REPORT

# SAFETY FACTOR ASSESSMENT REPORT

## Oak Grove Steam Electric Station



**Submitted To:** Luminant
1601 Bryan Street
Dallas, TX 75201

**Submitted By:** Golder Associates Inc.
500 Century Plaza Drive, Suite 190
Houston, TX 77073 USA


Professional Engineering Firm
Registration Number F-2578

**October 2016**

**Project No. 1648164**

Golder Associates

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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 safety factor assessments in accordance with §257.73(e). This letter provides the structural stability assessments and the safety factor assessments for the Oak Grove Steam Electric Station's (OGSES's) CCR Impoundments, identified as flue gas desulphurization (FGD) Ponds FGD-A, FGD-B, and FGD-C.

## 1.2 Site Background

The OGSES generates bottom ash, fly ash, boiler slag and flue gas desulfurization (FGD) sludge (gypsum) during electricity generation. The following surface impoundments, shown on Figure 1, are in operation at the OGSES:

- FGD-A Pond;
- FGD-B Pond; and
- FGD-C Pond.

## 1.3 Previous Slope Stability Evaluations

Golder performed previous evaluations on the FGD-A, and FGD-B ponds as part of the below reports submitted to Luminant:

- FGD-B Slope Stability Investigation Report (Revised), Luminant Oak Grove SES, Robertson County, Texas, dated June 2010
- FGD-A Slope Stability Evaluation Report, Luminant Oak Grove SES, Robertson County, Texas, dated March 2011
- Addendum To Slope Stability Investigation Reports Luminant Oak Grove SES, Robertson County, Texas, March 2014

These studies found the pond slopes to be adequately stable.

Construction of FGD-C Pond began on August 21, 2015. During the design of FGD-C Pond, Golder evaluated the stability of the embankments.

In this study, Golder has reviewed the previous analyses, modified the analyses where needed and added suitable cases to evaluate whether the ponds meet the required safety factors in §257.73(e)(1)(i)-(iv).

# 2.0 SUBSURFACE CONDITIONS

## 2.1 Regional Geology

The OGSES site is located in the Sandy Hills physiographic province of Texas. Ground elevations range from 400 to 425 feet MSL (mean sea level), and the topography is characterized by low rolling hills and shallow stream valleys (Espey, Huston & Associates, 1987). The regional terrain consists of a thick series of unconsolidated sediments consisting of sand, silt, clay, and lignite. The major geologic units are the tertiary age 'bedrock' strata and the quaternary age fluviatile deposits. Eroded bedrock is overlain by alluvium and terraces along the valleys of larger streams. The approximate thickness of alluvium in the area of the site varies from 0 to 50 ft. The alluvium typically consists of sand, silt, silty clay and sandy clay and is not easily differentiated from the underlying bedrock strata in many instances.

## 2.2 Site Geology

### *2.2.1 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 FGD-A pond in July 2008, prior to construction of the clay liner within the pond. Golder completed nine borings within the pond footprint with boring depths ranging from 16 to 28 feet below ground surface (bgs) (Golder, 2008). Golder also conducted a subsurface investigation for FGD-B pond in March 2010 (Golder, 2010). In December 2014, Golder completed another subsurface investigation including ten geotechnical boreholes and installation of 3 groundwater monitoring wells, to facilitate design and construction of the FGD-C pond. Appendix A includes the boring location maps and select, representative boring logs.

For each 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 results are presented in Appendix B.

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

### 2.2.2 Subsurface Site Conditions

#### 2.2.2.1 FGD-A Pond

The soils encountered under the FGD-A Pond consist of lean clays, sandy clays, silty clays, sands, silty sands, clayey sands, and sandy silts. The near surface soils under the pond generally consist of fine-grained soils extending to depths ranging from approximately 6 feet to more than 19 feet below the pond bottom. Coarse-grained soils (i.e., sands) were generally encountered at depths greater than 6 feet below the pond bottom. Sands were encountered at shallower depths in the northwest portion of the pond than in the southeast portion of the pond.

Historical monitoring well measurements near the FGD-A Pond indicate that the groundwater level is between approximately 406 and 409 ft-msl.

#### 2.2.2.2 FGD-B Pond

The soils encountered in the borings generally consisted of very stiff to hard clays and compact to very dense sands. The surficial soils were generally classified as very stiff to hard sandy (lean and fat) clay and ranged in thickness from 8 to 27 ft. The surficial clay stratum was underlain by layers of compact to very dense sand, clayey sand, silty sand, and/or very stiff to hard silty clay or clay.

Based on monitoring well measurements near FGD-B, the groundwater level ranges from approximately 405 to 410 ft-msl.

#### 2.2.2.3 FGD-C Pond

Based on the results of the geotechnical investigations at this facility, soils in the footprint of the FGD-C Pond in general comprise the following:

- Laminated clays, silty clays and sandy clays having low horizontal and vertical hydraulic conductivity;
- Thinly bedded clays, clayey silts, and silty sands characterized by low to moderate horizontal permeability and low net vertical permeability; and
- Bedded sands, silty sands, clayey sands, and silts of moderate to relatively high horizontal and moderate vertical permeability.

Based on monitoring well measurements near FGD-C, the groundwater level ranges from approximately 410 ft-msl to 412 ft-msl.

# 3.0 STABILITY ANALYSIS - §257.73(e)

## 3.1 Safety Factor Assessment

According to the CCR rules, structural stability factors of safety need to be evaluated for the critical cross-section of each CCR facility under static and seismic loading for “Maximum Storage Pool” (2 feet of freeboard for this facility) and “Maximum Surcharge Pool” conditions. Liquefaction potential analysis is only necessary when soil sampling, construction documentation or anecdotal evidence from personnel with knowledge about the facility, indicates that soils of the embankment are susceptible to liquefaction.

Slope stability analyses were performed using a limit-equilibrium-based commercial computer program, Slide v7.0 by Rocscience. The analyses used a searching routine to identify the potential failure surface with minimum factor of safety for a given set of geometry, ground and groundwater conditions. The Spencer method of analysis was used in the analyses, while the Morgenstern-Price method was used for verification. The factors of safety of numerous potential failure surfaces were computed to establish minimum factors of safety. Circular failure surfaces were considered for all cases except for section B1-B1’ (discussed later) that has a thin layer of silt, and hence, a block failure produces a lower factor of safety. Stability analyses were performed for “Maximum Storage Pool” (freeboard of 2 feet) and “Maximum Surcharge Pool” (no freeboard) conditions for both the interior and exterior slopes of the ponds. In addition, the interior slopes were analyzed while the pond is empty. For each case, respective slopes were analyzed for both static and seismic loading conditions.



## 3.2 Cross-Sections Analyzed

After considering multiple cross-sections a critical cross-section was identified for each pond and used for the stability analysis. The critical cross-section was determined considering the geometry of the slopes, soil profile, phreatic surface and loading conditions. More than one cross-section was used when required. For example, the critical section for the interior slopes of FGD-B is located to the east bordering pond FGD-A. However, since FGD-A adjoins FGD-B here, the critical section for exterior slopes of FGD-B are not located on this section. Hence, another section is analyzed on the west side of FGD-B to evaluate the exterior slopes. The critical cross-sections analyzed – A-A’, B-B’, B1-B1’, C-C’ – for each pond are shown in Figure 2.

## 3.3 Material Properties

Based on the previous subsurface investigations, appropriate material properties were selected for use in the stability analysis. Table 1, Table 2, Table 3, and Table 4 summarize the material properties used in the stability analysis.

Espey, Huston & Associates, 1987 present boreholes drilled on the embankment of FGD-A composed of structural fill. The borings on the embankment crest and the slopes show high pocket penetrometer values

of 4.5 tons/ft$^2$ or above, indicating considerably hard clays. Also, we reviewed the Atterberg limits on samples collected from fill at the FGD-C pond. Based on these, a conservative value of shear strength was assumed for the structural fill as shown in the below tables.

**Table 1: Soil Properties for Section A-A'**

| Soil Material | Description | Moist Unit Weight (lb/ft$^3$) | Saturated Unit Weight (lb/ft$^3$) | Drained Soil Properties | |
|---|---|---|---|---|---|
| | | | | Cohesion, c' (lb/ft$^2$) | Friction Angle, $\phi$' (°) |
| I | Sandy Clay | 127 | 132 | 270 | 26 |
| II | Silty Clay/ Clay | 127 | 132 | 0 | 26 |
| III | Clayey Sand | 127 | 132 | 0 | 32 |

**Table 2: Soil Properties for Section B-B'**

| Soil Material | Description | Moist Unit Weight (lb/ft$^3$)) | Saturated Unit Weight (lb/ft$^3$) | Drained Soil Properties | |
|---|---|---|---|---|---|
| | | | | Cohesion, c' (lb/ft$^2$) | Friction Angle, $\phi$' (°) |
| I | Clay/ Silty Clay/ Sandy Clay | 127 | 132 | 270 | 26 |
| II | Sandy Silt | 127 | 132 | 0 | 26 |
| III | Sand/ Silty Sand | 127 | 132 | 0 | 36 |
| | Structural Fill | 127 | 132 | 270 | 26 |

**Table 3: Soil Properties for Section B1-B1'**

| Soil Material | Description | Moist Unit Weight (lb/ft$^3$) | Saturated Unit Weight (lb/ft$^3$) | Drained Soil Properties | |
|---|---|---|---|---|---|
| | | | | Cohesion, c' (lb/ft$^2$) | Friction Angle, $\phi$' (°) |
| I | Clay/ Silty Clay/ Sandy Clay | 127 | 132 | 270 | 26 |
| II | Sand/ Silty Sand | 127 | 132 | 0 | 36 |
| | Structural Fill | 127 | 132 | 270 | 26 |

**Table 4: Soil Properties for Section C-C'**

| Soil Material | Description | Moist Unit Weight (lb/ft$^3$) | Saturated Unit Weight (lb/ft$^3$) | Drained Soil Properties | |
|---|---|---|---|---|---|
| | | | | Cohesion, c' (lb/ft$^2$) | Friction Angle, $\phi$' (°) |
| I | New Fill - compacted onsite low to moderate plasticity clay soils | 125 | n/a | 200 | 26 |
| II | Existing Fill - stiff to very stiff clays | 125 | n/a | 150 | 24 |
| III | Very stiff Silty Clay | 127 | 132 | 270 | 26 |
| IV | Very dense Silty Sand | 120 | 130 | n/a | 34 |



## 3.4 Phreatic Surface

For the stability analysis, the location of the phreatic surface within the FGD-A Pond embankment was conservatively assumed to correspond to the water level in the pond and to the ground surface of the exterior slope of the embankment. The only exception to this is Case 5a and 5b for FGD-B, where the phreatic surface from the adjoining FGD-A embankment was assumed to slope at approximately 3H:1V.

FGD-B and FGD-C Ponds are both lined with a composite geomembrane/clay liner; therefore, no phreatic surface is expected to develop within the embankments. The groundwater level below the FGD-B Pond was conservatively assumed to be at 410 ft-msl. The groundwater level near the cross-section analyzed for FGD-C Pond was assumed to be at 410 ft-msl, which is representative of the eastern portion of the pond.

Note that the phreatic surface elevations were conservatively assumed for stability analysis purposes -- they do not represent the elevation of the uppermost aquifer.

## 3.5 Seismic Loading

Based on the "US Seismic Hazard 2014 Map" prepared by the United States Geologic Survey (USGS) and the "2008 Interactive Deaggregations" (USGS), the peak ground acceleration (PGA) for a 2% probability of exceedance in 50 years (return period of 2,475 years) is 0.06g for the site location (including amplification factors for site soil conditions). Hence, a horizontal seismic load coefficient of 0.06g was used in the pseudostatic analysis.

## 3.6 Liquefaction Potential

Soil liquefaction describes a phenomenon whereby a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid. The phenomenon is most often observed in saturated, loose (low density or uncompacted), sandy soils. The embankment soils of ponds FGD-A, FGD-B, and FGD-C are all composed of clayey materials with significant fines content. The immediate foundation materials are also composed of soils containing a significant portion of fines, and are as well considerable dense. The subsurface investigations performed at each of the ponds do not indicate any soils in the embankment or its foundation, which are susceptible to liquefaction. Hence, failure of the pond slopes due to liquefaction is considered unlikely for the CCR surface impoundments at the OGSES.

## 3.7 Stability Analysis Results

Slope stability analyses were performed for long-term conditions for each of the critical cross-sections considered under static and seismic loading conditions. Both interior and exterior slopes were analyzed for "Maximum Storage Pool" (2 feet of freeboard) and "Maximum Surcharge Pool" (no freeboard) conditions. The interior slopes were analyzed for the condition where the pond is empty. The results of the slope stability analyses cases are presented in Table 5, Table 6, and Table 7 for ponds FGD-A, FGD-B, and FGD-C, respectively. The corresponding analysis outputs can be found in Appendix C. The results indicate that the pond slopes are sufficiently stable under all considered loading scenarios.

**Table 5: Slope Stability Analysis Results – FGD-A**

| Cross-Section | Case # | Slope Location | Pond Pool Level | Loading Condition | Req'd Safety Factor (1) | Calculated Safety Factor |
|---|---|---|---|---|---|---|
| A-A' | 1a | Exterior | Storage | Static | 1.50 | 1.89 |
| | 1b | | | Pseudostatic | 1.00 | 1.61 |
| | 2a | | Surcharge | Static | 1.40 | 1.84 |
| | 2b | | | Pseudostatic | 1.00 | 1.56 |

| Cross-Section | Case # | Slope Location | Pond Pool Level | Loading Condition | Req'd Safety Factor (1) | Calculated Safety Factor |
|---|---|---|---|---|---|---|
| | 3a | Interior | Storage | Static | 1.50 | 4.72 |
| | 3b | | | Pseudostatic | 1.00 | 3.58 |
| | 4a | | Surcharge | Static | 1.40 | 5.20 |
| | 4b | | | Pseudostatic | 1.00 | 3.90 |
| | 5a | | Empty | Static | 1.50 | 2.15 |
| | 5b | | | Pseudostatic | 1.00 | 1.77 |

Note: (1) Required safety factors per §257.73(e)(i)-(iii)

**Table 6: Slope Stability Analysis Results – FGD-B**

| Cross-Section | Case # | Slope Location | Pond level | Loading Condition | Req'd Safety Factor (1) | Calculated Safety Factor |
|---|---|---|---|---|---|---|
| B-B' | 1a | Exterior | Storage | Static | 1.50 | 2.43 |
| | 1b | | | Pseudostatic | 1.00 | 2.07 |
| | 2a | | Surcharge | Static | 1.40 | 2.43 |
| | 2b | | | Pseudostatic | 1.00 | 2.07 |
| B1-B1' | 3a | Interior | Storage | Static | 1.50 | 1.51 |
| | 3b | | | Pseudostatic | 1.00 | 1.20 |
| | 4a | | Surcharge | Static | 1.40 | 1.55 |
| | 4b | | | Pseudostatic | 1.00 | 1.25 |
| | 5a | | Empty | Static | 1.50 | 2.20 |
| | 5b | | | Pseudostatic | 1.00 | 1.79 |

Note: (1) Required safety factors per §257.73(e)(i)-(iii)

**Table 7: Slope Stability Analysis Results – FGD-C**

| Cross-Section | Case # | Slope Location | Pond Pool level | Loading Condition | Req'd Safety Factor (1) | Calculated Safety Factor |
|---|---|---|---|---|---|---|
| C-C' | 1a | Exterior | Storage | Static | 1.50 | 2.06 |
| | 1b | | | Pseudostatic | 1.00 | 1.72 |
| | 2a | | Surcharge | Static | 1.40 | 2.06 |
| | 2b | | | Pseudostatic | 1.00 | 1.72 |
| | 3a | Interior | Storage | Static | 1.50 | 5.53 |
| | 3b | | | Pseudostatic | 1.00 | 4.04 |
| | 4a | | Surcharge | Static | 1.40 | 6.19 |
| | 4b | | | Pseudostatic | 1.00 | 4.44 |
| | 5a | | Empty | Static | 1.50 | 2.16 |
| | 5b | | | Pseudostatic | 1.00 | 1.80 |

Note: (1) Required safety factors per §257.73(e)(i)-(iii)

## 4.0 CONCLUSION

Based on our review of the information provided by Luminant, on information prepared by Golder Associates Inc., and on our analyses, the calculated factors of safety through the critical cross sections in the surface impoundments exceed the values listed in §257.73(e)(1)(i)-(iv).

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.**

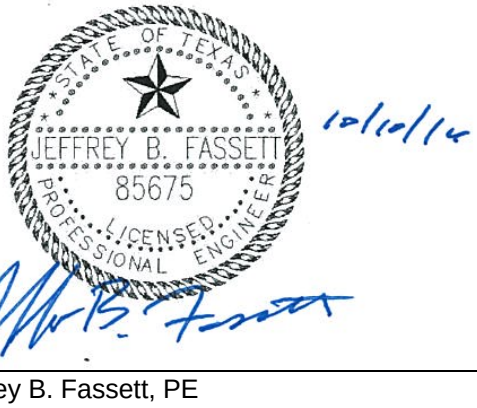
Varenya Kumar
Staff Engineer

Jeffrey B. Fassett, PE
Associate Geotechnical Engineer

VK-JBF

## 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(e).




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

## 6.0 REFERENCES

Espey, Huston & Associates, Inc., 1987, Hydrogeologic Assessment of Proposed Surface Impoundment Areas, Twin Oak SES, Robertson County, Texas.

Golder Associates Inc. 2008, Data Report - Oak Grove SES, FGD Pond Subsurface Investigation, Robertson County, Texas.

Golder Associates Inc. 2010, FGD-B Slope Stability Investigation Report (Revised), Luminant Oak Grove SES, Robertson County, Texas.

Golder Associates Inc. 2011, FGD-A Slope Stability Evaluation Report, Luminant Oak Grove SES, Robertson County, Texas.

Golder Associates Inc. 2014, Addendum to Slope Stability Investigation Reports, Luminant Oak Grove SES, Robertson County, Texas.


**REFERENCE(S)**
AERIAL PHOTO SOURCED FROM GOOGLE EARTH PRO DATED 2016

10/10/16

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED PROFESSIONAL ENGINEER

Professional Engineering Firm
Registration Number F-2578

0 400 800
1" = 800' FEET

CLIENT
LUMINANT POWER
OAK GROVE

CONSULTANT
Golder Associates

| | |
|---|---|
| YYYY-MM-DD | 2016-09-29 |
| DESIGNED | VK |
| PREPARED | TNB |
| REVIEWED | MX |
| APPROVED | JBF |

PROJECT
2016 COAL COMBUSTION RESIDUALS
ENGINEERING SERVICES

TITLE
**GENERAL SITE MAP**

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 1648164 | A | 1 |

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
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0


**LEGEND**

- FGD POND GRADE BREAK LINES
- FGD POND MAJOR CONTOUR
- FGD POND MINOR CONTOUR

**REFERENCE(S)**

AERIAL PHOTO SOURCED FROM GOOGLE EARTH PRO DATED 2016

10/10/16

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED PROFESSIONAL ENGINEER

Professional Engineering Firm
Registration Number F-2578

0 150 300
1" = 300' FEET

CLIENT
LUMINANT POWER
OAK GROVE

CONSULTANT
Golder Associates

| | |
|---|---|
| YYYY-MM-DD | 2016-09-29 |
| DESIGNED | VK |
| PREPARED | TNB |
| REVIEWED | MX |
| APPROVED | JBF |

PROJECT
2016 COAL COMBUSTION RESIDUALS
ENGINEERING SERVICES

TITLE
**CROSS-SECTIONS FOR SLOPE STABILITY ANALYSIS**

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 1648164 | A | 2 |

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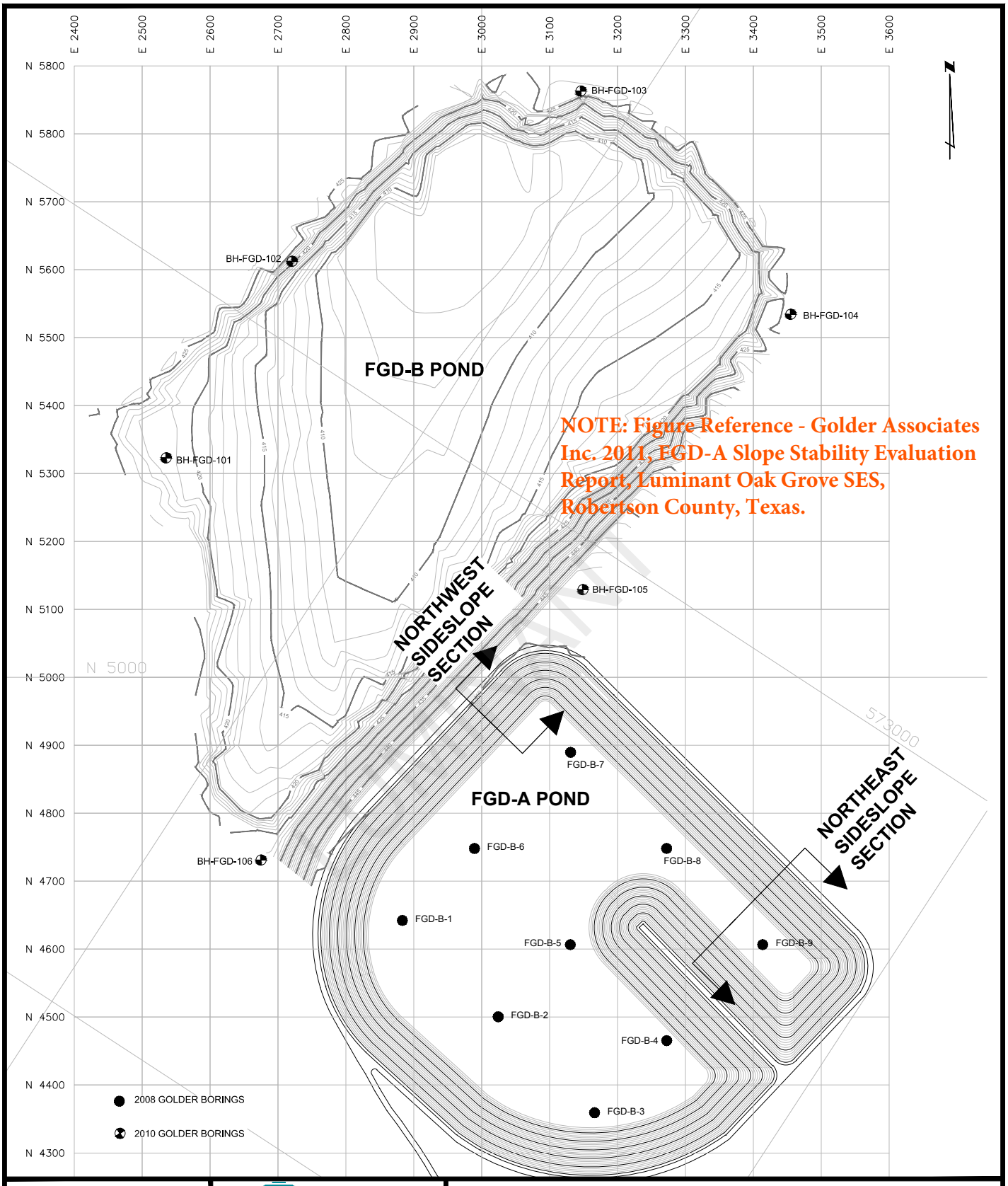
**APPENDIX A**
**BORING LOCATION MAPS & BORING LOGS**




**NOTE: Figure Reference - Golder Associates Inc. 2011, FGD-A Slope Stability Evaluation Report, Luminant Oak Grove SES, Robertson County, Texas.**

Luminant

Golder Associates
500 Century Plaza Drive, Suite 190
Houston, Texas USA 77073
Tel: (281) 821-6868
Texas Registration Number: F-2578

TITLE

# EXISTING BORING LOCATION PLAN

PROJECT

**FGD-A-POND SLOPE STABILITY ANALYSIS**
**LUMINANT OAK GROVE SES**
**ROBERTSON COUNTY, TEXAS**

| | | | |
|---|---|---|---|
| DRAWN | TLE | DATE | MARCH 2011 |
| CHECKED | PCM | SCALE | AS SHOWN |
| REVIEWED | PCM | JOB NO. | 113-94790 |
| FILE NO. | | DWG NO. | 11394790A003 |

FIGURE NUMBER **3**

Drawing File: J:\113-94790 - Oak Grove_A - FGD-A Pond\11394790A003.dwg | La out: ---- | Modified: 3.11.2011 12:16:58 PM TLe | Plotted: Friday, March 11, 2011 12:22:58 PM TLe

# RECORD OF BOREHOLE FGD-B-7

SHEET 1 OF 2
DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4889.56
EASTING (ft): 3130.96
ELEVATION (ft): 422.24

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Shear ■; UU - ✥ TORV. - ▲ UCS - ✱; 400 800 1200 1600) | ROCK QUALITY DESIGNATION (RQD) % ★ (20 40 60 80); WATER CONTENT PERCENT (PL — W — LL; 20 40 60 80) | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Hollow Stem Auger | GROUND SURFACE | | 422.2 | | | | | | | |
| | | Stiff to very stiff, reddish brown, sandy CLAY, damp | | 0.0 | 1 | SB | 4<br>7<br>8<br>N15 | | | | |
| | | dark brown at 1.5' | | | | | | | | | |
| 2 | | Very stiff, reddish brown and yellowish brown, CLAY, trace sand, damp | | 2.0 | 2 | SH | | | | perm<br>sieve | |
| 4 | | | | | 3 | SB | 7<br>10<br>13<br>N23 | | | sieve | |
| 6 | | Dense, reddish brown to brown, SAND, with clay, damp | | 6.0 | 4 | SB | 12<br>22<br>24<br>N46 | | | | |
| 8 | | light brown, sandy clay layer at 8.0' | | | | | | | | | |
| | | reddish brown at 8.5' | | | 5 | SB | 12<br>17<br>21<br>N38 | | | sieve | |
| 10 | | dense to very dense at 10.0' | | | 6 | SB | 11<br>14<br>17<br>N31 | | | | |
| 12 | | light brown at 12.0' | | | 7 | SB | 17<br>30<br>28<br>N58 | | | | |
| 14 | | clayey at 14' | | | 8 | SB | 17<br>17<br>22<br>N39 | | | sieve | |
| 16 | | moist at 16.0' | | | 9 | SB | 10<br>14<br>18<br>N32 | | | | ▼ 16' |
| 18 | | | | | | | | | | | |
| | | light gray at 19.0' | | | 10 | SB | 12<br>24<br>26<br>N50 | | | | |
| 20 | | — CONTINUED NEXT PAGE — | | | | | | | | | |



DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

REVISED October 21, 2008

LOGGED: CS
CHECKED: CFR

# RECORD OF BOREHOLE FGD-B-7

SHEET 2 OF 2
DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4889.56
EASTING (ft): 3130.96
ELEVATION (ft): 422.24

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Sheer ■; UU - ✥ TORV. - ▲ UCS - ✳; 400 800 1200 1600) | ROCK QUALITY DESIGNATION (RQD) % ★ (20 40 60 80); WATER CONTENT PERCENT (PL — W — LL; 20 40 60 80) | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | Hollow Stem Auger | — CONTINUED FROM PREVIOUS PAGE — | | 20.0 | 11 | SB | 12<br>24<br>24<br>N48 | | | | |
| 22 | | TOTAL DEPTH AT 22.0' | | 22.0 | | | | | | | |
| 24 | | | | | | | | | | | |
| 26 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |



DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

REVISED October 21, 2008

LOGGED: CS
CHECKED: CFR

# RECORD OF BOREHOLE FGD-B-8

SHEET 1 OF 2
DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4748.26
EASTING (ft): 3272.19
ELEVATION (ft): 426.97

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Shear ■; UU - ✥ TORV. - ▲ UCS - ✳) 400 800 1200 1600 | ROCK QUALITY DESIGNATION (RQD) % ★ 20 40 60 80 / WATER CONTENT PERCENT PL — W — LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Hollow Stem Auger | GROUND SURFACE | | 427.0 | | | | | | | |
| | | Stiff to very stiff, reddish brown, CLAY, wtih sand, damp | | 0.0 | 1 | SB | 3<br>4<br>6<br>N10 | | | | |
| | | silty at 1.5' | | | | | | | | | |
| 2 | | | | | 2 | SB | 11<br>10<br>10<br>N20 | | | | |
| 4 | | | | | 3 | SB | 4<br>4<br>6<br>N10 | | | | |
| 6 | | Stiff to very stiff, light brown and yellowish brown, silty CLAY, trace sand, damp | | 6.0 | 4 | SB | 4<br>7<br>8<br>N15 | | | | |
| 8 | | very stiff, brown with mottled yellowish brown at 8' | | | 5 | SH | | | ⊢○⊣ | perm<br>sieve | |
| 10 | | reddish brown at 10.0' | | | 6 | SB | 3<br>4<br>6<br>N10 | | | | |
| 12 | | | | | 7 | SB | 3<br>3<br>5<br>N8 | | | | |
| 14 | | dark brown at 14.5' | | | 8 | SB | 3<br>3<br>4<br>N7 | | | | |
| 16 | | | | | 9 | SH | | | ⊢○⊣ | sieve | |
| 18 | | | | | 10 | SB | 8<br>17<br>19<br>N36 | | | | |
| | | Hard, reddish brown, sandy CLAY, damp | | 19.0 | | | | | | | ▼ 20' |
| 20 | | — CONTINUED NEXT PAGE — | | | | | | | | | |



DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

REVISED October 21, 2008

LOGGED: CS
CHECKED: CFR

# RECORD OF BOREHOLE FGD-B-8



DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4748.26
EASTING (ft): 3272.19
ELEVATION (ft): 426.97

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Shear ■; UU - ✥ TORV. - ▲ UCS - ✳) 400 800 1200 1600 | ROCK QUALITY DESIGNATION (RQD) % ★ 20 40 60 80 / WATER CONTENT PERCENT PL — W — LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | Hollow Stem Auger | --- CONTINUED FROM PREVIOUS PAGE --- | | | | | | | | | |
| | | Compact to dense, brown, clayey SAND, moist | | 20.0 | 11 | SB | 7<br>17<br>24<br>N41 | | | sieve | |
| 22 | | light brown at 21.5' | | | 12 | SB | 4<br>7<br>10<br>N17 | | | | |
| 24 | | | | | 13 | SB | 14<br>19<br>24<br>N43 | | O | sieve | |
| 26 | | Firm, gray, CLAY | | 25.5 | | | | | | | |
| | | TOTAL DEPTH 26' | | 26.0 | | | | | | | |
| 28 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |





DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

REVISED October 21, 2008

LOGGED: CS
CHECKED: *CFR*

# RECORD OF BOREHOLE FGD-B-9

SHEET 1 OF 2
DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4606.63
EASTING (ft): 3413.66
ELEVATION (ft): 427.99

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Shear ■; UU - ✤ TORV. - ▲ UCS - ✳) 400 800 1200 1600 | ROCK QUALITY DESIGNATION (RQD) % ★ 20 40 60 80 / WATER CONTENT PERCENT PL — W — LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Hollow Stem Auger | GROUND SURFACE | | 428.0 | | | | | | | |
| | | Firm to stiff, yellowish brown and brown, CLAY, with sand, damp | | 0.0 | 1 | SB | 2<br>4<br>4<br>N8 | | | | |
| 2 | | | | | 2 | SB | 3<br>4<br>4<br>N8 | | | | |
| | | mottled reddish brown and light gray at 3.0' | | | | | | | | | |
| 4 | | Stiff to very stiff, brown with occasional yellow brown seams, silty CLAY, damp | | 4.0 | 3 | SB | 4<br>4<br>6<br>N10 | | | | |
| 8 | | | | | 4 | SB | 4<br>6<br>6<br>N12 | | | | |
| 8 | | | | | 5 | SH | | | | perm<br>sieve | |
| 10 | | dark brown with occasional streaks of reddish brown at 10.0' | | | 6 | SB | 3<br>4<br>5<br>N9 | | | | |
| 12 | | | | | 7 | SB | 4<br>10<br>10<br>N20 | | | | |
| 14 | | | | | 8 | SH | | | | | |
| 16 | | Hard, light gray with occasional yellowish brown and brown, CLAY, trace sand, moist | | 16.0 | 9 | SB | 11<br>12<br>19<br>N31 | | | | |
| 18 | | | | | | | | | | | 18' |
| | | | | | 10 | SB | 7<br>17<br>24<br>N41 | | | sieve | |
| 20 | | — CONTINUED NEXT PAGE — | | | | | | | | | |



DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

REVISED October 21, 2008

LOGGED: CS
CHECKED: CFR

# RECORD OF BOREHOLE FGD-B-9

SHEET 2 OF 2
DATUM: LOCAL

PROJECT: OAK GROVE SES
LOCATION: FRANKLIN, TEXAS

BORING STARTED: 17-Jul-2008
BORING FINISHED: 17-Jul-2008

DRILLING EQUIPMENT: MOBILE B-57 BUGGY
DRILLING OPERATOR: Lewis Environmental Drilling

NORTHING (ft): 4606.63
EASTING (ft): 3413.66
ELEVATION (ft): 427.99

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | UNDRAINED SHEAR STRENGTH Cu (CU - ● P.P. - ⊕ Field Vane Shear ■; UU - ✿ TORV. - ▲ UCS - ✳; 400 800 1200 1600) | ROCK QUALITY DESIGNATION (RQD) % ★ 20 40 60 80 / WATER CONTENT PERCENT PL — W — LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | Hollow Stem Auger | — CONTINUED FROM PREVIOUS PAGE — Hard, dark brown with occasional reddish brown, sandy CLAY, moist | | 20.0 | 11 | SB | 5<br>18<br>28<br>N46 | | | sieve | |
| 22 | | gray with occasional reddish brown at 23' | | | 12 | SB | 18<br>29<br>33<br>N62 | | | sieve | |
| 24 | | TOTAL DEPTH 24.0' | | 24.0 | | | | | | | |
| 26 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 34 | | | | | | | | | | | |
| 36 | | | | | | | | | | | |
| 38 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |



DEPTH SCALE
1 inch to 2.5 feet

Golder Associates

LOGGED: CS
REVISED October 21, 2008 CHECKED: CFR

# RECORD OF BOREHOLE BH-FGD-105

SHEET 1 OF 2
DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5129
EASTING (ft): 3149
ELEVATION (ft): 449

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ❂ TORV. ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL ⊢ W ⊣ LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grass | | 449.0 | | | | | | | | |
| 0 | | Very stiff, mottled dark brown, sandy fat CLAY (CH), trace organics, damp | | | 44 | SH | | 37 | | | | |
| | | hard, light brown at 2.0' | | | 45 | SH | | 33 | | | | |
| | | dark brown at 4.0' | | | 46 | SH | | 30 | | | | |
| 5 | | light brown at 6.0' | | | 47 | SH | | 50 | | | | |
| | | | | | 48 | SH | | 67 | | | (3) CU | c'=278 psf phi'=26 deg |
| 10 | | | | | | | | | | | | |
| | | mottled, trace lignite at 13.0' | | | 49 | SH | | 30 | | | | |
| 15 | | | | | | | | | | | | |
| | | very stiff, dark gray at 18.0' | | | 50 | SH | | 37 | | | | |
| 20 | | | | | | | | | | | | |
| | | hard, dark brown at 23.0' | | | 51 | SH | | 37 | | | | |
| 25 | | | | | | | | | | | | |
| | | Very stiff, mottled dark gray to brown, silty CLAY (CL-ML), few sand, moist | | 28.0 | 52 | SH | | 50 | | | | |
| 30 | | — CONTINUED NEXT PAGE — | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: PCM

# RECORD OF BOREHOLE BH-FGD-105

SHEET 2 OF 2
DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5129
EASTING (ft): 3149
ELEVATION (ft): 449

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✥ TORV. ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL ⊢ W ⊣ LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | — CONTINUED FROM PREVIOUS PAGE — | | | | | | | | | | |
| | | | | 30.0 | | | | | | | | |
| | | Stiff, black, sandy SILT (ML), trace clay, some organics, some wood fragments, moist | | 33.0 | | | | | | | | |
| | | Stiff, dark brown, fat CLAY (CH), trace organics, trace sand, moist | | 33.8 | 53 | SH | | 50 | ⊕ | ○ | | |
| 35 | | | | | | | | | | | | |
| | | Very dense, light brown, fine, poorly-graded SAND (SP), trace clay, damp | | 38.0 | 54 | SS | 50/6" N>50 | 56 | | ○ | | |
| 40 | | | | | | | | | | | | |
| | | Very dense, light brown, fine, poorly-graded SAND (SP-SM), with silt, moist | | 43.0 | 55 | SS | 24 34 38 N72 | 67 | | ○ | | |
| 45 | | | | | | | | | | | | |
| | | Very dense, grayish brown, silty SAND (SM), trace clay, moist | | 48.0 | 56 | SS | 22 26 50/5" N>50 | 83 | | ○ | | |
| 50 | | BORING TERMINATED AT 50.0' | | 50.0 | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: PCM

# RECORD OF BOREHOLE BH-FGD-101

SHEET 1 OF 2
DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 25-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5323
EASTING (ft): 2535
ELEVATION (ft): 421

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) | WATER CONTENT PERCENT | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Cleared ground | | 421.0 | | | | | CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | PL W LL 20 40 60 80 | | |
| | | Very stiff, mottled, sandy lean CLAY (CL), damp | | | 88 | SH | | 37 | | | | |
| | | hard, mottled reddish brown at 2.0' | | | 89 | SH | | 33 | | | | |
| | | trace silt at 4.0' | | | 90 | SH | | 30 | | | | |
| 5 | | very stiff, reddish brown and light gray, some silt at 6.0' | | | 91 | SH | | 33 | | | | |
| | | Dense, grayish brown, SAND (SP-SM), with silt, damp | | 8.0 | 92 | SH | | 23 | | | | |
| 10 | | Very stiff, grayish brown, clayey fine SAND (SC), with some silt, layered gray and light brown at 13.5' | | 13.0 | 93 | SH | | 40 | | | | |
| 15 | | Very dense, light brown, fine, poorly-graded SAND (SP), damp | | 18.0 | 94 | SS | 35<br>50/6"<br>N>50 | 50 | | | | |
| 20 | | little clay at 23.0' | | | 95 | SS | 40<br>50/4"<br>N>50 | 83 | | | | 27' 03/24/2010 |
| 25 | | dense, wet at 28.0' | | | 96 | SS | 7<br>14<br>21<br>N35 | 83 | | | | |
| | | BORING TERMINATED AT 30.0' | | | | | | | | | | |
| 30 | | --- CONTINUED NEXT PAGE --- | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: PCM

# RECORD OF BOREHOLE BH-FGD-101


DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 25-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5323
EASTING (ft): 2535
ELEVATION (ft): 421

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | 30.0 | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-102



DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation

LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010

BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig

DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5612

EASTING (ft): 2721

ELEVATION (ft): 421

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Grass | | 421.0 | | | | | | | | |
| | | Hard, mottled light brown, sandy lean CLAY (CL), damp | | | 79 | SH | | 40 | | | | |
| | | very stiff, brown at 2.0' | | | 80 | SH | | 37 | | | | |
| | | hard at 4.0' | | | 81 | SH | | 27 | | | | |
| 5 | | light gray, moist at 6.0' | | | 82 | SH | | 40 | | | | |
| | | very stiff at 8.0' | | | 83 | SH | | 48 | | | | |
| 10 | | little silt at 13.0' | | | 84 | SH | | 40 | | | | |
| | | Stiff, light to dark gray, silty fat CLAY (CH), trace sand, moist | | 18.0 | 85 | SH | | 53 | | | | |
| 20 | | Stiff, gray, sandy lean CLAY (CL), trace silt, moist | | 23.0 | 86 | SH | | 43 | | | | |
| 25 | | Very dense, light brown, fine, poorly-graded SAND (SP-SM), with clay, wet BORING TERMINATED AT 30.0' | | 28.0 | 87 | SS | 2 7 34 38 N72 | 67 | | | | |
| 30 | | *--- CONTINUED NEXT PAGE ---* | | | | | | | | | | |



DEPTH SCALE

1 inch to 3.8 feet

Golder Associates

LOGGED: DM

CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-102


DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5612
EASTING (ft): 2721
ELEVATION (ft): 421

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | 30.0 | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-103



DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation

LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010

BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig

DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5863
EASTING (ft): 3146
ELEVATION (ft): 426

| DEPTH SCALE FEET | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) | WATER CONTENT PERCENT | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Grass | | 426.0 | | | | | | | | |
| | Very soft to soft, light brown, sandy fat CLAY (CH), trace roots, damp | | | 66 | SH | | 27 | | | | |
| | stiff at 2.0' | | | 67 | SH | | 30 | | | | |
| | light brown to dark grayish brown at 4.0' | | | 68 | SH | | 40 | | | | |
| 5 | hard at 6.0' | | | 69 | SH | | 40 | | | | |
| | mottled at 8.0' | | | 70 | SH | | 23 | | | | |
| 10 | | | | | | | | | | | |
| | | | | 71 | SH | | 38 | | | | |
| 15 | | | | | | | | | | | |
| | Stiff, brown, silty CLAY (CL-ML), with sand, trace lignite, moist | | 18.0 | 72 | SH | | 47 | | | | |
| 20 | | | | | | | | | | | |
| | stiff to very stiff, mottled, damp at 23.0' | | | 73 | SH | | 40 | | | | |
| 25 | | | | | | | | | | | |
| | Stiff, mottled, sandy lean CLAY (CL), damp | | 28.0 | 74 | SH | | 57 | 5500 | | | |
| 30 | --- CONTINUED NEXT PAGE --- | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH Cu (psf)
CU - ● P.P. - ⊕ Field Vane Shear ■
UU - ✿ TORV. - ▲ UCS - ✳
1000 2000 3000 4000

WATER CONTENT PERCENT
PL W LL
20 40 60 80



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-103


DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5863
EASTING (ft): 3146
ELEVATION (ft): 426

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | | |
| 30 | | | | 30.0 | | | | | | | | ▼ 32' 03/24/2010 |
| | | Compact, light gray, SILT (ML), with sand, wet | | 33.0 | 75 | SH | 8<br>7<br>9<br>N16 | 67 | | | | |
| | | Firm, light gray and brown, silty SAND (SM), wet | | 33.7 | | | | | | | | |
| 35 | | | | | | | | | | | | |
| | | Very stiff, mottled light gray, lean CLAY (CL), trace lignite, trace sand, wet | | 38.0 | 76 | SH | | 57 | ✿ ⊕ | ⊕ | | |
| 40 | | | | | | | | | | | | |
| | | hard at 43.0' | | | 77 | SH | | 27 | ⊕ | | | |
| 45 | | | | | | | | | | | | |
| | | interbedded with sand layers at 48.0' | | | 78 | SH | | 37 | | | | |
| 50 | | BORING TERMINATED AT 50.0' | | 50.0 | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-104

SHEET 1 OF 2
DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5534
EASTING (ft): 3455
ELEVATION (ft): 425

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) | WATER CONTENT PERCENT | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Grass | | 425.0 | | | | | CU - ● P.P. - ⊕ Field Vane Shear ■<br>UU - ✿ TORV. - ▲ UCS - ✳<br>1000 2000 3000 4000 | PL — W — LL<br>20 40 60 80 | | |
| | | Very stiff, light brown to dark brown, sandy lean CLAY (CL), damp | | | 57 | SH | | 40 | | | | |
| | | hard, light brown at 2.0' | | | 58 | SH | | 35 | | | | |
| | | mottled to dark brown, trace silt at 4.0' | | | 59 | SH | | 30 | | | | |
| 5 | | grayish brown at 6.0' | | | 60 | SH | | 33 | | | | |
| | | | | | 61 | SH | | 37 | | | | |
| 10 | | | | | | | | | | | | |
| | | very stiff, moist at 13.0' | | | 62 | SH | | 53 | | | | |
| 15 | | | | | | | | | | | | |
| | | hard, damp at 18.0' | | | | | | | | | | |
| | | Very dense, grayish brown, medium to fine, silty clayey SAND (SC/SM), trace organic | | 18.5 | 63 | SH | | 40 | | | | 22' 03/24/2010 |
| 20 | | | | | | | | | | | | |
| | | Compact, light brown and gray, poorly-graded SAND (SP-SM), with silt, wet | | 23.0 | 64 | SS | 5<br>9<br>14<br>N23 | 67 | | | | |
| 25 | | | | | | | | | | | | |
| | | Dense, fine, silty SAND (SM), trace clay | | 28.0 | 65 | SS | 11<br>12<br>19<br>N31 | 67 | | | | |
| 30 | | --- CONTINUED NEXT PAGE --- | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: PCM

# RECORD OF BOREHOLE BH-FGD-104


DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010
BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5534
EASTING (ft): 3455
ELEVATION (ft): 425

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | | |
| | | BORING TERMINATED AT 30.0' | | 30.0 | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-105



DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation

LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010

BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig

DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5129
EASTING (ft): 3149
ELEVATION (ft): 449

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grass | | 449.0 | | | | | | | | |
| 0 | | Very stiff, mottled dark brown, sandy fat CLAY (CH), trace organics, damp | | | 44 | SH | | 37 | | | | |
| | | hard, light brown at 2.0' | | | 45 | SH | | 33 | | | | |
| | | dark brown at 4.0' | | | 46 | SH | | 30 | | | | |
| 5 | | light brown at 6.0' | | | 47 | SH | | 50 | | | | |
| | | | | | 48 | SH | | 67 | | | (3) CU | c'=278 psf<br>phi'=26 deg |
| 10 | | | | | | | | | | | | |
| | | mottled, trace lignite at 13.0' | | | 49 | SH | | 30 | | | | |
| 15 | | | | | | | | | | | | |
| | | very stiff, dark gray at 18.0' | | | 50 | SH | | 37 | | | | |
| 20 | | | | | | | | | | | | |
| | | hard, dark brown at 23.0' | | | 51 | SH | | 37 | | | | |
| 25 | | | | | | | | | | | | |
| | | Very stiff, mottled dark gray to brown, silty CLAY (CL-ML), few sand, moist | | 28.0 | 52 | SH | | 50 | | | | |
| 30 | | --- CONTINUED NEXT PAGE --- | | | | | | | | | | |



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-105



DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation

LOCATION: Oak Grove, Texas

BORING STARTED: 24-Mar-2010

BORING FINISHED: 24-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig

DRILLING OPERATOR: Van & Sons

NORTHING (ft): 5129

EASTING (ft): 3149

ELEVATION (ft): 449

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) | WATER CONTENT PERCENT | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | | |
| 30 | | | | 30.0 | | | | | | | | |
| | | Stiff, black, sandy SILT (ML), trace clay, some organics, some wood fragments, moist | | 33.0 | | | | | | | | |
| | | Stiff, dark brown, fat CLAY (CH), trace organics, trace sand, moist | | 33.8 | 53 | SH | | 50 | | | | |
| 35 | | | | | | | | | | | | |
| | | Very dense, light brown, fine, poorly-graded SAND (SP), trace clay, damp | | 38.0 | 54 | SS | 50/6" N>50 | 56 | | | | |
| 40 | | | | | | | | | | | | |
| | | Very dense, light brown, fine, poorly-graded SAND (SP-SM), with silt, moist | | 43.0 | 55 | SS | 24 34 38 N72 | 67 | | | | |
| 45 | | | | | | | | | | | | |
| | | Very dense, grayish brown, silty SAND (SM), trace clay, moist | | 48.0 | 56 | SS | 22 26 50/5" N>50 | 83 | | | | |
| 50 | | BORING TERMINATED AT 50.0' | | 50.0 | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH Cu (psf)
CU - ● P.P. - ⊕ Field Vane Shear ■
UU - ✿ TORV. - ▲ UCS - ✳
1000 2000 3000 4000

WATER CONTENT PERCENT
PL — W — LL
20 40 60 80



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM

CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-106



DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation

LOCATION: Oak Grove, Texas

BORING STARTED: 23-Mar-2010

BORING FINISHED: 23-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig

DRILLING OPERATOR: Van & Sons

NORTHING (ft): 4731
EASTING (ft): 2675
ELEVATION (ft): 425

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) | WATER CONTENT PERCENT | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Grass | | 425.0 | | | | | | | | |
| | | Stiff, mottled dark gray, sandy lean CLAY (CL), trace silt, damp | | | 97 | SH | | 37 | | | | |
| | | light brown to dark brown at 2.0' | | | 98 | SH | | 37 | | | | |
| | | hard, brownish red, moist at 4.0' | | | 99 | SH | | 40 | | | | |
| 5 | | damp at 6.0' | | | 100 | SH | | 33 | | | | |
| | | mottled brownish red at 8.0' | | | 101 | SH | | 33 | | | | |
| 10 | | | | | | | | | | | | |
| | | mottled gray, little silt at 13.0' | | | 102 | SH | | 40 | | | | |
| 15 | | | | | | | | | | | | |
| | | | | | 103 | SH | | 37 | | | | |
| 20 | | | | | | | | | | | | |
| | | Compact, light gray, fine silty SAND (SM), moist | | 23.0 | 104 | SH | | 43 | | | | |
| 25 | | wet at 28.0' | | | 105 | SS | 7<br>10<br>17<br>N27 | 61 | | | | |
| 30 | | *--- CONTINUED NEXT PAGE ---* | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH Cu (psf)
CU - ● P.P. - ⊕ Field Vane Shear ■
UU - ✿ TORV. - ▲ UCS - ✳
1000 2000 3000 4000

WATER CONTENT PERCENT
PL — W — LL
20 40 60 80



DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

# RECORD OF BOREHOLE BH-FGD-106


DATUM: GEODETIC

PROJECT: Luminant Pond Stability Geotechnical Investigation
LOCATION: Oak Grove, Texas

BORING STARTED: 23-Mar-2010
BORING FINISHED: 23-Mar-2010

DRILLING EQUIPMENT: Buggy Mounted Rig
DRILLING OPERATOR: Van & Sons

NORTHING (ft): 4731
EASTING (ft): 2675
ELEVATION (ft): 425

| DEPTH SCALE FEET | BORING METHOD | SOIL PROFILE DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (ft) | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES BLOWS/0.5 FT | RECOVERY % | UNDRAINED SHEAR STRENGTH Cu (psf) CU - ● P.P. - ⊕ Field Vane Shear ■ UU - ✿ TORV. - ▲ UCS - ✳ 1000 2000 3000 4000 | WATER CONTENT PERCENT PL W LL 20 40 60 80 | ADDITIONAL LAB. TESTING | INSTALLATION NOTES AND GROUNDWATER OBSERVATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | | |
| | | BORING TERMINATED AT 30.0' | | 30.0 | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |

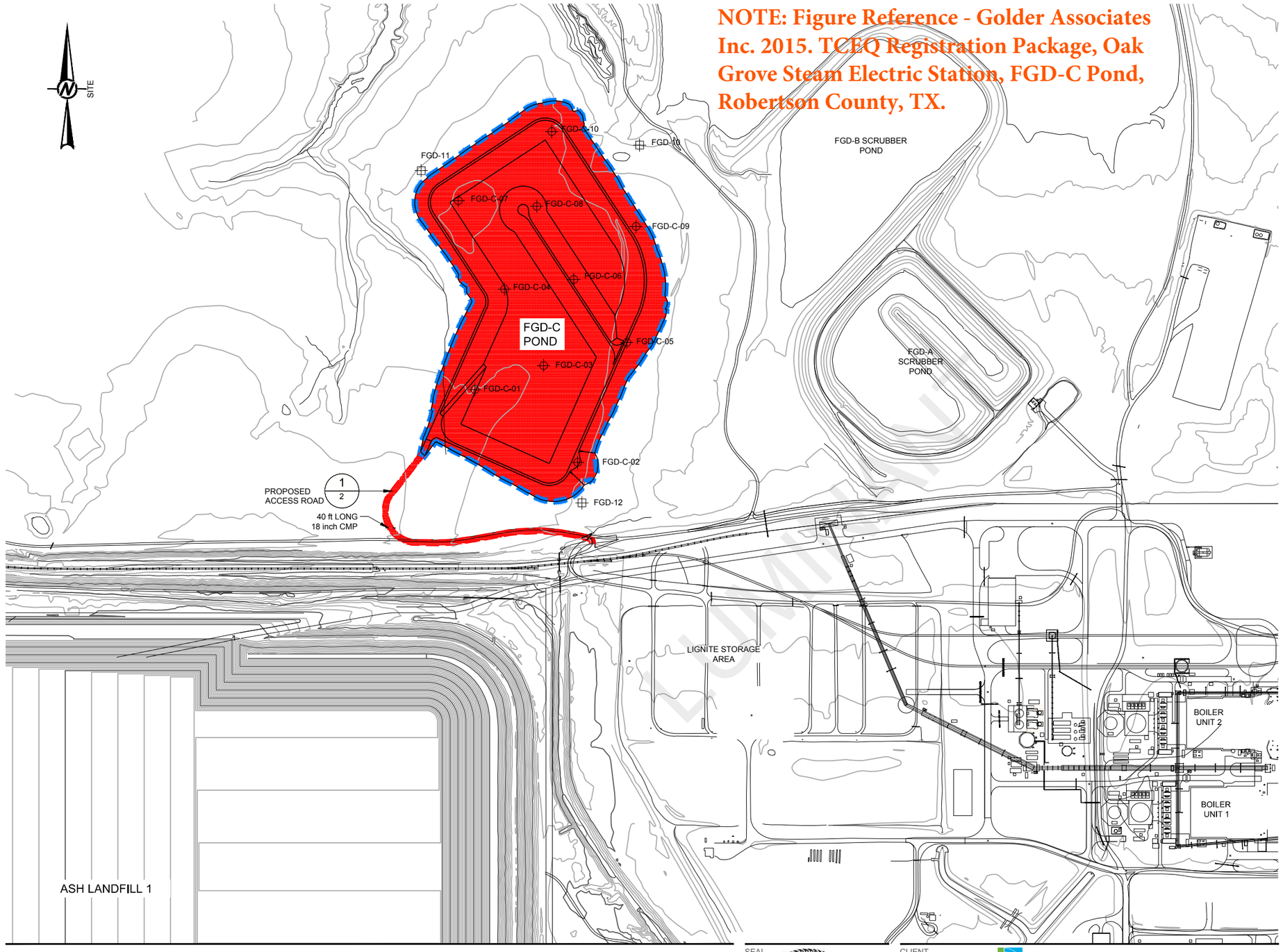


DEPTH SCALE
1 inch to 3.8 feet

Golder Associates

LOGGED: DM
CHECKED: *PCM*

**NOTE: Figure Reference - Golder Associates Inc. 2015. TCEQ Registration Package, Oak Grove Steam Electric Station, FGD-C Pond, Robertson County, TX.**

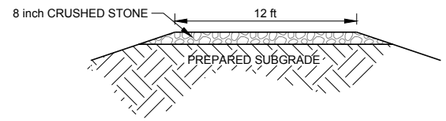



LEGEND

- 25 ft EXISTING CONTOUR
- 5 ft EXISTING CONTOUR
- CURRENT POND CONSTRUCTION AREA
- FGD-C-01 BOREHOLE
- FGD-01 MONITORING WELL

**NOTES**

1. EXISTING GROUND TOPOGRAPHY IS FROM AN AERIAL SURVEY PERFORMED BY GEODETIX, INC. ON MAY 27, 2010 AND GROUND SURVEY PERFORMED BY SAM INC. ON OCTOBER 23, 2014. EXISTING GROUND TOPOGRAPHY ELSEWHERE IS FROM FLOUR ENTERPRISE, INC. DRAWING A2YF00-0-CV-0-SW.PL.-01, AS PROVIDED BY LUMINANT.
2. COORDINATES ARE BASED ON OAK GROVE STEAM ELECTRIC STATION PLANT GRID SYSTEM.
3. ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM.
4. CLAY MATERIAL AND STRUCTURAL FILL STOCKPILE AREAS NEED TO BE CLEARED AND GRUBBED PRIOR TO STOCKPILING ACTIVITIES.




SCALE 1" = 10' 1/2 ACCESS ROAD

ISSUED FOR CONSTRUCTION

SCALE 0 0.5 10 FEET

SCALE 0 200 400 FEET

| Rev. | YYYY-MM-DD | DESCRIPTION | PREPARED | DESIGN | REVIEW | APPROVED |
|---|---|---|---|---|---|---|
| 0 | 2015-04-29 | ISSUED FOR CONSTRUCTION | AA | CEI | CEI | JBF |
| B | 2015-04-23 | ISSUED FOR CLIENT REVIEW | AA | CEI | CEI | JBF |
| A | 2015-03-30 | ISSUED FOR CLIENT REVIEW | AA | CEI | CEI | JBF |

SEAL

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

CLIENT

Luminant

CONSULTANT

Golder Associates


HOUSTON OFFICE
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HOUSTON, TEXAS 77073
USA
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PROJECT
OAK GROVE STEAM ELECTRIC STATION
FGD-C POND
ROBERTSON COUNTY, TEXAS

TITLE
**SITE OVERVIEW**

| PROJECT No. | LUMINANT DRAWING NO | Rev. | | FIGURE |
|---|---|---|---|---|
| 1406296 | A2YF00-0-CV-0-SW.PL-02 | 0 | 2 of 7 | 2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

1 in 0

Path: \\houston\drafting_2014\1406296_Luminant FGD-C\PRODUCTION\B - POND\ | File Name: 1406296B002.dwg

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# BOREHOLE FGD-C-01



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/25/14 **COMPLETED** 11/25/14
**GROUND ELEVATION** 444.5 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | (CH) Very stiff, brown and red, CLAY, topsoil, organics, moist | ST | 50 | | 2.5 | |
| | | hard, brown, sandy below 2.0' | ST | 83 | | 4.5 | |
| 5 | | brown and tan at 4.0' | ST | 83 | | 4.5 | |
| | | (CL) Hard, tan, sandy SILTY CLAY, moist | SS | 75 | 3-17-25-26 (42) | | |
| | | | SS | 88 | 7-15-28-24 (43) | | |
| 10 | | | SS | 92 | 8-16-26-29 (42) | | |
| | | white and orange at 12.0' | SS | 92 | 12-15-24-26 (39) | | |
| 15 | | | SS | 92 | 13-21-34-25 (55) | | |
| | | | SS | 92 | 13-17-20-24 (37) | | |
| 20 | | | SS | 92 | 7-12-18-20 (30) | | |
| | | (CL) Very stiff, gray, SILTY CLAY, with silt partings | SS | 71 | 6-8-10-15 (18) | | |
| | | interbedded clay layer at 21.0' | SS | 92 | 21-6-11-14 (17) | | |
| 25 | | | SS | 92 | 4-11-12-15 (23) | | |
| | | becomes black at 25.5' | | | | | |
| | | black and gray, moist at 26.0' | SS | 83 | 12-20-26-31 (46) | | |
| | | (CH) Hard, black, CLAY, moist | | | | | |
| | | (CL) Hard, black and gray, SILTY CLAY, moist | SS | 92 | 13-46-48-50 (94) | | |
| 30 | | interbedded black clay in gray silt at 29.0' | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
□ FINES CONTENT (%) □
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-01



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 30 | | (CL) Hard, black and gray, SILTY CLAY, moist *(continued)* | | | | | | |
| | | gray at 30.0' | SS | 71 | 12-24-48-50 (72) | | | ▲ |
| | | (SM) Very dense, brown and gray, SILTY SAND, moist | | | | | | |
| | | (CL) Hard, gray and black, SILTY CLAY, moist | | | | | | |
| | | 3" silty sand seam at 33.0' | SS | 83 | 18-30-48-50 (78) | | | ▲ |
| 35 | | dark gray and sandy at 34.0' | SS | 46 | 16-28-50 (78) | | | ▲ |
| | | (CH) Hard, black, CLAY, moist, little silt | SS | 79 | 10-15-28-27 (43) | | | ▲ |
| | | (CL) Hard, gray, sandy SILTY CLAY, moist to wet | SS | 83 | 16-24-44-46 (68) | | | ▲ |
| 40 | | wet at 41.0' | SS | 92 | 20-36-50 (86) | | | ▲ |
| | | moist at 42.0' | SS | 63 | 14-18-32-40 (50) | | | ▲ |
| | | silt partings at 44.0' | SS | 92 | 15-24-45-50 (69) | | | ▲ |
| 45 | | | SS | 92 | 12-22-42-48 (64) | | | ▲ |
| | | | ST | 100 | | | | ☐ |
| 50 | | | | | | | | |

Bottom of borehole at 50.0 feet.

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# BOREHOLE FGD-C-02



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/17/14 **COMPLETED** 11/17/14
**GROUND ELEVATION** _____ **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
▽ **AT TIME OF DRILLING 35** 35 ft bgs
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING** _____
**NOTES** _____
**AFTER DRILLING** _____

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | (CH) Stiff, red and brown, CLAY, moist | ST | 50 | | 1.25 | |
| | | hard, friable, dry at 2.0' | ST | 88 | | 4.5 | |
| 5 | | stiff, sandy, moist at 4.0' | ST | 83 | | 1.0 | |
| | | Brown, sandy SILT (ML) and sandy CLAY (CH), moist | SS | 83 | 4-5-8-8 (13) | 0.75 | |
| | | (CH) Stiff, brown, CLAY, moist, with silt partings | SS | 67 | 4-5-6-7 (11) | 1.75 | |
| 10 | | brown to red at 10.0' | SS | 67 | 4-5-7-12 (12) | 2.5 | |
| | | hard, brown, increased silt content, dry at 12.0' | SS | 83 | 13-13-20-18 (33) | | |
| 15 | | (ML) Compact, brown and gray, SILT, dry | SS | 79 | 11-11-17-17 (28) | | |
| | | | SS | 79 | 6-10-13-16 (23) | | |
| | | Very stiff, brown and gray, CLAYEY SILT (ML) and SILTY CLAY (CL), moist to dry | SS | 75 | 6-5-11-11 (16) | | |
| 20 | | (SM) Compact, gray and brown, SILTY SAND, dry | SS | 83 | 8-9-12-12 (21) | | |
| | | | SS | 83 | 5-7-10-8 (17) | | |
| | | with brown, clayey silt layer at 23.5', moist | | | | | |
| 25 | | Dense, tan, SAND, dry | SS | 92 | 13-16-20-17 (36) | | |
| | | | SS | 75 | 14-13-22-19 (35) | | |
| | | very dense, tan and gray, moist at 28.0' | SS | 100 | 14-17-30-26 (47) | | |
| 30 | | | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
□ FINES CONTENT (%) □
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-02



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | (CL) Hard, brown and gray, sandy SILTY CLAY, moist, with silt partings<br>iron staining at 31.0' | SS | 100 | 20-28-30-28 (58) | | |
| | | Dense, tan and gray, SAND, iron staining | SS | 83 | 16-17-19-27 (36) | | |
| 35 | | (CL) Hard, brown and gray, SILTY CLAY, moist to wet | SS | 92 | 15-17-29-32 (46) | | |
| | | Very dense, brown, tan, and gray, SAND, wet<br>6" clay layer at 37.5' | SS | 83 | 13-15-45-50 (60) | | |
| | | Very dense, brown and gray, SANDY SILT, with silt partings, wet | SS | 83 | 28-38-48-50 (86) | | |
| 40 | | Hard, brown, SANDY CLAY, moist<br>silty sand layer at 41.5' | SS | 92 | 8-6-20-50 (26) | | |
| | | Hard, brown and gray, SILTY CLAY, iron staining, moist | SS | 92 | 16-20-30-38 (50) | | |
| | | increased silt content at 44.0' | ST | 46 | | | |
| 45 | | | | | | | |

Bottom of borehole at 46.0 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

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# BOREHOLE FGD-C-03



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/24/14 **COMPLETED** 11/25/14
**GROUND ELEVATION** 443.7 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | (CH) Very stiff, red, CLAY, organics, top soil, moist | ST | 54 | | 2.5 | |
| | | red and orange, sandy, moist at 2.0' | ST | 50 | | 3.0 | |
| 5 | | increasing sand at 3.5'<br>hard, orange, friable at 4.0' | ST | 46 | | 4.0 | |
| | | (CL) Hard, tan and white, sandy SILTY CLAY, moist | SS | 79 | 12-14-20-13 (34) | | |
| | | increasing amounts of silt and sand at 7.0' | SS | 79 | 12-16-20-21 (36) | | |
| 10 | | very silty at 10.0' | SS | 79 | 7-14-15-15 (29) | | |
| | | Very stiff, gray, SILTY CLAY (CL), interbedded with CLAY (CH), moist | SS | 71 | 10-11-14-16 (25) | | |
| 15 | | | SS | 75 | 10-12-18-18 (30) | | |
| | | gray and orange, with silt partings at 16.0' | SS | 83 | 7-10-16-20 (26) | | |
| | | gray at 19.0' | SS | 79 | 7-9-15-14 (24) | | |
| 20 | | brown to gray, increasing silt at 20.0' | SS | 79 | 6-9-10-12 (19) | | |
| | | | SS | 88 | 6-8-14-14 (22) | | |
| | | sandy, moist at 24.0' | SS | 83 | 13-32-30-28 (62) | | |
| 25 | | | SS | 88 | 14-26-24-20 (50) | | |
| | | (SM) Dense, gray, SILTY SAND, moist | SS | 75 | 20-24-24-30 (48) | | |
| 30 | | (CL) Hard, gray, SILTY CLAY, moist | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-03



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □ FINES CONTENT (%) □ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 30 | | (CL) Hard, gray, SILTY CLAY, moist *(continued)* red, brown, and yellow at 30.5' | SS | 88 | 16-28-36-35 (64) | | | ▲ |
| | | very stiff to hard, gray at 31.5' moist to wet at 32.0' | SS | 71 | 10-11-10-16 (21) | | | ▲ |
| 35 | | increased sand at 33.0' | SS | 75 | 12-22-46-45 (68) | | | ▲ |
| | | increased silt and sand at 37.0' | SS | 79 | 14-30-36-42 (66) | | | ● ⊣ □ ▲ |
| | | black clay, less silt at 39.0' | SS | 92 | 12-26-39-39 (65) | | | ▲ |
| 40 | | | SS | 92 | 12-13-16-25 (29) | | | ▲ |
| | | Very dense, orange and gray, SILTY SAND moist at 42.0' | SS | 71 | 20-30-46-50 (76) | | | ▲ |
| | | iron staining at 43.0' | SS | 92 | 14-25-40-48 (65) | | | ▲ |
| 45 | | | SS | 75 | 14-40-48-50 (88) | | | ▲ |
| | | gray at 46.5' | | | | | | |

Bottom of borehole at 48.0 feet.

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# BOREHOLE FGD-C-04



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/20/14 **COMPLETED** 11/20/14
**GROUND ELEVATION** _____ **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING 42** 42 ft bgs
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING** _____
**NOTES** _____
**AFTER DRILLING** _____

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | (CH) Soft, brown, sandy CLAY, with organics, grass, moist | ST | 54 | | 0.5 | |
| | | hard to dense, more sand at 2.0' | ST | 71 | | 3.5 | |
| 5 | | dense, brown and tan, mostly sand at 4.0' | ST | 71 | | 3.75 | |
| | | stiff, brown, less sand at 6.0' | SS | 25 | 2-4-7-8 (11) | 0.75 | |
| | | very stiff, red and brown at 8.5' | SS | 67 | 5-6-10-12 (16) | 4.5 | |
| 10 | | | SS | 63 | 3-5-6-9 (11) | 4.5 | |
| | | orange, more sand at 12.0' | SS | 46 | 21-8-20-18 (28) | | |
| 15 | | | SS | 79 | 9-14-28-24 (42) | | |
| | | (SC) Dense to compact, white, CLAYEY SAND, moist | SS | 71 | 10-11-14-20 (25) | | |
| | | | SS | 100 | 8-12-22-26 (34) | | |
| 20 | | | SS | 79 | 6-16-24-26 (40) | | |
| | | brown, 1' sandy clay layer at 20.5' | SS | 67 | 11-8-20-20 (28) | | |
| | | white and orange, with silt and clay at 23.5' | SS | 83 | 10-12-24-26 (36) | | |
| 25 | | iron staining at 25.0' | SS | 75 | 10-24-14-30 (38) | | |
| | | 1' clay layer at 26.5' | SS | 100 | 20-34-46-45 (80) | | |
| 30 | | | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80





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# BOREHOLE FGD-C-04



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | Hard, brown and tan, red mottling, sandy CLAY (CH) to CLAYEY SAND (SC), moist, increasing sand with depth | SS | 83 | 7-15-40-48 (55) | 1.25 | |
| | | | SS | 100 | 12-20-28-35 (48) | | |
| 35 | | (CL) Hard, gray, SILTY CLAY, moist | SS | 100 | 13-20-48-42 (68) | | |
| | | 1' thick brown and tan silty clay at 35.0' | | | | | |
| | | silt partings and interbedded clay seams at 36.0' | SS | 100 | 10-16-20-24 (36) | | |
| | | | SS | 83 | 15-20-24-48 (44) | | |
| 40 | | | SS | 79 | 7-22-24-45 (46) | | |
| | | increasing sand content at 41.0' | | | | | |
| | | moist to wet at 42.0' | SS | 83 | 13-17-40-45 (57) | | |
| 45 | | | SS | 92 | 16-23-45-47 (68) | | |
| | | increase in clay at 47.0' | SS | 75 | 13-26-38-48 (64) | | |
| | | | ST | 100 | | | |
| 50 | | Bottom of borehole at 50.0 feet. | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
□ FINES CONTENT (%) □
20 40 60 80

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# BOREHOLE FGD-C-05



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/18/14 **COMPLETED** 11/18/14
**GROUND ELEVATION** 440.3 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
▽ **AT TIME OF DRILLING 34** 34.0 ft bgs
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|
| 0 | Stiff, brown and red, CLAY, moist | ST | 25 | | 2.0 | |
| | very stiff, some red mottling at 2.0' | ST | 100 | | 3.75 | |
| 5 | (CL) Very stiff, brown and red, sandy SILTY CLAY, moist, red mottling | ST | 54 | | 4.5 | |
| | with brown silt at 7.0' | ST | 71 | | 4.5 | |
| | stiff, brown clay at 8.0' | SS | 75 | 5-6-7-10 (13) | 4.5 | |
| 10 | Very stiff, brown, SILTY CLAY, red and black mottling, moist, trace gravel | SS | 75 | 6-6-12-22 (18) | 3.75 | |
| | brown and red, with silt partings at 12.0' | SS | 75 | 9-13-19-20 (32) | 4.5 | |
| 15 | hard, brown and gray, with silt partings at 14.0' | SS | 67 | 7-7-17-22 (24) | | |
| | red and brown, sandy at 17.5' | SS | 92 | 10-9-20-23 (29) | | |
| 20 | (SM) Very dense, gray and brown, SILTY SAND, moist, with clay seams | SS | 83 | 17-12-28-22 (40) | | |
| | | SS | 83 | 7-21-34-21 (55) | | |
| | | SS | 92 | 8-15-20-15 (35) | | |
| 25 | | SS | 83 | 6-20-16-20 (36) | 0.75 | |
| | | SS | 75 | 6-16-24-25 (40) | | |
| | (CH) Hard brown, sandy CLAY, moist | SS | 83 | 14-22-34-45 (56) | 1.5 | |
| 30 | | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
□ FINES CONTENT (%) □
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-05



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 30 | | (CH) Hard brown, sandy CLAY, moist *(continued)* very stiff, tan and brown at 30.0' | SS | 100 | 13-17-20-21 (37) | | | |
| | | (CL) Hard, gray, SILTY CLAY | | | | | | |
| | | becomes sandy, moist to wet at 32.0' | SS | 83 | 12-24-34-45 (58) | | | |
| 35 | | | SS | 83 | 20-27-31-25 (58) | | | |
| | | (CH) Stiff, brown, sandy CLAY, moist to wet | | | | | | |
| | | wet at 36.0' | SS | 100 | 6-8-9-12 (17) | 1.75 | | |
| | | moist at 37.0' | | | | | | |
| | | (SM) Very dense, brown and red, SILTY SAND, wet | SS | 92 | 17-20-34-47 (54) | | | |
| 40 | | interbedded sandy clay, moist at 39.0' | | | | | | |
| | | wet at 40.0' | SS | 83 | 12-20-30-42 (50) | | | |
| | | moist at 41.5' | SS | 83 | 20-34-47-50 (81) | | | |
| 45 | | | ST | 50 | | | | |
| | | gray with iron staining at 45.0' | | | | | | |
| | | loose at 46.5' | ST | 50 | | | | |
| | | | ST | | | | | |

Bottom of borehole at 49.5 feet.

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# BOREHOLE FGD-C-06



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/24/14 **COMPLETED** 11/24/14
**GROUND ELEVATION** 450.9 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|
| 0 | (CL) Stiff, brown, SILTY CLAY, topsoil, organics | | | | | |
| | (CH) Stiff, brown and tan, sandy CLAY, moist | ST | 75 | | 1.0 | |
| | hard at 2.0' | ST | 75 | | 4.5 | |
| 5 | increasing silt at 5.0' | ST | 42 | | | |
| | very stiff, tan at 6.0' | SS | 88 | 8-8-7-10 (15) | | |
| | | SS | 67 | 5-8-7-8 (15) | | |
| 10 | increasing sand at 9.5' | | | | | |
| | (SC) Compact, tan and white, CLAYEY SAND, moist | SS | 63 | 4-7-7-9 (14) | | |
| | | SS | 75 | 7-8-7-9 (15) | | |
| 15 | (CL) Hard, dark brown, SILTY CLAY, moist | SS | 75 | 6-10-13-12 (23) | | |
| | very stiff, tan and brown, sandy at 15.5' | SS | 100 | 6-8-11-13 (19) | | |
| | interbedded with gray clay at 18.0' | SS | 100 | 5-8-10-10 (18) | 1.5 | |
| 20 | | SS | 88 | 5-8-10-12 (18) | 2.5 | |
| | (SC) Dense, white and tan, CLAYEY SAND, moist | SS | 75 | 9-12-20-21 (32) | | |
| 25 | | SS | 83 | 10-12-16-23 (28) | | |
| | | SS | 83 | 9-19-28-30 (47) | | |
| | tan and orange at 28.0' | SS | 75 | 18-24-40-46 (64) | | |
| 30 | | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
□ FINES CONTENT (%) □
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-06



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | (SC) Dense, white and tan, CLAYEY SAND, moist *(continued)*<br>6" clay layer at 30.0'<br>very dense, tan, white, and orange, iron staining at 30.5' | SS | 83 | 7-30-46-44 (76) | | |
| | | | SS | 88 | 15-22-24-34 (46) | 3.0 | |
| 35 | | (CH) Hard, brown and orange, sandy CLAY, moist, silt partings<br>increased sand, less cohesive at 35.0' | SS | 88 | 10-26-39-46 (65) | | |
| | | increased sand at 37.0' | SS | 88 | 16-26-32-42 (58) | | |
| 40 | | some gray clay and increased silt at 40.0' | SS | 88 | 20-32-50 (82) | | |
| | | | SS | 88 | 20-42-50 (92) | | |
| | | increased silt, moist to wet at 42.5' | SS | 88 | 12-30-34-48 (64) | | |
| 45 | | (CL) Hard, gray, SILTY CLAY, moist | SS | 83 | 21-38-50 (88) | | |
| | | | SS | 88 | 23-48-48-50 (96) | | |
| 50 | | | ST | | | | |

Bottom of borehole at 50.0 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

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# BOREHOLE FGD-C-07



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/20/14 **COMPLETED** 11/21/14
**GROUND ELEVATION** 449.7 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|
| 0 | (CL) Very stiff, brown and tan, sandy SILTY CLAY, moist | ST | 75 | | 3.5 | |
| | mostly brown at 2.0' | ST | 121 | | 3.0 | |
| 5 | | ST | 92 | | 2.0 | |
| | increasing sand content, red and orange mottling at 5.5' | | | | | |
| | (CH) Very stiff, brown and tan, sandy CLAY, moist | SS | 50 | 3-9-14-12 (23) | | |
| | increasing sand content, red and orange mottling at 9.0' | SS | 79 | 5-8-9-10 (17) | | |
| 10 | | SS | 75 | 4-6-5-10 (11) | | |
| | white and tan, silty clay at 11.5' | | | | | |
| | very stiff to stiff, brown at 12.0' | SS | 100 | 8-9-12-9 (21) | | |
| 15 | some gravel at 15.0' | SS | 100 | 6-7-13-10 (20) | | |
| | brown and tan, small amount of gray clay at 16.0' | SS | 79 | 3-4-5-11 (9) | | |
| | increasing sand content with depth at 17.5' | SS | 83 | 8-8-12-17 (20) | | |
| 20 | gray, with silt partings at 19.5' | | | | | |
| | hard, brown and orange at 20.0' | SS | 33 | 6-9-27-25 (36) | | |
| | (SC) Very dense, gray, CLAYEY SAND, moist, with orange iron stains, and silt partings | SS | 100 | 26-21-32-30 (53) | | |
| 25 | more white than gray at 25.0' | SS | 71 | 20-28-48-40 (76) | | |
| | | SS | 58 | 16-24-46-48 (70) | | |
| | dense, white at 28.0' | SS | 100 | 16-28-30-50 (58) | | |
| 30 | | | | | | |

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80
FINES CONTENT (%)
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-07



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) | ▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 30 | | (SC) Very dense, gray, CLAYEY SAND, moist, with orange iron stains, and silt partings *(continued)* | SS | 75 | 28-30-48-50 (78) | | | |
| | | | SS | 96 | 28-34-48-50 (82) | | | |
| 35 | | moist to wet at 35.0' | SS | 100 | 20-46-46-50 (92) | | | |
| | | brown, moist at 36.0' | SS | 75 | 28-29-48-50 (77) | | | |
| | | | SS | 50 | 38-50 | | | |
| 40 | | | SS | 50 | 38-50 | | | |
| | | (CH) Hard, brown and tan, sandy CLAY, wet | SS | 83 | 40-42-48-35 (90) | | | |
| 45 | | | SS | 75 | 32-36-42-36 (78) | | | |
| | | (CL) Hard, gray, sandy SILTY CLAY, interbedded with clay, moist | SS | 83 | 40-46-50 (96) | | | |
| 50 | | | ST | 100 | | | | |

Bottom of borehole at 50.0 feet.

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# BOREHOLE FGD-C-08



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/19/14 **COMPLETED** 11/19/14
**GROUND ELEVATION** 448.7 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | (CL) Stiff, brown and gray, sandy SILTY CLAY, moist, with red slatey gravel | ST | 75 | | 1.75 | |
| | | very stiff at 2.0' | ST | 83 | | 3.0 | |
| 5 | | no gravel, increasing sand content at 4.0' | ST | 88 | | 3.5 | |
| | | stiff, brown and tan, increasing sand content at 6.0' | SS | 79 | 3-5-7-8 (12) | | |
| | | (SC) Compact, brown and tan, CLAYEY SAND, moist | SS | 50 | 6-13-10-10 (23) | | |
| 10 | | tan and white at 10.0' | SS | 42 | 4-4-5-10 (9) | | |
| | | | SS | 54 | 7-8-11-8 (19) | | |
| 15 | | (CL) Stiff, brown and tan, sandy SILTY CLAY, moist | SS | 63 | 5-6-8-6 (14) | | |
| | | with gravel at 15.0' | | | | | |
| | | brown and black, friable, increasing clay at 16.0' | SS | 75 | 6-5-6-5 (11) | | |
| | | soft, black wood debris at 18.0' | SS | 58 | 3-2-2-2 (4) | | |
| 20 | | more wood debris, some sandy clay at 20.0' | SS | 38 | 2-2-2-3 (4) | | |
| | | some black wood/organics at 22.5' | SS | 46 | 3-2-3-10 (5) | | |
| 25 | | Dense, red, orange, and brown, CLAYEY SAND (SC) to sandy CLAY (CH), moist | SS | 96 | 4-12-20-23 (32) | | |
| | | gray and tan, red staining at 27.0' | SS | 88 | 10-20-24-24 (44) | | |
| | | becomes brown with depth at 28.0' | SS | 88 | 5-12-24-28 (36) | | |
| 30 | | | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-08



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | (CH) Hard, brown to gray, sandy CLAY, with silt partings, moist | SS | 100 | 8-14-25-28 (39) | 2.6 | |
| | | (CL) Very stiff, gray, SILTY CLAY, with silt partings, moist | SS | 96 | 6-10-20-18 (30) | | |
| | | hard at 34.0' | | | | | |
| 35 | | red mottling, increase in sand content at 35.0' | SS | 100 | 7-16-30-32 (46) | | |
| | | | SS | 100 | 10-26-36-28 (62) | | |
| | | | SS | 100 | 10-14-32-37 (46) | | |
| 40 | | little sand, more silt at 39.0' | | | | | |
| | | wet at 40.0' | | | | | |
| | | moist to wet at 41.0' | SS | 83 | 14-15-43-32 (58) | | |
| | | | SS | 83 | 8-16-40-30 (56) | | |
| | | 1" think clayey sand layer at 43.0' | | | | | |
| 45 | | increasing silt at 45.0' | SS | 92 | 8-16-20-38 (36) | | |
| | | moist, some clay and silt partings at 46.0' | SS | 100 | 16-18-36-46 (54) | | |
| | | increasing silt, some silty clay at 48.0' | ST | 58 | | | |
| 50 | | | ST | 79 | | | |

Bottom of borehole at 52.0 feet.

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# BOREHOLE FGD-C-09



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/18/14 **COMPLETED** 11/19/14
**GROUND ELEVATION** 445 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY** AQ
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 0 | | Brown and black, SAND and SILT, moist | ST | 46 | | | |
| | | (MH) Brown and tan, sandy CLAYEY SILT, moist | ST | 50 | | | |
| 5 | | | ST | 50 | | | |
| | | (CL) Very stiff, brown and tan, SILTY CLAY, with gravel, red mottling, friable, dry | SS | 46 | 5-7-11-11 (18) | | |
| | | no gravel at 9.0' | SH | 67 | 7-10-9-8 (19) | | |
| 10 | | stiff, more cohesive at 10.0' | SS | 75 | 21-5-8-8 (13) | | |
| | | sandy, dry at 12.0' | SS | 79 | 8-6-8-7 (14) | | |
| | | friable at 14.0' | SS | 67 | 5-6-7-8 (13) | | |
| 15 | | | SS | 58 | 8-7-7-12 (14) | | |
| | | 1' thick silty sand at 17.0' | SS | 92 | 9-7-10-10 (17) | | |
| 20 | | | SS | 96 | 5-5-8-9 (13) | | |
| | | 5" of dark brown, interbedded clay at 21.0' | SS | 100 | 10-11-15-19 (26) | | |
| | | very stiff, gray, sandy, moist at 23.0' | SS | 96 | 8-19-23-28 (42) | | |
| 25 | | with silt partings at 24.0' | SS | 100 | 8-21-24-28 (45) | | |
| | | sand at 25.5' | SS | 92 | 27-21-45-48 (66) | | |
| | | (SC) Dense, red, brown, and orange, CLAYEY SAND, with silt, moist | | | | | |
| 30 | | gray and tan, silt partings, mostly silt and sand at 28.0' | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-09



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | (CL) Hard, brown and tan, SILTY CLAY, moist | SS | 92 | 9-20-46-50 (66) | | |
| | | 6" silty sand layer at 31.5' brown and gray, iron staining at 32.0' | SS | 83 | 13-28-48-32 (76) | | |
| | | increasing silt and sand at 33.0' | | | | | |
| 35 | | | SS | 100 | 14-26-46-48 (72) | | |
| | | gray, with silt partings, moist at 36.0' | SS | 92 | 20-32-48-50 (80) | | |
| | | with interbedded brown, silty clay at 37.0' | | | | | |
| | | | SS | 92 | 18-22-33-43 (55) | | |
| 40 | | moist to wet at 39.0' | | | | | |
| | | moist at 40.0' | SS | 42 | 24-34-46-30 (80) | | |
| | | with silt partings at 42.0' | SS | 67 | 26-32-38-34 (70) | | |
| 45 | | | SS | 92 | 13-40-48-50 (88) | | |
| | | with interbedded gray, clay at 45.0' brown, sandy at 46.0' | SS | 75 | 14-39-44-48 (83) | | |
| | | with interbedded gray clay at 47.0' | | | | | |
| 50 | | | ST | 67 | | 3.5 | |
| | | (CH) Very stiff, brown and gray, sandy CLAY, moist | ST | 50 | | 3.5 | |
| | | gray, with silt partings at 52.0' | ST | 100 | | 3.5 | |
| 55 | | | ST | 100 | | 4.0 | |
| | | stiff, increasing sand with depth at 56.0' | ST | 75 | | 1.75 | |
| | | Stiff, gray, SILTY CLAY | | | | | |
| 60 | | with black mudstone or slate at 59.0' | ST | 67 | | 1.75 | |

Bottom of borehole at 60.0 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

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# BOREHOLE FGD-C-10



**CLIENT** Luminant Power
**PROJECT NAME** Luminant
**PROJECT NUMBER** 1406296
**PROJECT LOCATION** Oak Grove SES
**DATE STARTED** 11/19/14 **COMPLETED** 11/20/14
**GROUND ELEVATION** 445 ft **HOLE SIZE** 6 inches
**DRILLING CONTRACTOR** Envirotech
**GROUND WATER LEVELS:**
**DRILLING METHOD** Auger
**AT TIME OF DRILLING**
**LOGGED BY** DMW **CHECKED BY**
**AT END OF DRILLING**
**NOTES**
**AFTER DRILLING**

| DEPTH (ft) | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|
| 0 | (CL) Hard, brown and gray, silty CLAY, with gravel, moist | | | | | |
| | orange mottlings at 1.0' | ST | 83 | | 4.5 | |
| | | ST | 75 | | 4.5 | |
| | very stiff, sandy at 4.0' | | | | | |
| 5 | | ST | 100 | | 2.25 | |
| | brown at 6.0' | | | | | |
| | increasing sand content, maroon staining in middle depth, iron staining throughout at 7.0' | SS | 83 | 5-5-9-10 (14) | | |
| | stiff at 8.0' | | | | | |
| | increasing sand with depth at 9.0' | SS | 50 | 5-8-8-9 (16) | | |
| 10 | very stiff, organics and gravel at 10.0' | SS | 88 | 6-7-9-11 (16) | | |
| | more sand at 13.0' | SS | 79 | 10-5-6-7 (11) | | |
| 15 | (CH) Very stiff, brown and and tan, sandy CLAY | SS | 83 | 5-5-6-9 (11) | | |
| | orange mottling, very sandy at 15.5' | | | | | |
| | brown and orange, moist at 16.0' | SS | 100 | 5-6-9-10 (15) | | |
| | orange mottling at 17.0' | | | | | |
| 20 | orange and tan, increasing sand at 19.0' | SS | 88 | 6-11-13-12 (24) | | |
| | more gray, increasing silt, but no partings, organic material, roots at 21.0' | SS | 100 | 9-10-12-13 (22) | | |
| | (SC) Dense, gray and tan, CLAYEY SAND, with silt partings, moist | SS | 88 | 11-16-24-26 (40) | | |
| | less cohesive at 23.0' | | | | | |
| | very dense at 24.0' | | | | | |
| 25 | increasing sand at 25.0' | SS | 83 | 18-24-38-35 (62) | | |
| | very dense, white and orange, moist at 26.0' | SS | 71 | 14-30-35-34 (65) | | |
| | (CL) Hard, gray and brown, SILTY CLAY, moist | SS | 92 | 14-20-35-34 (55) | | |
| 30 | orange mottling at 29.5' | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80





*(Continued Next Page)*

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# BOREHOLE FGD-C-10



**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN (tsf) | DRY UNIT WT. (pcf) |
|---|---|---|---|---|---|---|---|
| 30 | | (CL) Hard, gray and brown, SILTY CLAY, moist *(continued)* | | | | | |
| | | increasing clay content, interbedded clay at 31.0' | SS | 96 | 10-18-34-36 (52) | | |
| | | | SS | 92 | 10-20-26-24 (46) | | |
| 35 | | interbedded clay, increasing silt and sand with depth, silt partings at 35.0' | SS | 100 | 24-20-36-48 (56) | | |
| | | gray, moist to wet at 36.0' | SS | 100 | 20-22-48-40 (70) | | |
| | | more cohesive at 39.0' | SS | 79 | 22-42-48-50 (90) | | |
| 40 | | sandy at 40.0' | | | | | |
| | | less cohesive, more sand, less clay at 41.0' | SS | 83 | 22-26-42-50 (68) | | |
| | | tan and brown at 42.0' | | | | | |
| | | increasing sand at 43.0' | SS | 100 | 20-48-48-50 (96) | | |
| | | more iron staining than previous at 44.0' | | | | | |
| 45 | | gray and black, with silt partings at 45.0' | SS | 92 | 18-28-42-50 (70) | | |
| | | gray and brown, sand at 46.5' | SS | 100 | 24-44-48-48 (92) | | |
| | | very silty at 47.0' | | | | | |
| | | | ST | 50 | | | |
| 50 | | Bottom of borehole at 50.0 feet. | | | | | |

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

# APPENDIX B
# LABORATORY TEST RESULTS

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | Soil Description | Atterberg Limits | | | | | Particle Size Analysis | | | | Dry Unit wt (pcf) | Moist Unit wt (pcf) | CU Triaxial | | UU Triaxial | | Consolidation | | | | Gs | Organic Content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | | | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | | | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | | |
| BH-FGD-101 | 88 | 0.0-2.0 | | SH | | 18.2 | | Very stiff, mottled, sandy lean CLAY (CL), damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 89 | 2.0-4.0 | | SH | | 11.9 | | hard, mottled reddish brown at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 90 | 4.0-6.0 | | SH | | 18.4 | | trace silt at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 91 | 6.0-8.0 | | SH | | 13.6 | | very stiff, reddish brown and light gray, some silt at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 92 | 8.0-10.0 | | SH | | 18.4 | | Dense, grayish brown, SAND (SP-SM), with silt, damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 93 | 13.0-15.5 | | SH | | 27.0 | | Very stiff, grayish brown, clayey fine SAND (SC), with some silt, layered | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | | - | | | | | | gray and light brown at 13.5' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 94 | 18.0-20.0 | | SS | 50 | 25.5 | | Very dense, light brown, fine, poorly-graded SAND (SP), damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 95 | 23.0-25.0 | | SS | 50 | 27.6 | | little clay at 23.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | 96 | 28.0-30.0 | | SS | 35 | 28.7 | | dense, wet at 28.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-101 | | - | | | | | | BORING TERMINATED AT 30.0' | | | | | | | | | | | | | | | | | | | | | |





Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | Soil Description | Atterberg Limits | | | | | Particle Size Analysis | | | | Dry Unit wt (pcf) | Moist Unit wt (pcf) | CU Triaxial | | UU Triaxial | | Consolidation | | | | Gs | Organic Content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | | | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | | | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | | |
| BH-FGD-102 | 79 | 0.0-2.0 | | SH | | 20.1 | | Hard, mottled light brown, sandy lean CLAY (CL), damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 80 | 2.0-4.0 | | SH | | 8.3 | | very stiff, brown at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 81 | 4.0-6.0 | | SH | | 14.1 | | hard at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 82 | 6.0-8.0 | | SH | | 17.9 | | light gray, moist at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 83 | 8.0-10.0 | | SH | | 20.0 | | very stiff at 8.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 89 | 13.0-15.0 | | SH | | 20.7 | | little silt at 13.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 85 | 18.0-20.0 | | SH | | 25.1 | | Stiff, light to dark gray, silty fat CLAY (CH), trace sand, moist | 54 | 22 | 32 | 0.08 | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 86 | 23.0-25.0 | | SH | | 23.3 | | Stiff, gray, sandy lean CLAY (CL), trace silt, moist | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-102 | 87 | 28.0-30.0 | | SS | 72 | 26.7 | | Very dense, light brown, fine, poorly-graded SAND (SP-SM), with clay, wet | | | | | | 0.0 | 75.2 | 24.8 | | | | | | | | | | | | | |
| BH-FGD-102 | | - | | | | | | BORING TERMINATED AT 30.0' | | | | | | | | | | | | | | | | | | | | | |





Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | Atterberg Limits | | | | | Particle Size Analysis | | | | | | CU Triaxial | | UU Triaxial | | Consolidation | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | Soil Description | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | Dry Unit wt (pcf) | Moist Unit wt (pcf) | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | Gs | Organic Content (%) |
| BH-FGD-103 | 66 | 0.0-2.0 | | SH | | 18.9 | Very soft to soft, light brown, sandy fat CLAY (CH), trace roots, damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 67 | 2.0-4.0 | | SH | | 18.3 | stiff at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 68 | 4.0-6.0 | | SH | | 18.8 | light brown to dark grayish brown at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 69 | 6.0-8.0 | | SH | | 14.9 | hard at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 70 | 8.0-10.0 | | SH | | 15.0 | mottled at 8.0' | 53 | 18 | 36 | -0.08 | | | | | | 109.6 | 126.0 | | | 4900 | 1123 | | | | | | |
| BH-FGD-103 | 71 | 13.0-15.0 | | SH | | 19.0 | | 63 | 20 | 43 | -0.02 | | | | | | 105.0 | 125.0 | | | 4400 | 1541 | | | | | | |
| BH-FGD-103 | 72 | 18.0-20.0 | | SH | | 22.5 | Stiff, brown, silty CLAY (CL-ML), with sand, trace lignite, moist | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 73 | 23.0-25.0 | | SH | | 20.6 | stiff to very stiff, mottled, damp at 23.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 74 | 28.0-30.0 | | SH | | 19.0 | Stiff, mottled, sandy lean CLAY (CL), damp | 38 | 16 | 22 | 0.12 | | | | | | 111.6 | 132.8 | | | 5500 | 3571 | | | | | | |
| BH-FGD-103 | | - | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 75 | 33.0-34.5 | | SH | 16 | 21.3 | Compact, light gray, SILT (ML), with sand, wet | | | | | | 0.0 | 39.7 | 60.3 | | | | | | | | | | | | | |
| BH-FGD-103 | | - | | | | | Firm, light gray and brown, silty SAND (SM), wet | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 76 | 38.0-40.0 | | SH | | 16.0 | Very stiff, mottled light gray, lean CLAY (CL), trace lignite, trace sand, wet | 35 | 16 | 20 | 0.02 | | | | | | 111.8 | 129.7 | | | 3200 | 4435 | | | | | | |
| BH-FGD-103 | 77 | 43.0-45.0 | | SH | | 25.7 | hard at 43.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | 78 | 48.0-50.0 | | SH | | 23.6 | interbedded with sand layers at 48.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-103 | | - | | | | | BORING TERMINATED AT 50.0' | | | | | | | | | | | | | | | | | | | | | |





Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | Soil Description | Atterberg Limits | | | | | Particle Size Analysis | | | | Dry Unit wt (pcf) | Moist Unit wt (pcf) | CU Triaxial | | UU Triaxial | | Consolidation | | | | Gs | Organic Content (%) |
| | | | | | | | | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | | | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | | |
| BH-FGD-104 | 57 | 0.0-2.0 | | SH | | 14.7 | Very stiff, light brown to dark brown, sandy lean CLAY (CL), damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 58 | 2.0-4.0 | | SH | | 21.0 | hard, light brown at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 59 | 4.0-6.0 | | SH | | 17.6 | mottled to dark brown, trace silt at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 60 | 6.0-8.0 | | SH | | 13.3 | grayish brown at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 61 | 8.0-10.0 | | SH | | 15.6 | | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 62 | 13.0-15.0 | | SH | | 18.6 | very stiff, moist at 13.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 63 | 18.0-20.0 | | SH | | 15.2 | hard, damp at 18.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | | - | | | | | Very dense, grayish brown, medium to fine, silty clayey SAND (SC/SM), trace organic | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | 64 | 23.0-24.5 | | SS | 23 | 23.4 | Compact, light brown and gray, poorly-graded SAND (SP-SM), with silt, wet | | | | | | 0.0 | 83.8 | 16.2 | | | | | | | | | | | | | |
| BH-FGD-104 | 65 | 28.0-30.0 | | SS | 31 | 23.7 | Fine, silty SAND (SM), trace clay | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-104 | | - | | | | | BORING TERMINATED AT 30.0' | | | | | | | | | | | | | | | | | | | | | |





Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | Soil Description | Atterberg Limits | | | | | Particle Size Analysis | | | | Dry Unit wt (pcf) | Moist Unit wt (pcf) | CU Triaxial | | UU Triaxial | | Consolidation | | | | Gs | Organic Content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | | | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | | | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | | |
| BH-FGD-105 | 44 | 0.0-2.0 | | SH | | 8.3 | | Very stiff, mottled dark brown, sandy fat CLAY (CH), trace organics, damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 45 | 2.0-4.0 | | SH | | 19.3 | | hard, light brown at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 46 | 4.0-6.0 | | SH | | 13.5 | | dark brown at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 47 | 6.0-8.0 | | SH | | 10.3 | | light brown at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 48 | 8.0-10.0 | | SH | | 16.3 | | | 51 | 19 | 33 | -0.07 | CH | 0.0 | 12.3 | 87.7 | | | | | 278 | 26 | | | | | | | |
| BH-FGD-105 | 49 | 13.0-15.0 | | SH | | 16.0 | | mottled, trace lignite at 13.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 50 | 18.0-20.0 | | SH | | 18.0 | | very stiff, dark gray at 18.0' | 51 | 19 | 32 | -0.02 | | | | | | 107.9 | 127.3 | | | 4300 | 2434 | | | | | | |
| BH-FGD-105 | 51 | 23.0-25.0 | | SH | | 15.9 | | hard, dark brown at 23.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 52 | 28.0-30.0 | | SH | | 18.9 | | Very stiff, mottled dark gray to brown, silty CLAY (CL-ML), few sand, moist | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | | - | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 53 | 33.0-35.0 | | SH | | 22.3 | | Stiff, black, sandy SILT (ML), trace clay, some organics, some wood fragments, moist | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | | - | | | | | | Stiff, dark brown, fat CLAY (CH), trace organics, trace sand, moist | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-105 | 54 | 38.0-39.5 | | SS | 50 | 12.5 | | Very dense, light brown, fine, poorly-graded SAND (SP), trace clay, damp | | | | | | 1.2 | 62.0 | 36.8 | | | | | | | | | | | | | |
| BH-FGD-105 | 55 | 43.0-45.0 | | SS | 72 | 23.6 | | Very dense, light brown, fine, poorly-graded SAND (SP-SM), with silt, moist | | | | | | 0.0 | 78.8 | 21.2 | | | | | | | | | | | | | |
| BH-FGD-105 | 56 | 48.0-50.0 | | SS | 50 | 26.4 | | Very dense, grayish brown, silty SAND (SM), trace clay, moist | | | | | | 0.0 | 74.6 | 25.4 | | | | | | | | | | | | | |
| BH-FGD-105 | | - | | | | | | BORING TERMINATED AT 50.0' | | | | | | | | | | | | | | | | | | | | | |





Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

# SUMMARY OF SOIL DATA AND LABORATORY TEST RESULTS

| Sample | | | | | | | | Soil Description | Atterberg Limits | | | | | Particle Size Analysis | | | | Dry Unit wt (pcf) | Moist Unit wt (pcf) | CU Triaxial | | UU Triaxial | | Consolidation | | | | Gs | Organic Content (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Borehole Number | Sample Number | Depth Interval (ft-bgs) | Elevation of Top (ft) | Sample Type | SPT N Value (blows/ 1 ft) | Moisture Content (%) | | | LL | PL | PI | LI | USCS | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | | | c' (psf) | phi' (deg) | UU - $c_u$ (psf) | Confining Pressure (psf) | Type | $Cc_c$ | $Cr_c$ | $\sigma'_p$ (psf) | | |
| BH-FGD-106 | 97 | 0.0-2.0 | | SH | | 21.3 | | Stiff, mottled dark gray, sandy lean CLAY (CL), trace silt, damp | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 98 | 2.0-4.0 | | SH | | 23.8 | | light brown to dark brown at 2.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 99 | 4.0-6.0 | | SH | | 18.8 | | hard, brownish red, moist at 4.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 100 | 6.0-8.0 | | SH | | 13.1 | | damp at 6.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 101 | 8.0-10.0 | | SH | | 17.8 | | mottled brownish red at 8.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 102 | 13.0-15.0 | | SH | | 17.4 | | mottled gray, little silt at 13.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 103 | 18.0-20.0 | | SH | | 16.7 | | | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | 104 | 23.0-25.0 | | SH | | 22.8 | | Compact, light gray, fine silty SAND (SM), moist | | | | | | 0.0 | 64.6 | 35.4 | | | | | | | | | | | | | |
| BH-FGD-106 | 105 | 28.0-30.0 | | SS | 27 | 28.0 | | wet at 28.0' | | | | | | | | | | | | | | | | | | | | | |
| BH-FGD-106 | | - | | | | | | BORING TERMINATED AT 30.0' | | | | | | | | | | | | | | | | | | | | | |

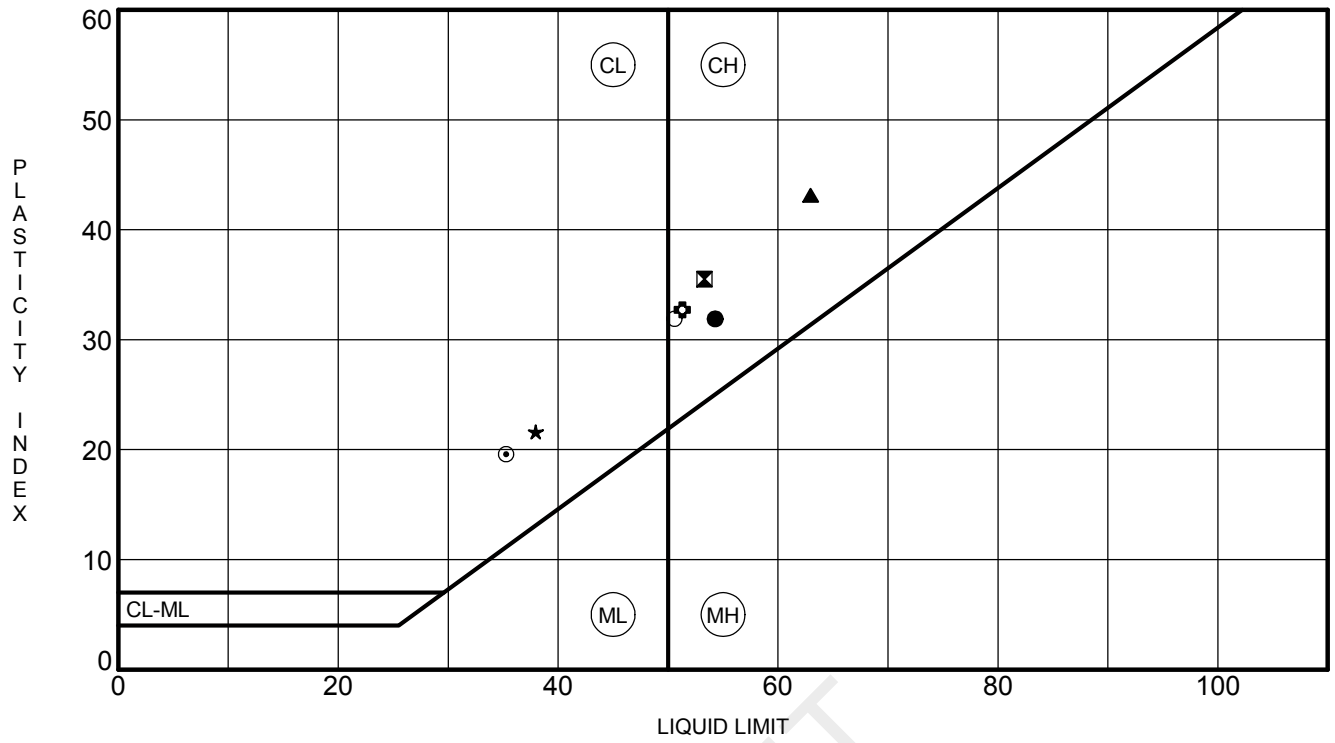




Golder Associates

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas




| | Specimen Identification | | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|---|---|
| ● | **BH-FGD-102** | **18.00ft** | **54** | **22** | **32** | | |
| ⊠ | **BH-FGD-103** | **8.00ft** | **53** | **18** | **35** | | |
| ▲ | **BH-FGD-103** | **13.00ft** | **63** | **20** | **43** | | |
| ★ | **BH-FGD-103** | **28.00ft** | **38** | **16** | **22** | | |
| ⊙ | **BH-FGD-103** | **38.00ft** | **35** | **16** | **19** | | |
| ✿ | **BH-FGD-105** | **8.00ft** | **51** | **19** | **32** | **88** | **FAT CLAY(CH)** |
| ○ | **BH-FGD-105** | **18.00ft** | **51** | **19** | **32** | | |

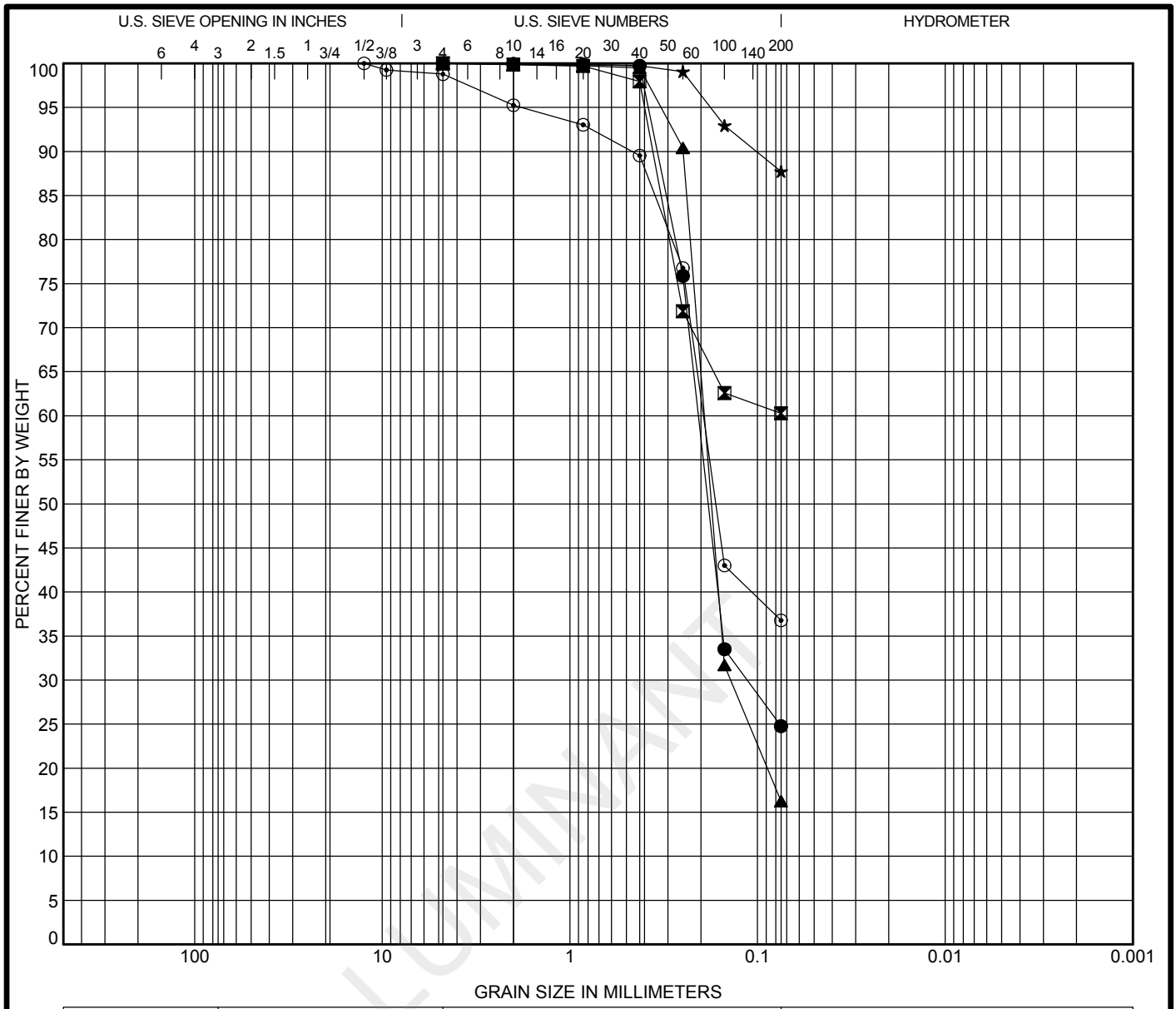


Golder Associates

## ATTERBERG LIMITS' RESULTS

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|
| ● BH-FGD-102 28.00ft | | | | | | |
| ⊠ BH-FGD-103 33.00ft | | | | | | |
| ▲ BH-FGD-104 23.00ft | | | | | | |
| ★ BH-FGD-105 8.00ft | **FAT CLAY(CH)** | **51** | **19** | **32** | | |
| ⊙ BH-FGD-105 38.00ft | | | | | | |

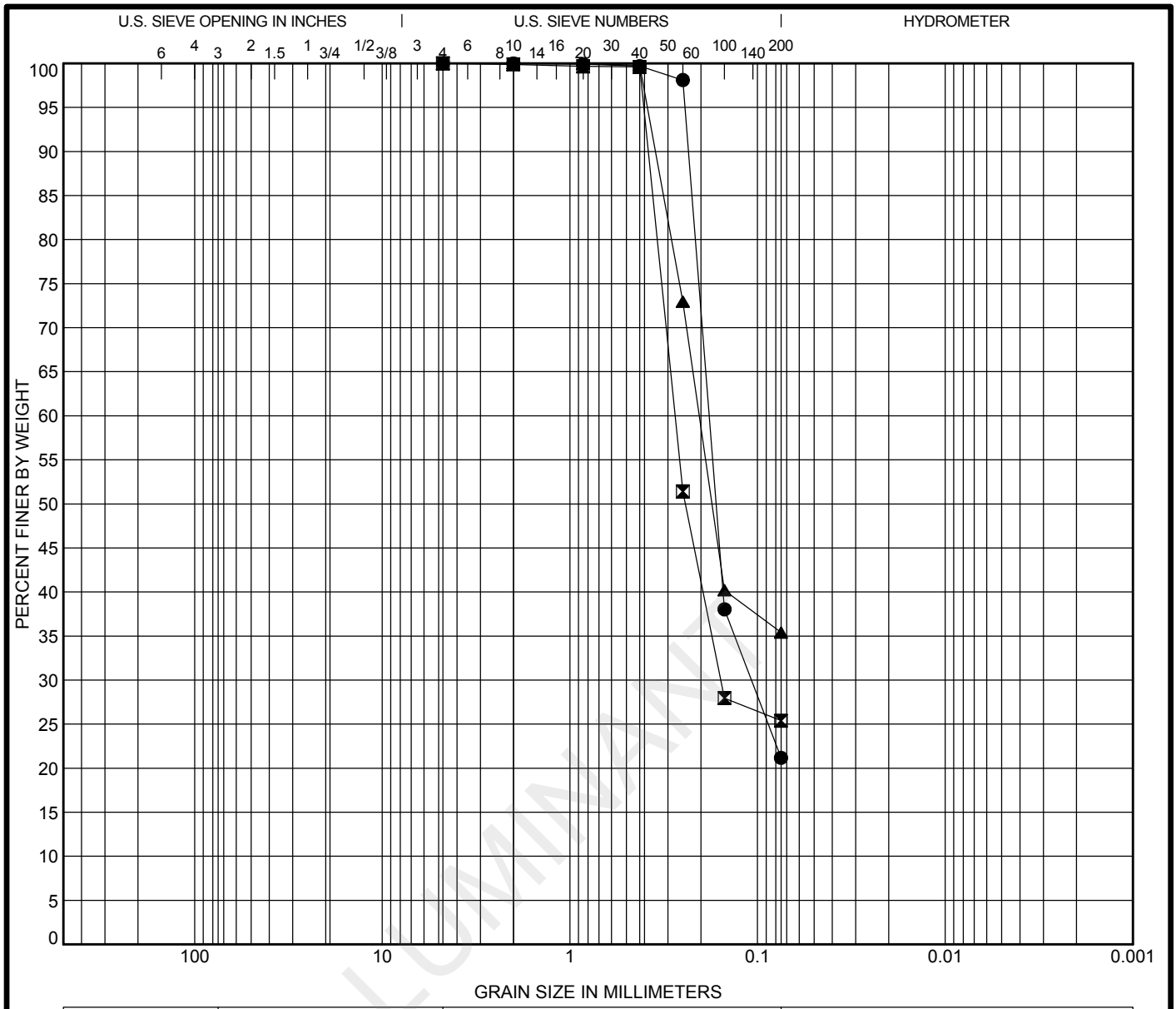
| Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|
| ● BH-FGD-102 28.00 ft | **4.75** | **0.206** | **0.114** | | **0.00** | **75.23** | **24.77** | |
| ⊠ BH-FGD-103 33.00 ft | **4.75** | | | | **0.00** | **39.73** | **60.27** | |
| ▲ BH-FGD-104 23.00 ft | **4.75** | **0.192** | **0.139** | | **0.00** | **83.76** | **16.24** | |
| ★ BH-FGD-105 8.00 ft | **4.75** | | | | **0.00** | **12.26** | **87.74** | |
| ⊙ BH-FGD-105 38.00 ft | **12.5** | **0.194** | | | **1.23** | **62.00** | **36.77** | |

Golder Associates

# GRAIN SIZE DISTRIBUTION

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● | **BH-FGD-105 43.00ft** | | | | | | |
| ⊠ | **BH-FGD-105 48.00ft** | | | | | | |
| ▲ | **BH-FGD-106 23.00ft** | | | | | | |

| | Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|
| ● | **BH-FGD-105 43.00 ft** | **4.75** | **0.181** | **0.108** | | **0.00** | **78.83** | **21.17** | |
| ⊠ | **BH-FGD-105 48.00 ft** | **4.75** | **0.275** | **0.157** | | **0.00** | **74.61** | **25.39** | |
| ▲ | **BH-FGD-106 23.00 ft** | **2** | **0.204** | | | **0.00** | **64.60** | **35.40** | |

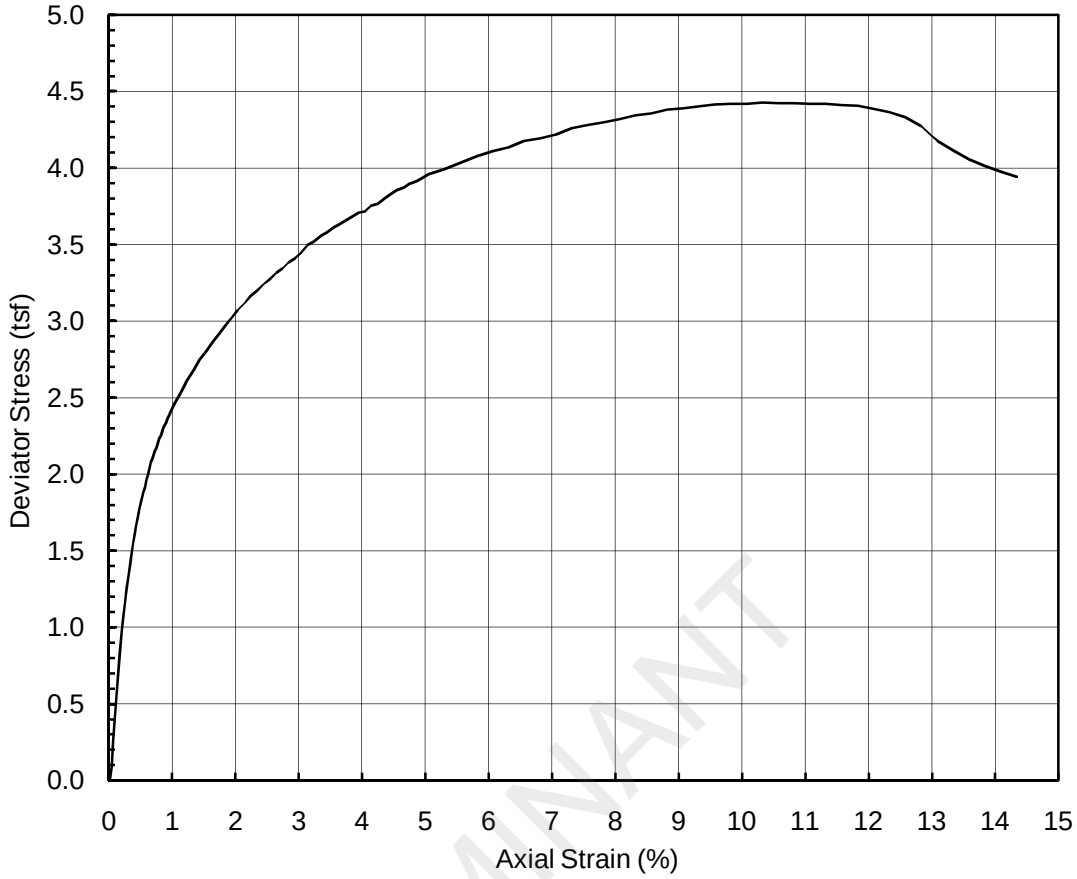
Golder Associates

## GRAIN SIZE DISTRIBUTION

Project: Luminant Pond Stability Geotechnical Investigation

Location: Oak Grove, Texas

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

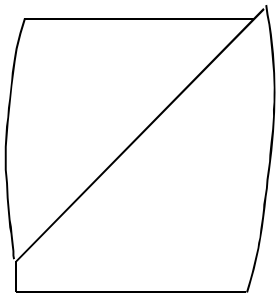





| Specimen Description | Reddish Brown Sandy Clay | | | | | | |
|---|---|---|---|---|---|---|---|
| LL | 63 | PI | 43 | LI | 0.0 | USCS | CH |

| | | | | |
|---|---|---|---|---|
| Depth (ft) | 13.0 | Confining Pressure (psi) | 10.7 |
| Specimen Height (inch) | 5.5 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (tsf) | 4.4 |
| Initial Specimen Weight (g) | 1113.5 | Axial Strain at Peak Stress (%) | 10.3 |
| Moist Unit Weight (pcf) | 125.0 | | |
| Initial Water Content (%) | 19 | | |
| Initial Dry Unit Weight (pcf) | 104.8 | | |

| | |
|---|---|
| Project Title | Luminant Pond Stability |
| Project Number | 103-94563 |
| Sample Type | Shelby Tube |
| Sample ID | FGD-103 SA-71 |
| Comments | |

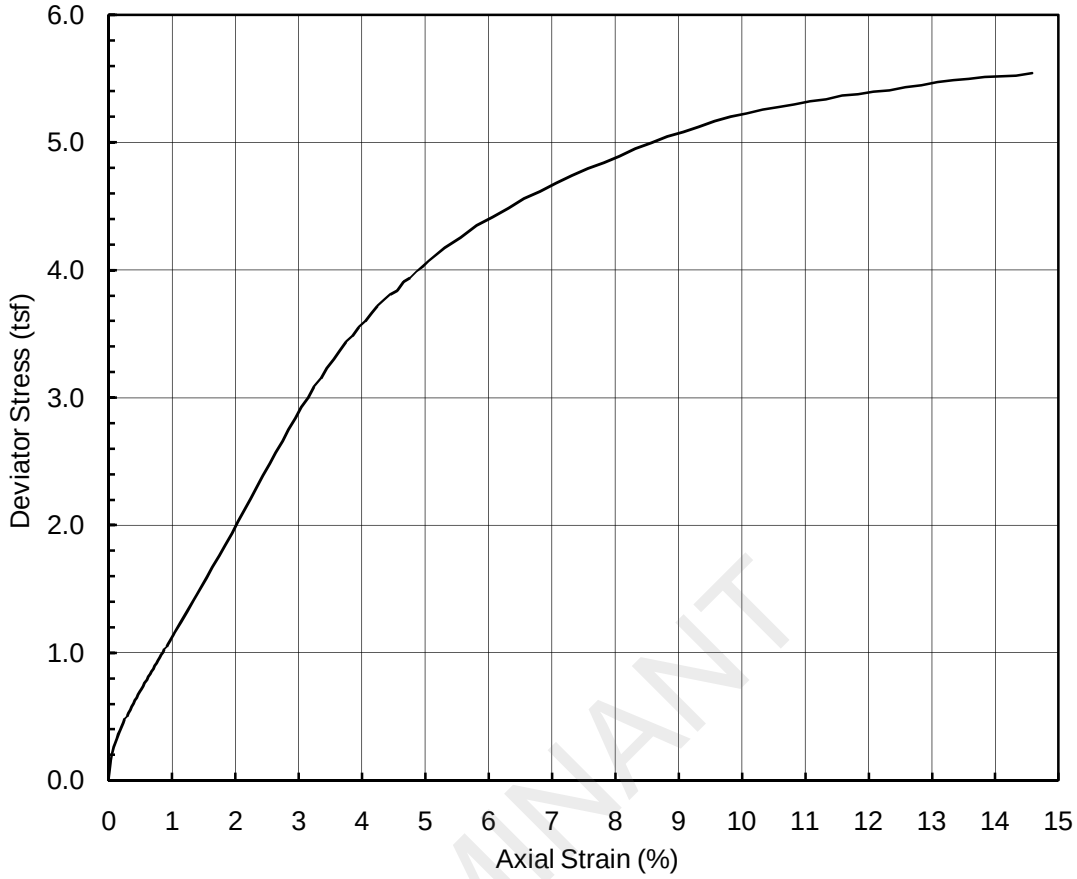


Failure Sketch

| | |
|---|---|
| Performed by | PN |
| Date | 27-Mar-10 |
| Check | DM |
| Review | PCM |

Golder Associates

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

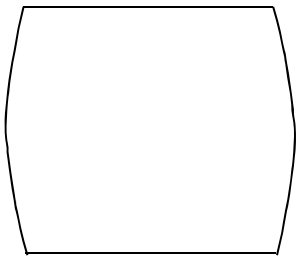





| Specimen Description | Light brown Sandy Clay | | | | | | |
|---|---|---|---|---|---|---|---|
| LL | 38 | PI | 22 | LI | 0.1 | USCS | CL |

| | | | |
|---|---|---|---|
| Depth (ft) | 28.0 | Confining Pressure (psi) | 24.8 |
| Specimen Height (inch) | 5.6 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (tsf) | 5.5 |
| Initial Specimen Weight (g) | 1225.2 | Axial Strain at Peak Stress (%) | 14.8 |
| Moist Unit Weight (pcf) | 132.8 | | |
| Initial Water Content (%) | 19 | | |
| Initial Dry Unit Weight (pcf) | 111.8 | | |

| | |
|---|---|
| Project Title | Luminant Pond Stability |
| Project Number | 103-94563 |
| Sample Type | Shelby Tube |
| Sample ID | FGD-103 SA-74 |
| Comments | |

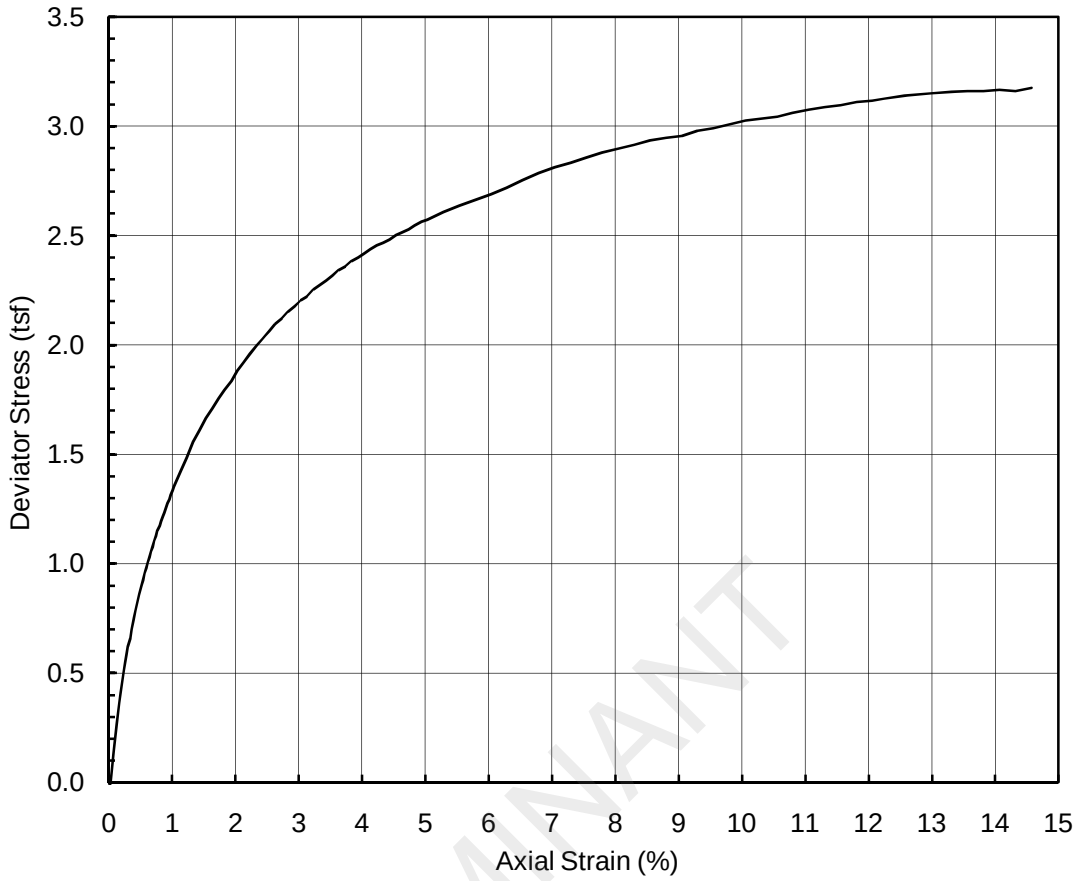


Failure Sketch

Golder Associates

| | |
|---|---|
| Performed by | PN |
| Date | 29-Mar-10 |
| Check | DM |
| Review | PCM |

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

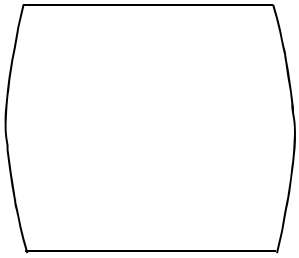





| Specimen Description | Light gray Sandy Clay | | | | | | |
|---|---|---|---|---|---|---|---|
| LL | 35 | PI | 19 | LI | 0.0 | USCS | CL |

| | | | | |
|---|---|---|---|---|
| Depth (ft) | 38.0 | Confining Pressure (psi) | 30.8 |
| Specimen Height (inch) | 5.5 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (tsf) | 3.2 |
| Initial Specimen Weight (g) | 1131.4 | Axial Strain at Peak Stress (%) | 15.0 |
| Moist Unit Weight (pcf) | 129.7 | | |
| Initial Water Content (%) | 16 | | |
| Initial Dry Unit Weight (pcf) | 111.8 | | |

| | |
|---|---|
| Project Title | Luminant Pond Stability |
| Project Number | 103-94563 |
| Sample Type | Shelby Tube |
| Sample ID | FGD-103 SA-76 |
| Comments | |

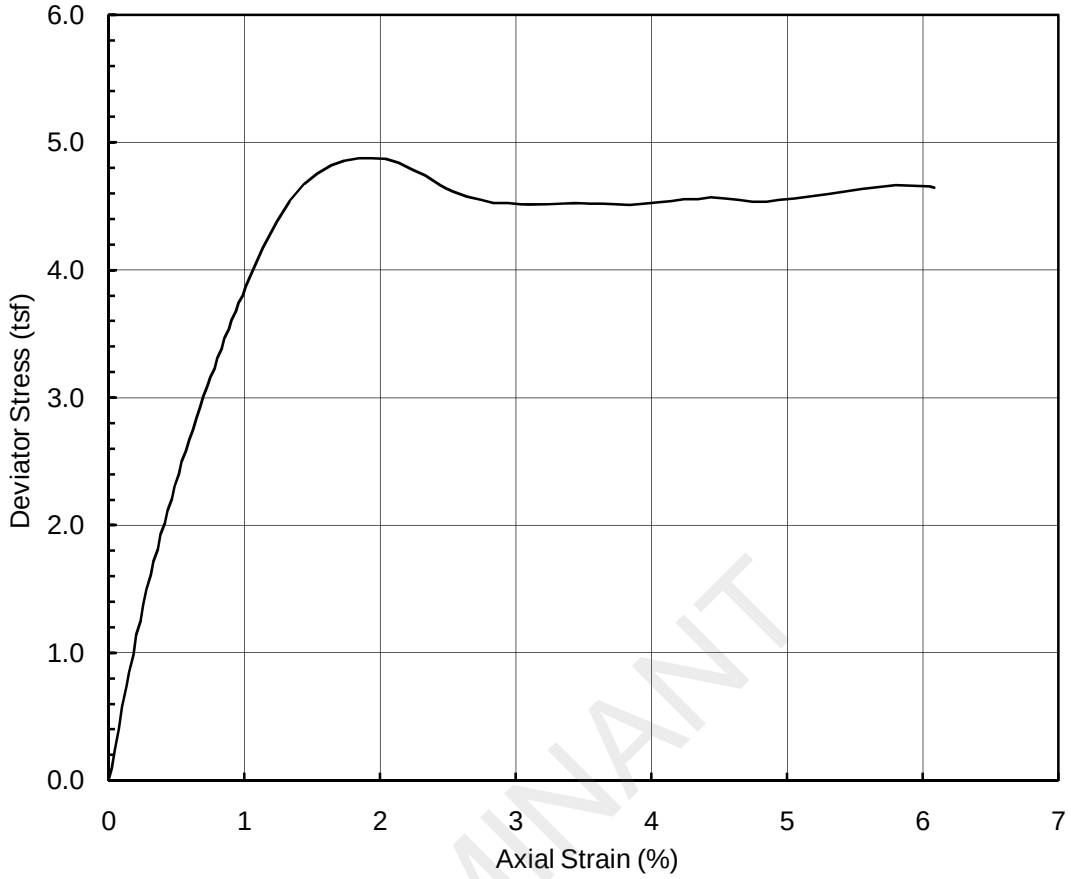


Failure Sketch

Golder Associates

| | |
|---|---|
| Performed by | PN |
| Date | 27-Mar-10 |
| Check | DM |
| Review | PCM |

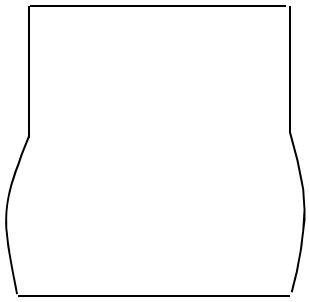
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850






| Specimen Description | Yellowish Brown Sandy Clay | | | | | | |
|---|---|---|---|---|---|---|---|
| LL | 53 | PI | 35 | LI | -0.1 | USCS | CH |

| | | | | |
|---|---|---|---|---|
| Depth (ft) | 8.0 | Confining Pressure (psi) | 7.8 |
| Specimen Height (inch) | 5.6 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (tsf) | 4.9 |
| Initial Specimen Weight (g) | 1108.3 | Axial Strain at Peak Stress (%) | 1.9 |
| Moist Unit Weight (pcf) | 126.0 | | |
| Initial Water Content (%) | 15 | | |
| Initial Dry Unit Weight (pcf) | 109.2 | | |



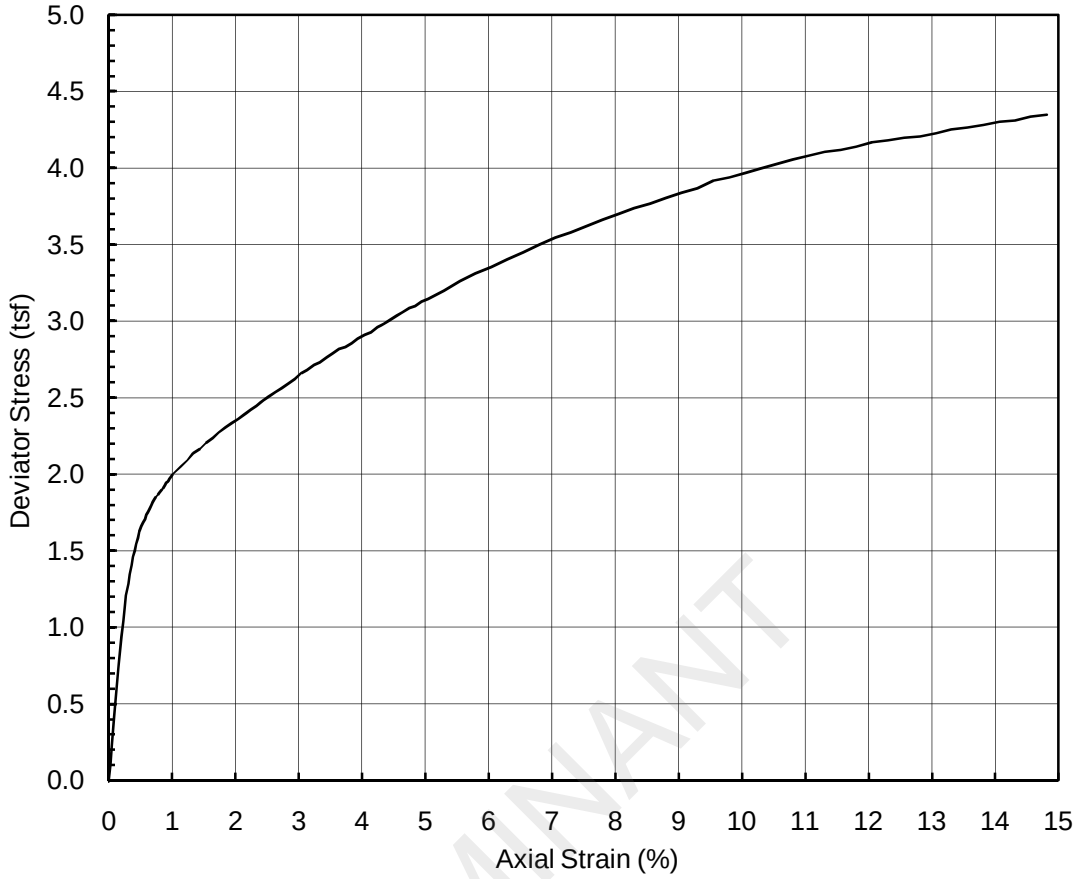
Failure Sketch

| | |
|---|---|
| Project Title | Luminant Pond Stability |
| Project Number | 103-94563 |
| Sample Type | Shelby Tube |
| Sample ID | FGD-103 SA-70 |
| Comments | |

| | |
|---|---|
| Performed by | PN |
| Date | 27-Mar-10 |
| Check | DM |
| Review | PCM |

Golder Associates

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850

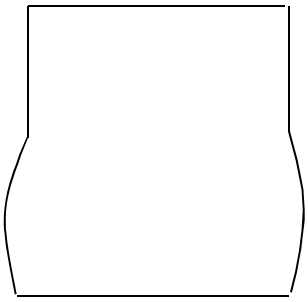





| Specimen Description | Brown Sandy Clay | | | | | | |
|---|---|---|---|---|---|---|---|
| LL | 51 | PI | 32 | LI | 0.0 | USCS | CH |

| | | | | |
|---|---|---|---|---|
| Depth (ft) | 18.0 | Confining Pressure (psi) | 16.9 |
| Specimen Height (inch) | 5.0 | Strain Rate (%/min) | 1.0 |
| Specimen Diameter (inch) | 2.8 | Peak Deviator Stress (tsf) | 4.3 |
| Initial Specimen Weight (g) | 1035.2 | Axial Strain at Peak Stress (%) | 15.0 |
| Moist Unit Weight (pcf) | 127.3 | | |
| Initial Water Content (%) | 18 | | |
| Initial Dry Unit Weight (pcf) | 107.9 | | |

| | |
|---|---|
| Project Title | Luminant Pond Stability |
| Project Number | 103-94563 |
| Sample Type | Shelby Tube |
| Sample ID | FGD-105 SA-50 |
| Comments | |



Failure Sketch

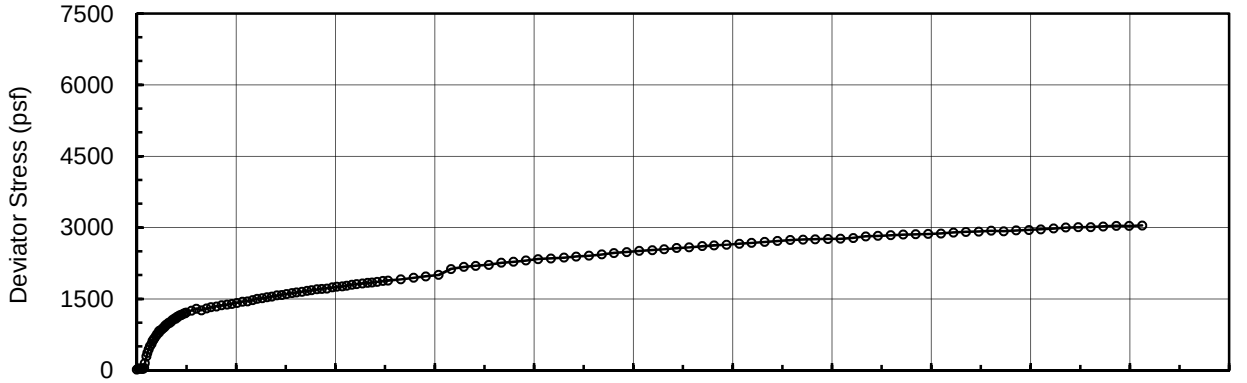
Golder Associates

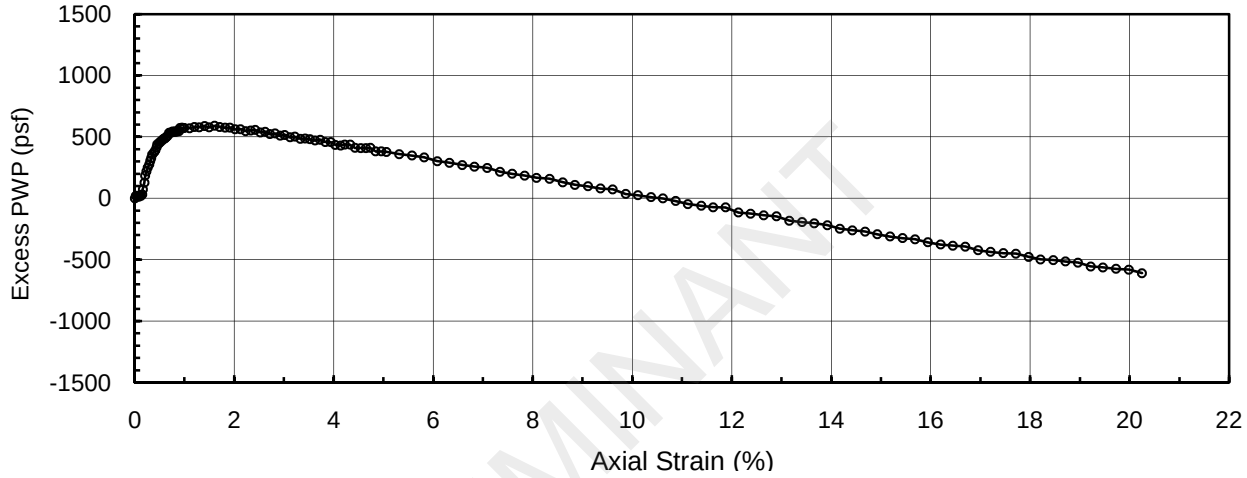
| | |
|---|---|
| Performed by | PN |
| Date | 27-Mar-10 |
| Check | DM |
| Review | SBK |

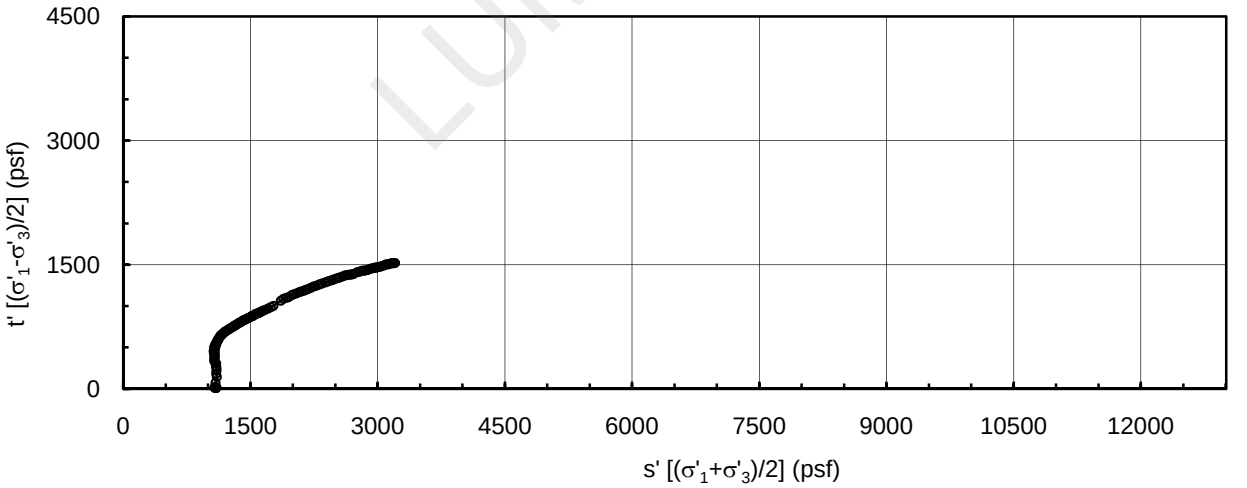
# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond **Project Number:** 103-94563 **Date:** 08-Apr-10

**Boring Number:** FGD-105 **Specimen Name:** SA-48 **Depth (ft):** 8.9



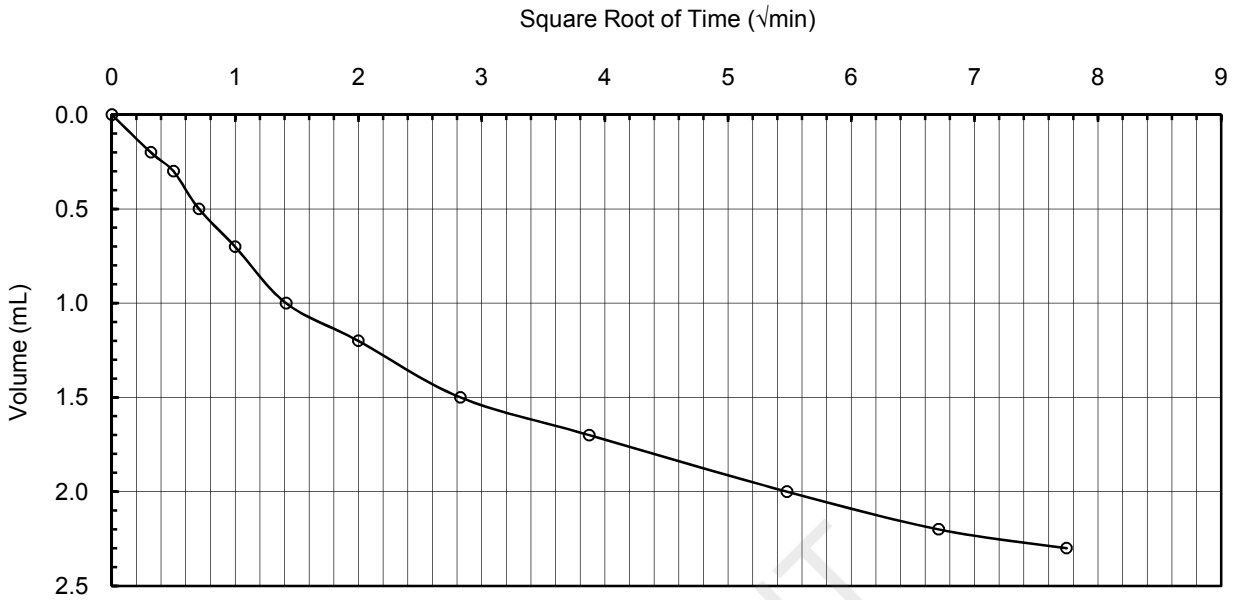



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Specimen Description: | Light Brown Fat CLAY | | | | | | |
| Initial Specimen Diameter (inch) = | | | | 2.94 | Initial Specimen Height (inch) = | | 5.29 |
| Initial Water Content (%) = | | | | 15.5 | Water Content at End of Test (%) = | | 22.4 |
| Initial Moist Unit Weight (pcf) = | | | | 121.8 | B-value = | | 0.95 |
| Back Pressure (BP, psf) = | | | | 10800 | Consolidation Stress ($\sigma'_3$, psf) = | | 1088 |
| Initial Lateral Stress ($\sigma'_3$, psf) = | | | | 1088 | Consolidation $t_{50}$ (min) = | | 3 |
| Initial Deviator Stress ($\sigma_1$ - $\sigma_3$, psf) = | | | | 16 | Rebound Stress ($\sigma'_3$, psf) = | | NA |
| Test Strain Rate (%/hour) = | | | | 1.0 | Rebound $t_{50}$ (min) = | | NA |
| LL = | 51 | PI = | 32 | USCS | CH | **Performed by** | DM |
| Comments: | | | | | | **Reviewed by** | PCM |

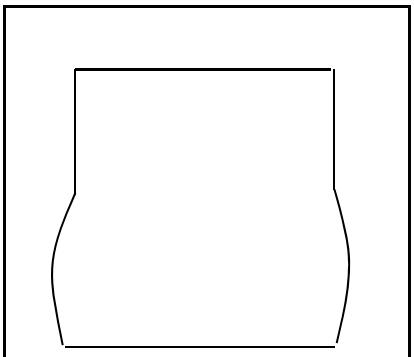
# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond | **Project Number:** 103-94563 | **Date:** 08-Apr-10

**Boring Number:** FGD-105 | **Specimen Name:** SA-48 | **Depth (ft):** 8.9





FAILURE SKETCH

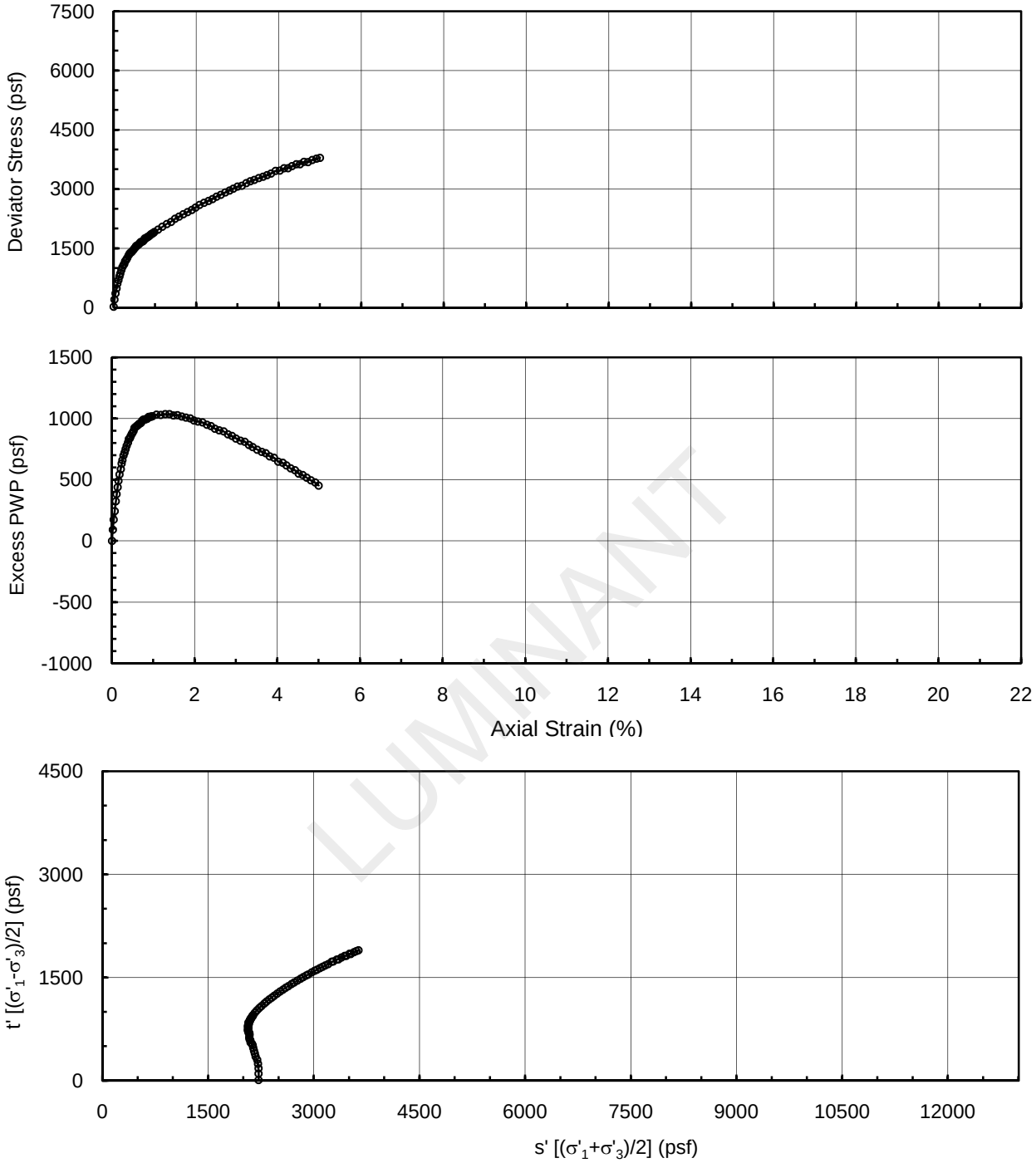
| | | | |
|---|---|---|---|
| Consolidation Stress ($\sigma'_3$, psf) = | | | 1088 |
| Consolidation $t_{50}$ (min) = | | | 3 |
| Consolidation Volume Change (mL) = | | | 2.3 |
| Unloading Stress (psf) = | | | NA |
| Unloading $t_{50}$ (min) = | | | NA |
| Unloading Volume Change (mL) = | | | NA |
| LL = | 51 | PI = | 32 |
| USCS | CH | | |
| Gs = | 2.65 | assumed | |

| | |
|---|---|
| **Performed by** | DM |
| **Reviewed by** | PCM |

# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond | **Project Number:** 103-94563 | **Date:** 09-Apr-10

**Boring Number:** FGD-105 | **Specimen Name:** SA-48 | **Depth (ft):** 8.0



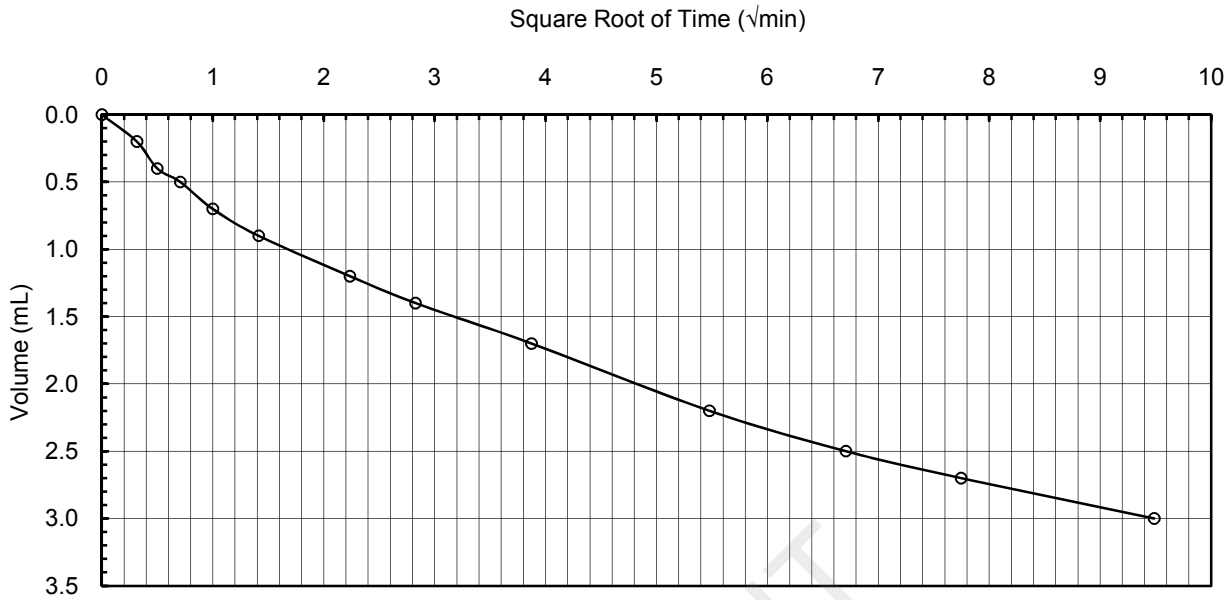



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Specimen Description: | Light Brown Fat CLAY | | | | | | |
| Initial Specimen Diameter (inch) = | | | | 2.94 | Initial Specimen Height (inch) = | | 5.56 |
| Initial Water Content (%) = | | | | 16.3 | Water Content at End of Test (%) = | | - |
| Initial Moist Unit Weight (pcf) = | | | | 123.6 | B-value = | | 0.95 |
| Back Pressure (BP, psf) = | | | | 9360 | Consolidation Stress ($\sigma'_3$, psf) = | | 2209 |
| Initial Lateral Stress ($\sigma'_3$, psf) = | | | | 2209 | Consolidation $t_{50}$ (min) = | | 17 |
| Initial Deviator Stress ($\sigma_1$ - $\sigma_3$, psf) = | | | | 18 | Rebound Stress ($\sigma'_3$, psf) = | | NA |
| Test Strain Rate (%/hour) = | | | | 1.0 | Rebound $t_{50}$ (min) = | | NA |
| LL = | 51 | PI = | 32 | USCS | CH | **Performed by** | DM |
| Comments: | Specimen #2 - Stage 1 | | | | | **Reviewed by** | PCM |

# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond | **Project Number:** 103-94563 | **Date:** 09-Apr-10

**Boring Number:** FGD-105 | **Specimen Name:** SA-48 | **Depth (ft):** 8.0






FAILURE SKETCH

| | | | |
|---|---|---|---|
| Consolidation Stress ($\sigma'_3$, psf) = | | | 2209 |
| Consolidation $t_{50}$ (min) = | | | 17 |
| Consolidation Volume Change (mL) = | | | 3.0 |
| Unloading Stress (psf) = | | | NA |
| Unloading $t_{50}$ (min) = | | | NA |
| Unloading Volume Change (mL) = | | | NA |
| LL = | 51 | PI = | 32 |
| USCS | CH | | |
| Gs = | 2.65 | assumed | |

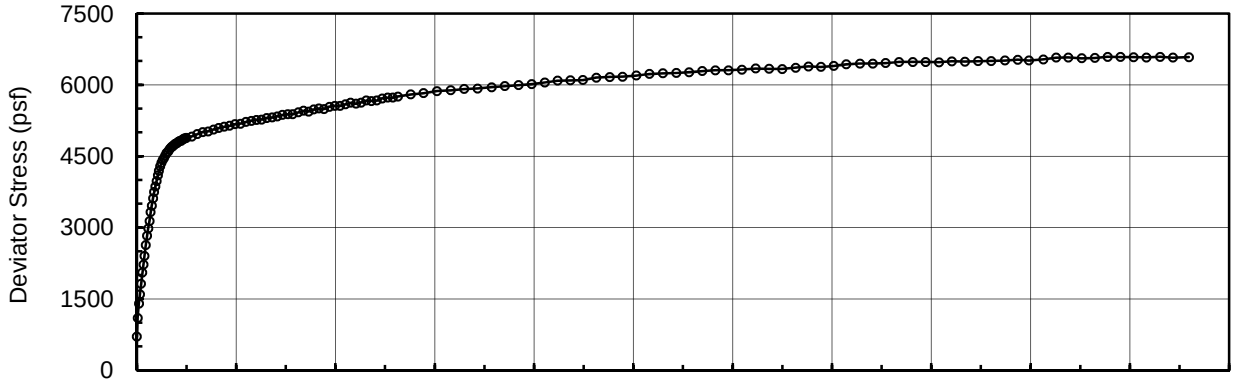
**Performed by** DM

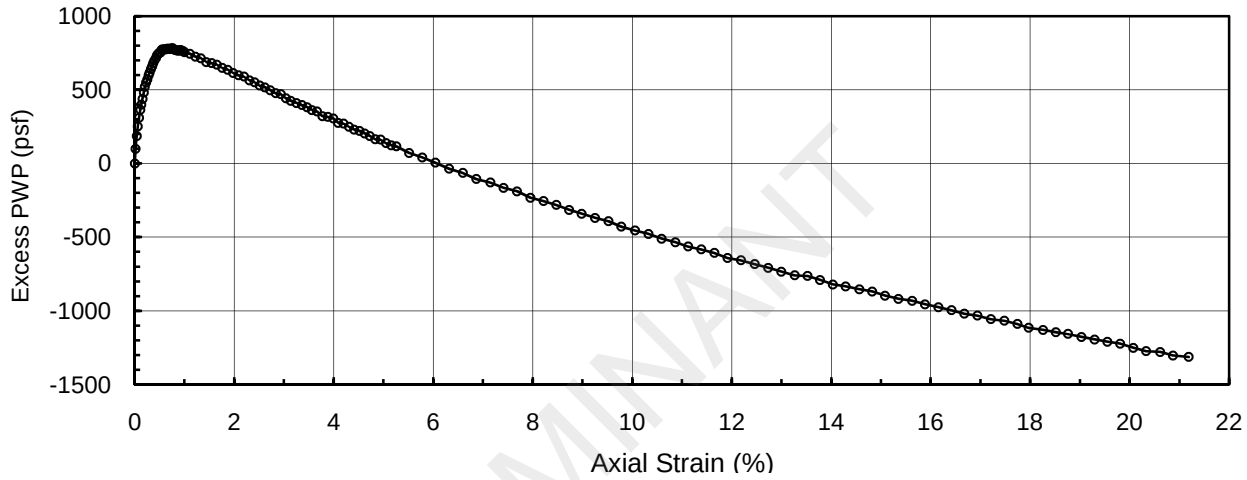
**Reviewed by** PCM

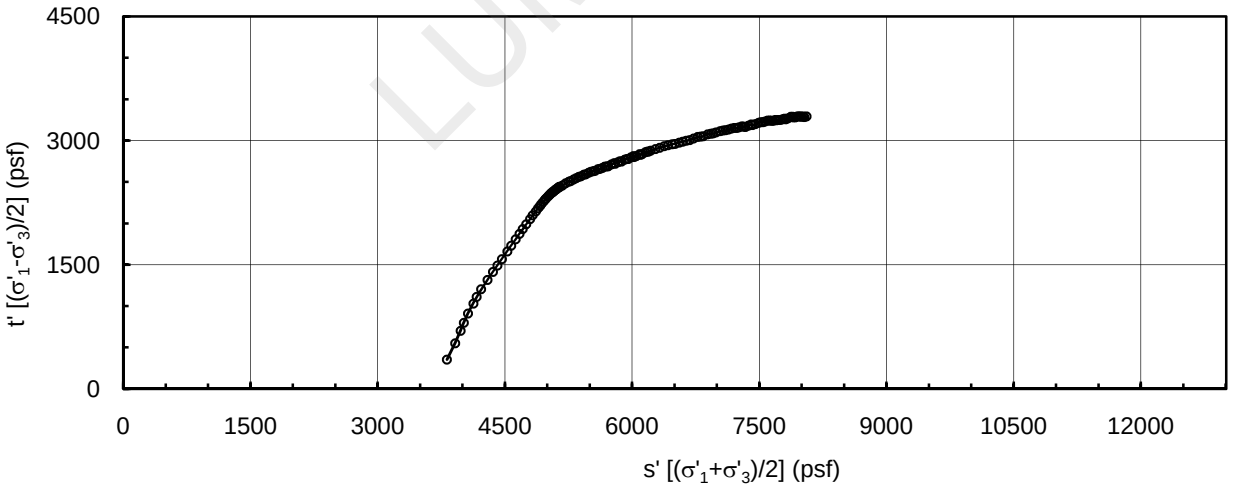
# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond **Project Number:** 103-94563 **Date:** 10-Apr-10

**Boring Number:** FGD-105 **Specimen Name:** SA-48 **Depth (ft):** 8.0



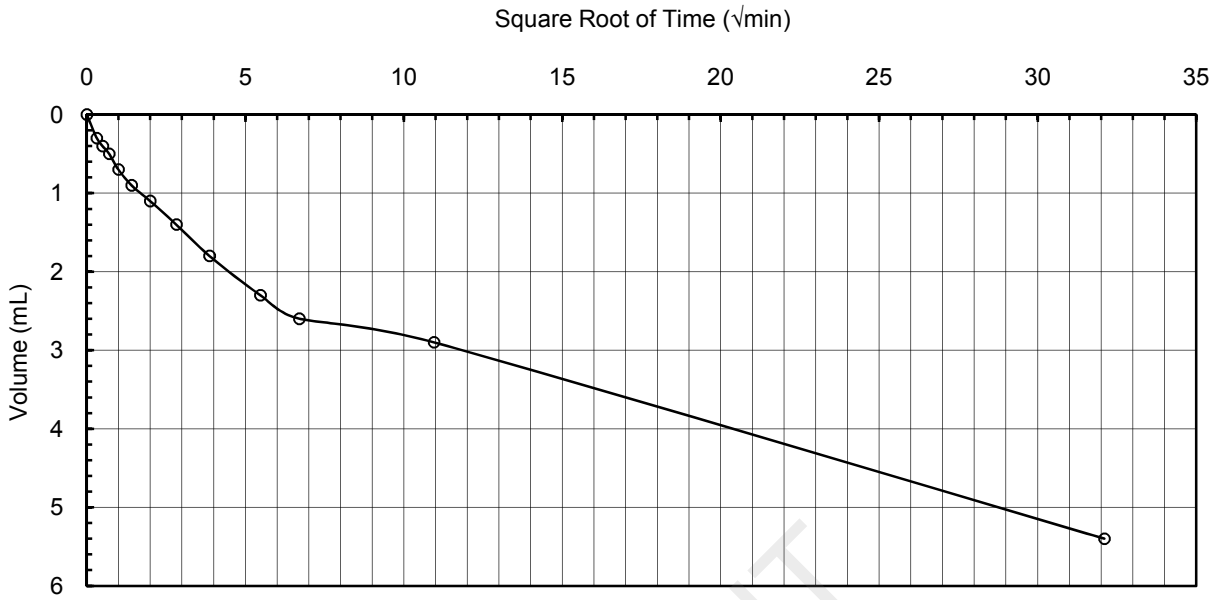



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Specimen Description: | Light Brown Fat CLAY | | | | | | |
| Initial Specimen Diameter (inch) = | | | | 3.00 | Initial Specimen Height (inch) = | | 5.28 |
| Initial Water Content (%) = | | | | - | Water Content at End of Test (%) = | | 21.2 |
| Initial Moist Unit Weight (pcf) = | | | | - | B-value = | | - |
| Back Pressure (BP, psf) = | | | | 9360 | Consolidation Stress ($\sigma'_3$, psf) = | | 3463 |
| Initial Lateral Stress ($\sigma'_3$, psf) = | | | | 3463 | Consolidation $t_{50}$ (min) = | | 6 |
| Initial Deviator Stress ($\sigma_1$ - $\sigma_3$, psf) = | | | | 708 | Rebound Stress ($\sigma'_3$, psf) = | | NA |
| Test Strain Rate (%/hour) = | | | | 1.0 | Rebound $t_{50}$ (min) = | | NA |
| LL = | 51 | PI = | 32 | USCS | CH | **Performed by** | DM |
| Comments: | Specimen #2 - Stage 2 | | | | | **Reviewed by** | PCM |

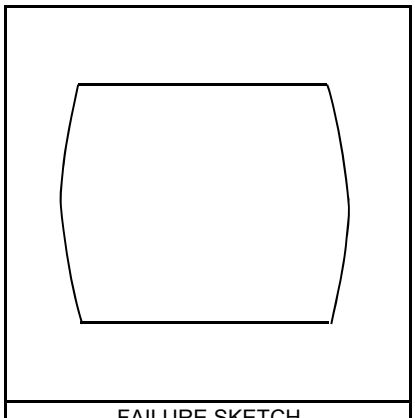
# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond | **Project Number:** 103-94563 | **Date:** 10-Apr-10

**Boring Number:** FGD-105 | **Specimen Name:** SA-48 | **Depth (ft):** 8.0





FAILURE SKETCH

| | | | |
|---|---|---|---|
| Consolidation Stress ($\sigma'_3$, psf) = | | | 3463 |
| Consolidation $t_{50}$ (min) = | | | 6 |
| Consolidation Volume Change (mL) = | | | 5.4 |
| Unloading Stress (psf) = | | | NA |
| Unloading $t_{50}$ (min) = | | | NA |
| Unloading Volume Change (mL) = | | | NA |
| LL = | 51 | PI = | 32 |
| USCS | CH | | |
| Gs = | 2.65 | assumed | |

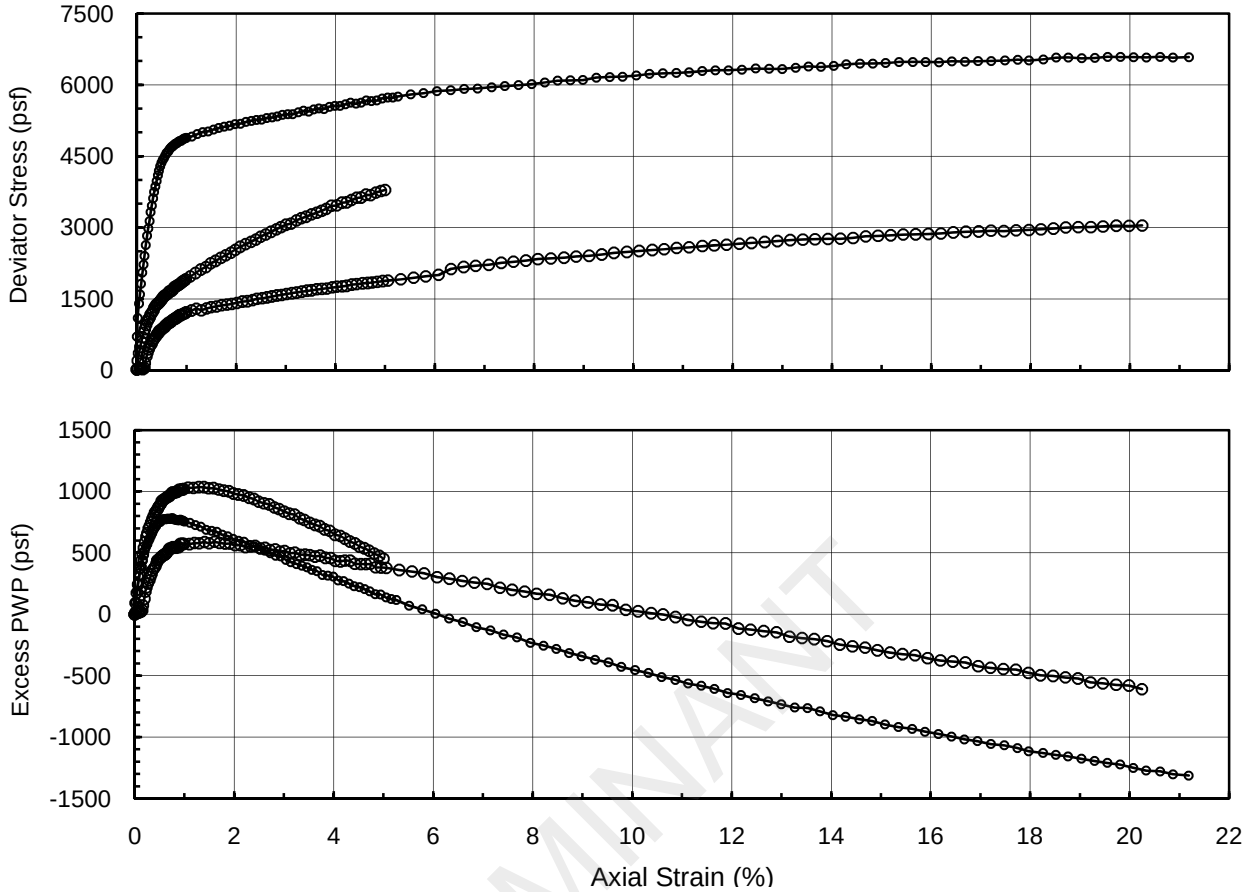
**Performed by** DM

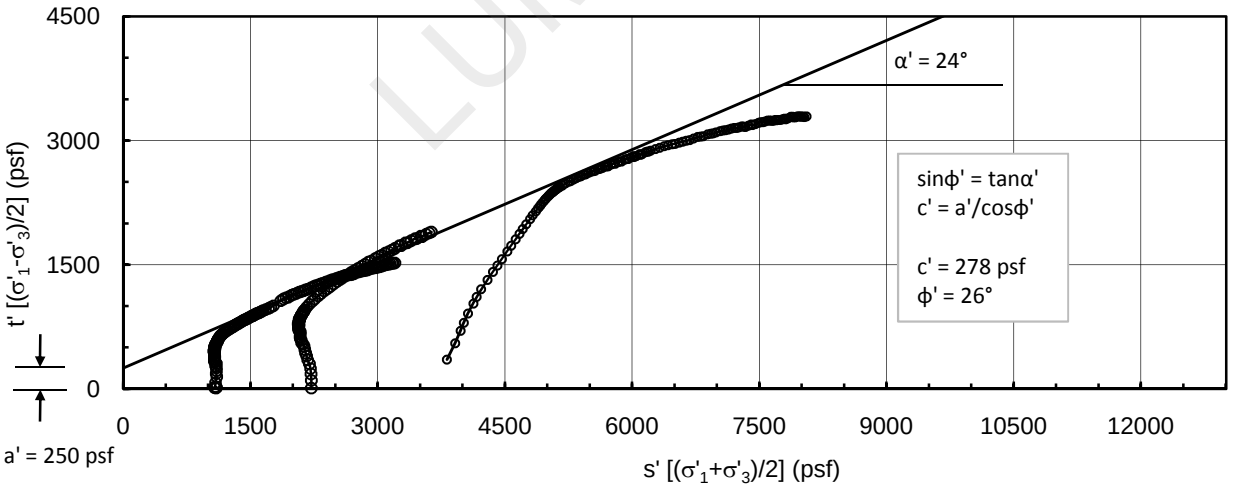
**Reviewed by** PCM

# Isotropically Consolidated Undrained Triaxial Test (ICU)

**Project Title:** Luminant Pond **Project Number:** 103-94563 **Date:** 10-Apr-10

**Boring Number:** FGD-105 **Specimen Name:** SA-48 **Depth (ft):**






| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Specimen Description: | Light Brown Fat CLAY | | | | | | |
| Initial Specimen Diameter (inch) = | | | | Initial Specimen Height (inch) = | | | |
| Initial Water Content (%) = | | | | Water Content at End of Test (%) = | | | |
| Initial Moist Unit Weight (pcf) = | | | | B-value = | | | |
| Back Pressure (BP, psf) = | | | | Consolidation Stress ($\sigma'_3$, psf) = | | | |
| Initial Lateral Stress ($\sigma'_3$, psf) = | | | | Consolidation $t_{50}$ (min) = | | | |
| Initial Deviator Stress ($\sigma_1$ - $\sigma_3$, psf) = | | | | Rebound Stress ($\sigma'_3$, psf) = | | | |
| Test Strain Rate (%/hour) = | | | | Rebound $t_{50}$ (min) = | | | |
| LL = | 51 | PI = | 32 | USCS | CH | **Performed by** | DM |
| Comments: | 3 Stages on 2 Specimens | | | | | **Reviewed by** | PCM |

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Fax: (281) 821-6870

# SUMMARY OF LABORATORY RESULTS

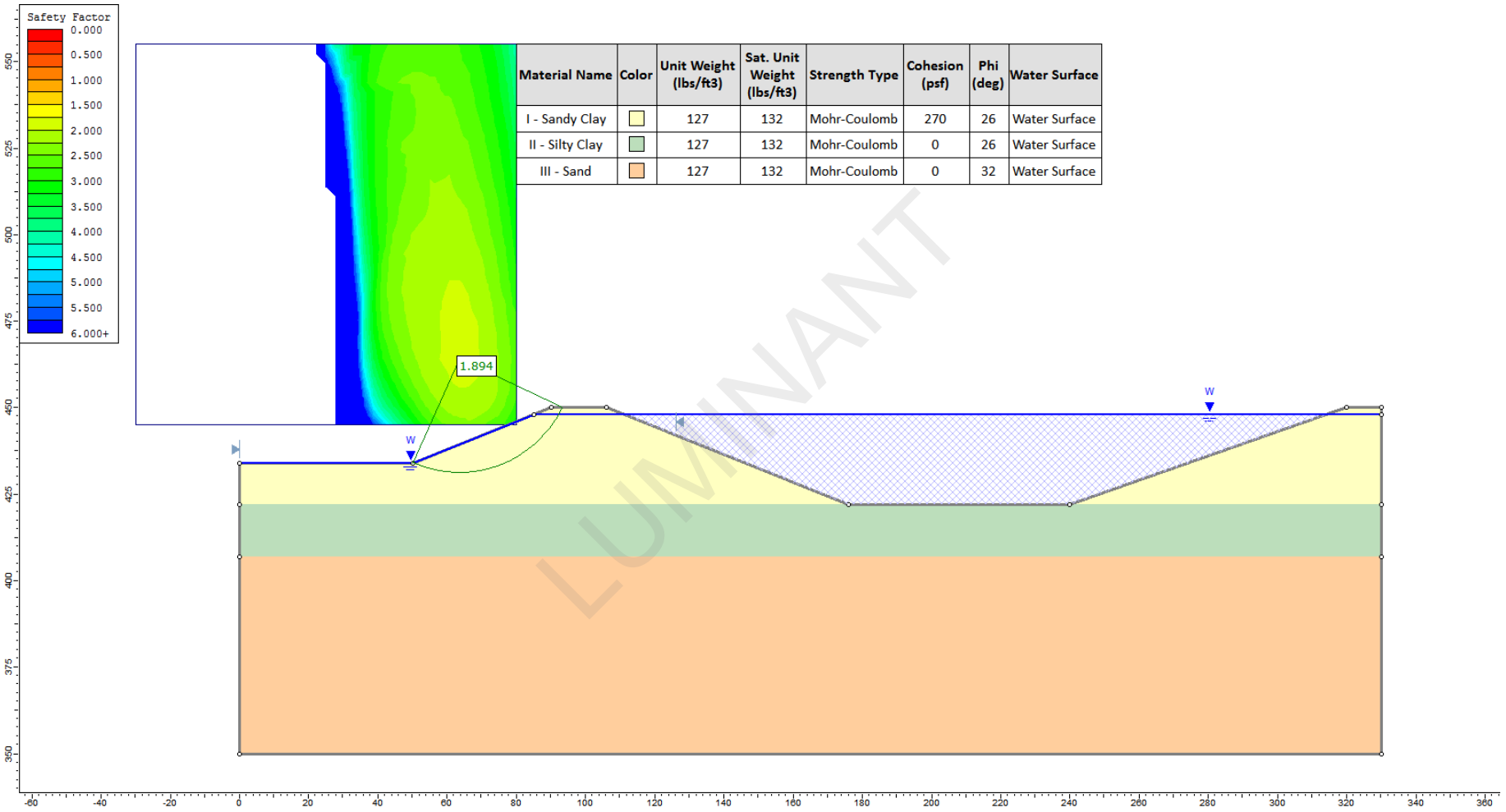


**CLIENT** Luminant Power **PROJECT NAME** Luminant

**PROJECT NUMBER** 1406296 **PROJECT LOCATION** Oak Grove SES

| Borehole | Depth | Liquid Limit | Plastic Limit | Plasticity Index | Maximum Size (mm) | %<#200 Sieve | Class-ification | Water Content (%) | Dry Density (pcf) | Satur-ation (%) | Specific Gravity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CELL 4 SF-01 | 0.0 | 45 | 14 | 31 | 9.5 | 58 | CL | 17.8 | | | |
| FGD-10 | 4.0 | | | | 4.75 | 82 | | 14.8 | | | |
| FGD-10 | 26.0 | | | | 4.75 | 33 | | 28.0 | | | |
| FGD-10 | 32.0 | 46 | 20 | 26 | 4.75 | 77 | CL | 21.5 | | | |
| FGD-11 | 4.0 | 52 | 17 | 35 | 4.75 | 93 | CH | 20.6 | | | |
| FGD-11 | 22.0 | | | | 4.75 | 15 | | 8.2 | | | |
| FGD-11 | 40.0 | | | | 4.75 | 24 | | 34.5 | | | |
| FGD-12 | 28.0 | | | | 4.75 | 20 | | 22.8 | | | |
| FGD-C-01 | 4.0 | 52 | 17 | 35 | 4.75 | 78 | CH | 11.5 | | | |
| FGD-C-01 | 12.0 | 39 | 20 | 19 | 4.75 | 77 | CL | 8.6 | | | |
| FGD-C-02 | 10.0 | 51 | 17 | 34 | 9.5 | 90 | CH | 15.1 | | | |
| FGD-C-02 | 36.0 | | | | 4.75 | 60 | | 28.3 | | | |
| FGD-C-03 | 4.0 | 39 | 20 | 19 | 4.75 | 67 | CL | 8.5 | | | |
| FGD-C-03 | 8.0 | 41 | 21 | 20 | 4.75 | 89 | CL | 9.0 | | | |
| FGD-C-03 | 36.0 | 36 | 24 | 12 | 4.75 | 51 | CL | 26.1 | | | |
| FGD-C-04 | 4.0 | 46 | 15 | 31 | 4.75 | 49 | SC | 6.6 | | | |
| FGD-C-04 | 10.0 | 68 | 21 | 47 | 4.75 | 61 | CH | 16.2 | | | |
| FGD-C-04 | 40.0 | 36 | 16 | 20 | 4.75 | 68 | CL | 18.5 | | | |
| FGD-C-05 | 2.0 | 56 | 17 | 39 | 4.75 | 84 | CH | 22.5 | | | |
| FGD-C-05 | 32.0 | 34 | 19 | 15 | 9.5 | 28 | SC | 29.9 | | | |
| FGD-C-06 | 16.0 | 41 | 15 | 26 | 9.5 | 66 | CL | 11.4 | | | |
| FGD-C-06 | 24.0 | | | | 4.75 | 29 | | 5.1 | | | |
| FGD-C-07 | 14.0 | 45 | 15 | 30 | 9.5 | 74 | CL | 12.3 | | | |
| FGD-C-07 | 36.0 | NP | NP | NP | 4.75 | 30 | SM | 24.1 | | | |
| FGD-C-08 | 4.0 | 37 | 17 | 20 | 9.5 | 59 | CL | 13.4 | | | |
| FGD-C-08 | 16.0 | 31 | 16 | 15 | 9.5 | 45 | SC | 8.3 | | | |
| FGD-C-09 | 12.0 | 39 | 15 | 24 | 4.75 | 62 | CL | 11.6 | | | |
| FGD-C-10 | 0.0 | 41 | 19 | 22 | 9.5 | 79 | CL | 19.8 | | | |
| FGD-C-10 | 2.0 | 42 | 18 | 24 | 9.5 | 73 | CL | 13.4 | | | |
| FGD-C-10 | 4.0 | 41 | 17 | 24 | 4.75 | 67 | CL | 13.9 | | | |

# APPENDIX C
# SLOPE STABILITY ANALYSIS RESULTS



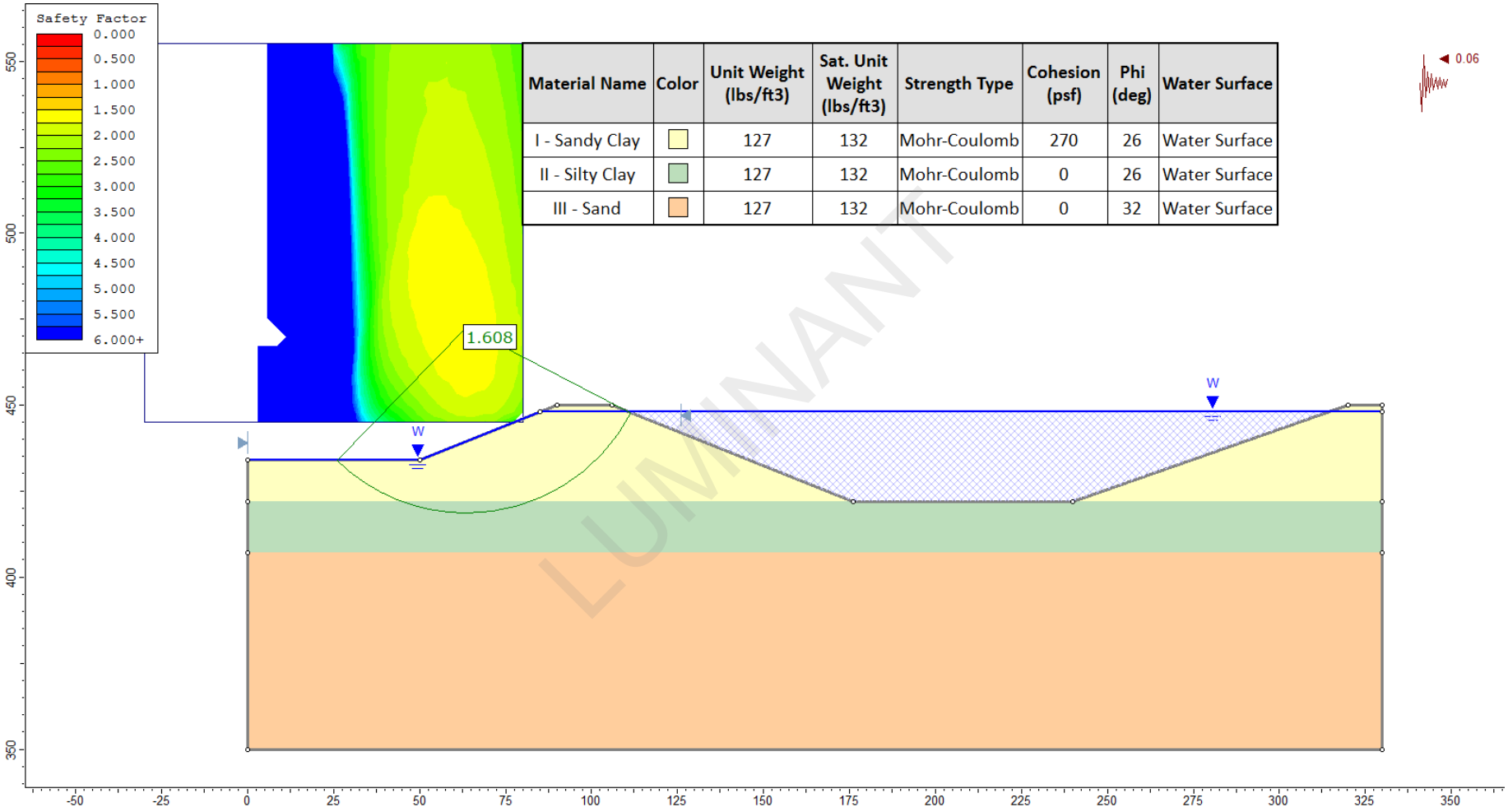

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 | Water Surface |



FIGURE **C.1**

## Results of Stability Analysis − FGD−A: A−A' − Case 1a

Stability and Safety Factor Assessment, Oak Grove SES



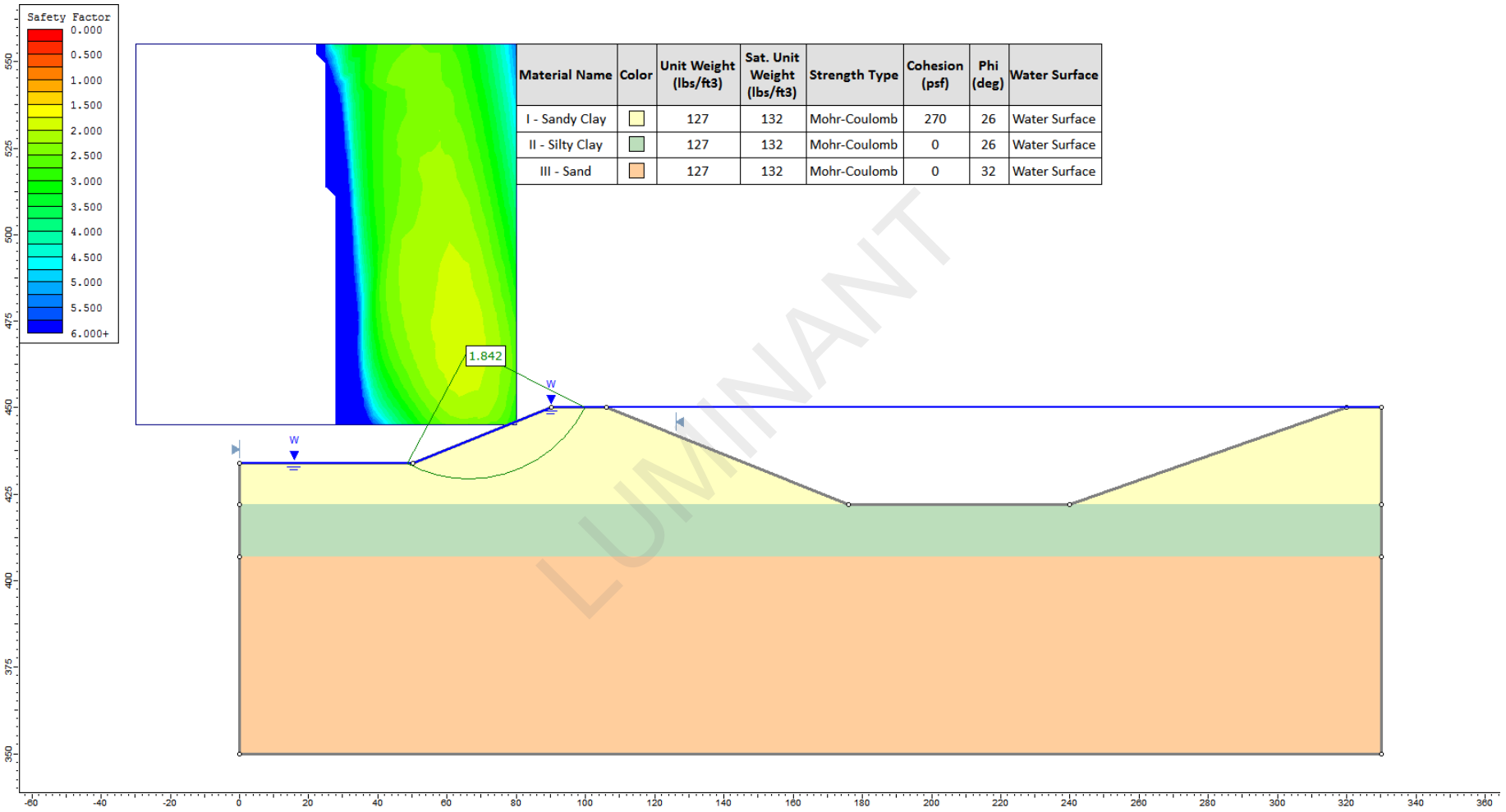

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 | Water Surface |



FIGURE **C.2**

## Results of Stability Analysis − FGD−A: A−A' − Case 1b

Stability and Safety Factor Assessment, Oak Grove SES



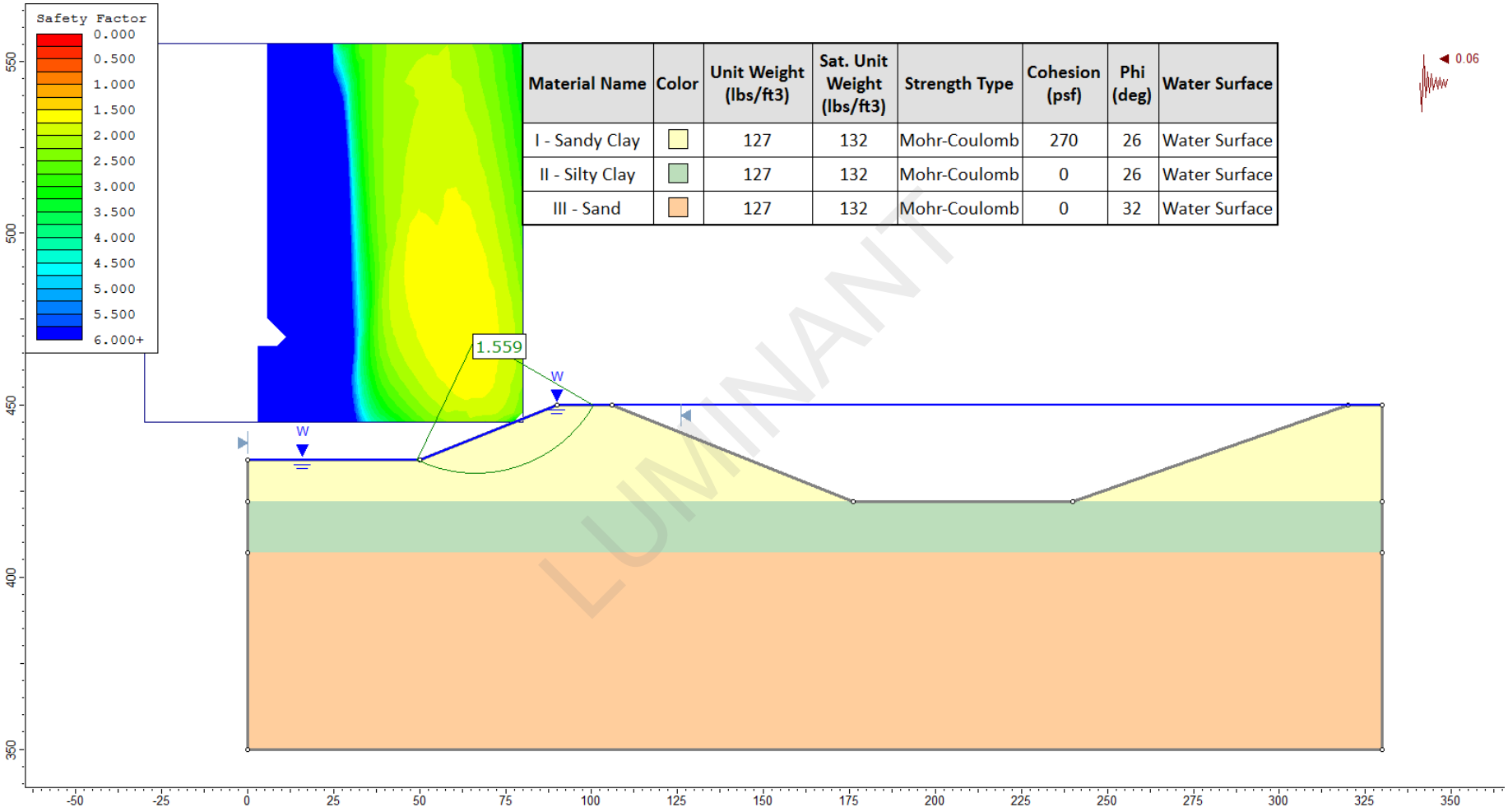

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 | Water Surface |



FIGURE **C.3**

## Results of Stability Analysis − FGD−A: A−A' − Case 2a

Stability and Safety Factor Assessment, Oak Grove SES



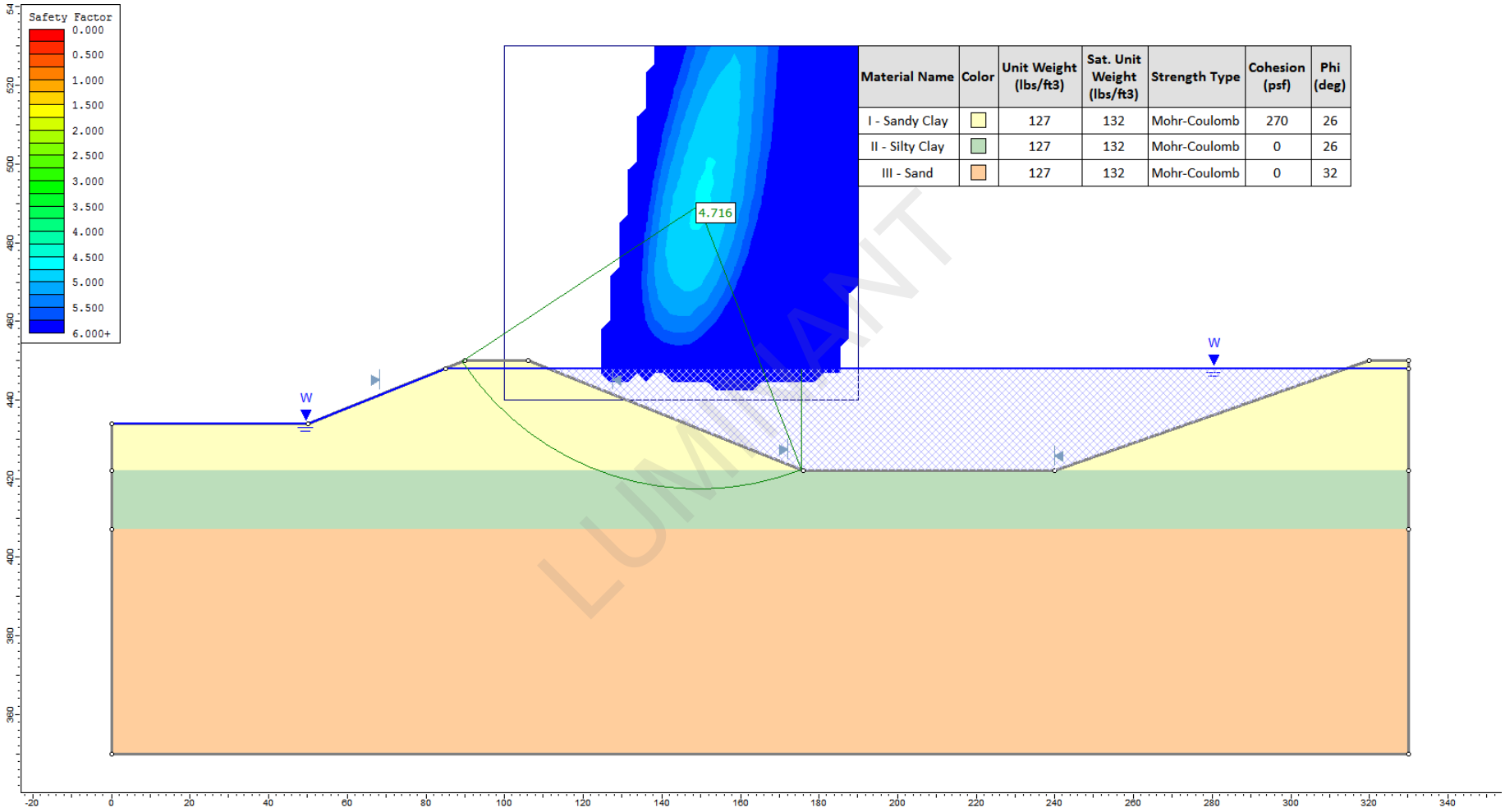

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 | Water Surface |



FIGURE **C.4**

## Results of Stability Analysis − FGD−A: A−A' − Case 2b

Stability and Safety Factor Assessment, Oak Grove SES

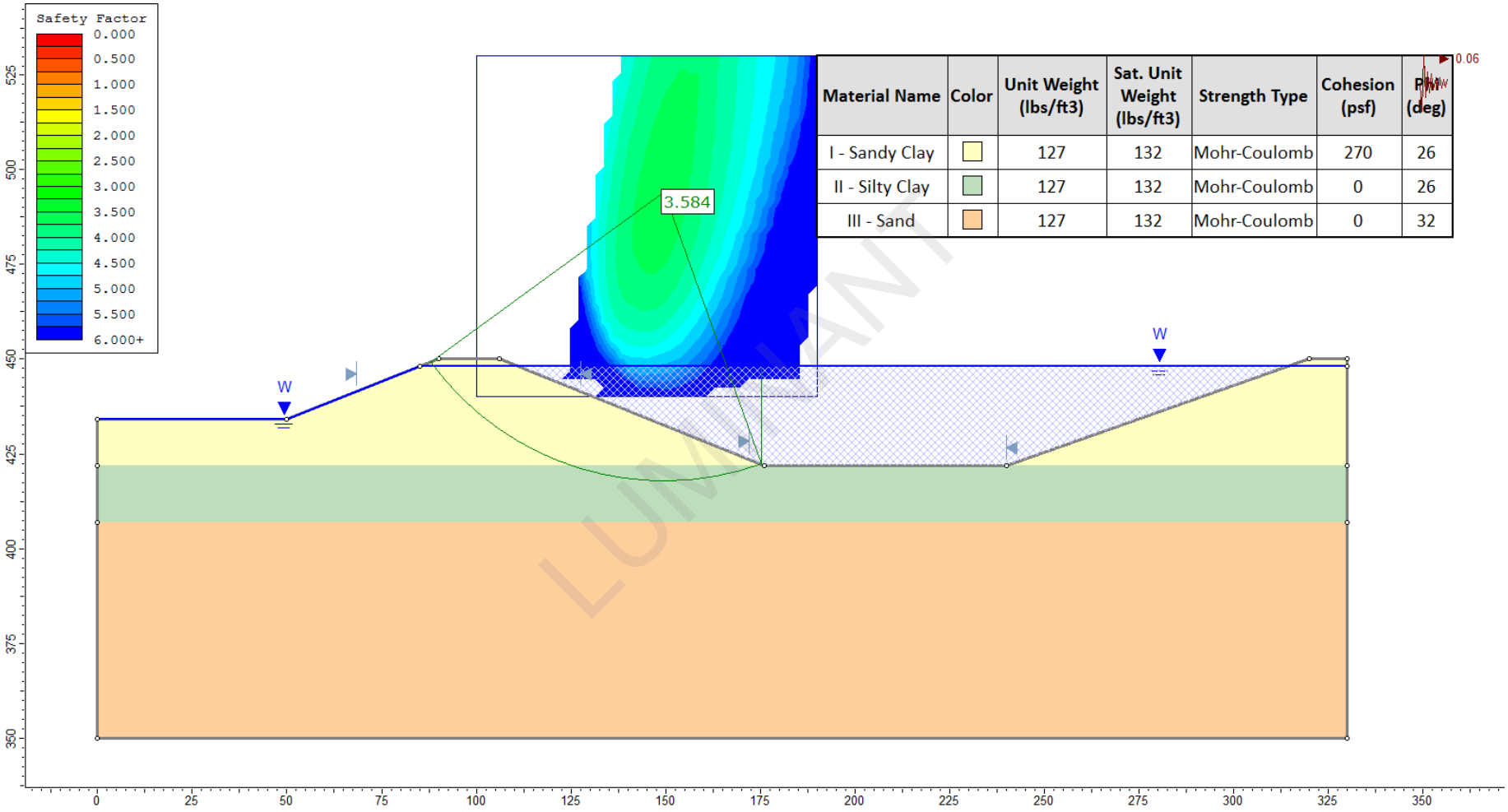



| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 |

FIGURE **C.5**

## Results of Stability Analysis − FGD−A: A−A' − Case 3a

Stability and Safety Factor Assessment, Oak Grove SES



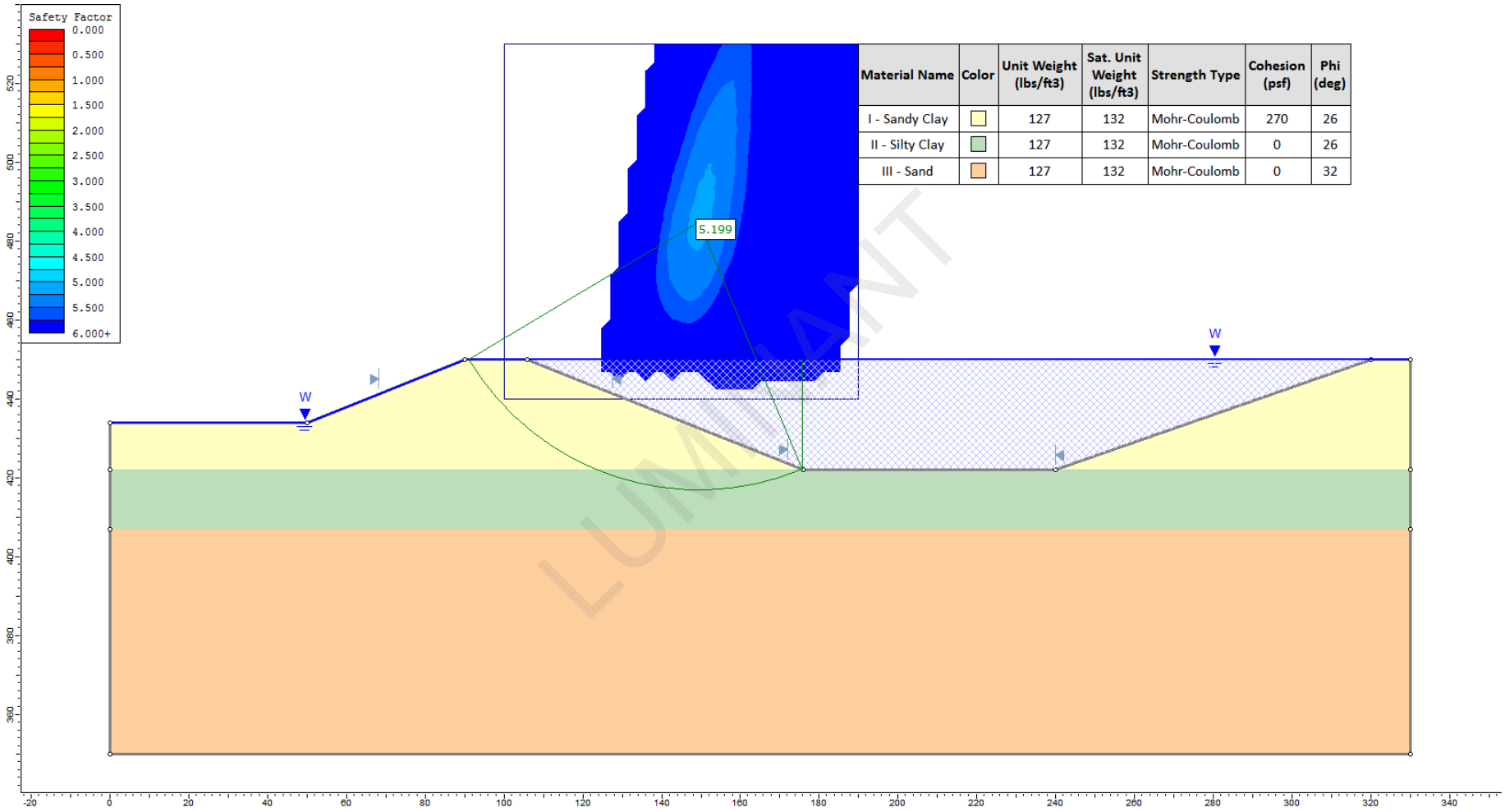

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 |



FIGURE **C.6**

## Results of Stability Analysis − FGD−A: A−A' − Case 3b

Stability and Safety Factor Assessment, Oak Grove SES

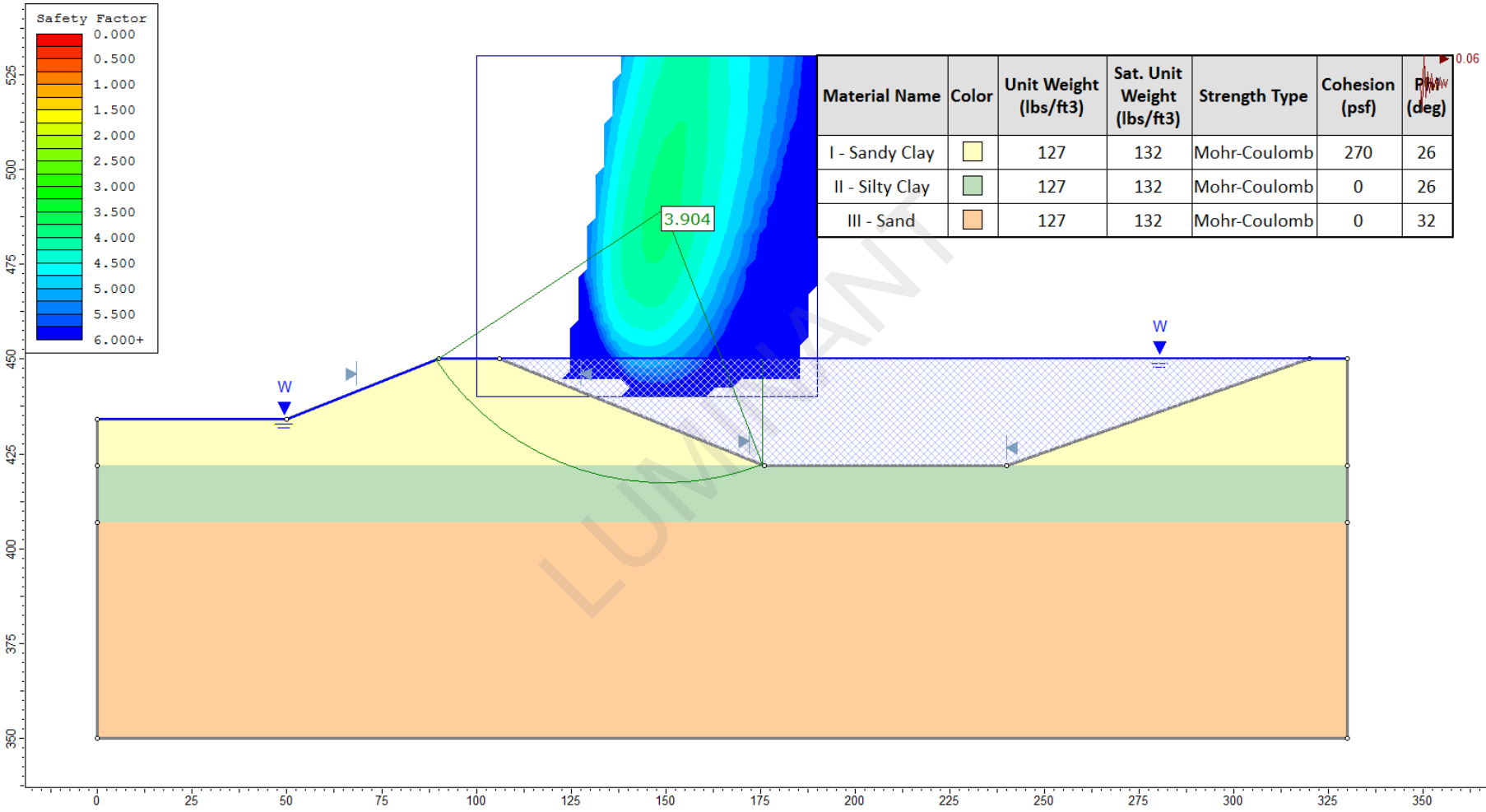



| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 |

FIGURE **C.7**

## Results of Stability Analysis − FGD−A: A−A' − Case 4a

Stability and Safety Factor Assessment, Oak Grove SES



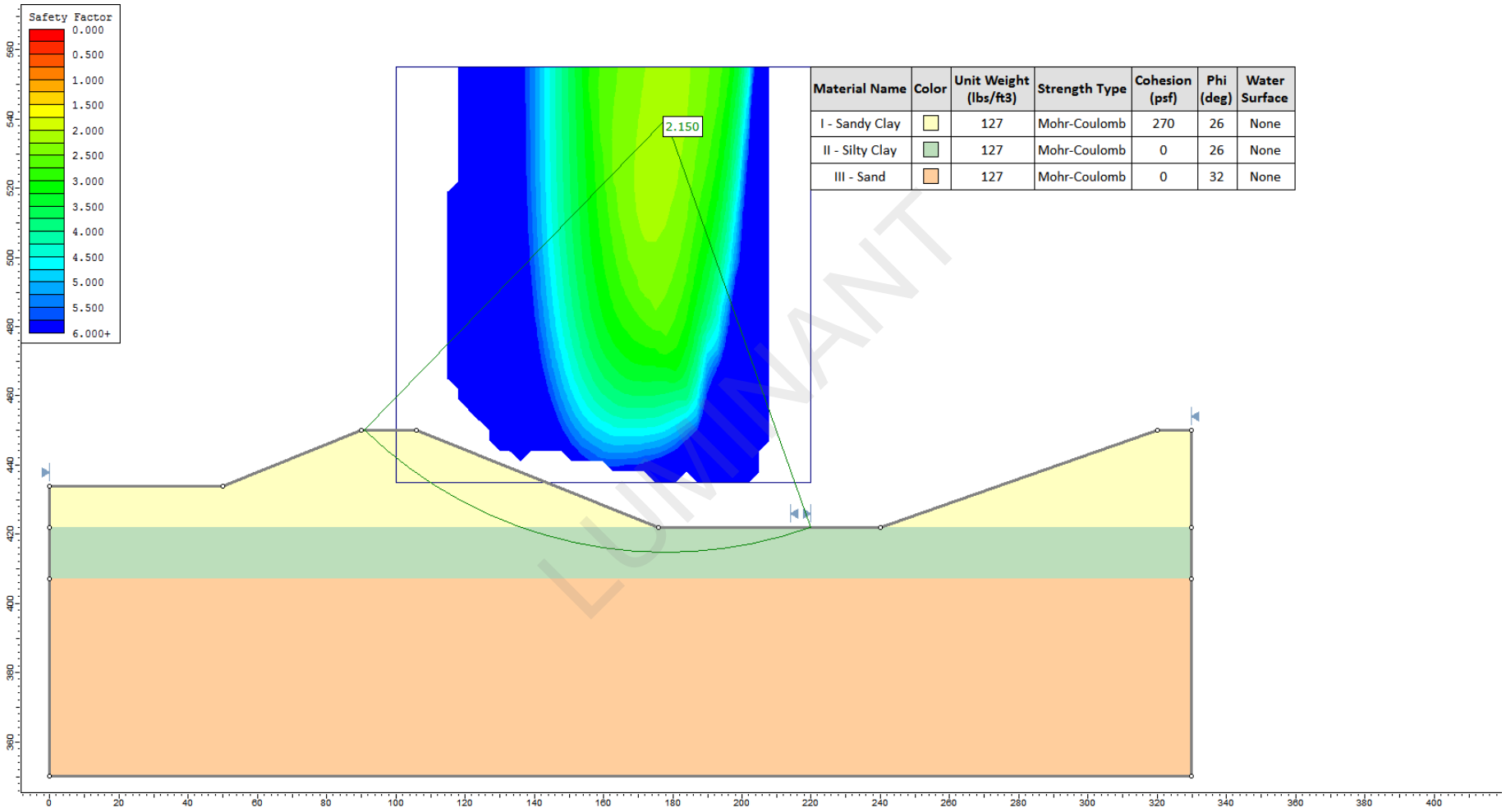

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 |
| II - Silty Clay | | 127 | 132 | Mohr-Coulomb | 0 | 26 |
| III - Sand | | 127 | 132 | Mohr-Coulomb | 0 | 32 |



FIGURE **C.8**

## Results of Stability Analysis − FGD−A: A−A' − Case 4b

Stability and Safety Factor Assessment, Oak Grove SES



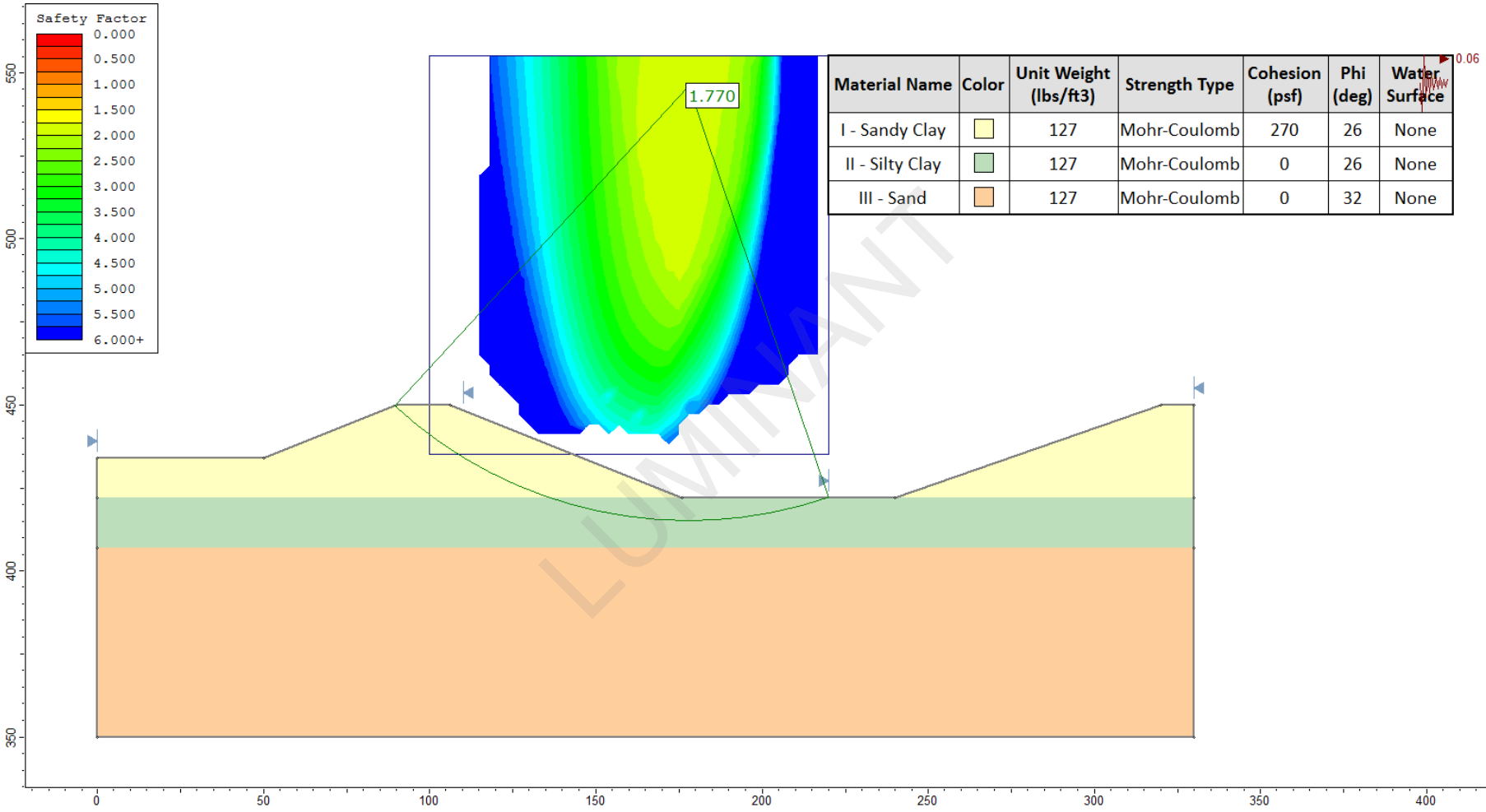

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | Mohr-Coulomb | 270 | 26 | None |
| II - Silty Clay | | 127 | Mohr-Coulomb | 0 | 26 | None |
| III - Sand | | 127 | Mohr-Coulomb | 0 | 32 | None |



FIGURE **C.9**

## Results of Stability Analysis − FGD−A: A−A' − Case 5a

Stability and Safety Factor Assessment, Oak Grove SES



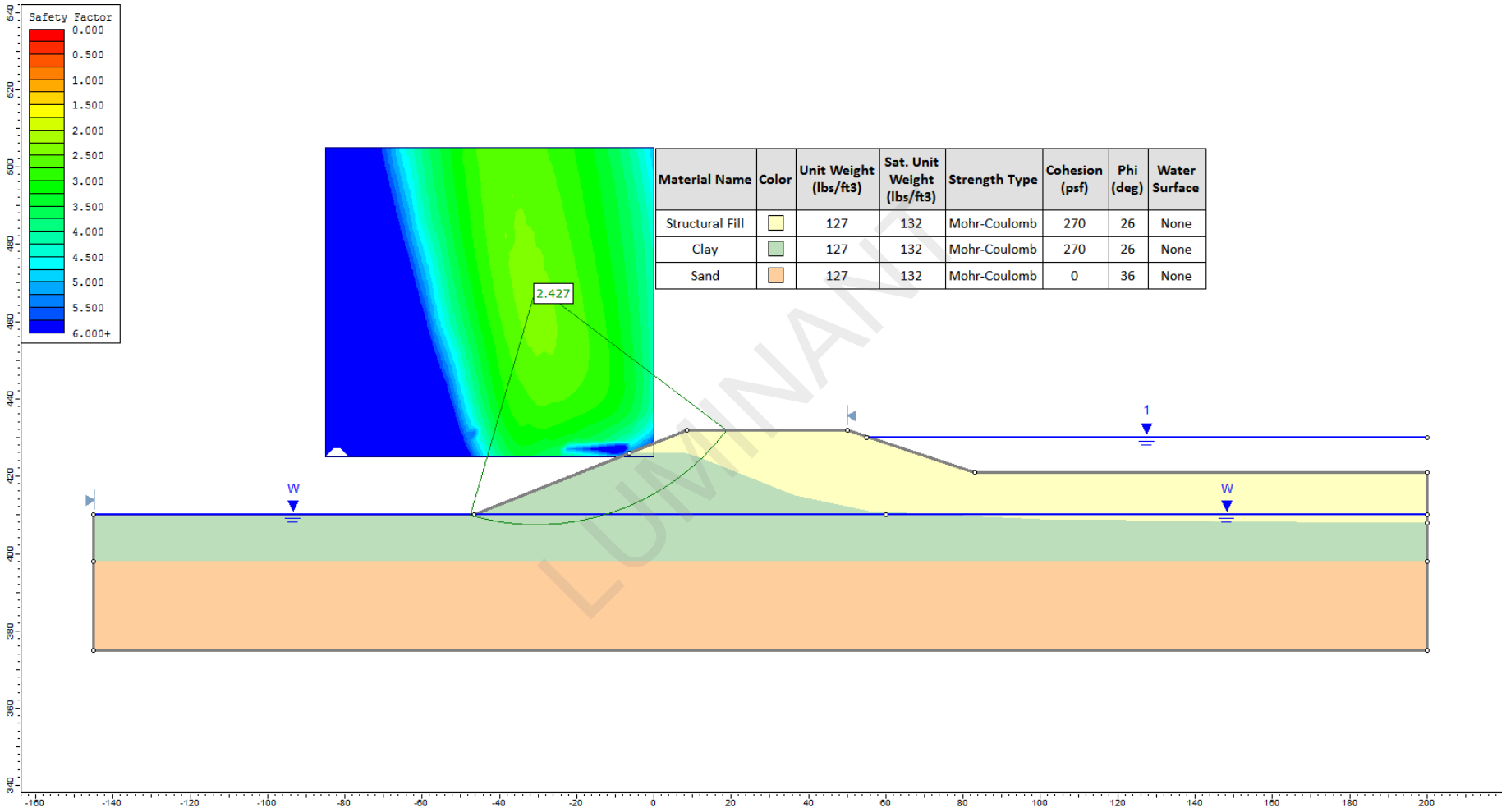

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|
| I - Sandy Clay | | 127 | Mohr-Coulomb | 270 | 26 | None |
| II - Silty Clay | | 127 | Mohr-Coulomb | 0 | 26 | None |
| III - Sand | | 127 | Mohr-Coulomb | 0 | 32 | None |



FIGURE **C.10**

**Results of Stability Analysis − FGD−A: A−A' − Case 5b**

Stability and Safety Factor Assessment, Oak Grove SES



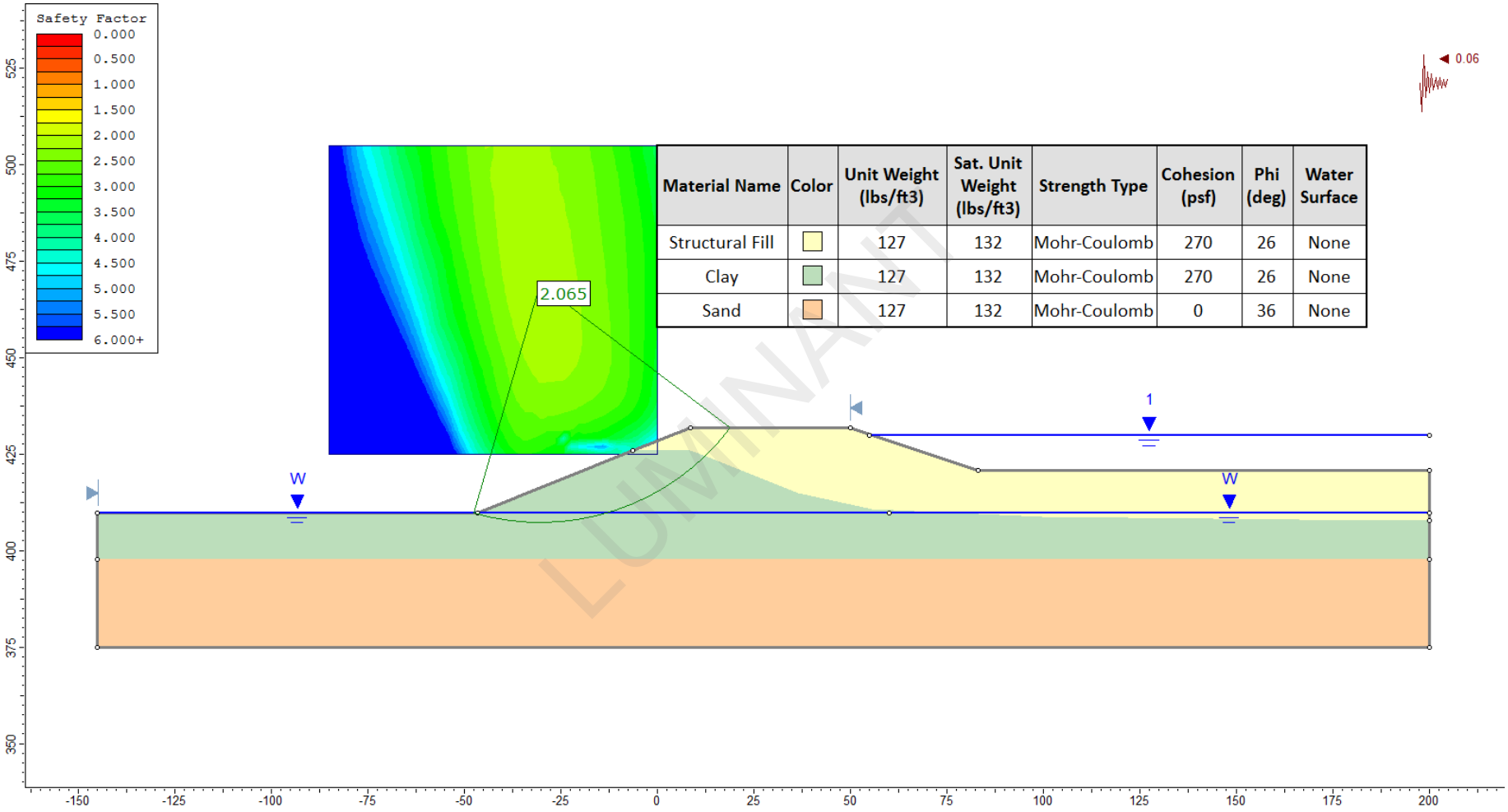

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | None |



FIGURE **C.11**

## Results of Stability Analysis − FGD−B: B−B' − Case 1a

Stability and Safety Factor Assessment, Oak Grove SES



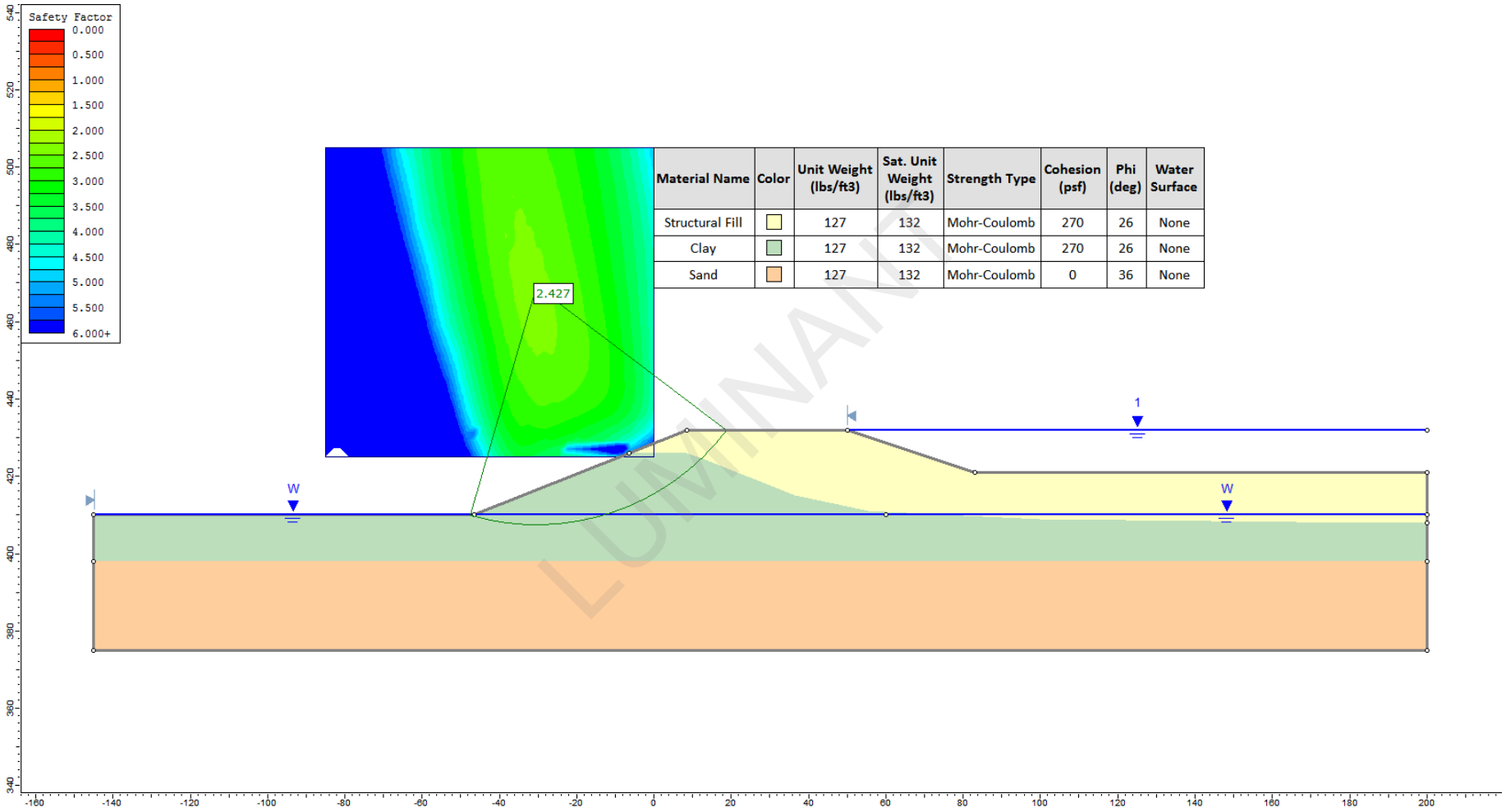

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | None |



FIGURE **C.12**

**Results of Stability Analysis – FGD–B: B–B' – Case 1b**

Stability and Safety Factor Assessment, Oak Grove SES



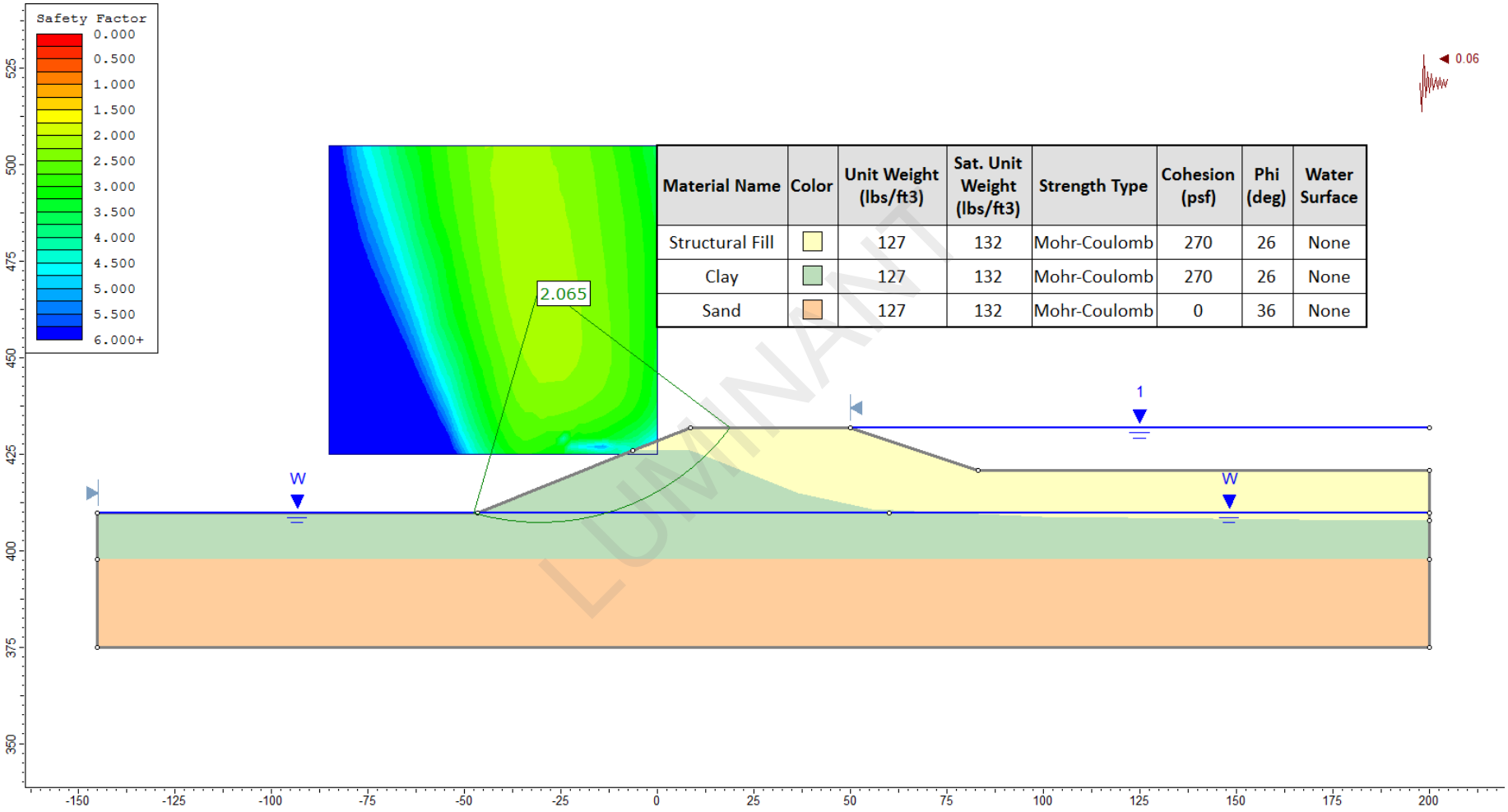

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | None |



FIGURE **C.13**

## Results of Stability Analysis − FGD−B: B−B' − Case 2a

Stability and Safety Factor Assessment, Oak Grove SES



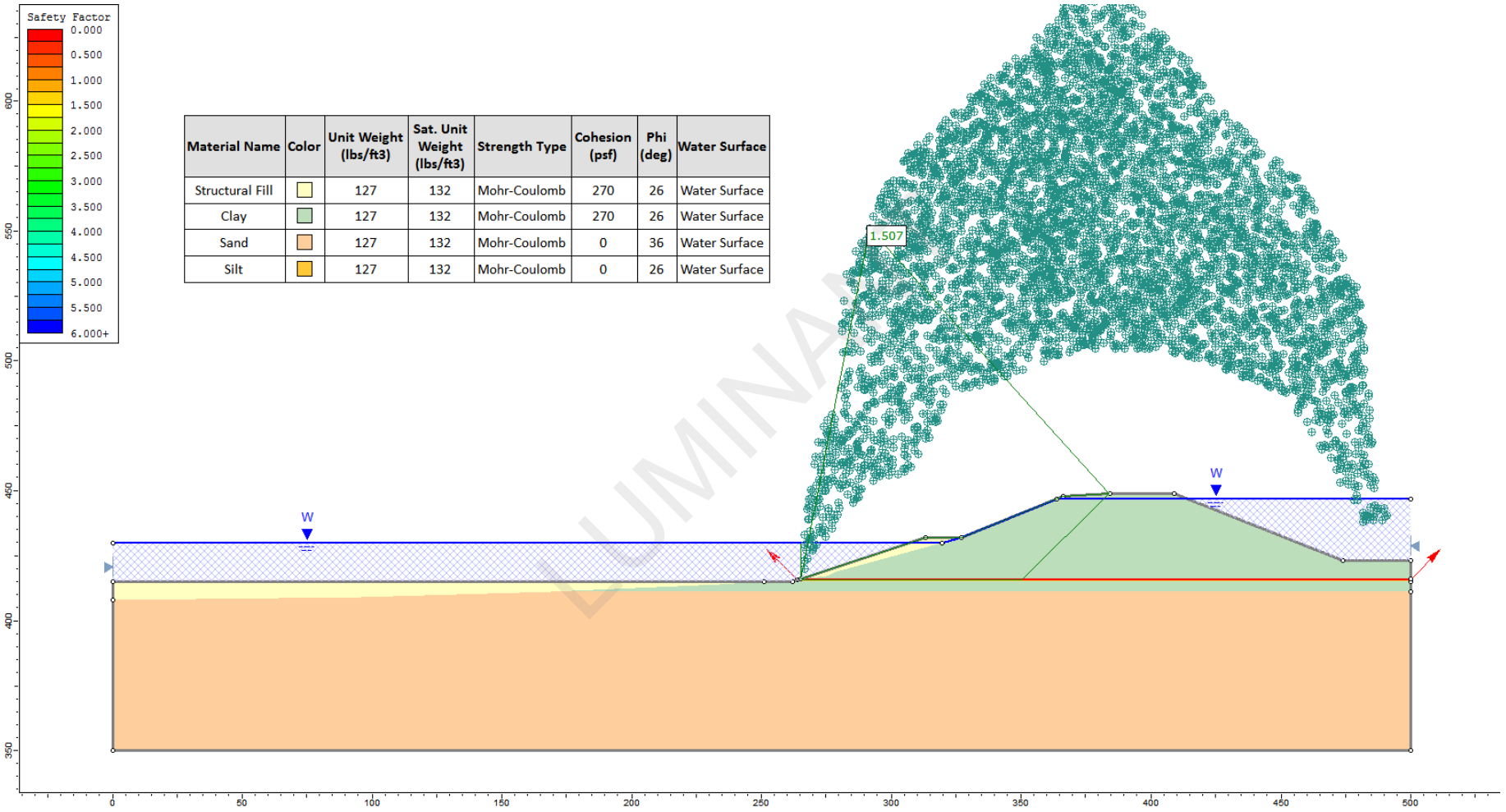

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | None |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | None |



FIGURE **C.14**

**Results of Stability Analysis – FGD–B: B–B' – Case 2b**

Stability and Safety Factor Assessment, Oak Grove SES



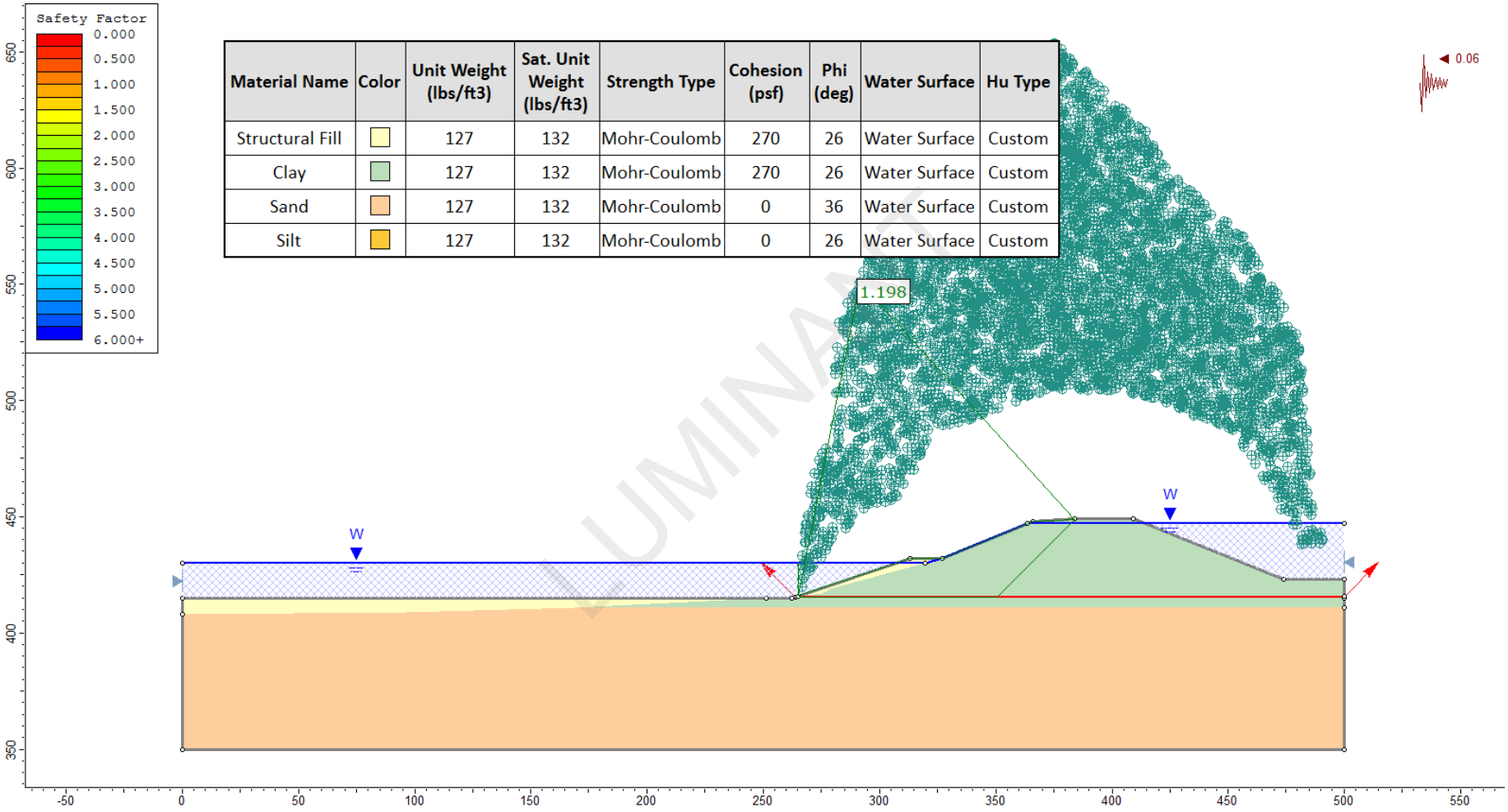

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |



FIGURE **C.15**

**Results of Stability Analysis − FGD−B: B1−B1' − Case 3a**

Stability and Safety Factor Assessment, Oak Grove SES



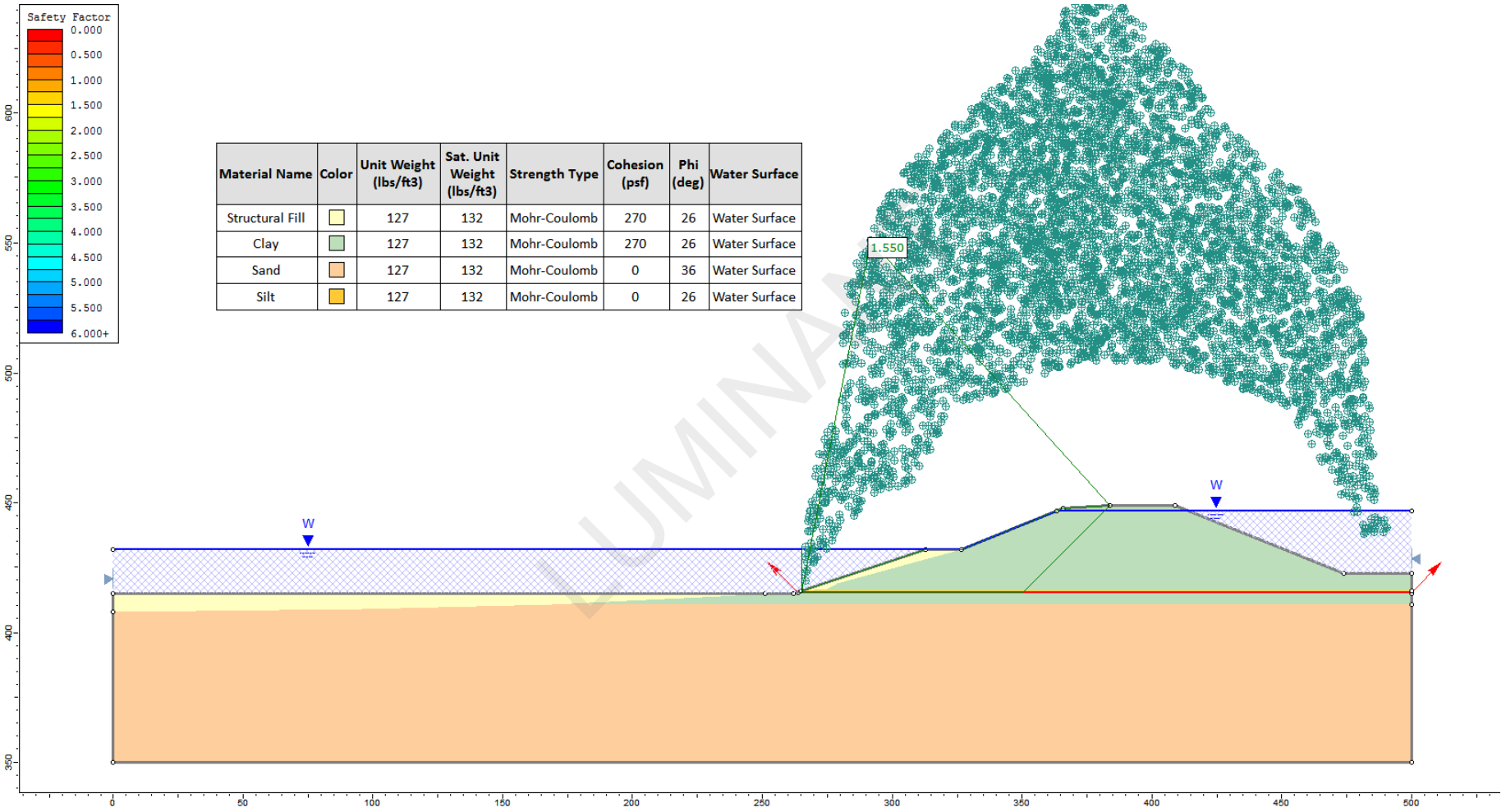

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface | Custom |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface | Custom |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Custom |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface | Custom |



FIGURE **C.16**

## Results of Stability Analysis − FGD−B: B1−B1' − Case 3b

Stability and Safety Factor Assessment, Oak Grove SES



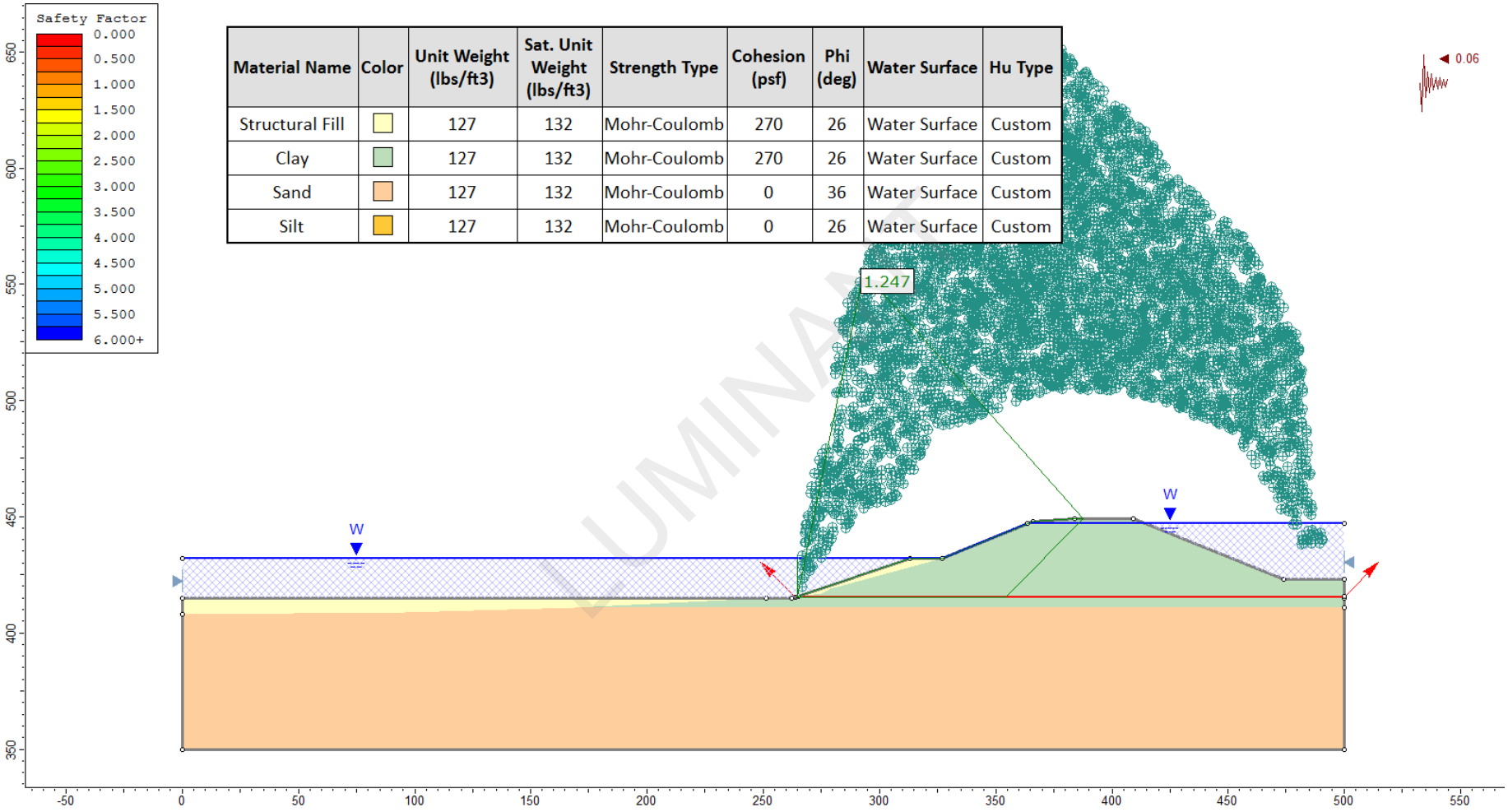

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |



FIGURE **C.17**

**Results of Stability Analysis – FGD–B: B1–B1' – Case 4a**

Stability and Safety Factor Assessment, Oak Grove SES



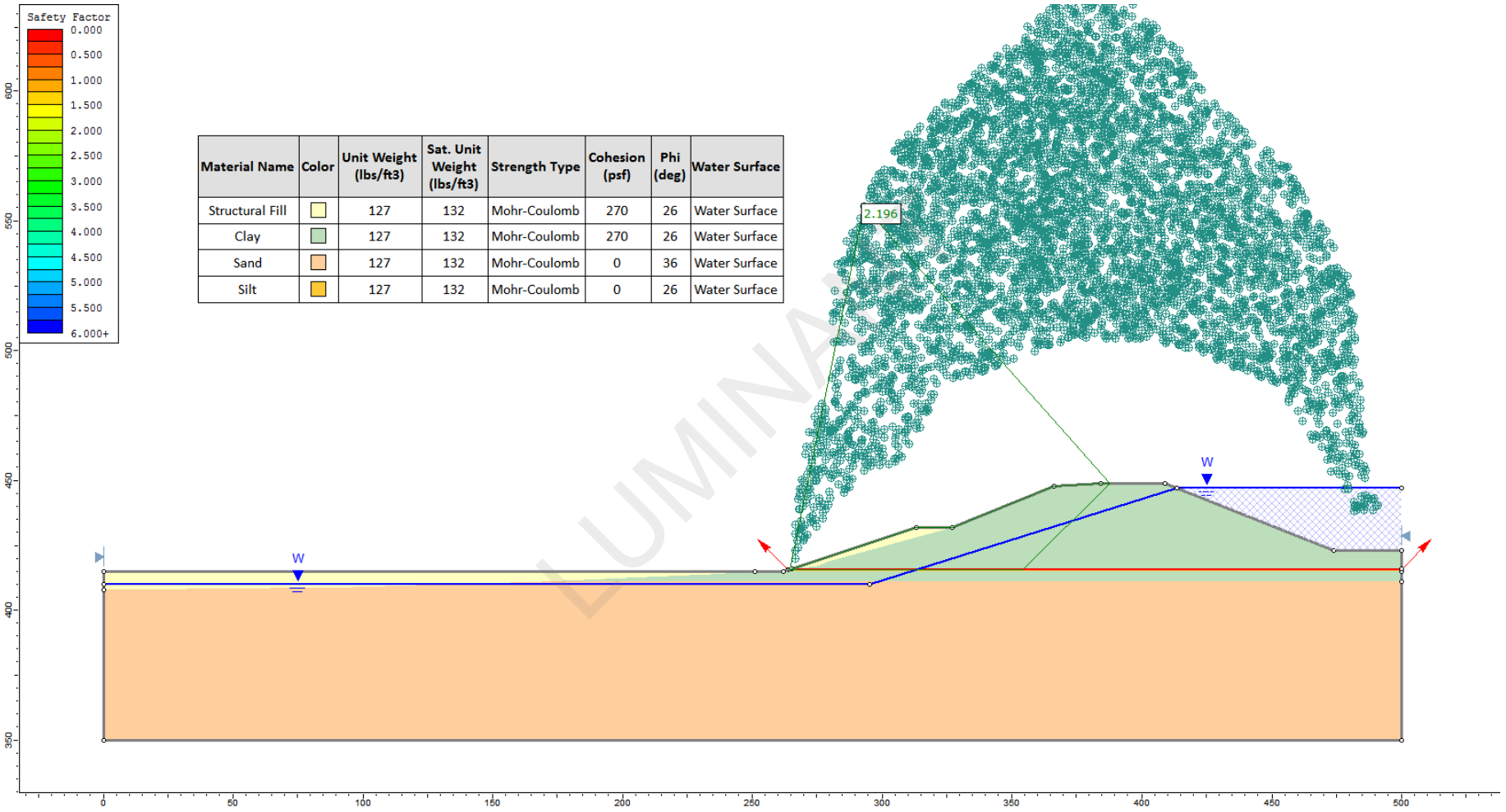

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface | Custom |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface | Custom |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Custom |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface | Custom |



FIGURE **C.18**

**Results of Stability Analysis − FGD−B: B1−B1' − Case 4b**

Stability and Safety Factor Assessment, Oak Grove SES



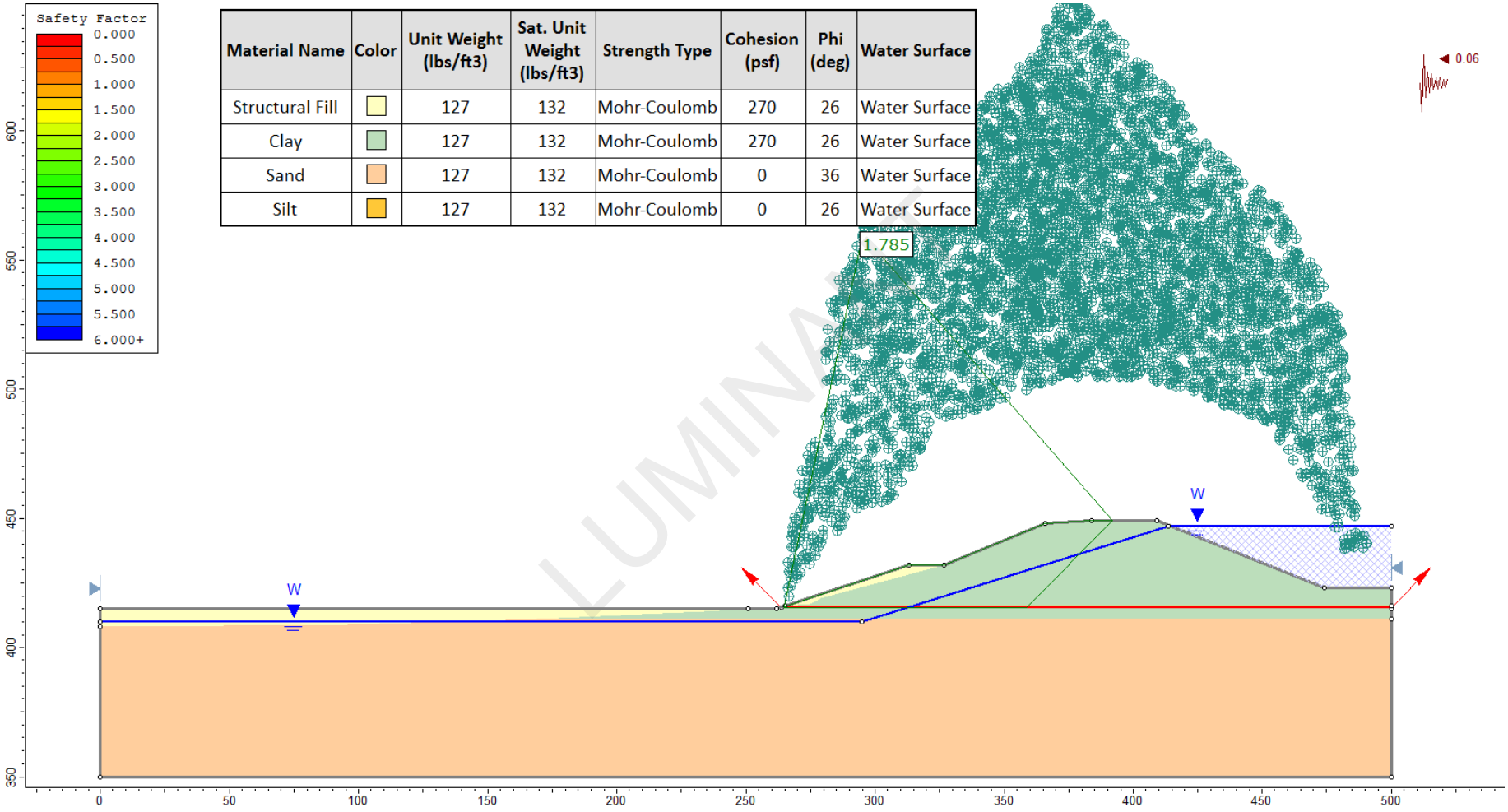

| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |



FIGURE **C.19**

## Results of Stability Analysis − FGD−B: B1−B1' − Case 5a

Stability and Safety Factor Assessment, Oak Grove SES

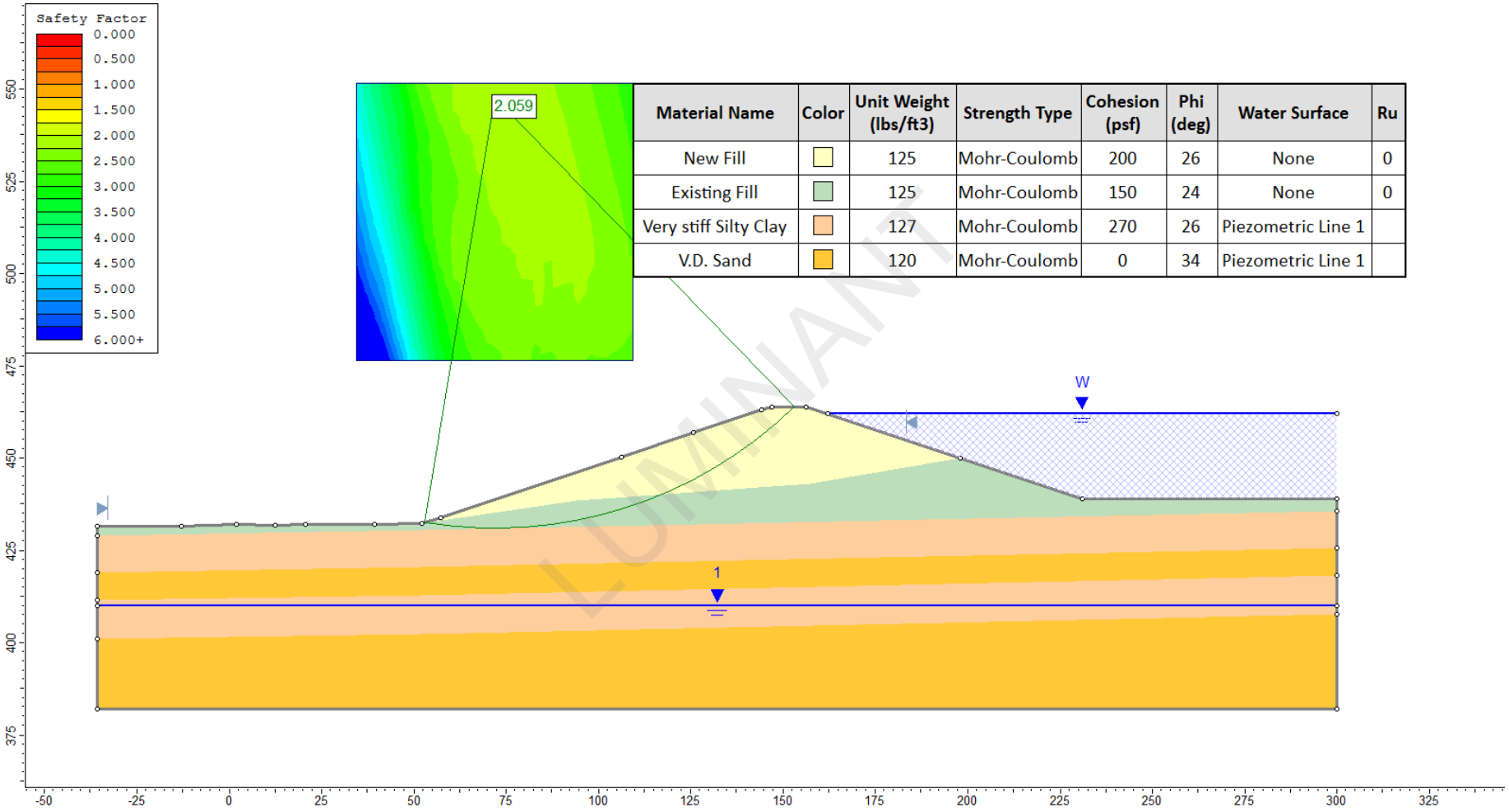



| Material Name | Color | Unit Weight (lbs/ft3) | Sat. Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface |
|---|---|---|---|---|---|---|---|
| Structural Fill | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Clay | | 127 | 132 | Mohr-Coulomb | 270 | 26 | Water Surface |
| Sand | | 127 | 132 | Mohr-Coulomb | 0 | 36 | Water Surface |
| Silt | | 127 | 132 | Mohr-Coulomb | 0 | 26 | Water Surface |

FIGURE **C.20**

## Results of Stability Analysis − FGD−B: B1−B1' − Case 5b

Stability and Safety Factor Assessment, Oak Grove SES



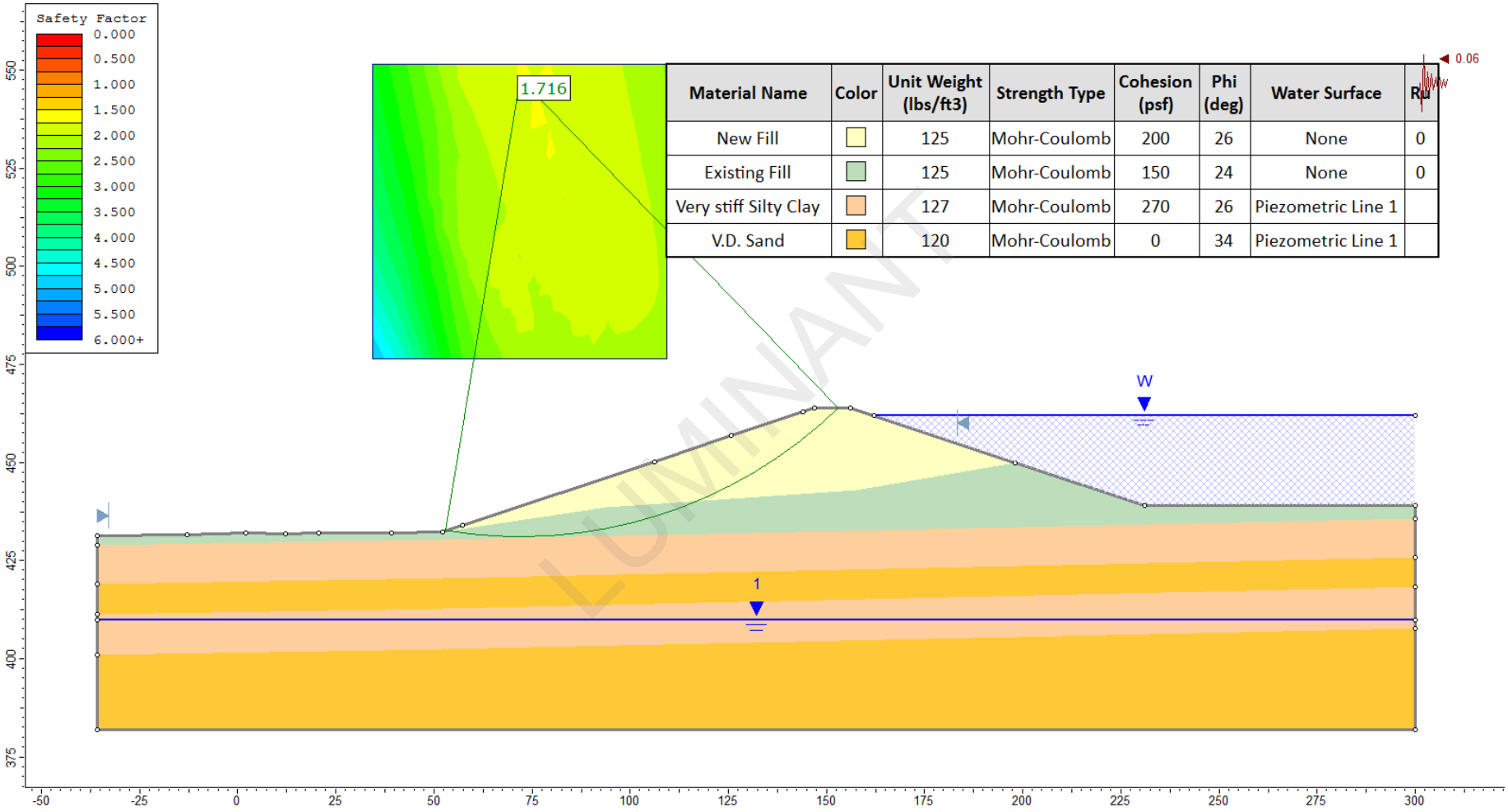

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.21**

**Results of Stability Analysis − FGD−C: C−C' − Case 1a**

Stability and Safety Factor Assessment, Oak Grove SES



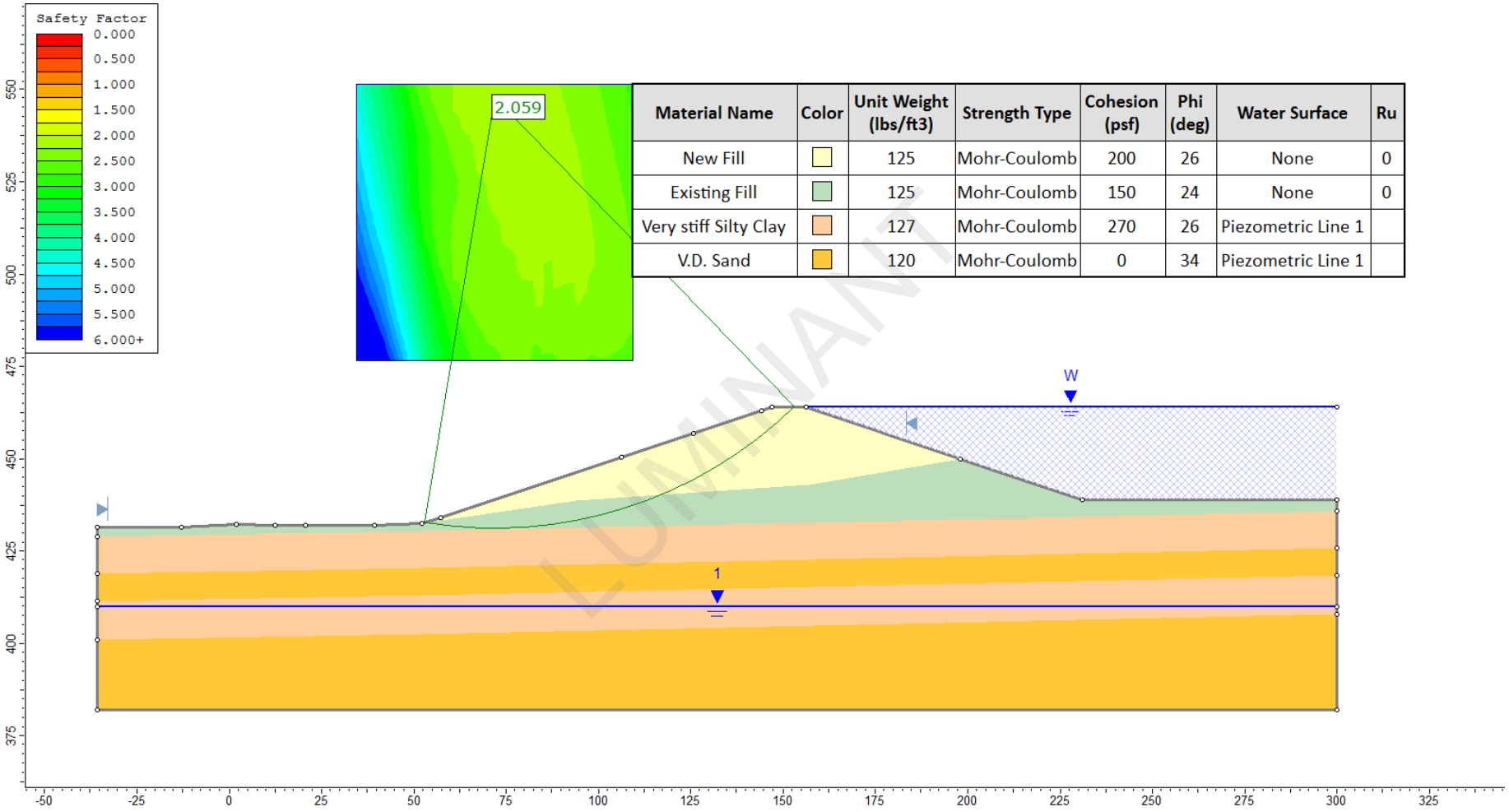

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.22**

## Results of Stability Analysis – FGD–C: C–C' – Case 1b

Stability and Safety Factor Assessment, Oak Grove SES



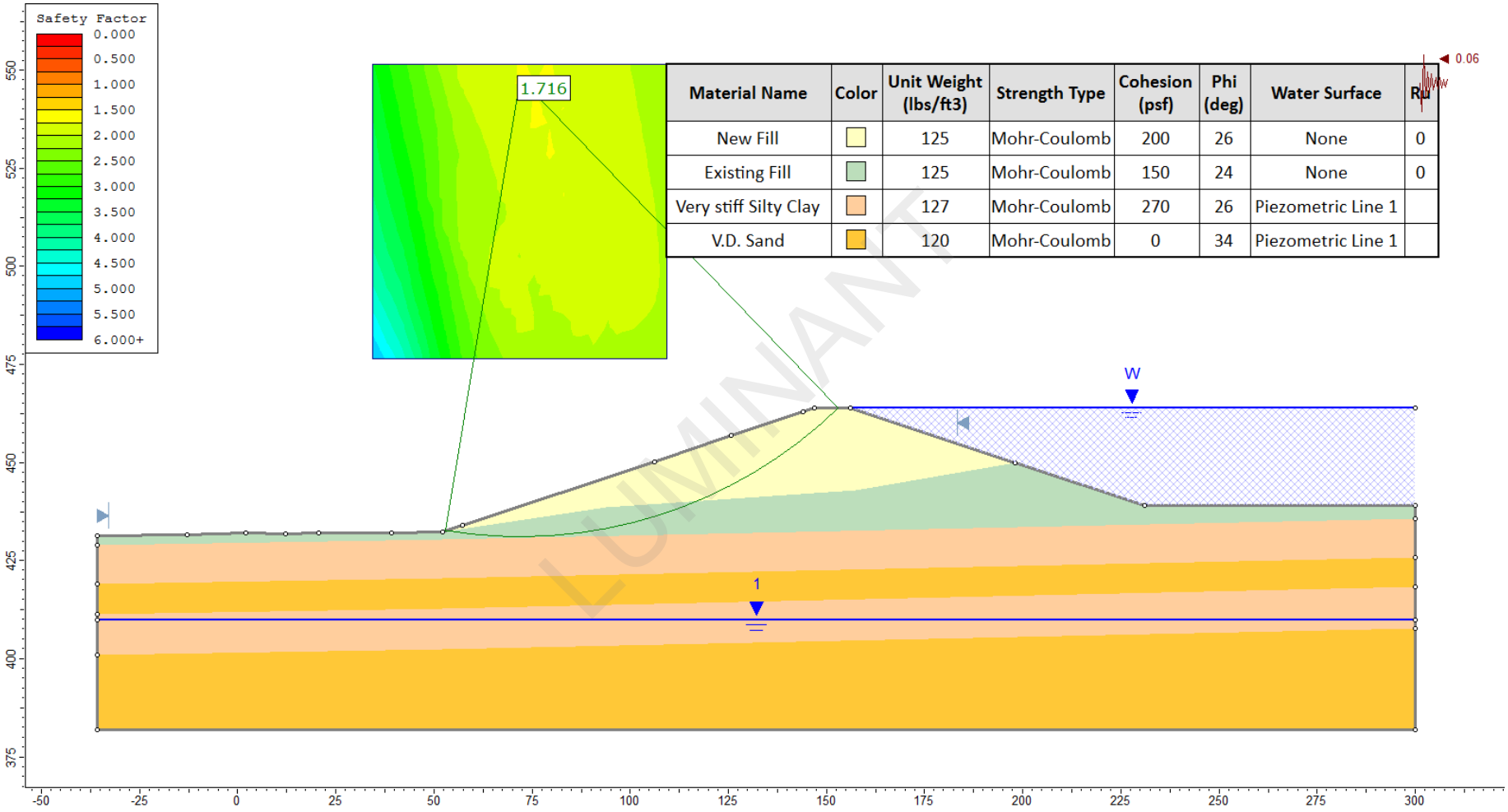

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.23**

## Results of Stability Analysis – FGD–C: C–C' – Case 2a

Stability and Safety Factor Assessment, Oak Grove SES



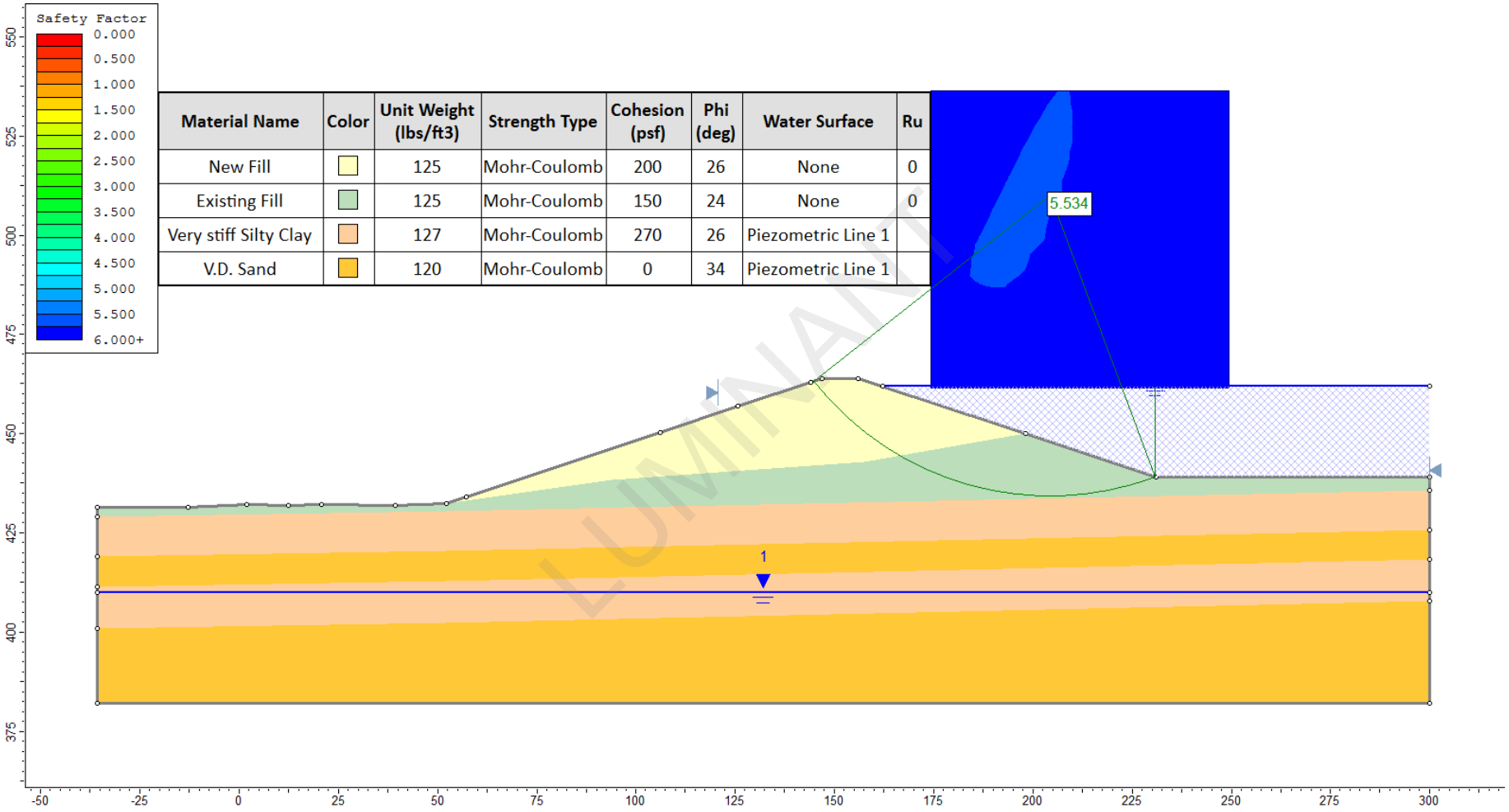

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.24**

**Results of Stability Analysis – FGD–C: C–C' – Case 2b**

Stability and Safety Factor Assessment, Oak Grove SES



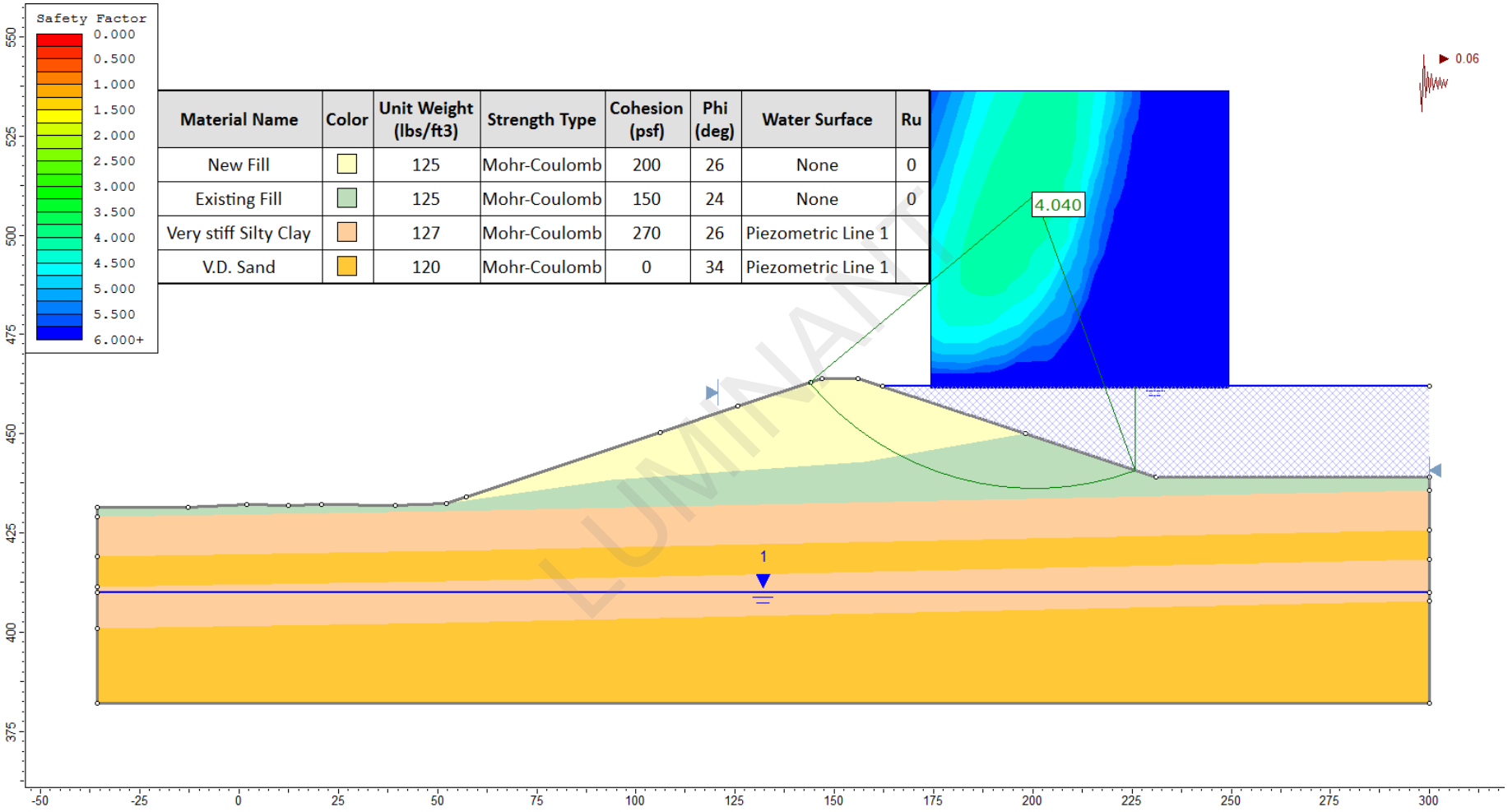

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.25**

## Results of Stability Analysis – FGD–C: C–C' – Case 3a

Stability and Safety Factor Assessment, Oak Grove SES



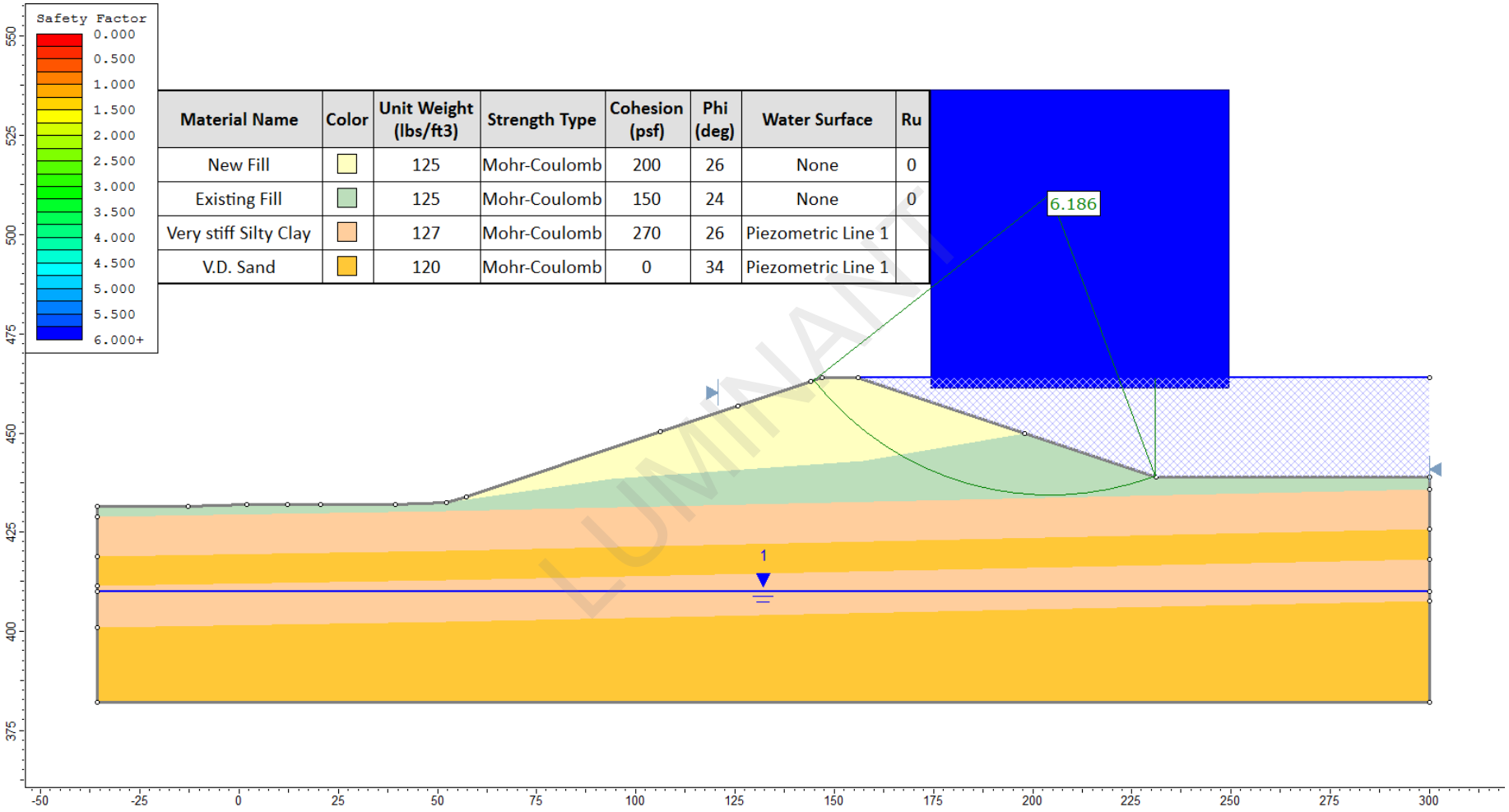

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.26**

**Results of Stability Analysis − FGD−C: C−C' − Case 3b**

Stability and Safety Factor Assessment, Oak Grove SES



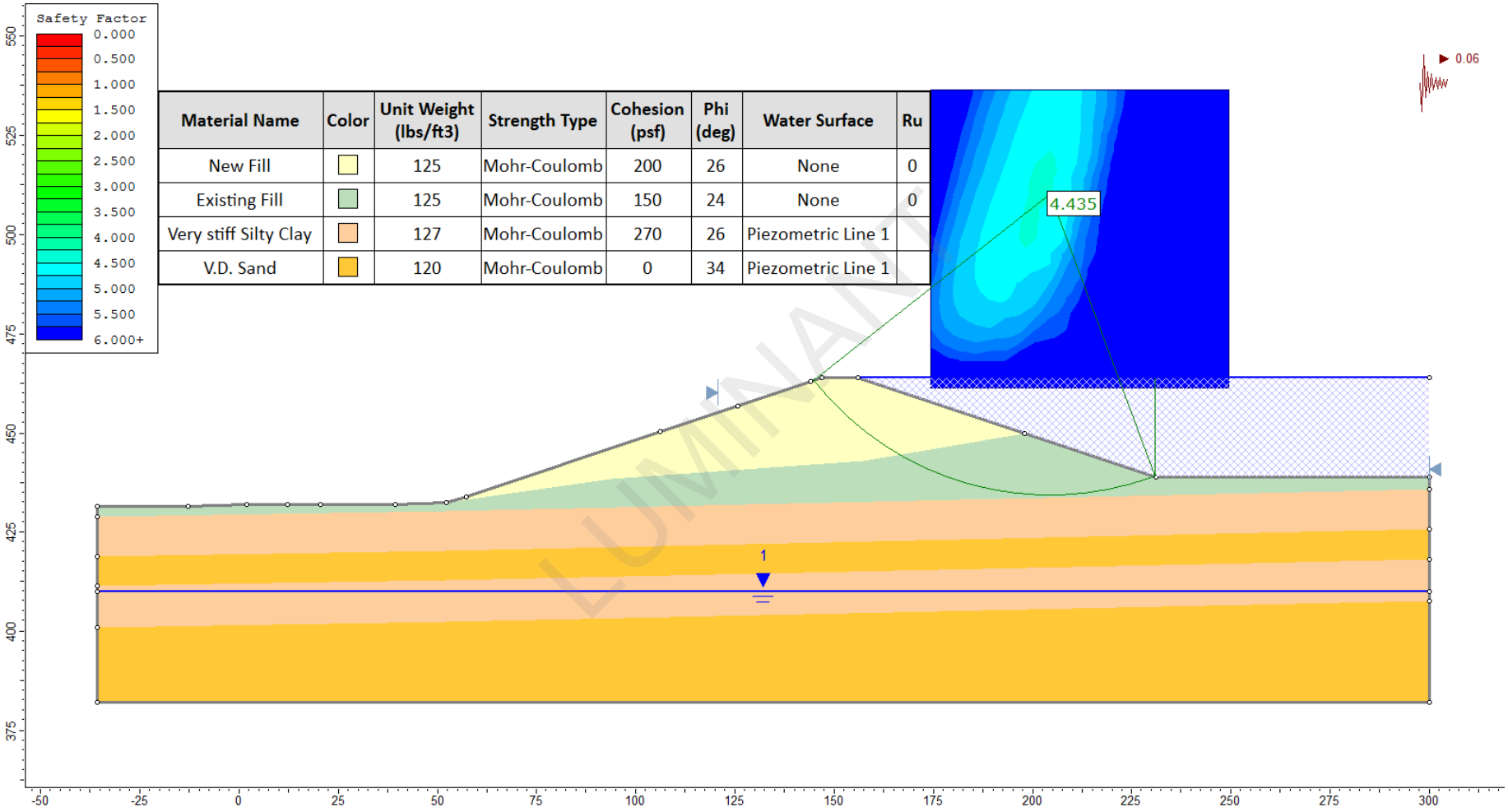

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.27**

## Results of Stability Analysis – FGD–C: C–C' – Case 4a

Stability and Safety Factor Assessment, Oak Grove SES



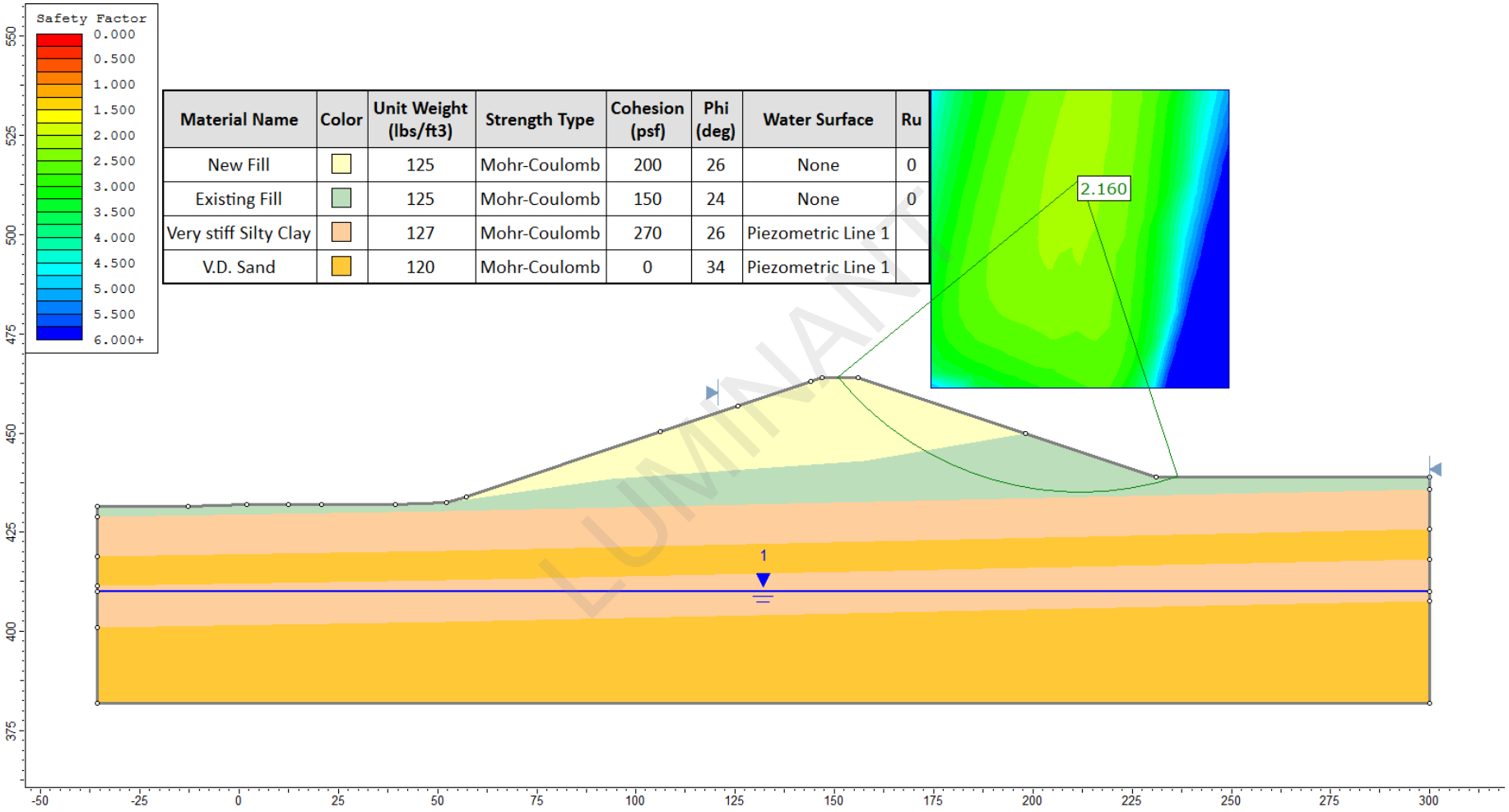

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.28**

**Results of Stability Analysis − FGD−C: C−C' − Case 4b**

Stability and Safety Factor Assessment, Oak Grove SES



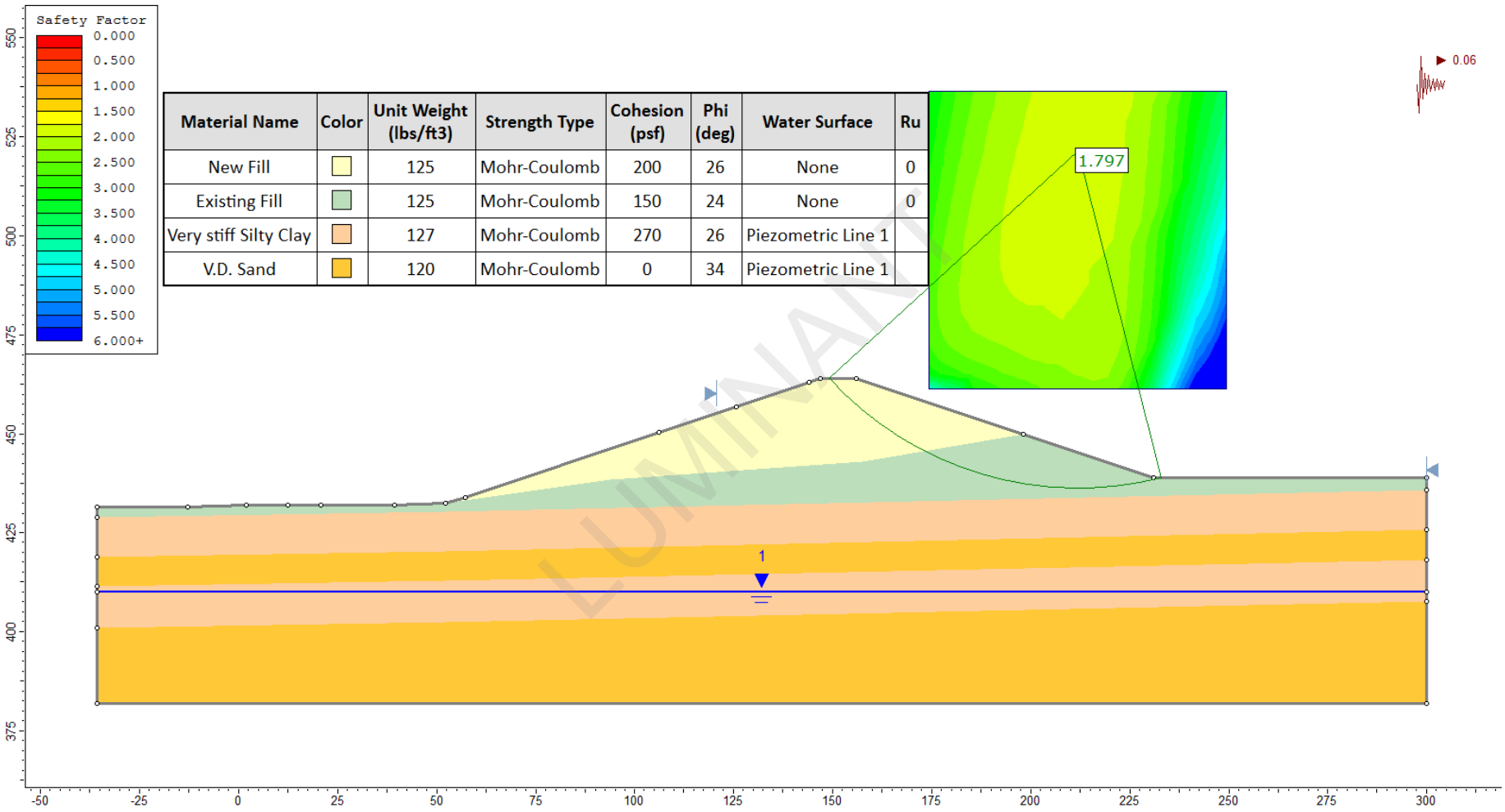

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.29**

## Results of Stability Analysis – FGD–C: C–C' – Case 5a

Stability and Safety Factor Assessment, Oak Grove SES




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Ru |
|---|---|---|---|---|---|---|---|
| New Fill | | 125 | Mohr-Coulomb | 200 | 26 | None | 0 |
| Existing Fill | | 125 | Mohr-Coulomb | 150 | 24 | None | 0 |
| Very stiff Silty Clay | | 127 | Mohr-Coulomb | 270 | 26 | Piezometric Line 1 | |
| V.D. Sand | | 120 | Mohr-Coulomb | 0 | 34 | Piezometric Line 1 | |



FIGURE **C.30**

**Results of Stability Analysis − FGD−C: C−C' − Case 5b**

Stability and Safety Factor Assessment, Oak Grove SES

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| North America | + 1 800 275 3281 |
| South America | + 56 2 2616 2000 |

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