIMETER BERMS

Figure 3

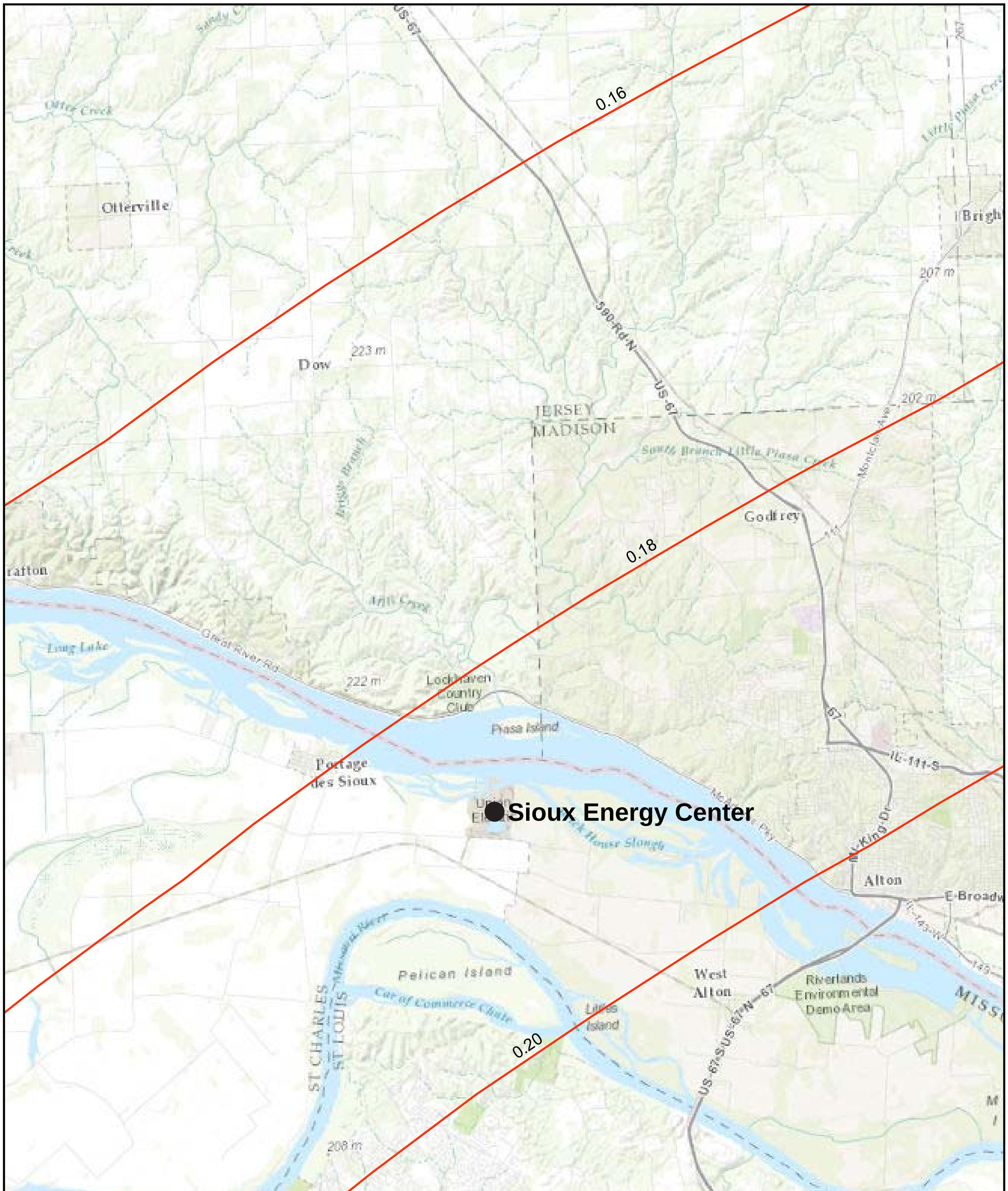
REITZ & JENS, INC.




Ameren Missouri Sioux Energy Center UWL
GENERALIZED SOIL PROFILE
ALONG SOUTH PERIMETER BERM

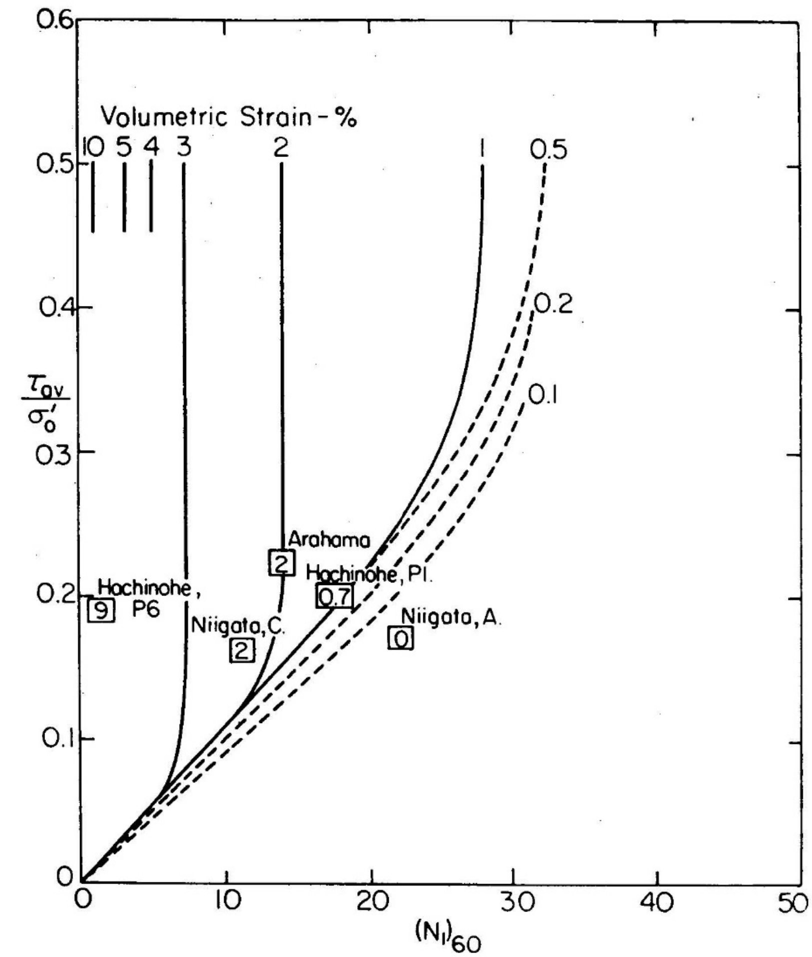
REITZ & JENS, INC.

Figure 4



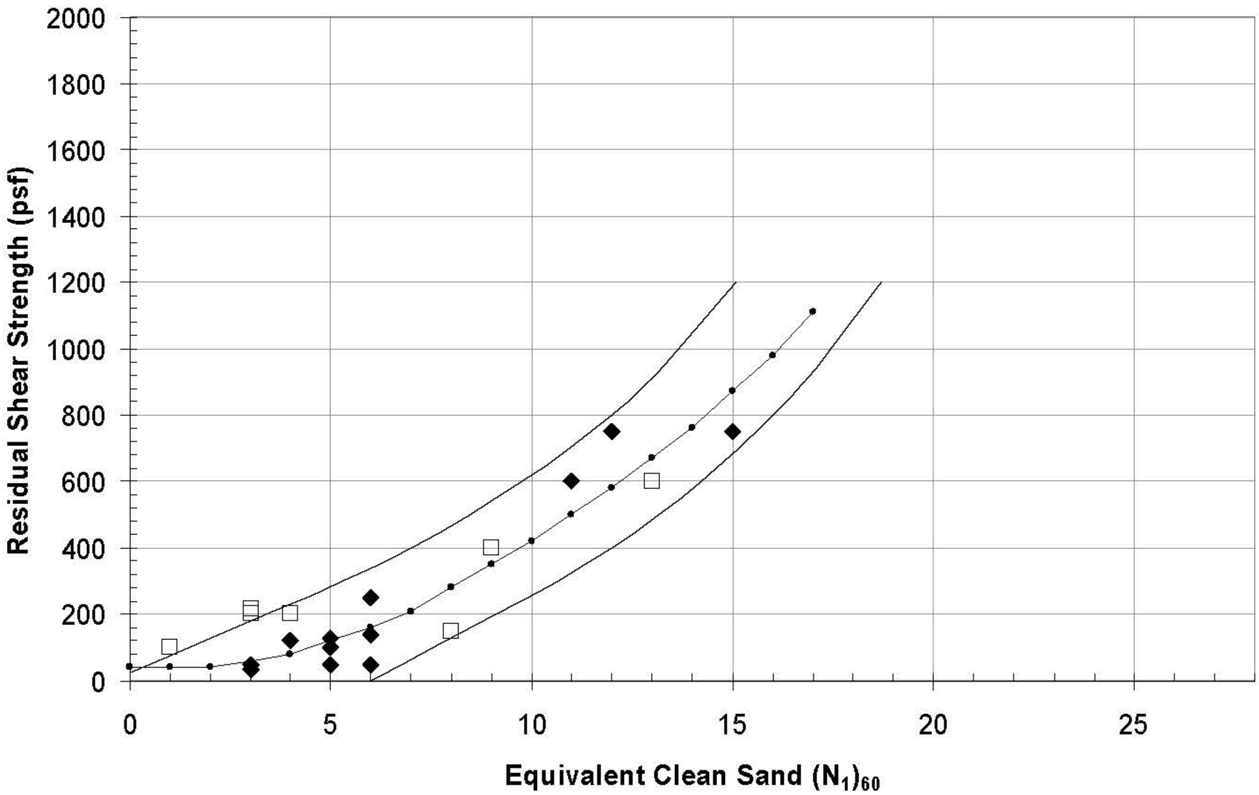

**2% Probability of Exceedance in 50 Years Map of Peak Ground Acceleration**

Ameren Missouri Sioux Energy Center UWL
2014 USGS Seismic Hazard Map




Earthquake Induced Settlements in Saturated Sands,
From Tokimatsu and Seed (1987)

Ameren Missouri Sioux Energy Center UWL
RELATIIONSHIP FOR EARTHQUAKE
INDUCED SETTLEMENT




Residual Shear Strength of Liquefied Sand from Seed (1997)
And Stark and Mesri (1992)

Ameren Missouri Sioux Energy Center UWL
RELATIIONSHIP FOR LOSS OF SHEAR
STRENGTH DUE TO LIQUEFACTION

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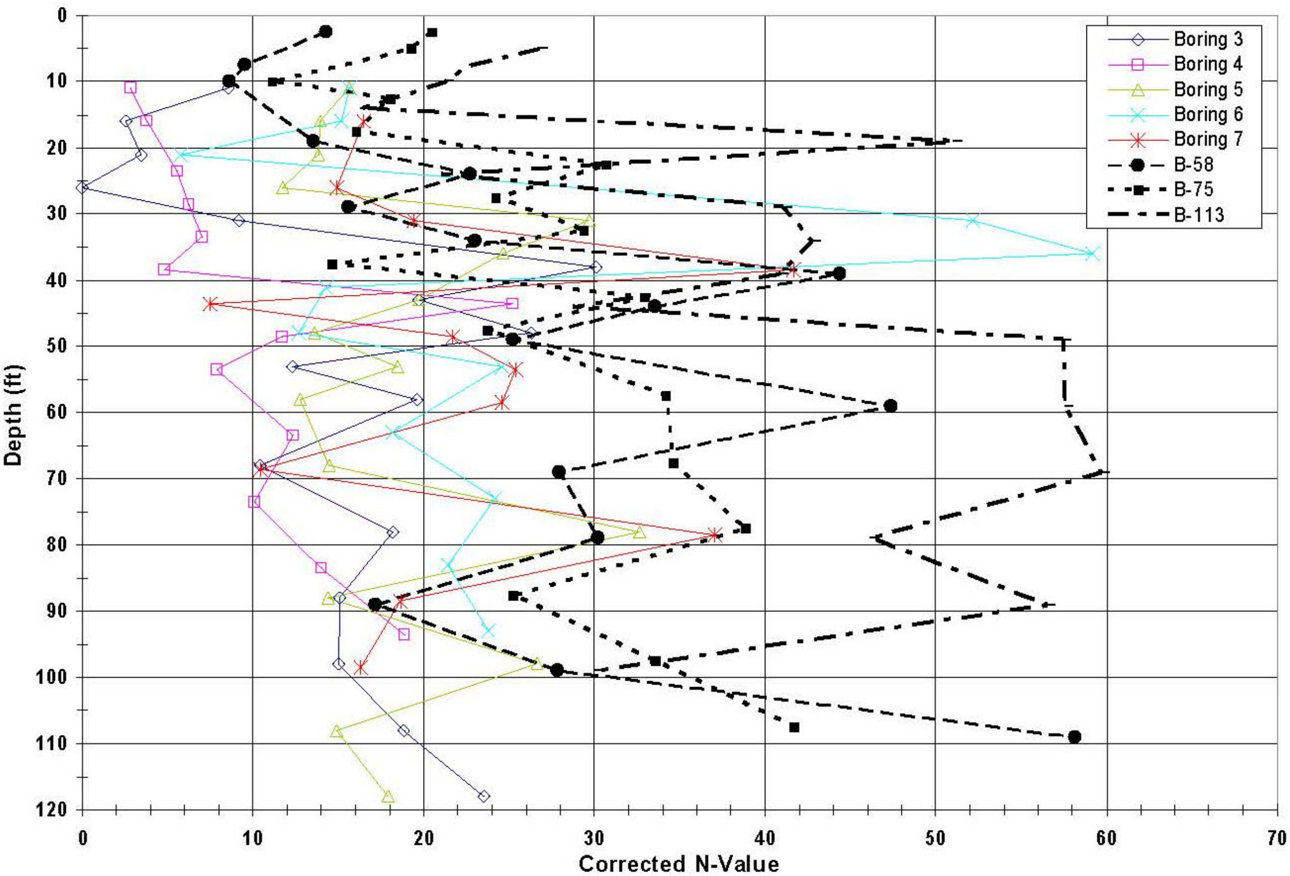
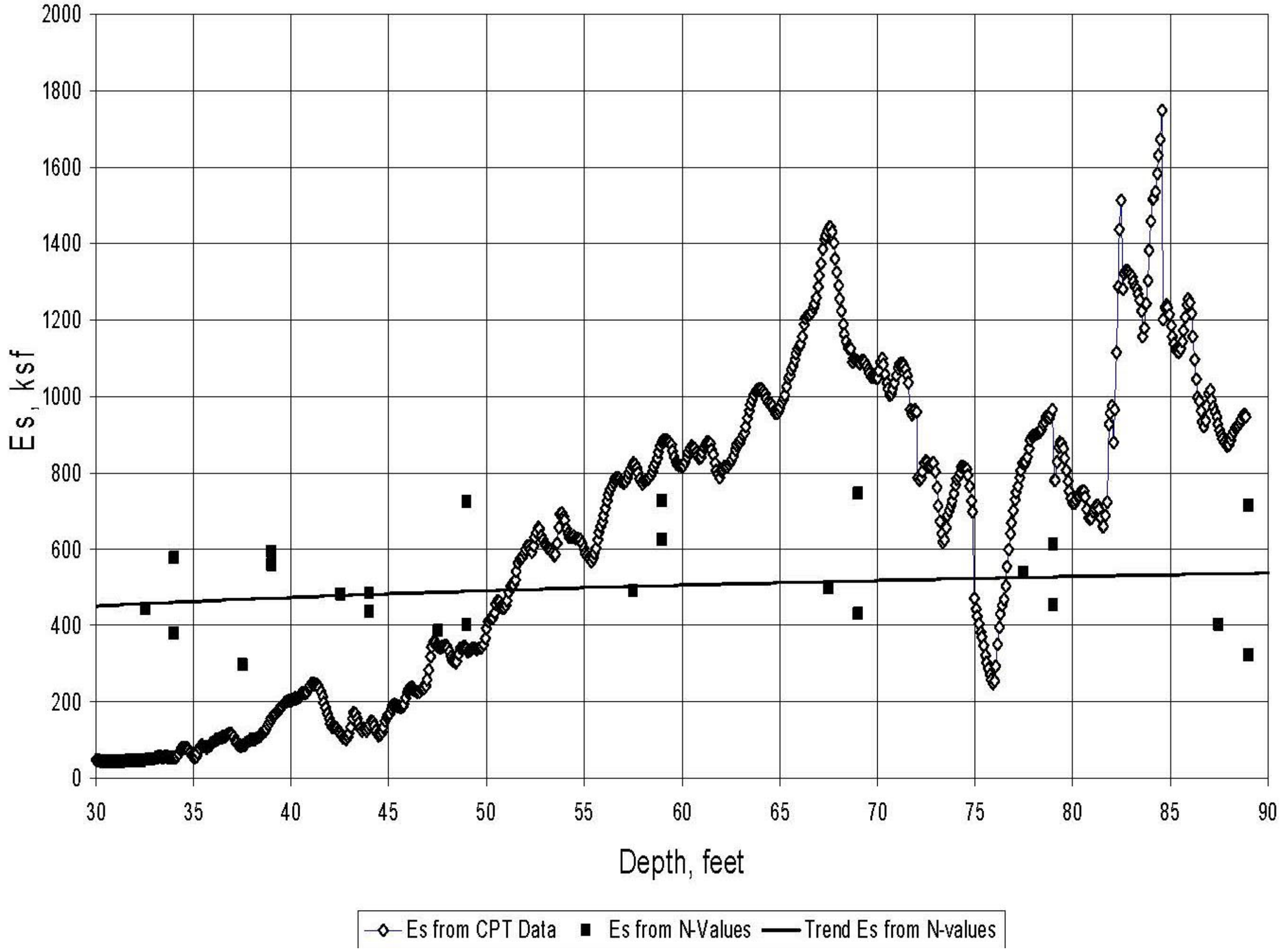



Ameren Missouri Sioux Energy Center UWL
COMPARISON OF CORRECTED N-VALUES
WITH DEPTH AT SIOUX ENERGY CENTER
AND UTILITY WASTE LANDFILL SITE



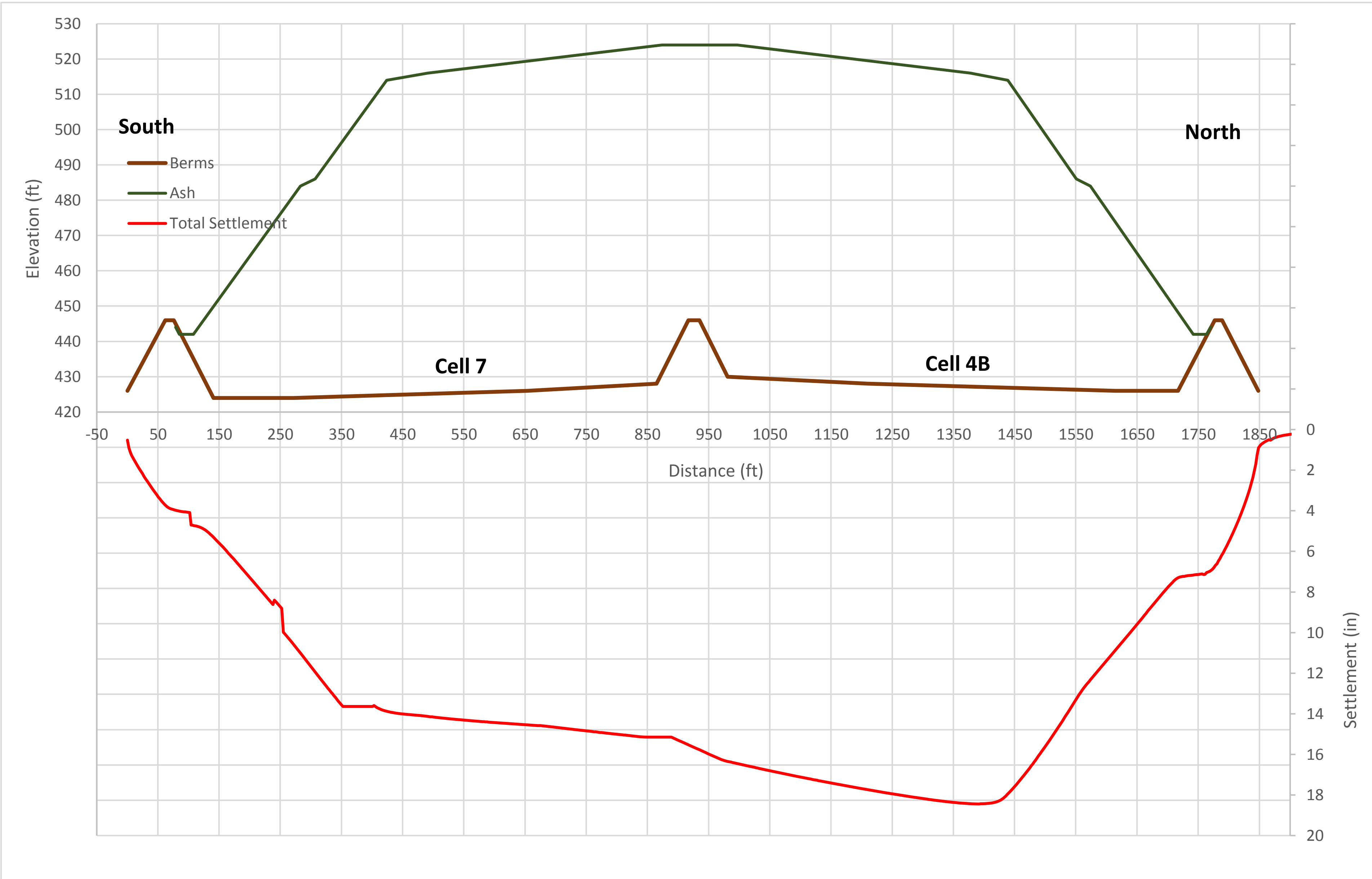

Ameren Missouri Sioux Energy Center UWL
COMPARISON OF ELASTIC SOIL MODULUS
(Es) OF SANDS VERSUS DEPTH

Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
EAST - WEST CENTERLINE

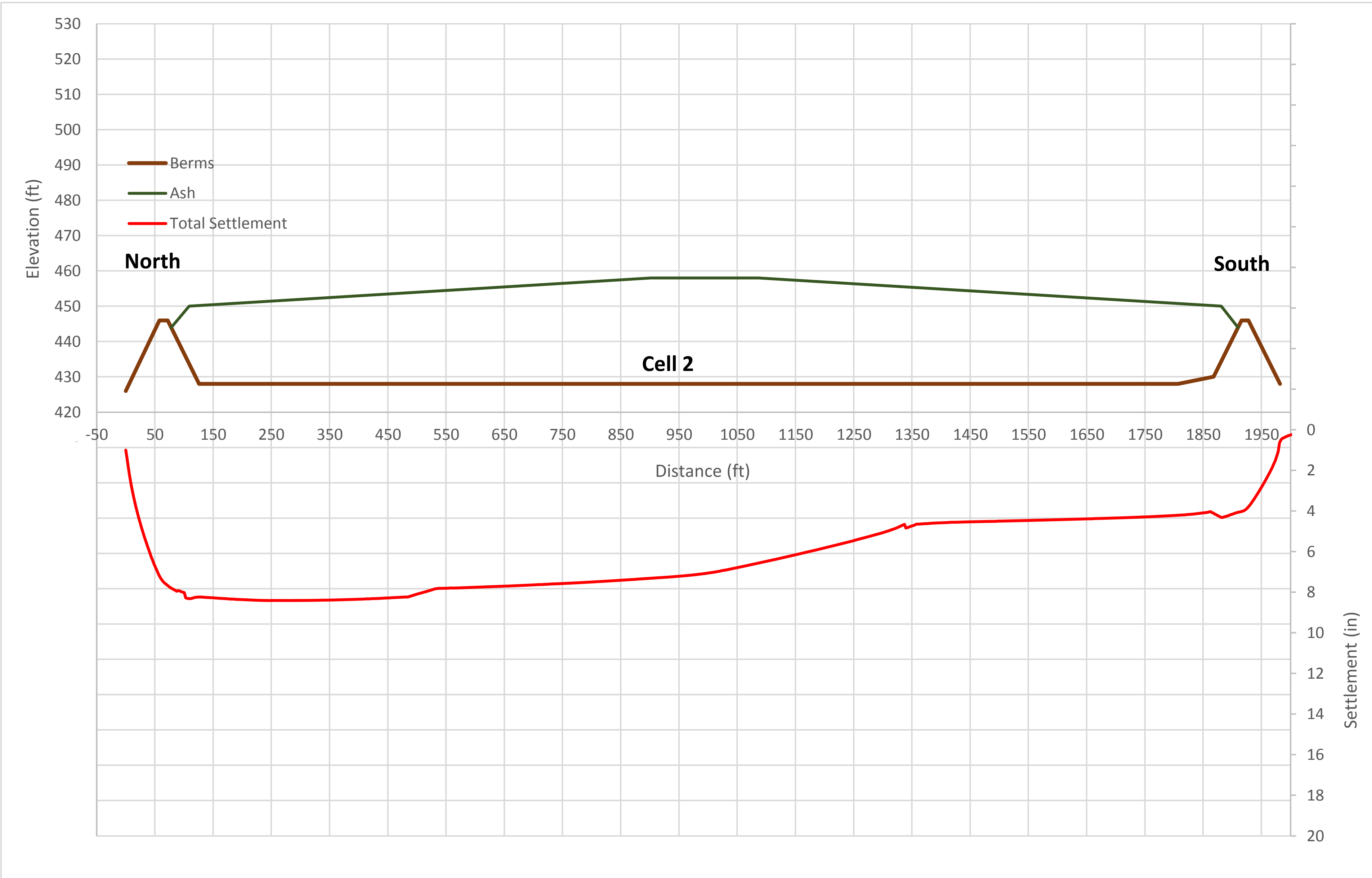


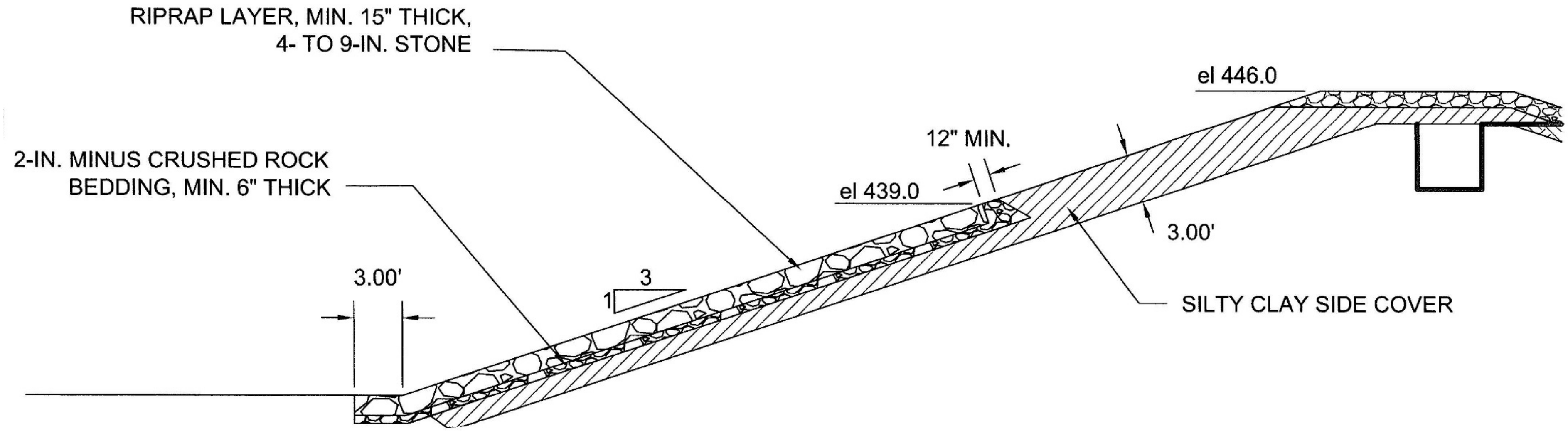

Figure 10

Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
NORTH-SOUTH THROUGH DRY CELLS 4B AND 7



Ameren Missouri Sioux Energy Center Utility Waste Landfill
PROFILE OF ESTIMATED SETTLEMENT
NORTH-SOUTH THROUGH CELL 2






Ameren Missouri Sioux Energy Center UWL
RIPRAP PROTECTION FOR CELL 1
PERIMETER BERMS

Figure 13

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**Appendix 1**

# LABORATORY CLASSIFICATION OF PHASE 2 SOIL SAMPLES

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 426.0 | 0.0 | 426.0 | 424.6 | 1.4 | ML | | | SILT, dark brown, slightly clayey | Discarded |
| | | | 426.0 | 1.4 | 424.6 | 424.0 | 0.6 | CH | | | CLAY, brown, high plastic | B-CH |
| | | | 426.0 | 2.0 | 424.0 | 423.3 | 0.7 | CL | | | Silty CLAY, low plastic, brown | Discarded |
| 115 | 1118716.09 | 878138.69 | 426.0 | 2.7 | 423.3 | 422.3 | 1.1 | CH | | | CLAY, brown, high plastic | B-CH |
| | | | 426.0 | 3.8 | 422.3 | 422.0 | 0.3 | ML | | | Clayey SILT, brownish tan | Discarded |
| | | | 426.0 | 4.0 | 422.0 | 421.0 | 1.0 | CL | | | CLAY, gray-brown, high plastic | B-2 |
| | | | 426.0 | 5.0 | 421.0 | | | | | | | |
| | | | 426.5 | 0.0 | 426.5 | 425.8 | 0.8 | ML | | | Clayey SILT, dary grayish brown | B-MCL |
| | | | 426.5 | 0.8 | 425.8 | 425.4 | 0.3 | CL | | | Silty CLAY, brown | B-CL |
| | | | 426.5 | 1.1 | 425.4 | 424.5 | 0.9 | ML | | | Clayey SILT, tan | Discarded |
| 116 | 1118664.14 | 878545.38 | 426.5 | 2.0 | 424.5 | 424.0 | 0.5 | ML | | | SILT, tan | Discarded |
| | | | 426.5 | 2.5 | 424.0 | 422.5 | 1.5 | CH | | | CLAY, dark brown, high plastic | B-CH |
| | | | 426.5 | 4.0 | 422.5 | 420.5 | 2.0 | CH | | | CLAY, brown & gray, high plastic | B-CH |
| | | | 426.5 | 6.0 | 420.5 | | | MCL | | | Silty CLAY, brown | B-CL |
| | | | 426.5 | 0.0 | 426.5 | 425.7 | 0.8 | CL | | | Silty CLAY, dark brown | C-CL |
| | | | 426.5 | 0.8 | 425.7 | 424.8 | 0.9 | CL | 19.4 | 100.3 | CLAY, dark brown, low plastic | C-CL |
| | | | 426.5 | 1.8 | 424.8 | 423.9 | 0.8 | CL | 25.4 | 97.6 | Silty CLAY, dark brown/tan, low plasti | C-CL |
| 117 | 1118612.20 | 878952.08 | 426.5 | 2.6 | 423.9 | 421.8 | 2.2 | CL-ML | | | Clayey SILT/Silty CLAY, light brown | B-MCL |
| | | | 426.5 | 4.8 | 421.8 | 420.5 | 1.3 | ML | | | SILT, lt. brown/tan, very slightly clayey | Discarded |
| | | | 426.5 | 6.0 | 420.5 | 420.2 | 0.3 | CL | | | CLAY, dark brown, low plastic | C-CL |
| | | | 426.5 | 6.3 | 420.2 | 419.6 | 0.6 | SM | | | SAND, light tan, fine | Discarded |
| | | | 426.5 | 6.9 | 419.6 | | | ML | | | Sandy SILT, brown | Discarded |
| | | | 426.5 | 0.0 | 426.5 | 425.8 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | Discarded |
| | | | 426.5 | 0.8 | 425.8 | 423.8 | 2.0 | CL | | | Dark Brown Clay | C-CL |
| | | | 426.5 | 2.8 | 423.8 | 423.0 | 0.8 | CH | | | Dark Black/Gray Clay | C-CH |
| 118 | 1118560.25 | 879358.78 | 426.5 | 3.5 | 423.0 | 422.2 | 0.8 | MCL | | | Dark Brown Silty Clay | C-MCL |
| | | | 426.5 | 4.3 | 422.2 | 420.0 | 2.2 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 426.5 | 6.5 | 420.0 | 419.7 | 0.3 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 426.5 | 6.8 | 419.7 | 418.6 | 1.1 | MCL | | | Gray/Brown Silty Clay | C-MCL |
| | | | 426.5 | 7.9 | 418.6 | | | MCL | | | Dark Brown slightly clayey Silt | C-MCL |
| | | | 426.5 | 0.0 | 426.5 | 426.3 | 0.2 | MCL | | | Dark Gray Silty Clay | D-MCL |
| | | | 426.5 | 0.2 | 426.3 | 425.5 | 0.8 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 426.5 | 1.0 | 425.5 | 425.3 | 0.3 | MCL | | | Lt Tan/Brown Silty Clay/Clayey Siilt | D-MCL |
| | | | 426.5 | 1.3 | 425.3 | 424.3 | 1.0 | CL | | | Dark Brown Clay w Trace Silt | C-CL |
| | | | 426.5 | 2.3 | 424.3 | 423.1 | 1.2 | CH | | | Dark Brown/Gray Clay | D-CH |
| 119 | 1118508.30 | 879765.47 | 426.5 | 3.4 | 423.1 | 421.8 | 1.3 | CH | | | Brown Gray Clay | D-CH |
| | | | 426.5 | 4.7 | 421.8 | 420.2 | 1.7 | CL | | | Gray Brown Clay | D-CL |
| | | | 426.5 | 6.3 | 420.2 | 420.0 | 0.2 | CL | | | Brown Clay | D-CL |
| | | | 426.5 | 6.5 | 420.0 | 419.8 | 0.2 | MCL | 32.5 | 89.1 | Gray/Brown Clayey Silt | D-MCL |
| | | | 426.5 | 6.7 | 419.8 | 419.2 | 0.7 | CL | | | Gray/Brown Clay | D-CL |
| | | | 426.5 | 7.3 | 419.2 | | | MCL | | | Gray/Brown Clayey Silt | D-MCL |
| | | | 427.5 | 0.0 | 427.5 | 425.3 | 2.3 | CL | | | Dark Brown/Gray Clay | D-CL |
| | | | 427.5 | 2.3 | 425.3 | 424.5 | 0.8 | CH | | | Dark Black Grey Clay | D-CH |
| | | | 427.5 | 3.0 | 424.5 | 423.7 | 0.8 | MCL | | | Dark Brown/Gray Silty Clay | D-MCL |
| 120 | 1118456.36 | 880172.17 | 427.5 | 3.8 | 423.7 | 423.1 | 0.6 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.4 | 423.1 | 421.1 | 2.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 420.7 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.8 | 420.7 | | | MCL | | | Gray/Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 427.0 | 0.0 | 427.0 | 426.6 | 0.4 | MCL | | | Dark Black/Gray Silty Clay | D-MCL |
| | | | 427.0 | 0.4 | 426.6 | 425.6 | 1.0 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 427.0 | 1.4 | 425.6 | 424.8 | 0.8 | CH | | | Dark Brown Clay | D-CH |
| 121 | 1118378.44 | 880782.21 | 427.0 | 2.3 | 424.8 | 422.8 | 2.0 | CH | | | Brown/Gray Clay | D-CH |
| | | | 427.0 | 4.3 | 422.8 | 420.8 | 2.0 | CH | | | Dark Brown Clay | D-CH |
| | | | 427.0 | 6.3 | 420.8 | 420.5 | 0.3 | CL | | | Dark Brown/Gray Clay | D-CL |
| | | | 427.0 | 6.5 | 420.5 | 419.7 | 0.8 | MCL | | | Dark Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 427.0 | 7.3 | 419.7 | | | SM | | | Lt Tan Brown Very Fine Sandy Silt | Discarded |
| | | | 426.5 | 0.0 | 426.5 | 425.5 | 1.0 | SC | | | Brown Silty Clayey Fine Sand | Discarded |
| | | | 426.5 | 1.0 | 425.5 | 424.5 | 1.0 | CL | | | Dark Gray Brown Clay w Silt | A-CL |
| | | | 426.5 | 2.0 | 424.5 | 421.5 | 3.0 | CH | | | Dark Gray Brown Clay | A-CH |
| 122 | 1118564.69 | 877706.02 | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | MCL | | | Dark Gray Silty Clay | A-MCL |
| | | | 426.5 | 5.5 | 421.0 | 420.5 | 0.5 | CH | | | Dark Gray Brown Clay | A-CH |
| | | | 426.5 | 6.0 | 420.5 | 419.5 | 1.0 | CL | | | Dark Gray Brown Clay | A-CL |
| | | | 426.5 | 7.0 | 419.5 | | | MCL | | | Dark Brown Silty Clay | A-MCL |
| | | | 426.5 | 0.0 | 426.5 | 425.9 | 0.6 | MCL | | | Dark Gray/Brown Silty Clay | C-MCL |
| | | | 426.5 | 0.6 | 425.9 | 424.4 | 1.5 | CH | | | Dark Gray/Brown Clay | C-CH |
| | | | 426.5 | 2.1 | 424.4 | 422.3 | 2.2 | CH | | | Brown Clay | C-CH |
| 123 | 1118356.90 | 879332.80 | 426.5 | 4.3 | 422.3 | 421.5 | 0.8 | CL | | | Brown Clay | C-CL |
| | | | 426.5 | 5.0 | 421.5 | 421.3 | 0.3 | MCL | | | Brown/Gray Silty Clay | C-MCL |
| | | | 426.5 | 5.3 | 421.3 | 420.2 | 1.1 | SM | | | Lt Tan Sandy Silt - Silty Sand | Discarded |
| | | | 426.5 | 6.3 | 420.2 | | | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 427.0 | 0.0 | 427.0 | 424.8 | 2.2 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 427.0 | 2.2 | 424.8 | 423.9 | 0.9 | CH | | | Dark Brown Gray Clay | D-CH |
| 124 | 1118201.06 | 880552.89 | 427.0 | 3.1 | 423.9 | 422.9 | 1.0 | CL | | | Dark Brown Clay | D-CL |
| | | | 427.0 | 4.1 | 422.9 | 420.9 | 2.0 | CL | | | Gray/Brown Clay | D-CL |
| | | | 427.0 | 6.1 | 420.9 | 419.9 | 1.0 | MCL | | | Gary/Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 427.0 | 7.1 | 419.9 | | | SP | | | Lt Tan/Brown Silt w Very Fine Sand | Discarded |
| | | | 426.5 | 0.0 | 426.5 | 426.3 | 0.2 | MCL | | | Dark Black/Gray Silty Clay | E-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 125 | 1118097.17 | 881366.28 | 426.5 | 0.2 | 426.3 | 425.5 | 0.8 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.5 | 1.0 | 425.5 | 424.2 | 1.3 | CH | | | Brown Clay | E-CH |
| | | | 426.5 | 2.3 | 424.2 | 421.8 | 2.3 | CH | | | Brown Clay | E-CH |
| | | | 426.5 | 4.7 | 421.8 | 420.1 | 1.8 | CH | | | Dark Brown Clay | E-CH |
| | | | 426.5 | 6.4 | 420.1 | | | CL | | | Dark Brown Clay | E-CL |
| 126 | 1118387.31 | 877476.70 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Gray Brown Sand/Silt/Clay | Discarded |
| | | | 427.0 | 0.8 | 426.2 | 425.8 | 0.3 | MCL | | | Dark Brown Silty Clay | A-MCL |
| | | | 427.0 | 1.2 | 425.8 | 425.5 | 0.3 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 427.0 | 1.5 | 425.5 | 424.5 | 1.0 | MCL | | | Dark Brown Gray Clay w Silt | A-MCL |
| | | | 427.0 | 2.5 | 424.5 | 423.8 | 0.7 | CH | | | Dark Brown Gray Clay | A-CH |
| | | | 427.0 | 3.2 | 423.8 | 422.3 | 1.6 | MCL | | | Dark Brown Gray Clay w Silt | A-MCL |
| | | | 427.0 | 4.8 | 422.3 | 420.8 | 1.5 | CH | 31.9 | 89.4 | Dark Brown Gray Clay | A-CH |
| | | | 427.0 | 6.3 | 420.8 | 419.7 | 1.1 | CH | | | Dark Brown Clay | A-CH |
| | | | 427.0 | 7.3 | 419.7 | | | SP | | | Brown/Gray Very Fine Sand | Discarded |
| 127 | 1118335.37 | 877883.39 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | B-MCL |
| | | | 427.0 | 0.8 | 426.3 | 424.8 | 1.5 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 427.0 | 2.3 | 424.8 | 422.4 | 2.4 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 427.0 | 4.7 | 422.4 | 420.3 | 2.1 | MCL | | | Lt Tan Silt w Dark Brown Clay | B-MCL |
| | | | 427.0 | 6.8 | 420.3 | 419.4 | 0.9 | CL | | | Brown Clay | B-CL |
| | | | 427.0 | 7.7 | 419.4 | | | SM | | | Brown/Tan Silt w Very Fine Sand | Discarded |
| 128 | 1118283.42 | 878290.09 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Gray/Brown Silty Clay | B-MCL |
| | | | 427.0 | 0.8 | 426.2 | 425.0 | 1.2 | CH | | | Dark Gray Brown Clay | B-CH |
| | | | 427.0 | 2.0 | 425.0 | 423.3 | 1.8 | CH | | | Brown Clay | B-CH |
| | | | 427.0 | 3.8 | 423.3 | 423.0 | 0.3 | ML | | | Brown/Tan Silt w Clay | Discarded |
| | | | 427.0 | 4.0 | 423.0 | 421.0 | 2.0 | ML | | | Brown Tan Silt to Silty Clay | Discarded |
| | | | 427.0 | 6.0 | 421.0 | 420.8 | 0.2 | CL | | | Mottled Gray/Brown Clay | B-CL |
| | | | 427.0 | 6.2 | 420.8 | | | SM | | | Tan Slightly Silty Sand | Discarded |
| 129 | 1118231.47 | 878696.79 | 427.0 | 0.0 | 427.0 | 426.3 | 0.7 | MCL | 16.5 | 96.8 | Dark Brown Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.7 | 426.3 | 424.8 | 1.5 | CL | | | Dark Brown Clay | C-CL |
| | | | 427.0 | 2.2 | 424.8 | 424.2 | 0.7 | CH | | | Dark Black/Grey Clay | C-CH |
| | | | 427.0 | 2.8 | 424.2 | 422.3 | 1.8 | CH | | | Brown Clay | C-CH |
| | | | 427.0 | 4.7 | 422.3 | 421.5 | 0.8 | CL | 30.1 | 82.6 | Brown Clay | C-CH |
| | | | 427.0 | 5.5 | 421.5 | 420.7 | 0.8 | MCL | | | Brown Silty Clay | C-MCL |
| | | | 427.0 | 6.3 | 420.7 | 420.3 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 6.8 | 420.3 | 419.6 | 0.7 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 427.0 | 7.4 | 419.6 | | | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 130 | 1118179.53 | 879103.48 | 428.0 | 0.0 | 428.0 | 427.3 | 0.8 | MCL | | | Dark Brown Sandy Silty Clay | Discarded |
| | | | 428.0 | 0.8 | 427.3 | 425.8 | 1.5 | MCL | | | Dark Brown Lt Brown Silty Clay | C-MCL |
| | | | 428.0 | 2.3 | 425.8 | 425.3 | 0.5 | CH | | | Dark Black Grey Clay | C-CH |
| | | | 428.0 | 2.8 | 425.3 | 424.5 | 0.8 | CL | | | Dark Brown Clay w Silt Seams | C-CL |
| | | | 428.0 | 3.5 | 424.5 | 423.7 | 0.8 | MCL | | | Dark Brown Clay w Tan Silt | C-MCL |
| | | | 428.0 | 4.3 | 423.7 | 423.2 | 0.5 | CL | 7.2 | 82.1 | Dark Brown Clay | C-CL |
| | | | 428.0 | 4.8 | 423.2 | 421.6 | 1.6 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 428.0 | 6.4 | 421.6 | 420.0 | 1.6 | ML | | | Lt Tan/Brown Silt w Clay &Fine Sand | Discarded |
| | | | 428.0 | 8.0 | 420.0 | | | MCL | | | Dark Brown Silty Clay | C-MCL |
| 131 | 1118127.58 | 879510.18 | 427.5 | 0.0 | 427.5 | 426.8 | 0.7 | MCL | | | Dark Brown Silty Clay w Sand | Discarded |
| | | | 427.5 | 0.7 | 426.8 | 425.2 | 1.7 | CH | | | Dark Gray Brown Clay | C-CH |
| | | | 427.5 | 2.3 | 425.2 | 423.8 | 1.3 | CH | | | Dark Brown Clay | C-CH |
| | | | 427.5 | 3.7 | 423.8 | 422.8 | 1.0 | MCL | | | Lt Tan Silt w Brown Clay | C-MCL |
| | | | 427.5 | 4.7 | 422.8 | 421.0 | 1.8 | CH | | | Brown Clay | C-CH |
| | | | 427.5 | 6.5 | 421.0 | 420.4 | 0.6 | CL | | | Brown Clay | C-CL |
| | | | 427.5 | 7.1 | 420.4 | 420.1 | 0.3 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 427.5 | 7.4 | 420.1 | 419.8 | 0.3 | CL | | | Brown Clay | C-CL |
| | | | 427.5 | 7.8 | 419.8 | | | SM | | | Brown Silt w Fine Sand | Discarded |
| 132 | 1118075.64 | 879916.87 | 427.5 | 0.0 | 427.5 | 426.5 | 1.0 | MCL | | | Dark Brown Silty Clay | D-MCL |
| | | | 427.5 | 1.0 | 426.5 | 424.0 | 2.5 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 427.5 | 3.5 | 424.0 | 422.9 | 1.1 | CH | | | Gray/Brown Clay | D-CH |
| | | | 427.5 | 4.6 | 422.9 | 422.3 | 0.7 | CH | | | Gray/Brown Clay | D-CH |
| | | | 427.5 | 5.3 | 422.3 | 422.0 | 0.3 | CL | | | Dark Gray Clay w Silt Seams | D-CL |
| | | | 427.5 | 5.5 | 422.0 | 421.1 | 0.9 | SM | | | Lt Tan Silty Sand w Sandy Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 421.0 | 0.1 | CH | | | Dark Brown Gray Clay | D-CH |
| | | | 427.5 | 6.5 | 421.0 | 420.8 | 0.3 | SM | | | Lt Tan Silty Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | 419.6 | 1.2 | MCL | | | Gray Brown Sitly Clay | D-MCL |
| | | | 427.5 | 7.9 | 419.6 | | | SM | | | Brown Very Fine Sand | Discarded |
| 133 | 1118023.69 | 880323.57 | 427.0 | 0.0 | 427.0 | 426.0 | 1.0 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 427.0 | 1.0 | 426.0 | 422.3 | 3.7 | CH | | | Dark Gray Brown Clay | D-CH |
| | | | 427.0 | 4.7 | 422.3 | 420.5 | 1.8 | CH | 30.5 | 88.89 | Dark Gray Brown Clay | D-CH |
| | | | 427.0 | 6.5 | 420.5 | 419.7 | 0.8 | CH | | | Gary Brown Mottled Clay | D-CH |
| | | | 427.0 | 7.3 | 419.7 | | | MCL | | | Brown Gray Clayey Silt | D-MCL |
| 134 | 1117971.74 | 880730.27 | 427.0 | 0.0 | 427.0 | 426.2 | 0.8 | MCL | | | Dark Brown Gray Silty Clay | D-MCL |
| | | | 427.0 | 0.8 | 426.2 | 424.8 | 1.4 | CH | | | Dark Black/Gray Clay | D-CH |
| | | | 427.0 | 2.2 | 424.8 | 422.5 | 2.3 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 427.0 | 4.5 | 422.5 | 422.3 | 0.3 | CL | | | Brown Gray Clay | D-CL |
| | | | 427.0 | 4.8 | 422.3 | 421.9 | 0.3 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 427.0 | 5.1 | 421.9 | 420.5 | 1.4 | CL | | | Brown Gray Clay | D-CL |
| | | | 427.0 | 6.5 | 420.5 | | | CL | | | Gray Brown Clay | D-CL |
| | | | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 135 | 1117919.80 | 881136.96 | 426.0 | 0.3 | 425.7 | 423.5 | 2.2 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.0 | 2.5 | 423.5 | 422.6 | 0.9 | CH | | | Dark Black/Gray Clay | E-CH |
| | | | 426.0 | 3.4 | 422.6 | 421.5 | 1.1 | CH | | | Dark Gray/Brown Clay | E-CH |
| | | | 426.0 | 4.5 | 421.5 | | | CH | | | Dark Gray/Brown Clay | E-CH |
| 136 | 1117867.85 | 881543.66 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |
| | | | 427.0 | 0.8 | 426.3 | 425.6 | 0.7 | CL | | | Dark Black/Gray Clay | E-CL |
| | | | 427.0 | 1.4 | 425.6 | 424.7 | 0.9 | CH | | | Dark Gray/Black Clay | E-CH |
| | | | 427.0 | 2.3 | 424.7 | 424.2 | 0.5 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 427.0 | 2.8 | 424.2 | 422.5 | 1.7 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.0 | 4.5 | 422.5 | 421.8 | 0.7 | CH | | | Dark Gray Brown Clay | E-CH |
| | | | 427.0 | 5.2 | 421.8 | 421.5 | 0.3 | MCL | | | Dark Brown Silty Clay | E-MCL |
| | | | 427.0 | 5.5 | 421.5 | 420.5 | 1.0 | SP | | | Tan Very Fine Silty Sand | Discarded |
| | | | 427.0 | 6.5 | 420.5 | | | SM | | | Tan Slightly Silty Fine Sand | Discarded |
| 137 | 1117815.90 | 881950.35 | 427.5 | 0.0 | 427.5 | 426.9 | 0.6 | MCL | | | Dark Black/Gray Slightly Silty Clay | E-MCL |
| | | | 427.5 | 0.6 | 426.9 | 425.5 | 1.4 | CL | | | Dark Brown Gray Clay | E-CL |
| | | | 427.5 | 2.0 | 425.5 | 422.9 | 2.6 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.5 | 4.6 | 422.9 | 422.3 | 0.6 | CL | | | Dark Brown Clay | E-CL |
| | | | 427.5 | 5.2 | 422.3 | 421.8 | 0.5 | MCL | | | Dark Brown Silty Clay | E-MCL |
| | | | 427.5 | 5.7 | 421.8 | 421.2 | 0.7 | MCL | | | Lt Brown Clayey Silt w Trace Sand | E-MCL |
| | | | 427.5 | 6.3 | 421.2 | 420.8 | 0.4 | SP | | | Tan Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | | | SM | | | Brown Sand Silt | Discarded |
| 138 | 1118183.96 | 877450.73 | 426.0 | 0.0 | 426.0 | 425.5 | 0.5 | MCL | | | Dark Gray/Black Silty Clay | A-MCL |
| | | | 426.0 | 0.5 | 425.5 | 423.6 | 1.9 | CH | | | Dark Gray/Black Clay | A-CH |
| | | | 426.0 | 2.4 | 423.6 | 421.2 | 2.4 | CH | | | Dark Brown/Gray Clay | A-CH |
| | | | 426.0 | 4.8 | 421.2 | 421.0 | 0.2 | CH | | | Dark Brown/Gray Clay | A-CH |
| | | | 426.0 | 5.0 | 421.0 | | | CL | | | Dark Brown Clay | A-CL |
| 139 | 1117586.58 | 882127.73 | 427.5 | 0.0 | 427.5 | 427.3 | 0.2 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 0.2 | 427.3 | 426.9 | 0.4 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 0.6 | 426.9 | 425.4 | 1.5 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 427.5 | 2.1 | 425.4 | 424.4 | 1.0 | CH | | | Dark Gray Brown Clay | E-CH |
| | | | 427.5 | 3.1 | 424.4 | 423.2 | 1.3 | CH | | | Dark Brown Clay | E-CH |
| | | | 427.5 | 4.3 | 423.2 | 422.3 | 0.8 | CH | | | Brown Clay | E-CH |
| | | | 427.5 | 5.2 | 422.3 | 421.3 | 1.1 | SM | | | Lt Tan Slightly Silty Sand w Silt | Discarded |
| | | | 427.5 | 6.3 | 421.3 | | | SP | | | Tan Fine Sand | Discarded |
| 140 | 1117980.62 | 877424.75 | 427.0 | 0.0 | 427.0 | 426.7 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | A-MCL |
| | | | 427.0 | 0.3 | 426.7 | 426.3 | 0.4 | MCL | | | Dark Brown Silty Clay | A-MCL |
| | | | 427.0 | 0.8 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown Clay | A-CL |
| | | | 427.0 | 1.1 | 426.0 | 424.8 | 1.2 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 427.0 | 2.3 | 424.8 | 424.2 | 0.6 | CH | 15.3 | 87 | Dark Brown Clay | A-CH |
| | | | 427.0 | 2.8 | 424.2 | 423.3 | 0.9 | MCL | | | Lt Tan Silt w Dark Brown Clay | A-MCL |
| | | | 427.0 | 3.8 | 423.3 | 422.5 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 4.5 | 422.5 | 422.0 | 0.5 | MCL | 12.2 | 88 | Lt Tan w Brown Clayey Silt | A-MCL |
| | | | 427.0 | 5.0 | 422.0 | 421.0 | 1.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 6.0 | 421.0 | 420.5 | 0.5 | MCL | | | Lt Tannish Brown Silty Clay | A-MCL |
| | | | 427.0 | 6.5 | 420.5 | | | ML | | | Lt Tan Silt | Discarded |
| 141 | 1117928.67 | 877831.45 | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 427.5 | 0.4 | 427.1 | 426.6 | 0.5 | CL | | | Brown Clay | B-CL |
| | | | 427.5 | 0.9 | 426.6 | 425.5 | 1.1 | CH | 24.5 | 99.7 | Brown/Gray Clay | B-CH |
| | | | 427.5 | 2.0 | 425.5 | 425.0 | 0.5 | CH | | | Brown Clay | B-CH |
| | | | 427.5 | 2.5 | 425.0 | 423.5 | 1.5 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 4.0 | 423.5 | 423.0 | 0.5 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.9 | 0.1 | MCL | | | Brown Clay Silty | B-MCL |
| | | | 427.5 | 4.6 | 422.9 | 422.1 | 0.8 | ML | | | Tan Silt | Discarded |
| | | | 427.5 | 5.4 | 422.1 | 421.8 | 0.3 | CH | | | Brown Clay | B-CH |
| | | | 427.5 | 5.8 | 421.8 | 421.5 | 0.3 | SM | | | Brown/Gray Fine Sandy Silt | Discarded |
| | | | 427.5 | 6.0 | 421.5 | 421.0 | 0.5 | MCL | | | Tan Clayey Silt | B-MCL |
| | | | 427.5 | 6.5 | 421.0 | 420.9 | 0.1 | MCL | | | Brown Clayey silt | B-MCL |
| | | | 427.5 | 6.6 | 420.9 | 420.8 | 0.2 | SP | | | Tan Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | 420.3 | 0.4 | MCL | | | Brown Silty Clay | B-MCL |
| | | | 427.5 | 7.2 | 420.3 | | | SM | | | Tan Silty Fine Sand | Discarded |
| 142 | 1117876.72 | 878238.14 | 428.0 | 0.0 | 428.0 | 427.4 | 0.6 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 428.0 | 0.6 | 427.4 | 427.2 | 0.3 | MCL | | | Dark Gray/Brown Clayey Silt | B-MCL |
| | | | 428.0 | 0.8 | 427.2 | 426.0 | 1.2 | CH | | | Brown Clay | B-CH |
| | | | 428.0 | 2.0 | 426.0 | 425.3 | 0.8 | SM | | | Tan Very Fine Silty Sand | Discarded |
| | | | 428.0 | 2.8 | 425.3 | 424.0 | 1.3 | SP | | | Tan Very Fine Sand | Discarded |
| | | | 428.0 | 4.0 | 424.0 | 422.6 | 1.4 | MCL | | | Brown/Gray clayey silt | B-MCL |
| | | | 428.0 | 5.4 | 422.6 | 422.0 | 0.6 | SM | | | Tan Slightly Silty Sand | Discarded |
| | | | 428.0 | 6.0 | 422.0 | 421.2 | 0.8 | MCL | | | Gray Brown Clayey Silty w Fine Sand | Discarded |
| | | | 428.0 | 6.8 | 421.2 | 420.5 | 0.7 | SP | | | Tan Fine Sand | Discarded |
| | | | 428.0 | 7.5 | 420.5 | | | MCL | | | Gray/Brown Clayey Silt to silty Clay | B-MCL |
| 143 | 1117824.78 | 878644.84 | 428.5 | 0.0 | 428.5 | 427.9 | 0.6 | MCL | | | Dark Brown/Brown Silty Clay | C-MCL |
| | | | 428.5 | 0.6 | 427.9 | 426.9 | 1.0 | CH | | | Dark Black/Gray Clay | C-CH |
| | | | 428.5 | 1.6 | 426.9 | 426.2 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 2.3 | 426.2 | 425.3 | 0.9 | MCL | | | Dark Brown/Brown Silty Clay | C-MCL |
| | | | 428.5 | 3.3 | 425.3 | 424.1 | 1.2 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 428.5 | 4.4 | 424.1 | 422.2 | 1.9 | SM | | | Lt Tan Silty Sand | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.7 | 0.5 | MCL | | | Brown/Tan Clayey Silt/Silty Clay | C-MCL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.5 | 6.8 | 421.7 | | | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 428.5 | 0.0 | 428.5 | 428.3 | 0.3 | MCL | | | Dark Brown Siilty Clay | C-MCL |
| | | | 428.5 | 0.3 | 428.3 | 427.0 | 1.3 | CL | | | Dark Gray Brown/Black Clay | C-CL |
| | | | 428.5 | 1.5 | 427.0 | 426.8 | 0.2 | MCL | | | Dark Brown w Tan Silty Clay | C-MCL |
| | | | 428.5 | 1.7 | 426.8 | 426.1 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 2.4 | 426.1 | 425.5 | 0.6 | MCL | | | Dark Brown Silty Clay/Clayey Silt | C-MCL |
| 144 | 1117772.83 | 879051.54 | 428.5 | 3.0 | 425.5 | 425.1 | 0.4 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 3.4 | 425.1 | 424.7 | 0.4 | CL | | | Dark Brown/Gray Clay | C-CL |
| | | | 428.5 | 3.8 | 424.7 | 423.9 | 0.8 | SP | | | Lt Tan Very Fine Sand | Discarded |
| | | | 428.5 | 4.6 | 423.9 | 422.6 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 5.9 | 422.6 | 421.8 | 0.8 | MCL | | | Brown Clayey Silt | C-MCL |
| | | | 428.5 | 6.7 | 421.8 | | | ML | | | Lt Tan w Brown Silt w Clay w Sand | Discarded |
| | | | 429.0 | 0.0 | 429.0 | 428.2 | 0.8 | MCL | | | Dark Brown Silty Clay | C-MCL |
| | | | 429.0 | 0.8 | 428.2 | 427.4 | 0.8 | CL | | | Dark Brown Clay | C-CL |
| | | | 429.0 | 1.6 | 427.4 | 426.4 | 1.0 | MCL | | | Dark Brown Lt Tan Silty Clay | C-MCL |
| 145 | 1117720.89 | 879458.23 | 429.0 | 2.6 | 426.4 | 424.3 | 2.1 | MCL | | | Lt Brown Clayey Silt w Silty Clay | C-MCL |
| | | | 429.0 | 4.7 | 424.3 | 423.0 | 1.3 | MCL | | | Lt Tan Brown Clayey Silt | C-MCL |
| | | | 429.0 | 6.0 | 423.0 | 422.7 | 0.3 | CL | | | Dark Brown Clay | C-CL |
| | | | 429.0 | 6.3 | 422.7 | 422.1 | 0.6 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 429.0 | 6.9 | 422.1 | | | SM | | | Brown Sandy Silt | Discarded |
| | | | 428.5 | 0.0 | 428.5 | 426.3 | 2.3 | CL | | | Dark Brown Slightly Silty Clay | D-CL |
| | | | 428.5 | 2.3 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown Slightly Silty Clay | D-Cl |
| | | | 428.5 | 2.5 | 426.0 | 425.3 | 0.7 | MCL | | | Lt Tan Clayey Silt | D-MCL |
| | | | 428.5 | 3.2 | 425.3 | 424.8 | 0.6 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 3.8 | 424.8 | 423.6 | 1.2 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 4.9 | 423.6 | 423.4 | 0.2 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 428.5 | 5.1 | 423.4 | 423.0 | 0.4 | MCL | | | Lt Tan Slightly Clayey Silt | D-MCL |
| 146 | 1117668.94 | 879864.93 | 428.5 | 5.5 | 423.0 | 422.2 | 0.8 | SM | | | Lt Tan Very Fine Sand Silt/Silty Sand | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.8 | 0.3 | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 6.7 | 421.8 | 421.4 | 0.4 | SM | | | Lt Tan Very Slightly Silty Sand | Discarded |
| | | | 428.5 | 7.1 | 421.4 | 420.8 | 0.7 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 7.8 | 420.8 | 419.9 | 0.8 | MCL | | | Dark Brown Clayey Silt | D-MCL |
| | | | 428.5 | 8.6 | 419.9 | 419.3 | 0.6 | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| | | | 428.5 | 9.2 | 419.3 | 419.1 | 0.3 | MCL | | | Brown Slightly Clayey Silt | D-MCL |
| | | | 428.5 | 9.4 | 419.1 | | | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| | | | 429.0 | 0.0 | 429.0 | 427.0 | 2.0 | MCL | | | Dark Brown/Gray Silty Sandy Clay | D-MCL |
| | | | 429.0 | 2.0 | 427.0 | 425.8 | 1.2 | MCL | | | Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 429.0 | 3.2 | 425.8 | 424.8 | 1.0 | MCL | 7.3 | 87.93 | Lt Tan Very Sllightly Clayey Silt w Ver | D-MCL |
| | | | 429.0 | 4.2 | 424.8 | 424.7 | 0.2 | MCL | | | Lt Tan Clayey Silt/ Silty Clay | D-MCL |
| | | | 429.0 | 4.3 | 424.7 | 424.2 | 0.5 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 147 | 1117616.99 | 880271.62 | 429.0 | 4.8 | 424.2 | 422.3 | 1.8 | CH | 26.4 | 87.32 | Brown/Gray Clay | D-CH |
| | | | 429.0 | 6.7 | 422.3 | 420.3 | 2.1 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 420.0 | 0.3 | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| | | | 429.0 | 9.0 | 420.0 | 419.7 | 0.3 | MCL | | | Gray/Brown Silty Clay/Clayey Silt | D-MCL |
| | | | 429.0 | 9.3 | 419.7 | | | SM | | | Lt Brown Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | MCL | | | Dary Gray/Brown Silty Clay | D-MCL |
| | | | 430.0 | 0.2 | 429.8 | 428.6 | 1.3 | CH | | | Dark Brown/Gray Clay | D-CH |
| | | | 430.0 | 1.4 | 428.6 | 427.5 | 1.1 | CL | | | Dark Brown Gray Clay | D-CL |
| | | | 430.0 | 2.5 | 427.5 | 425.5 | 2.0 | ML | | | Lt Tan Silt | Discarded |
| 148 | 1117565.05 | 880678.32 | 430.0 | 4.5 | 425.5 | 425.0 | 0.5 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 5.0 | 425.0 | 424.5 | 0.5 | MCL | | | Gray/Brown Clayey Silt | D-MCL |
| | | | 430.0 | 5.5 | 424.5 | 423.5 | 1.0 | CL | | | Brown Gray Clay | D-CL |
| | | | 430.0 | 6.5 | 423.5 | 421.6 | 1.9 | CH | 37 | 86.1 | Gray/Brown Clay | D-CH |
| | | | 430.0 | 8.4 | 421.6 | | | CH | 34.6 | 84.4 | Gray/Brown Clay | D-CH |
| | | | 429.0 | 0.0 | 429.0 | 428.8 | 0.2 | MCL | | | Dark Brown/Gray Silty Clay | E-MCL |
| | | | 429.0 | 0.2 | 428.8 | 427.5 | 1.3 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 429.0 | 1.5 | 427.5 | 426.5 | 1.0 | CL | | | Dark Brown Clay | E-CL |
| | | | 429.0 | 2.5 | 426.5 | 425.8 | 0.8 | CH | | | Dark Black Grey Clay | E-CH |
| | | | 429.0 | 3.3 | 425.8 | 425.2 | 0.6 | MCL | | | Lt Tan Clayey Silt | E-MCL |
| 149 | 1117513.10 | 881085.02 | 429.0 | 3.8 | 425.2 | 424.1 | 1.1 | MCL | 14.9 | 96.1 | Lt Tan Silt & Dark Brown Clay | E-MCL |
| | | | 429.0 | 4.9 | 424.1 | 422.8 | 1.3 | CL | | | Brown w Trace Tan Clay | E-CL |
| | | | 429.0 | 6.3 | 422.8 | 422.0 | 0.8 | CL | 31.5 | 89.6 | Brown Clay | E-CL |
| | | | 429.0 | 7.0 | 422.0 | 420.6 | 1.4 | MCL | | | Brown w Grey Silty Clay | E-MCL |
| | | | 429.0 | 8.4 | 420.6 | 420.3 | 0.3 | CL | | | Dark Brown Clay | E-CL |
| | | | 429.0 | 8.8 | 420.3 | 419.8 | 0.4 | MCL | | | Dark Brown/Gray Clayey Silt/Silty Clay | E-MCL |
| | | | 429.0 | 9.2 | 419.8 | | | SP | | | Lt Tan Sand | Discarded |
| | | | 428.0 | 0.0 | 428.0 | 427.0 | 1.0 | MCL | | | Dark Black Silty Loose Clay | E-MCL |
| | | | 428.0 | 1.0 | 427.0 | 424.1 | 2.9 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 428.0 | 3.9 | 424.1 | 423.4 | 0.7 | MCL | | | Dark Gray/Brown Silty Clay | E-MCL |
| 150 | 1117461.15 | 881491.71 | 428.0 | 4.6 | 423.4 | 422.8 | 0.6 | CH | | | Brown Clay | E-CH |
| | | | 428.0 | 5.2 | 422.8 | 421.8 | 1.1 | MCL | | | Brown Silty Clay | E-MCL |
| | | | 428.0 | 6.3 | 421.8 | 421.3 | 0.5 | CL | | | Dark Brown Clay w Silt Seams | E-CL |
| | | | 428.0 | 6.8 | 421.3 | | | MCL | | | Dark Brown Silty Clay | E-MCL |
| | | | 427.5 | 0.0 | 427.5 | 427.2 | 0.3 | MCL | | | Dark Black/Gray Silty Clay | E-MCL |
| | | | 427.5 | 0.3 | 427.2 | 425.2 | 2.0 | CH | | | Dark Brown Clay | E-CH |
| 151 | 1117409.21 | 881898.41 | 427.5 | 2.3 | 425.2 | 422.6 | 2.6 | CH | | | Dark Gray/Brown Clay | E-CH |
| | | | 427.5 | 4.9 | 422.6 | 421.7 | 0.9 | CL | | | Brown Grey Clay | E-CL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 427.5 | 5.8 | 421.7 | 421.3 | 0.4 | MCL | | | Lt Grey/Tan Clayey Silt | E-MCL |
| | | | 427.5 | 6.3 | 421.3 | | | CL | | | Brown Clay w Silt Seams | E-CL |
| 152 | 1117803.24 | 877195.43 | 428.0 | 0.0 | 428.0 | 426.7 | 1.3 | MCL | | | Dark Gary/Brown Silty Clay | A-MCL |
| | | | 428.0 | 1.3 | 426.7 | 426.3 | 0.4 | CL | | | Dark Brown Clay | A-CL |
| | | | 428.0 | 1.8 | 426.3 | 425.5 | 0.8 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 428.0 | 2.5 | 425.5 | 424.8 | 0.8 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 428.0 | 3.3 | 424.8 | 424.2 | 0.6 | CH | | | Dark Brown Clay | A-CH |
| | | | 428.0 | 3.8 | 424.2 | 423.7 | 0.5 | MCL | | | Lt Tan/Dark Brown Silt & Clay | A-MCL |
| | | | 428.0 | 4.3 | 423.7 | 423.2 | 0.5 | MCL | | | Dark Brown Clay & Lt Tan Silt | A-MCL |
| | | | 428.0 | 4.8 | 423.2 | 421.8 | 1.4 | ML | | | Lt. Tan Silt | Discarded |
| | | | 428.0 | 6.3 | 421.8 | 420.8 | 0.9 | ML | | | Lt. Tan Silt | Discarded |
| | | | 428.0 | 7.2 | 420.8 | | | SM | | | Lt. Tan Silt w Very Fine Sand | Discarded |
| 153 | 1117179.89 | 882075.78 | 428.0 | 0.0 | 428.0 | 427.3 | 0.8 | CL | | | Dark Black/Gray Clay | E-CL |
| | | | 428.0 | 0.8 | 427.3 | 425.8 | 1.4 | CL | | | Dark Gray/Brown Clay | E-CL |
| | | | 428.0 | 2.2 | 425.8 | 425.0 | 0.8 | CH | | | Dark Brown/Gray Clay | E-CH |
| | | | 428.0 | 3.0 | 425.0 | 424.3 | 0.8 | MCL | | | Lt Brown/Dark Brown Silty Clay/Claye | E-MCL |
| | | | 428.0 | 3.8 | 424.3 | 423.8 | 0.5 | CL | | | Dark Black Grey Clay | E-CL |
| | | | 428.0 | 4.3 | 423.8 | 422.8 | 1.0 | CH | | | Brown Clay | E-CH |
| | | | 428.0 | 5.3 | 422.8 | 421.7 | 1.1 | CL | | | Brown Clay | E-CL |
| | | | 428.0 | 6.3 | 421.7 | | | MCL | | | Brown Silty Clay | E-MCL |
| 154 | 1117573.92 | 877372.81 | 429.0 | 0.0 | 429.0 | 427.8 | 1.3 | MCL | | | Dark Black/Gray Silty Clay w Sand | Discarded |
| | | | 429.0 | 1.3 | 427.8 | 426.5 | 1.3 | MCL | | | Lt Brown Silty Clay | E-MCL |
| | | | 429.0 | 2.5 | 426.5 | 426.2 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | E-MCL |
| | | | 429.0 | 2.8 | 426.2 | 425.5 | 0.7 | CH | | | Dark Gray/Brown Clay | A-CH |
| | | | 429.0 | 3.5 | 425.5 | 424.0 | 1.5 | CH | | | Dark Brown Clay | A-CH |
| | | | 429.0 | 5.0 | 424.0 | 423.8 | 0.2 | MCL | | | Dark Black/Gray Silty Clay | A-MCL |
| | | | 429.0 | 5.2 | 423.8 | 423.5 | 0.3 | MCL | | | Lt. Brown Clayey Silt | A-MCL |
| | | | 429.0 | 5.5 | 423.5 | 422.5 | 1.0 | ML | | | Lt. Tan Silt | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 420.3 | 2.3 | MCL | | | Lt. Tan Silty Clayey Silt w Very Fine S | Discarded |
| | | | 429.0 | 8.8 | 420.3 | | | MCL | | | Lt. Tan/Brown Silty Clay Clayey Silt | A-MCL |
| 155 | 1117521.97 | 877779.50 | 428.5 | 0.0 | 428.5 | 427.9 | 0.6 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 428.5 | 0.6 | 427.9 | 427.1 | 0.8 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 428.5 | 1.4 | 427.1 | 426.1 | 1.0 | MCL | | | Tan Slightly Clayey Silt | B-MCL |
| | | | 428.5 | 2.4 | 426.1 | 425.4 | 0.7 | MCL | | | Tan Slightly Clayey Silt | B-MCL |
| | | | 428.5 | 3.1 | 425.4 | 424.3 | 1.2 | CH | | | Dark Brown Clay | B-CH |
| | | | 428.5 | 4.3 | 424.3 | 423.3 | 0.9 | CH | | | Dark Gray/Brown Clay | B-CH |
| | | | 428.5 | 5.2 | 423.3 | 423.2 | 0.2 | CL | | | Brown/Tan Slightly Silty Clay | B-CL |
| | | | 428.5 | 5.3 | 423.2 | 422.2 | 1.0 | SM | | | Lt Tan Sandy Silt | Discarded |
| | | | 428.5 | 6.3 | 422.2 | 421.5 | 0.7 | MCL | | | Brown Silty Clay w Clayey Silt | B-MCL |
| | | | 428.5 | 7.0 | 421.5 | 420.9 | 0.6 | CL | | | Brown Slightly Silty Clay | B-CL |
| | | | 428.5 | 7.6 | 420.9 | 420.5 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | B-MCL |
| | | | 428.5 | 8.0 | 420.5 | 420.0 | 0.5 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 8.5 | 420.0 | 419.6 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | B-MCL |
| | | | 428.5 | 8.9 | 419.6 | | | SM | | | Lt Brown Slightly Silty Sand | Discarded |
| 156 | 1117470.03 | 878186.20 | 430.0 | 0.0 | 430.0 | 428.8 | 1.2 | CL | | | Dark Brown Slightly Silty Clay | B-CL |
| | | | 430.0 | 1.2 | 428.8 | 428.5 | 0.3 | ML | | | Brown Clayey silt w silty clay | Discarded |
| | | | 430.0 | 1.5 | 428.5 | 428.1 | 0.4 | CL | 10.2 | 103.29 | Tan Silt | B-CL |
| | | | 430.0 | 1.9 | 428.1 | 427.8 | 0.3 | MCL | | | Dark Brown Silty Clay | B-MCL |
| | | | 430.0 | 2.3 | 427.8 | 427.0 | 0.8 | MCL | | | Brown Silty Clay | B-MCL |
| | | | 430.0 | 3.0 | 427.0 | 426.6 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 3.4 | 426.6 | 425.7 | 0.9 | CL | | | Brown Clay | B-CL |
| | | | 430.0 | 4.3 | 425.7 | 425.4 | 0.3 | MCL | | | Lt Tan Slighly Clayey Silt | B-MCL |
| | | | 430.0 | 4.6 | 425.4 | 424.3 | 1.2 | CH | 36.7 | 86.18 | Brown Clay | B-CH |
| | | | 430.0 | 5.8 | 424.3 | 423.6 | 0.7 | SP | | | Brown Sand | Discarded |
| | | | 430.0 | 6.4 | 423.6 | | | SP | | | Lt Brown Sand | Discarded |
| 157 | 1117418.08 | 878592.89 | 426.0 | 0.0 | 426.0 | 425.3 | 0.8 | SM | | | Dark Gray Sandy Silty Clay | Discarded |
| | | | 426.0 | 0.8 | 425.3 | 423.7 | 1.6 | CH | 32.1 | 89.5 | Dark Gray/Brown Clay | F-CH |
| | | | 426.0 | 2.3 | 423.7 | 423.5 | 0.2 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.0 | 2.5 | 423.5 | 423.4 | 0.1 | ML | | | Lt Tan Silt Seam | Discarded |
| | | | 426.0 | 2.6 | 423.4 | 422.5 | 0.9 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.0 | 3.5 | 422.5 | 421.8 | 0.7 | ML | | | Tan Brown/Gray Silt | Discarded |
| | | | 426.0 | 4.2 | 421.8 | 421.5 | 0.3 | CL | | | Dark Brown Clay | F-CL |
| | | | 426.0 | 4.5 | 421.5 | | | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 158 | 1117366.08 | 879000.00 | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 426.0 | 0.3 | 425.7 | 425.1 | 0.6 | CL | | | Dark Brown Gary Clay | F-CL |
| | | | 426.0 | 0.9 | 425.1 | 423.8 | 1.3 | CH | | | Dark Gray Brown Clay | F-CH |
| | | | 426.0 | 2.3 | 423.8 | 423.2 | 0.6 | CH | | | Dark Gray Brown Clay | F-CH |
| | | | 426.0 | 2.8 | 423.2 | 422.3 | 0.9 | MCL | | | Lt Tan/Gray Silty Clay, Clayey Silt | F-MCL |
| | | | 426.0 | 3.8 | 422.3 | 421.4 | 0.9 | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 426.0 | 4.6 | 421.4 | 421.2 | 0.2 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 426.0 | 4.8 | 421.2 | 420.9 | 0.3 | CL | | | Brown Clay | F-CL |
| | | | 426.0 | 5.1 | 420.9 | 420.1 | 0.8 | SM | | | Lt Tan Slightly Sandy Silt | Discarded |
| | | | 426.0 | 5.9 | 420.1 | | | MCL | | | Brown Clayey Silt/Silty Clay | F-MCL |
| 159 | 1117314.19 | 879406.29 | 426.5 | 0.0 | 426.5 | 425.5 | 1.0 | CL | | | Dark Brown/Gray Slightly Silty Clay | F-CL |
| | | | 426.5 | 1.0 | 425.5 | 423.5 | 2.0 | CH | | | Dark Gray Clay | F-CH |
| | | | 426.5 | 3.0 | 423.5 | 423.3 | 0.2 | CL | | | Dark Gray Silty Clay | F-CL |
| | | | 426.5 | 3.2 | 423.3 | 421.8 | 1.6 | SM | | | Lt Tan Slightly Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 426.5 | 4.8 | 421.8 | 419.9 | 1.8 | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| | | | 426.5 | 6.6 | 419.9 | 419.1 | 0.8 | SM | | | Lt Tan Very Fine Silty Sane/Sandy Silt | Discarded |
| | | | 426.5 | 7.4 | 419.1 | | | SM | | | Brown/Gray Silty Clay/Clayey Silt | Discarded |
| | | | 426.0 | 0.0 | 426.0 | 425.8 | 0.3 | MCL | | | Dark Gray Sandy Silty Clay | G-MCL |
| | | | 426.0 | 0.3 | 425.8 | 425.3 | 0.4 | CL | | | Dark Brown/Gray Silty Sandy Clay | G-CL |
| 160 | 1117262.24 | 879812.98 | 426.0 | 0.7 | 425.3 | 423.8 | 1.5 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 426.0 | 2.2 | 423.8 | 421.7 | 2.2 | CH | | | Dark Gray/Brown Clay | G-CH |
| | | | 426.0 | 4.3 | 421.7 | 421.3 | 0.3 | CH | | | Dark Gray Clay | G-CH |
| | | | 426.0 | 4.7 | 421.3 | | | MCL | | | Lt Brown Silty Clay Clayey Silt | G-MCL |
| | | | 426.0 | 0.0 | 426.0 | 424.5 | 1.5 | CH | | | Dark Gray Clay | G-CH |
| | | | 426.0 | 1.5 | 424.5 | 421.4 | 3.1 | CH | | | Dark Brown/Gray Clay | G-CH |
| 161 | 1117210.30 | 880219.68 | 426.0 | 4.6 | 421.4 | 421.0 | 0.4 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 426.0 | 5.0 | 421.0 | 420.5 | 0.5 | MCL | | | Lt Brown Silty Clay Clayey Silt | G-MCL |
| | | | 426.0 | 5.5 | 420.5 | | | ML | | | Lt Tan Brown Silt | Discarded |
| | | | 427.5 | 0.0 | 427.5 | 426.9 | 0.6 | CH | | | Dark Black/Gray Clay | G-CH |
| | | | 427.5 | 0.6 | 426.9 | 425.3 | 1.6 | CH | 31.6 | 89.4 | Dark Black/Gray Clay | G-CH |
| | | | 427.5 | 2.2 | 425.3 | 424.5 | 0.8 | CH | | | Dark Gray Clay | G-CH |
| | | | 427.5 | 3.0 | 424.5 | 424.0 | 0.5 | MCL | | | Black/Gray Clay w Clayey Silt | G-MCL |
| 162 | 1117158.35 | 880626.37 | 427.5 | 3.5 | 424.0 | 423.0 | 1.0 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.3 | 0.7 | MCL | | | Lt Brown Silty Clay/Clayey Silt | G-MCL |
| | | | 427.5 | 5.2 | 422.3 | 421.1 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 6.4 | 421.1 | 420.2 | 0.9 | SM | 28.9 | 89.6 | Lt Brown Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 7.3 | 420.2 | | | MCL | | | Lt Brown/Gray Silty Clay/Clayey Silt | G-MCL |
| | | | 427.5 | 0.0 | 427.5 | 425.5 | 2.0 | CL | | | Dark Gray Clay w Fine Sand | H-CL |
| | | | 427.5 | 2.0 | 425.5 | 424.8 | 0.8 | CH | | | Dark Gray Clay | H-CH |
| | | | 427.5 | 2.8 | 424.8 | 424.3 | 0.5 | MCL | | | Dark Gray Sandy Silty Clay | H-MCL |
| 163 | 1117106.40 | 881033.07 | 427.5 | 3.3 | 424.3 | 423.3 | 1.0 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 4.3 | 423.3 | 421.3 | 2.0 | SM | 18.2 | 81.3 | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 6.3 | 421.3 | 420.5 | 0.8 | CL | | | Brown/Gray Clay | H-CL |
| | | | 427.5 | 7.0 | 420.5 | | | ML | | | Lt Tan Silt | Discarded |
| | | | 426.0 | 0.0 | 426.0 | 425.7 | 0.3 | MCL | | | Dark Brown Silty Clayey Sand | H-MCL |
| | | | 426.0 | 0.3 | 425.7 | 425.4 | 0.3 | SP | | | Lt Tan Sand | Discarded |
| 164 | 1117054.46 | 881439.77 | 426.0 | 0.6 | 425.4 | 423.7 | 1.8 | CH | | | Dark Black/Gray Clay | H-CH |
| | | | 426.0 | 2.3 | 423.7 | 421.3 | 2.4 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.0 | 4.8 | 421.3 | 420.3 | 0.9 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.0 | 5.7 | 420.3 | | | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 426.5 | 0.0 | 426.5 | 424.7 | 1.8 | CH | | | Dark Gray Clay | H-CH |
| | | | 426.5 | 1.8 | 424.7 | 422.3 | 2.3 | CH | 33.5 | 83.5 | Dark Brown/Gray Clay | H-CH |
| | | | 426.5 | 4.2 | 422.3 | 421.7 | 0.6 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 426.5 | 4.8 | 421.7 | 421.5 | 0.2 | ML | | | Lt Tan Silt | Discarded |
| 165 | 1117002.51 | 881846.46 | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | CL | | | Dark Gray/Brown Clay | H-CL |
| | | | 426.5 | 5.5 | 421.0 | 420.1 | 0.9 | ML | | | Lt Tan Silt | Discarded |
| | | | 426.5 | 6.4 | 420.1 | 418.9 | 1.2 | CL | | | Dark Gray/Brown Clay | H-CL |
| | | | 426.5 | 7.6 | 418.9 | 418.5 | 0.4 | SM | | | Dark Brown/Gray Slightly Sandy Silt | Discarded |
| | | | 426.5 | 8.0 | 418.5 | | | MCL | | | Dark Gray/Brown Silty Clay | H-MCL |
| | | | 429.0 | 0.0 | 429.0 | 427.8 | 1.3 | MCL | | | Dark Brown Gray Silty Clay | H-MCL |
| | | | 429.0 | 1.3 | 427.8 | 426.7 | 1.1 | CL | | | Dark Brown Clay | A-CL |
| | | | 429.0 | 2.3 | 426.7 | 426.2 | 0.5 | CL | 30.9 | 89.8 | Dark Gary/Brown Clay | A-CL |
| | | | 429.0 | 2.8 | 426.2 | 424.5 | 1.7 | CL | | | Brown Clay | A-CL |
| 166 | 1117396.55 | 877143.48 | 429.0 | 4.6 | 424.5 | 424.3 | 0.2 | CL | | | Dark Brown/Gray Clay | A-CL |
| | | | 429.0 | 4.8 | 424.3 | 422.5 | 1.8 | SM | | | Lt. Tan Sandy Silt | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 421.7 | 0.8 | MCL | | | Brown Silty Clay | A-MCL |
| | | | 429.0 | 7.3 | 421.7 | 420.3 | 1.4 | SM | | | Lt. Tan Silt w Very Fine Sand | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 419.3 | 1.0 | SM | | | Lt Tan Very Fine Sandy Silt w Clay Se | Discarded |
| | | | 429.0 | 9.8 | 419.3 | | | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| | | | 425.0 | 0.0 | 425.0 | 424.3 | 0.7 | CH | | | Black/Gray Clay | H-CH |
| | | | 425.0 | 0.7 | 424.3 | 422.9 | 1.4 | CH | 32.4 | 89.4 | Brown/Gray Clay | H-CH |
| 167 | 1116773.19 | 882023.84 | 425.0 | 2.1 | 422.9 | 420.7 | 2.3 | ML | 8.8 | 78.9 | Lt Tan Silt | Discarded |
| | | | 425.0 | 4.3 | 420.7 | 418.7 | 2.0 | SM | | | Lt Tan Fine Silt w Fine Sand | Discarded |
| | | | 425.0 | 6.3 | 418.7 | 417.5 | 1.2 | MCL | 30.1 | 86.2 | Brown Silty Clay/Clayey Silt | H-MCL |
| | | | 425.0 | 7.5 | 417.5 | | | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 0.0 | 429.0 | 428.3 | 0.8 | CL | | | Dark Gray/Brown Clayey Silt | F-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.8 | 1.5 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 429.0 | 2.3 | 426.8 | 424.3 | 2.4 | CH | | | Dark Black/Gray Clay | F-CH |
| | | | 429.0 | 4.7 | 424.3 | 424.3 | 0.1 | CL | | | Dark Black/Gray Clay | F-CL |
| | | | 429.0 | 4.8 | 424.3 | 422.4 | 1.8 | SP | | | Lt Tan Silt Very Fine Sand | Discarded |
| 168 | 1117065.14 | 878134.48 | 429.0 | 6.6 | 422.4 | 421.4 | 1.0 | CL | | | Lt Tan Very Sandy Silt | F-CL |
| | | | 429.0 | 7.6 | 421.4 | 421.1 | 0.3 | CL | | | Dark Brown Clay | F-CL |
| | | | 429.0 | 7.9 | 421.1 | 420.5 | 0.6 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 419.8 | 0.8 | CL | 33.3 | 87.11 | Tan Silt w Trace Clay | F-CL |
| | | | 429.0 | 9.3 | 419.8 | 419.1 | 0.7 | MCL | | | Tan Slightly Silty Clay | F-MCL |
| | | | 429.0 | 9.9 | 419.1 | | | MCL | | | Tannish Brown Very Slightly Clayey S | F-MCL |
| | | | 427.0 | 0.0 | 427.0 | 425.6 | 1.4 | MCL | 13.6 | 101.7 | Dark Gray/Brown Sandy Clay | F-MCL |
| | | | 427.0 | 1.4 | 425.6 | 424.8 | 0.8 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 427.0 | 2.2 | 424.8 | 424.2 | 0.7 | SM | | | Lt Tan Firm Silt w Trace Fine Sand | Discarded |
| | | | 427.0 | 2.8 | 424.2 | 422.3 | 1.9 | CH | | | Dark Brown/Gray Clay | F-CH |
| 169 | 1117011.39 | 878540.95 | 427.0 | 4.8 | 422.3 | 421.8 | 0.4 | CL | | | Dark Gray/Brown Silty Clay | F-CL |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 427.0 | 5.2 | 421.8 | 420.5 | 1.3 | CH | | | Dark Brown/Gray Clay | F-CH |
| | | | 427.0 | 6.5 | 420.5 | 420.3 | 0.3 | MCL | | | Lt Gray/Brown Clayey Silt | F-MCL |
| | | | 427.0 | 6.8 | 420.3 | 420.0 | 0.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.0 | 7.0 | 420.0 | | | MCL | | | Lt Gray/Brown Clayey Silt | F-MCL |
| | | | 429.5 | 0.0 | 429.5 | 429.3 | 0.2 | CL | | | Dark Brown/Gray Loose Clay | F-CL |
| | | | 429.5 | 0.2 | 429.3 | 428.4 | 0.9 | CL | 20.5 | 100.6 | Dark Brown/Gray Clay | F-CL |
| | | | 429.5 | 1.1 | 428.4 | 427.0 | 1.4 | MCL | | | Lt Brown/Gray Silty Clay | F-MCL |
| | | | 429.5 | 2.5 | 427.0 | 424.6 | 2.4 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 429.5 | 4.9 | 424.6 | 422.8 | 1.8 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 170 | 1116959.44 | 878947.64 | 429.5 | 6.8 | 422.8 | 421.1 | 1.7 | SM | | | Lt Tan w Trace Fine Sandy Silt | Discarded |
| | | | 429.5 | 8.4 | 421.1 | 420.7 | 0.4 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.5 | 8.8 | 420.7 | 420.2 | 0.5 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 429.5 | 9.3 | 420.2 | 419.8 | 0.4 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.5 | 9.8 | 419.8 | 419.5 | 0.3 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 429.5 | 10.0 | 419.5 | | | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 0.0 | 430.0 | 429.9 | 0.1 | MCL | | | Dark Gray Sandy Silty Clay | F-MCL |
| | | | 430.0 | 0.1 | 429.9 | 429.5 | 0.4 | CH | | | Dary Gray Clay | F-CH |
| | | | 430.0 | 0.5 | 429.5 | 429.2 | 0.3 | MCL | | | Gray Brown Clayey Sand | F-MCL |
| | | | 430.0 | 0.8 | 429.2 | 428.7 | 0.5 | CL | | | Gray/Brown Slightly Sandy Silty Clay | F-CL |
| | | | 430.0 | 1.3 | 428.7 | 428.4 | 0.3 | CH | | | Dark Gray/Brown Clay | F-CH |
| | | | 430.0 | 1.6 | 428.4 | 427.5 | 0.9 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 430.0 | 2.5 | 427.5 | 427.1 | 0.4 | CL | | | Dark Gray/Brown Slightly Silty Clay | F-CL |
| 171 | 1116907.49 | 879354.34 | 430.0 | 2.9 | 427.1 | 426.6 | 0.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 3.4 | 426.6 | 425.6 | 1.0 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 4.4 | 425.6 | 424.4 | 1.2 | SM | | | Lt Tan Silt Very Fine Sand | Discarded |
| | | | 430.0 | 5.6 | 424.4 | 423.3 | 1.2 | MCL | | | Brown Silty Clay | F-MCL |
| | | | 430.0 | 6.8 | 423.3 | 422.5 | 0.8 | SP | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 7.5 | 422.5 | 421.5 | 1.0 | MCL | | | Dark Brown Silty Clay | F-MCL |
| | | | 430.0 | 8.5 | 421.5 | 421.0 | 0.5 | SM | | | Lt Brown/Tan Silt w Fine Sand | Discarded |
| | | | 430.0 | 9.0 | 421.0 | 420.7 | 0.3 | MCL | | | Tan/Gray Silty Clay/Clayey Silt | F-MCL |
| | | | 430.0 | 9.3 | 420.7 | | | SM | | | Tan/Gray Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 0.0 | 430.0 | 429.8 | 0.3 | CL | | | Dark Gray Clay | G-CL |
| | | | 430.0 | 0.3 | 429.8 | 429.0 | 0.8 | CL | | | Dark Gray Slightly Silty Clay | G-CL |
| | | | 430.0 | 1.0 | 429.0 | 428.5 | 0.5 | CH | | | Dark Brown/Gray Clay | G-CH |
| | | | 430.0 | 1.5 | 428.5 | 428.0 | 0.5 | CL | 26 | 94.5 | Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 2.0 | 428.0 | 427.8 | 0.3 | CH | | | Dark Gray Clay | G-CH |
| 172 | 1116855.55 | 879761.04 | 430.0 | 2.3 | 427.8 | 425.3 | 2.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 4.7 | 425.3 | 424.8 | 0.6 | MCL | | | Lt Tan Silty Clay/Clayey Silt | G-MCL |
| | | | 430.0 | 5.3 | 424.8 | 423.9 | 0.8 | CH | | | Lt Gray/Brown Clay | G-CH |
| | | | 430.0 | 6.1 | 423.9 | 423.5 | 0.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 421.3 | 2.2 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 8.7 | 421.3 | 420.3 | 1.1 | SM | | | Lt Tan Very Fine Sandy Siilt | Discarded |
| | | | 430.0 | 9.8 | 420.3 | | | MCL | | | Lt Tan Silty Clay/Clayey Silt | G-MCL |
| | | | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | MCL | | | Dark Gray Sandy Silty Clay | G-MCL |
| | | | 430.0 | 0.2 | 429.8 | 429.4 | 0.4 | CH | | | Dark Gray Clay | G-CH |
| | | | 430.0 | 0.6 | 429.4 | 429.0 | 0.4 | CH | | | Dark Gray/Brown Clay | G-CH |
| | | | 430.0 | 1.0 | 429.0 | 427.8 | 1.2 | CL | 19.9 | 99.3 | Brown Silty Clay | G-CL |
| | | | 430.0 | 2.2 | 427.8 | 425.4 | 2.4 | SM | 9.8 | 80.8 | Lt Tan Silt w Very Fine Sand | Discarded |
| 173 | 1116803.60 | 880167.73 | 430.0 | 4.6 | 425.4 | 424.7 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 5.3 | 424.7 | 424.5 | 0.2 | CL | | | Dark Gray/Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 5.5 | 424.5 | 423.3 | 1.2 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 6.7 | 423.3 | 421.6 | 1.7 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 8.4 | 421.6 | | | ML | | | Lt Tan/Brown/Gray Slightly Clayey Silt | Discarded |
| | | | 430.0 | 0.0 | 430.0 | 429.0 | 1.0 | CL | | | Dark Brown/Gray Silty Clay | G-CL |
| | | | 430.0 | 1.0 | 429.0 | 428.5 | 0.5 | CH | 24.8 | 97.2 | Dark Gray Clay | G-CH |
| | | | 430.0 | 1.5 | 428.5 | 427.7 | 0.8 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 2.3 | 427.7 | 427.0 | 0.7 | ML | 8.3 | 86 | Lt Tan Silt | Discarded |
| | | | 430.0 | 3.0 | 427.0 | 425.5 | 1.5 | CL | | | Black/Gray Clay Brick | Discarded |
| 174 | 1116751.65 | 880574.43 | 430.0 | 4.5 | 425.5 | 425.2 | 0.3 | | | | Brick & Debris | Discarded |
| | | | 430.0 | 4.8 | 425.2 | 424.6 | 0.6 | CL | | | Lt Brown Slightly Silty Clay | G-CL |
| | | | 430.0 | 5.4 | 424.6 | 423.5 | 1.1 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 421.3 | 2.2 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 8.7 | 421.3 | 420.5 | 0.8 | | | | Misc Silt Clay Brick etc | Discarded |
| | | | 430.0 | 9.5 | 420.5 | | | MCL | | | Lt Tan Silt/Silty Clay w Clay | G-MCL |
| | | | 430.0 | 0.0 | 430.0 | 429.8 | 0.2 | SM | | | Dark Brown Slightly Sandy Silt | Discarded |
| | | | 430.0 | 0.2 | 429.8 | 428.0 | 1.8 | CL | | | Dark Brown/Gray Clay | H-CL |
| | | | 430.0 | 2.0 | 428.0 | 427.6 | 0.4 | CL | | | Dark Brown/Gray Clay | H-CL |
| | | | 430.0 | 2.4 | 427.6 | 426.9 | 0.7 | CL-CH | | | Dark Brown/Gray Clay | H-CL-CH |
| | | | 430.0 | 3.1 | 426.9 | 426.4 | 0.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 3.6 | 426.4 | 426.0 | 0.4 | SM | | | Lt Brown Fine Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 4.0 | 426.0 | 425.4 | 0.6 | MCL | | | Brown Silty Clay | H-MCL |
| | | | 430.0 | 4.6 | 425.4 | 425.0 | 0.4 | CL | | | Lt Gray/Brown Clay | H-CL |
| 175 | 1116699.71 | 880981.12 | 430.0 | 5.0 | 425.0 | 423.5 | 1.5 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 6.5 | 423.5 | 422.9 | 0.6 | MCL | | | Lt Brown Silty Clay/Clayey Silt | H-MCL |
| | | | 430.0 | 7.1 | 422.9 | 422.5 | 0.4 | SM | | | Lt Brown Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 7.5 | 422.5 | 422.0 | 0.5 | SM | | | Dark Brown slightly clayey Silt | Discarded |
| | | | 430.0 | 8.0 | 422.0 | 421.3 | 0.7 | SM | | | Brown Silt w Fine Sand | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 430.0 | 8.7 | 421.3 | 421.1 | 0.2 | CL | | | Dark Brown Clay | H-CL |
| | | | 430.0 | 8.9 | 421.1 | 420.8 | 0.3 | SP | | | Lt Tan Fine Sand | Discarded |
| | | | 430.0 | 9.2 | 420.8 | 420.1 | 0.8 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 430.0 | 9.9 | 420.1 | | | SM | | | Gray/Brown Fine Sandy Silt | Discarded |
| 176 | 1116647.76 | 881387.82 | 428.5 | 0.0 | 428.5 | 428.3 | 0.3 | SM | | | Brown Slightly Sandy Silt | Discarded |
| | | | 428.5 | 0.3 | 428.3 | 427.5 | 0.8 | SM | | | Brown Slightly Sandy Silt | Discarded |
| | | | 428.5 | 1.0 | 427.5 | 427.0 | 0.5 | SM | | | Lt Tan Very Fine Slightly Sandy Silt | Discarded |
| | | | 428.5 | 1.5 | 427.0 | 426.5 | 0.5 | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| | | | 428.5 | 2.0 | 426.5 | 426.3 | 0.2 | SM | | | Brown Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 2.2 | 426.3 | 424.8 | 1.6 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 3.8 | 424.8 | 424.5 | 0.3 | CL-CH | | | Dark Brown/Gray Clay | H-CL-CH |
| | | | 428.5 | 4.0 | 424.5 | 424.3 | 0.3 | ML | | | Lt Brown Silt | Discarded |
| | | | 428.5 | 4.3 | 424.3 | 423.7 | 0.6 | CL | | | Dark Brown Clay w Very Fine Sand | H-CL |
| | | | 428.5 | 4.8 | 423.7 | 423.2 | 0.5 | SM | | | Lt Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 5.3 | 423.2 | 422.5 | 0.7 | SM | | | Lt Tan Very Fine Slightly Silty Sand | Discarded |
| | | | 428.5 | 6.0 | 422.5 | 422.3 | 0.2 | SM | | | Tan Silty Fine Sand | Discarded |
| | | | 428.5 | 6.2 | 422.3 | 421.8 | 0.5 | CL | | | Dark Brown Clay w Slightly Clayey Sil | H-CL |
| | | | 428.5 | 6.7 | 421.8 | 421.3 | 0.5 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 428.5 | 7.2 | 421.3 | 420.7 | 0.6 | CL | | | Dark Gray Clay | H-CL |
| | | | 428.5 | 7.8 | 420.7 | | | SM | | | Lt Tan Very Slightly Silty Sand | Discarded |
| 177 | 1116595.82 | 881794.52 | 427.0 | 0.0 | 427.0 | 425.0 | 2.0 | CH | | | Dark Gray/Brown Clay | H-CH |
| | | | 427.0 | 2.0 | 425.0 | 424.0 | 1.0 | CH | | | Dark Brown/Gray Clay | H-CH |
| | | | 427.0 | 3.0 | 424.0 | 423.4 | 0.6 | MCL | | | Brown/Gray Silty Clay | H-MCL |
| | | | 427.0 | 3.6 | 423.4 | 423.0 | 0.4 | ML | 9.4 | 78.9 | Lt Tan Silt | Discarded |
| | | | 427.0 | 4.0 | 423.0 | 422.8 | 0.3 | CH | | | Dark Black/Gray Clay | H-CH |
| | | | 427.0 | 4.3 | 422.8 | 420.3 | 2.5 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 427.0 | 6.8 | 420.3 | | | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| 178 | 1116730.12 | 879125.02 | 430.0 | 0.0 | 430.0 | 429.3 | 0.7 | CL | 17.3 | 93.8 | Dark Brown/Gray Slightly Silty Clay | F-CL |
| | | | 430.0 | 0.7 | 429.3 | 428.8 | 0.5 | CL/CH | 22.8 | 102.2 | Dark Brown/Gray Clay | F-CL/CH |
| | | | 430.0 | 1.2 | 428.8 | 428.3 | 0.5 | MCL | | | Brown Clayey Silt/Silty Clay | F-MCL |
| | | | 430.0 | 1.7 | 428.3 | 427.4 | 0.9 | ML | | | Lt Brown Silt | Discarded |
| | | | 430.0 | 2.6 | 427.4 | 425.6 | 1.8 | ML | | | Lt Tan w some Brown Silt | Discarded |
| | | | 430.0 | 4.4 | 425.6 | 423.4 | 2.2 | ML | | | Lt Tan Silt | Discarded |
| | | | 430.0 | 6.6 | 423.4 | 422.8 | 0.6 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 430.0 | 7.2 | 422.8 | 422.4 | 0.4 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 430.0 | 7.6 | 422.4 | 421.0 | 1.4 | CL | | | Brown/Gray Clay | F-CL |
| | | | 430.0 | 9.0 | 421.0 | 420.3 | 0.7 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| | | | 430.0 | 9.7 | 420.3 | | | SM | | | Lt Tan Very Fine Silty Sand | Discarded |
| 179 | 1116574.28 | 880345.11 | 427.0 | | 427.0 | 430.0 | -3.0 | | | | | G- |
| 180 | 1116366.50 | 881971.89 | 430.0 | 0.0 | 430.0 | 429.9 | 0.1 | ML | | | Brown Silt | Discarded |
| | | | 430.0 | 0.1 | 429.9 | 428.9 | 1.0 | CH | | | Dark Gray Clay | H-CH |
| | | | 430.0 | 1.1 | 428.9 | 427.8 | 1.2 | MCL | | | Dark Gray/Brown Silty Clay | G-MCL |
| | | | 430.0 | 2.3 | 427.8 | 425.4 | 2.3 | SM | | | Lt Brown Silt w Fine Sand | Discarded |
| | | | 430.0 | 4.6 | 425.4 | 425.2 | 0.2 | SP | | | Lt Tan Sand | Discarded |
| | | | 430.0 | 4.8 | 425.2 | 424.8 | 0.4 | MCL | | | Dark Brown Silty Clay | G-MCL |
| | | | 430.0 | 5.3 | 424.8 | 423.6 | 1.2 | SM | | | Gray/Brown Silt w Very Fine Sand | Discarded |
| | | | 430.0 | 6.4 | 423.6 | 421.4 | 2.2 | CL | 30.8 | 89.5 | Tan Grey Clay w Silt Seams | H-CL |
| | | | 430.0 | 8.6 | 421.4 | 420.9 | 0.5 | CL | | | Dark Brown Clay | H-CL |
| | | | 430.0 | 9.1 | 420.9 | | | ML | | | Lt Brown Silt | Discarded |
| 181 | 1116224.69 | 878629.75 | 429.5 | 0.0 | 429.5 | 429.0 | 0.5 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.5 | 0.5 | 429.0 | 428.5 | 0.5 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.5 | 1.0 | 428.5 | 427.1 | 1.4 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 429.5 | 2.4 | 427.1 | 424.9 | 2.2 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.5 | 4.6 | 424.9 | 424.8 | 0.2 | CL | | | Dark Brown Clay Seam | I-CL |
| | | | 429.5 | 4.8 | 424.8 | 423.0 | 1.8 | SM | | | Lt Tan Very Fine Silty Sand/Sandy Sil | Discarded |
| | | | 429.5 | 6.5 | 423.0 | 422.5 | 0.5 | ML | | | Lt Tan Very Slightly Clayey Silt | Discarded |
| | | | 429.5 | 7.0 | 422.5 | 421.6 | 0.9 | MCL | 31.5 | 89.7 | Lt Gray Tan Silty Clay | I-MCL |
| | | | 429.5 | 7.9 | 421.6 | 420.8 | 0.8 | CH | 28.6 | 89.4 | Lt Gray Tan Clay | I-CH |
| | | | 429.5 | 8.8 | 420.8 | | | CL | | | Brown Clay | I-CL |
| 182 | 1116173.11 | 878925.49 | 429.0 | 0.0 | 429.0 | 428.3 | 0.8 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.8 | 428.3 | 427.8 | 0.5 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 1.3 | 427.8 | 426.5 | 1.3 | CH | | | Dark Brown Clay | I-CH |
| | | | 429.0 | 2.5 | 426.5 | 425.8 | 0.8 | MCL | | | Dark Brown/Tan Silty Clay | I-MCL |
| | | | 429.0 | 3.3 | 425.8 | 424.4 | 1.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 4.6 | 424.4 | 422.4 | 2.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 421.9 | 0.5 | MCL | | | Tan/Dark Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 7.1 | 421.9 | 420.7 | 1.3 | CL | 38.1 | 83.5 | Brown Clay | I-CL |
| | | | 429.0 | 8.3 | 420.7 | | | CL | | | Brown Clay | I-CL |
| 183 | 1116128.04 | 879222.11 | 429.0 | 0.0 | 429.0 | 428.7 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 429.0 | 0.3 | 428.7 | 428.3 | 0.4 | CL | | | Dark Gray/Brown Clay | I-CL |
| | | | 429.0 | 0.8 | 428.3 | 427.6 | 0.7 | CH | | | Dark Brown Clay | I-CH |
| | | | 429.0 | 1.4 | 427.6 | 426.7 | 0.9 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 429.0 | 2.3 | 426.7 | 425.9 | 0.8 | ML | | | Dark Brown Clayey Silt | Discarded |
| | | | 429.0 | 3.1 | 425.9 | 424.5 | 1.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.5 | 424.5 | 424.1 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.9 | 424.1 | 423.8 | 0.3 | MCL | | | Dark Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 5.3 | 423.8 | 422.8 | 1.0 | SM | | | Lt Tan Fine Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 429.0 | 6.3 | 422.8 | 421.8 | 1.0 | MCL | | | Brown/Tan Silty Clay/Clayey Silt w Sa | I-MCL |
| | | | 429.0 | 7.3 | 421.8 | 420.2 | 1.6 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.2 | 419.9 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.1 | 419.9 | 419.3 | 0.6 | SM | | | Brown Silt w Fine Sand | Discarded |
| | | | 429.0 | 9.7 | 419.3 | | | MCL | | | Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 429.0 | 0.0 | 429.0 | 428.7 | 0.3 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.3 | 428.7 | 428.3 | 0.3 | MCL | | | Dary Gray/Brown Silty Clay | I-MCL |
| | | | 429.0 | 0.7 | 428.3 | 427.9 | 0.4 | CL | | | Dark Black/Gray Clay | I-CL |
| | | | 429.0 | 1.1 | 427.9 | 426.5 | 1.4 | CH | 32.3 | 90.8 | Dark Black/Gray Clay | I-CH |
| | | | 429.0 | 2.5 | 426.5 | 425.2 | 1.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 3.8 | 425.2 | 424.3 | 0.9 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| 184 | 1116077.44 | 879517.98 | 429.0 | 4.8 | 424.3 | 424.0 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 5.0 | 424.0 | 422.3 | 1.7 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 6.7 | 422.3 | 421.5 | 0.8 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 7.5 | 421.5 | 420.4 | 1.1 | SM | | | Dark Brown Fine Sandy Silt | Discarded |
| | | | 429.0 | 8.6 | 420.4 | 420.0 | 0.4 | SM | | | Lt Brown Silt w Fine Sand | Discarded |
| | | | 429.0 | 9.0 | 420.0 | 419.3 | 0.8 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.8 | 419.3 | | | MCL | | | Dark Brown Clayey Silt | I-MCL |
| | | | 429.0 | 0.0 | 429.0 | 428.6 | 0.4 | MCL | | | Dark Brown/Gray Silty Clay | I-MCL |
| | | | 429.0 | 0.4 | 428.6 | 428.3 | 0.3 | CL | | | Dark Brown Clay | I-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.4 | 1.8 | CH | | | Dark Brown/Gray Clay | I-CH |
| | | | 429.0 | 2.6 | 426.4 | 425.7 | 0.8 | MCL | | | Dark Brown Silty Clay | I-MCL |
| 185 | 1116033.48 | 879814.76 | 429.0 | 3.3 | 425.7 | 424.3 | 1.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.8 | 424.3 | 424.0 | 0.3 | ML | | | Lt Tan Silt | Discarded |
| | | | 429.0 | 5.0 | 424.0 | 422.4 | 1.6 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 420.5 | 1.9 | SM | | | Lt Tan Silty Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 419.6 | 0.9 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 429.0 | 9.4 | 419.6 | | | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 429.0 | 0.0 | 429.0 | 428.0 | 1.0 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 1.0 | 428.0 | 426.6 | 1.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 2.4 | 426.6 | 424.4 | 2.2 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 4.6 | 424.4 | 424.0 | 0.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 5.0 | 424.0 | 423.5 | 0.5 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| 186 | 1115992.84 | 880112.00 | 429.0 | 5.5 | 423.5 | 422.3 | 1.2 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 429.0 | 6.7 | 422.3 | 421.6 | 0.7 | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 429.0 | 7.4 | 421.6 | 420.5 | 1.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | 420.3 | 0.3 | SM | | | Lt Brown Silty Sand/Sandy Silt | Discarded |
| | | | 429.0 | 8.8 | 420.3 | 419.3 | 0.9 | MCL | | | Brown/Gray Silty Clay | J-MCL |
| | | | 429.0 | 9.7 | 419.3 | | | SM | | | Lt Tan Slightly Silty Fine Sand | Discarded |
| | | | 428.5 | 0.0 | 428.5 | 428.0 | 0.5 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 428.5 | 0.5 | 428.0 | 426.9 | 1.1 | CL | | | Dark Gray/Brown Clay | J-CL |
| | | | 428.5 | 1.6 | 426.9 | 426.0 | 0.9 | CH | | | Dark Brown Clay | J-CH |
| 187 | 1115947.77 | 880408.62 | 428.5 | 2.5 | 426.0 | 423.8 | 2.2 | CL | | | Dark Brown Clay w Silt Seams | J-CL |
| | | | 428.5 | 4.7 | 423.8 | 421.9 | 1.9 | CH | | | Dark Brown Clay | J-CH |
| | | | 428.5 | 6.6 | 421.9 | 419.8 | 2.1 | MCL | | | Brown/Tan Silty Clay | J-MCL |
| | | | 428.5 | 8.7 | 419.8 | | | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.5 | 0.0 | 428.5 | 428.3 | 0.2 | MCL | | | Dark Brown Slightly Silty Clay | J-MCL |
| | | | 428.5 | 0.2 | 428.3 | 427.9 | 0.4 | CL | | | Dark Brown Clay | J-CL |
| | | | 428.5 | 0.6 | 427.9 | 427.4 | 0.5 | CH | | | Dark Brown Clay | J-CH |
| | | | 428.5 | 1.1 | 427.4 | 426.2 | 1.3 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 2.3 | 426.2 | 425.5 | 0.7 | SM | | | Lt Tan Clayey Silt w Fine Sand | Discarded |
| | | | 428.5 | 3.0 | 425.5 | 425.0 | 0.5 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 188 | 1115902.70 | 880705.25 | 428.5 | 3.5 | 425.0 | 424.0 | 1.0 | SM | | | Lt Tan Silty Fine Sand | Discarded |
| | | | 428.5 | 4.5 | 424.0 | 423.6 | 0.4 | ML | | | Lt Brown Silt | Discarded |
| | | | 428.5 | 4.9 | 423.6 | 421.9 | 1.7 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 6.6 | 421.9 | 421.5 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.5 | 7.0 | 421.5 | 420.0 | 1.5 | MCL | | | Lt Brown/Tan Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 8.5 | 420.0 | 418.5 | 1.5 | MCL | | | Brown/Tan Silty Clay/Clayey Silt | J-MCL |
| | | | 428.5 | 10.0 | 418.5 | | | MCL | | | Lt Brown/Tan Slightly Clayey Silt w Fi | J-MCL |
| | | | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | SM | | | Dark Gray/Brown Silty Slightly Sandy | Discarded |
| | | | 427.5 | 0.4 | 427.1 | 426.7 | 0.4 | CL | | | Dark Black/Gray Clay | K-CL |
| | | | 427.5 | 0.8 | 426.7 | 425.1 | 1.6 | CH | | | Dark Black/Gray Clay | K-CH |
| | | | 427.5 | 2.4 | 425.1 | 423.0 | 2.1 | CH | | | Dark Brown/Gray Clay | K-CH |
| 189 | 1115857.92 | 881000.00 | 427.5 | 4.5 | 423.0 | 422.3 | 0.8 | CH | | | Dark Brown/Black Clay | K-CH |
| | | | 427.5 | 5.3 | 422.3 | 421.3 | 0.9 | MCL | | | Lt Tan/Gray Silty Clay, Clayey Silt | K-MCL |
| | | | 427.5 | 6.2 | 421.3 | 420.5 | 0.8 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 427.5 | 7.0 | 420.5 | 419.7 | 0.8 | MCL | | | Brown Silty Clay | K-MCL |
| | | | 427.5 | 7.8 | 419.7 | | | SP | | | Lt Tan Very Fine Sand | Discarded |
| | | | 428.0 | 0.0 | 428.0 | 427.7 | 0.3 | MCL | | | Dark Gray/Brown Sandy Silty Clay | K-MCL |
| | | | 428.0 | 0.3 | 427.7 | 427.3 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 428.0 | 0.7 | 427.3 | 425.7 | 1.7 | CH | | | Dark Gray/Brown Clay | K-CH |
| | | | 428.0 | 2.3 | 425.7 | 425.0 | 0.7 | CH | | | Dark Brown/Gray Clay | K-CH |
| 190 | 1115812.57 | 881298.50 | 428.0 | 3.0 | 425.0 | 424.5 | 0.5 | MCL | 10.6 | 88.8 | Lt Tan Silty Clay | K-MCL |
| | | | 428.0 | 3.5 | 424.5 | 423.5 | 1.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 428.0 | 4.5 | 423.5 | 423.3 | 0.3 | ML | | | Lt Tan/Brown Silt | Discarded |
| | | | 428.0 | 4.8 | 423.3 | 423.0 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 428.0 | 5.0 | 423.0 | 421.5 | 1.5 | ML | 15.8 | 81.6 | Lt Tan/Brown Silt w clay seams | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.0 | 6.5 | 421.5 | | | ML | | | Lt Tan/Brown Silt | Discarded |
| 191 | 1115963.24 | 879198.81 | 428.0 | 0.0 | 428.0 | 427.5 | 0.5 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 428.0 | 0.5 | 427.5 | 425.8 | 1.7 | CH | | | Dark Gray/Brown Clay | I-CH |
| | | | 428.0 | 2.2 | 425.8 | 425.5 | 0.3 | CH | | | Dark Gray/Brown Clay | I-CH |
| | | | 428.0 | 2.5 | 425.5 | 425.3 | 0.3 | ML | | | Lt Brown Clayey Silt | Discarded |
| | | | 428.0 | 2.8 | 425.3 | 423.3 | 1.9 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.0 | 4.7 | 423.3 | 422.5 | 0.8 | ML | | | Lt Tan/Brown Slightly Clayey Silt | Discarded |
| | | | 428.0 | 5.5 | 422.5 | 422.3 | 0.2 | ML | | | Brown Clayey Silt | Discarded |
| | | | 428.0 | 5.7 | 422.3 | 422.1 | 0.2 | CL | | | Dark Brown Clay | I-CL |
| | | | 428.0 | 5.9 | 422.1 | 421.1 | 1.0 | MCL | | | Brown Silty Clay | I-MCL |
| | | | 428.0 | 6.9 | 421.1 | | | MCL | | | Brown Silty Clay | I-MCL |
| 192 | 1115785.72 | 879477.97 | 428.5 | 0.0 | 428.5 | 428.2 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 428.5 | 0.3 | 428.2 | 427.8 | 0.4 | CL | | | Dark Gray/Brown Clay | I-CL |
| | | | 428.5 | 0.8 | 427.8 | 426.1 | 1.7 | MCL | | | Dark Gray/Brown Silty Clay | I-MCL |
| | | | 428.5 | 2.4 | 426.1 | 426.0 | 0.1 | CH | | | Dark Brown/Gray Clay | I-CH |
| | | | 428.5 | 2.5 | 426.0 | 423.6 | 2.4 | ML | | | Lt Tan Silt | Discarded |
| | | | 428.5 | 4.9 | 423.6 | 421.8 | 1.8 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 428.5 | 6.7 | 421.8 | | | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| 193 | 1115740.66 | 879774.60 | 427.5 | 0.0 | 427.5 | 427.2 | 0.3 | MCL | | | Dark Brown Silty Clay | I-MCL |
| | | | 427.5 | 0.3 | 427.2 | 425.1 | 2.1 | CL | 30.9 | 92.3 | Dark Brown Gray Clay | I-CL |
| | | | 427.5 | 2.4 | 425.1 | 423.5 | 1.6 | MCL | | | Dark Brown/Tan Silty Clay | I-MCL |
| | | | 427.5 | 4.0 | 423.5 | 423.0 | 0.5 | ML | | | Lt Tan Silt | Discarded |
| | | | 427.5 | 4.5 | 423.0 | 422.5 | 0.5 | MCL | | | Lt Tan Clayey Silt/ Silty Clay | I-MCL |
| | | | 427.5 | 5.0 | 422.5 | 421.2 | 1.3 | CL | | | Dark Brown Clay | I-CL |
| | | | 427.5 | 6.3 | 421.2 | 420.8 | 0.4 | MCL | | | Brown Silty Clay/Clayey Silt | I-MCL |
| | | | 427.5 | 6.8 | 420.8 | | | ML | | | Lt Tan Silt | Discarded |
| 194 | 1115695.59 | 880071.22 | 427.5 | 0.0 | 427.5 | 427.1 | 0.4 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 427.5 | 0.4 | 427.1 | 426.8 | 0.3 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 427.5 | 0.7 | 426.8 | 425.2 | 1.7 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.5 | 2.3 | 425.2 | 423.2 | 2.0 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| | | | 427.5 | 4.3 | 423.2 | 422.5 | 0.7 | MCL | | | Dark Brown w Trace Tan Silty Clay | J-MCL |
| | | | 427.5 | 5.0 | 422.5 | 421.2 | 1.3 | SM | | | Lt Tan Fine Sandy Silt | Discarded |
| | | | 427.5 | 6.3 | 421.2 | | | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| 195 | 1115650.52 | 880367.85 | 429.0 | 0.0 | 429.0 | 428.8 | 0.3 | MCL | | | Dark Black/Gray Silty Clay | J-MCL |
| | | | 429.0 | 0.3 | 428.8 | 428.3 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.8 | 1.4 | CH | | | Dark Brown Clay | J-CH |
| | | | 429.0 | 2.2 | 426.8 | 426.0 | 0.8 | CL | | | Dark Gray/Brown Clay w Silt Seam | J-CL |
| | | | 429.0 | 3.0 | 426.0 | 424.6 | 1.4 | MCL | | | Brown Clayey Silt | J-MCL |
| | | | 429.0 | 4.4 | 424.6 | 424.2 | 0.4 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 4.8 | 424.2 | 422.4 | 1.8 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 6.6 | 422.4 | 420.5 | 1.9 | MCL | 26.2 | 82.1 | Lt Tan/Brown Clayey Silt | J-MCL |
| | | | 429.0 | 8.5 | 420.5 | 420.3 | 0.3 | MCL | | | Brown Silty Clay | J-MCL |
| | | | 429.0 | 8.8 | 420.3 | 419.8 | 0.4 | SM | | | Lt Tan Sandy Silt | Discarded |
| | | | 429.0 | 9.2 | 419.8 | | | SM | | | Lt Tan Silty Sand | Discarded |
| 196 | 1115605.45 | 880664.48 | 429.0 | 0.0 | 429.0 | 428.8 | 0.3 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 0.3 | 428.8 | 427.9 | 0.8 | CH | | | Dark Black/Gray Clay | J-CH |
| | | | 429.0 | 1.1 | 427.9 | 427.0 | 0.9 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 429.0 | 2.0 | 427.0 | 426.8 | 0.3 | MCL | | | Dark Gray/Brown Silty Clay | J-MCL |
| | | | 429.0 | 2.3 | 426.8 | 425.7 | 1.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 3.3 | 425.7 | 424.8 | 0.9 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.3 | 424.8 | 422.5 | 2.3 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 421.6 | 0.9 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 7.4 | 421.6 | 420.6 | 1.0 | MCL | | | Lt Brown Clayey Silt/Silty Clay | J-MCL |
| | | | 429.0 | 8.4 | 420.6 | 419.8 | 0.8 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 429.0 | 9.3 | 419.8 | 419.0 | 0.8 | MCL | | | Brown Silty Clay/Clayey Silt | J-MCL |
| | | | 429.0 | 10.0 | 419.0 | | | SM | | | Lt Tan Silty Sand | Discarded |
| 197 | 1115560.39 | 880961.11 | 429.0 | 0.0 | 429.0 | 428.6 | 0.4 | CL | | | Black/Gray Clay | K-CL |
| | | | 429.0 | 0.4 | 428.6 | 428.3 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 429.0 | 0.8 | 428.3 | 426.7 | 1.6 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 429.0 | 2.3 | 426.7 | 426.3 | 0.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 429.0 | 2.7 | 426.3 | 425.8 | 0.6 | MCL | 18.3 | 86.2 | Dark Brown/Tan Silty Clay | K-MCL |
| | | | 429.0 | 3.3 | 425.8 | 424.5 | 1.3 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 429.0 | 4.5 | 424.5 | 422.5 | 2.0 | ML | | | Lt Tan Silt w Clay Seam | Discarded |
| | | | 429.0 | 6.5 | 422.5 | 420.5 | 2.0 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 429.0 | 8.5 | 420.5 | | | MCL | | | Brown/Gray Silty Clay | K-MCL |
| 198 | 1115515.32 | 881257.73 | 428.5 | 0.0 | 428.5 | 428.3 | 0.2 | MCL | | | Dark Brown/Gray Sandy Silty Clay | K-MCL |
| | | | 428.5 | 0.2 | 428.3 | 428.0 | 0.3 | CL | | | Dark Brown/Gray Slightly Silty Clay | K-CL |
| | | | 428.5 | 0.5 | 428.0 | 426.0 | 2.0 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 428.5 | 2.5 | 426.0 | 425.0 | 1.0 | MCL | | | Lt Tan Silt w Brown Clay | K-MCL |
| | | | 428.5 | 3.5 | 425.0 | 424.1 | 0.9 | SM | | | Lt Tan Slightly Silty Very Fine Sand | Discarded |
| | | | 428.5 | 4.4 | 424.1 | 424.0 | 0.1 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 428.5 | 4.5 | 424.0 | 423.8 | 0.3 | CL | | | Dark Gray Clay Seam | K-CL |
| | | | 428.5 | 4.8 | 423.8 | 423.1 | 0.7 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 5.4 | 423.1 | 421.7 | 1.4 | SM | | | Lt Tan Very Fine Sandy Silt/Silty Sand | Discarded |
| | | | 428.5 | 6.8 | 421.7 | 421.0 | 0.7 | SM | | | Lt Brown w Sandy Silt | Discarded |
| | | | 428.5 | 7.5 | 421.0 | 419.8 | 1.2 | SM | | | Lt Tan Slightly Silty Sand | Discarded |
| | | | 428.5 | 8.7 | 419.8 | 419.6 | 0.2 | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |

**Summary of Samples from Phase 2 Test Holes**

| Test Hole Number | Northing | Easting | Approx. Surface Elevation | Starting Depth (feet) | Starting Elevation | Ending Elevation | Thickness (feet) | Visually Classified | Moisture Content, % | Density, pcf | Description | Composite Sample Sector/Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 428.5 | 8.9 | 419.6 | | | MCL | | | Brown Silty Clay/Clayey Silt | K-MCL |
| 199 | 1115472.83 | 880040.59 | 428.0 | 0.0 | 428.0 | 427.5 | 0.5 | MCL | | | Dark Black/Gray Silty Clay | J-MCL |
| | | | 428.0 | 0.5 | 427.5 | 427.0 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 428.0 | 1.0 | 427.0 | 425.7 | 1.3 | CH | | | Dark Gray/Brown Clay | J-CH |
| | | | 428.0 | 2.3 | 425.7 | 423.5 | 2.2 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 4.5 | 423.5 | 421.5 | 2.0 | MCL | | | Dark Brown/Tan Silty Clay | J-MCL |
| | | | 428.0 | 6.5 | 421.5 | | | MCL | | | Brown Clayey Silt | J-MCL |
| 200 | 1115353.27 | 880327.08 | 428.0 | 0.0 | 428.0 | 427.6 | 0.4 | MCL | | | Dark Black/Gray Slightly Silty Clay | J-MCL |
| | | | 428.0 | 0.4 | 427.6 | 427.1 | 0.5 | CL | | | Dark Black/Gray Clay | J-CL |
| | | | 428.0 | 0.9 | 427.1 | 425.5 | 1.6 | CH | 27.9 | 95.8 | Dark Black/Gray Clay | J-CH |
| | | | 428.0 | 2.5 | 425.5 | 423.6 | 1.9 | CH | 35.1 | 84 | Dark Brown Clay | J-CH |
| | | | 428.0 | 4.4 | 423.6 | 423.2 | 0.4 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 4.8 | 423.2 | 423.1 | 0.1 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 428.0 | 4.9 | 423.1 | 421.5 | 1.6 | MCL | | | Dark Brown Silty Clay | J-MCL |
| | | | 428.0 | 6.5 | 421.5 | 421.3 | 0.2 | MCL | | | Brown Slightly Clayey Silt | J-MCL |
| | | | 428.0 | 6.7 | 421.3 | 421.0 | 0.3 | SP | | | Lt Tan Sand | Discarded |
| | | | 428.0 | 7.0 | 421.0 | | | MCL | | | Brown w Tan Clayey Silt/Silty Clay | J-MCL |
| 201 | 1115308.21 | 880623.71 | 427.0 | 0.0 | 427.0 | 426.6 | 0.4 | MCL | | | Dark Brown Slightly Silty Clay | J-MCL |
| | | | 427.0 | 0.4 | 426.6 | 426.1 | 0.5 | CL | | | Dark Brown Gray Clay | J-CL |
| | | | 427.0 | 0.9 | 426.1 | 424.5 | 1.6 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.0 | 2.5 | 424.5 | 422.4 | 2.1 | CH | | | Dark Brown Clay | J-CH |
| | | | 427.0 | 4.6 | 422.4 | 420.5 | 1.9 | MCL | 14.3 | 92.9 | Brown/Gray clayey silt | J-MCL |
| | | | 427.0 | 6.5 | 420.5 | | | SM | 14.6 | 88.5 | Lt Tan Fine Sandy Silt | Discarded |
| 202 | 1115263.14 | 880920.33 | 426.5 | 0.0 | 426.5 | 426.3 | 0.3 | SM | | | Dark Brown/Gray Silty Sandy Clay | Discarded |
| | | | 426.5 | 0.3 | 426.3 | 424.1 | 2.2 | CH | | | Dark Gray Clay | K-CH |
| | | | 426.5 | 2.4 | 424.1 | 421.8 | 2.3 | CH | 32.6 | 86.7 | Brown/Gray Mottled Clay | K-CH |
| | | | 426.5 | 4.8 | 421.8 | 421.5 | 0.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 426.5 | 5.0 | 421.5 | 421.0 | 0.5 | MCL | | | Brown/Gray Silty Clay/Clayey Silt | K-MCL |
| | | | 426.5 | 5.5 | 421.0 | 420.3 | 0.7 | CL | | | Dark Brown Clay | K-CL |
| | | | 426.5 | 6.2 | 420.3 | 420.2 | 0.2 | MCL | | | Brown Slightly Clayey Silt w Fine Sand | K-MCL |
| | | | 426.5 | 6.3 | 420.2 | | | CL | | | Brown/Gray Clay | K-CL |
| 203 | 1115218.07 | 881216.96 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.8 | 426.3 | 424.8 | 1.5 | CH | | | Dark Gray/Brown Mottled Clay | K-CH |
| | | | 427.0 | 2.3 | 424.8 | 423.9 | 0.8 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 427.0 | 3.1 | 423.9 | 422.5 | 1.4 | MCL | 27.7 | 80.7 | Dark Brown Silty Clay | K-MCL |
| | | | 427.0 | 4.5 | 422.5 | 422.0 | 0.5 | CL | | | Dark Brown/Gray Clay w Silt Seams | K-CL |
| | | | 427.0 | 5.0 | 422.0 | 420.3 | 1.7 | SM | | | Lt Tan Silty Sand/Sandy Silt | Discarded |
| | | | 427.0 | 6.7 | 420.3 | 419.8 | 0.5 | MCL | | | Brown Silty Clay | K-MCL |
| | | | 427.0 | 7.2 | 419.8 | 418.9 | 0.9 | CH | | | Dark Brown Clay | K-CH |
| | | | 427.0 | 8.1 | 418.9 | | | SM | | | Lt Tan Very Fine Sandy Silt | Discarded |
| 204 | 1115058.87 | 880891.85 | 427.5 | 0.0 | 427.5 | 427.3 | 0.3 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.5 | 0.3 | 427.3 | 426.3 | 0.9 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.5 | 1.2 | 426.3 | 425.1 | 1.3 | CL | | | Brown/Gray Slightly Silty Clay | K-CL |
| | | | 427.5 | 2.4 | 425.1 | 424.8 | 0.3 | CL | | | Brown/Gray Clay | K-CL |
| | | | 427.5 | 2.8 | 424.8 | 423.3 | 1.5 | SM | | | Tan Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 4.3 | 423.3 | 422.8 | 0.4 | SM | | | Lt Tan Silt w Fine Sand | Discarded |
| | | | 427.5 | 4.7 | 422.8 | 422.7 | 0.1 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.5 | 4.8 | 422.7 | 420.8 | 1.9 | SM | | | Lt Tan Silt w Very Fine Sand | Discarded |
| | | | 427.5 | 6.8 | 420.8 | | | SM | | | Lt Tan Very Fine Sandy Silt w Clay Se | Discarded |
| 205 | 1114920.82 | 881176.19 | 427.0 | 0.0 | 427.0 | 426.3 | 0.8 | SM | | | Dark Brown/Gray Sandy Silty Clay | Discarded |
| | | | 427.0 | 0.8 | 426.3 | 426.0 | 0.3 | CL | | | Dark Brown/Gray Clay | K-CL |
| | | | 427.0 | 1.0 | 426.0 | 424.6 | 1.4 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 2.4 | 424.6 | 423.6 | 1.0 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 3.4 | 423.6 | 422.3 | 1.3 | CH | | | Dark Brown/Gray Clay | K-CH |
| | | | 427.0 | 4.7 | 422.3 | 420.3 | 2.1 | CL | 24 | 97.4 | Dark Gray/Brown Clay | K-CL |
| | | | 427.0 | 6.8 | 420.3 | | | MCL | | | Brown Clayey Silt | K-MCL |

**Appendix 2**

# STUDY OF GEOTECHNICAL ENGINEERING PROPERTIES OF ASH FROM SIOUX POWER PLANT

## ENGINEERING PROPERTIES OF FLYASH

### Test Pits

Fifteen tests pits were made in the flyash pond in November 2001. The approximate locations of the test pits are shown in Figure B-1. The water level in the pond had been lowered as much as possible. The tests pits were dug by Energy Resources, Inc., using a tracked Bobcat with a small backhoe. The Bobcat had to use 4’x8’ plywood mats to move around most areas of the pond. The locations of the test pits were selected by Reitz & Jens. Our Senior Soils Technician directed the excavations, logged the test pits, and collected bulk samples. Bag samples were obtained at intervals of 1 foot in each test pit. The depths of the test pits were between 6 and 8 feet. Some test pits would stand open while digging, and others caved soon after digging began. We also obtained relatively undisturbed samples of the flyash by driving a thin-wall tube sampler by hand. The tube samples could only be obtained from depths up to 18 inches because they were done by hand.

Normally, sediment in a pond is sorted by grain size, with larger particles settling first and finer particles staying in suspension longer. As the pond fills, the sediments become finer with depth. However, channels have been dug through the deposited flyash near the discharge pipes at the north end to keep the pond operational. Therefore, the grain-size distribution of the flyash appeared to vary randomly by location and with depth in the pond.

### Laboratory Tests on Test Pit Samples

The moisture content and dry unit weight of the tube samples were measured in the lab. These are summarized in Table B-1. The dry unit weights ranged from 53 to 77 lbs/ft$^3$, and averaged about 65 lbs/ft$^3$. The dry unit weights generally increased with depth over the 18 inches that were sampled. Moisture contents ranged from 42% to 57% in the flyash, and 31% to 43% in the coarser economizer ash.

Table B-1 – Moisture Contents and Dry Unit Weights of Flyash Samples

| Test No. | Sample Location | Sample Depth, in. | Wet Unit Weight, pcf | Moisture Content, % | Dry Unit Weight, pcf |
|---|---|---|---|---|---|
| 1 | Discharge | 3 – 9 | 100.2 | 51.0 | 69.5 |
| 2 | TP-2 | 0 – 6 | 88.0 | 57.2 | 56.0 |
| 3 | TP-2 | 6 – 12 | 101.8 | 51.7 | 67.1 |
| 4 | TP-5 | 0 – 6 | 96.5 | 52.1 | 63.4 |
| 5 | TP-5 | 8 – 14 | 109.6 | 42.5 | 76.9 |
| 6 | TP-8 | 0 – 6 | 100.0 | 57.5 | 63.5 |
| 7 | TP-8 | 6 – 12 | 104.8 | 49.6 | 70.1 |
| 8 | TP-11 | 3 – 9 | 108.1 | 45.4 | 74.4 |
| 9 | Economizer | 0 – 6 | 83.7 | 31.1 | 63.9 |
| 10 | Economizer | 12 – 18 | 93.7 | 42.6 | 65.7 |
| 11 | Economizer | 0 – 6 | 87.4 | 35.8 | 64.4 |
| 12 | TP-13 | 0 – 6 | 92.0 | 44.2 | 63.8 |
| 13 | TP-14 | 0 – 6 | 80.4 | 51.9 | 52.9 |
| 14 | TP-15 | 0 – 6 | 96.5 | 56.9 | 61.5 |

We ran several hydrometer tests to obtain the grain-size distribution of the flyash. Generally, there were slightly-cemented conglomerates of flyash mixed throughout each sample. Most of these conglomerates were easily crushed by hand. We tried not to crush the conglomerates since these will occur in the flyash fill. Therefore, instead of deflocculating the samples, we ran hydrometer tests on 50-gram and 100-gram samples, to determine the affect on the results. We ran hydrometer tests on samples at 1-foot and 2-foot depths from Test Pit 5. The results are shown in Figure B-2. The differences between the 50-gram and 100-gram samples were not significant. The sample at 2-foot depth was coarser than the sample at 1-foot. The sample at 2-foot depth may be classified as a sandy silt or a silty sand. The sample at 1-foot depth may be classified as a clayey silt.

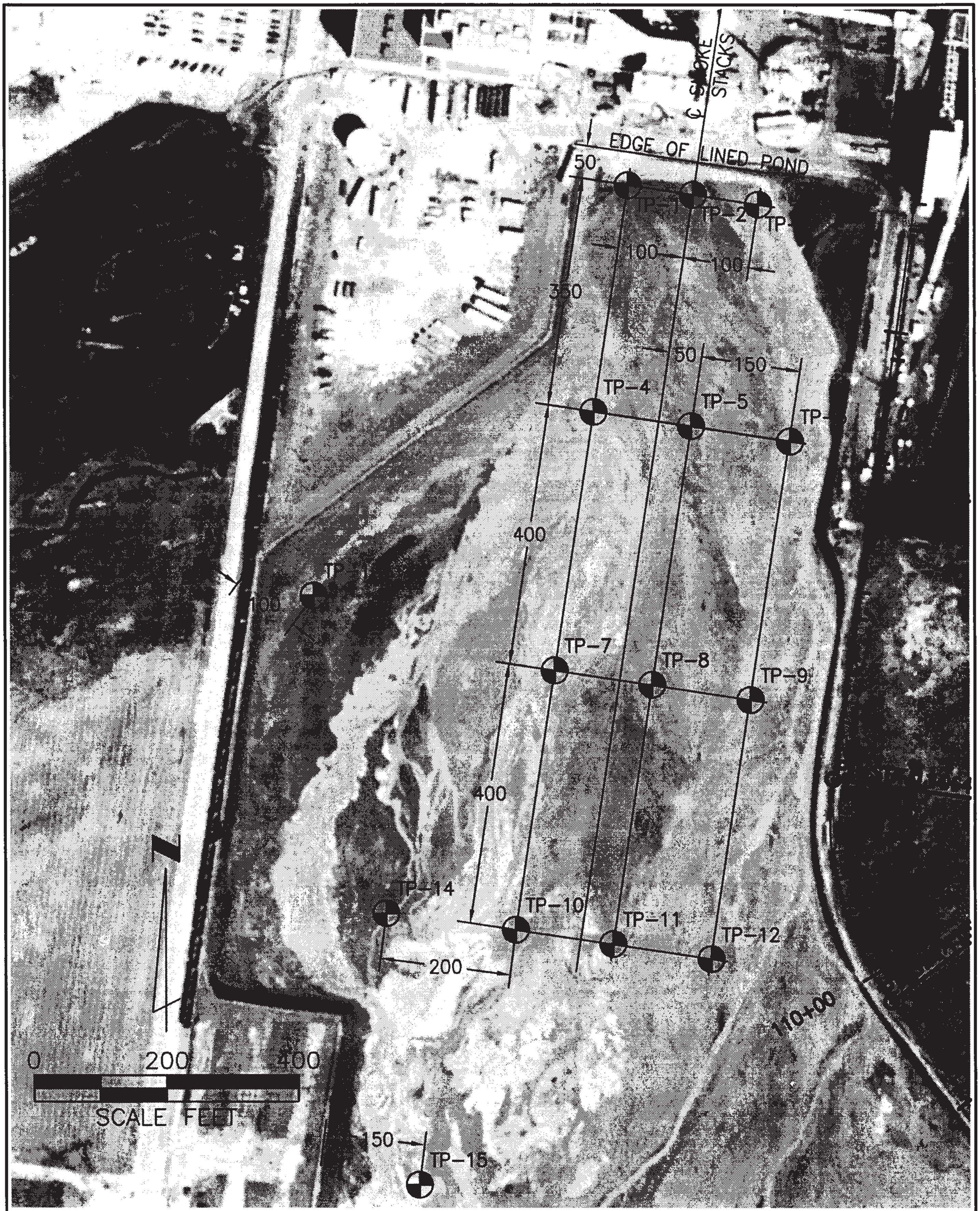
We combined the flyash samples from Test Pits 4, 5 and 6, and from Test Pits 10, 11 and 12, for two standard Proctor compaction tests (ASTM D-698). The results are shown in Figures B-3 and B-4, respectively. From Test Pits 4-6, the maximum dry unit weight ($\gamma_{d,max}$) was 73.8 lbs/ft$^3$ and the optimum moisture content was 39%. From Test Pits 10-12, $\gamma_{d,max}$ was 77.3 lbs/ft$^3$ and the optimum moisture content was 29%.

We ran four series of unconsolidated-undrained triaxial tests to determine the shear strength characteristics of the compacted flyash. Three samples were compacted in a miniature mold at 99% of $\gamma_{d,max}$ for each series. We ran two series on a combined sample from Test Pits 4, 5 and 6 – one series compacted wet of optimum and one series compacted dry of optimum. Similarly, we ran two series on a combined sample from Test Pits 10, 11 and 12. Confining pressures of 3, 6 and 9 psi were used. comparable to the stresses that we expect in the field. The results from each series of tests are shown in Figures B-5 through B-8, and are summarized in the following table.

Table B-2 – Results of Triaxial Shear Strength Tests on Compacted Flyash Samples

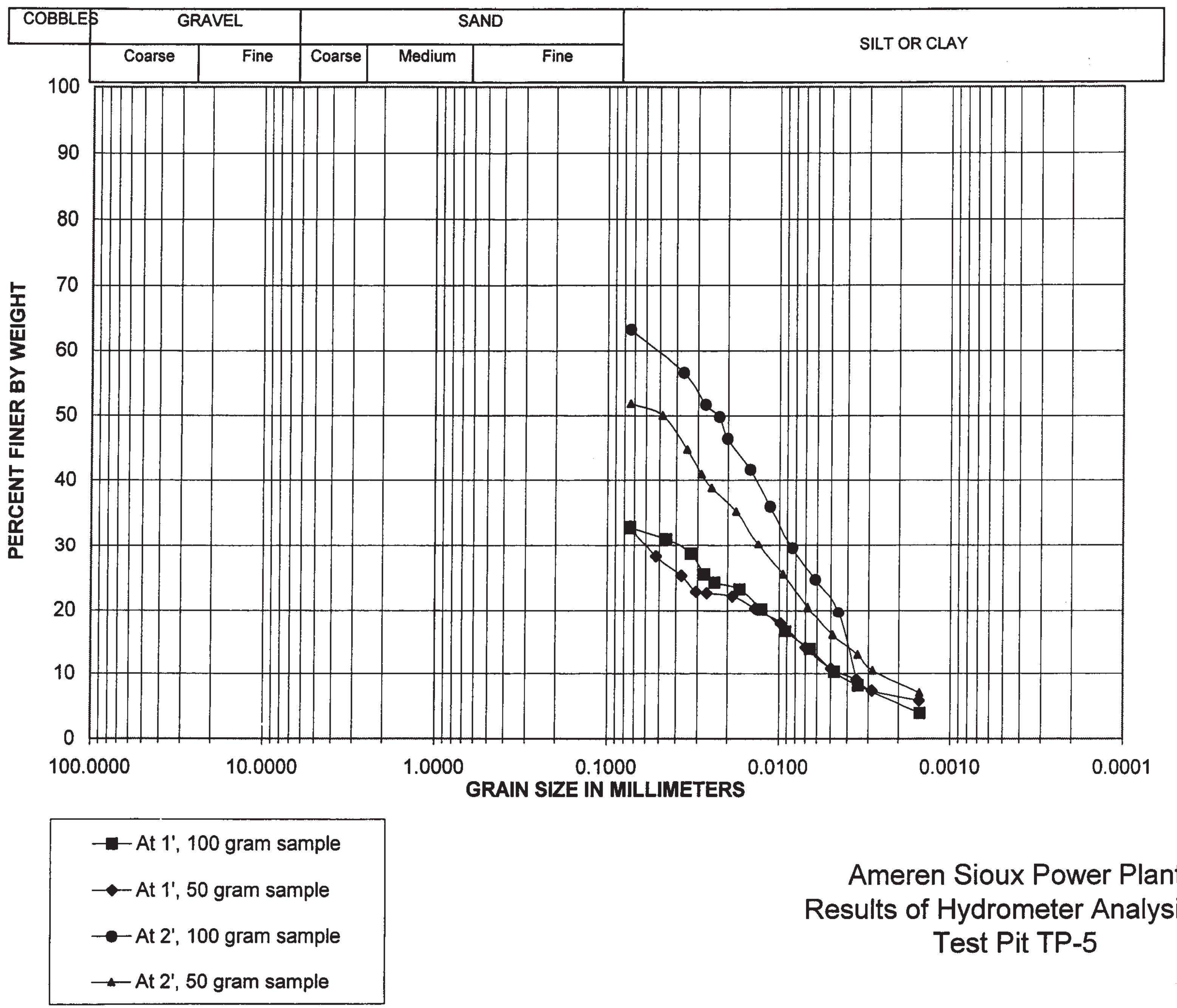
| Test Pits | Moisture Content | Friction Angle (ϕ') | Cohesion c', psf | Initial Tangent Modulus k, psi |
|---|---|---|---|---|
| 4, 5, 6 | 45% (wet) | 18° | 960 | 500 – 1000 |
| | 30% (dry) | 34° | 2100 | 5500 |
| 10, 11, 12 | 40% (wet) | 35° | 1400 | 1000 – 4600 |
| | 23% (dry) | 43° | 1800 | 5200 – 6000 |

We also performed flexible-wall hydraulic conductivity tests (ASTM D-5084) on combined samples from Test Pits 4, 5 and 6 and Test Pits 10, 11 and 12. The samples were compacted in a miniature mold to 98% of the corresponding $\gamma_{d,max}$ and at moisture contents of 45% and 40%, respectively. At a hydraulic gradient of 3% and net confining pressure of 2.5 psi, the measured permeability (K) was 1.8x10$^{-4}$ cm/sec for the sample from Test Pits 4-6, and 9.9x10$^{-5}$ cm/sec for the sample from Test Pits 10-12.




Ameren Sioux Power Plant
APPROXIMATE LOCATIONS OF
TEST PITS IN FLYASH POND

Figure B-1

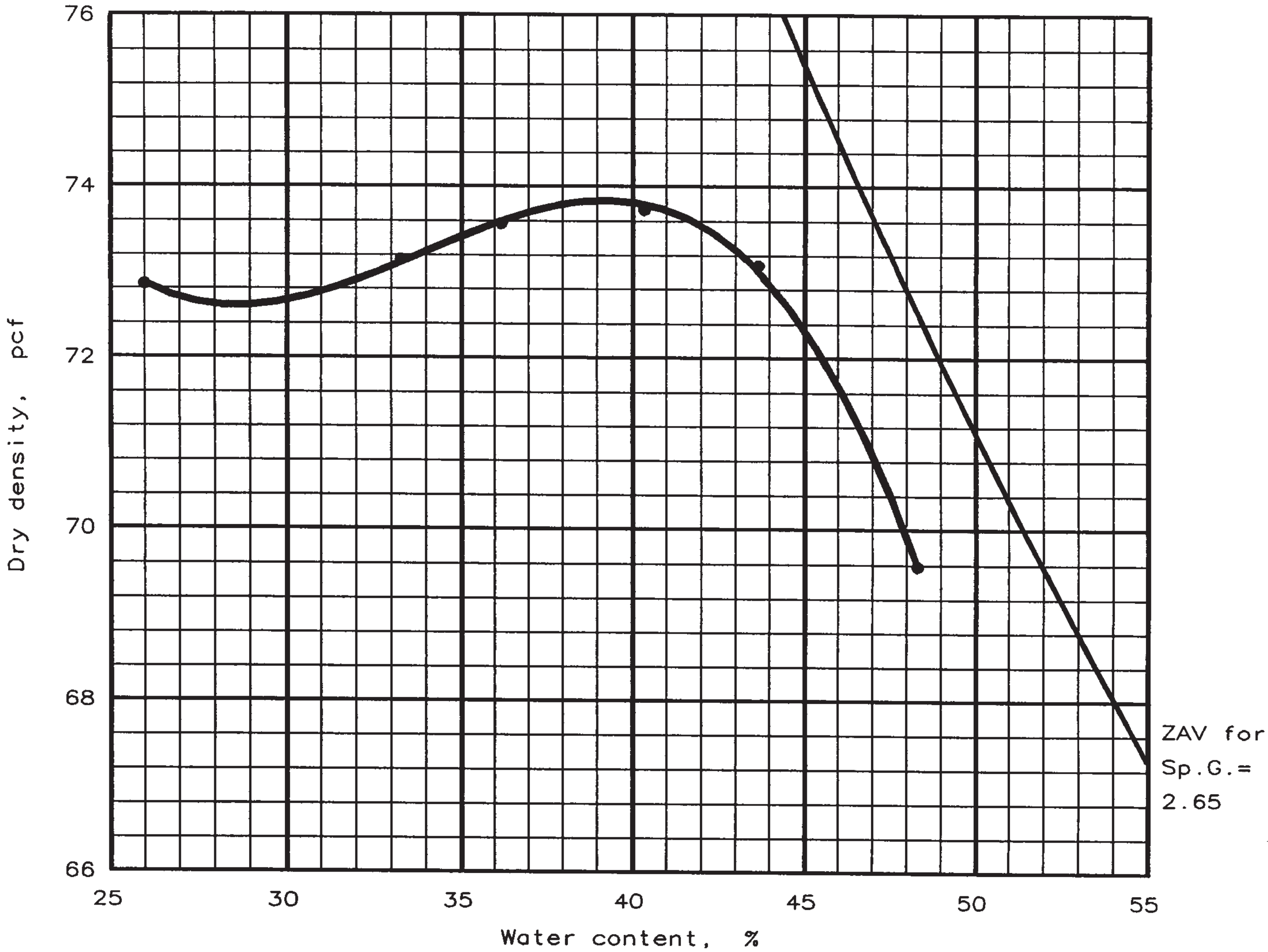



Ameren Sioux Power Plant
Results of Hydrometer Analysis
Test Pit TP-5

Figure B-2

REITZ & JENS, INC.

# RESULTS OF MOISTURE-DENSITY TEST




Test specification: ASTM D 698-91 Procedure A, Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > No.4 | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| | | | | | | | | 62 % |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 73.8 pcf<br>Optimum moisture = 39.2 % | Type F Flyash |

Project No.: 2001012413

Project: Ameren Sioux Power Plant Railroad Loop

Location: Test Pits 4, 5, 6

Date: 1-22-1902

Remarks:

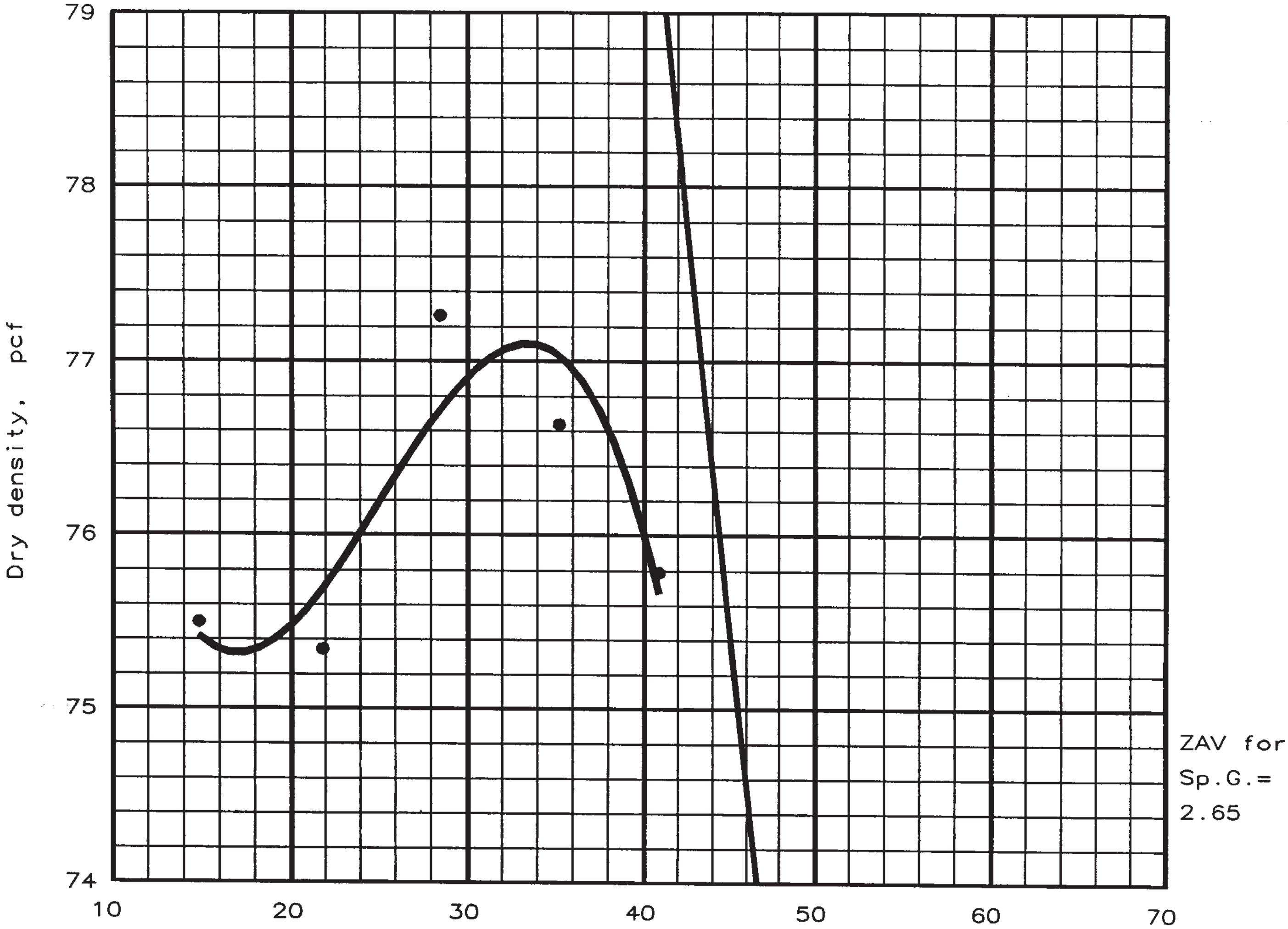
Combined sample

RESULTS OF MOISTURE-DENSITY TEST

REITZ & JENS, Inc.

Fig. No. B-3

# RESULTS OF MOISTURE-DENSITY TEST




Test specification: ASTM D 698-91 Procedure A, Standard

| Elev/ Depth | Classification | | Nat. Moist. | Sp.G. | LL | PI | % > No.4 | % < No.200 |
|---|---|---|---|---|---|---|---|---|
| | USCS | AASHTO | | | | | | |
| | | | | | | | | |

| TEST RESULTS | MATERIAL DESCRIPTION |
|---|---|
| Maximum dry density = 77.3 pcf<br>Optimum moisture = 28.5 % | Type F Flyash |

Project No.: 2001012413

Project: Ameren Sioux Power Plant Railroad Loop

Location: Test Pits 10, 11, 12

Date: 1-22-1902

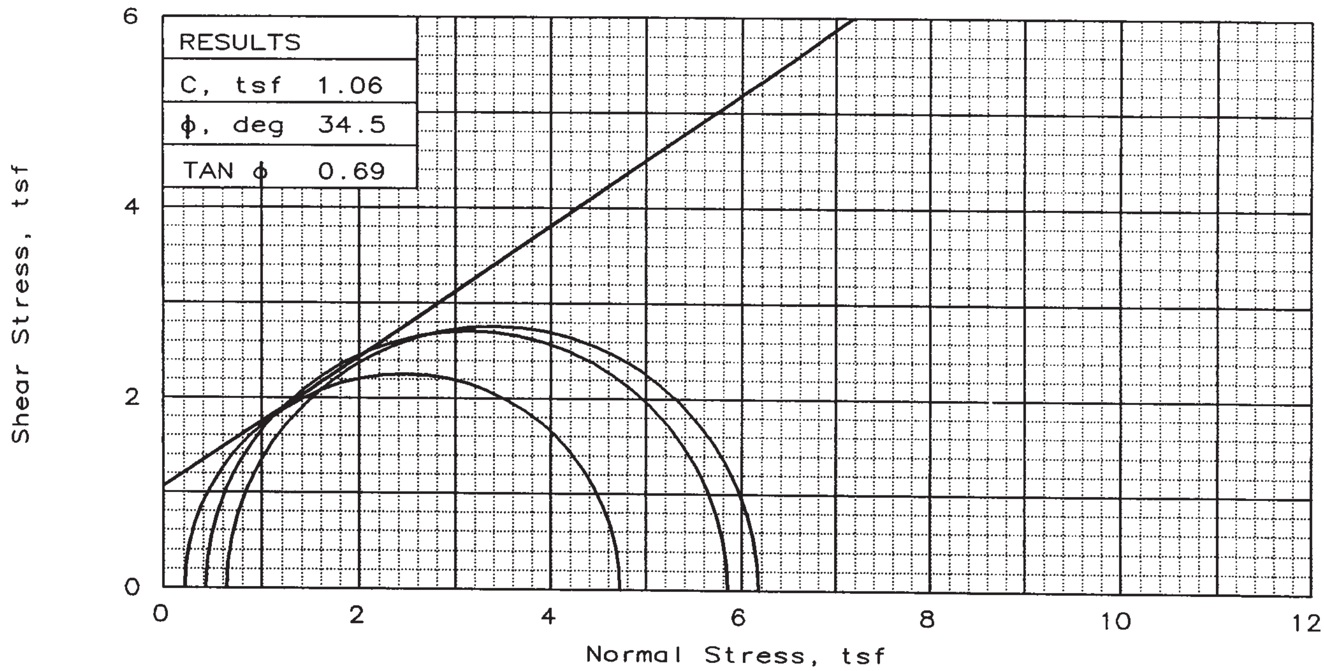
Remarks:

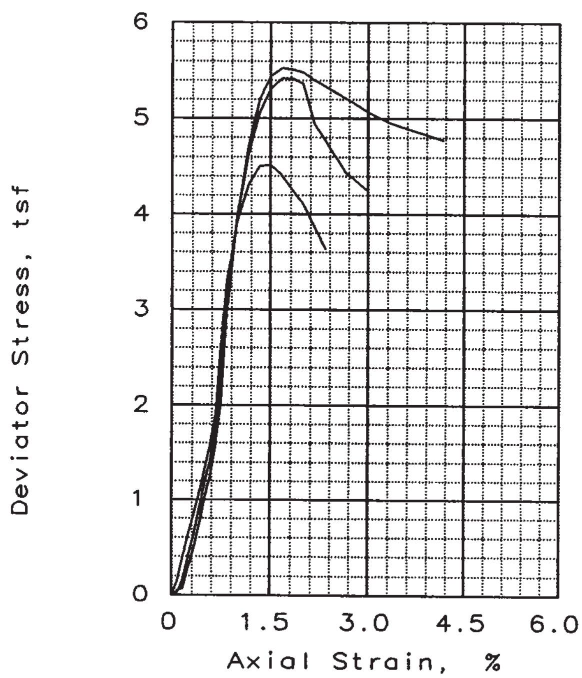
Combined sample

RESULTS OF MOISTURE-DENSITY TEST

REITZ & JENS, Inc.

Fig. No. B-4




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 29.8 | 29.8 | 29.8 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 66.8 | 66.8 | 66.8 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 44.6 | 44.6 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 0.0 | 100.0 | 100.0 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 4.51 | 5.42 | 5.52 |
| STRAIN, % | | 1.5 | 1.7 | 1.7 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 4.73 | 5.85 | 6.17 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted dry of optimum

Fig. No.: B-5

CLIENT: Ameren Services

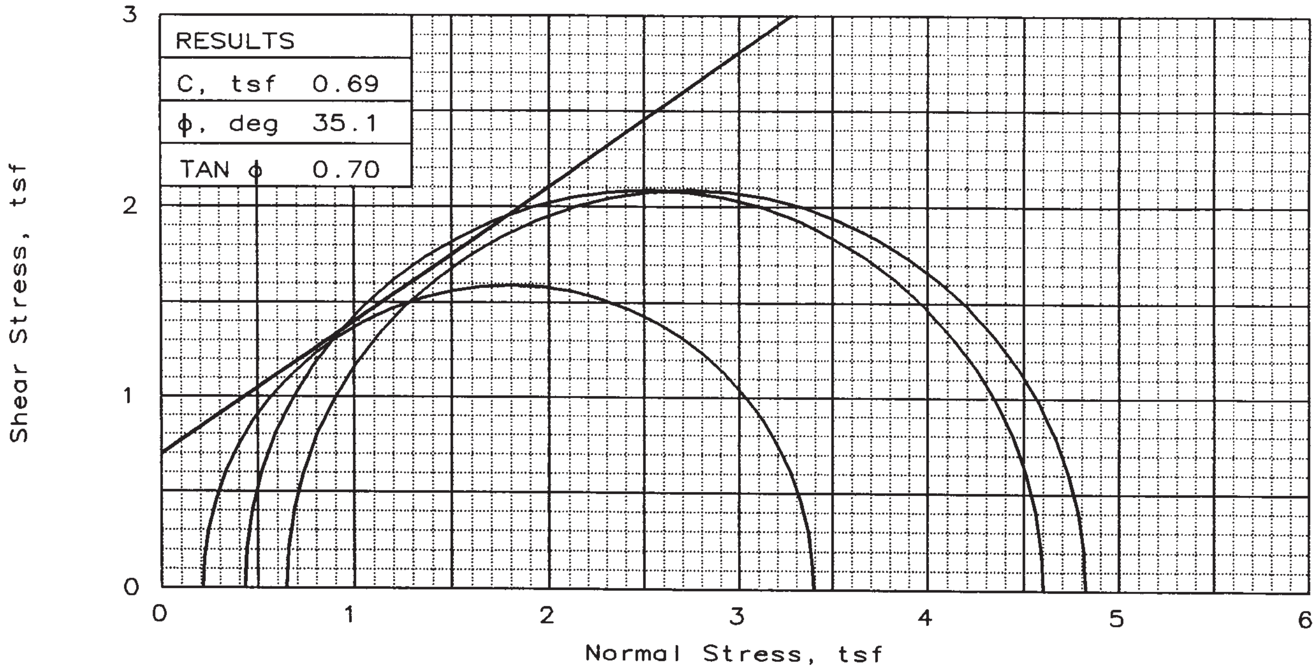
PROJECT: Sioux Plant Rail Loop Extension

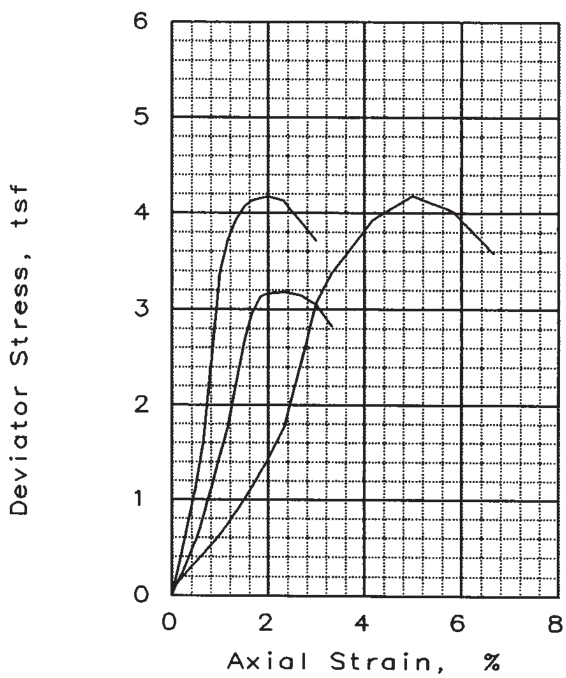
SAMPLE LOCATION: TP-4, -5, -6 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 40.0 | 40.0 | 40.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 98.3 | 98.3 | 98.3 |
| | VOID RATIO | 0.996 | 0.996 | 0.996 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 0.996 | 0.996 | 0.996 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 3.18 | 4.17 | 4.18 |
| STRAIN, % | | 2.3 | 2.0 | 5.0 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 3.39 | 4.60 | 4.82 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted wet of optimum

Fig. No.: B-6

CLIENT: Ameren Services

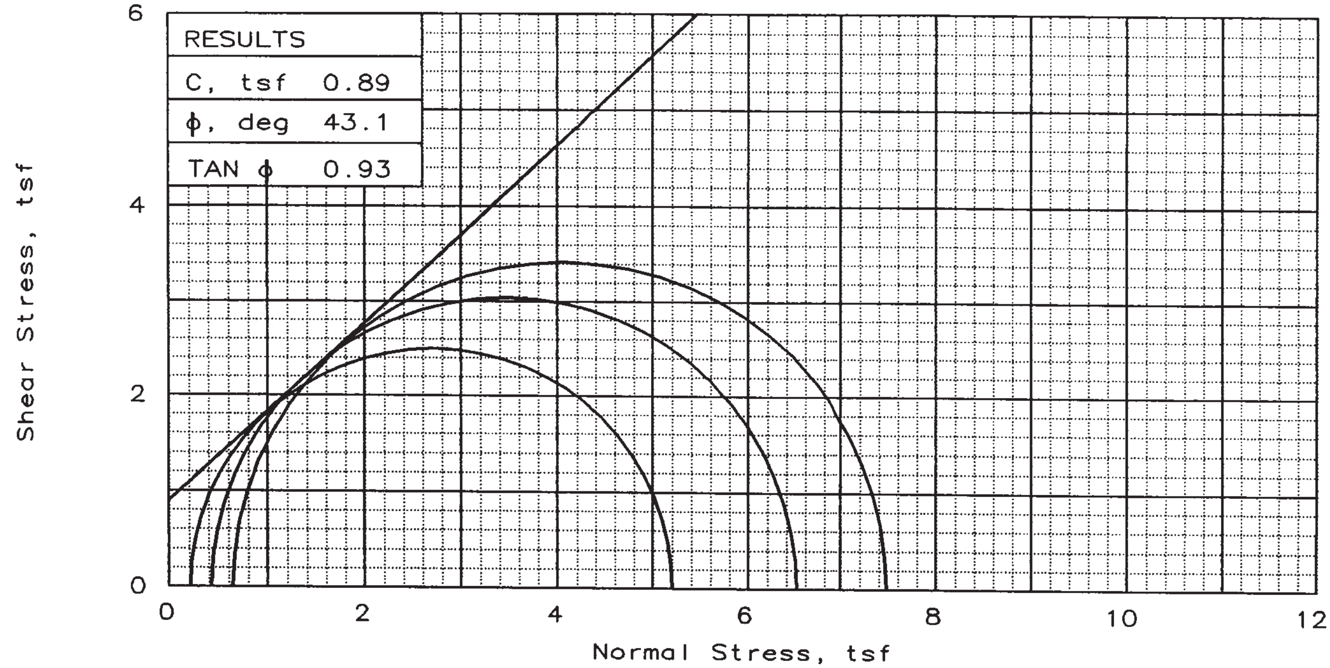
PROJECT: Sioux Plant Rail Loop Extension

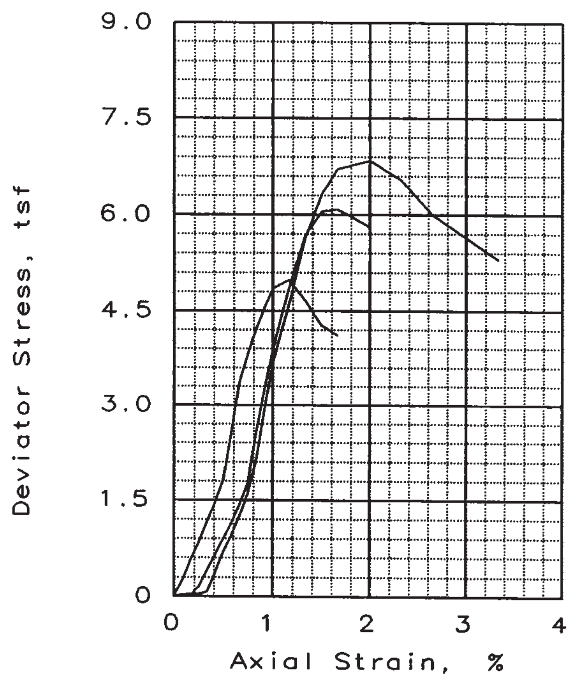
SAMPLE LOCATION: TP-10,-11,-12 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 22.7 | 22.7 | 22.7 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 55.8 | 55.8 | 55.8 |
| | VOID RATIO | 0.997 | 0.997 | 0.997 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 76.6 | 76.6 | 76.6 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 0.997 | 0.997 | 0.997 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 4.99 | 6.08 | 6.84 |
| STRAIN, % | | 1.2 | 1.7 | 2.0 |
| ULT. STRESS, tsf | | | | |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 5.21 | 6.51 | 7.48 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted dry of optimum

Fig. No.: B-7

CLIENT: Ameren Services

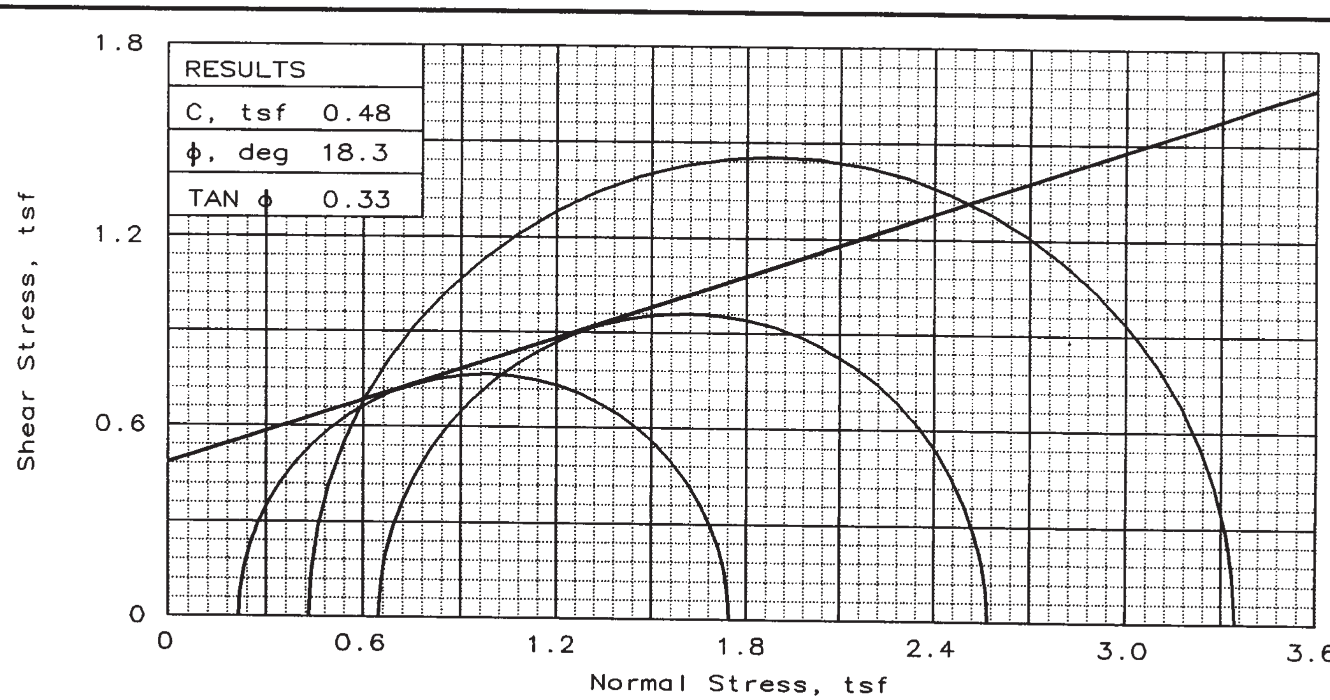
PROJECT: Sioux Plant Rail Loop Extension

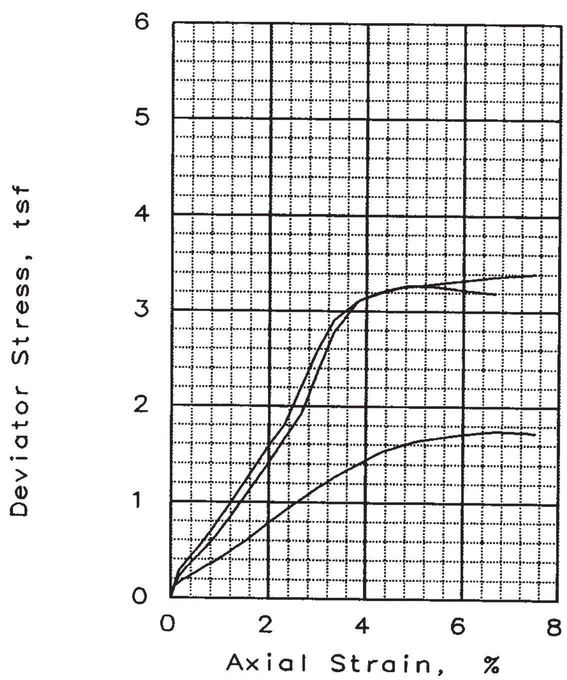
SAMPLE LOCATION: TP-10,-11,-12 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

TRIAXIAL SHEAR TEST REPORT

REITZ & JENS, Inc.




| SAMPLE NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 45.0 | 45.0 | 45.0 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 100.9 | 100.9 | 100.9 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 73.1 | 73.1 | 73.1 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 1.093 | 1.093 | 1.093 |
| | DIAMETER, in | 2.85 | 2.85 | 2.85 |
| | HEIGHT, in | 6.00 | 6.00 | 6.00 |
| Strain rate, %/min | | 0.85 | 0.85 | 0.85 |
| BACK PRESSURE, tsf | | 0.00 | 0.00 | 0.00 |
| CELL PRESSURE, tsf | | 0.22 | 0.43 | 0.65 |
| FAIL. STRESS, tsf | | 1.53 | 2.91 | 1.92 |
| STRAIN, % | | 4.3 | 3.3 | 2.7 |
| ULT. STRESS, tsf | | 1.75 | 3.40 | 3.27 |
| STRAIN, % | | | | |
| $\sigma_1$ FAILURE, tsf | | 1.75 | 3.34 | 2.57 |
| $\sigma_3$ FAILURE, tsf | | 0.22 | 0.43 | 0.65 |

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: Bulk

DESCRIPTION: Flyash

SPECIFIC GRAVITY= 2.45

REMARKS: Compacted to 100% of standard Proctor dry density, compacted wet of optimum

CLIENT: Ameren Services

PROJECT: Sioux Plant Rail Loop Extension

SAMPLE LOCATION: TP-4, -5, -6 (Bulk Mix)

PROJ. NO.: 2001012413 DATE: 12-12-01

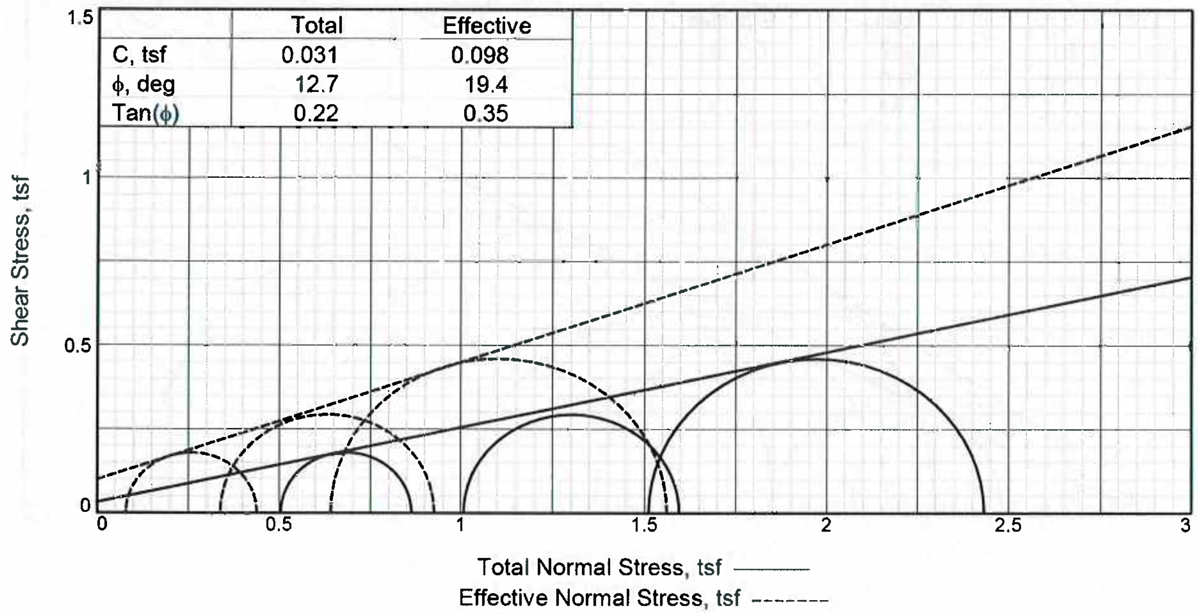
TRIAXIAL SHEAR TEST REPORT

**REITZ & JENS, Inc.**

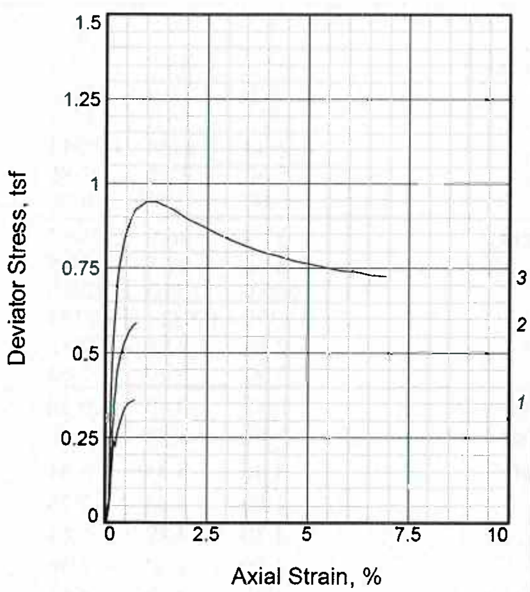
Fig. No.: B-8

**Appendix 2.1**

# RESULTS OF LABORATORY TESTING ON FLY ASH FROM ADDENDUM




| | Total | Effective |
|---|---|---|
| C, tsf | 0.031 | 0.098 |
| ϕ, deg | 12.7 | 19.4 |
| Tan(ϕ) | 0.22 | 0.35 |




| | Sample No. | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 34.5 | 34.5 | 34.5 |
| | Dry Density, pcf | 64.1 | 64.1 | 64.1 |
| | Saturation, | 59.7 | 59.7 | 59.7 |
| | Void Ratio | 1.4555 | 1.4555 | 1.4555 |
| | Diameter, in. | 2.86 | 2.86 | 2.86 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, | 50.5 | 49.0 | 48.2 |
| | Dry Density, pcf | 69.2 | 70.4 | 71.1 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 1.2721 | 1.2346 | 1.2135 |
| | Diameter, in. | 2.79 | 2.78 | 2.79 |
| | Height, in. | 5.85 | 5.78 | 5.72 |
| | Strain rate, %/min. | 0.30 | 0.30 | 0.10 |
| | Back Pressure, tsf | 4.68 | 5.11 | 5.83 |
| | Cell Pressure, tsf | 5.18 | 6.12 | 7.34 |
| | Fail. Stress, tsf | 0.36 | 0.59 | 0.92 |
| | Total Pore Pr., tsf | 5.10 | 5.78 | 6.70 |
| | Ult. Stress, tsf | 0.36 | 0.59 | 0.92 |
| | Total Pore Pr., tsf | 5.10 | 5.78 | 6.70 |
| | $\bar{\sigma}_1$ Failure, tsf | 0.44 | 0.93 | 1.56 |
| | $\bar{\sigma}_3$ Failure, tsf | 0.08 | 0.34 | 0.64 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted

**Description:** Fly Ash, at approximately 81% of standard proctor maximum dry density

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 1

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

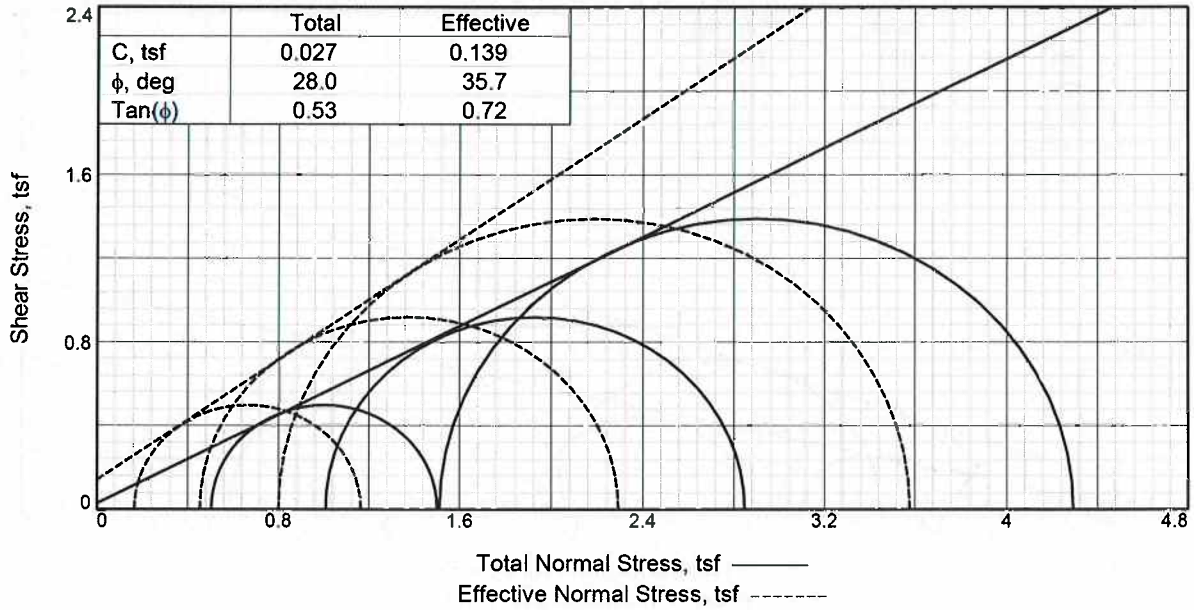
**Source of Sample:** Sioux Fly Ash

**Sample Number:** Grab-1

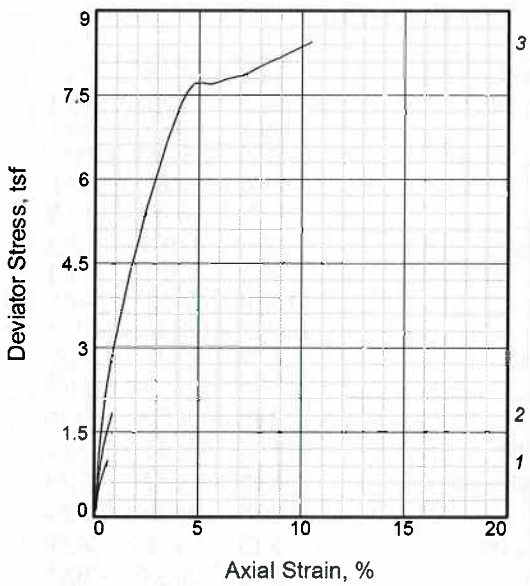
**Proj. No.:** 2009012470 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




| | Total | Effective |
|---|---|---|
| C, tsf | 0.027 | 0.139 |
| ϕ, deg | 28.0 | 35.7 |
| Tan(ϕ) | 0.53 | 0.72 |



| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 35.2 | 35.2 | 35.2 |
| | Dry Density, pcf | 78.9 | 78.9 | 78.9 |
| | Saturation, | 89.3 | 89.3 | 89.3 |
| | Void Ratio | 0.9944 | 0.9944 | 0.9944 |
| | Diameter, in. | 2.86 | 2.86 | 2.86 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, | 37.2 | 36.9 | 36.7 |
| | Dry Density, pcf | 81.2 | 81.5 | 81.8 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9370 | 0.9311 | 0.9242 |
| | Diameter, in. | 2.84 | 2.84 | 2.85 |
| | Height, in. | 5.95 | 5.90 | 5.84 |
| Strain rate, %/min. | | 0.30 | 0.30 | 0.30 |
| Back Pressure, tsf | | 3.96 | 4.32 | 4.90 |
| Cell Pressure, tsf | | 4.46 | 5.33 | 6.41 |
| Fail. Stress, tsf | | 1.00 | 1.84 | 2.78 |
| Total Pore Pr., tsf | | 4.30 | 4.87 | 5.61 |
| Ult. Stress, tsf | | 1.00 | 1.84 | 2.78 |
| Total Pore Pr., tsf | | 4.30 | 4.87 | 5.61 |
| $\bar{\sigma}_1$ Failure, tsf | | 1.16 | 2.29 | 3.58 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.17 | 0.45 | 0.80 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted

**Description:** Fly Ash, at approximately 100% of standard proctor maximum dry density

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 2

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

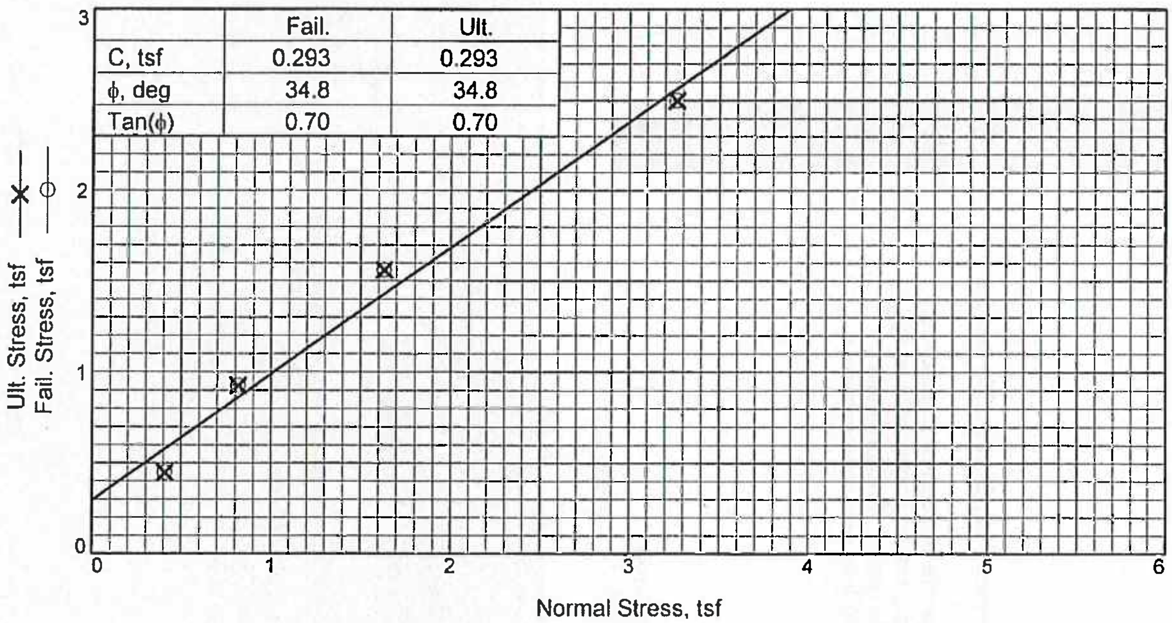
**Source of Sample:** Sioux Fly Ash

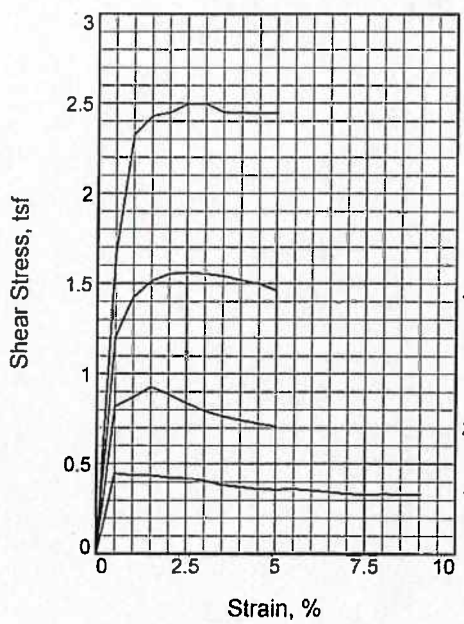
**Sample Number:** Grab-1

**Proj. No.:** 2009012470 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




| Sample No. | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Initial | Water Content, % | 30.0 | 30.0 | 30.0 | 30.0 |
| | Dry Density, pcf | 54.4 | 59.2 | 57.5 | 59.9 |
| | Saturation, % | 39.9 | 47.0 | 44.9 | 47.9 |
| | Void Ratio | 1.8943 | 1.5319 | 1.6053 | 1.5033 |
| | Diameter, in. | 1.99 | 1.99 | 1.99 | 1.99 |
| | Height, in. | 1.07 | 1.03 | 1.15 | 1.11 |
| At Test | Water Content, % | 30.0 | 30.0 | 30.0 | 30.0 |
| | Dry Density, pcf | 54.4 | 59.2 | 57.5 | 59.9 |
| | Saturation, % | 39.9 | 47.0 | 44.9 | 47.9 |
| | Void Ratio | 1.8943 | 1.5319 | 1.6053 | 1.5033 |
| | Diameter, in. | 1.99 | 1.99 | 1.99 | 1.99 |
| | Height, in. | 1.07 | 1.03 | 1.15 | 1.11 |
| Normal Stress, tsf | | 0.408 | 0.816 | 1.631 | 3.263 |
| Fail. Stress, tsf | | 0.446 | 0.927 | 1.560 | 2.498 |
| Strain, % | | 0.5 | 1.5 | 2.5 | 2.5 |
| Ult. Stress, tsf | | 0.446 | 0.927 | 1.560 | 2.498 |
| Strain, % | | 0.5 | 1.5 | 2.5 | 2.5 |
| Strain rate, %/min. | | N/A | N/A | N/A | N/A |

**Sample Type:** Compacted

**Description:** Fly Ash on textured liner, compacted to approximately 58 pcf dry unit weight

**Assumed Specific Gravity=** 2.52

**Remarks:**

**Figure** 14

**Client:** Ameren UE

**Project:** UWL Dry Cell Design

**Source of Sample:** Sioux Fly Ash

**Sample Number:** Grab-1

**Proj. No.:** 2009012470 **Date:** 6/15/10

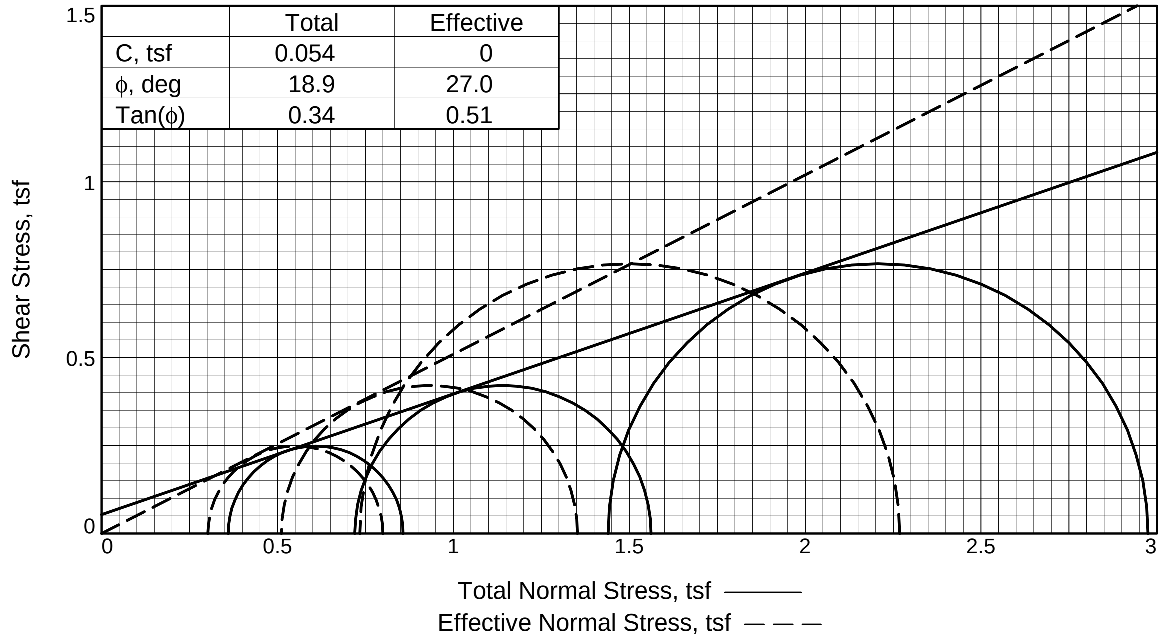
REITZ & JENS, INC.
CONSULTING ENGINEERS

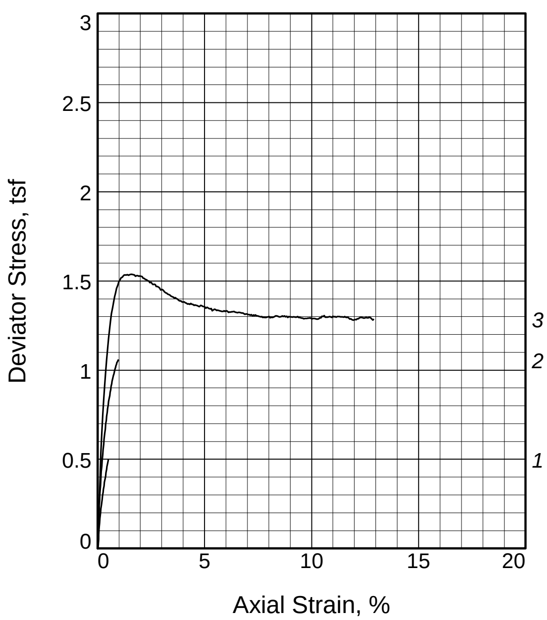
**Tested By:** J. Crose, J. Pruett **Checked By:** J. Fouse

**Appendix 2.2**

# RESULTS OF LABORATORY TESTING ON FLY ASH FROM CQA REPORT FOR CELL 4A PHASE 3 – INITIAL FILLING

| | Total | Effective |
|---|---|---|
| C, tsf | 0.054 | 0 |
| ϕ, deg | 18.9 | 27.0 |
| Tan(ϕ) | 0.34 | 0.51 |




| | Sample No. | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, % | 55.9 | 55.9 | 55.9 |
| | Dry Density, pcf | 57.5 | 57.5 | 57.5 |
| | Saturation, % | 79.7 | 79.7 | 79.7 |
| | Void Ratio | 1.8227 | 1.8227 | 1.8227 |
| | Diameter, in. | 2.87 | 2.87 | 2.87 |
| | Height, in. | 6.00 | 6.00 | 6.00 |
| At Test | Water Content, % | 69.6 | 69.5 | 69.1 |
| | Dry Density, pcf | 57.8 | 57.8 | 58.0 |
| | Saturation, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 1.8100 | 1.8058 | 1.7973 |
| | Diameter, in. | 2.86 | 2.87 | 2.88 |
| | Height, in. | 5.99 | 5.96 | 5.90 |
| | Strain rate, %/min. | 0.10 | 0.10 | 0.10 |
| | Back Pressure, tsf | 3.24 | 3.31 | 3.60 |
| | Cell Pressure, tsf | 3.60 | 4.03 | 5.04 |
| | Fail. Stress, tsf | 0.50 | 0.84 | 1.53 |
| | Total Pore Pr., tsf | 3.30 | 3.52 | 4.31 |
| | Ult. Stress, tsf | | | |
| | Total Pore Pr., tsf | | | |
| | $\bar{\sigma}_1$ Failure, tsf | 0.80 | 1.35 | 2.27 |
| | $\bar{\sigma}_3$ Failure, tsf | 0.30 | 0.51 | 0.73 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Laboratory Compacted

**Description:** Sioux Ash, dark grey to black, silt to fine sand sized grains

**Assumed Specific Gravity=** 2.6

**Remarks:**

**Figure** _______

**Client:** Ameren Missouri

**Project:** Sioux UWL-Cell 4 Construction CQA

**Source of Sample:** Offsite Borrow

**Sample Number:** Ballast Fill Grab

**Proj. No.:** 2013012477 **Date Sampled:** 2/4/14

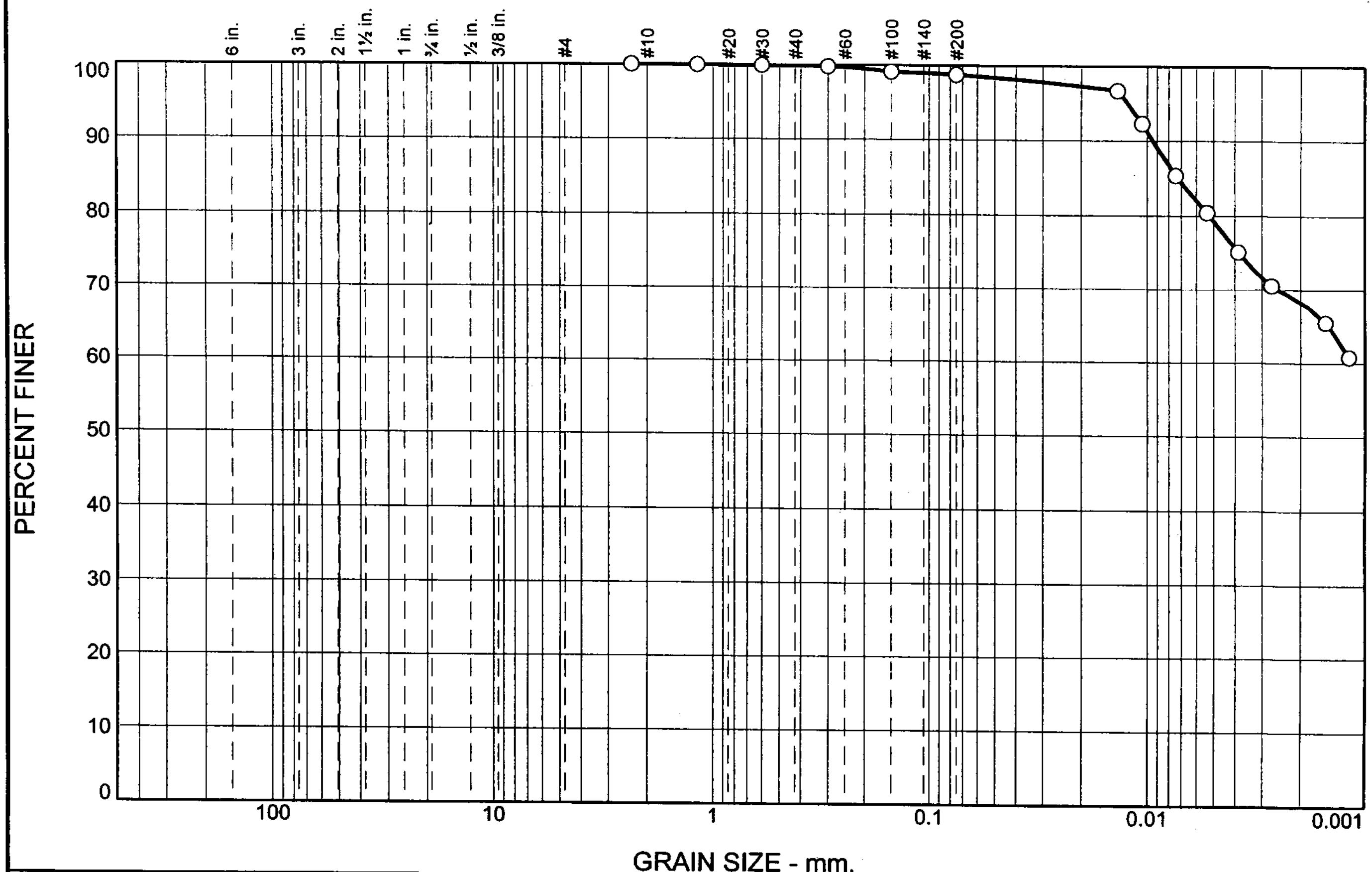
REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Bertel

**Appendix 3**

# RESULTS OF GRAIN SIZE ANALYSES ON COMPOSITE SAMPLES

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.2 | 19.4 | 79.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.1 | | |
| .075mm | 98.7 | | |

* (no specification provided)

**Material Description**

Clay (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 26 LL= 69 PI= 43

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0072 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "CH"
**Material Description:** Clay (CH), brown to greyish brown, high plastic
**PL:** 26 **LL:** 69 **PI:** 43
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =37.88
**Tare Wt.** =37.18
**Minus #200 from wash** =98.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.12 | 99.8 |
| | | | .15mm | 0.46 | 99.1 |
| | | | .075mm | 0.65 | 98.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

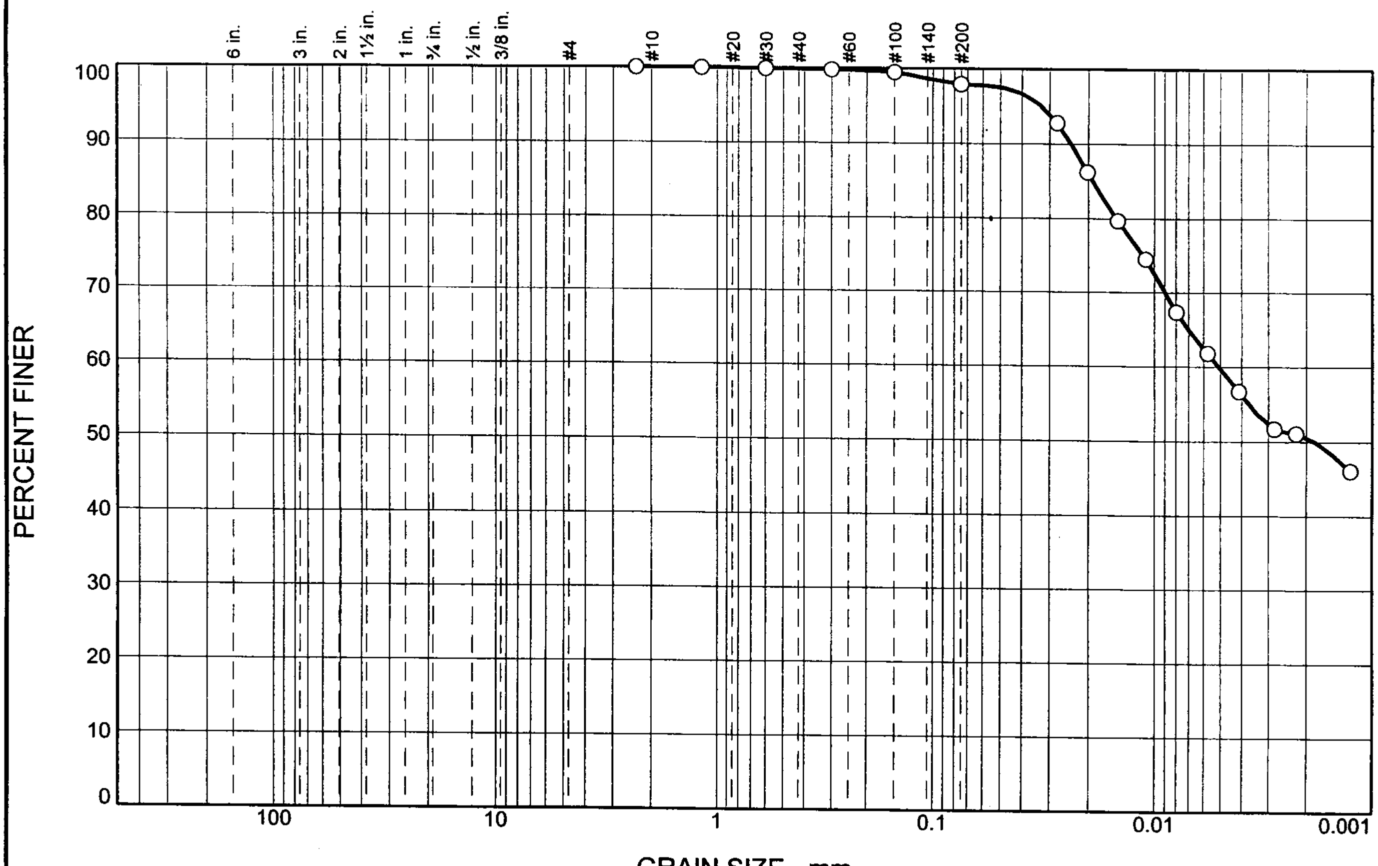
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.1 | 48.2 | 48.6 | 0.0132 | 47.2 | 8.6 | 0.0136 | 96.6 |
| 14.00 | 22.1 | 46.0 | 46.4 | 0.0132 | 45.0 | 8.9 | 0.0105 | 92.3 |
| 30.00 | 22.2 | 42.5 | 43.0 | 0.0132 | 41.5 | 9.5 | 0.0074 | 85.4 |
| 60.00 | 22.2 | 40.0 | 40.5 | 0.0132 | 39.0 | 9.9 | 0.0053 | 80.4 |
| 120.00 | 22.3 | 37.3 | 37.8 | 0.0131 | 36.3 | 10.3 | 0.0039 | 75.1 |
| 252.00 | 22.7 | 34.9 | 35.5 | 0.0131 | 33.9 | 10.7 | 0.0027 | 70.5 |
| 815.00 | 23.0 | 32.3 | 33.0 | 0.0130 | 31.3 | 11.2 | 0.0015 | 65.5 |
| 1468.00 | 20.6 | 30.5 | 30.6 | 0.0134 | 29.5 | 11.5 | 0.0012 | 60.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.2 | 1.3 | 19.4 | 79.3 | 98.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0052 | 0.0072 | 0.0094 | 0.0122 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.9 | 38.2 | 59.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.4 | | |
| .075mm | 97.9 | | |

* (no specification provided)

**Material Description**

Clay (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 52 PI= 31

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0191 $D_{60}$= 0.0051 $D_{50}$= 0.0018
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12-01-06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "CL"
**Material Description:** Clay (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 21 **LL:** 52 **PI:** 31
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12-01-06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =38.41
**Tare Wt.** =37.31
**Minus #200 from wash** =97.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.29 | 99.4 |
| | | | .075mm | 1.05 | 97.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

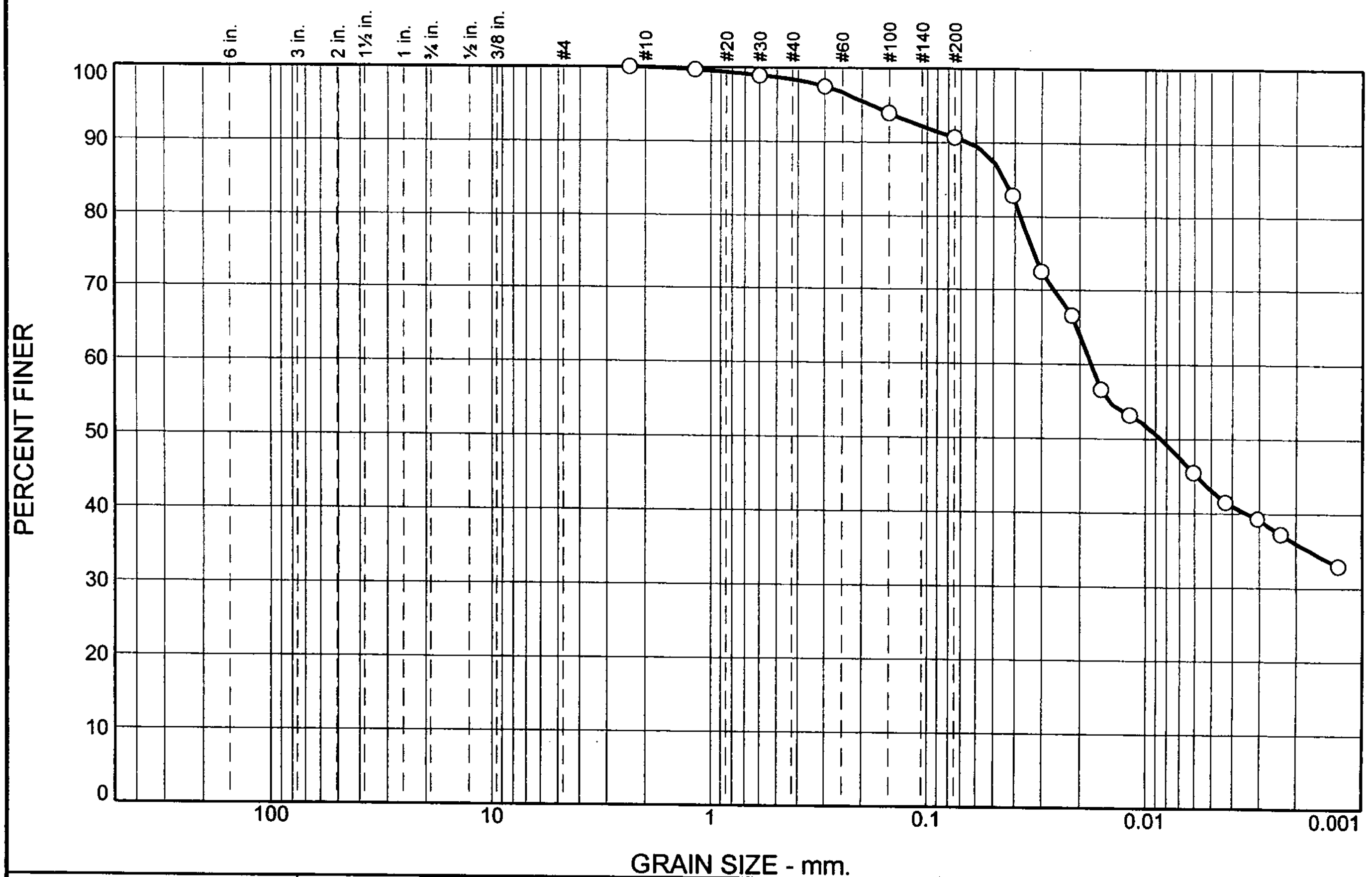
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 22.3 | 46.2 | 46.7 | 0.0131 | 45.2 | 8.9 | 0.0277 | 92.8 |
| 4.00 | 22.3 | 42.9 | 43.4 | 0.0131 | 41.9 | 9.4 | 0.0202 | 86.2 |
| 8.00 | 22.3 | 39.6 | 40.1 | 0.0131 | 38.6 | 10.0 | 0.0147 | 79.7 |
| 15.00 | 22.3 | 37.0 | 37.5 | 0.0131 | 36.0 | 10.4 | 0.0109 | 74.5 |
| 30.00 | 22.3 | 33.4 | 33.9 | 0.0131 | 32.4 | 11.0 | 0.0080 | 67.3 |
| 60.00 | 22.3 | 30.6 | 31.1 | 0.0131 | 29.6 | 11.4 | 0.0057 | 61.8 |
| 120.00 | 22.4 | 28.0 | 28.5 | 0.0131 | 27.0 | 11.9 | 0.0041 | 56.7 |
| 265.00 | 22.8 | 25.4 | 26.0 | 0.0131 | 24.4 | 12.3 | 0.0028 | 51.7 |
| 423.00 | 23.1 | 25.0 | 25.7 | 0.0130 | 24.0 | 12.4 | 0.0022 | 51.1 |
| 1440.00 | 20.6 | 23.1 | 23.2 | 0.0134 | 22.1 | 12.7 | 0.0013 | 46.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.9 | 2.1 | 38.2 | 59.7 | 97.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0018 | 0.0051 | 0.0150 | 0.0191 | 0.0240 | 0.0325 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 1.5 | 7.7 | 47.7 | 43.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.9 | | |
| .3mm | 97.4 | | |
| .15mm | 93.9 | | |
| .075mm | 90.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 39 PI= 20

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0441 $D_{60}$= 0.0178 $D_{50}$= 0.0085
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section A **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section A
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 19 **LL:** 39 **PI:** 20
**USCS Classification:** CL
**Tested By:** JLC **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =45.96
**Tare Wt.** =41.01
**Minus #200 from wash** =90.1%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.18 | 99.6 |
| | | | .6mm | 0.56 | 98.9 |
| | | | .3mm | 1.28 | 97.4 |
| | | | .15mm | 3.06 | 93.9 |
| | | | .075mm | 4.66 | 90.7 |

**Hydrometer test uses material passing**#4
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 **x Rm**

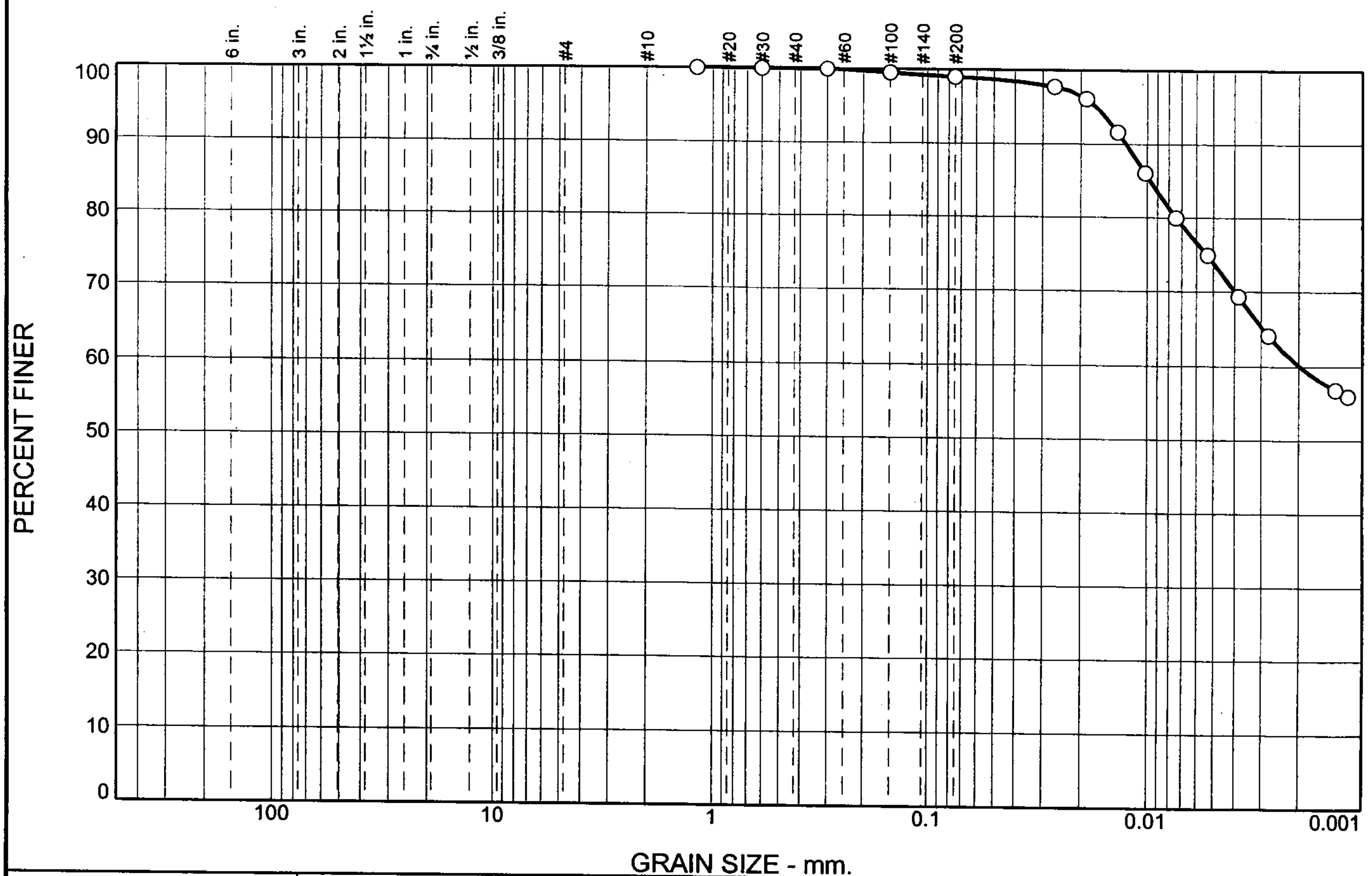
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.7 | 41.1 | 41.7 | 0.0131 | 40.1 | 9.7 | 0.0408 | 82.8 |
| 2.00 | 22.7 | 35.9 | 36.5 | 0.0131 | 34.9 | 10.6 | 0.0301 | 72.5 |
| 4.00 | 22.7 | 32.9 | 33.5 | 0.0131 | 31.9 | 11.1 | 0.0218 | 66.5 |
| 8.00 | 22.7 | 27.9 | 28.5 | 0.0131 | 26.9 | 11.9 | 0.0159 | 56.6 |
| 15.00 | 22.7 | 26.2 | 26.8 | 0.0131 | 25.2 | 12.2 | 0.0118 | 53.2 |
| 60.00 | 22.7 | 22.3 | 22.9 | 0.0131 | 21.3 | 12.8 | 0.0060 | 45.5 |
| 120.00 | 23.0 | 20.2 | 20.9 | 0.0130 | 19.2 | 13.1 | 0.0043 | 41.5 |
| 240.00 | 23.7 | 18.9 | 19.8 | 0.0129 | 17.9 | 13.4 | 0.0030 | 39.3 |
| 409.00 | 23.6 | 17.9 | 18.7 | 0.0129 | 16.9 | 13.5 | 0.0024 | 37.2 |
| 1440.00 | 22.3 | 16.1 | 16.6 | 0.0131 | 15.1 | 13.8 | 0.0013 | 33.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.5 | 7.7 | 9.3 | 47.7 | 43.0 | 90.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0085 | 0.0178 | 0.0375 | 0.0441 | 0.0643 | 0.1835 |

| Fineness Modulus |
|---|
| 0.10 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 25.1 | 73.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 27 LL= 71 PI= 44

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0097 $D_{60}$= 0.0020 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 27 **LL:** 71 **PI:** 44
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.32
**Tare Wt.** =40.76
**Minus #200 from wash** =98.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.27 | 99.5 |
| | | | .075mm | 0.52 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

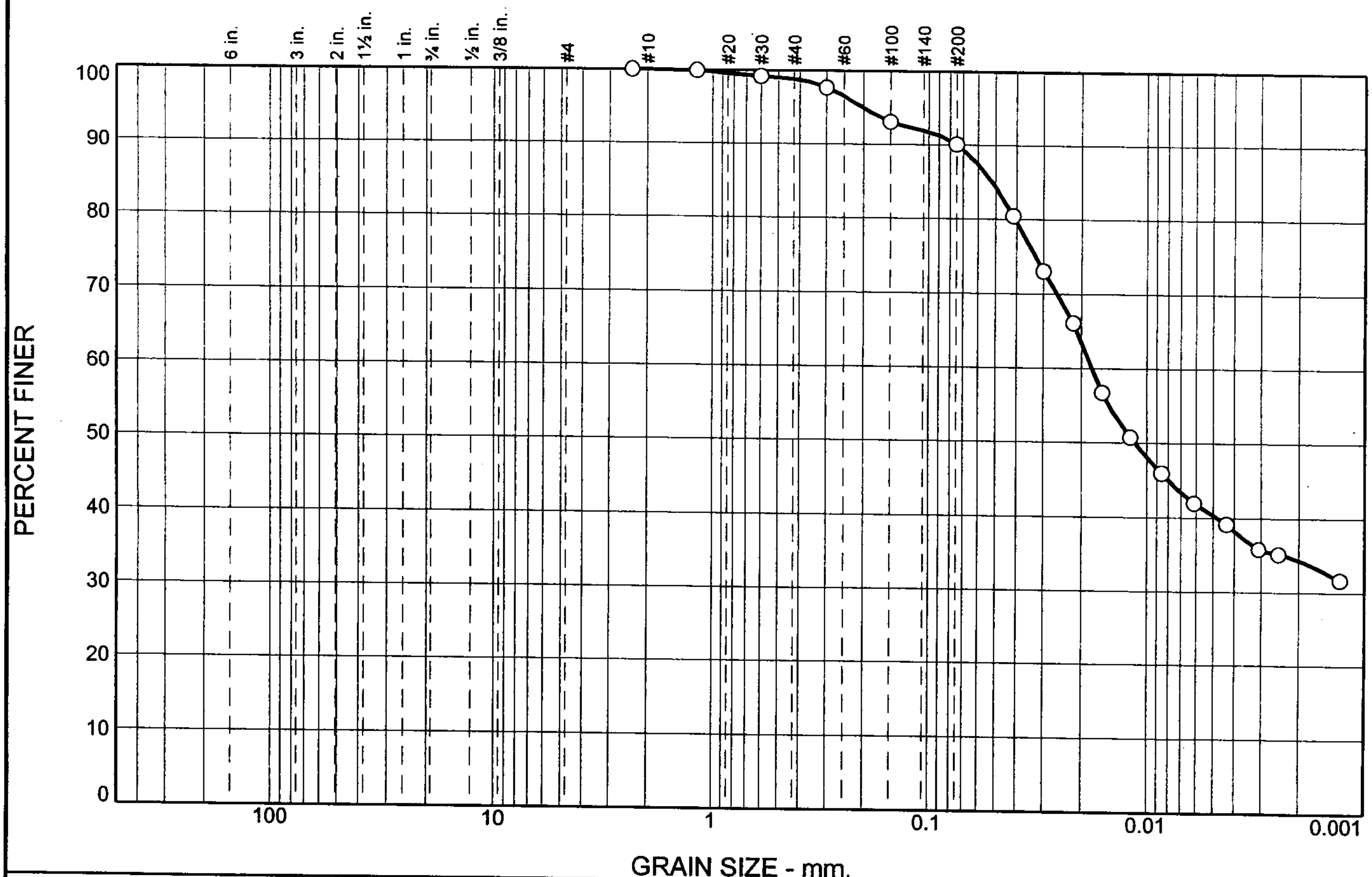
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.7 | 48.0 | 49.2 | 0.0128 | 47.0 | 8.6 | 0.0265 | 97.7 |
| 4.00 | 24.7 | 47.2 | 48.4 | 0.0128 | 46.2 | 8.7 | 0.0189 | 96.1 |
| 8.00 | 24.5 | 45.0 | 46.1 | 0.0128 | 44.0 | 9.1 | 0.0136 | 91.6 |
| 15.00 | 24.5 | 42.2 | 43.3 | 0.0128 | 41.2 | 9.5 | 0.0102 | 86.1 |
| 30.00 | 24.5 | 39.1 | 40.2 | 0.0128 | 38.1 | 10.0 | 0.0074 | 79.9 |
| 60.00 | 25.0 | 36.4 | 37.7 | 0.0127 | 35.4 | 10.5 | 0.0053 | 74.9 |
| 120.00 | 25.3 | 33.5 | 34.9 | 0.0127 | 32.5 | 11.0 | 0.0038 | 69.3 |
| 240.00 | 25.0 | 31.0 | 32.3 | 0.0127 | 30.0 | 11.4 | 0.0028 | 64.1 |
| 1132.00 | 23.1 | 27.9 | 28.6 | 0.0130 | 26.9 | 11.9 | 0.0013 | 56.8 |
| 1440.00 | 25.0 | 26.9 | 28.2 | 0.0127 | 25.9 | 12.0 | 0.0012 | 56.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 25.1 | 73.9 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0020 | 0.0075 | 0.0097 | 0.0125 | 0.0170 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 8.8 | 49.7 | 40.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.2 | | |
| .3mm | 97.7 | | |
| .15mm | 93.1 | | |
| .075mm | 90.0 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 41 PI= 19

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0517 $D_{60}$= 0.0179 $D_{50}$= 0.0113
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 22 **LL:** 41 **PI:** 19
**USCS Classification:** CL
**Tested By:** JLC **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =**45.73
**Tare Wt. =**40.67
**Minus #200 from wash =**89.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.06 | 99.9 |
| | | | .6mm | 0.42 | 99.2 |
| | | | .3mm | 1.15 | 97.7 |
| | | | .15mm | 3.46 | 93.1 |
| | | | .075mm | 4.98 | 90.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 x Rm

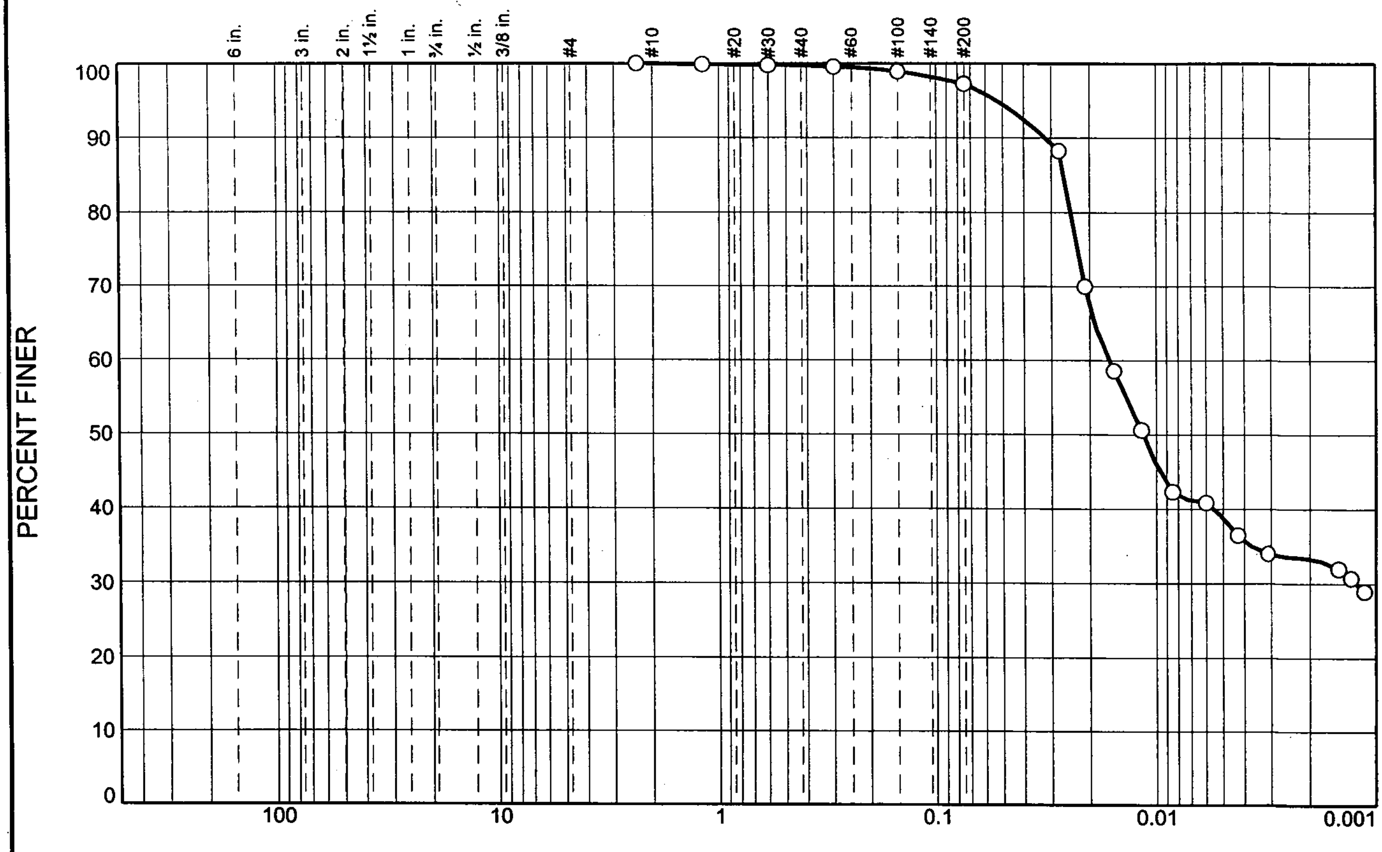
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 39.9 | 40.5 | 0.0131 | 38.9 | 9.9 | 0.0412 | 80.4 |
| 2.00 | 22.6 | 36.2 | 36.8 | 0.0131 | 35.2 | 10.5 | 0.0300 | 73.0 |
| 4.00 | 22.6 | 32.7 | 33.3 | 0.0131 | 31.7 | 11.1 | 0.0218 | 66.1 |
| 8.00 | 22.5 | 28.0 | 28.5 | 0.0131 | 27.0 | 11.9 | 0.0160 | 56.7 |
| 15.00 | 22.5 | 25.0 | 25.5 | 0.0131 | 24.0 | 12.4 | 0.0119 | 50.7 |
| 30.00 | 22.5 | 22.6 | 23.1 | 0.0131 | 21.6 | 12.8 | 0.0086 | 46.0 |
| 60.00 | 22.8 | 20.5 | 21.1 | 0.0131 | 19.5 | 13.1 | 0.0061 | 42.0 |
| 120.00 | 23.1 | 19.0 | 19.7 | 0.0130 | 18.0 | 13.3 | 0.0043 | 39.1 |
| 240.00 | 23.8 | 17.1 | 18.0 | 0.0129 | 16.1 | 13.7 | 0.0031 | 35.8 |
| 374.00 | 23.4 | 16.9 | 17.7 | 0.0130 | 15.9 | 13.7 | 0.0025 | 35.1 |
| 1440.00 | 22.4 | 15.4 | 15.9 | 0.0131 | 14.4 | 13.9 | 0.0013 | 31.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 8.8 | 10.0 | 49.7 | 40.3 | 90.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0113 | 0.0179 | 0.0405 | 0.0517 | 0.0747 | 0.2022 |

| Fineness Modulus |
|---|
| 0.10 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.5 | 58.5 | 38.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 99.5 | | |
| .15mm | 98.9 | | |
| .075mm | 97.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 39 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0263 $D_{60}$= 0.0164 $D_{50}$= 0.0114
$D_{30}$= 0.0012 $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section B **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section B
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 22 **LL:** 39 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.26
**Tare Wt.** =40.84
**Minus #200 from wash** =97.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.13 | 99.7 |
| | | | .3mm | 0.25 | 99.5 |
| | | | .15mm | 0.57 | 98.9 |
| | | | .075mm | 1.40 | 97.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

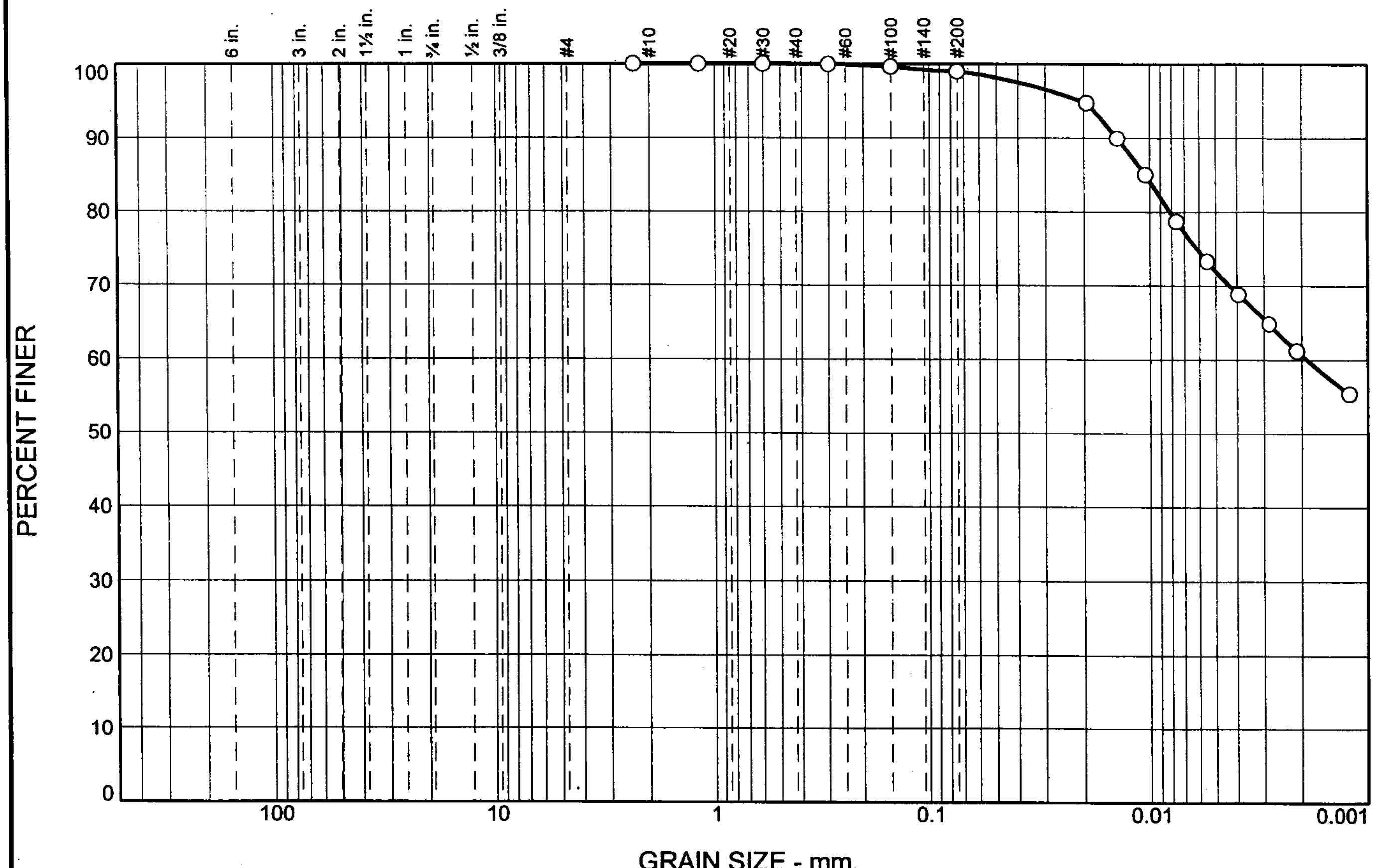
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.8 | 43.2 | 44.4 | 0.0128 | 42.2 | 9.4 | 0.0276 | 88.2 |
| 4.00 | 24.8 | 34.0 | 35.2 | 0.0128 | 33.0 | 10.9 | 0.0210 | 70.0 |
| 8.00 | 24.7 | 28.3 | 29.5 | 0.0128 | 27.3 | 11.8 | 0.0155 | 58.6 |
| 15.00 | 24.7 | 24.3 | 25.5 | 0.0128 | 23.3 | 12.5 | 0.0117 | 50.6 |
| 30.00 | 24.7 | 20.1 | 21.3 | 0.0128 | 19.1 | 13.2 | 0.0085 | 42.3 |
| 60.00 | 24.9 | 19.3 | 20.6 | 0.0127 | 18.3 | 13.3 | 0.0060 | 40.8 |
| 120.00 | 25.2 | 17.0 | 18.4 | 0.0127 | 16.0 | 13.7 | 0.0043 | 36.5 |
| 240.00 | 23.8 | 16.2 | 17.1 | 0.0129 | 15.2 | 13.8 | 0.0031 | 34.0 |
| 1165.00 | 19.6 | 16.2 | 16.1 | 0.0136 | 15.2 | 13.8 | 0.0015 | 32.0 |
| 1440.00 | 22.1 | 15.0 | 15.4 | 0.0132 | 14.0 | 14.0 | 0.0013 | 30.7 |
| 1917.00 | 22.1 | 14.1 | 14.5 | 0.0132 | 13.1 | 14.1 | 0.0011 | 28.9 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.5 | 2.8 | 58.5 | 38.7 | 97.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.0012 | 0.0114 | 0.0164 | 0.0244 | 0.0263 | 0.0319 | 0.0532 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 27.1 | 71.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 99.6 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 62 PI= 42

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0105 $D_{60}$= 0.0019 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 20 **LL:** 62 **PI:** 42
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.33
**Tare Wt.** =40.78
**Minus #200 from wash** =98.9%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.21 | 99.6 |
| | | | .075mm | 0.52 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

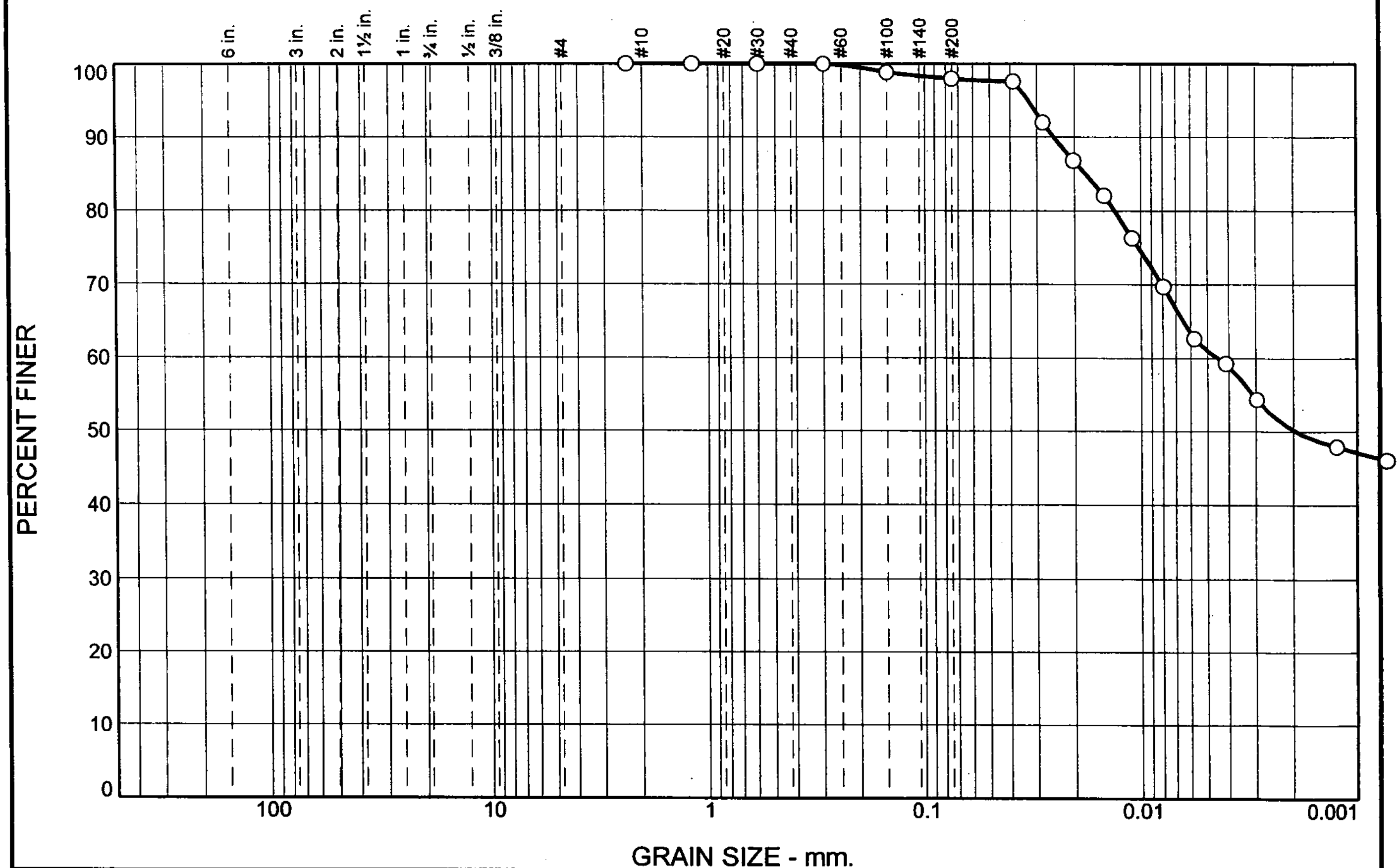
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 22.3 | 47.2 | 47.7 | 0.0131 | 46.2 | 8.7 | 0.0194 | 94.7 |
| 8.00 | 22.3 | 44.8 | 45.3 | 0.0131 | 43.8 | 9.1 | 0.0140 | 90.0 |
| 15.00 | 22.3 | 42.3 | 42.8 | 0.0131 | 41.3 | 9.5 | 0.0105 | 85.0 |
| 30.00 | 22.3 | 39.1 | 39.6 | 0.0131 | 38.1 | 10.0 | 0.0076 | 78.7 |
| 60.00 | 22.3 | 36.4 | 36.9 | 0.0131 | 35.4 | 10.5 | 0.0055 | 73.3 |
| 120.00 | 22.4 | 34.1 | 34.6 | 0.0131 | 33.1 | 10.9 | 0.0040 | 68.8 |
| 240.00 | 22.8 | 32.0 | 32.6 | 0.0131 | 31.0 | 11.2 | 0.0028 | 64.8 |
| 441.00 | 23.1 | 30.1 | 30.8 | 0.0130 | 29.1 | 11.5 | 0.0021 | 61.2 |
| 1454.00 | 20.6 | 27.8 | 27.9 | 0.0134 | 26.8 | 11.9 | 0.0012 | 55.4 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 27.1 | 71.9 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0019 | 0.0082 | 0.0105 | 0.0140 | 0.0205 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 36.9 | 61.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 98.8 | | |
| .075mm | 97.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 52 PI= 33

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0178 $D_{60}$= 0.0045 $D_{50}$= 0.0019
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/04/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 19 **LL:** 52 **PI:** 33
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/04/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.69
**Tare Wt.** =40.58
**Minus #200 from wash** =97.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.60 | 98.8 |
| | | | .075mm | 1.04 | 97.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

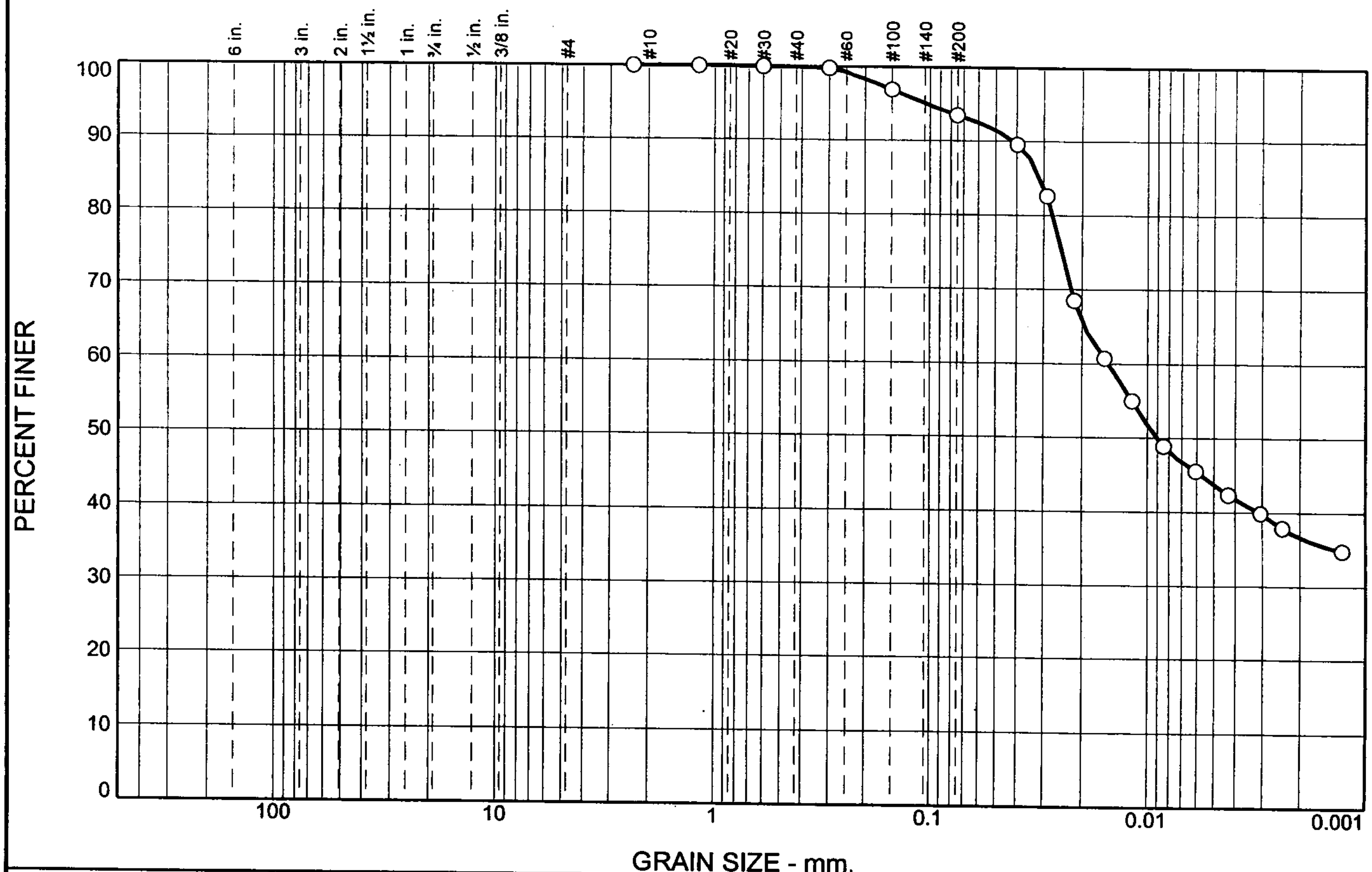
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 21.5 | 48.8 | 49.1 | 0.0133 | 47.8 | 8.5 | 0.0386 | 97.5 |
| 2.00 | 21.5 | 46.0 | 46.3 | 0.0133 | 45.0 | 8.9 | 0.0280 | 92.0 |
| 4.00 | 21.5 | 43.4 | 43.7 | 0.0133 | 42.4 | 9.3 | 0.0203 | 86.8 |
| 8.00 | 21.5 | 41.0 | 41.3 | 0.0133 | 40.0 | 9.7 | 0.0146 | 82.0 |
| 15.00 | 21.5 | 38.1 | 38.4 | 0.0133 | 37.1 | 10.2 | 0.0110 | 76.3 |
| 30.00 | 21.5 | 34.8 | 35.1 | 0.0133 | 33.8 | 10.8 | 0.0079 | 69.7 |
| 60.00 | 21.6 | 31.2 | 31.5 | 0.0133 | 30.2 | 11.3 | 0.0058 | 62.6 |
| 120.00 | 21.6 | 29.5 | 29.8 | 0.0133 | 28.5 | 11.6 | 0.0041 | 59.3 |
| 240.00 | 21.7 | 27.0 | 27.4 | 0.0132 | 26.0 | 12.0 | 0.0030 | 54.3 |
| 1439.00 | 20.7 | 24.0 | 24.1 | 0.0134 | 23.0 | 12.5 | 0.0013 | 47.9 |
| 4310.00 | 20.1 | 23.2 | 23.2 | 0.0135 | 22.2 | 12.7 | 0.0007 | 46.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 2.1 | 36.9 | 61.0 | 97.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0019 | 0.0045 | 0.0131 | 0.0178 | 0.0250 | 0.0328 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 6.4 | 49.8 | 43.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 96.9 | | |
| .075mm | 93.5 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 40 PI= 20

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0309 $D_{60}$= 0.0151 $D_{50}$= 0.0091
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section C **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section C
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 20 **LL:** 40 **PI:** 20
**USCS Classification:** CL
**Tested By:** JLC & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =44.05
**Tare Wt.** =40.63
**Minus #200 from wash** =93.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 1.57 | 96.9 |
| | | | .075mm | 3.27 | 93.5 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 **x Rm**

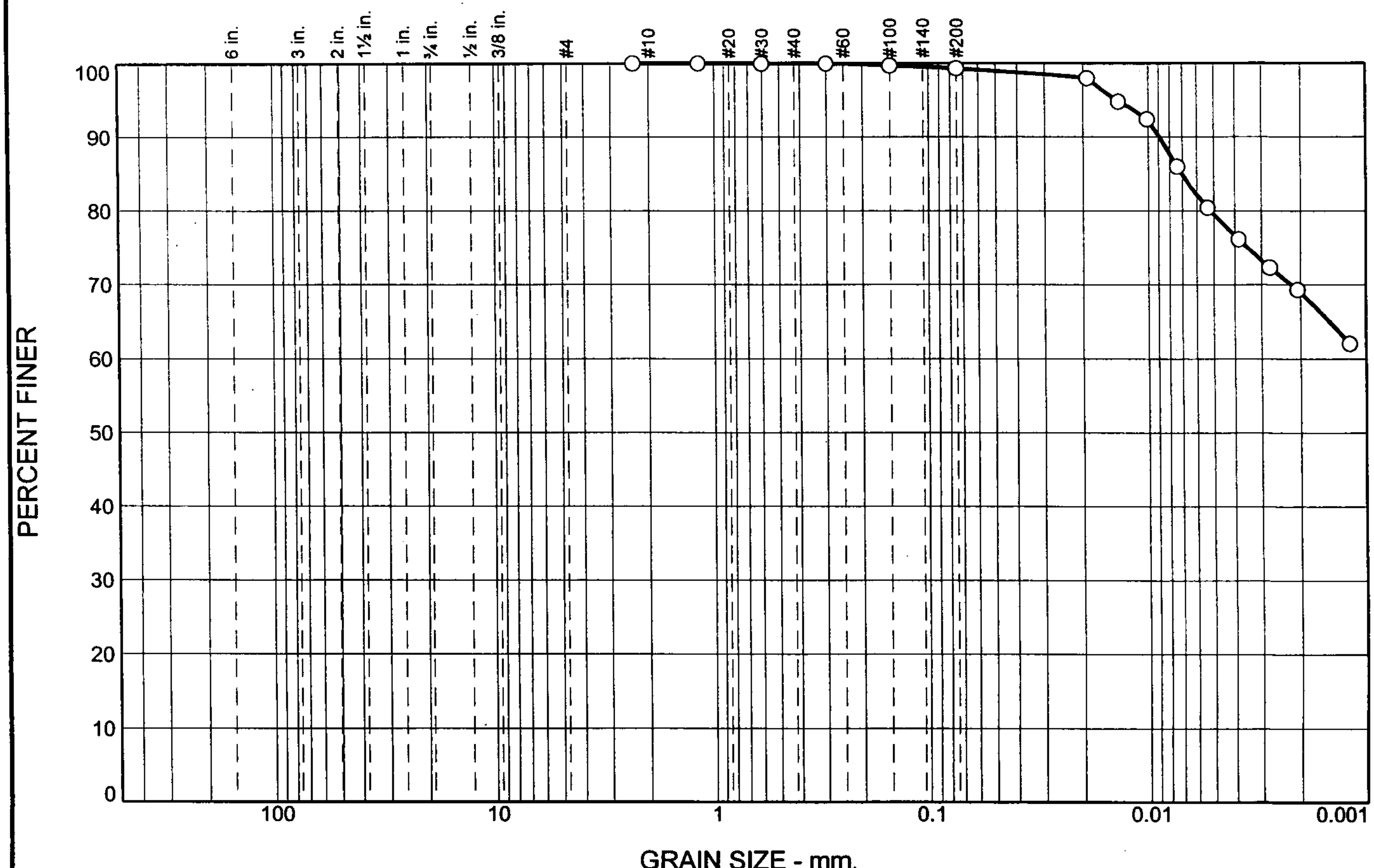
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 44.5 | 45.1 | 0.0131 | 43.5 | 9.2 | 0.0396 | 89.5 |
| 2.00 | 22.6 | 41.0 | 41.6 | 0.0131 | 40.0 | 9.7 | 0.0289 | 82.6 |
| 4.00 | 22.6 | 33.9 | 34.5 | 0.0131 | 32.9 | 10.9 | 0.0216 | 68.5 |
| 8.00 | 22.6 | 30.0 | 30.6 | 0.0131 | 29.0 | 11.5 | 0.0157 | 60.7 |
| 15.00 | 22.6 | 27.1 | 27.7 | 0.0131 | 26.1 | 12.0 | 0.0117 | 55.0 |
| 30.00 | 22.7 | 24.0 | 24.6 | 0.0131 | 23.0 | 12.5 | 0.0085 | 48.9 |
| 60.00 | 22.7 | 22.3 | 22.9 | 0.0131 | 21.3 | 12.8 | 0.0060 | 45.5 |
| 120.00 | 23.1 | 20.6 | 21.3 | 0.0130 | 19.6 | 13.1 | 0.0043 | 42.3 |
| 240.00 | 23.7 | 19.2 | 20.1 | 0.0129 | 18.2 | 13.3 | 0.0030 | 39.9 |
| 390.00 | 23.7 | 18.2 | 19.1 | 0.0129 | 17.2 | 13.5 | 0.0024 | 37.9 |
| 1440.00 | 22.4 | 17.0 | 17.5 | 0.0131 | 16.0 | 13.7 | 0.0013 | 34.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 6.4 | 6.5 | 49.8 | 43.7 | 93.5 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0091 | 0.0151 | 0.0273 | 0.0309 | 0.0415 | 0.1045 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 19.7 | 79.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.7 | | |
| .075mm | 99.2 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 31 LL= 76 PI= 45

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0070 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 31 **LL:** 76 **PI:** 45
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.09
**Tare Wt.** =40.70
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.17 | 99.7 |
| | | | .075mm | 0.38 | 99.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

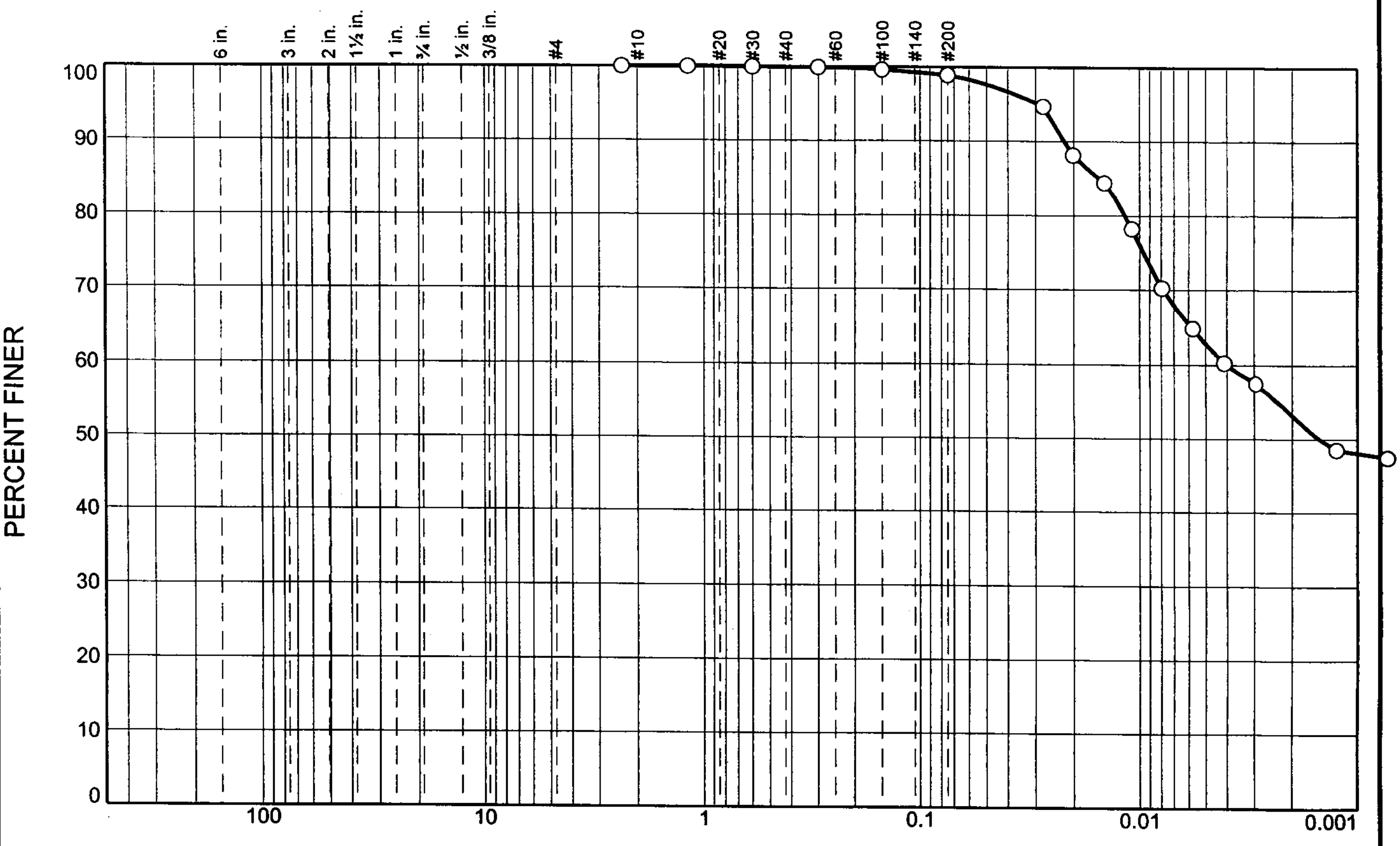
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 22.3 | 48.8 | 49.3 | 0.0131 | 47.8 | 8.5 | 0.0191 | 97.9 |
| 8.00 | 22.3 | 47.2 | 47.7 | 0.0131 | 46.2 | 8.7 | 0.0137 | 94.7 |
| 15.00 | 22.3 | 46.0 | 46.5 | 0.0131 | 45.0 | 8.9 | 0.0101 | 92.4 |
| 30.00 | 22.2 | 42.8 | 43.3 | 0.0132 | 41.8 | 9.4 | 0.0074 | 86.0 |
| 60.00 | 22.2 | 40.0 | 40.5 | 0.0132 | 39.0 | 9.9 | 0.0053 | 80.4 |
| 120.00 | 22.4 | 37.8 | 38.3 | 0.0131 | 36.8 | 10.3 | 0.0038 | 76.1 |
| 240.00 | 22.7 | 35.8 | 36.4 | 0.0131 | 34.8 | 10.6 | 0.0027 | 72.3 |
| 432.00 | 23.0 | 34.2 | 34.9 | 0.0130 | 33.2 | 10.9 | 0.0021 | 69.3 |
| 1445.00 | 20.6 | 31.1 | 31.2 | 0.0134 | 30.1 | 11.4 | 0.0012 | 62.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.8 | 19.7 | 79.5 | 99.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0052 | 0.0070 | 0.0089 | 0.0142 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 36.0 | 62.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 98.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 27 LL= 59 PI= 32

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0152 $D_{60}$= 0.0040 $D_{50}$= 0.0015
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/04/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 27 **LL:** 59 **PI:** 32
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/04/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.31
**Tare Wt.** =40.71
**Minus #200 from wash** =98.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.23 | 99.5 |
| | | | .075mm | 0.56 | 98.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.8 | 47.3 | 47.7 | 0.0132 | 46.3 | 8.7 | 0.0276 | 94.7 |
| 4.00 | 21.8 | 44.0 | 44.4 | 0.0132 | 43.0 | 9.2 | 0.0201 | 88.1 |
| 8.00 | 21.8 | 42.1 | 42.5 | 0.0132 | 41.1 | 9.6 | 0.0145 | 84.4 |
| 15.00 | 21.8 | 39.0 | 39.4 | 0.0132 | 38.0 | 10.1 | 0.0108 | 78.2 |
| 30.00 | 21.7 | 35.0 | 35.4 | 0.0132 | 34.0 | 10.7 | 0.0079 | 70.2 |
| 60.00 | 21.7 | 32.3 | 32.7 | 0.0132 | 31.3 | 11.2 | 0.0057 | 64.9 |
| 120.00 | 21.6 | 30.0 | 30.3 | 0.0133 | 29.0 | 11.5 | 0.0041 | 60.2 |
| 240.00 | 21.6 | 28.6 | 28.9 | 0.0133 | 27.6 | 11.8 | 0.0029 | 57.5 |
| 1431.00 | 20.7 | 24.3 | 24.4 | 0.0134 | 23.3 | 12.5 | 0.0013 | 48.5 |
| 4302.00 | 20.1 | 23.9 | 23.9 | 0.0135 | 22.9 | 12.5 | 0.0007 | 47.5 |

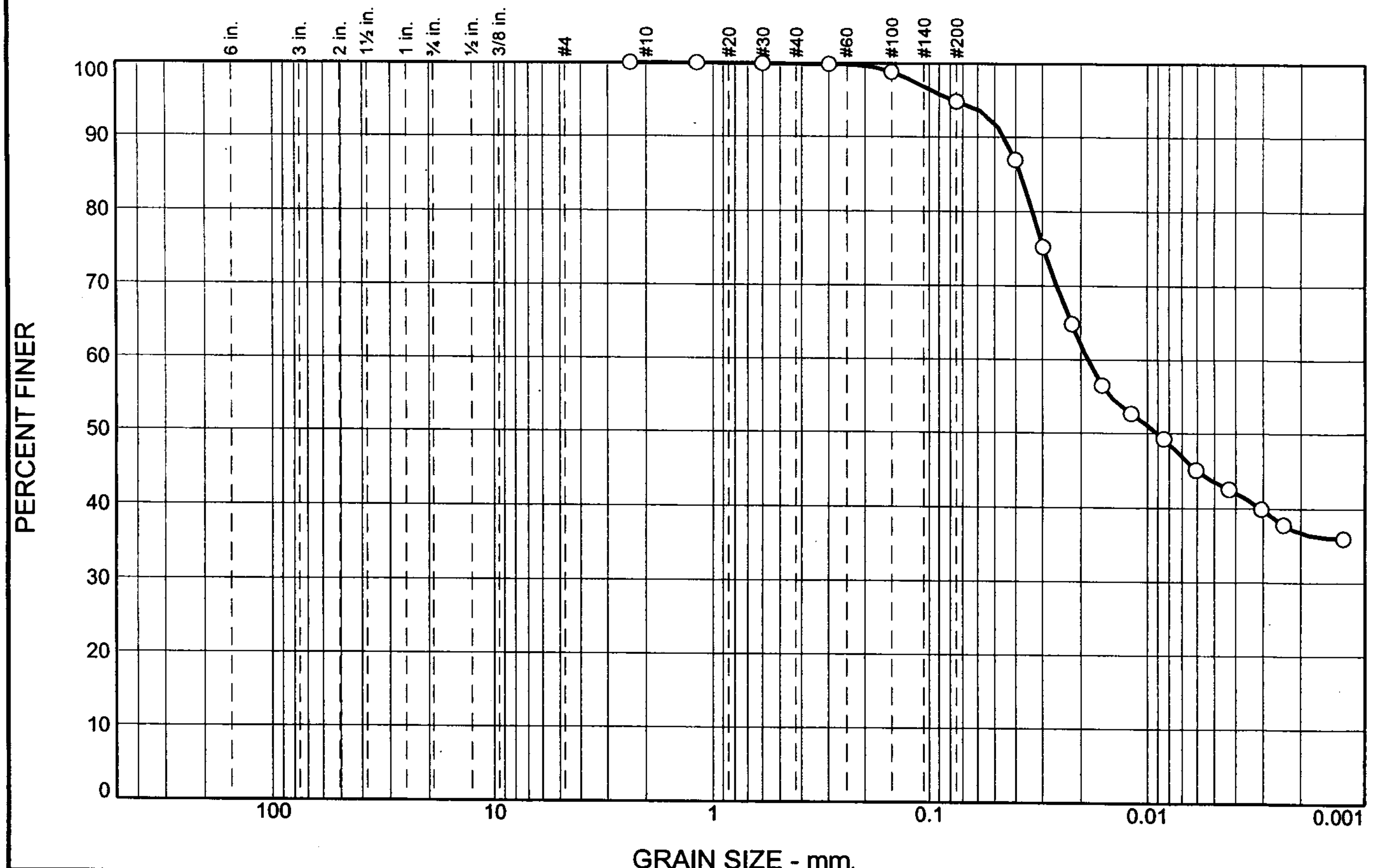
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 1.1 | 36.0 | 62.9 | 98.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0015 | 0.0040 | 0.0116 | 0.0152 | 0.0222 | 0.0290 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 5.0 | 51.3 | 43.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 98.8 | | |
| .075mm | 94.8 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 23 LL= 40 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0379 $D_{60}$= 0.0186 $D_{50}$= 0.0090
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC, JRD, RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section D **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section D
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 23 **LL:** 40 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC, JRD, RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =44.07
**Tare Wt.** =40.88
**Minus #200 from wash** =93.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.10 | 99.8 |
| | | | .15mm | 0.61 | 98.8 |
| | | | .075mm | 2.61 | 94.8 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

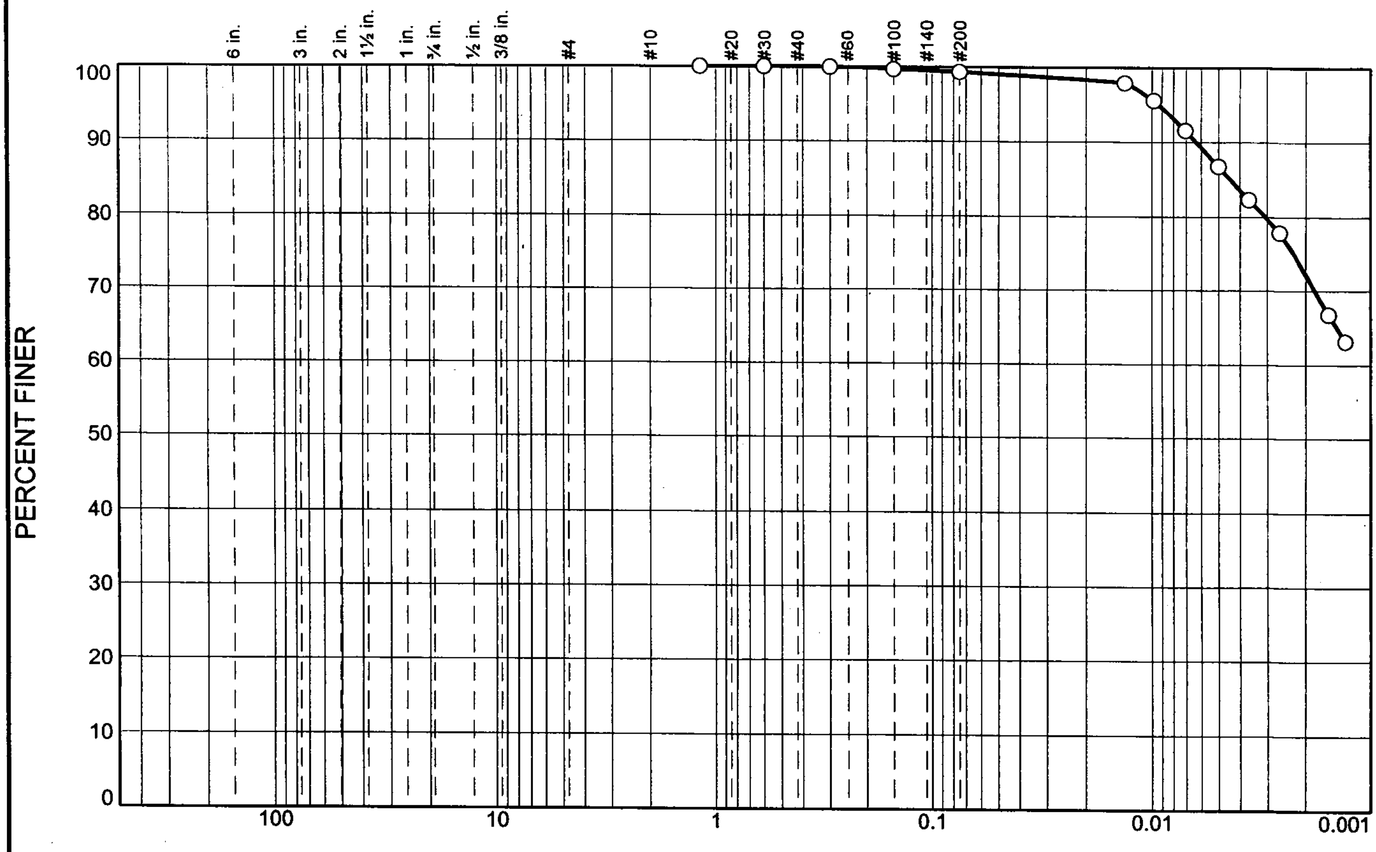
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.6 | 43.2 | 43.8 | 0.0131 | 42.2 | 9.4 | 0.0401 | 87.0 |
| 2.00 | 22.6 | 37.3 | 37.9 | 0.0131 | 36.3 | 10.3 | 0.0298 | 75.2 |
| 4.00 | 22.5 | 32.1 | 32.6 | 0.0131 | 31.1 | 11.2 | 0.0219 | 64.9 |
| 8.00 | 22.5 | 27.9 | 28.4 | 0.0131 | 26.9 | 11.9 | 0.0160 | 56.5 |
| 15.00 | 22.7 | 25.9 | 26.5 | 0.0131 | 24.9 | 12.2 | 0.0118 | 52.6 |
| 30.00 | 22.7 | 24.2 | 24.8 | 0.0131 | 23.2 | 12.5 | 0.0084 | 49.3 |
| 60.00 | 22.7 | 22.1 | 22.7 | 0.0131 | 21.1 | 12.8 | 0.0061 | 45.1 |
| 120.00 | 23.1 | 20.7 | 21.4 | 0.0130 | 19.7 | 13.1 | 0.0043 | 42.5 |
| 240.00 | 23.7 | 19.2 | 20.1 | 0.0129 | 18.2 | 13.3 | 0.0030 | 39.9 |
| 391.00 | 23.5 | 18.2 | 19.0 | 0.0130 | 17.2 | 13.5 | 0.0024 | 37.8 |
| 1440.00 | 23.4 | 17.3 | 18.1 | 0.0130 | 16.3 | 13.6 | 0.0013 | 35.9 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 5.0 | 5.2 | 51.3 | 43.5 | 94.8 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0090 | 0.0186 | 0.0334 | 0.0379 | 0.0449 | 0.0785 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 12.5 | 86.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.7 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 28 LL= 82 PI= 54

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0044 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 28 **LL:** 82 **PI:** 54
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 41.71
**Tare Wt. =** 41.32
**Minus #200 from wash =** 99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.17 | 99.7 |
| | | | .075mm | 0.35 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 x Rm

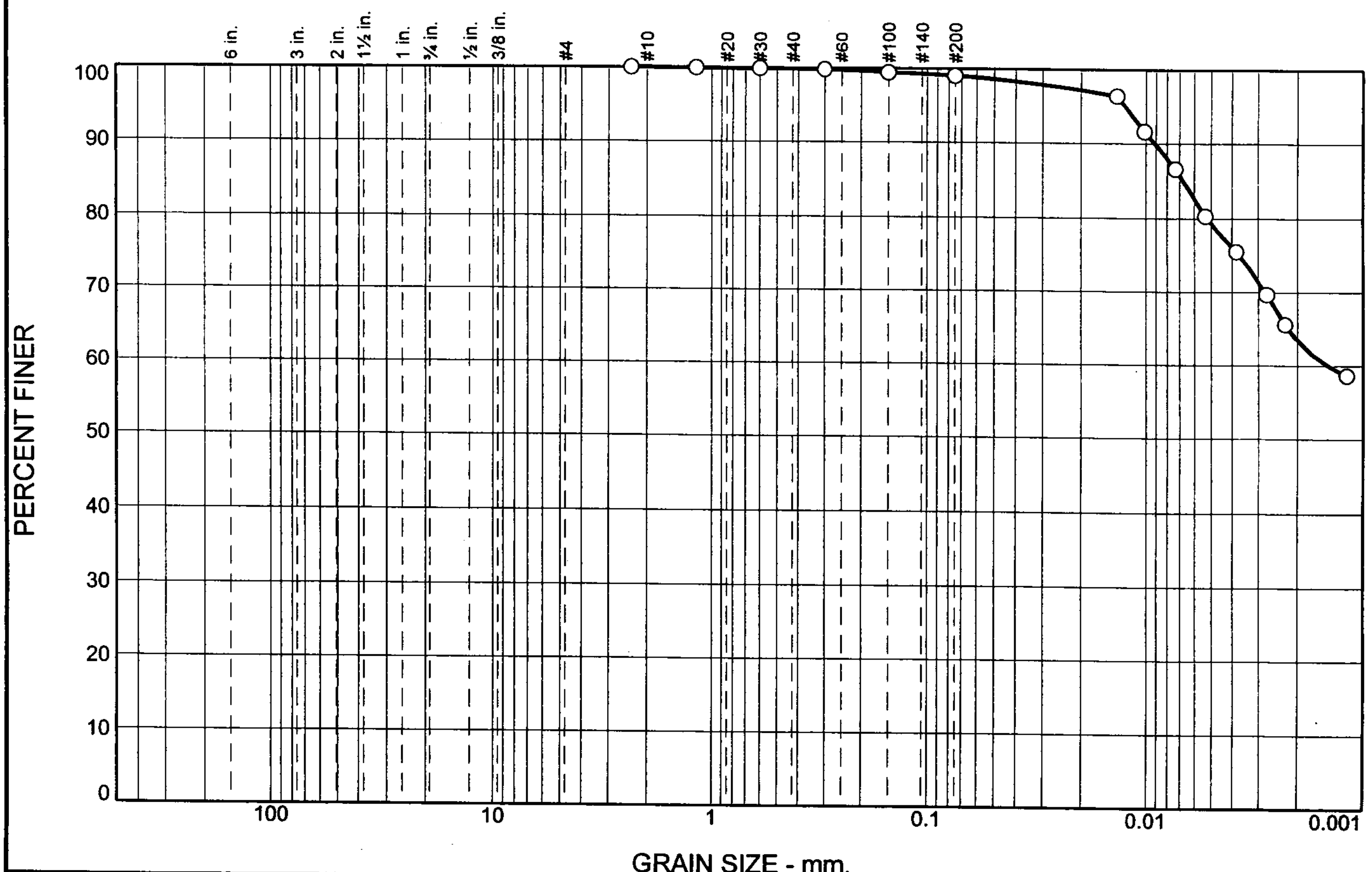
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 24.4 | 48.2 | 49.3 | 0.0128 | 47.2 | 8.6 | 0.0133 | 97.9 |
| 15.00 | 24.4 | 47.0 | 48.1 | 0.0128 | 46.0 | 8.8 | 0.0098 | 95.5 |
| 30.00 | 24.4 | 45.0 | 46.1 | 0.0128 | 44.0 | 9.1 | 0.0071 | 91.6 |
| 62.00 | 24.7 | 42.5 | 43.7 | 0.0128 | 41.5 | 9.5 | 0.0050 | 86.8 |
| 120.00 | 25.1 | 40.1 | 41.4 | 0.0127 | 39.1 | 9.9 | 0.0036 | 82.3 |
| 240.00 | 25.0 | 37.9 | 39.2 | 0.0127 | 36.9 | 10.2 | 0.0026 | 77.8 |
| 763.00 | 23.1 | 32.9 | 33.6 | 0.0130 | 31.9 | 11.1 | 0.0016 | 66.8 |
| 1080.00 | 25.0 | 30.5 | 31.8 | 0.0127 | 29.5 | 11.5 | 0.0013 | 63.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.7 | 12.5 | 86.8 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0030 | 0.0044 | 0.0063 | 0.0093 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 19.7 | 79.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.4 | | |
| .075mm | 99.0 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 24 LL= 67 PI= 43

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0067 $D_{60}$= 0.0014 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** JRD, RTH, & JLC

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 24 **LL:** 67 **PI:** 43
**USCS Classification:** CH
**Tested By:** JRD, RTH, & JLC **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.34
**Tare Wt.** =40.83
**Minus #200 from wash** =99.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.04 | 99.9 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.31 | 99.4 |
| | | | .075mm | 0.50 | 99.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

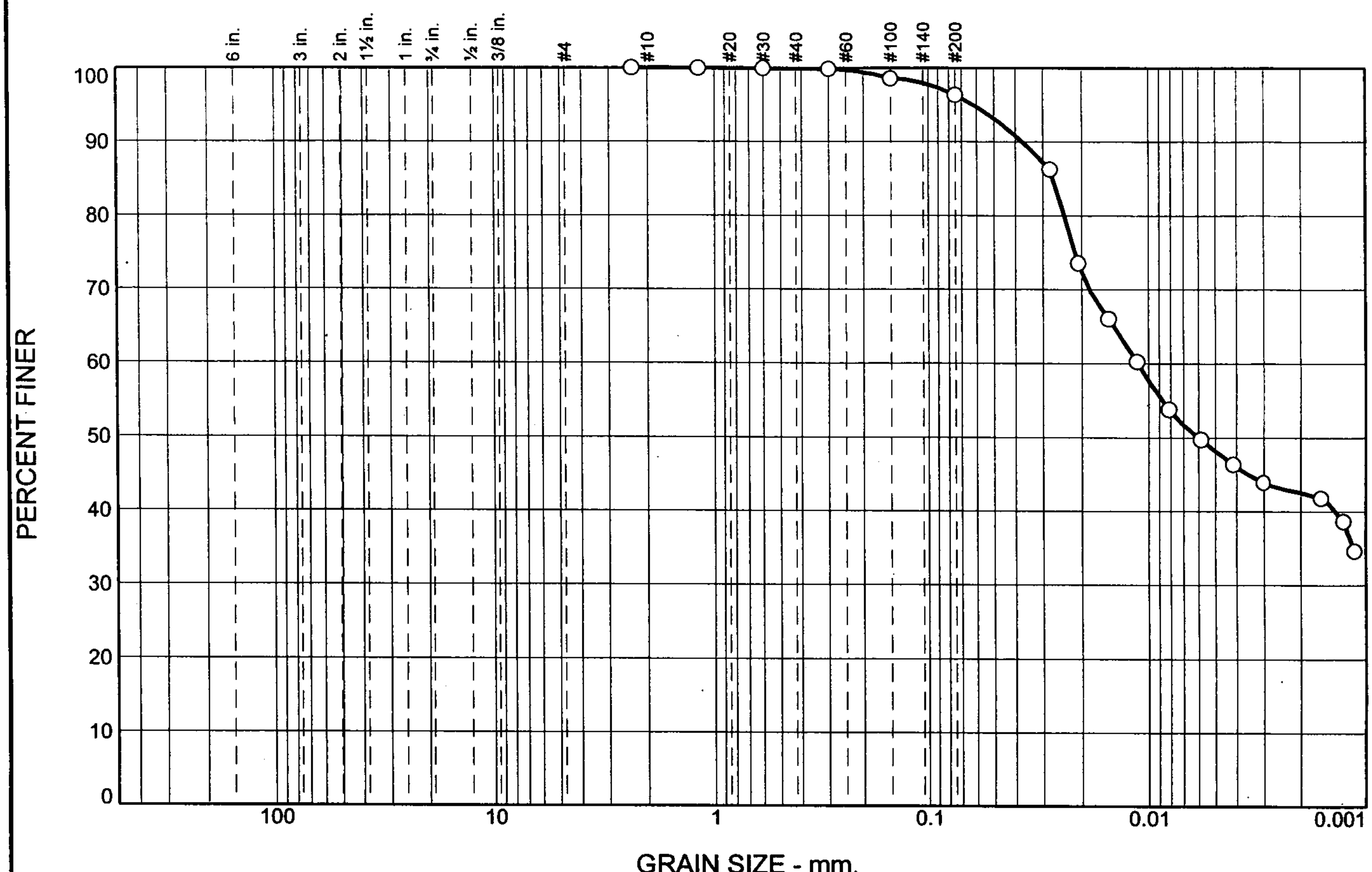
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.7 | 47.9 | 48.5 | 0.0131 | 46.9 | 8.6 | 0.0136 | 96.3 |
| 15.00 | 22.7 | 45.5 | 46.1 | 0.0131 | 44.5 | 9.0 | 0.0101 | 91.6 |
| 30.00 | 22.7 | 43.0 | 43.6 | 0.0131 | 42.0 | 9.4 | 0.0073 | 86.6 |
| 60.00 | 22.8 | 39.8 | 40.4 | 0.0131 | 38.8 | 9.9 | 0.0053 | 80.3 |
| 120.00 | 23.1 | 37.3 | 38.0 | 0.0130 | 36.3 | 10.3 | 0.0038 | 75.5 |
| 240.00 | 23.7 | 34.2 | 35.1 | 0.0129 | 33.2 | 10.9 | 0.0027 | 69.7 |
| 366.00 | 23.5 | 32.2 | 33.0 | 0.0130 | 31.2 | 11.2 | 0.0023 | 65.6 |
| 1440.00 | 22.4 | 29.0 | 29.5 | 0.0131 | 28.0 | 11.7 | 0.0012 | 58.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 1.0 | 19.7 | 79.3 | 99.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0014 | 0.0052 | 0.0067 | 0.0091 | 0.0125 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 3.5 | 48.1 | 48.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 98.5 | | |
| .075mm | 96.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 46 PI= 27

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0270 $D_{60}$= 0.0111 $D_{50}$= 0.0060
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH, JRD, & JLC

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section E **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section E
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 19 **LL:** 46 **PI:** 27
**USCS Classification:** CL
**Tested By:** RTH, JRD, & JLC **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =**43.19
**Tare Wt. =**41.30
**Minus #200 from wash =**96.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.06 | 99.9 |
| | | | .3mm | 0.10 | 99.8 |
| | | | .15mm | 0.73 | 98.5 |
| | | | .075mm | 1.85 | 96.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

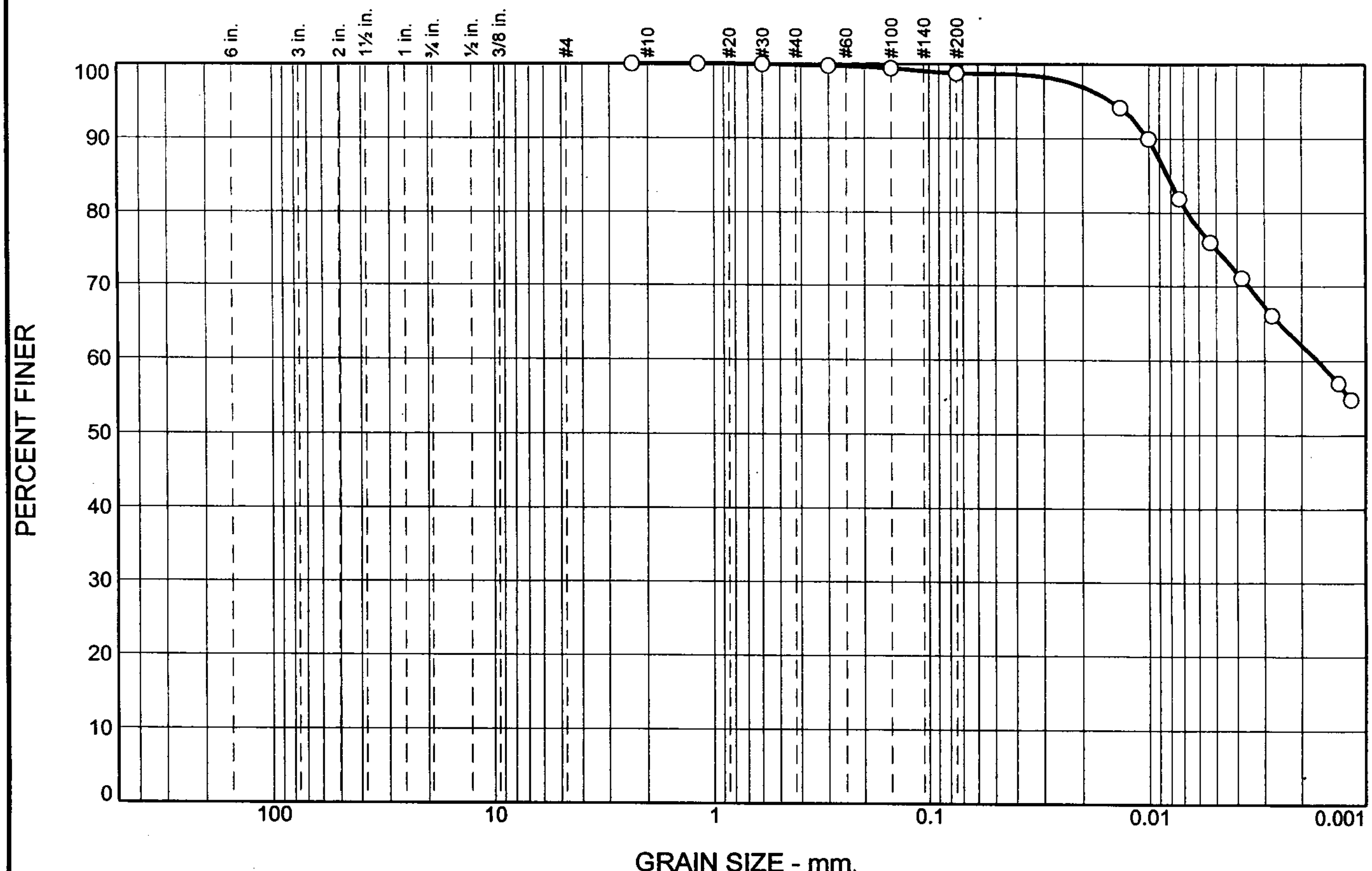
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.8 | 42.2 | 43.4 | 0.0128 | 41.2 | 9.5 | 0.0279 | 86.3 |
| 4.00 | 24.8 | 35.8 | 37.0 | 0.0128 | 34.8 | 10.6 | 0.0208 | 73.5 |
| 8.00 | 24.8 | 32.0 | 33.2 | 0.0128 | 31.0 | 11.2 | 0.0151 | 66.0 |
| 15.00 | 24.8 | 29.1 | 30.3 | 0.0128 | 28.1 | 11.7 | 0.0113 | 60.2 |
| 30.00 | 24.7 | 25.9 | 27.1 | 0.0128 | 24.9 | 12.2 | 0.0082 | 53.8 |
| 60.00 | 24.9 | 23.8 | 25.1 | 0.0127 | 22.8 | 12.6 | 0.0058 | 49.8 |
| 120.00 | 25.2 | 22.0 | 23.4 | 0.0127 | 21.0 | 12.9 | 0.0042 | 46.4 |
| 240.00 | 23.8 | 21.2 | 22.1 | 0.0129 | 20.2 | 13.0 | 0.0030 | 43.9 |
| 916.00 | 19.8 | 21.1 | 21.0 | 0.0136 | 20.1 | 13.0 | 0.0016 | 41.8 |
| 1440.00 | 22.1 | 19.0 | 19.4 | 0.0132 | 18.0 | 13.3 | 0.0013 | 38.6 |
| 1908.00 | 21.1 | 17.2 | 17.4 | 0.0133 | 16.2 | 13.6 | 0.0011 | 34.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 3.5 | 3.7 | 48.1 | 48.2 | 96.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0060 | 0.0111 | 0.0242 | 0.0270 | 0.0371 | 0.0620 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.1 | 23.7 | 75.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.7 | | |
| .15mm | 99.4 | | |
| .075mm | 98.7 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 28 LL= 72 PI= 44

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0083 $D_{60}$= 0.0017 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH, JDB, & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 28 **LL:** 72 **PI:** 44
**USCS Classification:** CH
**Tested By:** RTH, JDB, & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =38.83
**Tare Wt.** =38.09
**Minus #200 from wash** =98.5%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.04 | 99.9 |
| | | | .3mm | 0.14 | 99.7 |
| | | | .15mm | 0.30 | 99.4 |
| | | | .075mm | 0.63 | 98.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 24.4 | 46.3 | 47.4 | 0.0128 | 45.3 | 8.9 | 0.0135 | 94.1 |
| 15.00 | 24.4 | 44.2 | 45.3 | 0.0128 | 43.2 | 9.2 | 0.0100 | 90.0 |
| 30.00 | 24.5 | 40.1 | 41.2 | 0.0128 | 39.1 | 9.9 | 0.0073 | 81.9 |
| 60.00 | 24.8 | 37.0 | 38.2 | 0.0128 | 36.0 | 10.4 | 0.0053 | 75.9 |
| 120.00 | 25.0 | 34.5 | 35.8 | 0.0127 | 33.5 | 10.8 | 0.0038 | 71.1 |
| 240.00 | 24.9 | 32.0 | 33.3 | 0.0127 | 31.0 | 11.2 | 0.0028 | 66.1 |
| 1115.00 | 23.1 | 28.0 | 28.7 | 0.0130 | 27.0 | 11.9 | 0.0013 | 57.0 |
| 1440.00 | 25.0 | 26.3 | 27.6 | 0.0127 | 25.3 | 12.1 | 0.0012 | 54.8 |

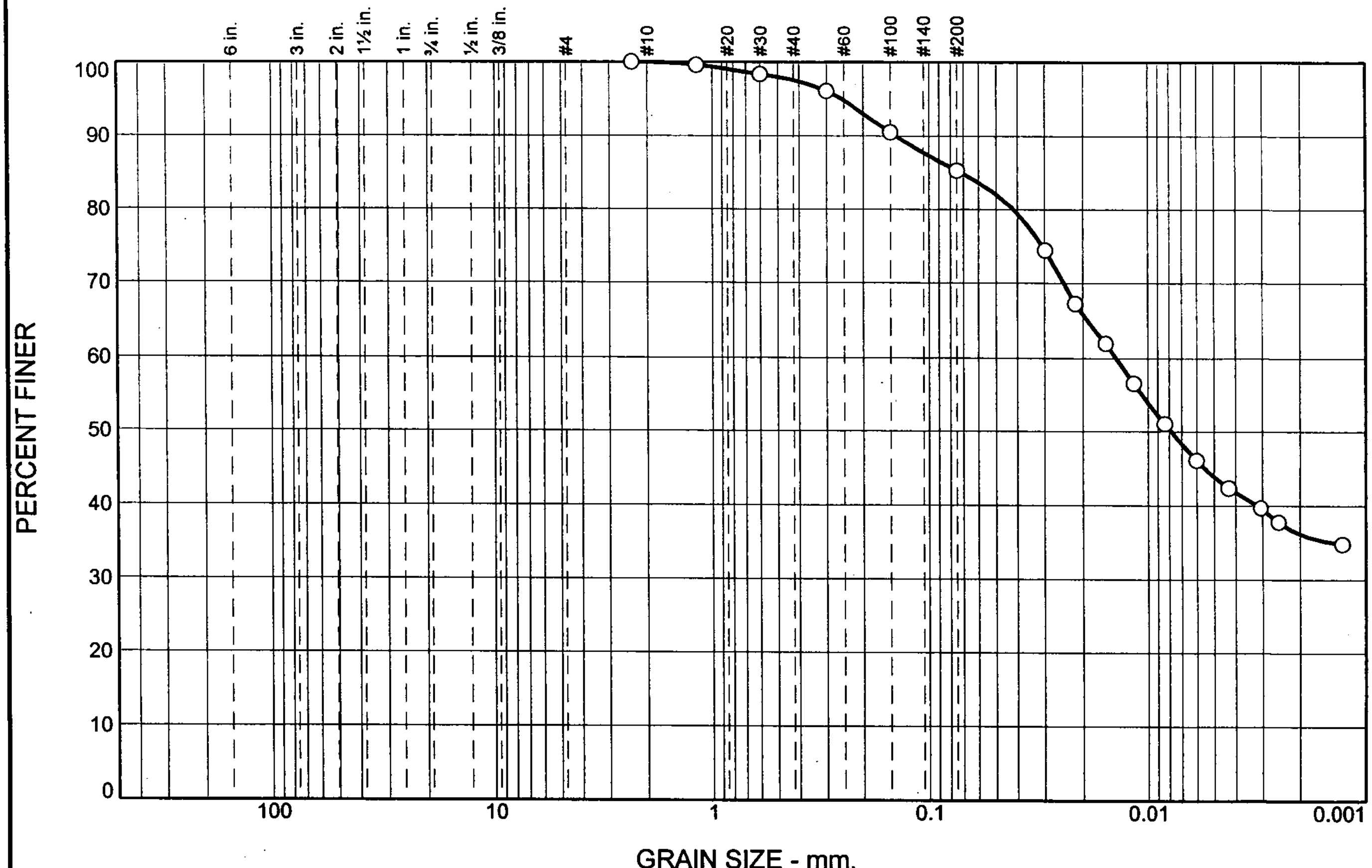
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1.1 | 1.3 | 23.7 | 75.0 | 98.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0017 | 0.0068 | 0.0083 | 0.0101 | 0.0149 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 2.4 | 12.2 | 41.5 | 43.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.3 | | |
| .3mm | 96.1 | | |
| .15mm | 90.5 | | |
| .075mm | 85.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 39 PI= 17

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0720 $D_{60}$= 0.0140 $D_{50}$= 0.0078
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 22 **LL:** 39 **PI:** 17
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 48.95
**Tare Wt. =** 41.13
**Minus #200 from wash =** 84.4%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.22 | 99.6 |
| | | | .6mm | 0.85 | 98.3 |
| | | | .3mm | 1.96 | 96.1 |
| | | | .15mm | 4.77 | 90.5 |
| | | | .075mm | 7.36 | 85.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 **x Rm**

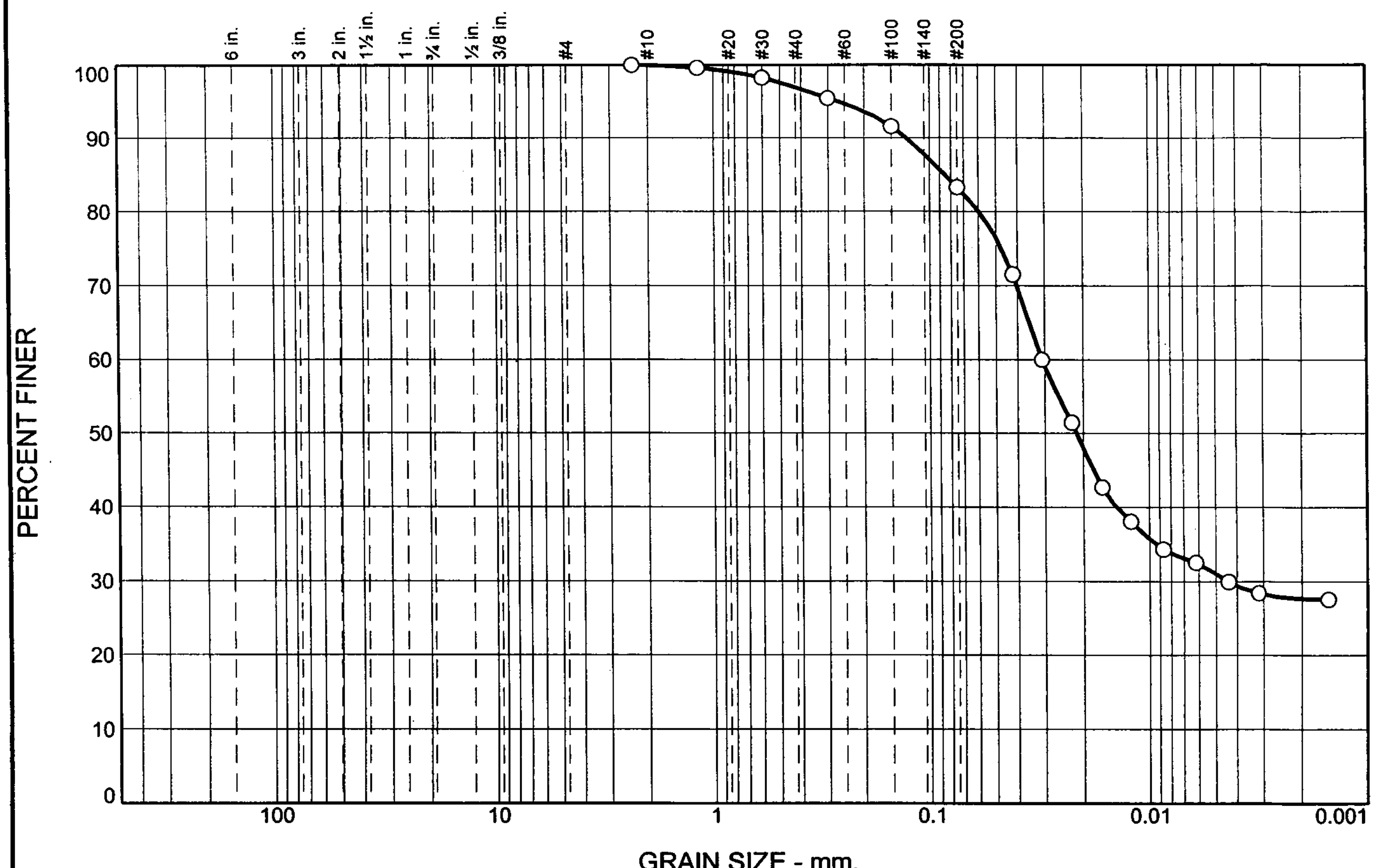
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 23.0 | 36.8 | 37.5 | 0.0130 | 35.8 | 10.4 | 0.0298 | 74.5 |
| 4.00 | 23.0 | 33.2 | 33.9 | 0.0130 | 32.2 | 11.0 | 0.0216 | 67.3 |
| 8.00 | 23.0 | 30.5 | 31.2 | 0.0130 | 29.5 | 11.5 | 0.0156 | 61.9 |
| 15.00 | 23.0 | 27.8 | 28.5 | 0.0130 | 26.8 | 11.9 | 0.0116 | 56.6 |
| 30.00 | 23.1 | 25.0 | 25.7 | 0.0130 | 24.0 | 12.4 | 0.0084 | 51.1 |
| 60.00 | 23.1 | 22.5 | 23.2 | 0.0130 | 21.5 | 12.8 | 0.0060 | 46.1 |
| 120.00 | 23.1 | 20.6 | 21.3 | 0.0130 | 19.6 | 13.1 | 0.0043 | 42.3 |
| 240.00 | 23.7 | 19.1 | 20.0 | 0.0129 | 18.1 | 13.3 | 0.0030 | 39.7 |
| 358.00 | 23.5 | 18.2 | 19.0 | 0.0130 | 17.2 | 13.5 | 0.0025 | 37.8 |
| 1440.00 | 22.4 | 17.0 | 17.5 | 0.0131 | 16.0 | 13.7 | 0.0013 | 34.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.4 | 12.2 | 14.7 | 41.5 | 43.8 | 85.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0078 | 0.0140 | 0.0414 | 0.0720 | 0.1420 | 0.2554 |

| Fineness Modulus |
|---|
| 0.16 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 3.0 | 13.7 | 52.3 | 30.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.6 | | |
| .6mm | 98.2 | | |
| .3mm | 95.4 | | |
| .15mm | 91.5 | | |
| .075mm | 83.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 33 PI= 13

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0857 $D_{60}$= 0.0309 $D_{50}$= 0.0214
$D_{30}$= 0.0044 $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/21/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section F **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section F
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 20 **LL:** 33 **PI:** 13
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/21/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =** 43.10
**Tare Wt. =** 34.48
**Minus #200 from wash =** 82.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.21 | 99.6 |
| | | | .6mm | 0.88 | 98.2 |
| | | | .3mm | 2.28 | 95.4 |
| | | | .15mm | 4.23 | 91.5 |
| | | | .075mm | 8.39 | 83.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =** 100.0
**Weight of hydrometer sample =** 50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** 01352
**Meniscus correction only =** -1.0
**Specific gravity of solids =** 2.68
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.7 | 34.8 | 36.0 | 0.0128 | 33.8 | 10.8 | 0.0419 | 71.5 |
| 2.00 | 24.7 | 29.0 | 30.2 | 0.0128 | 28.0 | 11.7 | 0.0309 | 60.0 |
| 4.00 | 24.7 | 24.7 | 25.9 | 0.0128 | 23.7 | 12.4 | 0.0225 | 51.4 |
| 8.00 | 24.7 | 20.3 | 21.5 | 0.0128 | 19.3 | 13.1 | 0.0164 | 42.7 |
| 15.00 | 24.6 | 18.0 | 19.2 | 0.0128 | 17.0 | 13.5 | 0.0121 | 38.0 |
| 30.00 | 24.6 | 16.1 | 17.3 | 0.0128 | 15.1 | 13.8 | 0.0087 | 34.3 |
| 60.00 | 24.6 | 15.2 | 16.4 | 0.0128 | 14.2 | 14.0 | 0.0062 | 32.5 |
| 120.00 | 25.2 | 13.7 | 15.1 | 0.0127 | 12.7 | 14.2 | 0.0044 | 29.9 |
| 240.00 | 23.4 | 13.5 | 14.3 | 0.0130 | 12.5 | 14.2 | 0.0032 | 28.4 |
| 1147.00 | 19.5 | 14.0 | 13.9 | 0.0136 | 13.0 | 14.2 | 0.0015 | 27.5 |

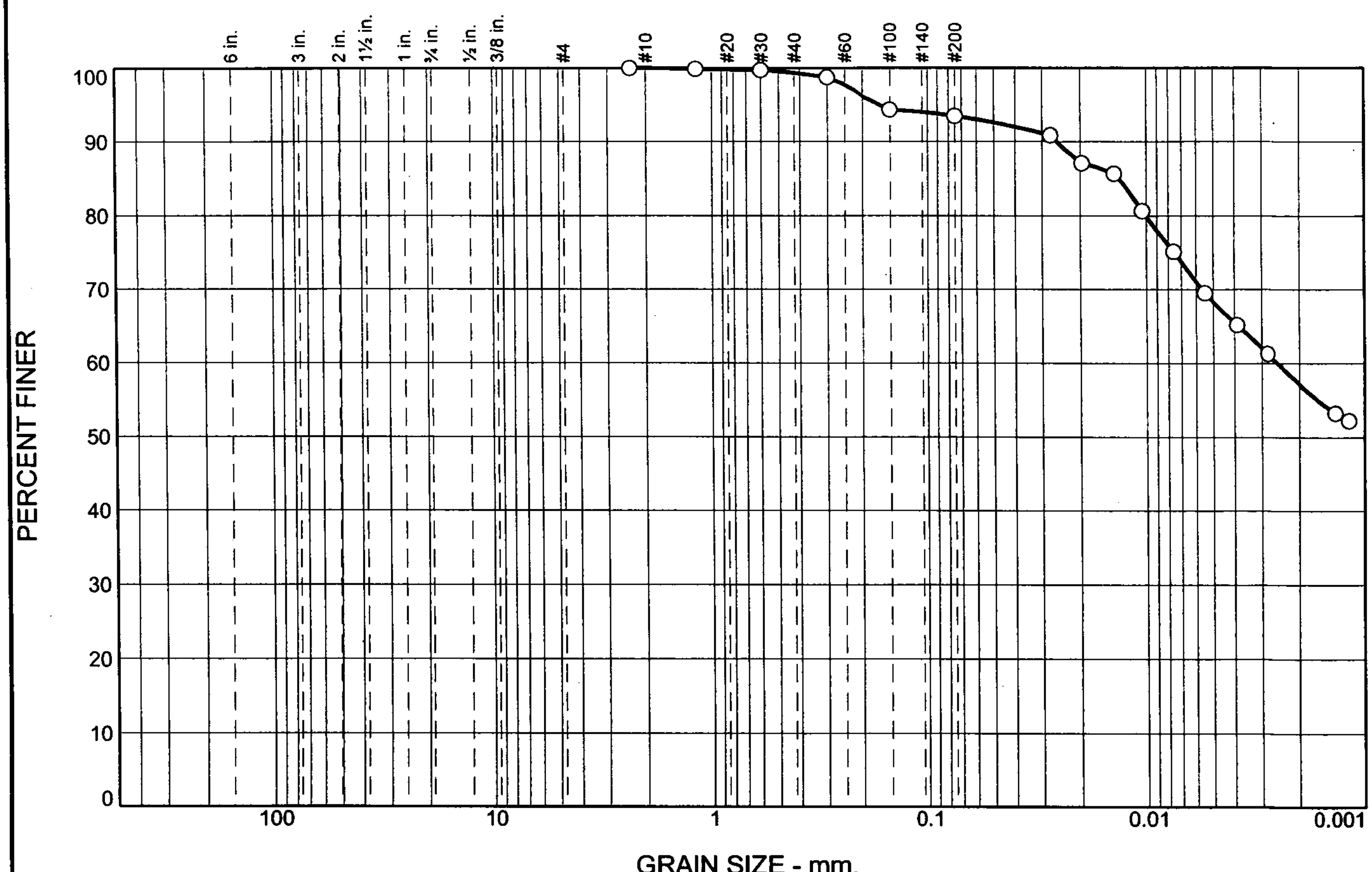
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 3.0 | 13.7 | 16.8 | 52.3 | 30.9 | 83.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.0044 | 0.0214 | 0.0309 | 0.0598 | 0.0857 | 0.1284 | 0.2703 |

| Fineness Modulus |
|---|
| 0.15 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 5.9 | 25.2 | 68.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 98.7 | | |
| .15mm | 94.3 | | |
| .075mm | 93.4 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 69 PI= 48

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0133 $D_{60}$= 0.0025 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 21 **LL:** 69 **PI:** 48
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =36.79
**Tare Wt.** =33.44
**Minus #200 from wash** =93.3%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.16 | 99.7 |
| | | | .3mm | 0.64 | 98.7 |
| | | | .15mm | 2.86 | 94.3 |
| | | | .075mm | 3.30 | 93.4 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 24.5 | 44.6 | 45.7 | 0.0128 | 43.6 | 9.1 | 0.0274 | 90.8 |
| 4.00 | 24.5 | 42.7 | 43.8 | 0.0128 | 41.7 | 9.5 | 0.0197 | 87.1 |
| 8.00 | 24.5 | 42.0 | 43.1 | 0.0128 | 41.0 | 9.6 | 0.0140 | 85.7 |
| 15.00 | 24.4 | 39.5 | 40.6 | 0.0128 | 38.5 | 10.0 | 0.0105 | 80.6 |
| 30.00 | 24.5 | 36.7 | 37.8 | 0.0128 | 35.7 | 10.4 | 0.0076 | 75.1 |
| 60.00 | 24.7 | 33.8 | 35.0 | 0.0128 | 32.8 | 10.9 | 0.0054 | 69.5 |
| 120.00 | 25.0 | 31.5 | 32.8 | 0.0127 | 30.5 | 11.3 | 0.0039 | 65.1 |
| 240.00 | 24.9 | 29.6 | 30.9 | 0.0127 | 28.6 | 11.6 | 0.0028 | 61.3 |
| 1107.00 | 23.1 | 26.1 | 26.8 | 0.0130 | 25.1 | 12.2 | 0.0014 | 53.2 |
| 1440.00 | 25.0 | 25.0 | 26.3 | 0.0127 | 24.0 | 12.4 | 0.0012 | 52.2 |

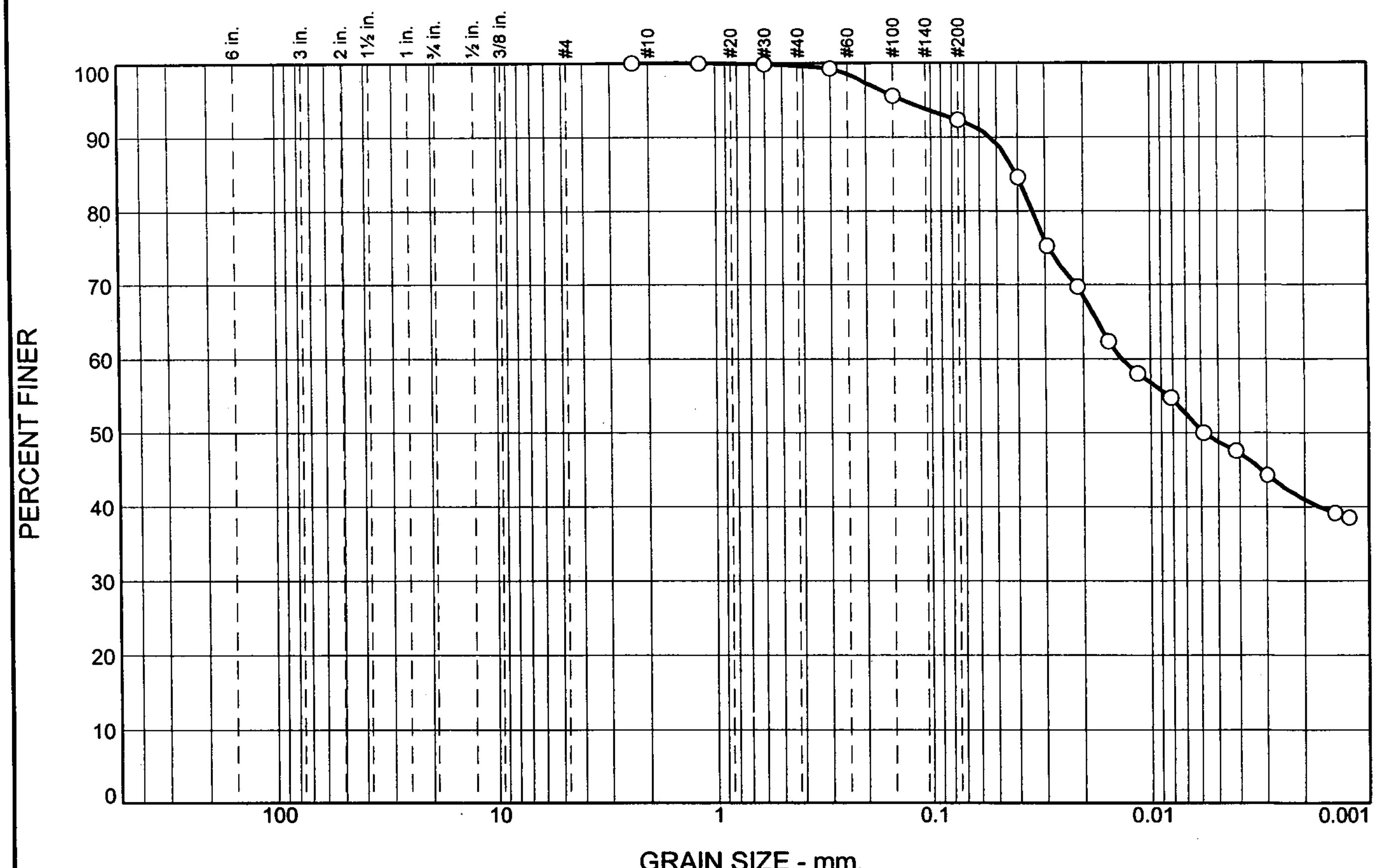
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 5.9 | 6.6 | 25.2 | 68.2 | 93.4 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0025 | 0.0101 | 0.0133 | 0.0256 | 0.1704 |

| Fineness Modulus |
|---|
| 0.07 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 7.3 | 43.5 | 48.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.2 | | |
| .15mm | 95.5 | | |
| .075mm | 92.3 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 18 LL= 47 PI= 29

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0404 $D_{60}$= 0.0135 $D_{50}$= 0.0058
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 18 **LL:** 47 **PI:** 29
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.43
**Tare Wt.** =39.44
**Minus #200 from wash** =92.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.09 | 99.8 |
| | | | .3mm | 0.39 | 99.2 |
| | | | .15mm | 2.24 | 95.5 |
| | | | .075mm | 3.87 | 92.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

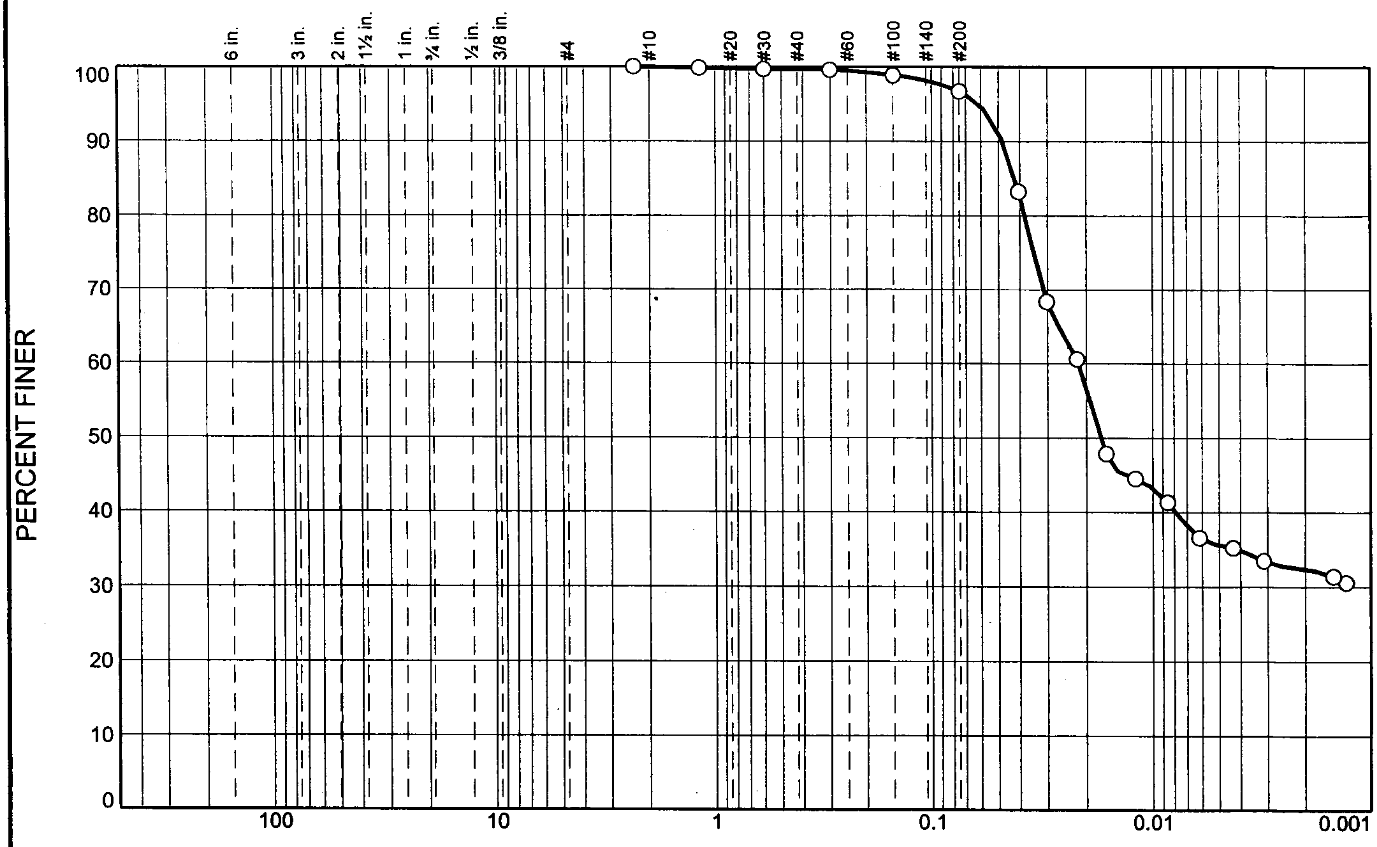
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.4 | 41.5 | 42.6 | 0.0128 | 40.5 | 9.7 | 0.0398 | 84.6 |
| 2.00 | 24.4 | 36.8 | 37.9 | 0.0128 | 35.8 | 10.4 | 0.0293 | 75.3 |
| 4.00 | 24.4 | 34.0 | 35.1 | 0.0128 | 33.0 | 10.9 | 0.0211 | 69.7 |
| 8.00 | 24.4 | 30.3 | 31.4 | 0.0128 | 29.3 | 11.5 | 0.0154 | 62.4 |
| 15.00 | 24.4 | 28.1 | 29.2 | 0.0128 | 27.1 | 11.9 | 0.0114 | 58.0 |
| 30.00 | 24.6 | 26.4 | 27.6 | 0.0128 | 25.4 | 12.1 | 0.0081 | 54.7 |
| 60.00 | 24.7 | 24.0 | 25.2 | 0.0128 | 23.0 | 12.5 | 0.0058 | 50.0 |
| 120.00 | 24.9 | 22.7 | 24.0 | 0.0127 | 21.7 | 12.7 | 0.0042 | 47.6 |
| 240.00 | 24.7 | 21.1 | 22.3 | 0.0128 | 20.1 | 13.0 | 0.0030 | 44.3 |
| 1099.00 | 23.1 | 19.0 | 19.7 | 0.0130 | 18.0 | 13.3 | 0.0014 | 39.1 |
| 1440.00 | 25.0 | 18.1 | 19.4 | 0.0127 | 17.1 | 13.5 | 0.0012 | 38.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 7.3 | 7.7 | 43.5 | 48.8 | 92.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0058 | 0.0135 | 0.0344 | 0.0404 | 0.0532 | 0.1364 |

| Fineness Modulus |
|---|
| 0.06 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.9 | 61.1 | 35.6 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.8 | | |
| .6mm | 99.7 | | |
| .3mm | 99.5 | | |
| .15mm | 98.8 | | |
| .075mm | 96.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 37 PI= 16

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0418 $D_{60}$= 0.0216 $D_{50}$= 0.0172
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section G **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section G
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 21 **LL:** 37 **PI:** 16
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =39.04
**Tare Wt.** =37.31
**Minus #200 from wash** =96.5%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.10 | 99.8 |
| | | | .6mm | 0.17 | 99.7 |
| | | | .3mm | 0.23 | 99.5 |
| | | | .15mm | 0.58 | 98.8 |
| | | | .075mm | 1.65 | 96.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

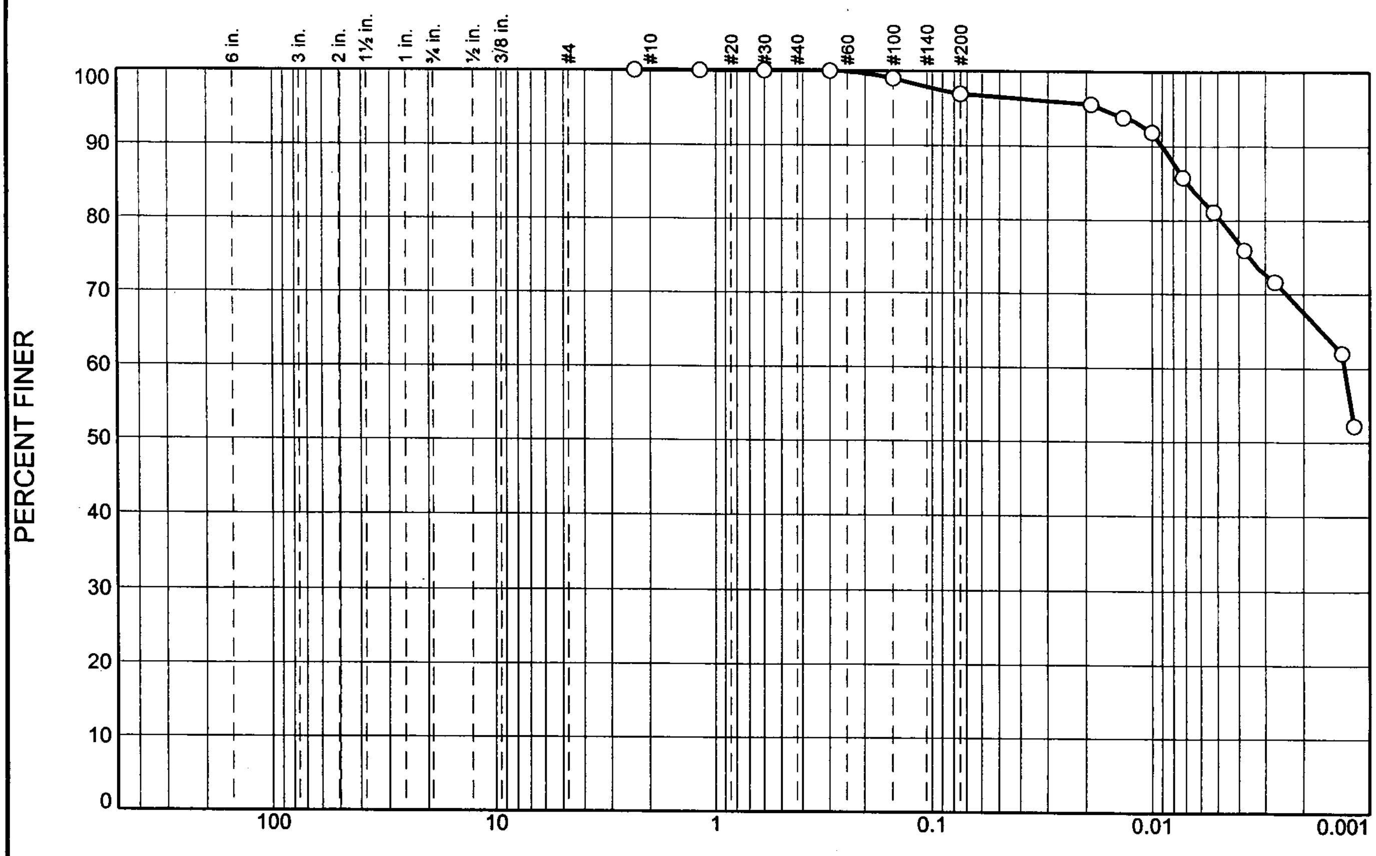
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.8 | 41.0 | 41.9 | 0.0129 | 40.0 | 9.7 | 0.0403 | 83.2 |
| 2.00 | 23.8 | 33.5 | 34.4 | 0.0129 | 32.5 | 11.0 | 0.0302 | 68.3 |
| 4.00 | 23.8 | 29.6 | 30.5 | 0.0129 | 28.6 | 11.6 | 0.0220 | 60.6 |
| 8.00 | 23.8 | 23.2 | 24.1 | 0.0129 | 22.2 | 12.7 | 0.0162 | 47.9 |
| 15.00 | 23.8 | 21.5 | 22.4 | 0.0129 | 20.5 | 12.9 | 0.0120 | 44.5 |
| 30.00 | 23.8 | 19.9 | 20.8 | 0.0129 | 18.9 | 13.2 | 0.0086 | 41.3 |
| 60.00 | 23.8 | 17.5 | 18.4 | 0.0129 | 16.5 | 13.6 | 0.0061 | 36.6 |
| 120.00 | 24.8 | 16.5 | 17.7 | 0.0128 | 15.5 | 13.8 | 0.0043 | 35.2 |
| 240.00 | 23.2 | 16.1 | 16.8 | 0.0130 | 15.1 | 13.8 | 0.0031 | 33.4 |
| 1163.00 | 19.7 | 15.9 | 15.8 | 0.0136 | 14.9 | 13.9 | 0.0015 | 31.4 |
| 1440.00 | 22.3 | 14.9 | 15.4 | 0.0131 | 13.9 | 14.0 | 0.0013 | 30.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 2.9 | 3.3 | 61.1 | 35.6 | 96.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0172 | 0.0216 | 0.0379 | 0.0418 | 0.0478 | 0.0611 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 16.4 | 80.5 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 98.9 | | |
| .075mm | 96.9 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 80 PI= 59

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0069 $D_{60}$= 0.0013 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill

**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 21 **LL:** 80 **PI:** 59
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.35
**Tare Wt.** =40.71
**Minus #200 from wash** =96.7%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.01 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.53 | 98.9 |
| | | | .075mm | 1.54 | 96.9 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 24.5 | 47.0 | 48.1 | 0.0128 | 46.0 | 8.8 | 0.0189 | 95.6 |
| 8.00 | 24.5 | 46.1 | 47.2 | 0.0128 | 45.1 | 8.9 | 0.0135 | 93.8 |
| 15.00 | 24.5 | 45.1 | 46.2 | 0.0128 | 44.1 | 9.1 | 0.0100 | 91.8 |
| 30.00 | 24.6 | 42.0 | 43.2 | 0.0128 | 41.0 | 9.6 | 0.0072 | 85.7 |
| 60.00 | 24.8 | 39.6 | 40.8 | 0.0128 | 38.6 | 10.0 | 0.0052 | 81.1 |
| 120.00 | 24.8 | 37.0 | 38.2 | 0.0128 | 36.0 | 10.4 | 0.0038 | 75.9 |
| 240.00 | 24.9 | 34.8 | 36.1 | 0.0127 | 33.8 | 10.8 | 0.0027 | 71.6 |
| 1083.00 | 23.1 | 30.5 | 31.2 | 0.0130 | 29.5 | 11.5 | 0.0013 | 62.0 |
| 1440.00 | 25.0 | 25.0 | 26.3 | 0.0127 | 24.0 | 12.4 | 0.0012 | 52.2 |

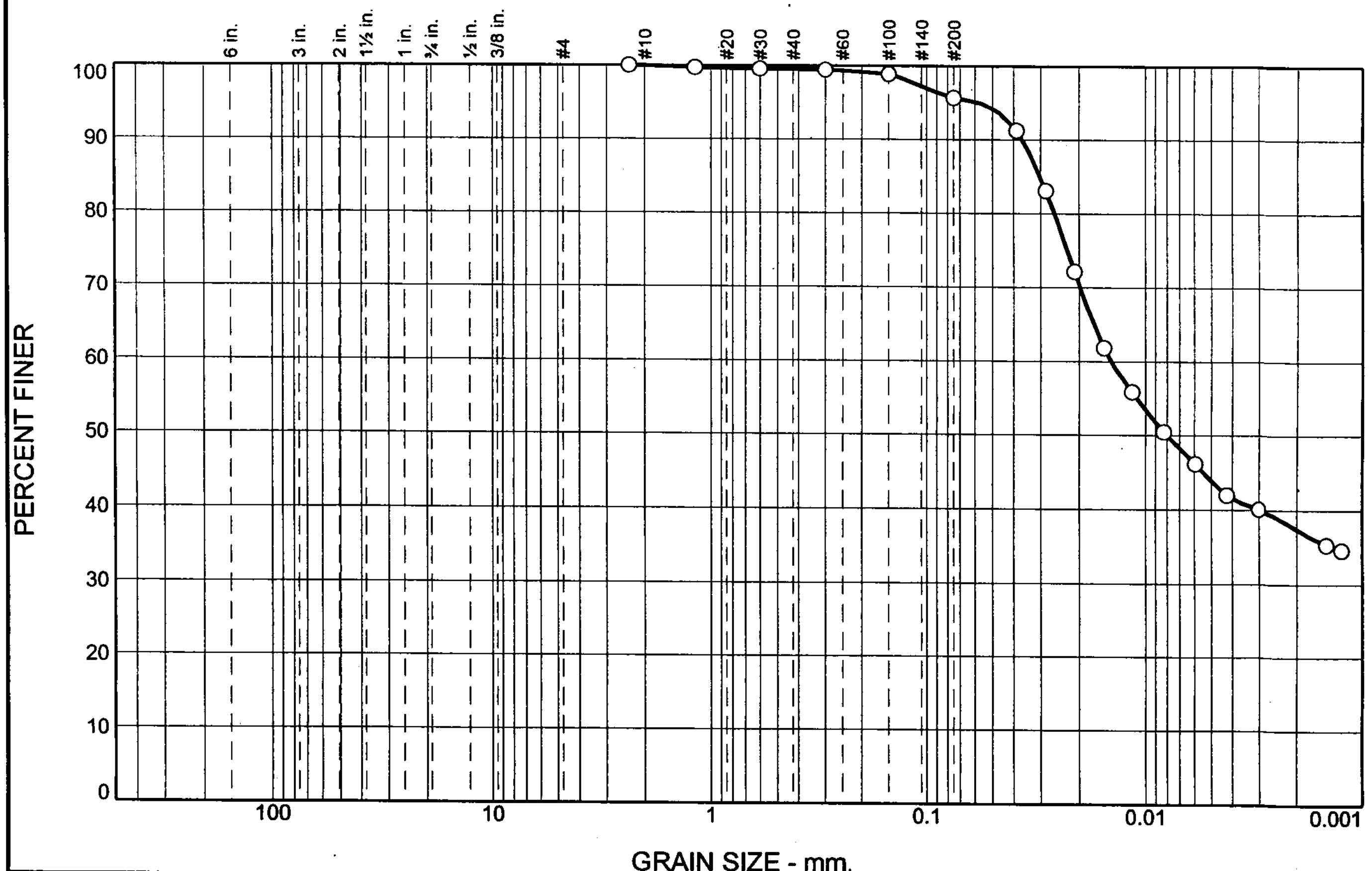
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 3.1 | 16.4 | 80.5 | 96.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0013 | 0.0048 | 0.0069 | 0.0089 | 0.0169 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 3.9 | 51.7 | 43.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.7 | | |
| .6mm | 99.5 | | |
| .3mm | 99.4 | | |
| .15mm | 98.8 | | |
| .075mm | 95.6 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 43 PI= 22

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0301 $D_{60}$= 0.0143 $D_{50}$= 0.0080
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty
**PL:** 21 **LL:** 43 **PI:** 22
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare =**39.90
**Tare Wt. =**37.58
**Minus #200 from wash =**95.4%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.15 | 99.7 |
| | | | .6mm | 0.24 | 99.5 |
| | | | .3mm | 0.30 | 99.4 |
| | | | .15mm | 0.59 | 98.8 |
| | | | .075mm | 2.18 | 95.6 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample =**100.0
**Weight of hydrometer sample =**50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =**01352
**Meniscus correction only =**-1.0
**Specific gravity of solids =**2.68
**Hydrometer type =**152H
**Hydrometer effective depth equation: L =**16.294964 - 0.164 x **Rm**

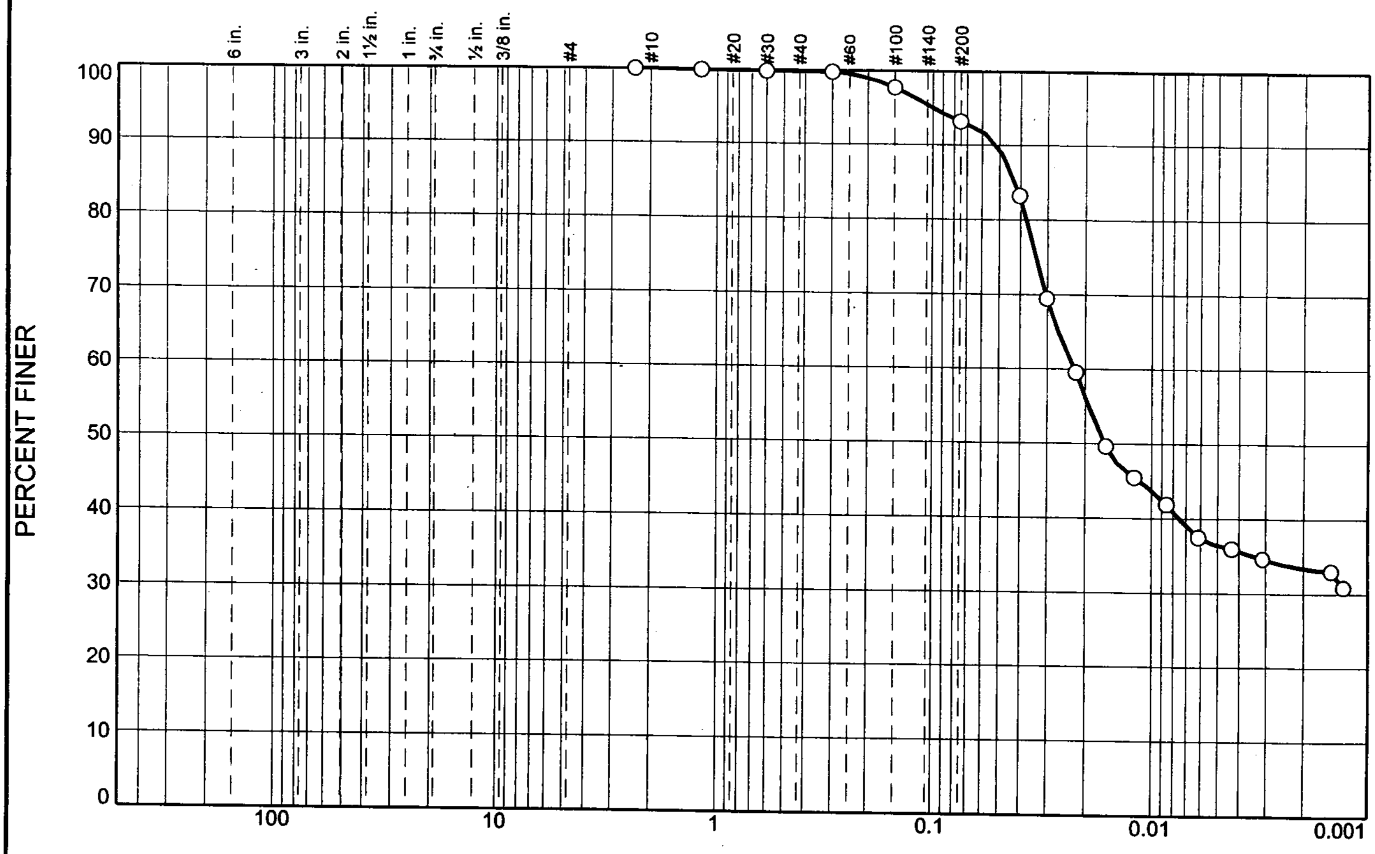
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.5 | 44.8 | 45.9 | 0.0128 | 43.8 | 9.1 | 0.0387 | 91.2 |
| 2.00 | 24.5 | 40.7 | 41.8 | 0.0128 | 39.7 | 9.8 | 0.0283 | 83.1 |
| 4.00 | 24.5 | 35.2 | 36.3 | 0.0128 | 34.2 | 10.7 | 0.0209 | 72.2 |
| 8.00 | 24.5 | 30.0 | 31.1 | 0.0128 | 29.0 | 11.5 | 0.0154 | 61.8 |
| 15.00 | 24.5 | 27.0 | 28.1 | 0.0128 | 26.0 | 12.0 | 0.0115 | 55.9 |
| 30.00 | 24.7 | 24.2 | 25.4 | 0.0128 | 23.2 | 12.5 | 0.0082 | 50.4 |
| 60.00 | 24.8 | 22.0 | 23.2 | 0.0128 | 21.0 | 12.9 | 0.0059 | 46.1 |
| 120.00 | 24.5 | 20.0 | 21.1 | 0.0128 | 19.0 | 13.2 | 0.0042 | 42.0 |
| 240.00 | 25.0 | 18.9 | 20.2 | 0.0127 | 17.9 | 13.4 | 0.0030 | 40.1 |
| 1075.00 | 23.1 | 17.1 | 17.8 | 0.0130 | 16.1 | 13.7 | 0.0015 | 35.4 |
| 1440.00 | 25.1 | 16.1 | 17.4 | 0.0127 | 15.1 | 13.8 | 0.0012 | 34.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 3.9 | 4.4 | 51.7 | 43.9 | 95.6 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0080 | 0.0143 | 0.0259 | 0.0301 | 0.0364 | 0.0582 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 6.6 | 56.8 | 36.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.8 | | |
| .15mm | 97.7 | | |
| .075mm | 93.2 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 36 PI= 14

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0423 $D_{60}$= 0.0224 $D_{50}$= 0.0164
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/27/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section H **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section H
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 22 **LL:** 36 **PI:** 14
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/27/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.21
**Tare Wt.** =37.73
**Minus #200 from wash** =93.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.06 | 99.9 |
| | | | .6mm | 0.09 | 99.8 |
| | | | .3mm | 0.12 | 99.8 |
| | | | .15mm | 1.14 | 97.7 |
| | | | .075mm | 3.42 | 93.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

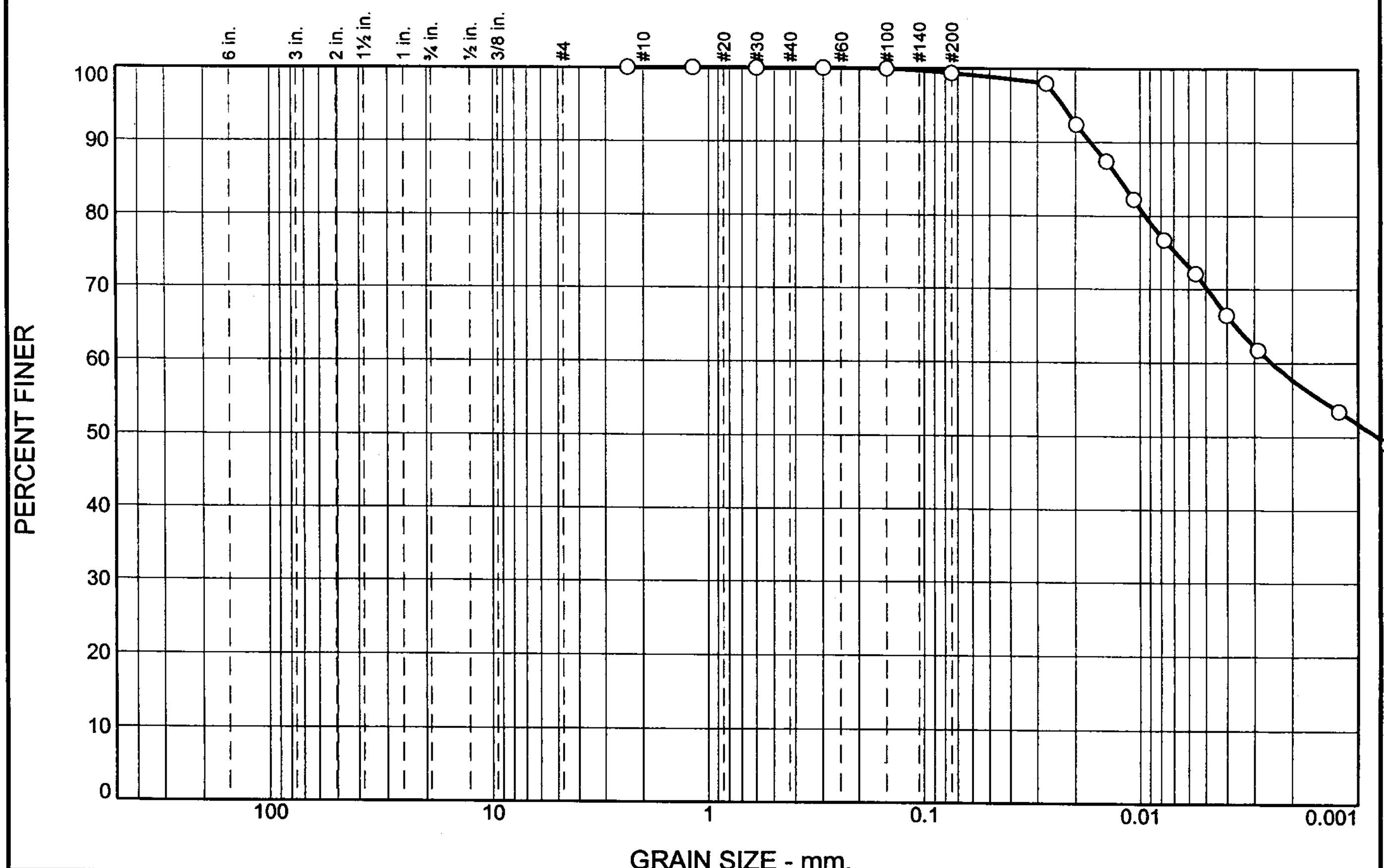
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.7 | 41.0 | 41.9 | 0.0129 | 40.0 | 9.7 | 0.0403 | 83.2 |
| 2.00 | 23.7 | 34.1 | 35.0 | 0.0129 | 33.1 | 10.9 | 0.0301 | 69.5 |
| 4.00 | 23.7 | 29.1 | 30.0 | 0.0129 | 28.1 | 11.7 | 0.0221 | 59.5 |
| 8.00 | 23.7 | 24.1 | 25.0 | 0.0129 | 23.1 | 12.5 | 0.0162 | 49.6 |
| 15.00 | 23.7 | 22.0 | 22.9 | 0.0129 | 21.0 | 12.9 | 0.0120 | 45.4 |
| 30.00 | 23.7 | 20.2 | 21.1 | 0.0129 | 19.2 | 13.1 | 0.0086 | 41.9 |
| 60.00 | 23.7 | 18.0 | 18.9 | 0.0129 | 17.0 | 13.5 | 0.0061 | 37.5 |
| 120.00 | 24.8 | 16.9 | 18.1 | 0.0128 | 15.9 | 13.7 | 0.0043 | 36.0 |
| 240.00 | 23.2 | 16.7 | 17.4 | 0.0130 | 15.7 | 13.7 | 0.0031 | 34.6 |
| 1154.00 | 19.7 | 16.7 | 16.6 | 0.0136 | 15.7 | 13.7 | 0.0015 | 33.0 |
| 1440.00 | 22.4 | 15.0 | 15.5 | 0.0131 | 14.0 | 14.0 | 0.0013 | 30.8 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 6.6 | 6.8 | 56.8 | 36.4 | 93.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0164 | 0.0224 | 0.0375 | 0.0423 | 0.0516 | 0.1000 |

| Fineness Modulus |
|---|
| 0.03 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 29.0 | 70.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.9 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 24 LL= 61 PI= 37

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0124 $D_{60}$= 0.0025 $D_{50}$= 0.0008
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 24 **LL:** 61 **PI:** 37
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.72
**Tare Wt.** =41.32
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.07 | 99.9 |
| | | | .075mm | 0.36 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

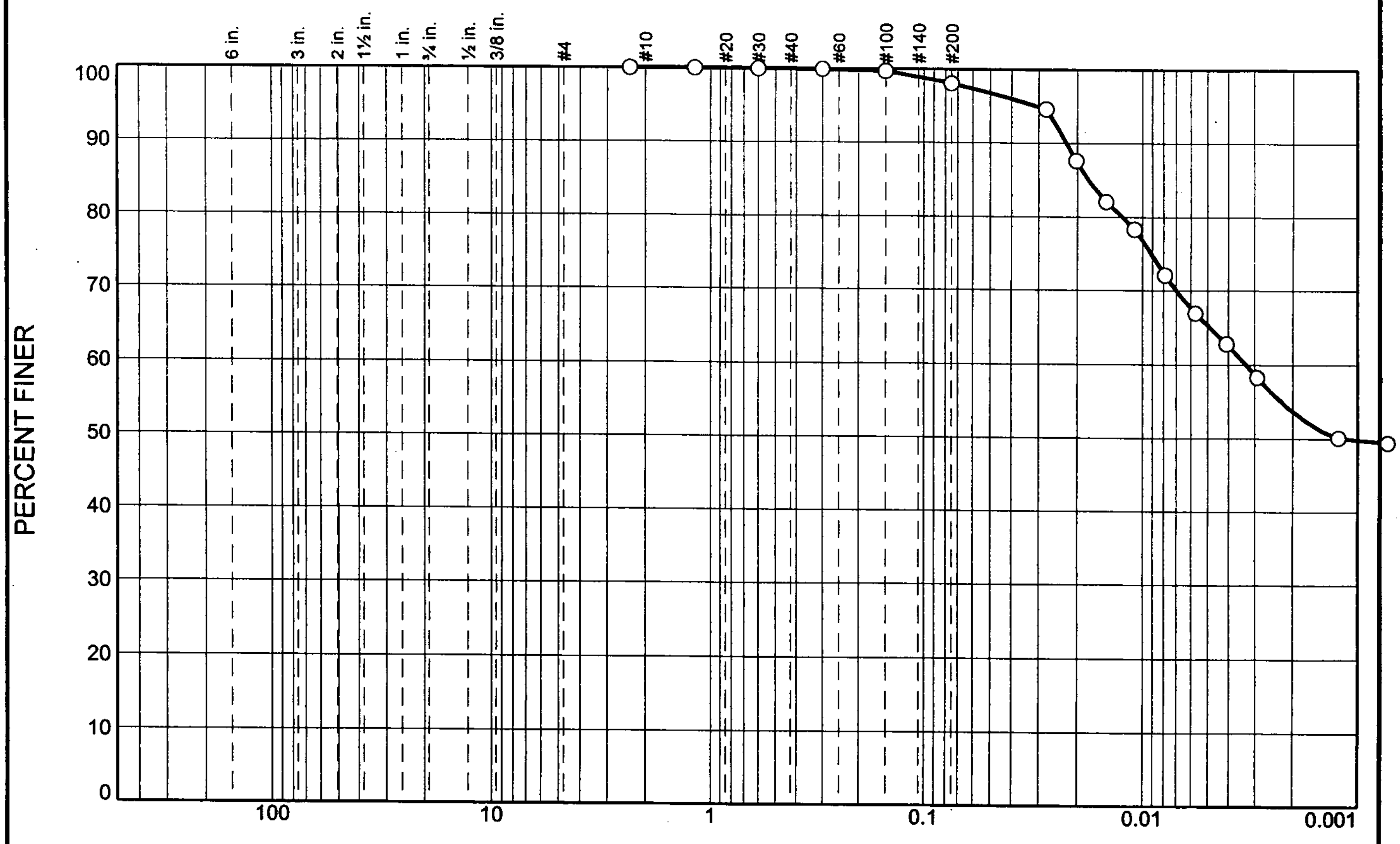
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 49.0 | 49.3 | 0.0133 | 48.0 | 8.4 | 0.0272 | 97.9 |
| 4.00 | 21.5 | 46.2 | 46.5 | 0.0133 | 45.2 | 8.9 | 0.0198 | 92.4 |
| 8.00 | 21.5 | 43.7 | 44.0 | 0.0133 | 42.7 | 9.3 | 0.0143 | 87.4 |
| 15.00 | 21.5 | 41.1 | 41.4 | 0.0133 | 40.1 | 9.7 | 0.0107 | 82.2 |
| 30.00 | 21.5 | 38.3 | 38.6 | 0.0133 | 37.3 | 10.2 | 0.0077 | 76.7 |
| 60.00 | 21.5 | 36.0 | 36.3 | 0.0133 | 35.0 | 10.6 | 0.0056 | 72.1 |
| 120.00 | 21.7 | 33.1 | 33.5 | 0.0132 | 32.1 | 11.0 | 0.0040 | 66.4 |
| 240.00 | 21.7 | 30.7 | 31.1 | 0.0132 | 29.7 | 11.4 | 0.0029 | 61.7 |
| 1448.00 | 20.7 | 26.8 | 26.9 | 0.0134 | 25.8 | 12.1 | 0.0012 | 53.5 |
| 4320.00 | 20.1 | 24.7 | 24.7 | 0.0135 | 23.7 | 12.4 | 0.0007 | 49.1 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 29.0 | 70.3 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0008 | 0.0025 | 0.0094 | 0.0124 | 0.0170 | 0.0229 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.9 | 32.7 | 65.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 99.9 | | |
| .15mm | 99.6 | | |
| .075mm | 98.0 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 55 PI= 35

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0177 $D_{60}$= 0.0033 $D_{50}$= 0.0011
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "CL"
**Material Description:** CLAY (CL), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 20 **LL:** 55 **PI:** 35
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

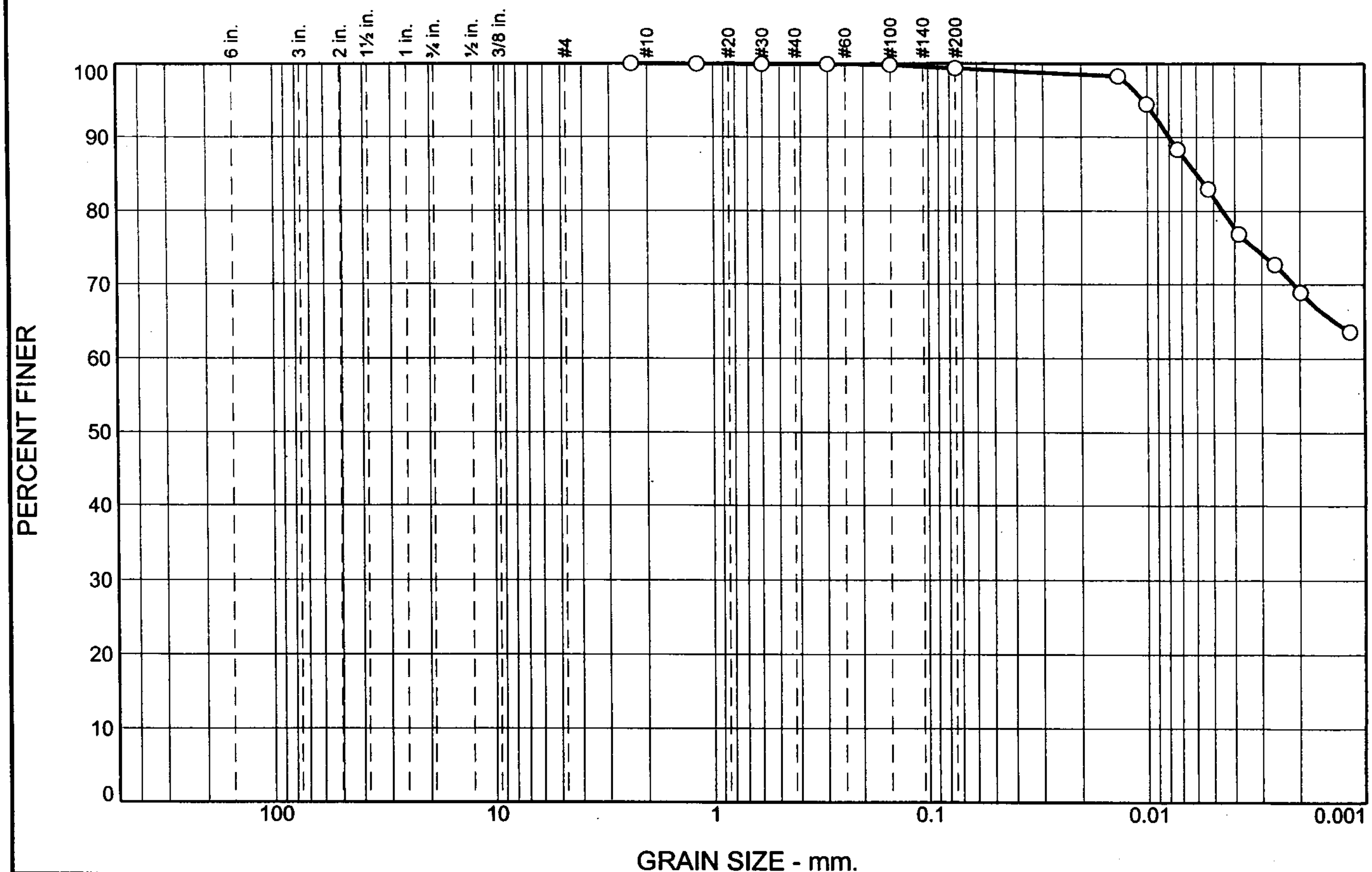
**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.15
**Tare Wt.** =41.13
**Minus #200 from wash** =98.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.19 | 99.6 |
| | | | .075mm | 1.00 | 98.0 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation:** L =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 47.3 | 47.6 | 0.0133 | 46.3 | 8.7 | 0.0277 | 94.6 |
| 4.00 | 21.5 | 43.8 | 44.1 | 0.0133 | 42.8 | 9.3 | 0.0202 | 87.6 |
| 8.00 | 21.5 | 41.0 | 41.3 | 0.0133 | 40.0 | 9.7 | 0.0146 | 82.0 |
| 15.00 | 21.5 | 39.1 | 39.4 | 0.0133 | 38.1 | 10.0 | 0.0109 | 78.3 |
| 30.00 | 21.5 | 36.0 | 36.3 | 0.0133 | 35.0 | 10.6 | 0.0079 | 72.1 |
| 60.00 | 21.5 | 33.4 | 33.7 | 0.0133 | 32.4 | 11.0 | 0.0057 | 67.0 |
| 120.00 | 21.6 | 31.3 | 31.6 | 0.0133 | 30.3 | 11.3 | 0.0041 | 62.8 |
| 240.00 | 21.7 | 29.0 | 29.4 | 0.0132 | 28.0 | 11.7 | 0.0029 | 58.3 |
| 1457.00 | 20.7 | 25.1 | 25.2 | 0.0134 | 24.1 | 12.3 | 0.0012 | 50.1 |
| 4320.00 | 20.1 | 24.9 | 24.9 | 0.0135 | 23.9 | 12.4 | 0.0007 | 49.5 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 17.5 | 81.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.8 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 29 LL= 75 PI= 46

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0060 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/1/06 **Tested By:** RTH

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

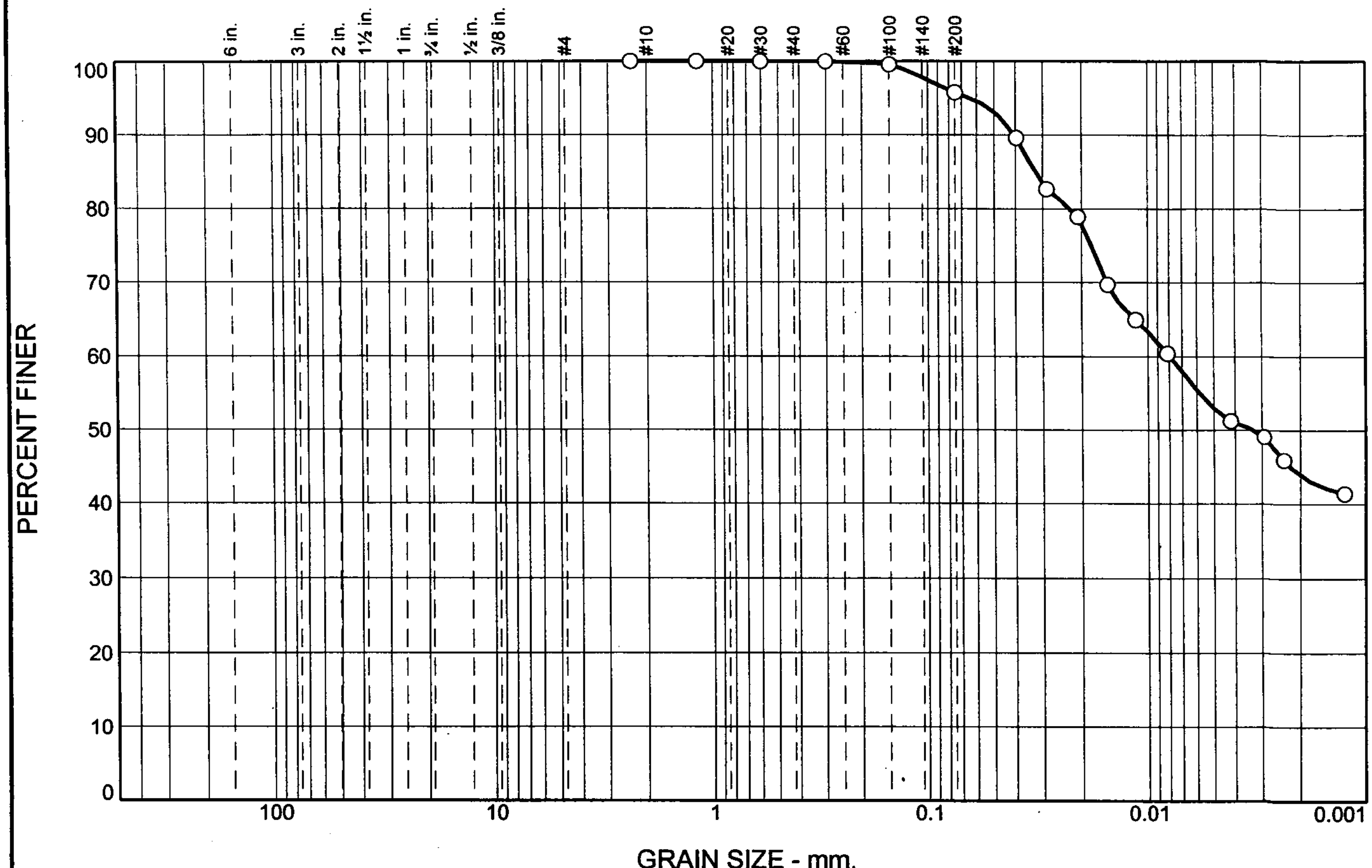
**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.9 | 2.0 | 32.7 | 65.3 | 98.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0011 | 0.0033 | 0.0123 | 0.0177 | 0.0224 | 0.0308 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 4.2 | 42.7 | 53.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.5 | | |
| .075mm | 95.7 | | |

* (no specification provided)

**Material Description**

CLAY (CL) brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 19 LL= 44 PI= 25

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0326 $D_{60}$= 0.0079 $D_{50}$= 0.0032
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section I **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill

**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section I
**Sample Number:** "MCL"
**Material Description:** CLAY (CL) brown, silty
**PL:** 19 **LL:** 44 **PI:** 25
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.94
**Tare Wt.** =41.35
**Minus #200 from wash** =94.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.00 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.04 | 99.9 |
| | | | .15mm | 0.24 | 99.5 |
| | | | .075mm | 2.15 | 95.7 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

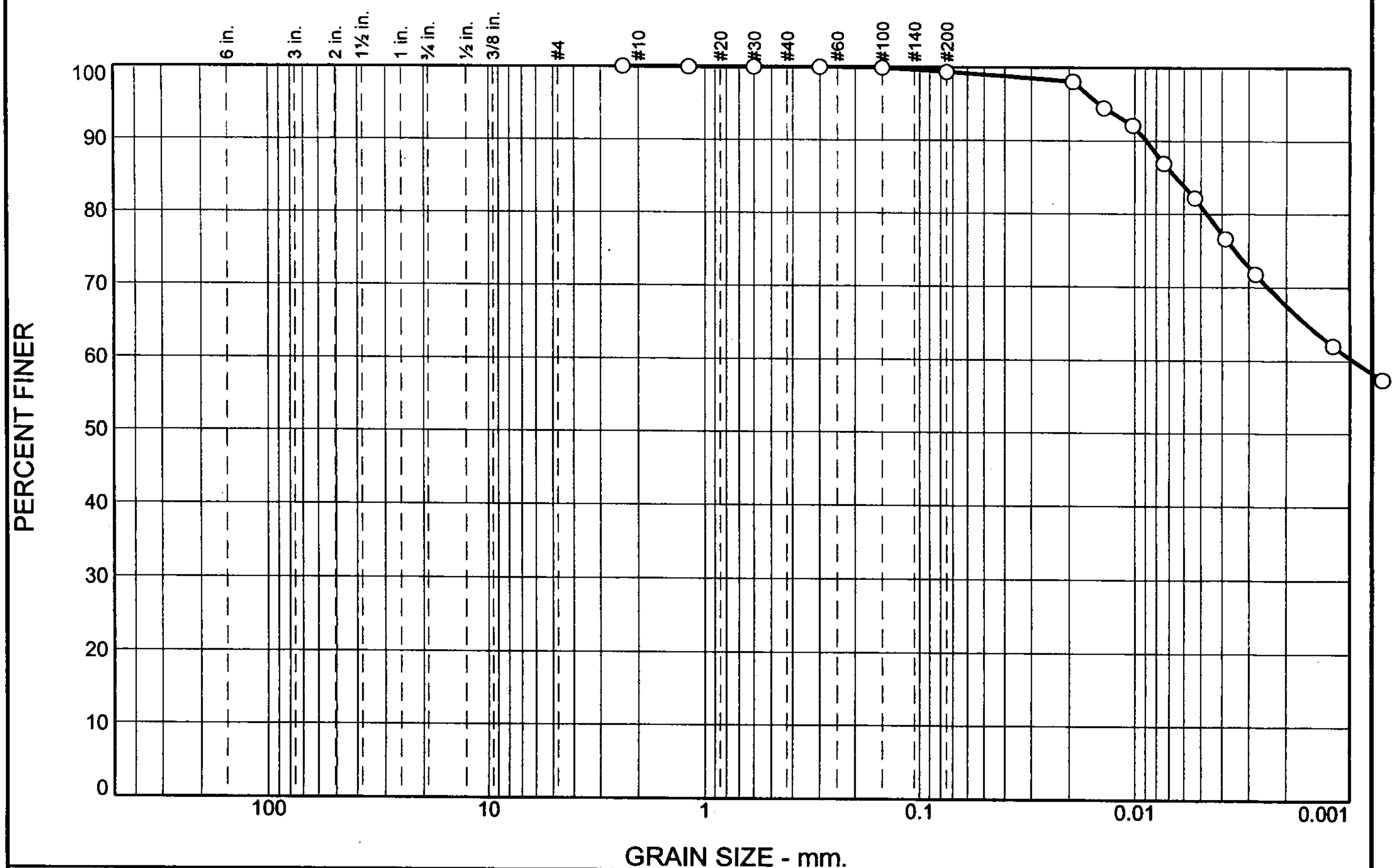
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 22.7 | 44.5 | 45.1 | 0.0131 | 43.5 | 9.2 | 0.0396 | 89.6 |
| 2.00 | 22.7 | 41.0 | 41.6 | 0.0131 | 40.0 | 9.7 | 0.0289 | 82.6 |
| 4.00 | 22.7 | 39.1 | 39.7 | 0.0131 | 38.1 | 10.0 | 0.0207 | 78.9 |
| 8.00 | 22.7 | 34.5 | 35.1 | 0.0131 | 33.5 | 10.8 | 0.0152 | 69.7 |
| 15.00 | 22.7 | 32.1 | 32.7 | 0.0131 | 31.1 | 11.2 | 0.0113 | 65.0 |
| 30.00 | 22.7 | 29.8 | 30.4 | 0.0131 | 28.8 | 11.6 | 0.0081 | 60.4 |
| 120.00 | 23.1 | 25.1 | 25.8 | 0.0130 | 24.1 | 12.3 | 0.0042 | 51.3 |
| 245.00 | 23.8 | 23.8 | 24.7 | 0.0129 | 22.8 | 12.6 | 0.0029 | 49.1 |
| 383.00 | 23.5 | 22.3 | 23.1 | 0.0130 | 21.3 | 12.8 | 0.0024 | 45.9 |
| 1440.00 | 22.4 | 20.3 | 20.8 | 0.0131 | 19.3 | 13.1 | 0.0013 | 41.4 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 4.2 | 4.3 | 42.7 | 53.0 | 95.7 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0032 | 0.0079 | 0.0222 | 0.0326 | 0.0404 | 0.0650 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 18.2 | 81.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.9 | | |
| .15mm | 99.8 | | |
| .075mm | 99.3 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 70 PI= 48

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0065 $D_{60}$= 0.0010 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CH" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 22 **LL:** 70 **PI:** 48
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =40.09
**Tare Wt.** = 39.73
**Minus #200 from wash** =99.3%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.02 | 100.0 |
| | | | .6mm | 0.03 | 99.9 |
| | | | .3mm | 0.03 | 99.9 |
| | | | .15mm | 0.08 | 99.8 |
| | | | .075mm | 0.34 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

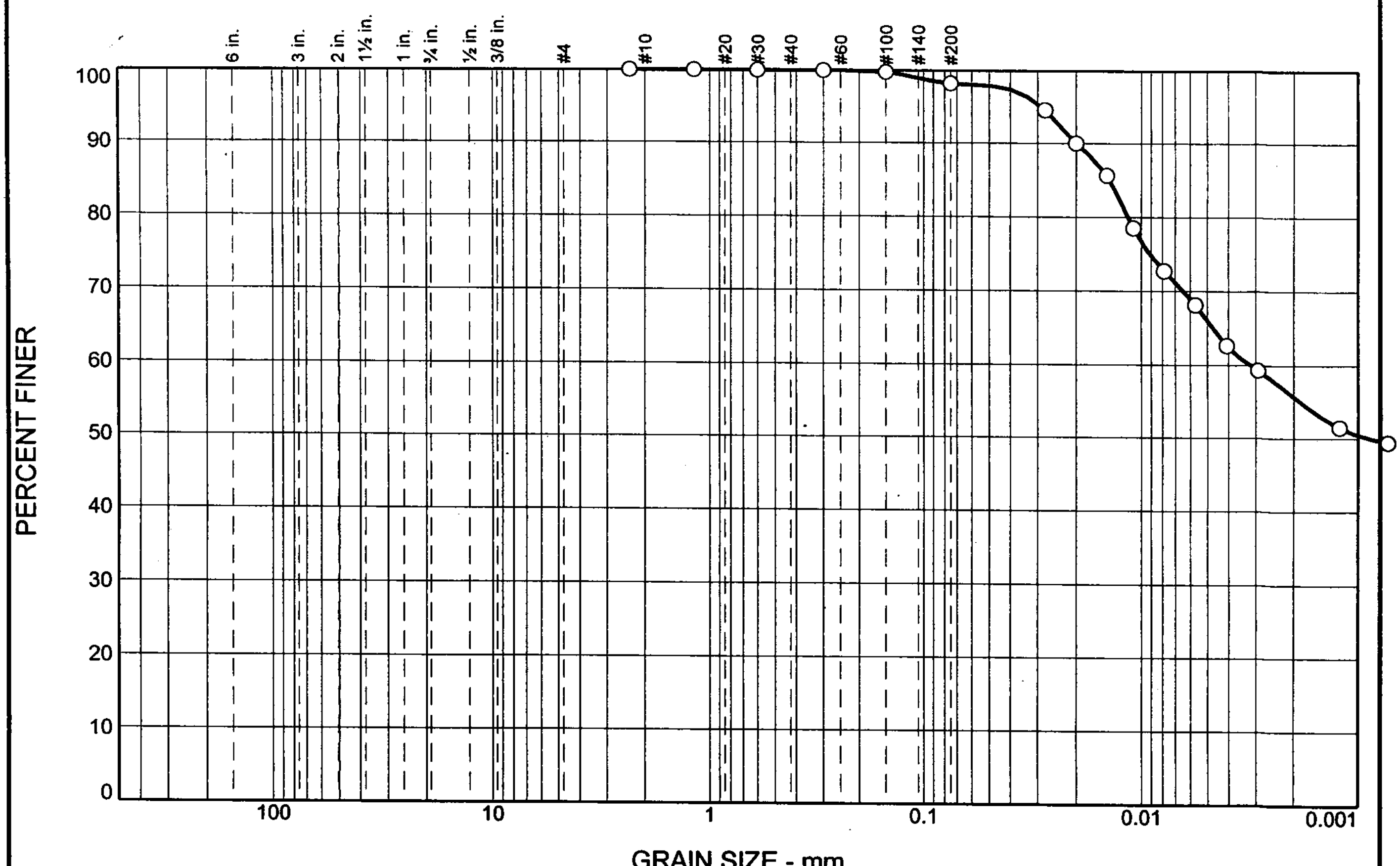
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 4.00 | 21.7 | 49.0 | 49.4 | 0.0132 | 48.0 | 8.4 | 0.0192 | 98.0 |
| 8.00 | 21.7 | 47.2 | 47.6 | 0.0132 | 46.2 | 8.7 | 0.0138 | 94.5 |
| 15.00 | 21.7 | 46.0 | 46.4 | 0.0132 | 45.0 | 8.9 | 0.0102 | 92.1 |
| 30.00 | 21.7 | 43.4 | 43.8 | 0.0132 | 42.4 | 9.3 | 0.0074 | 86.9 |
| 60.00 | 21.7 | 41.0 | 41.4 | 0.0132 | 40.0 | 9.7 | 0.0053 | 82.1 |
| 120.00 | 21.7 | 38.2 | 38.6 | 0.0132 | 37.2 | 10.2 | 0.0039 | 76.6 |
| 240.00 | 21.6 | 35.8 | 36.1 | 0.0133 | 34.8 | 10.6 | 0.0028 | 71.8 |
| 1422.00 | 20.7 | 31.1 | 31.2 | 0.0134 | 30.1 | 11.4 | 0.0012 | 62.0 |
| 4293.00 | 20.1 | 28.9 | 28.9 | 0.0135 | 27.9 | 11.7 | 0.0007 | 57.4 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 18.2 | 81.1 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0010 | 0.0047 | 0.0065 | 0.0089 | 0.0146 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 32.2 | 66.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 100.0 | | |
| .3mm | 100.0 | | |
| .15mm | 99.7 | | |
| .075mm | 98.2 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 20 LL= 53 PI= 33

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0140 $D_{60}$= 0.0032 $D_{50}$= 0.0009
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/4/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 20 **LL:** 53 **PI:** 33
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/4/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.31
**Tare Wt.** =41.35
**Minus #200 from wash** =98.1%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.02 | 100.0 |
| | | | .3mm | 0.02 | 100.0 |
| | | | .15mm | 0.14 | 99.7 |
| | | | .075mm | 0.91 | 98.2 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x **Rm**

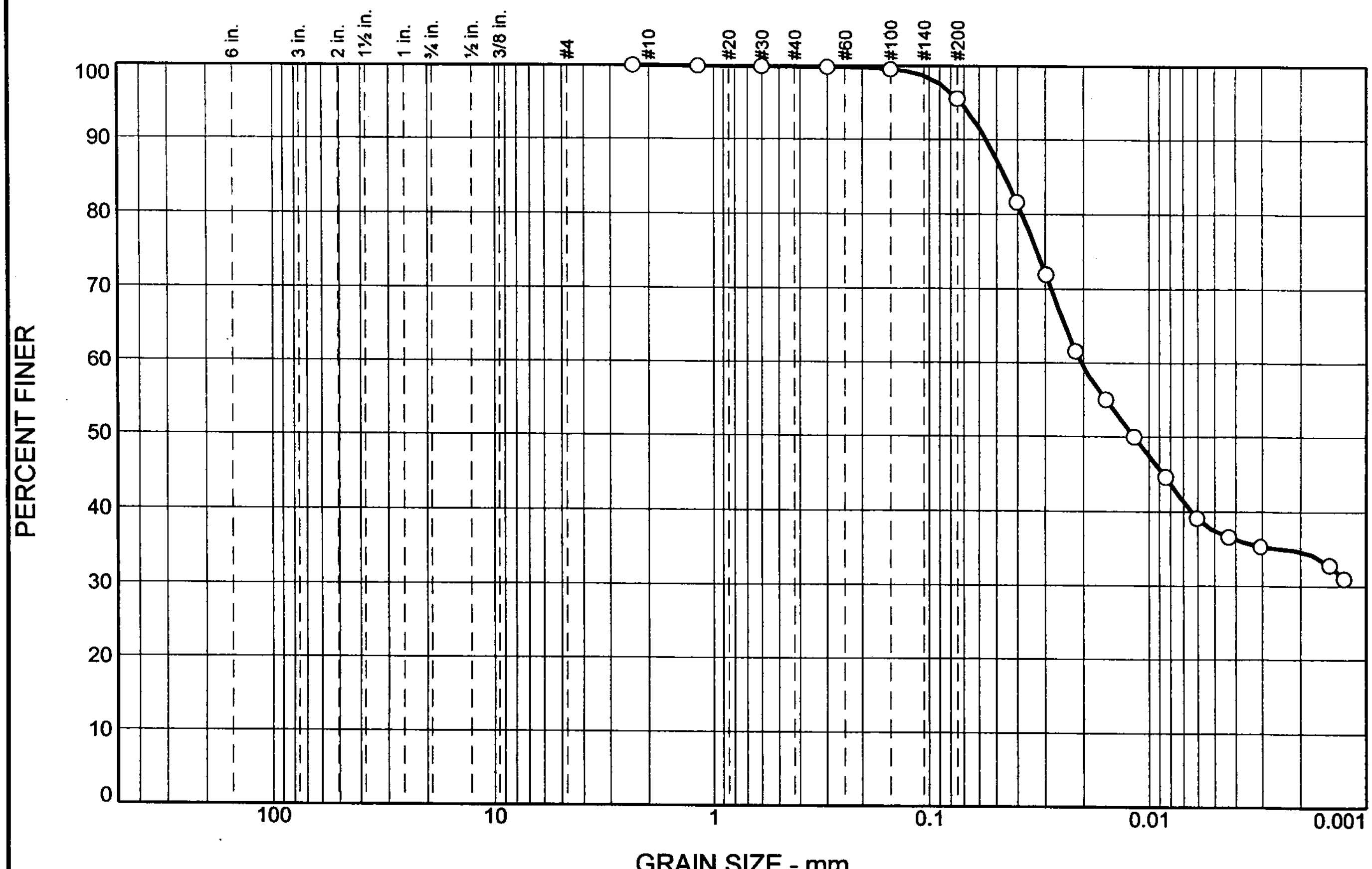
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.5 | 47.3 | 47.6 | 0.0133 | 46.3 | 8.7 | 0.0277 | 94.6 |
| 4.00 | 21.5 | 45.0 | 45.3 | 0.0133 | 44.0 | 9.1 | 0.0200 | 90.0 |
| 8.00 | 21.5 | 42.8 | 43.1 | 0.0133 | 41.8 | 9.4 | 0.0144 | 85.6 |
| 15.00 | 21.5 | 39.2 | 39.5 | 0.0133 | 38.2 | 10.0 | 0.0109 | 78.5 |
| 30.00 | 21.5 | 36.3 | 36.6 | 0.0133 | 35.3 | 10.5 | 0.0079 | 72.7 |
| 60.00 | 21.5 | 34.0 | 34.3 | 0.0133 | 33.0 | 10.9 | 0.0057 | 68.1 |
| 120.00 | 21.6 | 31.2 | 31.5 | 0.0133 | 30.2 | 11.3 | 0.0041 | 62.6 |
| 240.00 | 21.7 | 29.5 | 29.9 | 0.0132 | 28.5 | 11.6 | 0.0029 | 59.3 |
| 1465.00 | 20.7 | 25.8 | 25.9 | 0.0134 | 24.8 | 12.2 | 0.0012 | 51.5 |
| 4320.00 | 20.1 | 24.9 | 24.9 | 0.0135 | 23.9 | 12.4 | 0.0007 | 49.5 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 32.2 | 66.0 | 98.2 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0009 | 0.0032 | 0.0115 | 0.0140 | 0.0200 | 0.0287 |

| Fineness Modulus |
|---|
| 0.00 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 4.3 | 58.1 | 37.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.8 | | |
| .3mm | 99.8 | | |
| .15mm | 99.5 | | |
| .075mm | 95.5 | | |

* (no specification provided)

**Material Description**

CLAY (CL), brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 21 LL= 34 PI= 13

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0455 $D_{60}$= 0.0205 $D_{50}$= 0.0117
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section J **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section J
**Sample Number:** "MCL"
**Material Description:** CLAY (CL), brown, silty
**PL:** 21 **LL:** 34 **PI:** 13
**USCS Classification:** CL
**Tested By:** RTH & JRD **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =43.07
**Tare Wt.** =40.68
**Minus #200 from wash** =95.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.05 | 99.9 |
| | | | .6mm | 0.08 | 99.8 |
| | | | .3mm | 0.11 | 99.8 |
| | | | .15mm | 0.27 | 99.5 |
| | | | .075mm | 2.24 | 95.5 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 24.4 | 40.0 | 41.1 | 0.0128 | 39.0 | 9.9 | 0.0403 | 81.6 |
| 2.00 | 24.4 | 35.1 | 36.2 | 0.0128 | 34.1 | 10.7 | 0.0297 | 71.9 |
| 4.00 | 24.4 | 29.9 | 31.0 | 0.0128 | 28.9 | 11.6 | 0.0218 | 61.6 |
| 8.00 | 24.4 | 26.6 | 27.7 | 0.0128 | 25.6 | 12.1 | 0.0158 | 55.0 |
| 15.00 | 24.6 | 24.0 | 25.2 | 0.0128 | 23.0 | 12.5 | 0.0117 | 50.0 |
| 30.00 | 24.6 | 21.3 | 22.5 | 0.0128 | 20.3 | 13.0 | 0.0084 | 44.6 |
| 60.00 | 24.7 | 18.5 | 19.7 | 0.0128 | 17.5 | 13.4 | 0.0060 | 39.1 |
| 120.00 | 24.8 | 17.2 | 18.4 | 0.0128 | 16.2 | 13.6 | 0.0043 | 36.6 |
| 240.00 | 24.9 | 16.5 | 17.8 | 0.0127 | 15.5 | 13.8 | 0.0031 | 35.3 |
| 1091.00 | 23.1 | 15.8 | 16.5 | 0.0130 | 14.8 | 13.9 | 0.0015 | 32.8 |
| 1440.00 | 25.0 | 14.3 | 15.6 | 0.0127 | 13.3 | 14.1 | 0.0013 | 31.0 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 4.3 | 4.5 | 58.1 | 37.4 | 95.5 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0117 | 0.0205 | 0.0382 | 0.0455 | 0.0556 | 0.0724 |

| Fineness Modulus |
|---|
| 0.01 |

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "CH"
**Material Description:** CLAY (CH), brown to greyish brown, high plastic
**PL:** 29 **LL:** 75 **PI:** 46
**USCS Classification:** CH
**Tested By:** RTH **Test Date:** 12/1/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =34.95
**Tare Wt.** =34.57
**Minus #200 from wash** =99.2%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.03 | 99.9 |
| | | | .6mm | 0.05 | 99.9 |
| | | | .3mm | 0.06 | 99.9 |
| | | | .15mm | 0.12 | 99.8 |
| | | | .075mm | 0.36 | 99.3 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

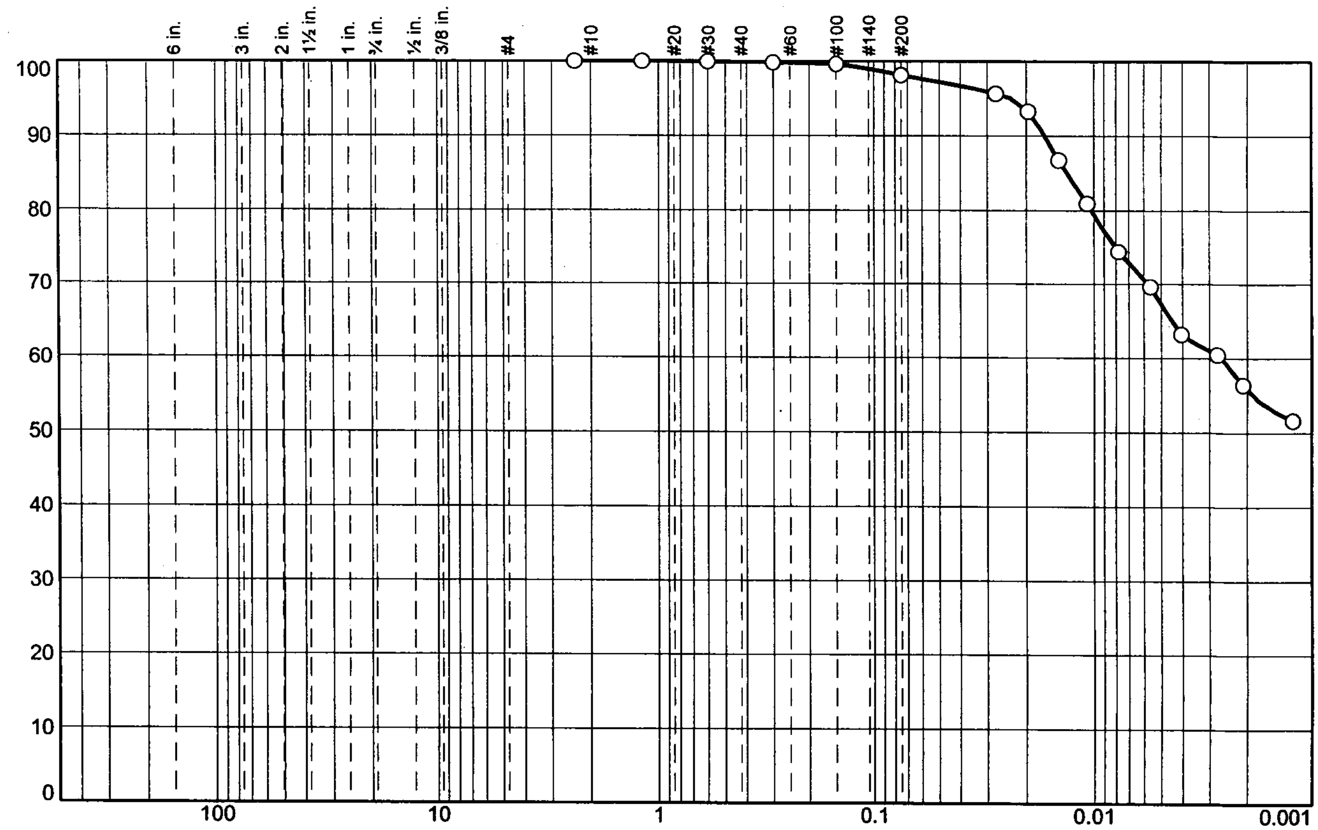
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 8.00 | 22.1 | 49.0 | 49.4 | 0.0132 | 48.0 | 8.4 | 0.0135 | 98.2 |
| 15.00 | 22.1 | 47.1 | 47.5 | 0.0132 | 46.1 | 8.7 | 0.0101 | 94.5 |
| 30.00 | 22.1 | 44.0 | 44.4 | 0.0132 | 43.0 | 9.2 | 0.0073 | 88.3 |
| 60.00 | 22.1 | 41.3 | 41.7 | 0.0132 | 40.3 | 9.7 | 0.0053 | 82.9 |
| 120.00 | 22.2 | 38.2 | 38.7 | 0.0132 | 37.2 | 10.2 | 0.0038 | 76.8 |
| 270.00 | 22.7 | 36.0 | 36.6 | 0.0131 | 35.0 | 10.6 | 0.0026 | 72.7 |
| 473.00 | 23.0 | 34.0 | 34.7 | 0.0130 | 33.0 | 10.9 | 0.0020 | 68.9 |
| 1485.00 | 20.6 | 31.9 | 32.0 | 0.0134 | 30.9 | 11.2 | 0.0012 | 63.6 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.7 | 17.5 | 81.8 | 99.3 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0046 | 0.0060 | 0.0080 | 0.0104 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.8 | 30.8 | 67.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 100.0 | | |
| .6mm | 99.9 | | |
| .3mm | 99.8 | | |
| .15mm | 99.6 | | |
| .075mm | 98.1 | | |

* (no specification provided)

**Material Description**

CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 60 PI= 38

**Classification**

USCS= CH AASHTO=

**Coefficients**

$D_{85}$= 0.0131 $D_{60}$= 0.0026 $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/01/06 **Tested By:** RTH & JRD

**Remarks**

**Sample No.:** "CL" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "CL"
**Material Description:** CLAY (CH), brown to greyish brown, slightly silty, med-high plasticity
**PL:** 22 **LL:** 60 **PI:** 38
**USCS Classification:** CH
**Tested By:** RTH & JRD **Test Date:** 12/01/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =41.82
**Tare Wt.** =40.84
**Minus #200 from wash** =98.0%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.01 | 100.0 |
| | | | .6mm | 0.04 | 99.9 |
| | | | .3mm | 0.09 | 99.8 |
| | | | .15mm | 0.21 | 99.6 |
| | | | .075mm | 0.94 | 98.1 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

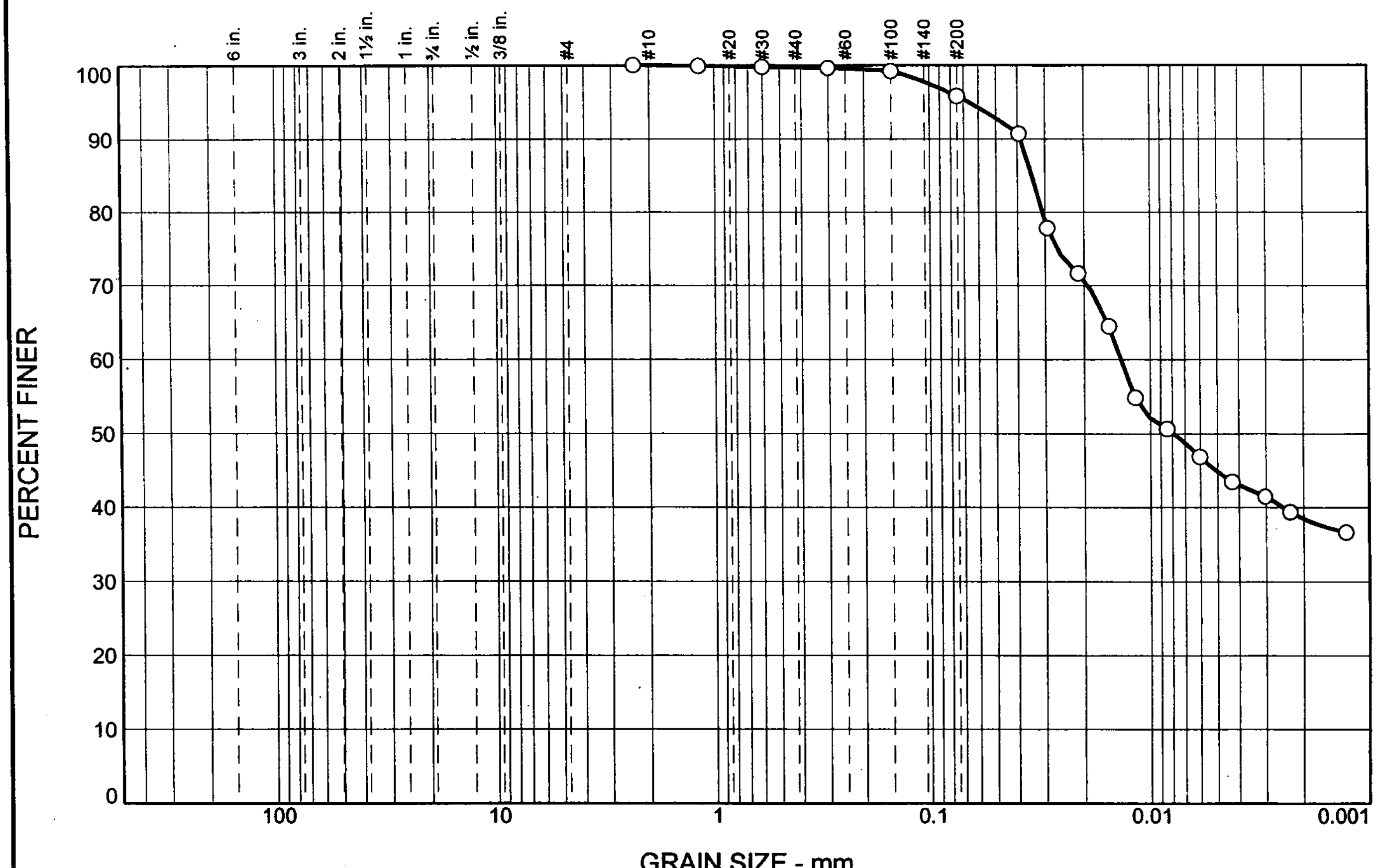
| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 22.1 | 47.7 | 48.1 | 0.0132 | 46.7 | 8.6 | 0.0274 | 95.6 |
| 4.00 | 22.1 | 46.5 | 46.9 | 0.0132 | 45.5 | 8.8 | 0.0196 | 93.3 |
| 8.00 | 22.1 | 43.2 | 43.6 | 0.0132 | 42.2 | 9.4 | 0.0143 | 86.7 |
| 15.00 | 22.1 | 40.3 | 40.7 | 0.0132 | 39.3 | 9.9 | 0.0107 | 80.9 |
| 30.00 | 22.1 | 37.0 | 37.4 | 0.0132 | 36.0 | 10.4 | 0.0078 | 74.4 |
| 60.00 | 22.1 | 34.6 | 35.0 | 0.0132 | 33.6 | 10.8 | 0.0056 | 69.6 |
| 120.00 | 22.3 | 31.3 | 31.8 | 0.0131 | 30.3 | 11.3 | 0.0040 | 63.2 |
| 261.00 | 22.8 | 29.8 | 30.4 | 0.0131 | 28.8 | 11.6 | 0.0028 | 60.4 |
| 464.00 | 23.0 | 27.7 | 28.4 | 0.0130 | 26.7 | 11.9 | 0.0021 | 56.4 |
| 1477.00 | 20.6 | 25.9 | 26.0 | 0.0134 | 24.9 | 12.2 | 0.0012 | 51.7 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.8 | 1.9 | 30.8 | 67.3 | 98.1 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0026 | 0.0102 | 0.0131 | 0.0165 | 0.0234 |

| Fineness Modulus |
|---|
| 0.01 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 51.0 | 44.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 2.36mm | 100.0 | | |
| 1.18mm | 99.9 | | |
| .6mm | 99.7 | | |
| .3mm | 99.6 | | |
| .15mm | 99.2 | | |
| .075mm | 95.8 | | |

* (no specification provided)

**Material Description**

CLAY (CL) brown, silty

**Atterberg Limits (ASTM D 4318)**

PL= 22 LL= 37 PI= 15

**Classification**

USCS= CL AASHTO=

**Coefficients**

$D_{85}$= 0.0345 $D_{60}$= 0.0136 $D_{50}$= 0.0078
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 11/30/06 **Tested By:** JLC & RTH

**Remarks**

**Sample No.:** "MCL" **Source of Sample:** Section K **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** J. Fouse **Title:** P.E.

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

# GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Section K
**Sample Number:** "MCL"
**Material Description:** CLAY (CL) brown, silty
**PL:** 22 **LL:** 37 **PI:** 15
**USCS Classification:** CL
**Tested By:** JLC & RTH **Test Date:** 11/30/06
**Checked By:** J. Fouse **Title:** P.E.
**Sieve opening list:** (Default opening sizes)

**Post #200 Wash Test Weights (grams): Dry Sample and Tare** =42.72
**Tare Wt.** =40.50
**Minus #200 from wash** =95.6%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 50.00 | 0.00 | 0.00 | 2.36mm | 0.00 | 100.0 |
| | | | 1.18mm | 0.07 | 99.9 |
| | | | .6mm | 0.14 | 99.7 |
| | | | .3mm | 0.21 | 99.6 |
| | | | .15mm | 0.42 | 99.2 |
| | | | .075mm | 2.09 | 95.8 |

**Hydrometer test uses material passing#4**
**Percent passing #4 based upon complete sample** =100.0
**Weight of hydrometer sample** =50
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C** =01352
**Meniscus correction only** =-1.0
**Specific gravity of solids** =2.68
**Hydrometer type** =152H
**Hydrometer effective depth equation: L** =16.294964 - 0.164 x Rm

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 1.00 | 23.0 | 45.0 | 45.7 | 0.0130 | 44.0 | 9.1 | 0.0393 | 90.7 |
| 2.00 | 23.0 | 38.5 | 39.2 | 0.0130 | 37.5 | 10.1 | 0.0294 | 77.8 |
| 4.00 | 23.3 | 35.3 | 36.1 | 0.0130 | 34.3 | 10.7 | 0.0212 | 71.6 |
| 8.00 | 23.3 | 31.7 | 32.5 | 0.0130 | 30.7 | 11.3 | 0.0154 | 64.5 |
| 15.00 | 22.8 | 27.0 | 27.6 | 0.0131 | 26.0 | 12.0 | 0.0117 | 54.9 |
| 30.00 | 22.7 | 24.9 | 25.5 | 0.0131 | 23.9 | 12.4 | 0.0084 | 50.7 |
| 60.00 | 22.7 | 23.0 | 23.6 | 0.0131 | 22.0 | 12.7 | 0.0060 | 46.9 |
| 120.00 | 23.0 | 21.2 | 21.9 | 0.0130 | 20.2 | 13.0 | 0.0043 | 43.5 |
| 240.00 | 23.7 | 20.0 | 20.9 | 0.0129 | 19.0 | 13.2 | 0.0030 | 41.5 |
| 418.00 | 23.5 | 19.0 | 19.8 | 0.0130 | 18.0 | 13.3 | 0.0023 | 39.4 |
| 1440.00 | 22.1 | 18.0 | 18.4 | 0.0132 | 17.0 | 13.5 | 0.0013 | 36.6 |

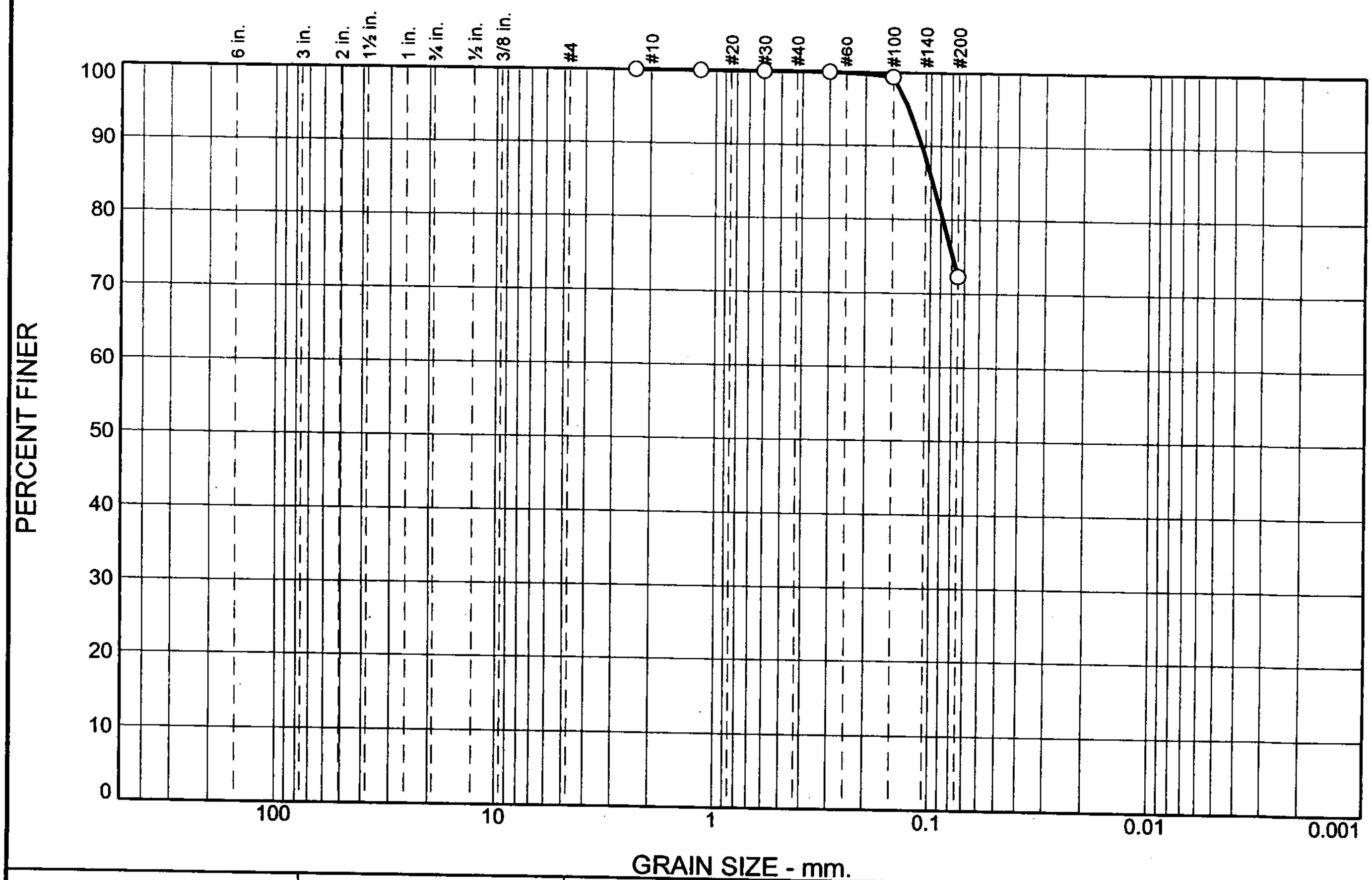
[redacted]

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.8 | 4.2 | 51.0 | 44.8 | 95.8 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0078 | 0.0136 | 0.0310 | 0.0345 | 0.0385 | 0.0663 |

| Fineness Modulus |
|---|
| 0.02 |

# Particle Size Distribution Report - ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.7 | 72.3 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #8 | 100.0 | | |
| #16 | 100.0 | | |
| #30 | 100.0 | | |
| #50 | 100.0 | | |
| #100 | 99.4 | | |
| #200 | 72.3 | | |

* (no specification provided)

**Material Description**

Sandy Silt/Silty Sand Tan Very Fine Grained Silty Sand

**Atterberg Limits (ASTM D 4318)**

PL= LL= PI=

**Classification**

USCS= AASHTO=

**Coefficients**

$D_{85}$= 0.0978 $D_{60}$= $D_{50}$=
$D_{30}$= $D_{15}$= $D_{10}$=
$C_u$= $C_c$=

**Date Tested:** 12/06/06 **Tested By:** RTH

**Remarks**

**Sample No.:** Silty Sand **Source of Sample:** Silty Sand **Date Sampled:**
**Location:** **Elev./Depth:**
**Checked By:** **Title:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project No:** 2005012477 **Figure**

## GRAIN SIZE DISTRIBUTION TEST DATA

1/11/2007

**Client:** Ameren Services
**Project:** Ameren UE Sioux Plant Utility Waste Landfill
**Project Number:** 2005012477
**Location:** Silty Sand
**Sample Number:** Silty Sand
**Material Description:** Sandy Silt/Silty Sand Tan Very Fine Grained Silty Sand
**Tested By:** RTH **Test Date:** 12/06/06
**Sieve opening list:** (Default opening sizes)

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 1138.25 | 0.00 | 0.00 | #8 | 0.00 | 100.0 |
| | | | #16 | 0.00 | 100.0 |
| | | | #30 | 0.10 | 100.0 |
| | | | #50 | 0.22 | 100.0 |
| | | | #100 | 6.95 | 99.4 |
| | | | #200 | 315.12 | 72.3 |

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.7 | 27.7 | | | 72.3 |

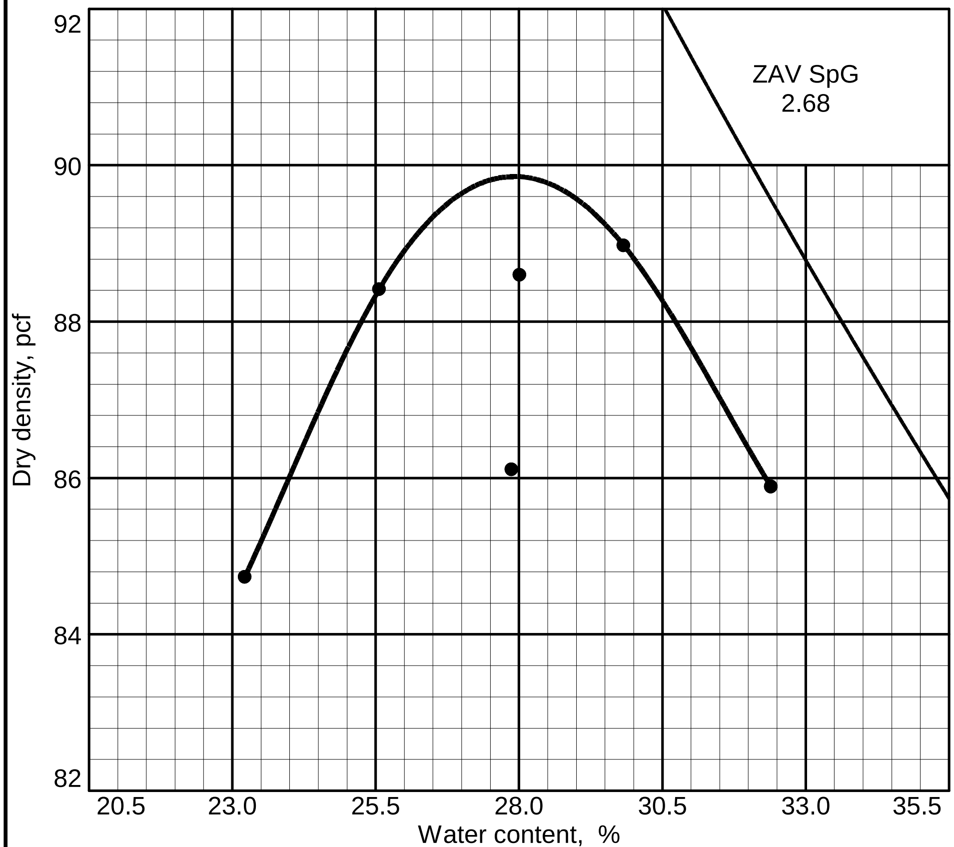
| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 0.0878 | 0.0978 | 0.1100 | 0.1264 |

| Fineness Modulus |
|---|
| 0.01 |

**Appendix 4**

# RESULTS OF STANDARD PROCTOR MOISTURE-DENSITY COMPACTION TESTS ON COMPOSITE SAMPLES

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #1

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 85 **PI** 62
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 11/26/2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.37 | 8.43 | 8.36 | 8.28 | 8.06 | 8.25 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 320.40 | 272.42 | 288.81 | 294.20 | 248.41 | 216.88 |
| **WD + T #1** | 251.19 | 219.13 | 235.11 | 242.47 | 207.87 | 179.16 |
| **TARE #1** | 40.80 | 40.68 | 40.80 | 38.58 | 32.72 | 43.78 |
| **WW + T #2** | 293.91 | 291.54 | 273.49 | 302.63 | 245.38 | 230.96 |
| **WD + T #2** | 232.59 | 233.92 | 221.34 | 248.74 | 206.19 | 190.11 |
| **TARE #2** | 40.28 | 40.47 | 37.58 | 39.44 | 37.93 | 43.60 |
| **MOISTURE** | 32.4 | 29.8 | 28.0 | 25.6 | 23.2 | 27.9 |
| **DRY DENSITY** | 85.9 | 89.0 | 88.6 | 88.4 | 84.7 | 86.1 |

| TEST RESULTS | Material Description |
|---|---|
| Maximum dry density = 89.9 pcf<br>Optimum moisture = 27.9 % | CLAY (CH), dark brownish grey, high plastic |

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #1 **Sample No.:** 1

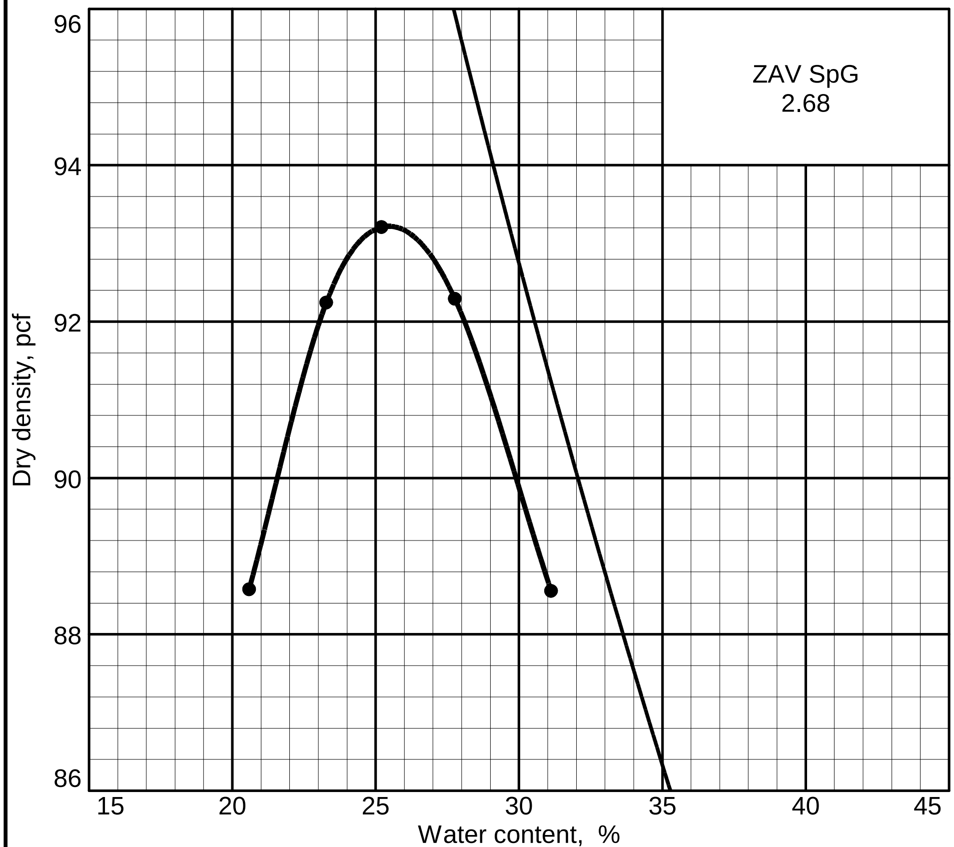
REITZ & JENS, INC.
CONSULTING ENGINEERS

**Remarks:**

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #2

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ___
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ___ **LL** 77 **PI** 53
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ___ **%<No.200** ___
**USCS** CH **AASHTO** ___
**Date Sampled** ___
**Date Tested** 11/30/2006
**Tested By** RTH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.14 | 8.37 | 8.47 | 8.51 | 8.45 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 263.15 | 283.93 | 292.87 | 345.45 | 276.48 | |
| **WD + T #1** | 225.29 | 238.00 | 242.29 | 279.31 | 220.62 | |
| **TARE #1** | 41.32 | 41.01 | 40.67 | 41.13 | 39.44 | |
| **WW + T #2** | 303.06 | 263.55 | 289.01 | 277.83 | 310.28 | |
| **WD + T #2** | 257.81 | 221.50 | 238.80 | 224.74 | 245.88 | |
| **TARE #2** | 38.09 | 40.50 | 40.68 | 33.44 | 40.83 | |
| **MOISTURE** | 20.6 | 23.3 | 25.2 | 27.8 | 31.1 | |
| **DRY DENSITY** | 88.6 | 92.2 | 93.2 | 92.3 | 88.6 | |

### TEST RESULTS

Maximum dry density = 93.2 pcf

Optimum moisture = 25.5 %

### Material Description

CLAY (CH), brownish grey, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

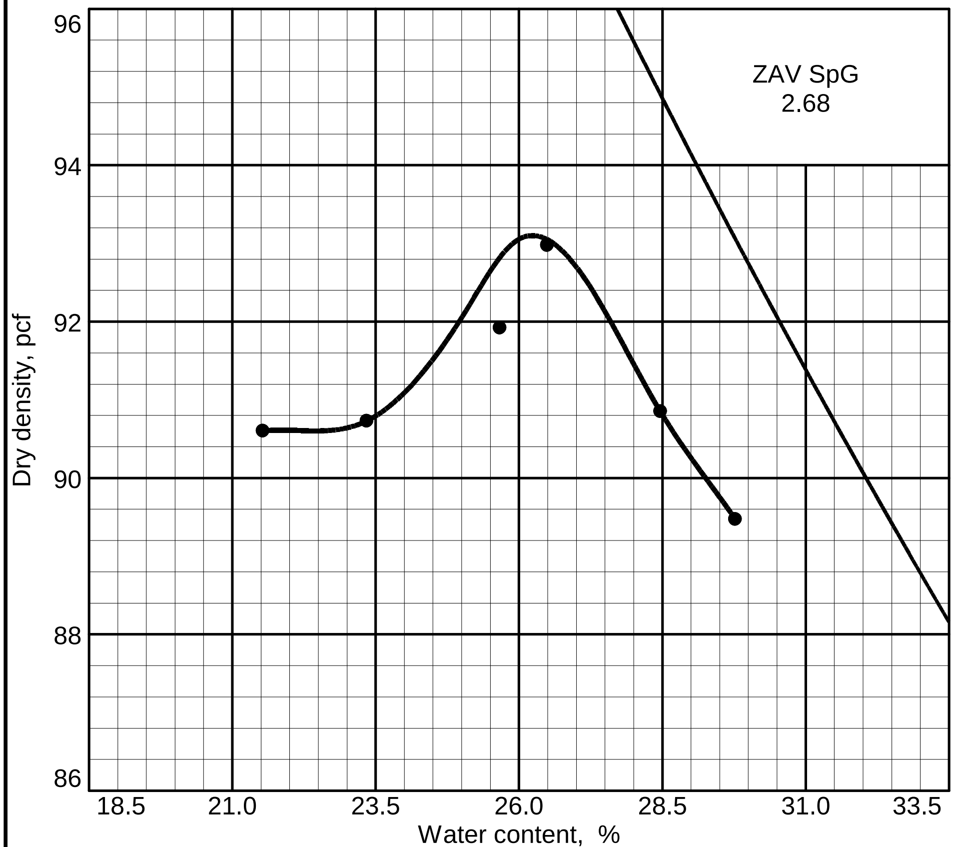
● **Source:** Composite #2 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #3**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 74 **PI** 52
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 01/04/2007
**Tested By** RTH & JJP

## TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.45 | 8.47 | 8.50 | 8.31 | 8.25 | 8.43 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 194.00 | 316.52 | 260.48 | 264.54 | 243.20 | 203.25 |
| **WD + T #1** | 157.16 | 255.84 | 213.62 | 222.02 | 206.94 | 170.45 |
| **TARE #1** | 33.44 | 40.79 | 36.76 | 41.32 | 39.49 | 43.56 |
| **WW + T #2** | 188.67 | 327.15 | 256.33 | 236.54 | 284.92 | 225.18 |
| **WD + T #2** | 154.79 | 263.05 | 211.19 | 198.89 | 241.90 | 188.29 |
| **TARE #2** | 40.94 | 39.77 | 40.76 | 36.31 | 40.90 | 43.48 |
| **MOISTURE** | 29.8 | 28.5 | 26.5 | 23.3 | 21.5 | 25.7 |
| **DRY DENSITY** | 89.5 | 90.9 | 93.0 | 90.7 | 90.6 | 91.9 |

## TEST RESULTS

Maximum dry density = 93.1 pcf

Optimum moisture = 26.2 %

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #3 **Sample No.:** 1

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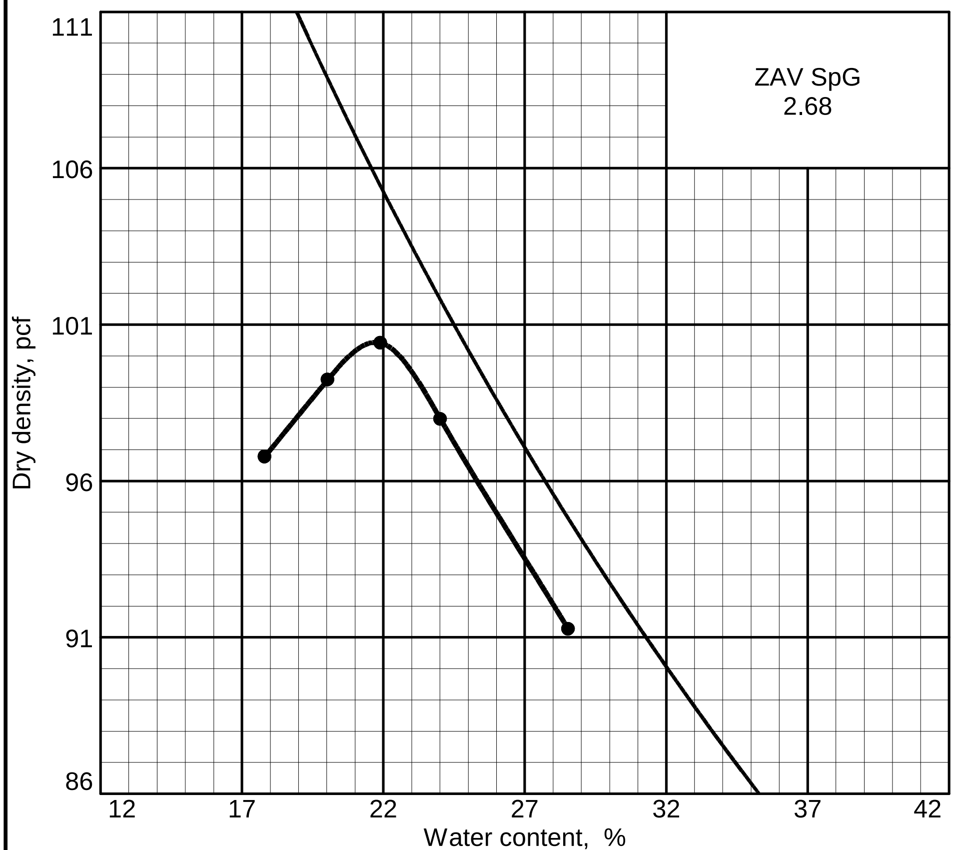
**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #4

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____________
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 54 **PI** 34
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CH **AASHTO** ______
**Date Sampled** ______
**Date Tested** 11/26/2006
**Tested By** RTH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.49 | 8.63 | 8.66 | 8.55 | 8.38 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 328.58 | 243.66 | 204.74 | 240.86 | 219.73 | |
| **WD + T #1** | 264.13 | 204.35 | 174.65 | 207.13 | 192.82 | |
| **TARE #1** | 38.09 | 40.84 | 37.37 | 40.24 | 40.70 | |
| **WW + T #2** | 289.27 | 238.68 | 211.86 | 246.80 | 213.52 | |
| **WD + T #2** | 234.21 | 200.20 | 181.11 | 212.73 | 187.26 | |
| **TARE #2** | 41.32 | 39.73 | 40.58 | 41.04 | 40.71 | |
| **MOISTURE** | 28.5 | 24.0 | 21.9 | 20.0 | 17.8 | |
| **DRY DENSITY** | 91.3 | 98.0 | 100.4 | 99.2 | 96.8 | |

### TEST RESULTS

Maximum dry density = 100.4 pcf

Optimum moisture = 21.7 %

### Material Description

CLAY (CH) brown, with trace silt, med-high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #4 **Sample No.:** 1

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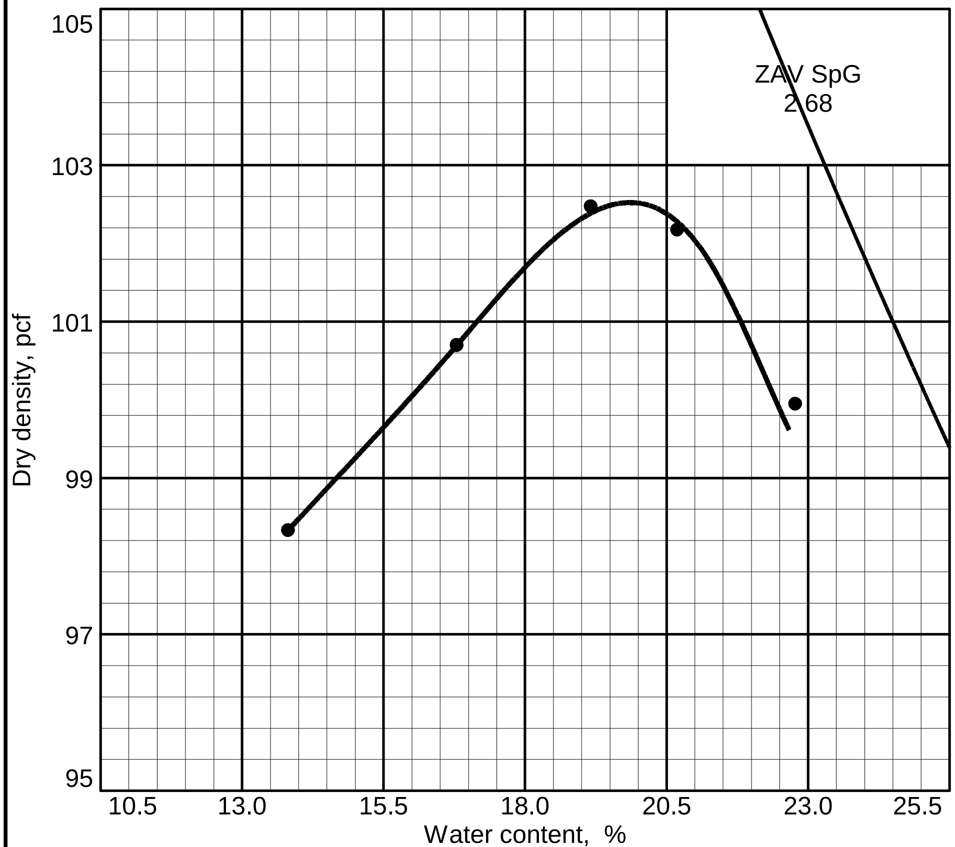
**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #5

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ________

**Hammer Wt.** 5.5 lb.

**Hammer Drop** 12 in.

**Number of Layers** three

**Blows per Layer** 25

**Mold Size** .03333 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** ________ **LL** 42 **PI** 22

**Sp.G. (ASTM D 854)** 2.68

**%>No.4** ________ **%<No.200** ________

**USCS** CL **AASHTO** ________

**Date Sampled** ________

**Date Tested** 11/29/2006

**Tested By** RTH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.67 | 8.69 | 8.65 | 8.50 | 8.31 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 256.14 | 282.53 | 321.53 | 218.32 | 259.39 | |
| **WD + T #1** | 216.18 | 241.82 | 275.55 | 191.99 | 233.30 | |
| **TARE #1** | 40.78 | 43.58 | 34.57 | 34.86 | 44.21 | |
| **WW + T #2** | 248.79 | 270.95 | 206.35 | 263.79 | 264.75 | |
| **WD + T #2** | 209.55 | 231.74 | 178.70 | 232.06 | 237.91 | |
| **TARE #2** | 37.18 | 43.60 | 35.06 | 43.56 | 43.78 | |
| **MOISTURE** | 22.8 | 20.7 | 19.2 | 16.8 | 13.8 | |
| **DRY DENSITY** | 100.0 | 102.2 | 102.5 | 100.7 | 98.3 | |

### TEST RESULTS

Maximum dry density = 102.5 pcf

Optimum moisture = 19.9 %

### Material Description

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services

**Project:** Sioux Plant UWLF

● **Source:** Composite #5 **Sample No.:** 1

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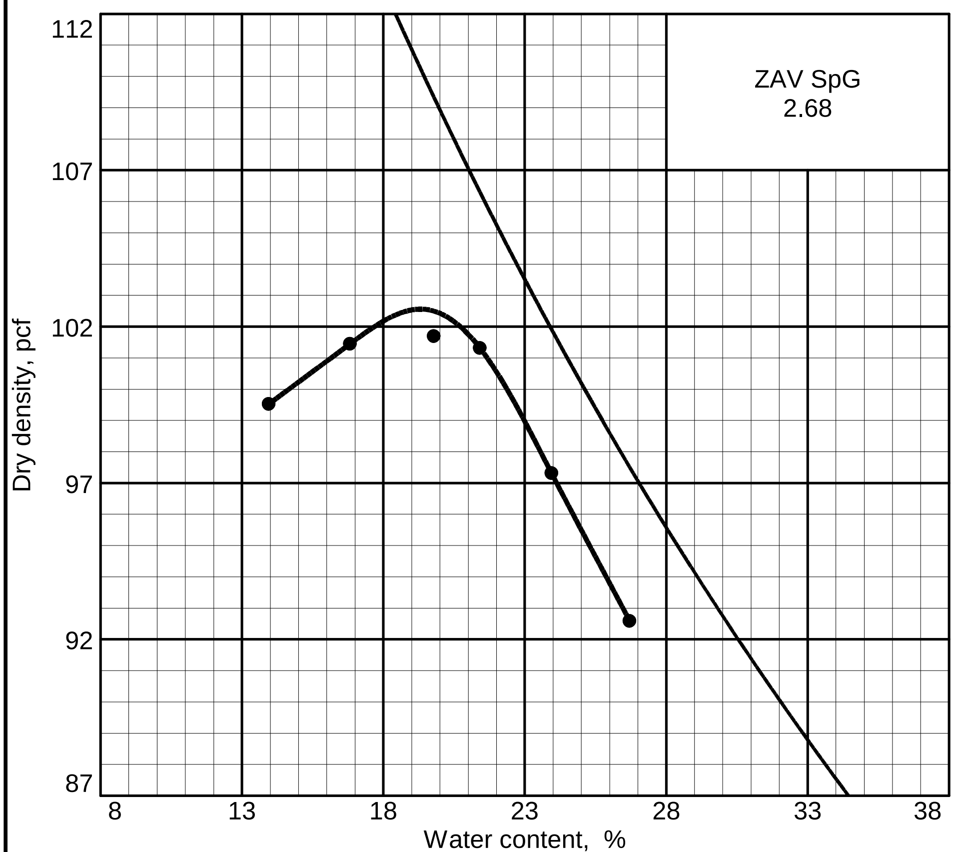
**Checked by:** KEK

**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #6**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ____ **LL** 40 **PI** 18
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ____ **%<No.200** ____
**USCS** CL **AASHTO** ____
**Date Sampled** ____
**Date Tested** 12/26/2006
**Tested By** JJP & RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.36 | 8.64 | 8.68 | 8.60 | 8.49 | 8.53 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 159.09 | 249.57 | 401.17 | 373.73 | 311.04 | 174.18 |
| **WD + T #1** | 144.84 | 215.57 | 337.96 | 308.58 | 253.44 | 155.20 |
| **TARE #1** | 43.58 | 43.66 | 40.84 | 36.76 | 37.73 | 43.48 |
| **WW + T #2** | 169.78 | 345.50 | 382.75 | 375.78 | 290.25 | 149.27 |
| **WD + T #2** | 154.45 | 295.15 | 322.01 | 311.16 | 236.93 | 134.18 |
| **TARE #2** | 43.60 | 40.70 | 40.24 | 40.94 | 37.31 | 43.56 |
| **MOISTURE** | 14.0 | 19.8 | 21.4 | 23.9 | 26.7 | 16.8 |
| **DRY DENSITY** | 99.5 | 101.7 | 101.3 | 97.3 | 92.6 | 101.4 |

**TEST RESULTS**

Maximum dry density = 102.6 pcf

Optimum moisture = 19.3 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #6 **Sample No.:** 1

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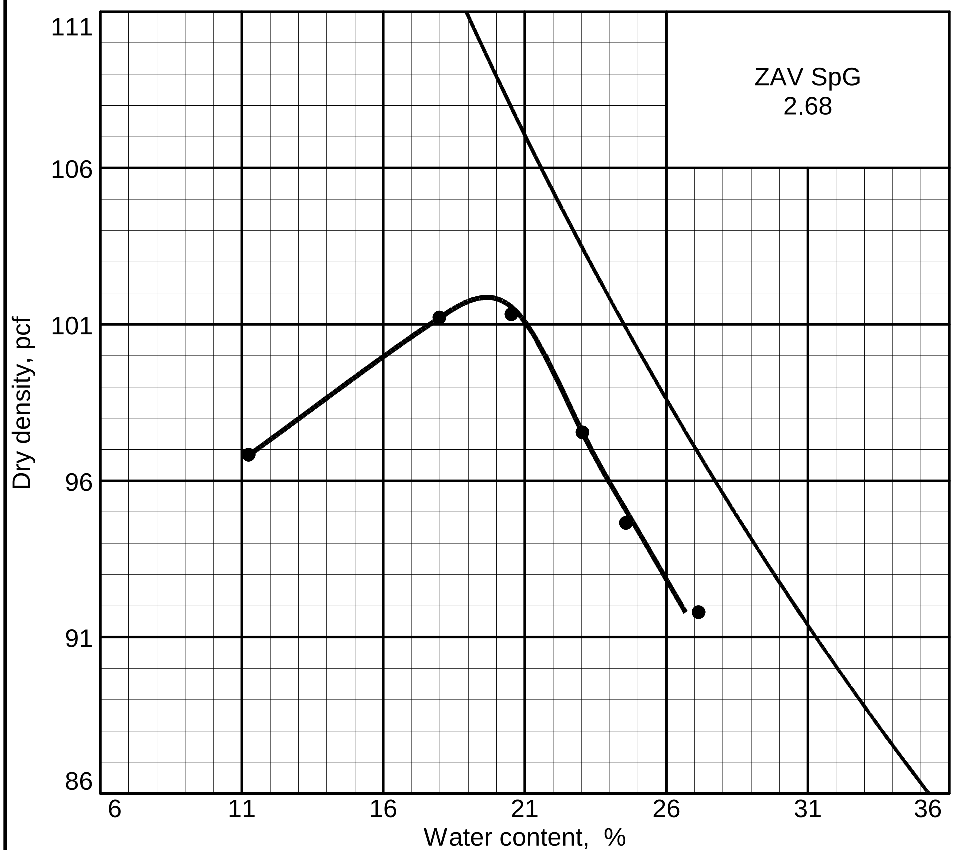
**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #7**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 36 **PI** 14
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CL **AASHTO** ______
**Date Sampled** ______
**Date Tested** 11-30-2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.65 | 8.47 | 8.58 | 8.51 | 8.56 | 8.17 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 344.04 | 327.90 | 314.93 | 388.66 | 307.05 | 142.97 |
| **WD + T #1** | 292.51 | 266.10 | 263.40 | 319.36 | 266.39 | 131.56 |
| **TARE #1** | 40.58 | 37.93 | 40.63 | 37.58 | 40.88 | 35.05 |
| **WW + T #2** | 292.23 | 284.49 | 289.12 | 362.27 | 322.88 | 149.80 |
| **WD + T #2** | 249.29 | 232.13 | 242.77 | 298.96 | 279.97 | 138.70 |
| **TARE #2** | 40.84 | 39.73 | 40.76 | 41.35 | 40.71 | 34.64 |
| **MOISTURE** | 20.5 | 27.1 | 23.0 | 24.6 | 18.0 | 11.2 |
| **DRY DENSITY** | 101.3 | 91.8 | 97.5 | 94.6 | 101.2 | 96.8 |

**TEST RESULTS**

Maximum dry density = 101.9 pcf

Optimum moisture = 19.7 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #7 **Sample No.:** 1

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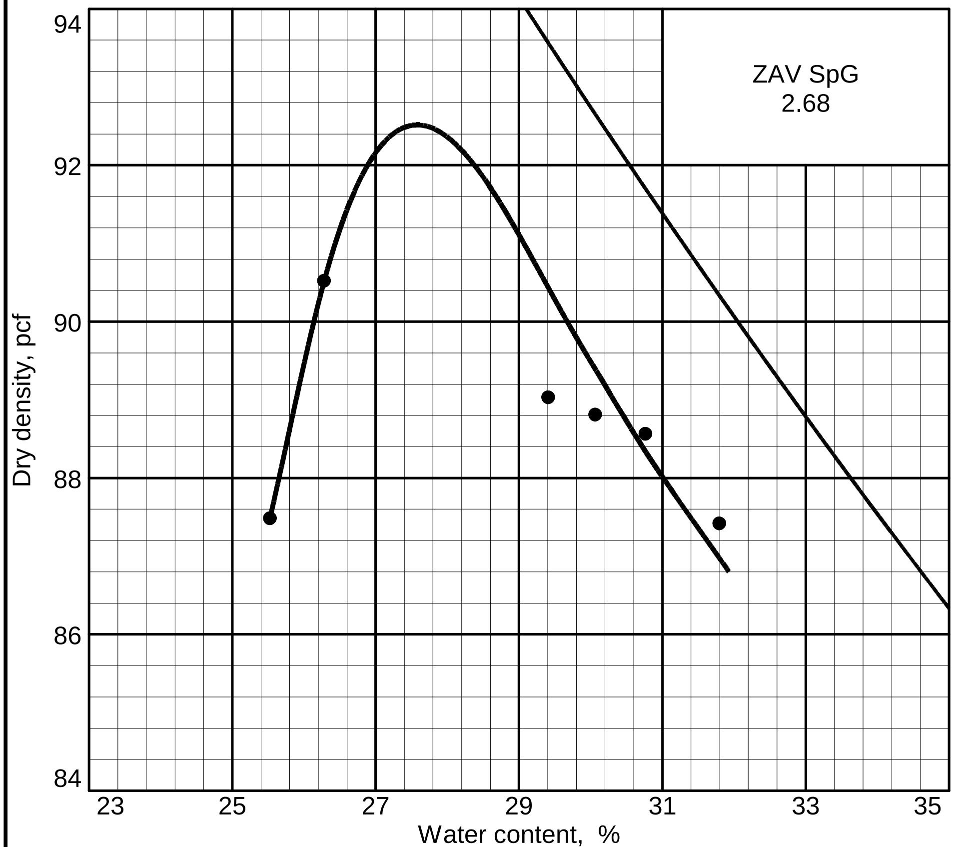
**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #8**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ____ **LL** 80 **PI** 58
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ____ **%<No.200** ____
**USCS** CH **AASHTO** ____
**Date Sampled** ____
**Date Tested** 01/04/2007
**Tested By** RTH & JJP

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.42 | 8.39 | 8.43 | 8.44 | 8.42 | 8.24 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 201.74 | 319.72 | 208.06 | 320.62 | 322.96 | 167.85 |
| **WD + T #1** | 161.42 | 261.94 | 168.22 | 254.40 | 259.09 | 140.82 |
| **TARE #1** | 35.08 | 40.47 | 35.05 | 37.40 | 40.70 | 34.64 |
| **WW + T #2** | 183.57 | 322.42 | 204.58 | 318.65 | 301.78 | 179.22 |
| **WD + T #2** | 147.80 | 263.47 | 165.21 | 252.84 | 242.23 | 149.81 |
| **TARE #2** | 34.88 | 40.80 | 34.91 | 40.63 | 40.83 | 34.89 |
| **MOISTURE** | 31.8 | 26.3 | 30.1 | 30.8 | 29.4 | 25.5 |
| **DRY DENSITY** | 87.4 | 90.5 | 88.8 | 88.6 | 89.0 | 87.5 |

**TEST RESULTS**

Maximum dry density = 92.5 pcf

Optimum moisture = 27.6 %

**Material Description**

CLAY (CH), brown to greyish brown, high plastic

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #8 **Sample No.:** 1

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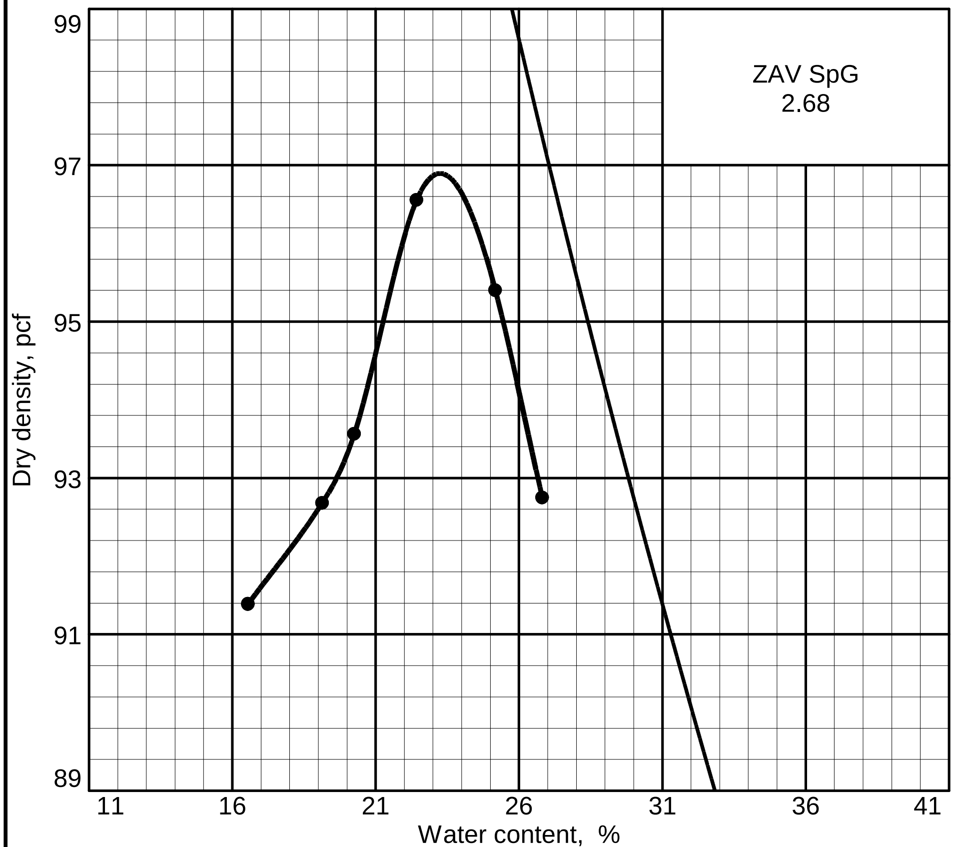
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #9

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ____
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ____ **LL** 61 **PI** 41
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ____ **%<No.200** ____
**USCS** CH **AASHTO** ____
**Date Sampled** ____
**Date Tested** 12/04/2006
**Tested By** RTH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.52 | 8.33 | 8.26 | 8.13 | 8.50 | 8.56 |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 |
| **WW + T #1** | 294.07 | 325.99 | 308.32 | 334.93 | 300.99 | 344.94 |
| **WD + T #1** | 247.63 | 277.78 | 264.93 | 293.18 | 246.27 | 283.51 |
| **TARE #1** | 40.84 | 40.80 | 36.76 | 40.28 | 40.84 | 40.79 |
| **WW + T #2** | 326.88 | 311.62 | 298.86 | 336.40 | 298.69 | 341.95 |
| **WD + T #2** | 274.00 | 266.16 | 257.22 | 294.42 | 243.80 | 281.67 |
| **TARE #2** | 37.93 | 40.68 | 40.88 | 41.32 | 40.30 | 40.84 |
| **MOISTURE** | 22.4 | 20.3 | 19.1 | 16.5 | 26.8 | 25.2 |
| **DRY DENSITY** | 96.6 | 93.6 | 92.7 | 91.4 | 92.8 | 95.4 |

**TEST RESULTS**

Maximum dry density = 96.9 pcf

Optimum moisture = 23.2 %

**Material Description**

CLAY (CH), brownish grey, moderately high plastic, trace silt

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Composite #9 **Sample No.:** 1

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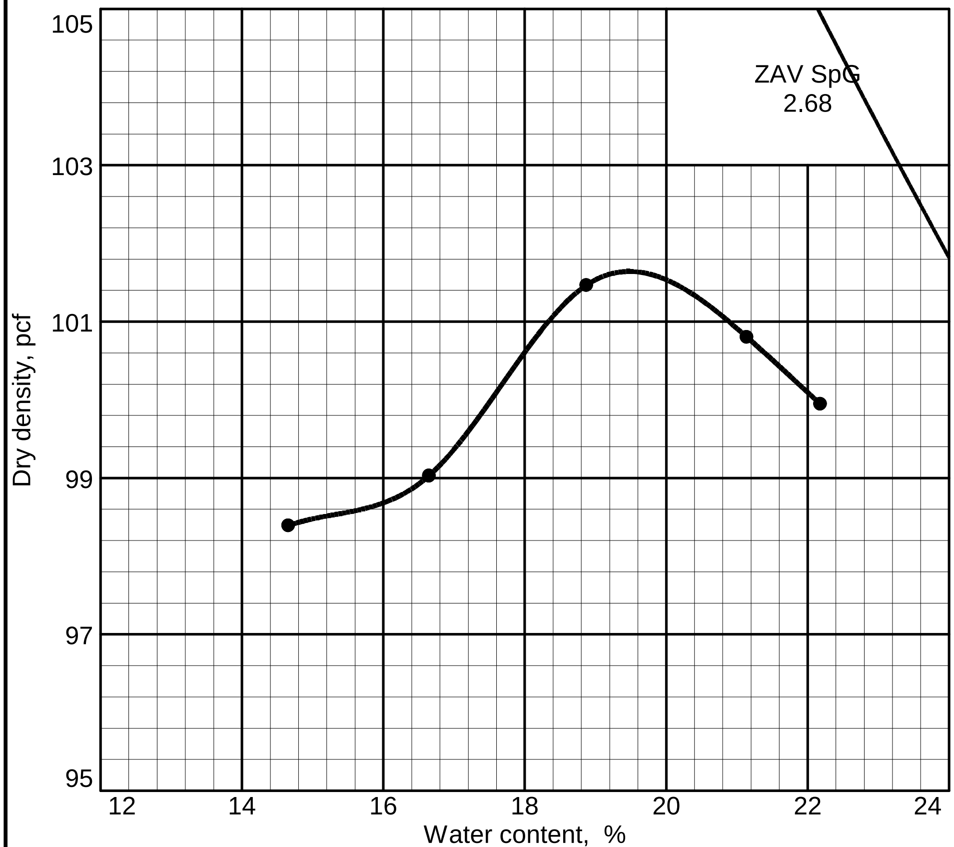
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




## Curve No.
## Composite #10

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 42 **PI** 25
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** CL **AASHTO** ______
**Date Sampled** ______
**Date Tested** 12/26/2006
**Tested By** RTH & JJP

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.65 | 8.65 | 8.60 | 8.43 | 8.34 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 127.16 | 309.62 | 313.73 | 329.25 | 331.10 | |
| **WD + T #1** | 109.88 | 262.10 | 270.22 | 288.02 | 293.95 | |
| **TARE #1** | 30.58 | 37.58 | 39.77 | 40.78 | 40.24 | |
| **WW + T #2** | 125.33 | 294.21 | 324.38 | 333.49 | 263.89 | |
| **WD + T #2** | 108.68 | 250.01 | 278.40 | 291.30 | 234.78 | |
| **TARE #2** | 34.88 | 40.67 | 34.57 | 37.31 | 36.31 | |
| **MOISTURE** | 22.2 | 21.1 | 18.9 | 16.6 | 14.7 | |
| **DRY DENSITY** | 99.9 | 100.8 | 101.5 | 99.0 | 98.4 | |

**TEST RESULTS**

Maximum dry density = 101.6 pcf

Optimum moisture = 19.5 %

**Material Description**

CLAY (CL), brown, silty

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

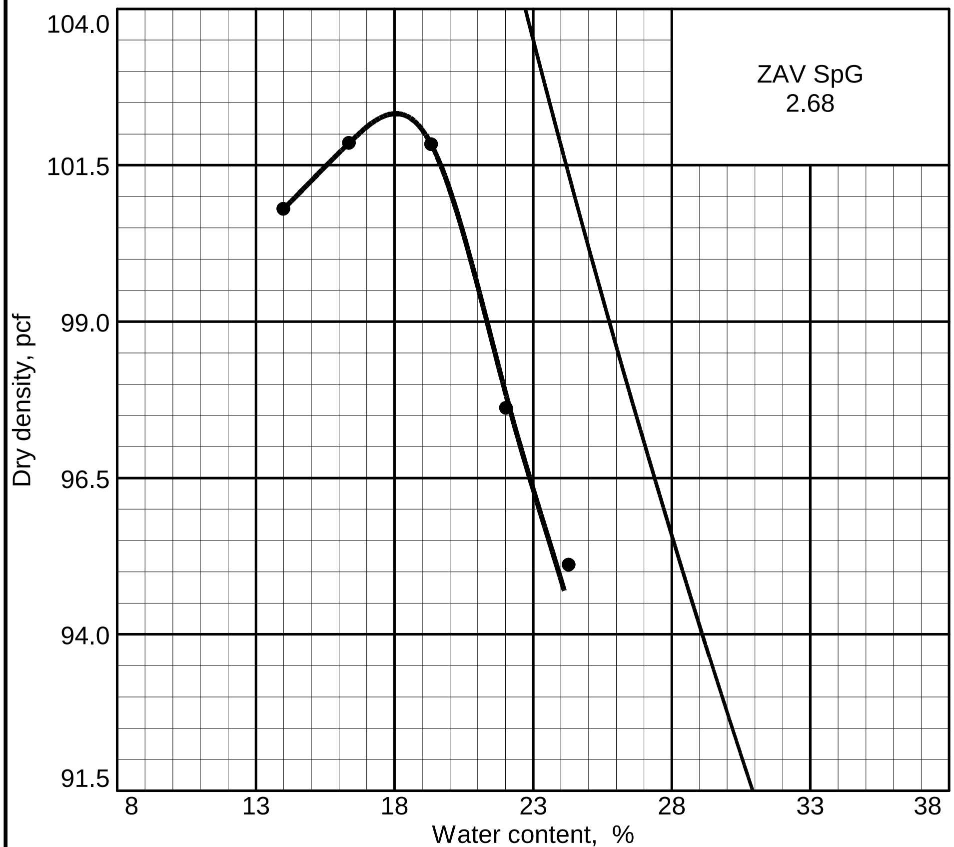
● **Source:** Composite #10 **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Composite #7.a**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** 30 **PI** 7
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** ML **AASHTO** ______
**Date Sampled** ______
**Date Tested** 01/02/2007
**Tested By** JJP

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.52 | 8.55 | 8.63 | 8.53 | 8.41 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 152.29 | 134.87 | 134.02 | 133.39 | 129.53 | |
| **WD + T #1** | 126.76 | 114.53 | 116.46 | 118.27 | 116.13 | |
| **TARE #1** | 21.80 | 22.25 | 22.26 | 22.44 | 22.07 | |
| **WW + T #2** | 165.77 | 151.01 | 152.42 | 144.56 | 133.37 | |
| **WD + T #2** | 137.77 | 127.80 | 130.73 | 126.82 | 119.88 | |
| **TARE #2** | 22.30 | 22.29 | 22.30 | 22.04 | 21.79 | |
| **MOISTURE** | 24.3 | 22.0 | 19.3 | 16.4 | 14.0 | |
| **DRY DENSITY** | 95.1 | 97.6 | 101.8 | 101.9 | 100.8 | |

**TEST RESULTS**

Maximum dry density = 102.3 pcf

Optimum moisture = 18.0 %

**Material Description**
SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand

**Remarks:**
70% Composite #7 with 30% silty fine sand

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

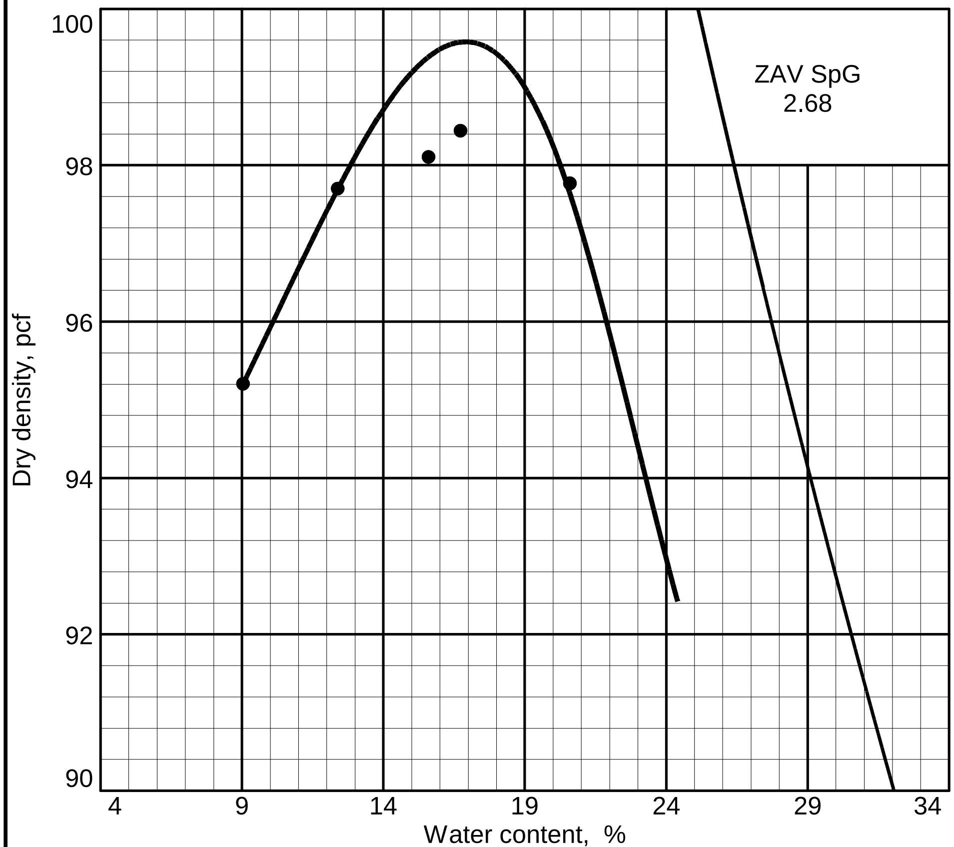
● **Source:** Composite#7(70%) & silty fine **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

# MOISTURE-DENSITY TEST REPORT




**Curve No.**
**Silty Fine Sand**

**Test Specification:**
ASTM D 698-00a Method A Standard

**Preparation Method** ______
**Hammer Wt.** 5.5 lb.
**Hammer Drop** 12 in.
**Number of Layers** three
**Blows per Layer** 25
**Mold Size** .03333 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** ______ **LL** ______ **PI** ______
**Sp.G. (ASTM D 854)** 2.68
**%>No.4** ______ **%<No.200** ______
**USCS** ______ **AASHTO** ______
**Date Sampled** ______
**Date Tested** 01/02/2007
**Tested By** JJP

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 8.04 | 8.51 | 8.41 | 8.36 | 8.24 | |
| **WM** | 4.58 | 4.58 | 4.58 | 4.58 | 4.58 | |
| **WW + T #1** | 131.20 | 177.62 | 171.70 | 226.85 | 210.00 | |
| **WD + T #1** | 122.87 | 153.38 | 151.99 | 202.17 | 191.64 | |
| **TARE #1** | 35.16 | 35.03 | 34.96 | 43.60 | 43.78 | |
| **WW + T #2** | 155.40 | 182.58 | 165.78 | 218.14 | 201.57 | |
| **WD + T #2** | 145.88 | 157.25 | 147.12 | 194.61 | 184.18 | |
| **TARE #2** | 34.96 | 35.06 | 34.86 | 44.21 | 43.66 | |
| **MOISTURE** | 9.0 | 20.6 | 16.7 | 15.6 | 12.4 | |
| **DRY DENSITY** | 95.2 | 97.8 | 98.4 | 98.1 | 97.7 | |

**TEST RESULTS**

Maximum dry density = 99.6 pcf

Optimum moisture = 16.9 %

**Material Description**

SAND (SM) light brown, silty, fine grained

**Remarks:**

**Project No.** 2005012477 **Client:** Ameren Services
**Project:** Sioux Plant UWLF

● **Source:** Silty Fine Sand **Sample No.:** 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Checked by:** KEK
**Title:** P.E.

**Figure**

**Appendix 5**

# RESULTS OF FLEXIBLE-WALL HYDRAULIC CONDUCTIVITY TESTS ON COMPACTED COMPOSITE SAMPLES

Ameren - S Power Plant
Utility Waste Disposal Area

**Test Pit Summary Table**

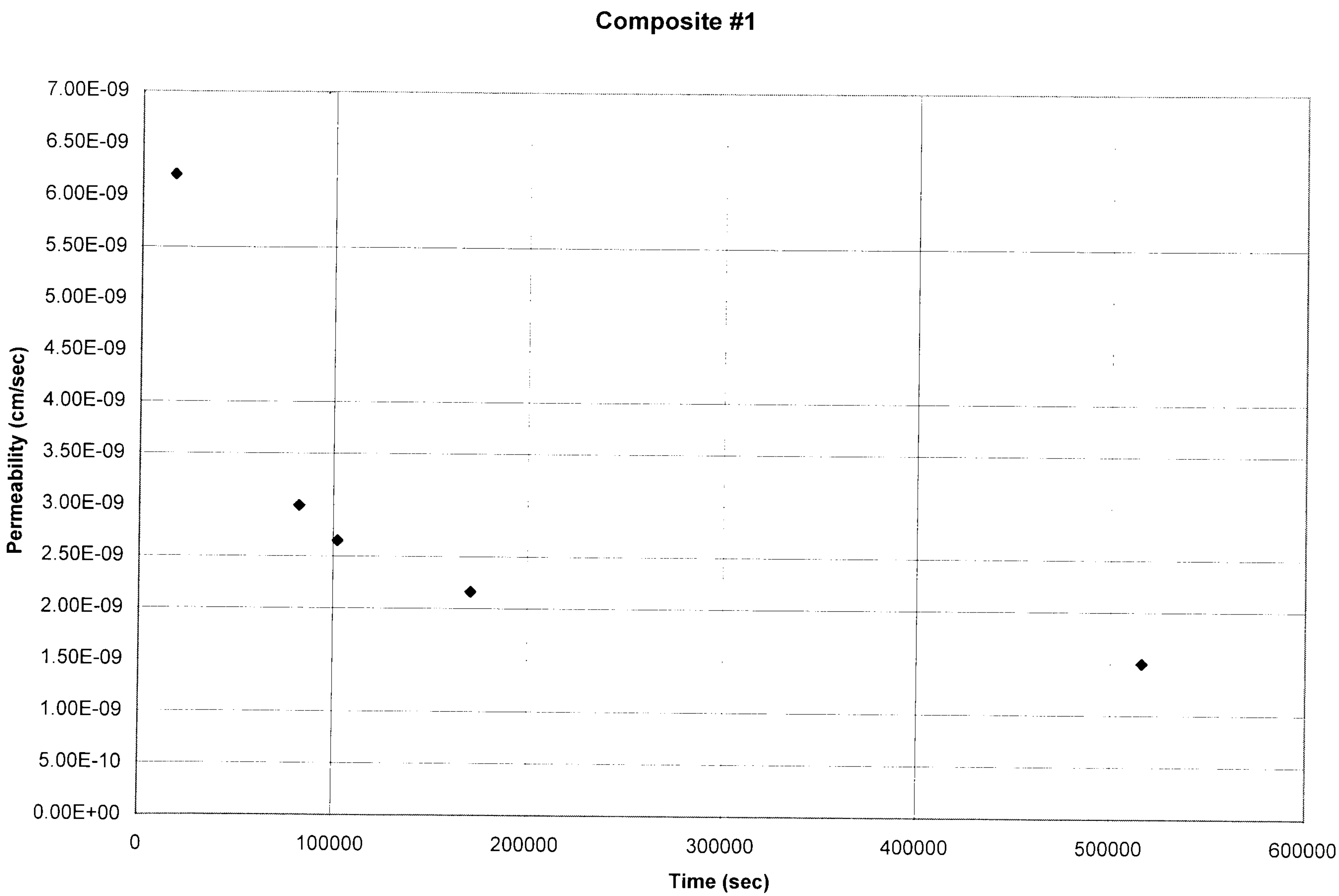
| | | | | Standard Proctor | | Permeability Sample | | |
|---|---|---|---|---|---|---|---|---|
| Composite # | USCS Class | Liquid Limit | Plastic Index | Maximum Dry Density (ASTM D-698) pcf | Optimum Moisture (ASTM D-698) | Dry Density (pcf) | Moisture Content | k (cm/sec) |
| 1 | CH | 85 | 62 | 89.9 | 27.9% | 90.7 | 29.3% | 1.5E-09 |
| 2 | CH | 77 | 53 | 93.2 | 25.5% | 93.7 | 27.1% | 2.2E-09 |
| 3 | CH | 74 | 52 | 93.0 | 26.3% | 92.7 | 28.2% | 1.9E-09 |
| 4 | CH | 54 | 34 | 100.4 | 21.7% | 100.5 | 23.8% | 3.0E-09 |
| 5 | CL | 42 | 22 | 102.5 | 19.6% | 103.7 | 20.6% | 2.7E-08 |
| 6 | CL | 40 | 18 | 101.7 | 20.2% | 94.2 | 26.5% | 1.7E-08 |
| 7 | CL | 36 | 14 | 101.7 | 19.5% | 96.1 | 25.0% | 2.3E-07 |
| 8 | CH | 80 | 58 | 90.6 | 26.5% | 91.3 | 27.8% | 3.6E-09 |
| 9 | CH | 61 | 41 | 96.9 | 23.2% | 95.2 | 26.5% | 2.8E-09 |
| 10 | CL | 42 | 25 | 101.6 | 19.4% | 99.2 | 22.3% | 1.6E-08 |
| 70% Composite #7 plus 30% fine sand | CL | 30 | 23 | 102.3 | 18.0% | 98.1 | 23.6% | 4.5E-07 |
| Silty Fine Sand | ML | | | 99.6 | 16.9% | 99.7 | 19.1% | 2.5E-05 |

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #1
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 117.3 (lbs/ft^3) | Wet Density = 116.8 (lbs/ft^3) |
| % Moisture = 29.3% | % Moisture = 35.0% |
| Dry Density = 90.7 (lbs/ft^3) | Dry Density = 86.5 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.359563 |
| A (cm^2)= | 20.662032 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/27/2006 | 9:05 | 0 | 10.7 | 10.00 | 27.200 | 0.00 | 78.000 | 240.770 | 20.9 | | | | |
| | 13:50 | 17100 | 10.8 | 9.93 | 27.556 | 0.06 | 77.695 | 240.110 | 21.7 | 21.30 | 6.40E-09 | 0.9693013 | 6.20E-09 |
| 12/28/2006 | 8:00 | 82500 | 11.0 | 9.81 | 28.165 | 0.11 | 77.441 | 239.246 | 20.1 | 20.98 | 3.06E-09 | 0.9766988 | 2.99E-09 |
| | 13:30 | 102300 | 10.9 | 9.81 | 28.165 | 0.14 | 77.289 | 239.094 | 22.7 | 21.06 | 2.72E-09 | 0.9748066 | 2.65E-09 |
| 12/29/2006 | 8:30 | 170700 | 11.2 | 9.73 | 28.572 | 0.18 | 77.086 | 238.484 | 20.2 | 21.22 | 2.23E-09 | 0.9711948 | 2.16E-09 |
| 1/2/2007 | 8:30 | 516300 | 11.7 | 9.56 | 29.435 | 0.48 | 75.562 | 236.096 | 19.7 | 20.37 | 1.51E-09 | 0.9912832 | 1.50E-09 |



Composite #1
Permeability (cm/sec)
7.00E-09
6.50E-09
6.00E-09
5.50E-09
5.00E-09
4.50E-09
4.00E-09
3.50E-09
3.00E-09
2.50E-09
2.00E-09
1.50E-09
1.00E-09
5.00E-10
0.00E+00
0
100000
200000
300000
400000
500000
600000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ameron Sioux UWLF
Location-
Sample--- Composite #1
Depth-----

a=
A=
L=

Cell No. 3

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 92.7 | 85.0 | 87.7 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-27-06 | 9:05 | 0 | 10.7 | 10.00 | 0.00 | | | | 20.9 | |
| | 13:50 | 285 | 10.75 | 9.93 | 0.06 | | | | 21.7 | |
| 12-28-06 | 8:00 | 1375 | 11.00 | 9.81 | 0.11 | | | | 20.1 | |
| | 13:30 | 1705 | 10.85 | 9.81 | 0.14 | | | | 22.7 | |
| 12-29-06 | 8:30 | 2845 | 11.20 | 9.73 | 0.18 | | | | 20.2 | |
| 1-2-07 | 8:30 | 8605 | 11.65 | 9.56 | 0.48 | | | | 19.7 | |
| | | | | | | | | | | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Amoren Sioux MWLF — Date: 11-28-06

Sample: Composite #1 — Depth: Standard Proctor +12% Moisture

Description: CLAY (CH), Brown & Grey, High Plastic

Type of Test: Hyd. Cond. — Confining Pressure Differential: ______

Cell Number: 3 — Saturate (before) after Consolidation: ______

Number of Membranes: 2 — Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | — |
| at saturation start | — |
| at consolidation start | |
| at axial load start | |

## MOISTURE CONTENT

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M34 | 43 | |
| Wet Wt. + Tare | 93.48 | 103.14 | |
| Dry Wt. + Tare | 77.42 | 84.66 | |
| Wt. Water | | | |
| Tare Wt. | 22.37 | 21.93 | |
| Dry Soil Wt. | | | |
| Moisture % | 29.173 | 29.480 | |
| Avg. w % | 29.3265 | | |

## MASS PROPERTIES

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 389.61 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

## SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.2235 | 3.2[illegible] | T 2.0000 | 2.0175 |
| 2 | 3.2210 | 3.2925 | M 1.9890 | 2.0165 |
| 3 | 3.2170 | 3.2930 | B 1.9910 | 2.0240 |
| Avg. | 3.2205<br>8.16007 | 3.29117<br>8.359563 | 1.99333<br>5.0631 | 2.019333<br>5.129107 |

A = 20.1345
V = 164.6

Description After Test: Final wt = 323.09 — $V_t$ = 164.69

$M_s$ = 239.402 — $M_w$ = 70.208

e = 0.8436397

Remarks:

| Initial | Final |
|---|---|
| $\gamma_{moist}$ = 117.3 | $\gamma_{moist}$ = 116.76 |
| $\gamma_{dry}$ = 90.7 | $\gamma_{dry}$ 86.5 |
| %m = 29.3 | %m 35.0 |

Failure Sketch

Trimmed By: KOL
Trimmed Date: 11-28-06
Setup By: KOL
Setup Date: 11-28-06
Taken Down By: ______
Take Down Date: ______

trxSTUP.dwg revl. /12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT: Ameren Sioux UWLF

SAMPLE: Composite #1 DEPTH: ______

INITIAL CELL PRESSURE: 71.0 START DATE: 11-28-06

INITIAL PORE PRESSURE: 70.0 CELL NUMBER: 3

INITIAL TRANSDUCER READING: 71.1 TRANSDUCER NUMBER: 3

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE (Transducer Constant ______): CELL DELTA (1) | TRANSDUCER: READING CHANGE | TRANSDUCER: PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-5-06 | 0 | 2.04 | 71.0 | 70.7 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 2 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 76.0 | 75.3 | 5.0 | | 4.6 | 0.92 |
| | | Continue to | Saturate | | | | | |
| 12-8-06 | 0 | 4.07 | 76.0 | 76.1 | | | | |
| | 1 | | 81.0 | 80.6 | 5.0 | | 4.5 | 0.90 |
| | 2 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 81.0 | 80.7 | 5.0 | | 4.6 | 0.92 |
| | | | Continue to | Sat. | | | | |
| 12-18-06 | 0 | 2.33 | 81.0 | 81.5 | | | | |
| | 1 | | 86.0 | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 2 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 4 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| | 8 | | ↓ | 86.2 | 5.0 | | 4.7 | 0.94 |
| 12-26-06 | 0 | 8.90 | 90.0 | 84.7 | | | | |
| | 1 | | 95.0 | 89.2 | 5.0 | | 4.5 | 0.90 |
| | 2 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |
| | 4 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |
| | 8 | | 95.0 | 89.3 | 5.0 | | 4.6 | 0.92 |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWLF

SAMPLE Composite #1 DEPTH

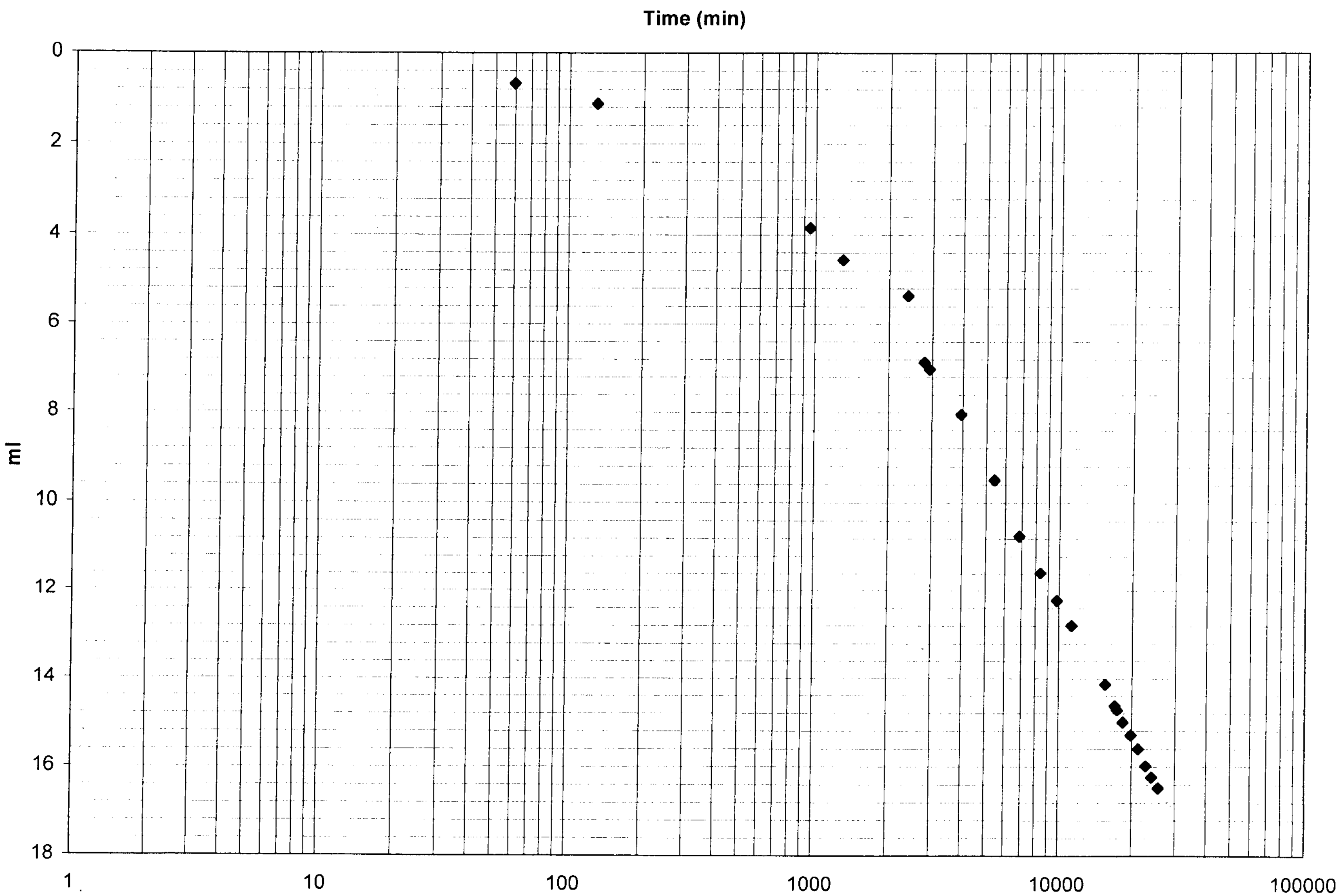
CONSOLIDATION CELL PRESSURE 90.0 CELL NUMBER 3

CONSOLIDATION PORE PRESSURE 85.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-19-06 | 10:40 | 10.00 | | | 0 | | Cell 8.00 |
| | | 9.86 | 0.14 | 0.14 | .1 | | |
| | | 9.86 | 0.00 | 0.14 | .25 | | |
| | | 9.85 | 0.01 | 0.15 | .5 | | |
| | 10:41 | 9.85 | 0.00 | 0.15 | 1 | | |
| | 10:42 | 9.84 | 0.01 | 0.16 | 2 | | Cell 8.70 |
| | 10:44 | 9.83 | 0.01 | 0.17 | 4 | | |
| | 10:48 | 9.82 | 0.01 | 0.18 | 8 | | |
| | 10:55 | 9.80 | 0.02 | 0.20 | 15 | | Cell 8.75 |
| | 11:10 | 9.78 | 0.02 | 0.22 | 30 | | |
| | 12:10 | 9.72 | 0.06 | 0.28 | 90 | | |
| | 13:40 | 9.68 | 0.04 | 0.32 | 180 | | |
| | 16:25 | 9.58 | 0.10 | 0.42 | 345 | | |
| 12-20-06 | 7:53 | 9.32 | 0.26 | 0.68 | 1273 | | Cell 9.10 |
| | 13:15 | 9.26 | 0.06 | 0.74 | 1595 | | |
| | 16:30 | 9.24 | 0.02 | 0.76 | 1790 | | |
| 12-21-06 | 8:20 | 9.11 | 0.13 | 0.89 | 2740 | | |
| 12-22-06 | 7:30 | 9.00 | 0.11 | 1.00 | 4130 | | Cell 9.7 |
| | 1508 | 8.95 | 0.05 | 1.05 | 4588 | | cell 9.5 |
| | 2240 | 8.94 | 0.01 | 1.06 | 5040 | | |
| 12/23 | 1339 | 8.96 | -0.02 | 1.04 | 5939 | | cell 10.0 |
| 12/24 | 14:22 | 8.88 | 0.08 | 1.12 | 7422 | | cell 10.0 |
| 12/26 | 7:40 | 8.99 | -0.11 | 1.01 | 9900 | | cell 10.4 |
| 12/27 | 9:00 | 8.98 | 0.01 | 0.02 | | | |

REITZ & JENS, INC. Consulting Engineers Sheet _____ of _____

Composite #1



## Ameren, Soiux UWLF

**Project # 2005012477**

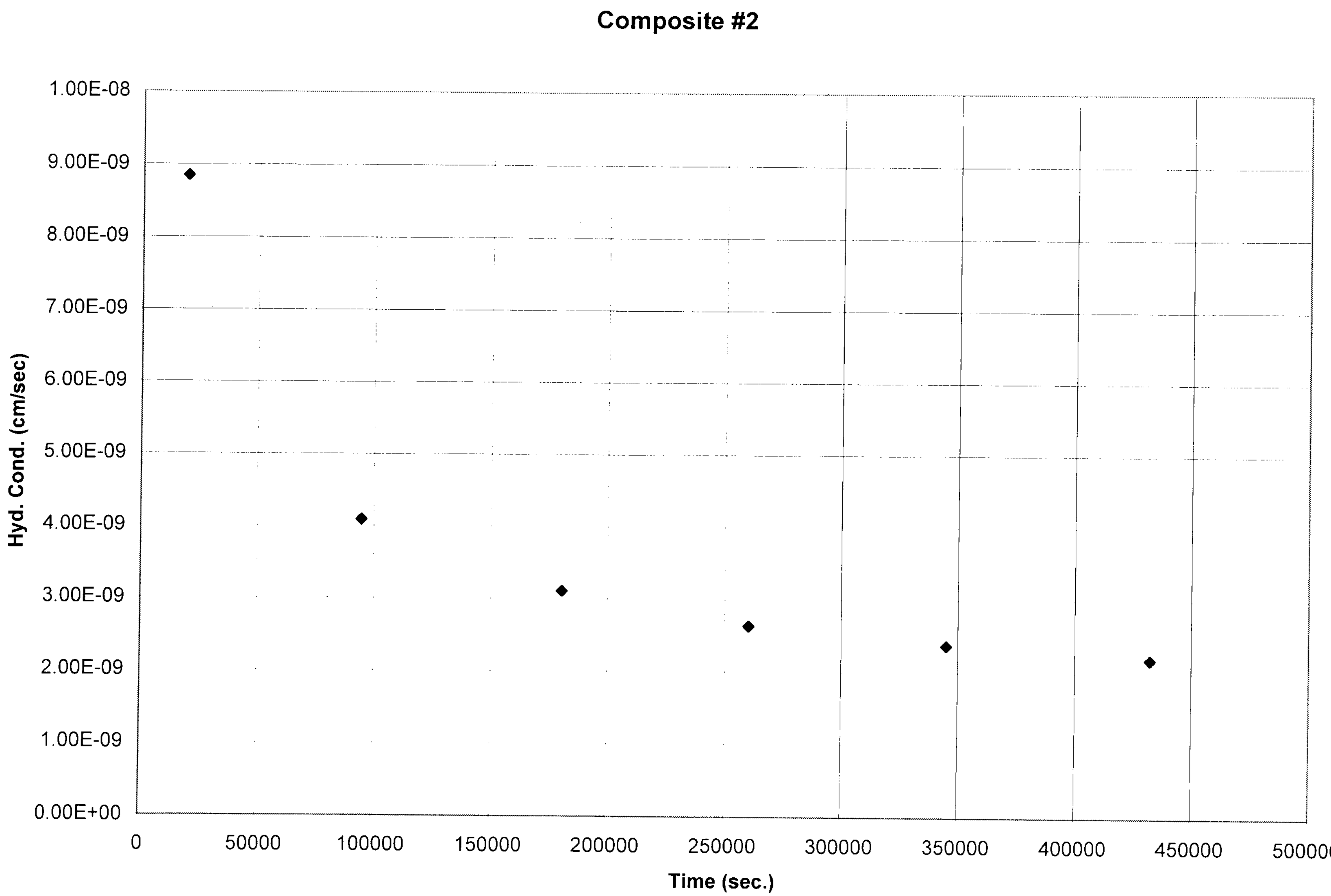
**Compostite #2**

**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 119.0 (lbs/ft^3) | Wet Density = 119.1 (lbs/ft^3) |
| % Moisture = 27.1% | % Moisture = 31.7% |
| Dry Density = 93.7 (lbs/ft^3) | Dry Density = 90.4 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.7176167 |
| A (cm^2)= | 20.468077 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/5/2007 | 7:40 | 0 | 1.4 | 10.00 | 27.200 | 0.00 | 78.000 | 290.017 | 21.3 | | | | |
| | 13:05 | 19500 | 1.5 | 9.84 | 28.013 | 0.06 | 77.695 | 288.900 | 22.4 | 21.85 | 9.25E-09 | 0.9566877 | 8.85E-09 |
| 1/6/2007 | 10:00 | 94800 | 1.8 | 9.63 | 29.080 | 0.12 | 77.390 | 287.528 | 20.7 | 21.61 | 4.25E-09 | 0.9621193 | 4.09E-09 |
| 1/7/2007 | 9:50 | 180600 | 1.9 | 9.50 | 29.740 | 0.20 | 76.984 | 286.461 | 20.4 | 21.11 | 3.19E-09 | 0.9737855 | 3.11E-09 |
| 1/8/2007 | 8:00 | 260400 | 2.0 | 9.43 | 30.096 | 0.28 | 76.578 | 285.699 | 20.5 | 20.91 | 2.69E-09 | 0.9785101 | 2.63E-09 |
| 1/9/2007 | 7:30 | 345000 | 2.1 | 9.35 | 30.502 | 0.36 | 76.171 | 284.886 | 20.8 | 20.84 | 2.42E-09 | 0.9799897 | 2.37E-09 |
| 1/10/2007 | 7:45 | 432300 | 2.2 | 9.29 | 30.807 | 0.45 | 75.714 | 284.124 | 20 | 20.75 | 2.22E-09 | 0.9821063 | 2.18E-09 |



Composite #2
1.00E-08
9.00E-09
8.00E-09
7.00E-09
6.00E-09
5.00E-09
4.00E-09
3.00E-09
2.00E-09
1.00E-09
0.00E+00
Hyd. Cond. (cm/sec)
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Time (sec.)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- Ammon UWLF
Location-
Sample--- Composites #2
Depth-----

a=
A=
L=

**Cell No.** 1

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 83.4 | 75.0 | 78.4 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-5-07 | 7:40 | 0 | 1.35 | 10.00 | 0.00 | | | | 21.3 | |
| | 13:05 | 325 | 1.50 | 9.84 | 0.06 | | | | 22.4 | |
| 1-6-09 | 10:00 | 1580 | 1.80 | 9.63 | 0.12 | | | | 20.7 | |
| 1-7-07 | 9:50 | 3010 | 1.90 | 9.50 | 0.20 | | | | 20.4 | |
| 1-8-07 | 8:00 | 4340 | 2.00 | 9.43 | 0.28 | | | | 20.5 | |
| 1-9-07 | 7:30 | 5750 | 2.10 | 9.35 | 0.36 | | | | 20.3 | |
| 1-10-07 | 7:45 | 7205 | 2.15 | 9.29 | 0.45 | | | | 20.0 | |
| | | | | | | | | | | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project Amoco Sioux Date 12-26-06
Sample Composite #2 Depth @+ 12% Moisture Stand. Proct
Description CLAY(CH), Brown

Type of Test Hydr. Cond. Confining Pressure Differential 5psi
Cell Number 1 Saturate (before) after Consolidation
Number of Membranes 2 Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | Y10 | Y8 | R-100 |
| Wet Wt. + Tare | 119.76 | 148.08 | |
| Dry Wt. + Tare | 101.72 | 123.94 | |
| Wt. Water | | | |
| Tare Wt. | 34.92 | 34.92 | 33.44 |
| Dry Soil Wt. | | | |
| Moisture % | 27.01 | 27.12 | |
| Avg. w % | 27.06 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 445 |
| at axial load start | 458 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

| SPECIMEN DIMENSIONS in. / mm. | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.8065 | 3.8285 | T 1.9855 | 2.025 |
| 2 | 3.8055 | 3.8270 | M 1.9785 | 1.9995 |
| 3 | 3.8060 | 3.8220 | B 1.9740 | 2.0175 |
| Avg. | 3.8060 in<br>9.66724 | 3.825833<br>9.71761667 | 1.9793333 in<br>5.0275067 cm | 2.0098333<br>5.10497667 |

Final Wt. = 379.35
Dry = 287.97

Description After Test

Remarks Initial $\gamma_m$ = 119.0 $\gamma_{Dry}$ = 93.7 %M = 27.1
Final $\gamma_m$ = 119.1 $\gamma_{Dry}$ = 90.4 %M = 31.72

Failure Sketch

Trimmed By JDB
Trimmed Date 12-26-06
Setup By JDB
Setup Date 12-26-06
Taken Down By
Take Down Date

(618) 659 9000 101

trxSTUP.dwg revised --/12/98

REITZ & JENS INC. Consulting Engineers Sheet ________ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Amaran Siano AWLF

SAMPLE Composite #2 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 70.5 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant ___ CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 1-2-07 | 0 | 436 | 71.0 | 70.5 | | | | |
| | 1 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 75.4 | 5.0 | | 4.9 | 0.98 |

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UwlF

SAMPLE Composite #2 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 1

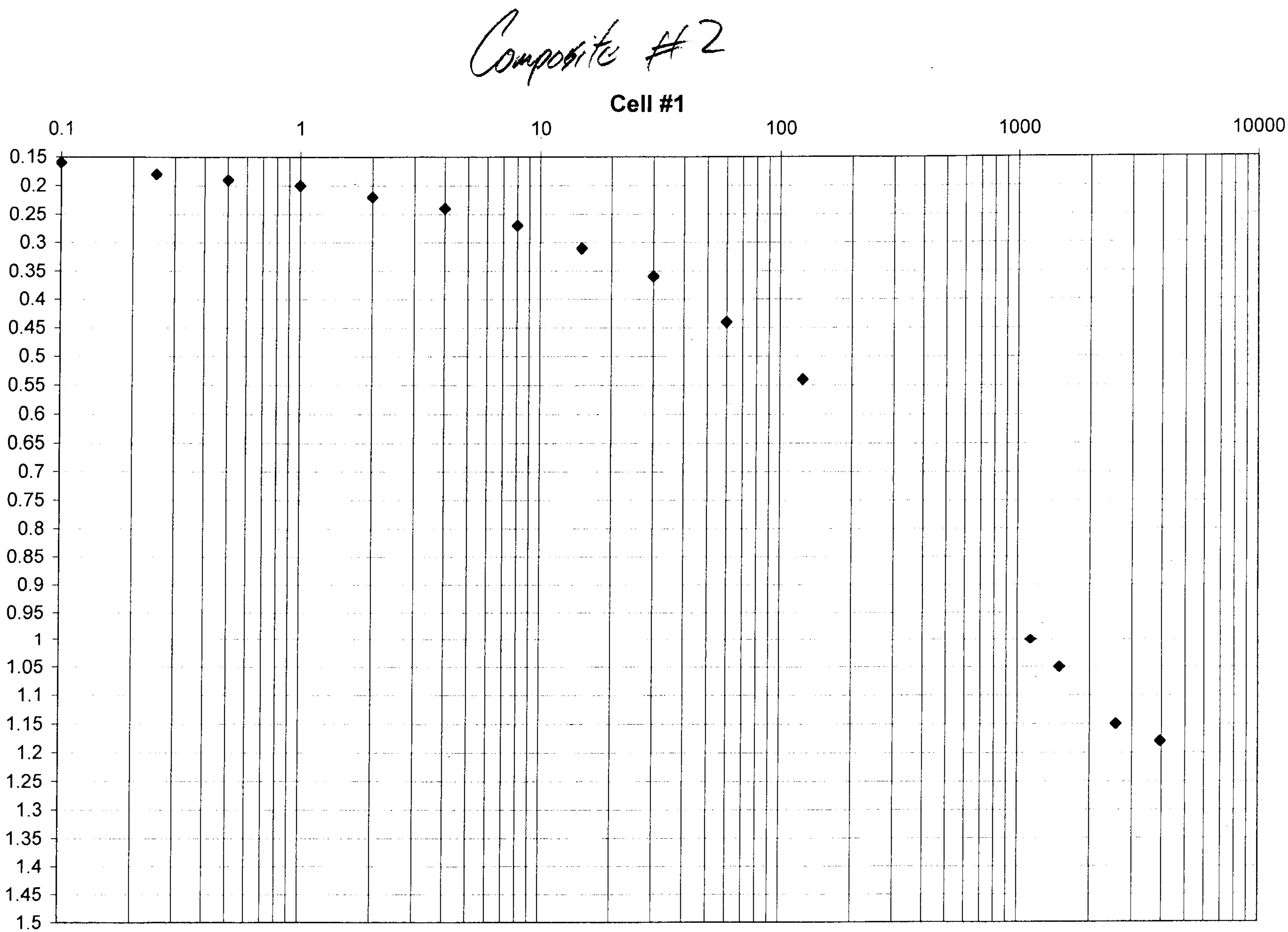
CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-2-07 | 13:35 | 10.00 | | | 0 | | |
| | | 9.84 | | 0.16 | .1 | | |
| | | 9.82 | | 0.18 | .25 | | |
| | | 9.81 | | 0.19 | .5 | | |
| | 13:36 | 9.80 | | 0.20 | 1 | | |
| | 13:37 | 9.78 | | 0.22 | 2 | | |
| | 13:39 | 9.76 | | 0.24 | 4 | | |
| | 13:43 | 9.73 | | 0.27 | 8 | | |
| | 13:50 | 9.69 | | 0.31 | 15 | | |
| | 14:05 | 9.64 | | 0.36 | 30 | | |
| | 14:35 | 9.56 | | 0.44 | 60 | | |
| | 15:40 | 9.46 | | 0.54 | 125 | | |
| 1-3-07 | 8:30 | 9.00 | | 1.00 | 1135 | | |
| | 14:30 | 8.95 | | 1.05 | 1495 | | |
| 1-4-07 | 8:30 | 8.85 | | 1.15 | 2575 | | |
| 1-5-07 | 7:30 | 8.82 | | 1.18 | 3955 | | |

1135
1440
2575

2575
1380
3955

Done



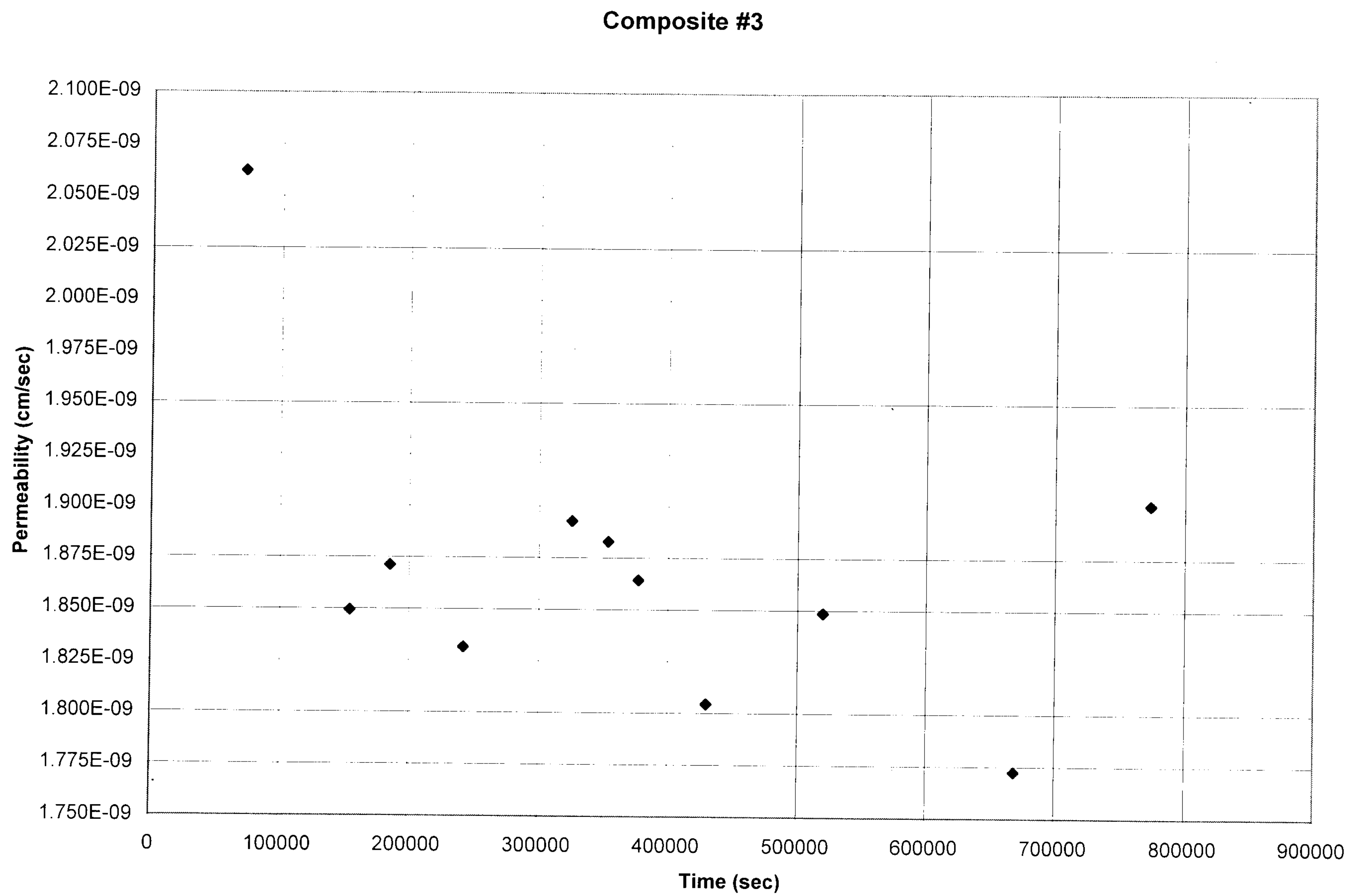
Composite #2
Cell #1
0.1
1
10
100
1000
10000
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
1.25
1.3
1.35
1.4
1.45
1.5

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #3**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 118.8 (lbs/ft^3) | Wet Density = 118.4(lbs/ft^3) |
| % Moisture = 28.2% | % Moisture = 32.8% |
| Dry Density = 92.7 (lbs/ft^3) | Dry Density = 89.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.541597 |
| A (cm^2)= | 22.395469 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/18/2006 | 13:00 | 0 | 3.1 | 10.00 | 27.200 | 0.00 | 78.000 | 156.337 | 21.8 | | | | |
| 12/19/2006 | 8:50 | 71400 | 3.0 | 9.95 | 27.454 | 0.07 | 77.644 | 155.727 | 17.9 | 19.85 | 2.05E-09 | 1.0039204 | 2.06E-09 |
| 12/20/2006 | 7:55 | 154500 | 3.1 | 9.94 | 27.505 | 0.17 | 77.136 | 155.169 | 20.2 | 19.42 | 1.82E-09 | 1.0146012 | 1.85E-09 |
| | 16:30 | 185400 | 3.2 | 9.93 | 27.556 | 0.21 | 76.933 | 154.915 | 20.3 | 19.56 | 1.85E-09 | 1.0111449 | 1.87E-09 |
| 12/21/2006 | 8:20 | 242400 | 3.3 | 9.90 | 27.708 | 0.26 | 76.679 | 154.508 | 20.9 | 19.80 | 1.82E-09 | 1.0050753 | 1.83E-09 |
| 12/22/2006 | 7:20 | 325200 | 3.3 | 9.84 | 28.013 | 0.34 | 76.273 | 153.797 | 20 | 19.97 | 1.89E-09 | 1.0010300 | 1.89E-09 |
| 12/22/2006 | 15:08 | 353280 | 3.5 | 9.86 | 27.911 | 0.40 | 75.968 | 153.594 | 20 | 19.97 | 1.88E-09 | 1.0009674 | 1.88E-09 |
| 12/22/2006 | 22:40 | 376800 | 3.4 | 9.83 | 28.064 | 0.40 | 75.968 | 153.441 | 20 | 19.97 | 1.86E-09 | 1.0009221 | 1.86E-09 |
| 12/23/2006 | 13:30 | 430200 | 3.5 | 9.83 | 28.064 | 0.46 | 75.663 | 153.137 | 20.7 | 20.02 | 1.80E-09 | 0.9997757 | 1.80E-09 |
| 12/24/2006 | 14:22 | 519720 | 3.5 | 9.80 | 28.216 | 0.58 | 75.054 | 152.375 | 20.7 | 20.14 | 1.85E-09 | 0.9969184 | 1.85E-09 |
| 12/26/2006 | 7:20 | 668400 | 3.4 | 9.76 | 28.419 | 0.72 | 74.342 | 151.460 | 20 | 20.18 | 1.78E-09 | 0.9957647 | 1.77E-09 |
| 12/27/2006 | 12:50 | 773400 | 3.6 | 9.72 | 28.622 | 0.83 | 73.784 | 150.698 | 21.2 | 17.44 | 1.78E-09 | 1.0663389 | 1.90E-09 |



Composite #3
Permeability (cm/sec)
2.100E-09
2.075E-09
2.050E-09
2.025E-09
2.000E-09
1.975E-09
1.950E-09
1.925E-09
1.900E-09
1.875E-09
1.850E-09
1.825E-09
1.800E-09
1.775E-09
1.750E-09
0
100000
200000
300000
400000
500000
600000
700000
800000
900000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
# Flow Rate Calculation

Job------- American Sioux WWLF
Location-
Sample---Composite #3
Depth-----

a=
A=
L=

**Cell No.** 2

| | Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|---|
| | 80.0 | 75.0 | 75.5 |
| Set New Pressures 12-15-06 | 81.5 | 75.0 | 76.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-18-06 | 13:00 | 0 | 3.05 | 10.00 | 0.00 | | | | 21.8 | |
| 12-19-06 | 8:50 | 1190 | 3.00 | 9.95 | 0.07 | | | | 17.9 | |
| 12-20-06 | 7:55 | 2575 | 3.10 | 9.94 | 0.17 | | | | 20.2 | |
| | 16:30 | 3090 | 3.20 | 9.93 | 0.21 | | | | 21.3 | |
| 12-21-06 | 8:20 | 4040 | 3.30 | 9.90 | 0.26 | | | | 20.8 | |
| 12-22-06 | 7:20 | 5420 | 3.30 | 9.84 | 0.34 | | | | 20.0 | |
| | 1508 | 5888 | 3.45 | 9.86 | 0.40 | | | | | |
| | 2240 | 6280 | 3.40 | 9.83 | 0.40 | | | | | |
| 12/23 | 1330 | 7170 | 3.50 | 9.83 | 0.46 | | | | 20.7 | |
| 12/24 | 1422 | 8662 | 3.50 | 9.80 | 0.58 | | | | | |
| 12/26 | 740 | 11140 | 3.40 | 9.76 | 0.72 | | | | 20.0 | |
| 12-27-06 | 12:50 | 12890 | 3.55 | 9.72 | 0.83 | | | | 21.2 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Ameren Sioux UWLF Date 11-28-06
Sample Composite #3 Depth Standard Proctor +1.2% moisture
Description CLAY (CH), Brown

Type of Test Hyd. Cond Confining Pressure Differential
Cell Number 2 Saturate (before) after Consolidation
Number of Membranes 2 Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 461 |
| at axial load start | 472 |

MOISTURE CONTENT

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 83 | 84 | |
| Wet Wt. + Tare | 121.31 | 108.83 | |
| Dry Wt. + Tare | 99.33 | 89.73 | |
| Wt. Water | | | |
| Tare Wt. | 21.71 | 21.57 | |
| Dry Soil Wt. | | | |
| Moisture % | 28.3174 | 28.0223 | |
| Avg. w % | 28.170 | | |

MASS PROPERTIES

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 350.28 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.3195 | 3.3695 | T 2.0770 | 2.1085 |
| 2 | 3.3155 | 3.3590 | M 2.0795 | 2.0985 |
| 3 | 3.3000 | 3.3600 | B 2.07665 | 2.1000 |
| Avg. | 3.31166 in<br>8.4116 cm | 3.362833 in<br>8.541597 cm | 2.0776 in<br>5.2773 cm | 2.102333<br>5.339927 |

Final Moist Wt = 362.89

Description After Test

Remarks initial $\gamma_m$ = 118.8 Final $\gamma_m$ = 118.4
$\gamma_{Dry}$ = 92.7 $\gamma_{Dry}$ = 89.2
%m = 28.2 %m = 32.8

Failure Sketch

Trimmed By KEK
Trimmed Date 11-28-06
Setup By KEK
Setup Date 11-28-06
Taken Down By KEK
Take Down Date 12-27-06

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# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameron UWLF

SAMPLE Composite #3 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.2 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-- DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-5-06 | 0 | 2.05 | 71.0 | 70.3 | | | | |
| | 1 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 75.2 | 5.0 | | 4.9 | 0.98 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWLF

SAMPLE Composite #3 DEPTH

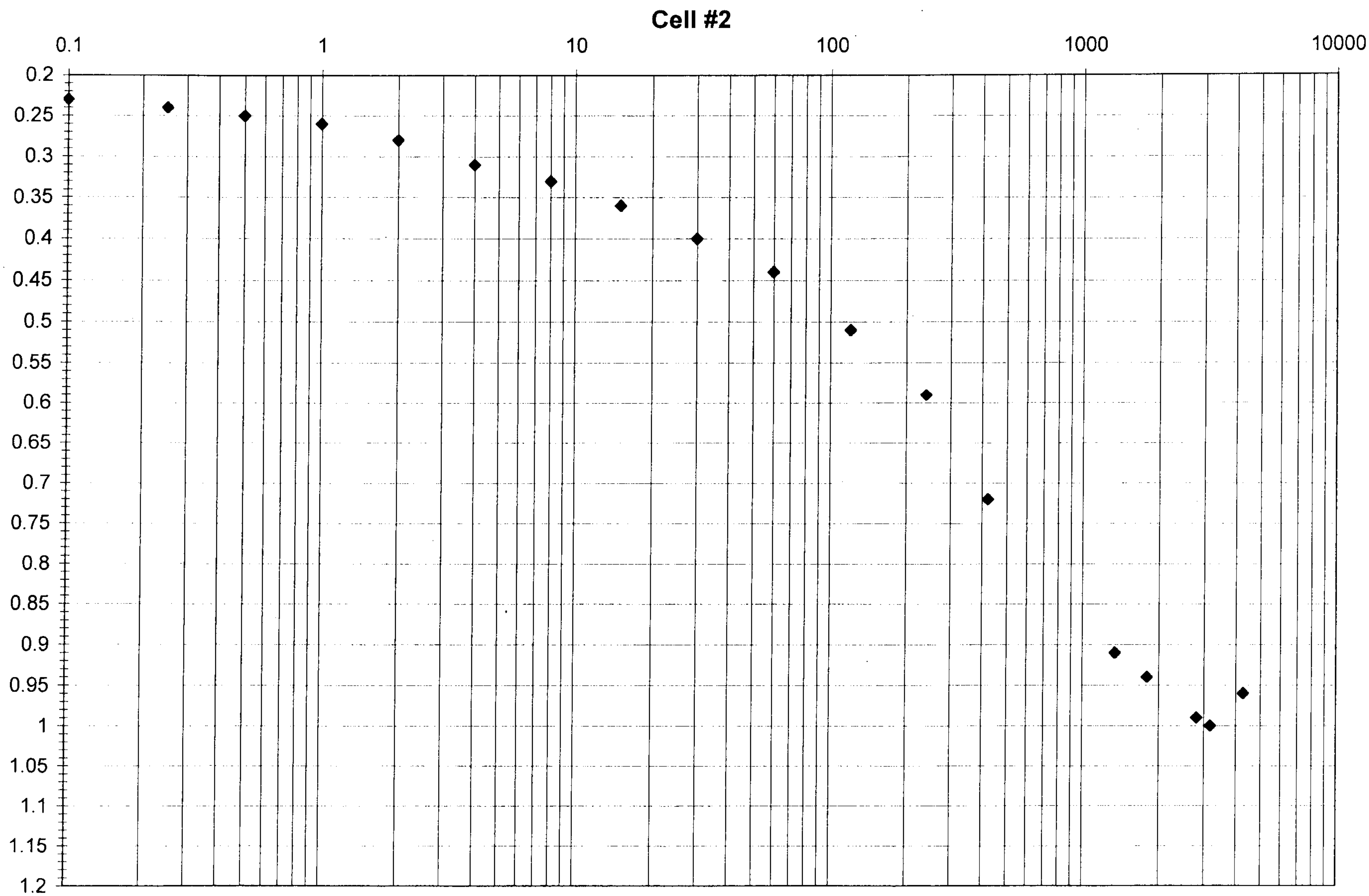
CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 2

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:57 | 10.00 | — | — | 0 | | |
| | | 9.77 | 0.23 | 0.23 | .1 | | |
| | | 9.76 | 0.01 | 0.24 | .25 | | |
| | | 9.75 | 0.01 | 0.25 | .5 | | |
| | 9:58 | 9.74 | 0.01 | 0.26 | 1 | | |
| | 9:59 | 9.72 | 0.02 | 0.28 | 2 | | |
| | 10:01 | 9.69 | 0.03 | 0.31 | 4 | | |
| | 10:05 | 9.67 | 0.02 | 0.33 | 8 | | |
| | 10:12 | 9.64 | 0.03 | 0.36 | 15 | | |
| | 10:27 | 9.60 | 0.04 | 0.40 | 30 | | |
| | 10:57 | 9.56 | 0.04 | 0.44 | 60 | | |
| | 11:57 | *9.49 | 0.07 | 0.51 | 120 | | |
| | 13:57 | 9.41 | 0.08 | 0.59 | 240 | | |
| | 16:59 | 9.28 | 0.13 | 0.72 | 422 | | |
| 12-6-06 | 8:22 | 9.09 | 0.19 | 0.91 | 1345 | | |
| | 15:57 | 9.06 | 0.03 | 0.94 | 1800 | | |
| 12/7 | 0848 | 9.01 | 0.05 | 0.99 | 2811 | | |
| | 15:00 | 9.00 | 0.01 | 1.00 | 3183 | | |
| 12-8-06 | 9:22 | 9.04 | -0.04 | 0.96 | 4285 | | |

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

Composite #3



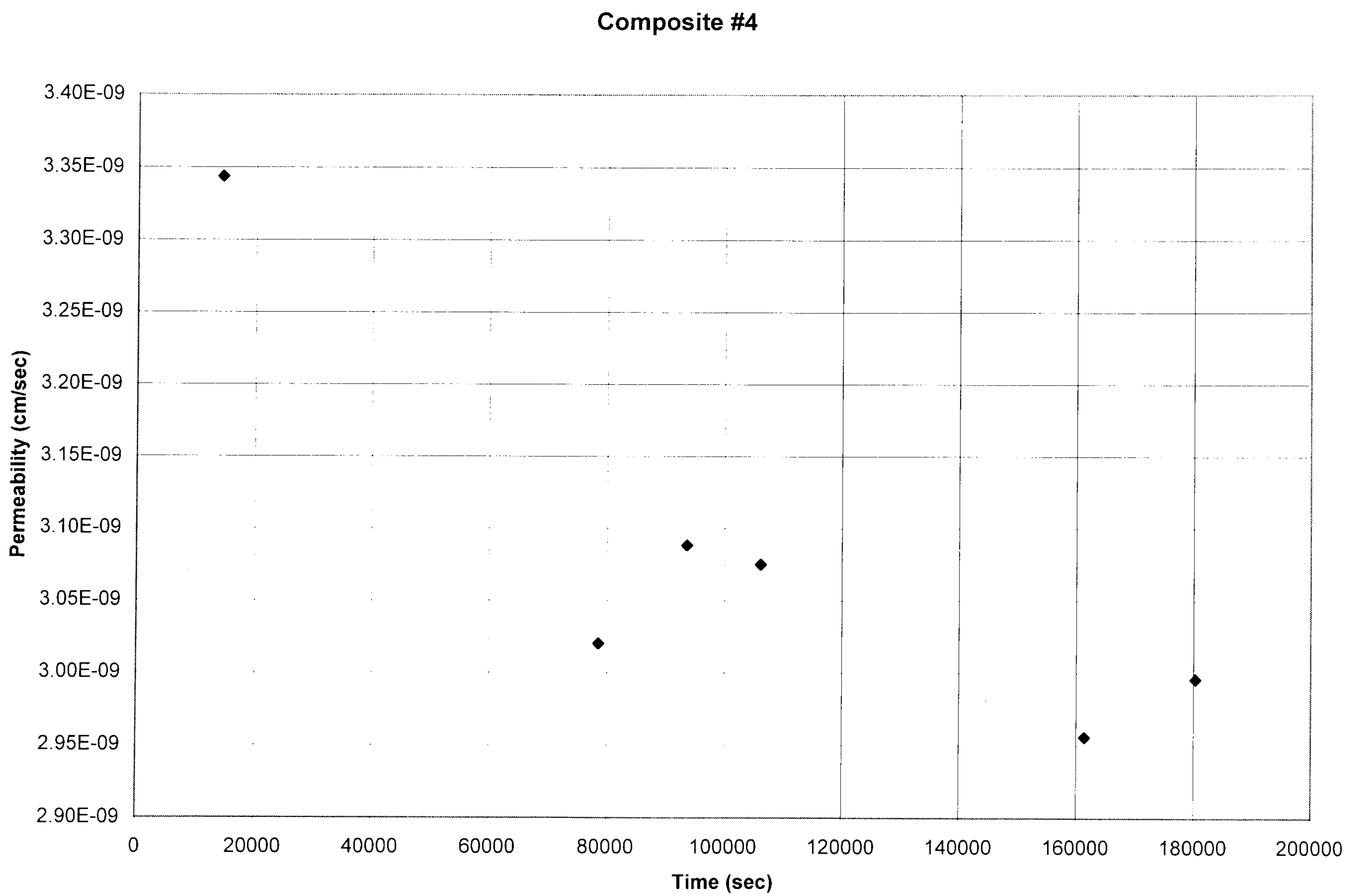
Cell #2
0.1
1
10
100
1000
10000
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #4**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 124.4 (lbs/ft^3) | Wet Density = 123.8 (lbs/ft^3) |
| % Moisture = 23.8% | % Moisture = 25.8% |
| Dry Density = 100.5 (lbs/ft^3) | Dry Density = 98.4 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 10.620587 |
| A (cm^2)= | 21.996012 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/18/2006 | 11:00 | 0 | 19.5 | 10.00 | 27.200 | 0.00 | 78.000 | 191.516 | 21.5 | | | | |
| | 15:00 | 14400 | 19.6 | 9.99 | 27.251 | 0.03 | 77.848 | 191.313 | 22.4 | 21.95 | 3.50E-09 | 0.9544233 | 3.34E-09 |
| 12/19/2006 | 8:50 | 78600 | 19.6 | 9.93 | 27.556 | 0.12 | 77.390 | 190.551 | 17.9 | 20.48 | 3.05E-09 | 0.9886321 | 3.02E-09 |
| | 13:00 | 93600 | 19.7 | 9.92 | 27.606 | 0.15 | 77.238 | 190.348 | 20.3 | 20.26 | 3.11E-09 | 0.9939545 | 3.09E-09 |
| | 16:30 | 106200 | 19.7 | 9.91 | 27.657 | 0.17 | 77.136 | 190.195 | 20.9 | 20.30 | 3.10E-09 | 0.9929760 | 3.08E-09 |
| 12/20/2006 | 7:50 | 161400 | 19.7 | 9.86 | 27.911 | 0.24 | 76.781 | 189.586 | 20.2 | 20.38 | 2.98E-09 | 0.9909087 | 2.96E-09 |
| | 13:05 | 180300 | 19.7 | 9.84 | 28.013 | 0.27 | 76.628 | 189.332 | 20.7 | 20.39 | 3.02E-09 | 0.9907446 | 3.00E-09 |



Composite #4
Permeability (cm/sec)
3.40E-09
3.35E-09
3.30E-09
3.25E-09
3.20E-09
3.15E-09
3.10E-09
3.05E-09
3.00E-09
2.95E-09
2.90E-09
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
200000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Amman Spray WLF
Location-
Sample--- Composite #4
Depth-----

a=
A=
L=

Cell No. 1

| | Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|---|
| | 80.0 | 75.0 | 75.5 |
| Reset To 12-15-06 | 82.0 | 75.0 | 77.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-11-06 | 8:15 | 0 | 17.7 | 10.00 | 0.00 | | | | 20.0 | |
| | 14:30 | | 17.7 | 10.00 | 0.04 | | | | 21.8 | |
| | 16:45 | | 17.7 | 10.00 | 0.04 | | | | 22.1 | |
| 12-12-06 | 9:15 | | 17.95 | 10.00 | 0.12 | | | | 21.5 | |
| | 15:55 | | 17.90 | 9.98 | 0.13 | | | | 23.5 | |
| 12-13-06 | 8:15 | | 18.10 | 9.96 | 0.19 | | | | 20.8 | |
| 12-14-06 | 8:05 | | 18.20 | 9.93 | 0.24 | | | | 21.4 | |
| 12-15-06 | 8:05 | | 18.30 | 9.93 | 0.34 | | | | 20.8 | |
| | | | AFTER PRESSURES WERE RESET | | | | | | | |
| | | | | | | | | | | |
| 12-18-06 | 11:00 | 0 | 19.45 | 10.00 | 0.00 | | | | 21.5 | |
| | 15:00 | 240 | 19.60 | 9.99 | 0.03 | | | | 22.4 | |
| 12-19-06 | 8:50 | 1310 | 19.55 | 9.93 | 0.12 | | | | 17.9 | |
| | 13:00 | 1560 | 19.70 | 9.92 | 0.15 | | | | 20.3 | |
| | 16:30 | 1770 | 19.70 | 9.91 | 0.17 | | | | 20.9 | |
| 12-20-06 | 7:50 | 2690 | 19.70 | 9.86 | 0.24 | | | | 20.2 | |
| | 13:05 | 3005 | 19.70 | 9.84 | 0.27 | | | | 20.7 | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K-Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Ameren Sioux UWLF Date 11-28-06

Sample Composite FF4 Depth +10% M on Plastic

Description CLAY(CL), Brown, with Trace Silt

Type of Test Hydr. Cond. Confining Pressure Differential 5 PSI

Cell Number 1 Saturate (before) after Consolidation

Number of Membranes 2 Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M 36 | M 15 | |
| Wet Wt. + Tare | 99.32 | 89.52 | |
| Dry Wt. + Tare | 84.39 | 76.66 | |
| Wt. Water | | | |
| Tare Wt. | 22.14 | 22.38 | |
| Dry Soil Wt. | | | |
| Moisture % | 23.9839 | 23.6920 | |
| Avg. w % | 23.84 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 499 |
| at axial load start | 512 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 455.87 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 4.1570 | 4.1775 | T 2.0710 | 2.0875 |
| 2 | 4.1610 | 4.1810 | M 2.0535 | 2.0780 |
| 3 | 4.1760 | 4.1855 | B 2.0720 | 2.0850 |
| Avg. | 4.1647 in<br>10.5783 cm | 4.181333 in<br>10.620587 cm | 2.0655 in<br>5.24637 cm | 2.0835 in<br>5.29209 cm |

Description After Test Dry Sol wt = 368.11 Post wt 463.36

Remarks Initial $\gamma_m$ = 124.4 Final $\gamma_m$ = 123.8

$\gamma_D$ = 100.5 $\gamma_D$ = 98.4

%M = 23.8 %M = 25.8

Failure Sketch

Trimmed By KEK
Trimmed Date 11-28-06
Setup By KEK
Setup Date 11-28-06
Taken Down By KEK
Take Down Date 12-20-06

trxSTUP.dwg rev '12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren Sioux UWLF

SAMPLE Composite #4 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 11-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 71.4 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-5-06 | 0 | 1.08 | 71.0 | 70.6 | | | | |
| | 1 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 2 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 4 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |
| | 8 | " | 76.0 | 75.5 | 5.0 | | 4.9 | 0.98 |

OK

REITZ & JENS, INC. Consulting Engineers Sheet ____ of ____

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Sioux UWF

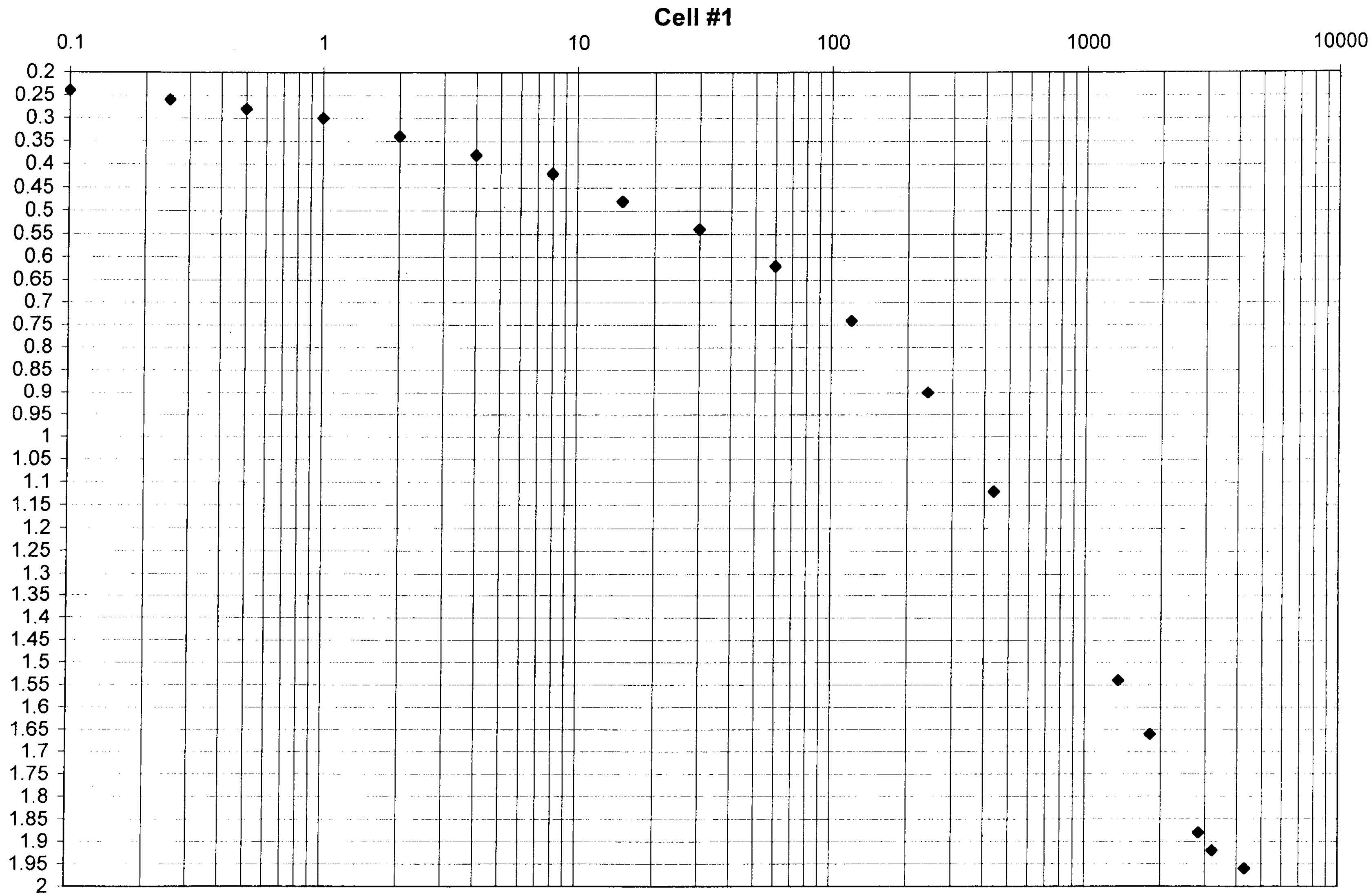
SAMPLE Composite #4 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 1

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:40 | 10.00 | | | 0 | | |
| | | 9.76 | 0.24 | 0.24 | .1 | | |
| | | 9.74 | 0.02 | 0.26 | .25 | | |
| | | 9.72 | 0.02 | 0.28 | .5 | | |
| | 9:41 | 9.70 | 0.02 | 0.30 | 1 | | |
| | 9:42 | 9.66 | 0.04 | 0.34 | 2 | | |
| | 9:44 | 9.62 | 0.04 | 0.38 | 4 | | |
| | 9:48 | 9.58 | 0.04 | 0.42 | 8 | | |
| | 9:55 | 9.52 | 0.06 | 0.48 | 15 | | |
| | 10:10 | 9.46 | 0.06 | 0.54 | 30 | | |
| | 10:40 | 9.38 | 0.08 | 0.62 | 60 | | |
| | 11:40 | * 9.26 | 0.12 | 0.74 | 120 | | |
| | 13:40 | 9.10 | 0.16 | 0.90 | 240 | | |
| | 16:57 | 8.88 | 0.22 | 1.12 | 437 | | |
| 12-6-05 | 8:20 | 8.46 | 0.42 | 1.54 | 1360 | | |
| | 15:58 | 8.34 | 0.12 | 1.66 | 1818 | | |
| 12/7 | 0852 | 8.20 | 0.14 | 1.88 | 2832 | | |
| | 15:00 | 8.16 | 0.04 | 1.92 | 3200 | | |
| 12/8 | 9:20 | 8.12 | 0.04 | 1.96 | 4300 | | |

Composite #4



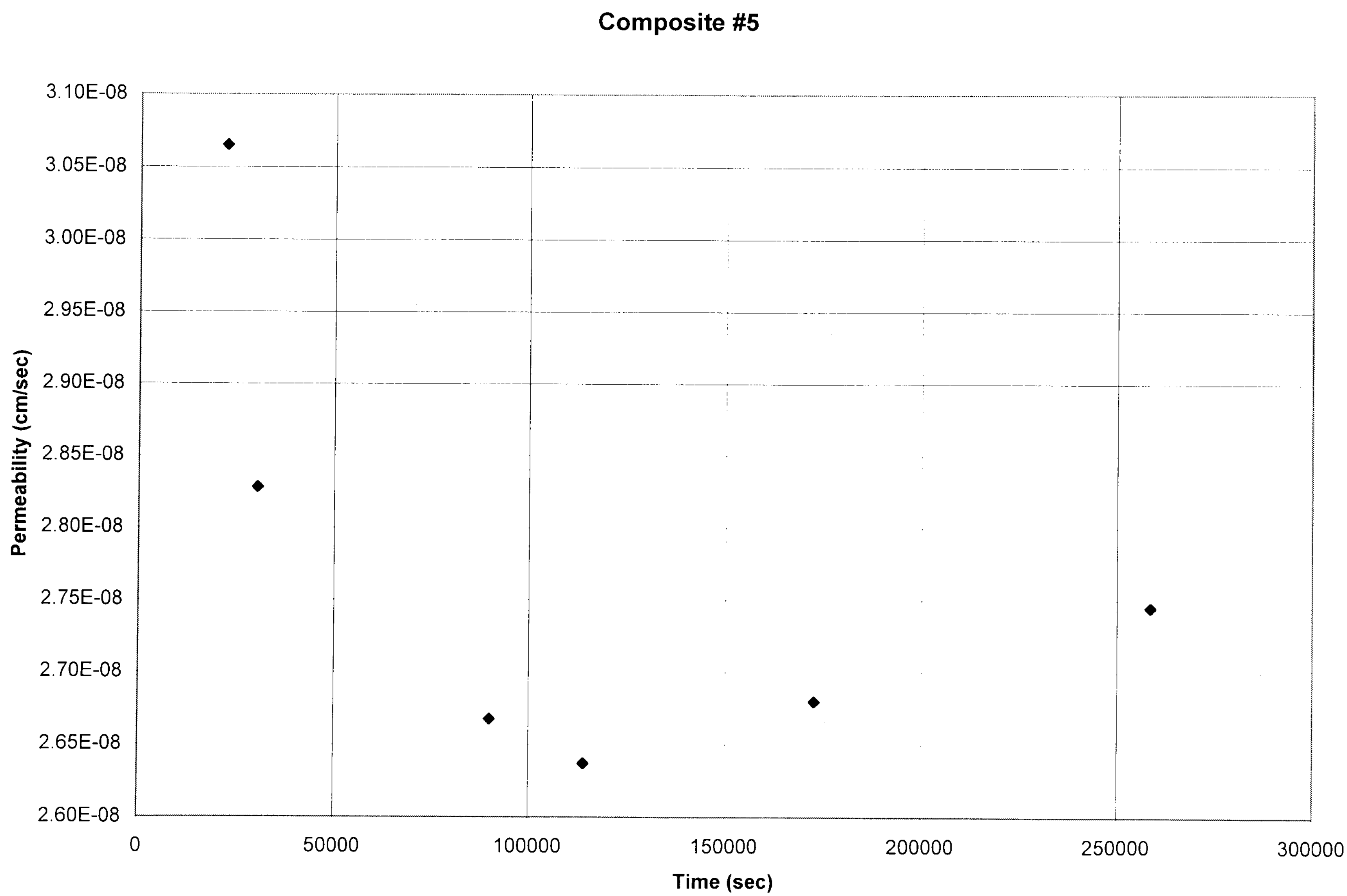
Cell #1
0.1
1
10
100
1000
10000
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
1.25
1.3
1.35
1.4
1.45
1.5
1.55
1.6
1.65
1.7
1.75
1.8
1.85
1.9
1.95
2

**Ameren, Soiux UWLF**
**Project # 2005012477**
**Compostite #5**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 125.1 (lbs/ft^3) | Wet Density = 127.3 (lbs/ft^3) |
| % Moisture = 20.6% | % Moisture = 23.0% |
| Dry Density = 103.7 (lbs/ft^3) | Dry Density = 103.5 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 10.6172 |
| A (cm^2)= | 20.288555 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/11/2006 | 8:15 | 0 | 9.9 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 20 | | | | |
| | 14:30 | 22500 | 9.8 | 9.89 | 27.759 | 0.12 | 77.390 | 84.811 | 21.8 | 20.90 | 3.13E-08 | 0.9786485 | 3.07E-08 |
| | 16:45 | 30600 | 9.7 | 9.85 | 27.962 | 0.14 | 77.289 | 84.506 | 22.1 | 21.18 | 2.91E-08 | 0.9721378 | 2.83E-08 |
| 12/12/2006 | 9:15 | 90000 | 10.1 | 9.63 | 29.080 | 0.43 | 75.816 | 81.915 | 21.5 | 21.59 | 2.77E-08 | 0.9626510 | 2.67E-08 |
| | 15:55 | 114000 | 9.7 | 9.52 | 29.638 | 0.52 | 75.358 | 80.899 | 23.5 | 21.78 | 2.75E-08 | 0.9582691 | 2.64E-08 |
| 12/13/2006 | 8:15 | 172800 | 10.2 | 9.30 | 30.756 | 0.82 | 73.834 | 78.257 | 20.8 | 21.91 | 2.80E-08 | 0.9554149 | 2.68E-08 |
| 12/14/2006 | 8:05 | 258600 | 10.2 | 8.95 | 32.534 | 1.21 | 71.853 | 74.498 | 21.4 | 21.64 | 2.85E-08 | 0.9615018 | 2.74E-08 |



Composite #5
Permeability (cm/sec)
3.10E-08
3.05E-08
3.00E-08
2.95E-08
2.90E-08
2.85E-08
2.80E-08
2.75E-08
2.70E-08
2.65E-08
2.60E-08
0
50000
100000
150000
200000
250000
300000
Time (sec)

Dr. Cell Suite 710

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Sioux UWLF
Location-
Sample--- Composite #5
Depth-----

a=
A=
L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.0 | 75.0 | 75.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-11-06 | 8:15 | 0 | 9.85 | 10.00 | 0.00 | | | | 20.0 | |
| | 14:30 | | 9.80 | 9.89 | 0.12 | | | | 21.8 | |
| | 16:45 | | 9.70 | 9.85 | 0.14 | | | | 22.1 | |
| 12-12-06 | 9:15 | | 10.05 | 9.63 | 0.43 | | | | 21.5 | |
| | 15:55 | | 9.70 | 9.52 | 0.52 | | | | 23.5 | |
| 12-13-06 | 8:15 | | 10.20 | 9.30 | 0.82 | | | | 20.8 | |
| 12-14-06 | 8:05 | | 10.20 | 8.95 | 1.21 | | | | 21.4 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF  Date: 11-29-06

Sample: Composite #5  Depth: Standard Proctor Point +8% Moisture

Description: CLAY (CL), Brown, Silty

Type of Test: Hyd. Cond.  Confining Pressure Differential: ______

Cell Number: 4  Saturate (before) after Consolidation ______

Number of Membranes: 2  Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | [illegible] |
| at saturation start | [illegible] |
| at consolidation start | |
| at axial load start | |

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M14 | M16 | |
| Wet Wt. + Tare | 118.52 | 121.26 | |
| Dry Wt. + Tare | 101.99 | 104.34 | |
| Wt. Water | | | |
| Tare Wt. | 22.10 | 21.72 | |
| Dry Soil Wt. | | | |
| Moisture % | 20.69 | 20.48 | |
| Avg. w % | 20.59 | | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 430.80 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant | | |
| 4.85/(D^2 * L) | | |
| Wet Density | 125.13 | pcf. |
| Dry Density | 103.7 | pcf. |

| SPECIMEN DIMENSIONS in. / mm. | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 4.1825 | 4.1820 | T 1.9900 | 1.9930 |
| 2 | 4.1880 | 4.1705 | M 1.9955 | 1.9910 |
| 3 | 4.1925 | 4.1875 | B 2.0050 | 2.0190 |
| Avg. | 4.18767 in / 10.63668 cm | 4.1800 / 10.6172 | 1.99683 in / 5.07195 cm | 2.0010 / 5.08254 |

Description After Test: Initial $\gamma_m = 125.1$, $\gamma_D = 103.7$, %M = 20.6; Final $\gamma_m = 127.3$, $\gamma_{Dry} = 103.5$, %M = 23.0

Remarks: Final wet Wt 439.24

Failure Sketch

Trimmed By: KEK
Trimmed Date: 11-29-06

Setup By: KEK
Setup Date: 11-29-06

Taken Down By: KEK
Take Down Date: 12-14-06

trxSTUP.dwg rev. -/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sioux UWLF

SAMPLE Composite #5 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 11-29-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 71.0 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-5-06 | 0 | 1.38 | 71.0 | 71.2 | | | | |
| | 1 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 2 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 4 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |
| | 8 | | 76.0 | 76.2 | 5.0 | | 5.0 | 1.0 |

OK

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

# TRIAXIAL CELL CONSOLIDATION TEST

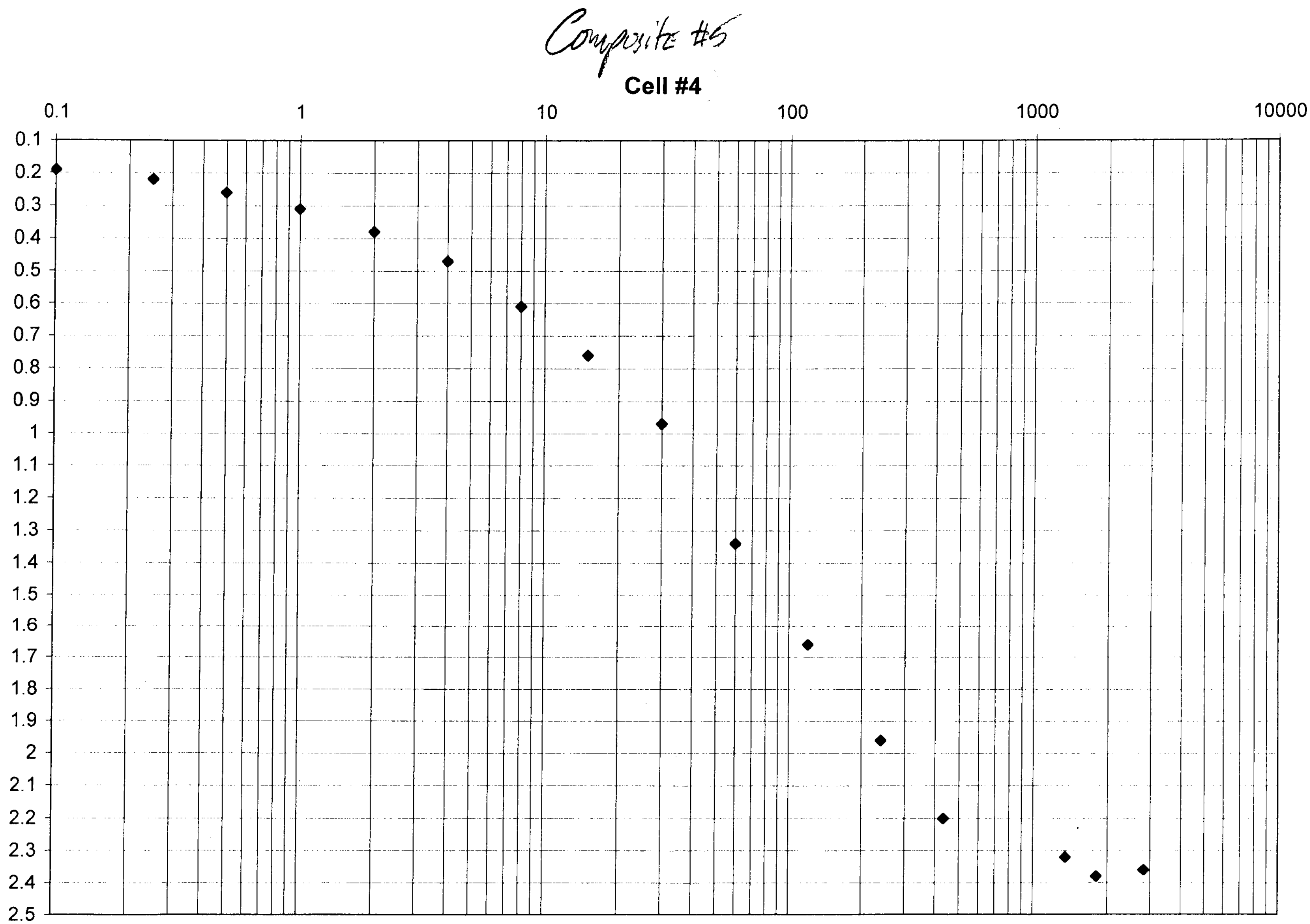
PROJECT American Sioux MWLF

SAMPLE Composite #5 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-5-06 | 9:46 | 10.00 | — | — | 0 | | |
| | | 9.81 | 0.19 | 0.19 | .1 | | |
| | | 9.78 | 0.03 | 0.22 | .25 | | |
| | | 9.74 | 0.04 | 0.26 | .5 | | |
| | 9:47 | 9.69 | 0.05 | 0.31 | 1 | | |
| | 9:48 | 9.62 | 0.07 | 0.38 | 2 | | |
| | 9:50 | 9.53 | 0.09 | 0.47 | 4 | | |
| | 9:54 | 9.39 | 0.14 | 0.61 | 8 | | |
| | 10:01 | 9.24 | 0.15 | 0.76 | 15 | | |
| | 10:16 | 9.03 | 0.19 | 0.97 | 30 | | |
| | 10:46 | 8.76 | 0.27 | 1.34 | 60 | | |
| | 11:46 | *8.44 | 0.32 | 1.66 | 120 | | |
| | 13:46 | 8.14 | 0.30 | 1.96 | 240 | | |
| | 16:58 | 7.90 | 0.24 | 2.20 | 432 | | |
| 12-6-06 | 8:22 | 7.78 | 0.12 | 2.32 | 1356 | | |
| | 15:57 | 7.72 | 0.06 | 2.38 | 1811 | | |
| 12/7 | 0851 | 7.74 | -0.02 | 2.36 | 2825 | | |

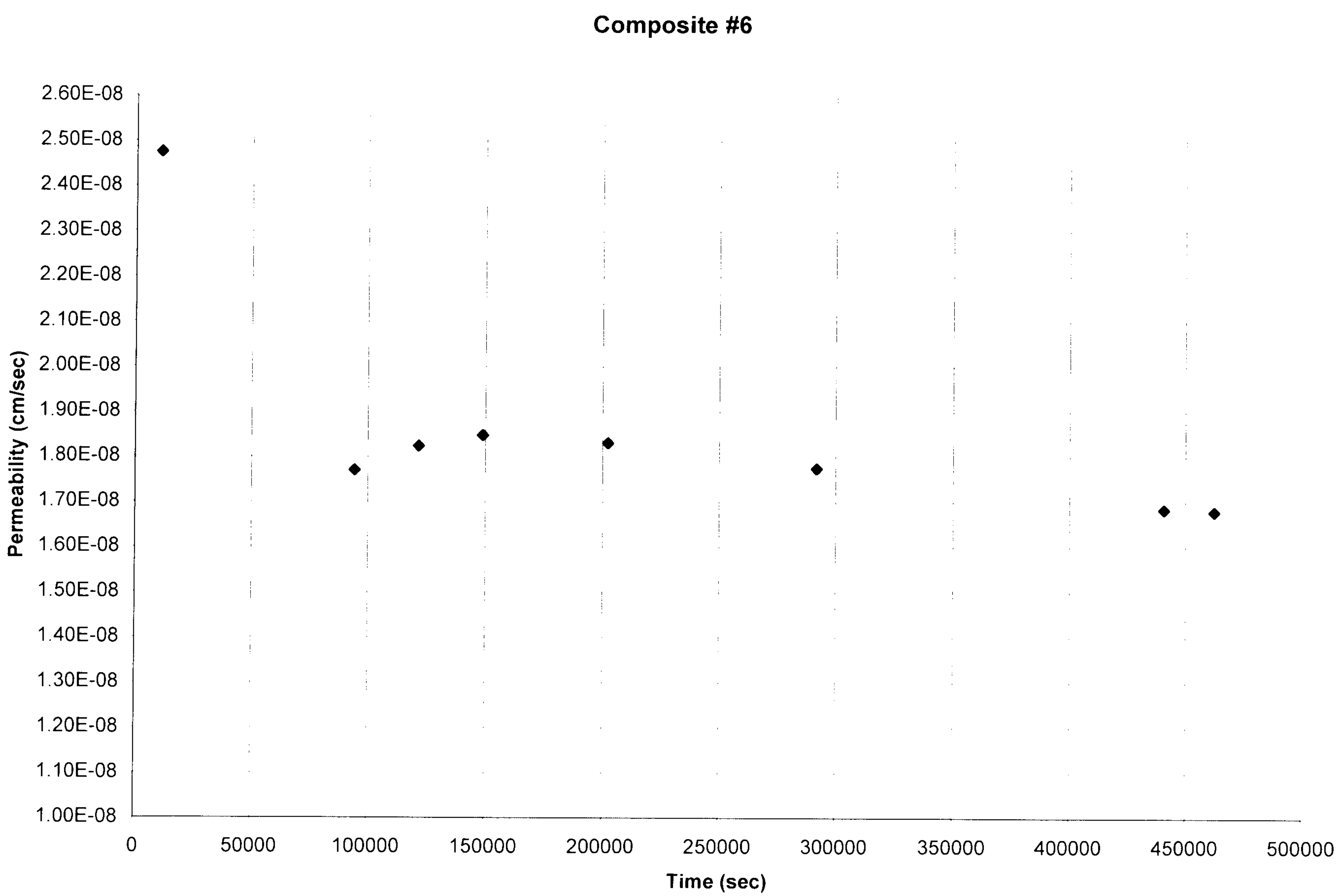

Composite #5
Cell #4
0.1
1
10
100
1000
10000
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #6
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 119.2 (lbs/ft^3) | Wet Density = 122.6 (lbs/ft^3) |
| % Moisture = 26.5% | % Moisture = 26.9% |
| Dry Density = 94.2 (lbs/ft^3) | Dry Density = 96.6 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.33492 |
| A (cm^2)= | 19.218163 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/21/2006 | 10:25 | 0 | 7.5 | 10.00 | 27.200 | 0.00 | 78.000 | 156.337 | 21.4 | | | | |
| 12/21/2006 | 13:25 | 10800 | 7.5 | 9.90 | 27.708 | 0.08 | 77.594 | 155.423 | 22.6 | 22.00 | 2.60E-08 | 0.9532943 | 2.48E-08 |
| 12/22/2006 | 7:30 | 94200 | 8.6 | 9.43 | 30.096 | 0.52 | 75.358 | 150.800 | 20 | 21.38 | 1.83E-08 | 0.9674437 | 1.77E-08 |
| 12/22/2006 | 15:06 | 121560 | 7.6 | 9.25 | 31.010 | 0.68 | 74.546 | 149.073 | 20 | 21.07 | 1.87E-08 | 0.9746672 | 1.82E-08 |
| 12/22/2006 | 22:40 | 148800 | 7.6 | 9.08 | 31.874 | 0.84 | 73.733 | 147.396 | 21.3 | 20.99 | 1.89E-08 | 0.9764671 | 1.85E-08 |
| 12/23/2006 | 13:29 | 202140 | 8.0 | 8.81 | 33.245 | 1.16 | 72.107 | 144.399 | 21.3 | 21.07 | 1.88E-08 | 0.9745676 | 1.83E-08 |
| 12/24/2006 | 14:21 | 291660 | 8.2 | 8.38 | 35.430 | 1.62 | 69.770 | 139.878 | 21.3 | 21.14 | 1.82E-08 | 0.9729462 | 1.77E-08 |
| 12/26/2006 | 7:45 | 440700 | 8.7 | 7.76 | 38.579 | 2.28 | 66.418 | 133.375 | 20 | 20.98 | 1.72E-08 | 0.9768505 | 1.68E-08 |
| 12/26/2006 | 13:45 | 462300 | 8.7 | 7.68 | 38.986 | 2.39 | 65.859 | 132.410 | 21.2 | 20.96 | 1.72E-08 | 0.9772637 | 1.68E-08 |


Composite #6
Permeability (cm/sec)
2.60E-08
2.50E-08
2.40E-08
2.30E-08
2.20E-08
2.10E-08
2.00E-08
1.90E-08
1.80E-08
1.70E-08
1.60E-08
1.50E-08
1.40E-08
1.30E-08
1.20E-08
1.10E-08
1.00E-08
0
50000
100000
150000
200000
250000
300000
350000
400000
450000
500000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Sioux WWLF
Location-
Sample--- Composite #6
Depth-----

a=
A=
L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.5 | 75.0 | 75.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-21-06 | 10:25 | 0 | 7.50 | 10.00 | 0.00 | | | | 21.4 | |
| | 13:25 | 180 | 7.50 | 9.90 | 0.08 | | | | 22.6 | |
| 12-22-06 | 7:30 | 1570 | 8.60 | 9.43 | 0.52 | | | | 20.0 | |
| | 1506 | 2026 | 7.6 | 9.25 | 0.68 | | | | | |
| | 2240 | 2480 | 7.6 | 9.08 | 0.84 | | | | 21.3 | |
| 12/23 | 1329 | 3369 | 8.0 | 8.81 | 1.16 | | | | | |
| 12/24 | 1421 | 4861 | 8.2 | 8.38 | 1.62 | | | | | |
| 12/26 | 745 | 7345 | 8.7 | 7.76 | 2.28 | | | | 20.0 | |
| | 13:45 | 7705 | 8.7 | 7.68 | 2.39 | | | | 21.2 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project Amarillo Stony Date 12-19-06

Sample Composite #6 Depth @+ 12% Moisture Shrink Curve

Description [redacted] Silty Brown CLAY (CL)

Type of Test Hyd. Cond. Confining Pressure Differential 5psi

Cell Number 4 Saturate (before) after Consolidation

Number of Membranes 2 Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | — |
| at saturation start | — |
| at consolidation start | — |
| at axial load start | — |

## MOISTURE CONTENT

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M2 | M43 | |
| Wet Wt. + Tare | 123.35 | 119.92 | |
| Dry Wt. + Tare | 102.10 | 99.48 | |
| Wt. Water | 21.25 | 20.44 | |
| Tare Wt. | 21.96 | 22.47 | |
| Dry Soil Wt. | 80.14 | 77.01 | |
| Moisture % | 26.52 | 26.54 | |
| Avg. w % | 26.53 | | |

## MASS PROPERTIES

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 351.13 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

## SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.7520 | 3.6295 | T 1.9620 | 1.9575 |
| 2 | 3.7465 | 3.722 | M 1.9500 | 1.9510 |
| 3 | 3.7450 | 3.6740 | B 1.9465 | 1.934 |
| Avg. | 3.747833 in<br>9.51949 | 3.675167 in<br>9.33192 cm | 1.95283<br>4.9602 | 1.9475 in<br>4.94665 cm |

Description After Test $W_{Final} = 352.29$

Remarks Initial $\gamma_m = 119.2$ $\gamma_{Dry} = 94.2$ %M = 26.5 Final $\gamma_m = 122.6$ $\gamma_{Dry} = 96.6$ %M = 26.9

Failure Sketch

Trimmed By KEK
Trimmed Date 12-19-06

Setup By KEK
Setup Date 12-19-06

Taken Down By ______
Take Down Date ______

trixSTUP.dwg rev. -/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sioux UWLF

SAMPLE Composite #6 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-19-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 71.7 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME 12:55 | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE (Transducer Constant ____) CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 12-20-06 | 0 | 4.64 | 71.0 | 71.2 | | | | |
| | 1 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 76.1 | 5.0 | | 4.9 | 0.98 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #6 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-20-06 | 13:10 | 10.00 | | | 0 | | Cell 3.88 |
| | | 9.68 | 0.32 | 0.32 | .1 | | |
| | | 9.63 | 0.05 | 0.37 | .25 | | |
| | | 9.58 | 0.05 | 0.42 | .5 | | |
| | 13:11 | 9.51 | 0.07 | 0.49 | 1 | | |
| | 13:12 | 9.42 | 0.09 | 0.58 | 2 | | |
| | 13:14 | 9.32 | 0.10 | 0.68 | 4 | | |
| | 13:18 | 9.17 | 0.15 | 0.83 | 8 | | |
| | 13:25 | 8.99 | 0.18 | 1.01 | 15 | | |
| | 13:40 | 8.73 | 0.26 | 1.27 | 30 | | |
| | 14:10 | 8.42 | 0.31 | 1.58 | 60 | | |
| | 15:10 | 8.05 | 0.37 | 1.95 | 120 | | |
| | 16:30 | 7.83 | 0.22 | 2.17 | 200 | | |
| 12-21-06 | 8:20 | 8.24 | | | | | |

Dave

Tom Eberhard 6/10

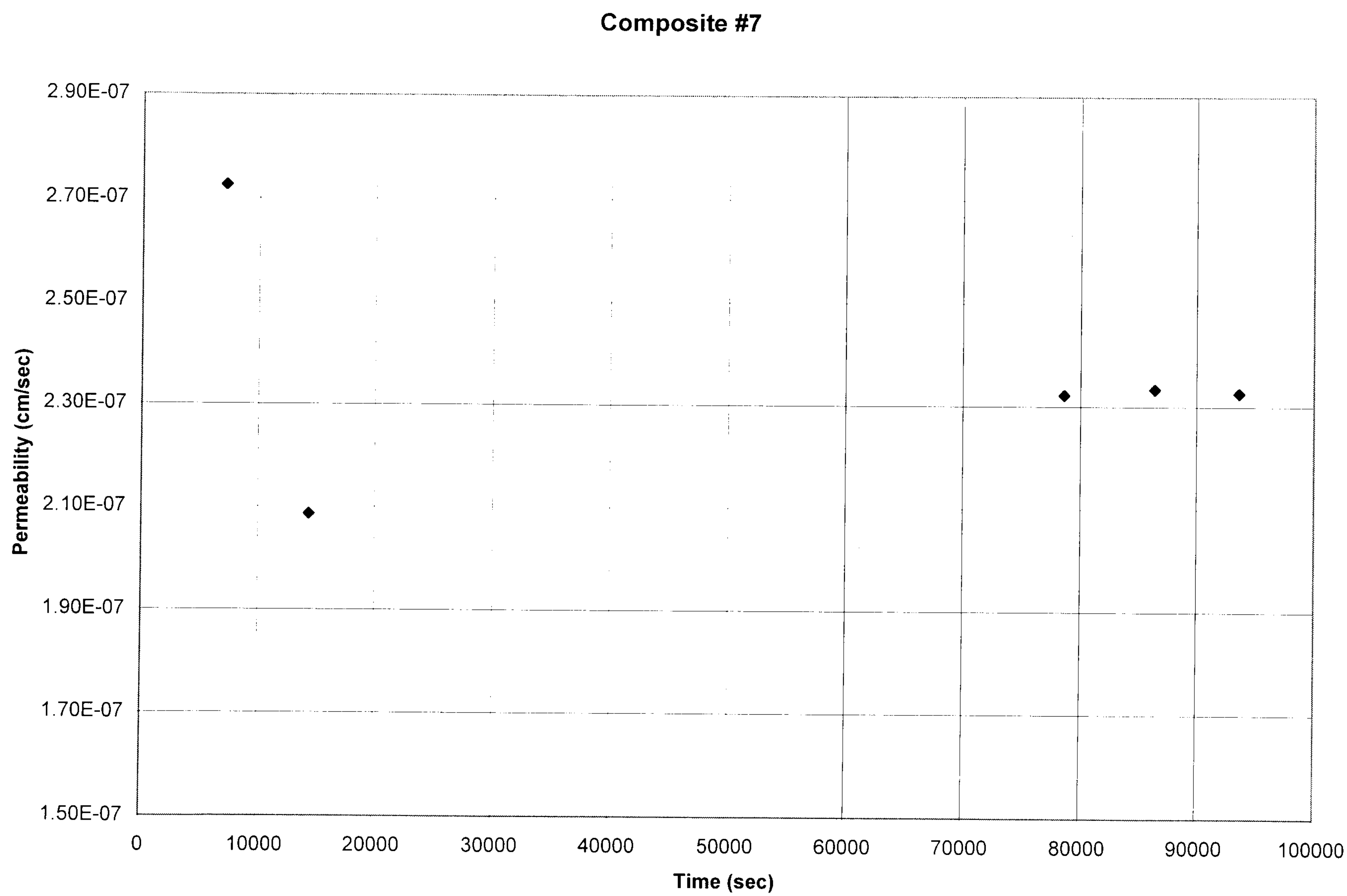
REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #7**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 120.2 (lbs/ft^3) | Wet Density = 124.6 (lbs/ft^3) |
| % Moisture = 25.0% | % Moisture = 25.6% |
| Dry Density = 96.1 (lbs/ft^3) | Dry Density = 99.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.7155 |
| A (cm^2)= | 19.658137 |

| | | | | Base Burette | | Top Burette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Reading (ml) | Distance from Datum (cm) | Reading (ml) | Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
| 12/18/2006 | 11:00 | 0 | 10.4 | 10.00 | 27.200 | 0.14 | 77.289 | 85.269 | 21.5 | | | | |
| | 13:00 | 7200 | 10.4 | 9.61 | 29.181 | 0.44 | 75.765 | 81.764 | 21.8 | 21.65 | 2.84E-07 | 0.9612431 | 2.73E-07 |
| | 15:00 | 14400 | 10.4 | 9.33 | 30.604 | 0.52 | 75.358 | 79.935 | 22.4 | 21.88 | 2.18E-07 | 0.9561208 | 2.09E-07 |
| 12/19/2006 | 8:50 | 78600 | 10.8 | 7.32 | 40.814 | 2.76 | 63.979 | 58.345 | 17.9 | 20.47 | 2.35E-07 | 0.9889614 | 2.32E-07 |
| | 11:00 | 86400 | 10.8 | 7.11 | 41.881 | 2.98 | 62.862 | 56.160 | 19.7 | 20.32 | 2.35E-07 | 0.9925785 | 2.33E-07 |
| | 13:00 | 93600 | 10.7 | 6.92 | 42.846 | 3.15 | 61.998 | 54.332 | 20.3 | 20.29 | 2.34E-07 | 0.9931645 | 2.33E-07 |


Composite #7
2.90E-07
2.70E-07
2.50E-07
2.30E-07
2.10E-07
1.90E-07
1.70E-07
1.50E-07
Permeability (cm/sec)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Amerom Stone

Location- a=

Sample--- Composite #7 A=

Depth----- L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 80.5 | 75.0 | 75.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-18-06 | 11:00 | 0 | 10.35 | 10.00 | 0.14 | | | | 21.5 | |
| | 13:00 | 120 | 10.35 | 9.61 | 0.44 | | | | 21.8 | |
| | 15:00 | 240 | 10.40 | 9.33 | 0.52 | | | | 22.4 | |
| 12-19-06 | 8:50 | 1310 | 10.75 | 7.32 | 2.76 | | | | 17.9 | |
| | 11:00 | 1440 | 10.80 | 7.11 | 2.98 | | | | 19.7 | |
| | 13:00 | 1560 | 10.70 | 6.92 | 3.15 | | | | 20.3 | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project American Sioux WWLF Date 12-14-06

Sample Composite #7 Depth Standard Proctor @ + 10% Moisture

Description Brown Silty CLAY [illegible]

Type of Test Hyd. Conduct. Confining Pressure Differential 5 psi

Cell Number 4 Saturate (before) after Consolidation

Number of Membranes 2 Filter Strips Yes (No)

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | — |
| at saturation start | — |
| at consolidation start | — |
| at axial load start | — |

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 2 | 45 | |
| Wet Wt. + Tare | 95.30 | 108.50 | |
| Dry Wt. + Tare | 80.71 | 91.11 | |
| Wt. Water | | | |
| Tare Wt. | 22.06 | 22.06 | |
| Dry Soil Wt. | | | |
| Moisture % | 24.876 | 25.185 | |
| Avg. w % | 25.03 | | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 379.62 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

| SPECIMEN DIMENSIONS in. / mm. | HEIGHT | | DIAMETER | |
|---|---|---|---|---|
| | Initial | Final | Initial | Final |
| 1 | 3.8915 | 3.8055 | T 1.9955 | 1.9690 |
| 2 | 3.8980 | 3.8350 | M 1.9770 | 1.9640 |
| 3 | 3.8985 | 3.8345 | B 1.9755 | 1.9760 |
| Avg. | 3.8960 in | 3.825 in 9.7155 | 1.9827 in | 1.969667 in 5.0029533 cm |
| | 9.89584 cm | | 5.036058 cm | |

Description After Test Dry Wt of Soil = 303.62 Post Test wt = 381.34

Remarks Initial $\gamma_m$ = 120.2 Final $\gamma_{moist}$ = 124.6

$\gamma_d$ = 96.1 $\gamma_{dry}$ = 99.2

% m = 25.0% % moisture = 25.6

Failure Sketch

| | |
|---|---|
| Trimmed By | KGL & JDB |
| Trimmed Date | 12-14-06 |
| Setup By | KGL & JDB |
| Setup Date | 12-14-06 |
| Taken Down By | KGK |
| Take Down Date | 12-19-06 |

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Signs UWLF

SAMPLE Composite #7 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-14-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 72.6 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-15-06 | 0 | 2.98 | 71.0 | 71.7 | | | | |
| | 1 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |
| | 8 | | 76.0 | 76.6 | 5.0 | | 4.9 | 0.98 |

REITZ & JENS, INC. Consulting Engineers Sheet ________ of ________

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT American Stone UWLF

SAMPLE Composite #7 DEPTH (6.9)

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75.0

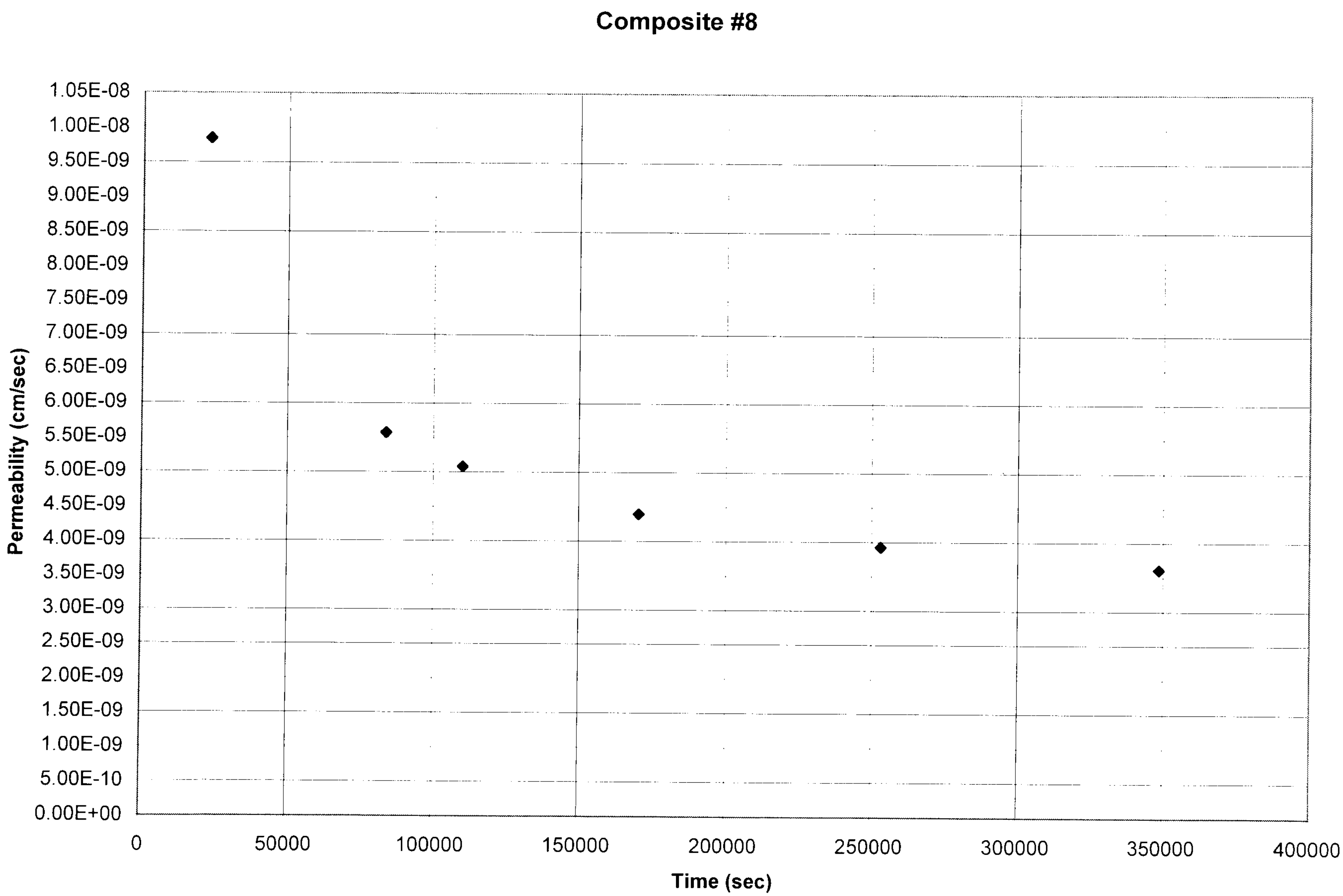
| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-15-06 | 11:00 | 10.00 | | | 0 | | |
| | | 9.69 | 0.31 | 0.31 | 0.1 | | |
| | | 9.63 | 0.06 | 0.37 | 0.25 | | |
| | | 9.57 | 0.06 | 0.43 | .5 | | |
| | 11:01 | 9.49 | 0.08 | 0.51 | 1 | | 8.10 cell |
| | 11:02 | 9.33 | 0.16 | 0.67 | 2 | | |
| | 11:04 | 9.17 | 0.16 | 0.83 | 4 | | |
| | 11:08 | 8.92 | 0.25 | 1.08 | 8 | | 8.60 cell |
| | 11:15 | 8.66 | 0.26 | 1.34 | 15 | | |
| | 11:38 | 8.36 | 0.30 | 1.64 | 38 | | |
| | 12:00 | 8.26 | 0.10 | 1.74 | 60 | | |
| | 13:00 | 8.17 | 0.09 | 1.83 | 120 | | 9.20 cell |
| | 15:02 | 8.11 | 0.06 | 1.89 | 242 | | |
| 12-16 | 10:55 | 8.32 | | | 1435 | | |

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #8
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 116.7 (lbs/ft^3) | Wet Density = 120.0 (lbs/ft^3) |
| % Moisture = 27.8% | % Moisture = 34.6% |
| Dry Density = 91.3 (lbs/ft^3) | Dry Density = 89.1 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 8.9983733 |
| A (cm^2)= | 20.315602 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/2/2007 | 9:10 | 0 | 3.5 | 10.00 | 27.200 | 0.00 | 78.000 | 261.874 | 19.7 | | | | |
| | 15:40 | 23400 | 3.4 | 9.82 | 28.114 | 0.10 | 77.492 | 260.452 | 22.8 | 21.25 | 1.01E-08 | 0.9704616 | 9.85E-09 |
| 1/3/2007 | 8:30 | 84000 | 3.8 | 9.67 | 28.876 | 0.24 | 76.781 | 258.978 | 20.3 | 21.47 | 5.77E-09 | 0.9654557 | 5.57E-09 |
| | 15:45 | 110100 | 3.6 | 9.62 | 29.130 | 0.30 | 76.476 | 258.420 | 22.5 | 21.45 | 5.26E-09 | 0.9658185 | 5.08E-09 |
| 1/4/2007 | 8:30 | 170400 | 3.8 | 9.53 | 29.588 | 0.44 | 75.765 | 257.251 | 20.8 | 21.52 | 4.56E-09 | 0.9641953 | 4.39E-09 |
| 1/5/2007 | 7:30 | 253200 | 3.9 | 9.43 | 30.096 | 0.63 | 74.800 | 255.778 | 21.3 | 21.37 | 4.06E-09 | 0.9677473 | 3.92E-09 |
| 1/6/2007 | 10:00 | 348600 | 4.0 | 9.32 | 30.654 | 0.83 | 73.784 | 254.203 | 20.7 | 21.27 | 3.72E-09 | 0.9700749 | 3.61E-09 |



Composite #8
1.05E-08
1.00E-08
9.50E-09
9.00E-09
8.50E-09
8.00E-09
7.50E-09
7.00E-09
6.50E-09
6.00E-09
5.50E-09
5.00E-09
4.50E-09
4.00E-09
3.50E-09
3.00E-09
2.50E-09
2.00E-09
1.50E-09
1.00E-09
5.00E-10
0.00E+00
Permeability (cm/sec)
0
50000
100000
150000
200000
250000
300000
350000
400000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ameren Sioux UWLF
Location-
Sample--- Composite #8
Depth-----

a=
A=
L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 83.0 | 75.0 | 78.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-2-07 | 9:10 | 0 | 3.45 | 10.00 | 0.00 | | | | 19.7 | |
| | 15:40 | 390 | 3.35 | 9.82 | 0.10 | | | | 22.8 | |
| 1-3-07 | 8:30 | 1400 | 3.75 | 9.67 | 0.24 | | | | 20.3 | |
| | 15:45 | 1835 | 3.55 | 9.62 | 0.30 | | | | 22.5 | |
| 1-4-07 | 8:30 | 2840 | 3.80 | 9.53 | 0.44 | | | | 20.8 | |
| 1-5-07 | 7:30 | 4220 | 3.90 | 9.43 | 0.63 | | | | 21.3 | |
| 1-6-07 | 10:00 | 5910 | 4.00 | 9.32 | 0.83 | | | | 20.7 | |
| | | | | | | | | | | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF  Date: 12-26-06
Sample: Composite #8  Depth:
Description: CH

Type of Test: Hyd Cond. (Flex-wall)  Confining Pressure Differential:
Cell Number: 4  Saturate before after Consolidation:
Number of Membranes: 2  Filter Strips Yes No

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | 12 | 70 | R/13 |
| Wet Wt. + Tare | 93.13 | 103.82 | 79.35 |
| Dry Wt. + Tare | 77.67 | 85.85 | 69.43 |
| Wt. Water | | | |
| Tare Wt. | 21.90 | 21.55 | 40.80 |
| Dry Soil Wt. | | | |
| Moisture % | 27.721 | 27.947 | |
| Avg. w % | 27.83 | | 34.649 |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | |
| at saturation start | |
| at consolidation start | |
| at axial load start | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.5365 | 3.5506 | T 1.982 | 1.9965 |
| 2 | 3.5265 | 3.5400 | M 1.9815 | 2.0005 |
| 3 | 3.5310 | 3.5376 | B 1.9805 | 2.0100 |
| Avg. | 3.5313<br>8.969587 | 3.5426667<br>8.99837333 | 1.981333<br>5.03259 | 2.002333<br>5.08592667 |

Description After Test: Final wt = 351.48
Dry = 261.03

Remarks: Initial $\gamma_m$ = 116.7  Final $\gamma_m$ = 120.0
$\gamma_{dry}$ = 91.3  $\gamma_{dry}$ = 89.1
%M = 27.8  %M = 34.6

Failure Sketch

Trimmed By: JDB
Trimmed Date: 12-26-06
Setup By: JDB
Setup Date: 12-26-06
Taken Down By: KEK
Take Down Date: 1-6-07

REITZ & JENS, INC. Consulting Engineers  Sheet ______ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Amerw NE Sioux UWLF

SAMPLE Composite #8 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-27-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 70.4 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-29-06 | 0 | 3.56 | 71.0 | 70.9 | | | | |
| | 1 | | 76.0 | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 4 | | " | 75.7 | 5.0 | | 4.8 | 0.96 |
| | 8 | | " | 75.7 | 5.0 | | 4.8 | 0.96 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #8 @ +12% DEPTH

CONSOLIDATION CELL PRESSURE 80 psi CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 75 psi

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-29-06 | 9:20 | 10.00 | | | 0 | | |
| | | 9.84 | 0.16 | 0.16 | .1 | | |
| | | 9.82 | 0.02 | 0.18 | .25 | | |
| | | 9.80 | 0.02 | 0.20 | .5 | | |
| | 9:21 | 9.78 | 0.02 | 0.22 | 1 | | |
| | 9:22 | 9.75 | 0.03 | 0.25 | 2 | | |
| | 9:24 | 9.72 | 0.03 | 0.28 | 4 | | |
| | 9:28 | 9.68 | 0.04 | 0.32 | 8 | | |
| | 9:35 | 9.64 | 0.04 | 0.36 | 15 | | |
| | 9:50 | 9.59 | 0.05 | 0.41 | 30 | | |
| | 10:20 | 9.53 | 0.06 | 0.47 | 60 | | |
| | 11:20 | 9.46 | 0.07 | 0.54 | 120. | | |
| | *4 15 | *9.30 | | | | | |
| 1-2-07 | 8:45 | 9.66 | | | | | |

Begin Hyd Cond

REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

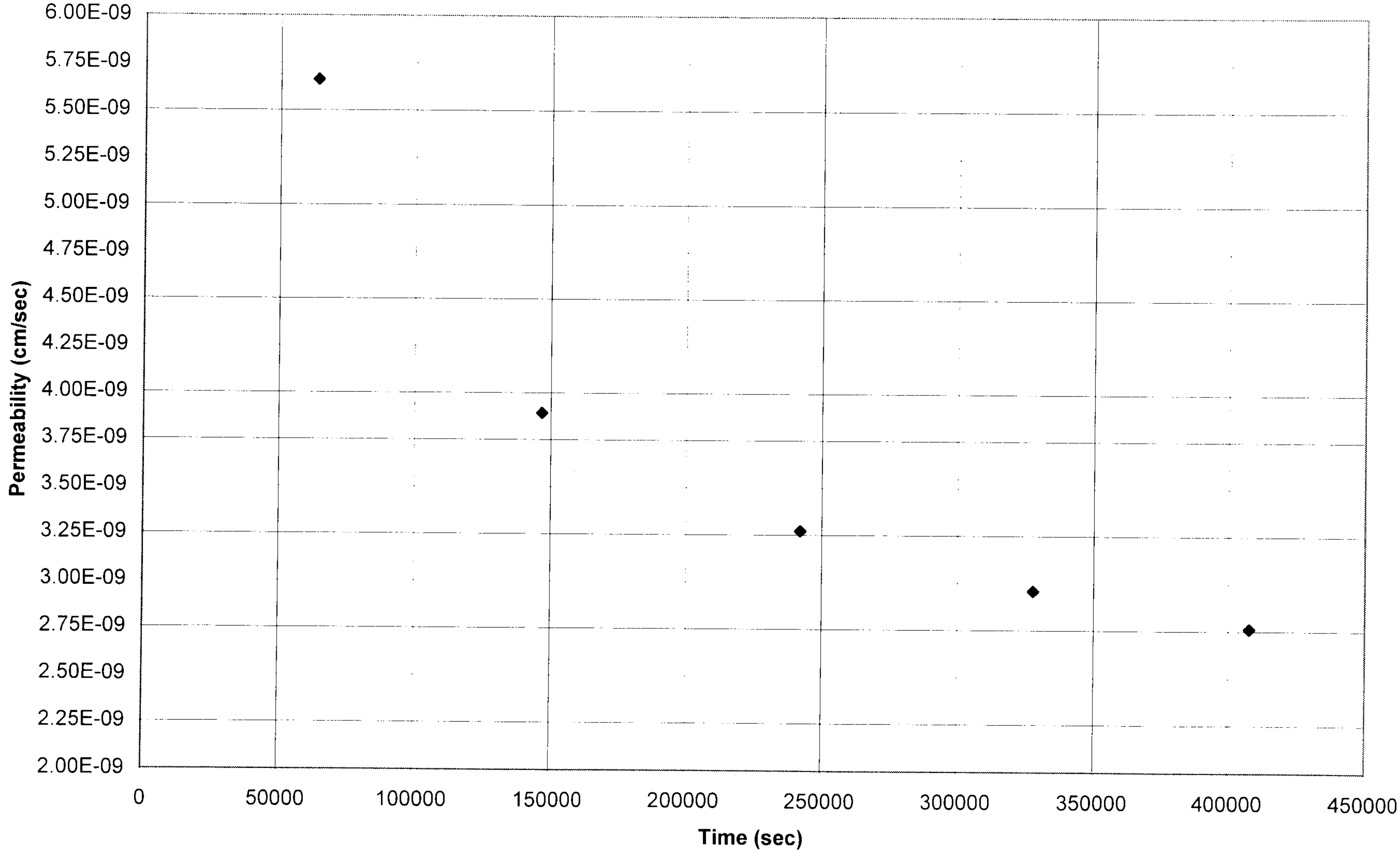
## Ameren, Soiux UWLF
**Project # 2005012477**
**Compostite #9**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 120.4 (lbs/ft^3) | Wet Density = 121.4 (lbs/ft^3) |
| % Moisture = 26.5% | % Moisture = 29.2% |
| Dry Density = 95.2 (lbs/ft^3) | Dry Density = 94.0 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.1025133 |
| A (cm^2)= | 20.312218 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/3/2007 | 14:45 | 0 | 14.7 | 10.00 | 27.200 | 0.00 | 78.000 | 191.516 | 22.4 | | | | |
| 1/4/2007 | 8:30 | 63900 | 15.0 | 9.72 | 28.622 | 0.04 | 77.797 | 189.890 | 20.8 | 21.60 | 5.88E-09 | 0.9623875 | 5.66E-09 |
| 1/5/2007 | 7:30 | 146700 | 15.3 | 9.60 | 29.232 | 0.10 | 77.492 | 188.976 | 21.3 | 21.29 | 4.01E-09 | 0.9695431 | 3.89E-09 |
| 1/6/2007 | 10:00 | 242100 | 15.5 | 9.50 | 29.740 | 0.19 | 77.035 | 188.011 | 20.7 | 21.18 | 3.37E-09 | 0.9721955 | 3.27E-09 |
| 1/7/2007 | 9:50 | 327900 | 15.6 | 9.44 | 30.045 | 0.28 | 76.578 | 187.249 | 20.4 | 21.01 | 3.03E-09 | 0.9760209 | 2.96E-09 |
| 1/8/2007 | 8:00 | 407700 | 15.7 | 9.38 | 30.350 | 0.35 | 76.222 | 186.588 | 20.3 | 20.88 | 2.82E-09 | 0.9790664 | 2.76E-09 |

## Composite #9



Permeability (cm/sec)
6.00E-09
5.75E-09
5.50E-09
5.25E-09
5.00E-09
4.75E-09
4.50E-09
4.25E-09
4.00E-09
3.75E-09
3.50E-09
3.25E-09
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2.50E-09
2.25E-09
2.00E-09
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100000
150000
200000
250000
300000
350000
400000
450000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- [illegible] UWLF
Location-
Sample--- Composite #9
Depth-----

a=
A=
L=

**Cell No.** 2

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 82.0 | 75.0 | 77.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-3-07 | 14:45 | 0 | 14.7 | 10.00 | 0.00 | | | | 22.4 | |
| 1-4-07 | 8:30 | 1065 | 15.0 | 9.72 | 0.04 | | | | 20.8 | |
| 1-5-07 | 7:30 | 2445 | 15.3 | 9.60 | 0.10 | | | | 21.3 | |
| 1-6-07 | 10:00 | 4035 | 15.5 | 9.50 | 0.19 | | | | 20.7 | |
| 1-7-07 | 9:50 | 5465 | 15.6 | 9.44 | 0.28 | | | | 20.4 | |
| 1-8-07 | 8:00 | 6795 | 15.7 | 9.38 | 0.35 | | | | 20.3 | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project Ameren Sioux Date 12-28-06

Sample Composite #9 Depth @+18% Moisture Std. Compac

Description CLAY (CL-CH), Brown

Type of Test Hyd. Cond. Confining Pressure Differential 5 psi

Cell Number 2 Saturate before after Consolidation

Number of Membranes 2 Filter Strips Yes No

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 492 |
| at axial load start | |

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M5 | M19 | |
| Wet Wt. + Tare | 110.34 | 111.55 | |
| Dry Wt. + Tare | 91.76 | 92.29 | |
| Wt. Water | | | |
| Tare Wt. | 22.12 | 21.66 | |
| Dry Soil Wt. | | | |
| Moisture % | 26.680 | 26.374 | |
| Avg. w % | 26.53 | | |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 352.24 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

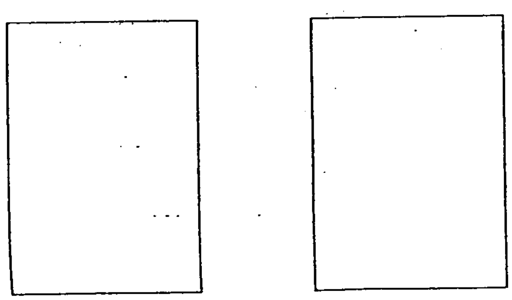
| | HEIGHT | | DIAMETER | | |
|---|---|---|---|---|---|
| | Initial | Final | | Initial | Final |
| 1 | 3.5675 | 3.5805 | T | 1.9940 | 2.0105 |
| 2 | 3.5535 | 3.5800 | M | 1.9925 | 1.9905 |
| 3 | 3.5725 | 3.5985 | B | 1.9980 | 2.0055 |
| Avg. | 3.5645<br>9.05383 | 3.583667<br>9.1025133 | | 1.99483<br>5.06687 | 2.002167<br>5.085503 |

Description After Test Final wt = 359.67

Remarks Initial
$\gamma_m$ = 120.4
$\gamma_{dry}$ = 95.2
%M = 26.5

Final
$\gamma_m$ = 121.4
$\gamma_{dry}$ = 94.0
%M = 29.2

Failure Sketch



Trimmed By KCK
Trimmed Date 12-28-06

Setup By KCK
Setup Date 12-28-06

Taken Down By KCK
Take Down Date 1-8-07

trxSTUP.dwg revised 2/12/98

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT American Sioux WWLF

SAMPLE Composite #9 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-28-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.1 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant: CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 1-2-07 | 0 | 5.40 | 71.0 | 70.3 | | | | |
| | 1 | | 76.0 | 75.2 | | | 4.9 | 0.98 |
| | 2 | | " | 75.2 | | | 4.9 | 0.98 |
| | 4 | | " | 75.2 | | | 4.9 | 0.98 |
| | 8 | | " | | | | | |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

SAMPLE Composite #9 DEPTH

CONSOLIDATION CELL PRESSURE 80.0 CELL NUMBER 2

CONSOLIDATION PORE PRESSURE 75.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-2-07 | 13:10 | 10.00 | | | 0 | | |
| | | 9.82 | | | .1 | | |
| | | 9.81 | | | .125 | | |
| | | 9.80 | | | .5 | | |
| | 13:11 | 9.79 | | | 1 | | |
| | 13:12 | 9.78 | | | 2 | | |
| | 13:14 | 9.76 | | | 4 | | |
| | 13:18 | 9.74 | | | 8 | | |
| | 13:25 | 9.71 | | | 15 | | |
| | 13:40 | 9.67 | | | 30 | | |
| | 14:10 | 9.62 | | | 60 | | |
| | 15:40 | 9.53 | | | | | |
| 1-3-07 | 8:30 | 9.40 | | | | | |
| | 14:30 | 9.46 | | | | | |

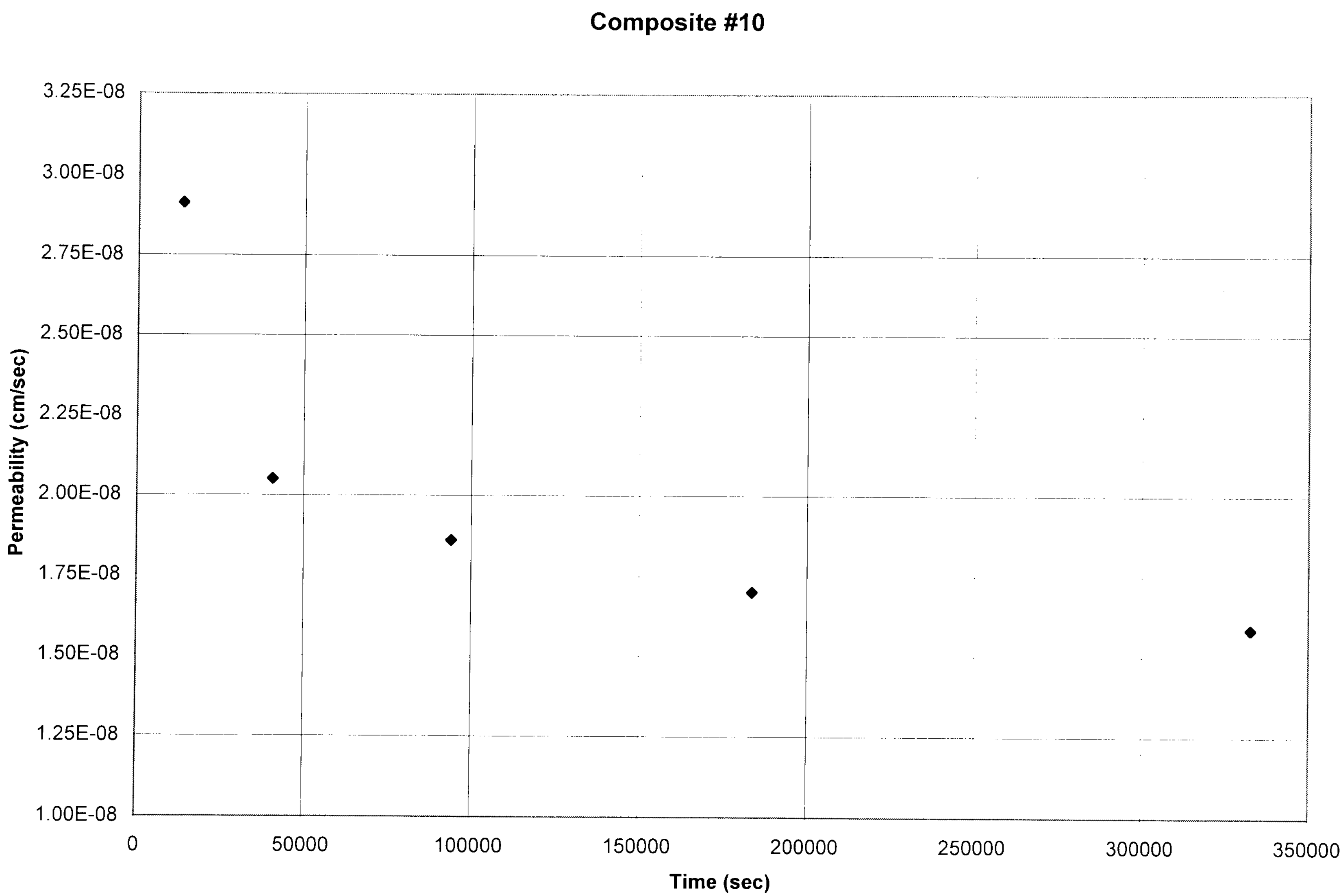
Done

**Ameren, Soiux UWLF**
**Project # 2005012477**
**Compostite #10**
**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 121.3 (lbs/ft^3) | Wet Density = 124.2 (lbs/ft^3) |
| % Moisture = 22.3% | % Moisture = 26.0% |
| Dry Density = 99.2 (lbs/ft^3) | Dry Density = 98.6 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.8743347 |
| A (cm^2)= | 20.005651 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/22/2006 | 11:20 | 0 | 9.8 | 10.00 | 27.200 | 0.00 | 78.000 | 121.158 | 21.3 | | | | |
| 12/22/2006 | 15:07 | 13620 | 10.1 | 9.88 | 27.810 | 0.08 | 77.594 | 120.142 | 21.3 | 21.30 | 3.00E-08 | 0.9693013 | 2.91E-08 |
| 12/22/2006 | 22:40 | 40800 | 10.8 | 9.72 | 28.622 | 0.14 | 77.289 | 119.024 | 21.3 | 21.30 | 2.12E-08 | 0.9693013 | 2.05E-08 |
| 12/23/2006 | 13:28 | 94080 | 12.0 | 9.53 | 29.588 | 0.40 | 75.968 | 116.738 | 21.3 | 21.30 | 1.92E-08 | 0.9693013 | 1.86E-08 |
| 12/24/2006 | 14:20 | 183600 | 13.2 | 9.23 | 31.112 | 0.76 | 74.139 | 113.386 | 21.3 | 21.30 | 1.75E-08 | 0.9693013 | 1.70E-08 |
| 12/26/2006 | 7:45 | 332700 | 14.6 | 8.78 | 33.398 | 1.29 | 71.447 | 108.407 | 20 | 21.01 | 1.62E-08 | 0.9760936 | 1.58E-08 |


Composite #10
Permeability (cm/sec)
3.25E-08
3.00E-08
2.75E-08
2.50E-08
2.25E-08
2.00E-08
1.75E-08
1.50E-08
1.25E-08
1.00E-08
0
50000
100000
150000
200000
250000
300000
350000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Ameron Sioux
Location-
Sample--- Composite #10
Depth-----

a=
A=
L=

**Cell No.**

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 81.0 | 75.0 | 76.0 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 12-22-06 | 11:20 | 0 | 9.80 | 10.00 | 0.00 | | | | 21.3 | |
| 12/22 | 1507 | 227 | 10.1 | 9.88 | 0.08 | | | | | |
| | 2240 | 680 | 10.8 | 9.72 | 0.14 | | | | 21.3 | |
| 12/23 | 1328 | 1568 | 12.0 | 9.53 | 0.40 | | | | | |
| 12/24 | 1420 | 3060 | 13.2 | 9.23 | 0.76 | | | | | |
| 12/26 | 745 | 5545 | 14.6 | 8.78 | 1.29 | | | | 20.0 | |
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| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameron Sioux — Date: 12-20-06

Sample: Composite #10 — Depth: @+122 ~~[illegible]~~; Standard Proctor

Description:

Type of Test: Hyd. Cond. — Confining Pressure Differential: 5psi

Cell Number: #1 — Saturate (before) after Consolidation

Number of Membranes: 2 — Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | M38 | M47 | |
| Wet Wt. + Tare | 102.54 | 92.28 | |
| Dry Wt. + Tare | 87.82 | 79.56 | |
| Wt. Water | 14.72 | 12.72 | |
| Tare Wt. | 21.81 | 22.26 | |
| Dry Soil Wt. | 66.01 | 57.3 | |
| Moisture % | 22.30 | 22.20 | |
| Avg. w % | ~~[illegible]~~ 22.3 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 502 |
| at axial load start | 530 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT | | DIAMETER | | |
|---|---|---|---|---|---|
| | Initial | Final | | Initial | Final |
| 1 | 3.920 | 3.888 | T | 1.9835 | 1.9935 |
| 2 | 3.910 | 3.887 | M | 1.9790 | 1.9840 |
| 3 | 3.900 | 3.8876 | B | 1.9648 | 1.9835 |
| Avg. | 3.91<br>9.9314 | 3.88753<br>9.87433 | | 1.9755<br>5.01777 | 1.9870<br>5.04698 |

Description After Test: $W_{Final}$ = 393.08; Dry = 312.04

Remarks: Initial $\gamma_m$ = 121.3; $\gamma_{dry}$ = 99.2; %M = 22.3 — Final $\gamma_m$ = 124.2; $\gamma_{dry}$ = 98.6; %M = 25.972

Failure Sketch

Trimmed By: KEK — Trimmed Date: 12-20-06

Setup By: KEK — Setup Date: 12-20-06

Taken Down By: JPB — Take Down Date: 12-26-06

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REITZ & JENS, INC. Consulting Engineers — Sheet ______ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren Sioux UWLF

SAMPLE Composite #10 DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 12-20-06

INITIAL PORE PRESSURE 70.0 CELL NUMBER 1

INITIAL TRANSDUCER READING 71.7 TRANSDUCER NUMBER 1

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS- DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 12-21-06 | 0 | 5.02 | 71.0 | 71.6 | | | | |
| | 1 | | 76.0 | 76.5 | 5.0 | | 4.9 | 0.98 |
| | 2 | | 76.0 | 76.5 | 5.0 | | 4.9 | 0.98 |
| | 4 | | 76.0 | 76.4 | 5.0 | | 4.8 | 0.96 |
| | 8 | | 76.0 | 76.4 | 5.0 | | 4.8 | 0.96 |

OK

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Anaconda Sioux CWLF

SAMPLE Composite #10 DEPTH

CONSOLIDATION CELL PRESSURE 80.0psi CELL NUMBER 1

CONSOLIDATION PORE PRESSURE 75psi

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 12-21-06 | 9:20 | 10.00 | | | 0 | | |
| | | 9.72 | 0.28 | 0.28 | .1 | | |
| | | 9.70 | 0.02 | 0.30 | .25 | | |
| | | 9.67 | 0.03 | 0.33 | .5 | | |
| | 9:21 | 9.64 | 0.03 | 0.36 | 1 | | |
| | 9:22 | 9.60 | 0.04 | 0.40 | 2 | | |
| | 9:24 | 9.54 | 0.06 | 0.46 | 4 | | |
| | 9:28 | 9.47 | 0.07 | 0.53 | 8 | | |
| | 9:35 | 9.39 | 0.08 | 0.61 | 15 | | |
| | 9:50 | 9.22 | 0.17 | 0.78 | 30 | | |
| | 10:20 | 9.04 | 0.18 | 0.96 | 60 | | |
| | 11:20 | 8.84 | 0.20 | 1.16 | 120 | | |
| | 12:20 | 8.70 | 0.14 | 1.30 | 180 | | |
| 12-22 | 7:20 | 8.50 | 0.20 | 1.50 | 1560 | 20.0 | |

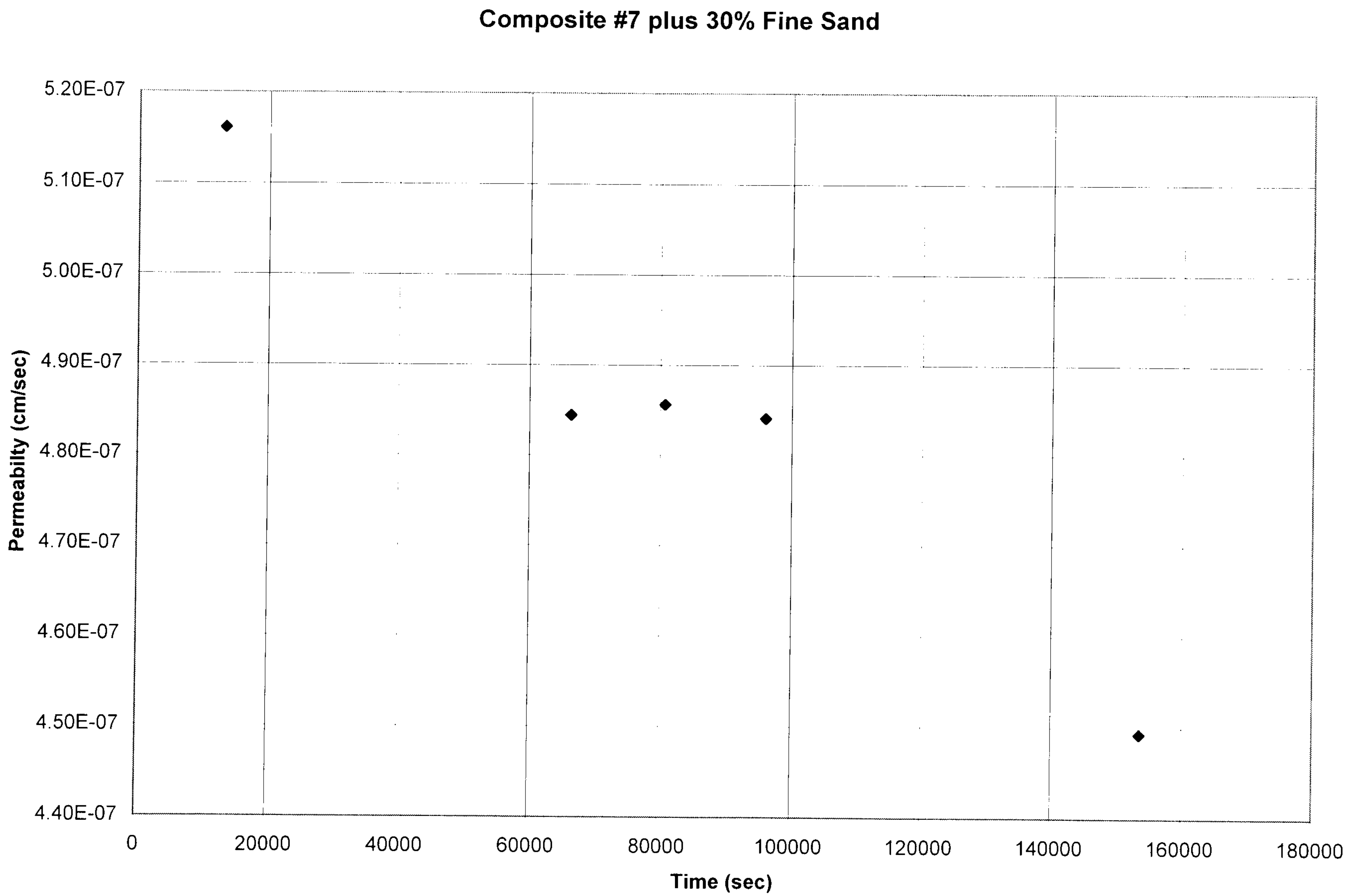
REITZ & JENS, INC. Consulting Engineers Sheet ______ of ______

## Ameren, Soiux UWLF
### Project # 2005012477
### Compostite #7 plus 30% fine sand
Hydraulic Conductivity

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 121.3 (lbs/ft^3) | Wet Density = 126.2 (lbs/ft^3) |
| % Moisture = 23.6% | % Moisture = 24.6% |
| Dry Density = 98.1 (lbs/ft^3) | Dry Density = 101.2 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.2650733 |
| A (cm^2)= | 19.004949 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8/2007 | 13:05 | | 19.9 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 21.8 | | | | |
| | 16:45 | 13200 | 19.7 | 8.79 | 33.347 | 1.15 | 72.158 | 73.990 | 22.9 | 22.35 | 5.46E-07 | 0.9454520 | 5.16E-07 |
| 1/9/2007 | 7:30 | 66300 | 21.1 | 5.75 | 48.790 | 4.27 | 56.308 | 42.697 | 20.6 | 21.87 | 5.07E-07 | 0.9562465 | 4.84E-07 |
| | 11:30 | 80700 | 20.1 | 5.17 | 51.736 | 4.86 | 53.311 | 36.754 | 20.8 | 21.66 | 5.05E-07 | 0.9609966 | 4.86E-07 |
| | 15:45 | 96000 | 20.0 | 4.65 | 54.378 | 5.39 | 50.619 | 31.420 | 21.9 | 21.61 | 5.03E-07 | 0.9621298 | 4.84E-07 |
| 1/10/2007 | 7:45 | 153600 | 20.3 | 3.50 | 60.220 | 6.59 | 44.523 | 19.482 | 19.8 | 21.33 | 4.64E-07 | 0.9687039 | 4.49E-07 |



Composite #7 plus 30% Fine Sand
Permeabilty (cm/sec)
5.20E-07
5.10E-07
5.00E-07
4.90E-07
4.80E-07
4.70E-07
4.60E-07
4.50E-07
4.40E-07
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- Amrean UWLF Sioux
Location-
Sample--- Composite #7 + 30% Sand
Depth-----

a=
A=
L=

**Cell No.** 4

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 76.5 | 71.0 | 71.5 |

1105
240
1345

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-8-07 | 13:05 | 0 | 19.85 | 10.00 | 0.00 | | | | 20.8 | |
| | 16:45 | 220 | 19.70 | 8.79 | 1.15 | | | | 22.9 | |
| 1-9-07 | 7:30 | 1105 | 20.10 | 5.75 | 4.27 | | | | 20.6 | |
| | 11:30 | 1345 | 20.05 | 5.17 | 4.86 | | | | 20.8 | |
| | 15:45 | 1600 | 20.00 | 4.65 | 5.39 | | | | 21.9 | |
| 1-10-07 | 7:45 | 2560 | 20.25 | 3.50 | 6.89 | | | | 19.8 | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project: Ameren Sioux UWLF    Date: 1-6-07

Sample: Composite 7 + 30% Silty Sand    Depth: Stand. Proc. @ +2% M

Description: Brown clayey SILT w/ FINE Sand

Type of Test: Hyd. Cond.    Confining Pressure Differential: 5 psi

Cell Number: 4    Saturate (before) after Consolidation

Number of Membranes: 2    Filter Strips Yes (No)

**LENGTH CHANGE**

STRAIN GAUGE at setup ______

at saturation start ______

at consolidation start ______

at axial load start ______

**MOISTURE CONTENT**

| | INITIAL | | FINAL |
|---|---|---|---|
| Tare No. | B-29 | B-21 | |
| Wet Wt. + Tare | 251.13 | 273.71 | |
| Dry Wt. + Tare | 211.10 | 228.88 | |
| Wt. Water | | | |
| Tare Wt. | 40.58 | 40.60 | |
| Dry Soil Wt. | | | |
| Moisture % | 23.475 | 23.820 | |
| Avg. w % | 23.6475 | | |

**MASS PROPERTIES**

| | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | 352.94 | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

**SPECIMEN DIMENSIONS** in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.6770 | 3.6380 | T 1.9540 | 1.9375 |
| 2 | 3.6805 | 3.6470 | M 1.9620 | 1.9380 |
| 3 | 3.6805 | 3.6590 | B 1.9600 | 1.9355 |
| Avg. | 3.67933<br>9.34551 | 3.6476667<br>9.2650733 | 1.9586667<br>4.975013 | 1.9366667<br>4.91913373 |

Description After Test ______ Final wt = 355.90

Remarks: Initial $\gamma_m$ = 121.3, $\gamma_{dry}$ = 98.1, %M = 23.6    Final $\gamma_m$ 126.2, $\gamma_{dry}$ 101.2, %M 24.6

Failure Sketch

Trimmed By: K.E.K.
Trimmed Date: 1-6-07

Setup By: KEK
Setup Date: 1-6-07

Taken Down By ______
Take Down Date ______

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REITZ & JENS INC. Consulting Engineers    Sheet ______ of ______

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Ameren Sioux UWLF

SAMPLE Composite #7 + 30% Silty Fine Sand DEPTH

INITIAL CELL PRESSURE 70.0 START DATE 1-6-07

INITIAL PORE PRESSURE 70.0 CELL NUMBER 4

INITIAL TRANSDUCER READING 70.8 TRANSDUCER NUMBER 4

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
| 1-8-07 | 0 | 4.00 | 71.0 | 70.4 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 2 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 4 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | 8 | | " | 75.3 | 5.0 | | 4.9 | 0.98 |
| | | | | | ~~5.0~~ | | | |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Ameren Sioux UWLF

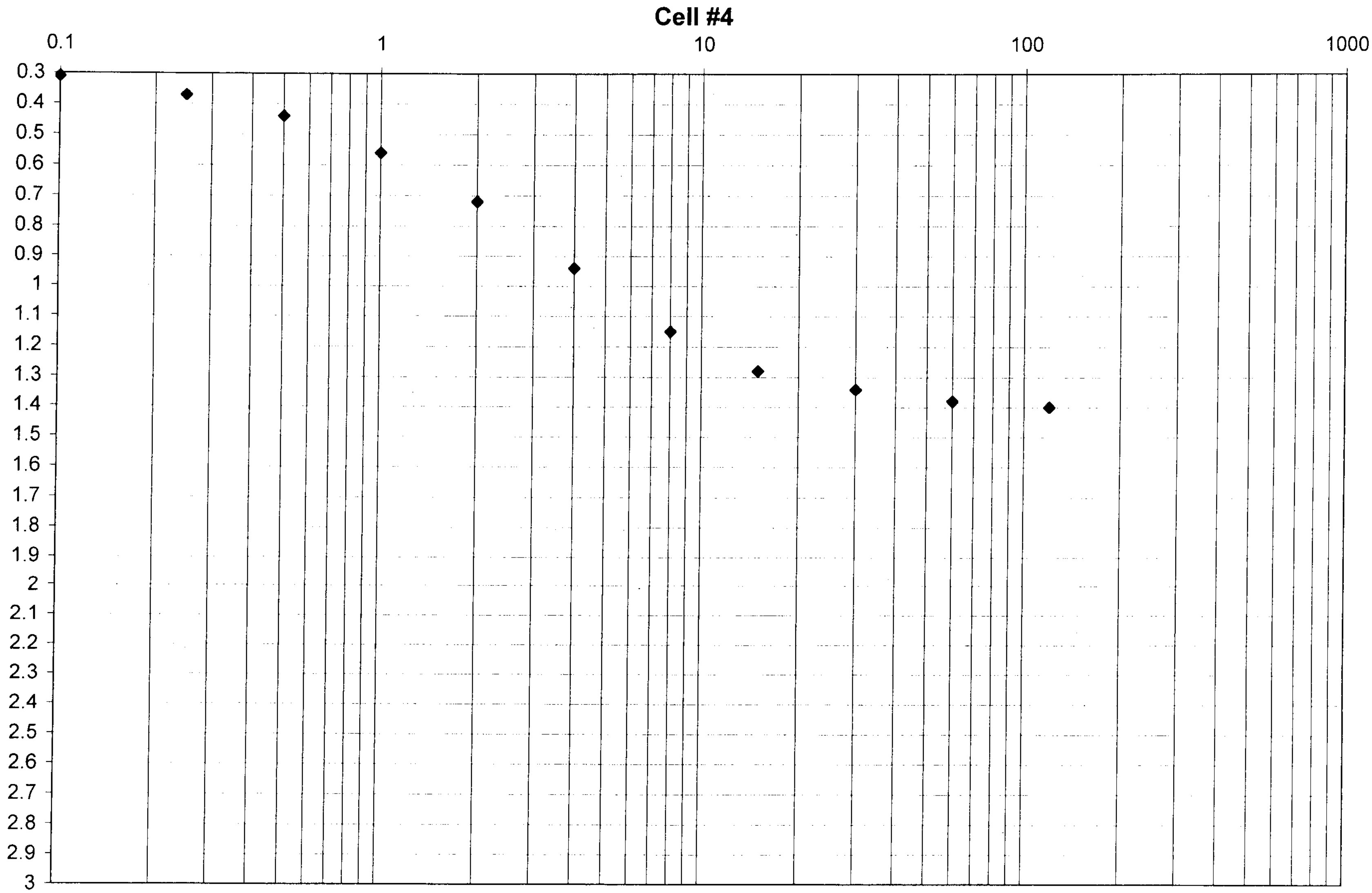
SAMPLE Composite #7 + 30% Silty Fine Sand DEPTH

CONSOLIDATION CELL PRESSURE 76.0 CELL NUMBER 4

CONSOLIDATION PORE PRESSURE 71.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-8-07 | 9:35 | 10.00 | | | 0 | | |
| | | 9.69 | | 0.31 | .1 | | |
| | | 9.63 | | 0.37 | .25 | | |
| | | 9.56 | | 0.44 | .5 | | |
| | 9:36 | 9.44 | | 0.56 | 1 | | |
| | 9:37 | 9.28 | | 0.72 | 2 | | |
| | 9:39 | 9.06 | | 0.94 | 4 | | |
| | 9:43 | 8.85 | | 1.15 | 8 | | |
| | 9:50 | 8.72 | | 1.28 | 15 | | |
| | 10:05 | 8.66 | | 1.34 | 30 | | |
| | 10:35 | 8.62 | | 1.38 | 60 | | |
| | 11:35 | 8.60 | | 1.40 | 120 | | |

Composite #7 + 30% Fine Sand



## Ameren, Soiux UWLF

**Project # 2005012477**

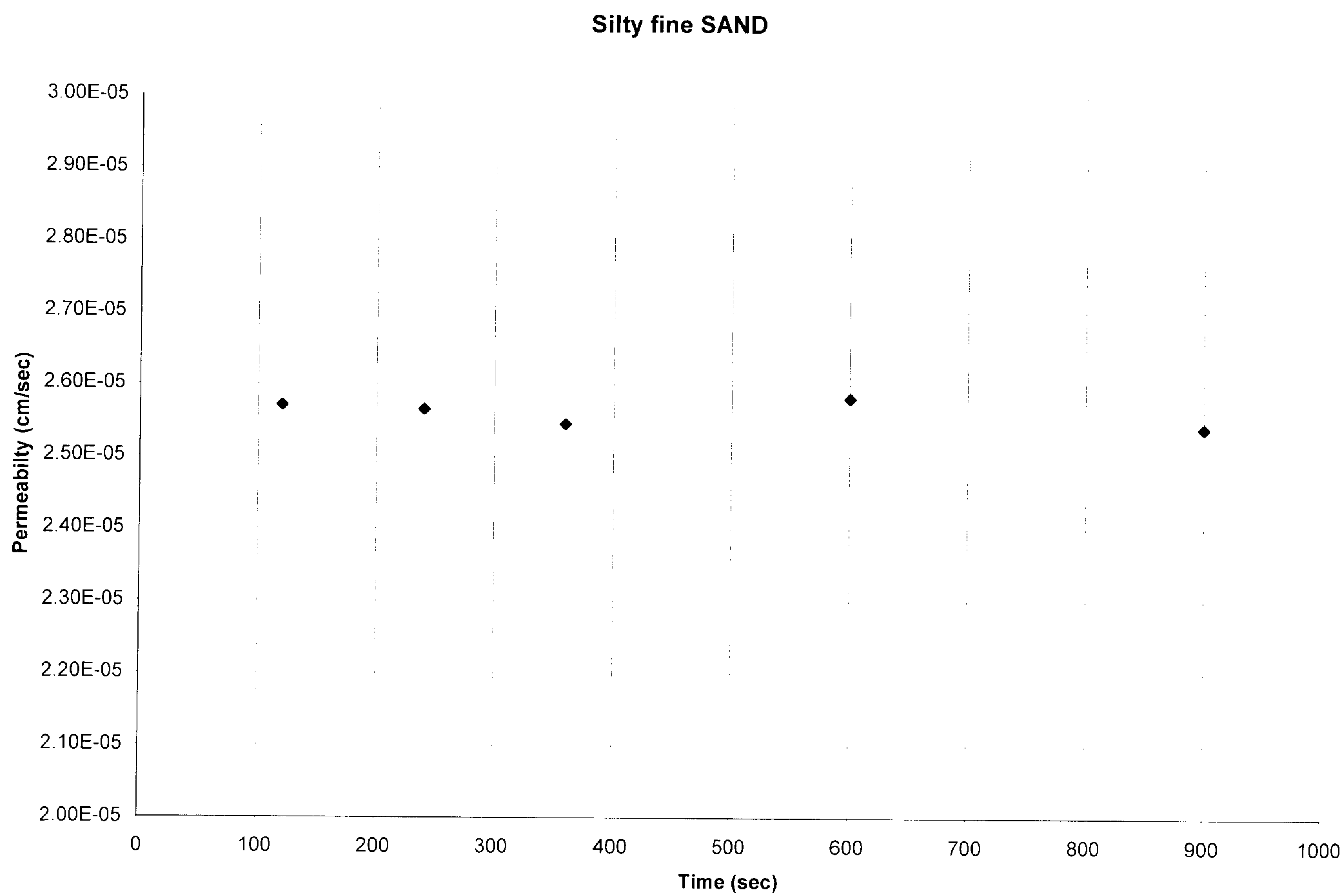
**Silty fine SAND**

**Hydraulic Conductivity**

| Soil Conditions | |
|---|---|
| **Pre-test conditions** | **Post-test Conditions** |
| Wet Density = 118.7 (lbs/ft^3) | Wet Density = 125.1 (lbs/ft^3) |
| % Moisture = 19.1% | % Moisture = 23.8% |
| Dry Density = 99.7 (lbs/ft^3) | Dry Density = 101.1 (lbs/ft^3) |

| Test Information | |
|---|---|
| a (cm^2)= | 0.19685 |
| L (cm)= | 9.03732 |
| A (cm^2)= | 19.781425 |

| Date | Time | Elapsed Time (seconds) | Cell Burette Reading (ml) | Base Burette Reading (ml) | Base Burette Distance from Datum (cm) | Top Burette Reading (ml) | Top Burette Distance from Datum (cm) | Total Head Across Sample (cm of water) | Temperature (°C) | Weighted Average Temp. (°C) | Uncorrected Hydraulic Conductivity (cm/sec) | Correction Factor | Corrected Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/11/2007 | 8:10 | | 20.2 | 10.00 | 27.200 | 0.00 | 78.000 | 85.979 | 20.3 | | | | |
| | 8:12 | 120 | 20.2 | 9.44 | 30.045 | 0.57 | 75.104 | 80.239 | 20.3 | 20.30 | 2.59E-05 | 0.9929555 | 2.57E-05 |
| | 8:14 | 240 | 20.2 | 8.91 | 32.737 | 1.09 | 72.463 | 74.905 | 20.3 | 20.30 | 2.58E-05 | 0.9929555 | 2.57E-05 |
| | 8:16 | 360 | 20.2 | 8.43 | 35.176 | 1.57 | 70.024 | 70.028 | 20.3 | 20.30 | 2.56E-05 | 0.9929555 | 2.55E-05 |
| | 8:20 | 600 | 20.2 | 7.52 | 39.798 | 2.48 | 65.402 | 60.782 | 20.3 | 20.30 | 2.60E-05 | 0.9929555 | 2.58E-05 |
| | 8:25 | 900 | 20.2 | 6.61 | 44.421 | 3.39 | 60.779 | 51.537 | 20.3 | 20.30 | 2.56E-05 | 0.9929555 | 2.54E-05 |


Silty fine SAND
Permeabilty (cm/sec)
3.00E-05
2.90E-05
2.80E-05
2.70E-05
2.60E-05
2.50E-05
2.40E-05
2.30E-05
2.20E-05
2.10E-05
2.00E-05
0
100
200
300
400
500
600
700
800
900
1000
Time (sec)

# Hydraulic Conductivity (ASTM-D 5084)
## Flow Rate Calculation

Job------- American Sioux MSW LF
Location-
Sample--- Grab Silty Fine SAND (SP)
Depth-----

a=
A=
L=

Cell No. 2

| Cell Pressure (p.s.i.) | Base Pressure (p.s.i.) | Top Pressure (p.s.i.) |
|---|---|---|
| 85.5 | 80.0 | 80.5 |

| Date | Time | Elapsed Time Minutes | Cell Reading ML | Base Reading ML | Top Reading ML | Top Head CM | Base Head CM | h CM | Temp. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-11-07 | 8:10 | 0 | 20.2 | 10.00 | 0.00 | | | | 20.3 | |
| | 8:11 | 1 | 20.2 | 9.71 | 0.30 | | | | 20.3 | |
| | 8:12 | 2 | 20.2 | 9.44 | 0.57 | | | | 20.3 | |
| | 8:13 | 3 | 20.2 | 9.17 | 0.83 | | | | 20.3 | |
| | 8:14 | 4 | 20.2 | 8.91 | 1.09 | | | | 20.3 | |
| | 8:15 | 5 | 20.2 | 8.67 | 1.33 | | | | 20.3 | |
| | 8:16 | 6 | 20.2 | 8.43 | 1.57 | | | | 20.3 | |
| | 8:20 | 10 | 20.2 | 7.52 | 2.48 | | | | 20.3 | |
| | 8:25 | 15 | 20.2 | 6.61 | 3.39 | | | | 20.3 | |
| | | | | | | | | | | |
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| | | | | | | | | | | |

| a x L | t (sec) | 2 x A x t | aL/2At | h1 | h2 | ln(h1/h2) | K | Temp. Cor. | K -Cor. | Hyd. Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
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# TRIAXIAL CELL SETUP & TAKEDOWN

Project: American Sioux UWLF  Date: 1-8-07
Sample: Silty Sand (SM)  Depth: — @ + 89% Std. Proctor
Description: Sand (SM), Brown, Silty

Type of Test: Und. Cons.  Confining Pressure Differential: 5.0 psi
Cell Number: 2  Saturate (before) after Consolidation
Number of Membranes: 2  Filter Strips Yes (No)

| MOISTURE CONTENT | INITIAL | | FINAL (Entire Sample) |
|---|---|---|---|
| Tare No. | B-14 | 36 | Bowl 18 |
| Wet Wt. + Tare | 247.40 | 277.03 | 929.44 |
| Dry Wt. + Tare | 214.38 | 239.06 | 860.65 |
| Wt. Water | | | 68.79 |
| Tare Wt. | 40.72 | 41.32 | 571.06 |
| Dry Soil Wt. | | | 289.59 |
| Moisture % | 19.014 | 19.202 | 23.75427 |
| Avg. w % | 19.108 | | |

| LENGTH CHANGE | |
|---|---|
| STRAIN GAUGE at setup | 500 |
| at saturation start | 500 |
| at consolidation start | 498 |
| at axial load start | 514 |

| MASS PROPERTIES | | |
|---|---|---|
| Wt. Tube + Soil | | gm. |
| Wt. Tube | | gm. |
| Wt. Soil | No wt. Due to Brittle Sample | gm. |
| Tube Diameter | | in. |
| Sample Length | | in |
| tube length | | in. |
| top trim | | in. |
| bottom trim | | in. |
| total trim | | in. |
| sample length | | in. |
| Density constant 4.85/(D^2 * L) | | |
| Wet Density | | pcf. |
| Dry Density | | pcf. |

SPECIMEN DIMENSIONS in. / mm.

| | HEIGHT Initial | HEIGHT Final | DIAMETER Initial | DIAMETER Final |
|---|---|---|---|---|
| 1 | 3.5770 | 3.5510 | T 1.9860 | 1.9685 |
| 2 | 3.5745 | 3.5630 | M 1.9820 | 1.9715 |
| 3 | 3.5715 | 3.5600 | B 1.9895 | 1.9875 |
| Avg. | 3.574333 in<br>9.078807 cm | 3.55800<br>9.03732 | 1.985833<br>5.044017 | 1.97583333<br>5.0136147 |

Description After Test

Remarks: Initial $\gamma_m$ 118.7  $\gamma_D$ 99.6  $\%_M$ 19.1    Final $\gamma_m$ = 125.1  $\gamma_{Dm}$ = 101.1  $\%_M$ = 23.8

Failure Sketch

Trimmed By: KOK
Trimmed Date: 1-8-07
Setup By: KOR
Setup Date: 1-8-07
Taken Down By:
Take Down Date:

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REITZ & JENS, INC. Consulting Engineers  Sheet ____ of ____

# TRIAXIAL CELL SATURATION & BETA FACTOR

PROJECT Andrew Sioux UWLF

SAMPLE Silty Fine Sand DEPTH

INITIAL CELL PRESSURE 71.0 START DATE 1-8-07

INITIAL PORE PRESSURE 70.0 CELL NUMBER 2

INITIAL TRANSDUCER READING 71.1 TRANSDUCER NUMBER 2

| TRIAL DATE | TRIAL TIME | BASE BURETTE READING | CELL PRESSURE | TRANS-DUCER READING | CHANGE IN PRESSURE Transducer Constant: CELL DELTA (1) | TRANSDUCER READING CHANGE | TRANSDUCER PRESSURE CHANGE (2) | BETA FACTOR (2/1) |
|---|---|---|---|---|---|---|---|---|
| 1-9-07 | 0 | 2.0 | 71.0 | 70.5 | | | | |
| | 1 | | 76.0 | 75.3 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 75.2 | 5.0 | | 4.7 | 0.94 |
| | 4 | | " | 75.2 | 5.0 | | 4.7 | 0.94 |
| | 8 | | " | | 5.0 | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 1-10-07 | 0 | 2.78 | 76.00 | 75.4 | | | | |
| | 1 | | 81.00 | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 2 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 4 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |
| | 8 | | " | 80.2 | 5.0 | | 4.8 | 0.96 |

# TRIAXIAL CELL CONSOLIDATION TEST

PROJECT Anderson Scour UWCF

SAMPLE # Silty Fine Sand DEPTH

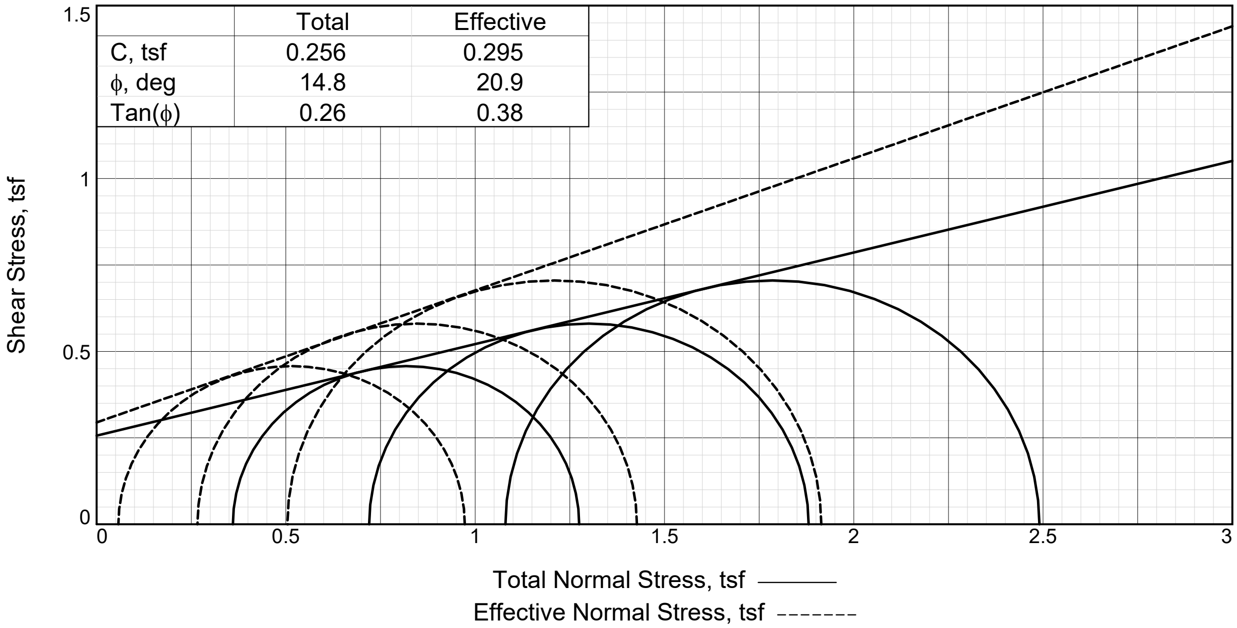
CONSOLIDATION CELL PRESSURE 85.0 CELL NUMBER 2

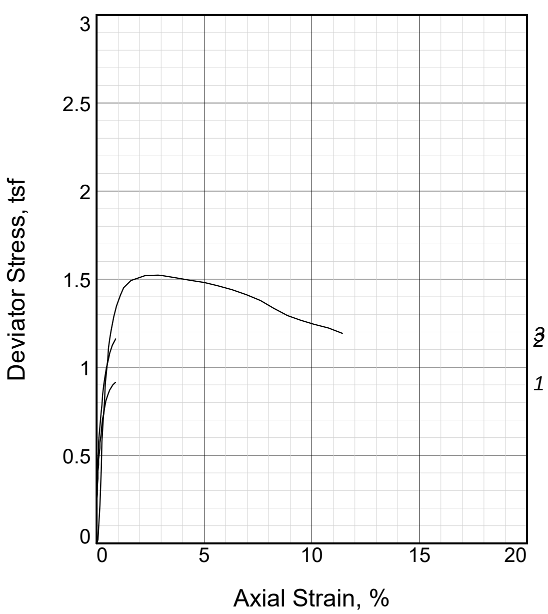
CONSOLIDATION PORE PRESSURE 80.0

| DATE | TIME | BURETTE READING | DELTA VOLUME | SUM DELTA VOLUME | DELTA TIME | TEMP | REMARKS |
|---|---|---|---|---|---|---|---|
| 1-10-06 | 10:35 | 10.00 | | | 0 | | |
| | | 9.42 | | 0.58 | .1 | | |
| | | 9.38 | | 0.62 | .25 | | |
| | | 9.37 | | 0.63 | .5 | | |
| | 10:36 | 9.36 | | 0.64 | 1 | | |
| | 10:37 | 9.36 | | 0.64 | 2 | | |
| | 10:39 | 9.35 | | 0.65 | 4 | | |
| | 10:43 | 9.34 | | 0.66 | 8 | | |
| | 10:50 | 9.33 | | 0.67 | 15 | | |
| | 11:05 | 9.32 | | 0.68 | 30 | | |
| | 11:35 | 9.33 | | | 60 | | |
| | 13:05 | 9.36 | | | | | |

**Appendix 6**

# RESULTS OF TRIAXIAL SHEAR STRENGTH TESTS ON COMPACTED COMPOSITE SAMPLES




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 34.7 | 35.6 | 35.9 |
| | Dry Density, pcf | 86.7 | 85.6 | 85.3 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9299 | 0.9541 | 0.9618 |
| | Diameter, in. | 2.02 | 2.03 | 2.03 |
| | Height, in. | 3.29 | 3.28 | 3.25 |
| At Test | Water Content, | 35.6 | 35.9 | 36.2 |
| | Dry Density, pcf | 85.6 | 85.2 | 84.9 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.9546 | 0.9630 | 0.9708 |
| | Diameter, in. | 2.03 | 2.03 | 2.03 |
| | Height, in. | 3.31 | 3.28 | 3.26 |
| Strain rate, %/min. | | 0.04 | 0.04 | 0.04 |
| Back Pressure, tsf | | 5.04 | 5.36 | 5.83 |
| Cell Pressure, tsf | | 5.40 | 6.08 | 6.91 |
| Fail. Stress, tsf | | 0.91 | 1.16 | 1.41 |
| Total Pore Pr., tsf | | 5.34 | 5.82 | 6.41 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.97 | 1.43 | 1.91 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.06 | 0.27 | 0.50 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard)

**Description:** CLAY (CH), dark brownish grey, high plastic

**LL=** 85 **PL=** 23 **PI=** 62

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

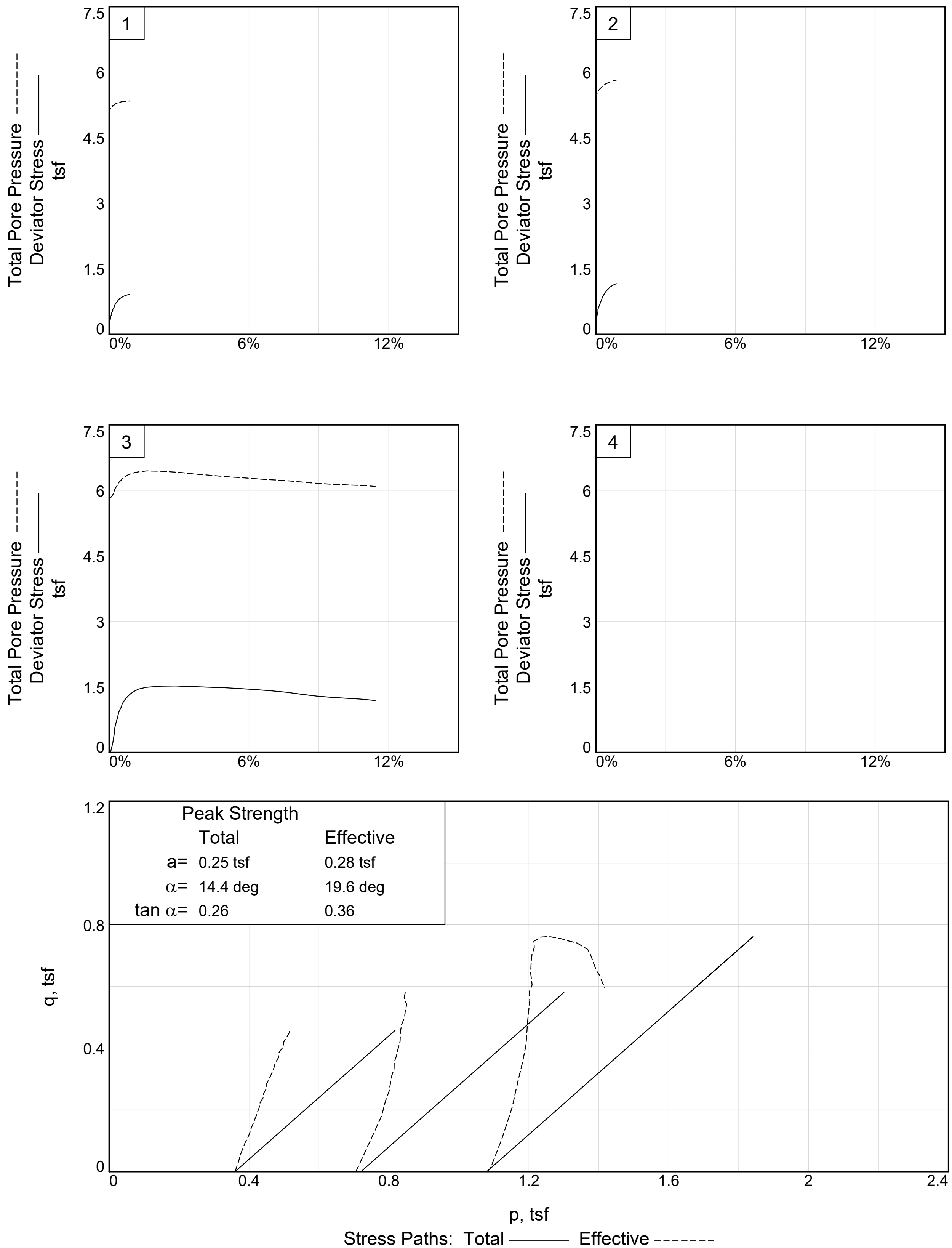
**Source of Sample:** Composite #1

**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




Peak Strength

| | Total | Effective |
|---|---|---|
| a= | 0.25 tsf | 0.28 tsf |
| α= | 14.4 deg | 19.6 deg |
| tan α= | 0.26 | 0.36 |

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Source of Sample:** Composite #1 **Sample Number:** 1

**Project No.:** 2005012477 **Figure** ________

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

**TRIAXIAL COMPRESSION TEST** 1/18/2007
CU with Pore Pressures 7:58 AM

**Date:**
**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Project No.:** 2005012477
**Location:** Composite #1
**Sample Number:** 1
**Description:** CLAY (CH), dark brownish grey, high plastic
**Remarks:**
**Type of Sample:** Compacted (standard)
**Assumed Specific Gravity=**2.68 **LL=**85 **PL=**23 **PI=**62
**Test Method:** COE uniform strain

**Parameters for Specimen No. 1**

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 134.700 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 34.7 | 35.0 | 35.6 | |
| Moist specimen weight, gms. | 323.1 | | | |
| Diameter, in. | 2.02 | 2.02 | 2.03 | |
| Area, in.² | 3.20 | 3.21 | 3.23 | |
| Height, in. | 3.29 | 3.30 | 3.31 | |
| Net decrease in height, in. | | 0.00 | -0.01 | |
| Wet Density, pcf | 116.8 | 116.6 | 116.1 | |
| Dry density, pcf | 86.7 | 86.4 | 85.6 | |
| Void ratio | 0.9299 | 0.9369 | 0.9546 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

**Test Readings for Specimen No. 1**

**Consolidation cell pressure =** 75.00 psi (5.400 tsf)
**Consolidation back pressure =** 70.00 psi (5.040 tsf)
**Consolidation effective confining stress =** 0.360 tsf
**Strain rate, %/min. =** 0.04
**Fail. Stress =** 0.915 tsf **at reading no.** 23

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 20.50 | 0.0 | 0.0 | 0.000 | 0.360 | 0.360 | 1.00 | 70.00 | 0.360 | 0.000 |
| 1 | 0.0000 | 23.30 | 2.8 | 0.0 | 0.062 | 0.338 | 0.401 | 1.18 | 70.30 | 0.370 | 0.031 |
| 2 | 0.0000 | 25.90 | 5.4 | 0.0 | 0.120 | 0.317 | 0.437 | 1.38 | 70.60 | 0.377 | 0.060 |
| 3 | 0.0000 | 28.90 | 8.4 | 0.0 | 0.187 | 0.295 | 0.482 | 1.63 | 70.90 | 0.389 | 0.094 |
| 4 | 0.0000 | 31.20 | 10.7 | 0.0 | 0.239 | 0.281 | 0.519 | 1.85 | 71.10 | 0.400 | 0.119 |
| 5 | 0.0010 | 33.00 | 12.5 | 0.0 | 0.279 | 0.266 | 0.545 | 2.05 | 71.30 | 0.406 | 0.139 |
| 6 | 0.0010 | 35.00 | 14.5 | 0.0 | 0.323 | 0.252 | 0.575 | 2.28 | 71.50 | 0.414 | 0.162 |
| 7 | 0.0020 | 37.00 | 16.5 | 0.1 | 0.368 | 0.238 | 0.605 | 2.55 | 71.70 | 0.421 | 0.184 |
| 8 | 0.0020 | 38.90 | 18.4 | 0.1 | 0.410 | 0.223 | 0.633 | 2.84 | 71.90 | 0.428 | 0.205 |
| 9 | 0.0030 | 40.50 | 20.0 | 0.1 | 0.445 | 0.209 | 0.654 | 3.13 | 72.10 | 0.432 | 0.223 |
| 10 | 0.0030 | 41.90 | 21.4 | 0.1 | 0.477 | 0.202 | 0.678 | 3.36 | 72.20 | 0.440 | 0.238 |
| 11 | 0.0040 | 43.40 | 22.9 | 0.1 | 0.510 | 0.187 | 0.697 | 3.72 | 72.40 | 0.442 | 0.255 |
| 12 | 0.0050 | 44.80 | 24.3 | 0.2 | 0.541 | 0.180 | 0.721 | 4.00 | 72.50 | 0.450 | 0.270 |
| 13 | 0.0050 | 46.10 | 25.6 | 0.2 | 0.570 | 0.166 | 0.735 | 4.44 | 72.70 | 0.451 | 0.285 |
| 14 | 0.0070 | 48.40 | 27.9 | 0.2 | 0.621 | 0.151 | 0.772 | 5.10 | 72.90 | 0.462 | 0.310 |
| 15 | 0.0080 | 50.50 | 30.0 | 0.2 | 0.667 | 0.137 | 0.804 | 5.88 | 73.10 | 0.470 | 0.334 |
| 16 | 0.0090 | 52.20 | 31.7 | 0.3 | 0.705 | 0.122 | 0.827 | 6.76 | 73.30 | 0.475 | 0.352 |
| 17 | 0.0110 | 53.70 | 33.2 | 0.3 | 0.738 | 0.115 | 0.853 | 7.40 | 73.40 | 0.484 | 0.369 |
| 18 | 0.0120 | 55.00 | 34.5 | 0.4 | 0.766 | 0.101 | 0.867 | 8.60 | 73.60 | 0.484 | 0.383 |
| 19 | 0.0140 | 56.90 | 36.4 | 0.4 | 0.808 | 0.094 | 0.902 | 9.63 | 73.70 | 0.498 | 0.404 |
| 20 | 0.0170 | 58.40 | 37.9 | 0.5 | 0.841 | 0.079 | 0.920 | 11.61 | 73.90 | 0.499 | 0.420 |
| 21 | 0.0200 | 59.80 | 39.3 | 0.6 | 0.871 | 0.072 | 0.943 | 13.09 | 74.00 | 0.507 | 0.435 |
| 22 | 0.0250 | 61.20 | 40.7 | 0.8 | 0.900 | 0.065 | 0.965 | 14.90 | 74.10 | 0.515 | 0.450 |
| 23 | 0.0290 | 61.90 | 41.4 | 0.9 | 0.915 | 0.058 | 0.972 | 16.88 | 74.20 | 0.515 | 0.457 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 135.600 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 35.6 | 35.6 | 35.9 | |
| Moist specimen weight, gms. | 323.1 | | | |
| Diameter, in. | 2.03 | 2.03 | 2.03 | |
| Area, in.² | 3.24 | 3.24 | 3.25 | |
| Height, in. | 3.28 | 3.28 | 3.28 | |
| Net decrease in height, in. | | 0.00 | -0.01 | |
| Wet Density, pcf | 116.1 | 116.1 | 115.9 | |
| Dry density, pcf | 85.6 | 85.6 | 85.2 | |
| Void ratio | 0.9541 | 0.9541 | 0.9630 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 84.50 psi (6.084 tsf)
**Consolidation back pressure =** 74.50 psi (5.364 tsf)
**Consolidation effective confining stress =** 0.720 tsf
**Strain rate, %/min. =** 0.04
**Fail. Stress =** 1.161 tsf **at reading no.** 18

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 23.10 | 0.0 | 0.0 | 0.000 | 0.706 | 0.706 | 1.00 | 74.70 | 0.706 | 0.000 |
| 1 | 0.0000 | 34.10 | 11.0 | 0.0 | 0.244 | 0.634 | 0.878 | 1.39 | 75.70 | 0.756 | 0.122 |
| 2 | 0.0010 | 39.50 | 16.4 | 0.0 | 0.364 | 0.598 | 0.961 | 1.61 | 76.20 | 0.779 | 0.182 |
| 3 | 0.0020 | 43.70 | 20.6 | 0.1 | 0.457 | 0.562 | 1.018 | 1.81 | 76.70 | 0.790 | 0.228 |
| 4 | 0.0030 | 46.60 | 23.5 | 0.1 | 0.521 | 0.540 | 1.061 | 1.96 | 77.00 | 0.800 | 0.260 |
| 5 | 0.0030 | 48.90 | 25.8 | 0.1 | 0.572 | 0.518 | 1.090 | 2.10 | 77.30 | 0.804 | 0.286 |
| 6 | 0.0040 | 51.20 | 28.1 | 0.1 | 0.622 | 0.497 | 1.119 | 2.25 | 77.60 | 0.808 | 0.311 |
| 7 | 0.0050 | 53.10 | 30.0 | 0.2 | 0.664 | 0.482 | 1.147 | 2.38 | 77.80 | 0.815 | 0.332 |
| 8 | 0.0060 | 55.10 | 32.0 | 0.2 | 0.708 | 0.461 | 1.169 | 2.54 | 78.10 | 0.815 | 0.354 |
| 9 | 0.0070 | 57.00 | 33.9 | 0.2 | 0.750 | 0.446 | 1.197 | 2.68 | 78.30 | 0.822 | 0.375 |
| 10 | 0.0080 | 58.60 | 35.5 | 0.2 | 0.785 | 0.432 | 1.217 | 2.82 | 78.50 | 0.825 | 0.393 |
| 11 | 0.0090 | 61.20 | 38.1 | 0.3 | 0.843 | 0.410 | 1.253 | 3.05 | 78.80 | 0.832 | 0.421 |
| 12 | 0.0110 | 63.90 | 40.8 | 0.3 | 0.902 | 0.382 | 1.283 | 3.36 | 79.20 | 0.833 | 0.451 |
| 13 | 0.0130 | 66.20 | 43.1 | 0.4 | 0.952 | 0.360 | 1.312 | 3.64 | 79.50 | 0.836 | 0.476 |
| 14 | 0.0150 | 68.30 | 45.2 | 0.5 | 0.998 | 0.346 | 1.343 | 3.89 | 79.70 | 0.845 | 0.499 |
| 15 | 0.0180 | 70.50 | 47.4 | 0.5 | 1.045 | 0.324 | 1.369 | 4.23 | 80.00 | 0.847 | 0.523 |
| 16 | 0.0200 | 72.20 | 49.1 | 0.6 | 1.082 | 0.310 | 1.392 | 4.50 | 80.20 | 0.851 | 0.541 |
| 17 | 0.0240 | 74.20 | 51.1 | 0.7 | 1.125 | 0.281 | 1.406 | 5.01 | 80.60 | 0.843 | 0.563 |
| 18 | 0.0290 | 75.90 | 52.8 | 0.9 | 1.161 | 0.266 | 1.427 | 5.36 | 80.80 | 0.847 | 0.580 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 135.900 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 35.9 | 35.9 | 36.2 | |
| **Moist specimen weight, gms.** | 320.2 | | | |
| **Diameter, in.** | 2.03 | 2.03 | 2.03 | |
| **Area, in.²** | 3.24 | 3.24 | 3.25 | |
| **Height, in.** | 3.25 | 3.25 | 3.26 | |
| **Net decrease in height, in.** | | 0.00 | -0.01 | |
| **Wet Density, pcf** | 115.9 | 115.9 | 115.6 | |
| **Dry density, pcf** | 85.3 | 85.3 | 84.9 | |
| **Void ratio** | 0.9618 | 0.9618 | 0.9708 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 3

**Consolidation cell pressure =** 96.00 psi (6.912 tsf)

**Consolidation back pressure =** 81.00 psi (5.832 tsf)

**Consolidation effective confining stress =** 1.080 tsf

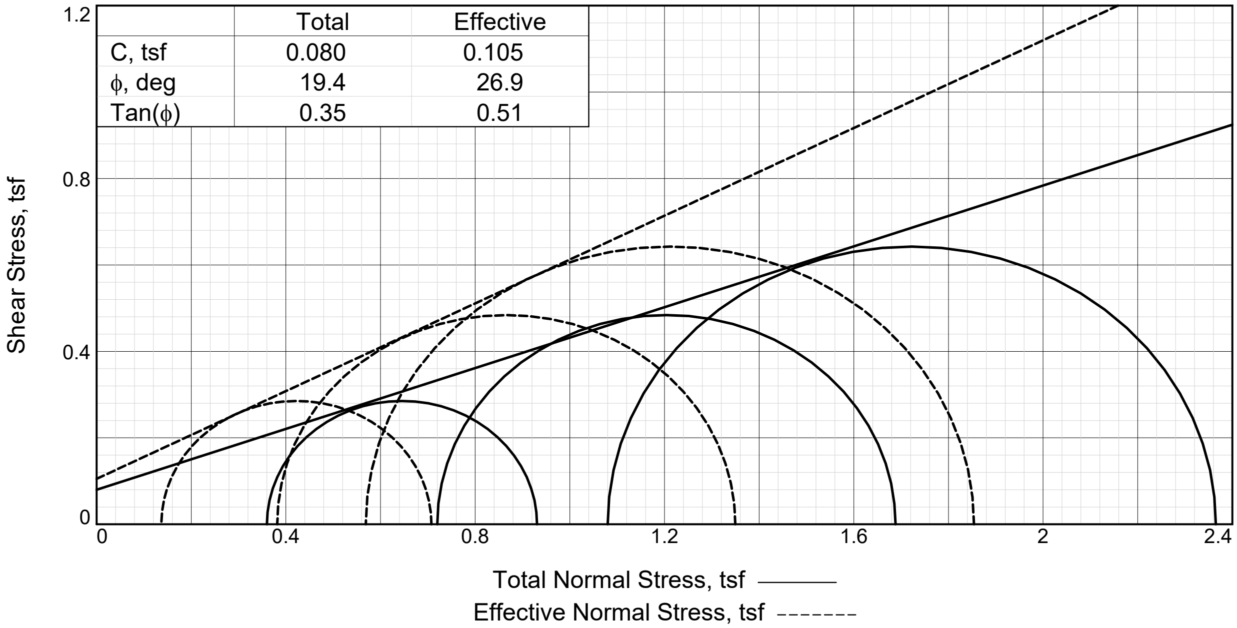
**Strain rate, %/min. =** 0.04

**Fail. Stress =** 1.410 tsf **at reading no.** 15

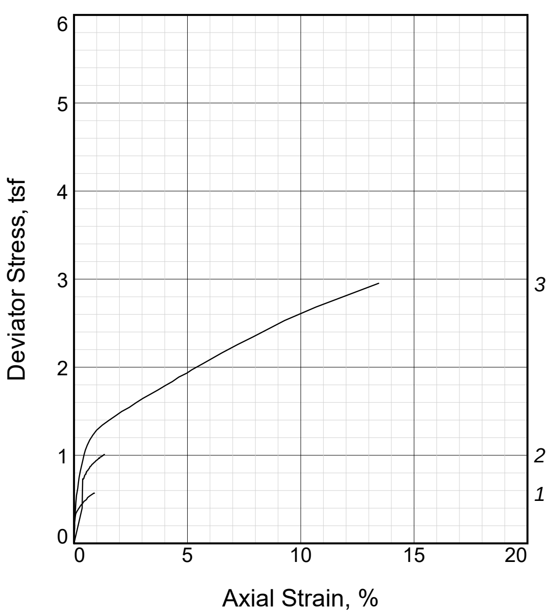
| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0100 | 26.60 | 0.0 | 0.0 | 0.000 | 1.080 | 1.080 | 1.00 | 81.00 | 1.080 | 0.000 |
| 1 | 0.0120 | 27.50 | 0.9 | 0.1 | 0.020 | 1.080 | 1.100 | 1.02 | 81.00 | 1.090 | 0.010 |
| 2 | 0.0150 | 36.40 | 9.8 | 0.2 | 0.217 | 1.015 | 1.232 | 1.21 | 81.90 | 1.124 | 0.109 |
| 3 | 0.0170 | 45.50 | 18.9 | 0.2 | 0.418 | 0.943 | 1.361 | 1.44 | 82.90 | 1.152 | 0.209 |
| 4 | 0.0180 | 52.80 | 26.2 | 0.2 | 0.580 | 0.878 | 1.458 | 1.66 | 83.80 | 1.168 | 0.290 |
| 5 | 0.0200 | 58.60 | 32.0 | 0.3 | 0.708 | 0.828 | 1.536 | 1.85 | 84.50 | 1.182 | 0.354 |
| 6 | 0.0220 | 63.40 | 36.8 | 0.4 | 0.813 | 0.785 | 1.598 | 2.04 | 85.10 | 1.191 | 0.407 |
| 7 | 0.0230 | 67.60 | 41.0 | 0.4 | 0.906 | 0.742 | 1.647 | 2.22 | 85.70 | 1.194 | 0.453 |
| 8 | 0.0250 | 71.10 | 44.5 | 0.5 | 0.982 | 0.706 | 1.688 | 2.39 | 86.20 | 1.197 | 0.491 |
| 9 | 0.0270 | 74.00 | 47.4 | 0.5 | 1.046 | 0.677 | 1.723 | 2.55 | 86.60 | 1.200 | 0.523 |
| 10 | 0.0280 | 76.90 | 50.3 | 0.6 | 1.109 | 0.648 | 1.757 | 2.71 | 87.00 | 1.203 | 0.555 |
| 11 | 0.0300 | 79.40 | 52.8 | 0.6 | 1.164 | 0.619 | 1.783 | 2.88 | 87.40 | 1.201 | 0.582 |
| 12 | 0.0320 | 81.50 | 54.9 | 0.7 | 1.209 | 0.605 | 1.814 | 3.00 | 87.60 | 1.209 | 0.605 |
| 13 | 0.0360 | 85.10 | 58.5 | 0.8 | 1.287 | 0.562 | 1.849 | 3.29 | 88.20 | 1.205 | 0.644 |
| 14 | 0.0400 | 87.90 | 61.3 | 0.9 | 1.347 | 0.533 | 1.880 | 3.53 | 88.60 | 1.206 | 0.673 |
| 15 | 0.0460 | 90.90 | 64.3 | 1.1 | 1.410 | 0.504 | 1.914 | 3.80 | 89.00 | 1.209 | 0.705 |
| 16 | 0.0510 | 92.90 | 66.3 | 1.3 | 1.452 | 0.490 | 1.941 | 3.97 | 89.20 | 1.216 | 0.726 |
| 17 | 0.0620 | 95.00 | 68.4 | 1.6 | 1.493 | 0.468 | 1.961 | 4.19 | 89.50 | 1.214 | 0.746 |
| 18 | 0.0830 | 96.70 | 70.1 | 2.2 | 1.520 | 0.475 | 1.995 | 4.20 | 89.40 | 1.235 | 0.760 |
| 19 | 0.1030 | 97.30 | 70.7 | 2.9 | 1.523 | 0.497 | 2.020 | 4.07 | 89.10 | 1.258 | 0.762 |
| 20 | 0.1090 | 97.30 | 70.7 | 3.0 | 1.520 | 0.504 | 2.024 | 4.02 | 89.00 | 1.264 | 0.760 |
| 21 | 0.1300 | 97.20 | 70.6 | 3.7 | 1.508 | 0.540 | 2.048 | 3.79 | 88.50 | 1.294 | 0.754 |
| 22 | 0.1520 | 97.00 | 70.4 | 4.4 | 1.493 | 0.569 | 2.062 | 3.63 | 88.10 | 1.315 | 0.747 |
| 23 | 0.1730 | 96.90 | 70.3 | 5.0 | 1.481 | 0.598 | 2.079 | 3.48 | 87.70 | 1.338 | 0.741 |
| 24 | 0.1930 | 96.50 | 69.9 | 5.6 | 1.463 | 0.619 | 2.082 | 3.36 | 87.40 | 1.351 | 0.732 |
| 25 | 0.2150 | 95.90 | 69.3 | 6.3 | 1.440 | 0.648 | 2.088 | 3.22 | 87.00 | 1.368 | 0.720 |
| 26 | 0.2370 | 95.00 | 68.4 | 7.0 | 1.411 | 0.670 | 2.081 | 3.11 | 86.70 | 1.375 | 0.706 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.2580 | 93.90 | 67.3 | 7.6 | 1.379 | 0.691 | 2.070 | 2.99 | 86.40 | 1.381 | 0.689 |
| 28 | 0.2780 | 92.20 | 65.6 | 8.2 | 1.335 | 0.720 | 2.055 | 2.85 | 86.00 | 1.388 | 0.668 |
| 29 | 0.2990 | 90.60 | 64.0 | 8.9 | 1.293 | 0.749 | 2.042 | 2.73 | 85.60 | 1.396 | 0.647 |
| 30 | 0.3190 | 89.70 | 63.1 | 9.5 | 1.267 | 0.770 | 2.037 | 2.64 | 85.30 | 1.404 | 0.633 |
| 31 | 0.3390 | 89.00 | 62.4 | 10.1 | 1.244 | 0.785 | 2.029 | 2.59 | 85.10 | 1.407 | 0.622 |
| 32 | 0.3610 | 88.40 | 61.8 | 10.8 | 1.223 | 0.799 | 2.022 | 2.53 | 84.90 | 1.411 | 0.611 |
| 33 | 0.3820 | 87.30 | 60.7 | 11.4 | 1.192 | 0.821 | 2.013 | 2.45 | 84.60 | 1.417 | 0.596 |




| | Total | Effective |
|---|---|---|
| C, tsf | 0.080 | 0.105 |
| $\phi$, deg | 19.4 | 26.9 |
| Tan($\phi$) | 0.35 | 0.51 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 24.3 | 24.0 | 24.4 |
| | Dry Density, pcf | 99.9 | 101.8 | 101.2 |
| | Saturation, | 96.6 | 100.0 | 100.0 |
| | Void Ratio | 0.6747 | 0.6431 | 0.6539 |
| | Diameter, in. | 1.98 | 1.96 | 1.96 |
| | Height, in. | 3.70 | 3.64 | 3.60 |
| At Test | Water Content, | 24.0 | 24.4 | 25.4 |
| | Dry Density, pcf | 101.9 | 101.2 | 99.5 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6423 | 0.6539 | 0.6816 |
| | Diameter, in. | 1.96 | 1.96 | 1.97 |
| | Height, in. | 3.67 | 3.65 | 3.62 |
| Strain rate, %/min. | | 0.20 | 0.20 | 0.20 |
| Back Pressure, tsf | | 4.68 | 4.90 | 5.26 |
| Cell Pressure, tsf | | 5.04 | 5.62 | 6.34 |
| Fail. Stress, tsf | | 0.57 | 0.97 | 1.29 |
| Total Pore Pr., tsf | | 4.90 | 5.24 | 5.77 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.71 | 1.35 | 1.85 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.14 | 0.38 | 0.57 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard)

**Description:** CLAY (CL), brown, silty

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

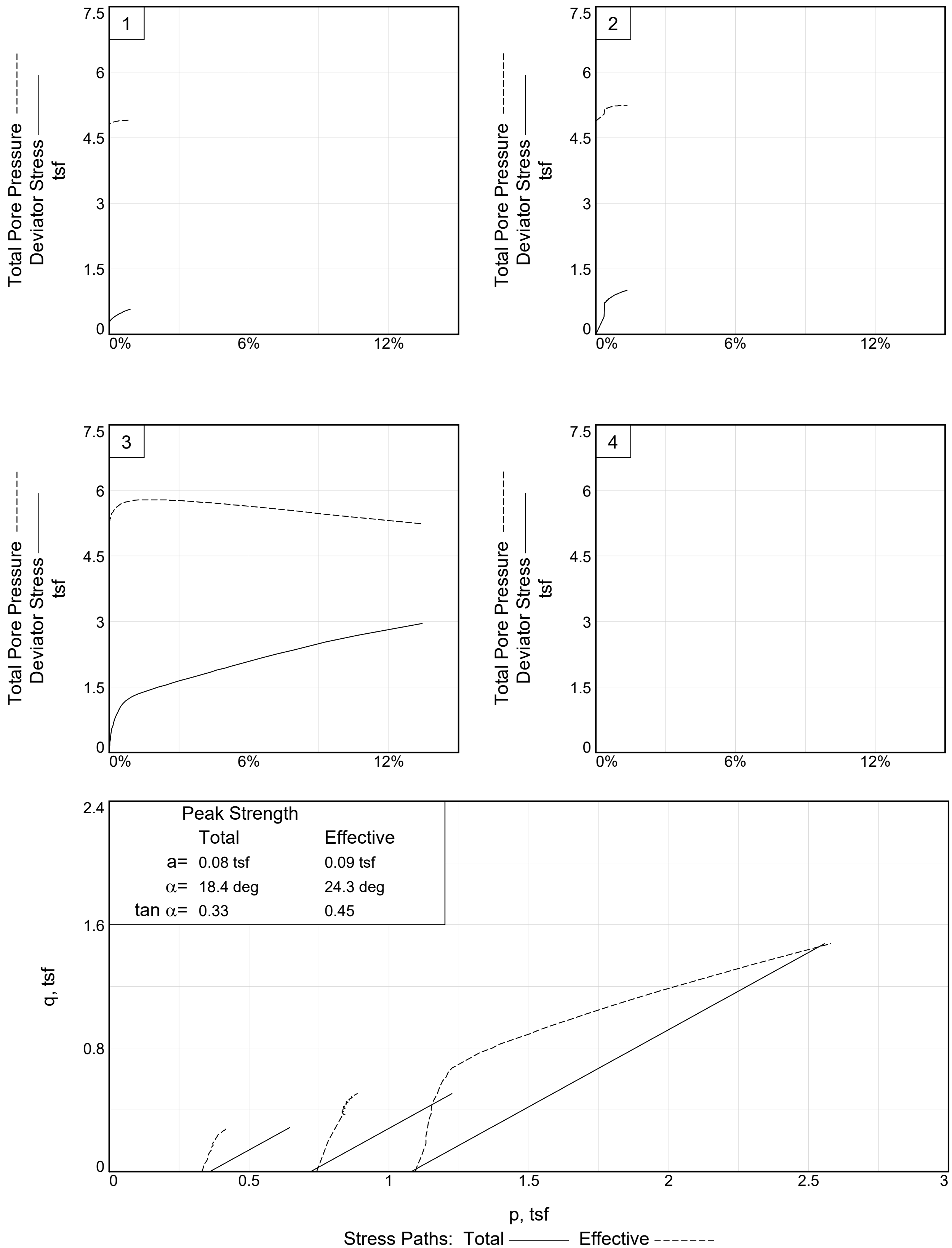
**Source of Sample:** Composite #7

**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Source of Sample:** Composite #7 **Sample Number:** 1

**Project No.:** 2005012477 **Figure** _______

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

# TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

1/16/2007
11:51 AM

**Date:**
**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Project No.:** 2005012477
**Location:** Composite #7
**Sample Number:** 1
**Description:** CLAY (CL), brown, silty
**Remarks:**
**Type of Sample:** Compacted (standard)
**Assumed Specific Gravity=**2.68 **LL=** **PL=** **PI=**
**Test Method:** COE uniform strain

## Parameters for Specimen No. 1

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 31.760 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 29.800 | | | 0.000 |
| Moisture content: Tare, gms. | 21.740 | | | 0.000 |
| Moisture, % | 24.3 | 24.6 | 24.0 | |
| Moist specimen weight, gms. | 369.6 | | | |
| Diameter, in. | 1.98 | 1.97 | 1.96 | |
| Area, in.$^2$ | 3.07 | 3.05 | 3.03 | |
| Height, in. | 3.70 | 3.69 | 3.67 | |
| Net decrease in height, in. | | 0.01 | 0.01 | |
| Wet Density, pcf | 124.2 | 125.6 | 126.3 | |
| Dry density, pcf | 99.9 | 100.8 | 101.9 | |
| Void ratio | 0.6747 | 0.6598 | 0.6423 | |
| Saturation, % | 96.6 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 1

**Consolidation cell pressure =** 70.00 psi (5.040 tsf)
**Consolidation back pressure =** 65.00 psi (4.680 tsf)
**Consolidation effective confining stress =** 0.360 tsf
**Strain rate, %/min. =** 0.20
**Fail. Stress =** 0.571 tsf **at reading no.** 24

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0000 | 17.70 | 0.0 | 0.0 | 0.000 | 0.331 | 0.331 | 1.00 | 65.40 | 0.331 | 0.000 |
| 1 | 0.0000 | 20.00 | 2.3 | 0.0 | 0.055 | 0.310 | 0.364 | 1.18 | 65.70 | 0.337 | 0.027 |
| 2 | 0.0000 | 21.10 | 3.4 | 0.0 | 0.081 | 0.295 | 0.376 | 1.27 | 65.90 | 0.336 | 0.040 |
| 3 | 0.0000 | 22.30 | 4.6 | 0.0 | 0.109 | 0.288 | 0.397 | 1.38 | 66.00 | 0.343 | 0.055 |
| 4 | 0.0000 | 23.30 | 5.6 | 0.0 | 0.133 | 0.281 | 0.414 | 1.47 | 66.10 | 0.347 | 0.067 |
| 5 | 0.0000 | 24.20 | 6.5 | 0.0 | 0.155 | 0.274 | 0.428 | 1.57 | 66.20 | 0.351 | 0.077 |
| 6 | 0.0000 | 25.60 | 7.9 | 0.0 | 0.188 | 0.259 | 0.447 | 1.73 | 66.40 | 0.353 | 0.094 |
| 7 | 0.0000 | 26.90 | 9.2 | 0.0 | 0.219 | 0.245 | 0.464 | 1.89 | 66.60 | 0.354 | 0.109 |
| 8 | 0.0000 | 27.80 | 10.1 | 0.0 | 0.240 | 0.238 | 0.478 | 2.01 | 66.70 | 0.358 | 0.120 |
| 9 | 0.0000 | 28.70 | 11.0 | 0.0 | 0.262 | 0.230 | 0.492 | 2.14 | 66.80 | 0.361 | 0.131 |
| 10 | 0.0000 | 29.80 | 12.1 | 0.0 | 0.288 | 0.223 | 0.511 | 2.29 | 66.90 | 0.367 | 0.144 |
| 11 | 0.0020 | 30.90 | 13.2 | 0.1 | 0.314 | 0.209 | 0.523 | 2.50 | 67.10 | 0.366 | 0.157 |
| 12 | 0.0030 | 32.00 | 14.3 | 0.1 | 0.340 | 0.202 | 0.542 | 2.69 | 67.20 | 0.372 | 0.170 |
| 13 | 0.0050 | 33.10 | 15.4 | 0.1 | 0.366 | 0.187 | 0.553 | 2.95 | 67.40 | 0.370 | 0.183 |
| 14 | 0.0070 | 34.10 | 16.4 | 0.2 | 0.389 | 0.180 | 0.569 | 3.16 | 67.50 | 0.375 | 0.195 |
| 15 | 0.0090 | 35.00 | 17.3 | 0.2 | 0.411 | 0.173 | 0.583 | 3.38 | 67.60 | 0.378 | 0.205 |
| 16 | 0.0110 | 35.90 | 18.2 | 0.3 | 0.432 | 0.166 | 0.597 | 3.61 | 67.70 | 0.381 | 0.216 |
| 17 | 0.0140 | 36.90 | 19.2 | 0.4 | 0.455 | 0.158 | 0.614 | 3.87 | 67.80 | 0.386 | 0.228 |
| 18 | 0.0160 | 37.80 | 20.1 | 0.4 | 0.476 | 0.151 | 0.627 | 4.15 | 67.90 | 0.389 | 0.238 |
| 19 | 0.0200 | 38.70 | 21.0 | 0.5 | 0.497 | 0.151 | 0.648 | 4.29 | 67.90 | 0.400 | 0.248 |
| 20 | 0.0220 | 39.70 | 22.0 | 0.6 | 0.520 | 0.144 | 0.664 | 4.61 | 68.00 | 0.404 | 0.260 |
| 21 | 0.0260 | 40.60 | 22.9 | 0.7 | 0.541 | 0.144 | 0.685 | 4.76 | 68.00 | 0.415 | 0.271 |
| 22 | 0.0310 | 41.70 | 24.0 | 0.8 | 0.566 | 0.137 | 0.703 | 5.14 | 68.10 | 0.420 | 0.283 |
| 23 | 0.0320 | 41.90 | 24.2 | 0.9 | 0.571 | 0.137 | 0.708 | 5.17 | 68.10 | 0.422 | 0.285 |
| 24 | 0.0330 | 41.90 | 24.2 | 0.9 | 0.571 | 0.137 | 0.707 | 5.17 | 68.10 | 0.422 | 0.285 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 124.000 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 24.0 | 24.0 | 24.4 | |
| Moist specimen weight, gms. | 364.1 | | | |
| Diameter, in. | 1.96 | 1.96 | 1.96 | |
| Area, in.² | 3.02 | 3.02 | 3.03 | |
| Height, in. | 3.64 | 3.64 | 3.65 | |
| Net decrease in height, in. | | 0.00 | -0.01 | |
| Wet Density, pcf | 126.3 | 126.3 | 125.8 | |
| Dry density, pcf | 101.8 | 101.8 | 101.2 | |
| Void ratio | 0.6431 | 0.6431 | 0.6539 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 78.10 psi (5.623 tsf)

**Consolidation back pressure =** 68.10 psi (4.903 tsf)

**Consolidation effective confining stress =** 0.720 tsf

**Strain rate, %/min. =** 0.20

**Fail. Stress =** 0.968 tsf **at reading no.** 32

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0030 | 20.00 | 0.0 | 0.0 | 0.000 | 0.742 | 0.742 | 1.00 | 67.80 | 0.742 | 0.000 |
| 1 | 0.0160 | 36.90 | 16.9 | 0.4 | 0.400 | 0.583 | 0.983 | 1.69 | 70.00 | 0.783 | 0.200 |
| 2 | 0.0170 | 50.90 | 30.9 | 0.4 | 0.731 | 0.468 | 1.199 | 2.56 | 71.60 | 0.834 | 0.366 |
| 3 | 0.0180 | 50.90 | 30.9 | 0.4 | 0.731 | 0.468 | 1.199 | 2.56 | 71.60 | 0.834 | 0.366 |
| 4 | 0.0190 | 51.40 | 31.4 | 0.4 | 0.743 | 0.468 | 1.211 | 2.59 | 71.60 | 0.839 | 0.371 |
| 5 | 0.0190 | 51.70 | 31.7 | 0.4 | 0.750 | 0.461 | 1.211 | 2.63 | 71.70 | 0.836 | 0.375 |
| 6 | 0.0200 | 52.20 | 32.2 | 0.5 | 0.761 | 0.454 | 1.215 | 2.68 | 71.80 | 0.834 | 0.381 |
| 7 | 0.0200 | 52.60 | 32.6 | 0.5 | 0.771 | 0.446 | 1.217 | 2.73 | 71.90 | 0.832 | 0.385 |
| 8 | 0.0210 | 53.00 | 33.0 | 0.5 | 0.780 | 0.446 | 1.227 | 2.75 | 71.90 | 0.836 | 0.390 |
| 9 | 0.0220 | 53.30 | 33.3 | 0.5 | 0.787 | 0.439 | 1.226 | 2.79 | 72.00 | 0.833 | 0.394 |
| 10 | 0.0220 | 53.70 | 33.7 | 0.5 | 0.797 | 0.439 | 1.236 | 2.81 | 72.00 | 0.837 | 0.398 |
| 11 | 0.0230 | 54.00 | 34.0 | 0.5 | 0.803 | 0.432 | 1.235 | 2.86 | 72.10 | 0.834 | 0.402 |
| 12 | 0.0230 | 54.40 | 34.4 | 0.5 | 0.813 | 0.432 | 1.245 | 2.88 | 72.10 | 0.838 | 0.406 |
| 13 | 0.0240 | 54.80 | 34.8 | 0.6 | 0.822 | 0.432 | 1.254 | 2.90 | 72.10 | 0.843 | 0.411 |
| 14 | 0.0250 | 55.00 | 35.0 | 0.6 | 0.827 | 0.425 | 1.251 | 2.95 | 72.20 | 0.838 | 0.413 |
| 15 | 0.0260 | 55.60 | 35.6 | 0.6 | 0.840 | 0.418 | 1.258 | 3.01 | 72.30 | 0.838 | 0.420 |
| 16 | 0.0270 | 55.90 | 35.9 | 0.7 | 0.847 | 0.418 | 1.265 | 3.03 | 72.30 | 0.841 | 0.424 |
| 17 | 0.0280 | 56.40 | 36.4 | 0.7 | 0.859 | 0.410 | 1.269 | 3.09 | 72.40 | 0.840 | 0.429 |
| 18 | 0.0290 | 57.00 | 37.0 | 0.7 | 0.873 | 0.410 | 1.283 | 3.13 | 72.40 | 0.847 | 0.436 |
| 19 | 0.0300 | 57.20 | 37.2 | 0.7 | 0.877 | 0.410 | 1.288 | 3.14 | 72.40 | 0.849 | 0.439 |
| 20 | 0.0310 | 57.60 | 37.6 | 0.8 | 0.886 | 0.403 | 1.290 | 3.20 | 72.50 | 0.846 | 0.443 |
| 21 | 0.0320 | 58.10 | 38.1 | 0.8 | 0.898 | 0.403 | 1.301 | 3.23 | 72.50 | 0.852 | 0.449 |
| 22 | 0.0330 | 58.30 | 38.3 | 0.8 | 0.902 | 0.396 | 1.298 | 3.28 | 72.60 | 0.847 | 0.451 |
| 23 | 0.0340 | 58.60 | 38.6 | 0.8 | 0.909 | 0.396 | 1.305 | 3.30 | 72.60 | 0.851 | 0.455 |
| 24 | 0.0350 | 58.90 | 38.9 | 0.9 | 0.916 | 0.396 | 1.312 | 3.31 | 72.60 | 0.854 | 0.458 |
| 25 | 0.0360 | 59.20 | 39.2 | 0.9 | 0.923 | 0.396 | 1.319 | 3.33 | 72.60 | 0.857 | 0.461 |
| 26 | 0.0370 | 59.40 | 39.4 | 0.9 | 0.927 | 0.396 | 1.323 | 3.34 | 72.60 | 0.860 | 0.464 |

## Test Readings for Specimen No. 2

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.0380 | 59.80 | 39.8 | 1.0 | 0.937 | 0.389 | 1.325 | 3.41 | 72.70 | 0.857 | 0.468 |
| 28 | 0.0390 | 60.10 | 40.1 | 1.0 | 0.943 | 0.389 | 1.332 | 3.43 | 72.70 | 0.860 | 0.472 |
| 29 | 0.0400 | 60.30 | 40.3 | 1.0 | 0.948 | 0.389 | 1.337 | 3.44 | 72.70 | 0.863 | 0.474 |
| 30 | 0.0410 | 60.50 | 40.5 | 1.0 | 0.952 | 0.389 | 1.341 | 3.45 | 72.70 | 0.865 | 0.476 |
| 31 | 0.0420 | 60.80 | 40.8 | 1.1 | 0.959 | 0.389 | 1.348 | 3.47 | 72.70 | 0.868 | 0.480 |
| 32 | 0.0430 | 61.20 | 41.2 | 1.1 | 0.968 | 0.382 | 1.350 | 3.54 | 72.80 | 0.866 | 0.484 |
| 33 | 0.0440 | 61.20 | 41.2 | 1.1 | 0.968 | 0.382 | 1.349 | 3.54 | 72.80 | 0.866 | 0.484 |
| 34 | 0.0450 | 61.70 | 41.7 | 1.2 | 0.979 | 0.382 | 1.361 | 3.57 | 72.80 | 0.871 | 0.490 |
| 35 | 0.0460 | 61.90 | 41.9 | 1.2 | 0.984 | 0.382 | 1.365 | 3.58 | 72.80 | 0.873 | 0.492 |
| 36 | 0.0470 | 61.90 | 41.9 | 1.2 | 0.983 | 0.382 | 1.365 | 3.58 | 72.80 | 0.873 | 0.492 |
| 37 | 0.0480 | 62.20 | 42.2 | 1.2 | 0.990 | 0.382 | 1.372 | 3.60 | 72.80 | 0.877 | 0.495 |
| 38 | 0.0490 | 62.50 | 42.5 | 1.3 | 0.997 | 0.382 | 1.379 | 3.61 | 72.80 | 0.880 | 0.499 |
| 39 | 0.0500 | 62.60 | 42.6 | 1.3 | 0.999 | 0.382 | 1.381 | 3.62 | 72.80 | 0.881 | 0.500 |
| 40 | 0.0510 | 63.00 | 43.0 | 1.3 | 1.008 | 0.382 | 1.390 | 3.64 | 72.80 | 0.886 | 0.504 |
| 41 | 0.0520 | 63.10 | 43.1 | 1.3 | 1.010 | 0.382 | 1.392 | 3.65 | 72.80 | 0.887 | 0.505 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 124.400 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 24.4 | 24.4 | 25.4 | |
| Moist specimen weight, gms. | 358.5 | | | |
| Diameter, in. | 1.96 | 1.96 | 1.97 | |
| Area, in.² | 3.02 | 3.02 | 3.05 | |
| Height, in. | 3.60 | 3.60 | 3.62 | |
| Net decrease in height, in. | | 0.00 | -0.02 | |
| Wet Density, pcf | 125.8 | 125.8 | 124.8 | |
| Dry density, pcf | 101.2 | 101.2 | 99.5 | |
| Void ratio | 0.6539 | 0.6539 | 0.6816 | |
| Saturation, % | 100.0 | 100.0 | 100.0 | |

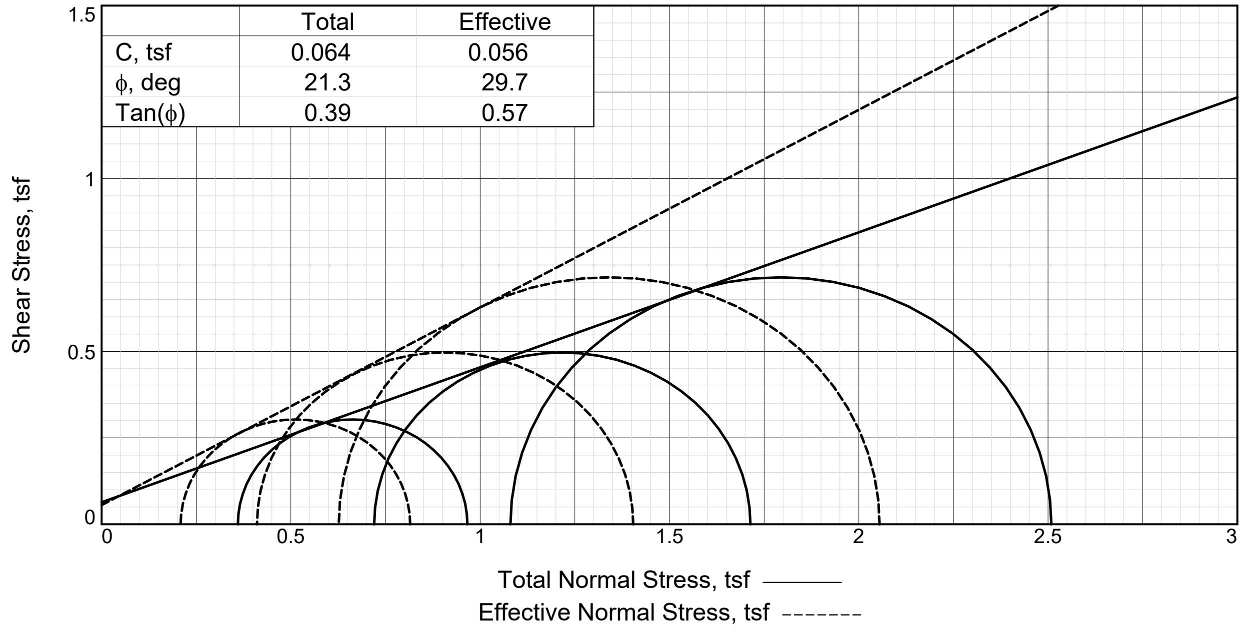
## Test Readings for Specimen No. 3

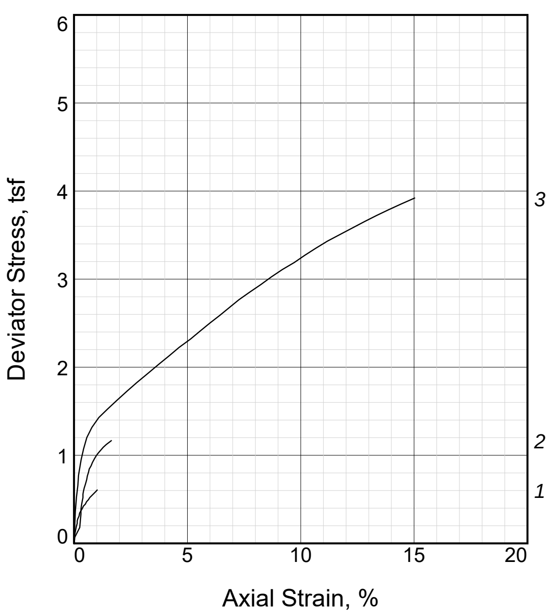
**Consolidation cell pressure =** 88.00 psi (6.336 tsf)
**Consolidation back pressure =** 73.00 psi (5.256 tsf)
**Consolidation effective confining stress =** 1.080 tsf
**Strain rate, %/min. =** 0.20
**Fail. Stress =** 1.285 tsf **at reading no.** 19

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0140 | 24.40 | 0.0 | 0.0 | 0.000 | 1.094 | 1.094 | 1.00 | 72.80 | 1.094 | 0.000 |
| 1 | 0.0140 | 28.10 | 3.7 | 0.0 | 0.087 | 1.058 | 1.146 | 1.08 | 73.30 | 1.102 | 0.044 |
| 2 | 0.0150 | 31.40 | 7.0 | 0.0 | 0.165 | 1.030 | 1.195 | 1.16 | 73.70 | 1.112 | 0.083 |
| 3 | 0.0150 | 34.50 | 10.1 | 0.0 | 0.238 | 1.001 | 1.239 | 1.24 | 74.10 | 1.120 | 0.119 |
| 4 | 0.0160 | 37.50 | 13.1 | 0.1 | 0.309 | 0.972 | 1.281 | 1.32 | 74.50 | 1.127 | 0.155 |
| 5 | 0.0160 | 39.80 | 15.4 | 0.1 | 0.363 | 0.950 | 1.314 | 1.38 | 74.80 | 1.132 | 0.182 |
| 6 | 0.0170 | 44.10 | 19.7 | 0.1 | 0.465 | 0.900 | 1.365 | 1.52 | 75.50 | 1.132 | 0.232 |
| 7 | 0.0180 | 47.60 | 23.2 | 0.1 | 0.547 | 0.864 | 1.411 | 1.63 | 76.00 | 1.137 | 0.273 |
| 8 | 0.0200 | 50.90 | 26.5 | 0.2 | 0.624 | 0.828 | 1.452 | 1.75 | 76.50 | 1.140 | 0.312 |
| 9 | 0.0210 | 53.70 | 29.3 | 0.2 | 0.690 | 0.799 | 1.489 | 1.86 | 76.90 | 1.144 | 0.345 |
| 10 | 0.0220 | 56.10 | 31.7 | 0.2 | 0.746 | 0.778 | 1.524 | 1.96 | 77.20 | 1.151 | 0.373 |
| 11 | 0.0240 | 59.20 | 34.8 | 0.3 | 0.819 | 0.742 | 1.561 | 2.10 | 77.70 | 1.151 | 0.410 |
| 12 | 0.0260 | 62.00 | 37.6 | 0.3 | 0.884 | 0.713 | 1.597 | 2.24 | 78.10 | 1.155 | 0.442 |
| 13 | 0.0280 | 64.50 | 40.1 | 0.4 | 0.943 | 0.691 | 1.634 | 2.36 | 78.40 | 1.163 | 0.471 |
| 14 | 0.0300 | 67.20 | 42.8 | 0.4 | 1.006 | 0.670 | 1.675 | 2.50 | 78.70 | 1.172 | 0.503 |
| 15 | 0.0320 | 69.50 | 45.1 | 0.5 | 1.059 | 0.648 | 1.707 | 2.63 | 79.00 | 1.178 | 0.530 |
| 16 | 0.0350 | 71.90 | 47.5 | 0.6 | 1.115 | 0.626 | 1.741 | 2.78 | 79.30 | 1.184 | 0.557 |
| 17 | 0.0390 | 74.50 | 50.1 | 0.7 | 1.174 | 0.605 | 1.779 | 2.94 | 79.60 | 1.192 | 0.587 |
| 18 | 0.0440 | 76.90 | 52.5 | 0.8 | 1.229 | 0.590 | 1.819 | 3.08 | 79.80 | 1.205 | 0.614 |
| 19 | 0.0500 | 79.40 | 55.0 | 1.0 | 1.285 | 0.569 | 1.854 | 3.26 | 80.10 | 1.211 | 0.643 |
| 20 | 0.0590 | 82.00 | 57.6 | 1.2 | 1.342 | 0.554 | 1.897 | 3.42 | 80.30 | 1.226 | 0.671 |
| 21 | 0.0690 | 84.40 | 60.0 | 1.5 | 1.395 | 0.554 | 1.949 | 3.52 | 80.30 | 1.252 | 0.697 |
| 22 | 0.0800 | 86.90 | 62.5 | 1.8 | 1.448 | 0.554 | 2.003 | 3.61 | 80.30 | 1.278 | 0.724 |
| 23 | 0.0900 | 89.20 | 64.8 | 2.1 | 1.497 | 0.554 | 2.052 | 3.70 | 80.30 | 1.303 | 0.749 |
| 24 | 0.1020 | 91.50 | 67.1 | 2.4 | 1.545 | 0.554 | 2.099 | 3.79 | 80.30 | 1.327 | 0.773 |
| 25 | 0.1130 | 94.00 | 69.6 | 2.7 | 1.598 | 0.569 | 2.166 | 3.81 | 80.10 | 1.368 | 0.799 |
| 26 | 0.1240 | 96.40 | 72.0 | 3.0 | 1.648 | 0.569 | 2.216 | 3.90 | 80.10 | 1.393 | 0.824 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.1360 | 98.70 | 74.3 | 3.4 | 1.694 | 0.583 | 2.278 | 3.91 | 79.90 | 1.430 | 0.847 |
| 28 | 0.1480 | 101.10 | 76.7 | 3.7 | 1.743 | 0.598 | 2.341 | 3.92 | 79.70 | 1.469 | 0.872 |
| 29 | 0.1590 | 103.40 | 79.0 | 4.0 | 1.790 | 0.612 | 2.402 | 3.92 | 79.50 | 1.507 | 0.895 |
| 30 | 0.1710 | 105.80 | 81.4 | 4.3 | 1.838 | 0.619 | 2.457 | 3.97 | 79.40 | 1.538 | 0.919 |
| 31 | 0.1810 | 108.30 | 83.9 | 4.6 | 1.889 | 0.634 | 2.522 | 3.98 | 79.20 | 1.578 | 0.944 |
| 32 | 0.1940 | 110.60 | 86.2 | 5.0 | 1.933 | 0.648 | 2.581 | 3.98 | 79.00 | 1.615 | 0.967 |
| 33 | 0.2020 | 112.50 | 88.1 | 5.2 | 1.971 | 0.662 | 2.634 | 3.98 | 78.80 | 1.648 | 0.986 |
| 34 | 0.2200 | 116.20 | 91.8 | 5.7 | 2.043 | 0.684 | 2.727 | 3.99 | 78.50 | 1.706 | 1.022 |
| 35 | 0.2500 | 122.50 | 98.1 | 6.5 | 2.164 | 0.727 | 2.891 | 3.98 | 77.90 | 1.809 | 1.082 |
| 36 | 0.2750 | 127.50 | 103.1 | 7.2 | 2.258 | 0.763 | 3.021 | 3.96 | 77.40 | 1.892 | 1.129 |
| 37 | 0.3000 | 132.30 | 107.9 | 7.9 | 2.345 | 0.799 | 3.144 | 3.93 | 76.90 | 1.972 | 1.173 |
| 38 | 0.3500 | 142.60 | 118.2 | 9.3 | 2.530 | 0.886 | 3.416 | 3.86 | 75.70 | 2.151 | 1.265 |
| 39 | 0.4000 | 151.70 | 127.3 | 10.7 | 2.684 | 0.958 | 3.641 | 3.80 | 74.70 | 2.299 | 1.342 |
| 40 | 0.5000 | 169.00 | 144.6 | 13.4 | 2.954 | 1.102 | 4.056 | 3.68 | 72.70 | 2.579 | 1.477 |




| Sample No. | | 1 | 2 | 3 |
|---|---|---|---|---|
| Initial | Water Content, | 24.6 | 23.5 | 23.6 |
| | Dry Density, pcf | 100.4 | 102.7 | 102.5 |
| | Saturation, | 99.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6660 | 0.6296 | 0.6324 |
| | Diameter, in. | 1.94 | 1.92 | 1.92 |
| | Height, in. | 3.65 | 3.58 | 3.52 |
| At Test | Water Content, | 23.5 | 23.6 | 25.7 |
| | Dry Density, pcf | 102.6 | 102.5 | 99.1 |
| | Saturation, | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.6305 | 0.6323 | 0.6884 |
| | Diameter, in. | 1.92 | 1.92 | 1.94 |
| | Height, in. | 3.62 | 3.58 | 3.56 |
| Strain rate, %/min. | | 0.50 | 0.50 | 0.50 |
| Back Pressure, tsf | | 4.39 | 4.57 | 5.04 |
| Cell Pressure, tsf | | 4.75 | 5.29 | 6.12 |
| Fail. Stress, tsf | | 0.61 | 0.99 | 1.43 |
| Total Pore Pr., tsf | | 4.54 | 4.88 | 5.49 |
| Ult. Stress, tsf | | | | |
| Total Pore Pr., tsf | | | | |
| $\bar{\sigma}_1$ Failure, tsf | | 0.81 | 1.40 | 2.05 |
| $\bar{\sigma}_3$ Failure, tsf | | 0.21 | 0.41 | 0.63 |

**Type of Test:**
CU with Pore Pressures

**Sample Type:** Compacted (standard

**Description:** SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand

**Assumed Specific Gravity=** 2.68

**Remarks:**

**Figure** ________

**Client:** Ameren Services

**Project:** Sioux Plant UWLF

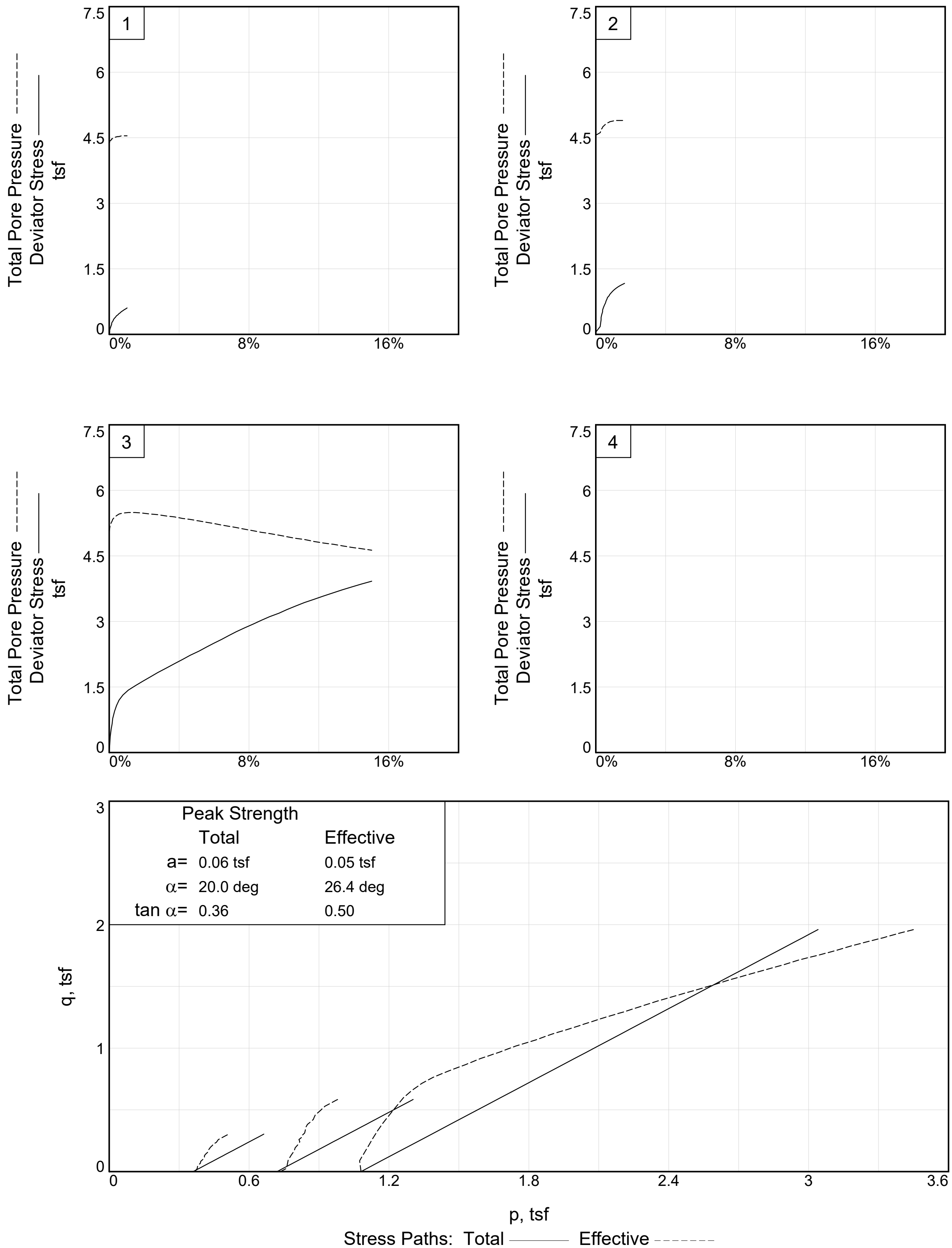
**Source of Sample:** Composite#7(70%) & silty fine sand(30%)

**Sample Number:** 1

**Proj. No.:** 2005012477 **Date:**

REITZ & JENS, INC.
CONSULTING ENGINEERS

**Tested By:** K. Kocher **Checked By:** J. Fouse




**Client:** Ameren Services

**Project:** Sioux Plant UWLF

**Source of Sample:** Composite#7(70%) & silty fine sand(30%) **Sample Number:** 1

**Project No.:** 2005012477 **Figure** _______

**REITZ & JENS, INC.**

**Tested By:** K. Kocher **Checked By:** J. Fouse

**TRIAXIAL COMPRESSION TEST** 1/16/2007
CU with Pore Pressures 10:20 AM

**Date:**
**Client:** Ameren Services
**Project:** Sioux Plant UWLF
**Project No.:** 2005012477
**Location:** Composite#7(70%) & silty fine sand(30%)
**Sample Number:** 1
**Description:** SILT, (ML) brown, slightly clayey with very fine sand
70% Composite #7 with 30% silty fine sand
**Remarks:**
**Type of Sample:** Compacted (standard
**Assumed Specific Gravity=**2.68 **LL=** **PL=** **PI=**
**Test Method:** COE uniform strain

**Parameters for Specimen No. 1**

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| Moisture content: Moist soil+tare, gms. | 124.600 | | | 0.000 |
| Moisture content: Dry soil+tare, gms. | 100.000 | | | 0.000 |
| Moisture content: Tare, gms. | 0.000 | | | 0.000 |
| Moisture, % | 24.6 | 24.0 | 23.5 | |
| Moist specimen weight, gms. | 352.9 | | | |
| Diameter, in. | 1.94 | 1.93 | 1.92 | |
| Area, in.² | 2.95 | 2.92 | 2.90 | |
| Height, in. | 3.65 | 3.63 | 3.62 | |
| Net decrease in height, in. | | 0.02 | 0.01 | |
| Wet Density, pcf | 125.1 | 126.2 | 126.8 | |
| Dry density, pcf | 100.4 | 101.8 | 102.6 | |
| Void ratio | 0.6660 | 0.6441 | 0.6305 | |
| Saturation, % | 99.0 | 100.0 | 100.0 | |

**Test Readings for Specimen No. 1**

**Consolidation cell pressure =** 66.00 psi (4.752 tsf)
**Consolidation back pressure =** 61.00 psi (4.392 tsf)
**Consolidation effective confining stress =** 0.360 tsf
**Strain rate, %/min. =** 0.50
**Fail. Stress =** 0.606 tsf **at reading no.** 21

## Test Readings for Specimen No. 1

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0070 | 16.90 | 0.0 | 0.0 | 0.000 | 0.367 | 0.367 | 1.00 | 60.90 | 0.367 | 0.000 |
| 1 | 0.0080 | 18.90 | 2.0 | 0.0 | 0.050 | 0.353 | 0.402 | 1.14 | 61.10 | 0.378 | 0.025 |
| 2 | 0.0080 | 20.80 | 3.9 | 0.0 | 0.097 | 0.331 | 0.428 | 1.29 | 61.40 | 0.380 | 0.048 |
| 3 | 0.0090 | 22.30 | 5.4 | 0.1 | 0.134 | 0.324 | 0.458 | 1.41 | 61.50 | 0.391 | 0.067 |
| 4 | 0.0100 | 23.60 | 6.7 | 0.1 | 0.166 | 0.310 | 0.476 | 1.54 | 61.70 | 0.393 | 0.083 |
| 5 | 0.0110 | 25.00 | 8.1 | 0.1 | 0.201 | 0.302 | 0.503 | 1.66 | 61.80 | 0.403 | 0.100 |
| 6 | 0.0120 | 26.10 | 9.2 | 0.1 | 0.228 | 0.295 | 0.523 | 1.77 | 61.90 | 0.409 | 0.114 |
| 7 | 0.0120 | 27.20 | 10.3 | 0.1 | 0.255 | 0.281 | 0.536 | 1.91 | 62.10 | 0.408 | 0.128 |
| 8 | 0.0130 | 28.10 | 11.2 | 0.2 | 0.277 | 0.274 | 0.551 | 2.01 | 62.20 | 0.412 | 0.139 |
| 9 | 0.0150 | 29.50 | 12.6 | 0.2 | 0.312 | 0.266 | 0.578 | 2.17 | 62.30 | 0.422 | 0.156 |
| 10 | 0.0160 | 30.80 | 13.9 | 0.2 | 0.344 | 0.252 | 0.596 | 2.36 | 62.50 | 0.424 | 0.172 |
| 11 | 0.0180 | 31.90 | 15.0 | 0.3 | 0.371 | 0.245 | 0.616 | 2.51 | 62.60 | 0.430 | 0.185 |
| 12 | 0.0200 | 32.80 | 15.9 | 0.4 | 0.393 | 0.238 | 0.630 | 2.65 | 62.70 | 0.434 | 0.196 |
| 13 | 0.0220 | 34.10 | 17.2 | 0.4 | 0.425 | 0.230 | 0.655 | 2.84 | 62.80 | 0.443 | 0.212 |
| 14 | 0.0250 | 35.00 | 18.1 | 0.5 | 0.447 | 0.223 | 0.670 | 3.00 | 62.90 | 0.446 | 0.223 |
| 15 | 0.0270 | 36.10 | 19.2 | 0.6 | 0.473 | 0.223 | 0.697 | 3.12 | 62.90 | 0.460 | 0.237 |
| 16 | 0.0300 | 37.00 | 20.1 | 0.6 | 0.495 | 0.216 | 0.711 | 3.29 | 63.00 | 0.464 | 0.248 |
| 17 | 0.0320 | 38.00 | 21.1 | 0.7 | 0.520 | 0.209 | 0.728 | 3.49 | 63.10 | 0.469 | 0.260 |
| 18 | 0.0350 | 38.90 | 22.0 | 0.8 | 0.541 | 0.209 | 0.750 | 3.59 | 63.10 | 0.479 | 0.271 |
| 19 | 0.0380 | 39.80 | 22.9 | 0.9 | 0.563 | 0.209 | 0.772 | 3.70 | 63.10 | 0.490 | 0.281 |
| 20 | 0.0420 | 40.90 | 24.0 | 1.0 | 0.589 | 0.209 | 0.798 | 3.82 | 63.10 | 0.503 | 0.295 |
| 21 | 0.0440 | 41.60 | 24.7 | 1.0 | 0.606 | 0.209 | 0.815 | 3.90 | 63.10 | 0.512 | 0.303 |

## Parameters for Specimen No. 2

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 123.500 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 23.5 | 23.5 | 23.6 | |
| **Moist specimen weight, gms.** | 344.8 | | | |
| **Diameter, in.** | 1.92 | 1.92 | 1.92 | |
| **Area, in.²** | 2.90 | 2.90 | 2.90 | |
| **Height, in.** | 3.58 | 3.58 | 3.58 | |
| **Net decrease in height, in.** | | 0.00 | 0.00 | |
| **Wet Density, pcf** | 126.8 | 126.8 | 126.7 | |
| **Dry density, pcf** | 102.7 | 102.7 | 102.5 | |
| **Void ratio** | 0.6296 | 0.6296 | 0.6323 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 2

**Consolidation cell pressure =** 73.50 psi (5.292 tsf)
**Consolidation back pressure =** 63.50 psi (4.572 tsf)
**Consolidation effective confining stress =** 0.720 tsf
**Strain rate, %/min. =** 0.50
**Fail. Stress =** 0.994 tsf **at reading no.** 21

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0010 | 16.60 | 0.0 | 0.0 | 0.000 | 0.734 | 0.734 | 1.00 | 63.30 | 0.734 | 0.000 |
| 1 | 0.0010 | 17.00 | 0.4 | 0.0 | 0.010 | 0.734 | 0.744 | 1.01 | 63.30 | 0.739 | 0.005 |
| 2 | 0.0010 | 18.70 | 2.1 | 0.0 | 0.052 | 0.734 | 0.787 | 1.07 | 63.30 | 0.760 | 0.026 |
| 3 | 0.0100 | 23.90 | 7.3 | 0.3 | 0.181 | 0.677 | 0.858 | 1.27 | 64.10 | 0.767 | 0.090 |
| 4 | 0.0110 | 27.30 | 10.7 | 0.3 | 0.265 | 0.648 | 0.913 | 1.41 | 64.50 | 0.781 | 0.133 |
| 5 | 0.0120 | 30.10 | 13.5 | 0.3 | 0.334 | 0.626 | 0.961 | 1.53 | 64.80 | 0.794 | 0.167 |
| 6 | 0.0120 | 32.20 | 15.6 | 0.3 | 0.386 | 0.605 | 0.991 | 1.64 | 65.10 | 0.798 | 0.193 |
| 7 | 0.0130 | 34.40 | 17.8 | 0.3 | 0.441 | 0.590 | 1.031 | 1.75 | 65.30 | 0.811 | 0.220 |
| 8 | 0.0140 | 36.10 | 19.5 | 0.4 | 0.483 | 0.576 | 1.059 | 1.84 | 65.50 | 0.817 | 0.241 |
| 9 | 0.0150 | 37.60 | 21.0 | 0.4 | 0.520 | 0.554 | 1.074 | 1.94 | 65.80 | 0.814 | 0.260 |
| 10 | 0.0150 | 39.20 | 22.6 | 0.4 | 0.559 | 0.547 | 1.106 | 2.02 | 65.90 | 0.827 | 0.280 |
| 11 | 0.0160 | 40.60 | 24.0 | 0.4 | 0.594 | 0.533 | 1.126 | 2.11 | 66.10 | 0.830 | 0.297 |
| 12 | 0.0170 | 41.90 | 25.3 | 0.4 | 0.626 | 0.526 | 1.151 | 2.19 | 66.20 | 0.838 | 0.313 |
| 13 | 0.0190 | 43.90 | 27.3 | 0.5 | 0.675 | 0.504 | 1.179 | 2.34 | 66.50 | 0.841 | 0.337 |
| 14 | 0.0210 | 45.90 | 29.3 | 0.6 | 0.724 | 0.482 | 1.206 | 2.50 | 66.80 | 0.844 | 0.362 |
| 15 | 0.0220 | 47.60 | 31.0 | 0.6 | 0.766 | 0.468 | 1.234 | 2.64 | 67.00 | 0.851 | 0.383 |
| 16 | 0.0240 | 49.40 | 32.8 | 0.6 | 0.810 | 0.461 | 1.270 | 2.76 | 67.10 | 0.866 | 0.405 |
| 17 | 0.0250 | 50.80 | 34.2 | 0.7 | 0.844 | 0.454 | 1.297 | 2.86 | 67.20 | 0.876 | 0.422 |
| 18 | 0.0280 | 52.30 | 35.7 | 0.8 | 0.880 | 0.439 | 1.319 | 3.00 | 67.40 | 0.879 | 0.440 |
| 19 | 0.0300 | 53.90 | 37.3 | 0.8 | 0.919 | 0.425 | 1.344 | 3.16 | 67.60 | 0.884 | 0.460 |
| 20 | 0.0330 | 55.50 | 38.9 | 0.9 | 0.958 | 0.418 | 1.375 | 3.29 | 67.70 | 0.896 | 0.479 |
| 21 | 0.0360 | 57.00 | 40.4 | 1.0 | 0.994 | 0.410 | 1.404 | 3.42 | 67.80 | 0.907 | 0.497 |
| 22 | 0.0390 | 58.30 | 41.7 | 1.1 | 1.025 | 0.403 | 1.428 | 3.54 | 67.90 | 0.916 | 0.512 |
| 23 | 0.0430 | 59.70 | 43.1 | 1.2 | 1.058 | 0.396 | 1.454 | 3.67 | 68.00 | 0.925 | 0.529 |
| 24 | 0.0470 | 61.10 | 44.5 | 1.3 | 1.091 | 0.396 | 1.487 | 3.76 | 68.00 | 0.942 | 0.546 |
| 25 | 0.0520 | 62.50 | 45.9 | 1.4 | 1.124 | 0.396 | 1.520 | 3.84 | 68.00 | 0.958 | 0.562 |
| 26 | 0.0580 | 63.90 | 47.3 | 1.6 | 1.156 | 0.396 | 1.552 | 3.92 | 68.00 | 0.974 | 0.578 |

## Test Readings for Specimen No. 2

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 0.0600 | 64.40 | 47.8 | 1.6 | 1.168 | 0.396 | 1.564 | 3.95 | 68.00 | 0.980 | 0.584 |

## Parameters for Specimen No. 3

| Specimen Parameter | Initial | Saturated | Consolidated | Final |
|---|---|---|---|---|
| **Moisture content: Moist soil+tare, gms.** | 123.600 | | | 0.000 |
| **Moisture content: Dry soil+tare, gms.** | 100.000 | | | 0.000 |
| **Moisture content: Tare, gms.** | 0.000 | | | 0.000 |
| **Moisture, %** | 23.6 | 23.6 | 25.7 | |
| **Moist specimen weight, gms.** | 338.9 | | | |
| **Diameter, in.** | 1.92 | 1.92 | 1.94 | |
| **Area, in.²** | 2.90 | 2.90 | 2.96 | |
| **Height, in.** | 3.52 | 3.52 | 3.56 | |
| **Net decrease in height, in.** | | 0.00 | -0.04 | |
| **Wet Density, pcf** | 126.7 | 126.7 | 124.5 | |
| **Dry density, pcf** | 102.5 | 102.5 | 99.1 | |
| **Void ratio** | 0.6324 | 0.6324 | 0.6884 | |
| **Saturation, %** | 100.0 | 100.0 | 100.0 | |

## Test Readings for Specimen No. 3

**Consolidation cell pressure =** 85.00 psi (6.120 tsf)
**Consolidation back pressure =** 70.00 psi (5.040 tsf)
**Consolidation effective confining stress =** 1.080 tsf
**Strain rate, %/min. =** 0.50
**Fail. Stress =** 1.429 tsf **at reading no.** 10

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0040 | 28.70 | 0.0 | 0.0 | 0.000 | 1.080 | 1.080 | 1.00 | 70.00 | 1.080 | 0.000 |
| 1 | 0.0050 | 35.90 | 7.2 | 0.0 | 0.175 | 0.986 | 1.161 | 1.18 | 71.30 | 1.074 | 0.088 |
| 2 | 0.0060 | 43.70 | 15.0 | 0.1 | 0.365 | 0.922 | 1.286 | 1.40 | 72.20 | 1.104 | 0.182 |
| 3 | 0.0080 | 50.60 | 21.9 | 0.1 | 0.532 | 0.864 | 1.396 | 1.62 | 73.00 | 1.130 | 0.266 |
| 4 | 0.0100 | 55.90 | 27.2 | 0.2 | 0.660 | 0.821 | 1.481 | 1.80 | 73.60 | 1.151 | 0.330 |
| 5 | 0.0110 | 60.60 | 31.9 | 0.2 | 0.774 | 0.785 | 1.559 | 1.99 | 74.10 | 1.172 | 0.387 |
| 6 | 0.0150 | 67.80 | 39.1 | 0.3 | 0.948 | 0.734 | 1.682 | 2.29 | 74.80 | 1.208 | 0.474 |
| 7 | 0.0190 | 73.10 | 44.4 | 0.4 | 1.075 | 0.698 | 1.773 | 2.54 | 75.30 | 1.236 | 0.538 |
| 8 | 0.0240 | 78.40 | 49.7 | 0.6 | 1.202 | 0.662 | 1.864 | 2.81 | 75.80 | 1.263 | 0.601 |
| 9 | 0.0320 | 83.30 | 54.6 | 0.8 | 1.317 | 0.641 | 1.958 | 3.06 | 76.10 | 1.299 | 0.659 |
| 10 | 0.0430 | 88.10 | 59.4 | 1.1 | 1.429 | 0.626 | 2.055 | 3.28 | 76.30 | 1.341 | 0.714 |
| 11 | 0.0570 | 92.50 | 63.8 | 1.5 | 1.528 | 0.626 | 2.155 | 3.44 | 76.30 | 1.391 | 0.764 |
| 12 | 0.0720 | 97.00 | 68.3 | 1.9 | 1.629 | 0.641 | 2.270 | 3.54 | 76.10 | 1.455 | 0.815 |
| 13 | 0.0880 | 101.70 | 73.0 | 2.4 | 1.733 | 0.662 | 2.396 | 3.62 | 75.80 | 1.529 | 0.867 |
| 14 | 0.1030 | 106.10 | 77.4 | 2.8 | 1.830 | 0.677 | 2.506 | 3.70 | 75.60 | 1.592 | 0.915 |
| 15 | 0.1200 | 110.80 | 82.1 | 3.3 | 1.931 | 0.706 | 2.637 | 3.74 | 75.20 | 1.671 | 0.966 |
| 16 | 0.1370 | 115.60 | 86.9 | 3.7 | 2.034 | 0.727 | 2.761 | 3.80 | 74.90 | 1.744 | 1.017 |
| 17 | 0.1540 | 120.30 | 91.6 | 4.2 | 2.133 | 0.763 | 2.897 | 3.80 | 74.40 | 1.830 | 1.067 |
| 18 | 0.1690 | 124.70 | 96.0 | 4.6 | 2.226 | 0.785 | 3.011 | 3.84 | 74.10 | 1.898 | 1.113 |
| 19 | 0.1870 | 129.30 | 100.6 | 5.1 | 2.320 | 0.821 | 3.141 | 3.83 | 73.60 | 1.981 | 1.160 |
| 20 | 0.2020 | 133.70 | 105.0 | 5.6 | 2.411 | 0.850 | 3.261 | 3.84 | 73.20 | 2.055 | 1.206 |
| 21 | 0.2170 | 138.10 | 109.4 | 6.0 | 2.501 | 0.878 | 3.379 | 3.85 | 72.80 | 2.129 | 1.250 |

## Test Readings for Specimen No. 3

| No. | Def. Dial in. | Load Dial | Load lbs. | Strain % | Deviator Stress tsf | Minor Eff. Stress tsf | Major Eff. Stress tsf | 1:3 Ratio | Pore Press. psi | P tsf | Q tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 0.2330 | 142.50 | 113.8 | 6.4 | 2.589 | 0.914 | 3.503 | 3.83 | 72.30 | 2.209 | 1.295 |
| 23 | 0.2480 | 147.00 | 118.3 | 6.9 | 2.679 | 0.943 | 3.623 | 3.84 | 71.90 | 2.283 | 1.340 |
| 24 | 0.2630 | 151.40 | 122.7 | 7.3 | 2.766 | 0.972 | 3.738 | 3.85 | 71.50 | 2.355 | 1.383 |
| 25 | 0.2800 | 155.90 | 127.2 | 7.8 | 2.853 | 1.008 | 3.861 | 3.83 | 71.00 | 2.435 | 1.427 |
| 26 | 0.2970 | 160.30 | 131.6 | 8.2 | 2.937 | 1.044 | 3.981 | 3.81 | 70.50 | 2.512 | 1.468 |
| 27 | 0.3140 | 165.00 | 136.3 | 8.7 | 3.026 | 1.080 | 4.106 | 3.80 | 70.00 | 2.593 | 1.513 |
| 28 | 0.3310 | 169.50 | 140.8 | 9.2 | 3.109 | 1.109 | 4.218 | 3.80 | 69.60 | 2.663 | 1.555 |
| 29 | 0.3500 | 174.00 | 145.3 | 9.7 | 3.190 | 1.145 | 4.334 | 3.79 | 69.10 | 2.740 | 1.595 |
| 30 | 0.3660 | 178.40 | 149.7 | 10.2 | 3.270 | 1.181 | 4.451 | 3.77 | 68.60 | 2.816 | 1.635 |
| 31 | 0.3830 | 182.80 | 154.1 | 10.6 | 3.348 | 1.217 | 4.565 | 3.75 | 68.10 | 2.891 | 1.674 |
| 32 | 0.4020 | 187.60 | 158.9 | 11.2 | 3.432 | 1.246 | 4.677 | 3.76 | 67.70 | 2.961 | 1.716 |
| 33 | 0.4210 | 192.00 | 163.3 | 11.7 | 3.506 | 1.289 | 4.794 | 3.72 | 67.10 | 3.042 | 1.753 |
| 34 | 0.4400 | 196.40 | 167.7 | 12.2 | 3.578 | 1.325 | 4.903 | 3.70 | 66.60 | 3.114 | 1.789 |
| 35 | 0.4600 | 201.00 | 172.3 | 12.8 | 3.653 | 1.354 | 5.006 | 3.70 | 66.20 | 3.180 | 1.826 |
| 36 | 0.4790 | 205.40 | 176.7 | 13.3 | 3.723 | 1.390 | 5.113 | 3.68 | 65.70 | 3.251 | 1.862 |
| 37 | 0.4980 | 209.60 | 180.9 | 13.9 | 3.788 | 1.426 | 5.214 | 3.66 | 65.20 | 3.320 | 1.894 |
| 38 | 0.5180 | 214.00 | 185.3 | 14.4 | 3.855 | 1.454 | 5.309 | 3.65 | 64.80 | 3.382 | 1.928 |
| 39 | 0.5390 | 218.50 | 189.8 | 15.0 | 3.921 | 1.490 | 5.412 | 3.63 | 64.30 | 3.451 | 1.961 |

**Appendix 7**

# RESULTS OF LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

Project: AmerenUE Sioux Power Plant Utility Waste Landfill

Calc. by: C Cook

Checked J Fouse

Groundwater Elevation (ft) 417

Ground Motion Ratio (amax/g): 0.268

Earthquake Magnitude: 7.5

Hammer Efficiency: 60 %

Unit Wt. FGD 110

Depth (ft) 0

FGD Stress (psf) 0

# High Risk 51

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.59 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 1.02 | 10 | n.a. | 10 | 0.82 | 10 | 1.10 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.73 | 19 | n.a. | 15 | 0.90 | 15 | 1.22 | 14 | n.a. | 15 | 1.05 | 14 | 0.82 | 15 | n.a. | 19 | 0.73 |
| 24 | 1.06 | 24 | 0.38 | 19 | 0.60 | 19 | 0.81 | 19 | 0.79 | 19 | 1.85 | 19 | 1.69 | 19 | 0.97 | 24 | 0.56 |
| 29 | 0.70 | 29 | 0.89 | 24 | 0.74 | 24 | 0.40 | 24 | 1.13 | 23 | 1.63 | 24 | 2.83 | 24 | 0.62 | 29 | 0.72 |
| 36 | 0.85 | | | 29 | 0.99 | 29 | 0.83 | 29 | 0.72 | 29 | 0.68 | 29 | 1.96 | 29 | 0.69 | | |
| 41 | 2.72 | | | | | | | | | | | | | | | | |
| 44 | 1.47 | | | | | | | | | | | | | | | | |
| 49 | 0.97 | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
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| FS | 0.70 | FS | 0.38 | FS | 0.60 | FS | 0.40 | FS | 0.72 | FS | 0.68 | FS | 0.82 | FS | 0.62 | FS | 0.56 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 1.06 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.91 |
| 14 | n.a. | 14 | n.a. | 14 | 1.01 | 19 | n.a. | 14 | 1.24 | 14 | 1.64 | 14 | 0.72 | 14 | 1.23 | 13 | 1.15 | 20 | 0.85 |
| 19 | 4.60 | 19 | 2.76 | 19 | 0.57 | 24 | 1.90 | 19 | n.a. | 19 | 4.52 | 19 | 0.71 | 19 | 1.15 | 19 | 0.78 | 25 | 0.61 |
| 24 | 3.02 | 24 | 1.04 | 24 | n.a. | 29 | 0.83 | 24 | 0.97 | 24 | 1.07 | 24 | 0.83 | 24 | 1.28 | 24 | 1.54 | 29 | 0.50 |
| 29 | 1.00 | 29 | 2.65 | 29 | 0.96 | | | 29 | 0.60 | 29 | 0.73 | 29 | 0.93 | 29 | 1.35 | 29 | 0.99 | | |
| | | | | | | | | | | | | | | | | 34 | 1.18 | | |
| | | | | | | | | | | | | | | | | 39 | 0.53 | | |
| | | | | | | | | | | | | | | | | 44 | 1.33 | | |
| | | | | | | | | | | | | | | | | 49 | 0.86 | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.00 | FS | 1.04 | FS | 0.57 | FS | 0.83 | FS | 0.60 | FS | 0.73 | FS | 0.71 | FS | 1.15 | FS | 0.53 | FS | 0.50 |
| Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

# LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.50 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.16 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.68 | 10 | 1.34 | 10 | 2.75 | 10 | n.a. | 10 | 5.54 | 10 | 1.54 |
| 20 | 1.25 | 15 | 1.04 | 15 | 0.98 | 15 | 2.65 | 19 | 1.18 | 15 | 0.75 | 14 | 2.38 | 14 | 0.79 | 14 | 4.06 | 14 | 1.03 |
| 25 | 0.74 | 20 | 0.88 | 20 | 0.83 | 20 | 1.31 | 24 | 1.07 | 20 | 0.72 | 19 | 0.72 | 19 | 0.65 | 19 | 0.58 | 19 | 0.72 |
| 30 | 0.65 | 25 | 0.61 | 25 | 1.14 | 25 | 0.95 | 29 | 1.10 | 25 | 1.96 | 24 | 1.06 | 24 | 0.42 | 24 | 0.68 | 24 | 1.06 |
| | | 30 | 0.55 | 30 | 0.58 | 30 | 0.87 | | | 30 | 0.58 | 29 | 0.79 | 29 | 1.94 | 29 | 1.21 | 29 | 0.87 |
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| FS | 0.65 | FS | 0.55 | FS | 0.58 | FS | 0.87 | FS | 0.50 | FS | 0.58 | FS | 0.72 | FS | 0.42 | FS | 0.58 | FS | 0.72 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.64 | 14 | 0.85 | 14 | 5.04 | 14 | 0.73 | 14 | 3.88 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.27 |
| 19 | 2.19 | 19 | 0.75 | 19 | 2.25 | 19 | 1.37 | 19 | 0.89 | 19 | n.a. | 19 | 0.86 | 19 | n.a. | 19 | 0.37 | 19 | 1.94 |
| 24 | 0.86 | 24 | 1.29 | 24 | 1.00 | 24 | 2.56 | 24 | 1.22 | 24 | n.a. | 24 | 0.63 | 24 | n.a. | 24 | 0.70 | 24 | 0.35 |
| 29 | 1.99 | 29 | 1.22 | 29 | 0.84 | 29 | 1.05 | 29 | 0.99 | 29 | 1.22 | 29 | 2.12 | 29 | 1.43 | 29 | 0.90 | 29 | 0.30 |
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| FS | 0.64 | FS | 0.75 | FS | 0.84 | FS | 0.73 | FS | 0.89 | FS | 1.22 | FS | 0.63 | FS | 1.43 | FS | 0.37 | FS | 0.30 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.47 | 14 | 1.40 | 14 | 3.08 | 14 | n.a. | 14 | 0.70 | 14 | 1.48 | 14 | 0.94 | 14 | 1.49 | 14 | n.a. | 14 | n.a. |
| 19 | 1.16 | 19 | 1.12 | 19 | 2.31 | 19 | 1.07 | 19 | 0.81 | 19 | 0.85 | 19 | 1.97 | 19 | 1.19 | 19 | 0.72 | 19 | n.a. |
| 24 | 0.79 | 24 | 0.86 | 24 | 3.05 | 24 | 4.25 | 24 | 2.43 | 24 | 2.05 | 24 | 0.43 | 24 | 2.11 | 24 | 2.11 | 24 | 1.20 |
| 29 | 0.51 | 29 | 0.66 | 29 | 1.10 | 29 | 0.77 | 29 | 0.78 | 29 | 1.11 | 29 | 0.60 | 29 | 2.03 | 29 | 1.75 | 29 | 0.84 |
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| FS | 0.51 | FS | 0.66 | FS | 1.10 | FS | 0.77 | FS | 0.70 | FS | 0.85 | FS | 0.43 | FS | 1.19 | FS | 0.72 | FS | 0.84 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.34 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 2.67 | 19 | 1.14 | 14 | n.a. | 14 | n.a. | 14 | 1.11 | 14 | 1.29 | 14 | 0.78 | 14 | 1.72 |
| 19 | 1.33 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.83 | 19 | 2.95 | 19 | 1.44 | 19 | 0.87 |
| 24 | 0.80 | 29 | 0.82 | 24 | 1.04 | 24 | 0.34 | 24 | 2.28 | 24 | 0.85 | 24 | 0.74 | 24 | 1.01 |
| 29 | 2.01 | | | 29 | 0.88 | 29 | 0.66 | 29 | 0.60 | 29 | 0.77 | 29 | 1.60 | 29 | 0.51 |
| | | | | | | | | | | | | 34 | 1.79 | | |
| | | | | | | | | | | | | 39 | 1.64 | | |
| | | | | | | | | | | | | 44 | 0.86 | | |
| | | | | | | | | | | | | 49 | 2.03 | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.80 | FS | 0.16 | FS | 0.88 | FS | 0.34 | FS | 0.60 | FS | 0.77 | FS | 0.74 | FS | 0.51 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 51 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 10 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 476 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.57 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.88 | 10 | n.a. | 10 | 0.71 | 10 | 1.00 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.68 | 19 | n.a. | 15 | 0.90 | 15 | 1.11 | 14 | n.a. | 15 | 1.00 | 14 | 0.76 | 15 | n.a. | 19 | 0.74 |
| 24 | 1.01 | 24 | 0.40 | 19 | 0.58 | 19 | 0.81 | 19 | 0.80 | 19 | 1.44 | 19 | 1.37 | 19 | 0.95 | 24 | 0.55 |
| 29 | 0.69 | 29 | 0.89 | 24 | 0.69 | 24 | 0.39 | 24 | 1.06 | 23 | 1.41 | 24 | 3.00 | 24 | 0.59 | 29 | 0.74 |
| 36 | 0.89 | | | 29 | 0.97 | 29 | 0.84 | 29 | 0.74 | 29 | 0.69 | 29 | 2.20 | 29 | 0.69 | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| FS | 0.68 | FS | 0.40 | FS | 0.58 | FS | 0.39 | FS | 0.74 | FS | 0.69 | FS | 0.76 | FS | 0.59 | FS | 0.55 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.98 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.88 |
| 14 | n.a. | 14 | n.a. | 14 | 0.95 | 19 | n.a. | 14 | 1.20 | 14 | 1.38 | 14 | 0.69 | 14 | 1.15 | 13 | 1.06 | 20 | 0.83 |
| 19 | 2.30 | 19 | 2.30 | 19 | 0.57 | 24 | 1.38 | 19 | n.a. | 19 | 4.95 | 19 | 0.72 | 19 | 1.14 | 19 | 0.76 | 25 | 0.63 |
| 24 | 3.31 | 24 | 1.01 | 24 | n.a. | 29 | 0.83 | 24 | 0.95 | 24 | 1.01 | 24 | 0.83 | 24 | 1.17 | 24 | 1.37 | 29 | 0.51 |
| 29 | 1.00 | 29 | 2.63 | 29 | 0.97 | | | 29 | 0.58 | 29 | 0.74 | 29 | 0.93 | 29 | 1.29 | 29 | 0.96 | | |
| | | | | | | | | | | | | | | | | 34 | 1.18 | | |
| | | | | | | | | | | | | | | | | 39 | 0.55 | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.00 | FS | 1.01 | FS | 0.57 | FS | 0.83 | FS | 0.58 | FS | 0.74 | FS | 0.69 | FS | 1.14 | FS | 0.55 | FS | 0.51 |
| Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.45 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.08 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.74 | 10 | 1.23 | 10 | 1.78 | 10 | n.a. | 10 | 2.79 | 10 | 1.30 |
| 20 | 1.15 | 15 | 1.00 | 15 | 0.96 | 15 | 1.66 | 19 | 1.10 | 15 | 0.70 | 14 | 2.58 | 14 | 0.73 | 14 | 4.12 | 14 | 0.98 |
| 25 | 0.76 | 20 | 0.88 | 20 | 0.84 | 20 | 1.18 | 24 | 1.01 | 20 | 0.72 | 19 | 0.68 | 19 | 0.61 | 19 | 0.57 | 19 | 0.68 |
| 30 | 0.62 | 25 | 0.63 | 25 | 1.07 | 25 | 0.93 | 29 | 1.07 | 25 | 2.21 | 24 | 1.00 | 24 | 0.42 | 24 | 0.64 | 24 | 1.00 |
| | | 30 | 0.59 | 30 | 0.56 | 30 | 0.88 | | | 30 | 0.56 | 29 | 0.80 | 29 | 2.18 | 29 | 1.17 | 29 | 0.88 |
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| FS | 0.62 | FS | 0.59 | FS | 0.56 | FS | 0.88 | FS | 0.45 | FS | 0.56 | FS | 0.68 | FS | 0.42 | FS | 0.57 | FS | 0.68 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.61 | 14 | 0.79 | 14 | 5.40 | 14 | 0.73 | 14 | 2.60 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.18 |
| 19 | 2.42 | 19 | 0.68 | 19 | 2.47 | 19 | 1.21 | 19 | 0.87 | 19 | n.a. | 19 | 0.85 | 19 | n.a. | 19 | 0.38 | 19 | 1.58 |
| 24 | 0.87 | 24 | 1.17 | 24 | 0.97 | 24 | 2.28 | 24 | 1.18 | 24 | n.a. | 24 | 0.60 | 24 | n.a. | 24 | 0.65 | 24 | 0.35 |
| 29 | 2.14 | 29 | 1.18 | 29 | 0.85 | 29 | 1.01 | 29 | 0.97 | 29 | 1.18 | 29 | 1.92 | 29 | 1.28 | 29 | 0.90 | 29 | 0.30 |
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| FS | 0.61 | FS | 0.68 | FS | 0.85 | FS | 0.73 | FS | 0.87 | FS | 1.18 | FS | 0.60 | FS | 1.28 | FS | 0.38 | FS | 0.30 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.32 | 14 | 1.29 | 14 | 1.98 | 14 | n.a. | 14 | 0.68 | 14 | 1.34 | 14 | 0.90 | 14 | 1.33 | 14 | n.a. | 14 | n.a. |
| 19 | 1.15 | 19 | 1.07 | 19 | 1.50 | 19 | 1.06 | 19 | 0.76 | 19 | 0.83 | 19 | 1.39 | 19 | 1.10 | 19 | 0.74 | 19 | n.a. |
| 24 | 0.78 | 24 | 0.85 | 24 | 3.34 | 24 | 4.68 | 24 | 1.99 | 24 | 1.43 | 24 | 0.42 | 24 | 1.83 | 24 | 2.33 | 24 | 1.12 |
| 29 | 0.52 | 29 | 0.63 | 29 | 1.07 | 29 | 0.78 | 29 | 0.79 | 29 | 1.07 | 29 | 0.58 | 29 | 2.25 | 29 | 1.41 | 29 | 0.85 |
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| | | | | | | | | | | | | | | | | | | | |
| FS | 0.52 | FS | 0.63 | FS | 1.07 | FS | 0.78 | FS | 0.68 | FS | 0.83 | FS | 0.42 | FS | 1.10 | FS | 0.74 | FS | 0.85 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| **B-107** | | **B-108** | | **B-109** | | **B-110** | | **B-111** | | **B-112** | | **B-113** | | **B-114** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.19 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.76 | 19 | 1.07 | 14 | n.a. | 14 | n.a. | 14 | 1.04 | 14 | 1.23 | 14 | 0.75 | 14 | 1.43 |
| 19 | 1.24 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.47 | 19 | 1.64 | 19 | 1.32 | 19 | 0.84 |
| 24 | 0.80 | 29 | 0.82 | 24 | 1.00 | 24 | 0.33 | 24 | 1.53 | 24 | 0.86 | 24 | 0.71 | 24 | 0.98 |
| 29 | 2.10 | | | 29 | 0.89 | 29 | 0.63 | 29 | 0.58 | 29 | 0.78 | 29 | 1.41 | 29 | 0.52 |
| | | | | | | | | | | | | 34 | 1.48 | | |
| | | | | | | | | | | | | 39 | 1.64 | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.80 | FS | 0.16 | FS | 0.89 | FS | 0.33 | FS | 0.58 | FS | 0.78 | FS | 0.71 | FS | 0.52 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 50 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 20 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 952 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.56 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.82 | 10 | n.a. | 10 | 0.67 | 10 | 0.97 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.68 | 19 | n.a. | 15 | 0.89 | 15 | 1.08 | 14 | n.a. | 15 | 0.97 | 14 | 0.71 | 15 | n.a. | 19 | 0.75 |
| 24 | 1.02 | 24 | 0.42 | 19 | 0.57 | 19 | 0.77 | 19 | 0.81 | 19 | 1.36 | 19 | 1.27 | 19 | 0.94 | 24 | 0.56 |
| 29 | 0.69 | 29 | 0.93 | 24 | 0.70 | 24 | 0.40 | 24 | 1.06 | 23 | 1.36 | 24 | 2.98 | 24 | 0.60 | 29 | 0.75 |
| 36 | n.a. | | | 29 | 1.01 | 29 | 0.88 | 29 | 0.75 | 29 | 0.69 | 29 | 1.83 | 29 | 0.69 | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| FS | 0.68 | FS | 0.42 | FS | 0.57 | FS | 0.40 | FS | 0.75 | FS | 0.67 | FS | 0.71 | FS | 0.60 | FS | 0.56 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.95 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.80 |
| 14 | n.a. | 14 | n.a. | 14 | 0.94 | 19 | n.a. | 14 | 1.16 | 14 | 1.28 | 14 | 0.67 | 14 | 1.11 | 13 | 1.03 | 20 | 0.80 |
| 19 | 1.91 | 19 | 1.68 | 19 | 0.59 | 24 | 1.32 | 19 | n.a. | 19 | 3.73 | 19 | 0.73 | 19 | 1.13 | 19 | 0.70 | 25 | 0.67 |
| 24 | 3.61 | 24 | 1.03 | 24 | n.a. | 29 | 0.88 | 24 | 0.97 | 24 | 1.03 | 24 | 0.84 | 24 | 1.14 | 24 | 1.34 | 29 | 0.53 |
| 29 | 1.03 | 29 | 1.74 | 29 | 1.00 | | | 29 | 0.60 | 29 | 0.75 | 29 | 0.96 | 29 | 1.30 | 29 | 1.00 | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.03 | FS | 1.03 | FS | 0.59 | FS | 0.88 | FS | 0.60 | FS | 0.75 | FS | 0.67 | FS | 1.11 | FS | 0.70 | FS | 0.53 |
| Risk | Moderate | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.42 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.04 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 2.15 | 10 | 1.17 | 10 | 1.59 | 10 | n.a. | 10 | 2.09 | 10 | 1.20 |
| 20 | 1.13 | 15 | 0.99 | 15 | 0.97 | 15 | 1.44 | 19 | 1.07 | 15 | 0.66 | 14 | 1.98 | 14 | 0.68 | 14 | 2.06 | 14 | 0.96 |
| 25 | 0.80 | 20 | 0.91 | 20 | 0.82 | 20 | 1.15 | 24 | 1.02 | 20 | 0.68 | 19 | 0.65 | 19 | 0.60 | 19 | 0.56 | 19 | 0.65 |
| 30 | 0.64 | 25 | 0.67 | 25 | 1.07 | 25 | 0.94 | 29 | 1.08 | 25 | 1.65 | 24 | 1.02 | 24 | 0.42 | 24 | 0.64 | 24 | 1.02 |
| | | 30 | 0.64 | 30 | 0.59 | 30 | 0.92 | | | 30 | 0.59 | 29 | 0.84 | 29 | 2.46 | 29 | 1.18 | 29 | 0.92 |
| FS | 0.64 | FS | 0.64 | FS | 0.59 | FS | 0.92 | FS | 0.42 | FS | 0.59 | FS | 0.65 | FS | 0.42 | FS | 0.56 | FS | 0.65 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.59 | 14 | 0.76 | 14 | 5.76 | 14 | 0.73 | 14 | 1.78 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.12 |
| 19 | 2.42 | 19 | 0.66 | 19 | 2.35 | 19 | 1.18 | 19 | 0.85 | 19 | n.a. | 19 | 0.85 | 19 | n.a. | 19 | 0.41 | 19 | 1.45 |
| 24 | 0.86 | 24 | 1.18 | 24 | 0.98 | 24 | 1.63 | 24 | 1.18 | 24 | n.a. | 24 | 0.61 | 24 | n.a. | 24 | 0.65 | 24 | 0.36 |
| 29 | 1.68 | 29 | 1.18 | 29 | 0.89 | 29 | 1.05 | 29 | 1.01 | 29 | 1.18 | 29 | 1.68 | 29 | 1.27 | 29 | 0.94 | 29 | 0.31 |
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| FS | 0.59 | FS | 0.66 | FS | 0.89 | FS | 0.73 | FS | 0.85 | FS | 1.18 | FS | 0.61 | FS | 1.27 | FS | 0.41 | FS | 0.31 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.23 | 14 | 1.22 | 14 | 1.63 | 14 | n.a. | 14 | 0.67 | 14 | 1.30 | 14 | 0.82 | 14 | 1.22 | 14 | n.a. | 14 | n.a. |
| 19 | 1.12 | 19 | 1.05 | 19 | 1.35 | 19 | 1.04 | 19 | 0.71 | 19 | 0.78 | 19 | 1.28 | 19 | 1.07 | 19 | 0.76 | 19 | n.a. |
| 24 | 0.75 | 24 | 0.87 | 24 | 3.67 | 24 | 5.09 | 24 | 1.90 | 24 | 1.34 | 24 | 0.42 | 24 | 1.60 | 24 | 2.29 | 24 | 1.11 |
| 29 | 0.53 | 29 | 0.64 | 29 | 1.09 | 29 | 0.82 | 29 | 0.82 | 29 | 1.09 | 29 | 0.61 | 29 | 2.53 | 29 | 1.42 | 29 | 0.89 |
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| | | | | | | | | | | | | | | | | | | | |
| FS | 0.53 | FS | 0.64 | FS | 1.09 | FS | 0.82 | FS | 0.67 | FS | 0.78 | FS | 0.42 | FS | 1.07 | FS | 0.76 | FS | 0.89 |
| Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.14 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.51 | 19 | 1.05 | 14 | n.a. | 14 | n.a. | 14 | 1.00 | 14 | 1.18 | 14 | 0.71 | 14 | 1.33 |
| 19 | 1.16 | 24 | 0.16 | 19 | n.a. | 19 | 0.65 | 19 | 1.35 | 19 | 1.44 | 19 | 1.24 | 19 | 0.78 |
| 24 | 0.82 | 29 | 0.86 | 24 | 1.01 | 24 | 0.33 | 24 | 1.44 | 24 | 0.85 | 24 | 0.69 | 24 | 1.01 |
| 29 | 1.68 | | | 29 | 0.93 | 29 | 0.65 | 29 | 0.61 | 29 | 0.81 | 29 | 1.42 | 29 | 0.53 |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.82 | FS | 0.16 | FS | 0.93 | FS | 0.33 | FS | 0.61 | FS | 0.81 | FS | 0.69 | FS | 0.53 |
| Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 35 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 30 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 1428 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.57 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.79 | 10 | n.a. | 10 | 0.63 | 10 | 0.94 | 10 | n.a. | 14 | n.a. |
| 18.5 | 0.70 | 19 | n.a. | 15 | 0.92 | 15 | 1.07 | 14 | n.a. | 15 | 0.98 | 14 | 0.71 | 15 | n.a. | 19 | 0.79 |
| 24 | n.a. | 24 | n.a. | 19 | 0.58 | 19 | 0.75 | 19 | 0.84 | 19 | 1.34 | 19 | 1.26 | 19 | 0.97 | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 23 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 36 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| FS | 0.70 | FS | 0.00 | FS | 0.58 | FS | 0.75 | FS | 0.84 | FS | 0.63 | FS | 0.71 | FS | 0.97 | FS | 0.57 |
| Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.93 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | 0.77 |
| 14 | n.a. | 14 | n.a. | 14 | 0.94 | 19 | n.a. | 14 | 1.15 | 14 | 1.25 | 14 | 0.66 | 14 | 1.08 | 13 | 0.96 | 20 | 0.83 |
| 19 | 1.72 | 19 | 1.60 | 19 | 0.62 | 24 | n.a. | 19 | n.a. | 19 | 3.80 | 19 | 0.76 | 19 | 1.15 | 19 | 0.72 | 25 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.72 | FS | 1.60 | FS | 0.62 | FS | 0.00 | FS | 0.93 | FS | 1.25 | FS | 0.66 | FS | 1.08 | FS | 0.72 | FS | 0.77 |
| Risk | Low | Risk | Low | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.40 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | 1.04 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | 1.75 | 10 | 1.12 | 10 | 1.43 | 10 | n.a. | 10 | 1.76 | 10 | 1.15 |
| 20 | 1.16 | 15 | 1.02 | 15 | 1.00 | 15 | 1.41 | 19 | 1.09 | 15 | 0.67 | 14 | 1.81 | 14 | 0.68 | 14 | 1.79 | 14 | 0.93 |
| 25 | n.a. | 20 | 0.96 | 20 | 0.82 | 20 | 1.17 | 24 | n.a. | 20 | 0.70 | 19 | 0.67 | 19 | 0.62 | 19 | 0.57 | 19 | 0.67 |
| 30 | n.a. | 25 | n.a. | 25 | n.a. | 25 | n.a. | 29 | n.a. | 25 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| | | 30 | n.a. | 30 | n.a. | 30 | n.a. | | | 30 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
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| | | | | | | | | | | | | | | | | | | | |
| FS | 1.04 | FS | 0.96 | FS | 0.82 | FS | 1.17 | FS | 0.40 | FS | 0.67 | FS | 0.67 | FS | 0.62 | FS | 0.57 | FS | 0.67 |
| Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 0.57 | 14 | 0.75 | 14 | 6.21 | 14 | 0.76 | 14 | 1.62 | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | 1.13 |
| 19 | 1.92 | 19 | 0.68 | 19 | 1.92 | 19 | 1.19 | 19 | 0.83 | 19 | n.a. | 19 | 0.89 | 19 | n.a. | 19 | 0.44 | 19 | 1.46 |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
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| FS | 0.57 | FS | 0.68 | FS | 1.92 | FS | 0.76 | FS | 0.83 | FS | 0.00 | FS | 0.89 | FS | 0.00 | FS | 0.44 | FS | 1.13 |
| Risk | HIGH | Risk | HIGH | Risk | Low | Risk | HIGH | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | Moderate |

Ameren Missouri Sioux Energy Center Utility Waste Landfill



LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.23 | 14 | 1.22 | 14 | 1.58 | 14 | n.a. | 14 | 0.68 | 14 | 1.27 | 14 | 0.78 | 14 | 1.20 | 14 | n.a. | 14 | n.a. |
| 19 | 1.15 | 19 | 1.09 | 19 | 1.36 | 19 | 1.08 | 19 | 0.72 | 19 | 0.76 | 19 | 1.30 | 19 | 1.09 | 19 | 0.81 | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
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| | | | | | | | | | | | | | | | | | | | |
| FS | 1.15 | FS | 1.09 | FS | 1.36 | FS | 1.08 | FS | 0.68 | FS | 0.76 | FS | 0.78 | FS | 1.09 | FS | 0.81 | FS | 0.00 |
| Risk | Moderate | Risk | Moderate | Risk | Low | Risk | Moderate | Risk | HIGH | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | 1.12 | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | 1.42 | 19 | 1.08 | 14 | n.a. | 14 | n.a. | 14 | 0.96 | 14 | 1.17 | 14 | 0.70 | 14 | 1.30 |
| 19 | 1.18 | 24 | n.a. | 19 | n.a. | 19 | 0.68 | 19 | 1.33 | 19 | 1.42 | 19 | 1.25 | 19 | 0.77 |
| 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 1.18 | FS | 1.08 | FS | 0.00 | FS | 0.68 | FS | 0.96 | FS | 1.17 | FS | 0.70 | FS | 0.77 |
| Risk | Moderate | Risk | Moderate | Risk | n.a. | Risk | HIGH | Risk | HIGH | Risk | Moderate | Risk | HIGH | Risk | HIGH |

LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSES BASED ON N-VALUES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | AmerenUE Sioux Power Plant Utility Waste Landfill | | | | | | |
| Calc. by: | C Cook | Groundwater Elevation (ft) | 417 | Unit Wt. FGD | 110 | # High Risk | 6 |
| Checked | J Fouse | Ground Motion Ratio ($a_{max}$/g): | 0.268 | Depth (ft) | 40 | | |
| | | Earthquake Magnitude: | 7.5 | FGD Stress (psf) | 1904 | | |
| | | Hammer Efficiency: | 60 % | | | | |

| B-58 | | B-59 | | B-60 | | B-61 | | B-62 | | B-63 | | B-64 | | B-65 | | B-66 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 10 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.60 |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | 0.79 | 10 | n.a. | 10 | 0.63 | 10 | 0.96 | 10 | n.a. | 14 | n.a. |
| 18.5 | n.a. | 19 | n.a. | 15 | n.a. | 15 | n.a. | 14 | n.a. | 15 | n.a. | 14 | n.a. | 15 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 23 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 36 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| 41 | n.a. | | | | | | | | | | | | | | | | |
| 44 | n.a. | | | | | | | | | | | | | | | | |
| 49 | n.a. | | | | | | | | | | | | | | | | |
| 59 | n.a. | | | | | | | | | | | | | | | | |
| 69 | n.a. | | | | | | | | | | | | | | | | |
| 79 | n.a. | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.79 | FS | 0.00 | FS | 0.63 | FS | 0.96 | FS | 0.00 | FS | 0.60 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | HIGH | Risk | HIGH | Risk | n.a. | Risk | HIGH |

LIQUEFACTION ANALYSES

| B-67 | | B-68 | | B-69 | | B-70 | | B-71 | | B-72 | | B-73 | | B-74 | | B-75 | | B-76 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 4.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 4 | n.a. | 6.5 | n.a. | 5 | n.a. | 7 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 0.96 | 10 | n.a. | 10 | n.a. | 9 | n.a. | 10 | n.a. | 15 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 19 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 13 | n.a. | 20 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 25 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 29 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | | |
| | | | | | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.96 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-77 | | B-78 | | B-79 | | B-80 | | B-81 | | B-82 | | B-83 | | B-84 | | B-85 | | B-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 10 | 0.41 | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 15 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 14 | n.a. | 10 | 1.14 | 10 | 1.42 | 10 | n.a. | 10 | 1.72 | 10 | 1.15 |
| 20 | n.a. | 15 | n.a. | 15 | n.a. | 15 | n.a. | 19 | n.a. | 15 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 25 | n.a. | 20 | n.a. | 20 | n.a. | 20 | n.a. | 24 | n.a. | 20 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 30 | n.a. | 25 | n.a. | 25 | n.a. | 25 | n.a. | 29 | n.a. | 25 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| | | 30 | n.a. | 30 | n.a. | 30 | n.a. | | | 30 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
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| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.41 | FS | 1.14 | FS | 1.42 | FS | 0.00 | FS | 1.72 | FS | 1.15 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | HIGH | Risk | Moderate | Risk | Low | Risk | n.a. | Risk | Low | Risk | Moderate |

LIQUEFACTION ANALYSES

| B-87 | | B-88 | | B-89 | | B-90 | | B-91 | | B-92 | | B-93 | | B-94 | | B-95 | | B-96 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
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| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-97 | | B-98 | | B-99 | | B-100 | | B-101 | | B-102 | | B-103 | | B-104 | | B-105 | | B-106 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 2.5 | n.a. |
| 7.5 | n.a. | 7.5 | n.a. | 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
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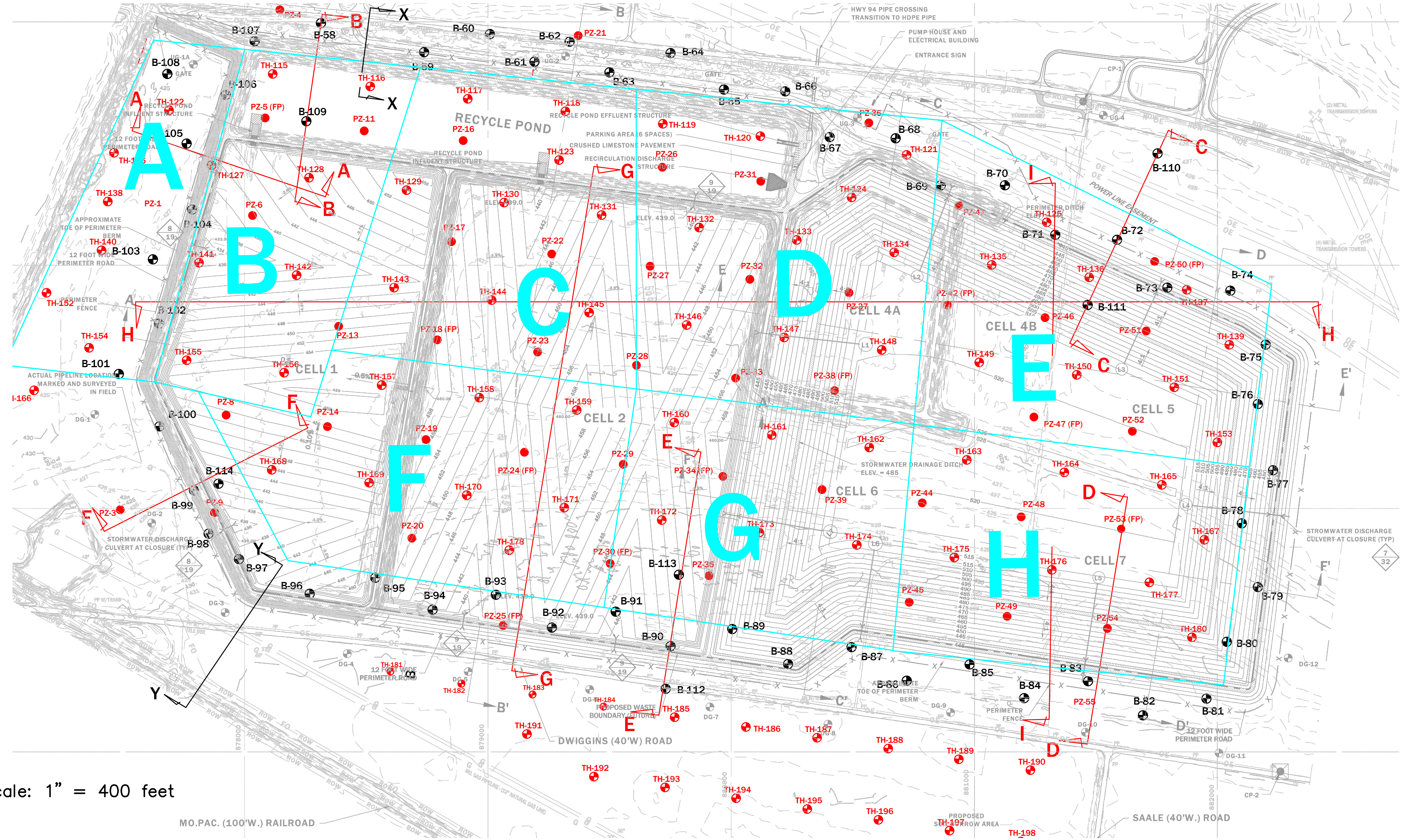
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

LIQUEFACTION ANALYSES

| B-107 | | B-108 | | B-109 | | B-110 | | B-111 | | B-112 | | B-113 | | B-114 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS | Depth (ft) | FS |
| 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 2.5 | n.a. | 5 | n.a. | 5 | n.a. | 2.5 | n.a. |
| 5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. | 7.5 | n.a. |
| 10 | n.a. | 14 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. | 10 | n.a. |
| 14 | n.a. | 19 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. | 14 | n.a. |
| 19 | n.a. | 24 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. | 19 | n.a. |
| 24 | n.a. | 29 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. | 24 | n.a. |
| 29 | n.a. | | | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. | 29 | n.a. |
| | | | | | | | | | | | | 34 | n.a. | | |
| | | | | | | | | | | | | 39 | n.a. | | |
| | | | | | | | | | | | | 44 | n.a. | | |
| | | | | | | | | | | | | 49 | n.a. | | |
| | | | | | | | | | | | | 59 | n.a. | | |
| | | | | | | | | | | | | 69 | n.a. | | |
| | | | | | | | | | | | | 79 | n.a. | | |
| | | | | | | | | | | | | 89 | n.a. | | |
| | | | | | | | | | | | | 99 | n.a. | | |
| FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 | FS | 0.00 |
| Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. | Risk | n.a. |

**Appendix 8**

# RESULTS OF SLOPE STABILITY ANALYSES




Scale: 1" = 400 feet

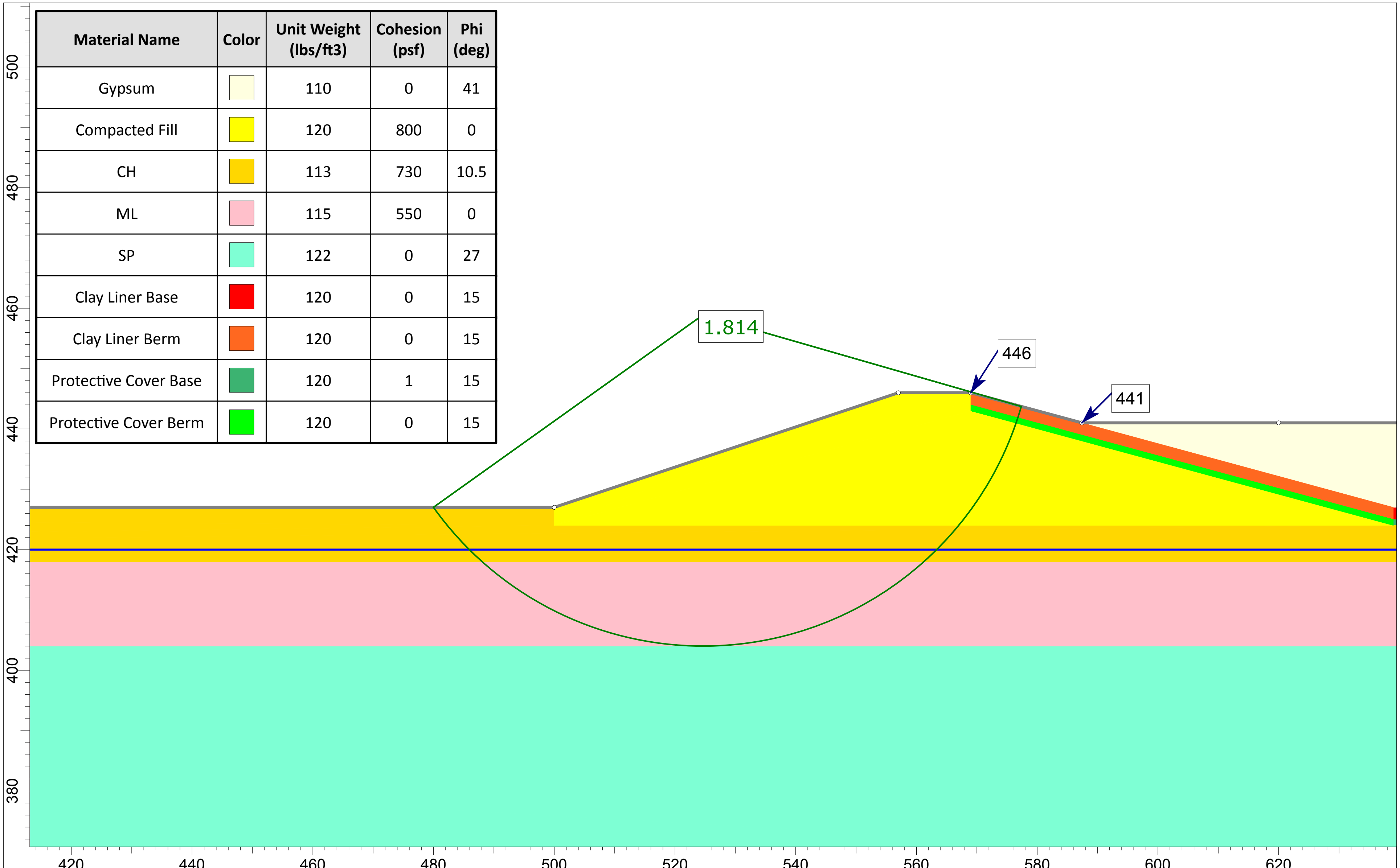
Note: Sections A–A through F–F for stability analyses shown in red. Sections G–G through I–I for settlement profiles shown in red. Sections X–X and Y–Y refer to erosion protection calculations in Appendix 11. Other sections in gray are for permit drawings.

Ameren Missouri Sioux Energy Center UWL
PLAN OF SECTIONS AND BORING COMPOSITE AREAS

REITZ & JENS, INC.

Figure 8–0

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 550 | 0 |
| SP | | 122 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 1 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
SHORT TERM - INITIAL FILLING

REITZ & JENS, INC.

Figure 8-1

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115 | 122 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 0 | 0 | 1 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 420 |
| 1370 | 420 |

## External Boundary

| X | Y |
|---|---|
| 587.421 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 418 |
| 0 | 404 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 404 |
| 1370 | 418 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |
| 620 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 587.421 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

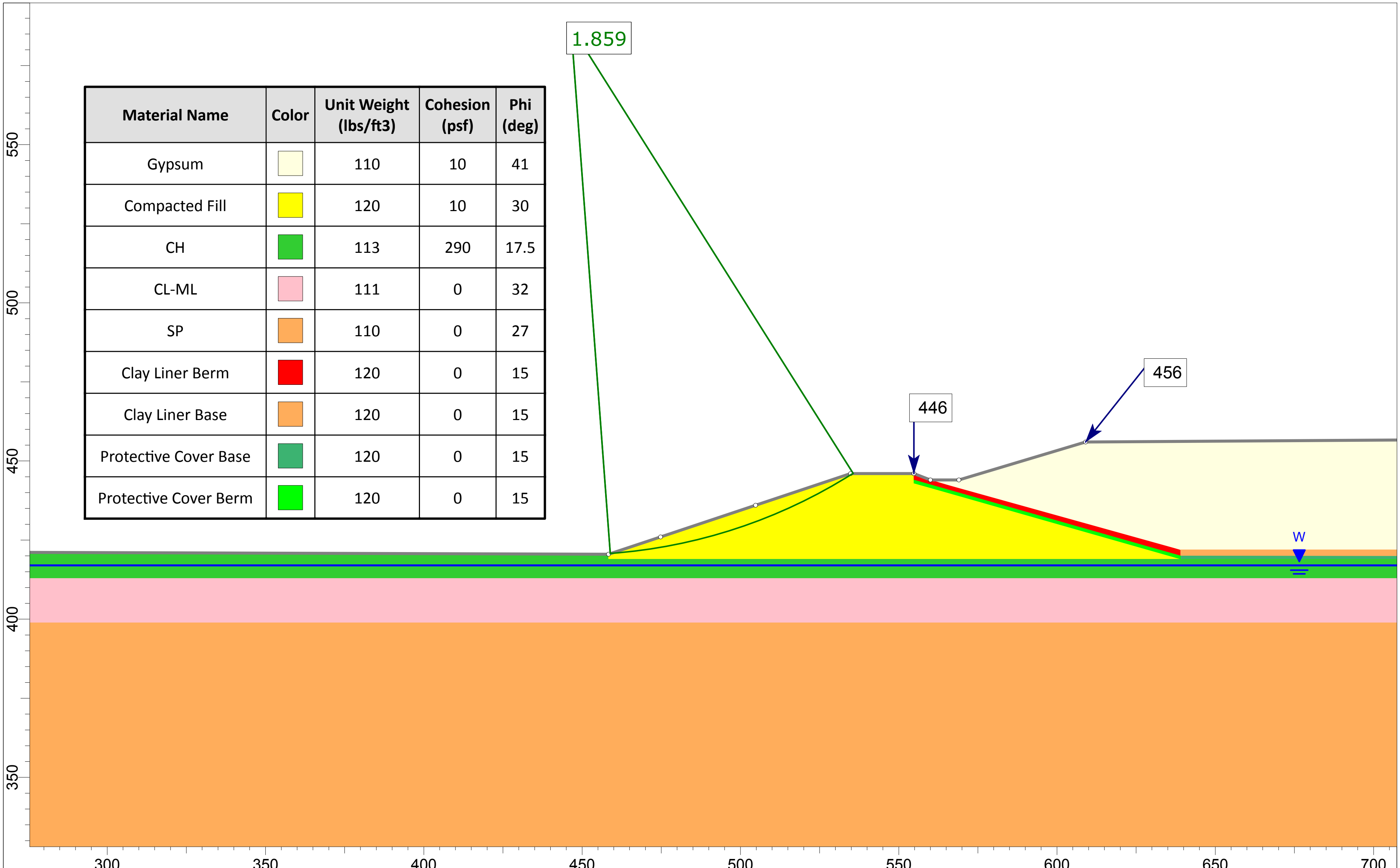
| X | Y |
|---|---|
| 569 | 443 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 444 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 10 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Clay Liner Base | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
LONG TERM - CLOSED CELL

REITZ & JENS, INC.

Figure 8-2

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 30 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Enabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Berm | Clay Liner Base | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 10 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 0 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| -16.95 | 417 |

| | |
|---|---|
| 1370 | 417 |

## External Boundary

| X | Y |
|---|---|
| 554.774 | 446 |
| 534.774 | 446 |
| 504.774 | 436 |
| 474.774 | 426 |
| 458.343 | 420.523 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 458.343 | 420.523 |
| 458.343 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554.774 | 443 |
| 554.774 | 444 |
| 554.774 | 446 |

## Material Boundary

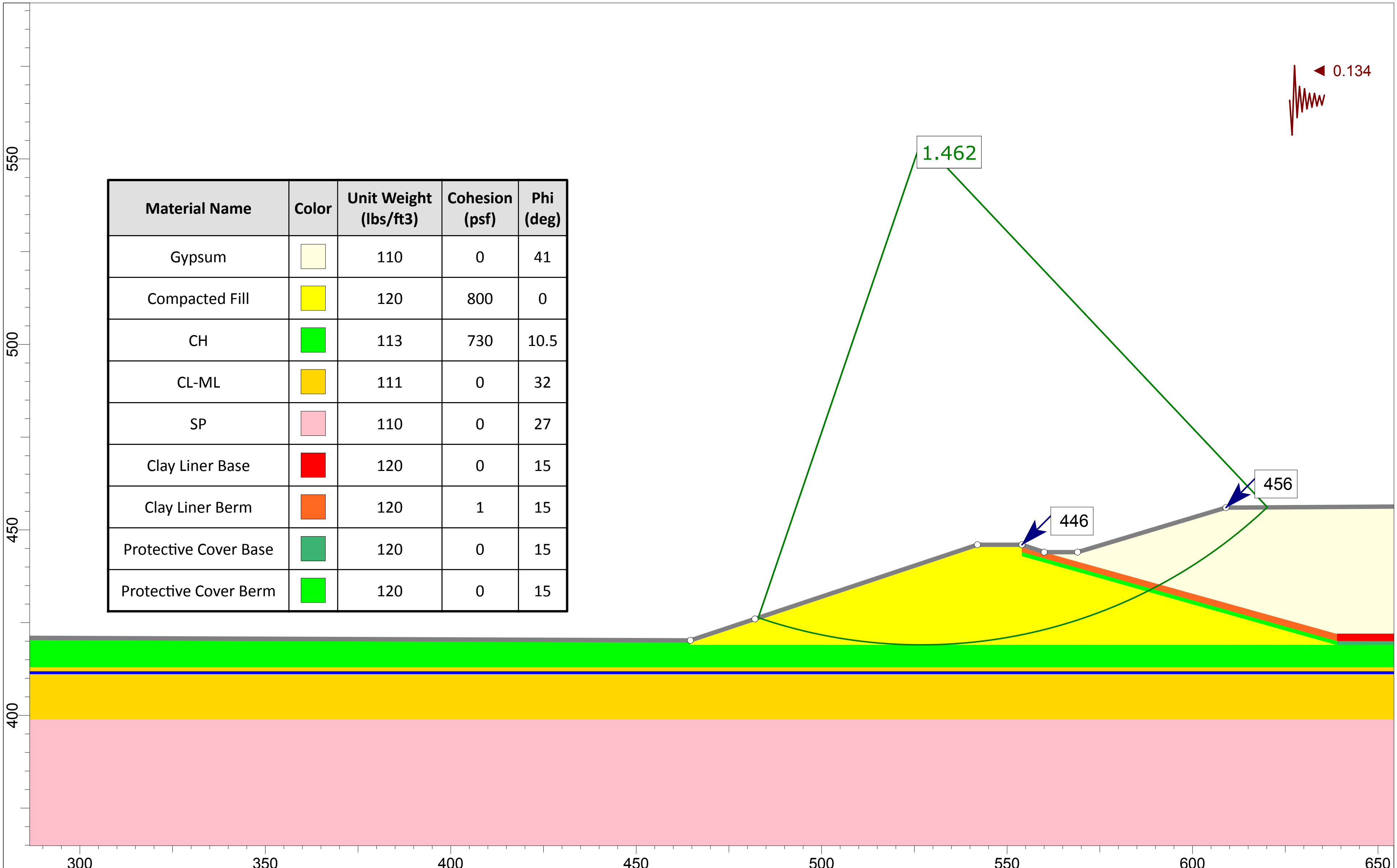
| X | Y |
|---|---|
| 554.774 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554.774 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 1 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
SEISMIC - CLOSED CELL

REITZ & JENS, INC.

Figure 8-3

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 0 | 0 | 0 | 1 | 0 |
| Friction Angle [°] | 41 | 0 | 10.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 482 | 426 |
| 464.603 | 420.201 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 464.603 | 420.201 |
| 464.603 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

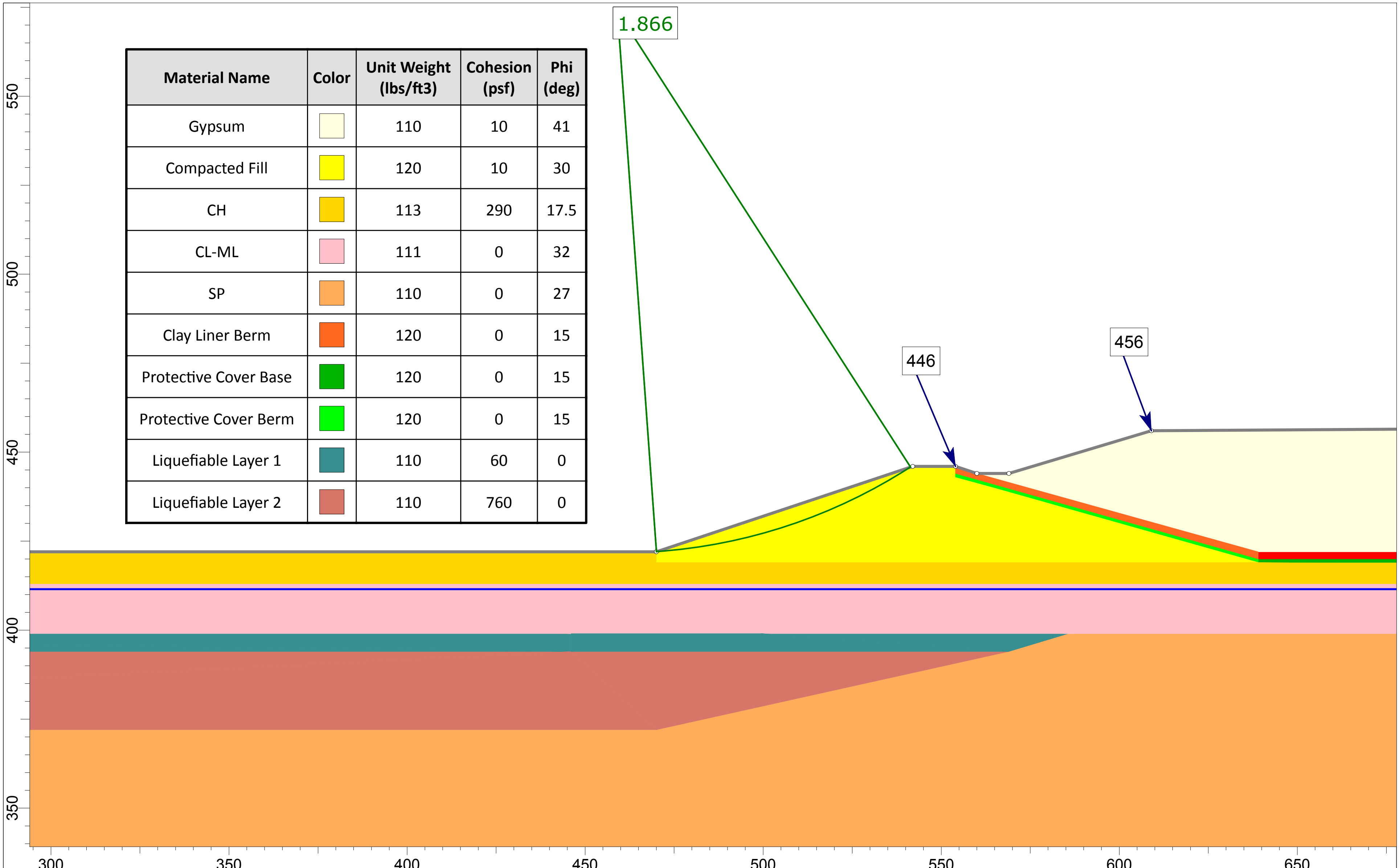
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 10 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 60 | 0 |
| Liquefiable Layer 2 | | 110 | 760 | 0 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, WEST BERM (SECTION A-A)
WITH LIQUEFACTION - CLOSED CELL

REITZ & JENS, INC.

Figure 8-4

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 10 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 |
|---|---|---|---|
| Color | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 |
| Cohesion [psf] | 0 | 60 | 760 |
| Friction Angle [°] | 15 | 0 | 0 |
| Water Surface | None | None | None |
| Ru Value | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 609 | 456 |
| 569 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 413 |
| 0 | 399 |
| 0 | 394 |
| 0 | 372 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 399 |
| 1370 | 413 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 458 |
| 926 | 458 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 413 |
| 1370 | 413 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399 |
| 446.064 | 399 |
| 500 | 399 |
| 585.667 | 399 |
| 1370 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 372 |
| 470 | 372 |
| 569 | 394 |
| 585.667 | 399 |

## Material Boundary

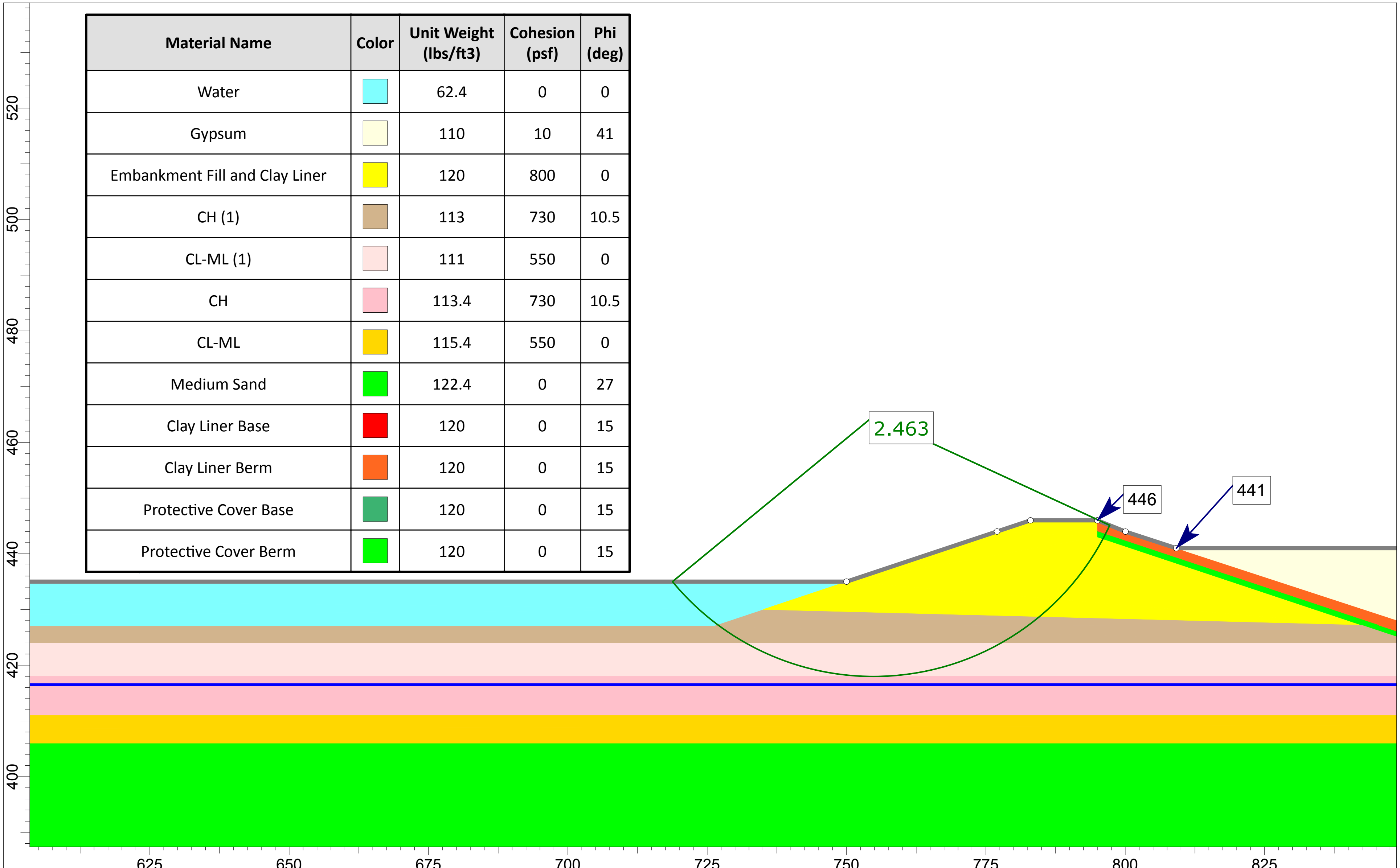
| X | Y |
|---|---|
| 0 | 394 |

| | |
|---|---|
| 446.064 | 394 |

## Material Boundary

| X | Y |
|---|---|
| 446.064 | 394 |
| 569 | 394 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | 0 | 0 |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 800 | 0 |
| CH (1) | | 113 | 730 | 10.5 |
| CL-ML (1) | | 111 | 550 | 0 |
| CH | | 113.4 | 730 | 10.5 |
| CL-ML | | 115.4 | 550 | 0 |
| Medium Sand | | 122.4 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
SHORT-TERM, INITIAL FILLING, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-5

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.03

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113.4 | 115.4 | 122.4 |
| Cohesion [psf] | 0 | 10 | 800 | 730 | 550 | 730 | 550 | 0 |
| Friction Angle [°] | 0 | 41 | 0 | 10.5 | 0 | 10.5 | 0 | 27 |
| Water Surface | None | None | None | None | None | Piezometric Line 2 | Piezometric Line 2 | Piezometric Line 2 |
| Hu Value | | | | | | 1 | 1 | 1 |
| Ru Value | 0 | 0 | 0 | 0 | 0 | | | |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1603.05 | 441 |
| 809.171 | 441 |
| 800.052 | 443.981 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |
| 1603.05 | 327 |
| 1603.05 | 406 |
| 1603.05 | 411 |
| 1603.05 | 418 |
| 1603.05 | 424 |
| 1603.05 | 425 |
| 1603.05 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 809.171 | 441 |
| 852 | 427 |
| 1603.05 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1603.05 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.05 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1603.05 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1603.05 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |

| | |
|---|---|
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

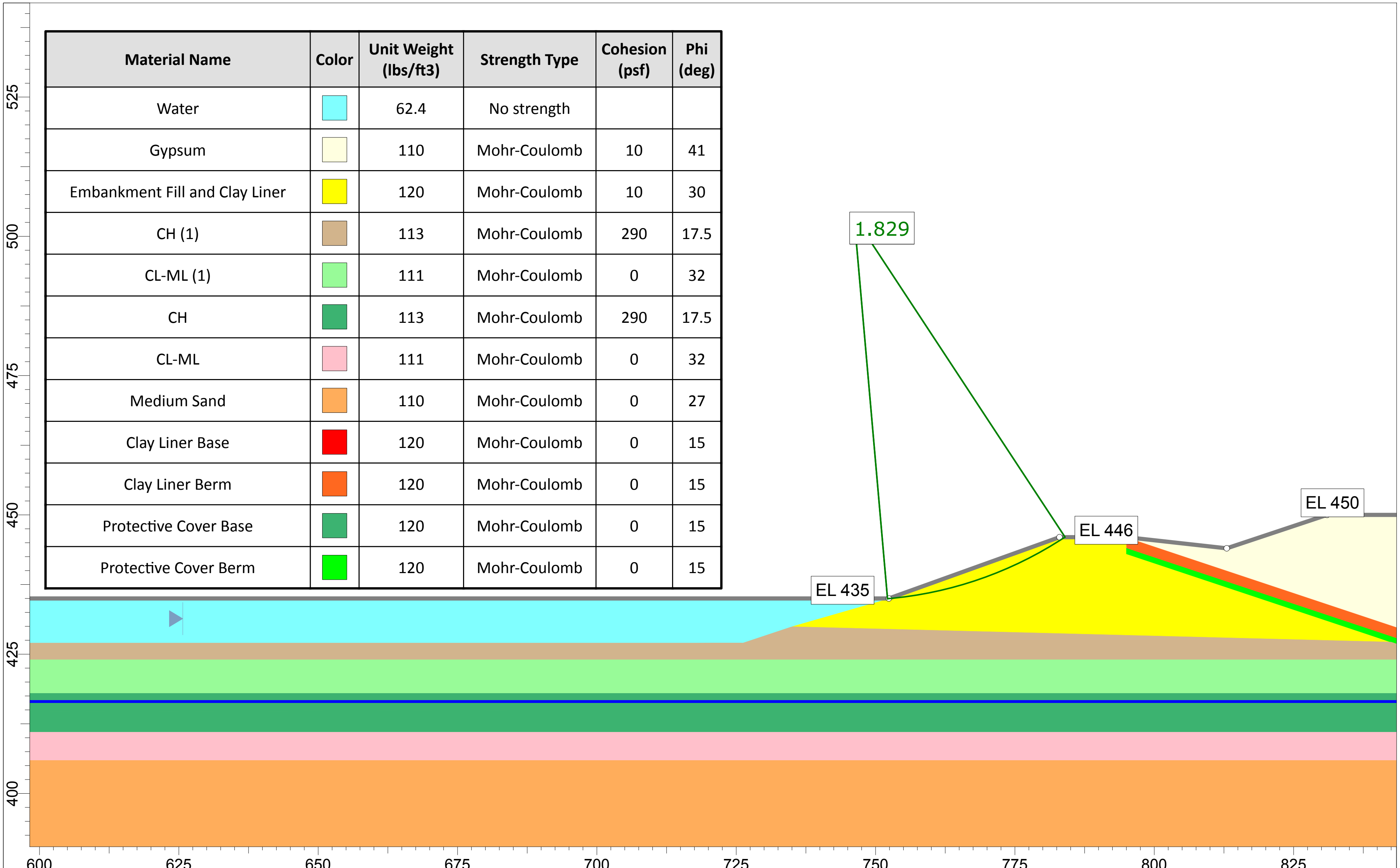
## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1603.05 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|
| Water | | 62.4 | No strength | | |
| Gypsum | | 110 | Mohr-Coulomb | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | Mohr-Coulomb | 10 | 30 |
| CH (1) | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML (1) | | 111 | Mohr-Coulomb | 0 | 32 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| Medium Sand | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |
| Protective Cover Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Protective Cover Berm | | 120 | Mohr-Coulomb | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
LONG-TERM, CLOSED CELL, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-6

# Slide Analysis Information

# Sioux UWL

## Project Summary

| | |
|---|---|
| Slide Modeler Version: | 8.03 |
| Compute Time: | 00h:00m:05.699s |

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |

| | |
|---|---|
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## *Seismic Loading*

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## *Materials*

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113 | 111 | 110 |
| Cohesion [psf] | | 10 | 10 | 290 | 0 | 290 | 0 | 0 |
| Friction Angle [°] | | 41 | 30 | 17.5 | 32 | 17.5 | 32 | 27 |
| Water Surface | None | Piezometric Line 2 | None | None | None | None | None | None |
| Hu Value | | 1 | | | | | | |
| Ru Value | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## *Global Minimums*

### Method: spencer

| FS | 1.955830 |
|---|---|
| Center: | 745.057, 507.303 |
| Radius: | 72.587 |
| Left Slip Surface Endpoint: | 749.570, 434.857 |
| Right Slip Surface Endpoint: | 783.926, 446.000 |
| Left Slope Intercept: | 749.570 435.000 |
| Right Slope Intercept: | 783.926 446.000 |
| Resisting Moment: | 316924 lb-ft |
| Driving Moment: | 162041 lb-ft |
| Resisting Horizontal Force: | 4127.28 lb |
| Driving Horizontal Force: | 2110.24 lb |
| Total Slice Area: | 60.295 ft2 |
| Surface Horizontal Width: | 34.3557 ft |
| Surface Average Height: | 1.75502 ft |

## *Valid/Invalid Surfaces*

### Method: spencer

Number of Valid Surfaces: 60345
Number of Invalid Surfaces: 0

## Slice Data

**Global Minimum Query (spencer) - Safety Factor**: 1.95583

| Slice Number | Width [ft] | Weight [lbs] | Angle of Slice Base [degrees] | Base Material | Base Cohesion [psf] | Base Friction Angle [degrees] | Shear Stress [psf] | Shear Strength [psf] | Base Normal Stress [psf] | Pore Pressure [psf] | Effective Normal Stress [psf] | Base Vertical Stress [psf] | Effective Vertical Stress [psf] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.687114 | 9.46658 | 3.83653 | Embankment Fill and Clay Liner | 10 | 30 | 9.88935 | 19.3419 | 16.1806 | 0 | 16.1806 | 16.8438 | 16.8438 |
| 2 | 0.687114 | 22.3583 | 4.3803 | Embankment Fill and Clay Liner | 10 | 30 | 15.5617 | 30.436 | 35.3961 | 0 | 35.3961 | 36.5881 | 36.5881 |
| 3 | 0.687114 | 36.6328 | 4.92447 | Embankment Fill and Clay Liner | 10 | 30 | 21.8745 | 42.7829 | 56.7816 | 0 | 56.7816 | 58.6664 | 58.6664 |
| 4 | 0.687114 | 50.3649 | 5.46908 | Embankment Fill and Clay Liner | 10 | 30 | 27.8697 | 54.5083 | 77.0905 | 0 | 77.0905 | 79.7589 | 79.7589 |
| 5 | 0.687114 | 63.5532 | 6.01419 | Embankment Fill and Clay Liner | 10 | 30 | 33.5516 | 65.6213 | 96.3388 | 0 | 96.3388 | 99.8736 | 99.8736 |
| 6 | 0.687114 | 76.1963 | 6.55985 | Embankment Fill and Clay Liner | 10 | 30 | 38.9251 | 76.1308 | 114.542 | 0 | 114.542 | 119.018 | 119.018 |
| 7 | 0.687114 | 88.2924 | 7.1061 | Embankment Fill and Clay Liner | 10 | 30 | 43.9944 | 86.0455 | 131.715 | 0 | 131.715 | 137.199 | 137.199 |
| 8 | 0.687114 | 99.8396 | 7.65301 | Embankment Fill and Clay Liner | 10 | 30 | 48.7636 | 95.3734 | 147.87 | 0 | 147.87 | 154.423 | 154.423 |
| 9 | 0.687114 | 110.836 | 8.20061 | Embankment Fill and Clay Liner | 10 | 30 | 53.237 | 104.123 | 163.025 | 0 | 163.025 | 170.697 | 170.697 |
| 10 | 0.687114 | 121.279 | 8.74898 | Embankment Fill and Clay Liner | 10 | 30 | 57.4186 | 112.301 | 177.19 | 0 | 177.19 | 186.026 | 186.026 |
| 11 | 0.687114 | 131.167 | 9.29815 | Embankment Fill and Clay Liner | 10 | 30 | 61.3116 | 119.915 | 190.378 | 0 | 190.378 | 200.416 | 200.416 |
| 12 | 0.687114 | 140.496 | 9.84818 | Embankment Fill and Clay Liner | 10 | 30 | 64.9198 | 126.972 | 202.601 | 0 | 202.601 | 213.871 | 213.871 |
| 13 | 0.687114 | 149.265 | 10.3991 | Embankment Fill and Clay Liner | 10 | 30 | 68.2467 | 133.479 | 213.873 | 0 | 213.873 | 226.397 | 226.397 |
| 14 | 0.687114 | 157.47 | 10.9511 | Embankment Fill and Clay Liner | 10 | 30 | 71.2961 | 139.443 | 224.202 | 0 | 224.202 | 237.998 | 237.998 |
| 15 | 0.687114 | 165.109 | 11.504 | Embankment Fill and Clay Liner | 10 | 30 | 74.0709 | 144.87 | 233.601 | 0 | 233.601 | 248.676 | 248.676 |
| 16 | 0.687114 | 172.177 | 12.0581 | Embankment Fill and Clay Liner | 10 | 30 | 76.5736 | 149.765 | 242.08 | 0 | 242.08 | 258.437 | 258.437 |
| 17 | 0.687114 | 178.672 | 12.6133 | Embankment Fill and Clay Liner | 10 | 30 | 78.808 | 154.135 | 249.65 | 0 | 249.65 | 267.285 | 267.285 |
| 18 | 0.687114 | 184.59 | 13.1697 | Embankment Fill and Clay Liner | 10 | 30 | 80.7764 | 157.985 | 256.318 | 0 | 256.318 | 275.219 | 275.219 |
| 19 | 0.687114 | 189.927 | 13.7273 | Embankment Fill and Clay Liner | 10 | 30 | 82.4821 | 161.321 | 262.096 | 0 | 262.096 | 282.244 | 282.244 |
| 20 | 0.687114 | 194.679 | 14.2863 | Embankment Fill and Clay Liner | 10 | 30 | 83.9275 | 164.148 | 266.992 | 0 | 266.992 | 288.363 | 288.363 |
| 21 | 0.687114 | 198.841 | 14.8467 | Embankment Fill and Clay Liner | 10 | 30 | 85.1148 | 166.47 | 271.015 | 0 | 271.015 | 293.578 | 293.578 |
| 22 | 0.687114 | 202.41 | 15.4086 | Embankment Fill and Clay Liner | 10 | 30 | 86.0474 | 168.294 | 274.173 | 0 | 274.173 | 297.888 | 297.888 |
| 23 | 0.687114 | 205.38 | 15.9719 | Embankment Fill and Clay Liner | 10 | 30 | 86.7264 | 169.622 | 276.474 | 0 | 276.474 | 301.296 | 301.296 |
| 24 | 0.687114 | 207.746 | 16.5369 | Embankment Fill and Clay Liner | 10 | 30 | 87.1548 | 170.46 | 277.925 | 0 | 277.925 | 303.803 | 303.803 |
| 25 | 0.687114 | 209.504 | 17.1035 | Embankment Fill and Clay Liner | 10 | 30 | 87.3348 | 170.812 | 278.535 | 0 | 278.535 | 305.409 | 305.409 |
| 26 | 0.687114 | 210.647 | 17.6719 | Embankment Fill and Clay Liner | 10 | 30 | 87.2683 | 170.682 | 278.309 | 0 | 278.309 | 306.113 | 306.113 |
| 27 | 0.687114 | 211.17 | 18.242 | Embankment Fill and Clay Liner | 10 | 30 | 86.9575 | 170.074 | 277.257 | 0 | 277.257 | 305.918 | 305.918 |
| 28 | 0.687114 | 211.067 | 18.814 | Embankment Fill and Clay Liner | 10 | 30 | 86.4042 | 168.992 | 275.382 | 0 | 275.382 | 304.82 | 304.82 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 0.687114 | 210.332 | 19.388 | Embankment Fill and Clay Liner | 10 | 30 | 85.6102 | 167.439 | 272.693 | 0 | 272.693 | 302.821 | 302.821 |
| 30 | 0.687114 | 208.958 | 19.964 | Embankment Fill and Clay Liner | 10 | 30 | 84.5774 | 165.419 | 269.194 | 0 | 269.194 | 299.918 | 299.918 |
| 31 | 0.687114 | 206.938 | 20.5421 | Embankment Fill and Clay Liner | 10 | 30 | 83.3079 | 162.936 | 264.892 | 0 | 264.892 | 296.109 | 296.109 |
| 32 | 0.687114 | 204.264 | 21.1225 | Embankment Fill and Clay Liner | 10 | 30 | 81.8026 | 159.992 | 259.793 | 0 | 259.793 | 291.395 | 291.395 |
| 33 | 0.687114 | 200.93 | 21.7051 | Embankment Fill and Clay Liner | 10 | 30 | 80.0632 | 156.59 | 253.901 | 0 | 253.901 | 285.77 | 285.77 |
| 34 | 0.687114 | 196.927 | 22.29 | Embankment Fill and Clay Liner | 10 | 30 | 78.0917 | 152.734 | 247.223 | 0 | 247.223 | 279.235 | 279.235 |
| 35 | 0.687114 | 192.247 | 22.8774 | Embankment Fill and Clay Liner | 10 | 30 | 75.8895 | 148.427 | 239.763 | 0 | 239.763 | 271.785 | 271.785 |
| 36 | 0.687114 | 186.881 | 23.4674 | Embankment Fill and Clay Liner | 10 | 30 | 73.4578 | 143.671 | 231.525 | 0 | 231.525 | 263.416 | 263.416 |
| 37 | 0.687114 | 180.82 | 24.06 | Embankment Fill and Clay Liner | 10 | 30 | 70.7981 | 138.469 | 222.514 | 0 | 222.514 | 254.124 | 254.124 |
| 38 | 0.687114 | 174.055 | 24.6554 | Embankment Fill and Clay Liner | 10 | 30 | 67.9113 | 132.823 | 212.736 | 0 | 212.736 | 243.908 | 243.908 |
| 39 | 0.687114 | 166.575 | 25.2536 | Embankment Fill and Clay Liner | 10 | 30 | 64.7991 | 126.736 | 202.192 | 0 | 202.192 | 232.759 | 232.759 |
| 40 | 0.687114 | 158.37 | 25.8548 | Embankment Fill and Clay Liner | 10 | 30 | 61.4624 | 120.21 | 190.89 | 0 | 190.89 | 220.675 | 220.675 |
| 41 | 0.687114 | 149.43 | 26.4591 | Embankment Fill and Clay Liner | 10 | 30 | 57.9028 | 113.248 | 178.831 | 0 | 178.831 | 207.648 | 207.648 |
| 42 | 0.687114 | 139.741 | 27.0665 | Embankment Fill and Clay Liner | 10 | 30 | 54.121 | 105.852 | 166.02 | 0 | 166.02 | 193.675 | 193.675 |
| 43 | 0.687114 | 129.293 | 27.6773 | Embankment Fill and Clay Liner | 10 | 30 | 50.1181 | 98.0225 | 152.459 | 0 | 152.459 | 178.746 | 178.746 |
| 44 | 0.687114 | 118.073 | 28.2915 | Embankment Fill and Clay Liner | 10 | 30 | 45.8952 | 89.7633 | 138.154 | 0 | 138.154 | 162.857 | 162.857 |
| 45 | 0.687114 | 106.067 | 28.9093 | Embankment Fill and Clay Liner | 10 | 30 | 41.4533 | 81.0757 | 123.107 | 0 | 123.107 | 145.999 | 145.999 |
| 46 | 0.687114 | 93.2613 | 29.5307 | Embankment Fill and Clay Liner | 10 | 30 | 36.7934 | 71.9617 | 107.321 | 0 | 107.321 | 128.164 | 128.164 |
| 47 | 0.687114 | 79.6414 | 30.156 | Embankment Fill and Clay Liner | 10 | 30 | 31.9164 | 62.4231 | 90.7995 | 0 | 90.7995 | 109.343 | 109.343 |
| 48 | 0.687114 | 65.1917 | 30.7853 | Embankment Fill and Clay Liner | 10 | 30 | 26.8232 | 52.4616 | 73.5458 | 0 | 73.5458 | 89.5263 | 89.5263 |
| 49 | 0.687114 | 48.7585 | 31.4188 | Embankment Fill and Clay Liner | 10 | 30 | 21.1328 | 41.3321 | 54.2687 | 0 | 54.2687 | 67.1777 | 67.1777 |
| 50 | 0.687114 | 17.7399 | 32.0565 | Embankment Fill and Clay Liner | 10 | 30 | 10.7359 | 20.9976 | 19.0484 | 0 | 19.0484 | 25.7717 | 25.7717 |

## *Interslice Data*

**Global Minimum Query (spencer) - Safety Factor**: 1.95583

| Slice Number | X coordinate [ft] | Y coordinate - Bottom [ft] | Interslice Normal Force [lbs] | Interslice Shear Force [lbs] | Interslice Force Angle [degrees] |
|---|---|---|---|---|---|
| 1 | 749.57 | 434.857 | 0.641241 | 0 | 0 |
| 2 | 750.257 | 434.903 | 6.69018 | 2.11567 | 17.5488 |
| 3 | 750.944 | 434.955 | 15.5189 | 4.90761 | 17.5487 |
| 4 | 751.631 | 435.015 | 27.1863 | 8.59725 | 17.5488 |
| 5 | 752.318 | 435.08 | 41.2626 | 13.0487 | 17.5488 |
| 6 | 753.005 | 435.153 | 57.3403 | 18.133 | 17.5488 |
| 7 | 753.693 | 435.232 | 75.0335 | 23.7282 | 17.5488 |
| 8 | 754.38 | 435.317 | 93.9775 | 29.719 | 17.5488 |
| 9 | 755.067 | 435.41 | 113.828 | 35.9964 | 17.5488 |
| 10 | 755.754 | 435.509 | 134.262 | 42.4583 | 17.5488 |
| 11 | 756.441 | 435.614 | 154.974 | 49.0083 | 17.5488 |
| 12 | 757.128 | 435.727 | 175.682 | 55.5567 | 17.5487 |
| 13 | 757.815 | 435.846 | 196.119 | 62.0196 | 17.5488 |
| 14 | 758.502 | 435.972 | 216.039 | 68.3191 | 17.5488 |

| | | | | | |
|---|---|---|---|---|---|
| 15 | 759.19 | 436.105 | 235.215 | 74.3832 | 17.5488 |
| 16 | 759.877 | 436.245 | 253.437 | 80.1458 | 17.5488 |
| 17 | 760.564 | 436.392 | 270.515 | 85.5465 | 17.5488 |
| 18 | 761.251 | 436.546 | 286.276 | 90.5305 | 17.5488 |
| 19 | 761.938 | 436.706 | 300.564 | 95.0488 | 17.5488 |
| 20 | 762.625 | 436.874 | 313.241 | 99.0578 | 17.5488 |
| 21 | 763.312 | 437.049 | 324.189 | 102.52 | 17.5488 |
| 22 | 763.999 | 437.231 | 333.304 | 105.402 | 17.5487 |
| 23 | 764.686 | 437.421 | 340.502 | 107.679 | 17.5488 |
| 24 | 765.374 | 437.617 | 345.715 | 109.327 | 17.5487 |
| 25 | 766.061 | 437.821 | 348.895 | 110.333 | 17.5488 |
| 26 | 766.748 | 438.033 | 350.008 | 110.685 | 17.5488 |
| 27 | 767.435 | 438.252 | 349.04 | 110.379 | 17.5488 |
| 28 | 768.122 | 438.478 | 345.994 | 109.416 | 17.5489 |
| 29 | 768.809 | 438.712 | 340.892 | 107.802 | 17.5488 |
| 30 | 769.496 | 438.954 | 333.771 | 105.55 | 17.5488 |
| 31 | 770.183 | 439.204 | 324.689 | 102.678 | 17.5488 |
| 32 | 770.87 | 439.461 | 313.722 | 99.21 | 17.5488 |
| 33 | 771.558 | 439.727 | 300.964 | 95.1754 | 17.5488 |
| 34 | 772.245 | 440 | 286.528 | 90.6103 | 17.5488 |
| 35 | 772.932 | 440.282 | 270.547 | 85.5565 | 17.5488 |
| 36 | 773.619 | 440.572 | 253.173 | 80.0622 | 17.5488 |
| 37 | 774.306 | 440.87 | 234.578 | 74.1819 | 17.5488 |
| 38 | 774.993 | 441.177 | 214.956 | 67.9767 | 17.5488 |
| 39 | 775.68 | 441.492 | 194.52 | 61.5141 | 17.5488 |
| 40 | 776.367 | 441.816 | 173.506 | 54.8688 | 17.5488 |
| 41 | 777.054 | 442.149 | 152.173 | 48.1224 | 17.5488 |
| 42 | 777.742 | 442.491 | 130.8 | 41.3637 | 17.5488 |
| 43 | 778.429 | 442.842 | 109.694 | 34.689 | 17.5487 |
| 44 | 779.116 | 443.203 | 89.1816 | 28.2024 | 17.5488 |
| 45 | 779.803 | 443.573 | 69.619 | 22.016 | 17.5488 |
| 46 | 780.49 | 443.952 | 51.3866 | 16.2502 | 17.5487 |
| 47 | 781.177 | 444.341 | 34.8924 | 11.0342 | 17.5488 |
| 48 | 781.864 | 444.741 | 20.5731 | 6.50595 | 17.5488 |
| 49 | 782.551 | 445.15 | 8.89517 | 2.81296 | 17.5488 |
| 50 | 783.238 | 445.57 | 0.63655 | 0.2013 | 17.5488 |
| 51 | 783.926 | 446 | 0 | 0 | 0 |

## *Entity Information*

### Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

### External Boundary

| X | Y |
|---|---|
| 1228 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |

| | |
|---|---|
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |
| 1604.19 | 327 |
| 1604.19 | 406 |
| 1604.19 | 411 |
| 1604.19 | 418 |
| 1604.19 | 424 |
| 1604.19 | 425.211 |
| 1604.19 | 426.211 |
| 1604.19 | 428.211 |
| 1604.19 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1604.19 | 428.211 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1604.19 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1604.19 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1604.19 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1604.19 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

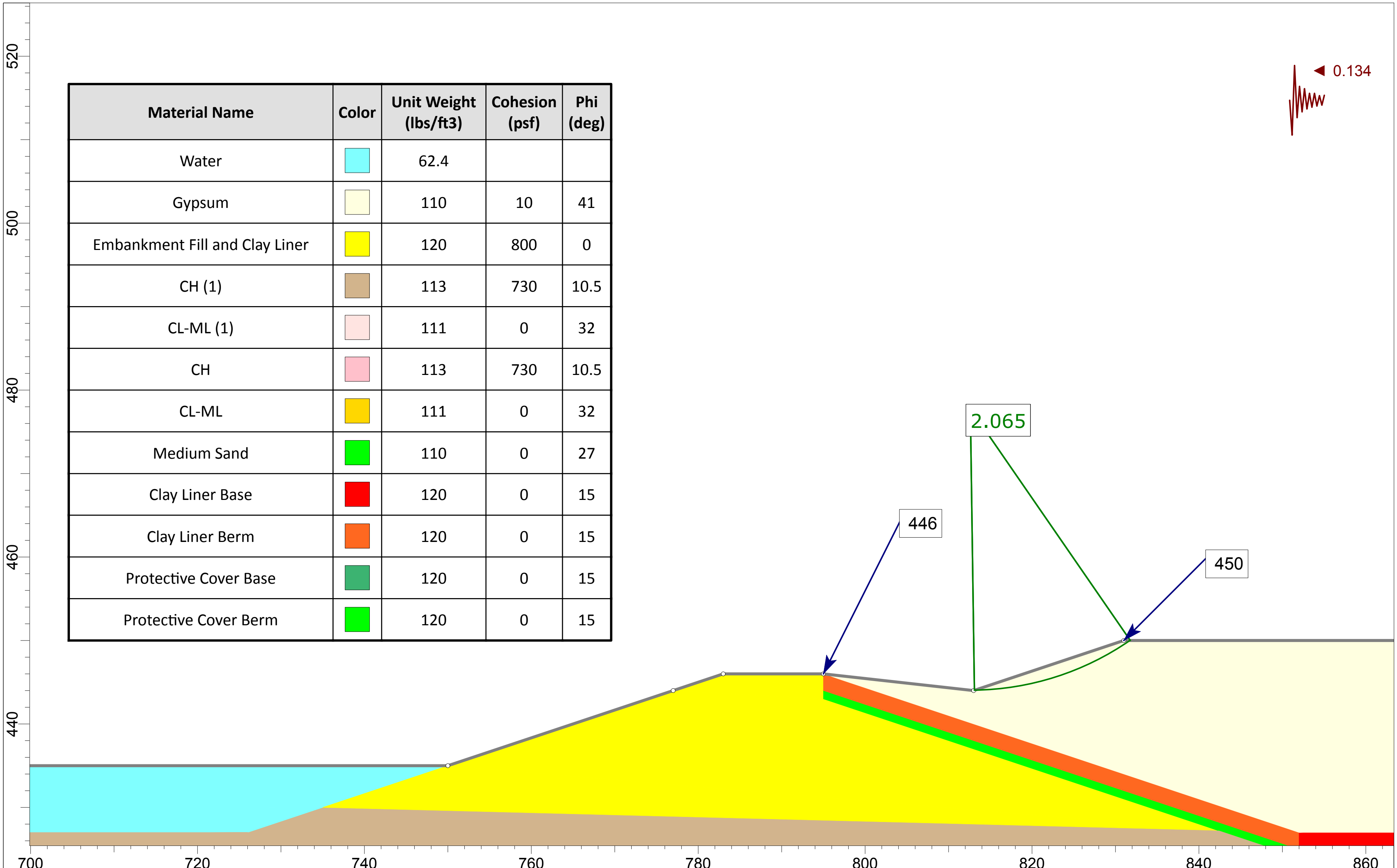
## Material Boundary

| X | Y |
|---|---|
| 852 | 424 |
| 1604.19 | 425.211 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1604.19 | 426.211 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | | |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 800 | 0 |
| CH (1) | | 113 | 730 | 10.5 |
| CL-ML (1) | | 111 | 0 | 32 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 0 | 32 |
| Medium Sand | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
SEISMIC, CLOSED CELL, LOW RECYCLE POND

REITZ & JENS, INC.

Figure 8-7

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.03

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CH (1) | CL-ML (1) | CH | CL-ML | Medium Sand |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 113 | 111 | 113 | 111 | 110 |
| Cohesion [psf] | | 10 | 800 | 730 | 0 | 730 | 0 | 0 |
| Friction Angle [°] | | 41 | 0 | 10.5 | 32 | 10.5 | 32 | 27 |
| Water Surface | None | Piezometric Line 2 | None | None | None | None | None | None |
| Hu Value | | 1 | | | | | | |
| Ru Value | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 15 | 15 | 15 | 15 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1603.97 | 337.937 |
| 1603.97 | 406 |
| 1603.97 | 411 |
| 1603.97 | 418 |
| 1604.05 | 424 |
| 1604.07 | 425 |
| 1604.09 | 427 |
| 1604.01 | 425 |
| 1603.97 | 424 |
| 1603.97 | 425 |
| 1603.97 | 427 |
| 1603.97 | 440 |
| 1208 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 750 | 435 |
| 302 | 435 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 421 |
| -500 | 418 |
| -500 | 411 |
| -500 | 406 |
| -500 | 327 |

## Material Boundary

| X | Y |
|---|---|
| 302 | 435 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 750 | 435 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1603.97 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |
| 852 | 424 |
| 1603.97 | 424 |
| 1604.05 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.97 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 411 |
| 1603.97 | 411 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 406 |
| 1603.97 | 406 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 1603.97 | 418 |

| | |
|---|---|
| 1603.97 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

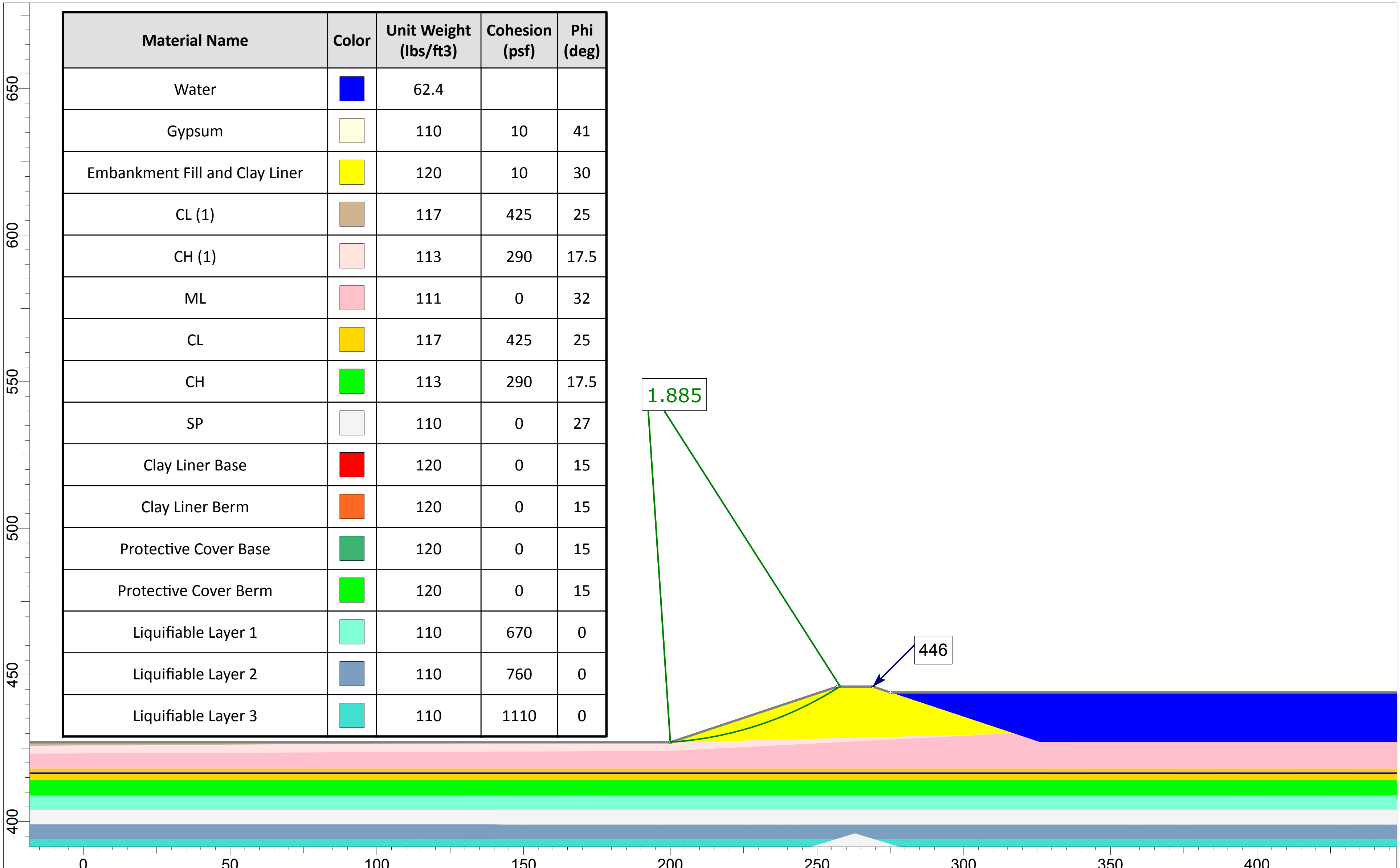
## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |
| 1603.97 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 1604.01 | 425 |
| 1604.07 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Water | | 62.4 | | |
| Gypsum | | 110 | 10 | 41 |
| Embankment Fill and Clay Liner | | 120 | 10 | 30 |
| CL (1) | | 117 | 425 | 25 |
| CH (1) | | 113 | 290 | 17.5 |
| ML | | 111 | 0 | 32 |
| CL | | 117 | 425 | 25 |
| CH | | 113 | 290 | 17.5 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquifiable Layer 1 | | 110 | 670 | 0 |
| Liquifiable Layer 2 | | 110 | 760 | 0 |
| Liquifiable Layer 3 | | 110 | 1110 | 0 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, NORTH BERM AT RECYCLE POND (SECTION B-B)
WITH LIQUEFACTION, NORTH BERM OF RECYCLE POND

REITZ & JENS, INC.

Figure 8-8

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Water | Gypsum | Embankment Fill and Clay Liner | CL (1) | CH (1) | ML | CL | CH |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | No strength | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 62.4 | 110 | 120 | 117 | 113 | 111 | 117 | 113 |
| Cohesion [psf] | | 10 | 10 | 425 | 290 | 0 | 425 | 290 |
| Friction Angle [°] | | 41 | 30 | 25 | 17.5 | 32 | 25 | 17.5 |
| Water Surface | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 | Piezometric Line 1 |
| Hu Value | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base | Protective Cover Berm | Liquifiable Layer 1 | Liquifiable Layer 2 | Liquifiable Layer 3 |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 120 | 120 | 120 | 110 | 110 | 110 |
| Cohesion [psf] | 0 | 0 | 0 | 0 | 0 | 670 | 760 | 1110 |
| Friction Angle [°] | 27 | 15 | 15 | 15 | 15 | 0 | 0 | 0 |
| Water Surface | Piezometric Line 1 | None | None | None | None | Piezometric Line 1 | None | None |
| Hu Value | 1 | | | | | 1 | | |
| Ru Value | | 0 | 0 | 0 | 0 | | 0 | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| -500 | 416.5 |
| 3324 | 416.5 |

## External Boundary

| X | Y |
|---|---|
| 1220 | 440 |
| 902 | 450 |
| 831 | 450 |
| 813 | 444 |
| 795 | 446 |
| 783 | 446 |
| 777 | 444 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| -500 | 427 |
| -500 | 423 |
| -500 | 421 |
| -500 | 418 |
| -500 | 414 |
| -500 | 409 |
| -500 | 404 |
| -500 | 399 |
| -500 | 394 |
| -500 | 389 |
| -500 | 379 |
| -500 | 377 |
| -500 | 327 |
| 1603.92 | 327 |
| 1603.92 | 390 |
| 1603.92 | 394 |
| 1603.92 | 399 |
| 1603.92 | 404 |
| 1603.92 | 409 |
| 1603.92 | 414 |
| 1603.92 | 418 |
| 1603.92 | 424 |
| 1603.92 | 425 |
| 1603.92 | 427 |
| 1603.92 | 440 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 275 | 444 |
| 317 | 430 |
| 326 | 427 |
| 726 | 427 |
| 735 | 430 |
| 777 | 444 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 446 |
| 852 | 427 |
| 1603.92 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 200 | 424 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 423 |
| 200 | 427 |
| 317 | 430 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 421 |
| 200 | 424 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 418 |
| 1603.92 | 418 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 414 |
| 1603.92 | 414 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 409 |
| 1603.92 | 409 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 404 |
| 139.448 | 404 |
| 888 | 404 |
| 1603.92 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 735 | 430 |
| 842.25 | 427.25 |
| 845.5 | 427.167 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 795 | 444 |
| 795 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 443 |
| 842.25 | 427.25 |
| 852 | 424 |
| 852 | 425 |
| 852 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 795 | 444 |
| 845.5 | 427.167 |
| 852 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 424 |
| 1603.92 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 852 | 425 |
| 1603.92 | 425 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 377 |
| 200 | 377 |
| 206.629 | 379 |
| 239.777 | 389 |
| 256.351 | 394 |
| 262.98 | 396 |
| 269.614 | 394 |
| 286.198 | 389 |
| 319.366 | 379 |
| 326 | 377 |
| 726 | 377 |
| 732.348 | 379 |
| 764.091 | 389 |
| 779.962 | 394 |
| 786.31 | 396 |
| 819.827 | 399 |
| 831 | 400 |
| 869.9 | 399 |
| 1064.4 | 394 |
| 1220 | 390 |
| 1603.92 | 390 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 379 |
| 139.448 | 389 |
| 139.448 | 394 |
| 139.448 | 399 |
| 139.448 | 404 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 379 |
| 139.448 | 379 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 379 |
| 206.629 | 379 |
| 319.366 | 379 |
| 732.348 | 379 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| -500 | 399 |
| 139.448 | 399 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 399 |
| 819.827 | 399 |
| 869.9 | 399 |
| 1603.92 | 399 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 394 |
| 139.448 | 394 |

## Material Boundary

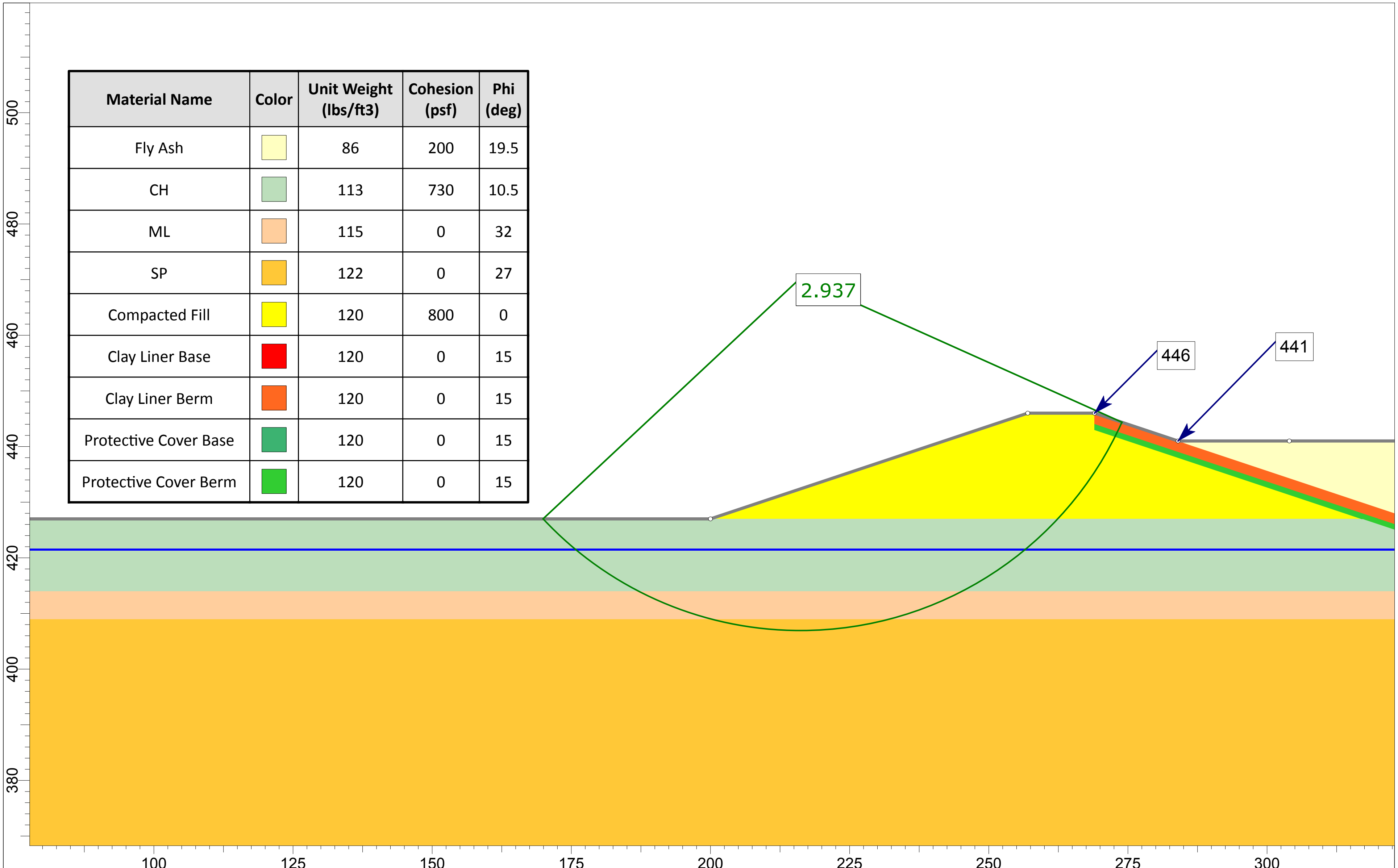
| X | Y |
|---|---|
| 139.448 | 394 |
| 256.351 | 394 |
| 269.614 | 394 |
| 779.962 | 394 |
| 1064.4 | 394 |
| 1603.92 | 394 |

## Material Boundary

| X | Y |
|---|---|
| -500 | 389 |
| 139.448 | 389 |

## Material Boundary

| X | Y |
|---|---|
| 139.448 | 389 |
| 239.777 | 389 |
| 286.198 | 389 |
| 764.091 | 389 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

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STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-9

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth [ft]: | 2 |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 0 | 0 | 800 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 32 | 27 | 0 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.362071 | 421.482 |

| | |
|---|---|
| 920.362 | 421.482 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 441 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

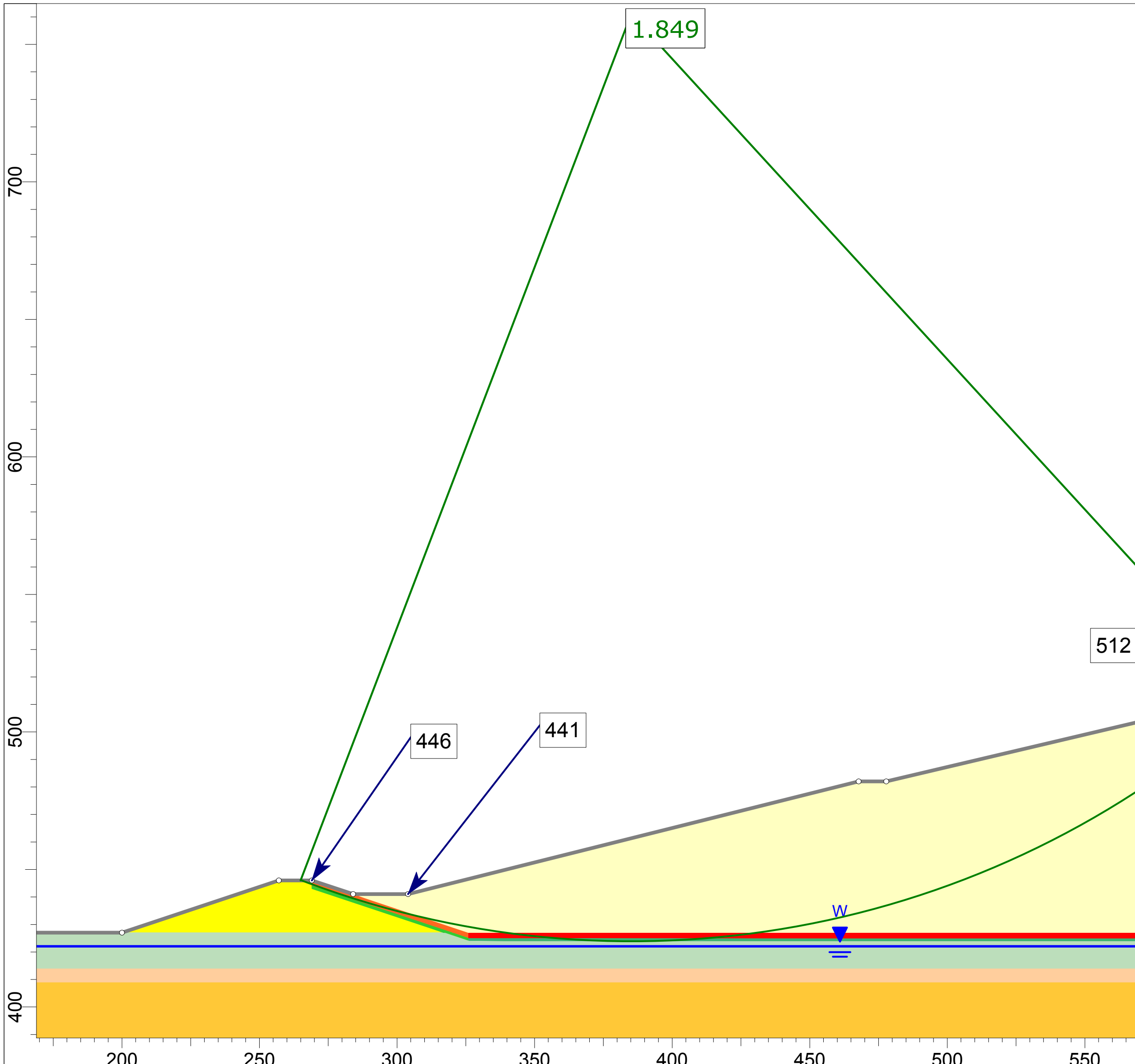
| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

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STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-10

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.983889 | 422.014 |

| | |
|---|---|
| 920.984 | 422.014 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 605 | 512 |
| 920 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

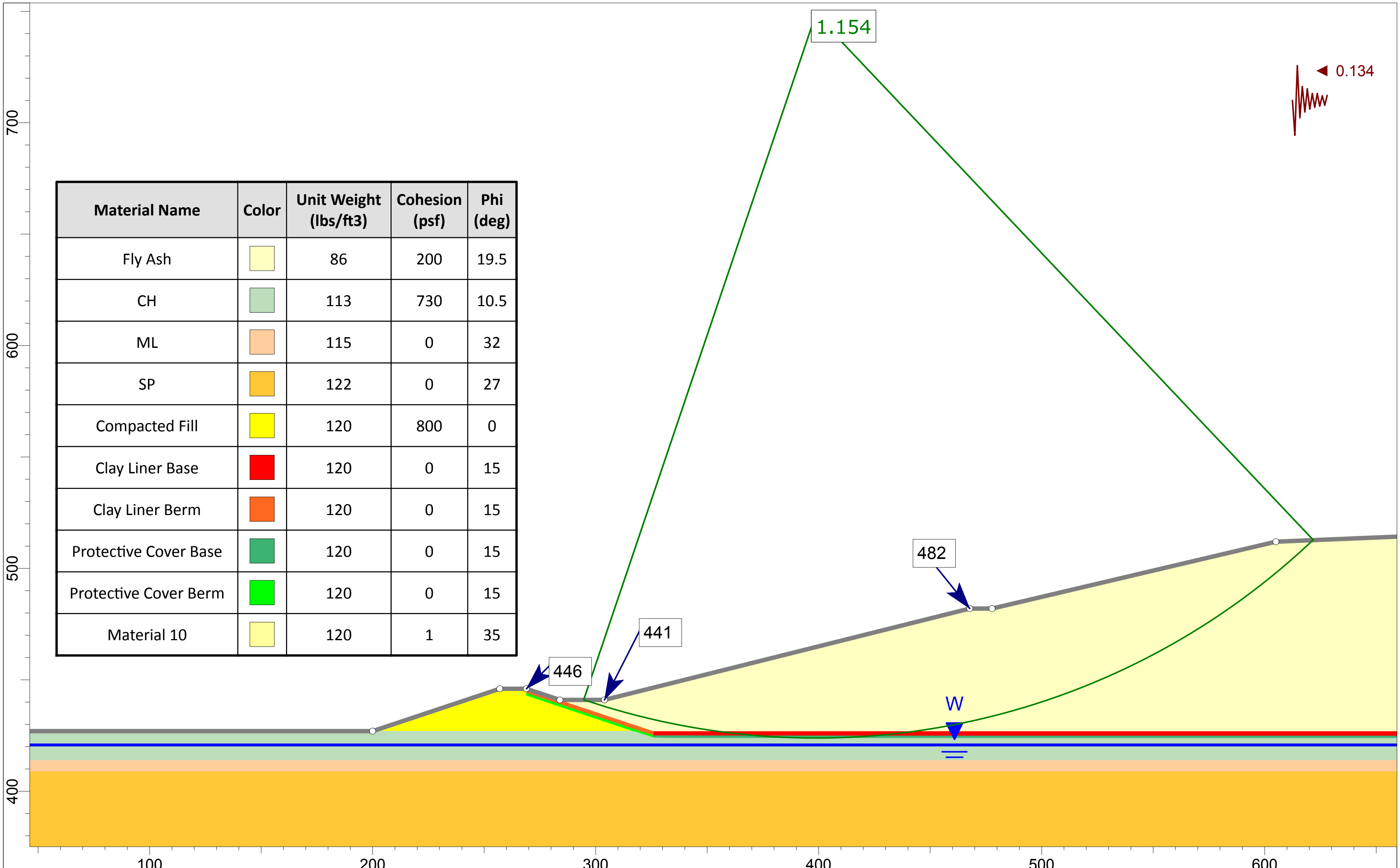
| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Material 10 | | 120 | 1 | 35 |

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STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-11

# Slide Analysis Information
# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 0 | 0 | 800 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 32 | 27 | 0 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.978654 | 420.786 |
| 920.979 | 420.786 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

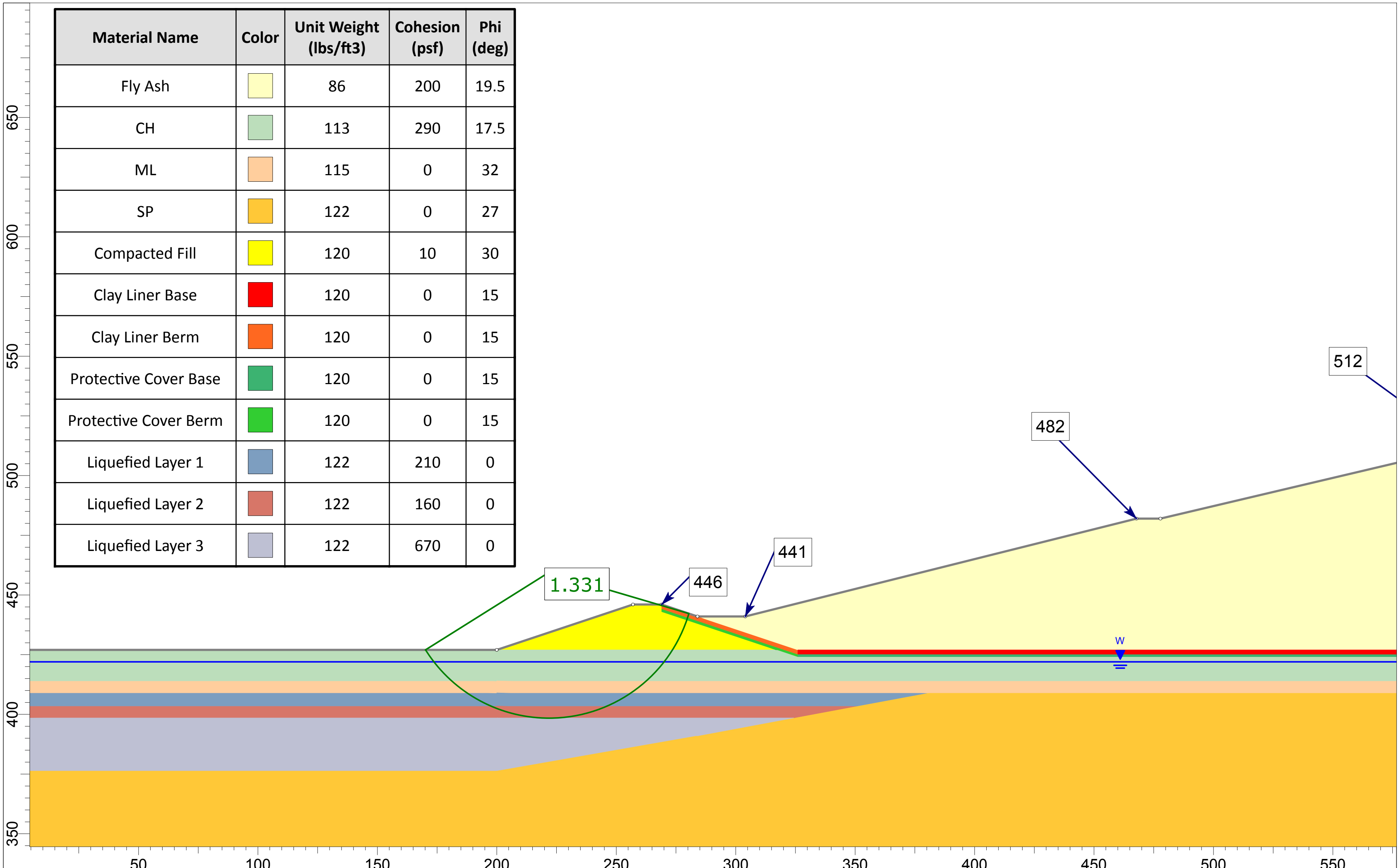
## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| ML | | 115 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefied Layer 1 | | 122 | 210 | 0 |
| Liquefied Layer 2 | | 122 | 160 | 0 |
| Liquefied Layer 3 | | 122 | 670 | 0 |

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STABILITY ANALYSES - CELLS 4 & 5, NORTH BERM (SECTION C-C)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-12

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | ML | SP | Compacted Fill | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 115 | 122 | 120 | 120 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 0 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 15 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Berm | Liquefied Layer 1 | Liquefied Layer 2 | Liquefied Layer 3 |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 122 | 122 | 122 |
| Cohesion [psf] | 0 | 210 | 160 | 670 |
| Friction Angle [°] | 15 | 0 | 0 | 0 |
| Water Surface | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0.983889 | 422.014 |

| | |
|---|---|
| 920.984 | 422.014 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 414 |
| 0 | 409 |
| 0 | 403.5 |
| 0 | 398.5 |
| 0 | 376.244 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 200 | 414 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 200 | 409 |
| 380.664 | 409 |
| 920 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 605 | 512 |
| 920 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 403.5 |
| 200 | 403.5 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 376.244 |
| 200 | 376.244 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 376.244 |
| 284 | 391 |
| 324.277 | 398.5 |
| 351.128 | 403.5 |
| 380.664 | 409 |
| 381.182 | 409.096 |

## Material Boundary

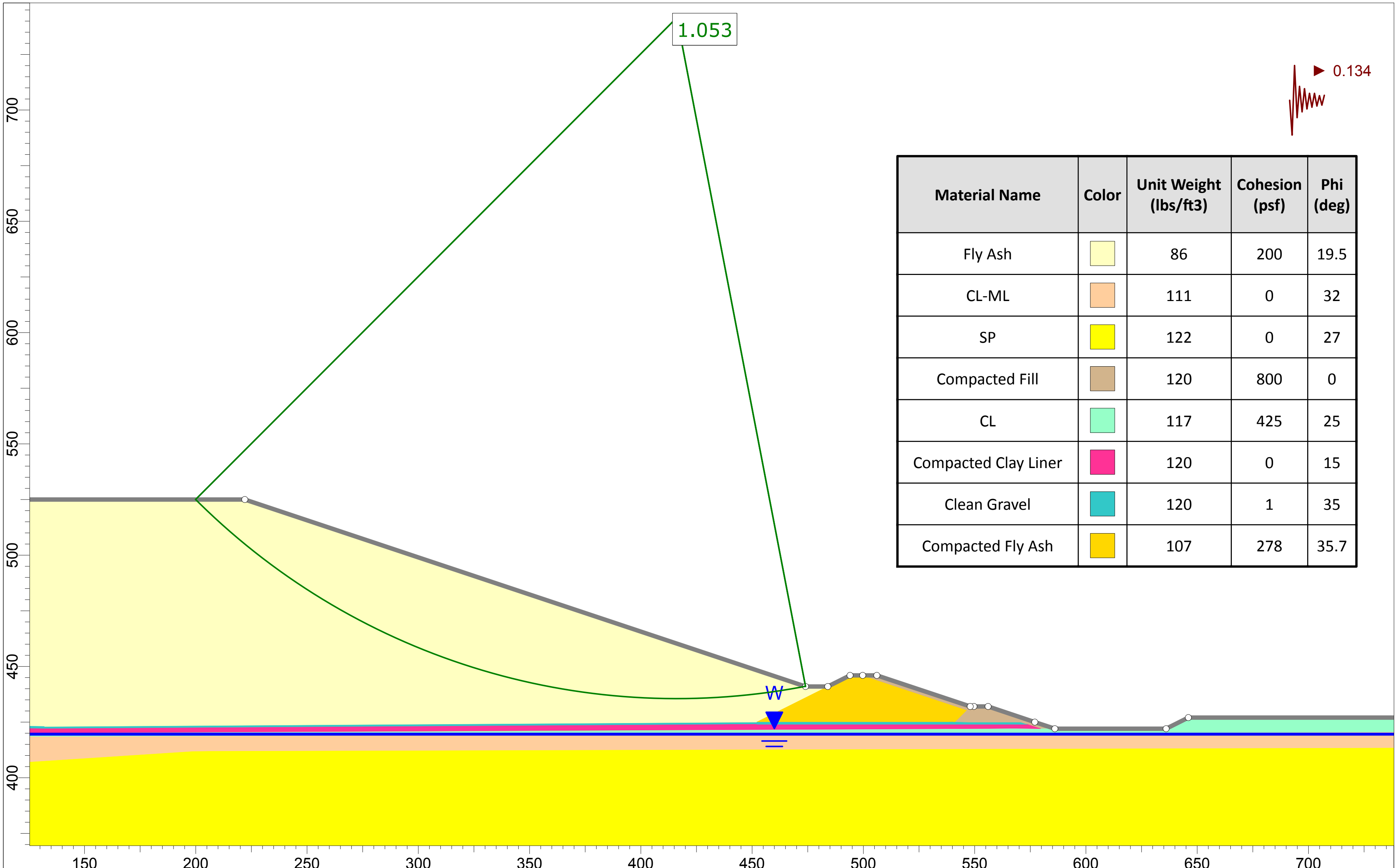
| X | Y |
|---|---|
| 200 | 403.5 |
| 351.128 | 403.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 398.5 |
| 200 | 398.5 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 398.5 |
| 324.277 | 398.5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner | | 120 | 0 | 15 |
| Clean Gravel | | 120 | 1 | 35 |
| Compacted Fly Ash | | 107 | 278 | 35.7 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 4A, EAST TEMPORARY CCR BERM
SEISMIC, FULL CELL 4A

REITZ & JENS, INC.

Figure 8-13

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Left to Right |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

# Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

# Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.131

# Materials

| Property | Fly Ash | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner | Clean Gravel | Compacted Fly Ash |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unsaturated Unit Weight [lbs/ft3] | | | | | | | | 107 |
| Saturated Unit Weight [lbs/ft3] | | | | | | | | 107 |
| Cohesion [psf] | 200 | 0 | 0 | 800 | 425 | 0 | 1 | 278 |
| Friction Angle [°] | 19.5 | 32 | 27 | 0 | 25 | 15 | 35 | 35.7 |
| Water Surface | None | Water Table | Water Table | Water Table | Water Table | Water Table | None | None |
| Hu Value | | 1 | 1 | 1 | 1 | 1 | | |
| Ru Value | 0 | | | | | | 0 | 0 |

# Entity Information

## Water Table

| X | Y |
|---|---|
| -0.0025923 | 419.574 |
| 919.997 | 419.574 |

## Block Search Polyline

| X | Y |
|---|---|
| 132 | 422 |
| 449.766 | 423.986 |

## External Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 0 | 424 |
| 0 | 422 |
| 2.13163e-14 | 418 |
| 7.10543e-15 | 399 |
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 414 |
| 920 | 421 |
| 920 | 423 |
| 920 | 427 |
| 646 | 427 |
| 636 | 422 |
| 586 | 422 |
| 577 | 425 |
| 556 | 432 |
| 549.675 | 432 |
| 548 | 432 |
| 506 | 446 |
| 499.675 | 446 |
| 494 | 446 |
| 484 | 441 |
| 474 | 441 |
| 222 | 525 |
| 0 | 525 |

## Material Boundary

| X | Y |
|---|---|
| 7.10543e-15 | 399 |
| 200 | 412 |
| 920 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 422 |
| 132 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 420 |

| | |
|---|---|
| 132 | 422 |
| 132 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 424 |
| 132 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 422 |
| 452 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 452 | 425 |
| 541 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 570.675 | 425 |
| 577 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 423 |
| 452 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 132 | 420 |
| 579.675 | 422 |
| 586 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 132 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 2.13163e-14 | 418 |
| 920 | 421 |

### Material Boundary

| X | Y |
|---|---|
| 452 | 425 |
| 484 | 441 |

### Material Boundary

| X | Y |
|---|---|
| 541 | 425 |
| 546.419 | 430.419 |
| 548 | 432 |

### Material Boundary

| X | Y |
|---|---|
| 499.675 | 446 |
| 546.419 | 430.419 |

### Material Boundary

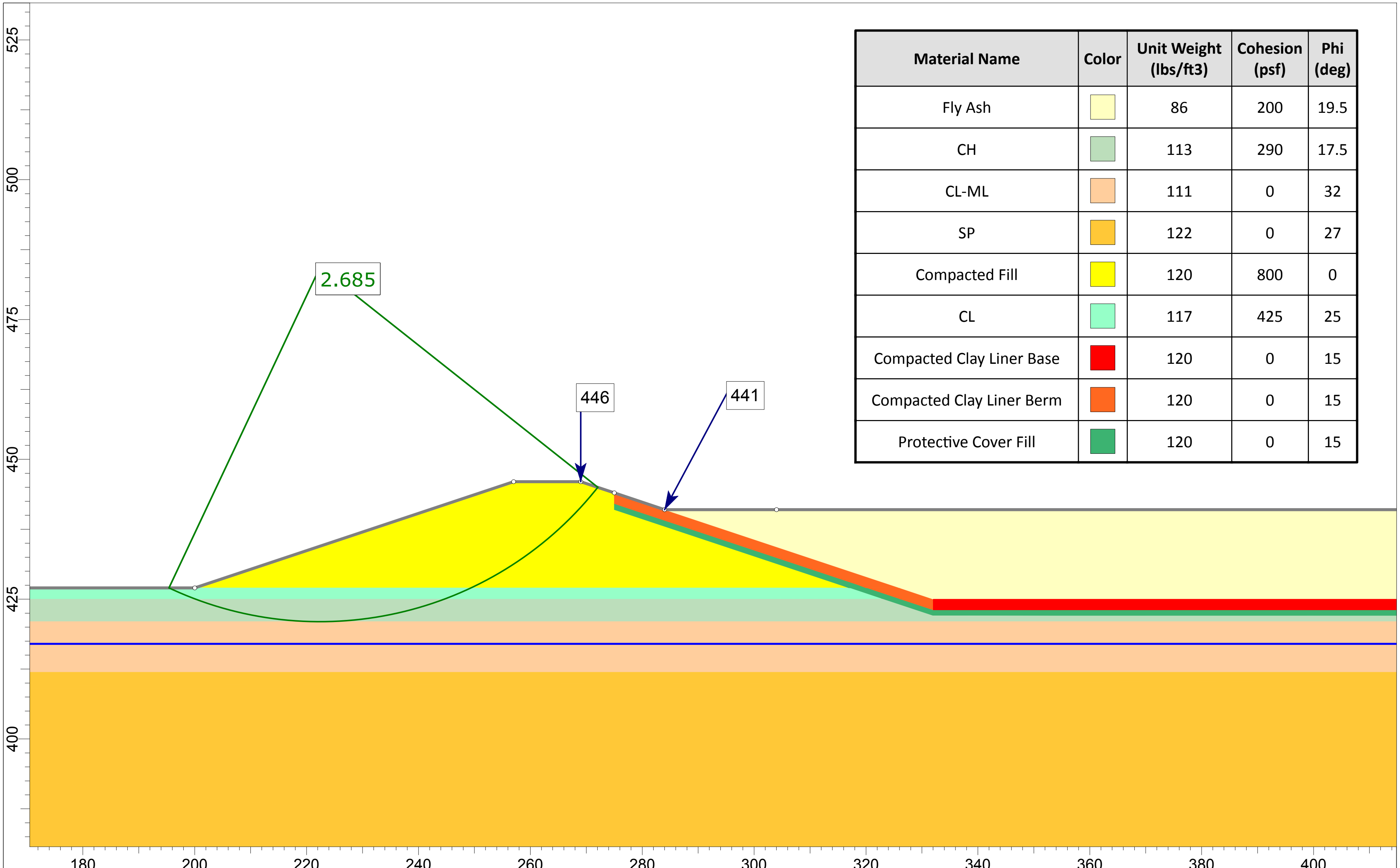
| X | Y |
|---|---|
| 570.675 | 425 |
| 573.675 | 424 |
| 579.675 | 422 |

### Material Boundary

| X | Y |
|---|---|
| 541 | 425 |
| 570.675 | 425 |

### Material Boundary

| X | Y |
|---|---|
| 452 | 424 |
| 573.675 | 424 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Fill | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-14

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner Base | Compacted Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 800 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 0 | 25 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Fill |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 417 |
| 920 | 417 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 422 |
| 920 | 423 |
| 920 | 425 |
| 920 | 427 |
| 920 | 441 |
| 304 | 441 |
| 284 | 441 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320.006 | 427 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
| --- | --- |
| 275 | 444 |
| 275 | 442 |
| 320.006 | 427 |
| 326.003 | 425 |
| 332 | 423 |
| 920 | 423 |

## Material Boundary

| X | Y |
| --- | --- |
| 284 | 441 |
| 326 | 427 |
| 332 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
| --- | --- |
| 0 | 425 |
| 323 | 425 |
| 326.003 | 425 |

## Material Boundary

| X | Y |
| --- | --- |
| 275 | 441 |
| 275 | 442 |

## Material Boundary

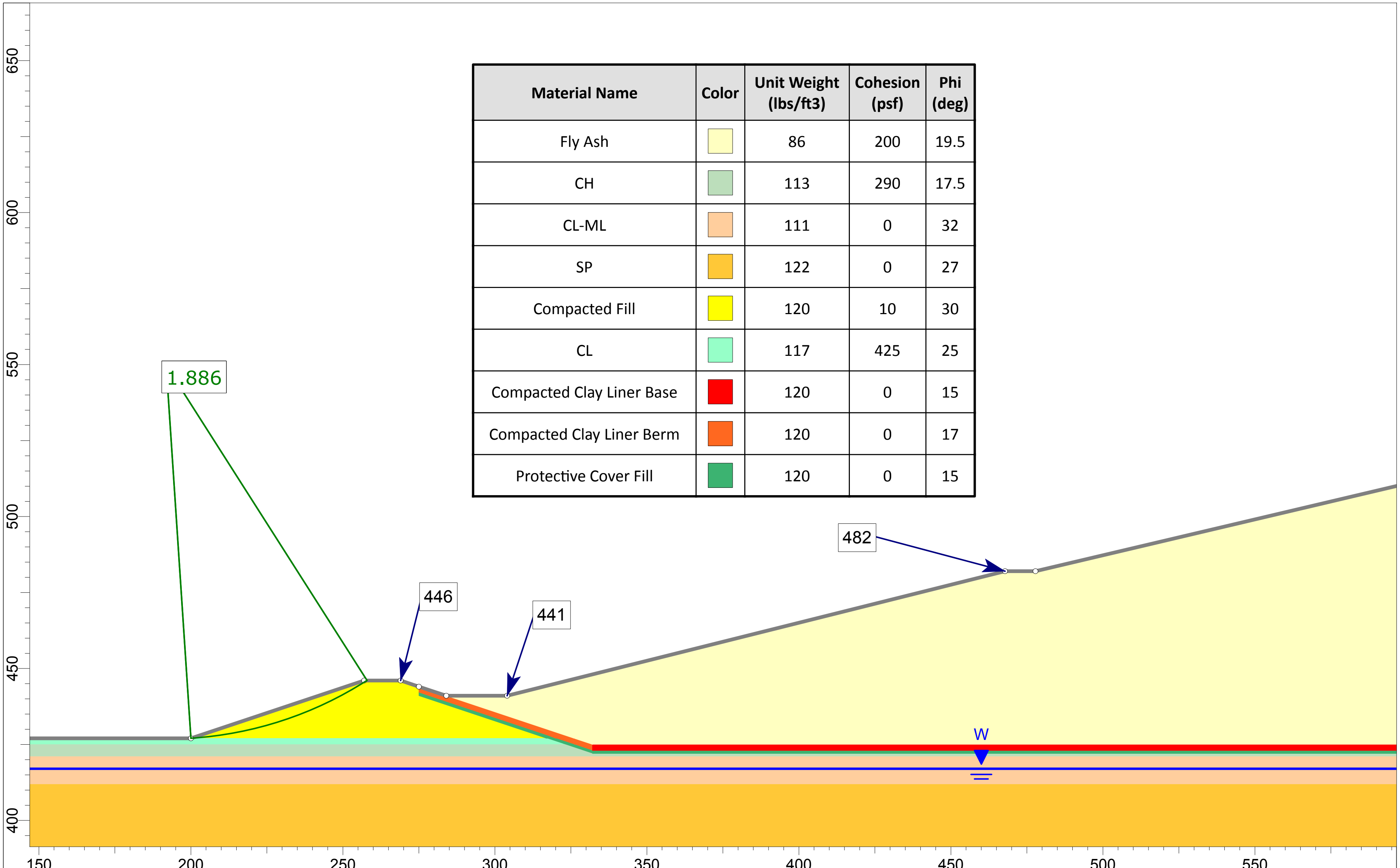
| X | Y |
| --- | --- |
| 275 | 441 |
| 317 | 427 |
| 323 | 425 |
| 332 | 422 |
| 332 | 423 |

## Material Boundary

| X | Y |
| --- | --- |
| 332 | 422 |
| 920 | 422 |

## Material Boundary

| X | Y |
| --- | --- |
| 332 | 423 |
| 332 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 17 |
| Protective Cover Fill | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-15

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Compacted Clay Liner Base | Compacted Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 25 | 15 | 17 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Cover Fill |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | Water Table |
| Hu Value | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 417 |
| 920 | 417 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 422 |
| 920 | 423 |
| 920 | 425 |
| 920 | 427 |
| 920 | 428 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 275 | 444 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320.006 | 427 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 444 |
| 275 | 442 |
| 320.006 | 427 |
| 326.003 | 425 |
| 332 | 423 |
| 920 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |
| 332 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326.003 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 275 | 441 |
| 275 | 442 |

## Material Boundary

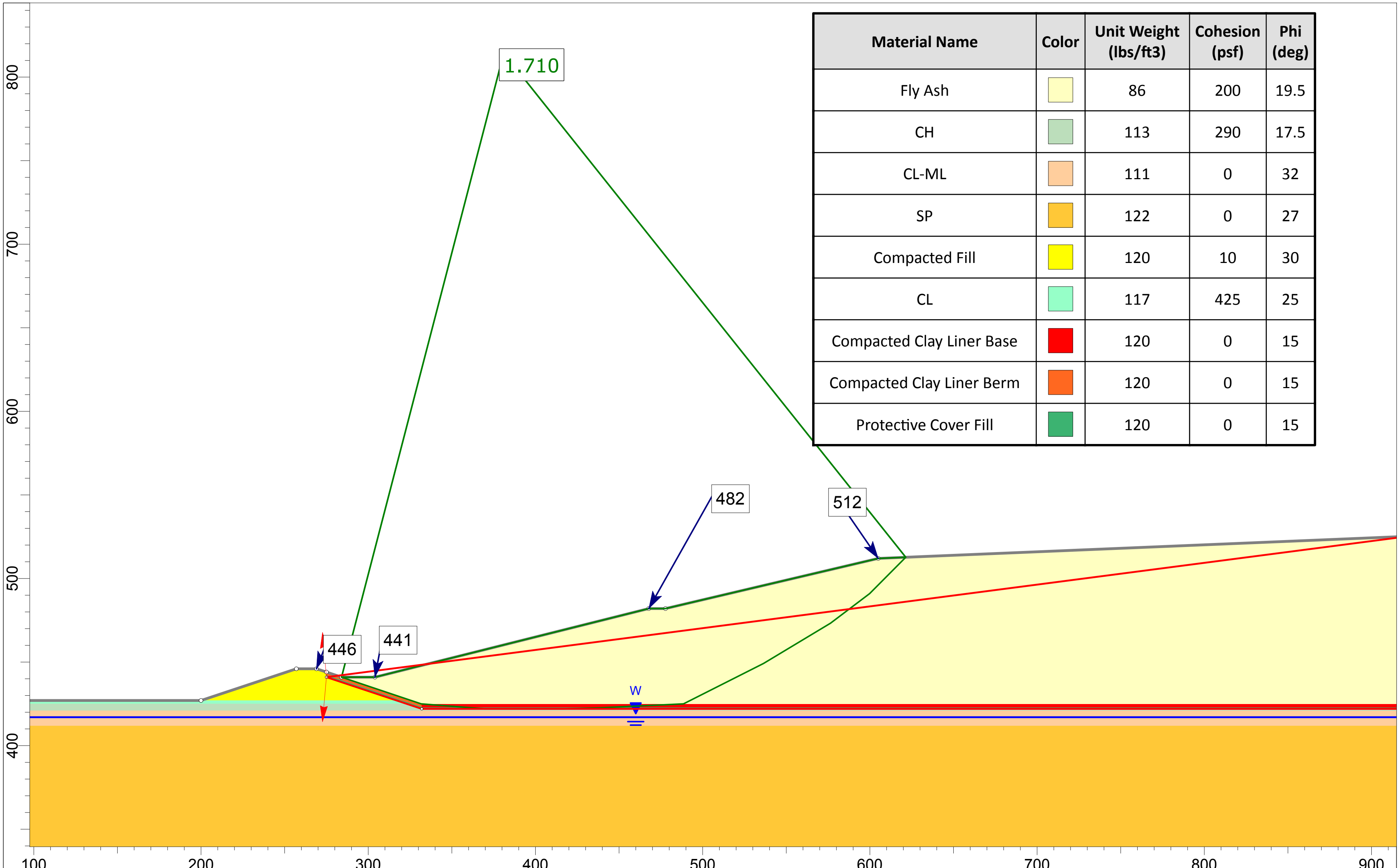
| X | Y |
|---|---|
| 275 | 441 |
| 317 | 427 |
| 323 | 425 |
| 332 | 422 |
| 332 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 332 | 422 |
| 920 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 332 | 423 |
| 332 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Compacted Clay Liner Base | | 120 | 0 | 15 |
| Compacted Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Fill | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
LONG-TERM, CLOSED CELL, SLIDING ALONG AQUICLUDE

REITZ & JENS, INC.

Figure 8-16

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Non-Circular Block Search |
| Number of Surfaces: | 100000 |
| Multiple Groups: | Disabled |
| Pseudo-Random Surfaces: | Enabled |
| Convex Surfaces Only: | Disabled |
| Left Projection Angle (Start Angle) [°]: | 95 |
| Left Projection Angle (End Angle) [°]: | 265 |
| Right Projection Angle (Start Angle) [°]: | -85 |
| Right Projection Angle (End Angle) [°]: | 85 |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.131

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

## Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## Block Search Window

| X | Y |
|---|---|
| 269 | 443 |
| 326 | 424 |
| 920 | 424 |
| 920 | 525 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

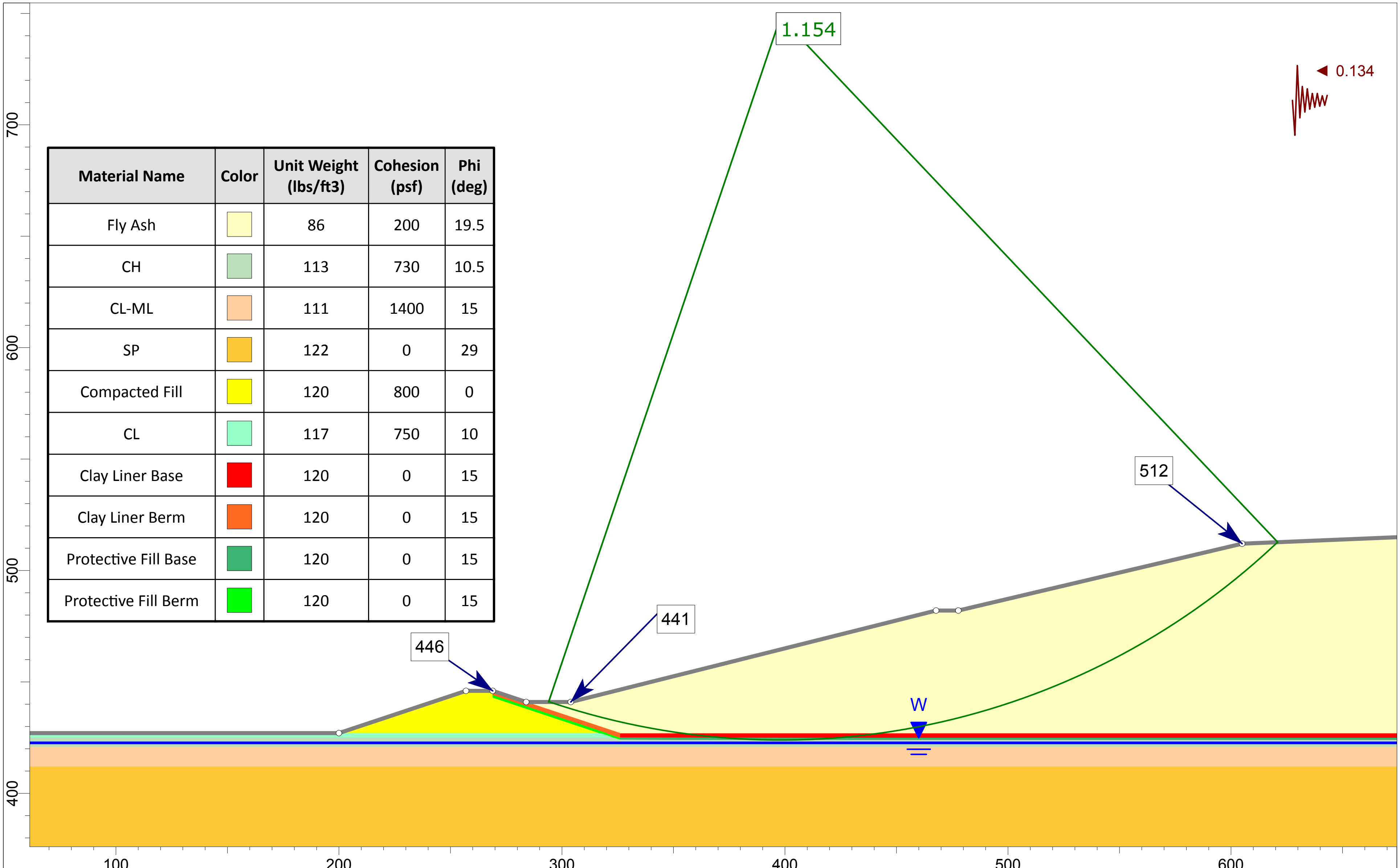
## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 1400 | 15 |
| SP | | 122 | 0 | 29 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 750 | 10 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-17

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 10 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |

| | |
|---|---|
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

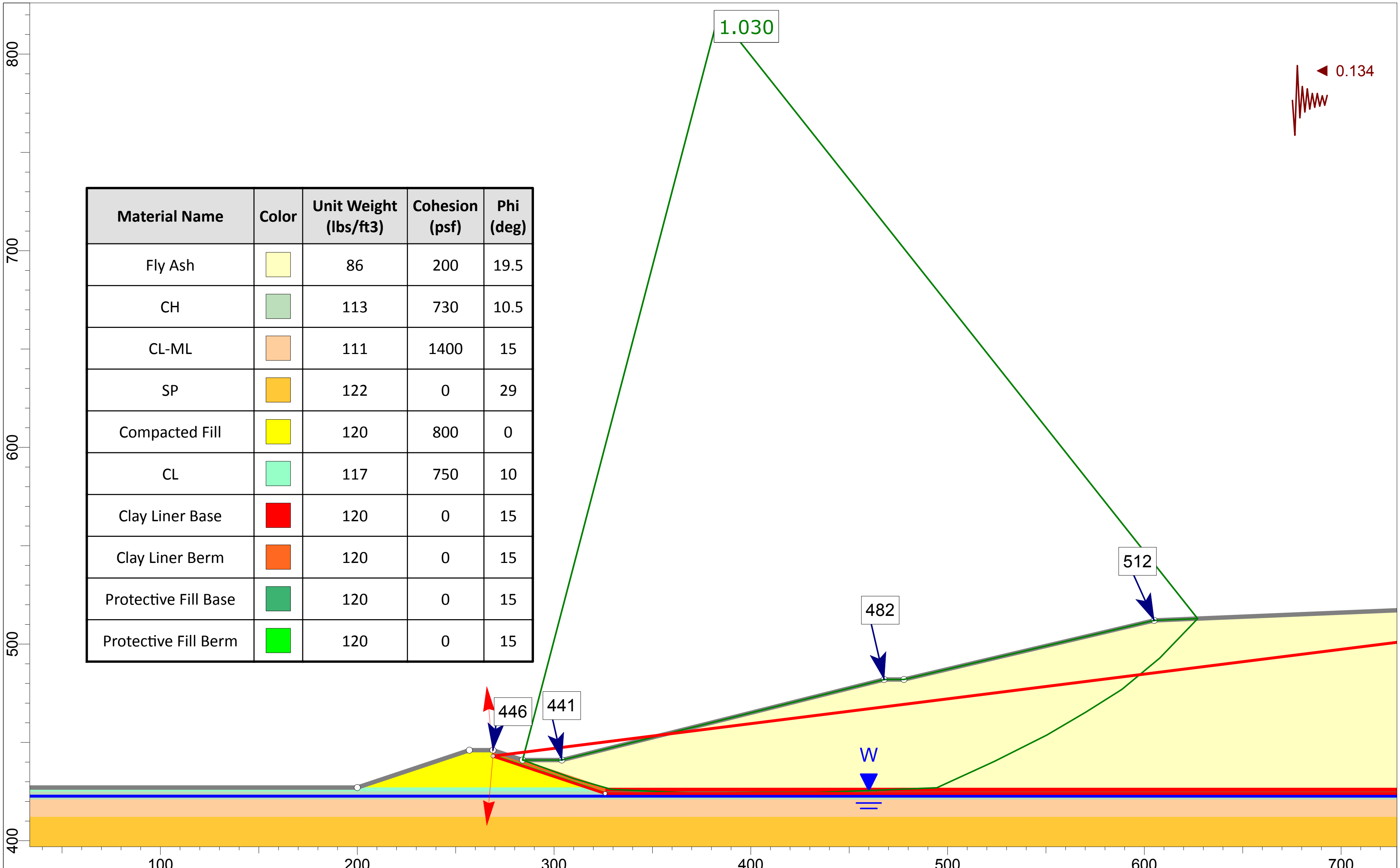
| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 730 | 10.5 |
| CL-ML | | 111 | 1400 | 15 |
| SP | | 122 | 0 | 29 |
| Compacted Fill | | 120 | 800 | 0 |
| CL | | 117 | 750 | 10 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |

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STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
SEISMIC, CLOSED CELL, SLIDING ALONG AQUICLUDE

REITZ & JENS, INC.

Figure 8-18

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Non-Circular Block Search |
| Number of Surfaces: | 100000 |
| Multiple Groups: | Disabled |
| Pseudo-Random Surfaces: | Enabled |
| Convex Surfaces Only: | Disabled |
| Left Projection Angle (Start Angle) [°]: | 95 |
| Left Projection Angle (End Angle) [°]: | 265 |
| Right Projection Angle (Start Angle) [°]: | -85 |
| Right Projection Angle (End Angle) [°]: | 85 |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 730 | 1400 | 0 | 800 | 750 | 0 | 0 |
| Friction Angle [°] | 19.5 | 10.5 | 15 | 29 | 0 | 10 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm |
|---|---|---|
| Color | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 |
| Cohesion [psf] | 0 | 0 |
| Friction Angle [°] | 15 | 15 |
| Water Surface | Water Table | Water Table |
| Hu Value | 1 | 1 |

## Entity Information

## Water Table

| X | Y |
|---|---|
| 0 | 422.655 |
| 920 | 422.655 |

## Block Search Window

| X | Y |
|---|---|
| 269 | 443 |
| 326 | 424 |
| 920 | 424 |
| 920 | 525 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

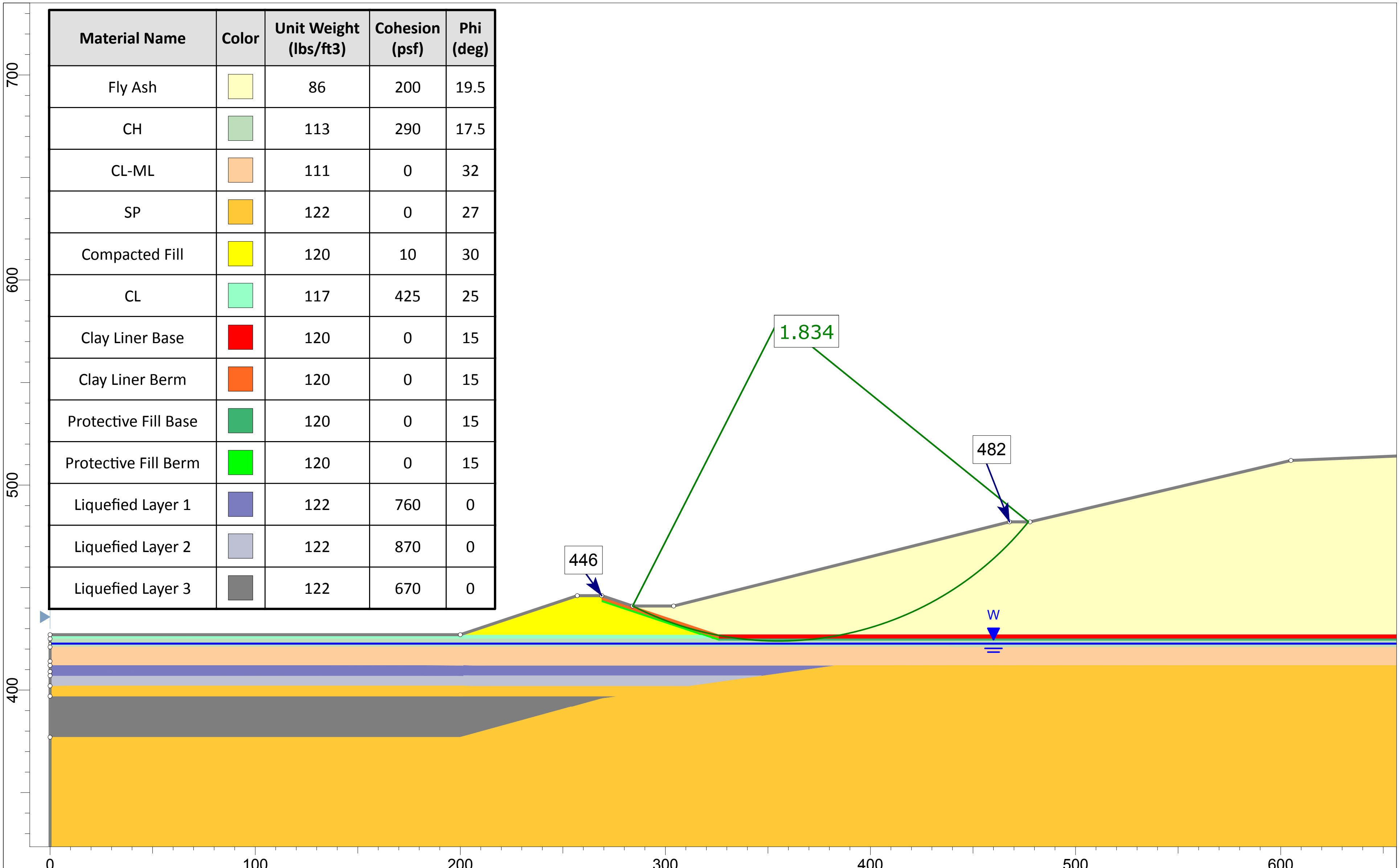
## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Fly Ash | | 86 | 200 | 19.5 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 122 | 0 | 27 |
| Compacted Fill | | 120 | 10 | 30 |
| CL | | 117 | 425 | 25 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Fill Base | | 120 | 0 | 15 |
| Protective Fill Berm | | 120 | 0 | 15 |
| Liquefied Layer 1 | | 122 | 760 | 0 |
| Liquefied Layer 2 | | 122 | 870 | 0 |
| Liquefied Layer 3 | | 122 | 670 | 0 |

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STABILITY ANALYSES - CELLS 6 & 7, SOUTH BERM (SECTION D-D)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-19

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 25 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 1 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | Park and Miller v.3 |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 50 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Fly Ash | CH | CL-ML | SP | Compacted Fill | CL | Clay Liner Base | Clay Liner Berm |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 86 | 113 | 111 | 122 | 120 | 117 | 120 | 120 |
| Cohesion [psf] | 200 | 290 | 0 | 0 | 10 | 425 | 0 | 0 |
| Friction Angle [°] | 19.5 | 17.5 | 32 | 27 | 30 | 25 | 15 | 15 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| Property | Protective Fill Base | Protective Fill Berm | Liquefied Layer 1 | Liquefied Layer 2 | Liquefied Layer 3 |
|---|---|---|---|---|---|
| Color | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 120 | 122 | 122 | 122 |
| Cohesion [psf] | 0 | 0 | 760 | 870 | 670 |
| Friction Angle [°] | 15 | 15 | 0 | 0 | 0 |
| Water Surface | Water Table | Water Table | Water Table | Water Table | Water Table |
| Hu Value | 1 | 1 | 1 | 1 | 1 |

## Entity Information

### Water Table

| X | Y |
|---|---|
| 0 | 422.655 |

| | |
|---|---|
| 920 | 422.655 |

## External Boundary

| X | Y |
|---|---|
| 0 | 320 |
| 920 | 320 |
| 920 | 409 |
| 920 | 412 |
| 920 | 414 |
| 920 | 421 |
| 920 | 424 |
| 920 | 425 |
| 920 | 427 |
| 920 | 525 |
| 916 | 525 |
| 605 | 512 |
| 477.785 | 482 |
| 467.785 | 482 |
| 304 | 441 |
| 284 | 441 |
| 269 | 446 |
| 257 | 446 |
| 200 | 427 |
| 0 | 427 |
| 0 | 425 |
| 0 | 421 |
| 0 | 414 |
| 0 | 412 |
| 0 | 409 |
| 0 | 407 |
| 0 | 402 |
| 0 | 397 |
| 0 | 377 |

## Material Boundary

| X | Y |
|---|---|
| 200 | 427 |
| 317 | 427 |
| 320 | 427 |
| 326 | 427 |
| 920 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 284 | 441 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 425 |
| 323 | 425 |
| 326 | 425 |
| 920 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 445.811 | 421 |
| 920 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 412 |
| 201.595 | 412 |
| 382.159 | 412 |
| 920 | 412 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 269 | 444 |
| 269 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 326 | 424 |
| 326 | 425 |
| 326 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 443 |
| 317 | 427 |
| 323 | 425 |
| 326 | 424 |
| 920 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 269 | 444 |
| 320 | 427 |
| 326 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 377 |
| 200 | 377 |
| 254.474 | 392 |
| 269 | 396 |
| 276.072 | 397 |
| 311.435 | 402 |
| 346.797 | 407 |
| 382.159 | 412 |
| 445.811 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 407 |
| 201.595 | 407 |

## Material Boundary

| X | Y |
|---|---|
| 201.595 | 407 |
| 346.797 | 407 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 402 |
| 201.595 | 402 |

## Material Boundary

| X | Y |
|---|---|
| 201.595 | 402 |
| 311.435 | 402 |

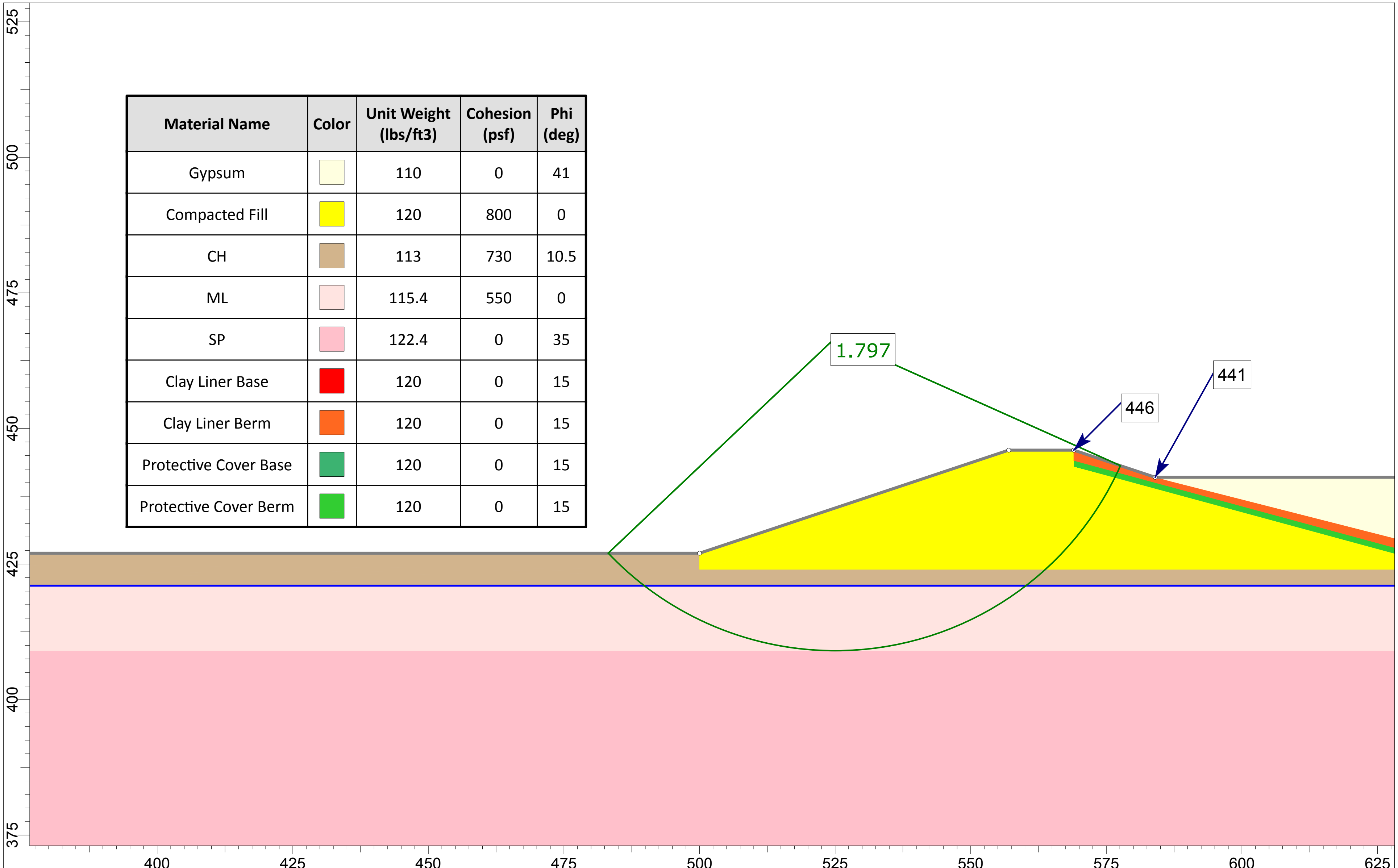
## Material Boundary

| X | Y |
|---|---|
| 0 | 397 |
| 201.595 | 397 |

## Material Boundary

| X | Y |
|---|---|
| 201.595 | 397 |
| 276.072 | 397 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115.4 | 550 | 0 |
| SP | | 122.4 | 0 | 35 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-20

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115.4 | 122.4 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 35 | 15 | 15 | 15 |
| Water Surface | None | None | Piezometric Line 2 | Piezometric Line 2 | Piezometric Line 2 | None | None | None |
| Hu Value | | | 1 | 1 | 1 | | | |
| Ru Value | 0 | 0 | | | | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 421 |
| 1370 | 421 |

## External Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 421 |
| 0 | 409 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 409 |
| 1370 | 421 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 421 |
| 1370 | 421 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

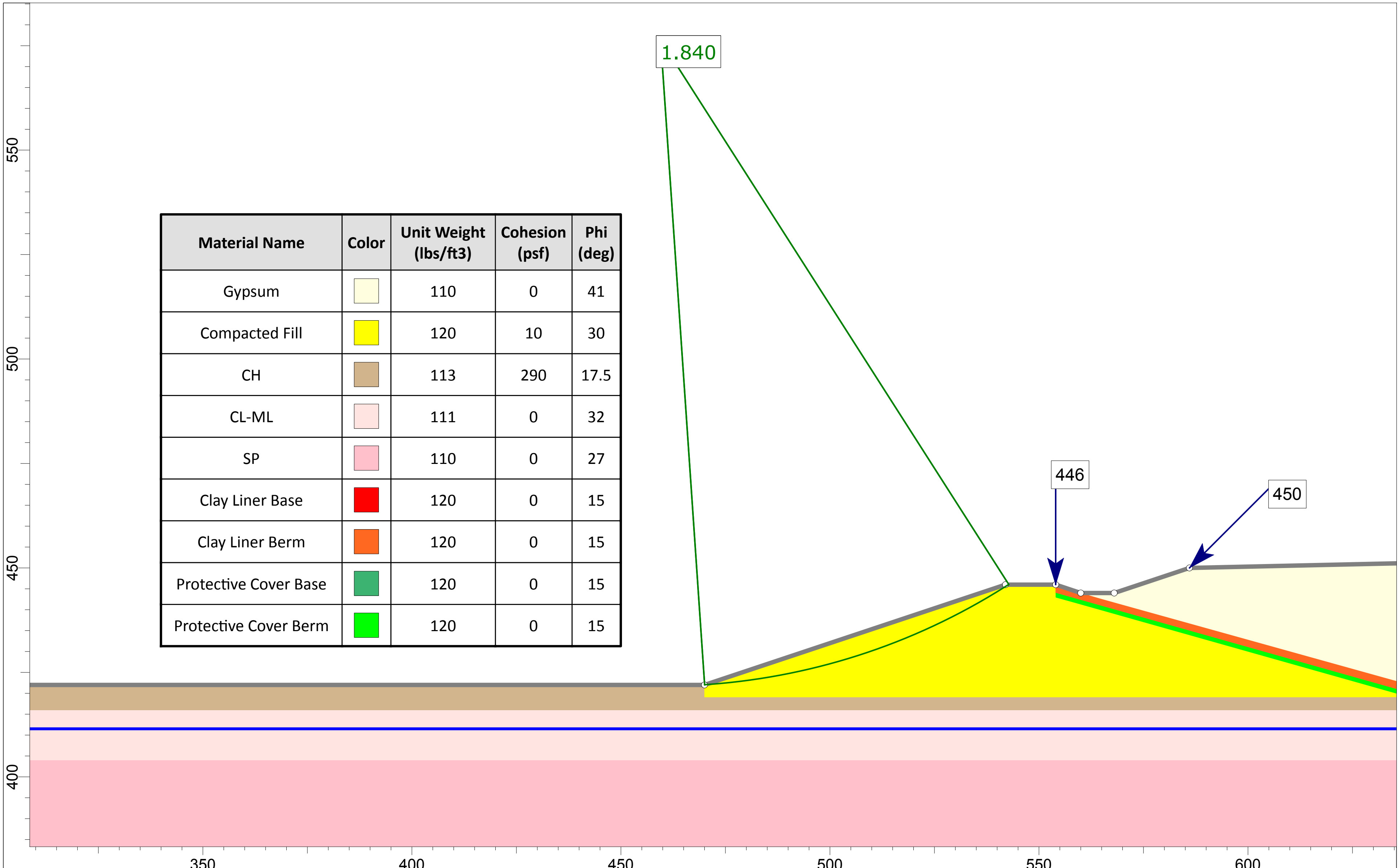
| X | Y |
|---|---|
| 569 | 443 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 444 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-21

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## *Surface Options*

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## *Seismic Loading*

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## *Materials*

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |
| 568 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

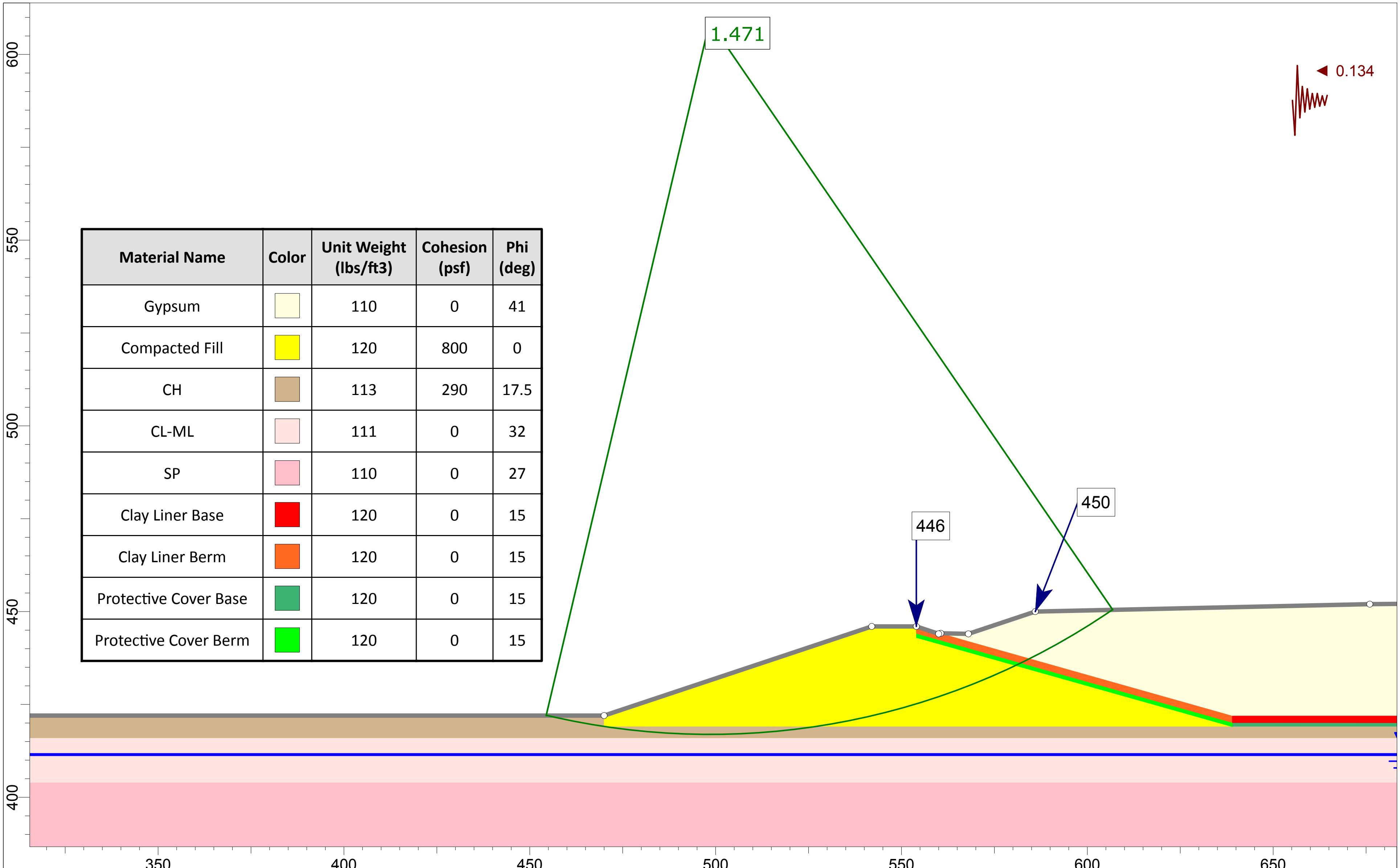
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

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STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-22

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 0 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 568 | 444 |
| 560.58 | 444.142 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |

## Material Boundary

| X | Y |
|---|---|
| 560.58 | 444.142 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

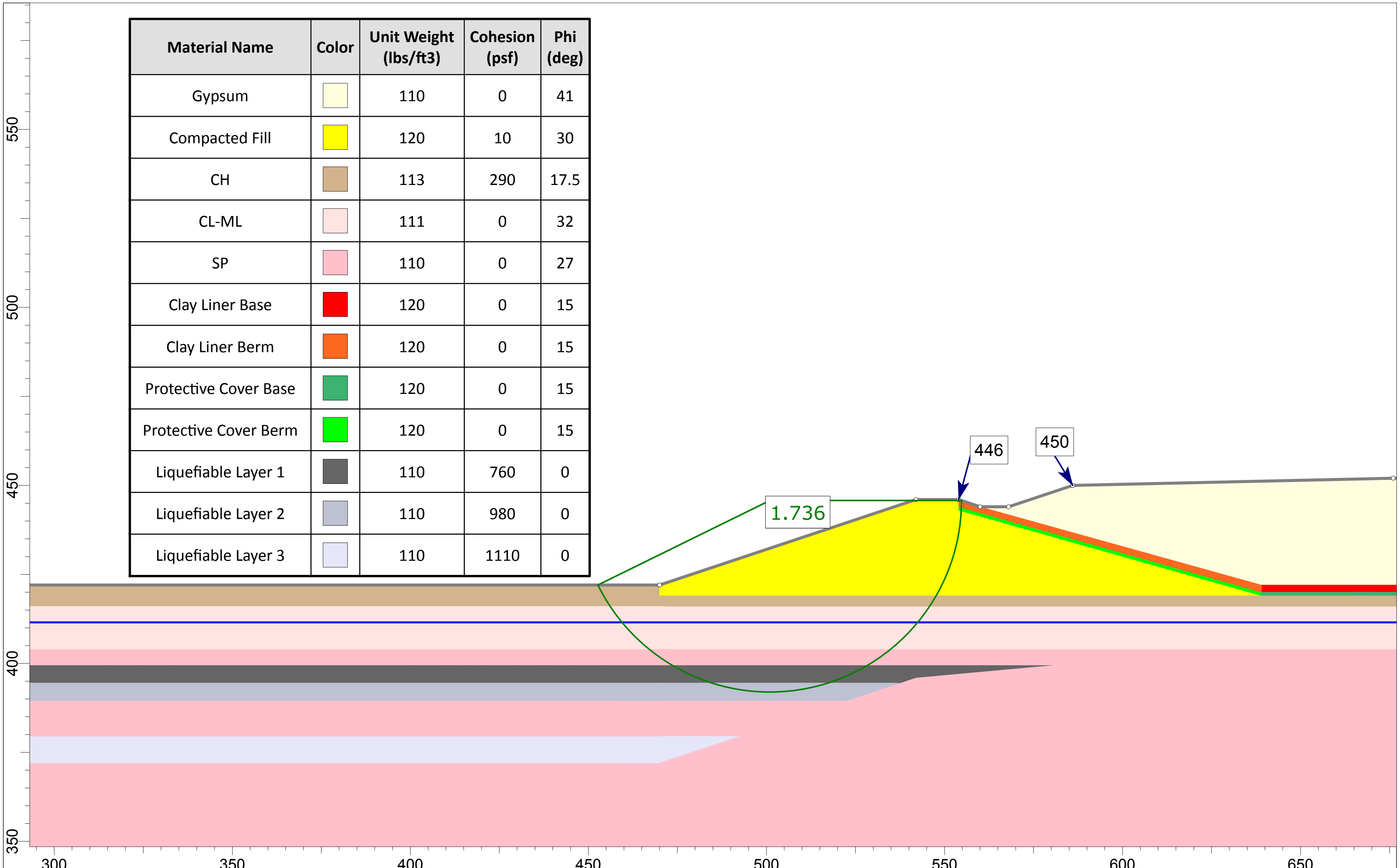
| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 760 | 0 |
| Liquefiable Layer 2 | | 110 | 980 | 0 |
| Liquefiable Layer 3 | | 110 | 1110 | 0 |

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STABILITY ANALYSES - CELL 2, SOUTH BERM (SECTION E-E)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-23

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: rand

## Surface Options

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 20
Circles per division: 10
Number of iterations: 10
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Minimum Area: Not Defined
Minimum Weight: Not Defined

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 | Liquefiable Layer 3 |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 | 110 |
| Cohesion [psf] | 0 | 760 | 980 | 1110 |
| Friction Angle [°] | 15 | 0 | 0 | 0 |
| Water Surface | None | None | None | None |
| Ru Value | 0 | 0 | 0 | 0 |

# *Entity Information*

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 1076 | 456 |
| 676 | 452 |
| 586 | 450 |
| 568 | 444 |
| 560 | 444 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 416 |
| 0 | 404 |
| 0 | 399.5 |
| 0 | 394.5 |
| 0 | 389.5 |
| 0 | 379.5 |
| 0 | 372 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 404 |
| 1370 | 416 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 560 | 444 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 416 |
| 470 | 416 |
| 1370 | 416 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 404 |
| 470 | 404 |
| 896.201 | 404 |
| 1370 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 639 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 372 |
| 470 | 372 |
| 492.5 | 379.5 |
| 522.5 | 389.5 |
| 537.5 | 394.5 |
| 542 | 396 |
| 580.5 | 399.5 |

| | |
|---|---|
| 586 | 400 |
| 896.201 | 403.754 |
| 896.201 | 404 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 379.5 |
| 492.5 | 379.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 389.5 |
| 470 | 389.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 389.5 |
| 522.5 | 389.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 394.5 |
| 537.5 | 394.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 394.5 |
| 470 | 394.5 |

## Material Boundary

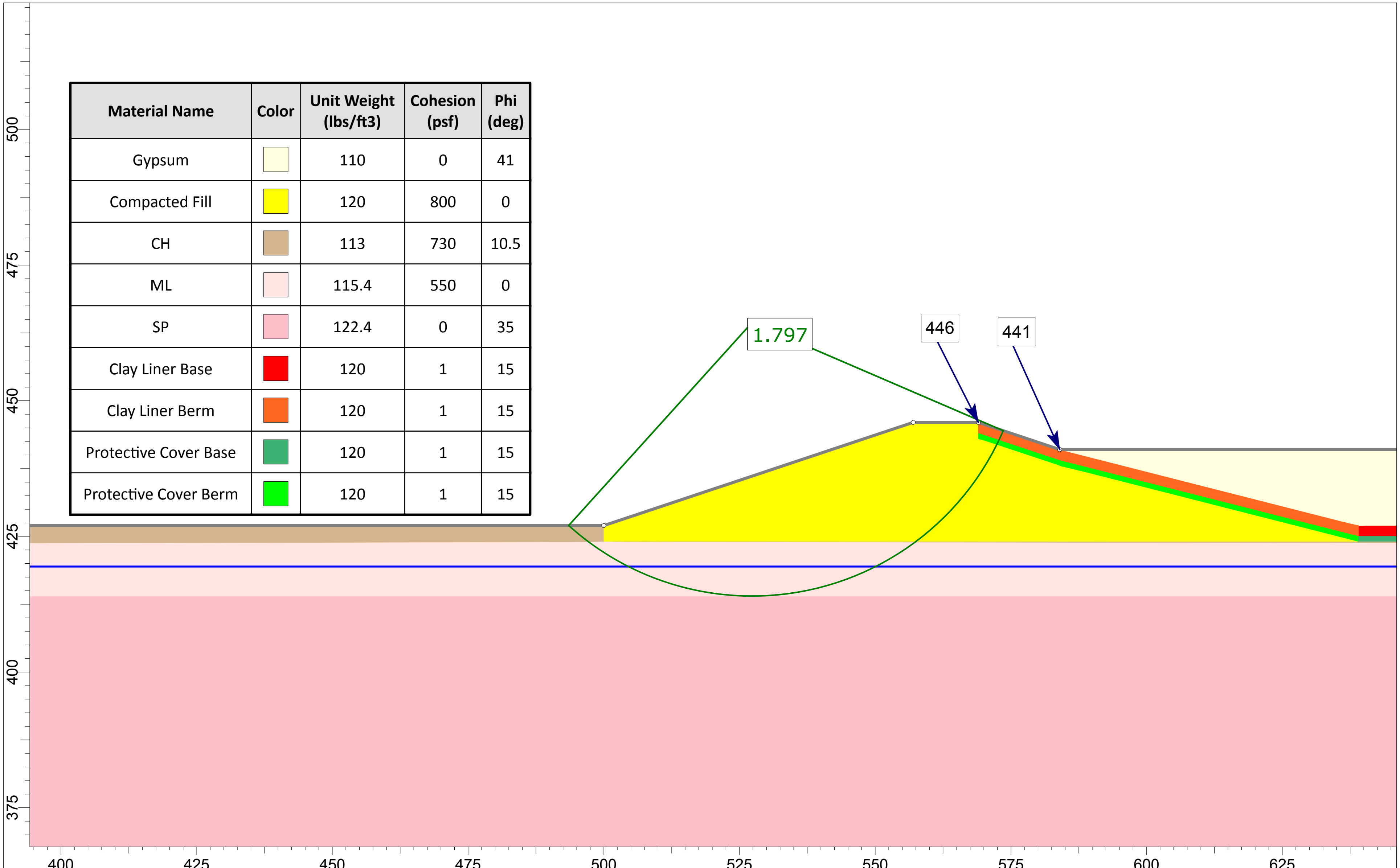
| X | Y |
|---|---|
| 0 | 399.5 |
| 470 | 399.5 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 399.5 |
| 580.5 | 399.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 379.5 |
| 470 | 379.5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 800 | 0 |
| CH | | 113 | 730 | 10.5 |
| ML | | 115.4 | 550 | 0 |
| SP | | 122.4 | 0 | 35 |
| Clay Liner Base | | 120 | 1 | 15 |
| Clay Liner Berm | | 120 | 1 | 15 |
| Protective Cover Base | | 120 | 1 | 15 |
| Protective Cover Berm | | 120 | 1 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
SHORT-TERM, INITIAL FILLING

REITZ & JENS, INC.

Figure 8-24

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 115.4 | 122.4 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 800 | 730 | 550 | 0 | 1 | 1 | 1 |
| Friction Angle [°] | 41 | 0 | 10.5 | 0 | 35 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 1 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| -0.52591 | 419.43 |
| 1370.3 | 419.43 |

## External Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 569 | 446 |
| 557 | 446 |
| 500 | 427 |
| 0 | 427 |
| 0 | 423 |
| 0 | 414 |
| 0 | 327 |
| 1370 | 327 |
| 1370 | 414 |
| 1370 | 423 |
| 1370 | 424 |
| 1370 | 425 |
| 1370 | 427 |
| 1370 | 441 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 441 |
| 639 | 427 |
| 1370 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 500 | 427 |
| 500 | 424 |
| 639 | 424 |
| 1370 | 424 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 423 |
| 500 | 424 |
| 1370 | 423 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 414 |
| 1370 | 414 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 569 | 444 |
| 569 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 584 | 438 |
| 584 | 439 |
| 584 | 441 |

## Material Boundary

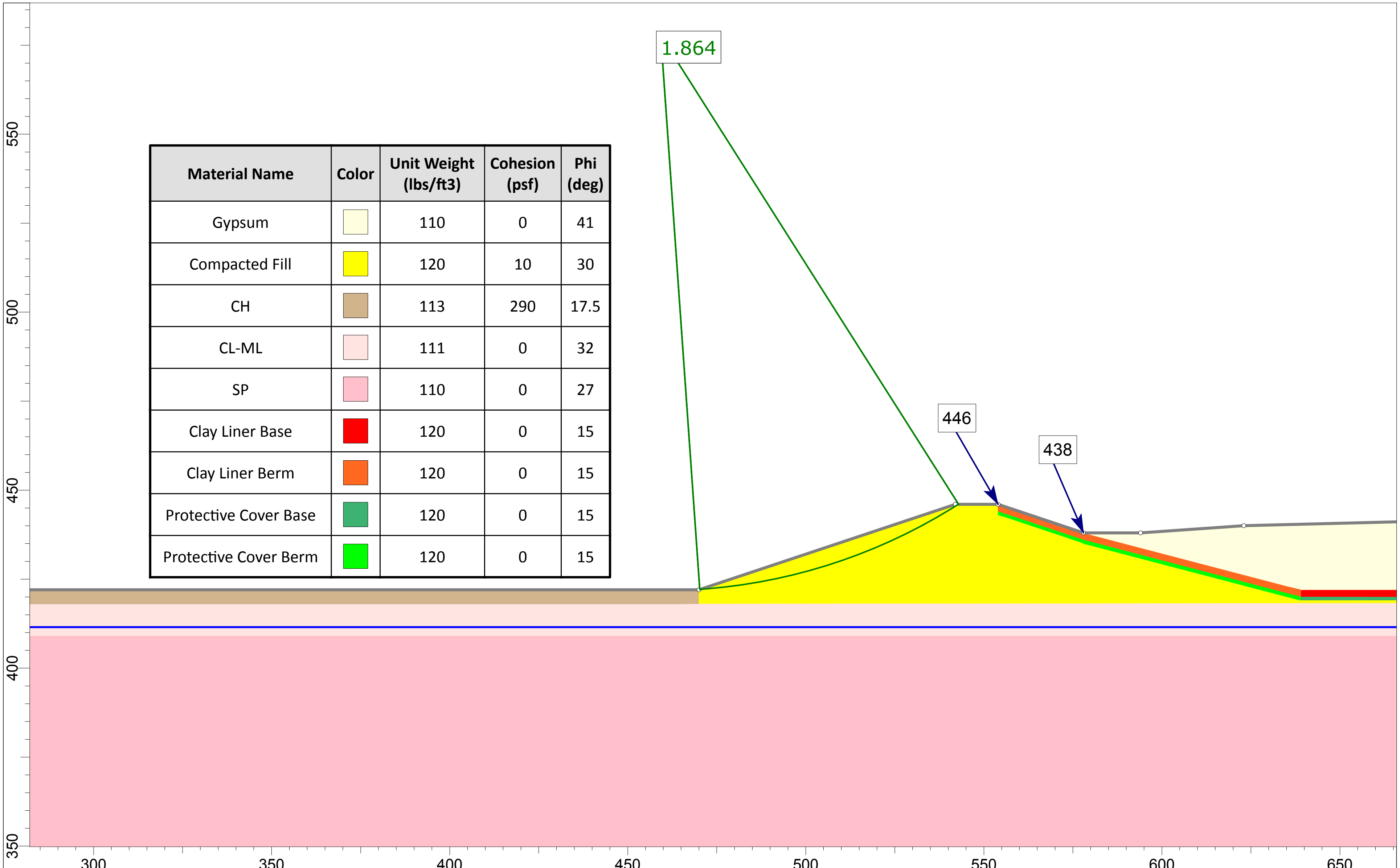
| X | Y |
|---|---|
| 569 | 444 |
| 584 | 439 |
| 639 | 425 |

## Material Boundary

| X | Y |
|---|---|
| 569 | 443 |
| 584 | 438 |
| 639 | 424 |
| 639 | 425 |
| 639 | 427 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 425 |
| 1370 | 425 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
LONG-TERM, CLOSED CELL

REITZ & JENS, INC.

Figure 8-25

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 623 | 440 |
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|

| | |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |

## Material Boundary

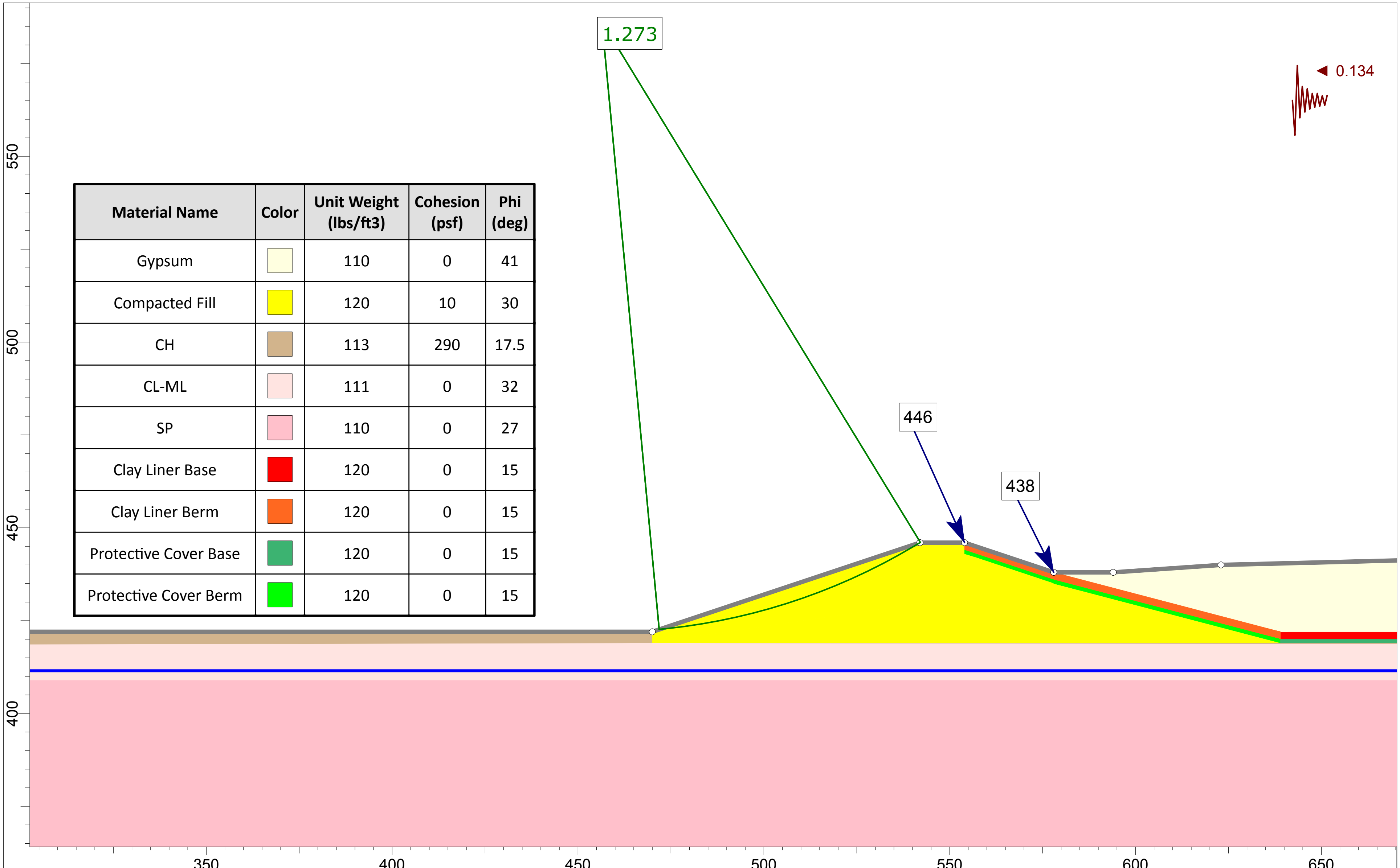
| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 420 |
| 1370 | 420 |




| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Base | | 120 | 0 | 15 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |

Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
SEISMIC, CLOSED CELL

REITZ & JENS, INC.

Figure 8-26

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

| | |
|---|---|
| Slices Type: | Vertical |

| Analysis Methods Used |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

Seismic Load Coefficient (Horizontal): 0.134

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm |
|---|---|
| Color | |
| Strength Type | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 |
| Cohesion [psf] | 0 |
| Friction Angle [°] | 15 |
| Water Surface | None |
| Ru Value | 0 |

## Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |
| 623 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 419 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 419 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

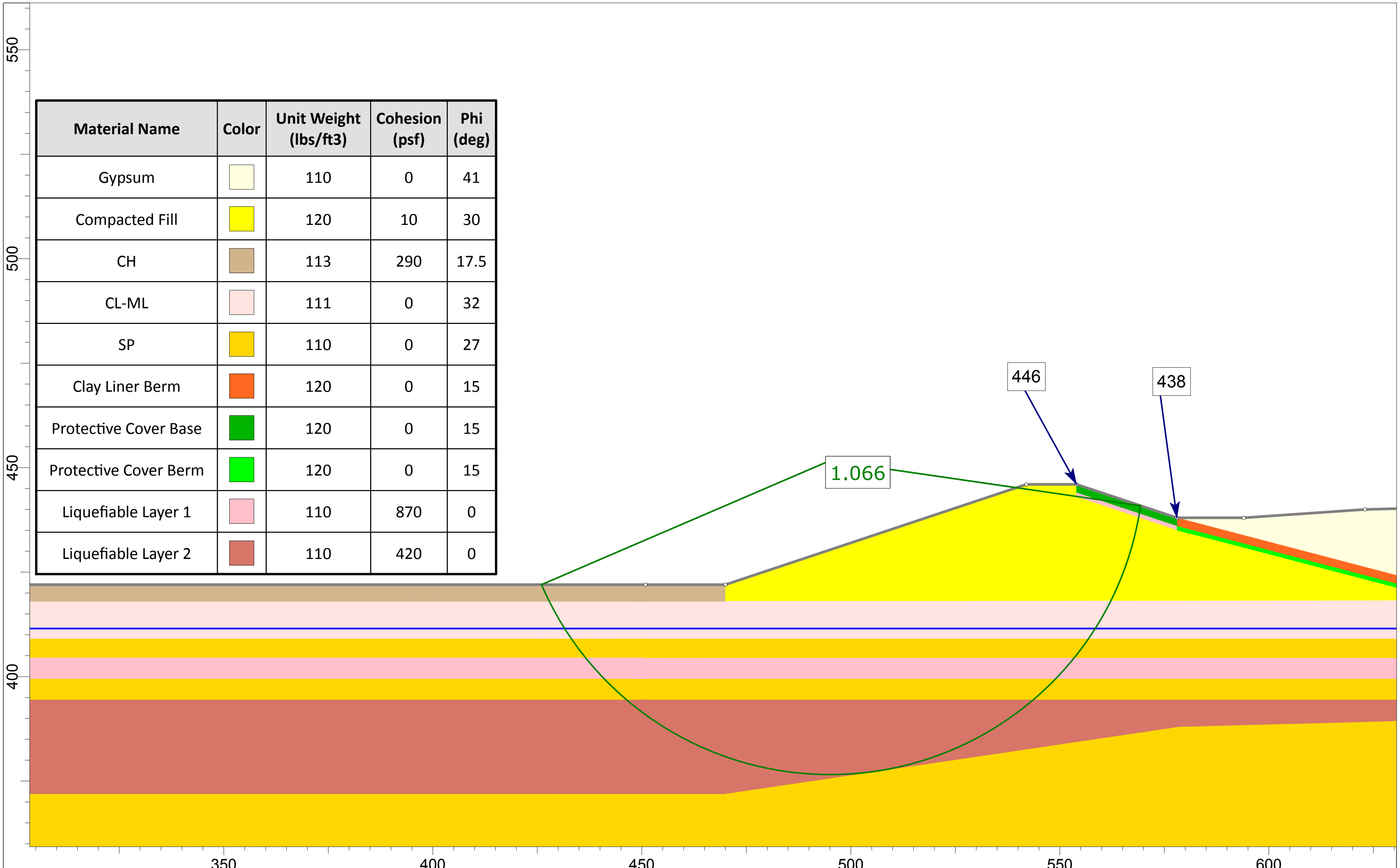
## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |
| 1370 | 420 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| Compacted Fill | | 120 | 10 | 30 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |
| Clay Liner Berm | | 120 | 0 | 15 |
| Protective Cover Base | | 120 | 0 | 15 |
| Protective Cover Berm | | 120 | 0 | 15 |
| Liquefiable Layer 1 | | 110 | 870 | 0 |
| Liquefiable Layer 2 | | 110 | 420 | 0 |




Ameren Missouri Sioux Energy Center UWL
STABILITY ANALYSES - CELL 1, SOUTHWEST BERM (SECTION F-F)
WITH LIQUEFACTION, CLOSED CELL

REITZ & JENS, INC.

Figure 8-27

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| Analysis Methods Used |
|---|
| Bishop simplified |
| GLE/Morgenstern-Price with interslice force function (Half Sine) |
| Janbu simplified |
| Janbu corrected |
| Ordinary/Fellenius |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: rand

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

Advanced seismic analysis: No
Staged pseudostatic analysis: No

## Materials

| Property | Gypsum | Compacted Fill | CH | CL-ML | SP | Clay Liner Base | Clay Liner Berm | Protective Cover Base |
|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 120 | 113 | 111 | 110 | 120 | 120 | 120 |
| Cohesion [psf] | 0 | 10 | 290 | 0 | 0 | 0 | 0 | 0 |
| Friction Angle [°] | 41 | 30 | 17.5 | 32 | 27 | 15 | 15 | 15 |
| Water Surface | Piezometric Line 2 | None | None | None | None | None | None | None |
| Hu Value | 1 | | | | | | | |
| Ru Value | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Property | Protective Cover Berm | Liquefiable Layer 1 | Liquefiable Layer 2 |
|---|---|---|---|
| Color | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 120 | 110 | 110 |
| Cohesion [psf] | 0 | 870 | 420 |
| Friction Angle [°] | 15 | 0 | 0 |
| Water Surface | None | None | None |
| Ru Value | 0 | 0 | 0 |

# Entity Information

## Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |
| 1370 | 411.5 |

## External Boundary

| X | Y |
|---|---|
| 594 | 438 |
| 578 | 438 |
| 554 | 446 |
| 542 | 446 |
| 470 | 422 |
| 450.91 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 404.5 |
| 0 | 404 |
| 0 | 399.5 |
| 0 | 394.5 |
| 0 | 371.888 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 405.96 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 419 |
| 1370 | 420 |
| 1370 | 422 |
| 1370 | 456 |
| 1255 | 456 |
| 623 | 440 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 438 |
| 639 | 422 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 450.91 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 409 |
| 450.91 | 409 |
| 666 | 409 |
| 1370 | 409 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 554 | 444 |
| 554 | 446 |

## Material Boundary

| X | Y |
|---|---|
| 578 | 435 |
| 578 | 436 |
| 578 | 438 |

## Material Boundary

| X | Y |
|---|---|
| 639 | 419 |
| 639 | 420 |
| 639 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 443 |
| 578 | 435 |
| 639 | 419 |
| 1370 | 419 |

## Material Boundary

| X | Y |
|---|---|
| 554 | 444 |
| 578 | 436 |
| 639 | 420 |
| 1370 | 420 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 371.888 |
| 469.254 | 371.841 |
| 578.433 | 388 |
| 823.387 | 394.5 |
| 1011.82 | 399.5 |
| 1200.25 | 404.5 |
| 1255.26 | 405.96 |
| 1370 | 405.96 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 394.5 |
| 450.91 | 394.5 |

## Material Boundary

| X | Y |
|---|---|
| 450.91 | 394.5 |
| 823.387 | 394.5 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 399.5 |
| 450.91 | 399.5 |

## Material Boundary

| X | Y |
|---|---|
| 450.91 | 399.5 |
| 1011.82 | 399.5 |

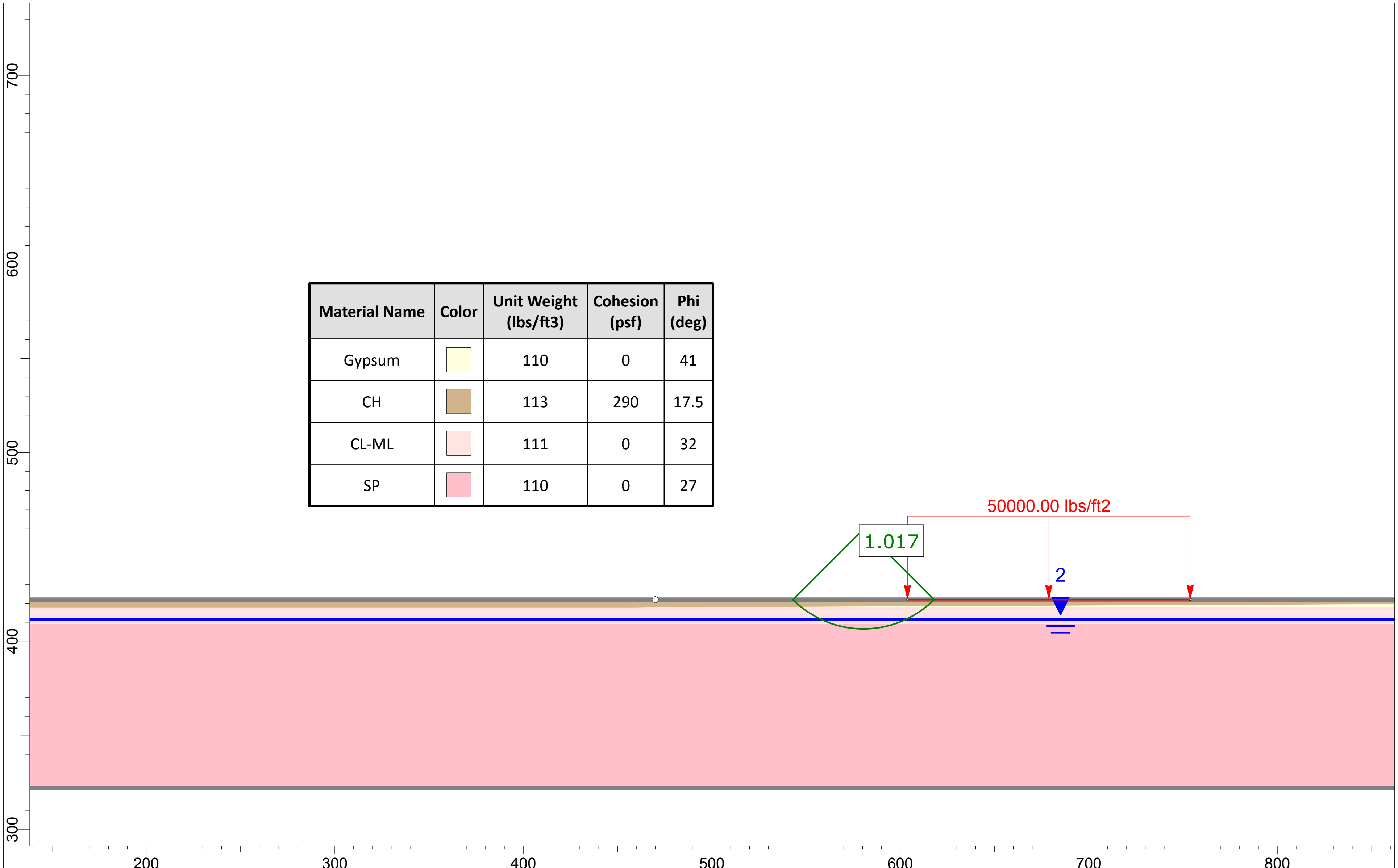
## Material Boundary

| X | Y |
|---|---|
| 0 | 404.5 |
| 450.91 | 404.5 |

## Material Boundary

| X | Y |
|---|---|
| 450.91 | 404.5 |
| 1200.25 | 404.5 |

| Material Name | Color | Unit Weight (lbs/ft3) | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|
| Gypsum | | 110 | 0 | 41 |
| CH | | 113 | 290 | 17.5 |
| CL-ML | | 111 | 0 | 32 |
| SP | | 110 | 0 | 27 |




Ameren Missouri Sioux Energy Center UWL
BEARING CAPACITY ANALYSIS - NATURAL SUBGRADE (SECTION F-F)

REITZ & JENS, INC.

Figure 8-28

# Slide Analysis Information

# Sioux UWL

## Project Summary

Last saved with Slide version: 8.029

## General Settings

| | |
|---|---|
| Units of Measurement: | Imperial Units |
| Time Units: | seconds |
| Permeability Units: | feet/second |
| Data Output: | Standard |
| Failure Direction: | Right to Left |

## Analysis Options

Slices Type: Vertical

| **Analysis Methods Used** |
|---|
| Spencer |

| | |
|---|---|
| Number of slices: | 50 |
| Tolerance: | 0.005 |
| Maximum number of iterations: | 50 |
| Check malpha < 0.2: | Yes |
| Initial trial value of FS: | 3 |
| Steffensen Iteration: | Yes |

## Groundwater Analysis

| | |
|---|---|
| Groundwater Method: | Water Surfaces |
| Pore Fluid Unit Weight [lbs/ft3]: | 62.4 |
| Use negative pore pressure cutoff: | Yes |
| Maximum negative pore pressure [psf]: | 0 |
| Advanced Groundwater Method: | None |

## Random Numbers

| | |
|---|---|
| Pseudo-random Seed: | 10116 |
| Random Number Generation Method: | rand |

## Surface Options

| | |
|---|---|
| Surface Type: | Circular |
| Search Method: | Auto Refine Search |
| Divisions along slope: | 20 |
| Circles per division: | 10 |
| Number of iterations: | 10 |
| Divisions to use in next iteration: | 50% |
| Composite Surfaces: | Disabled |
| Minimum Elevation: | Not Defined |
| Minimum Depth: | Not Defined |
| Minimum Area: | Not Defined |
| Minimum Weight: | Not Defined |

## Seismic Loading

| | |
|---|---|
| Advanced seismic analysis: | No |
| Staged pseudostatic analysis: | No |

## Loading

1 Distributed Load present

| Distributed Load 1 | |
|---|---|
| Distribution: | Constant |
| Magnitude [psf]: | 50000 |
| Orientation: | Vertical |

## Materials

| Property | Gypsum | CH | CL-ML | SP |
|---|---|---|---|---|
| Color | | | | |
| Strength Type | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb | Mohr-Coulomb |
| Unit Weight [lbs/ft3] | 110 | 113 | 111 | 110 |
| Cohesion [psf] | 0 | 290 | 0 | 0 |
| Friction Angle [°] | 41 | 17.5 | 32 | 27 |
| Water Surface | Piezometric Line 2 | None | None | None |
| Hu Value | 1 | | | |
| Ru Value | | 0 | 0 | 0 |

## Entity Information

### Piezoline

| X | Y |
|---|---|
| 0 | 411.5 |

| | |
|---|---|
| 1370 | 411.5 |

## Distributed Load

| X | Y |
|---|---|
| 603.777 | 422 |
| 753.777 | 422 |

## External Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 0 | 422 |
| 0 | 418 |
| 0 | 409 |
| 0 | 322 |
| 1370 | 322 |
| 1370 | 409 |
| 1370 | 418 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 470 | 422 |
| 470 | 418 |
| 1370 | 422 |

## Material Boundary

| X | Y |
|---|---|
| 0 | 418 |
| 470 | 418 |
| 1370 | 418 |

## Material Boundary

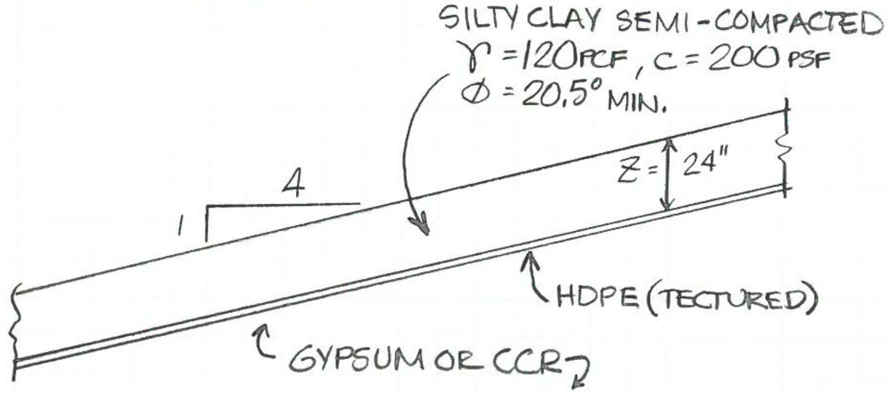
| X | Y |
|---|---|
| 0 | 409 |
| 1370 | 409 |

REITZ & JENS, INC.
CONSULTING ENGINEERS

PROJECT: AMEREN SIOUX EC UWL REDESIGN
SUBJECT: STABILITY OF FINAL COVER

DATE: 1/8/2020 BY: J. FOUSE Proj. Number: 2019012439 SHEET 1 OF ___

## STABILITY OF FINAL COVER




ASSUME NO SEEPAGE THROUGH HDPE MEMBRANE.

FOR "INFINITE SLOPE", $F = \frac{c}{\gamma z} \cdot \frac{1}{\sin\beta \cos\beta} + \frac{\tan \phi'}{\tan \beta}$

$\beta = \tan^{-1}\left(\frac{1}{4}\right) = 14.0°$

$F = \frac{200 \text{ PSF}}{(120 \text{ PCF})(2')} \cdot \frac{1}{\sin(14°)\cos(14°)} + \frac{\tan(20.5°)}{\tan(14°)} = 5.0$

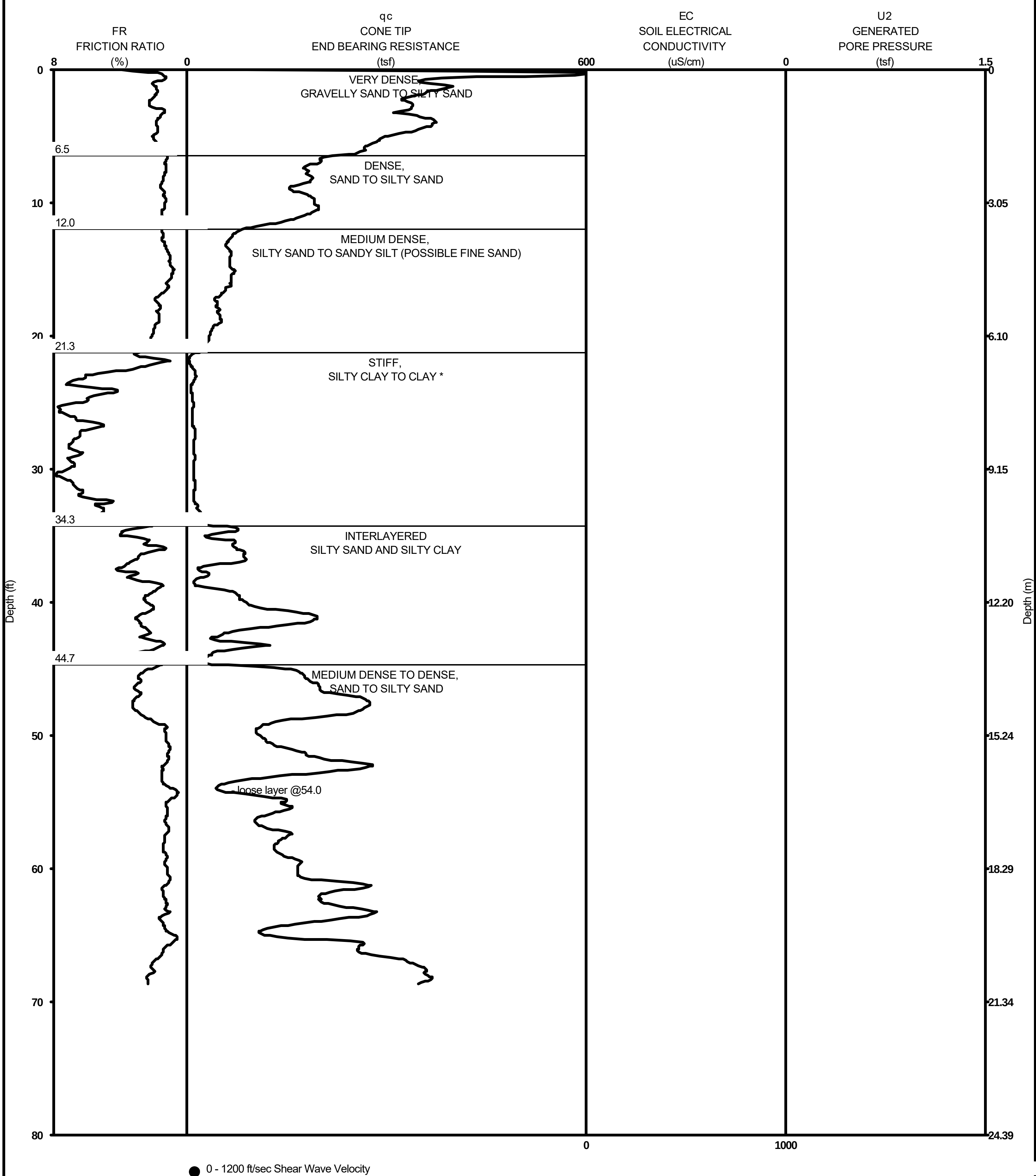
FOR $c = 0$, $F = \frac{\tan(20.5°)}{\tan(14°)} = 1.5$

SO, MINIMUM Ø FOR SOIL COVER IS 20.5°

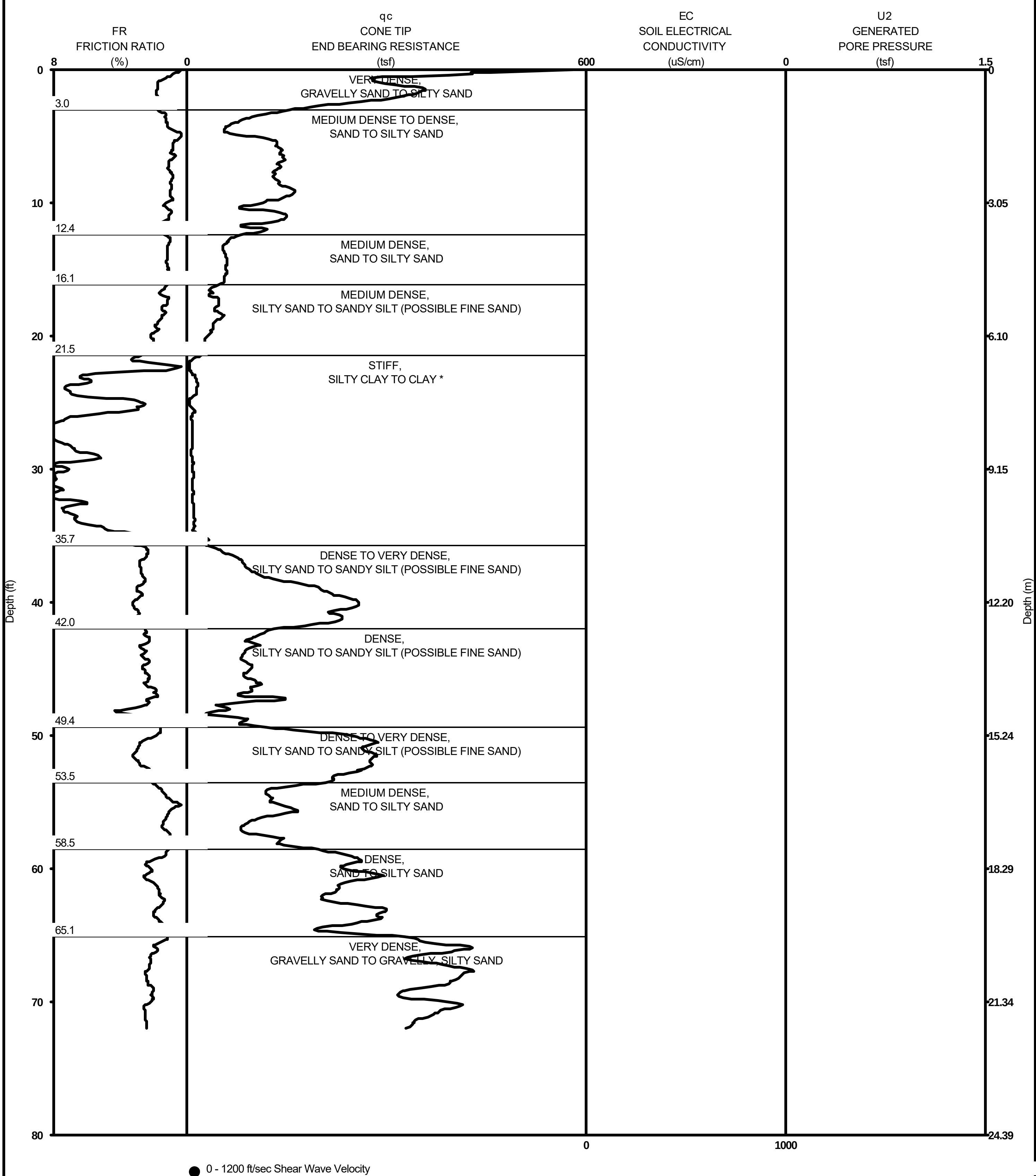
# Appendix 9

## RESULTS OF CONE PENETROMETER TESTS (CPT) AT SIOUX ENERGY CENTER

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T01



# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T02

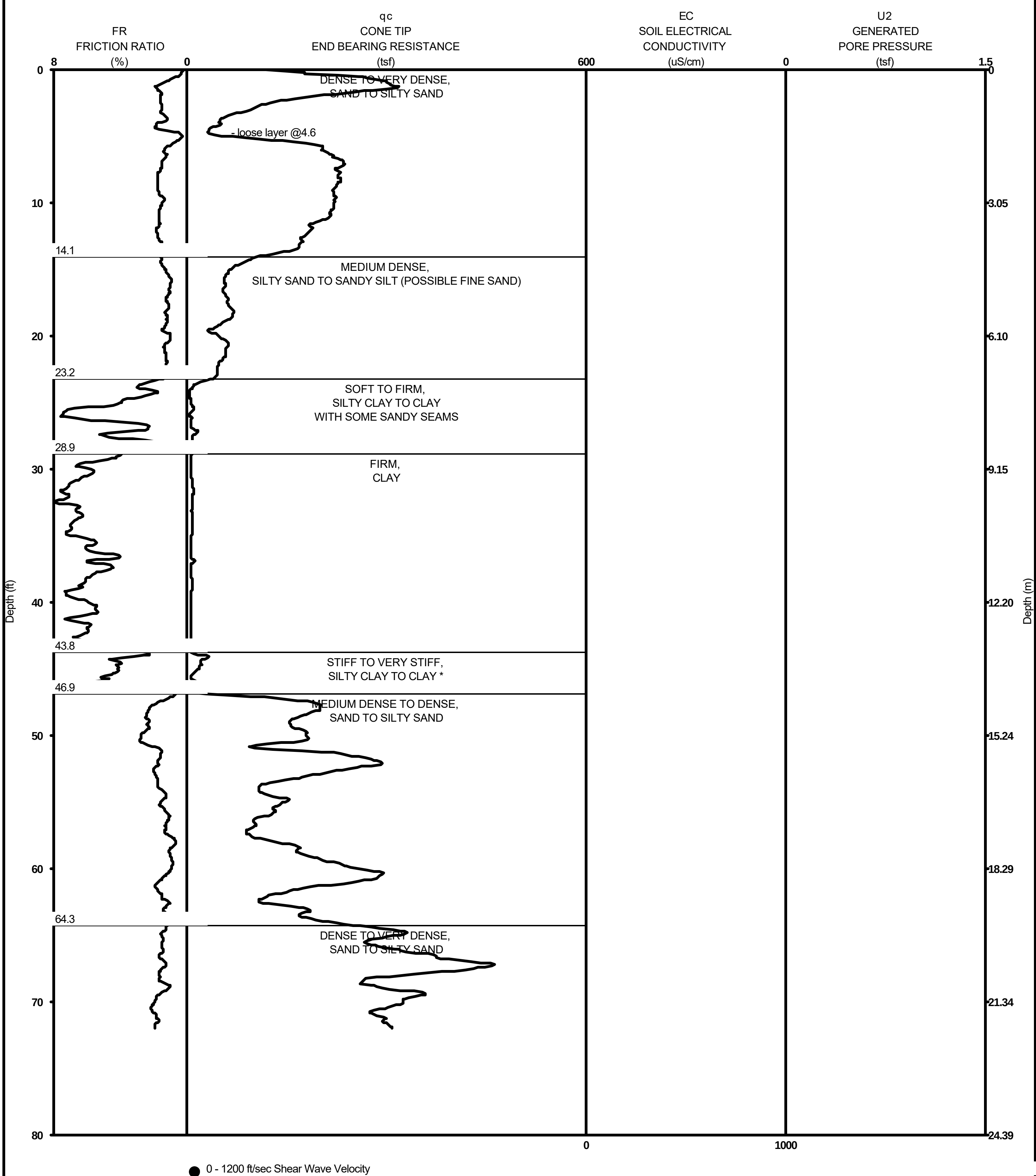



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**_STRATIGRAPHICS_**

R1DATE: 7-04-2006 TIME:17:25:21.56
SOUNDING NUMBER:CPT-02

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T03

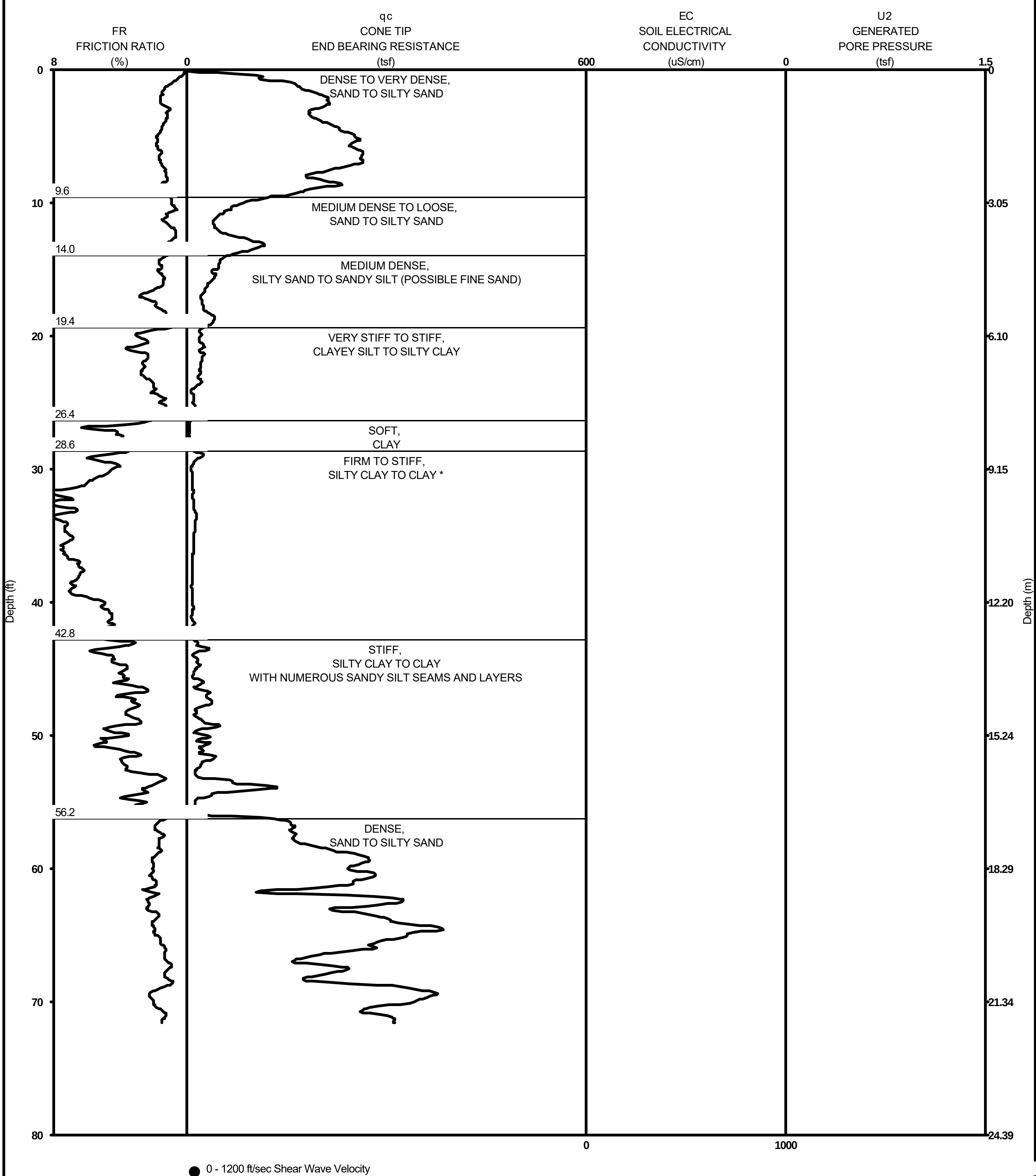



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:09:20:07.64
SOUNDING NUMBER:CPT-03

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T04

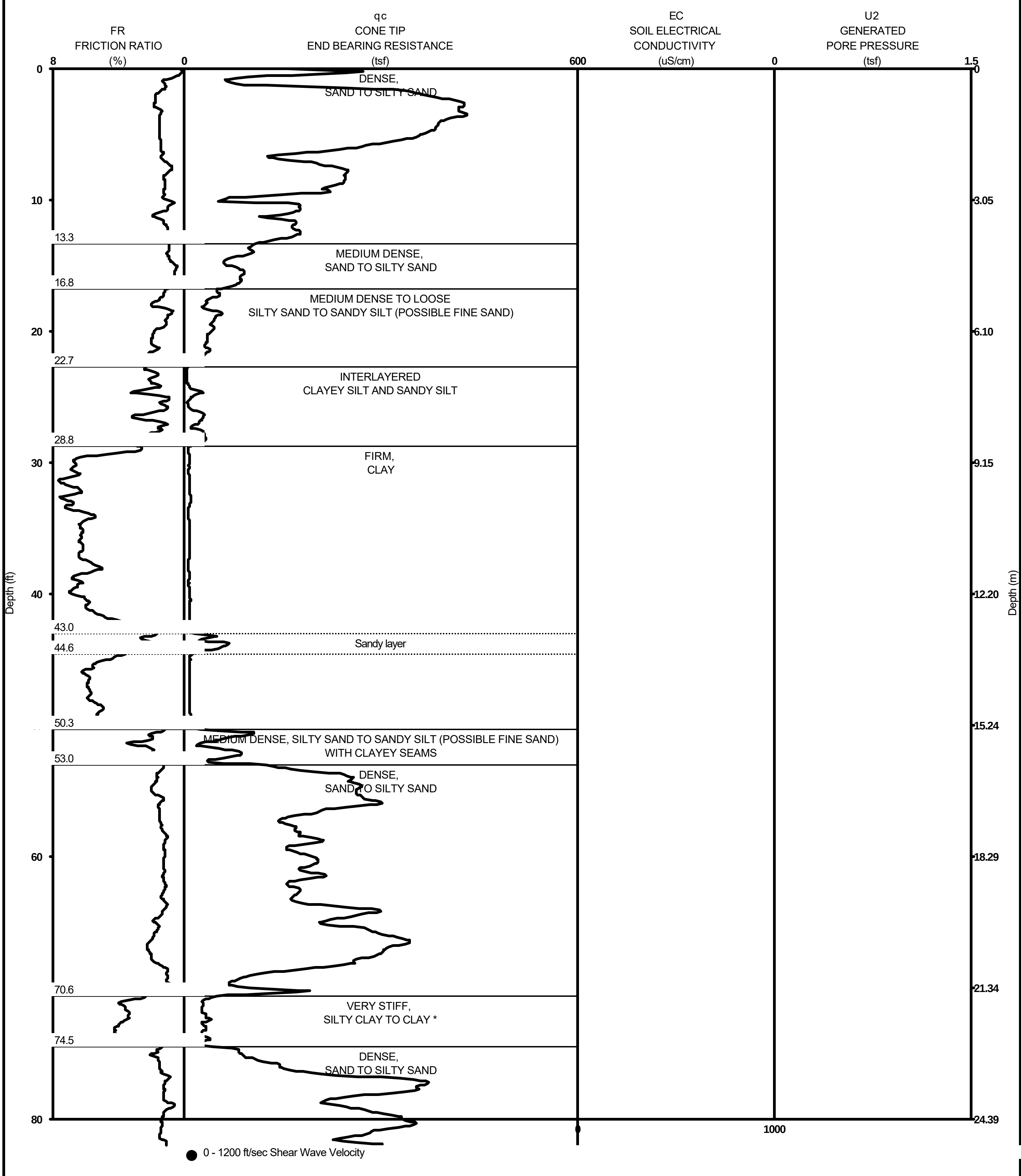



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-04-2006 TIME:13:43:16.14
SOUNDING NUMBER:CPT-04

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T05

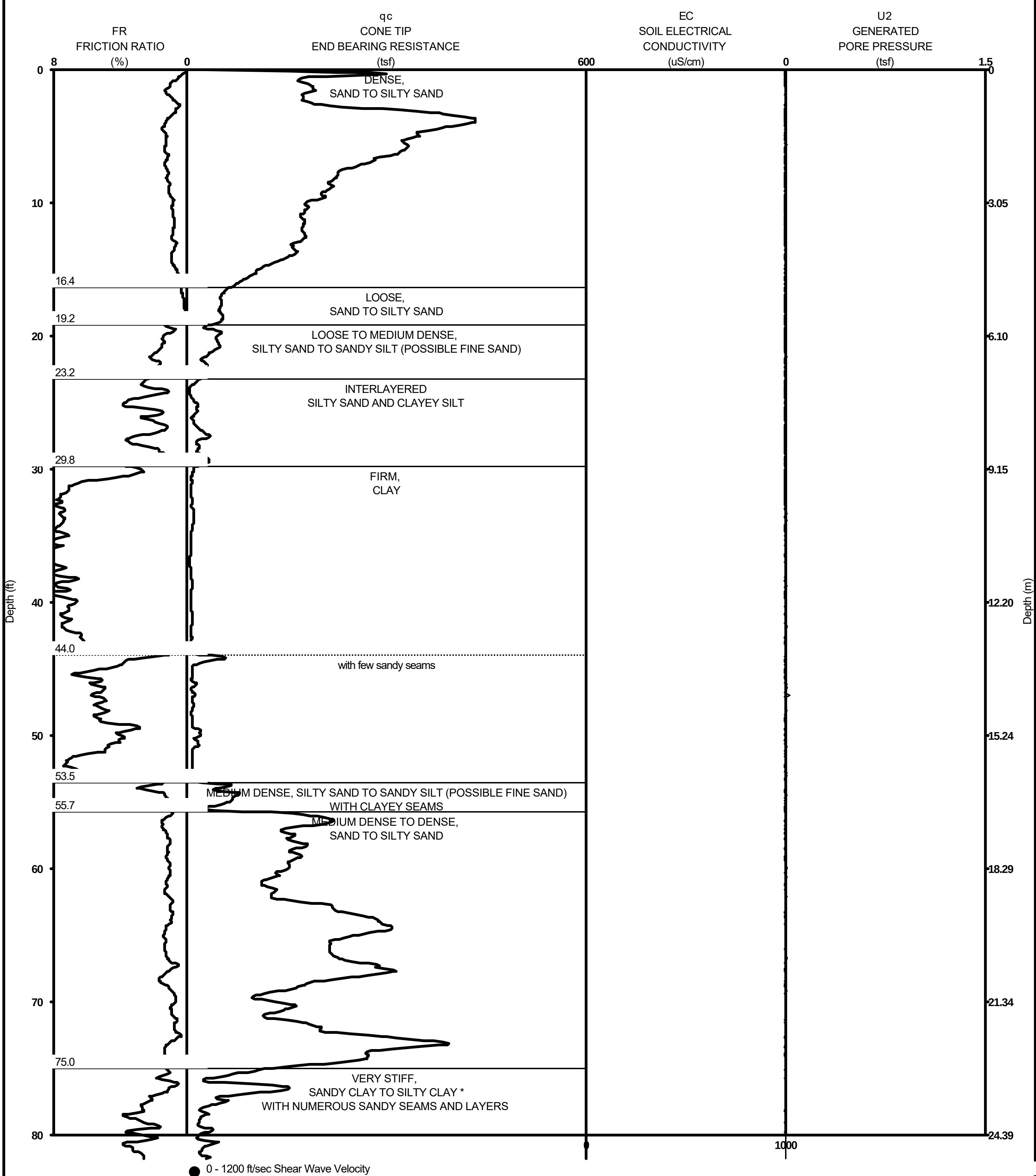



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-03-2006 TIME:14:29:28.28
SOUNDING NUMBER:CPT-05

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T06

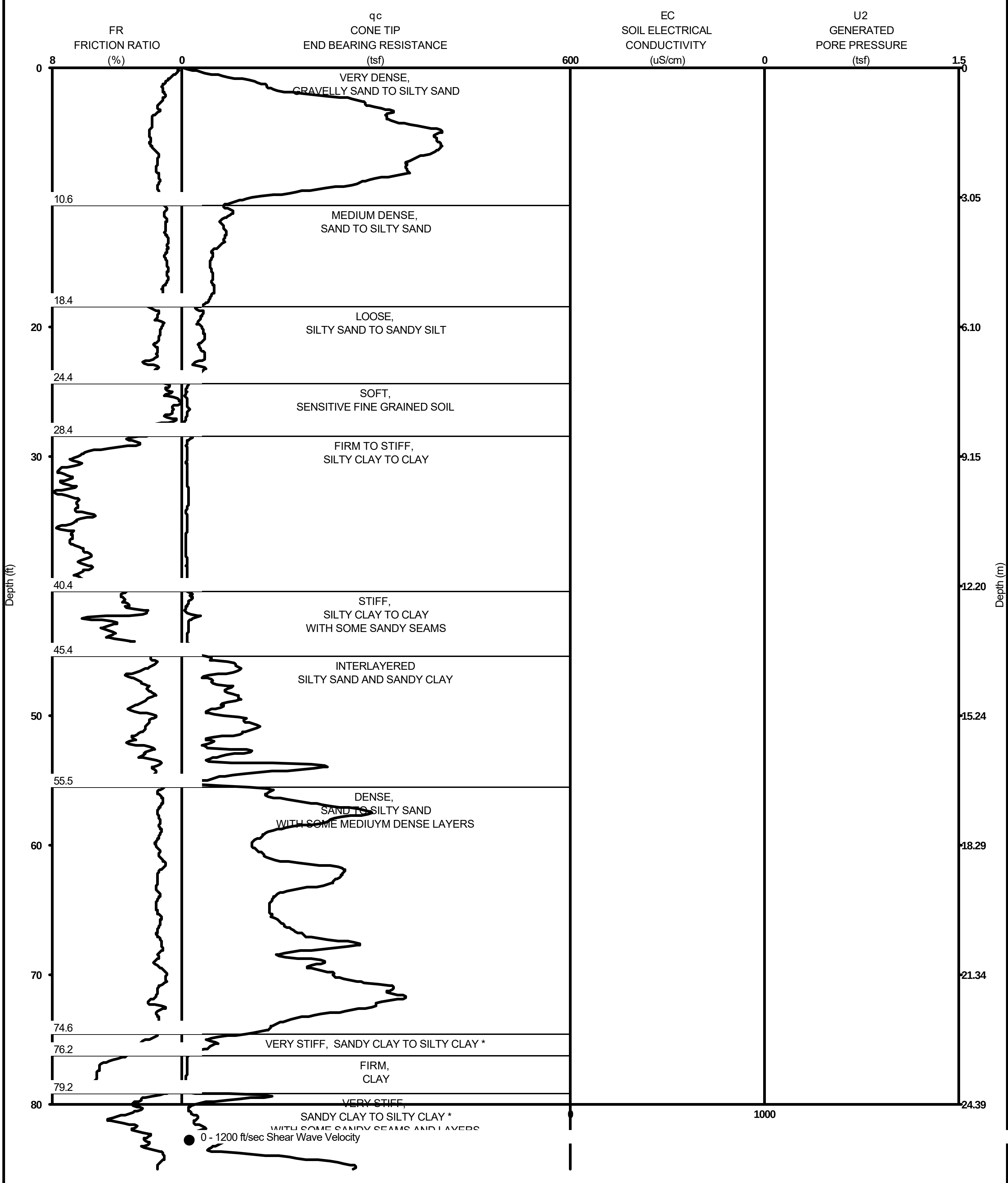



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**_STRATIGRAPHICS_**

R1DATE: 7-03-2006 TIME:11:45:18.00
SOUNDING NUMBER:CPT-06

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T07

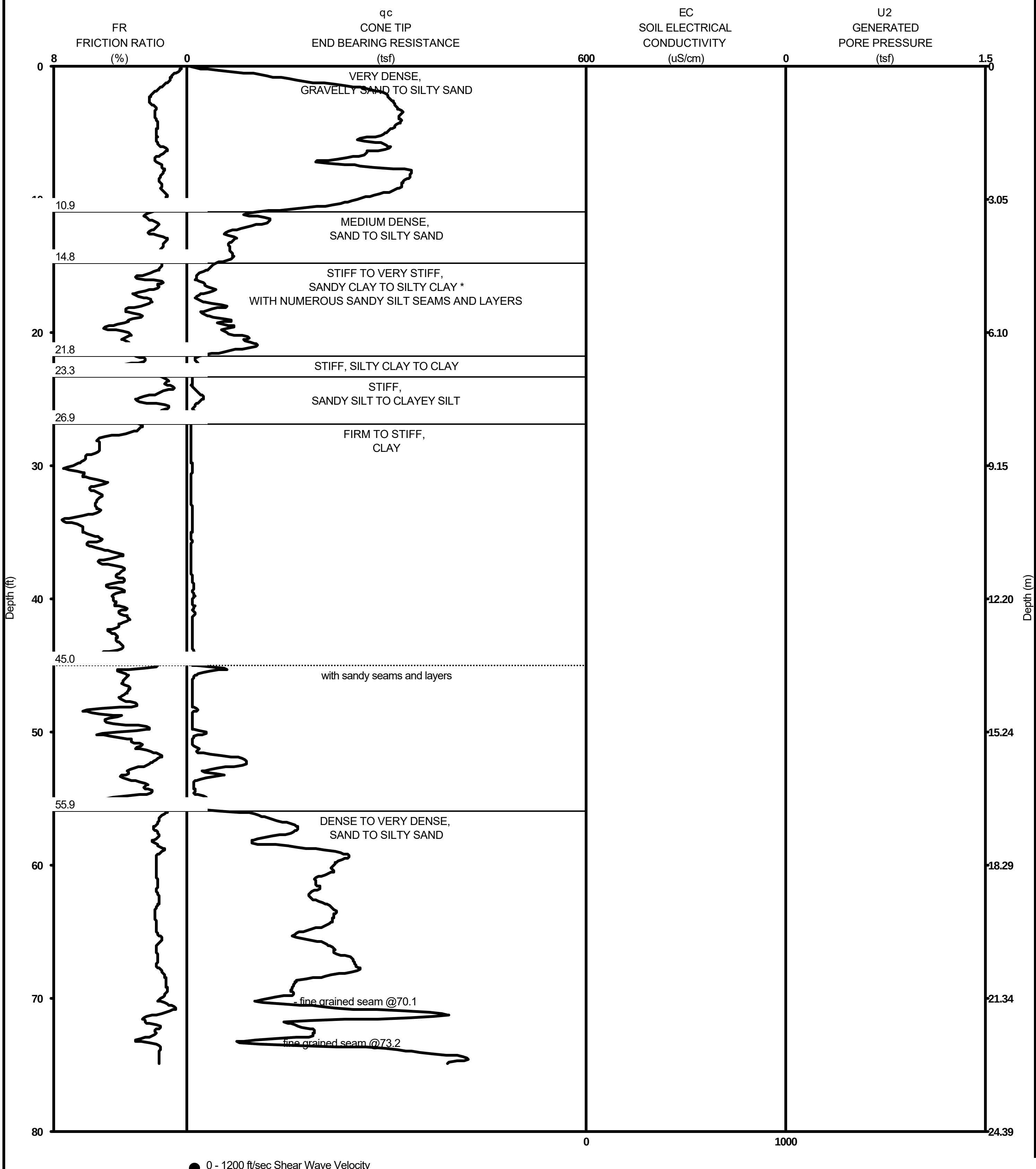



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:10:06:39.78
SOUNDING NUMBER:CPT-07

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T08

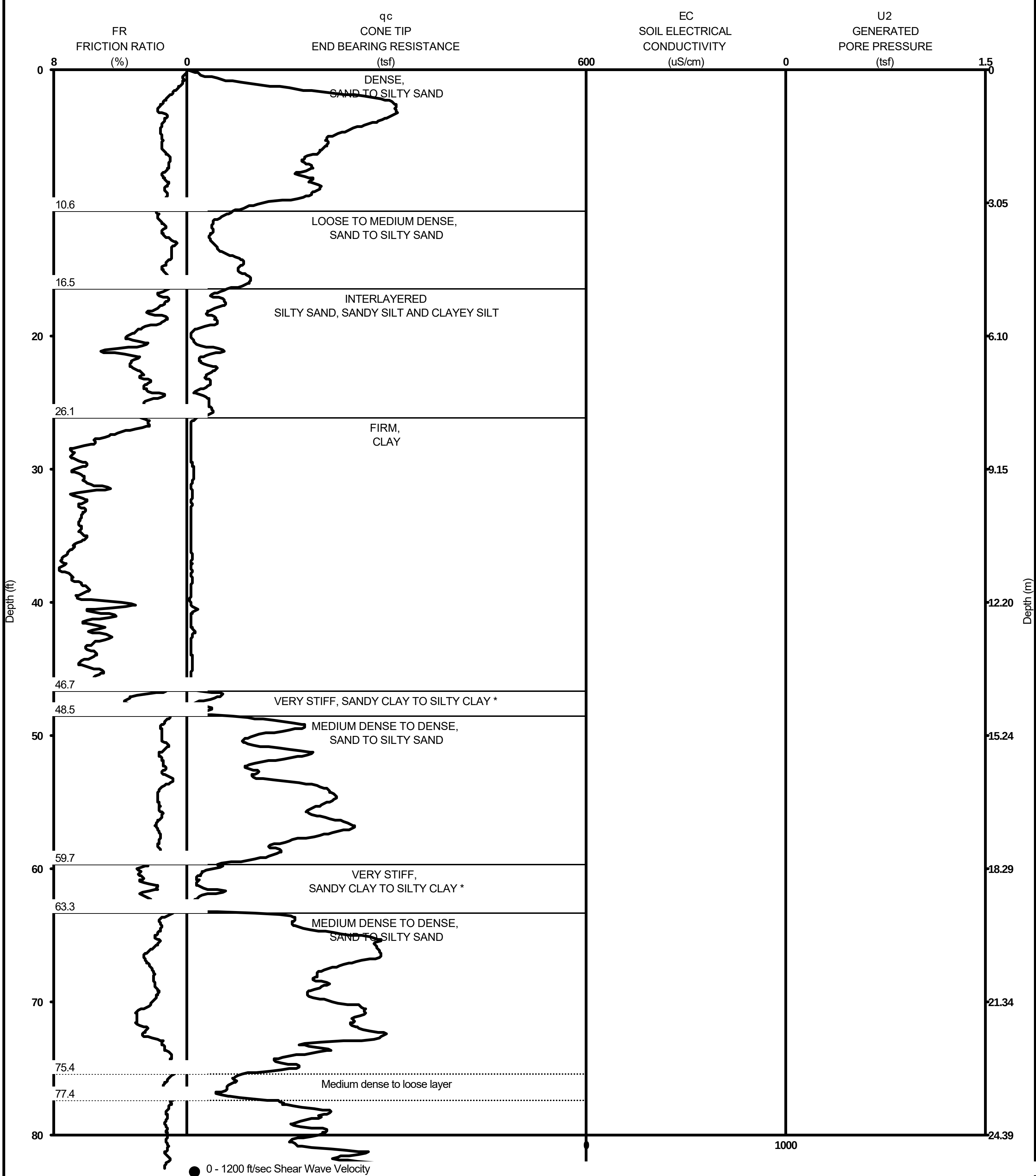



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**STRATIGRAPHICS**

R1DATE: 7-04-2006 TIME:11:19:41.35
SOUNDING NUMBER:CPT-08

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T09

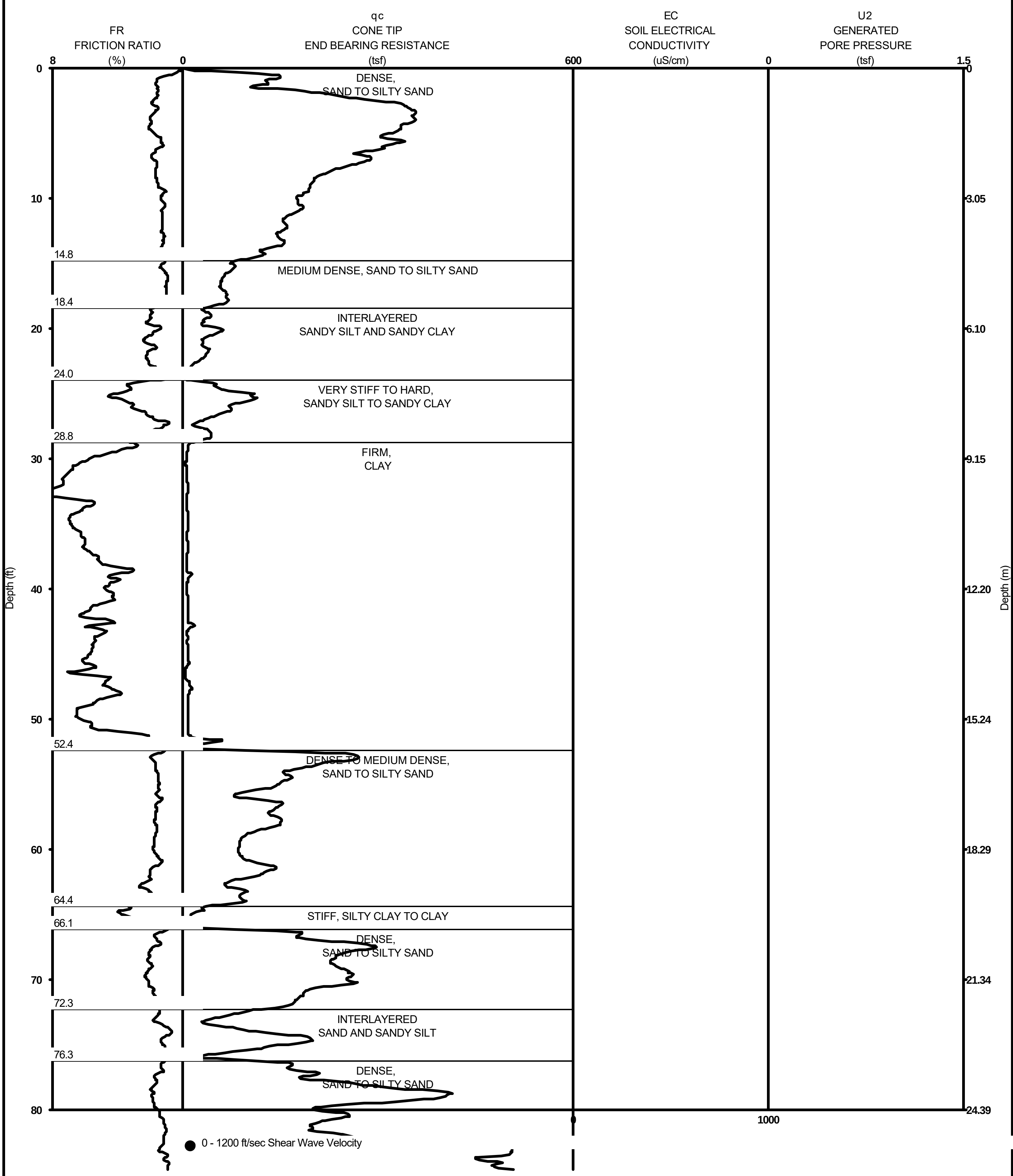



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

**_STRATIGRAPHICS_**

R1DATE: 7-03-2006 TIME:16:45:45.92
SOUNDING NUMBER:CPT-09

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T10

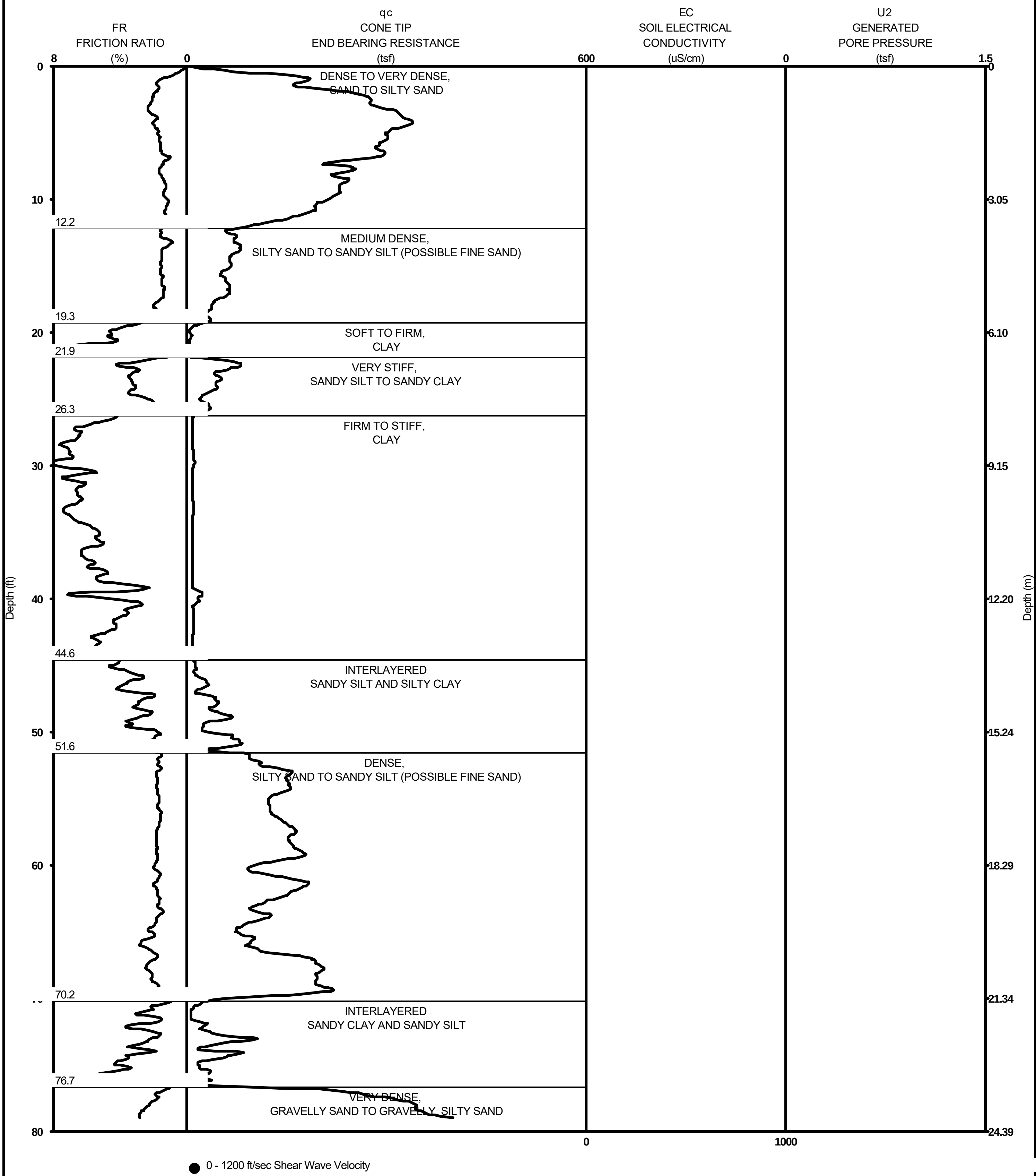



PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

***STRATIGRAPHICS***

R1DATE: 7-03-2006 TIME:15:39:36.35
SOUNDING NUMBER:CPT-10

# PRELIMINARY CPTU-EC LOG WITH LITHOLOGIC EVALUATION CP-T11




PROJECT NAME:Ameren Sioux WFGD
PROJECT NUMBER:06-110-170

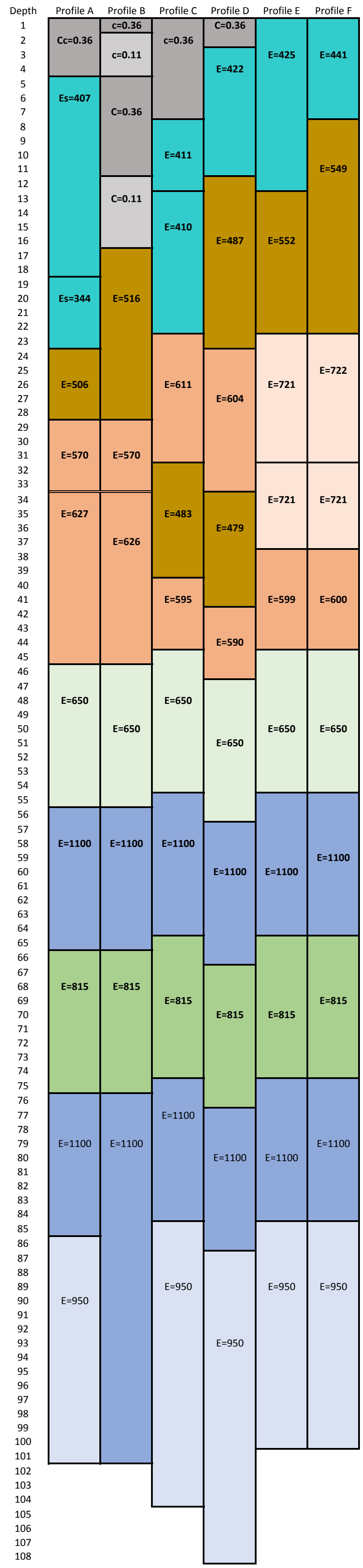
***STRATIGRAPHICS***

R1DATE: 7-04-2006 TIME:15:53:12.37
SOUNDING NUMBER:CPT-11

**Appendix 10**

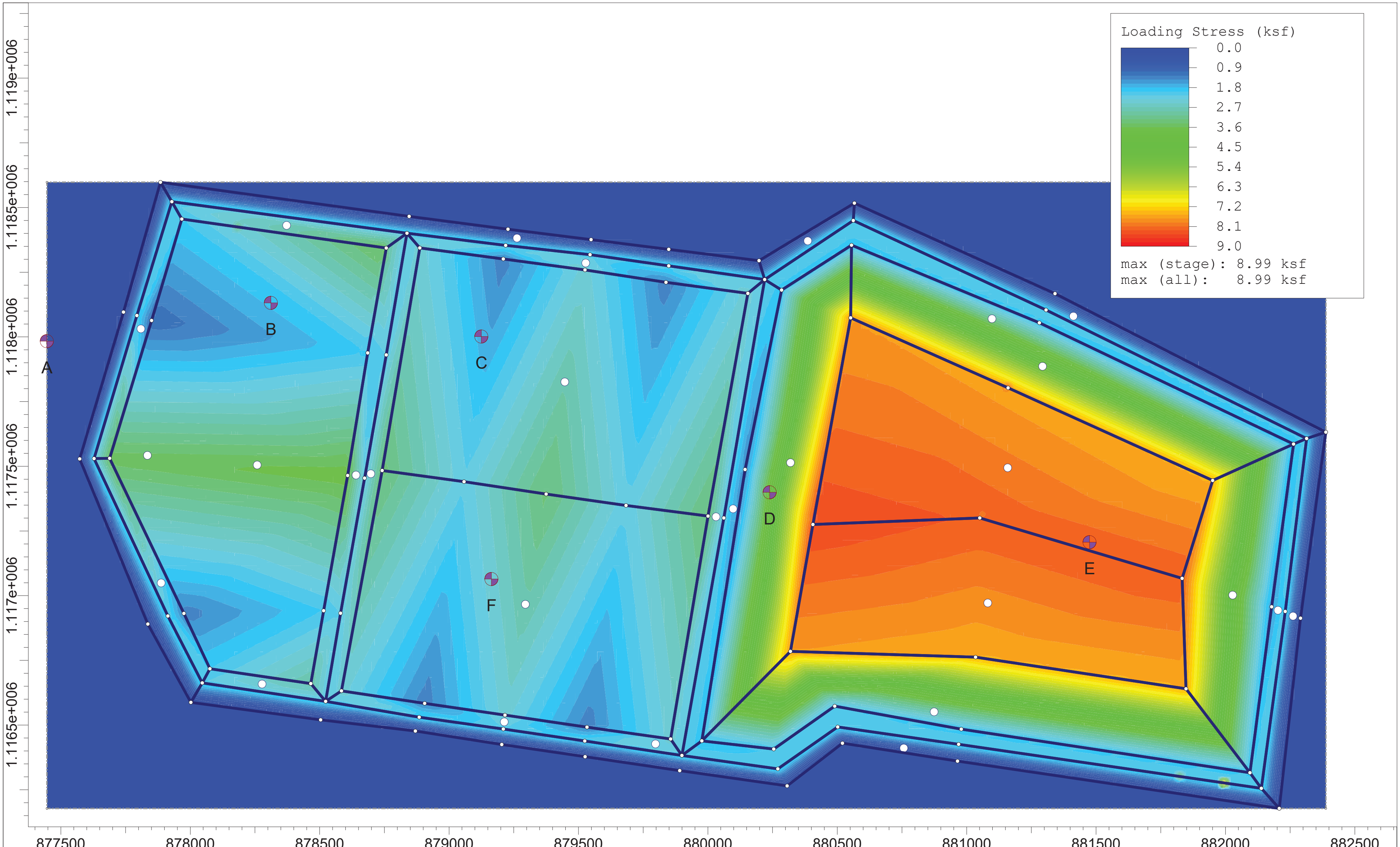
# RESULTS OF SETTLEMENT ANALYSES

# Ameren Missouri Sioux Energy Center UWL
# SUMMARY OF SOIL PROPERTIES FOR SETTLEMENT ANALYSES



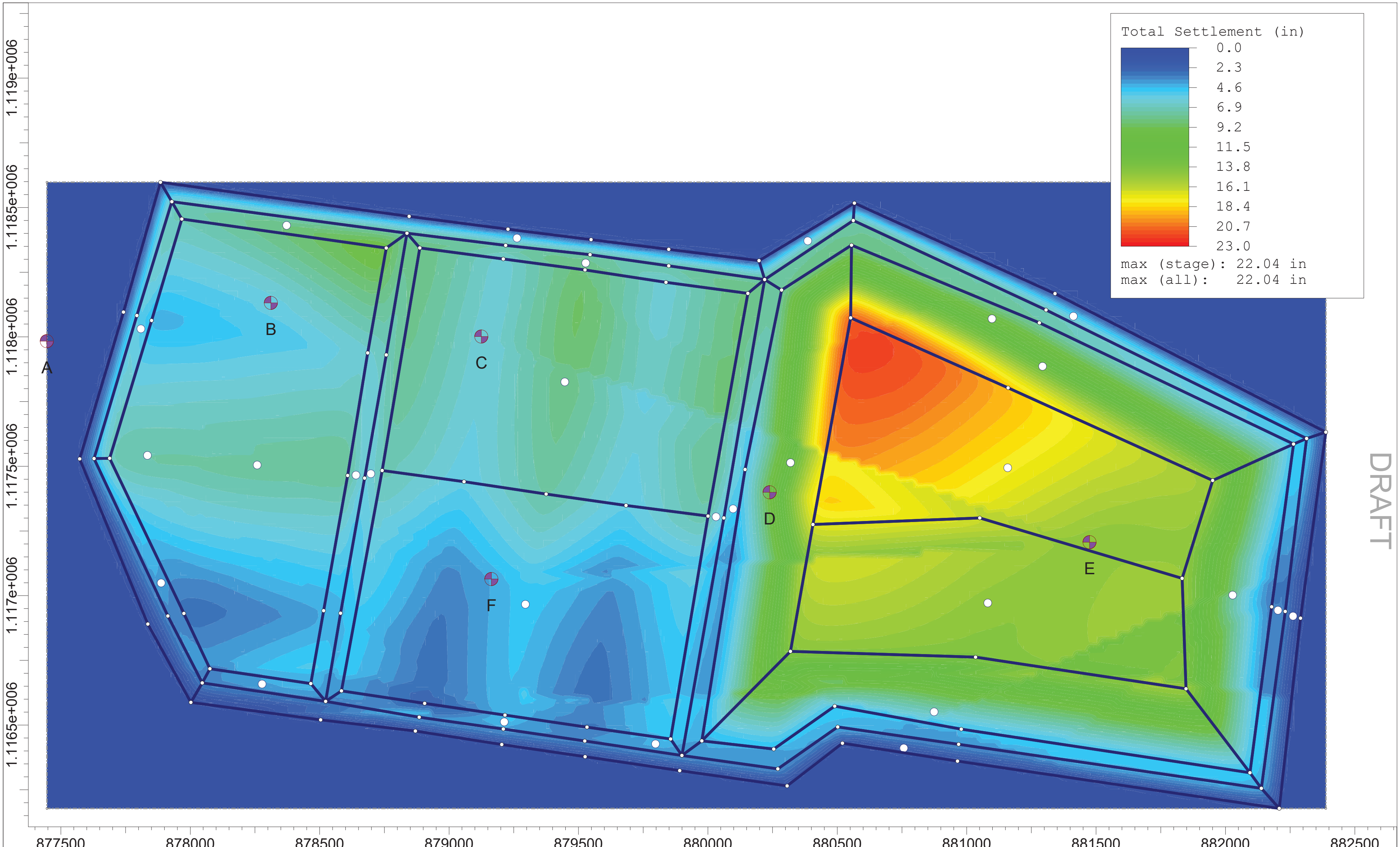

| | g (pcf) | g ' (pcf) | eo | ES (ksf) | CC | CR | Pc (psf) |
|---|---|---|---|---|---|---|---|
| CH | 113 | 50.6 | 1.125 | 0 | 0.36 | 0.07 | 5100 |
| CL-ML | 111 | 48.6 | 1.182 | 0 | 0.11 | 0.01 | 4260 |
| ML | 111 | 48.6 | | 400 | 0 | 0 | 0 |
| SP-SM | 110 | 47.6 | | 500 | 0 | 0 | 0 |
| SP1 | 110 | 47.6 | | 600 | 0 | 0 | 0 |
| SP2 | 110 | 47.6 | | 650 | 0 | 0 | 0 |
| SP3 | 110 | 47.6 | | 721 | 0 | 0 | 0 |
| SP4 | 110 | 47.6 | | 815 | 0 | 0 | 0 |
| SP5 | 110 | 47.6 | | 950 | 0 | 0 | 0 |
| SP6 | 110 | 47.6 | | 1100 | 0 | 0 | 0 |

| | x | y |
|---|---|---|
| Profile A | 877446 | 1117983 |
| Profile B | 878312 | 1118131 |
| Profile C | 879125 | 1118001 |
| Profile D | 880239 | 1117399 |
| Profile E | 881475 | 1117206 |
| Profile F | 879164 | 1117064 |




| | |
|---|---|
| *Project* | Ameren Missouri Sioux Energy Center Utility Waste Landfill |
| *Analysis Description* | Total Loading Stress |
| *Drawn By* C. Cook | *Company* Ameren Missouri |
| *Date* 12/9/2019, 1:13:39 PM | *File Name* Sioux UWL Settlement.s3z |

SETTLE3D 3.020




| | | | |
|---|---|---|---|
| SETTLE3D 3.020 | *Project* Ameren Missouri Sioux Energy Center Utility Waste Landfill | | |
| | *Analysis Description* Total Settlement | | |
| | *Drawn By* C. Cook | *Company* Ameren Missouri | |
| | *Date* 12/9/2019, 1:13:39 PM | *File Name* Sioux UWL Settlement.s3z | |

# Settle3D Analysis Information
# Sioux UWL

## Project Settings

| | |
|---|---|
| Document Name | Sioux UWL Settlement.s3z |
| Project Title | Sioux UWL |
| Analysis | Total Settlement |
| Author | C. Cook |
| Company | Ameren Services |
| Date Created | 12/9/2019, 1:13:39 PM |
| Stress Computation Method | Boussinesq |
| Use average properties to calculate layered stresses | |
| Improve consolidation accuracy | |
| Ignore negative effective stresses in settlement calculations | |

## Stage Settings

| Stage # | Name |
|---|---|
| 1 | Stage 1 |

## Results

Time taken to compute: 0 seconds

### Stage: Stage 1

| Data Type | Minimum | Maximum |
|---|---|---|
| Total Settlement [in] | 0 | 22.0367 |
| Consolidation Settlement [in] | 0 | 6.9319 |
| Immediate Settlement [in] | 0 | 16.5623 |
| Loading Stress [ksf] | 0 | 8.98723 |
| Effective Stress [ksf] | 0 | 14.1519 |
| Total Stress [ksf] | 0 | 21.4426 |
| Total Strain | 0 | 0.241847 |
| Pore Water Pressure [ksf] | 0 | 7.3008 |
| Degree of Consolidation [%] | 0 | 100 |
| Pre-consolidation Stress [ksf] | 0.00562808 | 14.1408 |
| Over-consolidation Ratio | 1 | 9.87743e+006 |
| Void Ratio | 0 | 1.182 |
| Hydroconsolidation Settlement [in] | 0 | 0 |
| Undrained Shear Strength | 0 | 1.45341 |

## Loads

### 1. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.30936e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878515 | 1.11694e+006 | 1.98 |
| 878608 | 1.11746e+006 | 3.74 |
| 878686 | 1.11794e+006 | 1.98 |
| 878757 | 1.11834e+006 | 3.52 |
| 877967 | 1.11846e+006 | 1.98 |
| 877851 | 1.11806e+006 | 1.1 |
| 877688 | 1.11753e+006 | 3.52 |
| 877975 | 1.11693e+006 | 1.32 |
| 878076 | 1.11672e+006 | 1.98 |
| 878466 | 1.11666e+006 | 2.86 |

### 2. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.11592e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878742 | 1.11748e+006 | 3.3 |
| 879058 | 1.11744e+006 | 2.2 |
| 879375 | 1.11739e+006 | 3.3 |
| 879684 | 1.11735e+006 | 2.2 |
| 880000 | 1.11731e+006 | 3.3 |
| 880155 | 1.11817e+006 | 2.42 |
| 879838 | 1.11821e+006 | 1.32 |
| 879525 | 1.11826e+006 | 2.42 |
| 879209 | 1.1183e+006 | 1.32 |
| 878887 | 1.11834e+006 | 2.42 |

### 3. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 1.11097e+006 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879684 | 1.11735e+006 | 2.2 |
| 879375 | 1.11739e+006 | 3.3 |
| 879058 | 1.11744e+006 | 2.2 |
| 878742 | 1.11748e+006 | 3.3 |
| 878584 | 1.11663e+006 | 2.42 |
| 878905 | 1.11658e+006 | 1.32 |
| 879216 | 1.11654e+006 | 2.42 |
| 879533 | 1.11649e+006 | 1.32 |
| 879856 | 1.11645e+006 | 2.42 |
| 880000 | 1.11731e+006 | 3.3 |

## 4. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 734334 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880319 | 1.11678e+006 | 7.74 |
| 881034 | 1.11676e+006 | 7.568 |
| 881848 | 1.11664e+006 | 7.568 |
| 881833 | 1.11707e+006 | 8.256 |
| 881051 | 1.1173e+006 | 8.256 |
| 880406 | 1.11728e+006 | 8.428 |

## 5. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 803038 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881950 | 1.11745e+006 | 7.568 |
| 881160 | 1.1178e+006 | 7.654 |
| 880552 | 1.11807e+006 | 7.74 |
| 880406 | 1.11728e+006 | 8.428 |
| 881051 | 1.1173e+006 | 8.256 |
| 881833 | 1.11707e+006 | 8.256 |

## 6. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 458740 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882263 | 1.11759e+006 | 1.72 |
| 881281 | 1.11805e+006 | 1.892 |
| 880555 | 1.11835e+006 | 1.892 |
| 880552 | 1.11807e+006 | 7.74 |
| 881160 | 1.1178e+006 | 7.654 |
| 881950 | 1.11745e+006 | 7.568 |

## 7. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 329946 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882095 | 1.11632e+006 | 1.892 |
| 882178 | 1.11696e+006 | 1.548 |
| 882263 | 1.11759e+006 | 1.72 |
| 881950 | 1.11745e+006 | 7.568 |
| 881833 | 1.11707e+006 | 8.256 |
| 881848 | 1.11664e+006 | 7.568 |

### 8. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 513704 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881848 | 1.11664e+006 | 7.568 |
| 881034 | 1.11676e+006 | 7.568 |
| 880319 | 1.11678e+006 | 7.74 |
| 879977 | 1.11644e+006 | 1.806 |
| 880255 | 1.11641e+006 | 1.978 |
| 880490 | 1.11657e+006 | 1.987 |
| 880979 | 1.11648e+006 | 1.892 |
| 882095 | 1.11632e+006 | 1.892 |

### 9. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 481941 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

#### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880319 | 1.11678e+006 | 7.74 |
| 880406 | 1.11728e+006 | 8.428 |
| 880552 | 1.11807e+006 | 7.74 |
| 880555 | 1.11835e+006 | 1.892 |
| 880285 | 1.11818e+006 | 1.892 |
| 880144 | 1.11749e+006 | 1.376 |
| 879977 | 1.11644e+006 | 1.806 |

### 10. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 25905.6 ft$^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878076 | 1.11672e+006 | 1.98 |
| 878046 | 1.11666e+006 | 2.16 |
| 878523 | 1.11659e+006 | 2.16 |
| 878466 | 1.11666e+006 | 2.86 |

## 11. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 120910 ft$^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878581 | 1.11693e+006 | 2.16 |
| 878674 | 1.11745e+006 | 2.16 |
| 878757 | 1.11793e+006 | 2.16 |
| 878837 | 1.1184e+006 | 2.16 |
| 878757 | 1.11834e+006 | 3 |
| 878686 | 1.11794e+006 | 1.98 |
| 878608 | 1.11746e+006 | 3.74 |
| 878515 | 1.11694e+006 | 1.98 |
| 878466 | 1.11666e+006 | 2.86 |
| 878523 | 1.11659e+006 | 2.16 |

## 12. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 105431 ft$^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878523 | 1.11659e+006 | 2.16 |
| 878584 | 1.11663e+006 | 2.43 |
| 878742 | 1.11748e+006 | 3.3 |
| 878887 | 1.11834e+006 | 2.42 |
| 878837 | 1.1184e+006 | 2.16 |
| 878757 | 1.11793e+006 | 2.16 |
| 878674 | 1.11745e+006 | 2.16 |
| 878581 | 1.11693e+006 | 2.16 |

## 13. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 78466.8 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878837 | 1.1184e+006 | 2.16 |
| 878887 | 1.11834e+006 | 2.42 |
| 879209 | 1.1183e+006 | 1.32 |
| 879525 | 1.11826e+006 | 2.42 |
| 879838 | 1.11821e+006 | 1.32 |
| 880155 | 1.11817e+006 | 2.42 |
| 880220 | 1.11822e+006 | 2.16 |
| 879849 | 1.11827e+006 | 2.16 |
| 879545 | 1.11832e+006 | 2.16 |
| 879219 | 1.11835e+006 | 2.16 |

## 14. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 104549 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880220 | 1.11822e+006 | 2.16 |
| 880155 | 1.11817e+006 | 2.42 |
| 880000 | 1.11731e+006 | 3.3 |
| 879856 | 1.11645e+006 | 2.42 |
| 879900 | 1.11638e+006 | 2.16 |
| 880062 | 1.1173e+006 | 2.16 |

## 15. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 72824.6 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878885 | 1.11653e+006 | 2.16 |
| 879210 | 1.11648e+006 | 2.16 |
| 879524 | 1.11644e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |
| 879856 | 1.11645e+006 | 2.42 |
| 879533 | 1.11649e+006 | 1.32 |
| 879216 | 1.11654e+006 | 2.42 |
| 878905 | 1.11658e+006 | 1.32 |
| 878584 | 1.11663e+006 | 2.42 |
| 878523 | 1.11659e+006 | 2.16 |

## 16. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 55332.9 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878837 | 1.1184e+006 | 2.16 |
| 877929 | 1.11852e+006 | 2.16 |
| 877967 | 1.11846e+006 | 1.98 |
| 878757 | 1.11834e+006 | 3.52 |

## 17. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 58655.3 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877929 | 1.11852e+006 | 2.16 |
| 877794 | 1.11808e+006 | 2.16 |
| 877628 | 1.11753e+006 | 2.16 |
| 877688 | 1.11753e+006 | 3.52 |
| 877851 | 1.11806e+006 | 1.1 |
| 877967 | 1.11846e+006 | 1.98 |

## 18. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 52912 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877628 | 1.11753e+006 | 2.16 |
| 877913 | 1.11692e+006 | 2.16 |
| 878046 | 1.11666e+006 | 2.16 |
| 878076 | 1.11672e+006 | 1.98 |
| 877975 | 1.11693e+006 | 1.32 |
| 877688 | 1.11753e+006 | 3.52 |

## 19. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 107034 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879977 | 1.11644e+006 | 1.86 |
| 880144 | 1.11749e+006 | 1.376 |
| 880285 | 1.11818e+006 | 1.892 |
| 880220 | 1.11822e+006 | 2.16 |
| 880062 | 1.1173e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |

## 20. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 141551 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 879900 | 1.11638e+006 | 2.16 |
| 880270 | 1.11633e+006 | 2.16 |
| 880502 | 1.11649e+006 | 2.16 |
| 880969 | 1.11643e+006 | 2.16 |
| 882139 | 1.11626e+006 | 2.16 |
| 882095 | 1.11632e+006 | 1.892 |
| 880979 | 1.11648e+006 | 1.892 |
| 880490 | 1.11657e+006 | 1.987 |
| 880255 | 1.11641e+006 | 1.978 |
| 879977 | 1.11644e+006 | 1.806 |

## 21. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 68800.3 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882231 | 1.11694e+006 | 2.16 |
| 882314 | 1.11761e+006 | 2.16 |
| 882263 | 1.11759e+006 | 1.72 |
| 882178 | 1.11696e+006 | 1.548 |
| 882095 | 1.11632e+006 | 1.892 |
| 882139 | 1.11626e+006 | 2.16 |

## 22. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 138996 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 881307 | 1.1181e+006 | 2.16 |
| 880562 | 1.11845e+006 | 2.16 |
| 880220 | 1.11822e+006 | 2.16 |
| 880285 | 1.11818e+006 | 1.892 |
| 880555 | 1.11835e+006 | 1.892 |
| 881281 | 1.11805e+006 | 1.892 |
| 882263 | 1.11759e+006 | 1.72 |
| 882314 | 1.11761e+006 | 2.16 |

## 23. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 150341 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880220 | 1.11822e+006 | 2.16 |
| 880198 | 1.11829e+006 | 0 |
| 879849 | 1.11834e+006 | 0 |
| 879549 | 1.11838e+006 | 0 |
| 879228 | 1.11842e+006 | 0 |
| 878846 | 1.11847e+006 | 0 |
| 877885 | 1.1186e+006 | 0 |
| 877929 | 1.11852e+006 | 2.16 |
| 878837 | 1.1184e+006 | 2.16 |
| 879219 | 1.11835e+006 | 2.16 |
| 879545 | 1.11832e+006 | 2.16 |
| 879849 | 1.11827e+006 | 2.16 |

## 24. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 130672 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 877885 | 1.1186e+006 | 0 |
| 877742 | 1.1181e+006 | 0 |
| 877573 | 1.11753e+006 | 0 |
| 877836 | 1.11689e+006 | 0 |
| 878002 | 1.11659e+006 | 0 |
| 878046 | 1.11666e+006 | 2.16 |
| 877913 | 1.11692e+006 | 2.16 |
| 877628 | 1.11753e+006 | 2.16 |
| 877794 | 1.11808e+006 | 2.16 |
| 877929 | 1.11852e+006 | 2.16 |

## 25. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 273720 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 878002 | 1.11659e+006 | 0 |
| 878504 | 1.11652e+006 | 0 |
| 878870 | 1.11648e+006 | 0 |
| 879203 | 1.11642e+006 | 0 |
| 879526 | 1.11638e+006 | 0 |
| 879891 | 1.11632e+006 | 0 |
| 880306 | 1.11626e+006 | 0 |
| 880520 | 1.11643e+006 | 0 |
| 880964 | 1.11636e+006 | 0 |
| 882208 | 1.11618e+006 | 0 |
| 882139 | 1.11626e+006 | 2.16 |
| 880969 | 1.11643e+006 | 2.16 |
| 880502 | 1.11649e+006 | 2.16 |
| 880270 | 1.11633e+006 | 2.16 |
| 879900 | 1.11638e+006 | 2.16 |
| 879524 | 1.11644e+006 | 2.16 |
| 879210 | 1.11648e+006 | 2.16 |
| 878885 | 1.11653e+006 | 2.16 |
| 878523 | 1.11659e+006 | 2.16 |
| 878046 | 1.11666e+006 | 2.16 |

## 26. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 96270.2 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 882290 | 1.11691e+006 | 0 |
| 882388 | 1.11763e+006 | 0 |
| 882314 | 1.11761e+006 | 2.16 |
| 882231 | 1.11694e+006 | 2.16 |
| 882139 | 1.11626e+006 | 2.16 |
| 882208 | 1.11618e+006 | 0 |

## 27. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 26866.1 $ft^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

### Coordinates and Load

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880198 | 1.11829e+006 | 0 |
| 880220 | 1.11822e+006 | 2.16 |
| 880562 | 1.11845e+006 | 2.16 |
| 880566 | 1.11852e+006 | 0 |

### 28. Polygonal Load

| | |
|---|---|
| Load Type | Flexible |
| Area of Load | 129286 ft$^2$ |
| Depth | 0 ft |
| Installation Stage | Stage 1 |

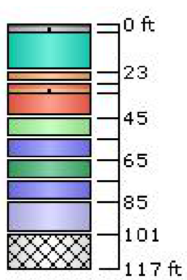
**Coordinates and Load**

| X [ft] | Y [ft] | Load Magnitude [ksf] |
|---|---|---|
| 880566 | 1.11852e+006 | 0 |
| 880562 | 1.11845e+006 | 2.16 |
| 881307 | 1.1181e+006 | 2.16 |
| 882314 | 1.11761e+006 | 2.16 |
| 882388 | 1.11763e+006 | 0 |
| 881341 | 1.11817e+006 | 0 |

## *Soil Layers*

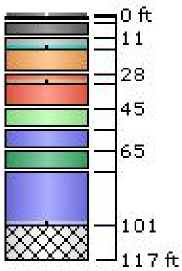
### A: (877446, 1.11798e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 4 | 0 |
| 2 | CL-ML | 0 | 4 |
| 3 | CH | 0 | 4 |
| 4 | CL-ML | 0 | 4 |
| 5 | ML | 19 | 4 |
| 6 | SP-SM | 5 | 23 |
| 7 | SP1 | 5 | 28 |
| 8 | SP3 | 0 | 33 |
| 9 | SP-SM | 0 | 33 |
| 10 | SP1 | 12 | 33 |
| 11 | SP2 | 10 | 45 |
| 12 | SP6 | 10 | 55 |
| 13 | SP4 | 10 | 65 |
| 14 | SP6 | 10 | 75 |
| 15 | SP5 | 16 | 85 |



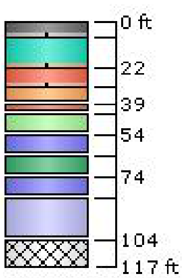

### B: (878312, 1.11813e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 1 | 0 |
| 2 | CL-ML | 3 | 1 |
| 3 | CH | 7 | 4 |
| 4 | CL-ML | 5 | 11 |
| 5 | ML | 0 | 16 |
| 6 | SP-SM | 12 | 16 |
| 7 | SP1 | 5 | 28 |
| 8 | SP3 | 0 | 33 |
| 9 | SP-SM | 0 | 33 |
| 10 | SP1 | 12 | 33 |
| 11 | SP2 | 10 | 45 |
| 12 | SP6 | 10 | 55 |
| 13 | SP4 | 10 | 65 |
| 14 | SP6 | 26 | 75 |
| 15 | SP5 | 0 | 101 |



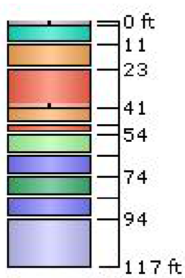

## C: (879125, 1.118e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 7 | 0 |
| 2 | CL-ML | 0 | 7 |
| 3 | CH | 0 | 7 |
| 4 | CL-ML | 0 | 7 |
| 5 | ML | 15 | 7 |
| 6 | SP-SM | 0 | 22 |
| 7 | SP1 | 9 | 22 |
| 8 | SP3 | 0 | 31 |
| 9 | SP-SM | 8 | 31 |
| 10 | SP1 | 5 | 39 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 20 | 84 |



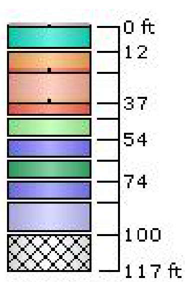

## D: (880239, 1.1174e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 2 | 0 |
| 2 | CL-ML | 0 | 2 |
| 3 | CH | 0 | 2 |
| 4 | CL-ML | 0 | 2 |
| 5 | ML | 9 | 2 |
| 6 | SP-SM | 12 | 11 |
| 7 | SP1 | 18 | 23 |
| 8 | SP3 | 0 | 41 |
| 9 | SP-SM | 8 | 41 |
| 10 | SP1 | 5 | 49 |
| 11 | SP2 | 10 | 54 |
| 12 | SP6 | 10 | 64 |
| 13 | SP4 | 10 | 74 |
| 14 | SP6 | 10 | 84 |
| 15 | SP5 | 23 | 94 |



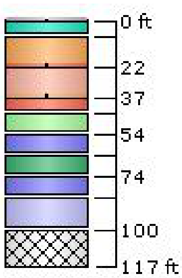

## E: (881475, 1.11721e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 0 | 0 |
| 2 | CL-ML | 0 | 0 |
| 3 | CH | 0 | 0 |
| 4 | CL-ML | 0 | 0 |
| 5 | ML | 12 | 0 |
| 6 | SP-SM | 10 | 12 |
| 7 | SP1 | 0 | 22 |
| 8 | SP3 | 15 | 22 |
| 9 | SP-SM | 0 | 37 |
| 10 | SP1 | 7 | 37 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 16 | 84 |




## F: (879164, 1.11706e+006)

| Layer # | Type | Thickness [ft] | Depth [ft] |
|---|---|---|---|
| 1 | CH | 0 | 0 |
| 2 | CL-ML | 0 | 0 |
| 3 | CH | 0 | 0 |
| 4 | CL-ML | 0 | 0 |
| 5 | ML | 7 | 0 |
| 6 | SP-SM | 15 | 7 |
| 7 | SP1 | 0 | 22 |
| 8 | SP3 | 15 | 22 |
| 9 | SP-SM | 0 | 37 |
| 10 | SP1 | 7 | 37 |
| 11 | SP2 | 10 | 44 |
| 12 | SP6 | 10 | 54 |
| 13 | SP4 | 10 | 64 |
| 14 | SP6 | 10 | 74 |
| 15 | SP5 | 16 | 84 |




## Soil Properties

| Property | CH | CL-ML | ML | SP-SM | SP1 | SP2 | SP3 | SP4 | SP5 | SP6 |
|---|---|---|---|---|---|---|---|---|---|---|
| Color | | | | | | | | | | |
| Unit Weight [kips/ft$^3$] | 0.113 | 0.111 | 0.111 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |
| Saturated Unit Weight [kips/ft$^3$] | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 | 0.115 |
| Immediate Settlement | Disabled | Disabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled | Enabled |
| Es [ksf] | | | 400 | 500 | 600 | 650 | 721 | 815 | 950 | 1100 |
| Esur [ksf] | | | 400 | 500 | 600 | 650 | 721 | 815 | 950 | 1100 |
| Primary Consolidation | Enabled | Enabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled |
| Material Type | Non-Linear | Non-Linear | | | | | | | | |
| Cc | 0.36 | 0.11 | | | | | | | | |
| Cr | 0.07 | 0.01 | | | | | | | | |
| e0 | 1.125 | 1.182 | | | | | | | | |
| Pc [ksf] | 5.1 | 4.26 | | | | | | | | |
| OCR | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Undrained Su A [kips/ft2] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Undrained Su S | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Undrained Su m | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Piezo Line ID | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## Groundwater

| | |
|---|---|
| Groundwater method | Piezometric Lines |
| Water Unit Weight | 0.0624 kips/ft$^3$ |

### Piezometric Line Entities

| ID | Depth (ft) |
|---|---|
| 1 | 0 ft |

## *Field Point Grid*

Number of points 19998
Expansion Factor 1

### Grid Coordinates

| X [ft] | Y [ft] |
|---|---|
| 884311 | 1.12052e+006 |
| 884311 | 1.11426e+006 |
| 875523 | 1.11426e+006 |
| 875523 | 1.12052e+006 |

**Appendix 11**

# DESIGN OF RIPRAP FOR PERIMETER BERM

12/26/06

<u>Sioux UWL Breach @</u> Blow hole. ①

RAPID PONDING to elev 430.1

MAX $\Delta h_2O$ = 435 (RR O.T.)

$\Delta h$ = 4.9'

MAX Flow = $CLH^{3/2}$ = $2.6 \times 160 \times 4.9^{3/2}$ = 4512 cfs.

---

Section

A-A

S = .0014

440 - 0

430 - 30

431 - 135 ] W-405'

430 - 250

430 - 435

433 - 448

435 - 470

from South Opening Spreadsheet.
D = 3.7'± for all flow thru south opening.
V = 2.8 fps.

---

Breach WAVE - (Impact Velocity.)

MAX DIFF = 4.9' (from above)

say 3' @ face of embankment.

for $V^2/2g$ = 3' V = $\sqrt{3 \times 64}$ = 13.8 fps impact. <u>NOT LIKELY</u>

---

initial flow path.


S = $\frac{4}{270}$ =  S = $\frac{3}{150}$

Z = 67.5  Z = 50

depth = 3.87'± V = 5.2 fps impact.
for Q = 4512 cfs.

check needed as a submerged weir. (see pg 2)

12/27/06

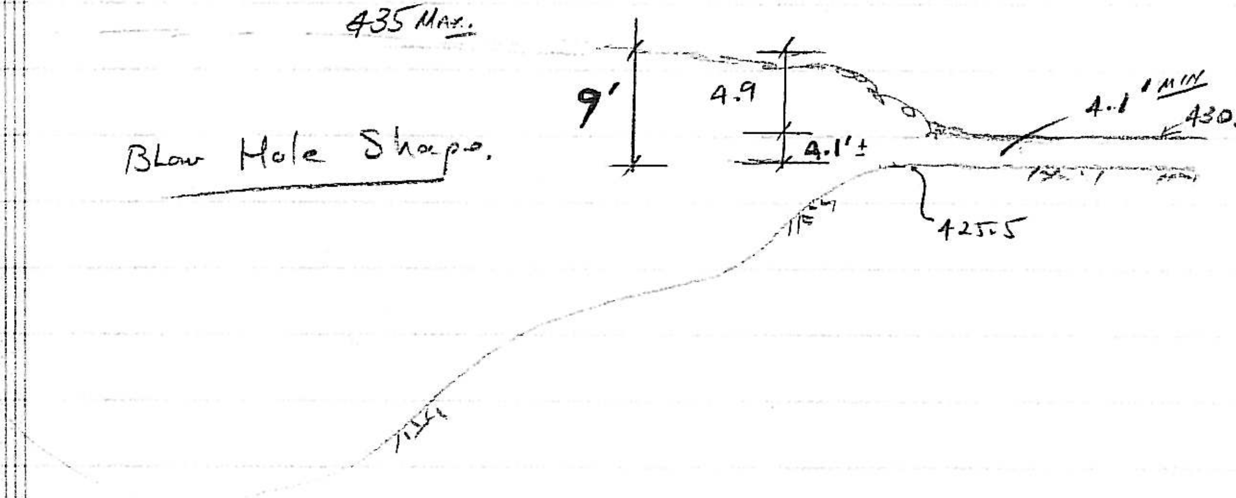
Sioux UWL Breach @ Blow hole (2)

For a Broad crested weir
max flow value occurs @ critical depth.

$Q = 3.087\ L H^{3/2}$ (KING & Brater 5-24)

$= 3.087 \times 160 \times 4.9^{3/2} = 5357$ cfs.

AS A SUBMERGED WEIR.




$H_1 = 9.0 \quad H_2 = 4.1$

$Q_1 = 2.8 \times 160 \times 9^{3/2} = 12096$ cfs.

from Fig 5-5

$\left(\frac{H_2}{H_1}\right)^n = \left(\frac{4.1}{9.0}\right)^{3/2} = 0.307 \quad \therefore \frac{Q}{Q_1} = 0.86$

$Q = 0.86 \times 12096 = 10\,402$ cfs

for $Q = 10\,402 \quad d = H_2 = 5.3'$± (from import flow spreadsheet)

if $H_1 = 9$ and $H_2 = 5.3$

$\left(\frac{H_2}{H_1}\right)^n = \left(\frac{5.3}{9}\right)^{1.5} = 0.45 \quad \frac{Q}{Q_1} = 0.79 \quad Q = .79 \times 12096 = 9555.$

$d = 5.1'$

use $d = 5.2' \quad Q = 9961 \quad v = 6.53$ fps.

South Exit Channel. $d = 6.0'$ elev = 436 to hi.

Q is slightly lower.

use V max e side channel = 3.8 fps.

Sioux UWL 12/27
Blowhole Breach. (3)

Conclusions. :

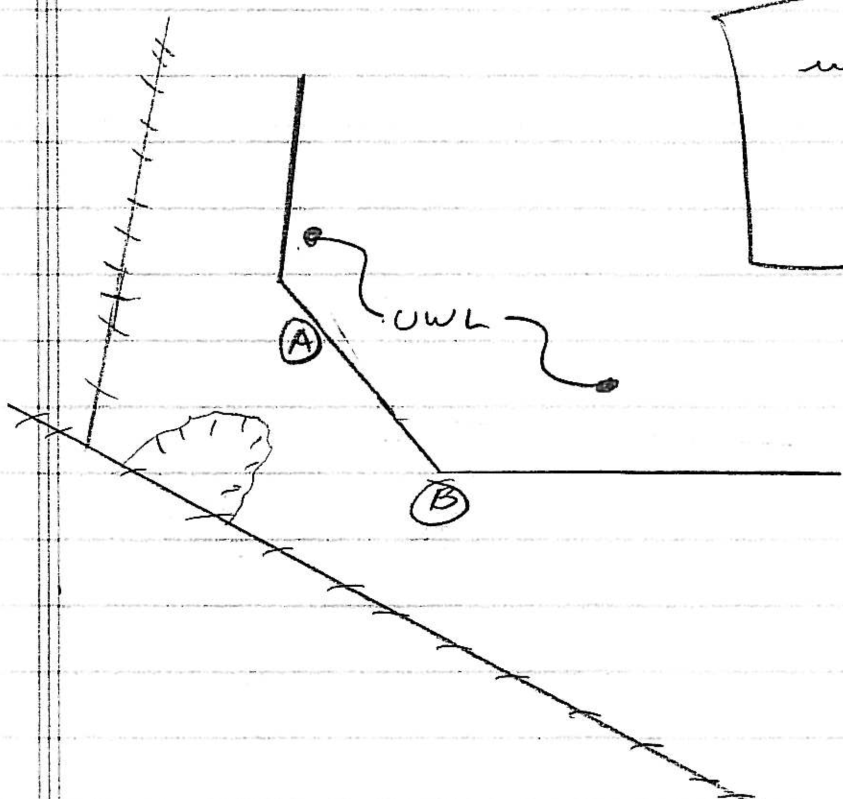
1) Ignore Narrow Openin @ N end

2) Max Breach Flow for 160' Wide Breach (a repeat of 1993) is ≈ 9800 cfs.

Impact Velocity on levee face ≈ 6.5 fps. (A)

Parallel Flow @ South Constriction.
Q = 9800 cfs. (B) $v \approx$ 3.9 fps say 4 fps.

use Min 15" Thick
9" to 4" over
2" Minus bedding

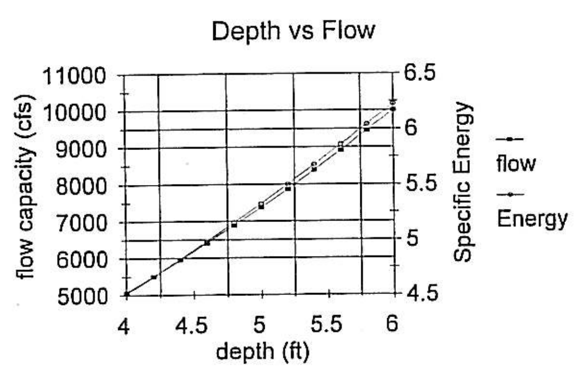


Channel Computation computed on **12/27/06**
by **DSE**

oject **Sioux UWL Breach flows**
**all flow to south**

| | | | | |
|---|---|---|---|---|
| Channel Slope | 0.0014 | Right Sideslope | | 2 |
| roughness factor | 0.045 | Left Sideslope | | 3 |
| bottom width | 405 | | | |
| Design Flow (cfs) | 9555.00 | Required A*R^(2/3) | | 7733.2202 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 4.00 | 425.00 | 1660.000 | 426.5934 | 3.89129 | 4106.80489 | 5.76 | 0.51 | 5074.28 | 4.514469 |
| 4.20 | 426.00 | 1745.100 | 427.6731 | 4.08045 | 4456.14459 | 5.48 | 0.47 | 5505.92 | 4.665516 |
| 4.40 | 427.00 | 1830.400 | 428.7527 | 4.26913 | 4816.94942 | 5.22 | 0.42 | 5951.72 | 4.823139 |
| 4.60 | 428.00 | 1915.900 | 429.8324 | 4.45732 | 5189.05933 | 4.99 | 0.39 | 6411.49 | 4.986216 |
| 4.80 | 429.00 | 2001.600 | 430.9121 | 4.64503 | 5572.32436 | 4.77 | 0.35 | 6885.04 | 5.153851 |
| 5.00 | 430.00 | 2087.500 | 431.9917 | 4.83227 | 5966.60361 | 4.58 | 0.33 | 7372.21 | 5.325329 |
| 5.20 | 431.00 | 2173.600 | 433.0714 | 5.01903 | 6371.76439 | 4.40 | 0.30 | 7872.81 | 5.500066 |
| 5.40 | 432.00 | 2259.900 | 434.1511 | 5.20533 | 6787.68150 | 4.23 | 0.28 | 8386.71 | 5.677586 |
| 5.60 | 433.00 | 2346.400 | 435.2307 | 5.39116 | 7214.23655 | 4.07 | 0.26 | 8913.75 | 5.857497 |
| 5.80 | 434.00 | 2433.100 | 436.3104 | 5.57653 | 7651.31740 | 3.93 | 0.24 | 9453.80 | 6.039472 |
| 6.00 | 435.00 | 2520.000 | 437.3901 | 5.76145 | 8098.81763 | 3.79 | 0.22 | 10006.72 | 6.223241 |

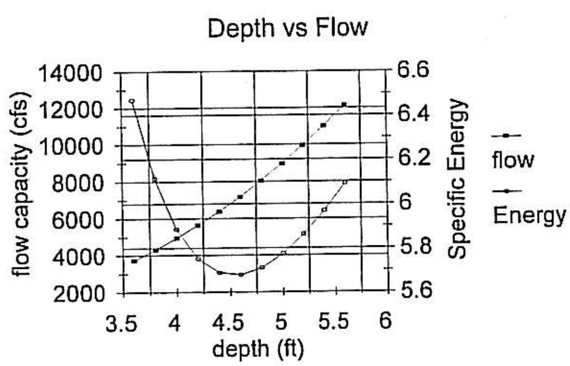


Channel Computation computed on 12/27/06
by **DSE**

oject **Sioux UWL Breach flows**
**impact flow channel**

| | | | |
|---|---|---|---|
| Channel Slope | 0.01 | Right Sideslope | 50 |
| roughness factor | 0.045 | Left Sideslope | 67.5 |
| bottom width | 1 | | |
| Design Flow (cfs) | 10402.00 | Required A*R^(2/3) | 3150.0000 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 3.60 | 424.00 | 765.000 | 424.0627 | 1.80398 | 1133.65881 | 13.60 | 2.87 | 3743.59 | 6.470946 |
| 3.80 | 447.50 | 852.150 | 447.5661 | 1.90396 | 1309.04707 | 12.21 | 2.31 | 4322.76 | 6.113746 |
| 4.00 | 471.00 | 944.000 | 471.0696 | 2.00395 | 1500.47901 | 11.02 | 1.89 | 4954.92 | 5.885401 |
| 4.20 | 494.50 | 1040.550 | 494.5731 | 2.10394 | 1708.51157 | 10.00 | 1.55 | 5641.88 | 5.751751 |
| 4.40 | 518.00 | 1141.800 | 518.0766 | 2.20392 | 1933.69254 | 9.11 | 1.29 | 6385.48 | 5.688747 |
| 4.60 | 541.50 | 1247.750 | 541.5801 | 2.30391 | 2176.56103 | 8.34 | 1.08 | 7187.49 | 5.679177 |
| 4.80 | 565.00 | 1358.400 | 565.0835 | 2.40389 | 2437.64811 | 7.66 | 0.91 | 8049.66 | 5.710526 |
| 5.00 | 588.50 | 1473.750 | 588.5870 | 2.50388 | 2717.47717 | 7.06 | 0.77 | 8973.71 | 5.773571 |
| 5.20 | 612.00 | 1593.800 | 612.0905 | 2.60386 | 3016.56443 | 6.53 | 0.66 | 9961.37 | 5.861424 |
| 5.40 | 635.50 | 1718.550 | 635.5940 | 2.70385 | 3335.41925 | 6.05 | 0.57 | 11014.30 | 5.968884 |
| 5.60 | 659.00 | 1848.000 | 659.0975 | 2.80383 | 3674.54452 | 5.63 | 0.49 | 12134.16 | 6.091976 |

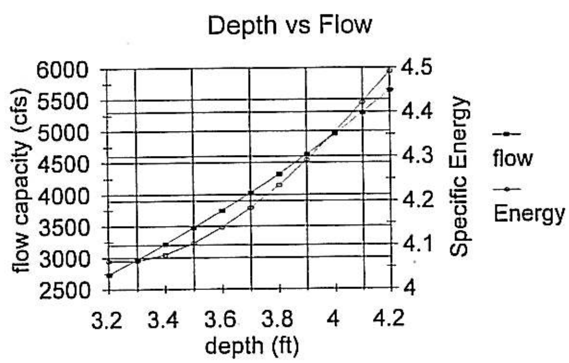


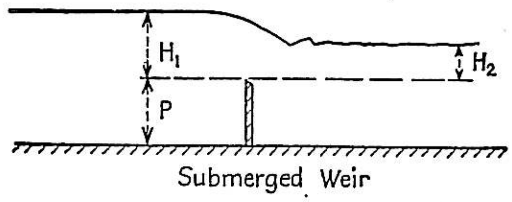
Channel Computation computed on 12/26/06
by DSE

oject **Sioux UWL Breach flows**
**impact flow channel**

| | | | |
|---|---|---|---|
| Channel Slope | 0.01 | Right Sideslope | 50 |
| roughness factor | 0.045 | Left Sideslope | 67.5 |
| bottom width | 1 | | |
| Design Flow (cfs) | 4512.00 | Required A*R^(2/3) | 1366.3526 |

| Depth | Top Width | Area | Wetted Perimeter | Hydraulic Radius | A*R^(2/3) | Velocity (fps) | Velocity Head | Capacity Manning Flow (cfs) | Specific Energy (D+Vel Hd |
|---|---|---|---|---|---|---|---|---|---|
| 3.20 | 377.00 | 604.800 | 377.0557 | 1.60401 | 828.73554 | 7.46 | 0.86 | 2736.67 | 4.064229 |
| 3.30 | 388.75 | 643.088 | 388.8074 | 1.65400 | 899.41557 | 7.02 | 0.76 | 2970.07 | 4.064385 |
| 3.40 | 400.50 | 682.550 | 400.5592 | 1.70399 | 973.74743 | 6.61 | 0.68 | 3215.53 | 4.078552 |
| 3.50 | 412.25 | 723.188 | 412.3109 | 1.75399 | 1051.80434 | 6.24 | 0.60 | 3473.29 | 4.104436 |
| 3.60 | 424.00 | 765.000 | 424.0627 | 1.80398 | 1133.65881 | 5.90 | 0.54 | 3743.59 | 4.140169 |
| 3.70 | 435.75 | 807.988 | 435.8144 | 1.85397 | 1219.38267 | 5.58 | 0.48 | 4026.67 | 4.18422 |
| 3.80 | 447.50 | 852.150 | 447.5661 | 1.90396 | 1309.04707 | 5.29 | 0.44 | 4322.76 | 4.235332 |
| 3.90 | 459.25 | 897.488 | 459.3179 | 1.95396 | 1402.72255 | 5.03 | 0.39 | 4632.10 | 4.29246 |
| 4.00 | 471.00 | 944.000 | 471.0696 | 2.00395 | 1500.47901 | 4.78 | 0.35 | 4954.92 | 4.354739 |
| 4.10 | 482.75 | 991.687 | 482.8214 | 2.05394 | 1602.38577 | 4.55 | 0.32 | 5291.43 | 4.421442 |
| 4.20 | 494.50 | 1040.550 | 494.5731 | 2.10394 | 1708.51157 | 4.34 | 0.29 | 5641.88 | 4.491962 |




H1
H2
P
Submerged Weir

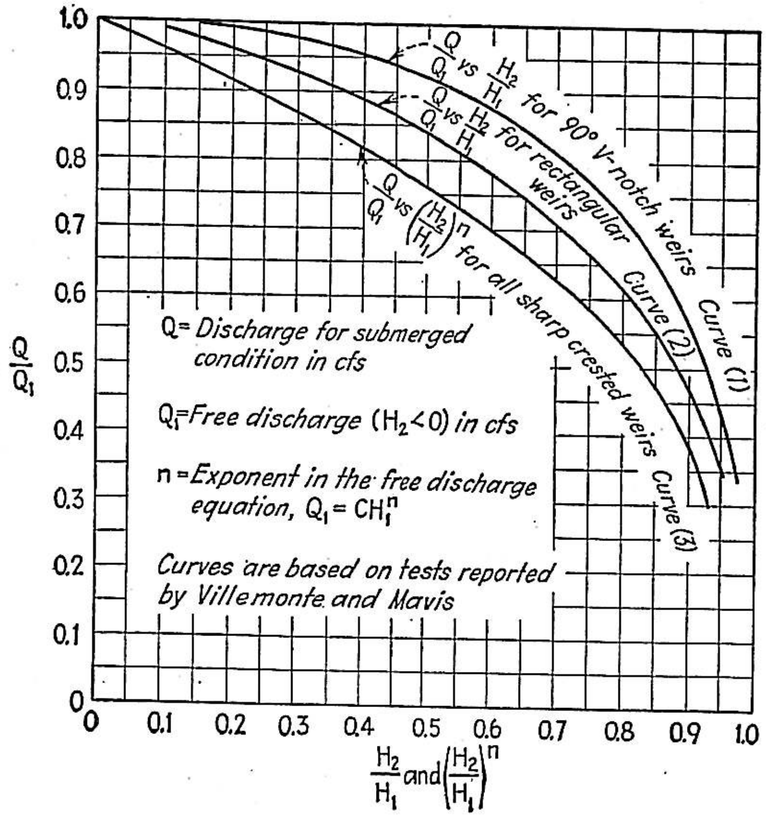

Q/Q1 vs H2/H1 for 90° V-notch weirs Curve (1)
Q/Q1 vs H2/H1 for rectangular weirs Curve (2)
Q/Q1 vs (H2/H1)^n for all sharp crested weirs Curve (3)
Q= Discharge for submerged condition in cfs
Q1=Free discharge (H2<0) in cfs
n =Exponent in the free discharge equation, Q1 = CH1^n
Curves are based on tests reported by Villemonte and Mavis
Q/Q1
H2/H1 and (H2/H1)^n
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

Fig. 5-5

SIOUX2

12/27/06

WEST Consultants, Inc.
2111 Palomar Airport Rd.
Suite 180
Carlsbad, CA 92009-1419

Riprap 2.0

PROGRAM OUTPUT
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USCOE Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2    Description: BREACH FAILURE

| | |
|---|---|
| Velocity | Average |
| Channel Type | Trapezoidal |
| Straight Channel | Yes |
| Bend Angle, ø | N/A |
| Average Channel Velocity, ft/sec | 6.50 |
| Bottom Width, ft | N/A |
| Minimum Centerline Bend Radius, ft | N/A |
| Water Surface Width, ft | N/A |
| Unit Weight of Stone, lbs/cu ft | 155.00 |
| Riprap Layer Thickness | 1.50 |
| Local Flow Depth, ft | 6.00 |
| Cotangent of Sideslope | 3.00 |
| Safety Factor | 2.00 |

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

| | |
|---|---|
| Computed Local Depth Average Velocity, ft/sec | 6.50 |
| Local Velocity / Avg. Channel Velocity | 1.00 |
| Correction for Layer Thickness | 0.88 |
| Side Slope Correction Factor | 1.01 |
| Correction for Secondary Currents | 1.00 |

*** Using Gradation from COE ETL 1110-2-120 ***

| | | |
|---|---|---|
| Computed D30, ft | 0.30 | |
| Specific Weight, pcf | 155.00 | |
| Layer Thickness, ft | 1.125 | (Increased by 50%) |
| Selected Minimum D30, ft | 0.37 | |
| Selected Minimum D90, ft | 0.53 | |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 14 | 34 |
| W50 | 7 | 10 |
| W15 | 2 | 5 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USBR Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2    Description: BREACH FAILURE

Average Channel Velocity, ft/sec    6.50

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Computed D50, ft    0.58

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.47 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 1.00 |
| Selected Minimum D30, ft | 0.49 |
| Selected Minimum D90, ft | 0.71 |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 32 | 81 |
| W50 | 16 | 24 |
| W15 | 5 | 12 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ USGS Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2    Description: BREACH FAILURE

Average Channel Velocity, ft/sec    6.50

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Computed D50, ft    0.96

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.79 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 1.75 |
| Selected Minimum D30, ft | 0.85 |
| Selected Minimum D90, ft | 1.23 |

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 174 | 435 |
| W50 | 87 | 129 |
| W15 | 27 | 64 |

ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ Isbash Method ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

Input Parameters:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
Run Name: SIOUX2    Description: BREACH FAILURE

| | |
|---|---|
| Average Channel Velocity, ft/sec | 6.50 |
| Unit Weight of Stone, lbs/cu ft | 155.00 |
| Turbulence Level | Low |

Output Results:
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

| | |
|---|---|
| Computed D50, ft | 0.31 |

*** Using Gradation from COE ETL 1110-2-120 ***

| | |
|---|---|
| Computed D30, ft | 0.25 |
| Specific Weight, pcf | 155.00 |
| Layer Thickness, ft | 0.75 |
| Selected Minimum D30, ft | 0.37 |
| Selected Minimum D90, ft | 0.53 |

use 9" to 4"

| Percent Lighter by Weight | Stone Weight, lbs Minimum | Maximum |
|---|---|---|
| W100 | 14 | 34 |
| W50 | 7 | 10 |
| W15 | 2 | 5 |

MIN 15" Thick on 2" min bedding.

# APPENDIX B

## HAZARD CLASSIFICATION

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**EVALUATION OF CCR UNITS**
**40 CFR PART 257**
**ST. CHARLES COUNTY, MISSOURI**

# APPENDIX B: PERIODIC HAZARD POTENTIAL CLASSIFICATION 257.74(a)(2)

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# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNITS
# ST. CHARLES COUNTY, MISSOURI

## APPENDIX B: PERIODIC HAZARD POTENTIAL CLASSIFICATION §257.74(a)(2)

## 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. The SEC is located within the floodplain of the Mississippi and Missouri Rivers and has one active CCR surface impoundments that is approximately 40-acres in size. The CCR surface impoundment, designated as Cell 2 (SCPD), is used for managing coal combustion residuals (CCR). SCPA, SCPB and SCPC no longer receive CCRs, have been dewatered, and are closed. SCPD is currently receiving CCRs. Decant water in SCPD discharges into the Recycle Pond where pumps recirculate the water back to the power plant. Cell 2 is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. A map showing the location of the surface impoundment and the Recycle Pond is attached as Figure 1.

### 1.1 Purpose

40 CFR Part §257.74(a)(2) requires the owner or operator of an existing surface impoundment to conduct an initial and periodic hazard potential classification assessment of the CCR unit. The owner or operator must document the hazard classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and each subsequent periodic classification was conducted in accordance with the requirements of §257.74(a)(2). The following documents Reitz & Jens, Inc.'s initial hazard potential classification evaluation for active surface impoundments SCPD at the Ameren Missouri Sioux Energy Center.

## 2.0 SIOUX ENEREGY CENTER CCR UNITS

SCPD is an active surface impoundment that is incised with perimeter berms extending above the natural ground surface. The surface impoundment locations and the centerline of the embankments are shown in Figure 1.

The initial hazard potential classification was determined for the active surface impoundment at the Sioux Energy Center based on the Federal Emergency Management Agency (FEMA) hazard potential classification criteria. Pertinent data regarding the surface impoundment is shown in Table 1.

**Table 1 – Active Surface Impoundment SCPD at the Sioux Energy Center**

| CCR Unit | Maximum Surface Area (acres) | Dam Height (feet) | Crest Length (feet) | Normal Pool Elevation (feet) |
|---|---|---|---|---|
| **SCPC (Cell 1 – Gypsum)** | 40.3 | 24 | 5,283 | 441.1 |

The FEMA classification system has three levels of Hazard Potential Classification: Low, Significant, and High. The hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests should the dam fail. The classification system relies heavily on judgement and common sense, because all possibilities cannot be defined. Allowances for evacuation or emergency actions by the population were not considered because emergency procedures should not be a substitute for appropriate design, construction, and maintenance of dam structures. A summary for the FEMA hazard classification system of dams is shown in Table 2.

**Table 2 - FEMA Hazard Classification System of Dams**

| Hazard Potential Classification | Loss of Human Life | Economic, Environmental, Lifeline Losses |
|---|---|---|
| **Low** | None expected | Low and generally limited to owner |
| **Significant** | None expected | Yes |
| **High** | Probable. One or more expected | Yes (but not necessary for this classification) |

## 2.1 SCPD (Cell 2)

SCPD is incised with a compacted earth fill embankment dam. The dam has a crest length of 5,283 lineal feet, minimum crest width of 12 feet, and the steepness of the side slopes is 3H to 1V. Currently, the maximum height of the dam is 24 feet. Gypsum slurry discharges into the cell at the approximate midpoint of the west embankment. The gypsum settles out into the pond and decant water flows into the Recycle Pond through a set of triple box culverts with an invert elevation of 441 feet. SCPD also has two emergency spillways on the north side of the impoundment. The bottom and side slopes of SCPD are lined with 80-mil HDPE liner, which was constructed over 24 inches of compacted, impervious clay.

Failure of SCPD would result in the release of water and CCR into the surrounding Ameren property and adjacent agricultural fields. Failure of the impoundment is not expected to cause a loss of human life, and the economic, environmental and lifeline losses are expected to be low and generally limited to the owner. Therefore, according to the FEMA Hazard Potential Classification of Dams, the SCPD should have a Low Hazard Potential Classification.

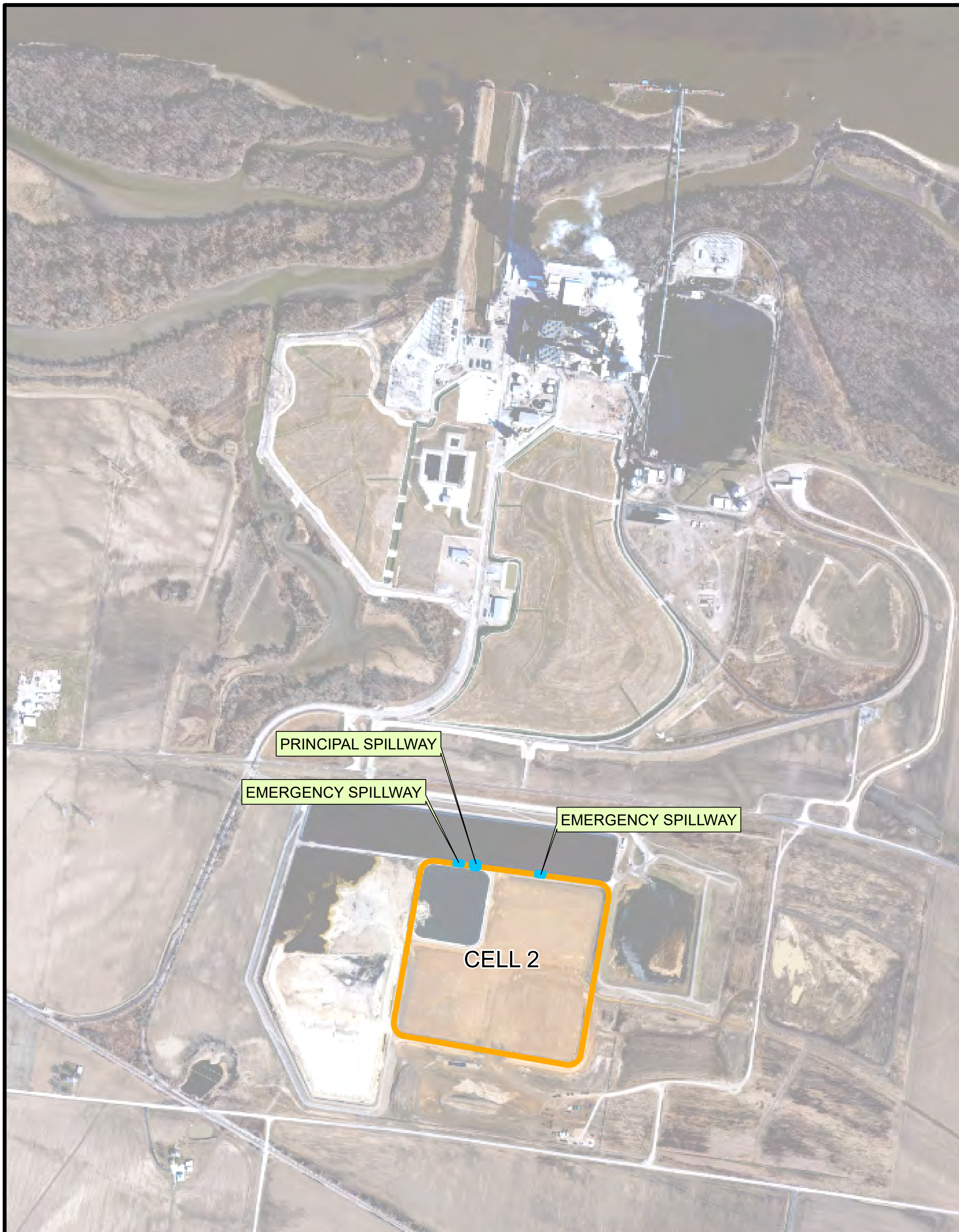
# 3.0 CONCLUSION

The initial hazard potential classifications for the active CCR surface impoundment SCPD at the Sioux Energy Center is Low Hazard Potential. The hazard potential classification should be re-evaluated within 5 years of the initial hazard potential classification.

# 4.0 REFERENCES

Environmental Protection Agency. (2015). "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule." 40 CFR Parts 257 and 261., Vol. 80, No. 74.

Federal Emergency Management Agency. (2004). "Federal Guidelines for Dam Safety, Hazard Potential Classification System for Dams." Interagency Committee on Dam Safety.




Legend
Embankment
Spillway

N

0 500 1,000 Feet

AMEREN MISSOURI
SIOUX ENERGY CENTER
ACTIVE CCR SURFACE IMPOUNDMENT
FIGURE 1

Ameren MISSOURI
REITZ & JENS, INC. CONSULTING ENGINEERS

# APPENDIX C

STRUCTURAL STABILITY ASSESSMENT

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**EVALUATION OF CCR UNITS**
**40 CFR PART 257**
**ST. CHARLES COUNTY, MISSOURI**

# APPENDIX C: INITIAL STRUCTURAL STABILITY ASSESSMENT 257.74(d)(1)

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**EVALUATION OF CCR UNITS**
**ST. CHARLES COUNTY, MISSOURI**

**APPENDIX C: INITIAL STRUCTURAL STABILITY ASSESSMENT 257.74(d)**

# 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. T The SEC is located within the floodplain of the Mississippi and Missouri Rivers and has one active CCR surface impoundments that is approximately 40-acres in size. The CCR surface impoundment, designated as Cell 2 (SCPD), is used for managing coal combustion residuals (CCR). SCPA, SCPB and SCPC no longer receive CCRs, have been dewatered, and are closed. SCPD is currently receiving CCRs. Decant water in SCPD discharges into the Recycle Pond where pumps recirculate the water back to the power plant. Cell 2 is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. A map showing the location of the surface impoundment and the Recycle Pond is attached as Figure 1.

## 1.1 Purpose

40 CFR Part 257.74(d)(1) specifies that the owner or operator of all existing CCR surface impoundments, except for incised CCR units, shall conduct initial and periodic structural stability assessments and document whether the design, construction, operation and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein.

The purpose of this periodic structural stability assessment for the SCPD at the Sioux Energy Center is to provide the information required by 40 CFR Part 257.74(d)(1). The initial structural stability assessment consisted of field inspections, design and construction document review. The SCPD is a new CCR surface impoundment, no operation and maintenance records were available for review. Additional information for SCPD at the Sioux Energy Center is included in the History of Construction Report.

# 2.0 FIELD INSPECTION

Reitz & Jens was the lead Construction Quality Assurance (CQA) firm during construction of SCPD at the Sioux Energy Center from the start of construction on April 19, 2022 to completion on December 6, 2023. Reitz & Jens was responsible for Quality Control (QC) pertaining to construction of general fill, clay liner, crushed rock pavement and other fill materials, and CQA for the HDPE membrane, HDPE pipes, and other appurtenances such as revetments, spillways and perimeter fence. The field operations were performed under the direction of Melissa Choflet, EI and under the oversight of Jeff Bertel, PE.

Reitz & Jens documented observations, test results and narratives of field activities from Reitz & Jens' engineers and soil technicians in Daily Field Reports. The daily field reports and additional supporting documentation including soil laboratory test results, the contractors QC test results and third-party conformance test data were compiled in Construction Quality Assurance (CQA) Reports and submitted to the Missouri Department of Natural Resources (MDNR) Waste Management Program (WMP). The following CQA reports were prepared and submitted for review:

1. Interim Cell 2 Construction Quality Assurance (CQA) Report, Part 1 – Clay Liner and Berms, Rev. October 6, 2022
2. Interim Cell 2 Construction Quality Assurance (CQA) Report, Part 2 – HDPE Geomembrane and Appurtenances, Rev. November 2, 2022
3. Cell 2 Construction Quality Assurance (CQA) Report, Part 1 – Clay Liner and Berms, Revised November 10, 2023
4. Cell 2 Construction Quality Assurance (CQA) Report, Part 1 – HDPE Geomembrane and Appurtenances, Revised November 10, 2023
5. Cell 2 Construction Quality Assurance (CQA) Report, Part 3 – HDPE Pipes and Appurtenances, December 27, 2023

All CQA reports were certified that the construction was in accordance with the intent of the construction plans and specifications and the requirements of the MDNR Construction Permit. The CQA reports are attached as Appendix I to this report. The WMP reviewed the reports for compliance with the Missouri State Solid Waste Management Law and the terms and conditions of Permit Number 0918301. The WMP concluded that compliance was satisfactorily demonstrated and issued an Authorization to Operate (ATO) on November 17, 2023.

## 2.1 SCPD

### 2.1.1 Embankment and Foundation Stability

The Cell 2 subgrade was stripped 6 to 18 inches across the cell floor depending on the thickness of topsoil as determined by Reitz & Jens field observations, and 18 inches at the berm locations. Prior to fill placement, the subgrade was inspected to confirm a suitable thickness of topsoil had been removed, and then it was proof-rolled with a scraper pulling one or two loaded pans. Reitz & Jens' geotechnical engineer observed the proof-roll. The subgrade was approved for fill placement if it was not yielding or pumping. If yielding or pumping was observed the subgrade was scarified with a disc and allowed to dry, compacted and proof-rolled.

General fill placed for the Cell 2 floor, berms and anchor trenches was imported from Ft. Belle Quarry and generally consisted of silty clay with varying amounts of silt and clay. Laboratory tests were run on samples of the soil which included Atterberg liquid and plastic limit tests, grain-size distribution, and standard Proctor moisture-density tests. The testing was supplemented by historical soil laboratory tests by Reitz & Jens. The soils from the Ft. Belle Quarry borrow source were determined to be suitable for general fill.

The imported fill was placed and graded on the cell floor and berms into approximate 12-inch loose lifts by a GPS-equipped dozer prior to compaction. The fill was generally too wet when it arrived onsite and required moisture conditioning which was achieved by discing. The fill was compacted with padfoot compactors that was supplemented as needed with wheel rolling by scrapers pulling loaded pans. Backfill from the anchor trenches generally consisted of general fill excavated from the berms to form the trenches. Anchor trenches were backfilled in two twelve-inch lifts and compacted with a vibrating plate tamper attached to an excavator.

Each lift of fill was tested and approved prior to placement of the subsequent lift. Fill that initially failed to meet the moisture and density requirements was reworked as necessary with additional compaction and/or conditioned to increase or lower the moisture content and compacted until a passing test was measured.

The site was closed for winter and no work was performed. Once work resumed, all surfaces across the cell and on the berms were scarified 6 to 8 inches deep with the disc, recompacted with the CAT 815, and tested to ensure sufficient compaction of the subgrade which had been unprotected over the winter.

Compilations of all field moisture/density tests for general fill placed on the cell floor, perimeter berms and anchor trenches are presented in the CQA Reports in Appendix A. The maximum measured dry unit weight was 116.6 pcf, the minimum measured dry unit weight was 95.6 pcf, and the average measured dry unit weight was 105.4 pcf. The compaction criterion for the cell floor, berms and anchor trench was a minimum of 95% of the maximum dry unit weight determined from the standard Proctor Moisture-Density Test (ASTM D698).

### 2.1.2 Slope Protection

The upstream slopes are lined with 80 mil HDPE geomembrane liner up to el. 444. The liner provides sufficient slope protection to prevent erosion from wave action from impounded water. The downstream slopes are vegetated. The existing CCR Units at the UWL also have vegetated downstream slopes which have provided adequate slope protection to prevent surface erosion.

### 2.1.3 Hydraulic Structures

The principal spillway for SCPD is a set of three box culverts. Each box culvert has a width of 6 feet and height of 3 feet. The flowline of the box culverts is at elevation 441 feet. The box culverts discharge into the Recycle Pond. The precast concrete box culverts were placed with a crane without damage to the HDPE geomembrane or clay liner. Reitz & Jens performed the field density tests on the MoDOT Type 5 backfill that was placed and compacted around the effluent structure box culverts. The spillway construction drawings are presented in Figure 7.

SCPD also has two broad crested weir emergency spillway located near the northeast corner of the impoundment. The spillway is lined with concrete. The spillway invert elevation is at 445.0 feet. At the invert elevation the spillway has a width of 12 feet, and the sides are tapered up to the top of the embankment elevation over a distance of 12 feet. Reitz & Jens observed placement of aggregate beneath the structures, concrete, dowels and joint material. The concrete placement was observed to be in accordance with the plans and specifications. A typical cross-section of the emergency spillway is shown in the construction drawings presented in Figure 3.

#### 2.1.4 SCPD Conclusions

Cell 2 was constructed in accordance with the intent of the construction plans and specifications and the requirements of the Construction Permit for the Ameren Missouri Sioux Utility Waste Landfill.

## 3.0 OPERATIONS AND MAINTENANCE REVIEW

The available operations and maintenance records were reviewed as part of the periodic structural stability assessment. The review included the Operation and Maintenance (O&M) Manual for SCPC and Recycle Pond. The O&M Manuals specifies minimum requirements for surveillance, maintenance and establishes operational requirements for CCR placement. The manual states that no alterations or repairs to structural elements should be made without the approval of the Chief Dam Safety Engineer. The O&M Manual is attached in Appendix A of the *Ameren Missouri Sioux Energy Center: Evaluation of CCR Units* report.

### 3.1 SCPD

#### 3.1.1 Operations

The SCPD receives gypsum sluice flow. There is no contributing watershed to the impoundment outside of the perimeter dike. Gypsum slurry is discharged near the center of the west embankment. Flow is conveyed south to north towards the box culverts that discharge into the Recycle Pond. The gypsum stack is spreading radially from the gypsum slurry discharge location along the east embankment.

Table 1 includes pertinent data regarding the volume and depth of impounded CCR in the SCPD.

**Table 1 - Volume and Depth of Impounded CCR in the SCPD**

| CCR Unit | Est. Volume of Water and CCR (CY) | Est. Bottom Elev. of CCR Unit (feet) | Est. Minimum CCR Elev. (feet) | Est. Minimum Depth of CCR (feet) | Est. Maximum CCR Elev. (feet) | Est. Maximum Depth of CCR (feet) |
|---|---|---|---|---|---|---|
| **SCPC (Cell 2 – Gypsum)** | 54,500 | 432 | 432 | 0 | 441.1 | 8.1 |

There was no instrumentation installed for monitoring the SCPD pool level. Pool levels relative to the flowline of the box culverts are recorded during weekly inspections. The normal pool elevation is 441.1 feet, which is approximately the flowline of the box culverts. The normal pool elevation is 3.9 feet below the emergency spillway elevation.

Ameren states there are no planned operational changes for the SCPD. Prior to the next periodic structural stability assessment, a topographic survey of the pond interior will be required to update the estimated volume and depth of impounded CCR.

#### 3.3.2 Maintenance

Weekly and annual inspection check sheets for SCPD are included in Appendix I. The Sioux UWL Cells 1, 2 & 4A and Recycle Pond O&M manual outline objectives, responsibilities, and procedures for Ameren personnel who are responsible for the management of the Sioux CCR units. The embankments of the CCR units are visually inspected weekly by Ameren plant operations staff. Ameren Missouri Dam Safety Group personnel perform annual inspections and periodic inspections or assessments with plant operations staff.

# 4.0 DESIGN AND CONSTRUCTION DOCUMENT REVIEW

## 4.1 SCPD

### 4.1.1 Embankment and Foundation Stability

The safety factor assessment is provided in the *Ameren Missouri Sioux Energy Center: Evaluation of CCR Units* report Appendix D. This report shows that the minimum factors of safety specified in 40 CFR Part 257.74(d)(1) for the critical embankment cross sections are achieved for the range of loading expected.

### 4.1.2 Slope Protection

The perimeter berm was designed with vegetated downstream slopes and upstream slopes lined with 80-mil HDPE. Based on observations during previous Annual and Periodic Structural Stability Assessments the slopes of the existing CCR Units at the Sioux UWL appear to be functioning adequately. There is good sod cover on the downstream slopes and there were no tears or punctures in the liner.

### 4.1.3 Spillway

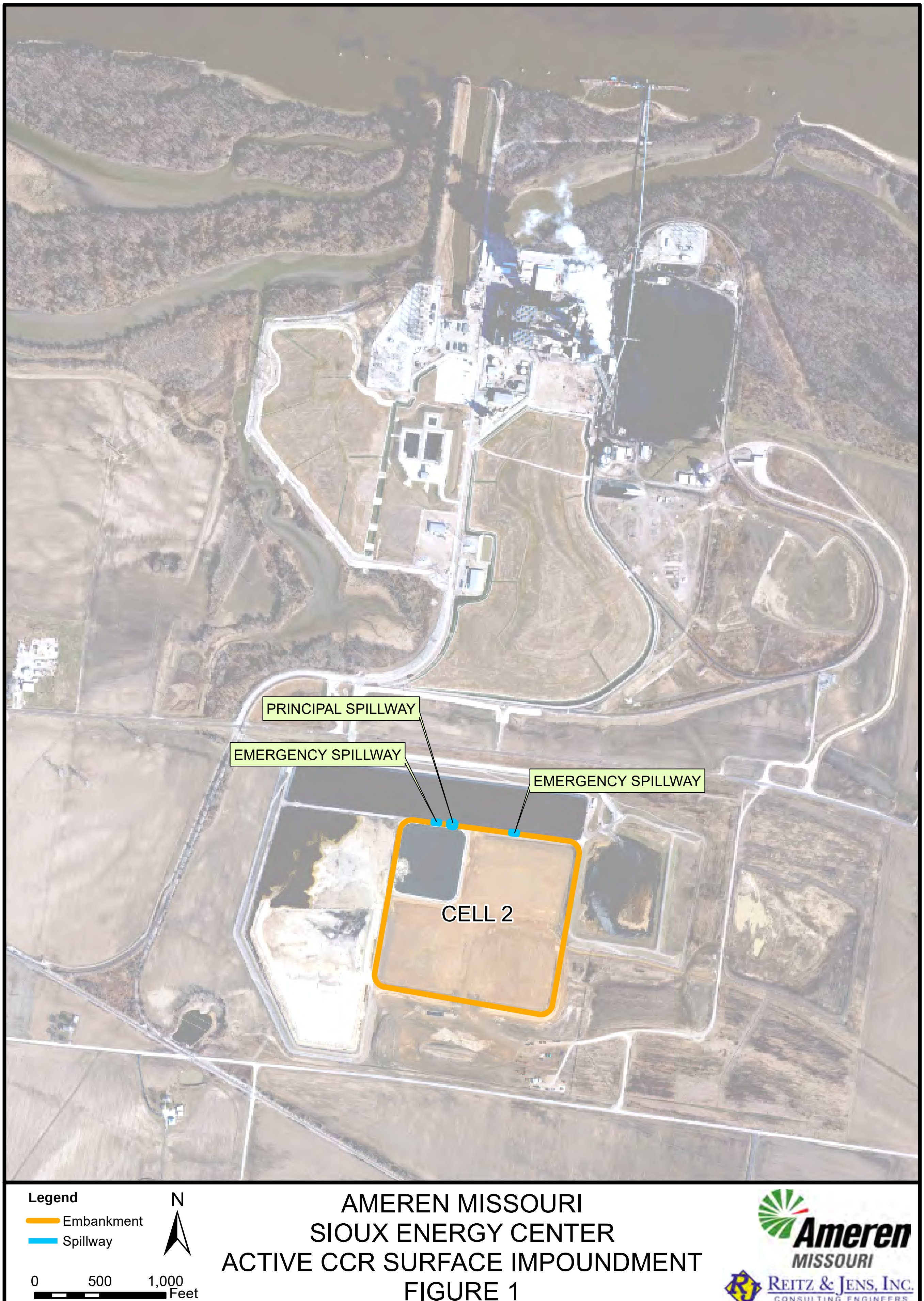
The principal spillway for SCPC is a set of triple box culverts that discharge into the Recycling Pond. The *Ameren Missouri Sioux Energy Center: Evaluation of CCR Units* report in Appendix E shows that the outlet works adequately manages flow during the 24-hour, 100-year storm event.

# 5.0 INITIAL STRUCTURAL STABILITY ASSESSMENT SUMMARY

The initial periodic structural stability assessment found no structural stability deficiencies, no significant issues with the operations and maintenance, and that the design and construction of the embankments and spillways were adequate for the range of loading conditions under which the CCR unit should be subjected.

## 6.0 REFERENCES

Environmental Protection Agency. (2015). "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule." 40 CFR Parts 257 and 261., Vol. 80, No. 74.




AMEREN MISSOURI
SIOUX ENERGY CENTER
ACTIVE CCR SURFACE IMPOUNDMENT
FIGURE 1

Ameren MISSOURI

REITZ & JENS, INC. CONSULTING ENGINEERS

# APPENDIX I

## SCPD WEEKLY INSPECTION CHECK SHEET
## SCPD ANNUAL INSPECTION CHECK SHEET

**SIOUX ENERGY CENTER**
Cell 2 (SCPD)
Weekly Inspection Checklist

| | |
|---|---|
| Date | |
| Inspector | |
| River Level | |
| Temperature | |
| Weather | |

| | Item | Condition Code | Comments |
|---|---|---|---|
| Earth Embankment | Vertical & Horizontal Alignment of Crest | | |
| | Seepage/Wetness/ Ponding Areas | | |
| | Erosion/Rutting | | |
| | Vegetation | | |
| | Sloughs/Slides/Cracks | | |
| | Animal Control | | |
| | Perimeter Roads and Ramps | | |
| | Perimeter Drainage Swale | | |
| | Other | | |
| Interim Cell 2 | HDPE Liner | | |
| | Emergency Spillway | | |
| | Imminent Discharge thru Emergency Spillway | | |
| | Effluent Structure | | |
| | Interim/Primary Spillway | | |
| | Sump Outlet and Gravel Cover | | |
| | Other | | |

Note location of observation on attached plan sheet

**Sioux Energy Center**
**Ash Pond Weekly Inspection Checklist**

| | Item | Condition Code | Comments |
|---|---|---|---|
| Primary Cell 2 | HDPE Liner | | |
| | Emergency Spillway | | |
| | Imminent Discharge thru Emergency Spillway | | |
| | Offloading Station and ABM | | |
| | Gypsum Slurry Pipes | | |
| | Gypsum Slurry Flowing Unobstructed | | |
| | Height from Discharge Pipe FL to Gypsum Level | | |
| | Eastern Sump Outlet and FCM | | |
| | Western Sump Outlet and FCM | | |
| | Northeast Bottom Drain Outlet and FCM | | |
| | Northwest Bottom Drain Outlet and FCM | | |
| | Southeast Bottom Drain Outlet and FCM | | |
| | Southwest Bottom Drain Outlet and FCM | | |
| | Stormwater Discharge from Cell 4A | | |
| | Fencing | | |
| | Other | | |

Note location of observation on attached plan sheet

**SIOUX ENERGY CENTER**
Recycle Pond and Cell 4A (SCL4A)
Weekly Inspection Checklist

| | |
|---|---|
| Date | |
| Inspector | |
| River Level | |
| Temperature | |
| Weather | |

| | |
|---|---|
| Recycle Pond Level by Visual Reading: | |
| Recycle Pond Level Reading through DCS: | |

| | Item | Condition Code | Comments |
|---|---|---|---|
| Recycle Pond | Erosion, sloughing, sliding, seepage | | |
| | Condition of grass cover, woody vegetation, burrows | | |
| | Recycle Pond between EL. 428 and 443 | | |
| | Settlements, Depressions, or Cracks in Embankment | | |
| | Effluent Pump Intake Structures (when visible) | | |
| | Gravel Ballast Covering Pump Intake Pipes | | |
| | Damage to transducer level controls or pipes | | |
| | Unevenness, movement of triple box culverts | | |
| | HDPE Recirculation Pipe | | |
| | Pump House Sump Discharge Pipe | | |
| | Erosion/Rutting of Gravel Top & Perimeter Roads | | |
| | HDPE Liner | | |
| | Precast Concrete Revetments Below Box Culverts | | |
| | Precast Concrete Revetments Below Discharge Pipes | | |
| | Emergency Spillway | | |
| | Imminent Discharge through Emergency Spillway | | |

Note location of observation on attached plan sheet

| | Item | Condition Code | Comments | | | |
|---|---|---|---|---|---|---|
| Cell 4A | Condition of Vegetative Cover | | | | | |
| | Erosion, sloughing, sliding, boils, seepage | | | | | |
| | Settlement, depression or crack in embankment | | | | | |
| | Interior Drainage/Sump Pump | | | | | |
| | Leachate Vault, Pipes and Pump Controls | | | | | |
| | Leachate Discharge (color and/or sediment) | | | | | |
| | Leachate Time from hour meter and level readings | | Hour Readings | | Level (inches) | |
| Other | Holes or breaks in perimeter fence, vandalism | | | | | |
| | Main and emergency gates locked | | | | | |

Drive slowly around tops of embankments looking for visible signs of present or developing major problems. Indicate location(s) of problems or anomalies on inspection plan - sign, date and attach sheet to report.

If a problem is noted, email or FAX report to appropriate persons. If emergency condition is noted, immediately contact the Shift Operations Supervisor and Chief Dam Safety Engineer.

## Condition Codes

| | | |
|---|---|---|
| **EC** | Emergency Condition | A serious dam safety condition exists that need immediate action. Emergency measures implemented as instructed by Chief Dam Safety Engineer; pool draw down, work stoppage, plant stoppage. |
| **IM** | Immediate Maintenance | Item needing immediate maintenance to restore or ensure its safety and integrity. Remediation should be complete within 1 month or as required. |
| **MM** | Minor Maintenance | Item needing minor maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled. |
| **OB** | Observation | Condition requires regular observation and potential future minor maintenance. |
| **GC** | Good Condition | |
| **NE** | No evidence of a problem | |
| **NI** | Not Inspected | State reason in comment column. |

Note location of observation on attached plan sheet

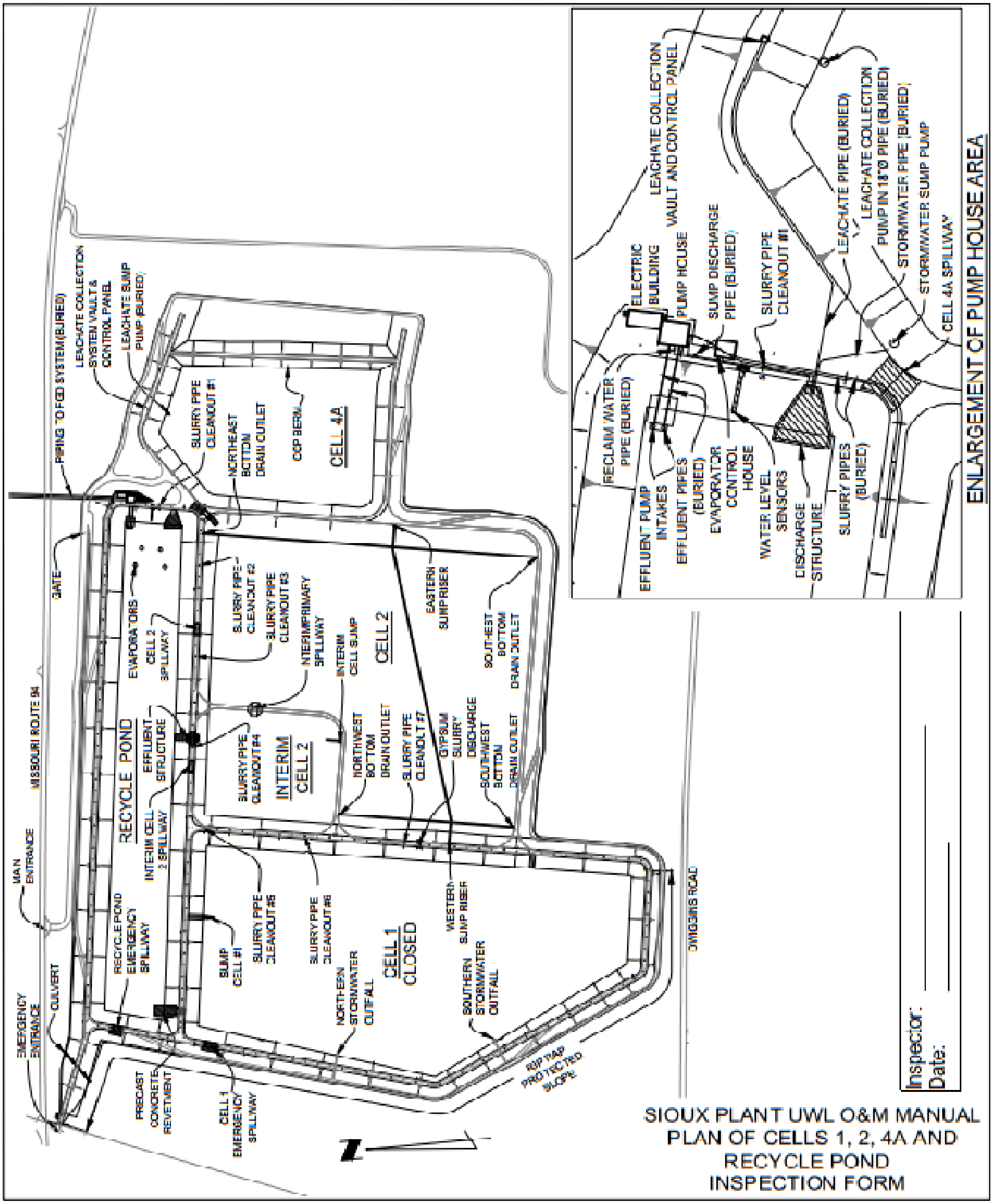
**SIOUX ENERGY CENTER**
Cell 1 (SCPC)
Weekly Inspection Checklist

| | |
|---|---|
| Date | |
| Inspector | |
| River Level | |
| Temperature | |
| Weather | |

| | Item | Condition Code | Comments |
|---|---|---|---|
| Closure Cap | Erosion/Rutting | | |
| | Vegetation | | |
| | Settlement/ Depressed Areas/ Ponding | | |
| | Other | | |
| Earth Embankment | Vertical & Horizontal Alignment of Crest | | |
| | Seepage/Wetness/ Ponding Areas | | |
| | Perimeter Roads and Ramps | | |
| | Erosion/Rutting | | |
| | Fencing | | |
| | Vegetation | | |
| | Sloughs/Slides/Cracks | | |
| | Riprap | | |
| | Animal Control | | |
| | Settlement Along Outfall Alignments | | |
| | Backflow Preventers | | |
| | Erosion Downstream of Outfalls | | |
| | Unusual/Discolored/ Sediment Discharge from Outfalls | | |

Note location of observation on attached plan sheet

**Sioux Energy Center**
**Ash Pond Weekly Inspection Checklist**




Note location of observation on attached plan sheet

**Sioux Energy Center**
Cell 2
Annual Inspection Checklist

| | |
|---|---|
| **Date** | |
| **River Level** | |
| **Temperature** | |
| **Weather** | |
| **Inspector** | |

**Date of Previous Annual Inspection:** ____________________
**Date of Previous Periodic Inspection:** ____________________

**Description of Emergency (EC) or Immediate Maintenance (IM) conditions observed since the last annual inspection**:

**Describe any action taken to restore or improve safety and integrity of impounding structure**:

**Describe any modifications to the geometry of the impounding structure since the previous annual inspection**:

**Describe any modifications to the operation of the impounding structure since the previous annual inspection**:

**List the approximate remaining storage capacity of the impounding structure:** ______________CY

**List the approximate maximum, minimum, and present depth and elevation of the impounded water in Interim Cell 2 since the previous annual inspection:**

**List the approximate maximum, minimum, and present depth and elevation of the impounded CCR in Interim Cell 2 since the previous annual inspection:**

**List the approximate volume of CCR at the time of inspection:** ______________CY

**Describe any changes to the downstream watershed:**

| | |
|---|---|
| **Date** | |
| **Inspector** | |

| | Item | Conditon Code* | Comments |
|---|---|---|---|
| **Earth Embankment** | **Vertical & Horizontal Alignment of Crest** | | |
| | **Seepage/Wetness/ Ponding Areas** | | |
| | **Erosion/Rutting** | | |
| | **Vegetation** | | |
| | **Sloughs/Slides/Cracks** | | |
| | **Animal Control** | | |
| | **Perimeter Roads and Ramps** | | |
| | **Perimeter Drainage Swale** | | |
| | **Other** | | |
| **Interim Cell 2** | **HDPE Liner** | | |
| | **Emergency Spillway** | | |
| | **Imminent Discharge thru Emergency Spillway** | | |
| | **Effluent Structure** | | |
| | **Interim/Primary Spillway** | | |
| | **Sump Outlet and Gravel Cover** | | |
| | **Other** | | |

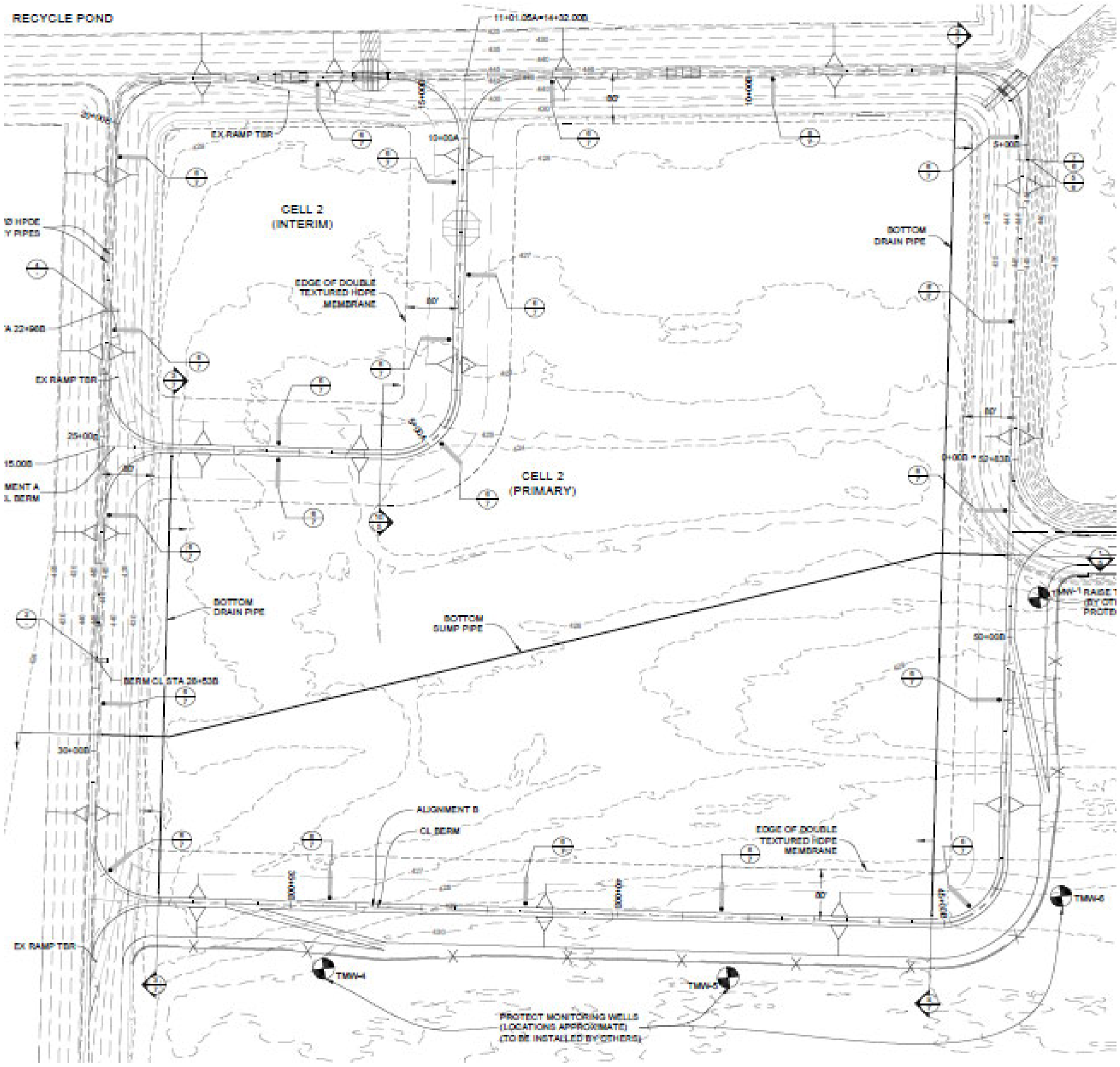
Note location of observation on attached plan sheet

| | |
|---|---|
| **Date** | |
| **Inspector** | |

| | Item | Conditon Code* | Comments |
|---|---|---|---|
| **Cell 2 (Primary)** | **HDPE Liner** | | |
| | **Emergency Spillway** | | |
| | **Imminent Discharge thru Emergency Spillway** | | |
| | **Offloading Station and ABM** | | |
| | **Gypsum Slurry Pipes** | | |
| | **Gypsum Slurry Flowing Unobstructed** | | |
| | **Height from Discharge Pipe FL to Gypsum Level** | | |
| | **Eastern Sump Outlet and FCM** | | |
| | **Western Sump Outlet and FCM** | | |
| | **Northeast Bottom Drain Outlet and FCM** | | |
| | **Northwest Bottom Drain Outlet and FCM** | | |
| | **Southeast Bottom Drain Outlet and FCM** | | |
| | **Southwest Bottom Drain Outlet and FCM** | | |
| | **Stormwater Discharge from Cell 4A** | | |
| | **Fencing** | | |
| | **Other** | | |

Note location of observation on attached plan sheet

| | |
|---|---|
| **Date** | |
| **Inspector** | |




*** Condition Codes**

| | |
|---|---|
| **EM** | Emergency Condition. A serious dam safety condition exists that needs immediate action; Emergency measures implemented as instructed by Chief Dam Safety Engineer, pool drawdown, work stoppage, plant stoppage. |
| **IM** | Immediate Maintenance. Item needing immediate maintenance to restore or ensure its safety and integrity. Remediation should be completed within 1 month or as required. |
| **MM** | Minor Maintenance. Item needing minor maintenance and/or repairs within the year. The safety or integrity of the item is not yet imperiled. |

# APPENDIX D

## SAFETY FACTOR ASSESSMENT

# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNITS
# 40 CFR PART 257
# ST. CHARLES COUNTY, MISSOURI

## APPENDIX D: SAFETY FACTOR ASSESSMENT §257.74(e)

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# AMEREN MISSOURI SIOUX ENERGY CENTER
# EVALUATION OF CCR UNITS
# ST. CHARLES COUNTY, MISSOURI

## APPENDIX D: SAFETY FACTOR ASSESSMENT §257.74(e)

## 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. The SEC is located within the floodplain of the Mississippi and Missouri Rivers and has one active CCR surface impoundment that is approximately 40-acres in size. The CCR surface impoundment, designated as Cell 2 (SCPD), is used for managing coal combustion residuals (CCR). SCPA, SCPB and SCPC no longer receive CCRs, have been dewatered, and are closed. SCPD is currently receiving CCRs. Decant water in SCPD discharges into the Recycle Pond where pumps recirculate the water back to the power plant. Cell 2 is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. A map showing the location of the surface impoundment and the Recycle Pond is attached as Figure 1.

### 1.1 Purpose

40 CFR §257.73(e) requires that the owner or operator of an existing CCR surface impoundment conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum factors of safety for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments should be supported by appropriate engineering calculations. The specified minimum safety factors are shown in Table 1.

**Table 1 - Minimum Safety Factors**

| Loading Condition | Minimum Factor of Safety |
|---|---|
| **Static, long-term, maximum storage pool** | 1.50 |
| **Static, maximum surcharge pool** | 1.40 |
| **Seismic** | 1.00 |
| **Liquefaction** | 1.20 |

A safety factor assessment has been conducted only for SCPD at the Sioux Energy Center.

# 2.0 SCPD - PERIODIC SAFETY FACTOR ASSESSMENT METHODOLOGY

## 2.1 Stability Analyses

The stability of the side slopes of the perimeter berms and the CCR fill were analyzed. Analyses was completed using the short-term and long-term shear strength properties as appropriate. The seismic loading conditions were also analyzed, as well as the postseismic condition with liquefaction occurring in the subsurface soil strata where indicated by the liquefaction analyses. Potential sliding block failures along the interface with the composite liner and aquiclude and the stability of the final cover were also analyzed. All of these analyses demonstrate that the proposed design meets or exceeds the minimum factors of safety for slope stability in accordance with the MDNR-SWMP regulations, the Draft Technical Guidance Document on Static and Seismic Slope Stability for Solid Waste Containment Facilities by MDNR-SWMP and Dr. Timothy Stark, and the EPA CCR Rule. Because the factors of safety against slope failure under the design seismic event were all greater than 1.2, the potential lateral displacement would be minor. The potential lateral displacements due to the seismic load were not estimated.

The slope stability analyses were performed using the computer program SLIDE 8. This program uses the Spencer method, which resolves the static forces on each vertical slice of soil profile along randomly generated failure surfaces. Two methods are used. The first method is to assume circular failure surfaces. A grid of possible centers for the circular failure surface is specified, as well as the possible bottom elevation of the failure surface. The program searches for the minimum factor of safety (FS) against slope failure for each center point in the grid by incrementally varying the radius of the failure surface. The plotted results from the program show the minimum FS, the center and radius of the failure surface with the minimum FS. The output of the program also plots contours of equal FS within the grid of possible center points. The second method is based upon a multi-linear failure surface. This method is used where there is a plane of weak shear strengths, such as along a composite liner or dual liner. The analyses are the same, that is searching for a configuration of a multi-linear failure surface which results in a minimum factor of safety. All of the results are presented graphically in Figure 3 to 6 and Appendix A. Stability analyses were performed at each section for initial and final stages of construction, and using short-term (undrained) properties and long-term properties as appropriate. Stability analyses were also performed for the pseudoseismic loading, and the post-seismic static conditions were liquefaction exist in the natural soil strata below the groundwater table where there is a high risk. The results of the stability analyses are presented in the following Table 2.

## 2.2 Seismic Stability Analyses

The critical cross-section was analyzed using a pseudo-static acceleration as a horizontal body force on the soil mass to calculate the minimum factor of safety for a seismic event. The seismic acceleration was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground Acceleration (PHGA) for seismic loading event with a 2% probability of exceedance in 50 years. The PHGA was factored for the seismic site class in accordance with ASCE 7 *Minimum Design Loads for Buildings and Other Structures, International Building Code*. A seismic coefficient of 0.5 was applied to the PHGA, which is consistent with MSHA's 2009 *Engineering and Design Manual for Coal Refuse Disposal Facilities*, in particular Chapter 7, "Seismic Design: Stability and Deformation Analyses." The manual cites research by Hynes-Griffen and Franklin (1984) which found that for seismic coefficient of 0.5 would result in deformations of less than 3 feet for a safety factor of 1.0.

The published 2014 USGS hazard map for the Sioux Energy Center is reproduced in Figure 2. This is the latest map available from the USGS website. The probabilistic PHGA for the design earthquake at the Sioux site is 0.187g (that is, 18.7% of standard gravity acceleration of 32.2 feet/sec$^2$). This value takes into account attenuation of bedrock shaking with distance from the probable sources and general soil interactions such as damping for a hypothetical soil profile. This value is meant to be a conservative estimate. Based upon the data, the most probable earthquake magnitudes ($M_w$) for these accelerations are between 7.0 and 8.0. We applied a multiplier of 1.434 to the base PHGA to account for the soil profile at the Sioux Energy Center to obtain a site specific PHGA of 0.268g. Therefore, the pseudo-static seismic load was 0.134g.

### 2.3 Liquefaction Stability Analyses

The liquefaction slope stability analysis is a post-earthquake, static analysis which includes the effects of potential liquefaction or softening of the soils. Liquefaction occurs when ground shaking is sufficient to produce cyclic particle movements that cause excess pore water pressures to build to the point that some of the shear strength of the soil is lost. Liquefaction occurs in loose sandy soils with less than about 35% fines (soils which are finer than standard U.S. #200 or 0.075mm). Liquefaction can occur in very loose soils with up to 50 percent fines and soils up to the size of fine gravel. Liquefaction only occurs below the ground water table (phreatic surface). The presence of soil susceptible to liquefaction in the top 50 feet of the soil profile at the Sioux Energy Center typically included the silty sand and sand. Conservative estimates of post-earthquake or residual shear strengths in the liquefied strata were assumed.

## 3.0 SCPD – STABILITY ANALYSES RESULTS

The results of the stability analyses for SCPD for each load case are presented in Table 2. The search for critical failure surfaces was limited to those that significantly impact SCPD's perimeter berm. The analyses showed that the calculated factors of safety exceed the minimum presented in §257.74(e) for each loading condition.

**Table 2 – SCPD – Stability Analyses Results**

| Loading Condition | Minimum Factor of Safety | Calculated Factor of Safety |
|---|---|---|
| **Static, long-term, maximum storage pool** | 1.50 | 1.84 |
| **Static, maximum surcharge pool** | 1.40 | 1.84 |
| **Seismic** | 1.00 | 1.48 |
| **Liquefaction** | 1.20 | 1.74 |

## 4.0 CONCLUSIONS

The initial safety factor assessment for SCPD at the Sioux Energy Center found that the calculated factors of safety for the critical cross-sections for this CCR unit exceed the minimum factors of safety for each loading condition required by 40 CFR §257.74(e). The subsequent periodic safety factor assessment should be conducted within 5 years of the date of this report.

## 5.0 REFERENCES

Ameren Missouri (2011), "Operation and Maintenance Manual; Meramec Ash Pond Embankment, St. Louis, Missouri, St. Louis County." Dam Safety and Hydro Engineering, St. Louis, Missouri.

American Society of Civil Engineers (2013), *Minimum Design Loads for Buildings and Other Structures*, Standards ASCE/SEI 7-10, 3rd Printing.

EM1110-2-1902 (2003), *Slope Stability*. U.S. Army Corps of Engineers, Washington, D.C.

Hynes-Griffen, M.E. and A.G. Franklin (1984), "Rationalizing the Seismic Coefficient Method," Miscellaneous Paper GL-84-13, U.S. Department of the Army, Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

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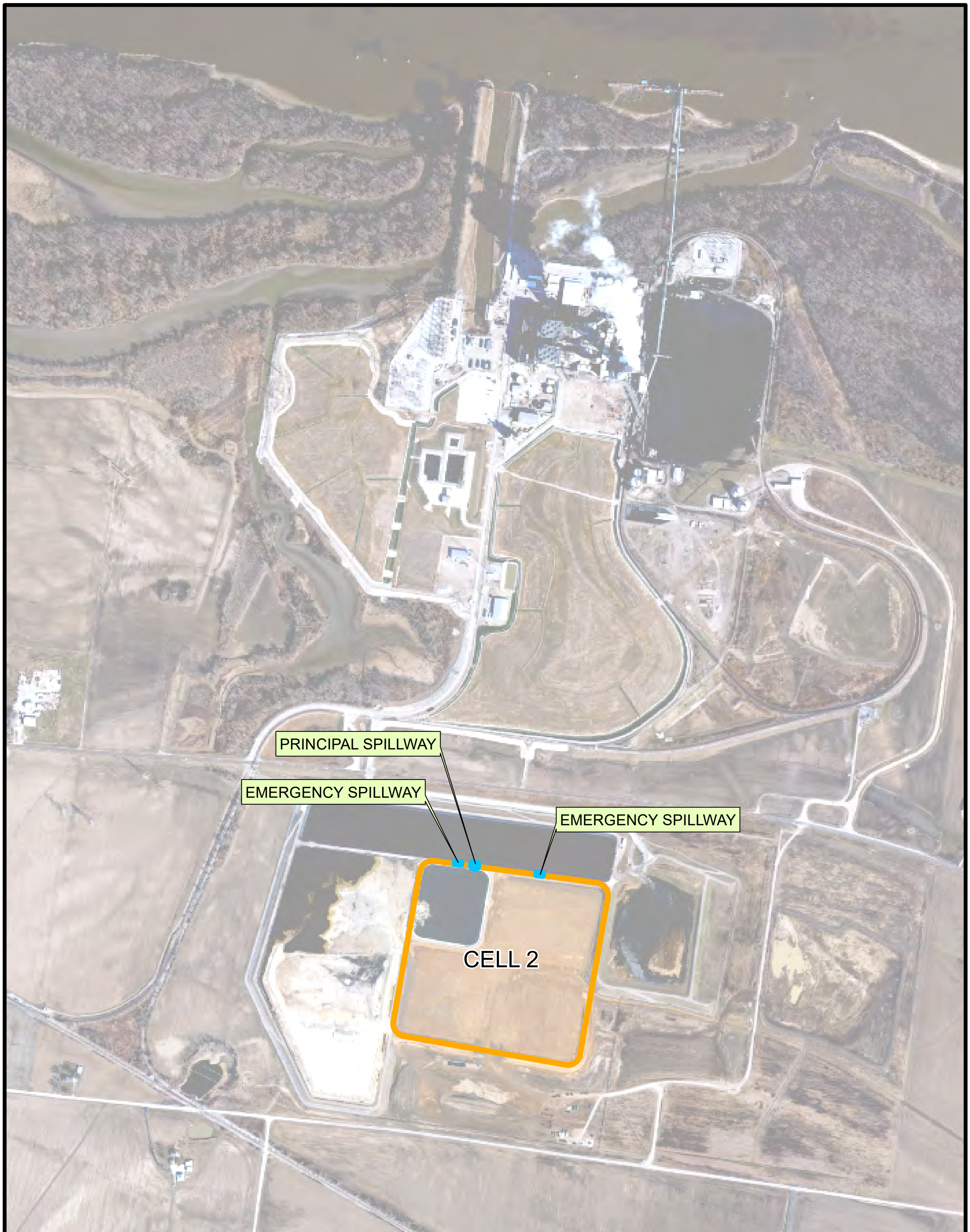


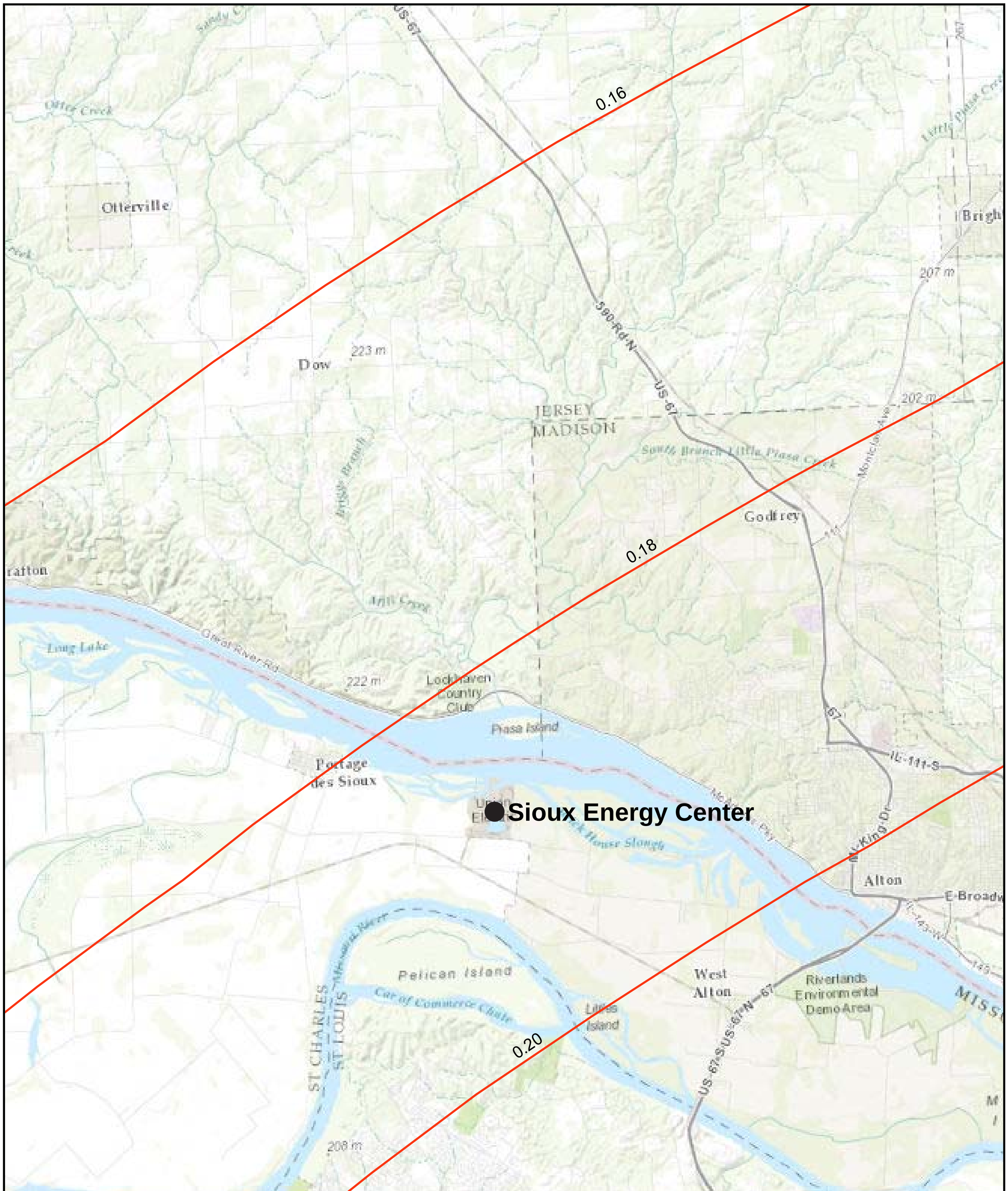

**Legend**
- Embankment
- Spillway

N

0 500 1,000 Feet

AMEREN MISSOURI
SIOUX ENERGY CENTER
ACTIVE CCR SURFACE IMPOUNDMENT
FIGURE 1

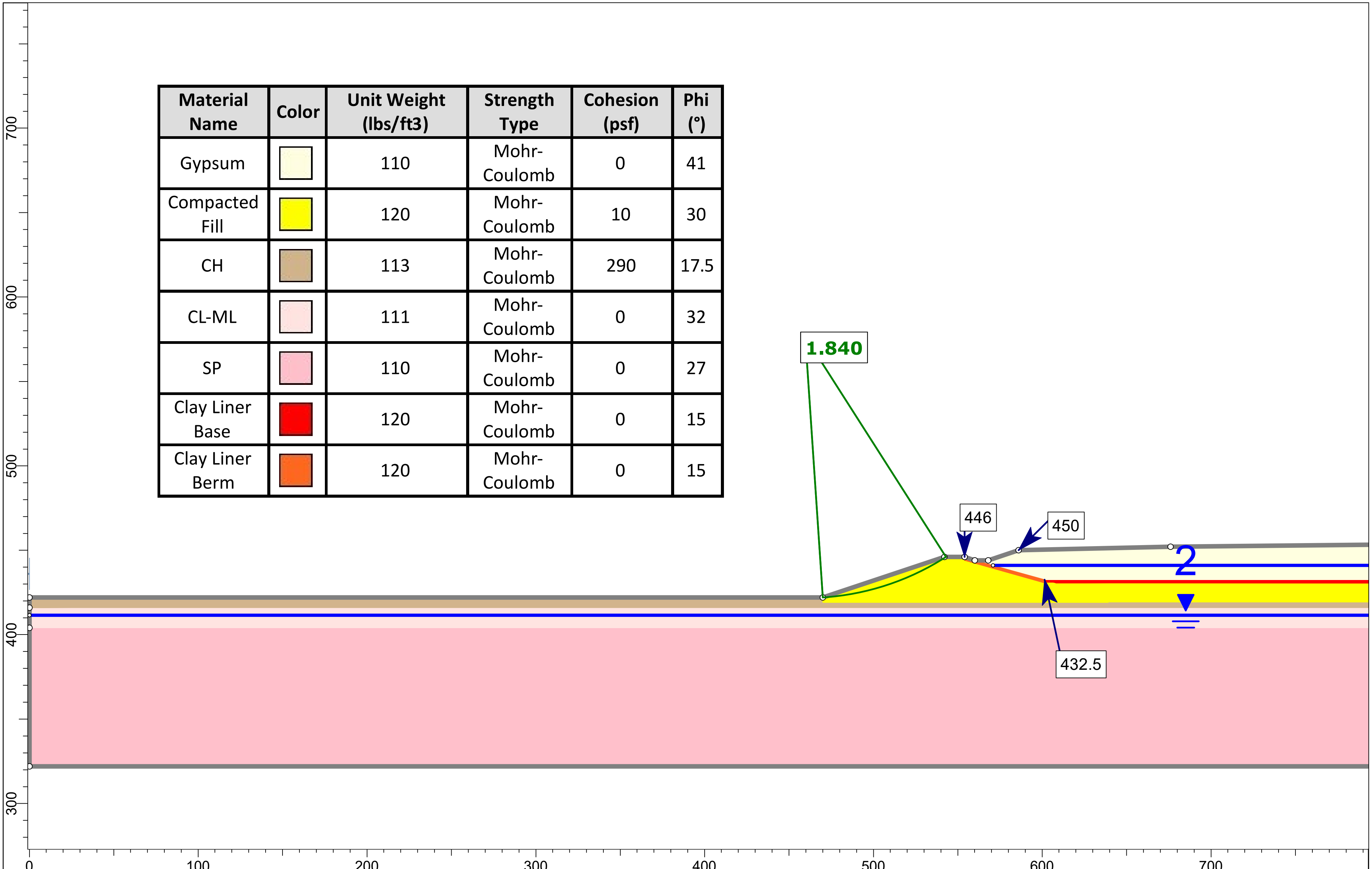
Ameren MISSOURI
REITZ & JENS, INC. CONSULTING ENGINEERS




**2% Probability of Exceedance in 50 Years Map of Peak Ground Acceleration**

Ameren Missouri: Sioux Energy Center
2014 USGS Seismic Hazard Map

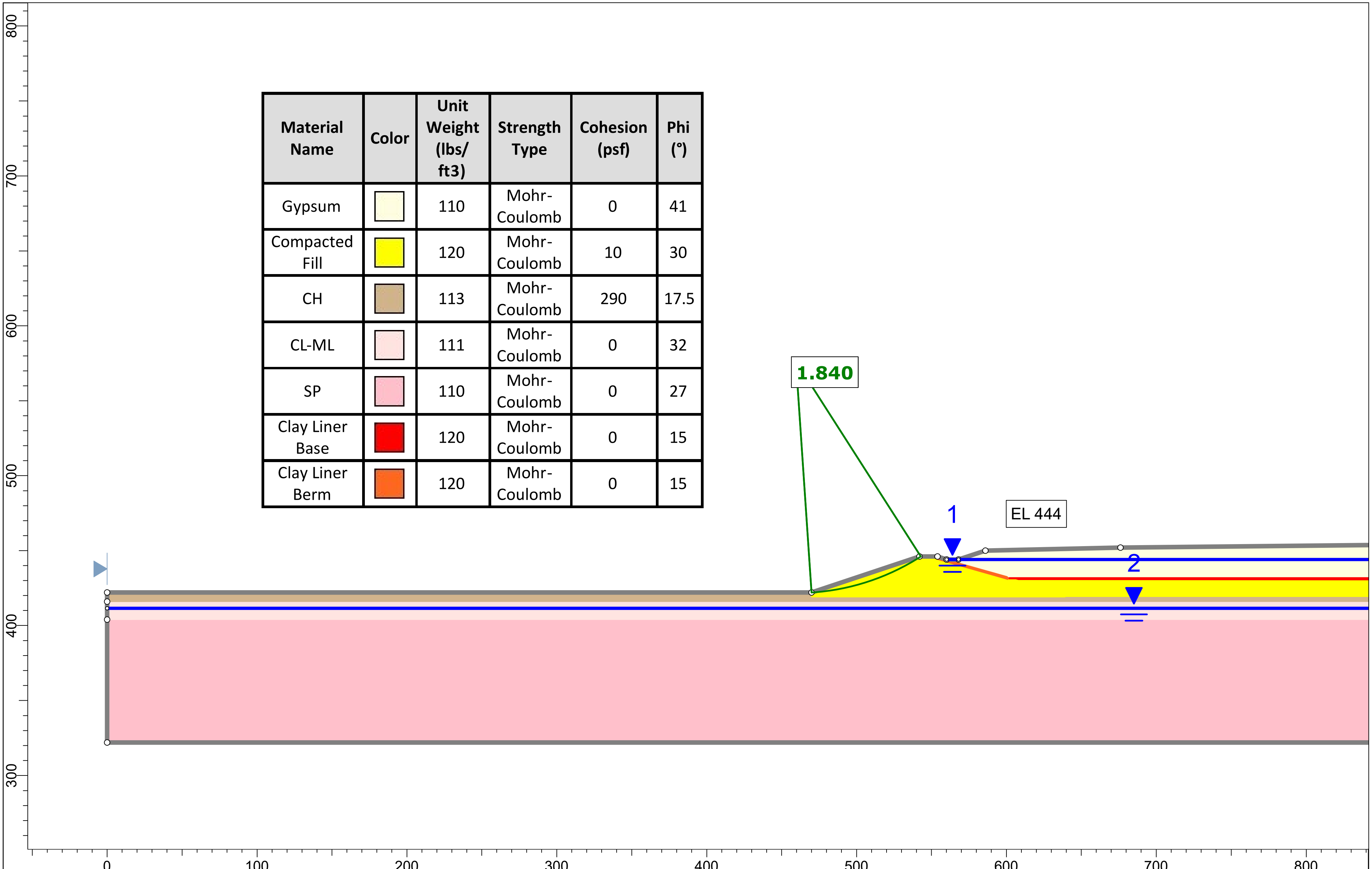
| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 10 | 30 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |




| Project Name: Sioux UWL | Client: Ameren |
|---|---|
| Section Location: E-E As-Built | Load Case: Long Term |

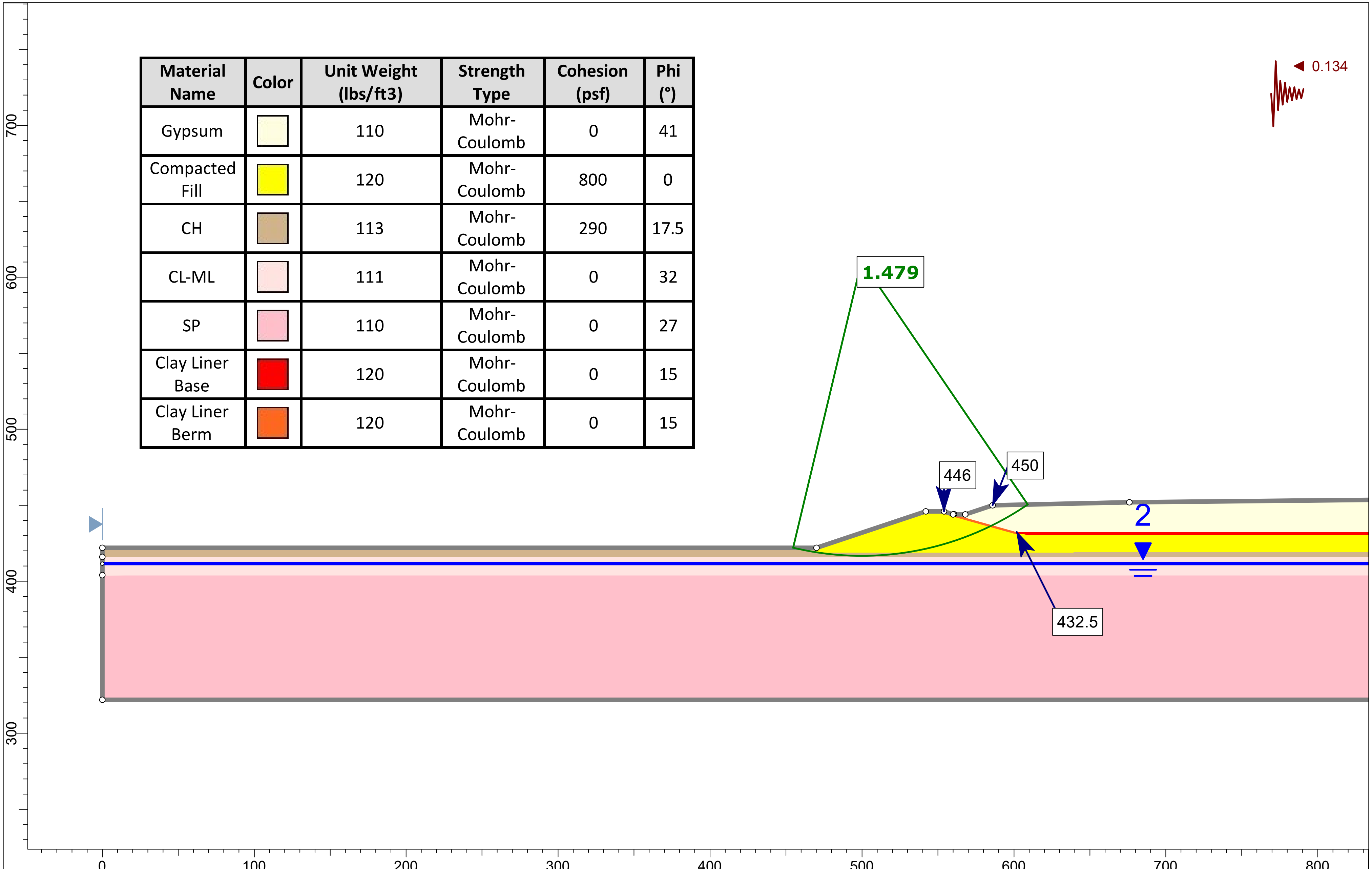
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: 3 |
|---|---|---|---|

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 10 | 30 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |

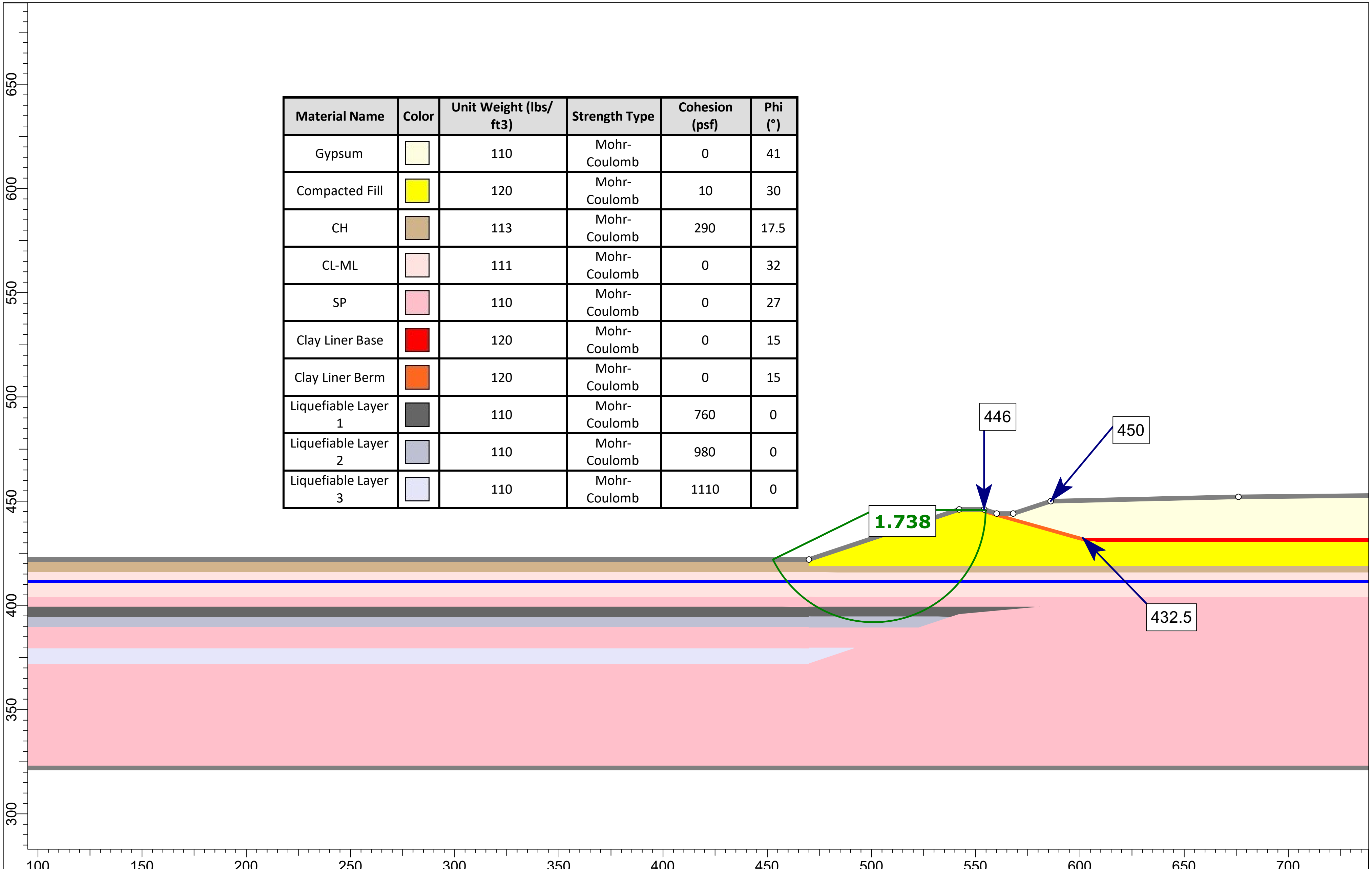



| | | | |
|---|---|---|---|
| Project Name: Sioux UWL | | Client: Ameren | |
| Section Location: E-E As-Built | | Load Case: Long Term | |
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: 4 |

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 800 | 0 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |




| | | | |
|---|---|---|---|
| Project Name: Sioux UWL | | Client: Ameren | |
| Section Location: E-E As-Built | | Load Case: Seismic | |
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: 5 |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (°) |
|---|---|---|---|---|---|
| Gypsum | | 110 | Mohr-Coulomb | 0 | 41 |
| Compacted Fill | | 120 | Mohr-Coulomb | 10 | 30 |
| CH | | 113 | Mohr-Coulomb | 290 | 17.5 |
| CL-ML | | 111 | Mohr-Coulomb | 0 | 32 |
| SP | | 110 | Mohr-Coulomb | 0 | 27 |
| Clay Liner Base | | 120 | Mohr-Coulomb | 0 | 15 |
| Clay Liner Berm | | 120 | Mohr-Coulomb | 0 | 15 |
| Liquefiable Layer 1 | | 110 | Mohr-Coulomb | 760 | 0 |
| Liquefiable Layer 2 | | 110 | Mohr-Coulomb | 980 | 0 |
| Liquefiable Layer 3 | | 110 | Mohr-Coulomb | 1110 | 0 |

| | |
|---|---|
| Project Name: Sioux UWL | Client: Ameren |
| Section Location: E-E As-Built | Load Case: Liquefaction |

| | | | |
|---|---|---|---|
| Project Number: 2019012439 | Analysis By: C. Cook | Checked By: J. Fouse | Figure: 6 |

# APPENDIX E

HYDROLOGY AND HYDRAULICS

**AMEREN MISSOURI SIOUX ENERGY CENTER**
**EVALUATION OF CCR UNITS**
**40 CFR PART 257**
**ST. CHARLES COUNTY, MISSOURI**

# APPENDIX E: INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN §257.82

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**EVALUATION OF CCR UNITS**
**ST. CHARLES COUNTY, MISSOURI**

**APPENDIX E: INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN §257.82**

# 1.0 INTRODUCTION

The Sioux Energy Center (SEC) is located in northeast St. Charles County, Missouri along the Mississippi River, approximately 14 miles upstream of the confluence with the Missouri River and approximately 3 miles east of Portage de Sioux, Missouri. The SEC is located within the floodplain of the Mississippi and Missouri Rivers and has one active CCR surface impoundment that is approximately 40-acres in size. The CCR surface impoundment, designated as Cell 2 (SCPD), is used for managing coal combustion residuals (CCR). SCPA, SCPB and SCPC no longer receive CCRs, have been dewatered, and are closed. SCPD is currently receiving CCRs. Decant water in SCPD discharges into the Recycle Pond where pumps recirculate the water back to the power plant. SCPD is permitted by the Missouri Department of Natural Resources Solid Waste Management Program (MDNR-SWMP) as a Solid Waste Disposal Area under Operating Permit Number 0918301. A map showing the location of the surface impoundment is attached as Figure 1.

## 1.1 Purpose

40 CFR §257.82 requires the owner or operator of an existing CCR surface impoundment to prepare an inflow design flood control system plan for the CCR unit. The plan should document how the inflow design flood control system has been designed, constructed, operated and maintained to meet the requirements of §257.82. The section specifies that the inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood and must manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood. Because the existing CCR surface impoundments at the Sioux Energy Center are classified as Low Hazard Potential dams, 40 CFR §257.82 requires that the 100-Year flood is used as the design flood in this analysis. The periodic inflow design flood control system plan has been developed for the active Sioux Energy Center surface impoundment SCPD.

# 2.0 SCPD (CELL 2)

## 2.1 Pertinent Data

The SCPD was brought online in 2022 and is incised with a perimeter dike. The Flue Gas Desulfurization (FGD) system produces gypsum as a byproduct. The gypsum slurry is pumped to SCPD where it is managed for long-term or permanent storage. The pond does not receive any additional stormwater run-off outside its bounded area. The gypsum slurry point of discharge is moved periodically by temporary pipes, but the origin of the discharge is at the approximate midpoint of the west embankment. The gypsum settles out into the pond and the decant water flows into the Recycle Pond through a set of triple box culverts. SCPD and the Recycle Pond are separated by an embankment. Triple box culverts connect SCPD with the Recycle Pond, and the culverts control the maximum normal water level in SCPD to el. 441. SCPD also has two emergency spillways on the north side of the impoundment. The outlet works construction drawings are shown in the as-built plans presented in Appendix A.

The normal pool elevation of the SCPD is el. 441.1 feet and the top of the embankment elevation is at 446 feet. The flowline of the emergency spillways are at el. 445 feet. The estimated volume of CCR impounded in the SCPD is about 54,500 cubic yards, leaving an approximate remaining storage capacity of about 669,000 cubic yards below el. 445. Table 5 includes pertinent hydrologic and hydraulic data regarding SCPC.

**Table 1 – SCPD (Cell 2) Hydrologic and Hydraulic Data**

| CCR Unit | Normal Pool Elev. (feet) | Normal Pool Water Surface Area (acres) | Max. Pool Elev. (feet) | Max. Pool Water Surface Area (acres) | Total Watershed Area (acres) | Sluice Flow (cfs) |
|---|---|---|---|---|---|---|
| **SCPD (Cell 2)** | 441.1 | 38.5 | 445.0 | 40.3 | 42.5 | 2.0 |

## 2.2 Hydrologic and Hydraulic Analysis

Hydrologic and hydraulic analysis was completed for SCPD to confirm the adequacy of the current inflow design flood control system. The total volume of stormwater and process water over a 24-hour time period was compared to the available storage. The 24-hour, 100-year precipitation event was taken from Bulletin 71, Rainfall Frequency Atlas of the Midwest (Huff and Angel, 1992). The total rainfall over the 24-hour period was 7.21 inches. The discharge of process water was assumed as 2 cfs, or the nominal flow rate assumed for design. The total volume of stormwater and process water over a 24-hour time period during the 24-hour, 100-year precipitation event is approximately 29.5 acre-feet.

The area-capacity curve for SCPD is presented in Figure 2. Based on the available storage and assuming no flow through the box culvert, the pool level would rise to about el. 442.0 during the 24-hour, 100-year storm event and with the assumed process water flow. This analysis suggests the inflow design flood control system for SCPD adequately manages flow into this CCR unit during the 24-hour, 100-year storm event as required by §257.82 even without a functioning primary spillway.

### 2.3 Inflow Design Flood Control System Plan

The Area-Capacity Curve presented in Figure 4 shows that provided SCPD is operated with a normal pool elevation of 441.1 feet, the pond has adequate storage capacity to contain the total rainfall from the 24-hour, 100-year flood event without the primary spillway operating. The area capacity curve is based on the as-built plans. Additional CCR disposal in this pond will lower the available storage. A topographic survey should be completed for the interior of the SCPD to confirm the necessary storage is available prior to developing the next periodic inflow design flood control system plans.

## 3.0 CONCLUSIONS

The periodic inflow design flood control system has been evaluated for the SCPD at the Sioux Energy Center. The inflow control system for this pond can adequately handle and discharge the 24-hour, 100-year design storm event. The following summarizes the conclusions of this report, and outlines recommendations for surveillance and operation of each CCR unit.

- If the water levels exceed the maximum surcharge pool elevations, special inspections of the primary spillways should be completed, and temporary measures should be implemented to prevent the water from overtopping the pond embankments until the primary spillways are functioning as designed.
- Before completing additional evaluations of the Periodic Inflow Design Flood Control System Plan, topographic surveys should be completed on the interior of all active ponds to confirm the necessary water storage is available.
- Pool level readings should be recorded during weekly inspections to confirm the assumed normal pool elevations.

# 4.0 REFERENCES

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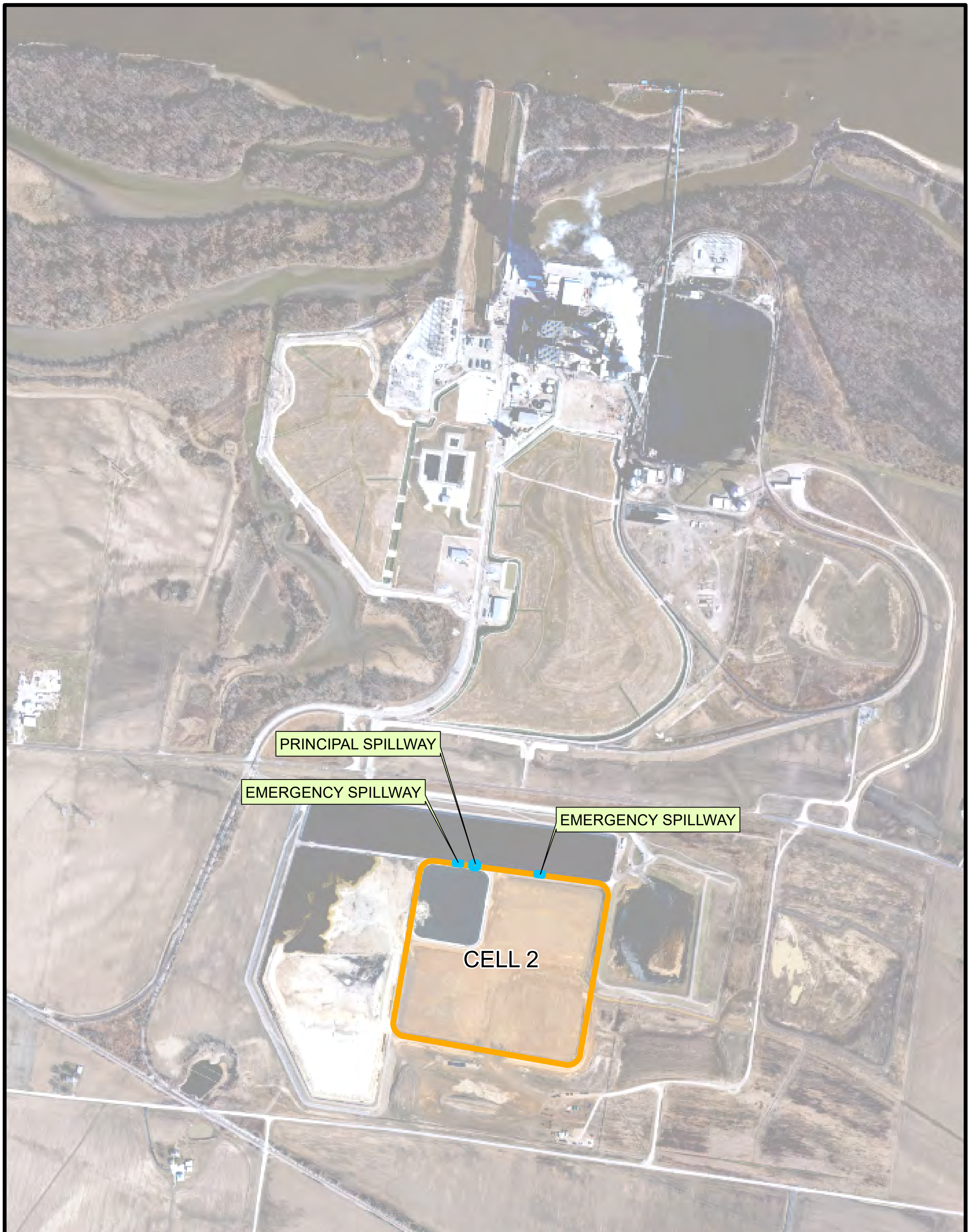
Environmental Protection Agency. (2015). "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule." 40 CFR Parts 257 and 261., Vol. 80, No. 74.

Huff, F.A. and J.R. Angel. (1992). "Rainfall Frequency Atlas of the Midwest." Bulletin 71, Midwestern Climate Center and Illinois State Water Survey.




**Legend**
- Embankment
- Spillway

N

0 500 1,000 Feet

# AMEREN MISSOURI
# SIOUX ENERGY CENTER
# ACTIVE CCR SURFACE IMPOUNDMENT
# FIGURE 1

Ameren MISSOURI

REITZ & JENS, INC. CONSULTING ENGINEERS

SCPD AREA-CAPACITY CURVE

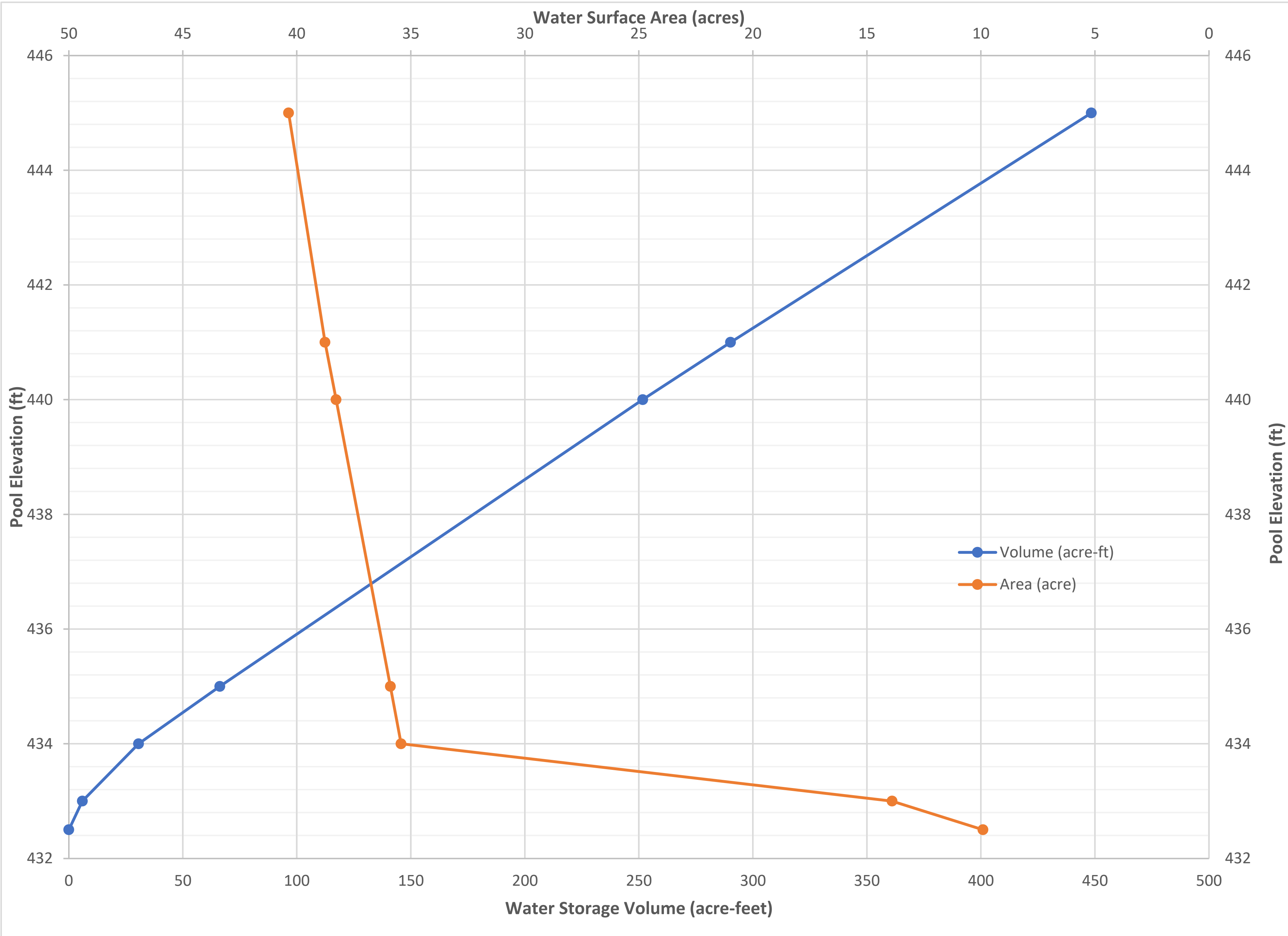



FIGURE 2