REPORT OF RECONNAISSANCE LEVEL
GEOTECHNICAL EXPLORATION

Airport Industrial Park
Sumter County, South Carolina
S&ME Project No. 1611-10-048

Prepared For:

Alliance Consulting Engineers, Inc.
PO Box 8147
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Prepared By:

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February 26, 2010

February 26, 2010

Alliance Consulting Engineers, Inc.
PO Box 8147
Columbia, South Carolina 29202-8147

Attention: Ms. Tristan Pressley

Reference: **REPORT OF RECONNAISSANCE LEVEL GEOTECHNICAL EXPLORATION**
Sumter Airport Industrial Park
Sumter, South Carolina
S&ME Project No. 1611-10-048

Dear Ms. Pressley:

As requested, S&ME, Inc. has conducted a reconnaissance level geotechnical exploration at the above referenced site. This work was performed in general accordance with S&ME Proposal No. 1614-7247-09 and under contract with Alliance Consulting Engineers. The purpose of this exploration was to characterize the general surface and subsurface conditions of the site, to provide the recommended seismic site classification according to IBC 2006, as well as preliminary recommendations regarding site preparation, suitability of on-site soils for use in construction and potential foundation types. This investigation was performed to aid in evaluation of the site's suitability for industrial development. The recommendations contained herein are not valid for design without the confirmation of an additional subsurface investigation after the locations of the proposed structures are determined.

S&ME appreciates this opportunity to work with Alliance Consulting Engineers, Inc. as your geotechnical engineering consultant on this project. Please contact us at (803) 561-9024 if you have any questions or need any additional information regarding this report.

Sincerely,
S&ME, Inc.

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
2/26/10
No. 26551
WILLIAM M. JONES, III

William M. Jones III, P.E.
Geotechnical Engineer

James T. Palmer, P.E.
Engineering Manager

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
S & ME, INC.
No. C00473

PROJECT INFORMATION

Information about the project was obtained through email correspondence between you and Marty Baltzegar of S&ME on December 17, 2009. You also provided a topographic site location map and aerial map on the same date.

We understand the site consists of approximately 221 acres located north of the town of Sumter in Sumter County, SC. The site is situated east of the Sumter Municipal Airport northwest of the intersection of Trucker's Inn Road and Brewington Road. Based on the provided 2006 aerial photograph and site reconnaissance, the property consists of wooded land and fields with a wooded and cleared Carolina Bays and a few old foundations from past structures in the north east side of the site.

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

EXPLORATION PROCEDURES

Prior to the exploration, subsurface data from adjacent properties, aerial photos of the subject property, and available topographic maps were reviewed to develop the proposed testing plan. On February 2, 2010, a representative of S&ME visited the site to perform the following tasks:

- Observe topography, ground cover, and surface soils in the proposed project area.

- Lay out locations for six soil test borings in areas where an ATV-mounted drill rig could obtain relatively easy access with little to no clearing or grading of the site.

Right-of-entry to perform borings and other fieldwork on the property was granted with acceptance of our proposal. The boring locations shown on Figure 2 should be considered approximate only. No survey of the boring locations or elevations was conducted by S&ME.

Subsurface Exploration

Soil test borings were performed at the site on February 12th and 15th, 2010, using an ATV-mounted drill rig. The borings were advanced to depths of 25 feet each; boring B-3 was advanced to a depth of 30 feet due to low Standard Penetration Tests (SPT) N-values obtained at a depth of 25 feet. Borings were advanced using a 2-1/4-inch inside diameter hollow-stem auger. Standard Penetration Testing (SPT), and split spoon sampling in general accordance with ASTM D-1586 was performed at maximum 5-foot intervals using a safety hammer. SPT "N" values were recorded for each sample taken. Samples of the soils obtained by the split-spoon sampler were collected and retained in glass jars. A summary of our exploration procedures is included in the Appendix.

To measure shear-wave velocities at the subject site, S&ME performed MASW (Multi-Channel Analysis of Surface Waves) and MAM (Microtremor Array Method) testing on February 16, 2010. The MASW and MAM arrays measure the travel times of surface generated vibrations or inherent ground vibrations, respectively, to geophones mounted on the ground surface at various incremental distances along an array. The results of both testing methods are combined prior to the data inversion process to produce a single shear wave velocity profile for each test location. A summary of our testing procedures as well as shear wave velocity profiles versus depth showing the results of the MASW and MAM testing are presented in the Appendix.

SITE CONDITIONS

Surface Conditions

The site currently consists of both forestland and open field with Whites Mill Branch running west to east across the approximate center of the site. A large wooded Carolina Bay is positioned on the south east corner of the site. Trees consist mainly of mature pines with some mature hardwoods scattered throughout the site. A couple of unpaved roads and state maintained roads traverse the interior and perimeter of the site. A portion of the site is currently being used by the Natural Resource Management Center which is fenced and gated along Brewington Road. Because of difficult access to the wooded portions of the site, soil test boring locations were generally confined to along the roadways and in the agricultural fields were conditions allowed.

Standing water was noted in a portion of the agricultural fields, drainage ditches, ruts in the existing roadways, and in topographically low areas of the site. No rock outcroppings or existing structures were observed on the site.

The USGS 7.5 minute topographic quadrangle map of Sumter, SC dated 1957 (revised1982) indicates the site to be nearly level to gently sloping to the west to east. The elevations shown on the boring logs were estimated from USGS topographic contours and should be considered approximate. Wet areas are indicated on the USGS map along Whites Mill Branch and a Carolina Bay in the southern portion of the site near Quinns Chapel. The USDA Soil Survey map for the area also indicates Carolina Bays in the southern portion of the site which have apparently be drained and are being used for agricultural activites.

Subsurface Conditions

Local Physiographic Conditions and Geology

The city of Sumter lies immediately southeast of a topographical feature termed the Citronelle Escarpment. The escarpment denotes the boundary between the upper and middle portions of the Atlantic Coastal Plain of South Carolina and is the major topographical feature of the coastal plain. The area northwest of the escarpment is termed the Santee Hills and is underlain by Tertiary age Coastal Plain residuum. Areas southeast of the escarpment, including downtown Sumter, lie within the Atlantic Flatwoods Region of the Lower Coastal Plain of South Carolina.

The Atlantic Flatwoods comprises most of the Lower Coastal Plain, extending to the Surry Escarpment 15 to 40 miles inland from the sea. The topography of this region is dominated by up to six archaic marine terraces, exposed above sea level by uplifting of the local area over the last one million years. The terraces exhibit minor surface erosion, but can be traced large distances on the basis of surface elevation. Abandoned tidal eddies on the terraces have been filled with sediments and now form shallow, poorly drained elliptical depressions on the surface, termed Carolina bays, which are commonly apparent on aerial photographs or local topographic maps. Materials comprising the terraces typically consist of a strand or beach ridge deposit of clean sands at the seaward margin, interbedded with progressively more fine grained soils to the west. The marine terraces form a thin veneer over an older, underlying Coastal Plain marl locally termed the Duplin Formation.

USDA Soil Survey Information

From a qualitative standpoint, the USDA Soil Conservation Service's (SCS) Soil Surveys can often provide helpful information. The SCS surveys map the near surface soils (i.e., depths $\leq$ 6 ft) and provide general descriptions. Soil map units are also described in terms of some relevant engineering properties or in terms of relative suitability for use in land development. The data is not intended to replace geotechnical evaluations and testing but it can help identify trends. USDA Soils Conservation Service soils mapping for Sumter County identifies seven soil series in the project area. Descriptions of the soil series mapped within the proposed site are summarized in Table 1:

Table 1 – USDA Soil Survey Soil Series

Soil Series	Soil Type	Depth to Seasonal High GW Table	Permeability (in/hr)	Remarks
Coxville fine sandy loam (Cv)	SM, ML, CL, SC	0 – 1 ft.	0.2 – 2.0	Nearly level and poorly drained, formed in clayey Coastal Plain Sediment.
Goldsboro loamy sand (Go)	SM, SC, ML	1.5 – 2.5 ft.	0.63 – 2.0	Nearly level, deep, moderately well drained soils formed in loamy Coastal Plaint sediment.
Goldsboro loamy sand (Gp)	SM, SM-SC, SC	1.5 – 2.5 ft.	0.63 – 6.3	Nearly level, deep, moderately well drained soils formed in loamy Coastal Plaint sediment.
McColl fine sandy loam (Mc)	SM, CL, SC	0 – 1 ft.	0.06 – 2.0	Nearly level and poorly drained, formed in the loamy Coastal Plain Sediment.
Norfolk loamy sand (NoA)	SM, SC, SM-SC	4 – 6 ft.	0.63 – 2.0	Nearly level to gently sloping and well drained, formed in the loamy Coastal Plain Sediment.
Rains (Ra)	SM, SC, CL	0 – 1 ft.	0.63 – 2.0	Nearly level and poorly drained, formed in the loamy Coastal Plain Sediment.
Rembert loam (Rm)	ML-CL, CL, SC, SM, SM-SC	0 – 1 ft.	.06 – 2.0	Nearly level, moderately deep, and poorly drained, formed in clayey and sandy Coastal Plain Sediment.

The seasonal high groundwater table as indicated by the Soil Survey is similar to the groundwater measurements made during our subsurface exploration. Groundwater elevations similar to those indicated for the site are also common within the Costal Plain region.

Interpreted Subsurface Profile

The generalized subsurface conditions at the site are described below. Subsurface conditions between the borings will likely vary. The nature and extent of variations between the sampling points will not become evident until construction, and stratification lines shown are not warranted. For detailed descriptions and stratification at a particular boring location, the respective boring record should be reviewed. Soil test boring logs are attached in the Appendix.

Organic plow zone material is present across much of site since the primary use of the property, at our boring locations, has been for farming. Borings conducted in grassed locations revealed one to two inches of topsoil. At our boring locations plow zone depths typically ranged from 10 to 12 inches, although in some areas they may be greater. Commonly in this area, Carolina Bays are drained and plowed as part of agricultural activities, obscuring their presence. The potential exists for organic-laden material to be 3 or 4 feet thick in drained bays on site.

The general soil profile mostly consists of clayey sands, silty sands, isolated lenses of poorly graded sands with silt or clay, and sandy lean clays with lenses of sandy silts common to the Coastal Plain province of South Carolina. Recovered samples were generally gray with brown, yellowish/brown, light purple, orange and brownish red and moist to wet. Standard Penetration Test N-values typically indicated a very loose to medium dense relative density or very soft to very stiff consistency. It is very likely that SPT N-values recorded in sands below the water table were somewhat reduced by the intrusion of groundwater into the boring. Fine grained samples exhibited low to moderate cohesion when manipulated by hand and contained varying amounts of sand content.

Groundwater

Groundwater measurements were taken at time of boring and after and elapse time of at lest 24 hours post drilling operations. Time of boring water levels ranged from 3 to 14 feet below existing ground elevations with and average depth of approximately 10 feet when considering all six borings. Groundwater measurements recorded at least 24 hours post drilling operations ranged from 2 to 4 feet with an average depth of approximately 3 feet across all six borings. Medium dense clayey sands or stiff to very stiff fine-grained soils were encountered within the upper 10 feet in a portion of our borings. These soils will likely limit rain water infiltration and perched groundwater is likely during periods of normal or above normal rainfall. It should be noted that our field exploration was conducted during above normal rainfall for a typical South Carolina winter.

In topographically low areas of the site, groundwater will significantly impact proposed construction. Saturated topsoil will have to be removed and ditching or other means will be required to lower the groundwater table to an adequate depth. At other areas of the site, dewatering measures may be necessary as well, depending on planned excavation depths, on the extent of perched water and elevation of the groundwater table at time of construction. We note that subsurface water levels are influenced by precipitation, long term climatic variations, and nearby construction. Groundwater measurements made at different times than our exploration may indicate groundwater levels substantially different than indicated on the boring logs in the Appendix.

SEISMIC CONSIDERATIONS

Seismic induced ground shaking at the foundation is the effect taken into account by seismic-resistant design provisions of the 2006 International Building Code (IBC). Other effects, including soil liquefaction, are not addressed in building codes but must also be considered.

IBC Site Class

This site has been classified according to one of the Site Classes defined in IBC Section 1613.5 (Table 1613.5.2) using the procedures described in Section 1613.5.5.1. The Site Class is used in conjunction with mapped spectral accelerations S_S and S_1 to determine Site Coefficients F_A and F_V in IBC Section 1613.5.3, tables 1613.5.3(1) and 1613.5.3(2).

The initial step in site class definition is a check for the four conditions described for Site Class F which would require a site specific evaluation to determine site coefficients F_A and F_V. Soils vulnerable to potential failure under item 1) including quick and highly sensitive clays or collapsible weakly cemented soils, were not observed in the soundings. Three other conditions, 2) peats and highly organic clays; 3) very high plasticity clays; and 4) very thick soft/medium stiff clays were also not evident in the borings at thicknesses that would indicate potential for collapse.

We then compared site conditions to the three conditions described for Site Class E. These are soft soils vulnerable to large strains under seismic motion. Borings did not include at least 10 feet having 1) plasticity index greater than 20, 2) moisture content greater than 40 percent, and 3) undrained shear strength less than 500 psf.

Based on Section 1613.5.5 and Equation 16-41 of the 2006 IBC, the calculated weighted average shear wave velocity, v_{si}, to a depth of 100 feet from the MASW profiles averaged approximately 842 feet per second. Based on this data and our knowledge of the general geologic profile of this area, IBC 2006 Site Class D appears to represent conditions in and around the site.

Design Spectral Values

S&ME determined the spectral response parameters for the site using the general procedures outlined under the 2006 International Building Code Section 1613.5. This approach utilizes a mapped acceleration response spectrum corresponding to an earthquake having a 2 percent statistical probability of exceedance in 50 years to determine the spectral response acceleration at the top of seismic bedrock for any period.

The 2006 International Building Code seismic provisions of Section 1613 use the 2002 Seismic Hazard Maps published by the National Earthquake Hazard Reduction Program (NEHRP) to define the base rock motion spectra. The Site Class is used in conjunction with mapped spectral accelerations S_S and S_1 to determine Site Coefficients F_A and F_V in IBC Section 1613.5.3, tables 1613.5.3(1) and 1613.5.3(2). For purposes of computation, the Code includes mapped induced acceleration at frequencies of 5 Hertz (S_S) and 1 Hertz (S_1), which are then used to derive the remainder of the response spectra at all other frequencies. Mapped S_S and S_1 values represent motion at the top of bedrock. The surface ground motion response spectrum, accounting for inertial effects within the soil column overlying rock, is then determined for the design earthquake using spectral coefficients F_A and F_V for the appropriate Site Class.

The Site Class is used in conjunction with mapped spectral accelerations S_S and S_1 to determine Site Coefficients F_A and F_V in IBC Section 1613.5.3, tables 1613.5.3(1) and 1613.5.3(2). For purposes of computation, the Code includes mapped induced acceleration at frequencies of 5 hertz (S_S) and 1 hertz (S_1), which are then used to derive the remainder of the response spectra at all other frequencies. Mapped S_S and S_1 values represent motion at the top of bedrock. The surface ground motion response spectrum, accounting for inertial effects within the soil column overlying rock, is then determined for the design earthquake using spectral coefficients F_A and F_V for the appropriate Site Class.

The design ground motion at any period is taken as 2/3 of the smoothed spectral acceleration as allowed in section 1613.5.4. The design spectral response acceleration values at short periods S_{DS} and at one second periods S_{D1} are tabulated below for the unimproved soil profile. Peak ground acceleration (PGA) was obtained by dividing the S_{DS} value by 2.5.

Table 2 – Design Spectral Values

Value	2002 Seismic Hazard Maps
S_{DS}	0.58 g
S_{D1}	0.25 g
PGA	0.23 g

For a structure having a Seismic Use Group classification of I or II, the S_{DS} and S_{D1} values obtained from the 2006 IBC are consistent with Seismic Design Category D as defined in section 1613.5.6.

Liquefaction

Loose saturated sandy soils were encountered in a portion of the borings within the upper 25 feet of the soil column. Where encountered this material appears to meet the general criteria for liquefaction, e.g. contain little fines, lie below the water table, and exhibit a loose relative density based on SPT N-values. However, empirical computations of liquefaction resistance based on SPT data do not account for the geologic age or origin of the deposit. In this case, use of the empirical charts would lead to very conservative results in terms of liquefaction susceptibility.

The effect of geologic age on the liquefaction susceptibility of a geologic formation was addressed in 1978 by Youd and Perkins[1]. Liquefaction potential decreases with

[1] Youd, T. L., and Perkins, D. M. (1978), " Mapping Liquefaction-Induced Ground Failure Potential", Journal of Geotechnical Engineering, ASCE, Vol. 104, No. GT4, pp. 433-446.

increasing age of a soil deposit. Many processes occur with aging, such as cementation, weathering, increased exposure to low level shaking, cold-bonding and consolidation. All of these processes tend to increase the liquefaction resistance of soils, but their effect can usually not be captured by penetration tests due to disturbance of the soil matrix during sampling.

In this case, the site is underlain by materials substantially older than considered susceptible to liquefaction by researchers. Nearly all known liquefaction features considered in the literature occur in Holocene-age strata (less than 11,000 years). Paleo-liquefaction features, or evidence of past liquefaction occurrence, have been discovered in the upper Pleistocene-age (Q3 or younger) deposits of the lower coastal plain in South Carolina in connection with the 1886 Charleston earthquake, but not in any older terrace deposits within the study area around Charleston. Regional geologic mapping in the area indicate the surface deposits to consist of Paleocene age sediments laid down between 65 million and 55 million years ago. Soils of this age are considered very unlikely to experience liquefaction.

S&ME's opinion is that while liquefaction is computationally possible based on penetration or blow count based empirical methods, these methods are not necessarily applicable to this site. It is our opinion that settlement due to liquefaction does not represent a creditable geologic hazard for the design earthquake required by the 2006 IBC.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations included in this section are based on the data obtained during our exploration. The following recommendations are given only to present a general idea of the soil conditions that may be anticipated at the site. More in-depth subsurface investigations should be performed in future building pads and parking areas. We recommend that S&ME be retained to perform these additional subsurface explorations.

Site Preparation and Earthwork

Stripping depths will likely be about 10 to 18 inches over the majority of the site. In drainage features and old Carolina Bays (if encountered), stripping depths may be considerably greater. Stripping depths may also be greater in fields where organic plow zone material extends to greater depths. We recommend conducting organic content tests within the building and pavement footprints. Organically stained soils with organic contents of 3 percent or less may be left in place but may need stabilization (compaction).

Areas of old concrete foundations and possible underground utilities were noted in the northwestern portion of the site. Removal of these abandon structures should be expected in this area prior to redevelopment. The extent of the removal depths will not become apparent until construction. We recommend test pits be conducted in this area prior to construction activity to help determine the extent of the area requiring removal of at or below ground structures. As with any previously developed site, the potential exists that old undocumented fills will be encountered in the area. If encountered these soils will likely require removal and replacement prior to placement of foundations or grade slabs.

Detention/retention ponds may be constructed to provide borrow material for site construction. Because of the likelihood of standing surface water in low areas and shallow groundwater elsewhere on site, this borrow is likely to be wet to saturated and drying will likely be required prior to compaction of the material. Establishing drainage such as ditching, sumps or other measures may help limit groundwater infiltration into the excavation area.

The clayey sands and sitly sands encountered in our soil test borings appear suitable for re-use as structural fill. The poorly graded sand with silt or clay if encountered at excavations depths appear to be suitable for reuse as structural fill. However, sands containing high fines content may be difficult to work if allowed to become wet and could require extensive drying. Sandy lean clays and sandy silt similar to those encountered in our borings have been used successfully at other nearby locations, but will be very difficult to work due to their tendency to retain moisture.

Foundations

The soil profiles encountered appear generally suitable for development for industrial use considering static loading. The use of shallow foundations for support of column loads up to 100 kips appears feasible for typical light to medium industrial structural column configurations, provided footings are properly designed and constructed. and settlements of about 1 inch can be tolerated. Column loading approaching 150 to 200 kips can likely be founded on shallow foundations provided settlements of up to 1½ inches can be tolerated. Area loads imposed by stacked materials or large vessels or tanks can likely be supported by mat or strip footings, provided that several inches of settlement can be withstood by the structure.

Depending on acceptable settlements, column loads greater than 150 kips will likely need to be supported on deep foundations. This would include column and area loads typical of heavy industry. Once building locations are established, mud rotary soils test borings or Cone Penetration Test soundings should be conducted within each building footprint prior to design of foundations. Settlement estimates given above are subject to change once formal site selections are made and final geotechnical explorations are conducted.

Control of Groundwater and Surface Runoff

Groundwater water was encountered in our borings at depths ranging from 2 to 4 feet at 24 hours post drilling operations across the site. The medium dense clayey sands or stiff to very stiff fine grained soils encountered within the upper 10 feet of the soil profile in a portion of our borings will likely limit rain water infiltration and perched water is likely during periods of normal or above normal rainfall.

During normal rainfall periods, ditching or other provisions for drainage should be provided prior to stripping and grading, especially in low areas of the site. 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 be damaged. Furthermore, construction equipment mobility may be impaired. In areas where machine pits may be constructed, ditching, well points or excavation of sumps and pumping may be necessary to sufficiently lower groundwater levels for construction of foundations. Capacity of sediment or detention ponds may also be limited in areas where shallow groundwater is encountered.

Grade Slab Support and Construction

It is likely that grade slabs will be supported by virgin on-site soils or on-site borrow soils.

1 The clayey sands and sandy clays similar to those penetrated by our borings will generally 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 of at least 4 inches of clean sand or crushed stone placed below floor slabs is recommended.

3 We recommend you place a vapor barrier such as "Visqueen," or the equivalent, to limit moisture infiltration into finished space, or other areas where moisture infiltration will potentially cause problems. The vapor barrier should be placed below the capillary break material.

Pavement Subgrade and Base Material Preparation

The clayey and silty sands encountered within the upper portion of the soil test borings will provide adequate bearing for pavements after being improved by drainage, rolling and compaction. However, the clayey and silty sands may be difficult to work if allowed to become wet and will not provide good bearing if proper moisture control is not used. The sandy lean clays encountered by our borings are less desirable for support of pavement sections but can be successfully used with proper construction practices.

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. Ditching or other provisions for drainage should be provided prior to stripping and grading. Groundwater and surface runoff must be controlled during construction in order to provide a stable subgrade for pavements. If groundwater or infiltrating surface water is not properly controlled during construction, the subgrade soils that will support pavements may be damaged. In areas where visible standing water is noted, additional measures to control drainage after the pavements are installed should be put in place. This may involve using french drains or similar underdrain systems or elevating the pavement surface to force runoff away from the pavement subgrade.

At least one laboratory Standard Proctor test and California Bearing Ratio (CBR) test should be performed upon representative soil samples of each soil type that is proposed for use as subgrade material. This is to establish the relationship between relative compaction and CBR for the soil in question and provide a CBR value for use in pavement section design.

Recommendations for Additional Exploration

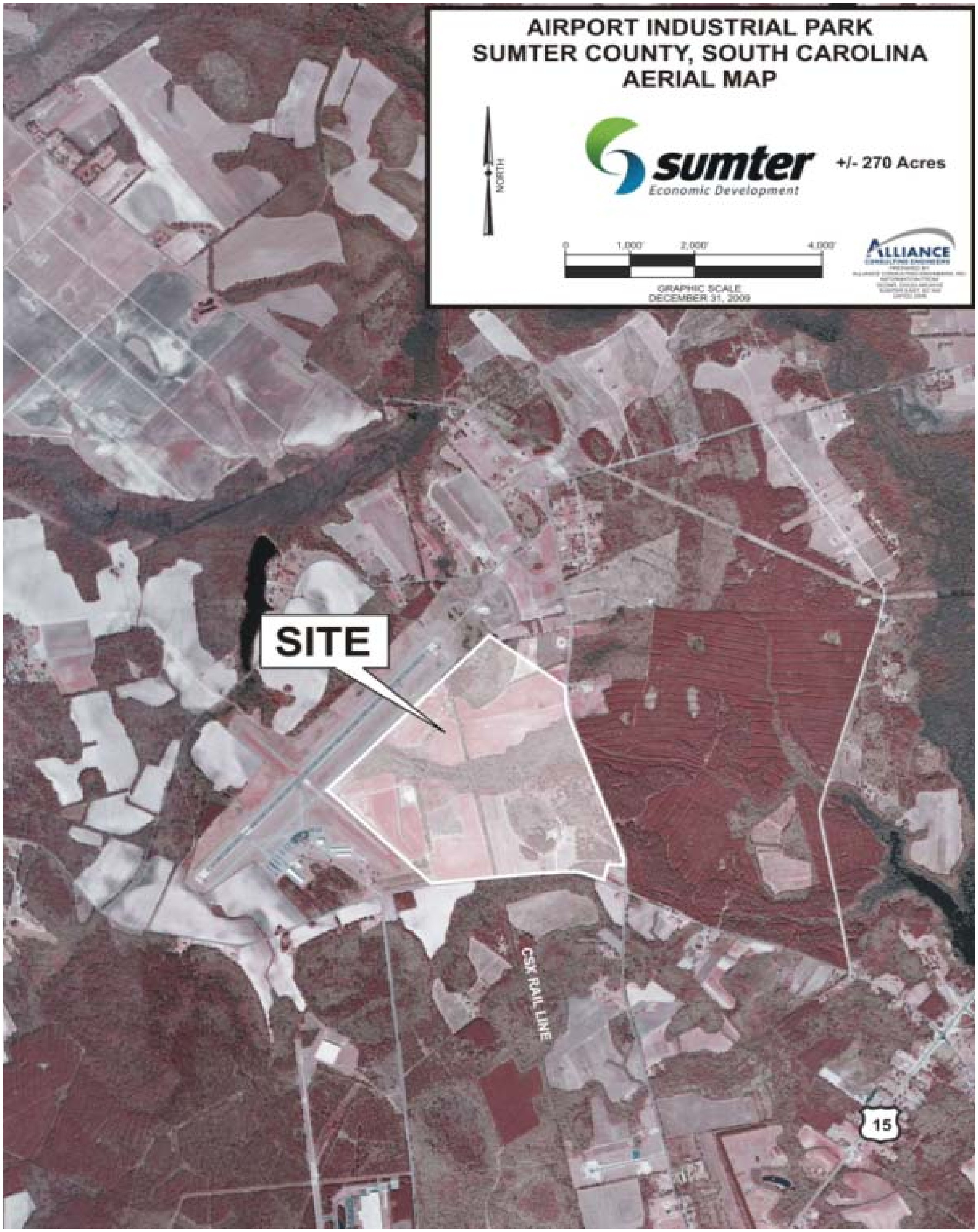
The current number of borings provides some indication of the range of conditions that may be encountered at the site. However, the spacing and number of borings does not provide a reliable basis for design of building foundations. Once building, possible railway, parking and access drive locations are decided, we recommend additional soil test borings or cone penetration test soundings be performed in the proposed footprints.

QUALIFICATIONS 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 contained in this report were based on the applicable standards of our profession at the time this report was prepared. No other warranty, express or implied, is made.

Due to the distance between each boring, subsurface conditions can be expected to vary from the conditions described herein. This report was intended to give general information about overall site conditions only. Additional geotechnical explorations should be conducted for each proposed structure, railway, pavement area or roadway.

APPENDIX

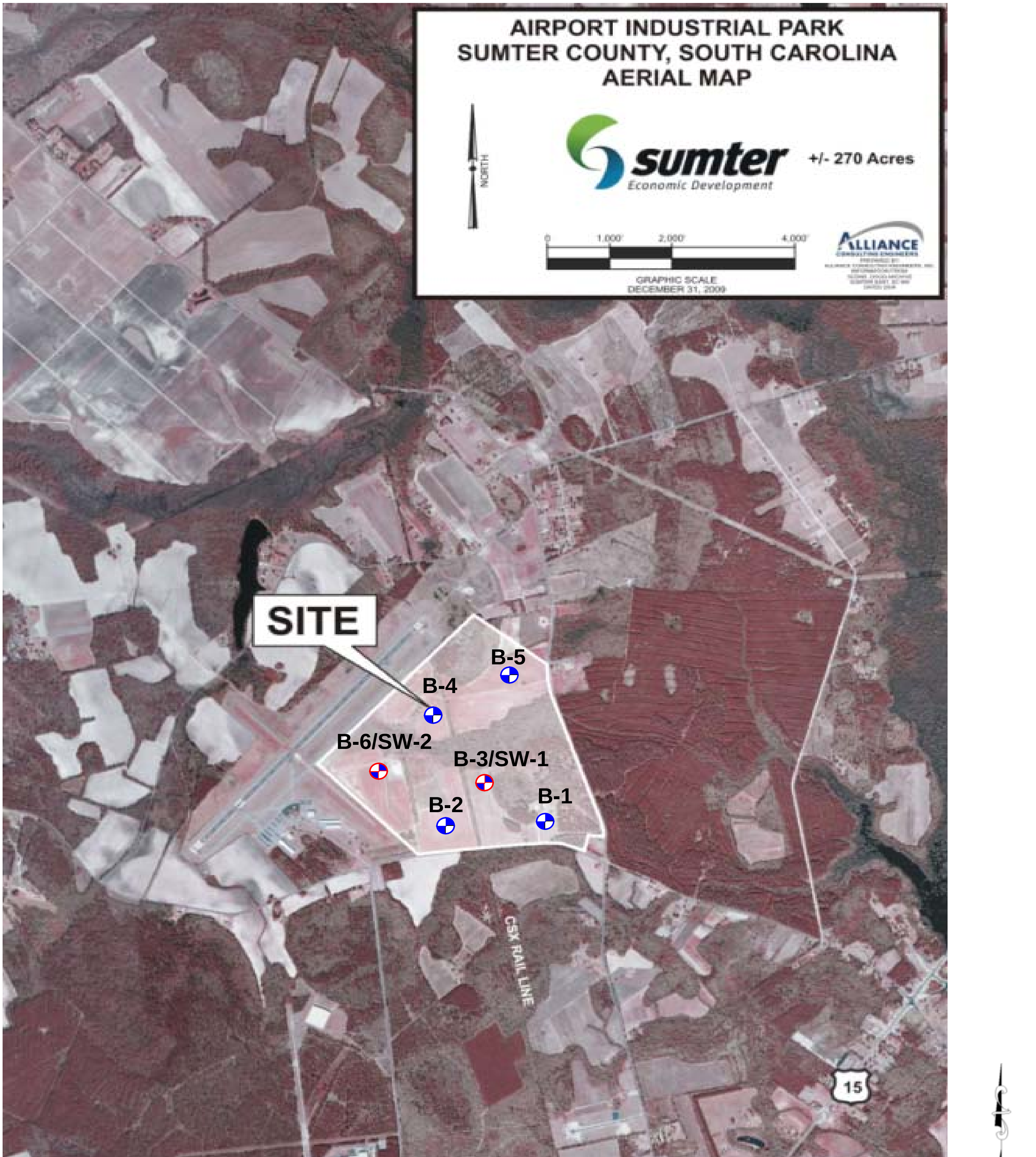


SOURCE: **Alliance Consulting Engineers**

SCALE:	AS SHOWN	S&ME	SITE LOCATION MAP AIRPORT INDUSTRIAL PARK SUMTER COUNTY, SOUTH CAROLINA
CHECKED BY:	JTP		
DRAWN BY:	WMJ		
DATE:	02/25/10		JOB NO. **1611-10-048**

FIGURE NO:

1



SOURCE: Alliance Consulting Engineers

SCALE:	NTS	S&ME	BORING LOCATION PLAN AIRPORT INDUSTRIAL PARK SUMTER COUNTY, SOUTH CAROLINA	FIGURE NO. 2
CHECKED BY:	JTP			
DRAWN BY:	WMJ			
DATE:	2/23/2010		JOB NO. 1611-10-048	

SUMMARY OF EXPLORATION PROCEDURES

Layout and Access to Boring Locations

Layout Plan - S&ME was provided an aerial photograph with sketched site boundaries prior to commencement of field work. This was a reconnaissance level exploration; therefore, structure locations are not yet known.

Staking of Borings - S&ME laid out the borings in areas where an ATV-mounted drill rig could obtain relatively easy access with little to no clearing or grading of the site necessary. Rough locations of the borings were sketched on an aerial photograph prior to leaving the site. No survey of boring locations was conducted by S&ME.

Boring and Sampling

Soil Test Boring with Hollow-Stem Auger – 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"*. At regular intervals, 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, and then driven an additional 12 inches with blows of a 140-pound hammer falling approximately 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. *(Boring B-9)*

Field Testing

Shear Wave Velocity Test - Shear wave velocity measurements can be obtained using either shear wave surveys such as crosshole and downhole tests or surface wave surveys such as SASW, MASW, MAM, or ReMi™. Analysis of surface waves (R-waves) can be used to determine shear-wave velocities (v_s) as surface waves are fundamentally similar in behavior to shear waves (S-waves). In addition, the surface waves propagate to depths that are proportional to their frequencies (i.e., dispersion). The surface waves are recorded at the ground surface along a spread of low-frequency geophones. Recorded surface waves are transformed from time domain into frequency domain, from which the phase characteristics of the surface waves can be determined. A dispersion curve (a.k.a., phase velocity curve, slowness curve) is developed allowing the phase velocity (C_f) of particular frequency waves to be calculated. The dispersion curve is then transformed into the shear-wave velocity profile through a complex inversion and iterative processing.

To measure shear-wave velocities at the subject site, S&ME performed MASW (Multi-Channel Analysis of Surface Waves) and MAM (Microtremor Array Method) with non-linear array geometry, combining the dispersion curves from both tests prior to the inversion process. Performing both MASW and MAM provides the greater depth of penetration associated with microtremor analyses (low frequency surface waves) without sacrificing resolution at shallower depths from MASW (higher frequency surface waves). In addition, our experience indicates using a combination of both methods to develop a shear wave velocity profile is more accurate than using Refraction Microtremor (ReMi^{TM}) exclusively, particularly when the ReMi^{TM} array geometry is linear.

At each of the two test locations shown on the attached "Boring Location Plan," MASW and MAM tests were performed to produce two separate shear wave velocity profiles at the site. The MASW and MAM testing was conducted using the 16-channel Geometrics ES3000 seismograph and 4.5 Hz vertical geophones. For the MASW testing, the geophones were spaced in a linear geometry at intervals of 6-feet and surface waves generated by both 2- and 10-pound sledgehammers striking a metal plate. MAM testing was conducted using an "L-shaped" array geometry with geophone spacing of 30 feet. Because the source locations of the microtremors are not known, the 2-dimensional array geometry is used for the MAM. The analysis was conducted using the OYO Corporation's SeisImager/SW software (*Pickwin v. 3.14* and *WaveEq)*. The two separate velocity profiles developed at each of the test locations are attached.

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)

- Fill
- Asphalt
- Concrete
- Topsoil
- Gravel
- Sand
- Silt
- Clay
- Organic
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Partially Weathered Rock
- Cored Rock

WATER LEVELS

(Shown in Water Level Column)

- ▽ = Water Level At Termination of Boring
- ▼ = Water Level Taken After 24 Hours
- ◄ = Loss of Drilling Water
- HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)

- Shelby Tube
- Split Spoon
- Rock Core
- No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

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PROJECT:	Sumter Airport Industrial Park Sumter, South Carolina 1611-10-048

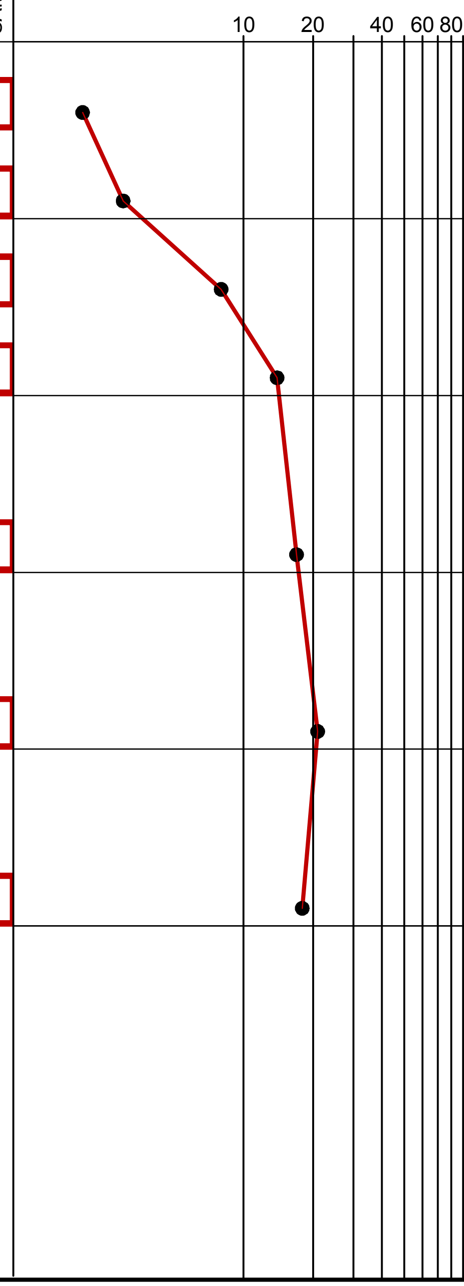
BORING LOG B-1

DATE DRILLED:	2/12/2010	ELEVATION:	170
DRILLING METHOD:	3¼" H.S.A.	BORING DEPTH:	25
LOGGED BY:	WMJ	WATER LEVEL:	14'@TOB; 3.5'@24hrs.
DRILLER:	Joe Lassiter	DRILL RIG:	CME 550

NOTES:
No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	N VALUE
	TOPSOIL - approximately 2 inches of topsoil.				
	CLAYEY SAND (SC) - mostly fine to medium sands, some low plasticity fines, moist to wet, brown, very loose to loose.			1	2
	- some low to medium plasticity fines, moist, gray, brown, trace orange.	▼		2	3
5			165.0		
	- some medium plasticity fines, moist, gray, trace brown.			3	8
	SANDY LEAN CLAY (CL) - mostly low to medium plasticity fines, some fine to medium sands, moist, gray, brown, orange, trace red, stiff.			4	14
10			160.0		
	SILTY SAND (SM) - mostly fine to medium sand, little low plasticity fines, saturated, light brown, tan, brown, gray, medium dense.	▽		5	17
15			155.0		
	- light gray.			6	21
20			150.0		
				7	18
25	BORING TERMINATED AT 25 FEET.		145.0		

STANDARD PENETRATION TEST DATA (blows/ft)



NOTES:

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2. ***BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.***
3. ***STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.***
4. ***WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.***

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PROJECT:	**Sumter Airport Industrial Park** **Sumter, South Carolina** **1611-10-048**

BORING LOG **B-2**

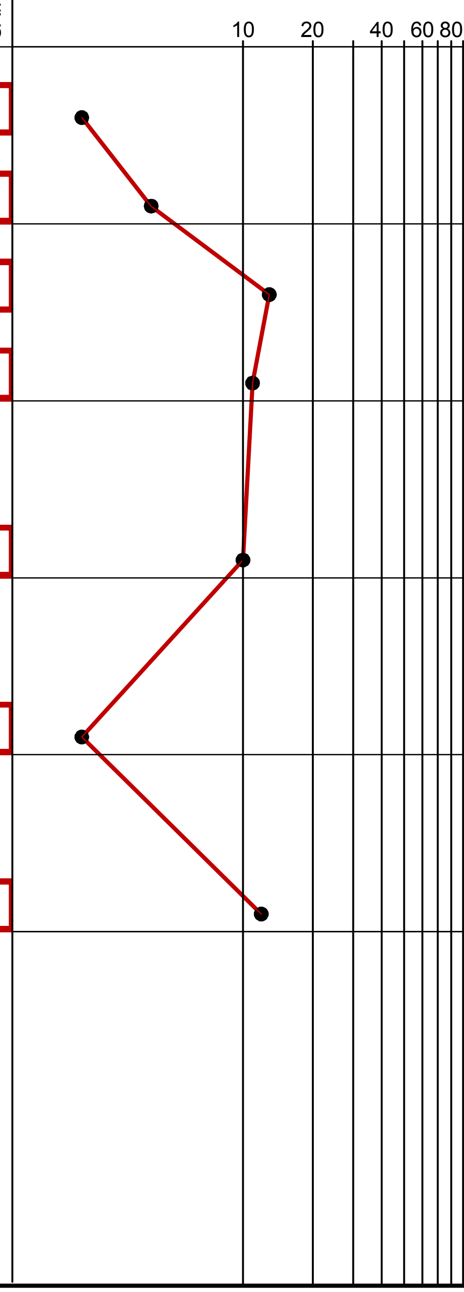
DATE DRILLED:	**2/12/2010**	ELEVATION:	**180**
DRILLING METHOD:	**3¼" H.S.A.**	BORING DEPTH:	**25**
LOGGED BY:	**WMJ**	WATER LEVEL:	**13'@TOB; 3.5'@24hrs.**
DRILLER:	**Joe Lassiter**	DRILL RIG:	**CME 550**

NOTES:
No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)
		PLOW ZONE - approximately 10 inches of organic plow zone.		
		CLAYEY SAND (SC) - mostly fine to medium sands, some low plasticity fines, moist, brown, very loose.	▼	
5		**SANDY LEAN CLAY (CL)** - mostly low to medium plasticity fines, some fine to medium sands, few cemented fragments, moist, light brown, brown, orange, soft to stiff. - gray, trace reddish/brown.		175.0
10		**CLAYEY SAND (SC)** - mostly fine to medium sands, some low to medium plasticity fines, moist, gray, brown, trace red, medium dense.		170.0
15		**SILTY SAND (SM)** - mostly fine sand, little low plasticity fines, saturated, tan, orange, medium dense to very loose.	▽	165.0
20		- mostly fine to medium sands, little low plasticity fines, saturated, yellowish/brown, trace red.		160.0
25		**SANDY SILT (ML)** - mostly low to medium plasticity fines, some fine sands, slightly micaceous, moist, light purple, light gray, stiff.		155.0
		BORING TERMINATED AT 25 FEET.		

SAMPLE NO.	N VALUE
1	2
2	4
3	13
4	11
5	10
6	2
7	12

STANDARD PENETRATION TEST DATA (blows/ft)



NOTES:

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PROJECT:	Sumter Airport Industrial Park Sumter, South Carolina 1611-10-048	**BORING LOG**	**B-3**

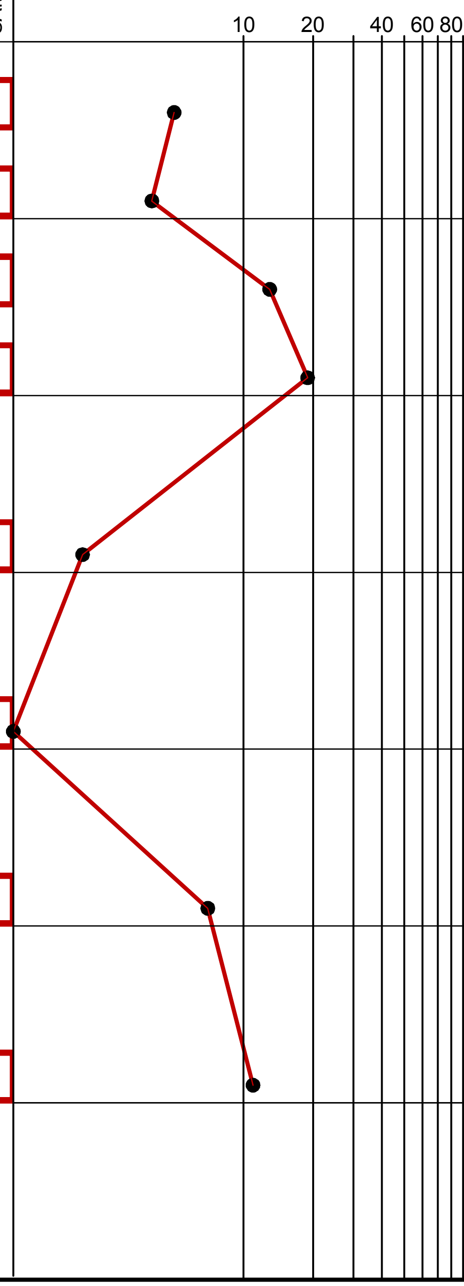
DATE DRILLED:	2/12/2010	ELEVATION:	170
DRILLING METHOD:	3¼" H.S.A.	BORING DEPTH:	30
LOGGED BY:	WMJ	WATER LEVEL:	9.5'@TOB; 3.5'@24hrs.
DRILLER:	Joe Lassiter	DRILL RIG:	CME 550

NOTES:
No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.

DEPTH (feet)	MATERIAL DESCRIPTION
0	**TOPSOIL** - approximately 1 inch of topsoil.
	CLAYEY SAND (SC) - mostly fine to medium sands, some low plasticity fines, moist, brown, very loose to medium dense.
	- some low to medium plasticity fines, moist, light brown to brown.
	- some low to medium plasticity fines, brown, gray, red.
	- mostly fine sands, some low plasticity fines, moist to wet, brown, orange.
12	**SILTY SAND (SM)** - mostly fine to medium sand, some low plasticity fines, slightly micaceous, saturated, light brown, light orange, light yellow, very loose.
17	**SANDY SILT (ML)** - mostly low to medium plasticity fines, some fine sands, micaceous, wet, light purple, light gray, very soft.
22	**POORLY GRADED SAND WITH CLAY (SP-SC)** - mostly fine to medium sands, few low plasticity fines, saturated, yellowish/brown, loose.
27	**CLAYEY SAND (SC)** - mostly fine to medium sands, little low plasticity fines, saturated, yellowish/brown, medium dense.
30	BORING TERMINATED AT 30 FEET.

DEPTH (feet)	ELEVATION (feet-MSL)	SAMPLE NO.	N VALUE
		1	5
5	165.0	2	4
		3	13
10	160.0	4	19
15	155.0	5	2
20	150.0	6	1
25	145.0	7	7
30	140.0	8	11

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 10-048LOGS.GPJ WITH CPT.GDT 2/26/10

NOTES:

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3. *STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.*
4. *WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.*

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PROJECT:	**Sumter Airport Industrial Park** **Sumter, South Carolina** **1611-10-048**

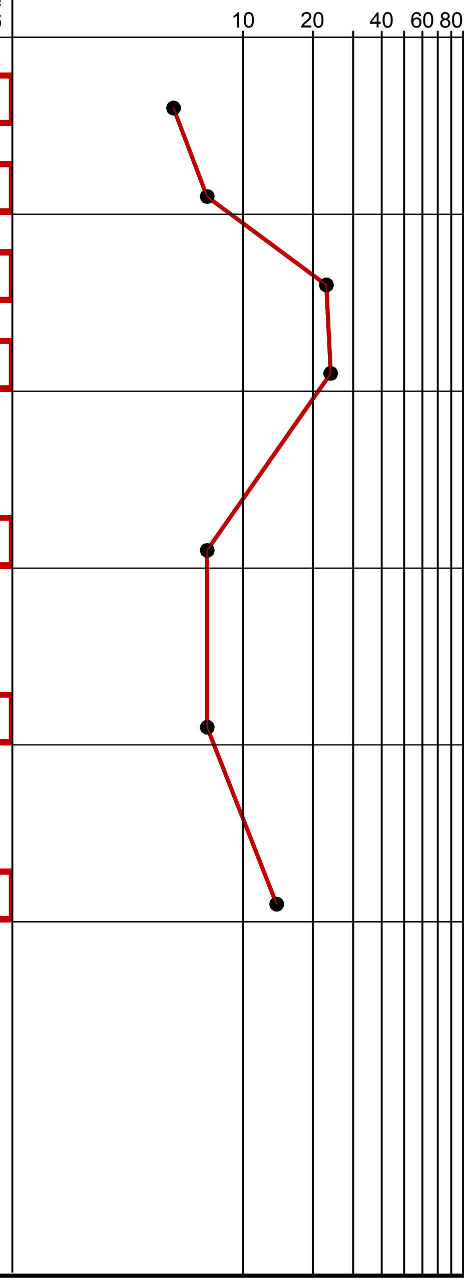
BORING LOG **B-4**

DATE DRILLED:	**2/12/2010**	ELEVATION:	**170**
DRILLING METHOD:	**3¼" H.S.A.**	BORING DEPTH:	**25**
LOGGED BY:	**WMJ**	WATER LEVEL:	**13'@TOB; 4'@24hrs.**
DRILLER:	**Joe Lassiter**	DRILL RIG:	**CME 550**

NOTES:
No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	N VALUE
0–1	**PLOW ZONE** - approximately 12 inches of organic plow zone.				
1–3	**CLAYEY SAND (SC)** - mostly fine to medium sands, some low plasticity fines, moist, brown, loose.			1	5
3–8	**SANDY LEAN CLAY (CL)** - mostly low to medium plasticity fines, some fine to medium sands, few cemented fragments, moist, brown, trace red, firm to very stiff. - gray, brown, red.	▼ (4')	165.0 (5)	2 3	7 23
8–12	**SILTY SAND (SM)** - mostly fine to medium sand, some low plasticity fines, moist, gray, brown, red, medium dense.		160.0 (10)	4	24
12–17	**POORLY GRADED SAND WITH SILT (SP-SM)** - mostly fine to medium sands, few low plasticity fines, wet, yellowish/brown, loose.	▽ (13')	155.0 (15)	5	7
17–25	**SILTY SAND (SM)** - mostly fine to medium sand, little low plasticity fines, saturated, purple, trace gray, trace brown, loose to medium dense. - slightly micaceous, some sandy silt nodules in sample.		150.0 (20) 145.0 (25)	6 7	7 14
25	BORING TERMINATED AT 25 FEET.				

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 10-048LOGS.GPJ WITH CPT.GDT 2/26/10

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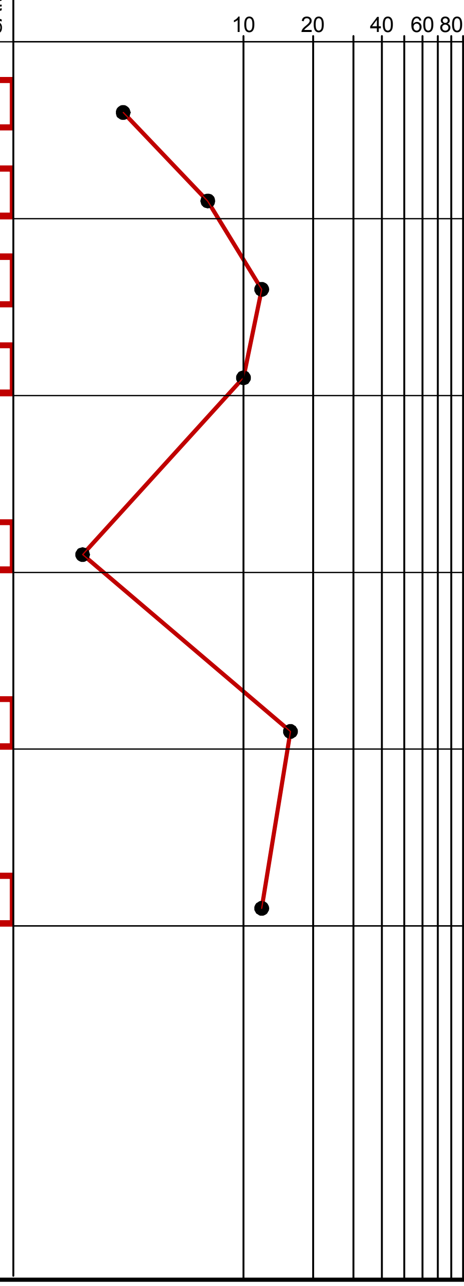
PROJECT:	Sumter Airport Industrial Park Sumter, South Carolina 1611-10-048	**BORING LOG B-5**

DATE DRILLED: 2/12/2010	ELEVATION: 170	NOTES: **No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.**
DRILLING METHOD: 3¼" H.S.A.	BORING DEPTH: 25	
LOGGED BY: WMJ	WATER LEVEL: 3'@TOB	
DRILLER: Joe Lassiter	DRILL RIG: CME 550	

DEPTH (feet)	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	N VALUE
0–1	**PLOW ZONE** - approximately 12 inches of organic plow zone.		170		
1–8	**CLAYEY SAND (SC)** - mostly fine to medium sands, some low plasticity fines, wet, brown, very loose to medium dense. - some low to medium plasticity fines, moist, gray, brown, trace orange. - few cemented fragments, moist, brown, gray, red.	∇ (3 ft)	165.0 (5 ft)	1 2 3	3 7 12
8–25	**SILTY SAND (SM)** - mostly fine to medium sand, little low plasticity fines, saturated, yellowish/brown, trace purple, very loose to medium dense.		160.0 (10 ft) 155.0 (15 ft) 150.0 (20 ft) 145.0 (25 ft)	4 5 6 7	10 2 16 12
25	BORING TERMINATED AT 25 FEET.				

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 10-048LOGS.GPJ WITH CPT.GDT 2/26/10

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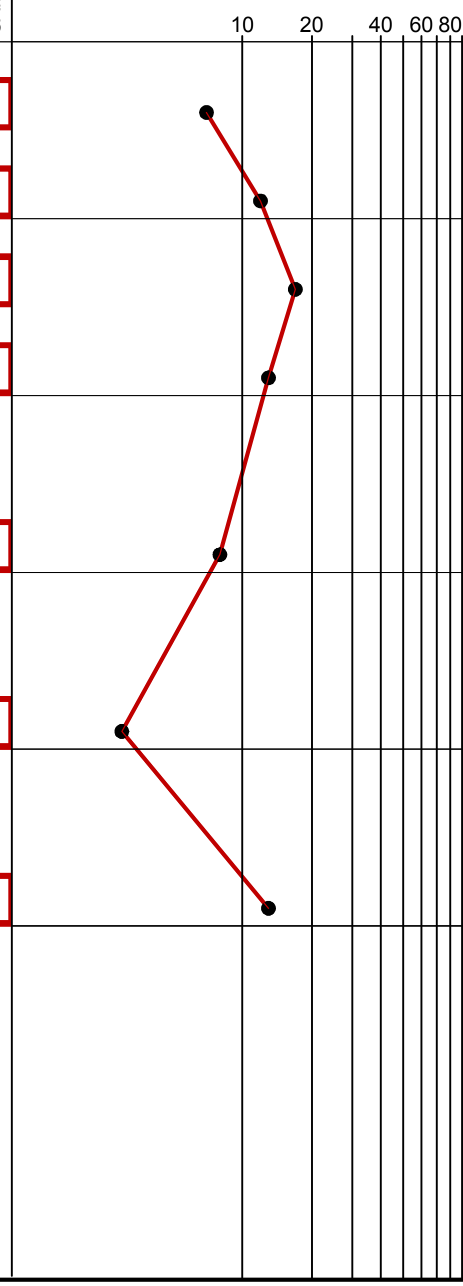
PROJECT:	Sumter Airport Industrial Park Sumter, South Carolina 1611-10-048			**BORING LOG B-6**
DATE DRILLED:	2/12/2010	ELEVATION:	170	NOTES: **No survey of boring location or elevation was performed by S&ME Inc. Approximate boring locations is shown on fig. 2 of this report.**
DRILLING METHOD:	3¼" H.S.A.	BORING DEPTH:	25	
LOGGED BY:	WMJ	WATER LEVEL:	7'@TOB; 2'@24hrs.	
DRILLER:	Joe Lassiter	DRILL RIG:	CME 550	

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO. SAMPLE TYPE	N VALUE
		PLOW ZONE - approximately 10 inches of organic plow zone.				
		SANDY LEAN CLAY (CL) - mostly low to medium plasticity fines, some fine to medium sands, few cemented fragments, moist, brown, red, trace gray, firm to stiff.	▼		1	7
5				165.0	2	12
		SILTY SAND (SM) - mostly fine to medium sand, some low plasticity fines, slightly micaceous, saturated, light brown, light orange, light yellow, very loose.	▽		3	17
		- little low plasticity fines, saturated, light gray, trace tan.			4	13
10				160.0		
15				155.0	5	8
		SANDY LEAN CLAY (CL) - mostly low to medium plasticity fines, some fine sands, slightly micaceous, wet, light gray brown, very stiff.			6	3
20				150.0		
		SILTY SAND (SM) - mostly fine to medium sand, little low plasticity fines, saturated, light orange, light tan, trace light purple, medium dense.			7	13
25				145.0		
		BORING TERMINATED AT 25 FEET.				

STANDARD PENETRATION TEST DATA (blows/ft)



BORING LOG 10-048LOGS.GPJ WITH CPT.GDT 2/26/10

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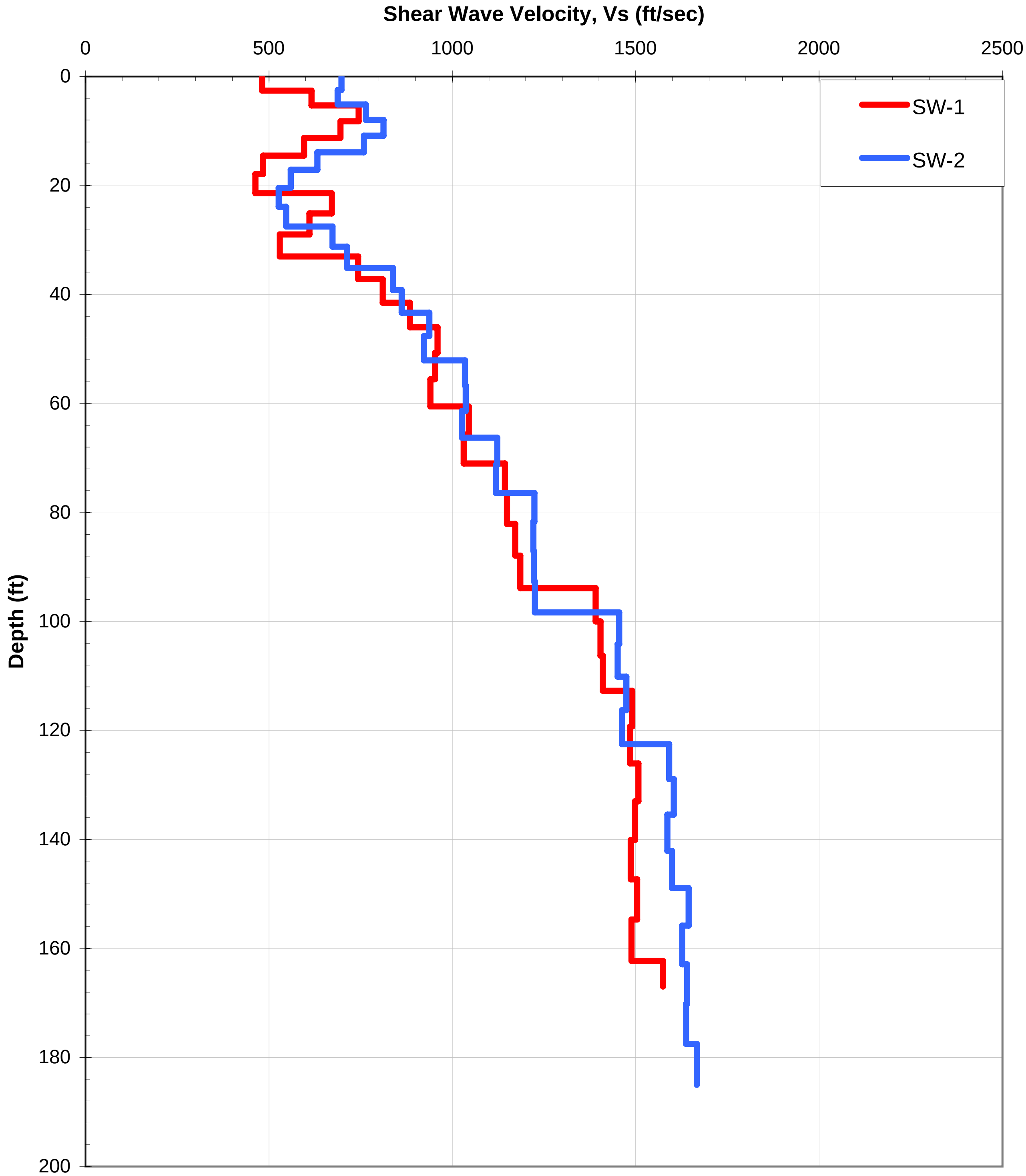
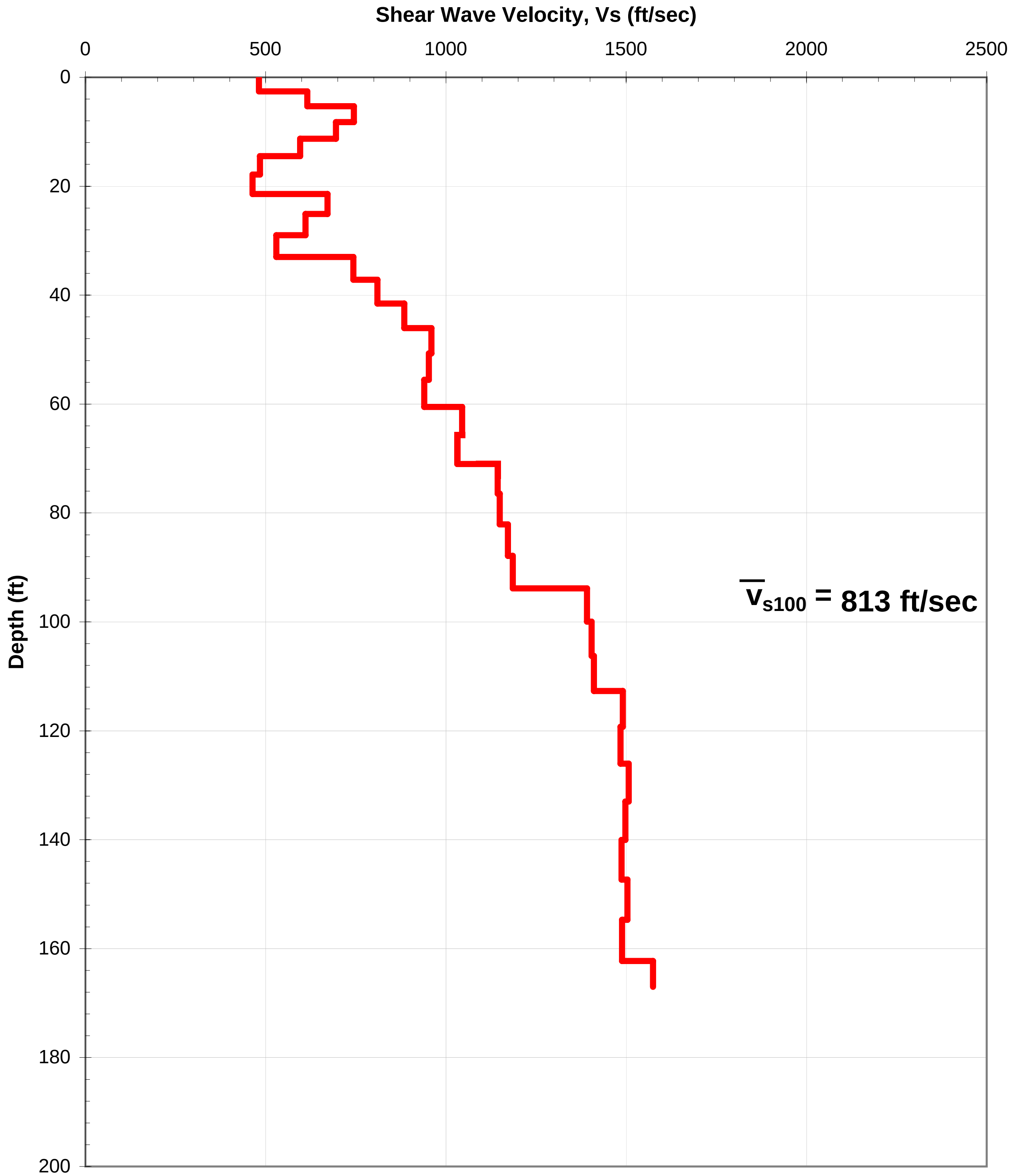
Shear Wave Velocity Profiles
SumterAirport Industrial Park
Sumter, SC
1611-10-048



Shear Wave Velocity Profile SW-1
Sumter Airport Industral Park
Sumter, SC
1611-10-048



Shear Wave Velocity Profile SW-2
SumterAirport Industrial Park
Sumter, SC
1611-10-048