STRUCTURAL STABILITY ASSESSMENT REPORT

Monticello Steam Electric Station

Submitted To: Luminant
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Dallas, TX 75201

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Project No. 164816403

Professional Engineering Firm
Registration Number F-2578
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1.0 INTRODUCTION

1.1 Purpose
The “Disposal of Coal Combustion Residuals (CCR) from Electric Utilities rule” (40 Code of Federal Regulations (40 CFR) Part 257), effective October 19, 2015, requires that existing CCR surface impoundments meeting the requirements of §257.73(b) conduct initial and periodic structural stability assessments in accordance with §257.73(d). This letter provides the structural stability assessment for the Monticello Steam Electric Station’s (MOSES’s) CCR Impoundments, identified as the Bottom Ash Ponds (BAPs) – the Southwest Ash Settling Pond (SASP), West Ash Settling Pond (WASP), and the Northeast Ash Water Retention Pond (NAWRP).

1.2 Site Background
The MOSES generates bottom ash, fly ash, boiler slag, and scrubber gypsum during electricity generation. The following surface impoundments, collectively referred to as the Bottom Ash Ponds (BAPs), shown on Figure 1, are in operation at the MOSES:

- Southwest Ash Settling Pond (SASP);
- West Ash Settling Pond (WASP); and
- Northeast Ash Water Retention Pond (NAWRP).

Each of these ponds are active, clay-lined, excavated impoundments surrounded and separated by engineered earthen berms. The WASP and NAWRP receive a slurry of bottom ash/boiler slag and water from the dewatering bins through two sets of pipes entering above the crest of the northern embankment. The WASP and NAWRP are used to separate the solids from the water using gravity sedimentation. A set of pipes pass above the crest near the northwestern corner of the SASP; however, these pipes are blanked off and have reportedly never been put into service. The SASP, connected to the WASP with two weirs, is used for overflow from the other two ponds. Water decanted from the WASP and the SASP ponds is returned to the power plant via the Low Pressure Ash Water (LPAW) pump station.

Four other surface impoundments are present at MOSES: the Rubber-lined Pond, (previously referred to as the scrubber pond), the North Operating Pond, the Low Volume Waste Pond, and the Runoff Collection Pond (RCP) which is located in the southeastern quadrant of the BAP area. The RCP collects stormwater runoff from the facility and is not hydraulically connected to the BAPs. These ponds are not subject to the CCR Rule.

1.3 Previous Slope Stability Evaluations
Golder performed previous evaluations on the BAPs as part of the reports listed below:
- Ash and Scrubber Pond Stability Investigation Report, Luminant Monticello SES, Titus County, Texas, dated December 2012

These studies found the pond slopes to be adequately stable.
2.0 SUBSURFACE CONDITIONS
The MOSES site is located in the West Gulf Coastal Plain subprovince, in Titus County, Texas. The primary rock units in the region comprise sedimentary rocks of the Mesozoic and Cenozoic eras. The principal geologic unit in the region of the site is the Wilcox Group which is composed of interbedded sand, silt, silty shale, clay and lignite (Cook-Joyce Inc., 1985). The surficial soils of comprise of moderately well-drained to poorly drained loamy soils (USDA, 1990).

2.1 Site Geology

2.1.1 Subsurface Investigations and Laboratory Testing
Information from previous subsurface investigations was used to characterize the subsurface site conditions. Golder conducted a subsurface investigation for the surface impoundments in December 2012. Golder completed eight borings within the pond footprints with boring depths of 50 feet below ground surface (bgs). The boring map and select, representative boring logs are included in Appendix A.

As part of the investigation, laboratory testing was performed on selected samples, in accordance with commonly accepted methods and practices. Undisturbed and disturbed soil samples were tested to determine water content, Atterberg limits, grain size distribution, and shear strength. Water content determination was performed in accordance with ASTM D2216; Atterberg limits were determined in accordance with ASTM D4318; and grain size distribution was performed in accordance with ASTM D422. Shear strength testing consisted of unconsolidated-undrained (UU) and consolidated-undrained (CU) triaxial compression tests in general accordance with ASTM D2850 and D4767, respectively. Laboratory test summary sheets results are presented in Appendix B. The test results can be found in Appendix C.

The findings from the above subsurface investigations were reviewed for their applicability to this study, and are summarized in the following sections.

2.1.2 Subsurface Site Conditions
All eight borings of the subsurface investigation, were drilled along the crest of the BAPs embankments at approximate elevation 386.5 feet mean sea level (ft-msl). Hence, the borings consisted of fill and native soils. The soils encountered in the borings generally consisted of stiff to hard sandy clays and compact to dense sands. The subsurface stratigraphy generally consisted of interchanging layers of clayey sand and sandy clay. The clayey sand layers ranged in thickness from 2 to 20 feet where encountered. The sandy clay and clay layers varied in thickness from 2 to 33 feet where encountered. Four of the borings terminated in a sandy clay/clayey sand layer, while a layer of compact to dense, silty or poorly graded sand was encountered beneath the sandy clay/clayey sand layers in four borings.
Water was encountered in each of the eight borings. Water elevations encountered during drilling ranged from 352.1 to 375.05 ft-msl with an average of EL 358.5 ft-msl.

Groundwater levels measured in 2015, from wells surrounding the BAPs, indicate that the groundwater level varies from approximately EL 364 ft-msl in the southeast corner to EL 358 ft-msl in the northwest corner.
3.0 STRUCTURAL STABILITY ASSESSMENT - §257.73(d)(1)(i)-(vii)

The CCR rules require conducting periodic structural stability assessments by a qualified professional engineer to document whether the design, construction, operation and maintenance is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater that can be impounded therein.

3.1 Foundations and Abutments - §257.73(d)(1)(i)

As noted above, the foundation soils generally consist of stiff to hard sandy clays and compact to dense sand. As discussed below, the embankment fill appear to be well-compacted. The foundation soils and abutments are stable.

3.2 Slope Protection - §257.73(d)(1)(ii)

The downstream slopes of the BAP embankments are protected from erosion and deterioration by the establishment of a vegetative cover. The vegetative cover is inspected weekly for erosion, signs of seepage, animal burrows, sloughing, and plants that could negatively impact the embankment.

The interior slopes are protected from wave action by concrete revetment mats or riprap.

3.3 Dikes (Embankment) - §257.73(d)(1)(iii)

The BAPs at the MOSES were originally constructed in 1974 as a two-basin system. In 1990, the ponds were segregated and relined with a 3-foot thick clay liner. In addition, the interior slopes of the NAWRP, and the east side interior slopes of the WASP were lined with concrete revetment mats. Riprap was placed on all the remaining interior slopes of the ponds for erosion protection.

No construction documentation or testing details of the original embankment fill are available. Based on the borings, the embankments were likely constructed using a clayey fill from an on-site borrow source (Pastor, Behling and Wheeler, 2015). Golder’s subsurface investigation of 2012, which comprised boreholes drilled into the embankment, found the embankment soils to generally consist of stiff to hard sandy clay, clayey sand, and clay, consistent with well-compacted fill.

No significant repairs have been performed to the BAP embankments since their initial construction, except the addition of an interior berms and a 3-foot thick clay liner in 1989. A shallow slope failure was observed at the northwestern corner of the WASP, on July 1, 2016. Based on our observations and previous inspections, it appears that the slope failure passes through fill placed against the original embankment slope and does not threaten the stability of the embankment.

Based on a review of past inspection reports and on recent observations, the BAP embankment is sufficient to withstand the range of loading conditions to which they are subjected.
3.4 Vegetated Slopes - §257.73(d)(1)(iv)
As of June 14, 2016 the US Court of Appeals for the District of Columbia Circuit issued an Order that remanded and vacated the CCR rule requirement that vegetation on the exterior portions of dikes on CCR surface impoundments be maintained not to exceed six inches in height. EPA will issue a new rulemaking in the future to address this issue.

Each of the surface impoundments at the MOSES are inspected weekly. Luminant maintains the vegetation in a manner that ensures adequate inspections can be conducted.

3.5 Spillways - §257.73(d)(1)(v)
There are no spillways on any of the surface impoundments.

3.6 Hydraulic Structures - §257.73(d)(1)(vi)
Two valve-controlled outlet structures with discharge pipes pass through the BAP embankment: a 3-foot diameter pipe through the western embankment near the southwestern corner of the WASP; and a pipe through the southern embankment of the SASP. These below-grade pipes are connected to concrete surge tanks, which are connected to a concrete chamber and pumps located west of the WASP.

Concrete weirs – two connecting the NAWRP to the WASP, and two connecting the WASP to the SASP – are present on the interior berms. Flow between the ponds is controlled with sluice gates.

All other piping to the BAPs passes above the crest of the embankments.

No significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, or debris were observed that may negatively affect the operation of the surface impoundments.

3.7 Downstream Slopes Adjacent to Water Body - §257.73(d)(1)(vii)
The south side of the NAWRP and the east side of the SASP border the Storm Water Collection Pond. The water level in this pond is maintained below EL 365 ft-msl, and the base of the BAPs is at EL 361 ft-msl. Since the maximum water level in the Stormwater Collection Pond is only 4 feet above the base of the adjacent ponds, rapid removal of water will not significantly affect the stability of the BAP embankment.

3.8 Structural Stability Deficiencies - §257.73(d)(2)
No structural stability deficiencies were identified during this assessment.
4.0 CONCLUSION

Based on our review of the information provided by Luminant, on information prepared by Golder Associates Inc., and on our on-site observations, no structural stability deficiencies were identified in the surface impoundments during this assessment.

Golder appreciates the opportunity to assist Luminant with this project. If you have any questions, or require further assistance from Golder, please contact the undersigned at (281) 821-6868.

GOLDER ASSOCIATES INC.

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Staff Engineer

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Associate Geotechnical Engineer

Author/Admin initials
5.0 CERTIFICATION

I hereby certify that this report has been prepared in general accordance with normally accepted civil engineering practices and in accordance with the requirements of 40 CFR §257.73(d).

Jeffrey B. Fassett, PE
Golder Associates Inc.
Registration Firm Number F-2578
6.0 REFERENCES

Cook-Joyce Inc. 1985, Geologic Investigation of the Monticello Steam Electric Station “West” Bottom Ash Pond.


APPENDIX A
BORING LOCATION MAP & BORING LOGS
NOTE: Figure Reference - Golder Associates Inc. 2012, Ash and Scrubber Pond Stability Investigation Report, Luminant Monticello SES, Titus County, Texas.
| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE | RECOVERY % | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | PL | MC | LL |
|-----------|-------------|----------------------|-------------|------------|-----------------------|----------------|------------------|    |    |    |
| 0         |             | (CL) SANDY CLAY, low plasticity, some to little silt, tan and gray, dry, firm | SH 1        | 54         | 3.5       |                  |                |                  |    |    |    |
| 5         |             | medium to low plasticity, dark gray sandy gravel seam at 4.0' | SH 2        | 54         | 3.25      |                  |                |                  |    |    |    |
| 10        |             | (SC) CLAYEY SAND, fine, uniform graded, subrounded, some silt, red and brown, dry | SH 3        | 56         | 4.0       |                  |                |                  |    |    |    |
| 15        |             | (CL) SANDY CLAY, some to little silt, red and gray, mottled, moist, firm | SH 4        | 88         | 2.25      |                  |                |                  |    |    |    |
| 20        |             | medium plasticity at 18.0' | SH 5        | 75         | 3.0       |                  |                |                  |    |    |    |
| 25        |             | dark gray clayey sand seam, stiff to hard at 23.0' | SH 6        | 54         | 3.5       |                  |                |                  |    |    |    |
| 30        |             | (CH) Fat CLAY, grading to a sandy clay, some silt, red and gray, mottled, hard to stiff, moist | SH 7        | 63         | 2.0       |                  |                |                  |    |    |    |
| 35        |             | (CL) SANDY CLAY, fine, tan and brown, moist | SH 8        | 54         | 4.75      |                  |                |                  |    |    |    |
|           |             |                      | SH 9        | 58         | 2.0       |                  |                |                  |    |    |    |
|           |             |                      | SH 10       | 71         | 5.0       |                  |                |                  |    |    |    |

(Continued Next Page)
**GRAPHIC LOG**

### MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE NUMBER</th>
<th>RECOVERY %</th>
<th>BLOW COUNTS (N VALUE)</th>
<th>POCKET PEN. (l/s)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>FINE CONTENT (%)</th>
<th>SPT N VALUE</th>
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<tbody>
<tr>
<td>35</td>
<td></td>
<td>(CL) SANDY CLAY, fine, tan and brown, moist (continued)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>(SC) CLAYEY SAND, low plasticity, some silt, brown and gray, moist</td>
<td>SH 11</td>
<td>63</td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
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<tr>
<td>45</td>
<td></td>
<td>high plasticity clay seams, wet at 43.0'</td>
<td>SH 12</td>
<td>67</td>
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<td>4.75</td>
<td></td>
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<tr>
<td>50</td>
<td></td>
<td>decreased clay content at 48.0'</td>
<td>SH 13</td>
<td>75</td>
<td></td>
<td>1.0</td>
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</tbody>
</table>

Bottom of borehole at 50.0 feet.
(SC) CLAYEY SAND, fine sand, low plasticity clay, little organics, dark brown, dry

subangular grains, some silt, little gravel, dark brown and tan at 2.0'

low plasticity, red and brown at 4.0'

high plasticity, 3" clay seam, soft at 6.0'

grading to sandy clay, tan and gray, mottled, stiff to hard at 8.0'

(CL) SANDY CLAY, fine sand, low plasticity clay, tan and gray, very stiff

red and gray, mottled, moist at 18.0'

decreased clay content, tan and brown at 28.0'

(CL) SANDY CLAY, fine, subangular, trace silt, gray and tan, moist, stiff to very stiff

Sample Type Number: SH

Sample Recovery (%):

Sample Blow Counts:

Sample Pocket Penetration (tsf):

Sample Dry Unit Weight (pcf):

Sample SPT N Value:

Sample Fines Content (%):

Sample Ground Water Levels:

Ground Elevation: 386.5 ft

Hole Size: 8 inches

Drilling Method: Hollow Stem Auger

Drilling Contractor: WEST Drilling

Notes:

(Continued Next Page)
(CL) SANDY CLAY, fine, subangular, trace silt, gray and tan, moist, stiff to very stiff (continued)

Bottom of borehole at 50.0 feet.
Roadway gravel removed
(CL) LEAN CLAY, low plasticity, some fine sand, tan and gray, dry, hard

medium plasticity, sand and gravel seam, white at 4.0'

(CL) SANDY CLAY, fine, subangular, low plasticity, brown and red, dry, hard

(SC) CLAYEY SAND, fine, subangular, low plasticity, little silt, gray and red, moist

(CH) SANDY CLAY, medium to high plasticity, gray and red, moist, hard

(SM) SILTY SAND, fine, sub angular, some clay, orange and tan, moist

wet, compact at 30.0'

medium to fine at 33.0'

GROUNDED WATER LEVELS:
\( \sqrt{26.30 \text{ ft} / \text{Elev 360.20 ft no reading, cave in at 26} \text{ ft}} \)
### MATERIAL DESCRIPTION

- **35 ft**: (SM) SILTY SAND, fine, sub angular, some clay, orange and tan, moist (continued)
- **40 ft**: (SM) SILTY SAND, fine, little clay, gray and red, wet, compact
  - Some oxidation at 43.0'
- **50 ft**: Bottom of borehole at 50.0 feet.

### Graph

- **Sample Type Number**: SS 13, SS 14, SS 15
- **Recovery % (RQD)**: 89, 100, 94
- **Blow Counts (N Value)**: 4-7-10 (17), 4-8-13 (21), 6-9-12 (21)
- **Pocket Pen (tsf)**: ▲
- **Dry Unit WT. (pcf)**: ▲
- **SPT N Value**: ▲
- **Fines Content (%)**: ▲
Remove gravel from road before drilling

(CL) LEAN CLAY, low plasticity, little to trace sand, brown and gray, dry, hard

high plastic (CH), soft at 4.0'

(CL) SANDY CLAY, low plasticity, some to little silt, red and gray, hard, dry at 6.0'

hard to stiff at 8.0'

(SC) CLAYEY SAND, fine, subangular, brown, moist

(CH) SANDY CLAY, fine, subangular, medium to high plasticity, red and gray, moist, hard

little silt, moist, soft at 23.0'

(SC) CLAYEY SAND, fine, subangular, low plasticity, red and gray, mottled, wet

(SP) SAND, fine, poorly graded, trace silt and clay, gray and red, wet, compact
(SP) SAND, fine, poorly graded, trace silt and clay, gray and red, wet, compact

(SP) SAND, medium to fine, subangular, poorly graded, some silt and fine gravel, red and brown, wet, compact

(SM) SILTY SAND, fine, subangular, some clay seams, tan and gray, wet, compact

some oxidation, trace clay seams at 48.0’

Bottom of borehole at 50.0 feet.
(CH) FAT CLAY, high plastic, tan and red, dry, soft

(OH) SILT, low plastic, organic, trace roots, black

(GP) SANDY GRAVEL, fine, subangular, white

(CL) LEAN CLAY, low plasticity, some sand, tan and gray, dry, firm

(CL) SANDY CLAY, low plasticity, red and gray, mottled, dry, hard

some sand seams at 6.0'

(SC) CLAYEY SAND, fine, subangular, gray, dry

compact at 10.0'

(CL) SANDY CLAY, low plasticity, some clayey sand seams, gray and red, mottled, dry, hard

increased sand content, moist at 23.0'

(SC) CLAYEY SAND, fine, subangular, low plasticity, red and gray, moist, loose

some clay seams, trace fine gravel, tan and gray, wet, compact at 33.0'
(SC) CLAYEY SAND, fine, subangular, low plasticity, red and gray, moist, loose (continued)

no gravel at 38.0'

(SS) SILTY SAND, fine with trace medium, subangular, little clay, tan, wet, compact

Bottom of borehole at 50.0 feet.
### Depth Log

<table>
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<th>Depth (ft)</th>
<th>Material Description</th>
<th>Sample Type</th>
<th>Recovery % (RQD)</th>
<th>Blow Counts (N Value)</th>
<th>Dry Unit WT. (psf)</th>
<th>Pocket Pen. (tsf)</th>
<th>SPT N Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(CL) GRAVELLY CLAY, low plastic, some sand, brown, dry, hard</td>
<td>SH 1</td>
<td>33</td>
<td></td>
<td>5.0</td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>(CH) FAT CLAY, medium to high plasticity, little silt and sand, brown, dry, hard</td>
<td>SH 2</td>
<td>46</td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>(CL) SANDY CLAY, medium plasticity, trace silt, red and gray, dry</td>
<td>SS 3</td>
<td>33</td>
<td>3-4-5 (9)</td>
<td>3.5</td>
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<td></td>
<td>low to non plastic, dark gray at 13.0'</td>
<td>SH 4</td>
<td>67</td>
<td></td>
<td>3.0</td>
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<tr>
<td></td>
<td>fine, subangular, tan and gray at 18.0'</td>
<td>SH 5</td>
<td>67</td>
<td></td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>little silt, red, compact at 20.0'</td>
<td>SH 6</td>
<td>46</td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
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<tr>
<td>25</td>
<td>(CL) SANDY CLAY, low plasticity, tan and gray, moist, firm to stiff</td>
<td>SH 7</td>
<td>50</td>
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<td>2.0</td>
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<td></td>
<td>(SM) SILTY SAND, fine, subangular, nonplastic, trace to little clay, tan, moist</td>
<td>SH 8</td>
<td>100</td>
<td>5-7-11 (18)</td>
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<td>(SM) SILTY SAND, medium to fine, poorly graded, nonplastic, trace gravel, tan and red, wet, compact</td>
<td>SS 9</td>
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<td>(SM) SILTY SAND, medium to fine, poorly graded, nonplastic, trace gravel, tan and red, wet, compact</td>
<td>SS 10</td>
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<td>SS 11</td>
<td>89</td>
<td>5-5-6 (11)</td>
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</table>

### Ground Water Levels:
- AT TIME OF DRILLING: 31.00 ft / Elev 355.50 ft no reading, cave in at 31 ft
- AT END OF DRILLING: ---
- AFTER DRILLING: ---

### Notes
(Continued Next Page)
**Silty Sand**

- Medium to fine, poorly graded, nonplastic, trace gravel, tan and red, wet, compact

**Clayey Sand**

- Fine, subangular, some clay seams, oxidation, tan and gray, mottled, wet, compact

No visible oxidation at 43.0’

Bottom of borehole at 50.0 feet.
remove 1' of sandy gravel from roadway

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>remove 1' of sandy gravel from roadway</td>
</tr>
<tr>
<td>5</td>
<td>(CL) LEAN CLAY, low plasticity, some sand, gray, dry, hard</td>
</tr>
<tr>
<td>10</td>
<td>some sand seams at 4.0'</td>
</tr>
<tr>
<td>15</td>
<td>(CL) SANDY CLAY, low plasticity, some silt, gray and red, dry, hard</td>
</tr>
<tr>
<td>20</td>
<td>(SC) CLAYEY SAND, fine, subangular, low plasticity, gray, dry</td>
</tr>
<tr>
<td>25</td>
<td>(CL) SANDY CLAY, low plasticity, little silt, red and gray, dry, firm to stiff</td>
</tr>
<tr>
<td>30</td>
<td>increased sand content, moist at 23.0'</td>
</tr>
<tr>
<td>35</td>
<td>(SP) SAND, nonplastic, poorly graded, some silt, little clay, tan, moist</td>
</tr>
<tr>
<td>40</td>
<td>(SM) SILTY SAND, fine with little medium, little clay, tan and gray, wet, compact</td>
</tr>
</tbody>
</table>

**GROUND WATER LEVELS:**
- AT TIME OF DRILLING 31.75 ft / Elev 354.75 ft

**LOGGED BY** FW **CHECKED BY** MP

**HOLE SIZE** 8 inches

**DATE STARTED** 10/23/12 **COMPLETED** 10/23/12

**PROJECT NAME** Pond Slope Stability

**PROJECT LOCATION** Monticello

**GROUND ELEVATION** 386.5 ft

**GROUND WATER LEVELS:**
- AT TIME OF DRILLING 31.75 ft / Elev 354.75 ft

**DRILLING METHOD** Hollow Stem Auger

**DRILLING CONTRACTOR** WEST Drilling

**NOTES** (Continued Next Page)
SILTY SAND, fine with little medium, little clay, tan and gray, wet, compact (continued)

3" dark gray clay seam (CL), little gravel at 38.0'

subangular, trace clay, oxidation, tan at 43.0'

some clay seams, tan and gray at 48.0'

Bottom of borehole at 50.0 feet.
**Removing 4" of gravel from roadway**

**CLAY**
- Lean Clay, low plasticity, some to little sand, trace silt, brown, dry, firm
- Some sand, tan and gray, firm to stiff at 2.0'
- Trace gravel, tan, red, and gray, stiff at 4.0'
- Increased sand content, little silt, hard at 6.0'

**SANDY CLAY**
- Lean Clay, low plasticity, some silt, gray and red, dry, stiff

**SANDY CLAY**
- Lean Clay, low plasticity, fine, subangular, dark gray, dry
- Some silt, tan and gray at 18.0'

**CLAY**
- Lean Clay, low plasticity, little silt, tan and gray, dry, hard
- Low plasticity, some silt, moist, firm at 28.0'

**CLAYEY SAND**
- Fine, subangular, low plasticity, little silt, some clay seams, tan and gray, moist

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**Notes:**
- (Continued Next Page)
(SC) CLAYEY SAND, fine, subangular, low plasticity, little silt, some clay seams, tan and gray, moist (continued) little medium at 35.0’

some silt, little oxidation, wet, compact at 43.0’

Bottom of borehole at 50.0 feet.
APPENDIX B
LABORATORY TEST RESULTS SUMMARY
### SUMMARY OF LABORATORY RESULTS

**CLIENT**  Luminant  
**PROJECT NAME**  Pond Slope Stability  
**PROJECT NUMBER**  123-94128  
**PROJECT LOCATION**  Monticello  

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APPENDIX C
LABORATORY TEST RESULTS
ATTERBERG LIMIT RESULTS
CLIENT: Luminant  
PROJECT NAME: Pond Slope Stability  
PROJECT NUMBER: 123-94128  
PROJECT LOCATION: Monticello  

ATTERBERG LIMITS' RESULTS

CLIENT: Luminant  
PROJECT NAME: Pond Slope Stability  
PROJECT NUMBER: 123-94128  
PROJECT LOCATION: Monticello  

ATTERBERG LIMITS - CQA - GINT STD US LAB.GDT - 11/20/12 14:49 - P:\_2012 PROJECT FOLDERS\123-94128 LUMINANT POND SLOPE STABILITY\MONTICELLO FIELD INVESTIGATION\94128MONTICELLO.GPJ

BOREHOLE DEPTH LL PL PI Fines Classification

BH-101 6 36 14 22
BH-101 33 28 13 15
BH-103 18 60 19 41
BH-104 4 55 17 38
BH-104 8 27 13 14
BH-104 18 50 16 34
BH-105 13 44 15 29
BH-106 2 59 18 41
BH-107 13 36 16 20
BH-107 18 42 17 25
BH-108 23 33 12 21
BH-109 18 27 16 11
BH-110 10 48 16 32
GRAIN SIZE ANALYSIS
### Grain Size Distribution

**Client:** Luminant  
**Project Name:** Pond Slope Stability  
**Project Number:** 123-94128  
**Project Location:** Monticello

#### Borehole Data

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#### Sieve Analysis

- **D100:** 2  
- **D60:** 0.165  
- **D30:** 0.033  
- **D10:** 0.0  
- **%Gravel:** 66.0  
- **%Sand:** 11.6  
- **%Silt:** 22.4  
- **%Clay:** 0.0

- **D100:** 2  
- **D60:** 0.089  
- **D30:** 0.009  
- **D10:** 0.0  
- **%Gravel:** 45.5  
- **%Sand:** 28.9  
- **%Silt:** 25.6  
- **%Clay:** 0.0

- **D100:** 4.75  
- **D60:** 0.179  
- **D30:** 0.099  
- **D10:** 0.0  
- **%Gravel:** 79.2  
- **%Sand:** 20.8  
- **%Silt:** 0.0  
- **%Clay:** 0.0

- **D100:** 4.75  
- **D60:** 0.164  
- **D30:** 0.000  
- **D10:** 0.0  
- **%Gravel:** 65.0  
- **%Sand:** 35.0  
- **%Silt:** 0.0  
- **%Clay:** 0.0

#### Summary

- **Grain Size Distribution**
- **Cobble:** coarse, fine
- **Gravel:** coarse, medium, fine
- **Sand:** coarse, medium, fine
- **Silt or Clay:**

---

**Project Name:** Pond Slope Stability  
**Project Location:** Monticello

**Borehole Data:**

- **BH-101:** 38  
- **BH-102:** 13  
- **BH-103:** 25  
- **BH-103:** 43

**Sieve Data:**

- **D100:** 2  
- **D60:** 0.165  
- **D30:** 0.033  
- **D10:** 0.0  
- **%Gravel:** 66.0  
- **%Sand:** 11.6  
- **%Silt:** 22.4  
- **%Clay:** 0.0

- **D100:** 4.75  
- **D60:** 0.179  
- **D30:** 0.099  
- **D10:** 0.0  
- **%Gravel:** 79.2  
- **%Sand:** 20.8  
- **%Silt:** 0.0  
- **%Clay:** 0.0

- **D100:** 4.75  
- **D60:** 0.164  
- **D30:** 0.000  
- **D10:** 0.0  
- **%Gravel:** 65.0  
- **%Sand:** 35.0  
- **%Silt:** 0.0  
- **%Clay:** 0.0
GRAIN SIZE DISTRIBUTION

CLIENT: Luminant  PROJECT NAME: Pond Slope Stability
PROJECT NUMBER: 123-94128  PROJECT LOCATION: Monticello

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UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH (UU)
### Specimen Description
Reddish Gray Sandy Clay

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<th>PI</th>
<th>LI</th>
<th>USCS</th>
</tr>
</thead>
</table>

### Project Information
- **Project Title**: Luminant - Monticello Slope Stability
- **Project Number**: 123-94128
- **Sample Type**: Shelby Tube
- **Sample ID**: BH-101 TL-4
- **Comments**: Sample L/D ratio < 2

### Test Parameters
- **Depth (ft)**: 6.0
- **Confining Pressure (psf)**: 878
- **Specimen Height (inch)**: 4.9
- **Strain Rate (%/min)**: 1.0
- **Specimen Diameter (inch)**: 2.8
- **Peak Deviator Stress (psf)**: 3620
- **Initial Specimen Weight (g)**: 1018.2
- **Axial Strain at Peak Stress (%)**: 14.8
- **Moist Unit Weight (pcf)**: 128.3
- **Initial Water Content (%)**: 17
- **Initial Dry Unit Weight (pcf)**: 109.6

### Graph
- **Graph Title**: UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
  - **ASTM D 2850**

### Performance Details
- **Performed by**: PN
- **Date**: 9-Nov-12
- **Check**: HR
- **Review**: PCM
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

Specimen Description: Reddish Gray Sandy Clay
LL | PI | LI | USCS

Depth (ft): 33.0
Confining Pressure (psf): 4026
Specimen Height (inch): 5.9
Strain Rate (%/min): 1.0
Specimen Diameter (inch): 2.8
Peak Deviator Stress (psf): 2122
Initial Specimen Weight (g): 1252.9
Axial Strain at Peak Stress (%): 15.0
Moist Unit Weight (pcf): 129.3
Initial Water Content (%): 23
Initial Dry Unit Weight (pcf): 104.9

Project Title: Luminant - Monticello Slope Stability
Project Number: 123-94128
Sample Type: Shelby Tube
Sample ID: BH-101 TO-10

Failure Sketch

Performed by: PN
Date: 10-Nov-12
Check: HR
Review: PCM
UNCONSOLIDATED / UNDRAINED COMPRESSION STRENGTH
ASTM D 2850

Specimen Description: Reddish Gray Clay

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<td>Initial Dry Unit Weight (pcf)</td>
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Project Title: Luminant - Monticello Slope Stability
Project Number: 123-94128
Sample Type: Shelby Tube
Sample ID: BH-103 TO-7
Comments: Performer by PN Date 10-Nov-12 Check HR Review PCM

Failure Sketch
Specimen Description: Reddish Gray Clay

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<th>LI</th>
<th>USCS</th>
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| Depth (ft) | 18.0 | Confining Pressure (psf) | 2873 |
| Specimen Height (inch) | 6.0 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (psf) | 10292 |
| Initial Specimen Weight (g) | 1257.9 | Axial Strain at Peak Stress (%) | 11.1 |
| Moist Unit Weight (pcf) | 131.0 |
| Initial Water Content (%) | 17 |
| Initial Dry Unit Weight (pcf) | 112.3 |

Project Title: Luminant - Monticello Slope Stability
Project Number: 123-94128
Sample Type: Shelby Tube
Sample ID: BH-104 TO-7
Comments: Load cell reached maximum capacity

Failure Sketch

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

Performe by PN
Date 10-Nov-12
Check HR
Review PCM
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

Specimen Description: Reddish Gray Clay

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- Depth (ft): 2.0
- Confining Pressure (psf): 364
- Specimen Height (inch): 6.0
- Strain Rate (%/min): 1.0
- Specimen Diameter (inch): 2.8
- Peak Deviator Stress (psf): 15637
- Initial Specimen Weight (g): 1242.3
- Axial Strain at Peak Stress (%): 3.5
- Moist Unit Weight (pcf): 129.1
- Initial Water Content (%): 17
- Initial Dry Unit Weight (pcf): 110.8

- Project Title: Luminant - Monticello Slope Stability
- Project Number: 123-94128
- Sample Type: Shelby Tube
- Sample ID: BH-106 TO-2
- Comments

Performed by: PN
Date: 10-Nov-12
Check: HR
Review: PCM
### Specimen Description

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### Test Parameters

- **Depth (ft)**: 18.0
- **Confining Pressure (psf)**: 2376
- **Specimen Height (inch)**: 5.9
- **Strain Rate (%/min)**: 1.0
- **Specimen Diameter (inch)**: 2.8
- **Peak Deviator Stress (psf)**: 8451
- **Initial Specimen Weight (g)**: 1281.6
- **Axial Strain at Peak Stress (%)**: 13.8
- **Moist Unit Weight (pcf)**: 136.8
- **Initial Water Content (%)**: 15
- **Initial Dry Unit Weight (pcf)**: 119.3

### Project Details

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### Failure Sketch

![Failure Sketch](image)

### Graph

**UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850**

- **x-axis**: Axial Strain (%)
- **y-axis**: Deviator Stress (psf)

- Failure Envelope
  - **0% Strain**: Deviator Stress 0 psf
  - **13.8% Strain**: Deviator Stress 8451 psf
Specimen Description: Light Grayish Brown Clay

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<td>Initial Dry Unit Weight (pcf)</td>
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Project Title: Luminant - Monticello Slope Stability

Sample Type: Shelby Tube

Sample ID: BH-108 TO-8

Comments: Performed by PN

Date: 10-Nov-12
Check: HR
Review: PCM
**Specimen Description**: Reddish Gray Clay

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<th>LI</th>
<th>USCS</th>
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</thead>
</table>

- **Depth (ft)**: 10.0
- **Confining Pressure (psf)**: 1357
- **Specimen Height (inch)**: 5.9
- **Strain Rate (%/min)**: 1.0
- **Specimen Diameter (inch)**: 2.8
- **Peak Deviator Stress (psf)**: 3430
- **Initial Specimen Weight (g)**: 1191.6
- **Axial Strain at Peak Stress (%)**: 14.1
- **Moist Unit Weight (pcf)**: 124.9
- **Initial Water Content (%)**: 19
- **Initial Dry Unit Weight (pcf)**: 105.3

**Project Title**: Luminant - Monticello Slope Stability

**Project Number**: 123-94128

**Sample Type**: Shelby Tube

**Sample ID**: BH-110 TO-6

**Comments**: Performed by PN, Date 10-Nov-12, Check HR, Review PCM

**Failure Sketch**

**Graph**: UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH

*ASTM D 2850*
ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL TEST (ICU)
Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Luminant
Project Number: 123-94128
Date: 16-Nov-12
Boring Number: BH-107
Specimen Name: TO-6
Depth (ft): 13.0

Consolidation Stress ($\sigma'_c$, psf) = 1743.9
Consolidation $t_{50}$ (min) = 9
Consolidation Volume Change (mL) = 3.5
Unloading Stress (psf) = NA
Unloading $t_{50}$ (min) = NA
Unloading Volume Change (mL) = NA
LL = 36  PI = 20
USCS = CL
Gs = 2.65 assumed

Performed by PN
Reviewed by HR

Golder Associates
**Specimen Description:** Light Gray Clay

- **Initial Specimen Diameter (inch):** 2.84
- **Initial Specimen Height (inch):** 5.30
- **Initial Water Content (%):** 16.8
- **Water Content at End of Test (%):** 19.5
- **Initial Moist Unit Weight (pcf):** 141.6
- **B-value:** 0.98
- **Back Pressure (BP, psf):** 5760.0
- **Consolidation Stress ($\sigma'_1$, psf):** 2867.8
- **Initial Lateral Stress ($\sigma'_3$, psf):** 2867.8
- **Consolidation $t_{50}$ (min):** 9
- **Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf):** 98.6
- **Rebound Stress ($\sigma'_3$, psf):** NA
- **Test Strain Rate (%/hour):** 1.0
- **Rebound $t_{50}$ (min):** NA

**Tests:**
- **LL:** 42
- **Plasticity Index (PI):** 25
- **USCS:** CL

**Performed by:** PN
**Reviewed by:** HR
Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Luminant
Project Number: 123-94128
Date: 17-Nov-12
Boring Number: BH-107
Specimen Name: TO-8
Depth (ft): 23.0

Consolidation Stress ($\sigma'_c$, psf) = 2867.8
Consolidation $t_{50}$ (min) = 9
Consolidation Volume Change (mL) = 9.7
Unloading Stress (psf) = NA
Unloading $t_{50}$ (min) = NA
Unloading Volume Change (mL) = NA

LL = 42  PI = 25
USCS CL
Gs = 2.65 assumed

Perform by PN
Reviewed by HR

Golder Associates
Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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