REPORT

Dam Safety Assessment of CCW Impoundments

Luminant Generation Co., LLC/MONTICELLO STEAM ELECTRIC STATION

United States Environmental Protection Agency
Washington, DC

June 3, 2014

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13498/46122

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Prepared for:
US Environmental Protection Agency
Washington, DC

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1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of CCW impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations.

The U.S. EPA has authorized O'Brien & Gere to provide site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of BPA# EP10W000673, Order EP-B12S-00065, dated July 18, 2012.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit (or shortly thereafter) to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.

- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the Monticello Bottom Ash Pond and Scrubber Pond Management Units at the Luminant Power Monticello Steam Electric Station near Mount Pleasant, TX. This power generation facility is owned and operated by Luminant Generation Co., LLC (Luminant). In the course of this assessment, O'Brien & Gere obtained information from Luminant representatives.

2. PROJECT/FACILITY DESCRIPTION

The Monticello Steam Electric Station (SES) is located near Mt. Pleasant, Titus County, Texas (see Figure 1 for location plan). The generating facility has three units; two at 610 megawatts and one at 850 megawatts for a combined capacity of 2,070 MW. Unit 1 began operation in 1974, Unit 2 became operational in 1975, and Unit 3 became operational in 1978. The plant burns lignite obtained from a Luminant-owned mine located near the Monticello SES along with coal imported from the Powder River Basin.

All fly ash generated at the facility is handled in a dry manner. It is collected through electrostatic precipitators and pneumatically conveyed to silos. It is transported off site via rail cars. Other CCW is handled in “hydrobins” or dry handled at the Monticello SES. Water is used to quench and transport the waste after burning the coal but the waste is not sluiced to the CCW impoundment. Rather, the CCW is separated from the transport water and sent to landfills or sold at approximately 5% moisture content. The transport water, which contains small amounts of CCW, is returned to the Bottom Ash Pond. Water is pumped from the impoundment to the plant for and reused for transport. The Scrubber Pond receives excess wastewater from the facility’s flue gas desulphurization (FGD) system wet scrubber blowdown.

The ponds are covered by a Texas State Pollutant Discharge Elimination System (TPDES) permit (Permit No. WQ0001528000). There is, however, no discharge structure from the ponds and site personnel indicate that, due to evaporation and water management, the ponds have never discharged any of their contents.

2.1 MANAGEMENT UNIT IDENTIFICATION

The Bottom Ash Pond is located southeast of the generating facility (see Figures 1 and 2), has three hydraulically connected ponds or cells that receive CCW and an adjacent pond which collects stormwater runoff from the facility. This “Runoff Collection Pond” is not hydraulically connected to the CCW impoundment. The Bottom Ash Pond was originally constructed in 1974.

The three ponds have been referred to as the Northeast Ash Settling Pond, the West Ash Settling Pond, and the Southwest Ash Settling Pond by site personnel. However, for the purposes of this report, the identifying names used in a 2012 stability analysis report for the CCW impoundment will be used. These names are: Settling Pond (Northeast); North Pond (West); and South Pond (Southwest). The locations of the Ponds are presented on Figure 2. As shown on Figure 2, the Settling Pond forms the northeast quadrant of the Bottom Ash Pond. It is hydraulically connected only to the North Pond which forms the northwest quadrant of the Bottom Ash Pond. The North Pond is, in turn, hydraulically connected only to the South Pond which forms the southwest quadrant of the Bottom Ash Pond. Discharge from the SES is directed only into the Settling Pond. A chute in the dividing dike between the Settling Pond and the North Pond permits water to move from the Settling Pond into the North Pond. A chute in the dividing dike between the North Pond and the South Pond permits water to move from the North Pond into the South Pond. The total impoundment area of the Bottom Ash Pond is approximately 22 acres. A site plan is provided as Figure 2.

The Scrubber Pond is located south of the Bottom Ash Pond. It was designed in 1996, but its completion date was not presented in the available data. The total impoundment area of the Scrubber Pond is approximately 1.4 acres. Its location is also shown on Figures 1 and 2.

2.2. HAZARD POTENTIAL CLASSIFICATION

The State of Texas classifies dams or embankments in accordance with Title 30 Texas Administrative Code (TAC), Chapter 299, Dams and Reservoirs. The regulations are administered by the Texas Commission on Environmental Quality (TCEQ), Texas Dam Safety Program. The TCEQ Dam Safety program regulations apply to “*design, review, and approval of construction plans and specifications; and construction, operation and maintenance, inspection, repair, removal, emergency management, site security, and enforcement of dams that:*

1. *have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet, as described in paragraph (2) of this subsection;*
2. *have a height greater than 6 feet and a maximum storage capacity greater than or equal to 50 acre-feet;*
3. *are a high- or significant-hazard dam as defined in §299.14 of this title (relating to Hazard Classification Criteria), regardless of height or maximum storage capacity; or*
4. *are used as a pumped storage or terminal storage facility.*

Dam and embankment hazard classifications are established by 30 TAC §299.14 and provide standards regarding impoundment facility structure classification:

> *The executive director shall classify dams for hazard based on either potential loss of human life or property damage, in the event of failure or malfunction of the dam or appurtenant structures, within affected developments, that are existing at the time of the classification. The hazard classification may include use of a breach analysis that addresses the incremental impact of the potential breach over and above the impact of the flood that may have caused the breach, as defined in §299.15(a)(4)(A)(i) of this title (relating to Hydrologic and Hydraulic Criteria for Dams). The classification must be according to the following.*
>
> *(1) Low. A dam in the low-hazard potential category has:*
> *(A) no loss of human life expected (no permanent habitable structures in the breach inundation area downstream of the dam); and*
> *(B) minimal economic loss (located primarily in rural areas where failure may damage occasional farm buildings, limited agricultural improvements, and minor highways as defined in §299.2(38) of this title (relating to Definitions)).*
> *(2) Significant. A dam in the significant-hazard potential category has:*
> *(A) loss of human life possible (one to six lives or one or two habitable structures in the breach inundation area downstream of the dam); or*
> *(B) appreciable economic loss, located primarily in rural areas where failure may cause:*
> *(i) damage to isolated homes;*
> *(ii) damage to secondary highways as defined in §299.2(58);*
> *(iii) damage to minor railroads; or*
> *(iv) interruption of service or use of public utilities, including the design purpose of the utility.*
> *(3) High. A dam in the high-hazard potential category has:*
> *(A) loss of life expected (seven or more lives or three or more habitable structures in the breach inundation area downstream of the dam); or*
> *(B) excessive economic loss, located primarily in or near urban areas where failure would be expected to cause extensive damage to:*
> *(i) public facilities;*
> *(ii) agricultural, industrial, or commercial facilities;*
> *(iii) public utilities, including the design purpose of the utility;*
> *(iv) main highways as defined in §299.2(33); or*

(v) railroads used as a major transportation system.

The TCEQ Dam Safety Program currently does not regulate the Bottom Ash or Scrubber Pond and, therefore, Hazard Potentials have not been previously designated. In the absence of a state-assigned classification, the FEMA guidelines, *Hazard Potential Classification System for Dams* (2004) have been applied in this assessment to recommend a hazard potential classification for the impoundment. The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A.

Based on site evaluation, both units are considered **Low** Hazard Potential. This classification assumes that no probable loss of human life and low economic and/or environmental losses would occur in the event of a dam failure. The area that would potentially be inundated by a breach of any embankment of the Bottom Ash Pond is limited to property owned by Luminant. The potential exists for some discharge to reach the Monticello Reservoir, which is also owned by Luminant. The Reservoir provides cooling water for the Monticello SES and is used for recreation, but is not a water supply reservoir. It is located adjacent to Lake Bob Sandlin, which is used for municipal and industrial water supply and for recreation. Water can be pumped from Lake Bob Sandlin Reservoir into the Monticello Reservoir and water can be mechanically released from the Monticello Reservoir to Bob Sandlin Reservoir. The Monticello Reservoir has a reported storage volume of 35,000 acre feet. The volume of water and CCWs impounded in the Bottom Ash and Scrubber Ponds is approximately 380 acre-feet. Thus, the quantity of a release from an embankment breach would represent approximately 1% of total available reservoir storage and the environmental damage would be limited to the adjacent area in the southern end of the reservoir.

2.3. IMPOUNDING STRUCTURE DETAILS

The following sections summarize the structural components and basic operations of the subject impoundments. The location of the impoundments on the plant grounds is shown on Figure 2.

2.3.1. Embankment Configuration

As indicated above, the Bottom Ash Pond is comprised of three smaller ponds or cells. All cells are impounded by earthen embankments constructed above grade and are separated by dividing dikes. Concrete sluices through the dividing dikes connect the ponds hydraulically. The total embankment length is approximately 4,630 linear feet (lf) and the combined storage of the Bottom Ash Pond is approximately 375 acre-feet (ac-ft). The embankment crest design elevation is EL. 386.5, the interior toe design elevation is EL. 361.0, and the elevation of the exterior toe varies according to drawings provided by Luminant. A breakdown of embankment lengths and storage by pond is provided in Table 2.1 below:

Table 2.1 *Summary of Embankment Lengths and Pond Storage*

Pond	Embankment ID	Length (ft.)	Notes
Settling Pond	Northern	490	
	Eastern	475	
	Southern	475	Forms Dividing Dike to Runoff Collection Pond
	Western	480	Forms Dividing Dike to North Pond
	Storage	100 ac.-ft.	
North Pond	Northern	475	
	Eastern	625	Forms Dividing Dike to Settling Pond
	Southern	475	Forms Dividing Dike to South Pond
	Western	620	
	Storage	130 ac.-ft.	
South Pond	Northern	475	Forms Dividing Dike to North Pond
	Eastern	825	Forms Dividing Dike to Runoff Collection Pond
	Southern	245	
	Western	910	Distance includes curvature
	Storage	145 ac.-ft.	
Scrubber Pond	Northern	190	
	Eastern	430	
	Southern	175	
	Western	350	
	Storage	8 ac.-ft.	

The drawings also indicate that the inboard slope of the Bottom Ash Pond embankment is approximately 2.5 horizontal to 1 vertical (2.5H:1V) and the outboard slope is approximately 3H:1V. The inboard faces have a clay liner approximately three feet thick. A 4" thick concrete revetment mat was installed over the clay liner within the Settling Pond and over the clay liner on the dividing dike between the Settling Pond and the North Pond. The outboard toe varies in elevation with the natural ground, low-point elevations are not provided on the drawings. There is no discharge from the pond; water is either evaporated or pumped to the steam electric station to be recycled.

The crest elevation of the Scrubber Pond is EL. 384.0 and the interior floor elevation is EL. 371.0, according to the provided documentation. The elevation of the outboard toe varies. The design slope is shown as 2.5H to 3H:1V on the Design Drawings. The constructed slope appears to be approximately 3H:1V, based on a visual inspection of the impoundment. The inboard face of the Scrubber Pond is covered with a 100-mil HDPE liner.

2.3.2. Type of Materials Impounded

Bottom ash, which is conveyed in small amounts in transport water after attempts to remove it in the hydrobins, is the principal product stored in the Bottom Ash Pond. FGD scrubber waste is the primary material that is impounded in the Scrubber Pond. Minor amounts of fly ash and other combustion by-products should be expected to be found in the ponds as well.

2.3.3. Outlet Works

The Bottom Ash and Scrubber Ponds do not have functioning outlet works. Luminant reported that pumps are used to draw water from the impoundments as needed. A concrete chamber located south of the South Pond was originally installed to allow discharge from the Bottom Ash Pond. Flow into the chamber was designed to be controlled by a valve housed in the South Pond. The valve is accessed via a walkway (see Photo 2). This system has reportedly never been used.

3. RECORDS REVIEW

3.1. GENERAL

A review of the available records related to design, construction, operation and inspection of the Bottom Ash and Scrubber Ponds was performed as part of this assessment. The documents provided by Luminant are listed below:

Table 3.1 *Summary of Documents Reviewed*

Document	Dates	By	Description
Texas Utilities Services, Inc. Monticello Steam Electric Station Geotechnical Investigation, Scrubber Pond	November, 1980	NFS/National Soil Services, Inc.	Subsurface investigation related to the original scrubber pond (now drained and out of service)
Contract Drawing: Monticello S.E.S. Operating Scrubber Pond	July 29, 1981	Texas Utilities Generating Co	Dwg. TUSI MO-2308 Sections, Notes and Details related to construction of operating scrubber pond
Geologic Investigation of the Monticello Steam Electric Station "West" Bottom Ash Pond	April 1985	Cook-Joyce, Inc.	Subsurface investigation of the original "West" Bottom Ash Pond
Contract Drawing: Monticello S.E.S. Bottom Ash Pond Modification. Embankment Cross Sections	December 11, 1989	Texas Utilities Generating Co	As-Built Dwg. No. 129-1009-301-01 Rev. 1 Sections and details for placement of clay liner within the Bottom Ash Pond
Contract Drawing: Monticello Steam Electric Station. Ash Disposal System. Gen Plan & Misc Det's	May 18, 1992	Ebasco Services Inc., New York	INDG-9788 G-672 As-Built PID 129-1423 Plan view of Bottom Ash Pond with proposed dividing dike. ASSUMED TO BE LATER MODIFICATIONS SHOWN ON A 1985 DRAWING RELATED TO DIVIDING THE WESTERN POND
Contract Drawings: Monticello S.E.E. Units 1, 2 & 3. Runoff Collection Pond Intake Structure. Plan, Sections & Details	May 18, 1992	Ebasco Services Inc., New York	DWG. No. 129-1423-302, Sh. 01, Rev. As-Built PID 129-1423, T#10657 Structural details for construction of intake structure
Contract Drawings: Monticello S.E.E. Units 1, 2 & 3. Ash Pond Sections & Details	May 18, 1992	Ebasco Services Inc., New York	DWG. No. 129-1423-302, Sh. 02, Rev. 3 As-Built PID 129-1423, T#10657 Sections and details for placement of concrete revetment matting within the Bottom Ash Pond

Document	Dates	By	Description
Contract Drawings: Monticello S.E.S. – Unit 3. Construct New Operating Scrubber Pond	June 4 & 5, 1996	TU Electric	Dwg. No. 123-2174-302 Sht. No. 01 – Plan and Sections Dwg. No. 123-2174-303 Sht. No. 01 – Plan and Sections Dwg. No. 123-2174-303 Sht. No. 02 – Leachate Sump Details Plan, Sections, Notes and Details related to construction of the new Operating Scrubber Pond
Monticello S.E.S. Unit 3 - Flow Diagram New Scrubber Pond Piping	Unknown	TU Electric	Dwg. No. 123-2174-401
Critical Impoundment Inspection Report for Monticello SES	March 29, 2011	Luminant	Report of annual inspection of the Bottom Ash and Scrubber Pond
Critical Impoundment Inspection Report for Monticello SES	April 26, 2012	HDR Engineering	Report of annual inspection of the Bottom Ash and Scrubber Pond
Flow Diagrams	Unknown	Luminant	Flow diagrams for Bottom Ash Pond and Scrubber Pond
Ash and Scrubber Pond Stability Investigation Report	December 2012	Golder Associates	Subsurface investigation and slope stability analyses for the Bottom Ash and Scrubber Ponds
Addendum to Ash and Scrubber Pond Stability Investigation Report	March 11, 2014	Golder Associates	Updated/revised subsurface investigation and slope stability analyses for the Bottom Ash and Scrubber Ponds

3.2. DESIGN DOCUMENTS

3.2.1. General

Review of the available drawings and reports revealed the following:

- The Bottom Ash Pond was originally constructed in 1974 as a two-basin system. It is known that one basin was referred to as the "West Basin", the name of the other basin was not provided. Additionally, it is not known if the Runoff Basin was constructed at this time.
- No documentation related to foundation preparation for the original embankment construction was provided.
- The "West Basin" appears to have been split into the North and South Ponds in 1989.
- The Bottom Ash and Scrubber Pond embankments are constructed of sandy clay/clayey sand, presumably from an on-site borrow area.
- The original Scrubber Pond was constructed in 1989 and the "New" Scrubber Pond was designed in 1996. The completion date of the "New" Scrubber Pond is not presented in the available data.
- No breach or overtopping event of either impoundment has been reported.

3.2.2. Stormwater Inflows

No hydrologic & hydraulic analyses have been conducted to evaluate stormwater inflow to the Bottom Ash or Scrubber Ponds. However, the impounding structures are above-grade on all sides except for the west side of the Scrubber Pond, therefore, storm runoff is limited to direct precipitation on the impoundments. Available volume provided by the normal operating freeboard is sufficient to contain a 24-hour, 100-year storm without overtopping the embankments. The 24-hour, 100-year rainfall at the site presented in Technical Paper 40 (TP-40) is approximately ten (10) inches and the generally-available freeboard is approximately three and a half (3.5) feet. Thus, the Ponds have the capacity to handle approximately 4 times the 100-year rainfall before the impoundments would be overtopped.

3.2.3. Stability Analyses

O'Brien & Gere reviewed the December 2012 Golder Associates (Golder) "Ash and Scrubber Pond Stability Investigation Report" as part of the investigation of the CCW impoundment at the Monticello Steam Electric Station. This report documents the stability analyses for the scrubber pond and the three cells of the bottom ash ponds. One cross-section, representing the existing conditions for each of the four ponds (identified as the North, South, Settling, and Scrubber Ponds), was analyzed using the slope stability software program SLIDE, version 6.019. The load cases analyzed include long term and short term steady-state seepage under both the "empty pond" and "full pond" conditions. Rapid drawdown and short term "empty pond" under seismic loading were also analyzed. All load cases analyzed were performed on the inboard slopes. The Golder stability report is included in Appendix C.

An addendum to the above Golder report dated March 11, 2014 was submitted to address some of the questions raised during the review of the December 2012 report, and presented in the draft assessment report. The March 2014 Addendum included stability analyses of the exterior slopes of all ponds at full pool, which were the missing load cases in the December 2012 report.

Soil shear strength parameters used in the slope stability analyses were based on a combination of laboratory testing and information obtained during the field (sampling) program. The vast majority of the fine-grained soils were sampled with pushed thin-walled steel Shelby tubes. The coarse-grained soils and a few fine-grained soil samples were obtained using Standard Penetration Tests (SPT). Selected samples were tested for grain-size analysis, Atterberg Limits, and natural moisture content. In addition, unconsolidated-undrained (UU) and consolidated-undrained (CU) triaxial compression tests were performed on undisturbed samples. The soil properties utilized for the slope stability analyses are presented in Table 3.2.

Table 3.2 *Soil Material Properties*

Location	Stratum	Description	γ_{moist} (pcf)	$\gamma_{saturated}$ (pcf)	Undrained Shear Strength		Drained Shear Strength	
					C (psf)	ϕ (°)	C (psf)	ϕ (°)
Settling Pond	I	Sandy Clay / Clayey Sand	127	132	1400	0	1000	14
North and South Pond	I	Sandy Clay / Clayey Sand	127	132	2000	0	1300	18
	II	Sand	120	125	0	30	0	30
Scrubber Pond	I	Sandy Clay / Clayey Sand	127	132	1500	0	1000	14

Based on review of the stability investigation report, it is unclear how the provided shear strength parameters (both undrained and drained) were assumed. A minimum of two specimens of the same soil, but typically three or more, must be performed at different confining pressures on each specimen for the UU tests. Similarly, a minimum of two specimens of the same soil, but typically three or more, must be performed at different consolidation stresses on each specimen for the CU tests. Multiple specimens tested at differing confining or consolidation pressures are necessary to develop Mohr strength envelopes. All of the samples presented in Appendix C of the stability investigation report were only sheared at one confining or consolidation pressure. Therefore, it is unclear how the triaxial compression tests aided in the development of the shear strength parameters. This question was not addressed in the March 2014 Addendum; however, after reviewing the laboratory and field testing data, the assumed strength parameters appear to be reasonable.

Table 3.3 below provides a summary of the minimum computed factors of safety for slope stability of the four ponds:

Table 3.3 *Summary of Minimum Computed Factors of Safety for Slope Stability*

Location	Case	Description	Factor of Safety
Settling Pond	1	North Slope; Empty Pond; Undrained Conditions	2.8
	2	North Slope; Empty Pond; Drained Conditions	3.2
	3	North Slope; Full Pond; Undrained Conditions	5.7
	4	North Slope; Full Pond; Drained Conditions	7.3
	5	North Slope; Rapid Drawdown	2.8
	6	North Slope; Empty Pond; Undrained Conditions under Seismic Loading	2.2
North Pond	7	North Slope; Empty Pond; Undrained Conditions	3.8
	8	North Slope; Empty Pond; Drained Conditions	3.4
	9	North Slope; Full Pond; Undrained Conditions	8.5
	10	North Slope; Full Pond; Drained Conditions	8.7
	11	North Slope; Rapid Drawdown	3.0
South Pond	12	West Slope; Empty Pond; Undrained Conditions	3.3
	13	West Slope; Empty Pond; Drained Conditions	3.1
	14	West Slope; Full Pond; Undrained Conditions	8.5
	15	West Slope; Full Pond; Drained Conditions	8.2
	16	West Slope; Rapid Drawdown	2.3
Scrubber Pond	17	South Slope; Empty Pond; Undrained Conditions	4.1
	18	South Slope; Empty Pond; Drained Conditions	4.1
	19	South Slope; Full Pond; Undrained Conditions	6.7
	20	South Slope; Full Pond; Drained Conditions	5.6
	21	South Slope; Rapid Drawdown	3.5
Slope Stability Results Presented in March 11, 2014 Addendum:			
Settling Pond	22	North Exterior Slope, Full Pond; Undrained Conditions	4.7
	23	North Exterior Slope, Full Pond; Drained Conditions	5.2
South Pond	24	East Exterior Slope, Full Pond, Undrained Conditions	3.6
	25	East Exterior Slope, Full Pond, Drained Conditions	3.4

The results of the slope stability analyses indicated that the computed factors of safety exceed the minimum standard set by Golder (Factor of Safety = 1.5) for all load cases.

Pseudostatic slope stability analysis was performed for the critical slope section of the Settling Pond. The results of this analysis indicated that the embankment has a factor of safety of 2.2 for the 2,500-year return period earthquake. The Golder report stated that the site soils were considered not susceptible to liquefaction based on the soil, site, and seismic conditions. The basis for this determination was not presented in the report; however, it is standard practice to perform a cursory liquefaction susceptibility screening as part of this assessment.

3.2.4. Summary of Design Modifications

The 1985 "Geologic Investigation of the Monticello Steam Electric Station "West Bottom Ash Pond" by Cook-Joyce, Inc. (CJI), 1985, and the 1985 and 1992 Ebasco Contract Drawings indicate that the current North and South Ponds were originally one pond referred to as the "West Bottom Ash Pond". The Contract Drawings represent the only information related to the division of the West Bottom Ash Pond provided by Luminant. The "New" Scrubber Pond was designed in 1996, but the Pond's construction time frame is not known. The "New" Pond replaced the previous pond located directly south of the "New" structure.

3.2.5. Instrumentation

Instrumentation at the site is limited to a staff gage located on the access walkway to the non-functioning outlet control valve in the South Pond.

3.3. PREVIOUS INSPECTIONS

Two previous inspection reports were provided by Luminant. The report dated March 2011 was prepared by Luminant and the April 2012 report was prepared by HDR Engineering Inc. Inspection reports from 2009 and 2010 were referenced in the 2011 and 2012 reports, but were not provided. Similar issues related to the embankments were noted in the two reports. These include minor rutting on the crests, animal burrows on the outboard faces and near the toe, and an apparent slide of the outboard face of the West Pond embankment at the northwest corner. The condition of the slide was noted as being stable throughout the years it was inspected.

3.4. OPERATOR INTERVIEWS

Numerous plant personnel took part in the inspection proceedings along with a representative of the United States Environmental Protection Agency (USEPA). The following is a list of participants for the September 2012 assessment of the Bottom Ash and Scrubber Ponds:

Table 3.4 *Personnel Present at the Assessment of the Monticello SES CCW Impoundments*

Name	Affiliation
Jim Barton	Luminant
George Sanford	Luminant
Mark Kelly	Luminant
Jeff Jones	Luminant
Pat Marshall	Luminant
Joe Griffin	Luminant
Gary Spicer	Luminant
Golam Mustafa, PhD	USEPA
Robert C. Ganley, PE	O'Brien & Gere
Johan Anestad, PE	O'Brien & Gere

Facility personnel provided a good working knowledge of the CCW impoundments, provided general plant operation background and provided requested historical documentation. These personnel also accompanied O'Brien & Gere and the USEPA representative throughout the visual inspections to answer questions and to provide additional information as needed in the field.

3.5. SITE GEOLOGY

The 1980 and 1985 reports provide descriptions of the underlying site geology. The reports state that the Wilcox Group is the principal exposed bedrock unit in the site area. The Wilcox Group is reportedly composed of "interbedded sand, silt, silty shale, clay and lignite". This description is borne out by the results of the various subsurface investigations of the embankments and foundations. It also indicates that local borrow materials were used to construct the embankments.

4. VISUAL ASSESSMENT

4.1. GENERAL

A visual assessment of the Bottom Ash Pond and the Scrubber Pond was performed on September 18, 2012. The individuals listed in Table 3.3 were present during the assessment.

The weather on the date of the assessment was sunny and approximately 70 degrees. A field checklist prepared by O'Brien & Gere to summarize the visual assessment is included as Appendix A. Photographs were taken by both Luminant and O'Brien & Gere. Pertinent photos taken by O'Brien & Gere are included as Appendix B.

4.2. SUMMARY OF FINDINGS

Prior to the visual assessment, staff from Luminant provided an overview of the facility operation, including the method of fly ash handling with the help of the flow diagrams listed in Table 3.1. The fly ash is handled in a dry manner and only trace amounts are discharged to the Bottom Ash Pond. Transport water discharge from the Steam Electric Station is directed to the Settling Pond and flows from there to the North and South Ponds via chutes through the dividing dikes. During the visual inspection of the Bottom Ash Pond, the full length of the crest and outboard faces of the embankment were walked and representative features observed. The following observations were made during the assessment:

Settling Pond

- Sluice water enters the pond through inflow pipes located above the water line on the northern embankment.
- Erosion gullies were observed on the northern embankment.
- The concrete revetment on the inside slopes of the pond has cracked in the southeast corner.
- Some water is retained in the Runoff Collection Pond located to the south of the Settling Pond at the toe of the southern embankment.
- Evidence of prior releases, failures or patchwork of the impoundment was not observed.

North Pond

- Inflow to the pond is limited to flow from the Settling Pond through sluices in the dividing dike.
- Small (6-12") riprap is visible on the inboard slopes of the embankment. The riprap is not shown on the available design drawings.
- Some erosion was observed beneath the pipes located on the west side of the western embankment. This erosion has been noted previously.
- Minor sloughing/sliding was observed near the toe of the western embankment.
- The outboard slope of the northwest corner of the northern embankment appears to be steeper than the design slope of 2.5H:1V. Additionally, sliding, sloughing or possibly excavation of the embankment material was observed. Luminant representatives noted that additional fill may have been placed against the original embankment along the north side of the North and Settling Ponds and the material movement could be within the additional fill, not the embankment. The slide/slough was noted in the previous inspection reports.
- Signs of uneven settlement of the concrete revetment (grout-filled bags) were observed on the inboard slope of the eastern embankment (dividing dike to the Settling Pond).
- Minor erosion of the concrete revetment was observed near the crest at the southeast corner.

- Evidence of prior releases, failures or patchwork of the impoundment was not observed.

South Pond

- Inflow to the pond is limited to flow from the North Pond through the sluices in the dividing dike.
- Small (6-12") riprap is visible on the inboard faces of the embankment. The riprap is not shown on the available design drawings.
- Minor erosion was observed near the base of the access walkway that extends north from the southern embankment. A staff gage is located on the walkway.
- A gate operator is located at the north end of the access platform. The gate is reportedly inoperable.
- Some rutting was observed on the roadway on the embankment crest. The rutting is minor and has been noted in previous inspection reports.
- Minor erosion was observed on the outboard slope. This erosion has also been noted during previous inspections.
- Some water is retained in the Runoff Collection Pond located to the east of the South Pond at the toe of the eastern embankment.
- Evidence of prior releases, failures or patchwork of the impoundment was not observed.

FGD blowdown discharge from the Steam Electric Station is directed to the Scrubber Pond from decant basins through a pipe in the western embankment. During the visual inspection of the Scrubber Pond, the full length of the crest and outboard slopes of the embankment were walked and representative features observed. The following observations were made during the assessment:

Scrubber Pond

- A small amount of overflow from the decant basins enters the pond through a pipe in the western embankment.
- The HDPE liner appeared to be in good condition, with no signs of cracking observed.
- Evidence of prior releases, failures or patchwork of the impoundment was not observed.

5. CONCLUSIONS

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of Bottom Ash Pond and the Scrubber Pond is considered to be **SATISFACTORY**. Acceptable performance is expected; however, some deficiencies exist that require repair.

Minor deficiencies include the following:

- Minor erosion gullies on the northern embankment of the Settling Pond
- Sloughing/sliding of material on the outboard slope of the northern embankment of the North Pond.

6. RECOMMENDATIONS

Based on the findings of our visual assessment and review of the available historical documents for the Bottom Ash Pond and the Scrubber Pond, O'Brien & Gere recommended further evaluation of embankment stability and continued monitoring of the two sloughs noted in the inspection on the northern embankment of the Settling Pond and at the northwest corner of the northern embankment of the North Pond. The additional slope stability analyses were performed by Golder Associates and reviewed by O'Brien & Gere in 2014.

6.1. URGENT ACTION ITEMS

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dam in the near term.

6.2. LONG TERM IMPROVEMENT/MAINTENANCE ITEMS

- Monitor/repair erosion on the northern embankment of the Settling Pond
- Monitor/repair sloughs/slides at the northwest corner of the North Pond, unless an investigation indicates that this material was placed against the embankment post-construction and that the stability of the embankment is not dependant on any stabilizing effects of the fill.
- NOTE: Luminant noted in their comments on the Draft Assessment Report that these improvement/ maintenance items have been completed as part of their routine maintenance program.

6.3. MONITORING AND FUTURE INSPECTION

Daily visual inspections are reportedly performed and the results of annual detailed inspections have been recorded in inspection reports. Deficiencies noted during the annual inspections and in this CCW assessment report should be addressed in a timely manner to maintain dam integrity. Consideration should be given to development of an O&M Plan that would establish a firm schedule for operations, maintenance and inspection activities.

6.4. RECOMMENDED SCHEDULE FOR COMPLETION OF ACTION ITEMS

The facility should address any items noted during visual inspections in a timely manner, depending on the severity and location of the deficiency. The regular inspection schedule should be maintained.

6.5. CERTIFICATION STATEMENT

I acknowledge that the Bottom Ash Pond and Scrubber Pond management units referenced herein were personally assessed by me on September 18, 2012 and were found to be in the following condition:

SATISFACTORY

FAIR

POOR

UNSATISFACTORY

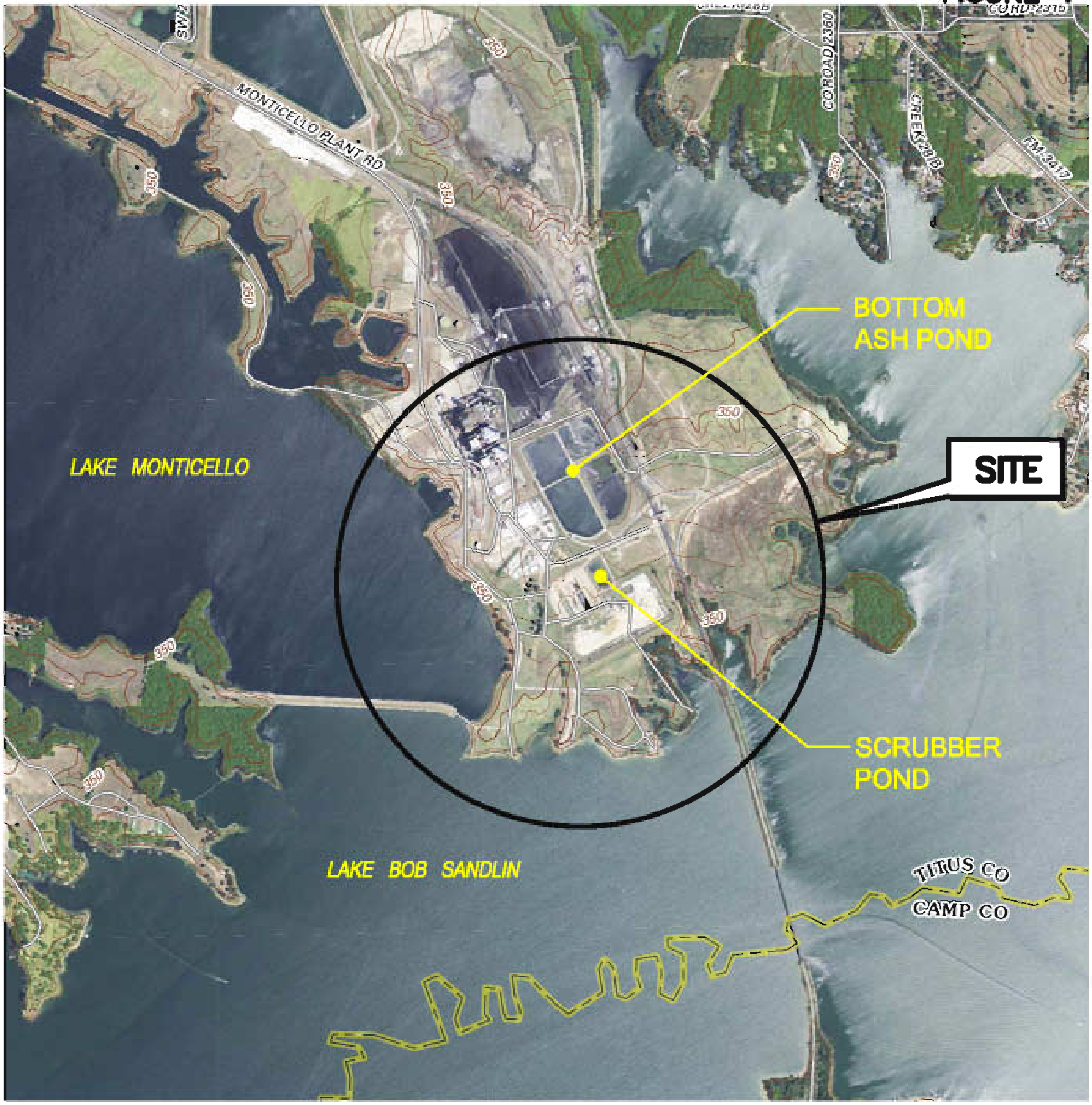
Signature: Robert Ganley   Date: June 3, 2014

Robert C. Ganley, PE
TX PE License # 67323

FIGURES

I:\US-EPA.13498\46122.ASSESS-OF-DAM-S\DOCS\DWG\SHEETS\46122-MONTICELLO-F01.DWG, 05/30/2014 12:37PM

FIGURE 1



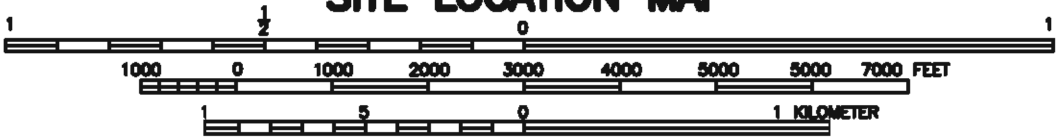
ADAPTED FROM: MONTICELLO QUADRANGLE, TEXAS U.S.G.S. 7.5 MIN. QUAD; 2013

QUADRANGLE LOCATION

US EPA
DAM SAFETY ASSESSMENT
OF CCW IMPOUNDMENTS

MONTICELLO STEAM ELECTRIC STATION
TITUS COUNTY, TEXAS

SITE LOCATION MAP



SCALE: 1:24000

46122-MONTICELLO-F01
MAY 2014

I:\US-EPA.13498\46122.ASSESS-OF-DAM-S\DOCS\DWG\SHEETS\46122-MONTICELLO-F02.DWG, 05/30/2014 12:32PM

FIGURE 2

① PHOTOGRAPH NUMBER AND ORIENTATION

US EPA
DAM SAFETY ASSESSMENT
OF CCW IMPOUNDMENTS
LUMINANT GENERATION CO., LLC
MONTICELLO STEAM
ELECTRIC STATION
TITUS COUNTY, TEXAS

SITE AERIAL PHOTOGRAPH AND PHOTOGRAPH LOCATION MAP

250 0 250
1"=250'

FILE NO. 13498.46122.F02
MAY 2014

O'BRIEN & GERE

APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Monticello Steam Electric Station
Date: September 18, 2012
Unit Name: SPD-4
Operator's Name: Luminant Power
Unit I.D.: Bottom Ash Pond - 3 Cells
Hazard Potential Classification: High Significant [✓ Low]
Inspector's Name: NJ Anestad, PE & RC Ganley, PE

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No
1. Frequency of Company's Dam Inspections?	Daily	
2. Pool elevation (operator records)?	378.0	
3. Decant inlet elevation (operator records)?	0.0	
4. Open channel spillway elevation (operator records)?	0.0	
5. Lowest dam crest elevation (operator records)?	383.5	
6. If instrumentation is present, are readings recorded (operator records)?		✓
7. Is the embankment currently under construction?		✓
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?		
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		
15. Are spillway or ditch linings deteriorated?		
16. Are outlets of decant or underdrains blocked?		
17. Cracks or scarps on slopes?	✓	

	Yes	No
18. Sloughing or bulging on slopes?	✓	
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		
Is water exiting outlet, but not entering inlet?		
Is water exiting outlet flowing clear?		
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain?		✓
At isolated points on embankment slopes?		✓
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?		✓
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?	✓	
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

3, 4, 12, 14, 15, 16, 20: N/A. Impoundment does not have decant pipes or spillway. Water is pumped from impoundment to facility for reuse.

17, 18: Minor erosion and some sloughs observed on western embankment of the West Cell and northern embankment of the Northwest and Northeast Cells.

23: Water in the "Runoff Pond" sits against the toe of the Northeast Cell's southern embankment and the against the toe of the West Cell's eastern embankment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WQ 0001528000 INSPECTOR NJ Anestad, PE & RC Ganley, PE

Date September 18, 2012

Impoundment Name SPD-4 (aka Bottom Ash Pond - 3 Cells)

Impoundment Company Luminant Power

EPA Region 6

State Agency (Field Office) Addresss 1445 Ross Avenue
Dallas, Texas 75202-2733

Name of Impoundment SPD-4

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New x Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Temporary storage of sluice water discharged from hydrobin bottom ash/sluice water separator prior to reuse in facility.

Nearest Downstream Town : Name n/a: facility sits adjacent to Lake Monticello

Distance from the impoundment Approx. 1,500'

Impoundment

Location:
Longitude 95 Degrees 02 Minutes 17 Seconds
Latitude 33 Degrees 05 Minutes 16 Seconds
State Texas County Titus

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______________________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

___X___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

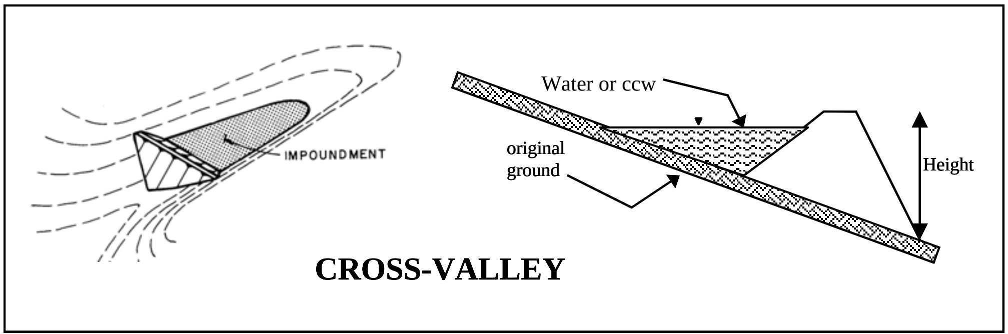
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

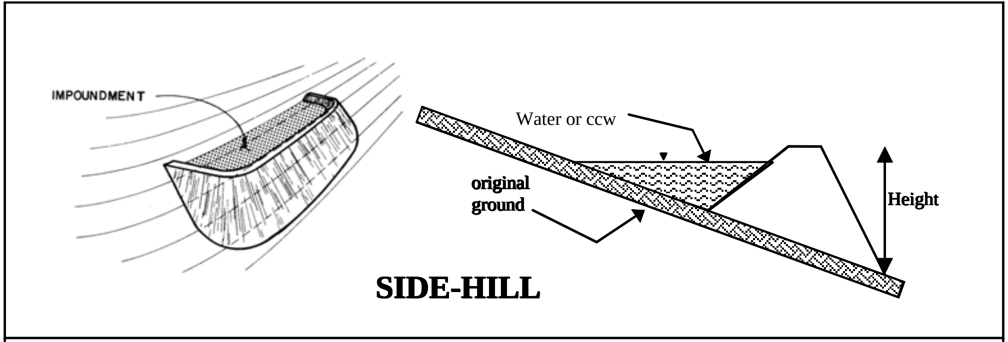
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

The area potentially inundated by a breach of any embankment of the CCW impoundment is limited to property owned by Luminant Power. The potential exists for some discharge to reach Lake Monticello which is also owned by Luminant Power. Environmental impacts with the waterbody are unknown due to unknown nature of stored materials constituent.

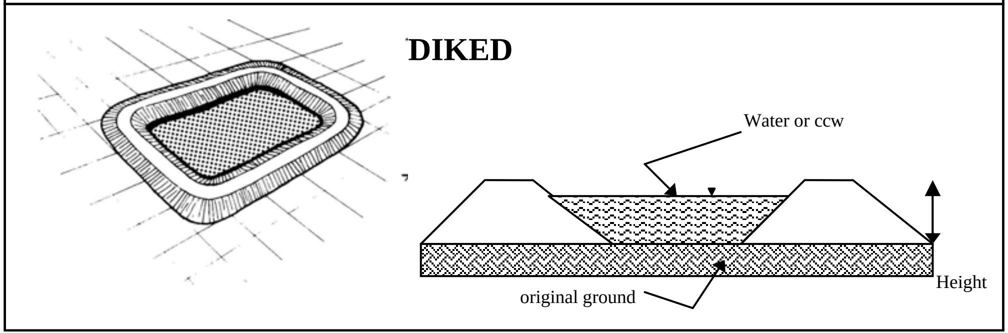
CONFIGURATION:



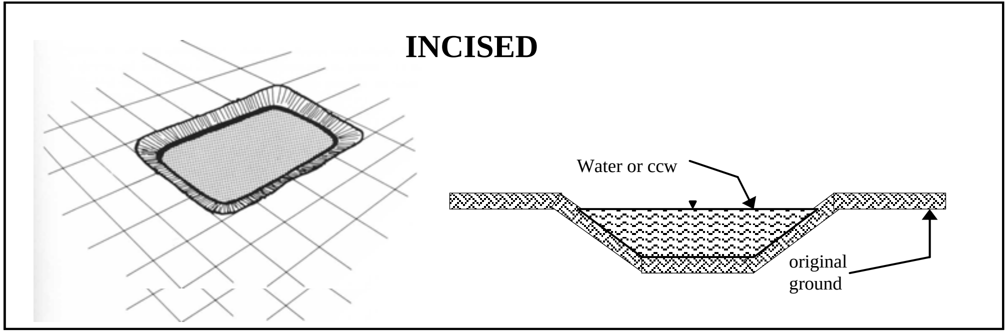
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

______ Cross-Valley
______ Side-Hill
______ Diked
______ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height 22.5 feet
Pool Area 20.23 acres
Current Freeboard Approx. 5.5 feet

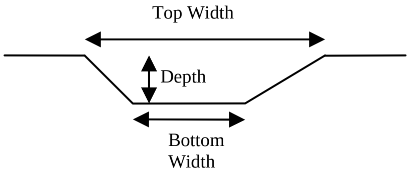
Embankment Material Native soil
Liner Clay with grout-filled bag cover
Liner Permeability Unknown

TYPE OF OUTLET (Mark all that apply)

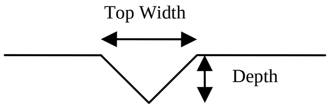
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

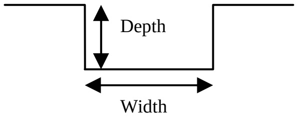
TRAPEZOIDAL



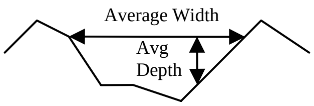
TRIANGULAR



RECTANGULAR

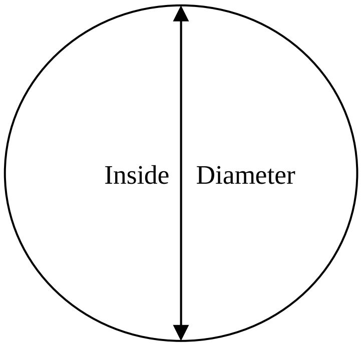


IRREGULAR



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _______________________

Is water flowing through the outlet? YES _______ NO _______

__X__ **No Outlet** None: water is pumped from impoundments when needed

_____ **Other Type of Outlet** (specify) _________________________________

The Impoundment was Designed By Texas Utility Generating Co. (TUG Co.)

Has there ever been a failure at this site? YES ___________ NO _____X_____

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES ________NO ___X_____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No information on original embankment foundation available

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	Monticello Steam Electric Station	**Date:**	September 18, 2012
Unit Name:	Scrubber Pond	**Operator's Name:**	Luminant Power
Unit I.D.:	Scrubber Pond	**Hazard Potential Classification:**	High Significant [✓ Low]
Inspector's Name:	NJ Anestad, PE & RC Ganley, PE		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	377.5		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	0.0		20. Decant Pipes:	■	■
4. Open channel spillway elevation (operator records)?	0.0		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)?	384.0		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	■	■
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?			From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?			Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?			22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?			23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?	✓		24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments

3, 4, 12, 14, 15, 16, 20: N/A. Impoundment does not have decant pipes or spillway. Water is pumped from impoundment if needed.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WQ 0001528000

INSPECTOR NJ Anestad, PE & RC Ganley, PE

Date September 18, 2012

Impoundment Name Scrubber Pond

Impoundment Company Luminant Power

EPA Region 6

State Agency (Field Office) Addresss 1445 Ross Avenue
Dallas, Texas 75202-2733

Name of Impoundment Scrubber Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?		X

IMPOUNDMENT FUNCTION: Temporary storage of FGD blowdown water prior to reuse in facility.

Nearest Downstream Town : Name n/a: facility sits adjacent to Lake Monticello

Distance from the impoundment Approx. 1,500'

Impoundment

Location: Longitude 95 Degrees 02 Minutes 17 Seconds
Latitude 33 Degrees 05 Minutes 16 Seconds
State Texas County Titus

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?______________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X__ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

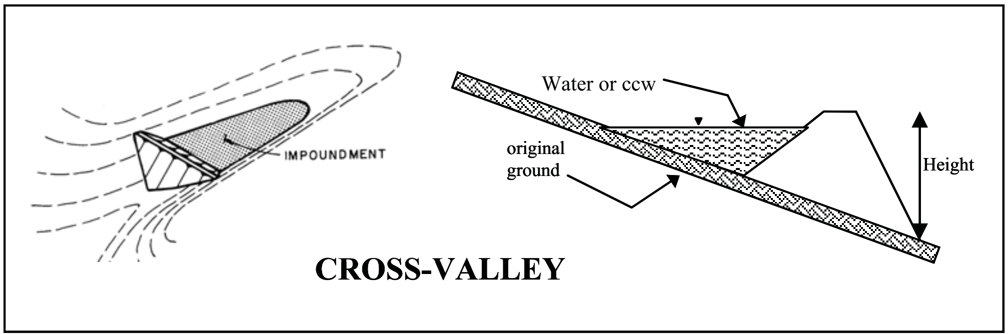
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

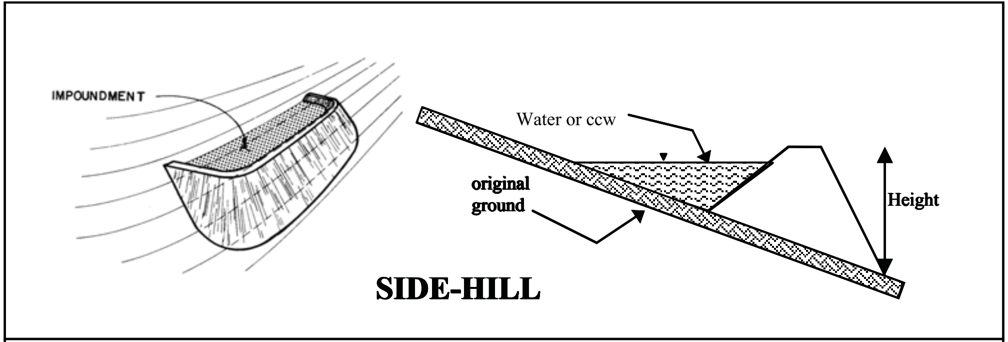
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

The area potentially inundated by a breach of any embankment of the CCW impoundment is limited to property owned by Luminant Power. The potential exists for some discharge to reach Lake Monticello which is also owned by Luminant Power. Environmental impacts with the waterbody are unknown due to unknown nature of stored materials constituent.

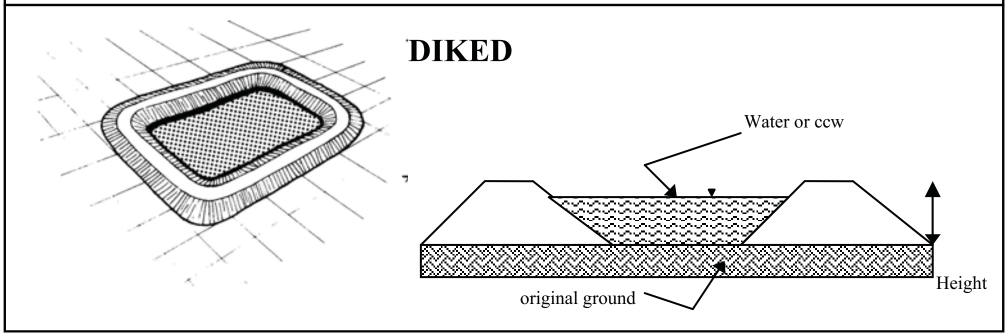
CONFIGURATION:



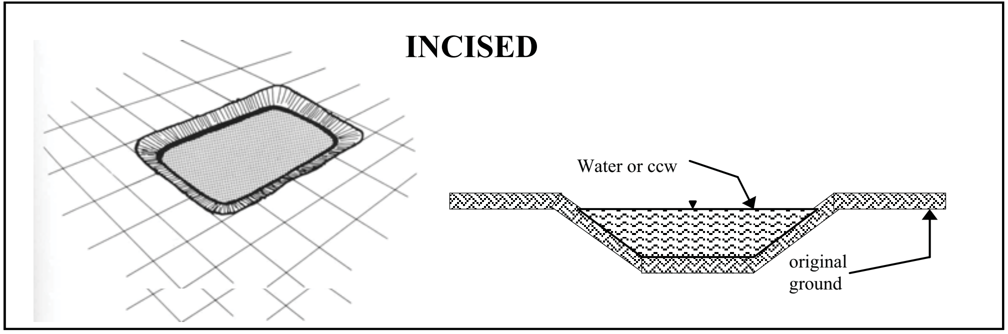
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

______ Cross-Valley
______ Side-Hill
______ Diked
______ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height Max. 8 feet
Pool Area 1.4 acres
Current Freeboard Approx. 6.5 feet

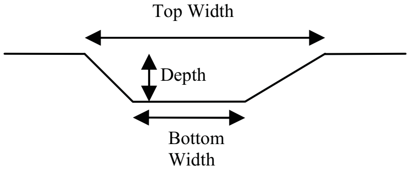
Embankment Material Native soil
Liner 100-mil HDPE
Liner Permeability Unknown

TYPE OF OUTLET (Mark all that apply)

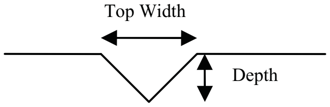
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

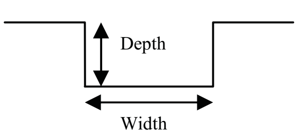
TRAPEZOIDAL



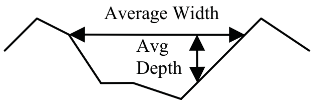
TRIANGULAR



RECTANGULAR



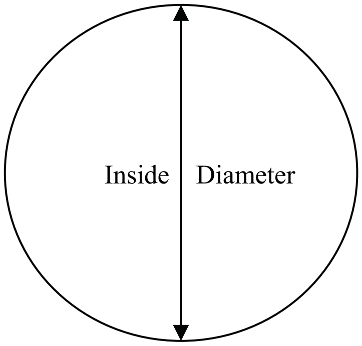
IRREGULAR



_____ **Outlet**

_____ inside diameter

Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ______________________



Is water flowing through the outlet? YES _______ NO _______

X **No Outlet** None: water is pumped from impoundment when needed

_____ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By TU Electric

Has there ever been a failure at this site? YES __________ NO ____X______

If So When? ____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ______________________________

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No information on embankment foundation available

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No

APPENDIX B

Photographs

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
E

Description:
Southern embankment of the South Pond.

Date:
9/18/12

Photo Number:
1

Photographer:
NJA

Orientation:
NW

Description:
Access walkway to gate operator in the South Pond. Note staff gages.

Date:
9/18/12

Photo Number:
2

Photographer:
NJA

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
N

Description:
Inboard face of the eastern embankment of the South Pond. Note riprap facing.

Date:
9/18/12

Photo Number:
3

Photographer:
NJA

Orientation:
N

Description:
Western embankment of South Pond. Minor rutting observed below pipes.

Date:
9/18/12

Photo Number:
4

Photographer:
NJA

Client: US EPA		Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
E

Description:
Dividing dike between the North and South Ponds. Note equalizing channel.

Date:
9/18/12

Photo Number:
5

Photographer:
NJA

Orientation:
N

Description:
Western embankment of North Pond

Date:
9/18/12

Photo Number:
6

Photographer:
NJA

Orientation:
S

Description:
Western embankment of North Pond.

Date:
9/18/12

Photo Number:
7

Photographer:
NJA

Orientation:
S

Description:
Northwest corner of the North Pond. Some erosion and slides. Owner noted that the material is additional fill placed against the original embankment. Slides have also been noted in previous inspection reports

Date:
9/18/12

Photo Number:
8

Photographer:
NJA

Client: US EPA		Project Number:	46122.270.100
Site Name: Monticello Steam Electric Station		Location:	Mount Pleasant. Titus County, TX

Orientation:
S

Description:
Interior of North Pond. Note discharge piping, currently not in use.

Date:
9/18/12

Photo Number:
9

Photographer:
NJA

Orientation:
E

Description:
Crest and interior of the North Pond.

Date:
9/18/12

Photo Number:
10

Photographer:
NJA

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
S

Description:
Dividing dike between the North Pond and the Settling Pond. Note the "concrete revetment" (grout-filled bags) on the faces of the dike.

Date:
9/18/12

Photo Number:
11

Photographer:
NJA

Orientation:
N

Description:
Northwest corner of the Settling Pond. Note concrete revetment. Inflow piping in background.

Date:
9/18/12

Photo Number:
12

Photographer:
NJA

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
E

Description:
Outboard face of the northern embankment of the Settling Pond.

Date:
9/18/12

Photo Number:
13

Photographer:
NJA

Orientation:
S

Description:
Small erosion gully at the crest of the Settling Pond.

Date:
9/18/12

Photo Number:
14

Photographer:
NJA

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
E

Description:
Inflow of wastewater into the Settling Pond.

Date:
9/18/12

Photo Number:
15

Photographer:
NJA

Orientation:
S

Description:
Outboard face of the eastern embankment of the Settling Pond.

Date:
9/18/12

Photo Number:
16

Photographer:
NJA

PHOTOGRAPHIC LOG

Client: US EPA | Project Number: 46122.270.100

Site Name: Monticello Steam Electric Station | Location: Mount Pleasant. Titus County, TX

Orientation:
SW

Description:
Inboard face of the eastern embankment of the Settling Pond.

Date:
9/18/12

Photo Number:
17

Photographer:
NJA

Orientation:
W

Description:
Inboard face of the southern embankment of the Settling Pond. Runoff Collection Pond is visible to the left (south).

Date:
9/18/12

Photo Number:
18

Photographer:
NJA

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
W

Description:
Outboard face of the southern embankment of the Settling Pond. This embankment serves as the dividing dike between the Settling and Runoff Collection Ponds.

Date:
9/18/12

Photo Number:
19

Photographer:
NJA

Orientation:
NW

Description:
Southwest corner of the Settling Pond.

Date:
9/18/12

Photo Number:
20

Photographer:
NJA

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
W

Description:
Dividing dike between the North and South Ponds.

Date:
9/18/12

Photo Number:
21

Photographer:
NJA

Orientation:
S

Description:
Outboard face of the eastern embankment of the South Pond and the interior of the Runoff Collection Pond.

Date:
9/18/12

Photo Number:
22

Photographer:
NJA

Client: US EPA		Project Number:	46122.270.100
Site Name: Monticello Steam Electric Station		Location:	Mount Pleasant. Titus County, TX

Orientation:
N

Description:
Interior of the Scrubber Pond.

Date:
9/18/12

Photo Number:
23

Photographer:
NJA

Orientation:
W

Description:
Southern inboard face of the Scrubber Pond.

Date:
9/18/12

Photo Number:
24

Photographer:
NJA

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
N

Description:
Eastern inboard face of Scrubber Pond and inflow pipe.

Date:
9/18/12

Photo Number:
25

Photographer:
NJA

Orientation:
E

Description:
Northern embankment of the Scrubber Pond.

Date:
9/18/12

Photo Number:
26

Photographer:
NJA

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Monticello Steam Electric Station	Location:	Mount Pleasant. Titus County, TX

Orientation:
S

Description:
Eastern embankment of the Scrubber Pond.

Date:
9/18/12

Photo Number:
27

Photographer:
NJA

Orientation:
N

Description:
Interior of abandoned Scrubber Pond and southern embankment of the "New" Scrubber Pond.

Date:
9/18/12

Photo Number:
28

Photographer:
NJA

APPENDIX C

Pertinent Documentation

REPORT

ASH AND SCRUBBER POND STABILITY INVESTIGATION REPORT

Luminant Monticello Power Plant, Titus County, Texas

Submitted To: Luminant – Systems Engineering
Energy Plaza, Floor 27
1601 Bryan Street
Dallas, Texas 75201

Submitted By: Golder Associates Inc.
500 Century Plaza Drive
Suite 190
Houston, TX 77073 USA
Texas Registration Number: F-2578

12/11/12
P. CHRIS MARSHALL
91893

P. Chris Marshall

December 2012

123-94128.002

Golder Associates

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1.0 INTRODUCTION

1.1 Project Description

Luminant–Systems Energy (Luminant) operates the Monticello Power Plant, a lignite-fueled power plant near Mount Pleasant, Titus County, Texas. As part of regulatory compliance, the existing ash ponds and scrubber pond are being characterized for slope stability. The ash and scrubber ponds are located northeast and southeast of the power plant. The ash ponds consist of three adjacent ponds identified as the north pond in the northwest quadrant, the south pond in the southwest quadrant, and the settling pond in the northeast quadrant. The scrubber pond is a standalone structure located to the south of the ash ponds. Relative pond locations are depicted on Figure 1 included herein. A stormwater runoff collection pond is located adjacent to the ash ponds in the southeast quandrant; the runoff collection pond is not included within the scope of this report.

Golder Associates Inc. (Golder) has been contracted by Luminant to perform a geotechnical site investigation at the facility and analyze the ash and scrubber pond slope stability. This report presents the findings of the field investigation, boring logs, laboratory test results, a description of the subsurface soil conditions, and results of the slope stability analyses.

1.2 Scope of Investigation

The scope of this investigation included:

- Drilling and sampling of eight (8) geotechnical soil borings at the ash ponds and two (2) at the scrubber pond,
- Laboratory testing of representative soil samples,
- Characterization of subsurface conditions, and
- Slope stability analyses.

The subsurface investigation was performed between October 22 and 24, 2012.

1.3 Coordinate System and Unit System

Soil boring locations were measured by Golder using a handheld GPS device. Elevations were estimated by Golder using existing topographic maps. We have reported coordinates with reference to latitude and longitude with WGS84 datum. All elevations are referenced to mean sea level (msl).

This report is presented using U.S. customary (or English) units.

2.0 SUBSURFACE EXPLORATION

Golder performed a total of ten (10) subsurface explorations at the Site. Eight (8) borings were drilled to a depth of 50 feet below ground surface (bgs) at the ash ponds and two (2) borings were drilled to a depth of 20 feet bgs at the scrubber pond. Table 1 provides the boring coordinates and elevations. Soil boring locations were measured by Golder using a handheld GPS device. Elevations were estimated by Golder using existing topographic maps. Boring locations are shown on Figure 1.

TABLE 1. BORING COORDINATES

Boring Number	Latitude	Longitude	Elevation (ft-msl)	Boring Depth (ft)
Ash Ponds				
BH-101	33.0908° N	95.0333° W	386.5	50
BH-102	33.0920° N	95.0340° W	386.5	50
BH-103	33.0879° N	95.0333° W	386.5	50
BH-104	33.0893° N	95.0342° W	386.5	50
BH-105	33.0913° N	95.0355° W	386.5	50
BH-106	33.0908° N	95.0369° W	386.5	50
BH-107	33.0893° N	95.0360° W	386.5	50
BH-108	33.0877° N	95.0348° W	386.5	50
Scrubber Pond				
BH-109	33.0866° N	95.0333° W	384	20
BH-110	33.0869° N	95.0338° W	384	22

2.4 Soil Boring Procedures

The borings were drilled by W.E.S.T. Drilling (West) of Waxahachie, Texas using an all-terrain truck-mounted drilling rig and rotary drilling methods with hollow stem augers. Soil samples were collected at 2-foot intervals within the top 10 feet of the boring and at 5-foot intervals below 10 feet. The boring logs from the site investigation are included as Appendix A.

Disturbed soil samples were obtained in sand using an ASTM standard split spoon sampler, i.e., 2-inch outer diameter and 1-3/8-inch inner diameter. Standard Penetration Tests (SPT) were conducted during sampling. Sampling and testing were carried out in general agreement with the guidelines in ASTM D1586.

SPTs involve counting the number of blows of a 140 lb hammer dropping 30 inches needed for the sampler to penetrate three successive 6-inch increments into the soil. The reported N value is the number of blows required to penetrate the second and third 6-inch intervals, with units of blows/12 inches. In some hard clays and very dense sands, 50 blows were insufficient to advance the sampler 6 inches and penetration “refusal” was encountered. In this case the N value is not obtained and the incomplete penetration is recorded. This is registered in the boring logs as, for example, 50/5 in., i.e. 50 blows with only 5 inches of penetration.

For clayey soils, thin-walled steel Shelby tubes were pushed to obtain the relatively undisturbed samples for laboratory testing. Shelby tubes were 30-inch long and 3-inch outer diameter (OD). The inside diameter was 2.87 inch giving an area ratio of 9% (Ca = 100 x (OD2 – ID2)/ID2). These Shelby tubes have a cutting edge diameter (De) of 2.85 in., thus an inside clearance ratio (Ci = 100 x (ID-De)/De) equal to 0.7%. The recovery ratio (length recovered/length pushed) is typically variable and dependent on the soil stiffness, with higher recovery values generally obtained in softer clays. The recovery ratio is reported in the individual boring logs.

All borings were sampled by a Golder field engineer and the soils were described using a modified version of the Unified Soil Classification System (ASTM D 2487). The soil description included a density or consistency qualifier, color, structural characteristics when evident, composition with major component in capital letters, and minor characteristics.

After visual classification, recovered samples from SPTs were placed in plastic bags to preserve the natural moisture content. After retrieval and visual soil identification of each Shelby tube sample, a pocket penetrometer test was performed at the bottom end of the sample. Shelby tubes pushed in stiff to hard clayey soils were extruded in the field and the recovered samples were placed in plastic storage tubes and plastic bags to preserve the moisture content. All samples were labeled and transported back to the Golder's Houston office for laboratory soils testing.

Boring logs were prepared from the field logs using the software package gINT v. 8.1.021. The boring logs are provided in Appendix A.

Following the completion of each soil boring, the boreholes were backfilled with bentonite pellets to the surface.

2.5 Laboratory Testing

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 data summary sheets are presented in Appendix B. Laboratory test result sheets are presented in Appendix C.

2.6 Subsurface Conditions

The soils encountered in the borings generally consisted of stiff to hard sandy clays and compact to dense sands. The subsurface stratigraphy generally consisted of interchanging layers of clayey sand and sandy clay. The clayey sand layers ranged in thickness from 2 to 20 feet where encountered. The sandy clay and clay layers varied in thickness from 2 to 33 feet where encountered. Boring BH-101, BH-102, BH-106, BH-108 and BH-110 all terminated in clayey sand layers. BH-109 terminated in a hard, sandy clay layer.

A layer of compact to dense, silty or poorly graded sand was encountered beneath the sandy clay/clayey sand layers in borings BH-103, BH-104, BH-105 and BH-107. These borings all terminated in this silty/poorly-graded sand layer. In borings BH-106 and BH-109 a layer of sand ranging from 2 to 10 feet was encountered in between the clayey sand/sandy clay layers.

Groundwater was encountered in 6 of the 10 borings. Groundwater elevations encountered during drilling ranged from EL 335.85 to 357.05 ft-msl with an average of El. 340.7 ft-msl. Our analyses were conducted assuming groundwater elevation at each cross section based on the boring closest to that cross section.

3.0 STABILITY ANALYSES

Slope stability analyses were performed using the commercial slope stability software program, SLIDE Version 6.019. The site topography and geometry used in the analyses were determined from site survey and design drawings provided by Luminant.

The typical containment dike section has an interior (wet side) slope of 3 horizontal to 1 vertical (3H:1V) and a minimum exterior (dry side) slope of 2.5H:1V at the ash ponds. Slopes range from 2.5H:1V to 3H:1V at the scrubber pond interior (wet side). The crest elevation of the containment dikes are at approximately 358.6 ft-msl and 384 ft-msl at the ash and scrubber ponds, respectively. The ash ponds are lined with 3 feet of compacted clay with a top of liner elevation on the pond floors of approximately 361 ft-msl. The scrubber pond is lined with a 60 mil HDPE liner with a top of liner elevation on the pond floor of approximately 370 to 371 ft-msl.

Stability analyses were performed for three (3) separate slope sections at the ash ponds (north, south and settling pond) and one (1) section at the scrubber pond to assess the various soil conditions and slope geometries around the ponds; analysis locations are shown on Figure 2. Stability analyses considered “empty pond” and “full pond” conditions.

A rapid drawdown scenario was analyzed for one full pond condition at each section. The analysis was completed on the drained or undrained section with the lower factor of safety in the full condition. The analysis was completed using the B-bar method to simulate the effects of rapid drawdown in a low permeability material such as the sandy clays and clayey sands encountered at Monticello. The initial water level was modeled as the full condition and the final water level was modeled at the pond floor, representing a final condition after drawdown where the pond is empty.

The most critical slope geometry was identified along the north slide slope at the settling pond, consisting of an approximately 25-foot high, 3H:1V slope. The effect of pseudo-static earthquake loading was also analyzed at this location. Based on the “US Seismic Hazard 2008 Map” by the USGS the peak ground acceleration (PGA) for a 2% probability of exceedance in 50 years event is about 6%g for the subject site. A seismic coefficient of 0.06g was therefore used in the earthquake loading analysis.

Based on a review of soil, site, and seismic conditions, the site soils are not susceptible to liquefaction.

3.1 Soil Properties

For each slope section, a conservative, generalized subsurface stratigraphy was developed based on soil boring information and laboratory soil testing results from the borings conducted as part of this investigation. The soil properties assumed for the slope sections are provided in Tables 2, 3 and 4.

TABLE 2. SOIL MATERIAL PROPERTIES FOR SETTLING POND SECTION

Soil Material	Description	Moist Unit Weight (lb/ft^3)	Saturated Unit Weight (lb/ft^3)	Undrained Soil Properties		Drained Soil Properties	
				Undrained Shear Strength, su (lb/ft^2)	Friction Angle, φ (°)	Cohesion, c' (lb/ft^2)	Friction Angle, φ' (°)
I	Sandy Clay/Clayey Sand	127	132	1400	0	1000	14

TABLE 3. SOIL MATERIAL PROPERTIES FOR NORTH AND SOUTH POND SECTIONS

Soil Material	Description	Moist Unit Weight (lb/ft^3)	Saturated Unit Weight (lb/ft^3)	Undrained Soil Properties		Drained Soil Properties	
				Undrained Shear Strength, su (lb/ft^2)	Friction Angle, φ (°)	Cohesion, c' (lb/ft^2)	Friction Angle, φ' (°)
I	Sandy Clay/Clayey Sand	127	132	2000	0	1300	18
II	Sand	120	125	0	30	0	30

TABLE 4. SOIL MATERIAL PROPERTIES FOR SCRUBBER POND SECTION

Soil Material	Description	Moist Unit Weight (lb/ft^3)	Saturated Unit Weight (lb/ft^3)	Undrained Soil Properties		Drained Soil Properties	
				Undrained Shear Strength, su (lb/ft^2)	Friction Angle, φ (°)	Cohesion, c' (lb/ft^2)	Friction Angle, φ' (°)
I	Sandy Clay/Clayey Sand	127	132	1500	0	1000	14

3.2 Slope Stability Results

Slope stability analyses were performed for both short-term and long-term conditions using undrained and drained soil properties, respectively. The results of the analyses are provided in Table 5. SLIDE output files are included in Appendix D. A factor of safety of 1.5 is typically considered adequate for permanent slopes. The minimum calculated factor of safety from our analyses is 2.8 for normal loading conditions.

Therefore, our analyses indicate that the proposed slopes will be stable. Additionally slope analyses for rapid drawdown and earthquake conditions have factors of safety greater than 1.5 as well.

TABLE 5. SLOPE STABILITY FACTORS OF SAFETY

Case	Description	Factor of Safety
1	Settling pond; north slope; empty pond; short term (undrained) conditions	2.8
2	Settling pond; north slope; empty pond; long term (drained) conditions	3.2
3	Settling pond; north slope; full pond; short term (undrained) conditions	5.7
4	Settling pond; north slope; full pond; long term (drained) conditions	7.3
5	Settling pond; north slope; rapid drawdown	2.8
6	Settling pond; north slope; empty pond; short term (undrained) conditions (seismic loading)	2.2
7	North pond; north slope; empty pond; short term (undrained) conditions	3.8
8	North pond; north slope; empty pond; long term (drained) conditions	3.4
9	North pond; north slope; full pond; short term (undrained) conditions	8.5
10	North pond; north slope; full pond; long term (drained) conditions	8.7
11	North pond; north slope; rapid drawdown	3.0
12	South pond; west slope; empty pond; short term (undrained) conditions	3.3
13	South pond; west slope; empty pond; long term (drained) conditions	3.1
14	South pond; west slope; full pond; short term (undrained) conditions	8.5
15	South pond; west slope; full pond; long term (drained) conditions	8.2
16	South pond; west slope; rapid drawdown	2.3
17	Scrubber pond; south slope; empty pond; short term (undrained) conditions	4.1
18	Scrubber pond; south slope; empty pond; long term (drained) conditions	4.1
19	Scrubber pond; south slope; full pond; short term (undrained) conditions	6.7
20	Scrubber pond; south slope; full pond; long term (drained) conditions	5.6
21	Scrubber pond: south slope: rapid drawdown	3.5

4.0 USE OF THIS REPORT

Attention is drawn to the document - “Important Information About Your Geotechnical Engineering Report”, which is included in Appendix E of this report. This document has been prepared by the ASFE (Professional Firms Practicing in the Geosciences), of which Golder is a member. The statements presented in this document are intended to advise owners of what their realistic expectations of this report should be, and to present recommendations on how to minimize the risks associated with the groundworks for this project. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

5.0 CLOSING

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.

Very truly yours,
GOLDER ASSOCIATES INC.

P. Chris Marshall

Maysill G. Pascal
Senior Geotechnical Engineer

P. Chris Marshall, P.E.
Senior Project Engineer

Charles F. Rickert, P.E.
Associate

Drawing file: 12394128A001.dwg Dec 04, 2012 – 1:42pm

LEGEND

● BH-101 BORING LOCATION

REFERENCE

1.) AERIAL SHOWN LICENSED FROM GOOGLE EARTH PROFESSIONAL.

300 0 300
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
LUMINANT - MONTICELLO
ASH & SCRUBBER SLOPE STABILITY INVESTIGATION REPORT
TITUS COUNTY, TEXAS

TITLE

BORING LOCATIONS

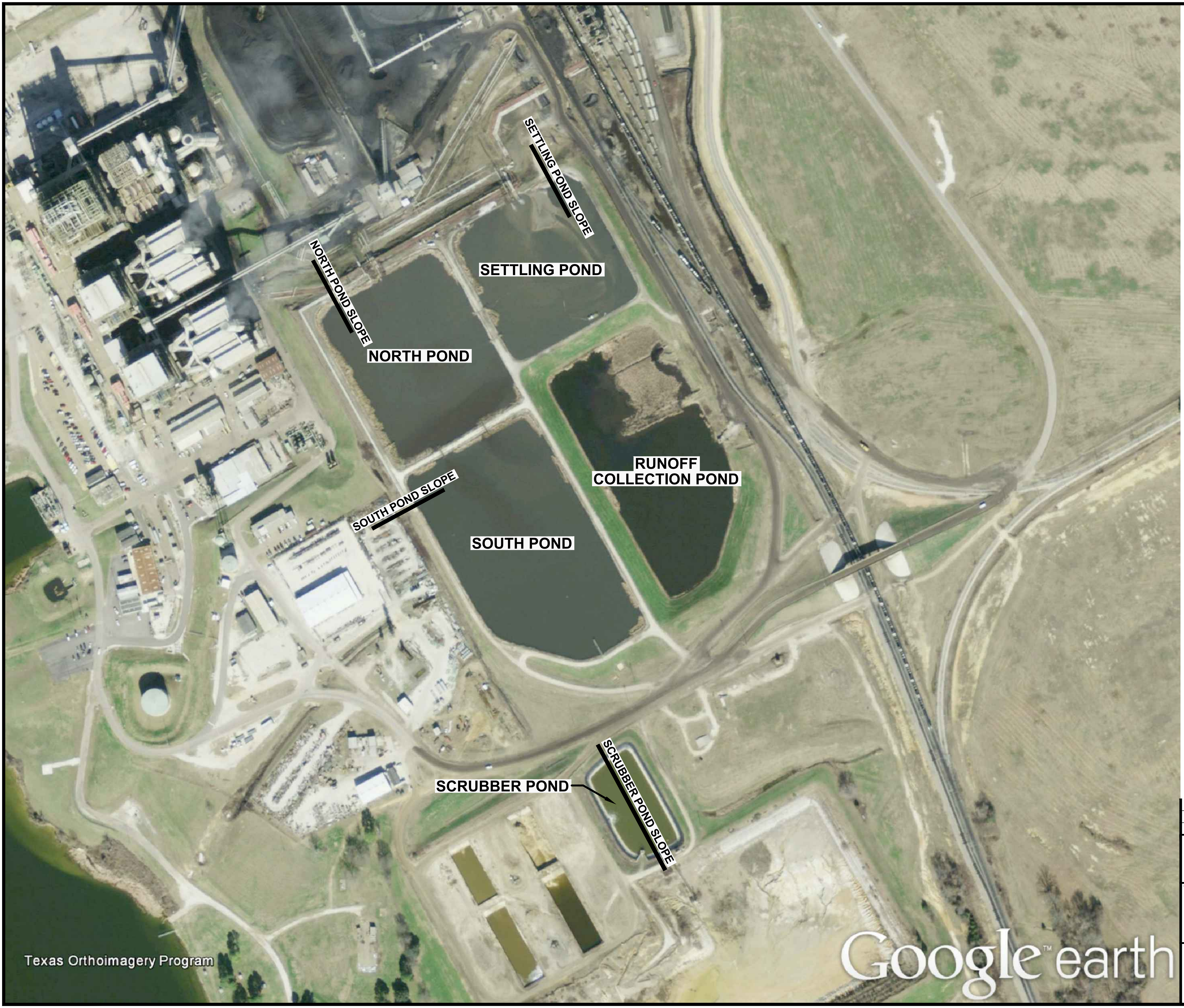
NJ Authorization #24GA28029100
Golder Associates
Mt. Laurel, New Jersey

PROJECT No.	123–94128	
DESIGN	MGP	11/21/12
CADD	RG	11/21/12
CHECK	MGP	11/21/12
REVIEW	PCM	11/21/12

FILE No. 12394128A001
SCALE AS SHOWN
REV. 0

FIGURE 1

Drawing file: 12394128A002.dwg Nov 21, 2012 - 5:05pm



LEGEND

▬ ANALYSIS LOCATION

REFERENCE

1.) AERIAL SHOWN LICENSED FROM GOOGLE EARTH PROFESSIONAL.

300 0 300
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
LUMINANT - MONTICELLO
ASH & SCRUBBER SLOPE STABILITY INVESTIGATION REPORT
TITUS COUNTY, TEXAS

TITLE
ANALYSIS LOCATIONS

NJ Authorization #24GA28029100
Golder Associates
Mt. Laurel, New Jersey

PROJECT No.		123–94128
DESIGN	MGP	11/21/12
CADD	RG	11/21/12
CHECK	MGP	11/21/12
REVIEW	PCM	11/21/12

FILE No. 12394128A002
SCALE AS SHOWN
REV. 0

FIGURE 2

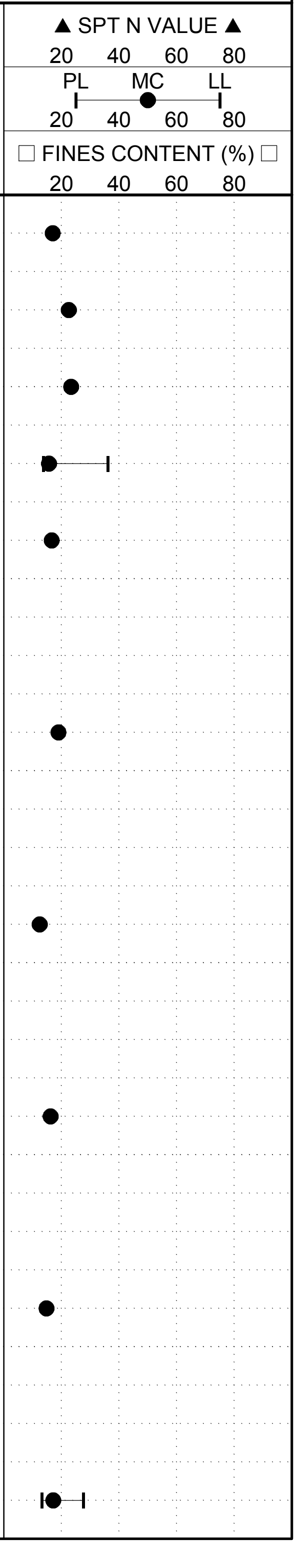
APPENDIX A
BORING LOGS

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

BORING NUMBER BH-101

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/22/12 **COMPLETED** 10/22/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 11.45 ft / Elev 375.05 ft
LOGGED BY FW **CHECKED BY** MP
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 CLAY, low plasticity, some to little silt, tan and gray, dry, firm	SH 1	54		3.5	
			SH 2	54		3.25	
5		medium to low plasticity, dark gray sandy gravel seam at 4.0'	SH 3	56		4.0	
			SH 4	88		2.25	
		(SC) CLAYEY SAND, fine, uniform graded, subrounded, some silt, red and brown, dry	SH 5	75		3.0	
10		▽					
15		(CL) SANDY CLAY, some to little silt, red and gray, mottled, moist, firm	SH 6	54		3.5	
20		medium plasticity at 18.0'	SH 7	63		2.0	
25		dark gray clayey sand seam, stiff to hard at 23.0'	SH 8	54		4.75	
30		(CH) Fat CLAY, grading to a sandy clay, some silt, red and gray, mottled, hard to stiff, moist	SH 9	58		2.0	
35		(CL) SANDY CLAY, fine, tan and brown, moist	SH 10	71		5.0	



(Continued Next Page)

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

BORING NUMBER BH-101

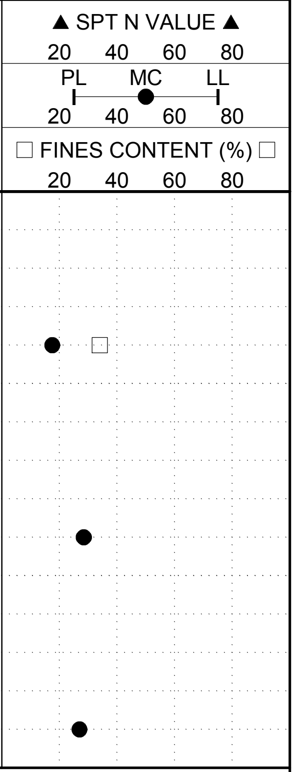
CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
35		(CL) SANDY CLAY, fine, tan and brown, moist *(continued)*					
		(SC) CLAYEY SAND, low plasticity, some silt, brown and gray, moist	SH 11	63		2.5	
40							
		high plasticity clay seams, wet at 43.0'	SH 12	67		4.75	
45							
		decreased clay content at 48.0'	SH 13	75		1.0	
50							



Bottom of borehole at 50.0 feet.

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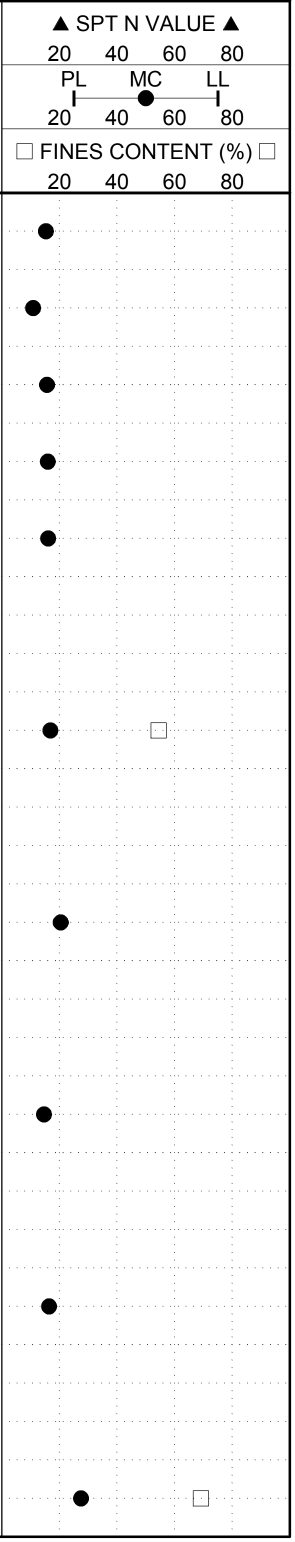
BORING NUMBER BH-102

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/22/12 **COMPLETED** 10/22/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 31.20 ft / Elev 355.30 ft
LOGGED BY FW **CHECKED BY** MP
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, fine sand, low plasticity clay, little organics, dark brown, dry	SH 1	56		5.0	
		subangular grains, some silt, little gravel, dark brown and tan at 2.0'	SH 2	33		5.0	
5		low plasticity, red and brown at 4.0'	SH 3	42		5.0	
		high plasticity, 3" clay seam, soft at 6.0'	SH 4	50		5.0	
10		grading to sandy clay, tan and gray, mottled, stiff to hard at 8.0'	SH 5	63		3.5	
15		(CL) SANDY CLAY, find sand, low plasticity clay, tan and gray, very stiff	SH 6	50		3.5	
		(SC) CLAYEY SAND, fine sand, low plasticity clays					
20		red and gray, mottled, moist at 18.0'	SH 7	58		5.0	
25			SH 8	58		3.25	
30		decreased clay content, tan and brown at 28.0'	SH 9	58		3.5	
		▽					
35		(CL) SANDY CLAY, fine, subangular, trace silt, gray and tan, moist, stiff to very stiff	SH 10	73		2.0	



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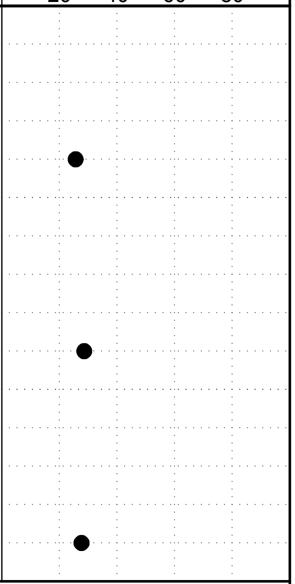
BORING NUMBER BH-102

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

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) SANDY CLAY, fine, subangular, trace silt, gray and tan, moist, stiff to very stiff *(continued)*						
40			SH 11	58		2.0		●
		wet at 43.0'						
45			SH 12	75		0.5		●
		(SC) CLAYEY SAND, fine, subangular, some clay seams, dark gray, wet						
50			SH 13	65		3.5		●

Bottom of borehole at 50.0 feet.



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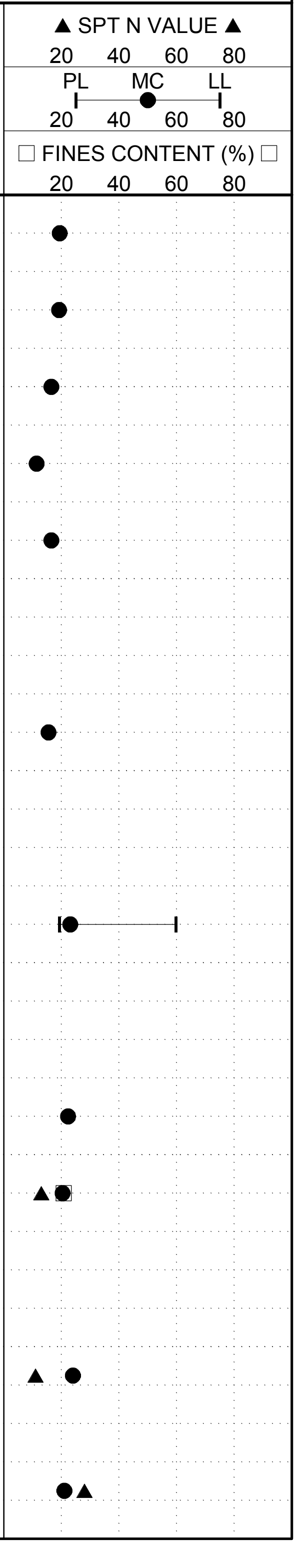
BORING NUMBER BH-103

PAGE 1 OF 2

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/22/12 **COMPLETED** 10/22/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
∇ **AT TIME OF DRILLING** 26.30 ft / Elev 360.20 ft no reading, cave in at 26
LOGGED BY FW **CHECKED BY** MP
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	Roadway gravel removed					
	(CL) LEAN CLAY, low plasticity, some fine sand, tan and gray, dry, hard	SH 1	50		5.0	
		SH 2	65		5.0	
5	medium plasticity, sand and gravel seam, white at 4.0'	SH 3	65		5.0	
	(CL) SANDY CLAY, fine, subangular, low plasticity, brown and red, dry, hard	SH 4	63		4.0	
10		SH 5	50		5.0	
15	(SC) CLAYEY SAND, fine, subangular, low plasticity, little silt, gray and red, moist	SH 6	71		4.0	
20	(CH) SANDY CLAY, medium to high plasticity, gray and red, moist, hard	SH 7	50		4.5	
25	(SM) SILTY SAND, fine, sub angular, some clay, orange and tan, moist	SH 8	42			
	∇	SS 9	71	6-6-7 (13)		
		SH 10	0			
30	wet, compact at 30.0'	SS 11	100	7-5-6 (11)		
35	medium to fine at 33.0'	SS 12	100	4-9-19 (28)		



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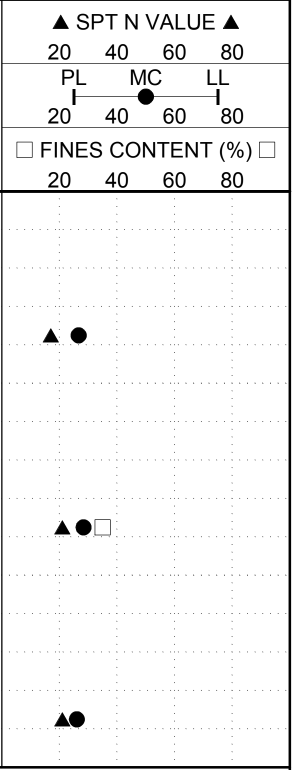
BORING NUMBER BH-103

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

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
35		(SM) SILTY SAND, fine, sub angular, some clay, orange and tan, moist *(continued)*					
		(SM) SILTY SAND, fine, little clay, gray and red, wet, compact	SS 13	89	4-7-10 (17)		
40							
		some oxidation at 43.0'	SS 14	100	4-8-13 (21)		
45							
			SS 15	94	6-9-12 (21)		
50							



Bottom of borehole at 50.0 feet.

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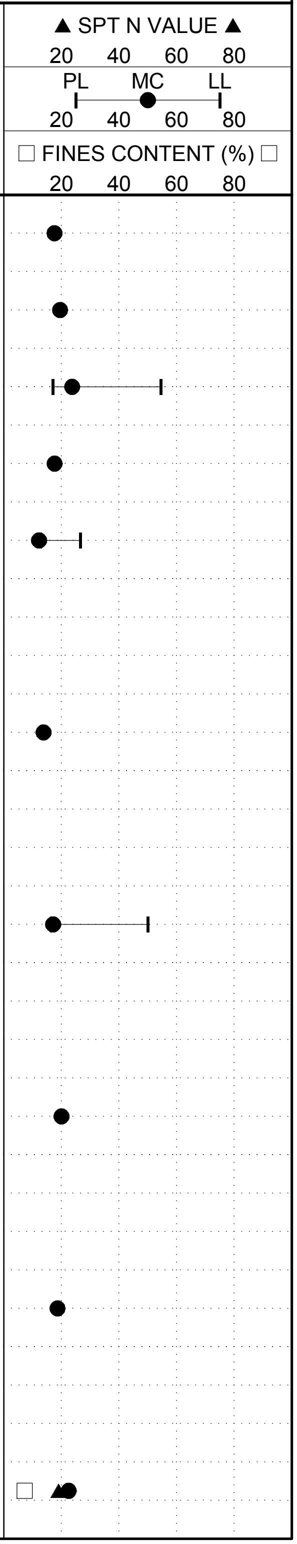
BORING NUMBER BH-104

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/23/12 **COMPLETED** 10/23/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 25.20 ft / Elev 361.30 ft
LOGGED BY FW **CHECKED BY** MP
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	Remove gravel from road before drilling					
	(CL) LEAN CLAY, low plasticity, little to trace sand, brown and gray, dry, hard	SH 1	33		5.0	
		SH 2	40		5.0	
5	high plastic (CH), soft at 4.0'	SH 3	46		1.25	
	(CL) SANDY CLAY, low plasticity, some to little silt, red and gray, hard, dry at 6.0'	SH 4			1.0	
10	hard to stiff at 8.0'	SH 5	46		3.25	
15	(SC) CLAYEY SAND, fine, subangular, brown, moist	SH 6	46			
20	(CH) SANDY CLAY, fine, subangular, medium to high plasticity, red and gray, moist, hard	SH 7			4.5	
25	little silt, moist, soft at 23.0' ▽	SH 8	67		1.5	
30	(SC) CLAYEY SAND, fine, subangluar, low plasticity, red and gray, mottled, wet	SH 9	71		1.5	
35	(SP) SAND, fine, poorly graded, trace silt and clay, gray and red, wet, compact	SS 10	94	6-8-11 (19)		



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BORING NUMBER BH-104

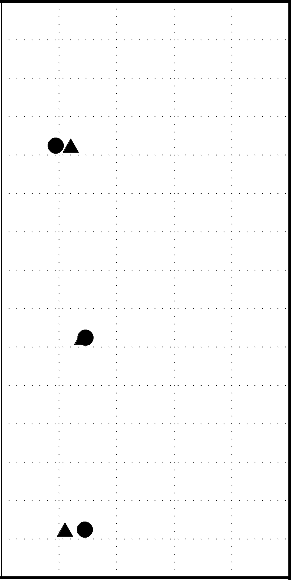
CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

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		(SP) SAND, fine, poorly graded, trace silt and clay, gray and red, wet, compact *(continued)*						
40		(SP) SAND, medium to fine, subangular, poorly graded, some silt and fine gravel, red and brown, wet, compact	SS 11	100	6-12-12 (24)			
45		(SM) SILTY SAND, fine, subangular, some clay seams, tan and gray, wet, compact	SS 12		3-12-16 (28)			
50		some oxidation, trace clay seams at 48.0'	SS 13	89	7-9-13 (22)			



Bottom of borehole at 50.0 feet.

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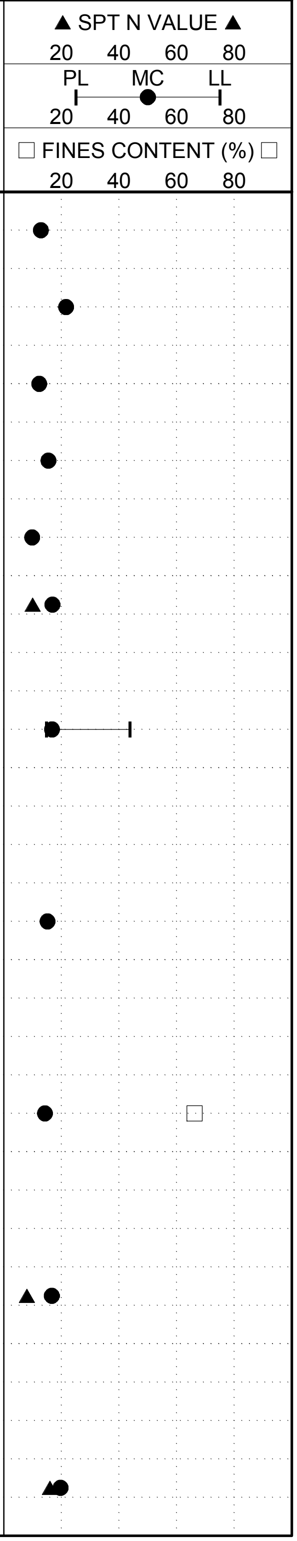
BORING NUMBER BH-105

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/23/12 **COMPLETED** 10/23/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 34.40 ft / Elev 352.10 ft
LOGGED BY FW **CHECKED BY** MP
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	(CH) FAT CLAY, high plastic, tan and red, dry, soft (OH) SILT, low plastic, organic, trace roots, black (GP) SANDY GRAVEL, fine, subangular, white	SH 1	33		1.0	
	(CL) LEAN CLAY, low plasticilty, some sand, tan and gray, dry, firm	SH 2	50		4.5	
5	(CL) SANDY CLAY, low plasticity, red and gray, mottled, dry, hard	SH 3	67		5.0	
	some sand seams at 6.0'	SH 4	92		3.0	
	(SC) CLAYEY SAND, fine, subangular, gray, dry	SH 5	54		1.5	
10	compact at 10.0'	SS 6	67	3-4-6 (10)		
15	(CL) SANDY CLAY, low plasticity, some clayey sand seams, gray and red, mottled, dry, hard	SH 7	54		5.0	
20		SH 8	60		3.75	
25	increased sand content, moist at 23.0'	SH 8	67		5.0	
30	(SC) CLAYEY SAND, fine, subangular, low plasticity, red and gray, moist, loose	SS 9	100	4-4-4 (8)		
35	some clay seams, trace fine gravel, tan and gray, wet, compact at 33.0' ▽	SS 10	100	7-7-9 (16)		



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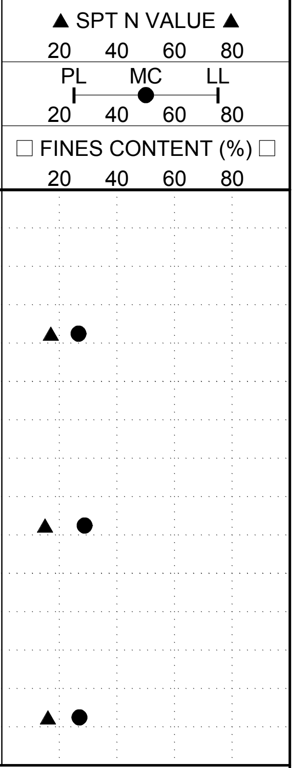
BORING NUMBER BH-105

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

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
35		(SC) CLAYEY SAND, fine, subangular, low plasticity, red and gray, moist, loose *(continued)*					
		no gravel at 38.0'	SS 11	100	5-7-10 (17)		
40							
			SS 12	100	5-6-9 (15)		
45							
		(SM) SILTY SAND, fine with trace medium, subangular, little clay, tan, wet, compact	SS 14	100	5-7-9 (16)		
50							



Bottom of borehole at 50.0 feet.

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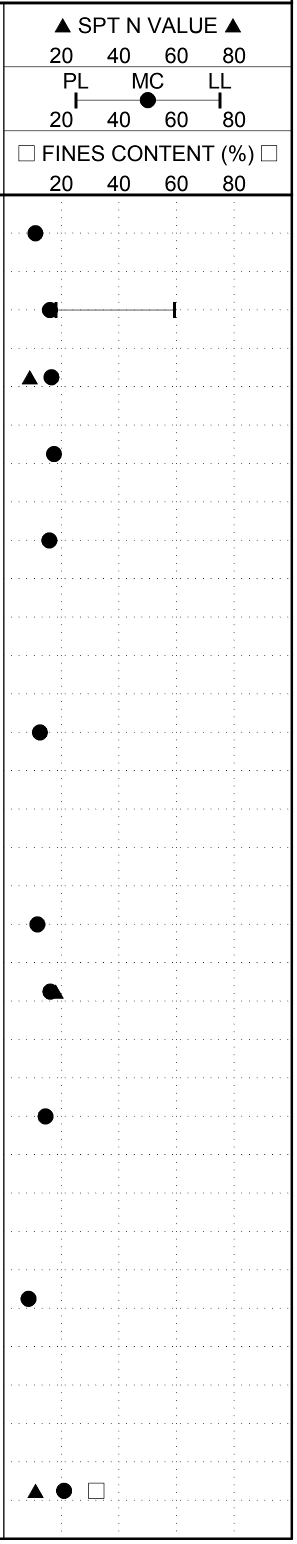
BORING NUMBER BH-106

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/23/12 **COMPLETED** 10/23/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
∇ **AT TIME OF DRILLING** 31.00 ft / Elev 355.50 ft no reading, cave in at 31
LOGGED BY FW **CHECKED BY** MP
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) GRAVELLY CLAY, low plastic, some sand, brown, dry, hard	SH 1	33		5.0	
		(CH) FAT CLAY, medium to high plasticity, little silt and sand, brown, dry, hard	SH 2	46		5.0	
5		(CL) SANDY CLAY, medium plasticity, trace silt, red and gray, dry	SS 3	33	3-4-5 (9)		
			SH 4	67		3.5	
			SH 5	67		3.0	
10		(SC) CLAYEY SAND, low plasticity for last 6", gray, dry					
		low to non plastic, dark gray at 13.0'	SH 6	46		5.0	
15							
		fine, subangular, tan and gray at 18.0'	SH 7	50		2.0	
20		little silt, red, compact at 20.0'	SS 8	100	5-7-11 (18)		
		(CL) SANDY CLAY, low plasticity, tan and gray, moist, firm to stiff	SH 9	67		3.5	
25							
		(SM) SILTY SAND, fine, subangular, nonplastic, trace to little clay, tan, moist	SH 10	67			
30		∇					
		(SM) SILTY SAND, medium to fine, poorly graded, nonplastic, trace gravel, tan and red, wet, compact	SS 11	89	5-5-6 (11)		
35							



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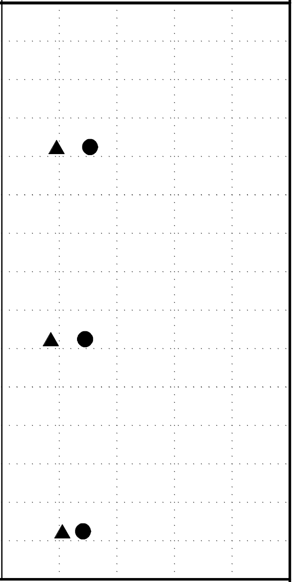
CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

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		(SM) SILTY SAND, medium to fine, poorly graded, nonplastic, trace gravel, tan and red, wet, compact *(continued)*						
		(SC) CLAYEY SAND, fine, subangular, some clay seams, oxidation, tan and gray, mottled, wet, compact	SS 12	72	4-8-11 (19)			
40								
		no visible oxidation at 43.0'	SS 13	44	5-7-10 (17)			
45								
			SS 14	100	7-8-13 (21)			
50								



Bottom of borehole at 50.0 feet.

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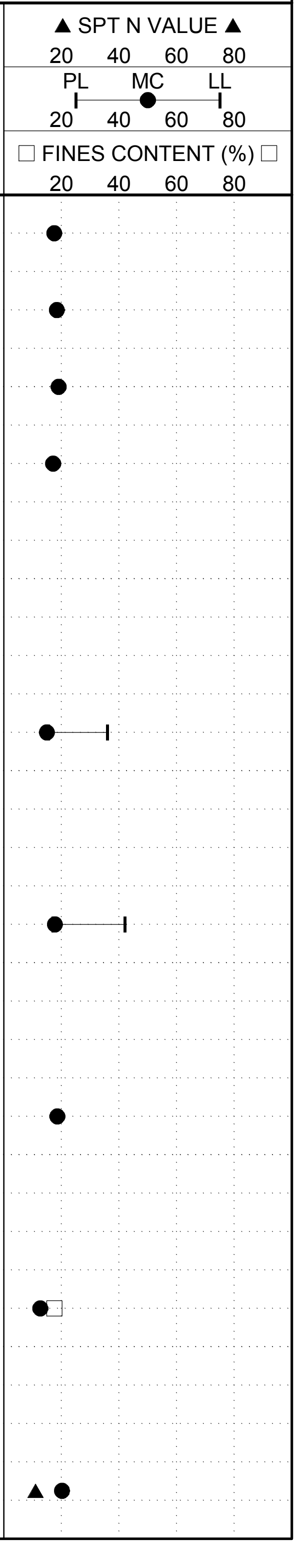
BORING NUMBER BH-107

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/23/12 **COMPLETED** 10/23/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 31.75 ft / Elev 354.75 ft
LOGGED BY FW **CHECKED BY** MP
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		remove 1' of sandy gravel from roadway					
		(CL) LEAN CLAY, low plasticity, some sand, gray, dry, hard	SH 1	42		5.0	
			SH 2	56		5.0	
5		some sand seams at 4.0'	SH 3	46		5.0	
		(CL) SANDY CLAY, low plasticity, some silt, gray and red, dry, hard	SH 4	71		4.25	
10		(SC) CLAYEY SAND, fine, subangular, low plasticity, gray, dry	SH 5	54		1.75	
15			SH 6	67		3.5	
20		(CL) SANDY CLAY, low plasticity, little silt, red and gray, dry, firm to stiff	SH 7	54		2.75	
25		increased sand content, moist at 23.0'	SH 8	58		4.0	
30		(SP) SAND, nonplastic, poorly graded, some silt, little clay, tan, moist	SH 9	58			
	▽						
35		(SM) SILTY SAND, fine with little medium, little clay, tan and gray, wet, compact	SS 10	89	5-5-6 (11)		



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BORING NUMBER BH-107

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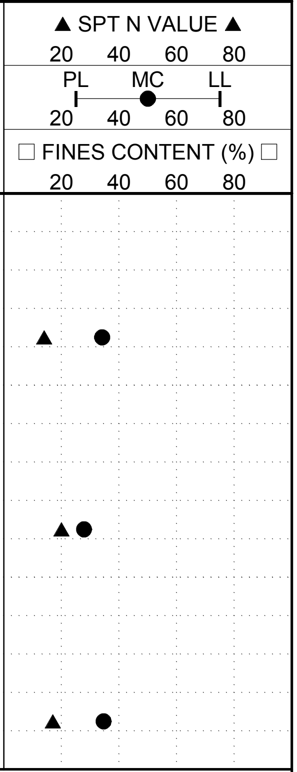
CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
35		(SM) SILTY SAND, fine with little medium, little clay, tan and gray, wet, compact *(continued)*					
		3" dark gray clay seam (CL), little gravel at 38.0'	SS 11	89	5-5-9 (14)		
40							
		subangular, trace clay, oxidation, tan at 43.0'	SS 12		5-9-11 (20)		
45							
		some clay seams, tan and gray at 48.0'	SS 13	89	4-8-9 (17)		
50							



Bottom of borehole at 50.0 feet.

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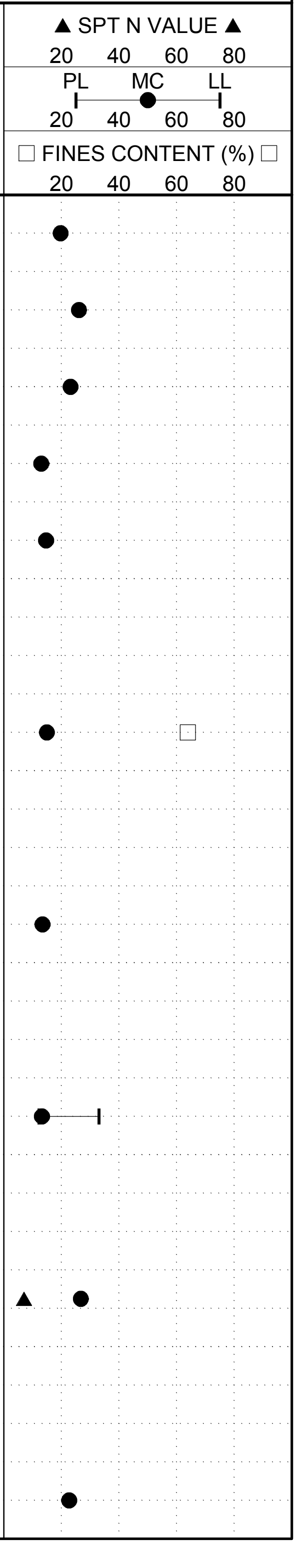
BORING NUMBER BH-108

CLIENT Luminant
PROJECT NAME Pond Slope Stability
PROJECT NUMBER 123-94128
PROJECT LOCATION Monticello
DATE STARTED 10/24/12 **COMPLETED** 10/24/12
GROUND ELEVATION 386.5 ft **HOLE SIZE** 8 inches
DRILLING CONTRACTOR WEST Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 32.65 ft / Elev 353.85 ft
LOGGED BY FW **CHECKED BY** MP
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		remove 4" of gravel from roadway (CL) LEAN CLAY, low plasticity, some to little sand, trace silt, brown, dry, firm	SH 1	38		2.5	
		some sand, tan and gray, firm to stiff at 2.0'	SH 2	75		2.75	
5		trace gravel, tan, red, and gray, stiff at 4.0'	SH 3	54		3.0	
		increased sand content, little silt, hard at 6.0'	SH 4	83		5.0	
10		(CL) SANDY CLAY, low plasticity, some silt, gray and red, dry, stiff	SH 5	44		3.75	
15		(CL) SANDY CLAY, low plasticity, fine, subangular, dark gray, dry	SH 6	75			
20		some silt, tan and gray at 18.0'	SH 7	50			
25		(CL) SANDY CLAY, low plasticity, little silt, tan and gray, dry, hard	SH 8	83			
30		low plasticity, some silt, moist, firm at 28.0'	SS 9	89	6-3-4 (7)		
	▽						
35		(SC) CLAYEY SAND, fine, subangular, low plasticity, little silt, some clay seams, tan and gray, moist	SH 10	46			



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BORING NUMBER BH-108

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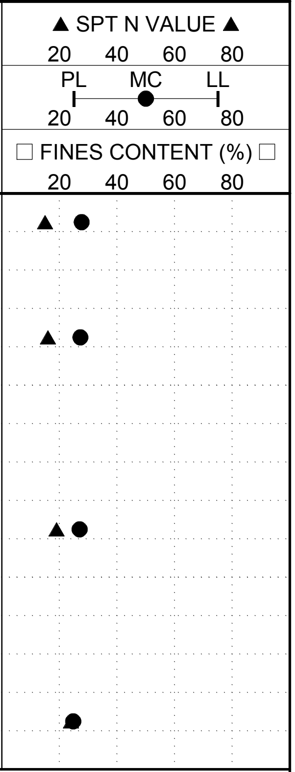
CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
35	(SC) CLAYEY SAND, fine, subangular, low plasticity, little silt, some clay seams, tan and gray, moist *(continued)* little medium at 35.0'	SS 11	100	4-6-9 (15)		
		SS 12	100	3-7-9 (16)		
40						
	some silt, little oxidation, wet, compact at 43.0'	SS 13	100	4-8-11 (19)		
45						
		SS 14		6-9-15 (24)		
50						



Bottom of borehole at 50.0 feet.

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

BORING NUMBER BH-109

PAGE 1 OF 1

CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

DATE STARTED 10/24/12 **COMPLETED** 10/24/12

GROUND ELEVATION 384 ft **HOLE SIZE** 8 inches

DRILLING CONTRACTOR WEST Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

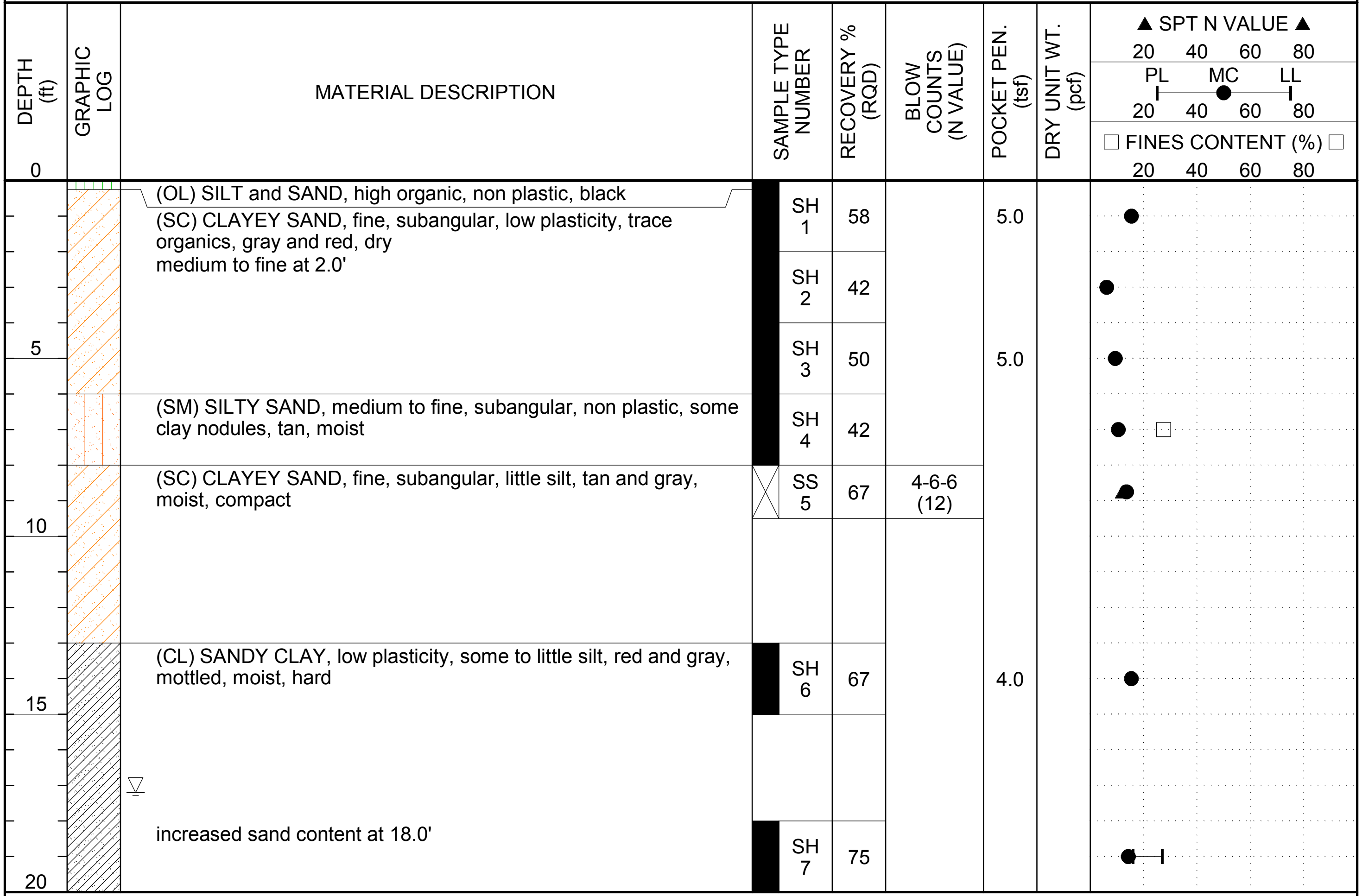
▽ **AT TIME OF DRILLING** 17.20 ft / Elev 366.80 ft no reading, cave in at 17

LOGGED BY FW **CHECKED BY** MP

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	(OL) SILT and SAND, high organic, non plastic, black					
	(SC) CLAYEY SAND, fine, subangular, low plasticity, trace organics, gray and red, dry medium to fine at 2.0'	SH 1	58		5.0	
		SH 2	42			
5		SH 3	50		5.0	
	(SM) SILTY SAND, medium to fine, subangular, non plastic, some clay nodules, tan, moist	SH 4	42			
	(SC) CLAYEY SAND, fine, subangular, little silt, tan and gray, moist, compact	SS 5	67	4-6-6 (12)		
10						
	(CL) SANDY CLAY, low plasticity, some to little silt, red and gray, mottled, moist, hard	SH 6	67		4.0	
15	▽					
	increased sand content at 18.0'	SH 7	75			
20						

Bottom of borehole at 20.0 feet.

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BORING NUMBER BH-110

PAGE 1 OF 1

CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

DATE STARTED 10/24/12 **COMPLETED** 10/24/12

GROUND ELEVATION 384 ft **HOLE SIZE** 8 inches

DRILLING CONTRACTOR WEST Drilling

GROUND WATER LEVELS:

DRILLING METHOD Hollow Stem Auger

▽ **AT TIME OF DRILLING** 18.10 ft / Elev 365.90 ft no reading, cave in at 1

LOGGED BY FW **CHECKED BY** MP

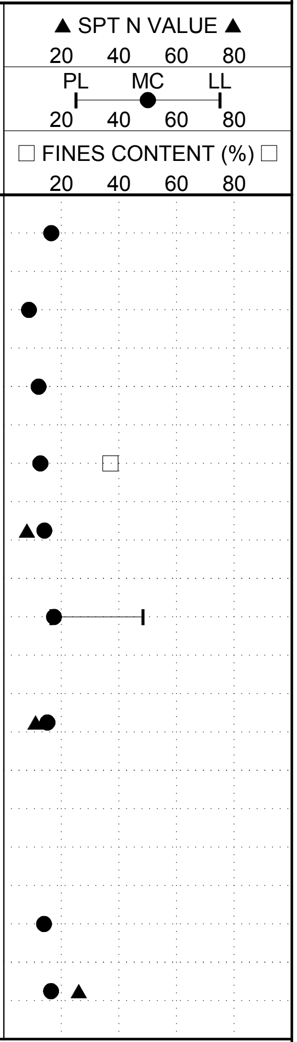
AT END OF DRILLING ---

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) LEAN CLAY and SILT, some organics					
	(CL) SILTY CLAY, low plasticity, trace organics, tan and gray, dry, hard	SH 1	56		5.0	
	(CL) SANDY CLAY, low plasticity, some silt, tan, red, and gray, dry, hard	SH 2	25			
5	increased sand content at 4.0'	SH 3	46		5.0	
	(SC) CLAYEY SAND, fine, subangular, low to plasticity, some silt, tan, red, and gray, dry	SH 4	58		4.0	
	(CL) SANDY CLAY, low plasticity, little silt, tan and gray, mottled, moist, firm to stiff	SS 5	67	2-4-4 (8)		
10	some high plasticity seams, trace gravels at 10.0'	SH 6	50			
	(SC) CLAYEY SAND, fine, subangular, non plastic to low plasticity, some silt, tan and gray, mottled, compact	SS 7	89	2-4-7 (11)		
15						
	▽ red and gray, moist at 18.0'	SH 8	67		5.0	
20		SS 9	89	8-13-13 (26)		

Bottom of borehole at 22.0 feet.



APPENDIX B
LABORATORY TEST SUMMARY SHEETS

Golder Associates
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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 Monticello

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-101	0	17.0									
BH-101	2	22.6									
BH-101	4	23.4									
BH-101	6	15.7	36	14	22						
BH-101	8	16.6									
BH-101	13	19.0									
BH-101	18	12.4									
BH-101	23	16.2									
BH-101	28	14.8									
BH-101	33	17.1	28	13	15						
BH-101	38	17.5				34					
BH-101	43	28.5									
BH-101	48	27.0									
BH-102	0	15.3									
BH-102	2	10.9									
BH-102	4	15.7									
BH-102	6	16.0									
BH-102	8	16.1									
BH-102	13	16.9				54					
BH-102	18	20.4									
BH-102	23	14.6									
BH-102	28	16.4									
BH-102	33	27.5				69					
BH-102	38	25.6									
BH-102	43	28.6									
BH-102	48	27.7									
BH-103	0	19.4									
BH-103	2	19.2									
BH-103	4	16.5									
BH-103	6	11.4									
BH-103	8	16.5									
BH-103	13	15.5									
BH-103	18	23.1	60	19	41						
BH-103	23	22.3									
BH-103	25	20.4				21					
BH-103	30	24.0									
BH-103	33	21.0									
BH-103	38	26.7									
BH-103	43	28.4				35					
BH-103	48	26.1									
BH-104	0	17.6									

CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello

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-104	2	19.5									
BH-104	4	23.7	55	17	38						
BH-104	6	17.6									
BH-104	8	12.2	27	13	14						
BH-104	13	13.8									
BH-104	18	17.1	50	16	34						
BH-104	23	20.0									
BH-104	28	18.6									
BH-104	33	22.5				7					
BH-104	38	18.8									
BH-104	43	29.1									
BH-104	48	28.9									
BH-105	0	12.9									
BH-105	2	21.6									
BH-105	4	12.3									
BH-105	6	15.5									
BH-105	8	9.8									
BH-105	10	16.9									
BH-105	13	16.7	44	15	29						
BH-105	18	15.1									
BH-105	23	14.3				66					
BH-105	28	16.7									
BH-105	33	19.7									
BH-105	38	26.6									
BH-105	43	28.7									
BH-105	48	26.9									
BH-106	0	11.0									
BH-106	2	16.0	59	18	41						
BH-106	4	16.5									
BH-106	6	17.4									
BH-106	8	15.8									
BH-106	13	12.5									
BH-106	18	11.7									
BH-106	20	16.1									
BH-106	23	14.5									
BH-106	28	8.6									
BH-106	33	20.9				32					
BH-106	38	30.6									
BH-106	43	28.9									
BH-106	48	28.2									
BH-107	0	17.5									

SUMMARY OF LABORATORY RESULTS

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

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-107	2	18.4									
BH-107	4	19.0									
BH-107	6	17.1									
BH-107	13	14.9	36	16	20						
BH-107	18	17.7	42	17	25						
BH-107	23	18.6									
BH-107	28	12.7				18					
BH-107	33	20.2									
BH-107	38	34.1									
BH-107	43	27.8									
BH-107	48	34.7									
BH-108	0	19.7									
BH-108	2	26.1									
BH-108	4	23.2									
BH-108	6	13.0									
BH-108	8	14.7									
BH-108	13	14.9				64					
BH-108	18	13.4									
BH-108	23	13.2	33	12	21						
BH-108	28	26.7									
BH-108	33	22.7									
BH-108	35	27.7									
BH-108	38	27.3									
BH-108	43	27.0									
BH-108	48	24.8									
BH-109	0	15.4									
BH-109	2	6.1									
BH-109	4	9.3									
BH-109	6	10.5				27					
BH-109	8	13.6									
BH-109	13	15.4									
BH-109	18	14.2	27	16	11						
BH-110	0	16.5									
BH-110	2	8.7									
BH-110	4	12.1									
BH-110	6	12.7				37					
BH-110	8	14.1									
BH-110	10	17.4	48	16	32						
BH-110	13	15.1									
BH-110	18	14.0									
BH-110	20	16.4									

APPENDIX C
LABORATORY TEST RESULTS

ATTERBERG LIMIT RESULTS

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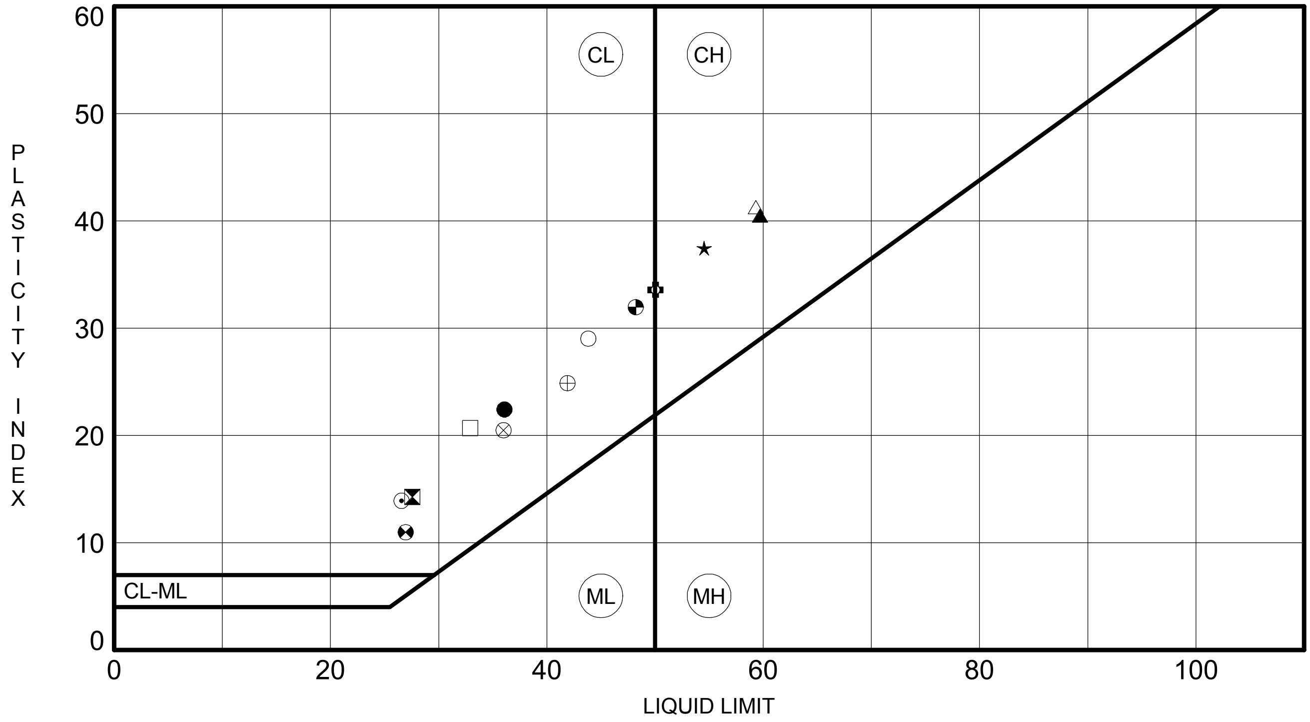
Fax: (281) 821-6870

ATTERBERG LIMITS' RESULTS

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



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BH-101**	**6**	**36**	**14**	**22**		
⧗	**BH-101**	**33**	**28**	**13**	**15**		
▲	**BH-103**	**18**	**60**	**19**	**41**		
★	**BH-104**	**4**	**55**	**17**	**38**		
⊙	**BH-104**	**8**	**27**	**13**	**14**		
✣	**BH-104**	**18**	**50**	**16**	**34**		
○	**BH-105**	**13**	**44**	**15**	**29**		
△	**BH-106**	**2**	**59**	**18**	**41**		
⊗	**BH-107**	**13**	**36**	**16**	**20**		
⊕	**BH-107**	**18**	**42**	**17**	**25**		
□	**BH-108**	**23**	**33**	**12**	**21**		
⊛	**BH-109**	**18**	**27**	**16**	**11**		
◕	**BH-110**	**10**	**48**	**16**	**32**		

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

GRAIN SIZE ANALYSIS

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

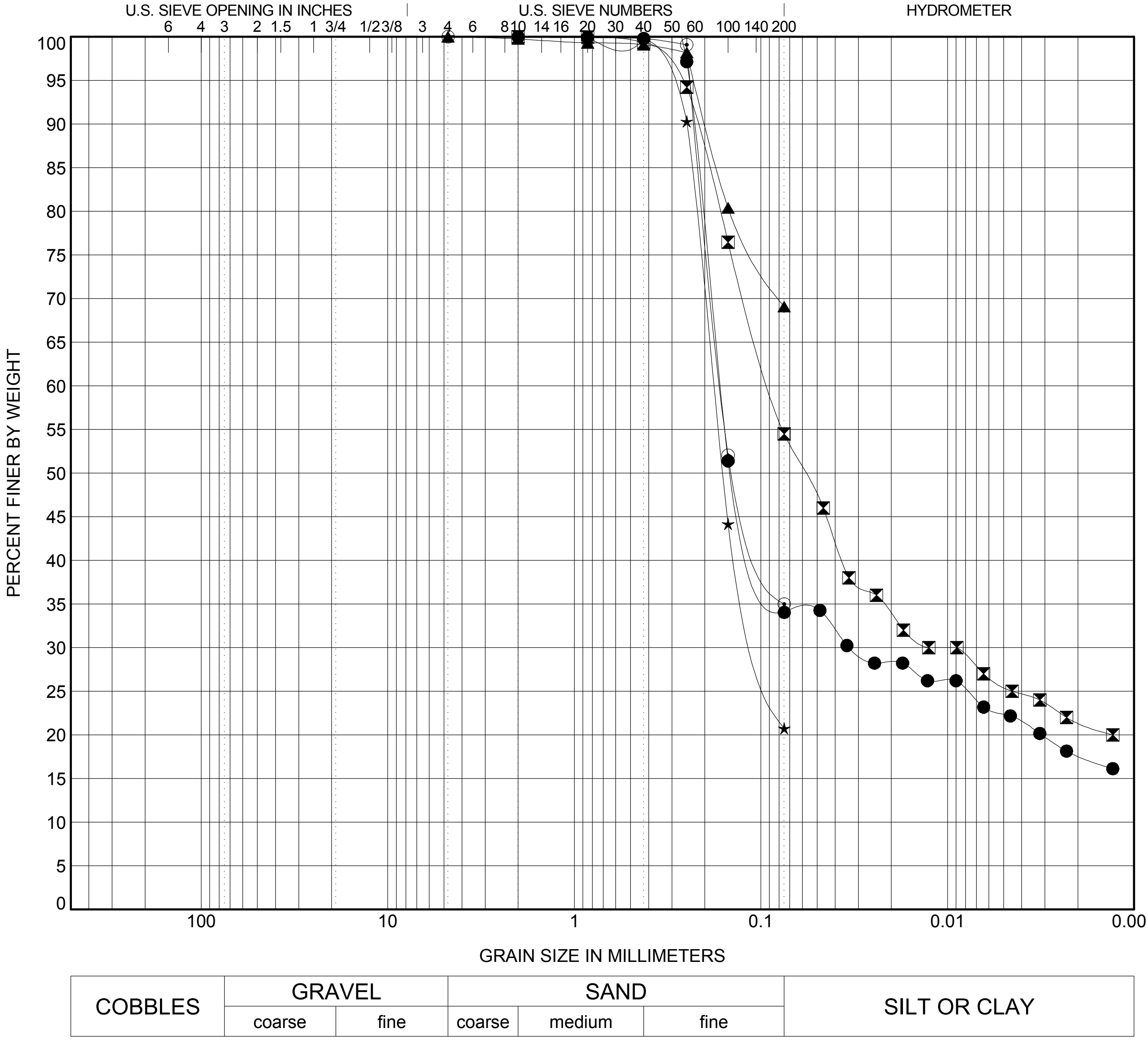
GRAIN SIZE DISTRIBUTION

CLIENT Luminant

PROJECT NAME Pond Slope Stability

PROJECT NUMBER 123-94128

PROJECT LOCATION Monticello



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-101**	**38**						
⧗	**BH-102**	**13**						
▲	**BH-102**	**33**						
★	**BH-103**	**25**						
⊙	**BH-103**	**43**						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-101**	**38**	**2**	**0.165**	**0.033**		**0.0**	**66.0**	**11.6**	**22.4**
⧗	**BH-102**	**13**	**2**	**0.089**	**0.009**		**0.0**	**45.5**	**28.9**	**25.6**
▲	**BH-102**	**33**	**4.75**				**0.0**	**30.9**	**69.1**	
★	**BH-103**	**25**	**4.75**	**0.179**	**0.099**		**0.0**	**79.2**	**20.8**	
⊙	**BH-103**	**43**	**4.75**	**0.164**			**0.0**	**65.0**	**35.0**	

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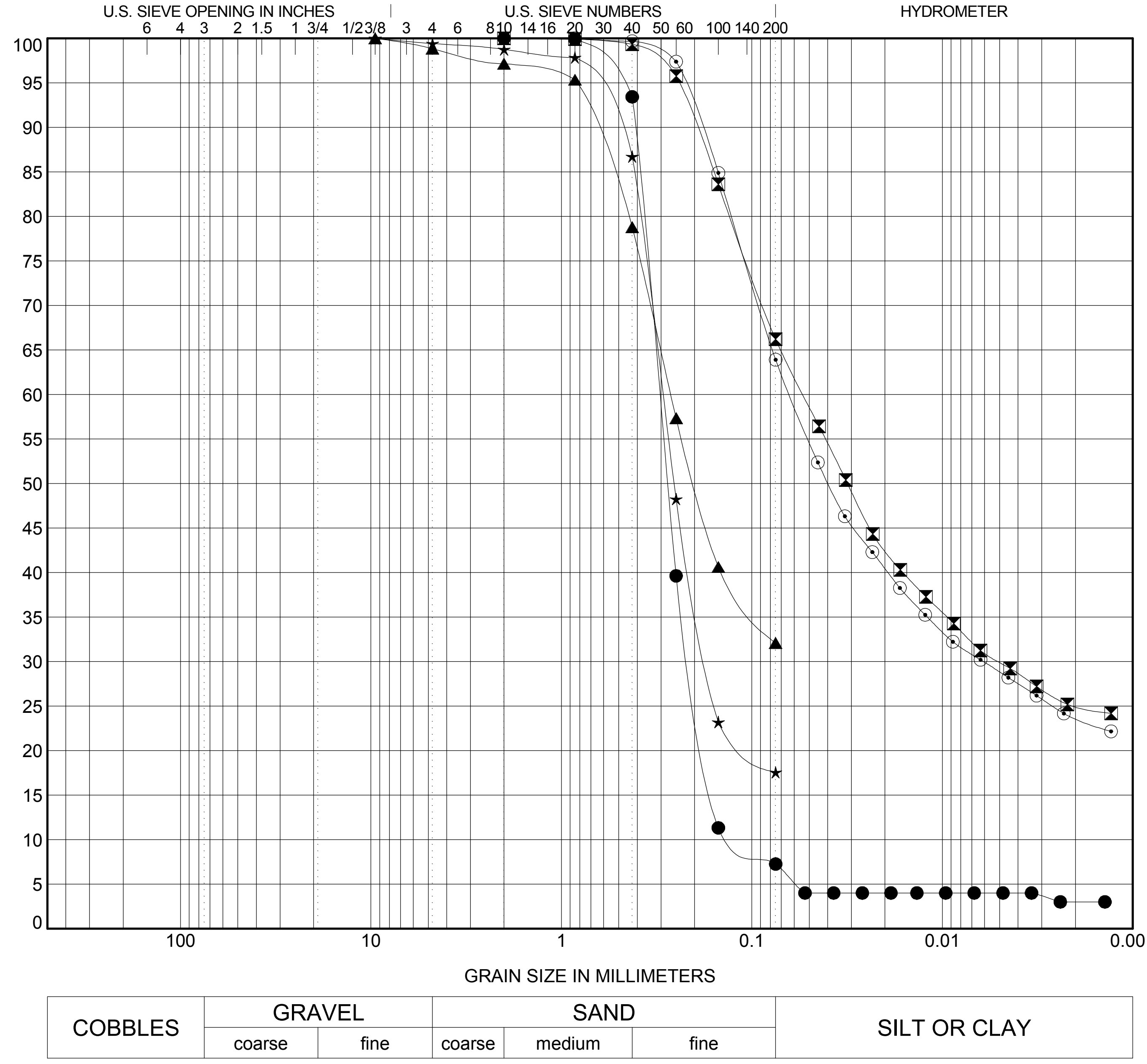
GRAIN SIZE DISTRIBUTION

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



	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-104**	**33**					**1.21**	**2.55**
⧗	**BH-105**	**23**						
▲	**BH-106**	**33**						
★	**BH-107**	**28**						
⊙	**BH-108**	**13**						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-104**	**33**	**2**	**0.306**	**0.21**	**0.12**	**0.0**	**92.7**	**3.3**	**4.0**
⧗	**BH-105**	**23**	**2**	**0.054**	**0.005**		**0.0**	**33.8**	**36.3**	**29.9**
▲	**BH-106**	**33**	**9.5**	**0.267**			**1.2**	**66.7**	**32.1**	
★	**BH-107**	**28**	**9.5**	**0.294**	**0.172**		**0.6**	**81.9**	**17.6**	
⊙	**BH-108**	**13**	**0.85**	**0.063**	**0.006**		**0.0**	**36.1**	**35.1**	**28.8**

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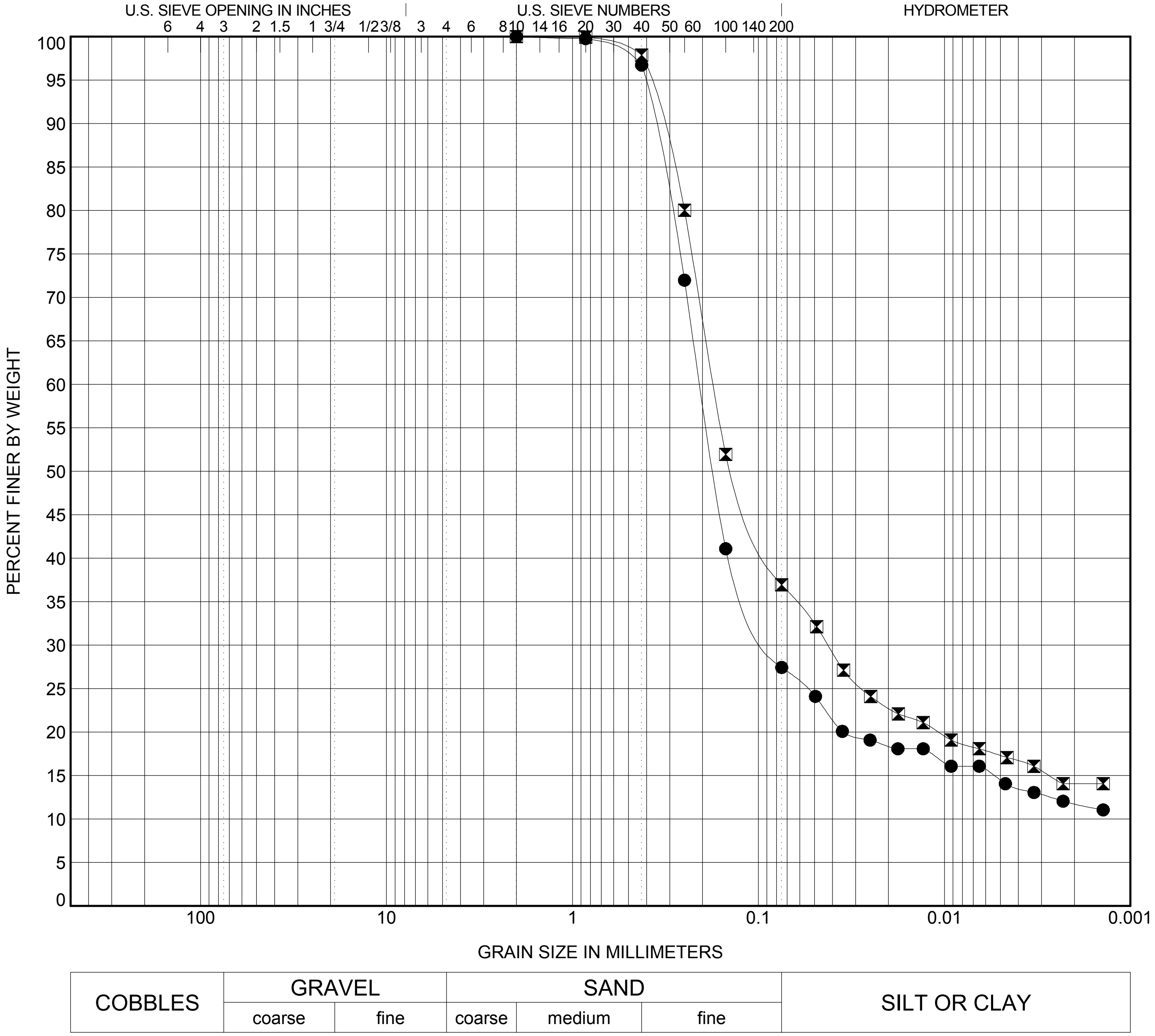
GRAIN SIZE DISTRIBUTION

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

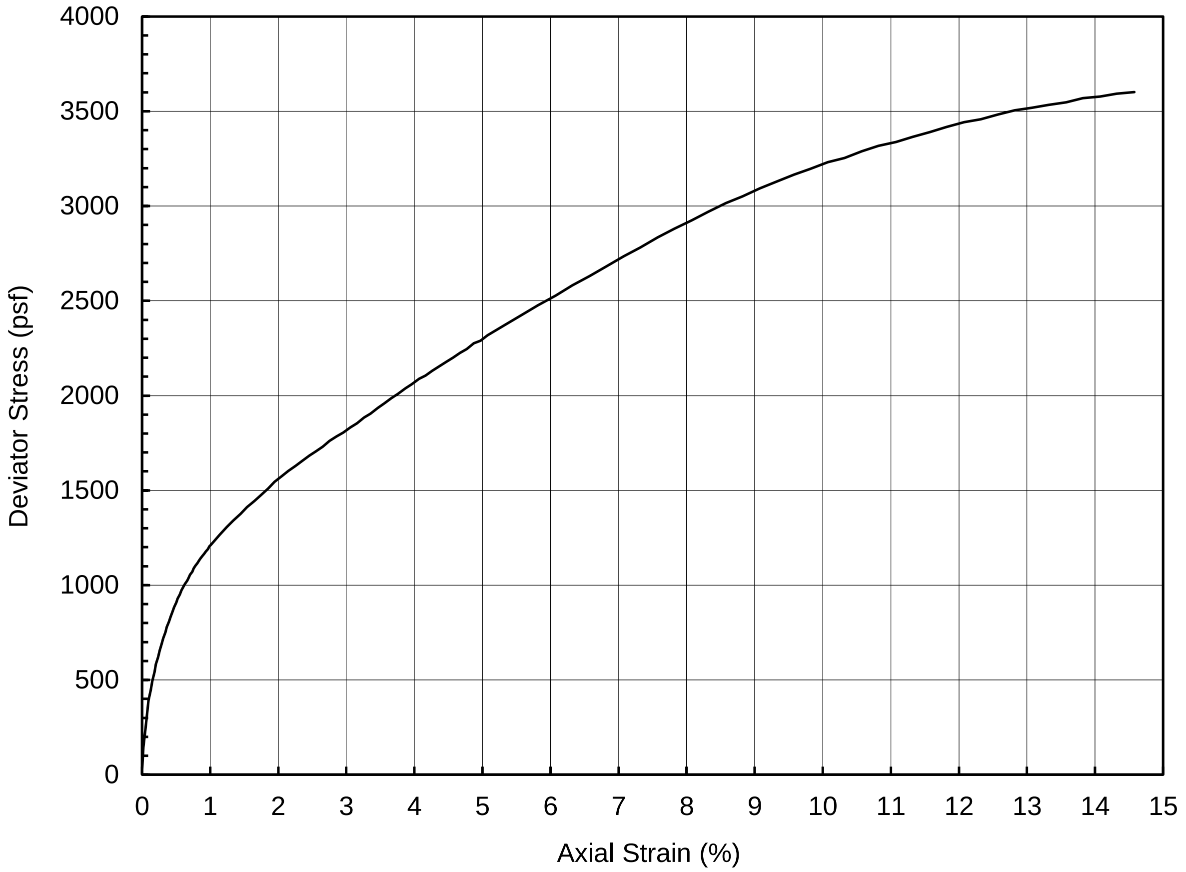


	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BH-109**	**6**						
⧗	**BH-110**	**6**						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-109**	**6**	**2**	**0.205**	**0.085**		**0.0**	**72.6**	**13.0**	**14.4**
⧗	**BH-110**	**6**	**2**	**0.174**	**0.042**		**0.0**	**63.0**	**19.6**	**17.3**

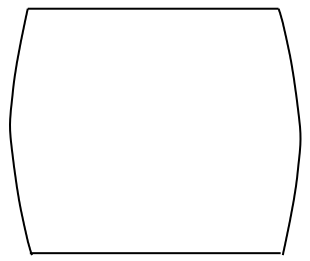
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH (UU)

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Sandy Clay						
LL		PI		LI		USCS	

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



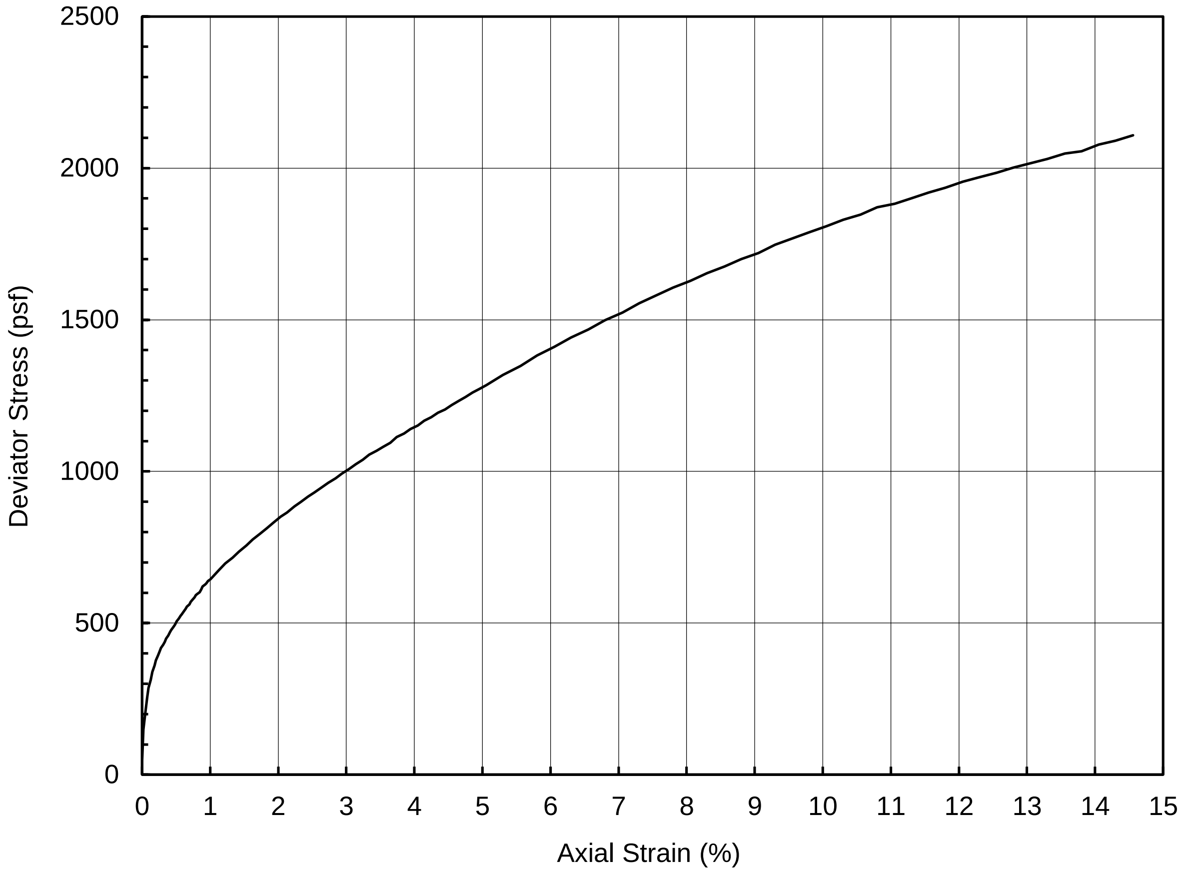
Failure Sketch

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

Golder Associates

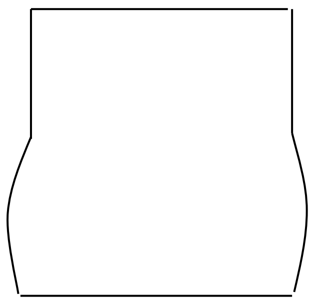
Performed by	**PN**
Date	**9-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Sandy Clay						
LL		PI		LI		USCS	

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



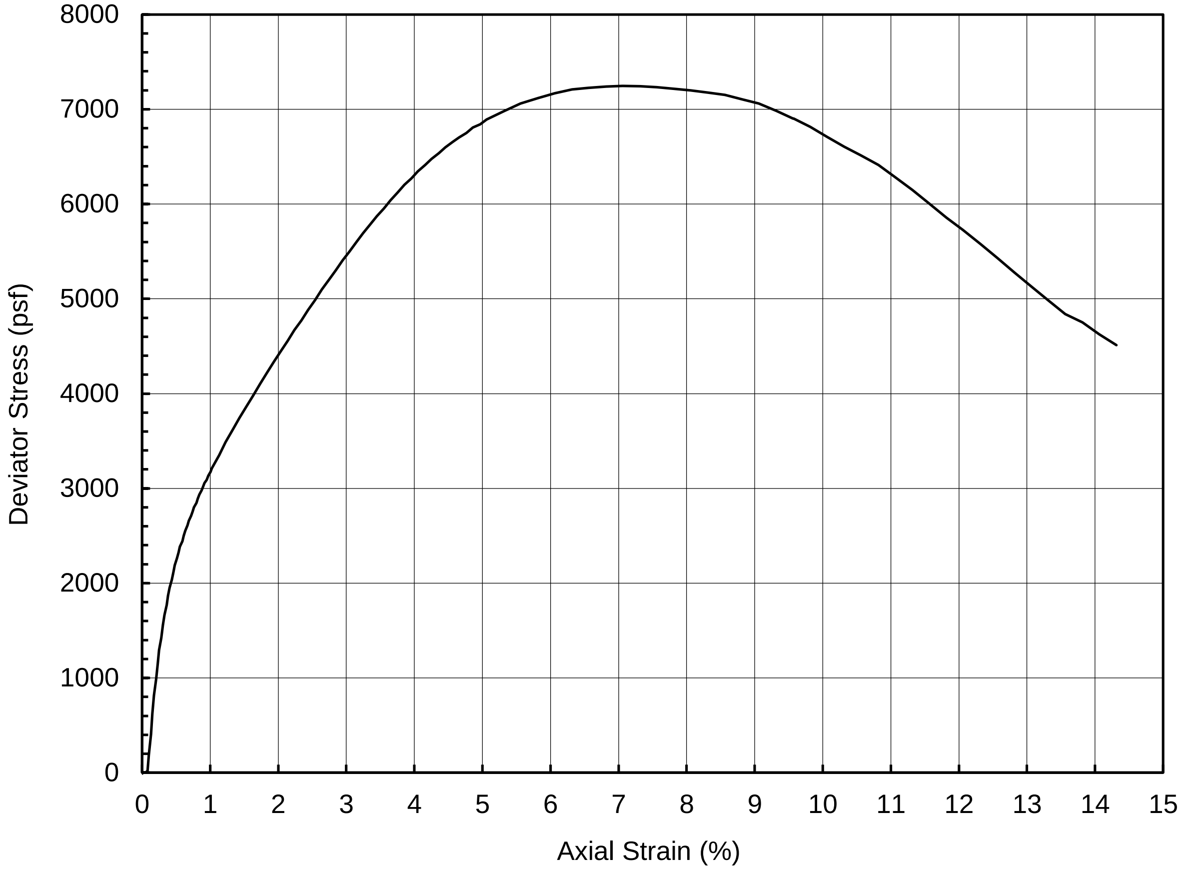
Failure Sketch

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

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

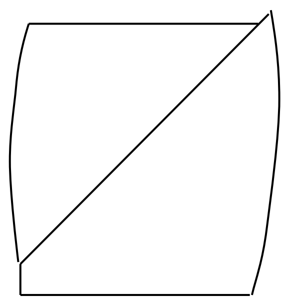
Golder Associates

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clay						
LL		PI		LI		USCS	

Depth (ft)	18.0	Confining Pressure (psf)	2251
Specimen Height (inch)	5.7	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	7245
Initial Specimen Weight (g)	1166.5	Axial Strain at Peak Stress (%)	7.1
Moist Unit Weight (pcf)	126.9		
Initial Water Content (%)	21		
Initial Dry Unit Weight (pcf)	104.5		



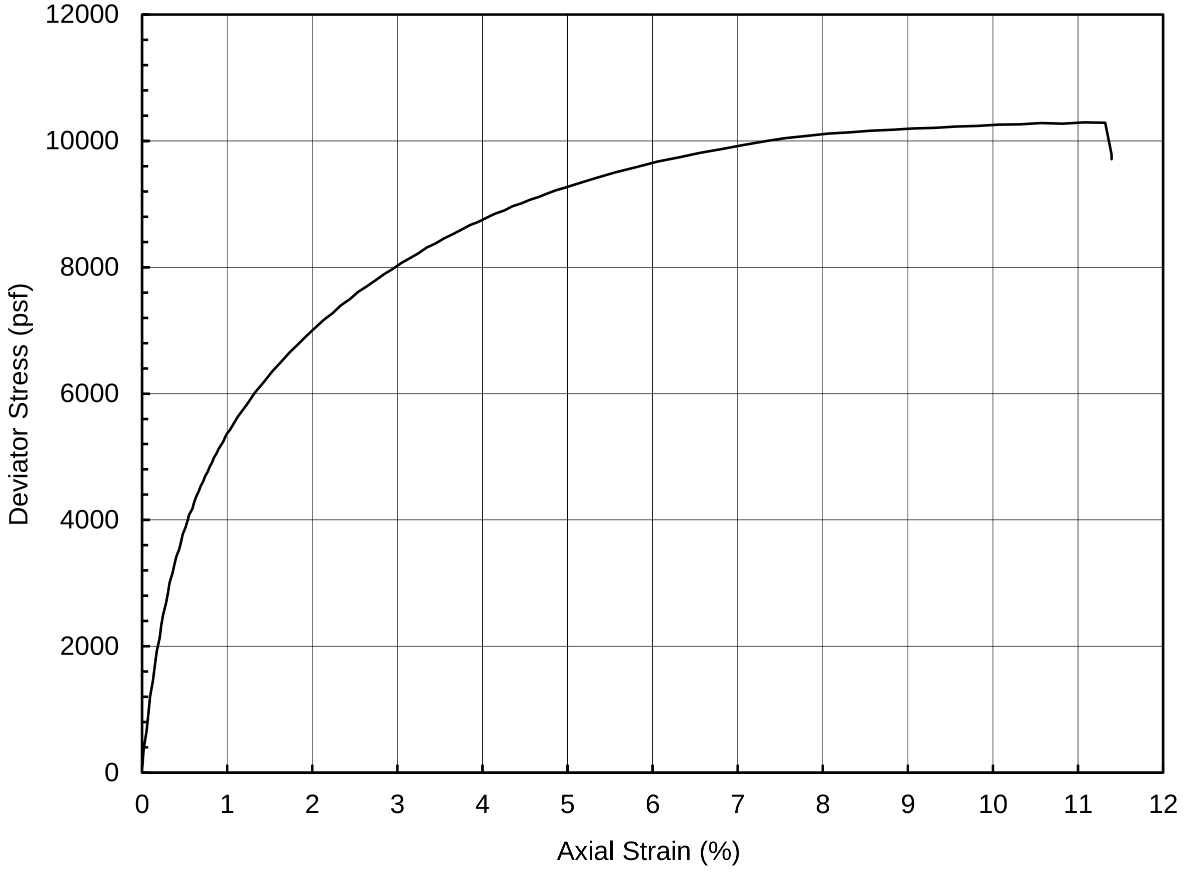
Failure Sketch

Project Title	Luminant - Monticello Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-103 TO-7
Comments	

Golder Associates

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

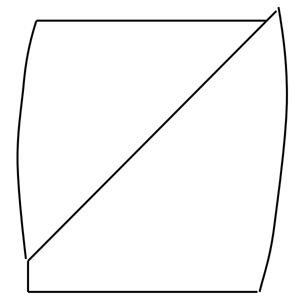
UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clay						
LL		PI		LI		USCS	

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

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

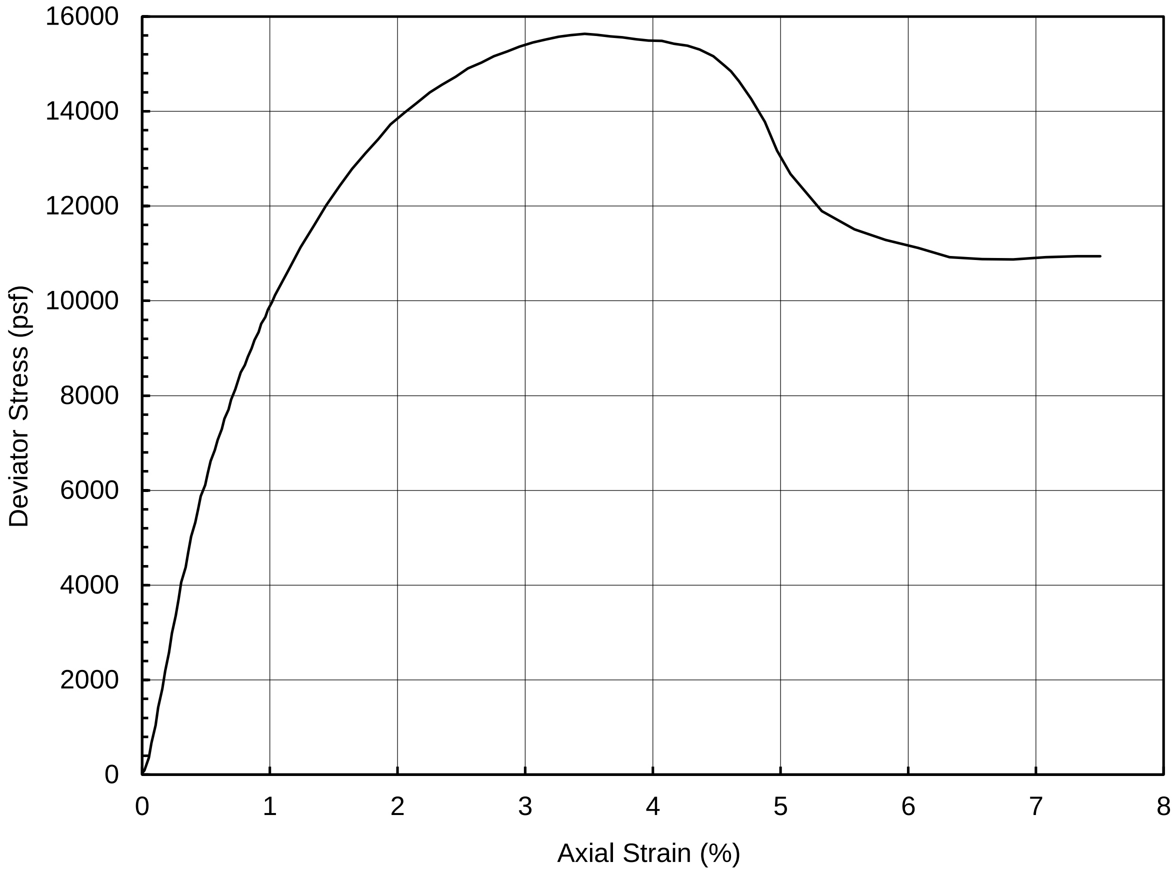


Failure Sketch

Golder Associates

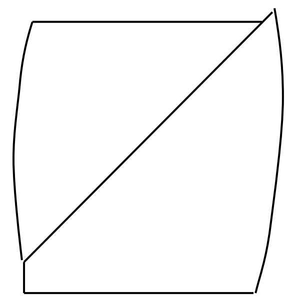
Performed by	**PN**
Date	**10-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clay						
LL		PI		LI		USCS	

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



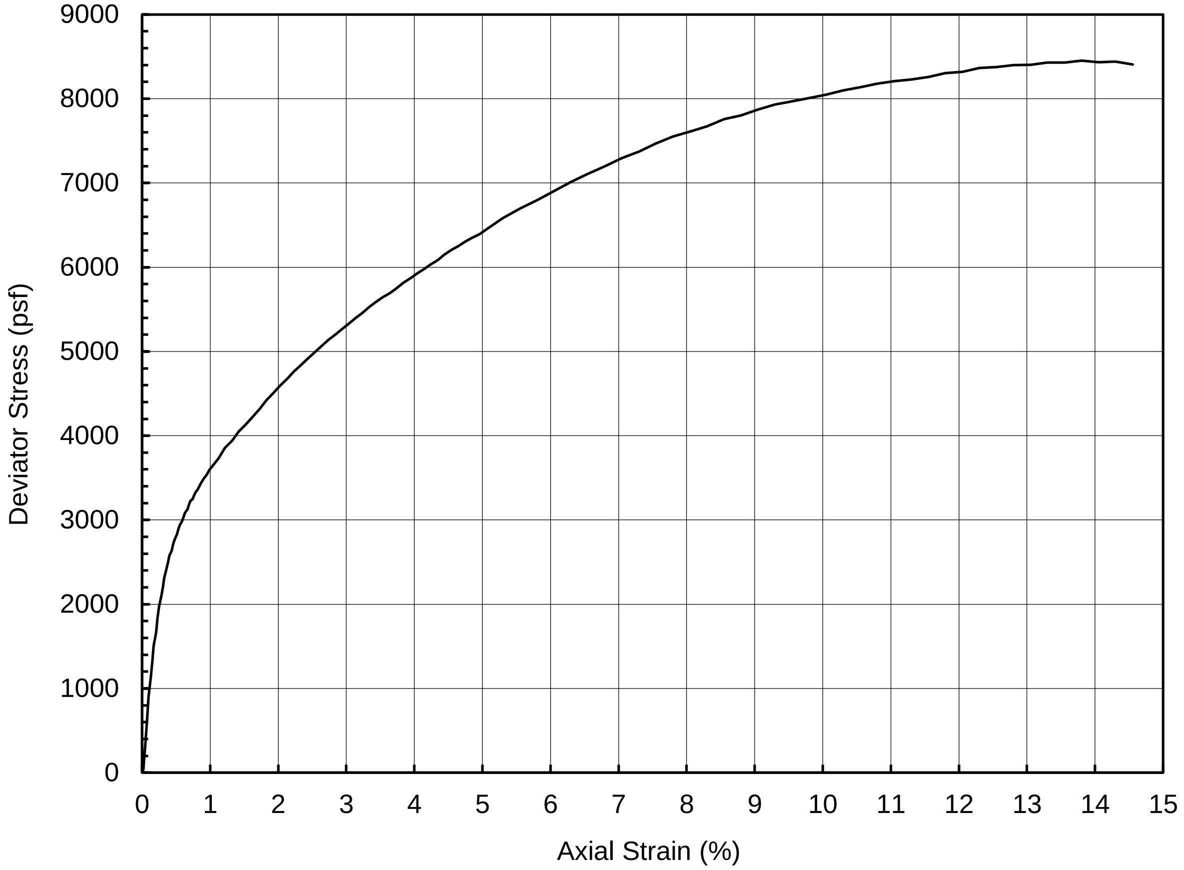
Failure Sketch

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

Golder Associates

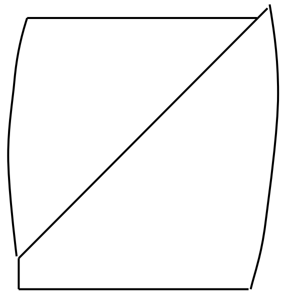
Performed by	**PN**
Date	**10-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Yellow Sandy Clay						
LL		PI		LI		USCS	

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



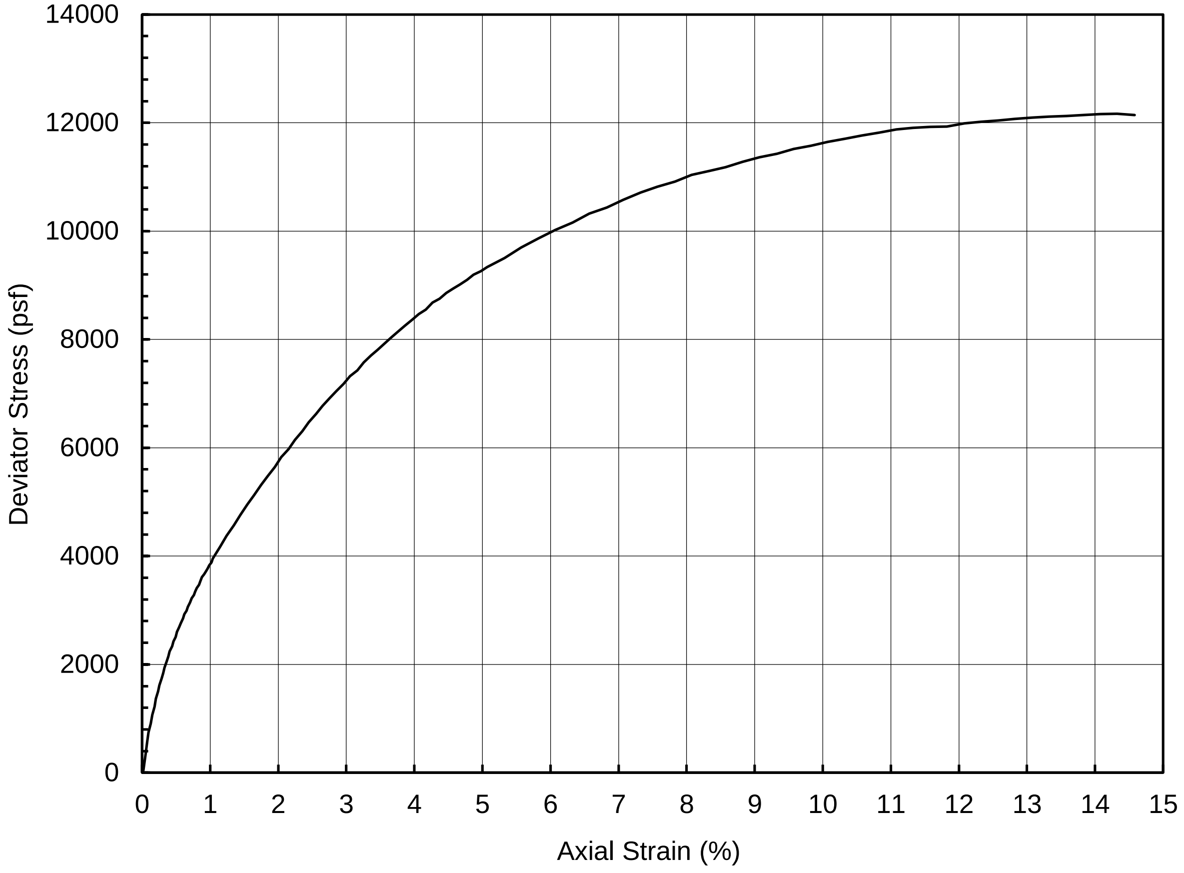
Failure Sketch

Project Title	Luminant - Monticello Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-107 TO-7
Comments	

Golder Associates

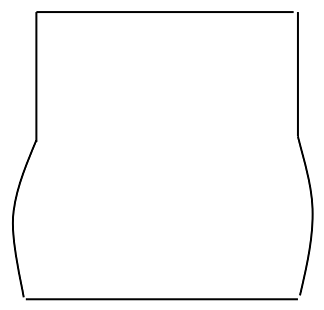
Performed by	**PN**
Date	**10-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Light Grayish Brown Clay						
LL		PI		LI		USCS	

Depth (ft)	23.0	Confining Pressure (psf)	2876
Specimen Height (inch)	6.0	Strain Rate (%/min)	1.0
Specimen Diameter (inch)	2.8	Peak Deviator Stress (psf)	12167
Initial Specimen Weight (g)	1292.1	Axial Strain at Peak Stress (%)	14.3
Moist Unit Weight (pcf)	133.6		
Initial Water Content (%)	14		
Initial Dry Unit Weight (pcf)	116.9		



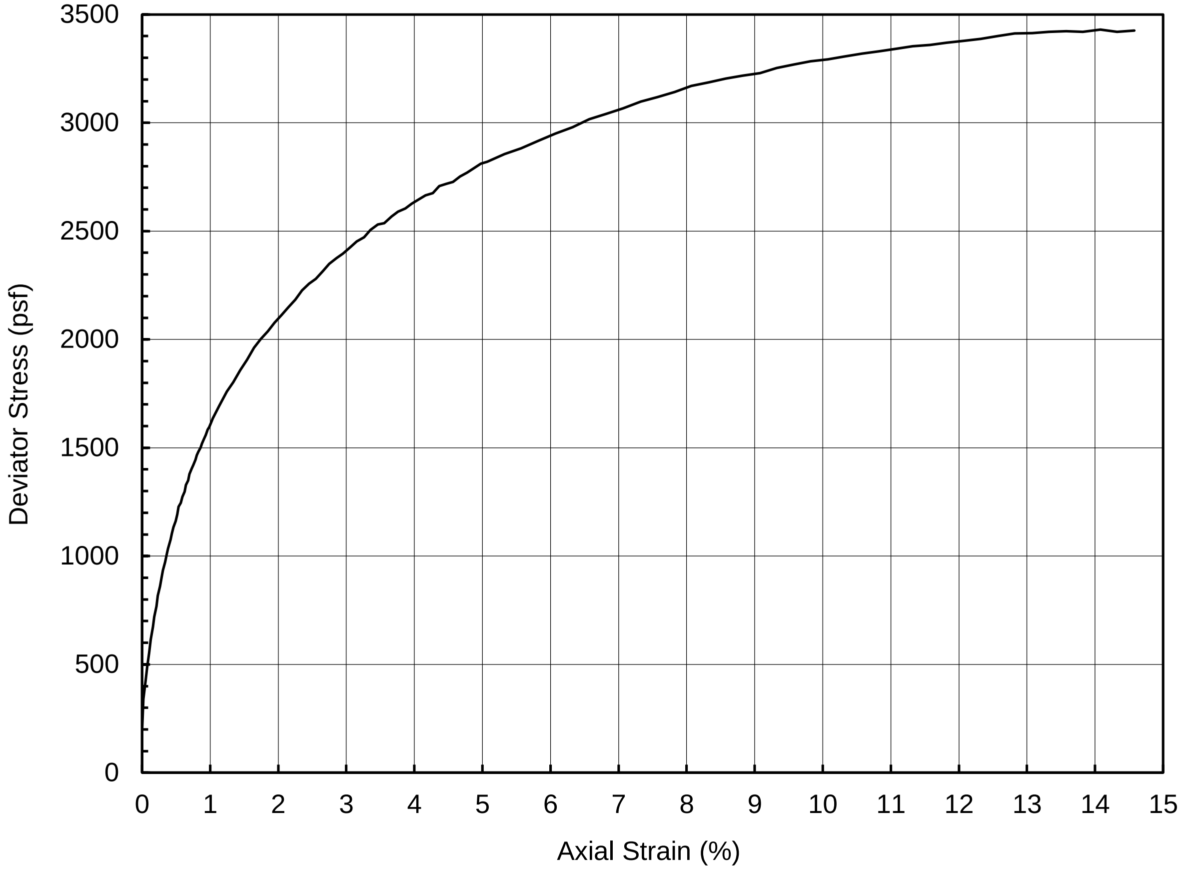
Failure Sketch

Project Title	Luminant - Monticello Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-108 TO-8
Comments	

Golder Associates

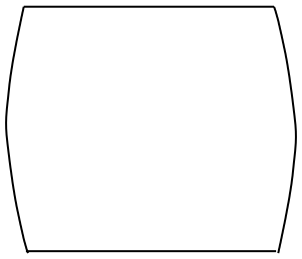
Performed by	**PN**
Date	**10-Nov-12**
Check	**HR**
Review	**PCM**

UNCONSOLIDATED / UNDRAINED COMPRESSIVE STRENGTH
ASTM D 2850



Specimen Description	Reddish Gray Clay						
LL		PI		LI		USCS	

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



Failure Sketch

Project Title	Luminant - Monticello Slope Stability
Project Number	123-94128
Sample Type	Shelby Tube
Sample ID	BH-110 TO-6
Comments	

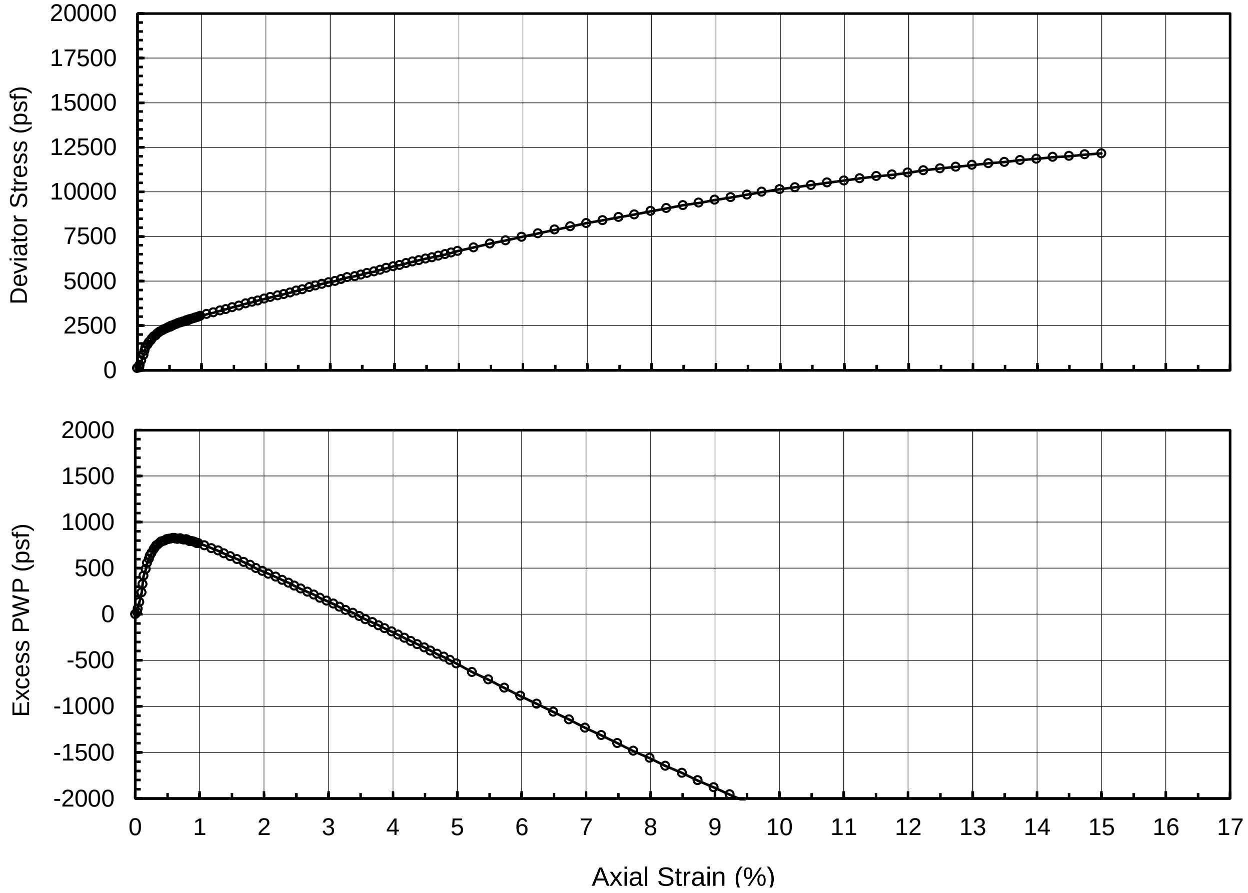
Golder Associates

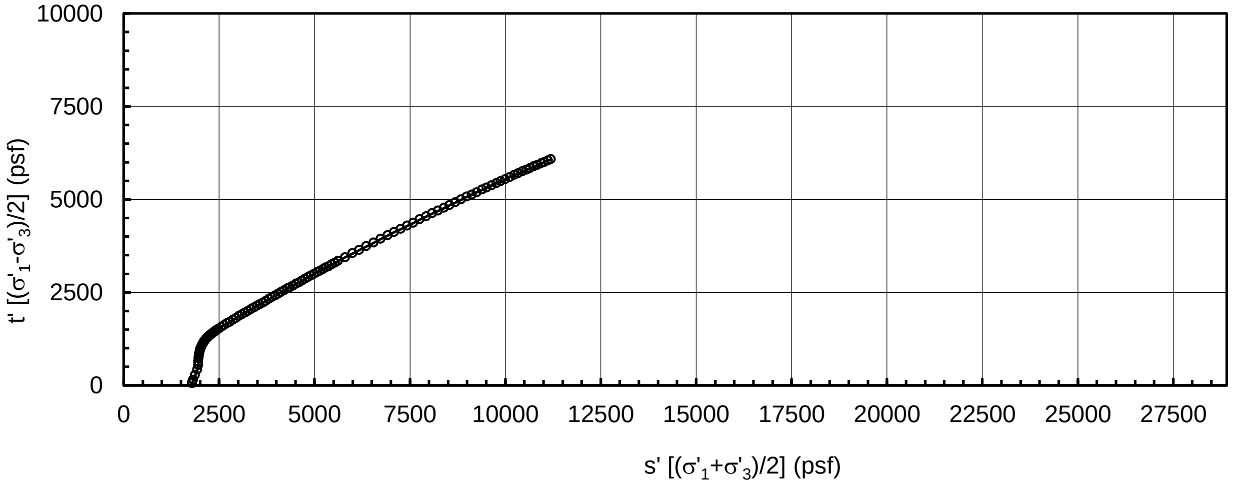
Performed by	**PN**
Date	**10-Nov-12**
Check	**HR**
Review	**PCM**

ISOTROPICALLY CONSOLIDATED UNDRAINED TRIAXIAL TEST (ICU)

Isotropically Consolidated Undrained Triaxial Test (ICU)

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





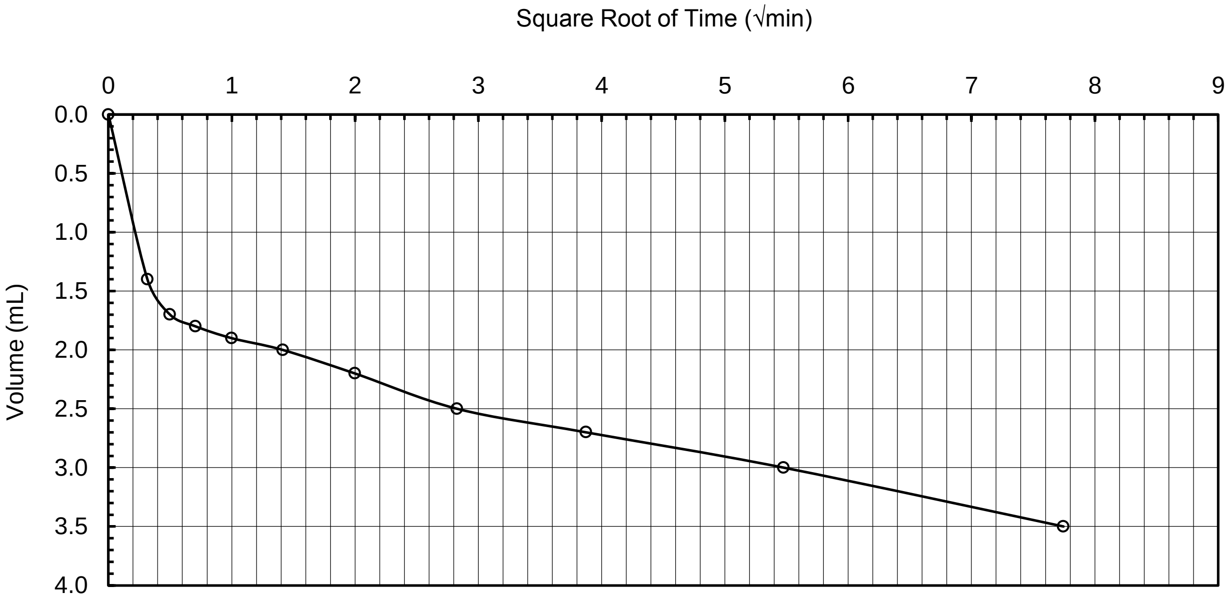
Specimen Description:	Reddish Gray Sandy Clay (visual classification)		
Initial Specimen Diameter (inch) =	2.81	Initial Specimen Height (inch) =	5.95
Initial Water Content (%) =	14.9	Water Content at End of Test (%) =	14.2
Initial Moist Unit Weight (pcf) =	134.9	B-value =	0.95
Back Pressure (BP, psf) =	5040.0	Consolidation Stress (σ'_3, psf) =	1743.9
Initial Lateral Stress (σ'_3, psf) =	1743.9	Consolidation t_{50} (min) =	9
Initial Deviator Stress ($\sigma_1 - \sigma_3$, psf) =	102.3	Rebound Stress (σ'_3, psf) =	NA
Test Strain Rate (%/hour) =	1.0	Rebound t_{50} (min) =	NA

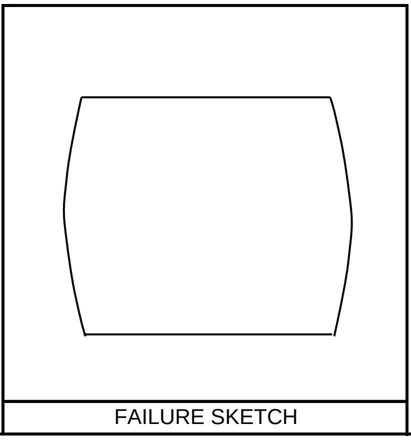
LL =	36	PI =	20	USCS	CL	**Performed by**	PN
Comments:						**Reviewed by**	HR

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

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





FAILURE SKETCH

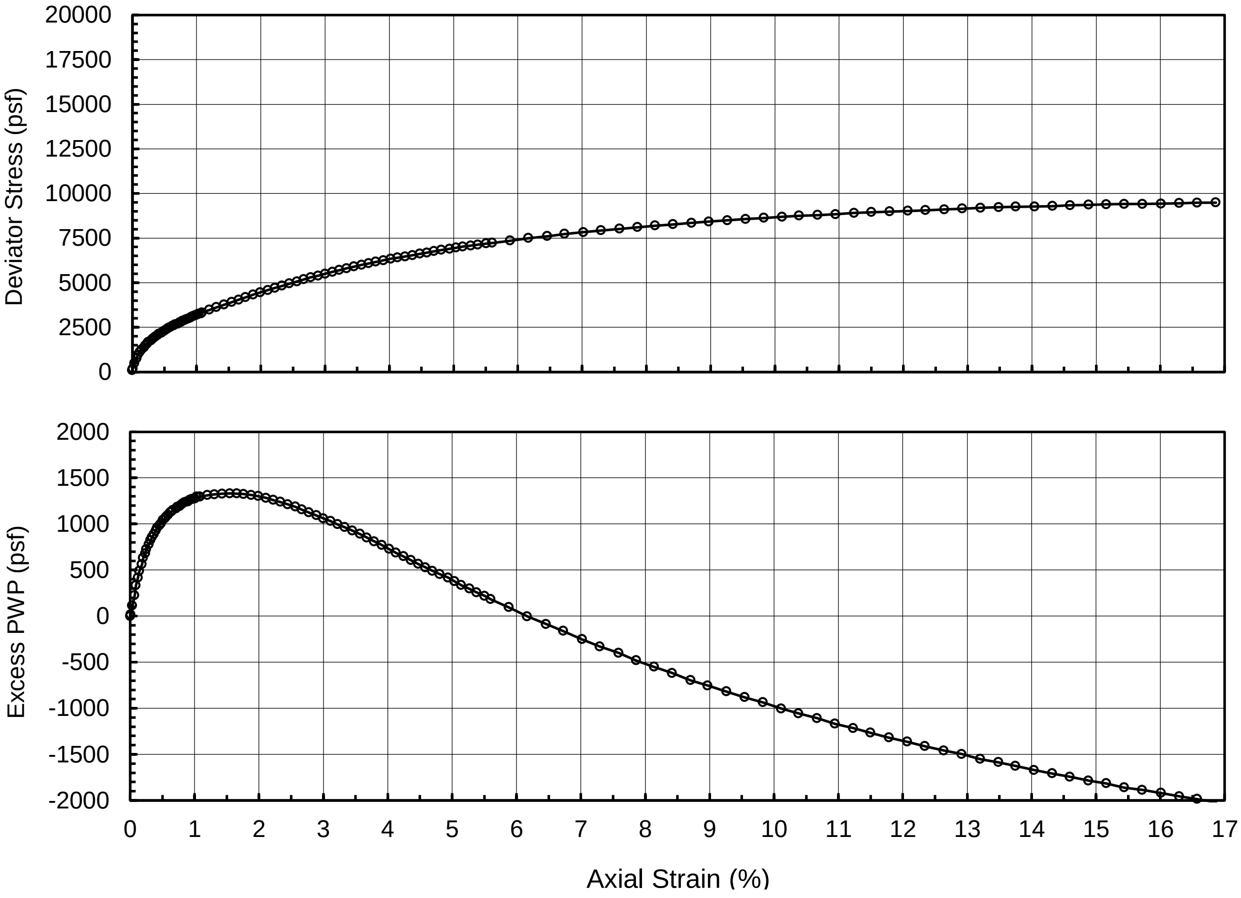
Consolidation Stress (σ'_3, psf) =			1743.9
Consolidation t_{50} (min) =			9
Consolidation Volume Change (mL) =			3.5
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	36	PI =	20
USCS	CL		
Gs =	2.65	assumed	

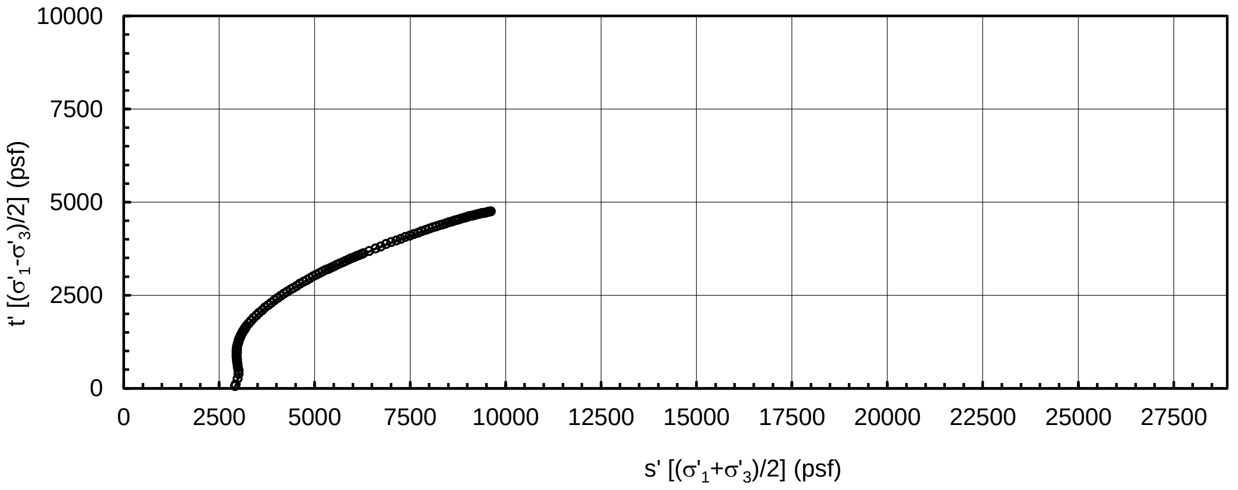
Performed by	PN
Reviewed by	HR

Golder Associates

Isotropically Consolidated Undrained Triaxial Test (ICU)

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





Specimen Description: Light Gray Clay

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

LL =	42	PI =	25	USCS	CL	**Performed by**	PN
Comments:						**Reviewed by**	HR

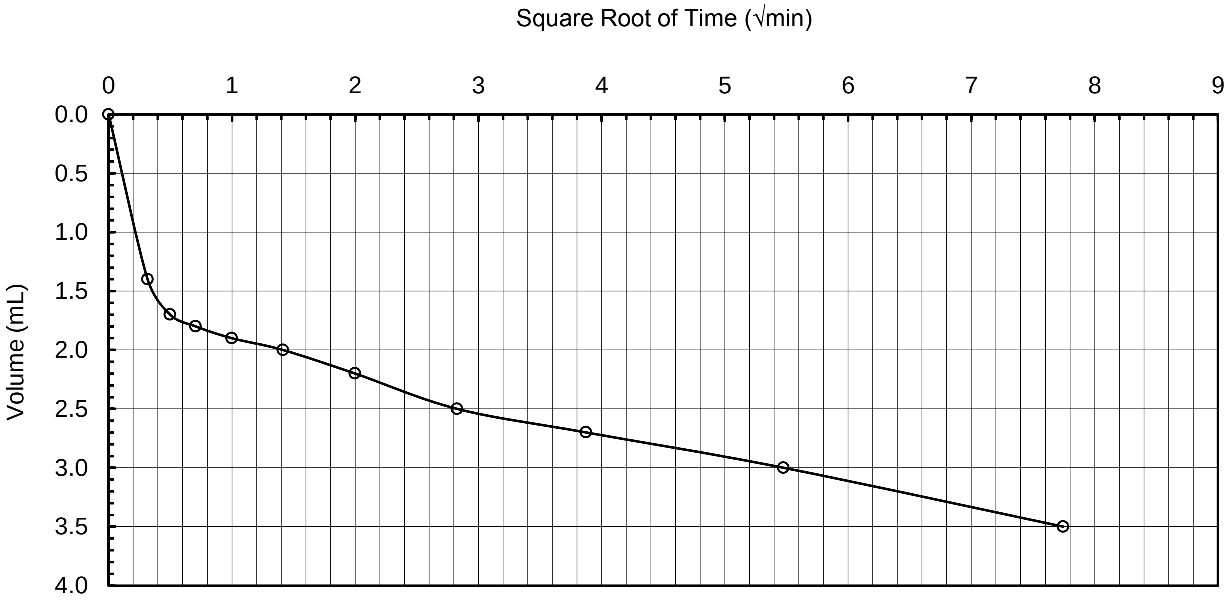
Golder Associates

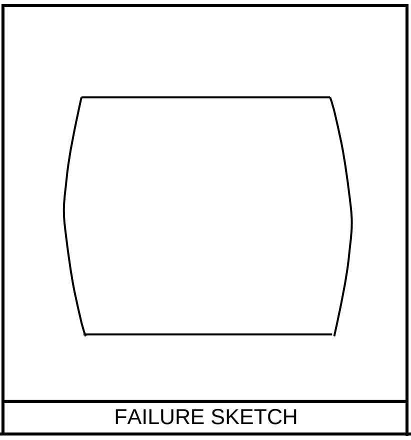
Isotropically Consolidated Undrained Triaxial Test (ICU)

Project Title: Luminant
Boring Number: BH-107

Project Number: 123-94128
Specimen Name: TO-8

Date: 17-Nov-12
Depth (ft): 23.0





FAILURE SKETCH

Consolidation Stress (σ'_3, psf) =			2867.8
Consolidation t_{50} (min) =			9
Consolidation Volume Change (mL) =			9.7
Unloading Stress (psf) =			NA
Unloading t_{50} (min) =			NA
Unloading Volume Change (mL) =			NA
LL =	42	PI =	25
USCS	CL		
Gs =	2.65	assumed	

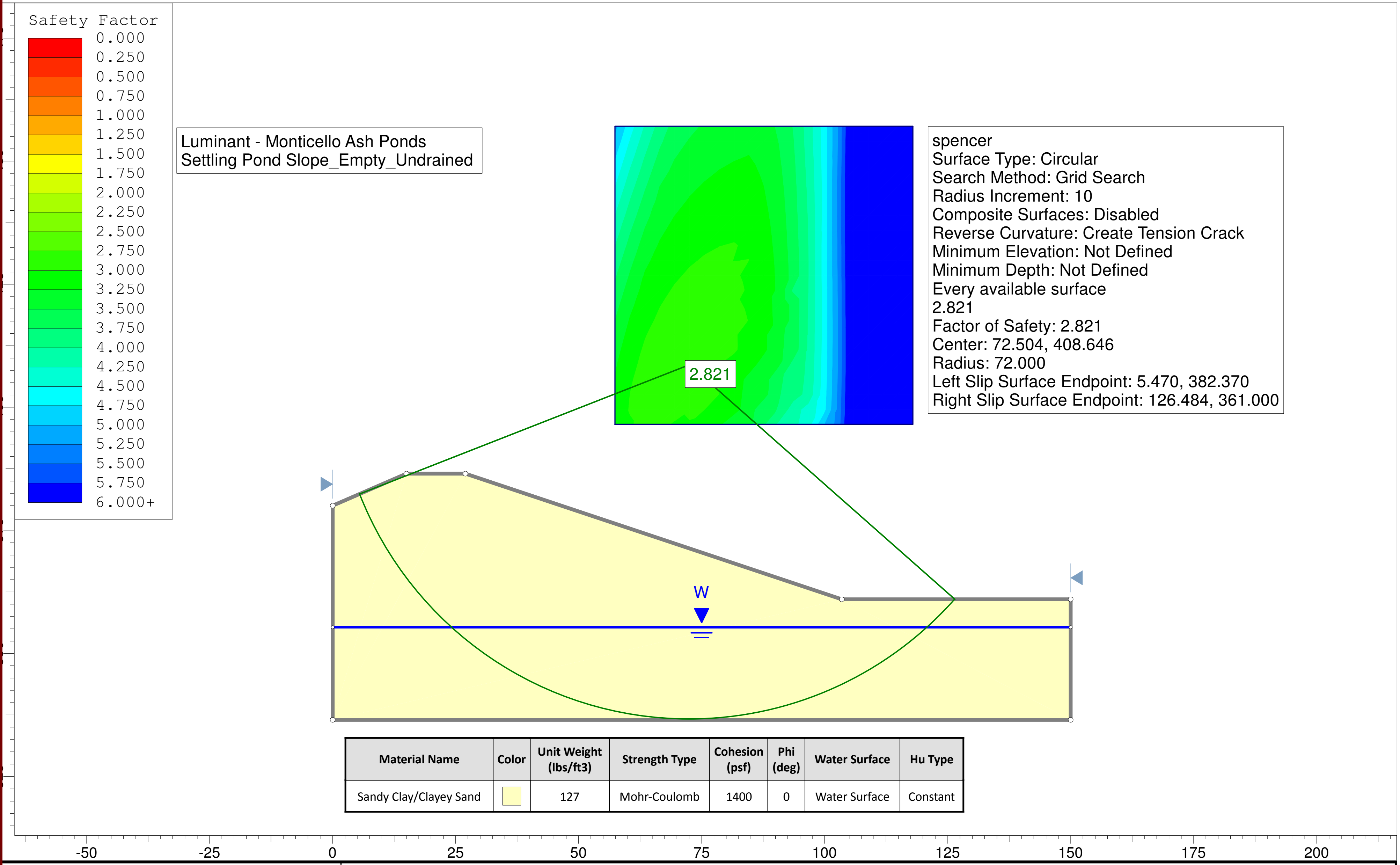
Performed by PN
Reviewed by HR

Golder Associates

APPENDIX D
SLOPE STABILITY CALCULATIONS

CASE 1

Luminant - Monticello Ash Ponds
Settling Pond Slope_Empty_Undrained



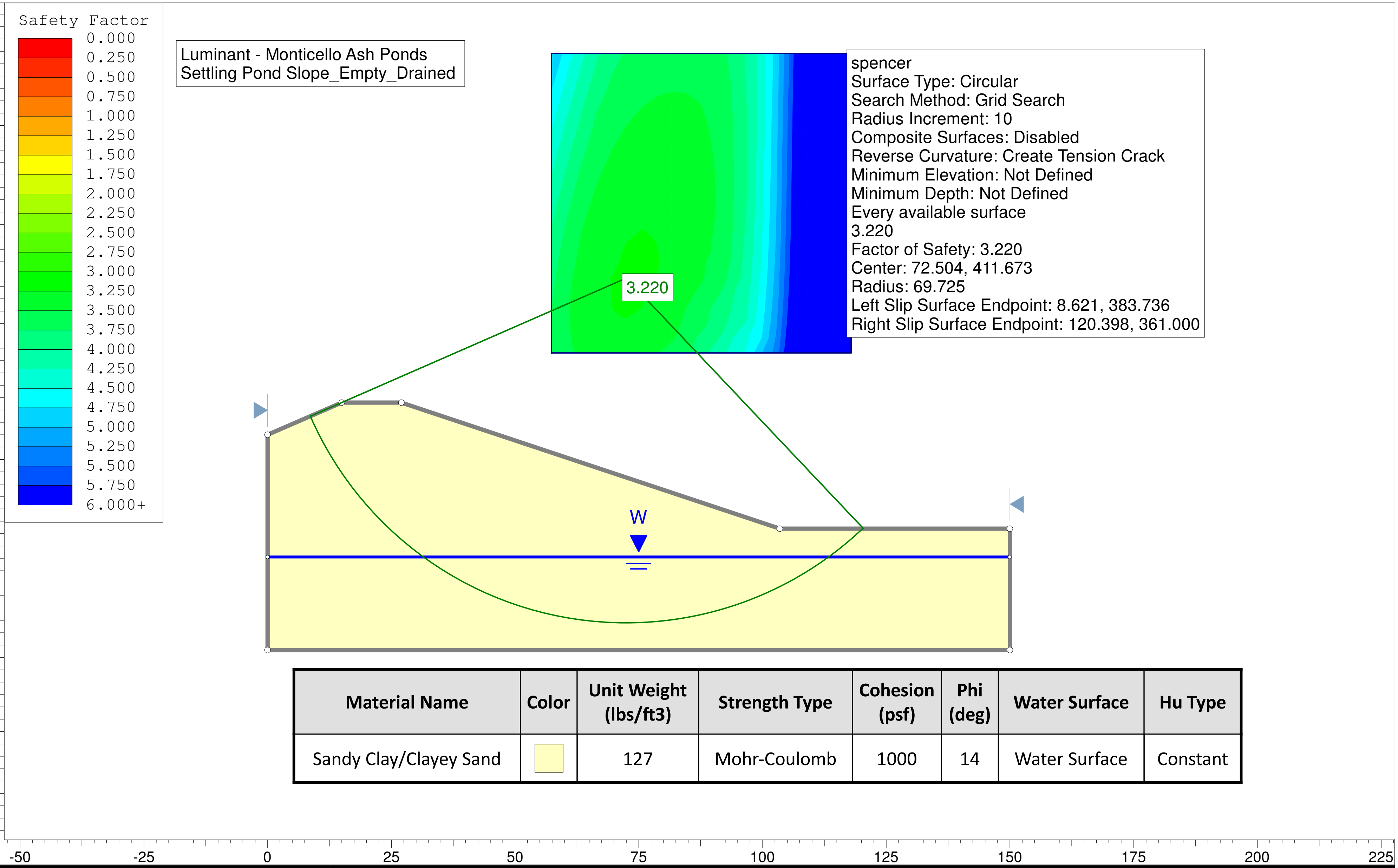
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.821
Factor of Safety: 2.821
Center: 72.504, 408.646
Radius: 72.000
Left Slip Surface Endpoint: 5.470, 382.370
Right Slip Surface Endpoint: 126.484, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1400	0	Water Surface	Constant

IDEINTERPRET 6.019

Project	Luminant - Monticello Ash Ponds
Analysis Description	Settling Pond Slope_Empty_Undrained
Drawn By	M Pascal
Scale	1:327
Company	Golder Associates Inc.
Date	11/21/2012, 11:53:19 AM
File Name	Settling Pond.slim

CASE 2



Luminant - Monticello Ash Ponds
Settling Pond Slope_Empty_Drained

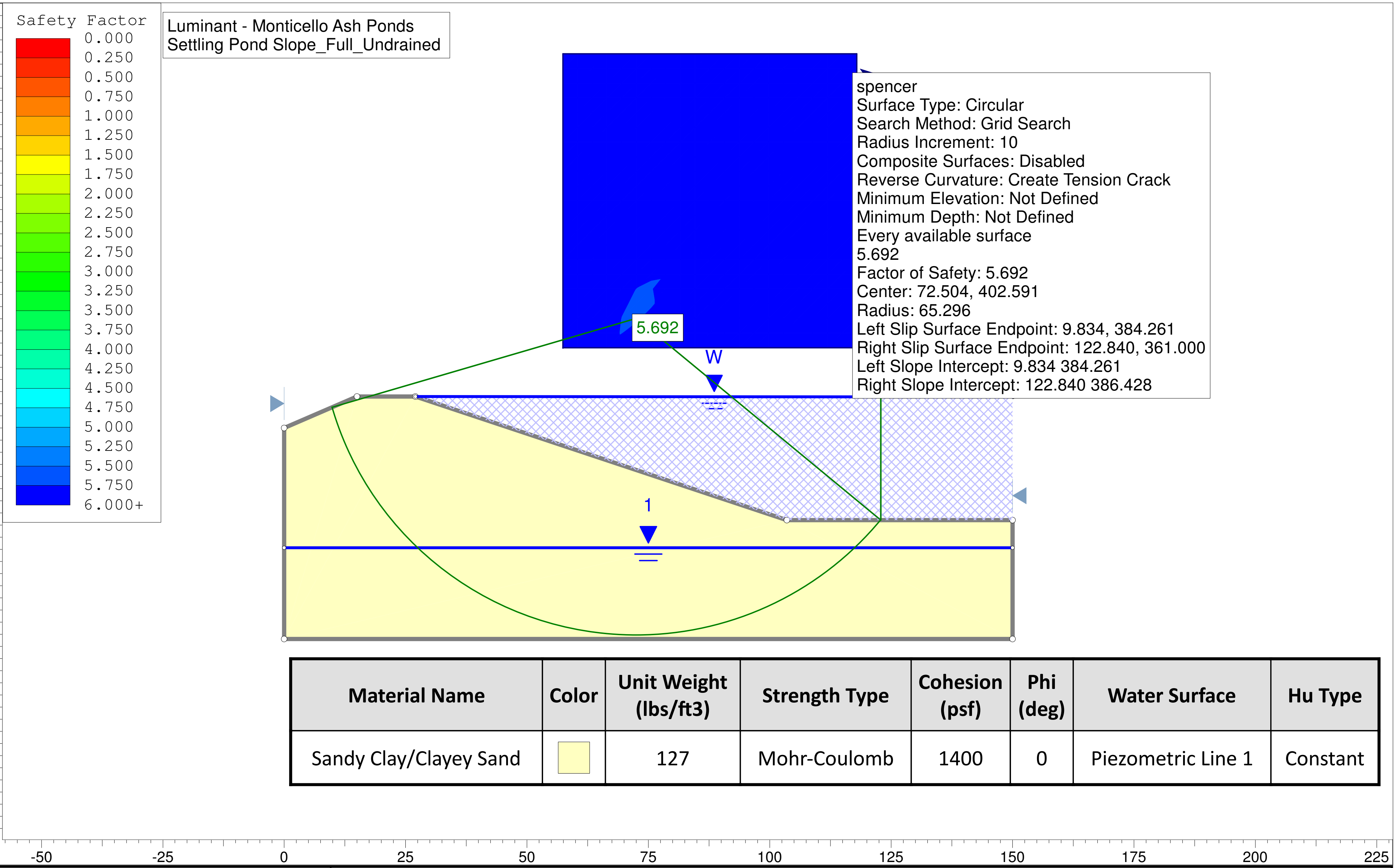
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.220
Factor of Safety: 3.220
Center: 72.504, 411.673
Radius: 69.725
Left Slip Surface Endpoint: 8.621, 383.736
Right Slip Surface Endpoint: 120.398, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	Water Surface	Constant

Project	Luminant - Monticello Ash Ponds
Analysis Description	Settling Pond Slope_Empty_Drained
Drawn By	M Pascal
Scale	1:327
Company	Golder Associates Inc.
Date	11/21/2012, 11:53:19 AM
File Name	Settling Pond_c.slim

IDEINTERPRET 6.019

CASE 3



spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
5.692
Factor of Safety: 5.692
Center: 72.504, 402.591
Radius: 65.296
Left Slip Surface Endpoint: 9.834, 384.261
Right Slip Surface Endpoint: 122.840, 361.000
Left Slope Intercept: 9.834 384.261
Right Slope Intercept: 122.840 386.428

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1400	0	Piezometric Line 1	Constant

IDEINTERPRET 6.019

Project Luminant - Monticello Ash Ponds

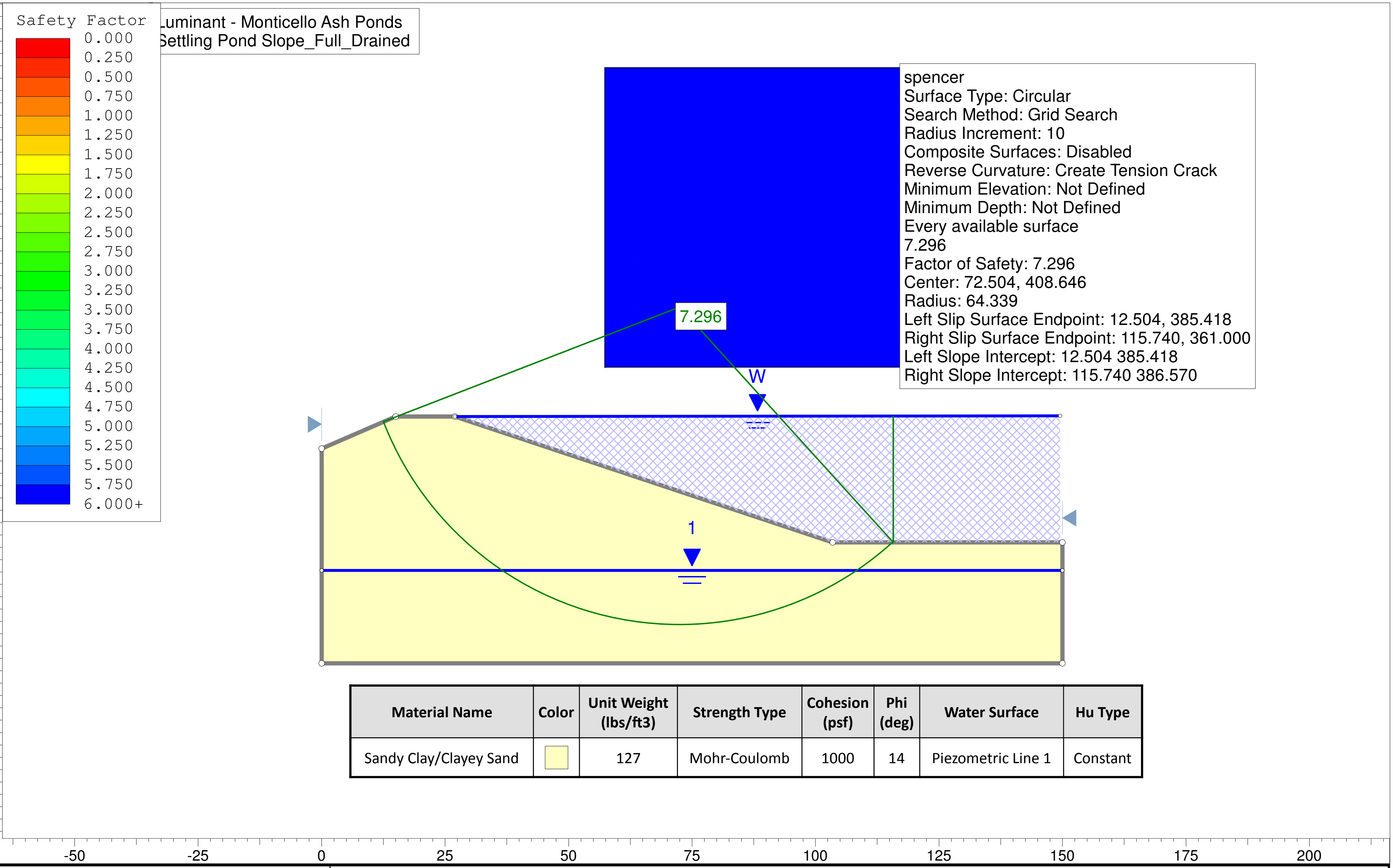
Analysis Description Settling Pond Slope_Full_Undrained

Drawn By M Pascal
Scale 1:333
Company Golder Associates Inc.

Date 11/21/2012, 11:53:19 AM
File Name Settling Pond_b.slim

CASE 4

Luminant - Monticello Ash Ponds
Settling Pond Slope_Full_Drained



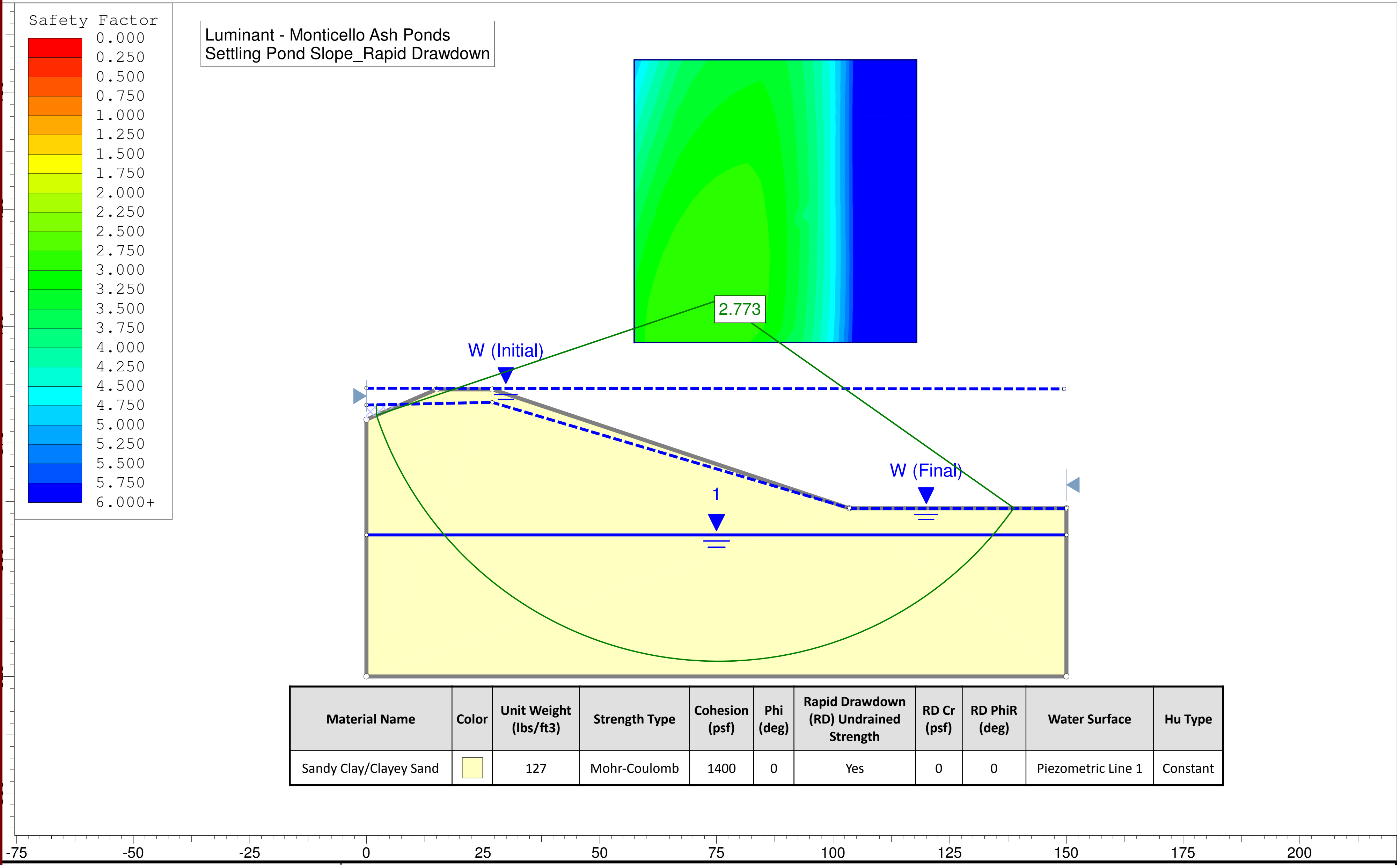
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
7.296
Factor of Safety: 7.296
Center: 72.504, 408.646
Radius: 64.339
Left Slip Surface Endpoint: 12.504, 385.418
Right Slip Surface Endpoint: 115.740, 361.000
Left Slope Intercept: 12.504 385.418
Right Slope Intercept: 115.740 386.570

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	Piezometric Line 1	Constant

IDEINTERPRET 6.019

Project	Luminant - Monticello Ash Ponds				
Analysis Description	Settling Pond Slope_Full_Drained				
Drawn By	M Pascal	*Scale*	1:327	*Company*	Golder Associates Inc.
Date	11/21/2012, 11:53:19 AM			*File Name*	Settling Pond_d.slim

CASE 5



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1400	0	Yes	0	0	Piezometric Line 1	Constant

rocscience

IDEINTERPRET 6.019

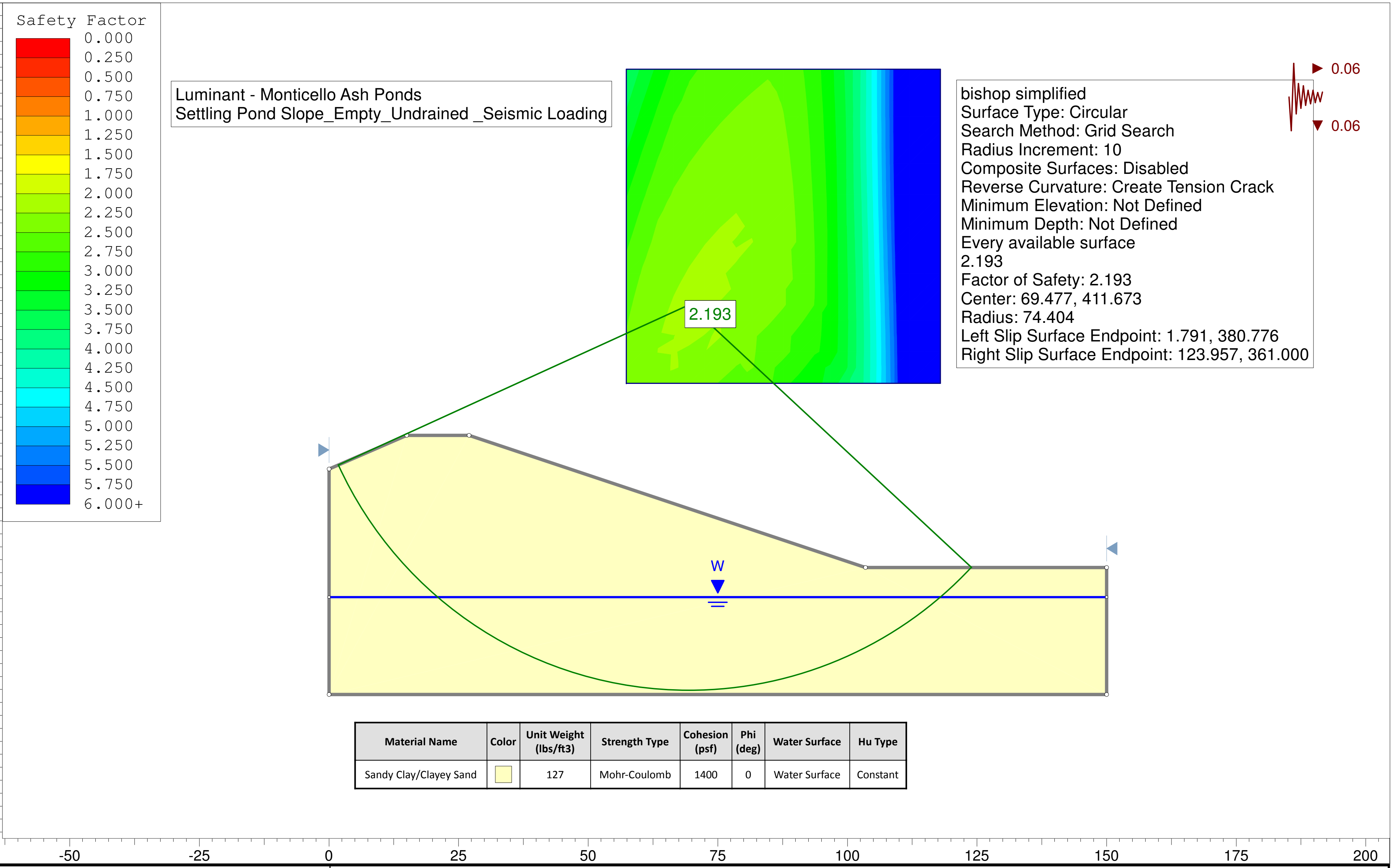
Project
Luminant - Monticello Ash Ponds

Analysis Description
Settling Pond Slope_Rapid Drawdown

Drawn By M Pascal
Scale 1:345
Company Golder Associates Inc.

Date 11/21/2012, 11:53:19 AM
File Name Settling Pond_rapid dd.slim

CASE 6



Luminant - Monticello Ash Ponds
Settling Pond Slope_Empty_Undrained _Seismic Loading

bishop simplified
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.193
Factor of Safety: 2.193
Center: 69.477, 411.673
Radius: 74.404
Left Slip Surface Endpoint: 1.791, 380.776
Right Slip Surface Endpoint: 123.957, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1400	0	Water Surface	Constant

Project
Luminant - Monticello Ash Ponds

Analysis Description
Settling Pond Slope_Empty_Undrained _Seismic Loading

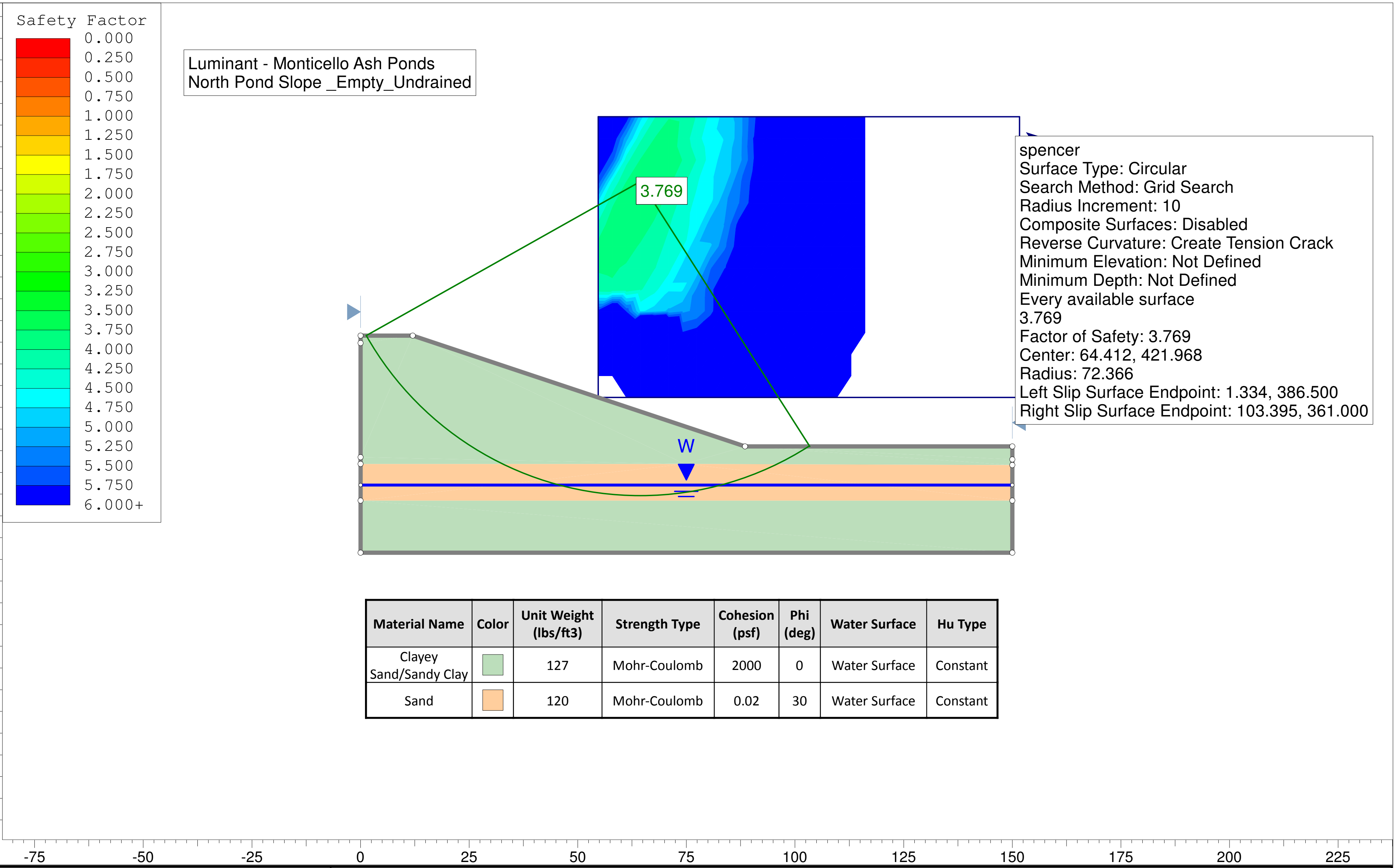
Drawn By M Pascal
Scale 1:312
Company Golder Associates Inc.

Date 11/21/2012, 11:53:19 AM
File Name Settling Pond_seismic loading.slim

IDEINTERPRET 6.019

CASE 7

Luminant - Monticello Ash Ponds
North Pond Slope _Empty_Undrained



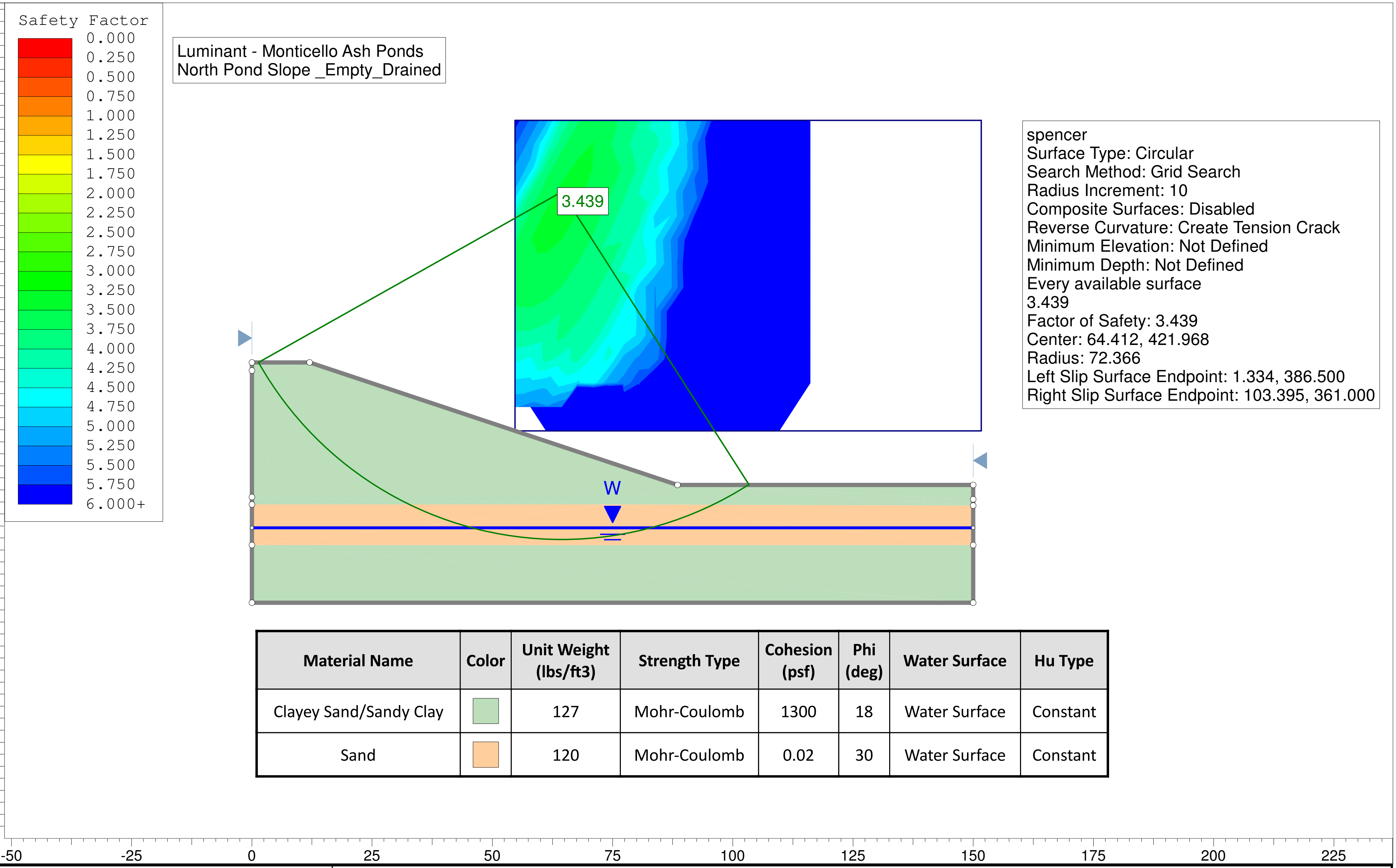
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.769
Factor of Safety: 3.769
Center: 64.412, 421.968
Radius: 72.366
Left Slip Surface Endpoint: 1.334, 386.500
Right Slip Surface Endpoint: 103.395, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	2000	0	Water Surface	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Water Surface	Constant

Project Luminant - Monticello Ash Ponds
Analysis Description North Pond Slope _Empty_Undrained
Drawn By M Pascal
Scale 1:373
Company Golder Associates Inc.
Date 11/20/2012, 6:26:53 PM
File Name North pond.slim

IDEINTERPRET 6.019

CASE 8



Luminant - Monticello Ash Ponds
North Pond Slope _Empty_Drained

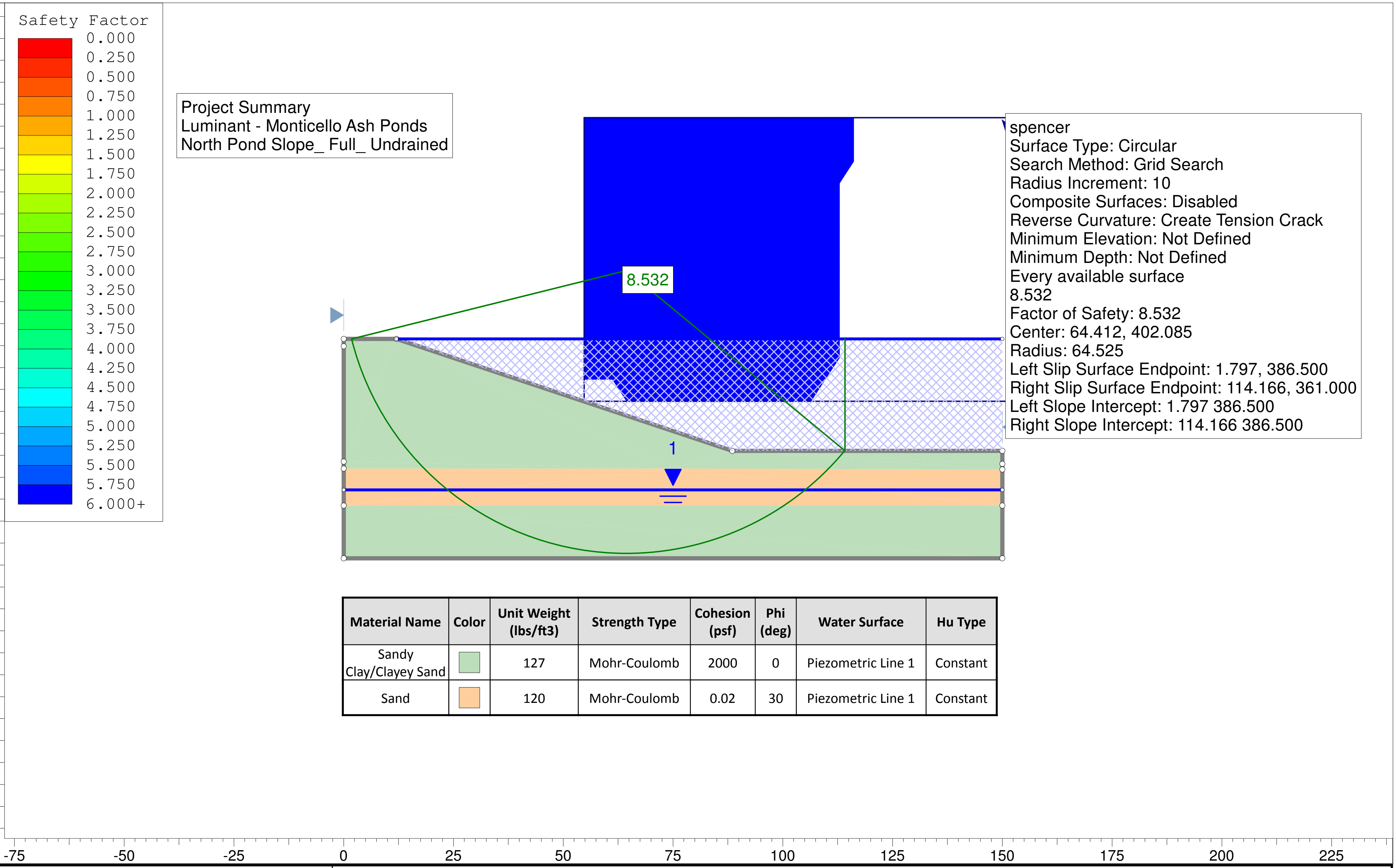
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.439
Factor of Safety: 3.439
Center: 64.412, 421.968
Radius: 72.366
Left Slip Surface Endpoint: 1.334, 386.500
Right Slip Surface Endpoint: 103.395, 361.000

Material Name	**Color**	**Unit Weight (lbs/ft3)**	**Strength Type**	**Cohesion (psf)**	**Phi (deg)**	**Water Surface**	**Hu Type**
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	1300	18	Water Surface	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Water Surface	Constant

Project	Luminant - Monticello Ash Ponds		
Analysis Description	North Pond Slope _Empty_Drained		
Drawn By	M Pascal	*Scale*	1:336
Company	Golder Associates Inc.		
Date	11/20/2012, 6:26:53 PM	*File Name*	North pond_c.slim

IDEINTERPRET 6.019

CASE 9



Project Summary
Luminant - Monticello Ash Ponds
North Pond Slope_ Full_ Undrained

spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
8.532
Factor of Safety: 8.532
Center: 64.412, 402.085
Radius: 64.525
Left Slip Surface Endpoint: 1.797, 386.500
Right Slip Surface Endpoint: 114.166, 361.000
Left Slope Intercept: 1.797 386.500
Right Slope Intercept: 114.166 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟩	127	Mohr-Coulomb	2000	0	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Piezometric Line 1	Constant

IDEINTERPRET 6.019

Project Luminant - Monticello Ash Ponds

Analysis Description North Pond Slope_ Full_ Undrained

Drawn By M Pascal

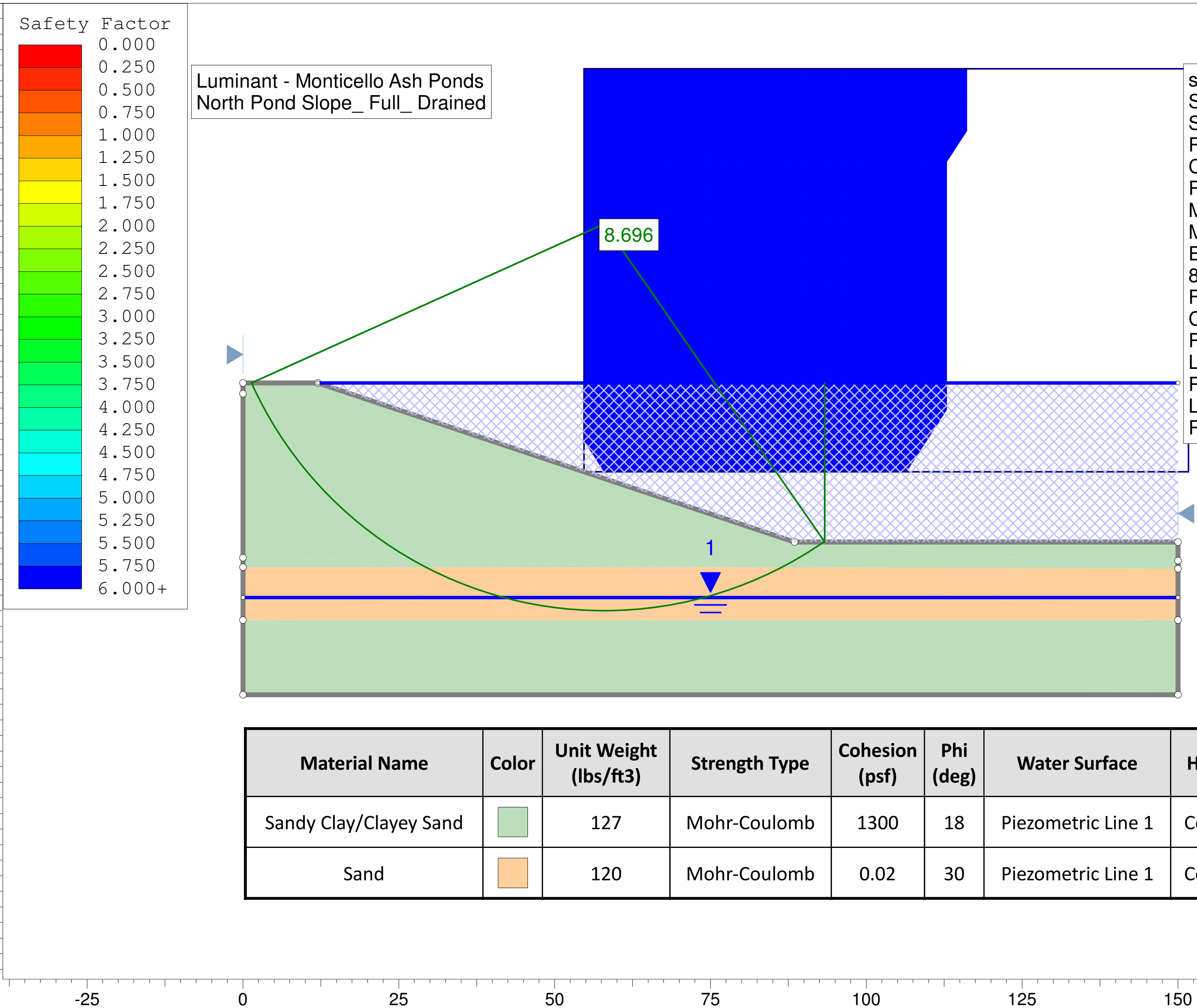
Scale 1:368

Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM

File Name North pond_b.slim

CASE 10



spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
8.696
Factor of Safety: 8.696
Center: 57.948, 412.027
Radius: 62.093
Left Slip Surface Endpoint: 1.345, 386.500
Right Slip Surface Endpoint: 93.328, 361.000
Left Slope Intercept: 1.345 386.500
Right Slope Intercept: 93.328 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟩	127	Mohr-Coulomb	1300	18	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Piezometric Line 1	Constant

IDEINTERPRET 6.019

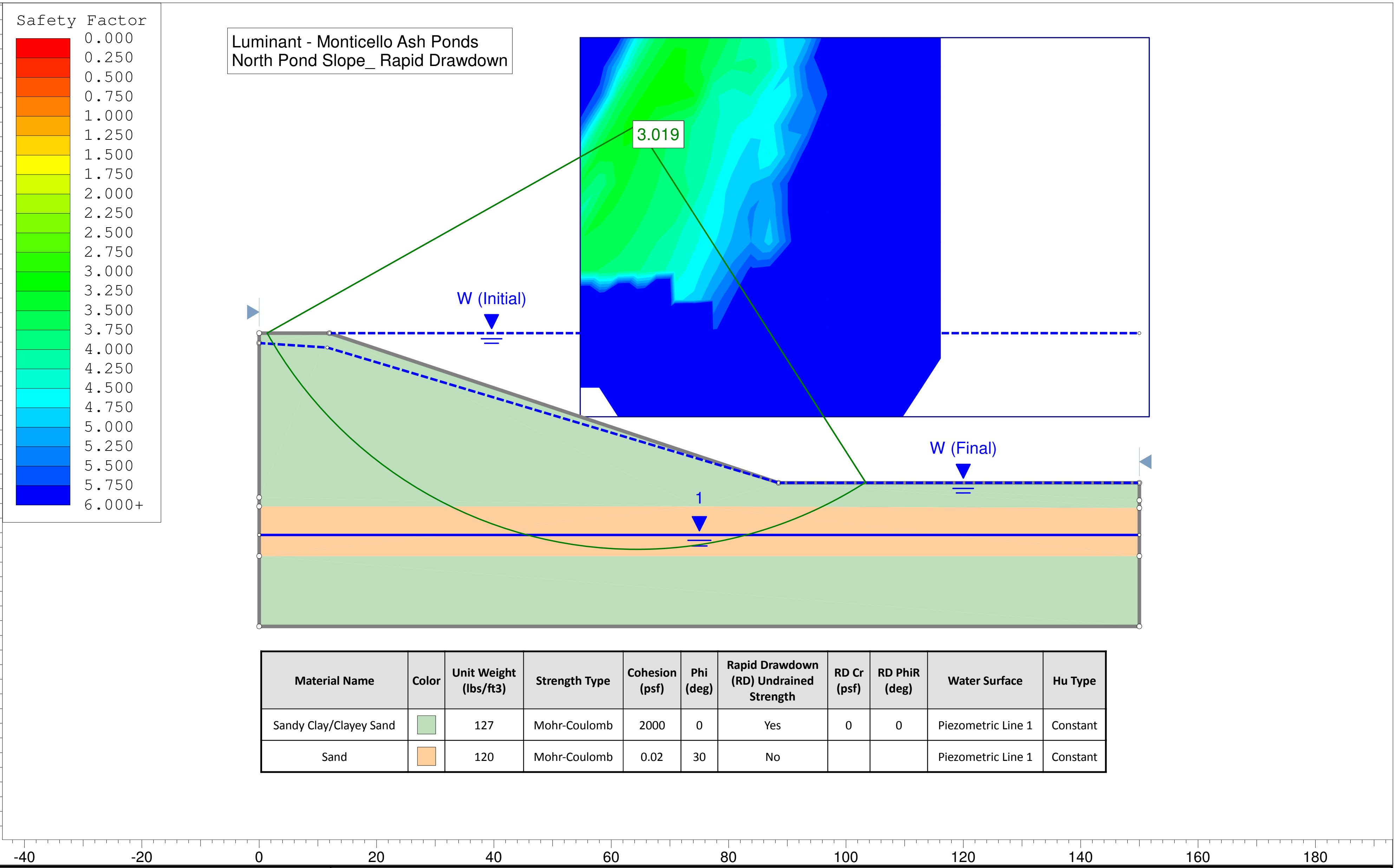
Project
Luminant - Monticello Ash Ponds

Analysis Description
North Pond Slope_ Full_ Drained

Drawn By M Pascal
Scale 1:303
Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM
File Name North pond_d.slim

CASE 11



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟩	127	Mohr-Coulomb	2000	0	Yes	0	0	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	No			Piezometric Line 1	Constant

rocscience

IDEINTERPRET 6.019

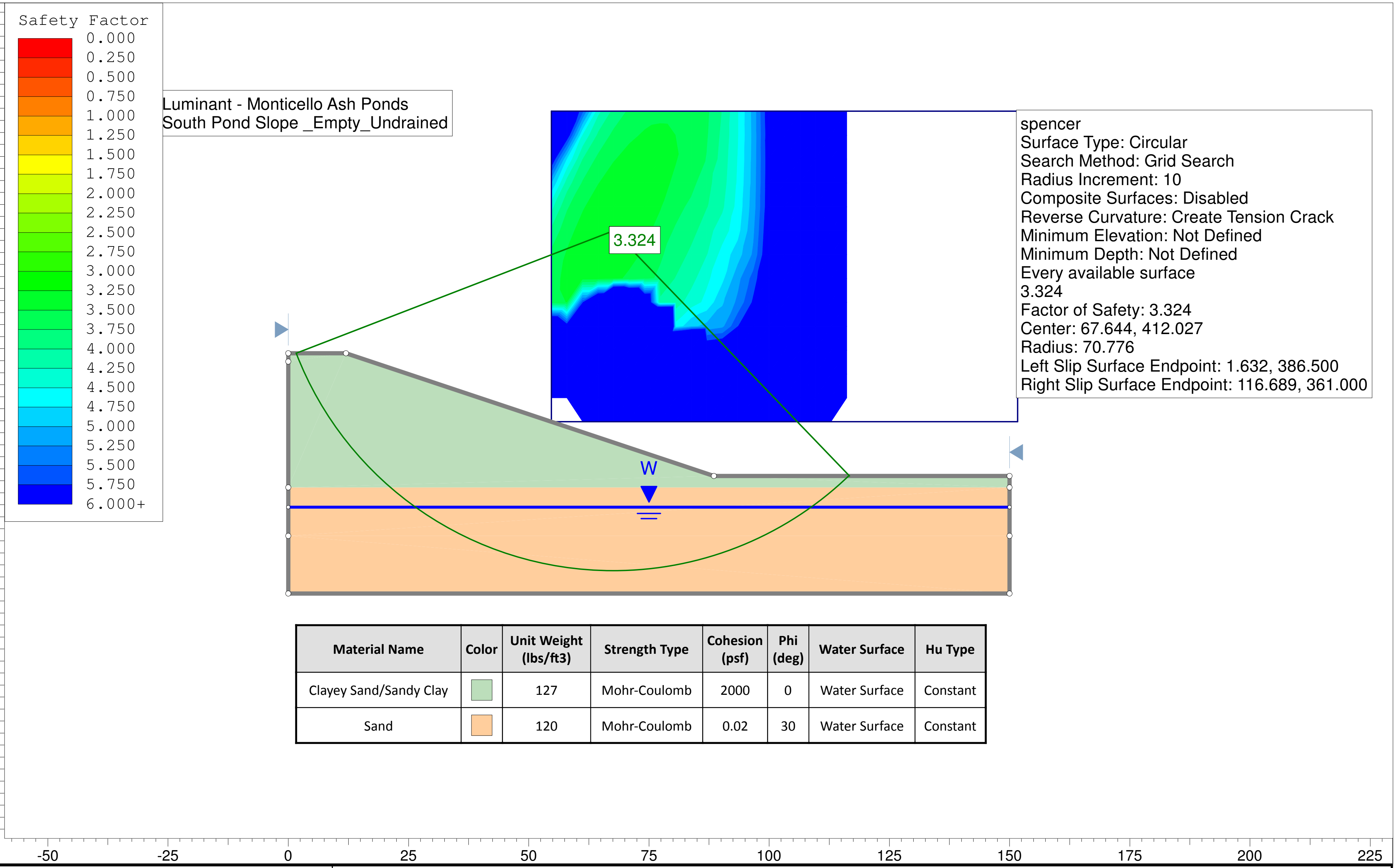
Project
Luminant - Monticello Ash Ponds

Analysis Description
North Pond Slope_ Rapid Drawdown

Drawn By M Pascal
Scale 1:276
Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM
File Name North pond_rapid dd_a.slim

CASE 12



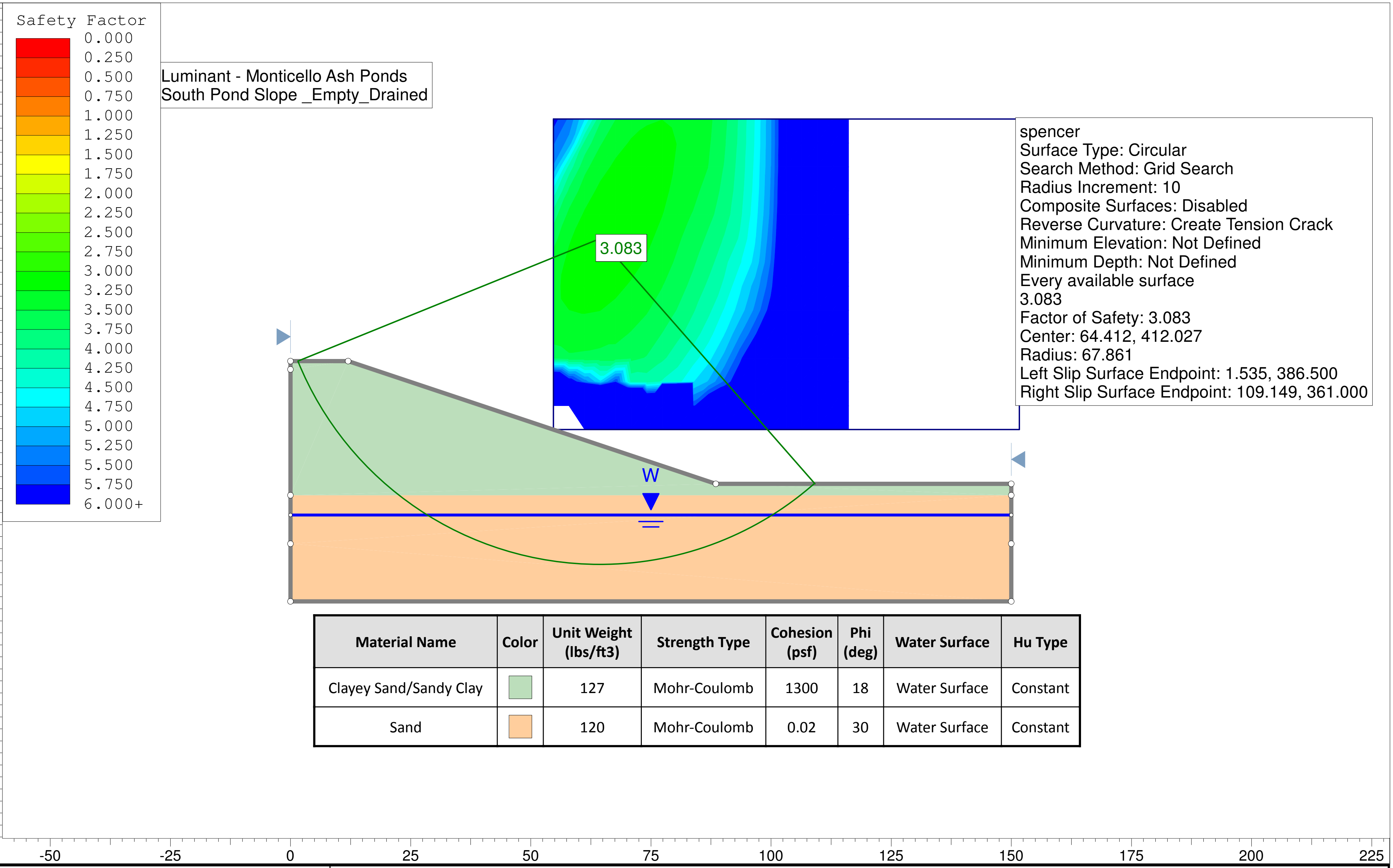
Luminant - Monticello Ash Ponds
South Pond Slope _Empty_Undrained

spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.324
Factor of Safety: 3.324
Center: 67.644, 412.027
Radius: 70.776
Left Slip Surface Endpoint: 1.632, 386.500
Right Slip Surface Endpoint: 116.689, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	2000	0	Water Surface	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Water Surface	Constant

Project Luminant - Monticello Ash Ponds
Analysis Description South Pond Slope _Empty_Undrained
Drawn By M Pascal
Scale 1:336
Company Golder Associates Inc.
Date 11/20/2012, 6:26:53 PM
File Name South pond.slim

Case 13



Luminant - Monticello Ash Ponds
South Pond Slope _Empty_Drained

spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.083
Factor of Safety: 3.083
Center: 64.412, 412.027
Radius: 67.861
Left Slip Surface Endpoint: 1.535, 386.500
Right Slip Surface Endpoint: 109.149, 361.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	1300	18	Water Surface	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Water Surface	Constant

Project Luminant - Monticello Ash Ponds

Analysis Description South Pond Slope _Empty_Drained

Drawn By M Pascal

Scale 1:336

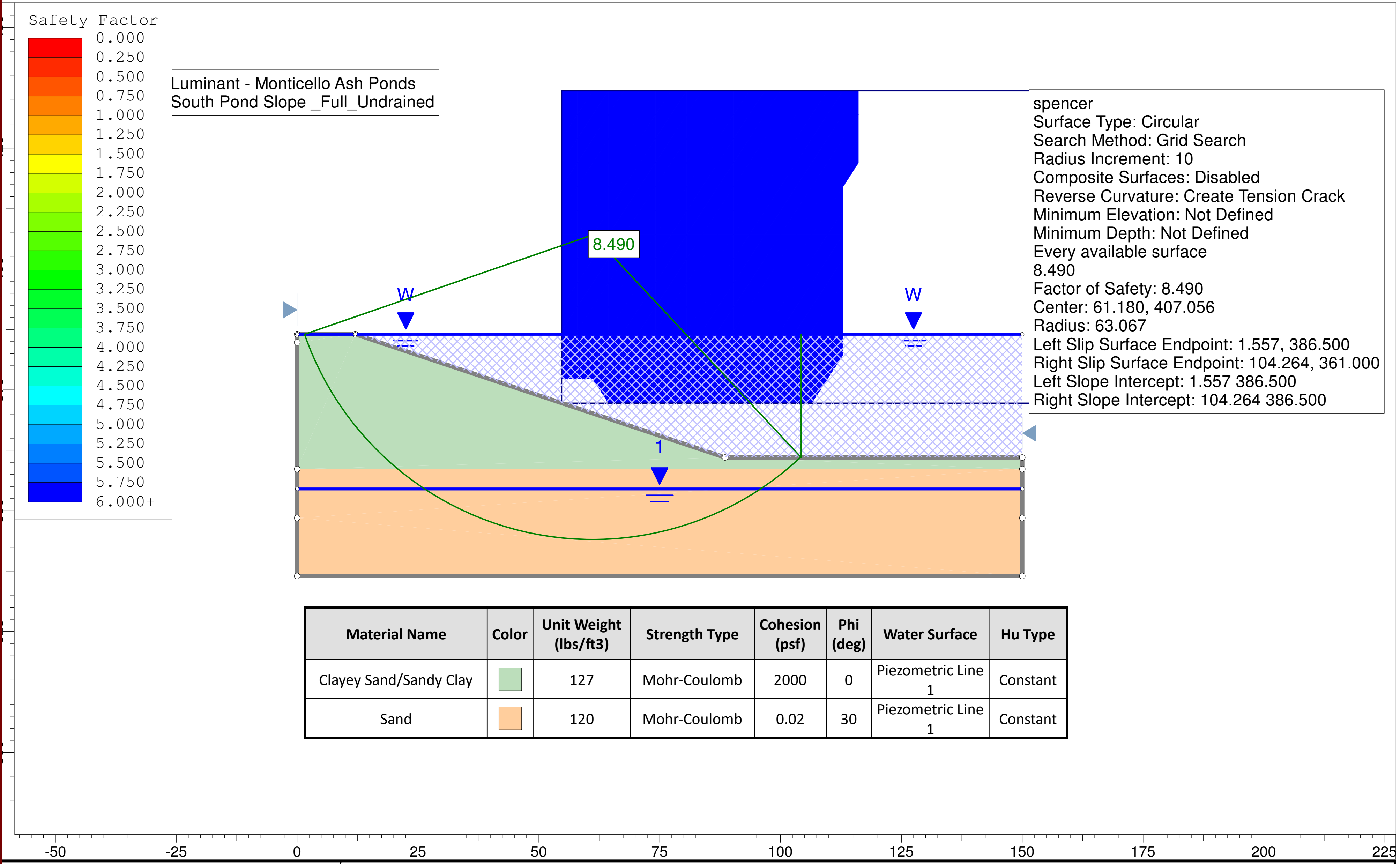
Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM

File Name South pond_b.slim

IDEINTERPRET 6.019

Case 14



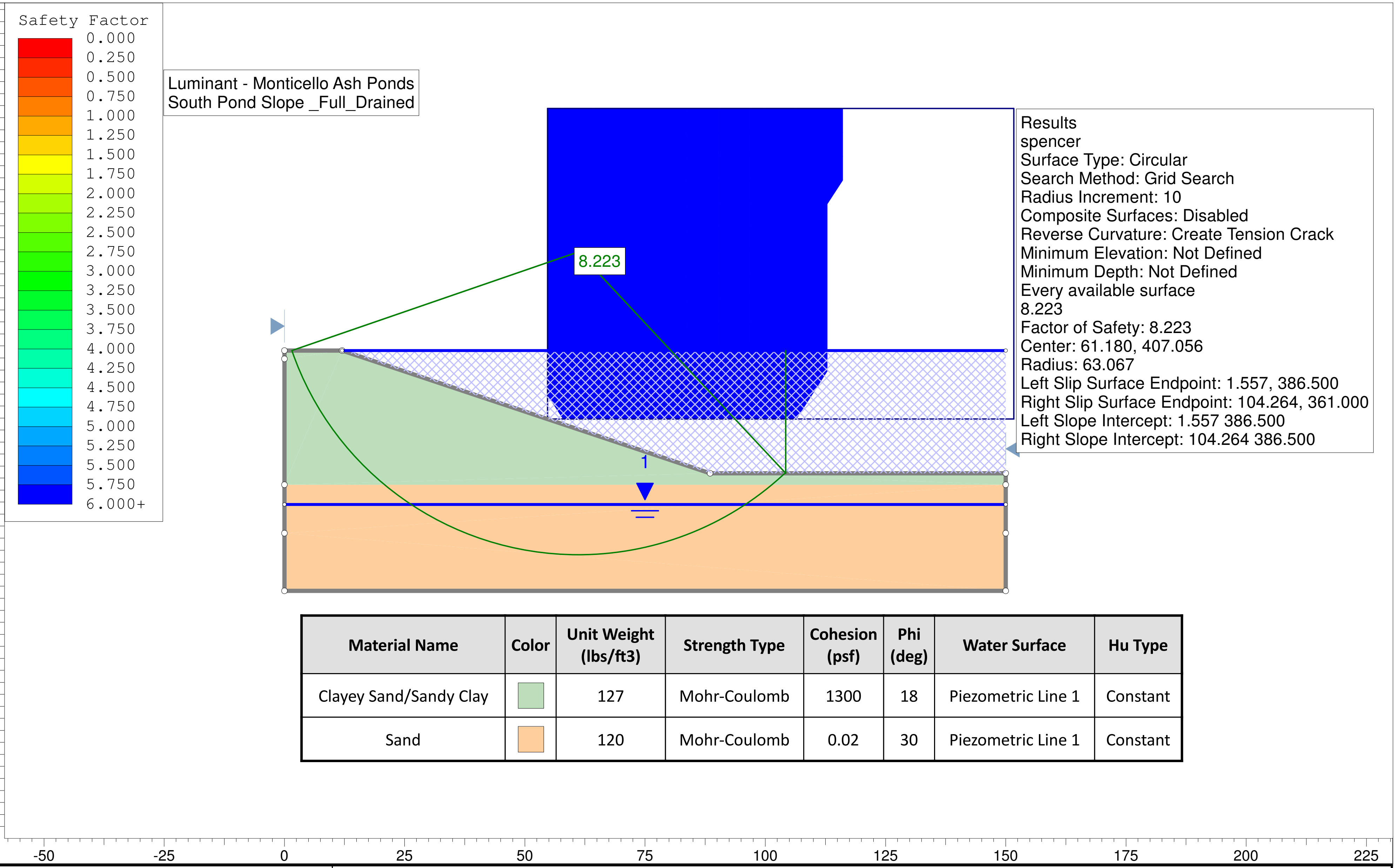
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
8.490
Factor of Safety: 8.490
Center: 61.180, 407.056
Radius: 63.067
Left Slip Surface Endpoint: 1.557, 386.500
Right Slip Surface Endpoint: 104.264, 361.000
Left Slope Intercept: 1.557 386.500
Right Slope Intercept: 104.264 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	2000	0	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Piezometric Line 1	Constant

Project	Luminant - Monticello Ash Ponds		
Analysis Description	South Pond Slope _Full_Undrained		
Drawn By M Pascal	*Scale* 1:333	*Company*	Golder Associates Inc.
Date	11/20/2012, 6:26:53 PM	*File Name*	South pond.slim

IDEINTERPRET 6.019

Case 15



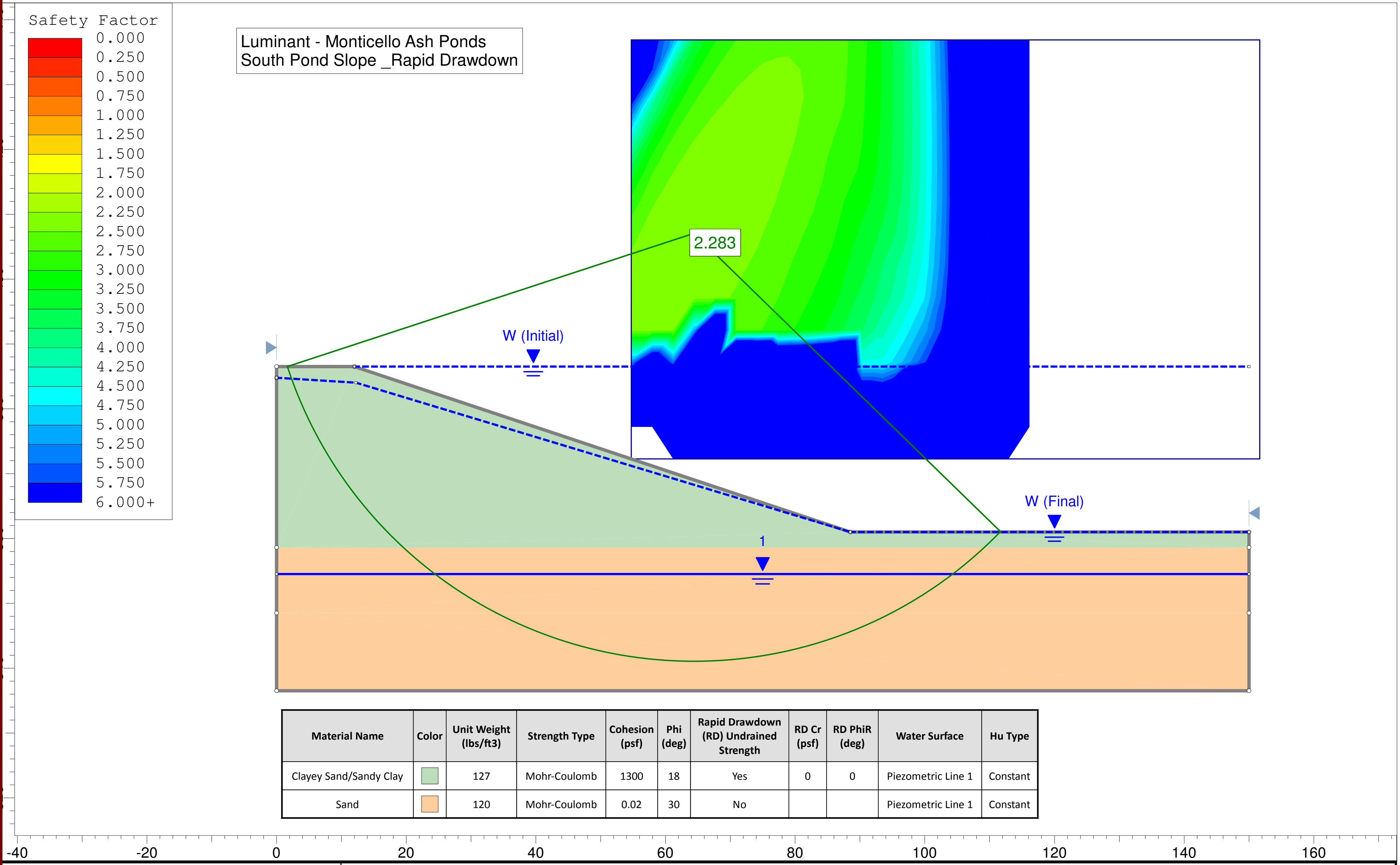
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
8.223
Factor of Safety: 8.223
Center: 61.180, 407.056
Radius: 63.067
Left Slip Surface Endpoint: 1.557, 386.500
Right Slip Surface Endpoint: 104.264, 361.000
Left Slope Intercept: 1.557 386.500
Right Slope Intercept: 104.264 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	1300	18	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	Piezometric Line 1	Constant

IDEINTERPRET 6.019

Project	Luminant - Monticello Ash Ponds
Analysis Description	South Pond Slope _Full_Drained
Drawn By	M Pascal
Scale	1:336
Company	Golder Associates Inc.
Date	11/20/2012, 6:26:53 PM
File Name	South pond_d.slim

Case 16

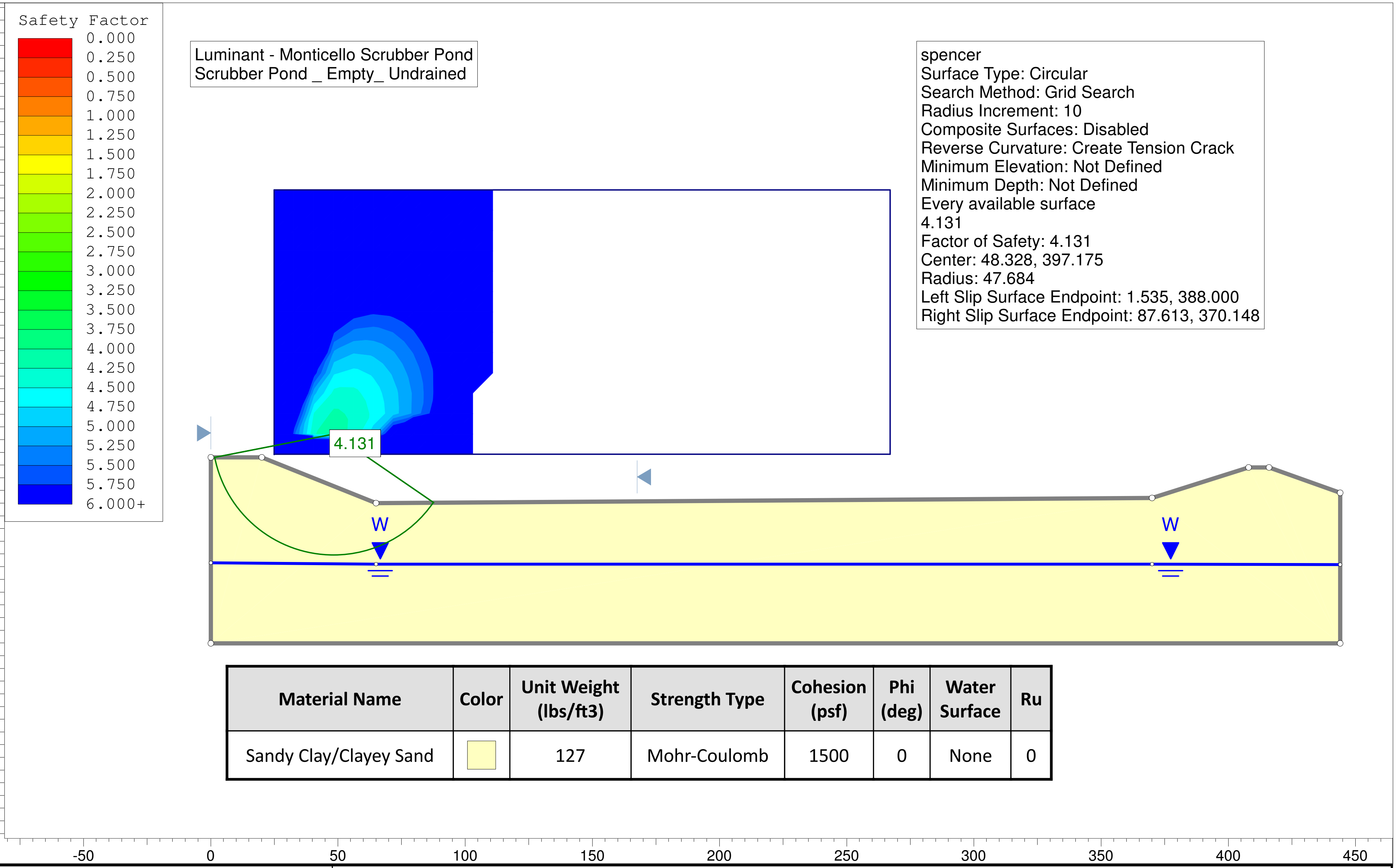


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)	Water Surface	Hu Type
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	1300	18	Yes	0	0	Piezometric Line 1	Constant
Sand	🟧	120	Mohr-Coulomb	0.02	30	No			Piezometric Line 1	Constant

Project	Luminant - Monticello Ash Ponds		
Analysis Description	South Pond Slope _Rapid Drawdown		
Drawn By M Pascal	*Scale* 1:248	*Company*	Golder Associates Inc.
Date	11/20/2012, 6:26:53 PM	*File Name*	South pond_rapid dd.slim

SLIDEINTERPRET 6.019

Case 17



Luminant - Monticello Scrubber Pond
Scrubber Pond _ Empty_ Undrained

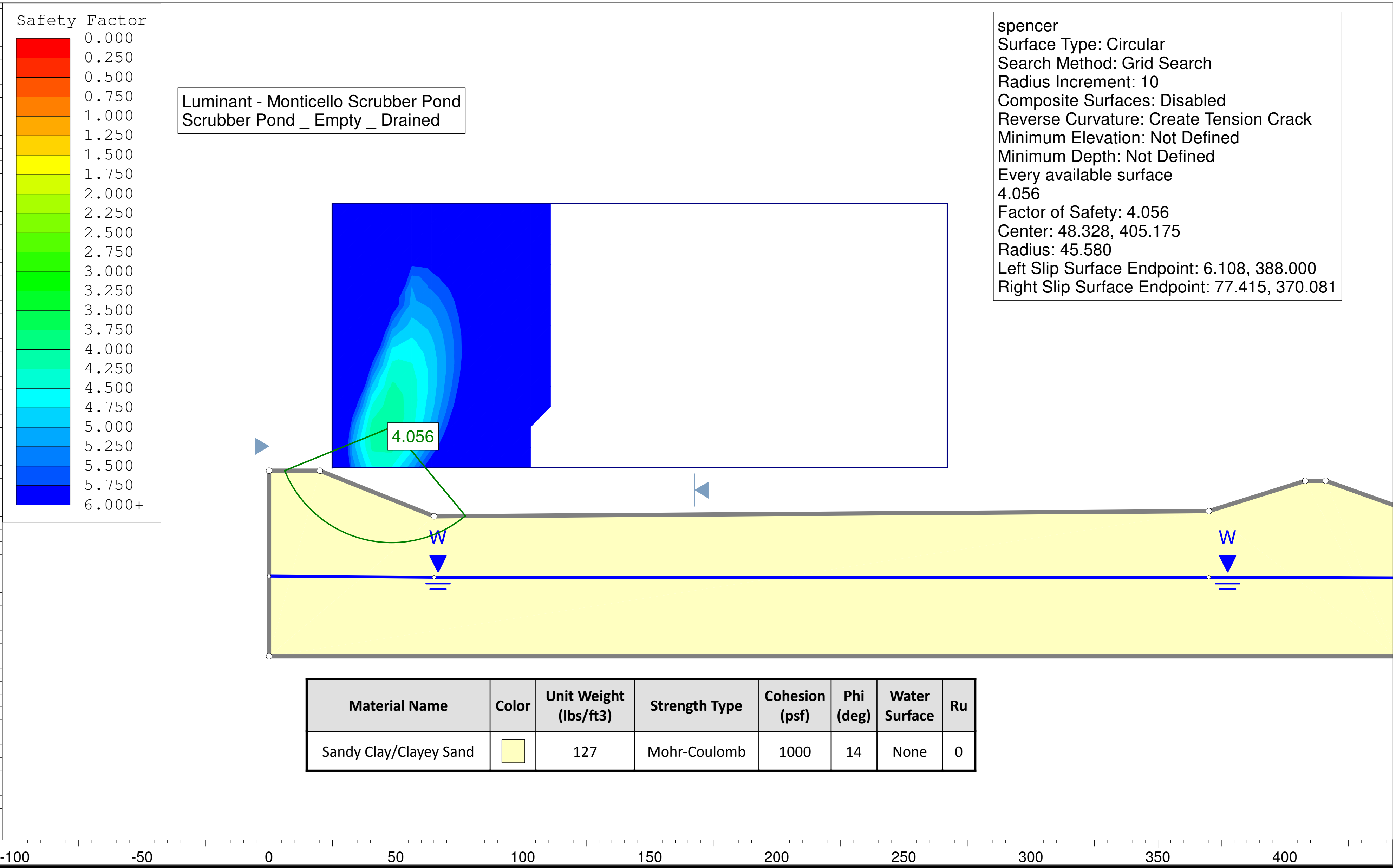
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
4.131
Factor of Safety: 4.131
Center: 48.328, 397.175
Radius: 47.684
Left Slip Surface Endpoint: 1.535, 388.000
Right Slip Surface Endpoint: 87.613, 370.148

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1500	0	None	0

IDEINTERPRET 6.019

Project	Luminant - Monticello Scrubber Pond
Analysis Description	Scrubber Pond _ Empty_ Undrained
Drawn By	M Pascal
Scale	1:635
Company	Golder Associates Inc.
Date	11/20/2012, 3:20:39 PM
File Name	Scrubber pond N_S_c.slim

CASE 18



Luminant - Monticello Scrubber Pond
Scrubber Pond _ Empty _ Drained

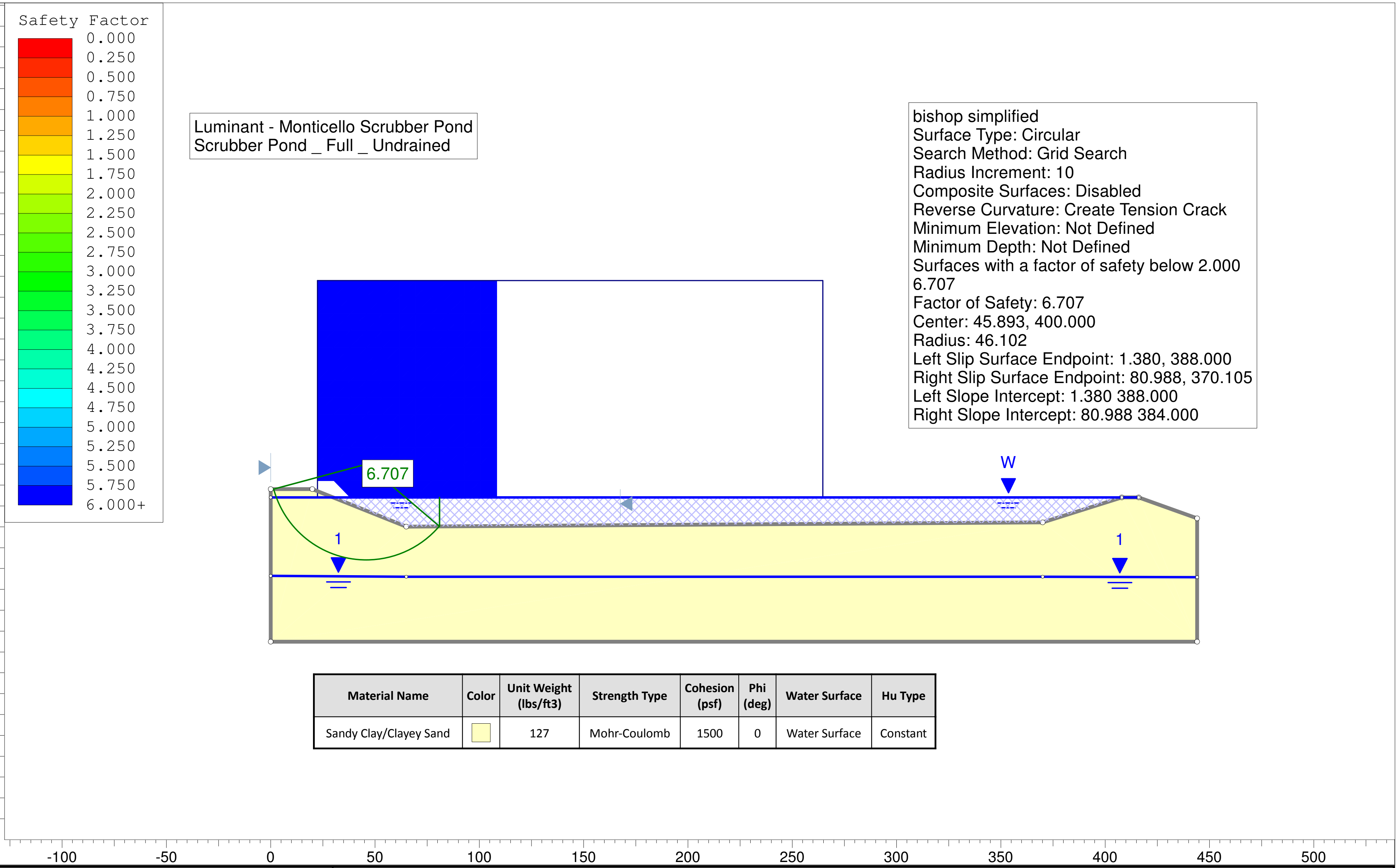
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
4.056
Factor of Safety: 4.056
Center: 48.328, 405.175
Radius: 45.580
Left Slip Surface Endpoint: 6.108, 388.000
Right Slip Surface Endpoint: 77.415, 370.081

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	None	0

IDEINTERPRET 6.019

Project	Luminant - Monticello Scrubber Pond		
Analysis Description	Scrubber Pond _ Empty _ Drained		
Drawn By	M Pascal	*Scale*	1:637
Company	Golder Associates Inc.		
Date	11/20/2012, 3:20:39 PM	*File Name*	Scrubber pond N_S_d.slim

CASE 19



Luminant - Monticello Scrubber Pond
Scrubber Pond _ Full _ Undrained

bishop simplified
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Surfaces with a factor of safety below 2.000
6.707
Factor of Safety: 6.707
Center: 45.893, 400.000
Radius: 46.102
Left Slip Surface Endpoint: 1.380, 388.000
Right Slip Surface Endpoint: 80.988, 370.105
Left Slope Intercept: 1.380 388.000
Right Slope Intercept: 80.988 384.000

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1500	0	Water Surface	Constant

Project
Luminant - Monticello Scrubber Pond

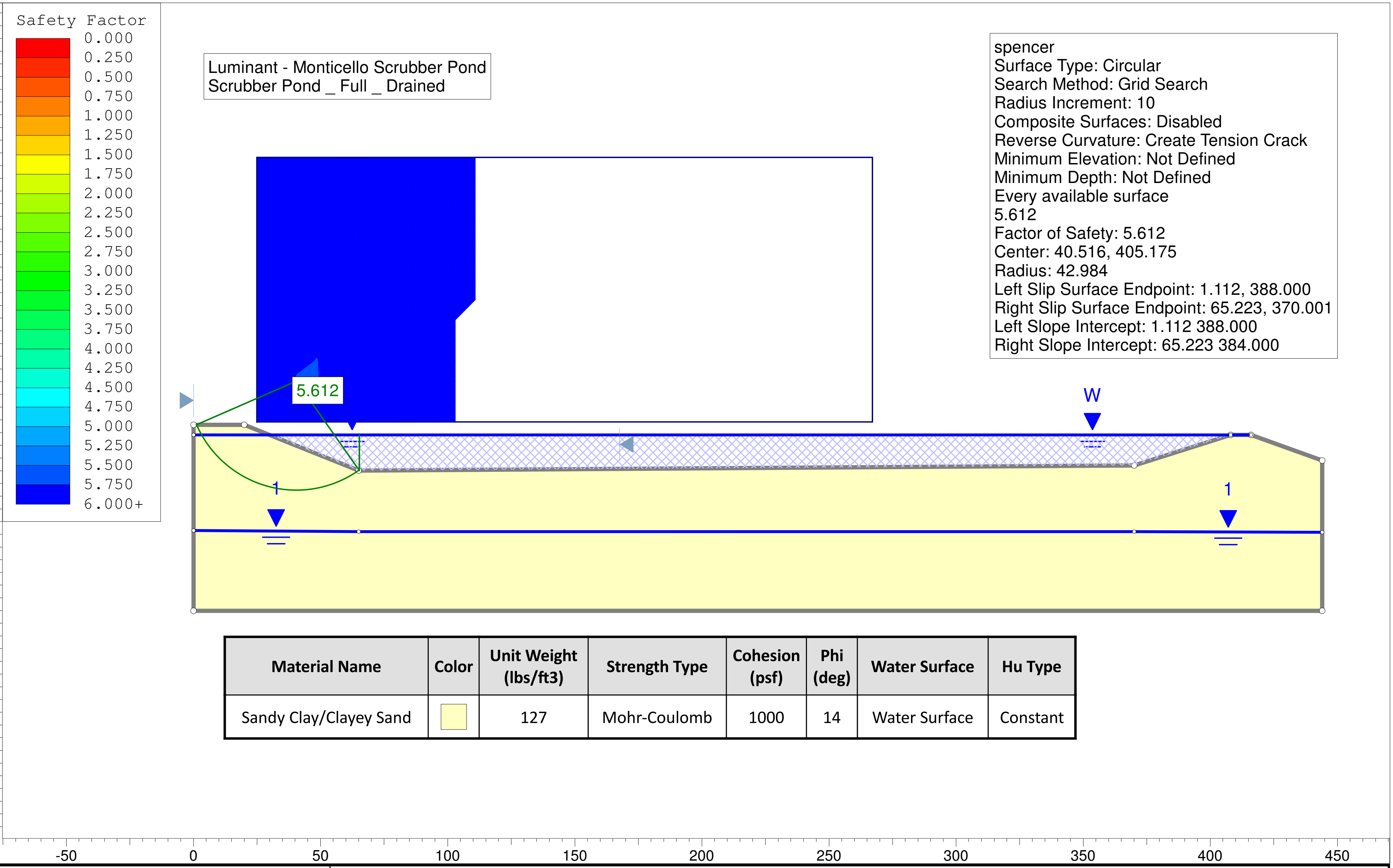
Analysis Description
Scrubber Pond _ Full _ Undrained

Drawn By M Pascal
Scale 1:776
Company Golder Associates Inc.

Date 11/20/2012, 3:20:39 PM
File Name Scrubber pond N_S.slim

IDEINTERPRET 6.019

CASE 20



Luminant - Monticello Scrubber Pond
Scrubber Pond _ Full _ Drained

spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
5.612
Factor of Safety: 5.612
Center: 40.516, 405.175
Radius: 42.984
Left Slip Surface Endpoint: 1.112, 388.000
Right Slip Surface Endpoint: 65.223, 370.001
Left Slope Intercept: 1.112 388.000
Right Slope Intercept: 65.223 384.000

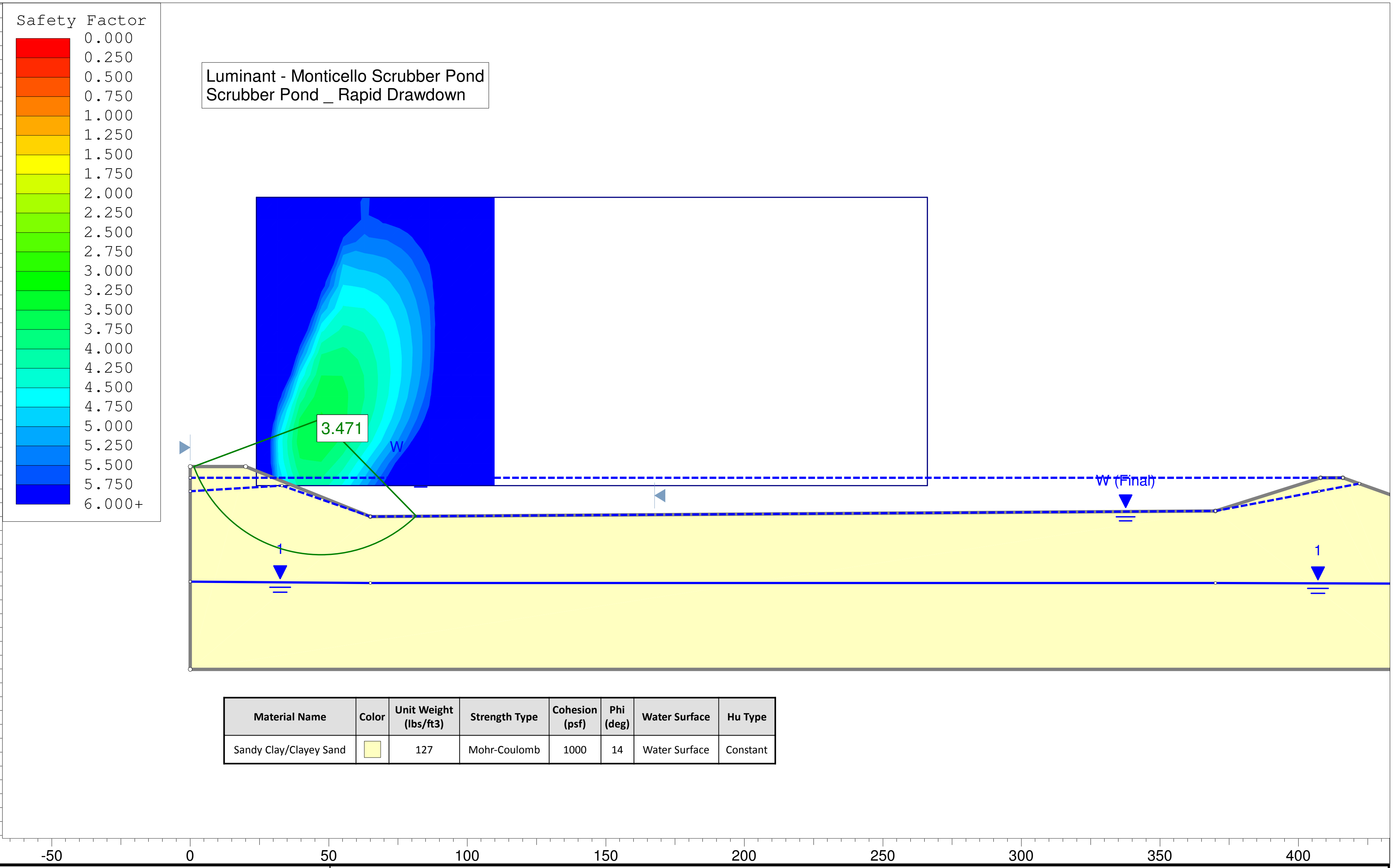
Material Name	**Color**	**Unit Weight (lbs/ft3)**	**Strength Type**	**Cohesion (psf)**	**Phi (deg)**	**Water Surface**	**Hu Type**
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	Water Surface	Constant

rocscience

IDEINTERPRET 6.019

Project	Luminant - Monticello Scrubber Pond		
Analysis Description	Scrubber Pond _ Full _ Drained		
Drawn By	M Pascal	*Scale*	1:635
Company	Golder Associates Inc.		
Date	11/20/2012, 3:20:39 PM	*File Name*	Scrubber pond N_S_b.slim

CASE 21



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	Water Surface	Constant

rocscience

IDEINTERPRET 6.019

Project Luminant - Monticello Scrubber Pond

Analysis Description Scrubber Pond _ Rapid Drawdown

Drawn By M Pascal

Scale 1:583

Company Golder Associates Inc.

Date 11/20/2012, 3:20:39 PM

File Name Scrubber pond N_S_b.slim

APPENDIX E
IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL REPORT

Important Information About Your
Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.
The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you -* should apply the report for any purpose or project except the one originally contemplated.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, Project-specific factors when establishing the scope of a study. Typical factors include the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report that was:*

- not prepared for you,
- not prepared for your project.
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes-even minor ones-and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations*. Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual sub-surface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions

A Report's Recommendations Are *Not* Final

Do not over-rely on the construction recommendations included in your report. Those *recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability* for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photo graphic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A brand conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations: e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures*. If you have not yet obtained your own geoenviromental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide army of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE

8811 Colesville Road Suite 3106 Silver Spring. MD 20910
Telephone: 301-565-2733 Facsimile: 301-589-2017
email: info@asde.org www.asfe.org

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

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Houston, TX 77073 USA
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Golder Associates

Golder Associates

March 11, 2014 Project No. 12394128.002

Mr. Gary L. Spicer
Luminant Power
1601 Bryan Street
Dallas, Texas 75201

RE: ADDENDUM TO ASH AND SCRUBBER POND STABILITY INVESTIGATION REPORT, LUMINANT MONTICELLO POWER PLANT, TITUS COUNTY, TEXAS

Dear Gary:

This letter report serves as an addendum to "Ash and Scrubber Pond Stability Investigation Report, Luminant Monticello Power Plant, Titus County, Texas," issued by Golder Associates Inc. (Golder) in December 2012. This report includes additional slope stability analyses for exterior pond slopes.

Details of the field investigation, subsurface conditions, and soil material properties used in the stability analyses are included in the December 2012 report.

1.0 ADDITIONAL STABILITY ANALYSES

Additional stability analyses are presented for two exterior slope sections at the ash ponds. Stability analyses considered "full pond" conditions, which is the most critical loading case for the exterior slopes. A representative exterior slope for the settling pond is located on the north side and consists of an approximately 13-foot high, 3 horizontal to 1 vertical (3H:1V) slope. A representative exterior slope for the north and south ponds is located on the east side of the south pond and consists of an approximately 23-foot high, 3H:1V slope. The results of the analyses are provided in Table A-1. SLIDE output files are included as an attachment.

TABLE 1-A. SLOPE STABILITY FACTORS OF SAFETY

Case	Description	Factor of Safety
22	Settling pond; north exterior slope; full pond; short term (undrained) conditions	4.7
23	Settling pond; north exterior slope; full pond; long term (drained) conditions	5.2
24	South pond; east exterior slope; full pond; short term (undrained) conditions	3.6
25	South pond; east exterior slope; full pond; long term (drained) conditions	3.4

In addition, Cases 1-6 (presented in the December 2012 report) are representative of the settling pond's south exterior slope (i.e. same geometry and soil conditions). Cases 12-16 (presented in the December 2012 report) are representative of the south pond's east exterior slope. Cases 22 and 23 are a conservative representation of the scrubber pond exterior slope. In summary, our analyses indicate that the exterior slopes are stable.

2.0 CLOSING

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.

Very truly yours,

GOLDER ASSOCIATES INC.
Texas Firm Registration Number: F-2578

P. Chris Marshall

3/11/14

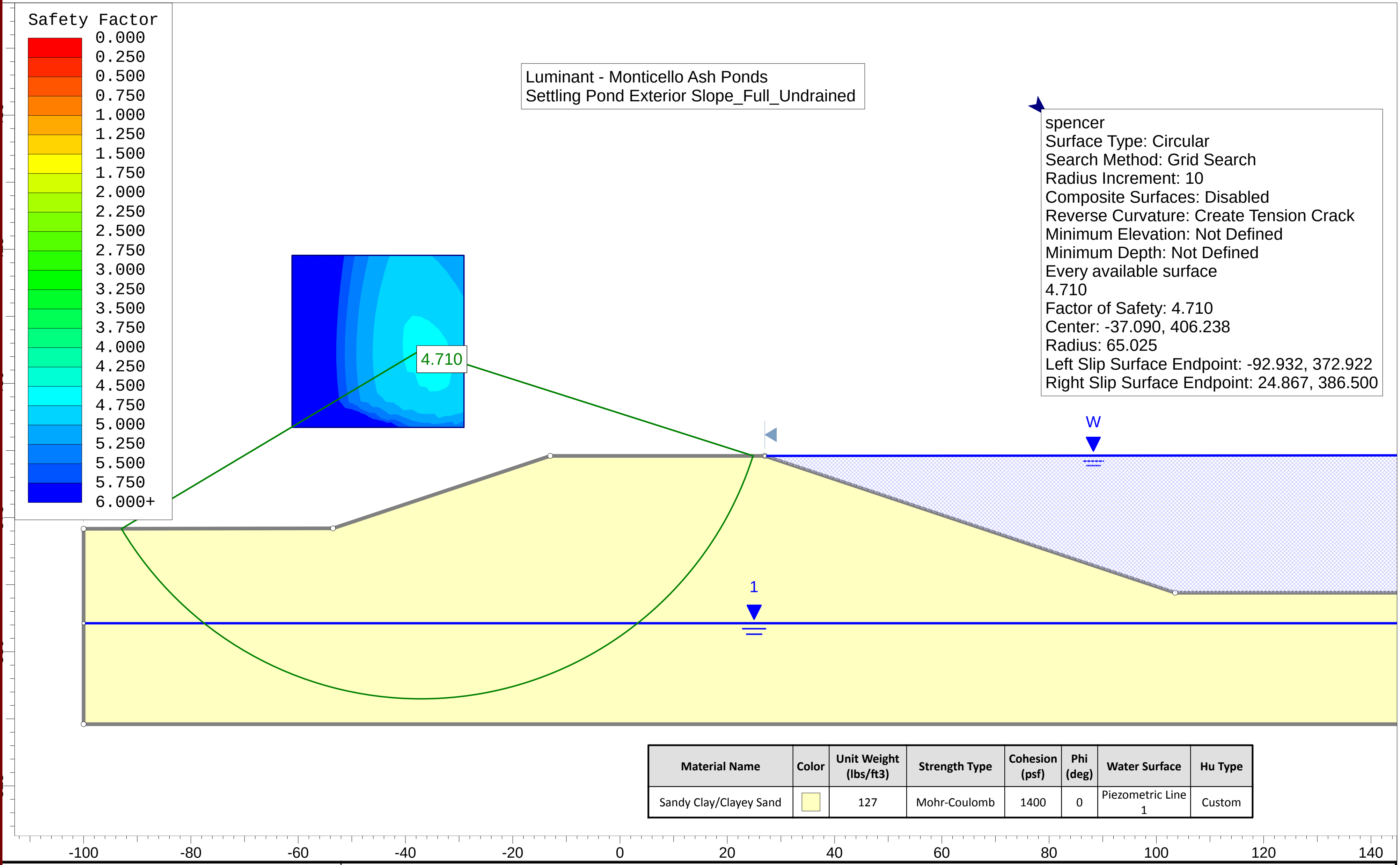
P. CHRIS MARSHALL
91893

P. Chris Marshall, P.E.
Senior Project Engineer

Charles F. Rickert, P.E.
Associate

Attachments

CASE 22



Luminant - Monticello Ash Ponds
Settling Pond Exterior Slope_Full_Undrained

spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
4.710
Factor of Safety: 4.710
Center: -37.090, 406.238
Radius: 65.025
Left Slip Surface Endpoint: -92.932, 372.922
Right Slip Surface Endpoint: 24.867, 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1400	0	Piezometric Line 1	Custom

Project
Luminant - Monticello Ash Ponds

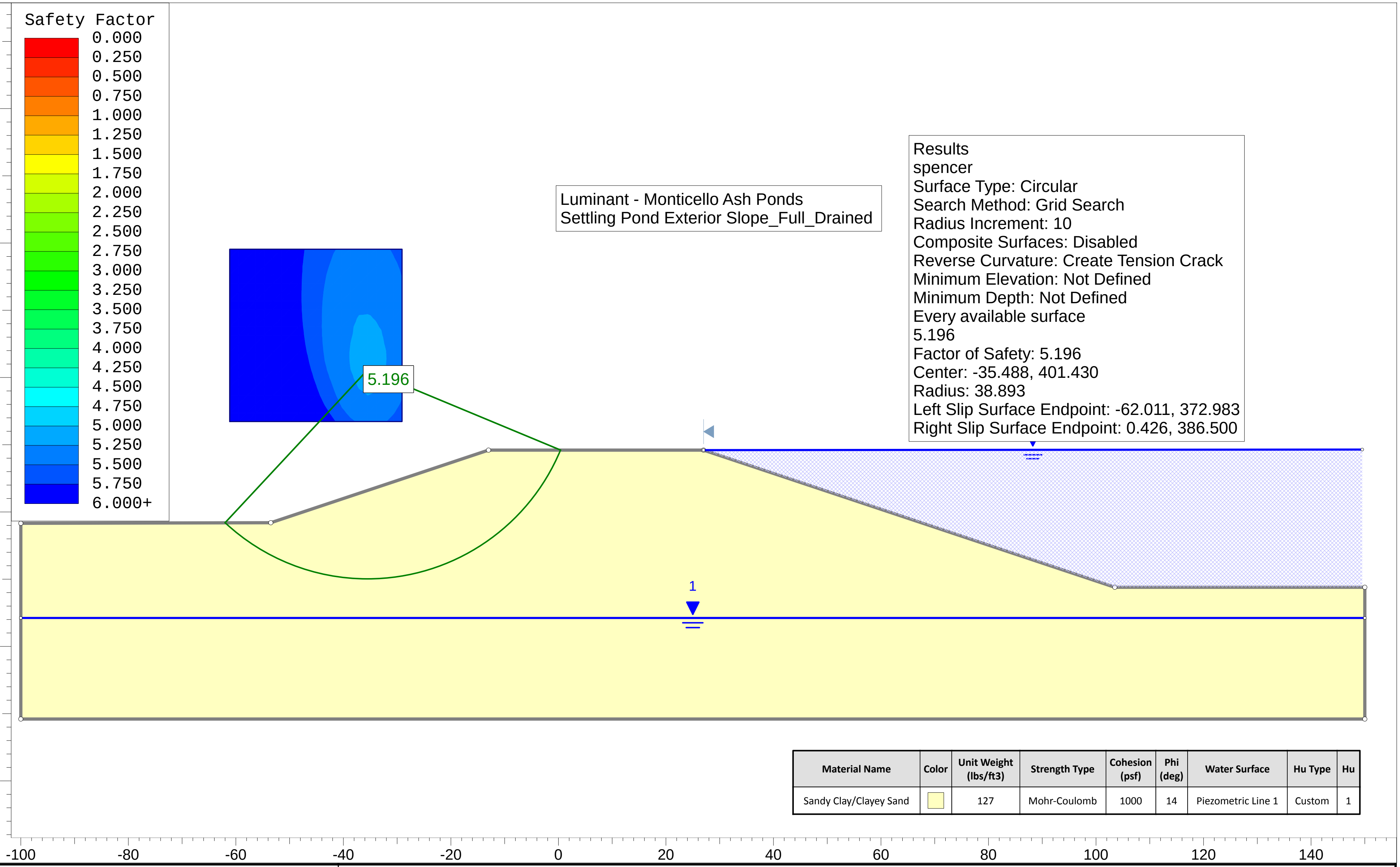
Analysis Description
Settling Pond Exterior Slope_Full_Undrained

Drawn By PCM
Scale 1:300
Company Golder Associates Inc.

Date 11/21/2012, 11:53:19 AM
File Name Settling Pond ext_a.slim

IDEINTERPRET 6.026

CASE 23



Luminant - Monticello Ash Ponds
Settling Pond Exterior Slope_Full_Drained

Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
5.196
Factor of Safety: 5.196
Center: -35.488, 401.430
Radius: 38.893
Left Slip Surface Endpoint: -62.011, 372.983
Right Slip Surface Endpoint: 0.426, 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Sandy Clay/Clayey Sand	🟨	127	Mohr-Coulomb	1000	14	Piezometric Line 1	Custom	1

Project Luminant - Monticello Ash Ponds

Analysis Description Settling Pond Exterior Slope_Full_Drained

Drawn By PCM

Scale 1:300

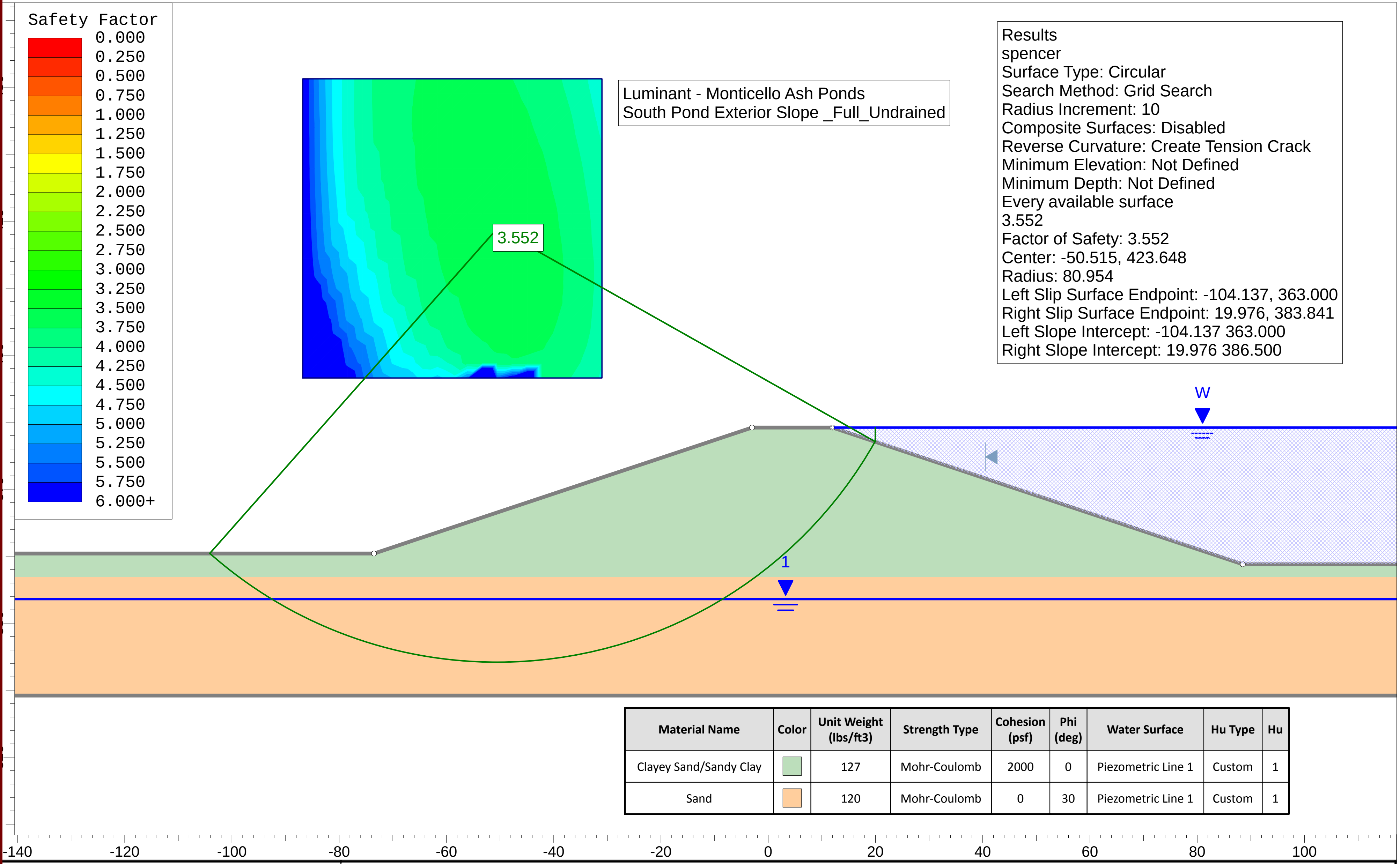
Company Golder Associates Inc.

Date 11/21/2012, 11:53:19 AM

File Name Settling Pond ext_b.slim

IDEINTERPRET 6.026

CASE 24



Luminant - Monticello Ash Ponds
South Pond Exterior Slope _Full_Undrained

Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.552
Factor of Safety: 3.552
Center: -50.515, 423.648
Radius: 80.954
Left Slip Surface Endpoint: -104.137, 363.000
Right Slip Surface Endpoint: 19.976, 383.841
Left Slope Intercept: -104.137 363.000
Right Slope Intercept: 19.976 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	2000	0	Piezometric Line 1	Custom	1
Sand	🟧	120	Mohr-Coulomb	0	30	Piezometric Line 1	Custom	1

Project
Luminant - Monticello Ash Ponds

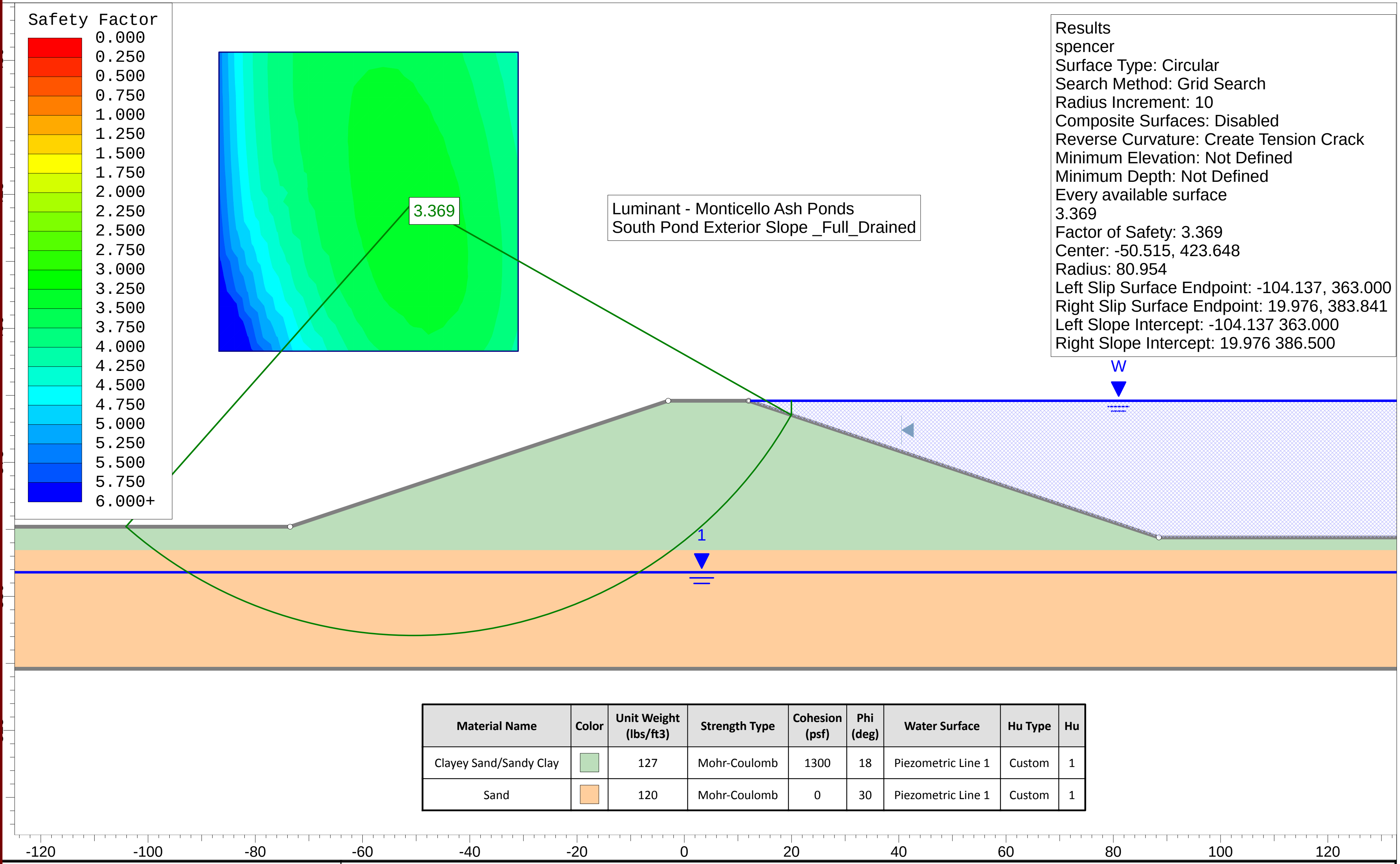
Analysis Description
South Pond Exterior Slope _Full_Undrained

Drawn By PCM
Scale 1:300
Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM
File Name South pond ext_a.slim

IDEINTERPRET 6.026

CASE 25



Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
3.369
Factor of Safety: 3.369
Center: -50.515, 423.648
Radius: 80.954
Left Slip Surface Endpoint: -104.137, 363.000
Right Slip Surface Endpoint: 19.976, 383.841
Left Slope Intercept: -104.137 363.000
Right Slope Intercept: 19.976 386.500

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Clayey Sand/Sandy Clay	🟩	127	Mohr-Coulomb	1300	18	Piezometric Line 1	Custom	1
Sand	🟧	120	Mohr-Coulomb	0	30	Piezometric Line 1	Custom	1

Project
Luminant - Monticello Ash Ponds

Analysis Description
South Pond Exterior Slope _Full_Drained

Drawn By PCM
Scale 1:300
Company Golder Associates Inc.

Date 11/20/2012, 6:26:53 PM
File Name South pond ext_b.slim

IDEINTERPRET 6.026