

Exhibit V. Grezaffi North Site Preliminary  
Geotechnical Engineering Report



Geotechnical, Environmental & Construction Materials Testing  
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**Preliminary Geotechnical Engineering  
Study Report**

**Proposed +/-160 Acre Grezaffi North Site  
Ascension Parish, LA**

Baton Rouge Area Chamber  
SESI Project No: B14-085  
October 14, 2014

11638 Sunbelt Court  
Baton Rouge, LA 70809

Tel: (225) 751-1727  
Fax: (225) 752-1467  
www.soeearth.com



Geotechnical, Environmental & Construction Materials Testing

October 14, 2014

**BATON ROUGE AREA CHAMBER**  
564 Laurel Street  
Baton Rouge, Louisiana 70801

**ATTENTION:** Mr. Jim Cavanaugh

**REFERENCE:** Preliminary Geotechnical Engineering Study for  
Proposed 160 +/- Acre Grezaffi North Site  
Ascension Parish, Louisiana  
SESI File No.: B14-085

Dear Mr. Cavanaugh:

**Southern Earth Sciences, Inc (SESI)** is pleased to submit our Preliminary Geotechnical Engineering Study Report for the above referenced project. The report includes the results of field and laboratory testing, general recommendations for the foundation design, and general site preparation as related to soils.

We appreciate the given opportunity to perform this Preliminary Geotechnical Study and look forward to continue participating during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Sincerely,

**SOUTHERN EARTH SCIENCES, INC.**

Mike Juneau, P.E.  
Registered, Louisiana 37242

Joe Cobena, E.I.  
Staff Engineer



Raja Madhyannapu, Ph.D. P.E.  
Registered, Louisiana 37040

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- General Notes from Literatures
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## **1.0 PROJECT INFORMATION**

### **1.1 Project Authorization**

Southern Earth Sciences, Inc. (SESI) has completed a subsurface exploration for the proposed preliminary site evaluation for marketing the project site in the Louisiana Economic Development Program (LEDP). Our geotechnical engineering services were performed in general accordance with our Geotechnical Proposal No: P14-125.08 dated August 13, 2014. Authorization to proceed with this investigation was received from Mr. Iain Vasey through signed *Work Authorization Sheet* dated August 21, 2014.

### **1.2 Project Description**

It is our understanding that the project site will be marketed in the Louisiana Economic Development Program (LEDP) for future industrial development, which has not been defined at this time. Based on the provided information, the proposed Grezaffi NORTH site will encompass approximately 160 acres. The proposed site is generally located east of Highway 73, and north of Highway 30 in Geismar, Louisiana. Based on the provided information, the majority of the project site is a mixture of agricultural land, grass covered pastures, some trees, and two (2) ponds.

Furthermore, it is understood that in order to market the project site in the LEDP, preliminary evaluation of subsoil characteristics of the project site verifying the compatibility with industrial development is required. Generally, for this purpose, we understand LEDP requires at least one (1) soil boring to a depth of 100 feet for an area of 50 acres. However, the field exploration for this project was performed as directed by client. In addition, LEDP requirements state that once the type of development is determined and a site plan is developed, additional subsurface investigations should be performed in order to provide project specific, geotechnical engineering recommendations.

## **2.0 PURPOSE AND SCOPE**

The purpose of this study was to explore the subsurface conditions at the site to provide preliminary evaluation of subsurface characteristics for future industrial development. As directed by client, two (2) soil borings to a depth of about 25 feet below existing grade and one (1) soil boring to a depth of about 75 feet were drilled and sampled.

The scope of services also included conducting laboratory tests on selected samples recovered from the soil borings. These tests included visual description and classification, moisture content, liquid limit, plastic limit, and unconfined compressive strength. Both field and laboratory testing procedures are briefly discussed in this report.

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This report includes a site description, discusses the conditions of the existing subsurface materials at the site and presents the following:

- Soil boring logs including identification and physical and engineering characteristics of subsurface materials encountered during the sampling and testing
- General discussion on subsurface conditions and their engineering characteristics
- Discussion on the suitability of existing subsurface soils for future industrial development including a “typical” 100,000 square foot warehouse building and associated roadways

The scope of geotechnical services did not include an environmental site assessment for determining the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater, or air on, below, or around the site. Any statement in this report or on the *Boring Log* sheets regarding odors, colors, and unusual or suspicious items or conditions is strictly for informational purposes.

In addition, SESI did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or amplification of the same. The client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The client further acknowledges that site conditions are outside of SESI’s control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, SESI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

### **3.0 FIELD EXPLORATION**

The field exploration performed to evaluate the engineering characteristics of the subsurface materials, included a reconnaissance visit to the project site by a SESI representative, drilling the soil borings and recovering soil samples.

As previously mentioned, two (2) soil borings to a depth of about 25 feet and one (1) soil boring to a depth of about 75 feet within the proposed project footprint were drilled and sampled for this project. The depths and locations of the borings were as proposed by SESI and understood by client following the RFP. The *Boring Location Plan*, included in the Appendix, presents the approximate location of the borings. Descriptions of soil and groundwater conditions encountered in the borings are shown on their respective logs in Appendix.

### **4.0 DRILLING AND SAMPLING PROCEDURES**

The borings were drilled with an ATV (all terrain vehicle) mounted drill rig using auger and rotary head wash drilling techniques to advance the borehole. Undisturbed samples were continuously obtained from the ground surface to a depth of ten (10) feet, then at five-foot intervals to the

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depth of the boring. They were obtained using thin-walled tube sampling procedures in general accordance with ASTM D-1587 *Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes*. These samples were extruded in the field with a hydraulic ram, and were identified according to project number, boring number and depth, wrapped in aluminum foil and placed in plastic bags to preserve the natural moisture condition; then, they were transported to the laboratory in containers to minimize disturbance.

### 5.0 LABORATORY TESTING PROGRAM

A supplemental laboratory testing program was conducted to determine additional pertinent engineering characteristics of the subsurface materials. This program included visual description and classification and determination of the moisture content (ASTM D2216 *Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass*) on all samples. Furthermore, selected samples were subjected to ASTM D4318 *Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils*, ASTM D1140 *Standard Test Method for Amount of Material in Soils Finer than the No. 200*, and ASTM D2166 *Standard Test Method for Unconfined Compressive Strength of Cohesive Soils*. The results of these tests are found in the accompanying boring logs located in the Appendix. Please note that the samples obtained and not tested will be retained for a period of thirty (30) days; if further instructions are not received they will be disposed at that time.

### 6.0 SUBSURFACE CONDITIONS

**Boring 1:** Boring 1 revealed the presence of very stiff fat clay with traces of roots from the existing ground surface to a depth of about two (2) feet. Following this, medium to stiff lean and fat clays were encountered to the depth of boring termination at about 25 feet.

**Boring 2:** Boring 2 revealed the presence of very stiff lean and fat clay from the existing ground surface to a depth of about four (4) feet. Following this, medium to stiff lean and fat clays were encountered to the depth of boring termination at about 75 feet. Please note that a layer of tan, silty sand was encountered from a depth of about 33 feet to about 38 feet at this location.

**Boring 3:** Boring 3 revealed the presence of medium to stiff consistency lean and fat clays from existing ground surface to the depth of boring termination at about 25 feet.

Generally, the clay material was sampled in gray and tan colors with variable amounts of silt and ferrous nodules. All references to depth are made with respect to the existing ground surface at the time the borings were performed.

The above subsurface description is a generalized nature to highlight the major subsurface materials features and characteristics. The *Boring Log* sheets, included in the Appendix, present specific information at individual boring location including: soil description, stratification, ground

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water level, unconfined compressive strength, samples' location, and laboratory tests results. This information represents the actual conditions at the boring locations. Variations may occur and should be expected between boring locations. The stratification represents the approximate boundary between subsurface materials and the actual transition may be gradual.

## 7.0 GROUNDWATER

Groundwater was encountered at all boring locations at the time of field exploration. A summary of the encountered groundwater conditions is presented in the following table.

<b>GROUND WATER TABLES</b>	
<b>Borehole</b>	<b>Reading (feet)</b>
B-1	8.0
B-2	5.5
B-3	8.0

We caution that the clay soils present at this site will have a tendency to retain moisture and to create perched water conditions after periods of wet weather. Isolated perched water conditions shallower than those encountered during our investigations may be possible after periods of rainfall. Fluctuations in the groundwater table will occur due to variances in rainfall, elevation, drainage, types of soil encountered and other factors not evident at the time measurements were made. Groundwater levels should be verified prior to construction. Groundwater levels encountered at each test location at the time of our investigation are shown on the appropriate Soil Boring Logs attached in Appendix. Reference to depth has been made with respect to the existing ground surface.

## 8.0 GENERAL RECOMMENDATIONS

### 8.1 Site Discussion

Generally, the laboratory and field test results indicate that the encountered materials exhibit fair to good strength parameters. Essentially clays at all borings locations tend to be predominately medium to stiff in consistency. Please refer to the boring logs attached to this report for strength and consistency characteristics of soils with depth.

Based on our review of the existing subsoil conditions and analysis of laboratory and field test results, we consider the proposed project to be feasible from a geotechnical point of view for future commercial development. However, it is recommended that based on the proposed future commercial development and project requirements, the project site should be further explored to provide specific recommendations related to site preparation,

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foundation design, pavement design and construction considerations. Please note that this report should be considered only for preliminary site evaluation and is not intended for design purposes.

We encourage contacting SESI to provide further geotechnical engineering and construction services, when the proposed commercial development is planned and ready to be implemented.

### **8.2 “Typical” Structure Recommendations**

Considering the subsurface materials encountered, construction of a “typical” 100,000 square foot warehouse building with associated parking and driveways would be possible from a geotechnical standpoint. Based on the assumed structural loads of 30 kip or less column loads and 3 kip per linear foot or less wall loads, the typical warehouse building may be supported on a shallow foundation system. Recommendations on shallow foundation systems will require further field exploration based on the site and project specific requirements.

## **9.0 REPORT LIMITATIONS**

The analyses and recommendations presented in this report are based on the existing field conditions at the time of the investigation. Furthermore, they are based on the assumption that the exploratory borings are a representation of the subsoil conditions throughout the site. Please note that variations in the subsoil conditions may occur between and beyond borings. If variations in those conditions are encountered during construction, SESI shall be notified immediately in order to assess the situation, confirm the recommendations included in this report, or modify them according to their own judgment. If SESI is not notified of such variations, SESI will not be responsible for the impact of those variations on the project.

This report for the preliminary site evaluation has been prepared for the exclusive use Baton Rouge Area Chamber and their design/construction team associated to this specific project.

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# **APPENDIX**



PROPOSED GREZAFFI NORTH SITE  
 ASCENSION PARISH, LOUISIANA  
 SESI FILE NO.: B14-085

**SOUTHERN EARTH SCIENCES, INC.**  
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FIGURE 1  
 BORING LOCATION PLAN

# BORING LOG

**BORING NO.:**  
**PROJECT:**  
**PROJECT LOCATION:**  
**BORING LOCATION:**  
**BORING ELEVATION:**  
**GEOL/ENGR:**  
**METHOD:**

**PROJECT NO.:**  
**DATE DRILLED:**  
**DATE COMPLETED:**  
**WATER LEVEL:**  
**WATER LEVEL DATE:**  
**LOGGED BY:**  
**DRILLER:**

DEPTH (FEET)	SAMPLE	Standard Penetration (Blows/Ft.) or Penetrometer (TSF)	Unconfined Compressive Strength (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	LL	PI	Symbol	MATERIAL CLASSIFICATION																
<div style="text-align: center;">5</div> <div style="text-align: center;">10</div> <div style="text-align: center;">15</div> <div style="text-align: center;">20</div> <div style="text-align: center;">25</div> <div style="text-align: center;">30</div> <div style="text-align: center;">35</div> <div style="text-align: center;">40</div>									<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">                     Description of strata as follows:                      Strength (or Consistency), Color, Minor Constituent, Major Constituent, additional observations, etc.                 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; color: orange;">                     Field evaluation of shear strength/relative density:                      Standard Penetration Test (ASTM D-1586) in Blows/Ft.                      Pocket penetrometer readings in Tons/Sq. Ft.                 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">                     Groundwater second reading                 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">                     Groundwater first encountered                 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>Graphical presentation of material type:</b> <table style="width: 100%; text-align: center;"> <tr> <td> Fat CLAY</td> <td> SILT</td> <td> SAND</td> <td> FILL</td> </tr> <tr> <td> Lean CLAY</td> <td> CLAYEY SILT</td> <td> CLAYEY SAND</td> <td> GRAVEL</td> </tr> <tr> <td> ORGANIC CLAY</td> <td> SANDY SILT</td> <td> SILTY SAND</td> <td> GRAVELLY SAND</td> </tr> <tr> <td> PEAT</td> <td> ORGANIC SILT</td> <td> SANDY CLAY</td> <td></td> </tr> </table> </div> <div style="border: 1px solid black; padding: 5px;"> <b>Laboratory Information</b>                      As determined by Unconfined Compression (ASTM D-2166) or Unconsolidated Undrained Triaxial (ASTM D-2850), if noted.                      Determined using applicable portions of ASTM D-2166 and ASTM D-2216.                      Determined using ASTM D-2216 or D-4959.                      Determined using ASTM D-4318. Provides data for application of Unified Classification System (UCS).                 </div>	Fat CLAY	SILT	SAND	FILL	Lean CLAY	CLAYEY SILT	CLAYEY SAND	GRAVEL	ORGANIC CLAY	SANDY SILT	SILTY SAND	GRAVELLY SAND	PEAT	ORGANIC SILT	SANDY CLAY	
Fat CLAY	SILT	SAND	FILL																						
Lean CLAY	CLAYEY SILT	CLAYEY SAND	GRAVEL																						
ORGANIC CLAY	SANDY SILT	SILTY SAND	GRAVELLY SAND																						
PEAT	ORGANIC SILT	SANDY CLAY																							

**COMMENTS:**

- Shelby Tube Sample
  - Auger Sample
  - Split-spoon Sample
  - No Recovery
- Sample recovery method.

# GENERAL NOTES FROM LITERATURE

## Unified Soil Classification System

Coarse-grained soils. More than 50% retained on US # 200 Sieve	Gravels: More than 50% retained on US # 4 Sieve	Clean Gravel (little or no fines)	GW	Well graded gravels and gravel-sand mixtures with little or no fines	
			GP	Poorly graded gravels and gravel-sand mixtures with little or no fines	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures	
			GC	Clayey gravels, gravel-sand-clay mixtures	
	Gravels: More than 50% passing through US # 4 Sieve	Clean sand (little or no fines)	SW	Well graded sands and gravelly sands, little or no fines	
			SP	Poorly graded sands and gravelly sands, little or no fines	
		Sands with fines	SM	Silty sands, sand-silt mixtures	
			SC	Clayey sands, sand-clay mixtures	
		Fine-grained soils. More than 50% passed through US Sieve # 200	Sils and Clays with liquid limit (LL) less than 50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity				
Sils and Clays with liquid limit (LL) greater than 50	MH		Inorganic silts, micaceous diatomaceous fine sand or silty soil, elastic silts		
	CH		Inorganic clays of high plasticity, fat clays		
	OH		Organic clays of medium to high plasticity		
	PT		Peat, muck and other highly organic soils		
<i>High organic soils</i>					

### Classification of Granular Soils as per U.S. Standard Sieve Analysis

Description	Boulders	Cobbles	Gravel		Sand			Silt or Clay
			Coarse	Fine	Coarse	Medium	Fine	
Sieve Size	>12 inches	3-12 inches	0.75 to 3inches	#4 to 0.75 inches	#10-#4	#40-#10	#200-#40	<#200

Note: #4=5mm, #10=5mm, #40=0.4mm, #200=0.8mm

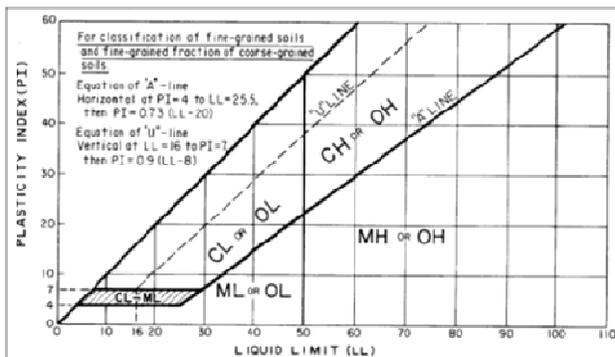
### Consistency of Cohesive Soils

Consistency	Unconfined Compressive Strength, (tsf)	SPT* (N)
Very Soft	<0.25	<2
Soft	0.25 to 0.50	2 to 4
Medium Stiff	0.50 to 1.0	5 to 8
Stiff	1.0 to 2.0	9 to 15
Very Stiff	2.0 to 4.0	16 to 30
Hard	>4.0	>30

### Relative Density of Granular Soils

Relative Density	SPT* (N)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 24
Dense	25 to 50
Very Dense	>50

\*Standard Penetration test (SPT) value (N-value) is a number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18 inches penetration with a 140-pound hammer falling from 30 in. height.



### Plasticity Characteristics

Plasticity	Plasticity Index (PI)
Non-Plastic	0
Slight	1 to 5
Low	5 to 10
Medium	11 to 20
High	21 to 40
Very high	> 40

# BORING LOG

**BORING NO.:** B-1  
**PROJECT:** GREZAFFI NORTH SITE  
**PROJECT LOCATION:** ASCENSION PARISH, LA  
**BORING LOCATION:** N 30° 13' 31.2", W 90° 59' 51.0"  
**BORING ELEVATION:** EXISTING GRADE  
**GEOL/ENGR:** RM  
**METHOD:** AUGER

**PROJECT NO.:** B14-085  
**DATE DRILLED:** 09/24/14  
**DATE COMPLETED:** 09/24/14  
**WATER LEVEL:** 8 ft  
**WATER LEVEL DATE:** 09/24/14  
**LOGGED BY:** WW  
**DRILLER:** DT

DEPTH (feet)	SAMPLE	Unconfined Compressive Strength (tsf)	Moisture Content (%)	Dry Unit Weight (pcf)	LL	PI	Symbol	MATERIAL CLASSIFICATION
0		2.11	18	103				Very Stiff, Dark Gray and Tan Fat CLAY with silt, roots and ferrous nodules (CH)
5		0.71	25	103	42	22		Brown and Tan Lean CLAY (CL) -- with large calcareous nodules and ferrous nodules
8			27		31	8		-- medium -- with roots
10			25					-- with ferrous nodules
15		1.13	26	98				Stiff, Light Gray and Tan Fat CLAY (CH) -- with ferrous nodules
20			32		47	21		Light Gray and Tan Lean CLAY (CL) -- with silt pockets, slickensided
25		1.06	44	77				Stiff, Light Gray and Tan Fat CLAY (CH) -- with trace ferrous nodules, jointed
25								Bottom at 25 Feet

**COMMENTS:**  
 SHELBY TUBE

# BORING LOG

**BORING NO.:** B-2  
**PROJECT:** GREZAFFI NORTH SITE  
**PROJECT LOCATION:** ASCENSION PARISH, LA  
**BORING LOCATION:** N 30° 13' 11.6", W 90° 59' 18.2"  
**BORING ELEVATION:** EXISTING GRADE  
**GEOL/ENGR:** RM  
**METHOD:** WET ROTARY

**PROJECT NO.:** B14-085  
**DATE DRILLED:** 09/23/14  
**DATE COMPLETED:** 09/23/14  
**WATER LEVEL:** 5.5 ft  
**WATER LEVEL DATE:** 09/23/14  
**LOGGED BY:** WW  
**DRILLER:** DT

DEPTH (feet)	SAMPLE	Unconfined Compressive Strength (tsf)	Moisture Content (%)	Dry Unit Weight (pcf)	LL	PI	Symbol	MATERIAL CLASSIFICATION
0			20					Light Gray and Tan Lean CLAY (CL) -- with ferrous nodules
2		3.14	25	99				Very Stiff, Light Gray and Tan Fat CLAY (CH) -- with silt and ferrous nodules
4			25		35	11		Light Gray and Tan Lean CLAY with ferrous nodules (CL)
6		0.93	26	100				-- medium
8			27					
10								
12								
14		1.11	23	104	55	40		Stiff, Tan Fat CLAY (CH) -- with calcareous nodules
16								
18			39					-- light gray and tan, jointed
20								
22			29					-- with ferrous nodules, jointed
24								
26								
28								
30		0.83	27	98	41	21		Medium, Light Gray and Tan Lean CLAY (CL) -- with ferrous nodules, jointed
32								
34			28					Tan Silty SAND (SP)
36								
38								
40			35					Light Gray and Tan Lean CLAY with sandy silt pockets (CL)

**COMMENTS:**

SHELBY TUBE

DISTURBED SAMPLE

# BORING LOG

**BORING NO.:** B-2  
**PROJECT:** GREZAFFI NORTH SITE  
**PROJECT LOCATION:** ASCENSION PARISH, LA  
**BORING LOCATION:** N 30° 13' 11.6", W 90° 59' 18.2"  
**BORING ELEVATION:** EXISTING GRADE  
**GEOL/ENGR:** RM  
**METHOD:** WET ROTARY

**PROJECT NO.:** B14-085  
**DATE DRILLED:** 09/23/14  
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**WATER LEVEL:** 5.5 ft  
**WATER LEVEL DATE:** 09/23/14  
**LOGGED BY:** WW  
**DRILLER:** DT

DEPTH (feet)	SAMPLE	Unconfined Compressive Strength (tsf)	Moisture Content (%)	Dry Unit Weight (pcf)	LL	PI	Symbol	MATERIAL CLASSIFICATION
45		0.89	27	97	34	14		-- medium, brittle
50			29					Light Gray and Tan Fat CLAY (CH) -- slickensided
55			30					-- with ferrous nodules
60		0.51	41	80	81	55		-- medium, with silt pockets, jointed
65			32					-- with concretions, slickensided
70			25					Light Gray and Tan Lean CLAY (CL) -- with sandy silt pockets
75		1.25	34	89				Stiff, Gray and Tan Fat CLAY (CH) -- jointed and slickensided
								Bottom at 75 Feet

**COMMENTS:**

 SHELBY TUBE

 DISTURBED SAMPLE

# BORING LOG

**BORING NO.:** B-3  
**PROJECT:** GREZAFFI NORTH SITE  
**PROJECT LOCATION:** ASCENSION PARISH, LA  
**BORING LOCATION:** N 30° 13' 11.6", W 90° 59' 18.2"  
**BORING ELEVATION:** EXISTING GRADE  
**GEOL/ENGR:** RM  
**METHOD:** AUGER

**PROJECT NO.:** B14-085  
**DATE DRILLED:** 09/24/14  
**DATE COMPLETED:** 09/24/14  
**WATER LEVEL:** 8 ft  
**WATER LEVEL DATE:** 09/24/14  
**LOGGED BY:** WW  
**DRILLER:** DT

DEPTH (feet)	SAMPLE	Unconfined Compressive Strength (tsf)	Moisture Content (%)	Dry Unit Weight (pcf)	LL	PI	Symbol	MATERIAL CLASSIFICATION
0 - 10	█		27		40	20	▨	Gray Lean CLAY (CL)
5		0.89	24	99				-- medium, with ferrous nodules
			25		44	26		-- with silt pockets and ferrous nodules
		1.00	27	94				-- stiff, light gray and tan with ferrous nodules
10 - 15			31		36	17		-- with ferrous nodules
15 - 20	◻	0.41	40	79			▩	Soft, Gray and Tan Fat CLAY (CH)
								-- with silt pockets and large calcareous nodules, jointed and slickensided
20	█		31		56	36		-- with ferrous nodules, slickensided
25	█	1.21	29	95				-- stiff, with ferrous nodules and silt pockets
25 - 40								Bottom at 25 Feet

**COMMENTS:**

█ SHELBY TUBE

◻ DISTURBED SAMPLE

## Your Partner in Managing Ever-changing Environmental Requirements

With increasing federal, state and local scrutiny on environmental issues of all kinds, it is vital to have a partner who understands these pressures and remains on the leading edge of every issue. From Phase I Environmental Site Assessments to site analyses for large petroleum storage facilities and hazardous waste landfills, SESI has the necessary resources to solve client issues with modern efficiency.



### Phase I Environmental Site Assessments

Phase I Environmental Site Assessments protect the purchaser and lender in commercial and industrial property transactions. New EPA requirements for All Appropriate Inquiry means contamination from off-site sources and vapor intrusion should be considered. SESI can also collect and analyze soil and groundwater samples, if required (Phase II).

#### Services

- Water quality evaluation
- Hydrogeological services
- Site inspections
- Stormwater / industrial discharge compliance
- Contamination assessments
- Remedial actions
- Risk assessments
- Phase I and II ESAs



### Landfills and Solid Waste Management

SESI professionals are uniquely qualified to resolve landfill and hazardous waste issues. Our expertise in this area includes site selection and auditing, groundwater contamination testing, and closure services for landfills and energy-to-steam facilities. Our team has participated in the design of several – “Subtitle D” – solid waste landfills.

Our studies include the use of integrated computer graphics to create map displays, soil cross sections, boring logs and plume analysis. These technologies provide the most comprehensive evaluation and reporting of landfill conditions available.

#### Services

- Hydrogeological / geotechnical investigation
- Groundwater and gas monitoring / statistical analysis
- Technical support
- Design
- Leachate treatment
- Operations and management studies

### Underground Storage Tanks

SESI is approved in Alabama (ADEM), Florida (FDEP) and Mississippi (MDEQ) as a qualified Underground Storage Tank Contractor. This gives our experts the ability to assist clients in every area including site assessment and site planning, permitting, remediation and corrective action plans, and compliance with regulatory requirements.

#### Services

- Regulatory compliance
- Permitting
- Remediation and corrective action planning
- Closure services
- Inspection and monitoring

### Environmental Engineering and Consulting

Our engineers and geologist are capable of providing a variety of services to assist our clients in meeting project goals.

#### Services

- Wetlands Permitting
- On-site sewage systems
- Pond and lake design
- Small flow wastewater systems

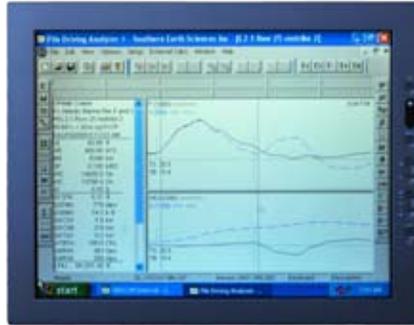
### Asbestos and Lead-Based Paint (LBP) Consulting

The SESI team of certified asbestos and lead professionals have considerable experience in this important discipline. Our laboratories have the capability to test air samples and provide monitoring and assessment information. All operations are supervised by a licensed asbestos consultant.

#### Services

- Risk assessments (LBP)
- Asbestos and LBP surveys
- Abatement plans and specs
- Abatement monitoring and inspections

The SESI multi-disciplined staff of professionals places the company in the unique position to combine efforts and give our clients the broad spectrum of geotechnical, environmental and construction consulting necessary to move a project forward quickly. We have drilling, cone penetration testing (CPT) and Geoprobe® equipment in-house to respond rapidly and efficiently to project schedules. Our team has assisted in thousands of projects ranging from single-story residential structures to multi-million dollar industrial facilities. SESI is truly your turn-key solution for site investigations.



### Pile Driving Analyzer®

#### Engineering Analysis and Design

SESI registered professional engineers and geologists solve unusual foundation, engineering and environmental issues on a regular basis. We specialize in pinpointing the obstacles and presenting alternative design options. All foundation aspects are covered from pavement analysis, slope stability to deep and shallow foundation analysis.

#### Services

- Pile and drilled shaft systems
- Excavation bracing
- Geological mapping / soil profiles
- Soil stabilization studies
- Shallow foundation systems
- Retaining walls
- Slope stability

#### Field Drilling and Site Investigation

SESI Drilling, Cone Penetration Testing (CPT), and Geoprobe® crews have successfully completed the Hazardous Assessment and Resource Management Course (29 CFR 1910-120). Senior drillers are also required to maintain water well drilling licenses. Regardless of the area or terrain, our crews are prepared to go virtually anywhere to provide you with accurate and current data.

#### Services

- Groundwater monitor wells
- Sediment sampling
- SPT testing
- CPT testing

#### Laboratory Testing

In an effort to coordinate and expedite efforts across our geotechnical engineering, drilling and environmental projects, SESI maintains branch offices across the Southeast. These laboratories allow project engineers to receive results quickly and accurately. Routine tests are conducted at these facilities under the direction of responsible professionals.

#### Tests

- Compaction
- CBR and LBR
- Permeability
- Swell pressure measurements
- Triaxial strength testing
- ASTM testing of soils and rock
- Soil cement, classification, conductivity and resistivity
- Consolidation

#### Instrumentation

When land suitable for building is in short supply, it becomes necessary to evaluate innovative foundation solutions. Instrumentation of soil and rock plays a key role in overcoming building limitations. Over the years, SESI has developed an expertise in evaluating, identifying, planning and designing highly refined field instrumentation programs using pore pressure instrumentation, inclinometers, geophysical exploration equipment and vibration monitoring devices to limit engineering problems.

#### Equipment

- Inclinometers
- Piezometers
- Sondex units
- Settlement plates
- Strain gauges
- Pressure cells
- Vibration monitoring
- Pile integrity testing
- Pile dynamic analyzer (PDA)



# Subsurface Investigations

## Conventional Drilling Cone Penetration Testing Direct Push Technology

To support Southern Earth Sciences, Inc.'s geotechnical and environmental exploration objectives, SESI is staffed with experienced crews and equipped with a variety of Cone Penetration Testing, Drilling and Direct Push rigs. The equipment is mounted on a variety of carriers including two-wheel and four-wheel drive trucks and track vehicles. All crew members investigating contaminated sites have completed the 40-hour Hazardous Assessment and Response Management Course (29 CFR 1910-120), and senior drillers maintain required state water well contractors licenses.

Employing CPT technology, SESI, Inc. is able to provide high quality geotechnical and hydrogeological in-situ soil properties. Our in-house CPT equipment gives SESI a unique advantage to offer clients increased accuracy, speed of deployment and reduced costs.



### CPT Technology

Cone Penetration Testing, commonly referred to as CPT, is an in-situ testing method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy. Today CPT is one of the most frequently used and accepted in-situ test methods for soil investigations worldwide although few CPT rigs are available in the Southeast area.

CPT works by pushing an instrumented cone into the ground at a controlled rate of 2 cm/sec. The data can be collected at any interval but is commonly collected every two-inches. Built-in load cells are used to continuously measure the cone tip and sleeve friction resistance. In addition to these values, a porous filter piezo-element, located behind the cone tip, is used to measure pore water pressure during penetration. All CPT field testing procedures are performed in accordance with ASTM D 5778-95 (2000).

### Advantages Over Standard Penetration Testing

The CPT test offers an advantage over conventional sampling methods by providing a virtually continuous profile of subsurface stratigraphy. From the data collected, correlations can be made for the soil characteristics such as internal friction angle, undrained shear strength and estimated unit weight. In addition, pore water dissipation tests can be conducted in order to determine other properties, such as permeability of saturated soils. In an environmental application, soil/gas, soil and groundwater samples can be collected without producing cuttings that would require collection and disposal. Small wells (from 1 to 2 inches in diameter) can also be installed with this equipment.



### Equipment Capabilities

- Climate controlled cabins
- 2.5, 5 and 10 ton cones
- Shear wave velocity measurement
- Video cone
- Instant feedback available through electronic logs

### Equipment

- 20-ton track-mounted CPT rig
- 20-ton truck-mounted CPT rig
- Two (2) track-mounted GeoProbe 6625 equipped for CPT and MacroCore

### Field Drilling

Southern Earth Sciences, Inc. has a variety of truck and track mounted drilling equipment to meet project objectives. SESI staff includes licensed well drillers in Louisiana, Mississippi and Florida.

Drilling methods include Flight Auger, Hollow Stem Auger, Rotary Wash and NQ Rock Coring. Specialty sampling equipment includes piston samplers up to 5" Dennison Samples, vane shear, etc.

### Direct Push

SESI operates several direct push platforms including a dual purpose Geoprobe 6625 CPT. This equipment can utilize conventional macro core sampling and groundwater/vapor sampling tools or, by utilizing earth anchors, can be converted to a 20-ton Cone Penetration Testing Machine.



# SOUTHERN EARTH SCIENCES, INC.

**SOUTHERN EARTH SCIENCES, INC. (SESI) WAS FOUNDED IN 1976 AND PROVIDES GEOTECHNICAL ENGINEERING, CONSTRUCTION MATERIALS TESTING AND ENVIRONMENTAL SERVICES THROUGHOUT THE SOUTHEAST ON INDUSTRIAL, COMMERCIAL AND GOVERNMENT PROJECTS**

## EQUIPMENT LIST



### **BARGE-MOUNTED (35'X12') DIEDRICH D-50**

SESI's 35 foot by 12 foot barge mounted drilling equipment is utilized for projects requiring subsurface investigations over the water. The Diedrich D-50 mounted on the barge is capable of borings in excess of 200 feet.



### **20 TON CPT TRACK-MOUNTED**

The 20 ton heavy-weight, track-mounted Penetrometer system is a self propelled hydraulic remote controlled CPT system designed for rough terrain or areas where low ground pressure is required for vehicle access. It has two double hydraulic cylinders coupled by a platen that pushes and pulls digital cones and other tools. It is powered by a 130 Hp diesel engine. The unit is equipped with hydraulic leveling jacks and a climate controlled operations center. The contact pressure is approximately 6 psi.



### **TRIPOD DRILLING**

The tripod equipment is used in sensitive environmental areas to minimize the impact of drilling operations. The equipment is manually operated to depths generally less than 100 feet. Standard penetration tests, Shelby tube samples and vane shear test can be performed using the manual equipment.



### **20 TON CPT TRUCK-MOUNTED**

The 20 ton truck CPT rig is an ideal vehicle to provide quick, cost effective mobile platform for high production in geotechnical and environmental soils investigations. This system is equipped with 5 and 10 ton seismic piezo cones and vision cones. The operations center is climate controlled for maximum production, regardless of weather conditions or time of day.



### **CME-45 TRUCK-MOUNTED**

The CME-45 is mounted on a four-wheel drive vehicle and is equipped with flight augers, hollow stem augers and mud rotary equipment.

Typical borehole depths are up to 120 feet.



### **BK-51 TRACK-MOUNTED VEHICLE**

The BK-51 is a versatile drill platform with a very low contact pressure of approximately 3 psi. The rig can be configured with augers, mud rotary or NQ wire-line.



### **SUPPORT EQUIPMENT CPT ON MARSH BUGGY**

SESI's CPT system has the capability to be mounted on a marsh buggy for access in swampy conditions.

This setup has been extensively used in south Louisiana for exploration work associated with bridges, pipelines, levees, etc. We have performed CPTs from marsh buggies to depths over 100 feet.



### **JACK-UP BARGE**

Our drilling and CPT equipment can be mounted on a Jack-Up barge for offshore projects where there is excessive wave action. Borings and CPT penetration have exceeded depths of 200 feet in areas where the water depths may be 50 feet.





**BK-66 ON TWO-WHEEL DRIVE VEHICLE**

The BK-66 is a high torque drill rig capable of turning 6.25" hollow stem augers to depths in excess of 100 feet. The rig is also equipped for mud rotary drilling with a Gardner Denver displacement pump.



**DIEDRICH D-50 ON TWO-WHEEL DRIVE VEHICLE**

This rig is mounted on a two-wheel drive vehicle and is equipped with flight augers, hollow stem augers, mud rotary equipment and NQ wireline.

Typical borehole depths are up to 120 feet.



**DIEDRICH D-50 ON FOUR-WHEEL DRIVE VEHICLE**

The CME-45 is mounted on a four-wheel drive vehicle and is equipped with flight augers, hollow stem augers and mud rotary equipment.

Typical borehole depths are up to 120 feet.



**VIBRACORE**

SESI's 3-inch Vibracore is barge-mounted and consists of a submersible pneumatic vibrating motor attached to a four-inch steel casing with an internal clear acrylic sampling tube and is capable of sampling up to 20 feet.



**DIEDRICH D-50 TRACK-MOUNTED**

The Diedrich D-50 is a very versatile drilling rig and has a very low contact pressure of approximately 3 psi. This particular rig can be configured with augers, mud rotary or NQ wireline.

In addition, a Gardner Denver displacement pump is utilized for advancing large diameter boreholes to depths of 200 feet for 4" diameter by 4' long tube samples required for the Corps of Engineers (COE) levee projects.



**GEOPROBE 6625 TRACK-MOUNTED CPT AND MACROCORE (SESI has two Geoprobes)**

The Geoprobe 6625 CPT is a self-anchoring multi-purpose push platform. The system has 20 tons of push capacity when anchored even though the equipment weighs less than 5 tons. The system is capable of collecting CPT data or can be switched to conventional "Geoprobe" mode for Macro-Core soil and groundwater sampling.

**ALABAMA**

*Mobile*

P.O. Box 160745  
Mobile, AL 36616

762 Downtowner Loop W.  
Mobile, AL 36609

(251) 344-7711  
(251) 341-9488 Fax

*Summerdale*

P.O. Box 155  
Summerdale, AL 36580

(251) 989-7726  
(251) 989-6722 Fax

*Montgomery*

1412 I-85 Parkway  
Montgomery, AL 36106

(334) 260-6227  
(334) 260-6229 Fax

**FLORIDA**

*Destin*

150 Industrial Park Rd., Ste. 6  
Destin, FL 32541

(850) 837-9966  
(850) 837-9967 Fax

*Panama City*

1438 Balboa Avenue  
Panama City, FL 32401

(850) 769-4773  
(850) 872-9967 Fax

*Tallahassee*

3642 Peddie Drive  
Tallahassee, FL 32303

(850) 576-4652  
(850) 576-4710 Fax

**LOUISIANA**

*Baton Rouge*

11638 Sun Belt Court  
Baton Rouge, LA 70809

(225) 356-4355 / (225) 751-1727  
(225) 752-1467 Fax

*Mandeville*

1931 Surgi Drive, Ste. A  
Mandeville, LA 70448

(985) 626-1314  
(985) 626-1314 Fax

*New Orleans*

P.O. Box 19172  
New Orleans, LA 70179

725 South Genois Street  
New Orleans, LA 70119

(504) 486-5595  
(504) 486-5598 Fax



**SOUTHERN EARTH SCIENCES, INC.**  
**WWW.SOEARTH.COM**



**Southern Earth Sciences, Inc. is a member  
of the following organizations:**

**American Council of Engineering Companies (ACEC)**

**American Society of Civil Engineers (ASCE)**

**American Society for Testing of Materials (ASTM)**

**National Ground Water Association (NGWA)**

**American Concrete Institute (ACI)**

**American Association of State Highway and Traffic Officials (AASHTO)**

**ADEM Approved**

Alabama Department of Environmental Management

**FDEP Approved**

Comprehensive Quality Assurance Plan

**MDEQ Approved**

Mississippi Department of Environmental Quality

**OSHA Certified**

Safety

**NIOSH Certified**

Asbestos

**AASHTO and CMEC Accredited**

**US Army Corps of Engineers Validated**