REPORT

SAFETY FACTOR ASSESSMENT REPORT

Big Brown Steam Electric Station

Submitted To: Luminant
1601 Bryan Street
Dallas, TX 75201

Submitted By: Golder Associates Inc.
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10/10/16

STATE OF TEXAS
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October 2016 **Project No. 164816401**

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1.0 INTRODUCTION

1.1 Purpose

The “Disposal of Coal Combustion Residuals (CCR) from Electric Utilities rule” (40 Code of Federal Regulations (40 CFR) Part 257), effective October 19, 2015, requires that existing CCR surface impoundments meeting the requirements of §257.73(b) conduct initial and periodic safety factor assessments in accordance with §257.73(e). This report provides the safety factor assessment for the Big Brown Steam Electric Station’s (BBSES’s) CCR Impoundment, identified as the North Bottom Ash Pond (NBAP) and the South Bottom Ash Pond (SBAP), also referred to collectively as the Bottom Ash Ponds (BAP).

1.2 Site Background

The BBSES generates fly ash, bottom ash and boiler slag during electricity generation. The NBAP and SBAP are active, clay lined, excavated impoundments surrounded and separated by an engineered earthen berm. Each pond receives a slurry of bottom ash/boiler slag and water and is used to separate the solids from the water using gravity sedimentation. Water decanted from the ponds is returned to the power plant. Separated solids accumulate in the ponds and are periodically removed and placed in an adjacent surface lignite mine operated by an affiliated Luminant company (Luminant Mining Company). Refer to Figure 1. This is the only CCR surface impoundment at the BBSES.

1.3 Previous Evaluations

Golder performed previous evaluations on the BAP as part of the below report submitted to Luminant:

- Ash Pond Slope Stability Investigation Report, Big Brown Power Plant, Freestone County, Texas, dated November 2012

In the study, we have 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 BBSES site is located in the western part of the East Texas Basin along the edge of the East Texas Salt Structure Province. Surface geology comprises of the Wilcox formation – irregularly bedded fine to coarse sand, more or less lignitic clay or lignite. Other formations in the region include the Carrizo Sand, the Queen City Sand and Sparta Sand (Guyton & Associates, 1972; Galloway et al, 1983).

2.2 Site Geology

Surficial soils in Big Brown consist of loamy, moderately permeable, gently to moderately sloping, well-drained soils. Underlying soils consist of randomly sorted strata containing shale, clayey, and sandy materials (USDA 2002). Despite the abrupt changes in dip, there is no evidence of faulting in the region of the BBSES site (ERM-Southwest Inc., 1986).

2.2.1 Subsurface Investigations and Laboratory Testing

Information from a previous subsurface investigation was used to characterize the subsurface site conditions. Golder conducted a subsurface investigation for the BAP in October 2012, as part of a slope stability evaluation. Golder completed six borings through the crest of the pond embankment at an elevation of approximately 350 feet – mean sea level (ft-msl). The boring depths ranged from 30 to 50 feet below ground surface (bgs) (Golder, 2012). Appendix A includes the boring location map and the boring logs.

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

The soils encountered in the borings generally consisted of very stiff to hard sandy clay and compact to very dense clayey sands. The subsurface stratigraphy generally consisted of clayey or silty sand with interspersed layers of sandy clay and lean clay. A thin layer of loose compact clayey sand was encountered in some boreholes at a depth of around 44 feet bgs.

Saturated soils were encountered in the embankment fill in only one of the six borings at a depth of 20 feet (i.e. at EL 330 ft-msl). Monitoring wells around the BAP indicate that groundwater is located between EL 309 to 313 ft-msl.

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

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” (3 feet of freeboard for this facility) and “Maximum Surcharge Pool” (no freeboard) 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. Stability analyses were performed for “Maximum Storage Pool” (freeboard of 3 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. The interior berm was not analyzed since the failure of the interior berm will not result in any release of CCR materials beyond the BAP embankment.

3.2 Cross-Sections Analyzed

Critical cross-sections were identified after considering multiple cross-sections, and used for the stability analysis. The critical cross-sections were determined considering the geometry of the slopes, soil profile, phreatic surface, and the loading conditions. Section A-A’ was analyzed for the exterior slopes due to the proximity of a water channel that will impact the safety factor of the exterior slope. For the interior slopes, Section B-B’ was chosen as the critical cross-section based on the geometry and soil profile. The critical cross-sections analyzed are shown in Figure 2.

There is no topographical survey information for the immediate area surrounding the ponds. Hence, Section A-A’ was created with suitable assumptions beyond the toe of the exterior slope, based on visual observations, Google Earth® images, and information provided in TWDB, 1999, regarding the topography and water elevations in the adjacent man-made reservoir (Fairfield Lake).

3.3 Material Properties

Based on the previous subsurface investigation, appropriate material properties were selected for use in the stability analysis. Table 1 summarizes the material properties used in the stability analysis. Long-term, drained (effective stress) strength parameters were generally used for the clay soils. Short-term, end-of-construction conditions (undrained) are not applicable for existing surface impoundments.

Table 1: Soil Properties for Section A-A' and 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, ϕ' (°)
I	Sandy Clay/Clayey Sand	127	132	1000	14
II	Clean Sand	127	132	0	29

3.4 Phreatic Surface

For the stability analysis of the exterior embankment slope, the location of the phreatic surface is estimated by allowing steady state seepage conditions to develop based on the water level in the BAP, and conservatively assuming that the water elevation within Fairfield Lake is equal to the crest elevation of the Fairfield Dam (EL 322 ft-msl).

For the stability analysis of the interior embankment slope, the location of the phreatic surface is estimated by allowing steady state seepage conditions to develop within the embankment conservatively assuming the saturated zone occurs at EL 335 ft-msl. For the empty pond condition, the phreatic surface was conservatively assumed to be constant at EL 335 ft-msl.

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

3.5 Seismic Loading

According to 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 about 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 the BAP are 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 considerably dense. The subsurface investigations performed at each of the ponds do not indicate any soils in the embankment or its foundation that are susceptible to liquefaction. Hence, failure of the pond slopes due to liquefaction is considered unlikely for the BAP surface impoundment at the BBSES.

3.7 Stability Analysis Results

As mentioned earlier, 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" (3 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 analysis cases are presented in Table 2, and the corresponding analysis outputs can be found in Appendix D. The results indicate that the BAP slopes are sufficiently stable under all considered loading scenarios.

Table 2: Slope Stability Analysis Results

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	1.93
	1b			Pseudostatic	1.00	1.51
	2a		Surcharge	Static	1.40	1.89
	2b			Pseudostatic	1.00	1.47
B-B'	3a	Interior	Storage	Static	1.50	4.11
	3b			Pseudostatic	1.00	3.07
	4a		Surcharge	Static	1.40	4.58
	4b			Pseudostatic	1.00	3.32
	5a		Empty	Static	1.50	2.50
	5b			Pseudostatic	1.00	2.08

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 BAP exceed the values listed in §257.73(e)(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.

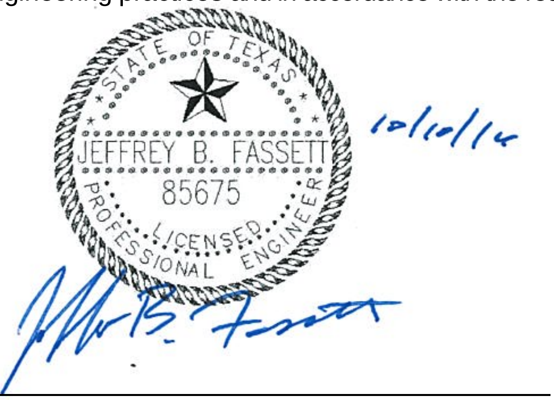
Varenya Kumar
Staff Engineer

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 §257.74(e).



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Golder Associates Inc.
Firm Registration Number F-2578

6.0 REFERENCES

40 CFR Parts 257 and 261, 2015, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, April 17, 2015.

Galloway, W. E., Ewing, T. E., Garrett, C. M., Jr., Tyler, Noel, and Bebout, D. G., 1983, Atlas of major Texas oil reservoirs: The University of Texas at Austin, Bureau of Economic Geology Special Publication, 139 p.

Golder Associates Inc., 2012, Ash Pond Slope Stability Investigation Report, Big Brown Power Plant, Freestone County, Texas, November 2012.

Guyton, W.F., and Associates, 1972, Ground-water conditions in Anderson, Cherokee, Freestone, and Henderson counties, Texas: TWDB Rept. 150, 80 p.

Texas Water Development Board., 1999, Volumetric Survey of Fairfield Lake – prepared for USACE, Fort Worth District; in conjunction with Sabine River Authority and TXU Electric Company.

REFERENCE(S)
AERIAL PHOTO SOURCED FROM GOOGLE EARTH PRO DATED 2014

JEFFREY B. FASSETT 85675 LICENSED PROFESSIONAL ENGINEER, STATE OF TEXAS
10/10/16

Professional Engineering Firm
Registration Number F-2578

0 400 800
1" = 800' FEET

CLIENT
LUMINANT POWER
BIG BROWN

PROJECT
2016 COAL COMBUSTION RESIDUALS
ENGINEERING SERVICES

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-06-23
DESIGNED	TNB
PREPARED	TNB
REVIEWED	JBF
APPROVED	JBF

TITLE
GENERAL SITE MAP

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

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REFERENCE(S)
AERIAL PHOTO SOURCED FROM GOOGLE EARTH PRO DATED 2014

10/10/16

STATE OF TEXAS
JEFFREY B. FASSETT
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0 150 300
1" = 300' FEET

CLIENT
LUMINANT POWER
BIG BROWN

PROJECT
2016 COAL COMBUSTION RESIDUALS
ENGINEERING SERVICES

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-19
DESIGNED	VK
PREPARED	TNB
REVIEWED	MX
APPROVED	JBF

TITLE
BOTTOM ASH PONDS
CROSS SECTIONS FOR SLOPE STABILITY ANALYSIS

PROJECT NO.	REV.	FIGURE
1648164-01	----	2

1 in

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

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APPENDIX A
BORING LOCATION MAP & BORING LOGS

NOTE: Figure Reference - Golder Associates Inc., 2012, Ash Pond Slope Stability Investigation Report, Big Brown Power Plant, Freestone County, Texas, November 2012

J:_2012\123-94128 - Luminant_A - Ash Pond Slope Stability\12394128A001.dwg | Layout: ANSI_A_FIGURE_LANDSCAPE | Modified: HRolwing 11/21/2012 8:09 AM | Plotted: HRolwing 11/21/2012

LEGEND

● BH-1 BORING LOCATION

REFERENCES / SPECIFICATIONS

IMAGE SOURCE:
GOOGLE EARTH PRO. 2010

####	####	####	HPR	VJE	HPR	PCM
REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT
LUMINANT - BIG BROWN
ASH POND SLOPE STABILITY INVESTIGATION REPORT
FREESTONE COUNTY, TEXAS

TITLE

BORING LOCATION PLAN

Golder Associates

PROJECT No.	123-94128	FILE No.	12394128A001
		SCALE	NTS
		FIG-1	

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Houston, Texas 77073
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Fax: (281) 821-6870

BORING NUMBER BH-1

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant
DATE STARTED 10/15/12 **COMPLETED** 10/15/12
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR Van & Sons Drilling Service
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY HR **CHECKED BY** PCM
AT END OF DRILLING ---
NOTES
AFTER DRILLING 20.00 ft

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
0		(SC) CLAYEY SAND, medium to fine, well graded, light brown, and low plasticity clay, moist	SH 1	78		3.0		
5		sandy clay lenses, dry at 3.5'	SH 2			4.9		
		no clay lenses at 6.0'	SH 3	78		4.5		
10		(CL) LEAN CLAY, low plasticity, with sand, brown-orange, cohesive, dry	SH 4			4.5		
15		(SC) CLAYEY SAND, medium to fine, well graded, brown to orange, and low plasticity clay, moist	SH 5	65				
20			SH 6	79		1.5		
25		gray at 23.0'	SH 7	83				
30		(CL) LEAN CLAY, low plasticity, some fine to medium sand, gray to brown, cohesive, moist	SH 8	79				
35			SH 9	83				

(Continued Next Page)

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BORING NUMBER BH-1

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant

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
35		(CL) LEAN CLAY, low plasticity, some fine to medium sand, gray to brown, cohesive, moist *(continued)*						
		(SC) CLAYEY SAND, medium to fine, well graded, with low plasticity clay, brown, wet	SS 10	83	12-13-14 (27)			
40								
45			SS 11	100	5-5-3 (8)			
50			SS 12	100	8-9-11 (20)			

Bottom of borehole at 50.0 feet.

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BORING NUMBER BH-2

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR Van & Sons Drilling Service
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY HR **CHECKED BY** PCM
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)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		(CL) LEAN CLAY, low plasticity, with sand and gravel, decreasing coarse content with depth, dry, gray and brown						
			SH 1	58		4.5		
5			SH 2	75		4.5		
		(SC) CLAYEY SAND, medium to fine, well graded, with low plasticity clay, brown, moist	SH 3	100		4.5		
10			SH 4	50		3.0		
15			SH 5	67		4.5		
20		decreasing clay with depth at 18.0'	SH 6	44		2.25		
25			SH 7	94		4.5		
30		gray and orange at 28.0'	SH 8	88		4.5		
35			SH 9	90		2.5		

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BORING NUMBER BH-2

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant

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
35		(SC) CLAYEY SAND, medium to fine, well graded, with low plasticity clay, brown, moist *(continued)*						
40		wet at 38.5'	SS 10	56	15-18-20 (38)			
45			SS 11	100	3-3-5 (8)			
50			SS 12	100	18-18-17 (35)			

Bottom of borehole at 50.0 feet.

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BORING NUMBER BH-3

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant
DATE STARTED 10/15/12 **COMPLETED** 10/15/12
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR Van & Sons Drilling Service
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY HR **CHECKED BY** PCM
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	(SC) CLAYEY SAND, medium to fine, some gravel, brown, moist					
		SH 1	56		2.5	
	increasing clay content and clay lenses at 3.5'	SH 2	67		4.5	
5						
	(CL) LEAN CLAY, low plasticity, and well graded, medium to fine sand, light brown, moist	SH 3	72		4.5	
10		SH 4	89		4.5	
15		SH 5	81		4.5	
	(SC) CLAYEY SAND, medium to fine, brown, moist	SH 6	75		4.0	
20						
	(SP) SAND, poorly graded, medium, tan, moist	SS 7	89	13-18-18 (36)		
25						
30		SS 8	100	13-24-30 (54)		

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

Bottom of borehole at 30.0 feet.

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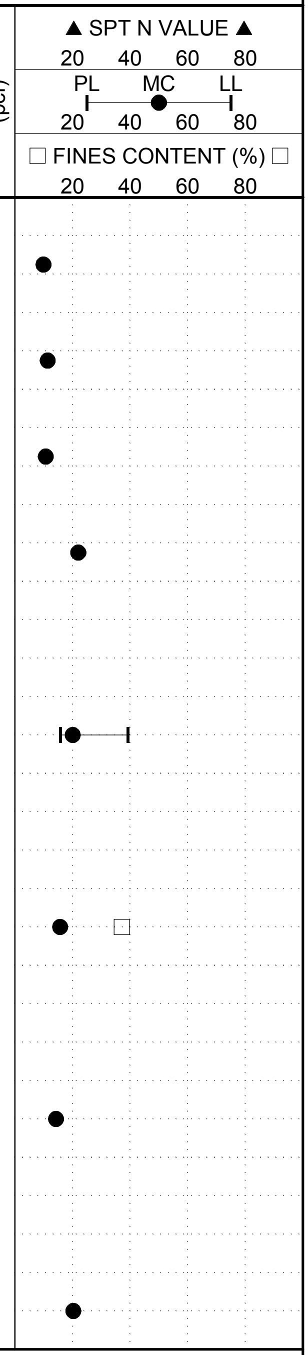
BORING NUMBER BH-4

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR Van & Sons Drilling Service
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY HR **CHECKED BY** PCM
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		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, moist	SH 1	56		4.5	
		dry at 3.5'	SH 2	67		4.5	
5		moist at 6.0'	SH 3	72		4.5	
10			SH 4	100		4.0	
15		(CL) LEAN CLAY, low plasticity, with medium to fine sand, gray - brown, moist, cohesive	SH 5	83		1.5	
20		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, moist	SH 6	54		1.5	
25			SH 7	58		2	
30			SH 8	92		1.0	



Bottom of borehole at 30.0 feet.

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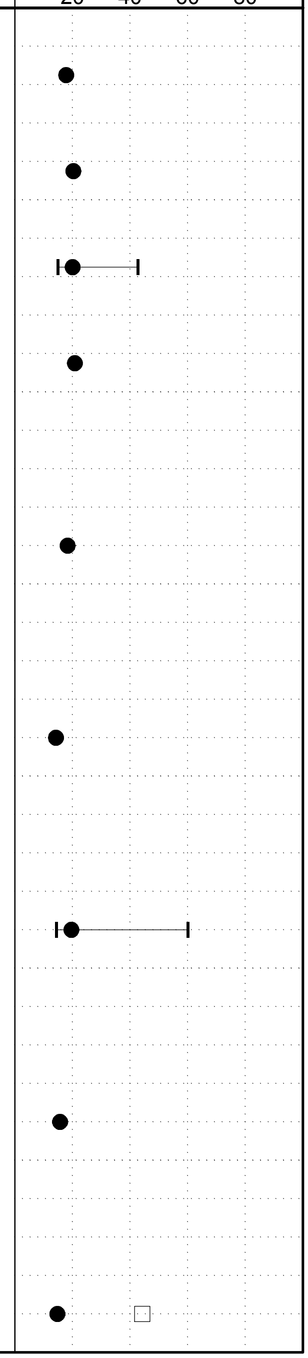
BORING NUMBER BH-5

CLIENT	Luminant	**PROJECT NAME**	Pond Slope Stability
PROJECT NUMBER	123-94128	**PROJECT LOCATION**	Big Brown Plant
DATE STARTED	10/16/12 **COMPLETED** 1/16/12	**GROUND ELEVATION**	**HOLE SIZE** inches
DRILLING CONTRACTOR	Van & Sons Drilling Service	**GROUND WATER LEVELS:**	
DRILLING METHOD	Mud Rotary	**AT TIME OF DRILLING**	---
LOGGED BY	HR **CHECKED BY** PCM	**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) SANDY LEAN CLAY, low plasticity, medium to fine, well graded, brown and orange, cohesive, moist	SH 1	78		4.5	
5		trace gravel, red and gray at 3.5'	SH 2	78		4.5	
			SH 3	100		2.25	
		(SC) CLAYEY SAND, medium to fine, well graded, some low plasticity clay, orange, cohesive, moist					
10		(CL) SANDY LEAN CLAY, low plasticity, medium to fine, well graded, brown and orange, cohesive, moist	SH 4	89		0.75	
		(SC) CLAYEY SAND, medium to fine, well graded, some low plasticity clay, gray to brown, non-cohesive, moist					
15		(CL) SANDY LEAN CLAY, low plasticity, medium to fine, well graded, gray and brown, cohesive, moist	SH 5	75		3.25	
20		(SW) WELL GRADED SAND, medium to fine, with low plasticity clay lenses, orange, non-cohesive, moist	SH 6	52		3.0	
25		(CH) SANDY FAT CLAY, high plasticity, medium to fine, well graded, gray, cohesive, moist	SH 7	83		2.75	
		(CL) SANDY LEAN CLAY, low plasticity, medium to fine, well graded, gray, cohesive, moist					
30		orange and gray at 28.0'	SH 8	73		4.5	
35		(SC) CLAYEY SAND, medium to fine, well graded, some low plasticity clay, gray and orange, cohesive, moist	SH 9	67		4.25	

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



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BORING NUMBER BH-5

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant

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
35		(SC) CLAYEY SAND, medium to fine, well graded, some low plasticity clay, gray and orange, cohesive, moist *(continued)*						
40			SS 10	100	13-15-16 (31)			
45		wet at 43.5'	SS 11	100	4-5-5 (10)			
50			SS		10-10-12 (22)			

Bottom of borehole at 50.0 feet.

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Houston, Texas 77073
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BORING NUMBER BH-6

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR Van & Sons Drilling Service
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
LOGGED BY HR **CHECKED BY** PCM
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)	▲ SPT N VALUE ▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐ FINES CONTENT (%) ☐ 20 40 60 80
0		(SC) CLAYEY SAND, medium to fine, well graded, some low plasticity clay, brown, cohesive, moist	SH 1	28				
5		and low plasticity clay at 3.5'	SH 2	67		4.5		
		(CL) SANDY LEAN CLAY, low plasticity, some medium to fine sand, orange, wet	SH 3	72		0.0		
		(SW) WELL GRADED SAND, medium to fine, gray, dry						
10		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, orange, dry, cohesive	SH 4	61		4.5		
15		(CL) LEAN CLAY, low plasticity, some medium to fine sand, orange, moist, cohesive	SH 5	54		4.5		
20		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, gray, moist, cohesive	SS 6	54	5-7-10 (17)			
25		(CL) SANDY LEAN CLAY, low plasticity, increasing sand with depth, gray, cohesive, moist	SH 7	100		2.0		
30		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, gray and orange, possible some lignite (black), moist, cohesive	SH 8	88		3.5		
35		no lignite at 33.0'	SH 9	69		3.5		

(Continued Next Page)

GEOTECH BH PLOTS - GINT STD US LAB.GDT - 11/20/12 15:10 - P:_2012 PROJECT FOLDERS\123-94128 LUMINANT POND SLOPE STABILITY\BIG BROWN FIELD INVESTIGATION\94128BIGBROWN.GPJ

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BORING NUMBER BH-6

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant

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
35		(SC) CLAYEY SAND, medium to fine, well graded, and low plasticity clay, gray and orange, possible some lignite (black), moist, cohesive *(continued)*						
40		(SW) WELL GRADED SAND, medium to fine, trace low plasticity clay lenses, gray, non-cohesive, moist	SH 10	60		0.0		
45		orange, clay nodules at 43.0'	SH 11	50		0.0		
50		with stiff, gray, clay nodules and lenses at 48.0'	SH 12	46		0.0		

Bottom of borehole at 50.0 feet.

APPENDIX B
LABORATORY TEST SUMMARY SHEETS

Golder Associates
500 Century Plaza Drive, Suite 190
Houston, Texas 77073
Telephone: (281) 821-6868
Fax: (281) 821-6870

SUMMARY OF LABORATORY RESULTS

CLIENT Luminant **PROJECT NAME** Pond Slope Stability
PROJECT NUMBER 123-94128 **PROJECT LOCATION** Big Brown Plant

Sample ID	Depth	Natural Moisture (%)	Atterberg Limits			%<#200 Sieve	Class-ification	Unit Weight		Permeability (cm/sec)	Additional Lab Testing
			Liquid Limit	Plastic Limit	Plasticity Index			Moisture Content (%)	Dry Density (psf)		
BH-1	1	19.3									
BH-1	4	11.9									
BH-1	6	8.8									
BH-1	9	13.6									
BH-1	13	19.1									
BH-1	18	15.5									
BH-1	23	15.4									
BH-1	28	19.9	33	13	20						
BH-1	33	16.0									
BH-1	39	22.9									
BH-1	44	25.6									
BH-1	49	27.6									
BH-2	1	20.1									
BH-2	4	13.3									
BH-2	6	16.2									
BH-2	9	9.9									
BH-2	13	18.3									
BH-2	18	17.9									
BH-2	23	15.0									
BH-2	28	17.2	34	17	17						
BH-2	33	22.5									
BH-2	39	24.2									
BH-2	44	26.1									
BH-2	49	25.6									
BH-3	1	12.2									
BH-3	4	17.3									
BH-3	6	16.7									
BH-3	9	18.6									
BH-3	13	18.7									
BH-3	18	14.1									
BH-3	24	8.5									
BH-3	29	7.0				17					
BH-4	1	9.9									
BH-4	4	11.4									
BH-4	6	10.7									
BH-4	9	22.0									
BH-4	13	20.1	39	16	23						
BH-4	18	15.7									
BH-4	23	14.3									
BH-4	28	20.3									
BH-5	1	17.8									

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SUMMARY OF LABORATORY RESULTS

CLIENT Luminant **PROJECT NAME** Pond Slope Stability

PROJECT NUMBER 123-94128 **PROJECT LOCATION** Big Brown Plant

Sample ID	Depth	Natural Moisture (%)	Atterberg Limits			%<#200 Sieve	Class-ification	Unit Weight		Permeability (cm/sec)	Additional Lab Testing
			Liquid Limit	Plastic Limit	Plasticity Index			Moisture Content (%)	Dry Density (psf)		
BH-5	4	20.3									
BH-5	6	20.0	43	15	28						
BH-5	9	20.8									
BH-5	13	18.3									
BH-5	18	14.2									
BH-5	23	19.6	60	14	46						
BH-5	28	15.7									
BH-5	33	14.8									
BH-5	39	19.6									
BH-5	44	22.5									
BH-5	49	20.9									
BH-6	1	16.5									
BH-6	4	11.9									
BH-6	6	28.2									
BH-6	9	12.3									
BH-6	13	17.7	49	16	33						
BH-6	19	20.6									
BH-6	23	19.3									
BH-6	28	13.3									
BH-6	33	21.9	44	14	30						
BH-6	38	21.5				69					
BH-6	43	26.0									
BH-6	48	31.1									

APPENDIX C
LABORATORY TEST RESULTS

ATTERBERG LIMIT RESULTS

Golder Associates
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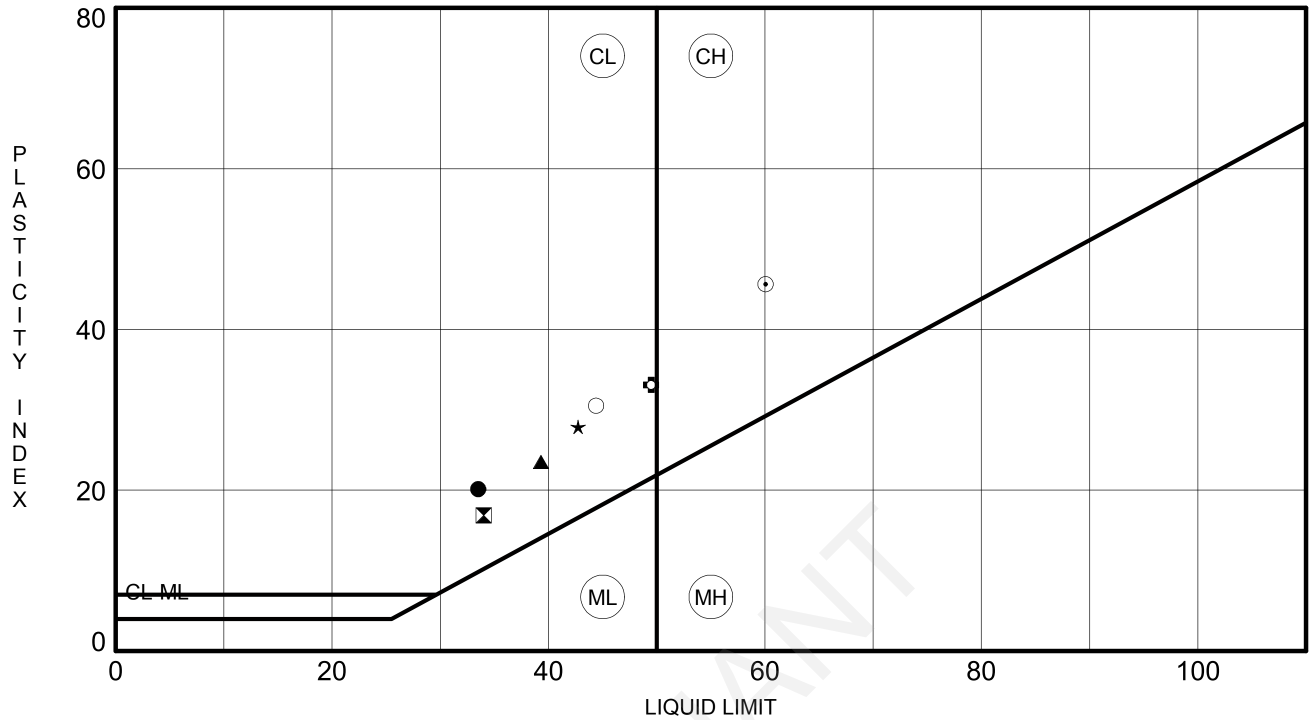
Telephone: (281) 821-6868
Fax: (281) 821-6870

ATTERBERG LIMITS' RESULTS

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Big Brown Plant



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BH-1**	**28.0**	**33**	**13**	**20**		
⧗	**BH-2**	**28.0**	**34**	**17**	**17**		
▲	**BH-4**	**13.0**	**39**	**16**	**23**		
★	**BH-5**	**6.0**	**43**	**15**	**28**		
⊙	**BH-5**	**23.0**	**60**	**14**	**46**		
✪	**BH-6**	**13.0**	**49**	**16**	**33**		
○	**BH-6**	**33.0**	**44**	**14**	**30**		

GRAIN SIZE ANALYSIS

Golder Associates
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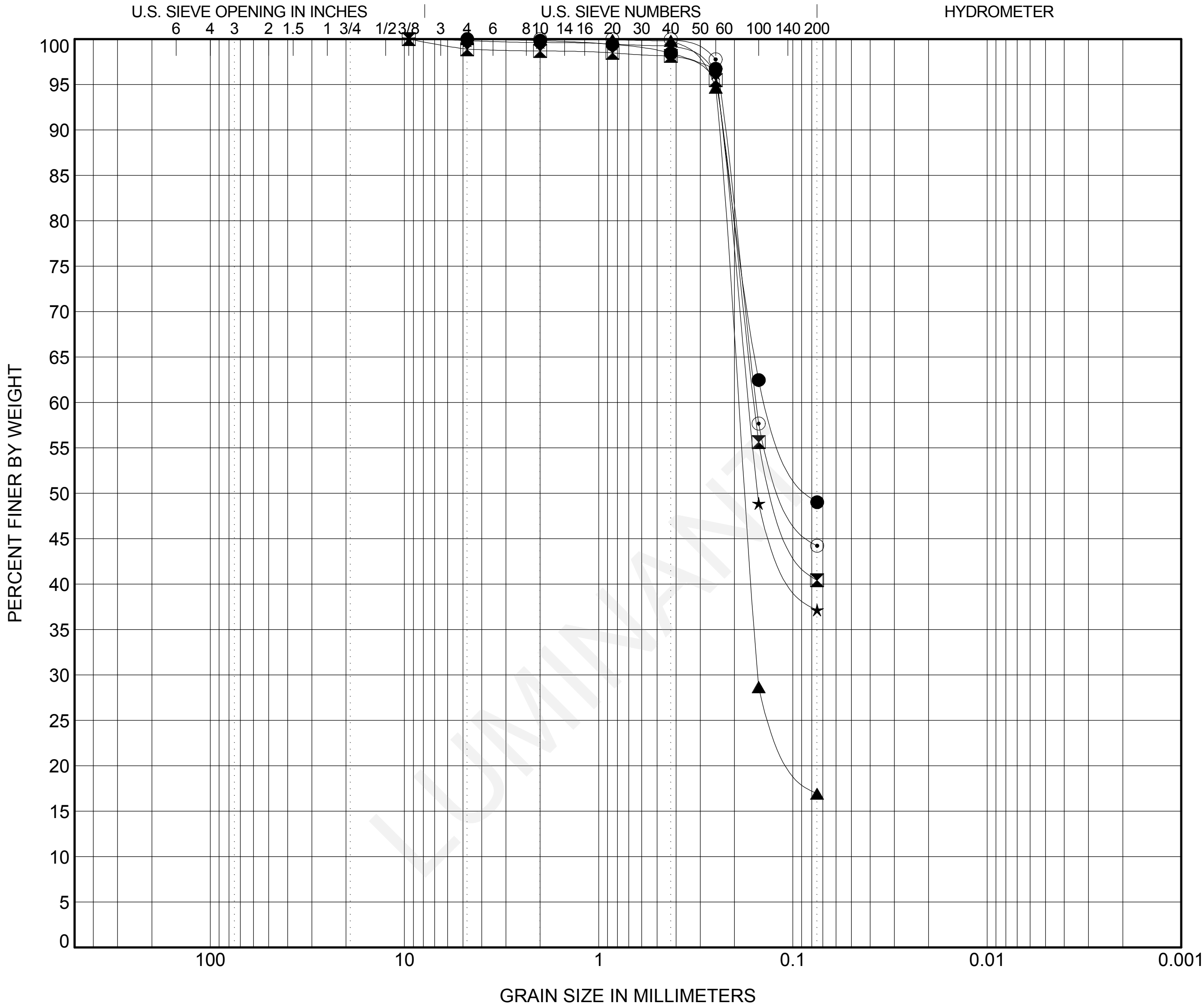
Houston, Texas 77073
Telephone: (281) 821-6868
Fax: (281) 821-6870

GRAIN SIZE DISTRIBUTION

CLIENT Luminant **PROJECT NAME** Pond Slope Stability

PROJECT NUMBER 123-94128 **PROJECT LOCATION** Big Brown Plant



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-1**	**6**						
⧗	**BH-2**	**39**						
▲	**BH-3**	**29**						
★	**BH-4**	**18**						
⊙	**BH-5**	**33**						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-1**	**6**	**4.75**	**0.132**			**0.0**	**51.0**	**49.0**	
⧗	**BH-2**	**39**	**9.5**	**0.159**			**1.1**	**58.5**	**40.4**	
▲	**BH-3**	**29**	**4.75**	**0.191**	**0.152**		**0.0**	**83.1**	**16.9**	
★	**BH-4**	**18**	**9.5**	**0.169**			**0.2**	**62.7**	**37.2**	
⊙	**BH-5**	**33**	**2**	**0.155**			**0.0**	**55.8**	**44.2**	

GRAIN SIZE - CQA - GINT STD US LAB.GDT - 11/16/12 13:59 - P:_2012 PROJECT FOLDERS\123-94128 LUMINANT POND SLOPE STABILITY\BIG BROWN FIELD INVESTIGATION\94128BIGBROWN.GPJ

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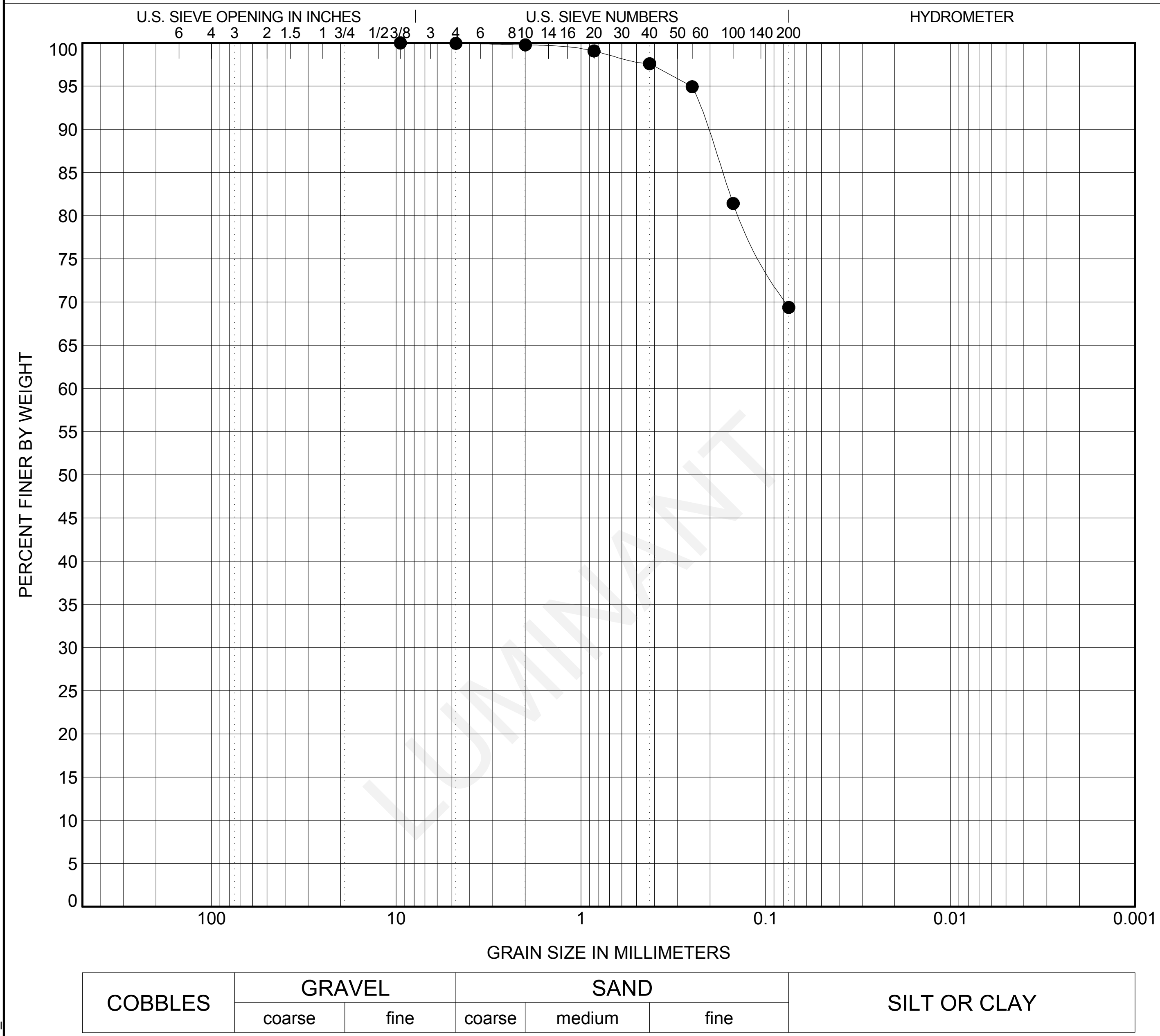
GRAIN SIZE DISTRIBUTION

CLIENT Luminant **PROJECT NAME** Pond Slope Stability

PROJECT NUMBER 123-94128 **PROJECT LOCATION** Big Brown Plant

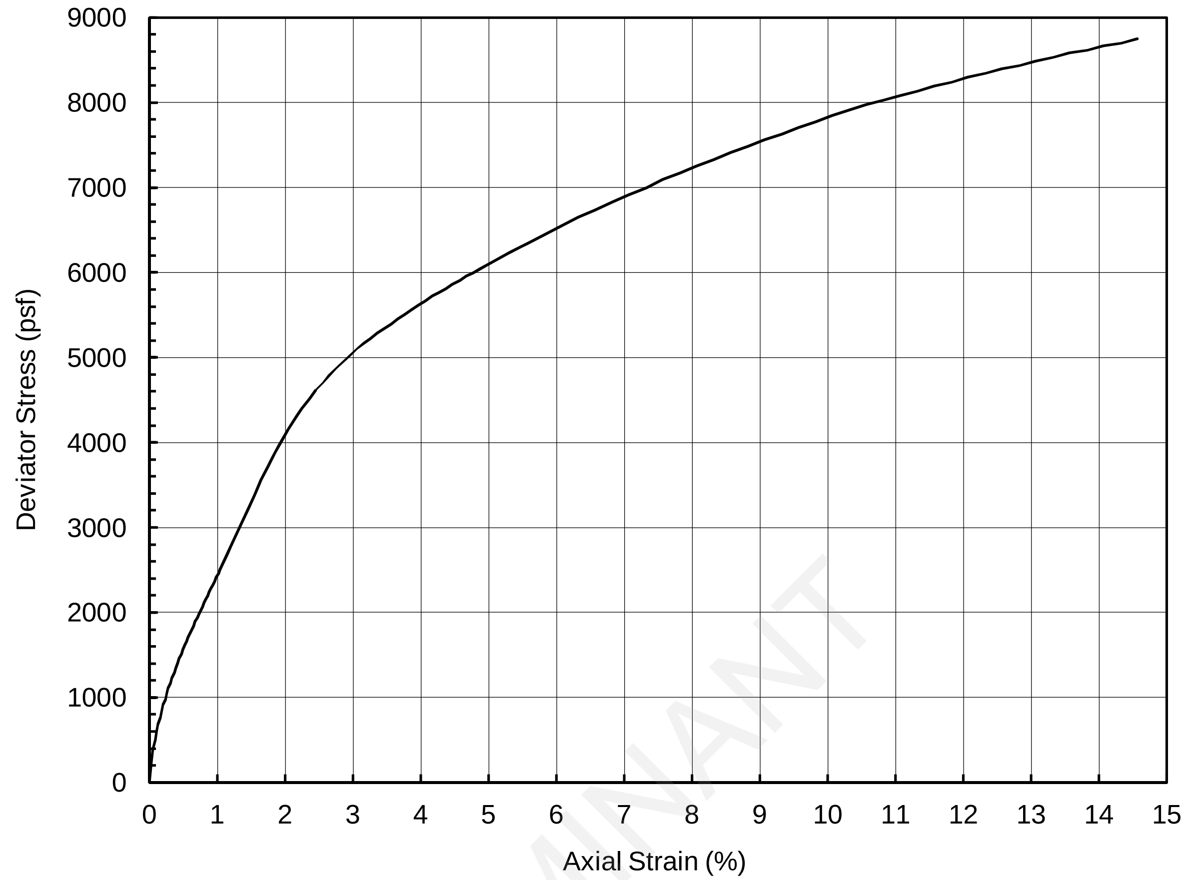


	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-6**	**38**						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-6**	**38**	**9.5**				**0.1**	**30.6**	**69.4**	

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH (UU)

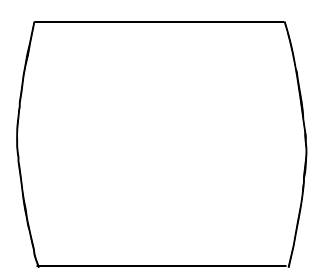
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Tan and Gray Clayey Sand						
LL	33	PI	20	LI	0.2	USCS	CL

Depth (ft)	28.0	Confining Pressure (psf)	2879
Specimen Height (inch)	5.9	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	8784
Initial Specimen Weight (g)	1253.7	Axial Strain at Peak Stress (%)	15.0
Moist Unit Weight (pcf)	132.8		
Initial Water Content (%)	17		
Initial Dry Unit Weight (pcf)	113.3		

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-2 TO-8
Comments	

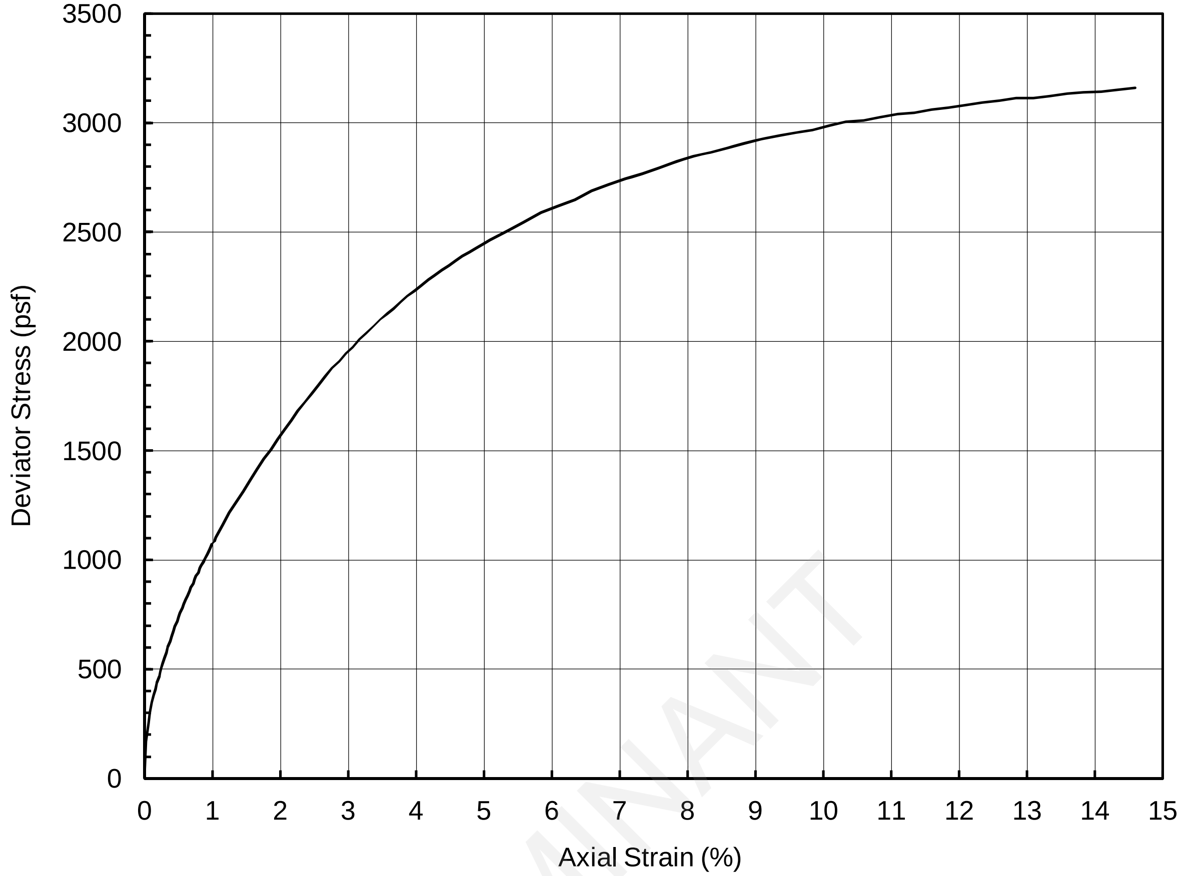


Failure Sketch

Golder Associates

Performed by	**PN**
Date	**7-Nov-12**
Check	**HR**
Review	**PCM**

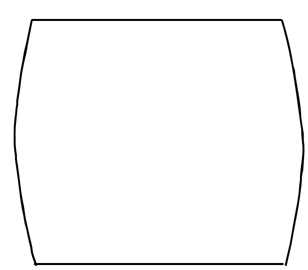
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Tan and Gray Clayey Sand						
LL	39	PI	23	LI	0.2	USCS	CL

Depth (ft)	13.0	Confining Pressure (psf)	1754
Specimen Height (inch)	4.9	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	3164
Initial Specimen Weight (g)	950.5	Axial Strain at Peak Stress (%)	14.8
Moist Unit Weight (pcf)	121.4		
Initial Water Content (%)	20		
Initial Dry Unit Weight (pcf)	101.3		

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-4 TO-5
Comments	Sample L/D ratio < 2

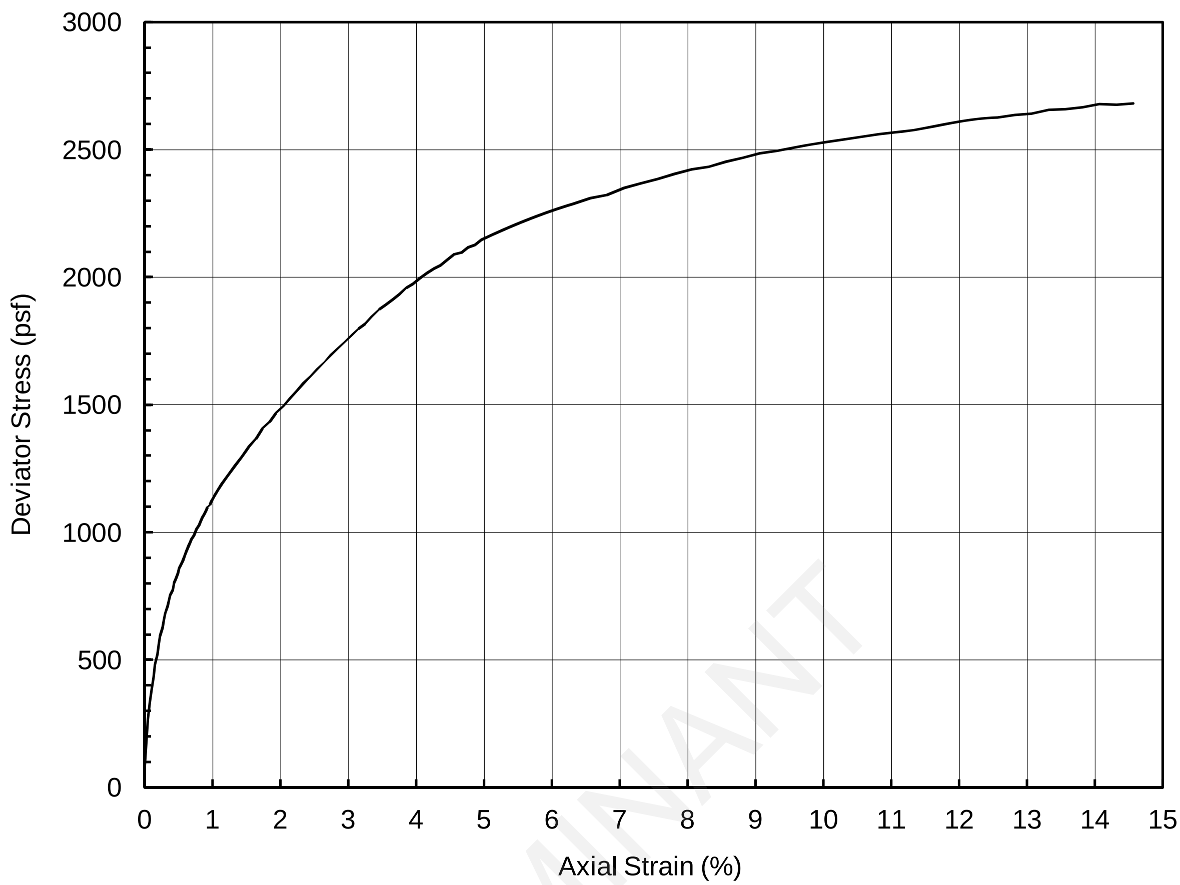


Failure Sketch

Golder Associates

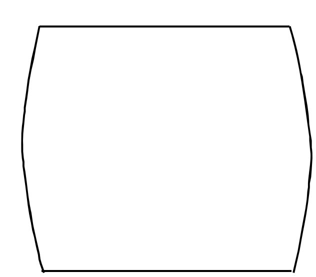
Performed by	PN
Date	7-Nov-12
Check	HR
Review	PCM

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clayey Sand						
LL	43	PI	28	LI	0.2	USCS	CL

Depth (ft)	6.0	Confining Pressure (psf)	891
Specimen Height (inch)	4.6	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	2688
Initial Specimen Weight (g)	926.5	Axial Strain at Peak Stress (%)	14.8
Moist Unit Weight (pcf)	122.1		
Initial Water Content (%)	20		
Initial Dry Unit Weight (pcf)	101.5		



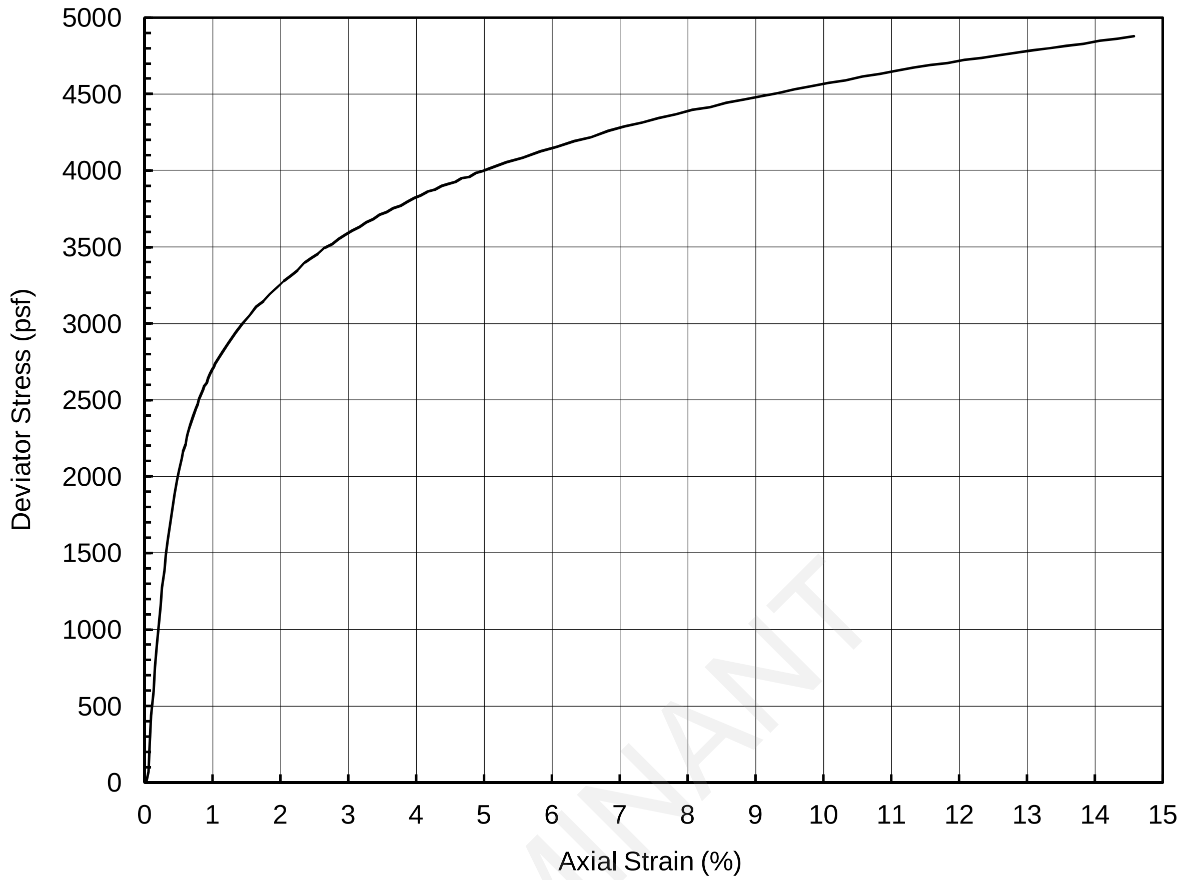
Failure Sketch

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-5 TO-3
Comments	Sample L/D ratio < 2

Golder Associates

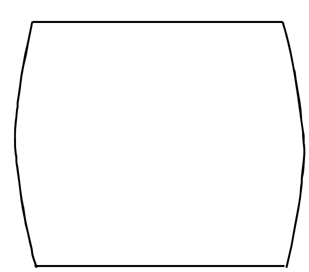
Performed by	**PN**
Date	**7-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clay						
LL	60	PI	46	LI	0.1	USCS	CH

Depth (ft)	23.0	Confining Pressure (psf)	2879
Specimen Height (inch)	6.0	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	4887
Initial Specimen Weight (g)	1218.0	Axial Strain at Peak Stress (%)	15.0
Moist Unit Weight (pcf)	131.2		
Initial Water Content (%)	20		
Initial Dry Unit Weight (pcf)	109.1		



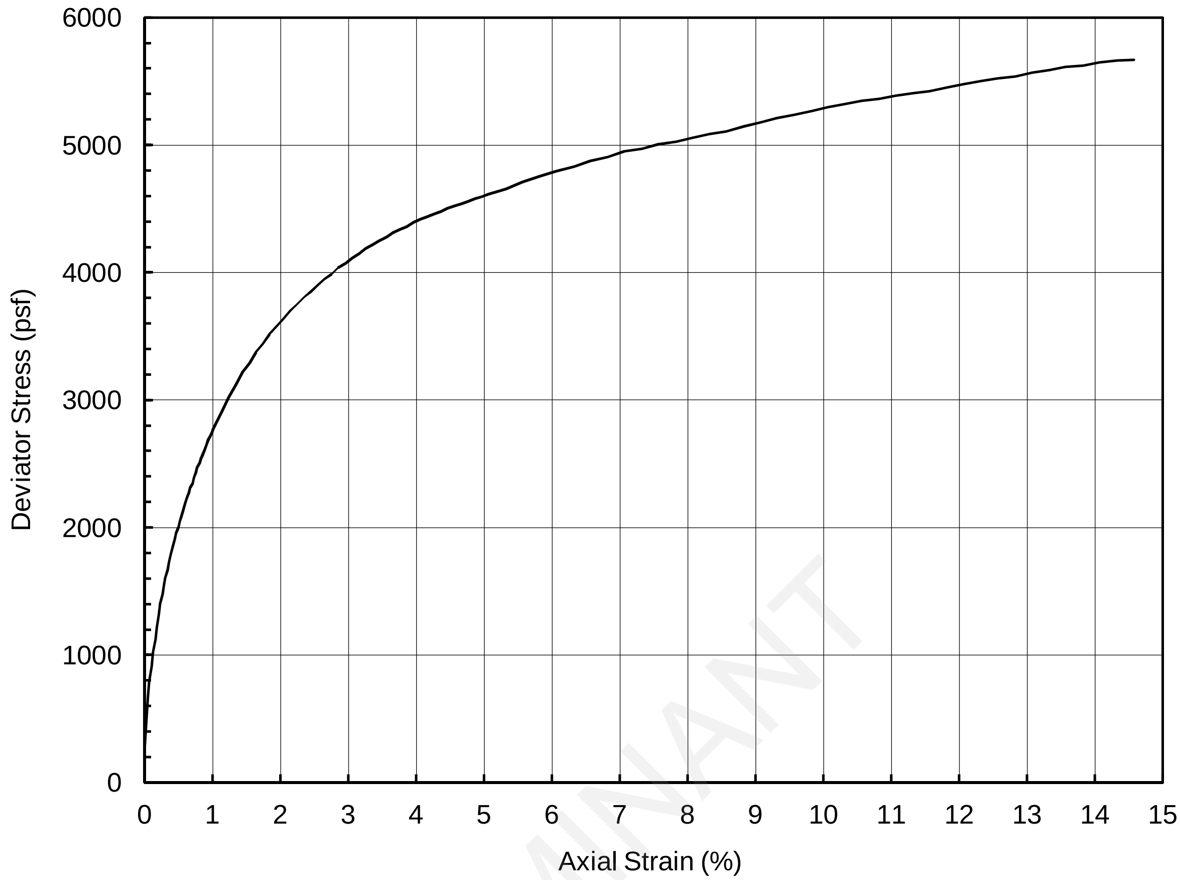
Failure Sketch

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-5 TO-7
Comments	

Golder Associates

Performed by	**PN**
Date	**8-Nov-12**
Check	**HR**
Review	**PCM**

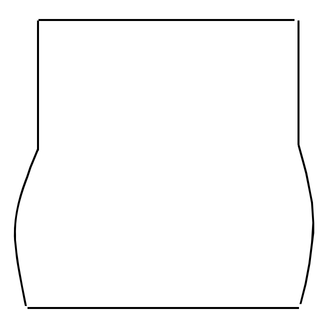
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Red Sandy Clay						
LL	49	PI	33	LI	0.0	USCS	CL

Depth (ft)	13.0	Confining Pressure (psf)	1752
Specimen Height (inch)	5.7	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	5685
Initial Specimen Weight (g)	1150.2	Axial Strain at Peak Stress (%)	14.8
Moist Unit Weight (pcf)	125.3		
Initial Water Content (%)	17		
Initial Dry Unit Weight (pcf)	107.5		

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-6 TO-5
Comments	

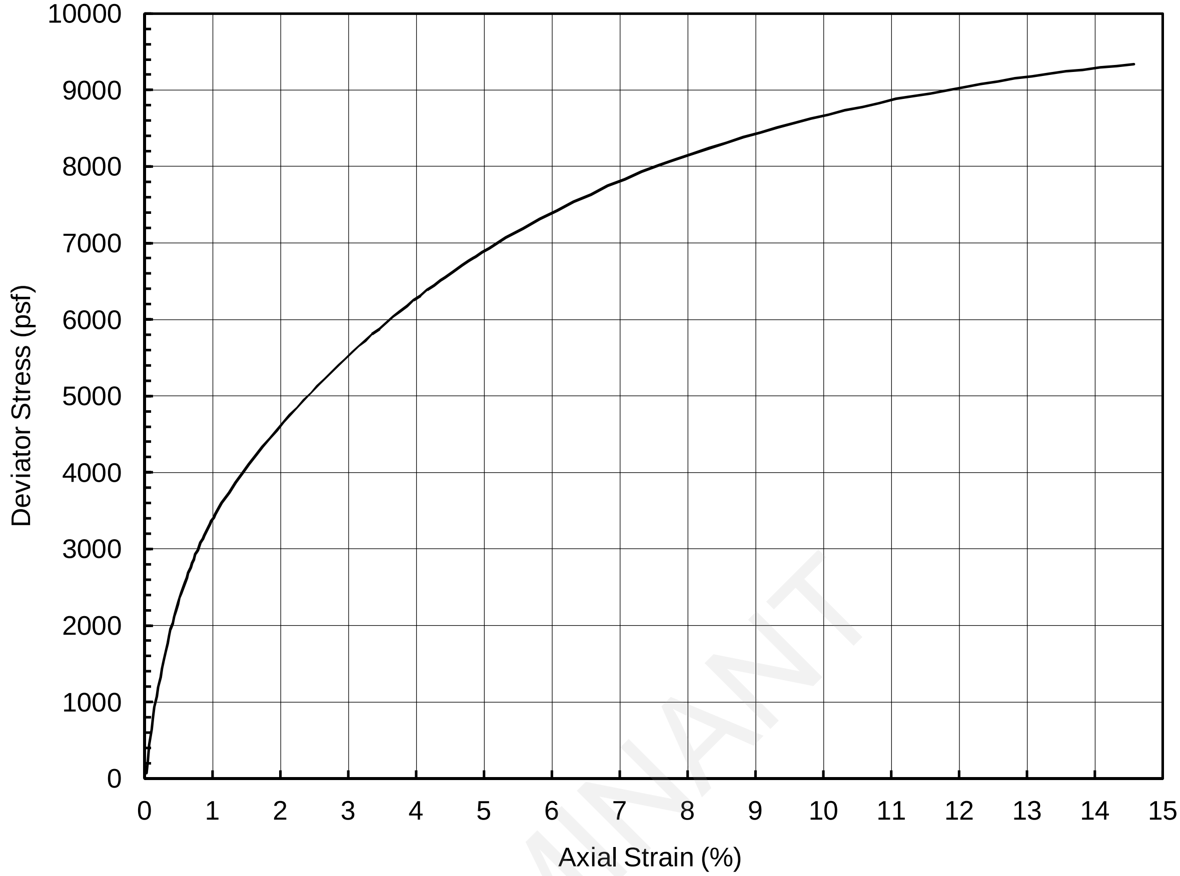


Failure Sketch

Golder Associates

Performed by	PN
Date	8-Nov-12
Check	HR
Review	PCM

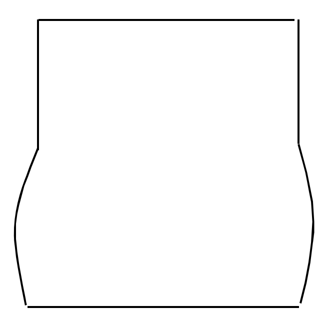
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Gray Sandy Clay						
LL	44	PI	30	LI	0.1	USCS	CL

Depth (ft)	33.0	Confining Pressure (psf)	3304
Specimen Height (inch)	6.0	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.9	Peak Deviator Stress (psf)	9360
Initial Specimen Weight (g)	1270.9	Axial Strain at Peak Stress (%)	15.0
Moist Unit Weight (pcf)	127.4		
Initial Water Content (%)	18		
Initial Dry Unit Weight (pcf)	107.9		

Project Title	Luminant - Big Brown Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-6 TO-9
Comments	



Failure Sketch

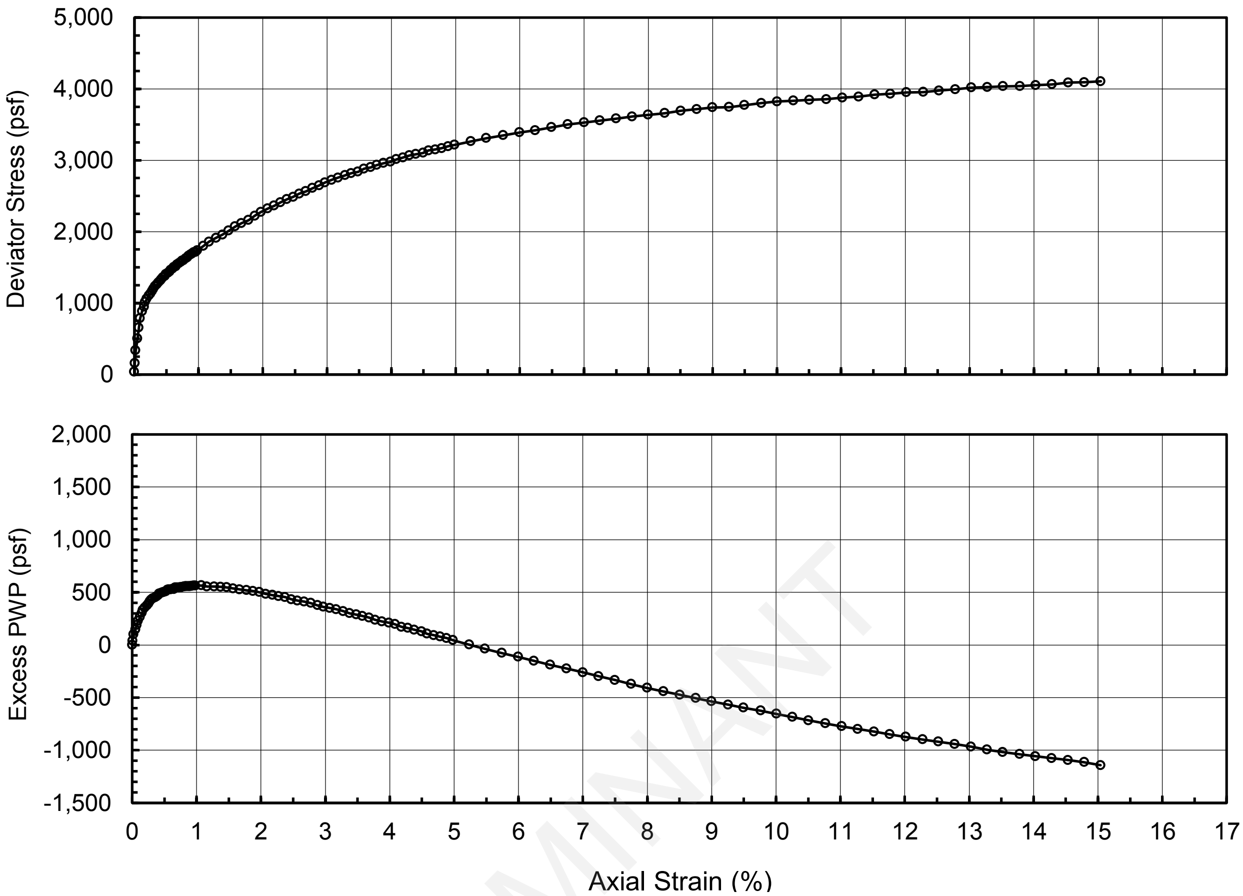
Golder Associates

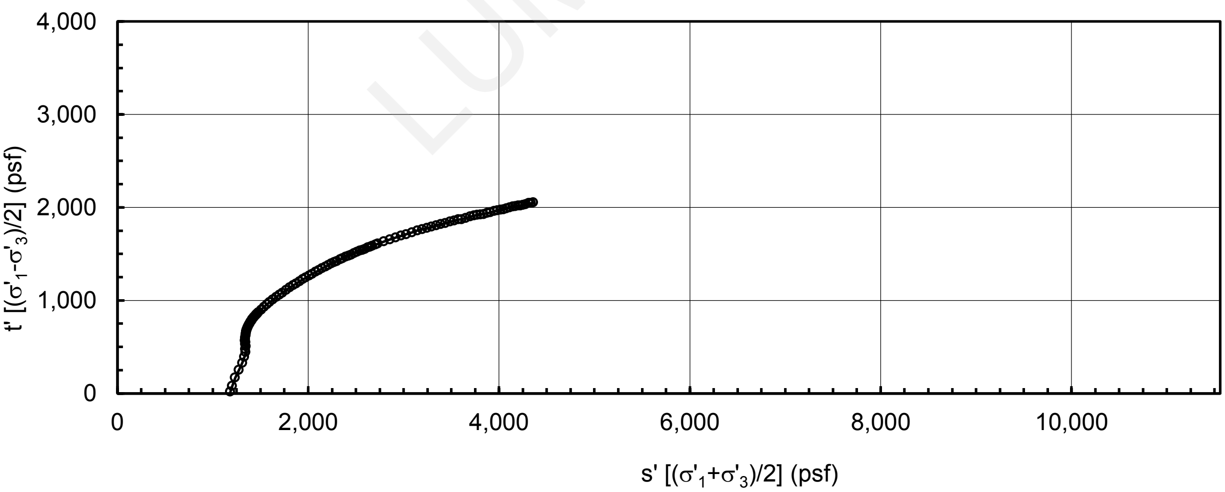
Performed by	**PN**
Date	**9-Nov-12**
Check	**HR**
Review	**PCM**

ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL TEST (ICU)

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 11-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-8 **Depth (ft):** 28.0





Specimen Description: Dark Gray Sandy CLAY

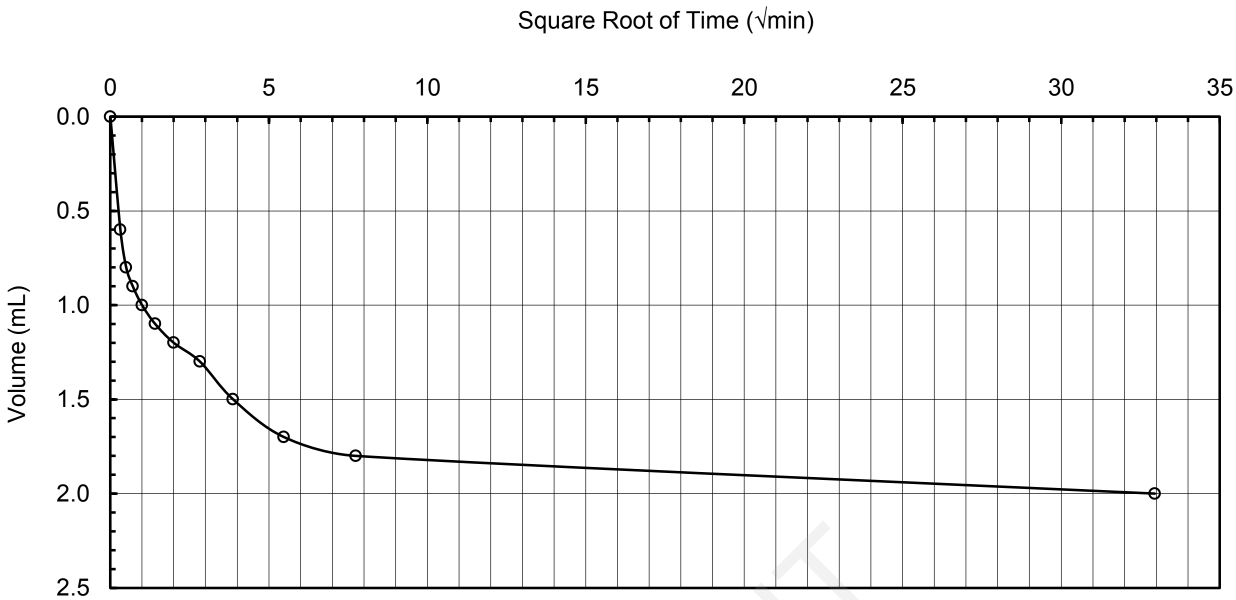
Initial Specimen Diameter (inch) =	2.84	Initial Specimen Height (inch) =	5.95
Initial Water Content (%) =	15.4	Water Content at End of Test (%) =	18.4
Initial Moist Unit Weight (pcf) =	127.6	B-value =	0.98
Back Pressure (BP, psf) =	4320.0	Consolidation Stress (σ'_3, psf) =	1165.6
Initial Lateral Stress (σ'_3, psf) =	1165.6	Consolidation t_{50} (min) =	10
Initial Deviator Stress (σ_1 - σ_3, psf) =	36.4	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA

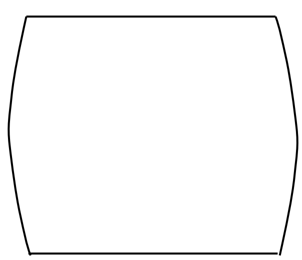
LL =	33	PI =	20	USCS	CL	**Performed by**	SBK
Comments:						**Reviewed by**	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 11-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-8 **Depth (ft):** 28.0





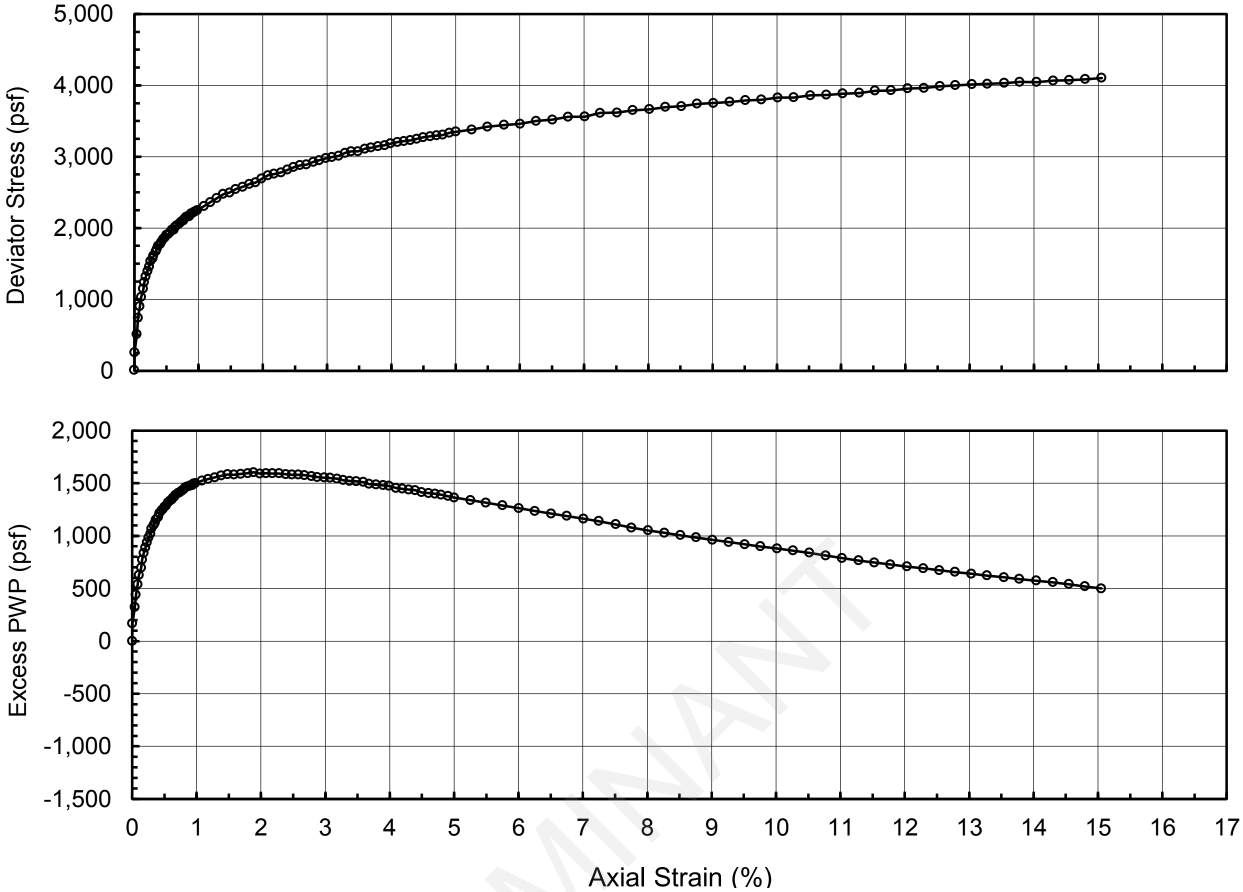
FAILURE SKETCH

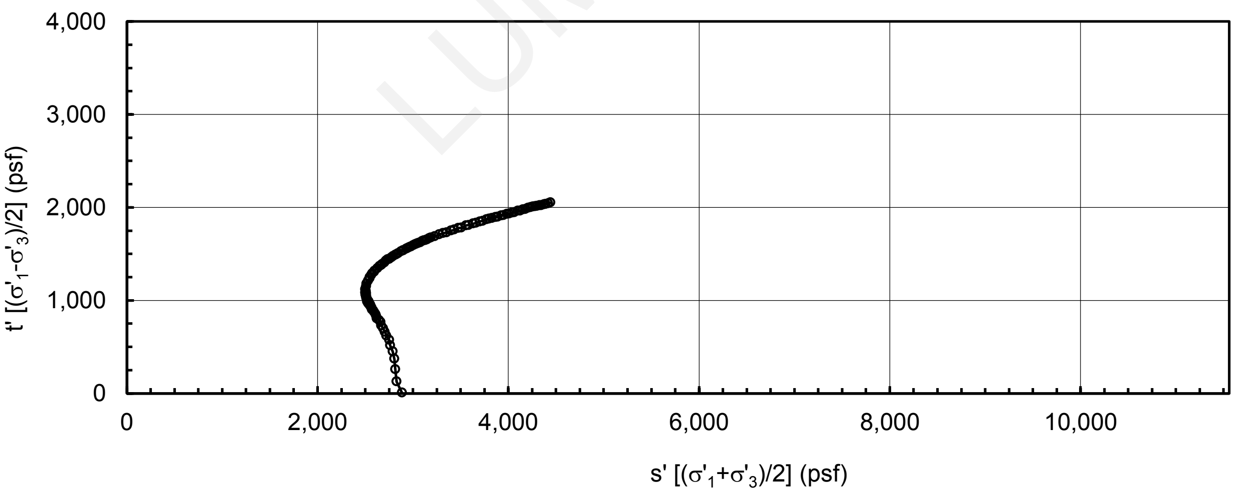
Consolidation Stress (σ'_3, psf) =			1165.6
Consolidation t_{50} (min) =			10
Consolidation Volume Change (mL) =			2.0
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	33	PI =	20
USCS	CL		
Gs =	2.65	assumed	

Performed by	SBK
Reviewed by	PCM

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 12-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-8 **Depth (ft):** 28.0



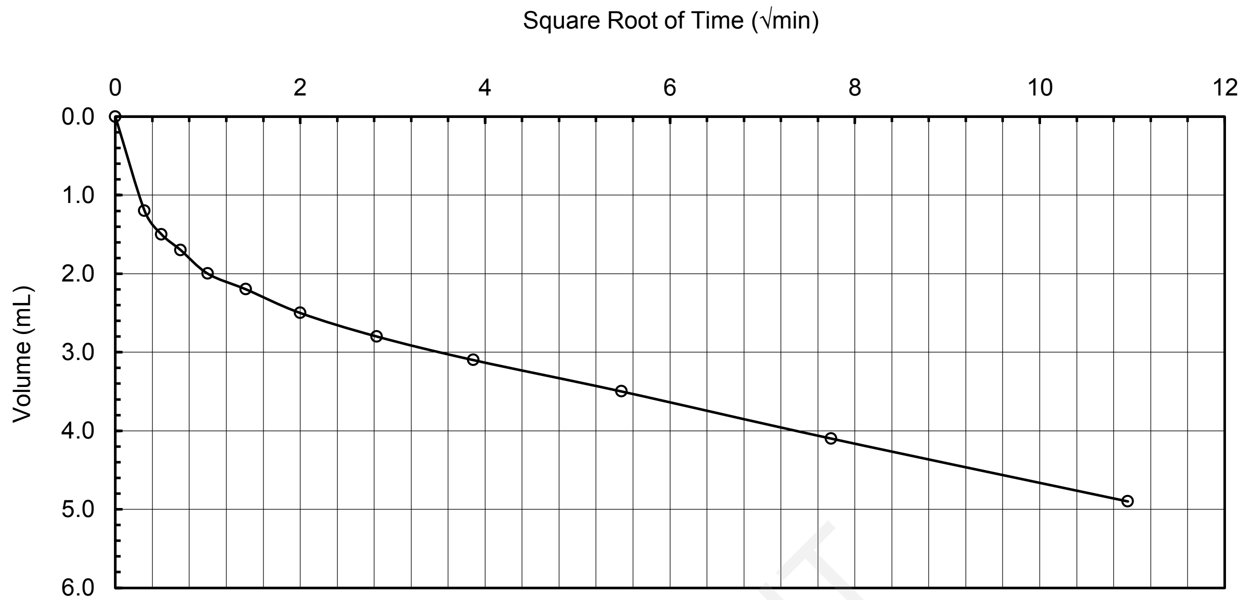


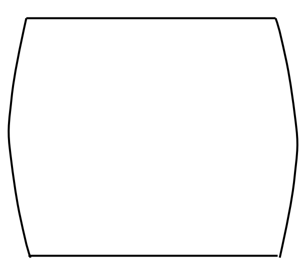
Specimen Description:	Dark Gray Sandy CLAY		
Initial Specimen Diameter (inch) =	2.83	Initial Specimen Height (inch) =	5.95
Initial Water Content (%) =	16.9	Water Content at End of Test (%) =	18.0
Initial Moist Unit Weight (pcf) =	128.7	B-value =	0.99
Back Pressure (BP, psf) =	3600.0	Consolidation Stress (σ'_3, psf) =	2879.8
Initial Lateral Stress (σ'_3, psf) =	2879.8	Consolidation t_{50} (min) =	3
Initial Deviator Stress (σ_1 - σ_3, psf) =	11.4	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = 33 PI = 20	USCS CL	**Performed by**	SBK
Comments:		**Reviewed by**	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 12-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-8 **Depth (ft):** 28.0





FAILURE SKETCH

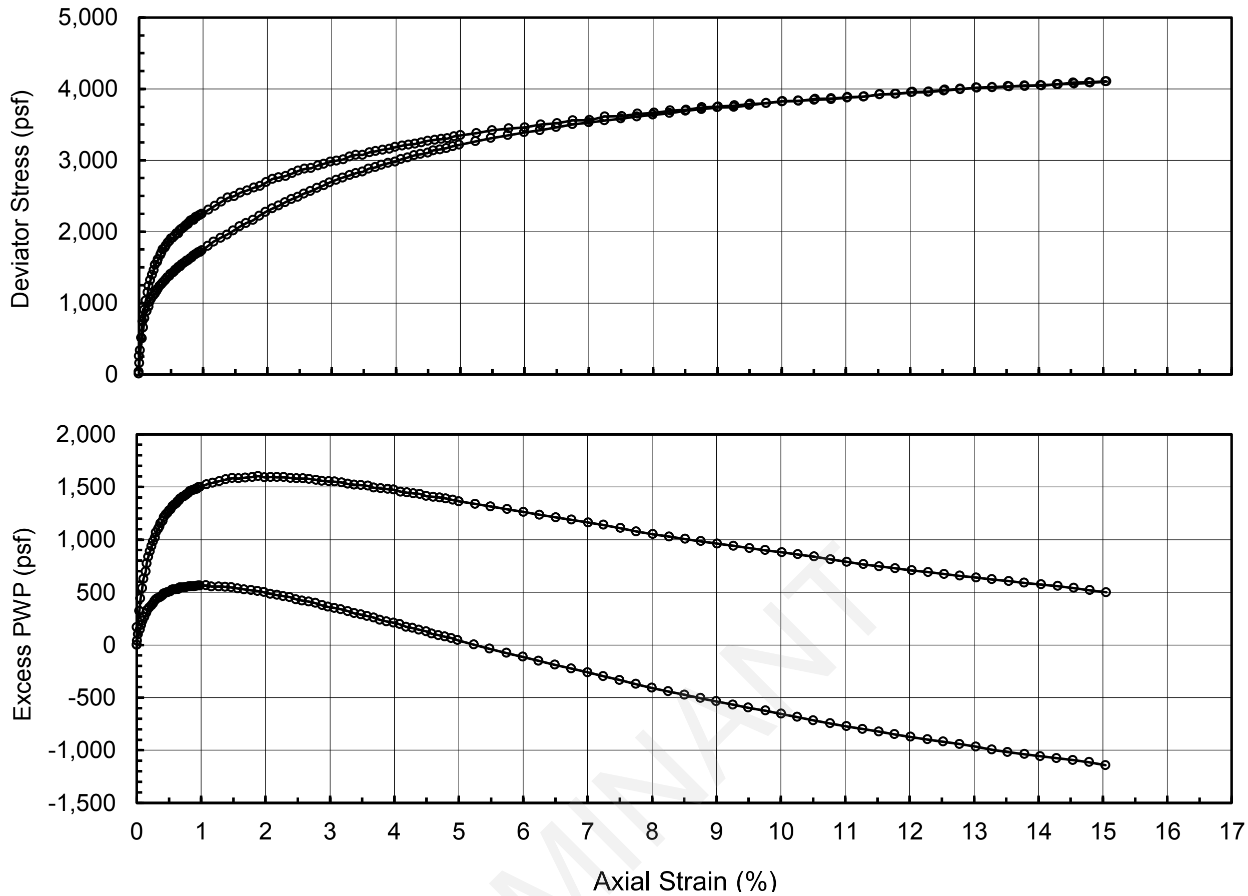
Consolidation Stress (σ'_3, psf) =			2879.8
Consolidation t_{50} (min) =			3
Consolidation Volume Change (mL) =			4.9
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	33	PI =	20
USCS	CL		
Gs =	2.65	assumed	

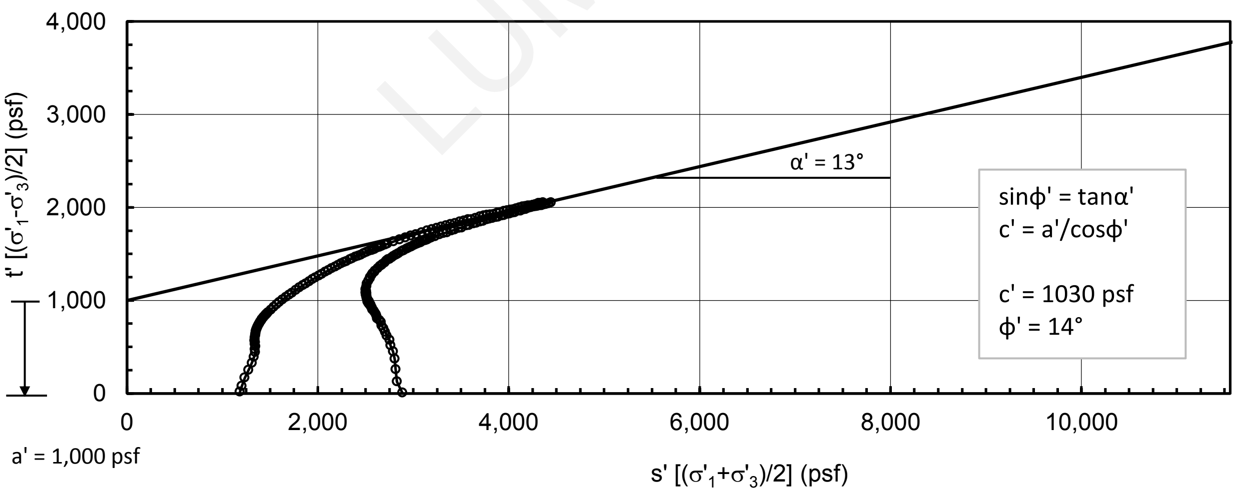
Performed by	SBK
Reviewed by	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 12-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-8 **Depth (ft):** 28.0





Specimen Description: Dark Gray Sandy CLAY

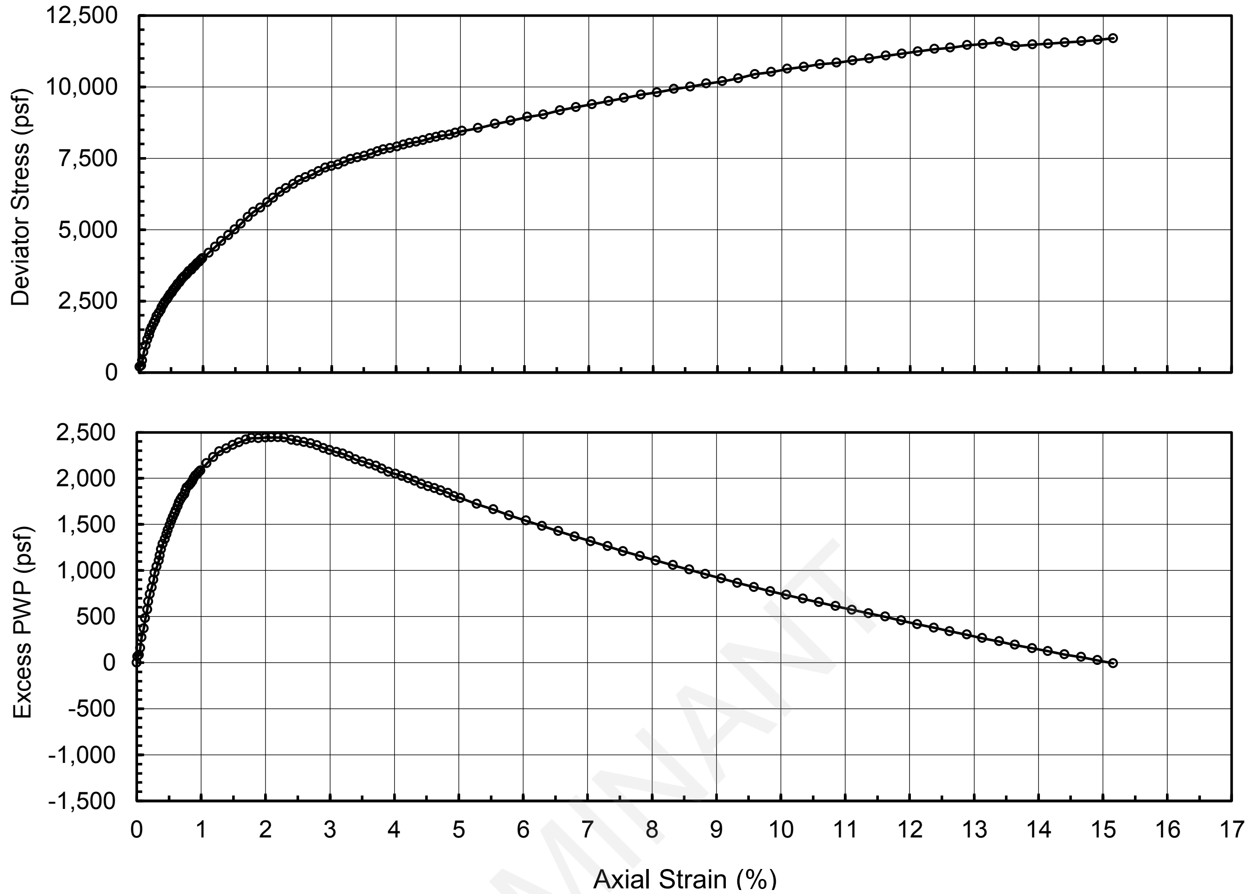
Initial Specimen Diameter (inch) =		Initial Specimen Height (inch) =	
Initial Water Content (%) =		Water Content at End of Test (%) =	
Initial Moist Unit Weight (pcf) =		B-value =	
Back Pressure (BP, psf) =		Consolidation Stress (σ'_3, psf) =	
Initial Lateral Stress (σ'_3, psf) =		Consolidation t_{50} (min) =	
Initial Deviator Stress (σ_1 - σ_3, psf) =		Rebound Stress (σ'_3, psf) =	
Test Strain Rate (%/hour) =		Rebound t_{50} (min) =	

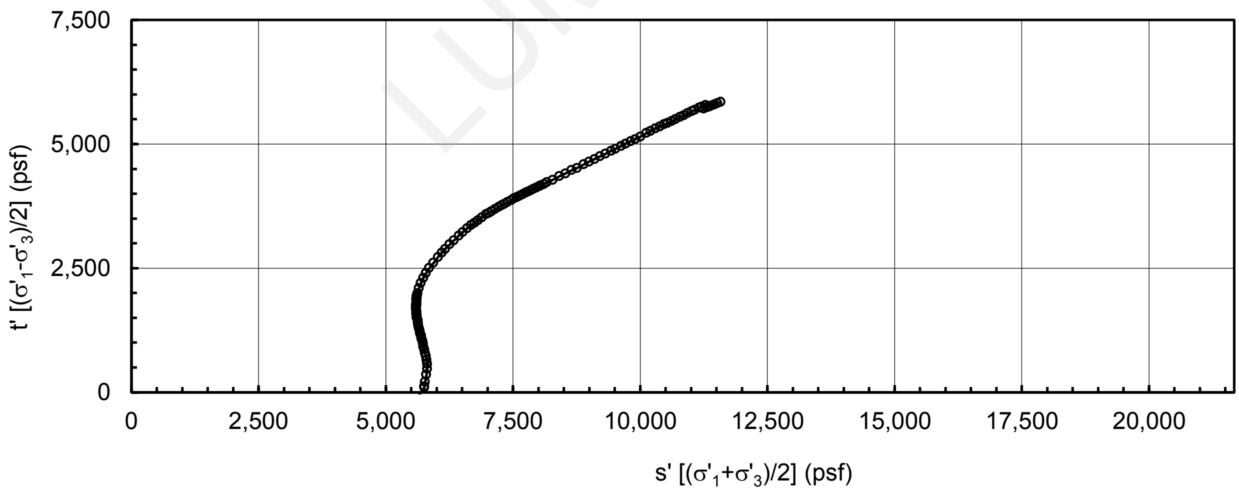
LL =	33	PI =	20	USCS	CL		**Performed by**	SBK
Comments:							**Reviewed by**	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title:	Big Brown Plant, Pond Stability	**Project Number:**	123-94128	**Date:**	13-Nov-12
Boring Number:	BH-1	**Specimen Name:**	TO-9	**Depth (ft):**	33.0



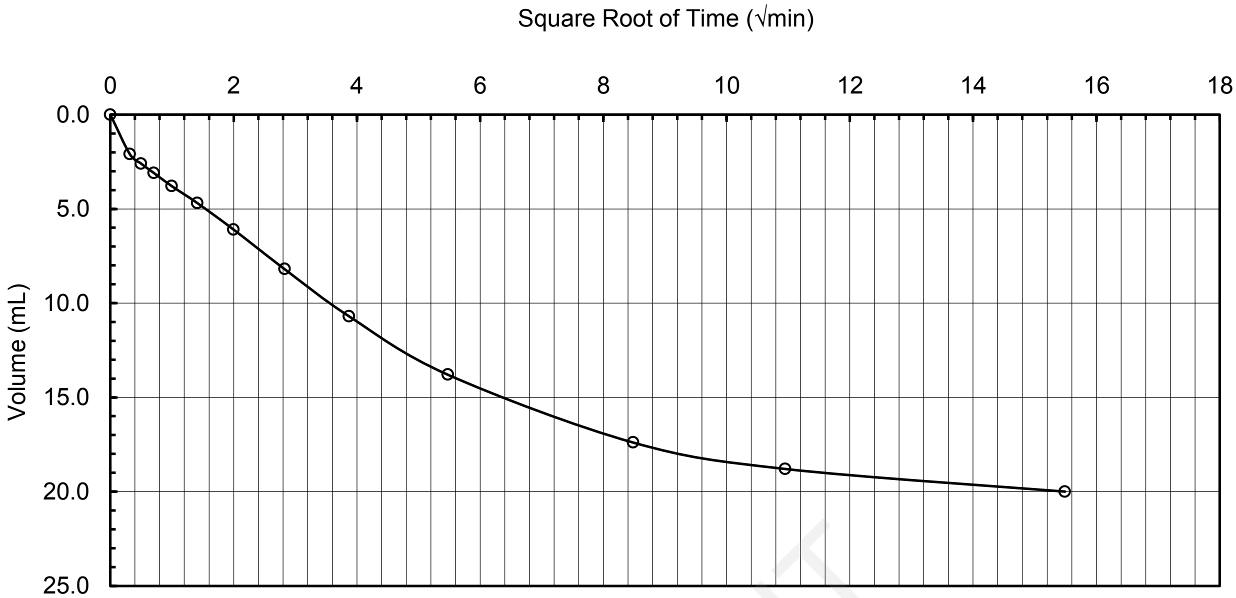


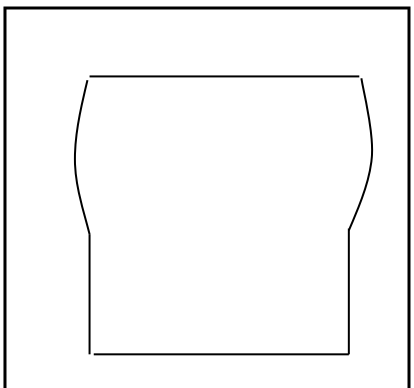
Specimen Description: Light Gray Sandy CLAY (visual classification)			
Initial Specimen Diameter (inch) =	2.83	Initial Specimen Height (inch) =	5.89
Initial Water Content (%) =	16.1	Water Content at End of Test (%) =	17.9
Initial Moist Unit Weight (pcf) =	127.4	B-value =	0.97
Back Pressure (BP, psf) =	5040.0	Consolidation Stress (σ'_3, psf) =	5717.7
Initial Lateral Stress (σ'_3, psf) =	5717.7	Consolidation t_{50} (min) =	11
Initial Deviator Stress (σ_1 - σ_3, psf) =	-164.7	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA
LL = PI =	USCS	(CL) **Performed by**	SBK
Comments:		**Reviewed by**	PCM

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Big Brown Plant, Pond Stability **Project Number:** 123-94128 **Date:** 13-Nov-12
Boring Number: BH-1 **Specimen Name:** TO-9 **Depth (ft):** 33.0





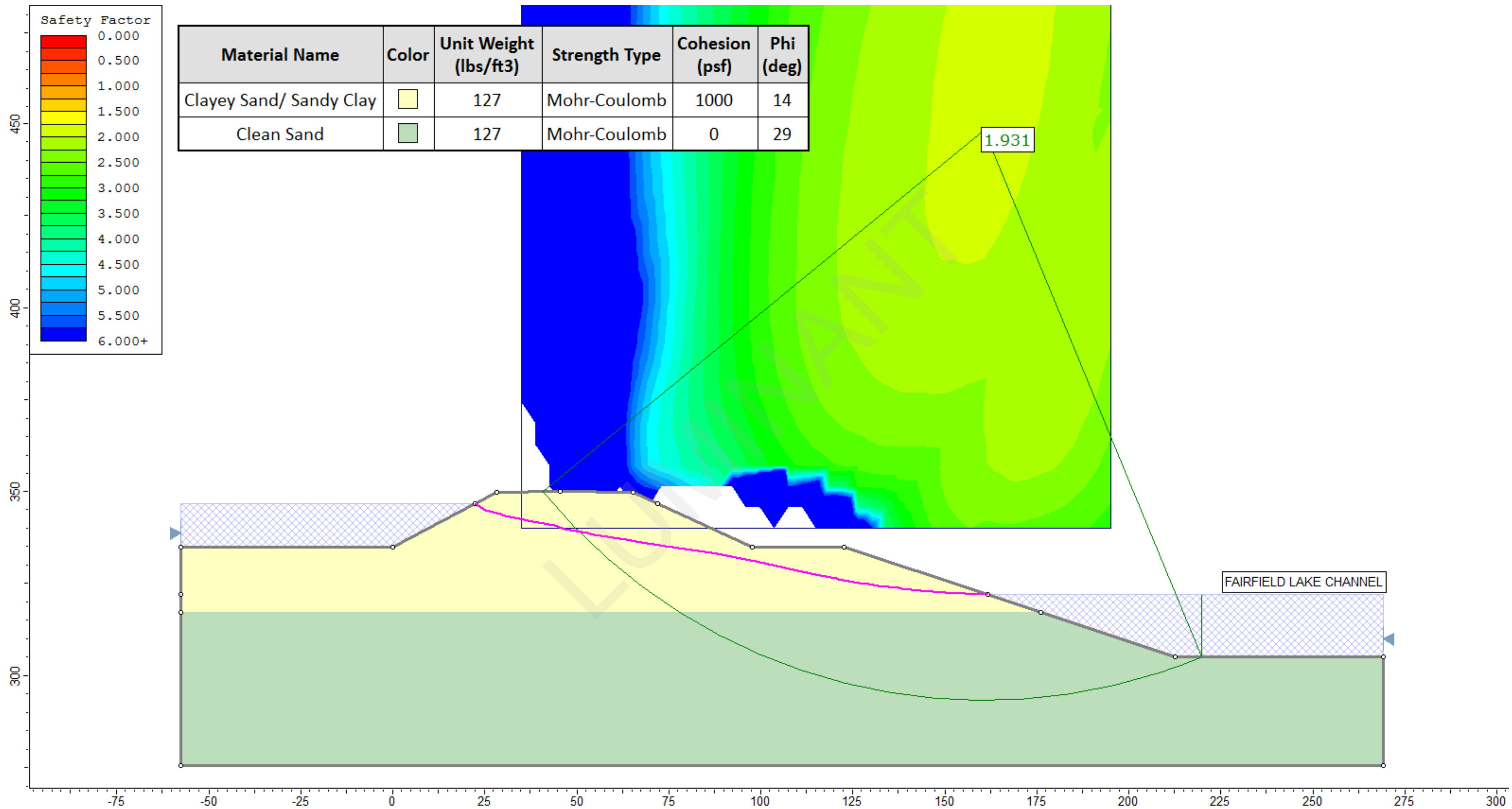
FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =	5717.7
Consolidation t_{50} (min) =	11
Consolidation Volume Change (mL) =	20.0
Unloading Stress (psf) =	NA
Unloading t_{50} (min) =	NA
Unloading Volume Change (mL) =	NA

LL =		PI =	
USCS	(CL)		
Gs =	2.65	assumed	

Performed by SBK
Reviewed by PCM

APPENDIX D
SLOPE STABILITY ANALYSIS RESULTS

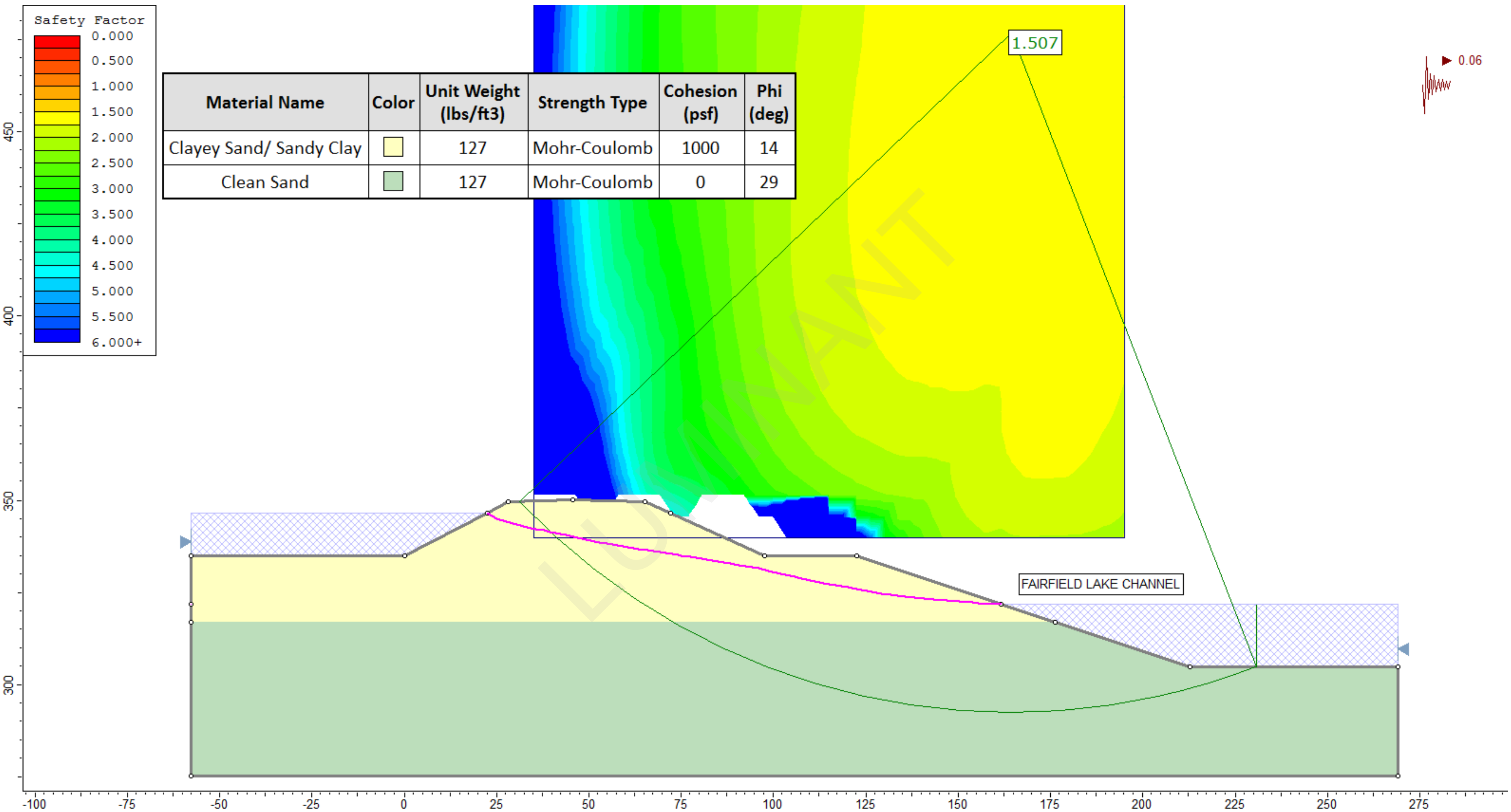


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.1**

Results of Stability Analysis – BAP: A–A' – Case 1a

Stability and Safety Factor Assessment, Big Brown SES

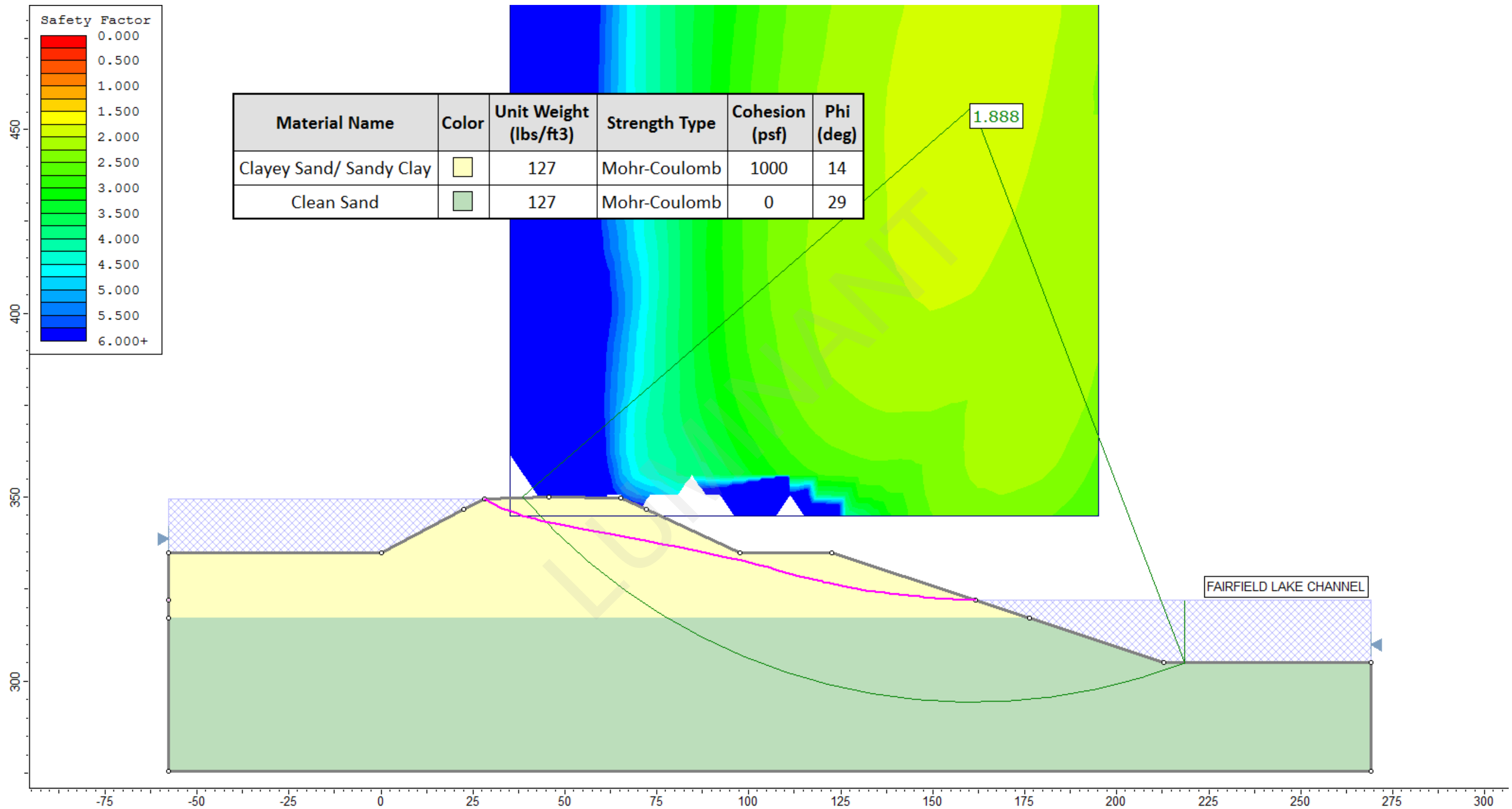


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.2**

Results of Stability Analysis – BAP: A–A' – Case 1b

Stability and Safety Factor Assessment, Big Brown SES

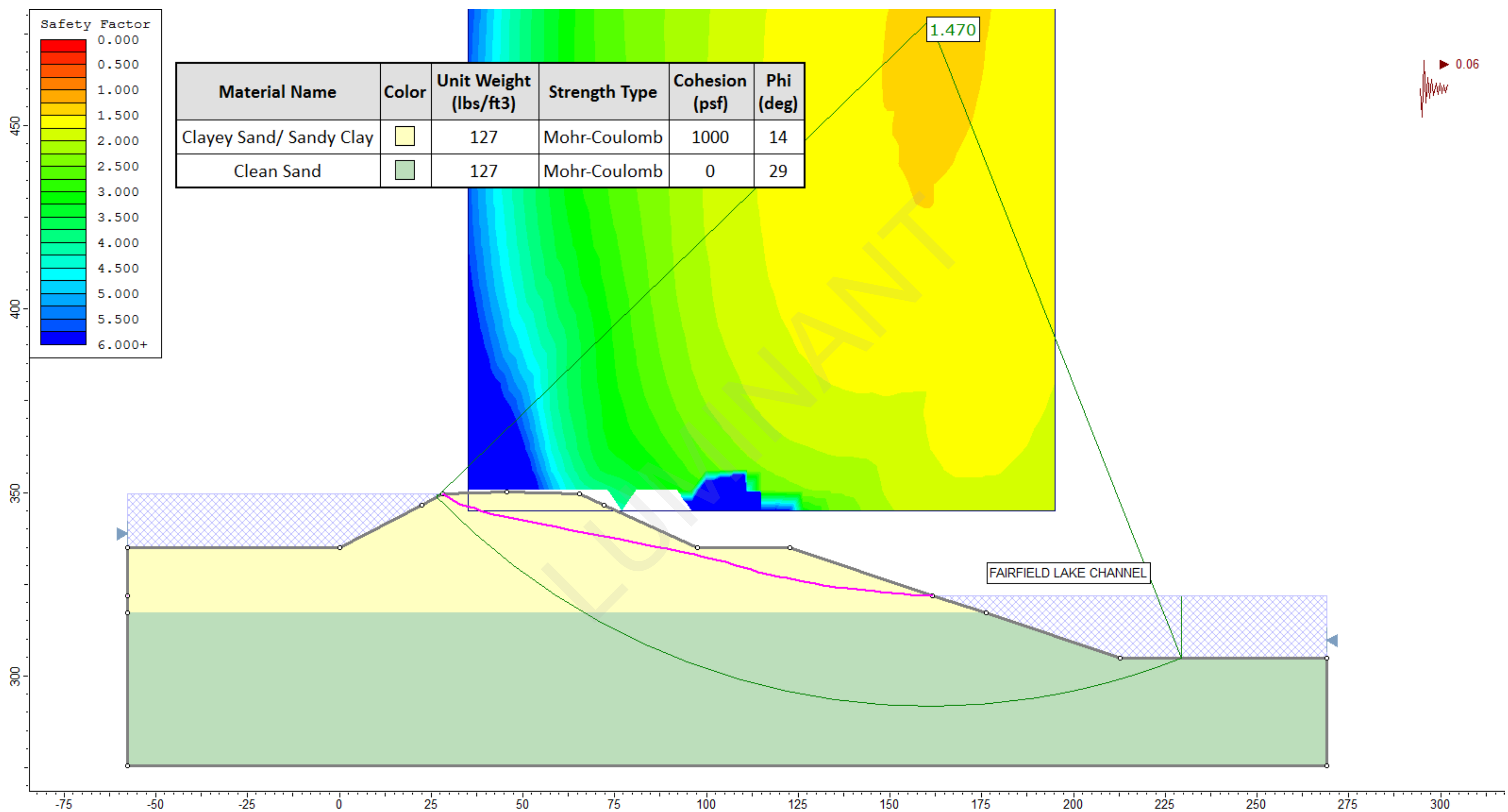


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.3**

Results of Stability Analysis – BAP: A–A' – Case 2a

Stability and Safety Factor Assessment, Big Brown SES

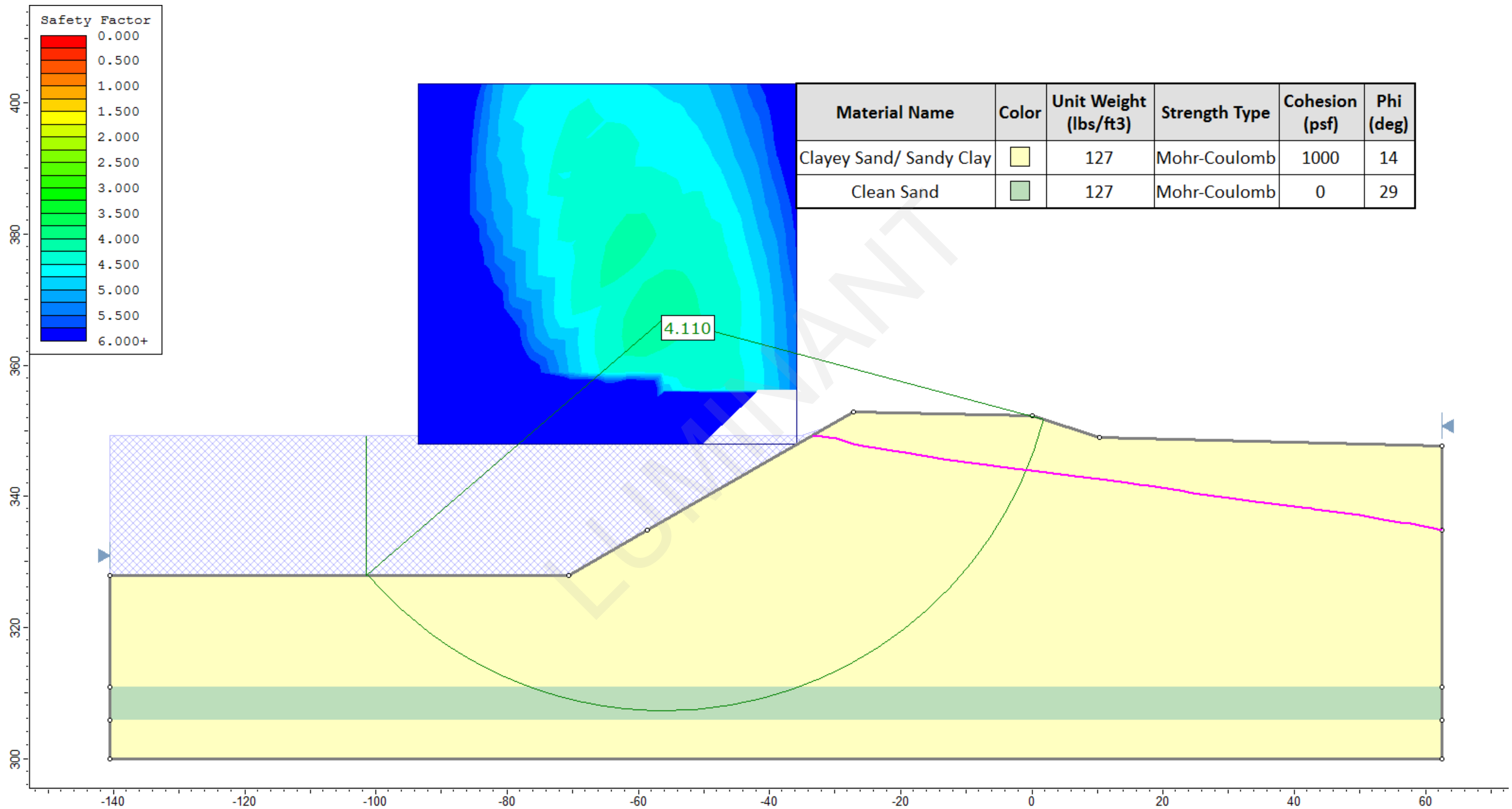


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.4**

Results of Stability Analysis – BAP: A–A' – Case 2b

Stability and Safety Factor Assessment, Big Brown SES

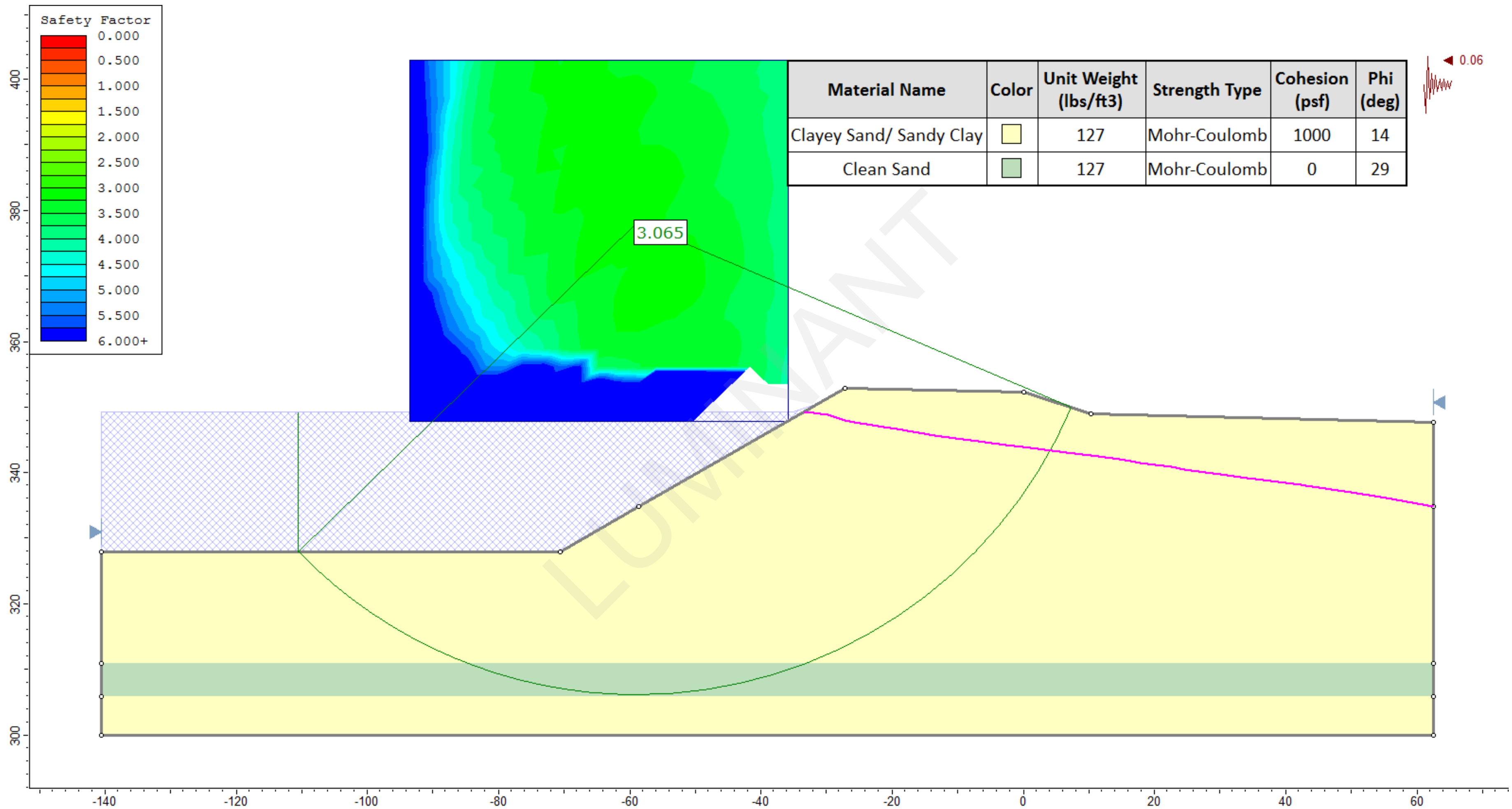


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.5**

Results of Stability Analysis – BAP: B–B' – Case 3a

Stability and Safety Factor Assessment, Big Brown SES

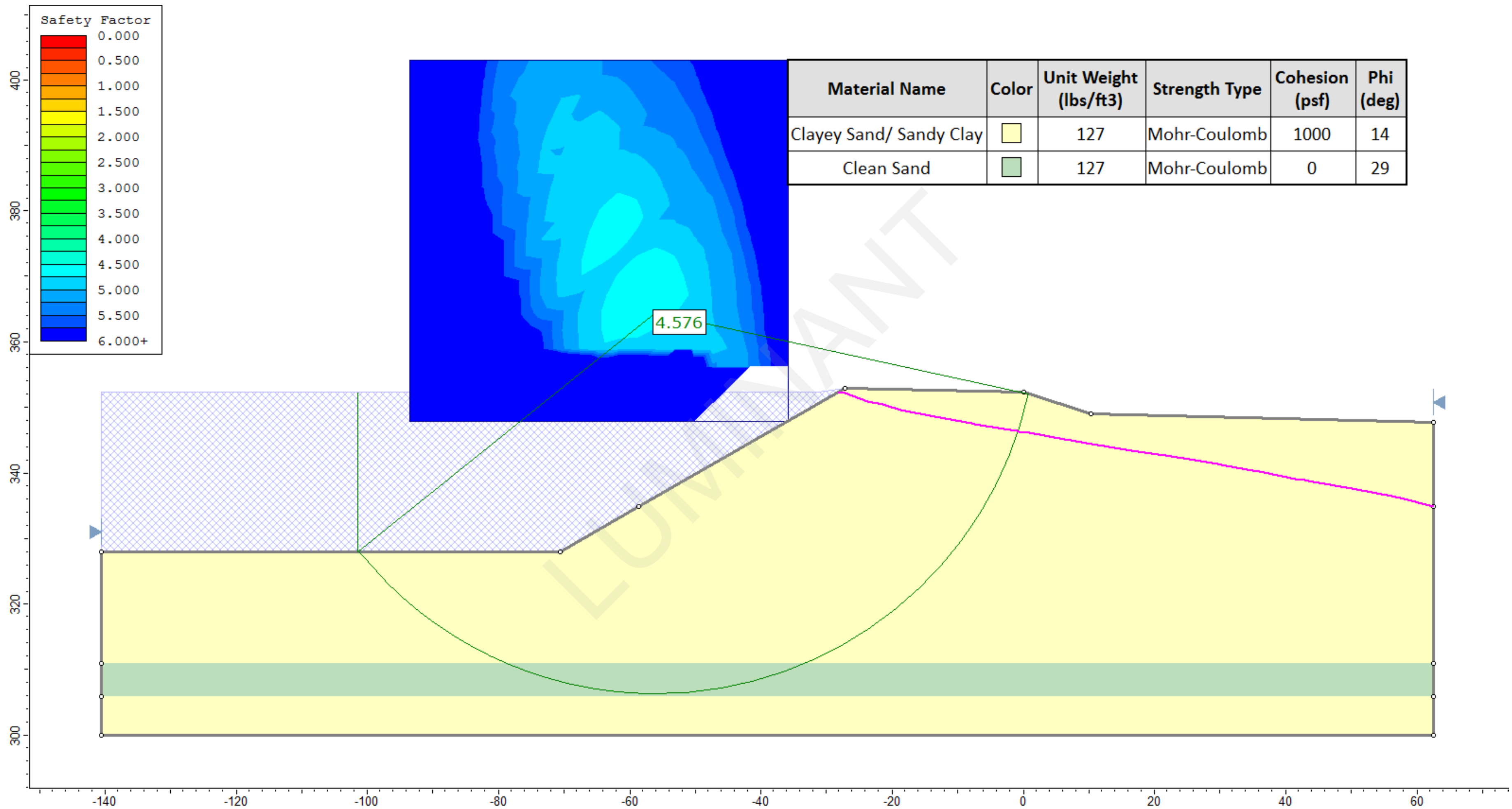


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.6**

Results of Stability Analysis – BAP: B–B' – Case 3b

Stability and Safety Factor Assessment, Big Brown SES



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	Mohr-Coulomb	1000	14
Clean Sand		127	Mohr-Coulomb	0	29

FIGURE **D.7**

Results of Stability Analysis – BAP: B–B' – Case 4a

Stability and Safety Factor Assessment, Big Brown SES

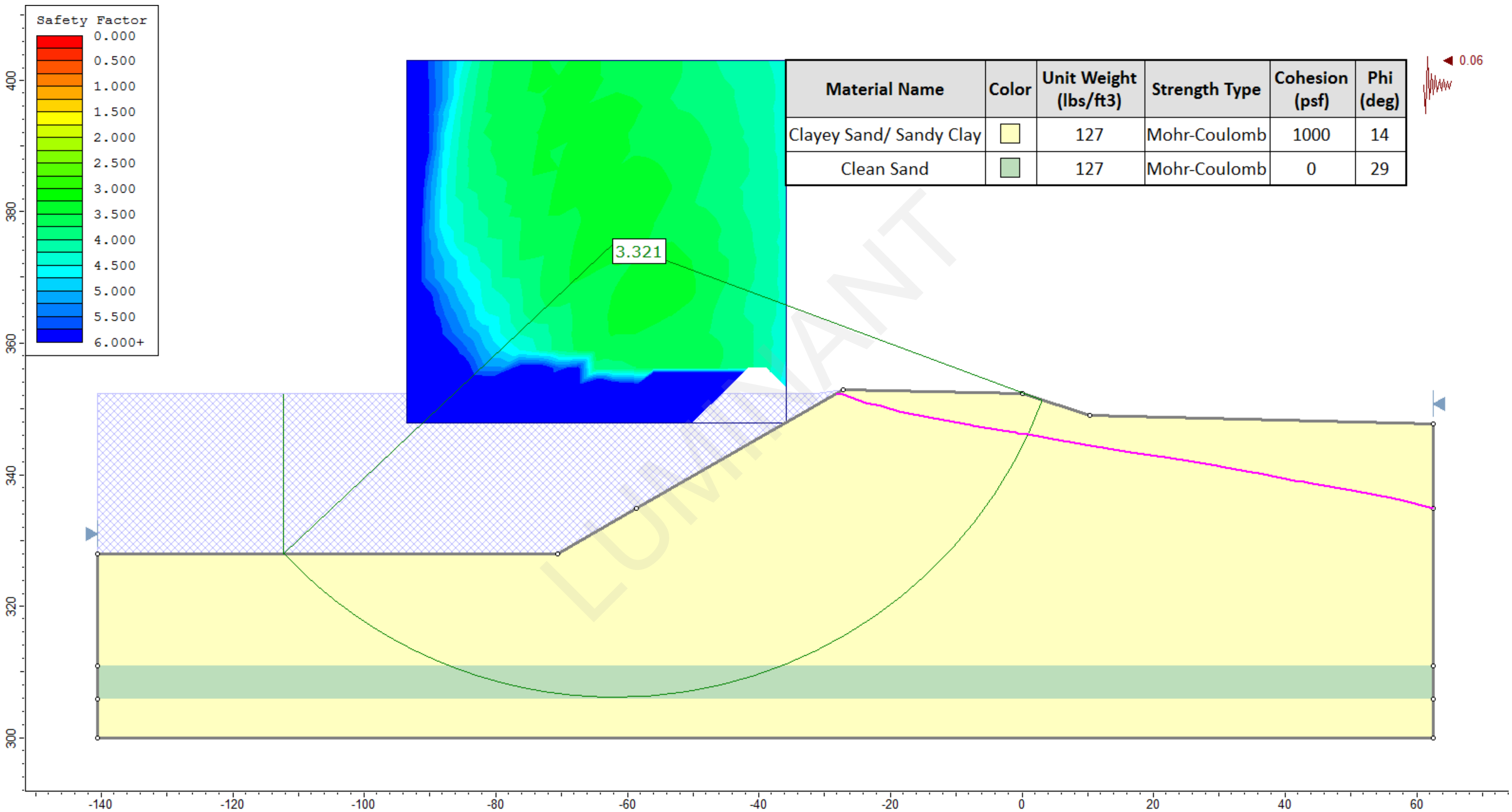
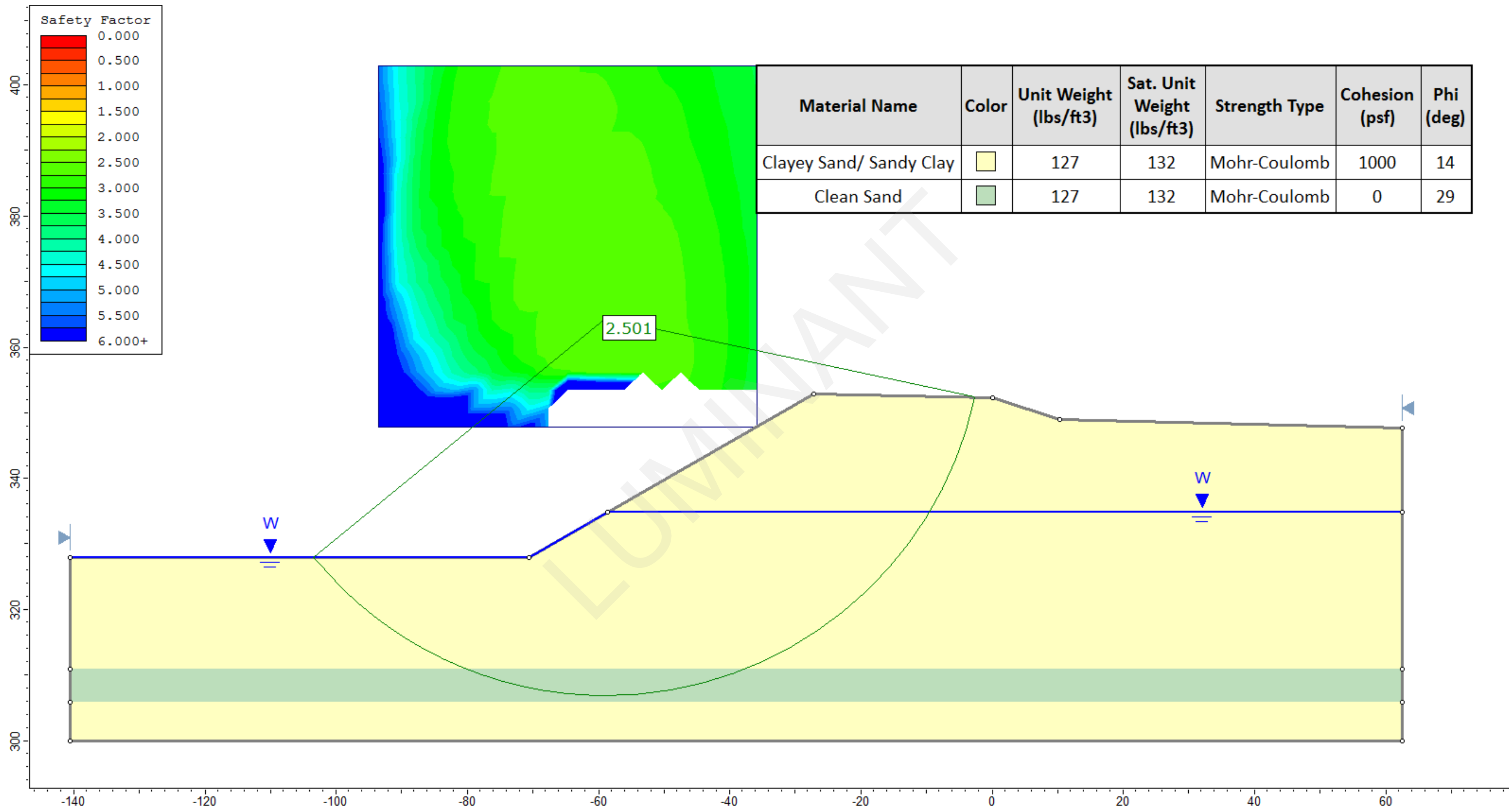


FIGURE **D.8**

Results of Stability Analysis – BAP: B–B' – Case 4b

Stability and Safety Factor Assessment, Big Brown SES

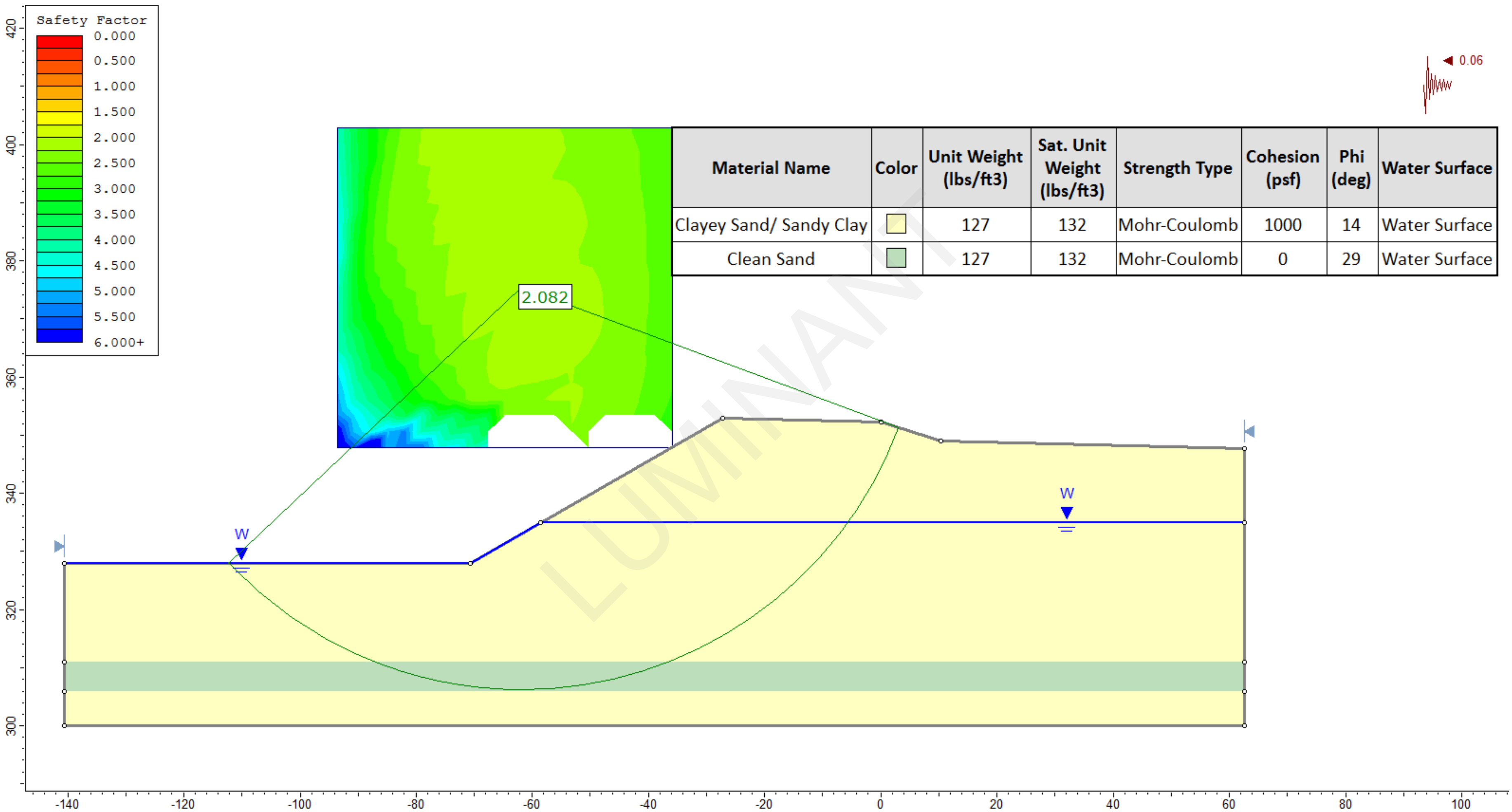


Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand/ Sandy Clay		127	132	Mohr-Coulomb	1000	14
Clean Sand		127	132	Mohr-Coulomb	0	29

FIGURE **D.9**

Results of Stability Analysis – BAP: B–B' – Case 5a

Stability and Safety Factor Assessment, Big Brown SES



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Clayey Sand/ Sandy Clay		127	132	Mohr-Coulomb	1000	14	Water Surface
Clean Sand		127	132	Mohr-Coulomb	0	29	Water Surface

FIGURE **D.10**

Results of Stability Analysis – BAP: B–B' – Case 5b

Stability and Safety Factor Assessment, Big Brown SES

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