

**REPORT OF
GEOTECHNICAL EXPLORATION**

Marlboro County Industrial Park

Bennettsville, South Carolina
S&ME Project No. 1639-12-111

Prepared By:



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August 17, 2012



August 17, 2012

Reference: **Preliminary Report of Geotechnical Exploration**
Marlboro County Industrial Park
Bennettsville, South Carolina
S&ME Project No. 1639-12-111

As requested S&ME, Inc. has conducted a preliminary geotechnical exploration at the above referenced site in general accordance with S&ME Proposal No. 1614-8311-11 dated July 16, 2012. The purpose of the exploration was to characterize and provide preliminary information about the on site subsurface soils based upon the borings conducted. Information obtained was then used to provide site specific recommendations for the potential construction of light to moderately loaded industrial facilities, including likely site preparation requirements, potential foundation types, and the identification of potential borrow areas.

S&ME appreciates this opportunity to work with Alliance Consulting Engineers, Inc. as your geotechnical engineering consultant on this project. If you have any questions or need any further information in regard to this geotechnical report, please do not hesitate to contact us.

Respectfully submitted,
S&ME, Inc.

W. Austin Graham, E.I.T.
Staff Professional



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SOIL CLASSIFICATION LEGEND

SPT BORING LOGS

EXECUTIVE SUMMARY

For your convenience, this report is summarized in outline form below. This brief summary should not be used for design or construction purposes without reviewing the more detailed information presented in the remainder of this report.

- 1. Soil Conditions:** The upper soil profile generally consists of silty sands and clayey sands (Stratum I), to a depth of about 6 to 8 feet. Below Stratum I, the test locations encountered a layer of sandy lean clay (Stratum II), to depths of 12 feet. Below Stratum II, poorly graded sands, sands with clay, and clayey sands were encountered (Stratum III), to a depth of 28 feet in B-1 and until boring termination at 30 feet in B-2. Beneath Stratum III, a lower stratum of lean clay (Stratum IV) was encountered in B-1 until boring termination at 30 feet.
- 2. Subsurface Water:** At the time of drilling, subsurface water was encountered at depths of approximately 9 to 11 feet below the ground surface. Water levels were measured approximately 72 hours after the time of drilling and were found to range from 17 to 18 feet below the ground surface.
- 3. Seismic Site Class:** Based on the soil profile, Seismic Site Class D is appropriate for use in design. The following seismic design coefficients are provided: $S_{DS} = 0.44g$, $S_{D1} = 0.20g$, and Peak Ground Acceleration (PGA) = 0.15g.
- 4. Foundations:** Considering typical light to moderately loaded industrial developments, and the anticipated range of static settlements, it is likely that the use of a shallow foundation system consisting of shallow isolated spread footings and wall footings with a soil-supported slab on grade should be appropriate for support of light to medium duty industrial structures.

1. INTRODUCTION

The purpose of the exploration was to generally characterize and provide preliminary information about the site subsurface soils based upon the borings conducted. Information obtained was then used to provide geotechnical recommendations for the construction of light to medium industrial facilities, to include likely site preparation requirements, potential foundation types, and the identification of potential borrow areas on site.

1.1 Project Description

Original information about the project was obtained through e-mail correspondence between you and Mr. Marty Baltzegar of S&ME, who received a request for a proposal from you via e-mail on July 9, 2010. We understand the site consists of approximately 315 acres located north of the intersection of Beauty Spot Road West and Industrial Lane in Bennettsville, Marlboro County, South Carolina. Lilly Quick Creek borders the site to the east. A Site Vicinity Map is included in Appendix A as Figure 1.

S&ME previously performed a similar scope of exploration services in 2005 (S&ME Project No. 1614-05-296 and 1611-05-288) on a 236 acre portion of the industrial park. This exploration concerns an additional 79-acre parcel located northwest and contiguous of the original industrial park site.

Potential proposed construction would likely consist of light to medium industrial facilities and associated parking and drive areas. Maximum column loads are anticipated to be less than 200 kips, and maximum wall loads are anticipated to be on the order of 3 to 4 kips per linear ft. Finished floor elevations are yet to be determined and will likely vary by building.

2. EXPLORATION PROCEDURES

2.1 Field Exploration

During the month of August, 2012, representatives of S&ME, Inc. visited the site several times. Using the information provided, we performed the following tasks:

- We performed a site walkover, observing features of topography, existing structures, ground cover, and surface soils at the project site.
- We established two standard penetration test (SPT) boring locations at the site by roughly measuring distances and turning right angles, as interpreted from the provided site layout sketch. A test location sketch is attached in Appendix A as Figure 2.
- We advanced two SPT borings (B-1 and B-2) within the subject parcel. Both borings were advanced to a depth of 30 feet. Each SPT boring was advanced by mud rotary methods. In conjunction with the penetration testing, split-spoon

disturbed soil samples were recovered at regular depth intervals and transported to our laboratory for visual classification of soil types.

- The subsurface water level at each boring was measured in the field at the time of drilling and about 72 hours after drilling.

A description of the field exploration procedures performed, as well as the SPT boring logs, are attached in Appendix B.

3. SURFACE CONDITIONS AND GEOLOGY

3.1 Topography

A project-specific topographic map was not provided for this project. By visual observations, topographic relief across the site appeared to be roughly three to five feet or less. This rough estimate should not be relied upon for site design purposes.

3.2 Existing Structures & Ground Cover

Vegetation on the site consisted mainly of small trees (typically 6 inches trunk diameter or less), scrub, and underbrush. The site appears to have been logged in the past. Logging debris such as stumps, logs, and wood chips were plentiful across the site.

3.3 Organic Topsoil

No significant depth of organic topsoil was encountered at the surface of the boring locations; however, in areas of previous logging operations, wood debris may reach several inches in thickness. Also, stumps and remaining rootmat material is likely present.

3.4 Local Physiographic Conditions and Geology

The site is located on one of several archaic coastal terraces that together make up the Southern Coastal Plain Physiographic Province of South Carolina. The terraces were formed over several periods in which the Atlantic Ocean intruded landward during warm periods of the Pleistocene Epoch. The lower terraces are relatively young features, exhibit only minor erosion, and can be traced large distances on the basis of surface elevation. The upper terraces, lying close to or adjacent to the upper margin of the Coastal Plain, are over million years old and have been severely eroded and in many areas have little surface expression. Each terrace forms a thin veneer over older, underlying Coastal Plain or Piedmont residual soils. Materials comprising the terraces typically consist of medium dense tan or reddish-brown sands with varying amounts of fines. Elliptical surface depressions, termed Carolina bays, are present on the surface and may represent areas of localized deep deposits of interlayered clays, peats, and sands.

“Carolina bays” also appear to be present in this industrial park. Carolina bays are natural shallow depressions that are largely fed by rain and shallow groundwater. Bays in South Carolina are found on relict marine barrier beaches associated with Pleistocene sea level fluctuations, in dune fields, on stream terraces and sandy portions of backbarrier flats. No bays occur on modern river flood plains or beaches. Carolina Bays are

6. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations included in this section are based on the project information outlined previously and the data obtained during our exploration. If the construction scope is altered or if conditions are encountered during construction that differ from those encountered by the borings, then S&ME, Inc. should be retained to review the following recommendations based upon the new information and make any necessary changes.

6.1 Foundations

The soil profiles encountered appear generally suitable for development of light to medium industrial use considering static loading. The use of shallow foundations for support of column loads up to 200 kips appears feasible with little risk of excessive settlement for typical light to moderately loaded industrial structural column configurations, provided that the footings are properly constructed. Heavy area loads on slabs such as may be imposed by stacked materials or large vessels or tanks can likely be supported by reinforced mats or strip footings.

6.2 Control of Subsurface Water and Surface Runoff

Subsurface water measured in our borings ranged from 17 to 18 feet; therefore, the subsurface water table is not anticipated to have a great impact on grading. However, medium dense to hard clayey sands, and sandy lean clay soils similar to those encountered at depths of 3 to 12 feet in our borings, will typically inhibit downward percolation of rainfall. This could result in the formation of a perched water table at relatively shallow depths during wet periods.

If perched water or groundwater is encountered during grading, ditching may become necessary to provide a stable bearing surface for construction of foundations or pavements. In areas where machine pits may be constructed, ditching or sumps and pumping may be necessary to sufficiently lower groundwater levels for construction of foundations. However, the rate of drainage and the elevation to which groundwater can be lowered by ditching is dependent upon the soil type and the availability of a sufficiently low outfall elevation. Construction of sediment or detention ponds may also be limited in areas where shallow groundwater is encountered. During normal rainfall periods, ditching or other provisions for surface drainage should be provided prior to stripping and grading in low areas. If subsurface water or infiltrating surface water is not properly controlled during construction, the subgrade soils that will support foundations, as well as pavements or floor slabs, may become deteriorated. Furthermore, construction equipment mobility may be impaired.

6.3 Site Preparation and Earthwork

Site preparation over most of the site will include stripping of surface vegetation, removal of rootmat, roots, stumps, and similar organic materials, and implementation and maintenance of drainage.

The near surface soils encountered in our borings between depths of about 3 and 12 feet did not appear suitable for re-use as structural fill. Sands containing high fines contents

and sandy lean clays such as those encountered between 3 and 12 feet may be difficult to work if allowed to become wet and could require extensive drying. It is not recommended that these soils be used for structural fill purposes. Soils above 3 feet depth, and between depths of 12 and 17 feet, are considerably sandier and may be suitable for re-use as structural fill. Soils below a depth of 17 feet are below the estimated water table and are therefore likely to be saturated.

6.4 Grade Slab Support and Construction

It is likely that grade slabs will be supported by native on-site soils or imported compacted fill soils.

1. The poorly graded sands and clayey sands similar to those penetrated by our borings in the upper five feet of the soil profile should provide adequate support to soil-supported slabs-on-grade, assuming proper preparation, moisture control, and compaction of the subgrade for static load conditions.
2. A capillary break layer of at least 4 inches of clean sand or crushed stone placed below floor slabs should be required.
3. We recommend that a vapor barrier such as "Visqueen," or the equivalent, be placed to limit moisture infiltration into finished spaces, or other areas where moisture infiltration will potentially cause problems. The vapor barrier should be placed below the capillary break layer material.

6.5 Pavement Subgrade and Base Material Preparation

The near surface poorly graded sands and clayey sands encountered in our borings appear suitable for support of pavements after being properly prepared and compacted. However, these sand mixes and clayey sands may be difficult to stabilize if allowed to become wet and will not provide good pavement support if proper moisture control is not used.

Drainage of subgrade material plays an important role in the performance of pavement sections. Site preparation should allow for drainage that results in groundwater elevations being maintained at least 2 feet below the top of the pavement section. At least one laboratory California Bearing Ratio (CBR) test should be performed upon representative soil samples of each soil type which is proposed for use as subgrade material. This is to establish the relationship between relative compaction and CBR for the soil in question. This will also confirm that the CBR value of the soils used at the required level of compaction is equal to or greater than the CBR value assumed during design of the pavement section.

6.6 Recommendations for Additional Exploration

The current number of borings provides some indication of the range of conditions that may be encountered at the site. However, the spacing and number of borings does not allow for a statistically reliable basis for design of building foundations or pavements.

Once building, parking and access drive locations are decided, we recommend that additional soil test borings or cone penetration test soundings be performed in both building and parking area footprints prior to design of foundations or pavements.

7. LIMITATIONS OF REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations in this report are based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations of the soils at the site to those encountered at our boring locations will not become evident until construction. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structure are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by the submitting engineers.

Assessment of site environmental conditions; sampling of soils, ground water or other materials for environmental contaminants; identification of jurisdictional wetlands, rare or endangered species, geological hazards or potential air quality and noise impacts were beyond the scope of this geotechnical exploration.

APPENDIX A

SITE VICINITY PLAN

TEST LOCATION PLAN

INTERPRETED SUBSURFACE PROFILE



SCALE:	NTS
SOURCE:	Google
DRAWN BY:	WAG
DATE:	August, 2012



Site Vicinity Map
Marlboro County Industrial Park
Bennettesville, South Carolina

JOB NO. 1639-12-111

FIGURE NO

1



LEGEND



- Boring

SCALE: Not To Scale
 SOURCE: Google
 DRAWN BY: WAG
 REVIEWED BY: RPF
 DATE: August, 2012



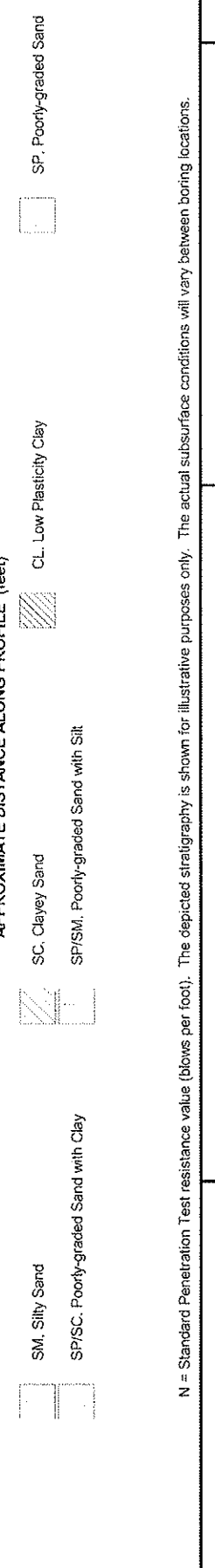
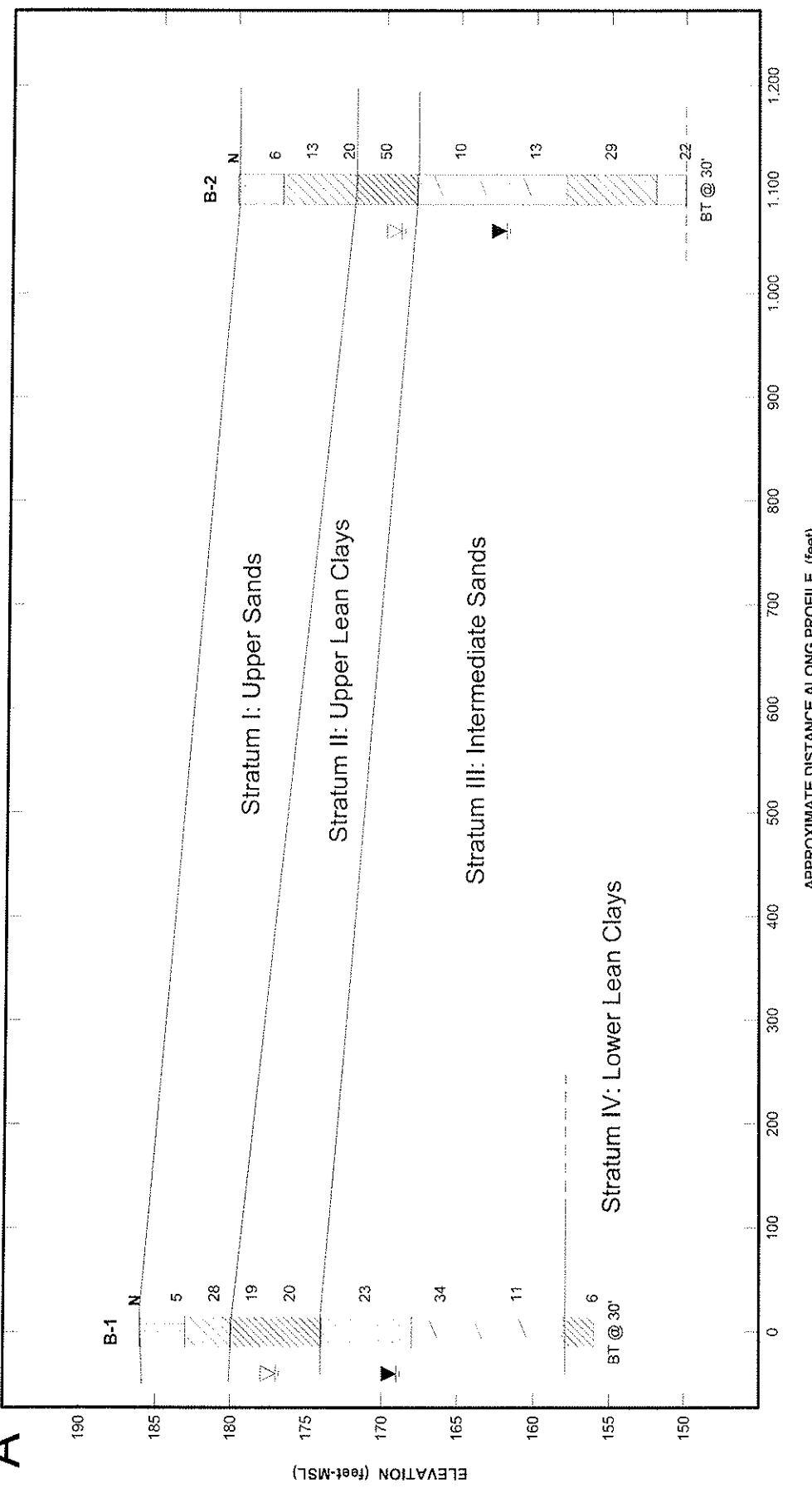
TEST LOCATION SKETCH
 Marlboro County Industrial Park
 Bennettsville, South Carolina

JOB NO. 1639-12-111

FIGURE NO

2

A



N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

A'

JOB NO: 1639-12-111

DATE: 8/10/12



Project: Marlboro Industrial Park
Location: Bennettsville, SC

Figure 3

APPENDIX B

SUMMARY OF EXPLORATION PROCEDURES

SOIL CLASSIFICATION CHART

SPT BORING LOGS

SUMMARY OF EXPLORATION PROCEDURES

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-98, "*Standard Guide to Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

RECONNAISSANCE OF THE PROJECT AREA

Where practical, we reviewed available topographic maps, county soil surveys, reports of nearby investigations and aerial photographs when preparing the boring and sampling plan. Then we walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the Palmetto Utility Protection Service (PUPS) before we drill or excavate at any site. PUPS is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of South Carolina. PUPS forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

BORING AND SAMPLING

Soil Test Boring with Rotary Wash

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, "*Standard Test Method for Penetration Test and Split Barrel Sampling of Soils.*" A rotary drilling process was used to advance the hole and a heavy drilling fluid was circulated in the bore holes to stabilize the sides and flush the cuttings. At regular intervals, drilling tools were removed and soil samples were obtained with a standard 1.4

inch I. D., two-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Subsurface Water Level Determination

Subsurface water levels in the borings were measured during the onsite exploration by measuring depths from the existing grade to the current water level using a tape.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		CLEAN SANDS (LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
		FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
					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		
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
			CH	INORGANIC CLAYS OF HIGH PLASTICITY		
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

PROJECT: **Marlboro County Industrial Park
Bennettsville, SC**
S&ME Project No.

BORING LOG B-1

DATE DRILLED: **8/2/12** ELEVATION: **186.0 ft**
 DRILL RIG: **Marooka** BORING DEPTH: **30.0 ft**
 DRILLER: **Malcolm** WATER LEVEL: **72 hrs = 17', TOB = 9'**
 HAMMER TYPE: **Safety Hammer** LOGGED BY: **A. Graham**

NOTES:
 NORTHING: **0** EASTING: **0**

SAMPLING METHOD: **Split spoon**
 DRILLING METHOD: **Mud Rotary**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SPT REC. (in.)	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
								1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
0-5		SILTY SAND (SM) - Loose, tan, mostly fine sand, some low plasticity fines, moist.			1	2	2	3							5
5-10		CLAYEY SAND (SC) - Medium dense, orange, mostly fine sand, some low to medium plasticity fines, moist.		181.0	2	12	13	15							28
10-15		SANDY LEAN CLAY (CL) - Very stiff, orange and tan, mostly low to medium plasticity fines, some fine sand, moist.	▽	176.0	3	7	7	12							19
15-20		POORLY GRADED SAND (SP) - Medium dense, orange, mostly fine to medium sand, trace low plasticity fines, moist.		171.0	4	6	8	12							20
20-25		POORLY GRADED SAND WITH CLAY (SP-SC) - Dense to medium dense, orange to yellow, mostly fine to coarse sand, few low to medium plasticity fines, wet.	▽	166.0	5	8	10	13							23
25-30		LEAN CLAY WITH SAND (CL) - Firm, yellow and light gray, mostly low to medium plasticity fines, few fine sand, saturated.		161.0	6	11	13	21							34
30		LEAN CLAY WITH SAND (CL) - Firm, yellow and light gray, mostly low to medium plasticity fines, few fine sand, saturated.		156.0	7	4	5	6							11
30		Boring terminated at 30 feet			8	4	3	3							6

S&ME BORING LOG 1639-12-111.GPJ S&ME GDT 8/20/12

- NOTES:**
- THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
 - BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
 - STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
 - WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



DATE DRILLED: 8/2/12	ELEVATION: 180.0 ft	NOTES:
DRILL RIG: Marooka	BORING DEPTH: 30.0 ft	
DRILLER: Malcolm	WATER LEVEL: 72 hrs = 18', TOB = 11'	
HAMMER TYPE: Safety Hammer	LOGGED BY: A. Graham	

SAMPLING METHOD: Split spoon NORTHING: 0 EASTING: 1100

DRILLING METHOD: Mud Rotary

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SPT REC. (in.)	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE
								1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/REMARKS				
											10	20	30	60/80	
1		POORLY GRADED SAND WITH SILT (SP-SM) - Loose, tan, mostly fine to medium sand, few low plasticity fines, moist.				3		3	3	3					6
2		CLAYEY SAND (SC) - Medium dense, orange and tan, mostly fine to medium sand, some low to medium plasticity fines, moist.		175.0		10		6	7						13
3						6		8	12						20
4		SANDY LEAN CLAY (CL) - Hard, orange and red, mostly low to medium plasticity fines, some fine sand, moist.	▽	170.0		8		12	38						50
5		POORLY GRADED SAND WITH CLAY (SP-SC) - Loose to medium dense, orange, mostly fine to medium sand, few low to medium plasticity fines, moist to wet.		165.0		5		4	6						10
6			▽	160.0		6		6	7						13
7		CLAYEY SAND (SC) - Medium dense, light gray and yellow, mostly fine sand, some low to medium plasticity fines, moist.		155.0		12		18	11						29
8		SILTY SAND (SM) - Medium dense, light yellow, mostly fine sand, some low plasticity fines, wet.		150.0		8		10	12						22
		Boring terminated at 30 feet													

S&ME BORING LOG 1639-12-111 GPJ S&ME GDT 8/20/12

NOTES:

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.

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