University of South Carolina
Athletic Village Tennis Complex Addition – RE-BID
Columbia, SC

Architect's Project No. 12.130.09
Addendum No. 2

Quackenbush Architects + Planners
1217 Hampton Street
Columbia, South Carolina 29201

June 20, 2014

ADDENDUM NO.2

The following items shall take precedence over the drawings and specifications for the above named project and shall become a part of the contract documents. Where any item called for in the specifications, or indicated on the drawings, is not supplemented hereby, the original requirements shall remain in effect. Where any original item is amended, voided or superseded hereby, the provisions of such item not specifically amended, voided or superseded shall remain in effect.

* *

BID CLOSING DATE, TIME & LOCATION

1. The Bid Closing Date is Thursday, June 26, 2014 at 3:00 in Conference Room #53 as noted in the original Advertisement. This date, time and location remain UNCHANGED.

* *

ATTACHEMENTS

1. Modification to Seismic Load Table on Sheet S3.0
2. Modification to Note #1 under the Geotechnical Heading on Sheet S3.0
3. Amendment to the original Geotechnical Exploration to update to the 2012 IBC, performed by GS2.
4. Original Tennis Project Geotechnical Exploration performed by GS2

GENERAL

1. Listing of multiple products or manufacturers within specifications or approval of products or manufacturers via substitution request does not waive or preclude any and all performance, warranty or specific requirements listed within the specification unless specifically noted in the Addendum. Only manufacturers and products meeting the specification requirements and listed in the specifications or included in the Addendum shall be approved for the project.

Questions:

1. Question: Clarify "Align existing courts with new concrete", note on sheet A1.2
   Answer: The intent of this note is to create a smooth transition between the surface of the courts and the new concrete paving by using the Ardex CD topping on the existing concrete that is to remain in place. We are trying to avoid a low area that could create ponding at this location.

2. Question: How many hand dryers are there?
   Answer: There are 3 hand dryer locations, 1 in the men's restroom, 1 in the women's restroom, and 1 in the visitors. They are noted in the electrical drawings. Please note that the hand dryers will be provided by the owner.

3. Question: Please clarify the Geotechnical comments in addendum #1.
   Answer: The Bid Construction Documents noted the Soil Site Class and Seismic Design Category as a "D" and has been changed to a "C". This has been done through an amendment to the original geotechnical exploration report. In addition, note #1 under the Geotechnical heading on sheet S3.0 has been amended to reference the geotechnical report for the soil bearing pressure. As noted on page 11 of the original geotechnical exploration report, the footings are to have "*an allowable bearing pressure of the 2,500 pounds per square foot*." Page 13 of this report notes the recommendations "*that a re-compacted modulus of subgrade reaction of 140 pounds per cubic inch be used for the on-site sandy soils for design of slab reinforcement at this site".* Lastly, this report is to be referenced for any additional information or recommendations associated with below grade activities as noted in the revised Structural Note issued herein.

   Additionally, the change from a Seismic Design Category "D" to a "C" alters the requirements for masonry seismic reinforcing, ceiling seismic bracing and edge trim requirements, and above ceiling bracing of HVAC and Plumbing equipment. No Seismic reinforcing or bracing of Architectural, HVAC or Plumbing elements will be required for this project.

<u>Drawings:</u>

<u>Item No.Description</u>

1. Drawing Sheet A1.4 – Exterior elevation reference tag at the northeast corner of the men's locker room building should read 13/A3.1. Also, an E.I.F.S. panel shall be provided in the east wall as indicated in elevation 12/A3.1.

2. Drawing Sheet A7.2 – Delete reference to epoxy base in detail 7/A7.2. The base in this room is RB-1.

3. Drawing Sheet S3.0 – Replace the Seismic Load Table with the one issued in this addendum.

4. Drawing Sheet S3.0 – Replace the Geotechnical Note #1 with the one issued in this addendum.

END OF ADDENDUM NO.2

SEISMIC LOADS:

2

SOIL SITE CLASS – C	(ASCE Chapter 20)
SPECTRAL RESPONSE ACCELERATIONS	(ASCE Figure 22-1 & 22-2)
Ss = .50 S1 = .15	
SPECTRAL RESPONSE COEFFICIENTS	(ASCE Section 11.4.4)
Sds = .34 Sd1 = .16	
SEISMIC IMPORTANCE FACTOR – Ie = 1.0	(ASCE Table 1.5-2)
SEISMIC DESIGN CATEGORY = C	(ASCE Section 11.6)
BASIC SEISMIC-FORCE RESISTING SYSTEM= SPECIAL REINFORCED MASONRY SHEARWALLS	(ASCE Table 12.2-1)
SEISMIC RESPONSE COEFFICIENT – Cs = 0.07	(ASCE Section 12.8.1.1)
RESPONSE MODIFICATION FACTOR – R = 5	(ASCE Table 12.2-1)
DESIGN BASE SHEAR – 1 kip per Building	(ASCE Section 12.8)
ANALYSIS PROCEDURE – EQUIVALENT FORCE METHOD	

Much of the information presented in this load table originates from the applicable building code(s). The structural design for systems such as metal studs, exterior doors, windows, skylights, roofing systems, etc. will likely be more complicated and more building specific than indicated in this table. Designers and suppliers must refer to the applicable building codes, site conditions and architectural drawings to adequately design and / or specify their individual components and systems.

SHEET INFORMATION

Date	06/05/14
Project No.	12.130.09
Scale	AS NOTED
Drawn By	NDJ
Checked By	KWT
State Project No.	CP00371744/FM00424821

TITLE

GENERAL NOTES

SHEET NO.

S3.0

ELECTRICAL AND MECHANICAL PLANS AND/OR REQUIREMENTS FOR SIZE AND LOCATION OF ALL OPENINGS FOR DUCTS, PIPING, CONDUCTS, ETC.

11. THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND/OR VENDER DRAWINGS FOR LOCATIONS OF DEPRESSED FLOOR AREAS, FLOOR DRAINS, FLOOR TOPPINGS, CMU COURSING AND ANY OTHER DETAILS NOT SHOWN ON THE STRUCTURAL DRAWINGS.

12. EXISTING BUILDINGS/STRUCTURES: DIMENSIONS, ELEVATIONS, AND EXISTING CONDITIONS WILL REQUIRE FIELD VERIFICATION. DEPENDING ON FIELD CONDITIONS BEYOND THE DESIGNER(S CONTROL, SOME STRUCTURAL/ARCHITECTURAL SECTIONS AND/OR DETAILS WILL REQUIRE MODIFICATION.

2

GEOTECHNICAL:

1. THE CONTRACTOR, SHALL FOLLOW ALL RECOMMENDATIONS INDICATED IN THE GEOTECHNICAL REPORT, WHICH SHALL BE CONSIDERED AN INTEGRAL PART OF THESE CONTRACT DOCUMENTS. REFERENCE IS MADE TO THE GEOTECHNICAL REPORT BY GS2 ENGINEERING, REPORT #09-3063-G DATED MARCH 10, 2009 & ADDENDUM #1 MEMO DATED JUNE 19, 2014. GEOTECHNICAL QUESTIONS ARE TO BE DIRECTED IN WRITING TO THE GEOTECHNICAL ENGINEER, ARCHITECT OR LEAD DESIGNER. TO MAINTAIN CONTINUITY IN GEOTECHNICAL SERVICES, THE GEOTECHNICAL TESTING COMPANY, AND THEIR GEOTECHNICAL ENGINEER, SHALL FOLLOW THE INTENT AND RECOMMENDATIONS STATED IN THE PROJECT GEOTECHNICAL ENGINEERING REPORT. ANY ADDITIONAL INFORMATION REQUIRED FROM KYZER AND TIMMERMAN SHALL BE REQUESTED, IN WRITING, BY THE GEOTECHNICAL ENGINEER OR ANY OTHER PARTY PROVIDING GEOTECHNICAL SERVICES.

2. CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL EXCAVATIONS AND SLOPES.

CONCRETE:

1. ALL CONCRETE AND REINFORCING BARS SHALL BE INSTALLED ACCORDING TO STANDARDS SET FORTH BY THE LATEST EDITION OF ACI-318.

2. REINFORCEMENT SHALL BE HELD IN PLACE DURING CONCRETE PLACEMENT. IF REQUIRED, ADDITIONAL BARS MAY BE PROVIDED BY THE CONTRACTOR TO FURNISH SUPPORT FOR ALL BARS.

3. 28 DAY MINIMUM CONCRETE COMPRESSIVE STRENGTH SHALL BE AS FOLLOWS:

FOOTINGS	3000 PSI
SLABS ON GRADE	3000 PSI
ELEVATED FORMED STAIRS	4500 PSI

NO CALCIUM CHLORIDE SHALL BE USED IN MIX.

4. THE CONTRACTOR SHALL TAKE ADDITIONAL PRECAUTIONS WHEN CONCRETE IS TO BE PLACED AND CURED DURING COLD OR HOT WEATHER. THE CONTRACTOR SHALL FOLLOW THE RECOMMENDATIONS PRESCRIBED BY AMERICAN CONCRETE INSTITUTE FOR COLD OR HOT

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ADDENDUM 1 MEMO

GEOTECHNICAL ~ ENVIRONMENTAL ~ FACILITIES
MATERIALS ~ INSPECTIONS ~ NDT ~ DRILLING

Corporate - Columbia Branch Office
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www.gs2engineering.com

To: **The University of South Carolina**
Campus Planning and Construction
743 Greene Street
Columbia, South Carolina 29208

Attention: **Ms. Ann Derrick**

From: **Shawn J. Etier, E.I.T., Senior Geotechnical Professional, V.P.**

Reference: **Report of Geotechnical Exploration - Seismic Update**
Proposed Tennis Complex for the University of South Carolina
Heyward Street
Columbia, South Carolina
GS2 Project No 09-3063-G

Date: **June 19, 2014**

Comments:

Dear Ms. Derrick;

We appreciate the opportunity to provide this addendum to our original *Report of Geotechnical Exploration* for the Proposed Tennis Complex for the University of South Carolina, in Columbia, South Carolina, dated March 10, 2009. It is our understanding that the project is moving forward for permitting and construction under the International Building Code, 2012 Edition (IBC2012), and will therefore require that the seismic design parameters presented in our original report be updated to the current code.

IBC 2012 Seismic Site Class: Our analysis of the soil seismic conditions was based on the information obtained from our SPT borings at the site, known site and vicinity geological conditions, known regional seismic conditions, and seismic design parameters established in data published in the International Building Code 2012 (IBC2012), section 1613.3 Therefore, from the known regional conditions, the SPT N-values measured, and the parameters established in the IBC 2012, we have determined that the site is best defined to have a **Site Class C**.

Earthquake Ground Motion: Earthquake ground motion parameters at the bedrock for this site were obtained from the International Building Code (IBC 2012) section 1613.3 The values for this site are presented in Table 1. Ground motions were obtained utilizing the mapped accelerations, with the design responses for both ground motions represented in the following sections.

Table 1: Probabilistic Ground Motion Values

Spectral Response Acceleration	***Ground Motion Values for Recurrence Period (g)***
	2% in 50 Years (2012)
0.2 sec Sa[1]	0.420
1.0 sec Sa	0.144

Note: 1. Sa is the Spectral Response Acceleration at the noted period.

Based on the information presented in the preceding table, and the IBC 2012 section 1613.3, the corresponding site coefficients for the site are calculated to be:

- F_a = 1.200
- F_v = 1.656

Design Spectral Response: Based on the information presented in the preceding table, and the corresponding site coefficients for the site, we have calculated the Design Spectral Response Acceleration Parameters, according to IBC 2012 section 1613.3.4, for this site to be:

- S_{DS} = 0.336
- S_{D1} = 0.159

BASIS FOR RECOMMENDATION

It is important to note that the above recommendations are based on the data gathered and reported in our original *Report Geotechnical Exploration* for the Proposed Tennis Complex for the University of South Carolina, dated March 10, 2009, and that no recommendations presented within the reports shall be altered unless directly addressed in this addendum.

CLOSING

In closing, we appreciate the opportunity to provide our services for your engineering needs. If there are any questions referencing our recommendations, please feel free to contact us.

Sincerely,
GS2 ENGINEERING, INC.

Shawn J. Etier, E.I.T.
Senior Geotechnical Professional, VP

George A. Sembos, P.E.
Senior Engineer, President

Proposed Tennis Complex for the University of South Carolina

Heyward Street
Columbia, South Carolina

GS2 Project Number 09-3063-G
March 10, 2009

Report of Geotechnical Exploration

<u>Prepared for:</u>

The University of South Carolina
Campus Planning and Construction
743 Greene Street
Columbia, South Carolina 29208

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www.gs2engineering.com

March 10, 2009

The University of South Carolina
Campus Planning and Construction
743 Greene Street
Columbia, South Carolina 29208

Attention: **Ms. Ann Derrick**

Reference: **Report of Geotechnical Exploration**
Proposed Tennis Complex for the University of South Carolina
Heyward Street
Columbia, South Carolina
GS2 Project No 09-3093-G

Dear Ms. Derrick,

This report presents our geotechnical exploration of the site of the proposed Tennis Complex for the University of South Carolina, in downtown Columbia, South Carolina. Information obtained from our geotechnical exploration has been used to evaluate the existing site conditions for the use of developing design parameters for the proposed structures. This work was performed in general accordance with industry standards and our proposal number P2330-09, dated February 2, 2009.

Recommendations detailed in this report are specific to the soil conditions in the immediate vicinity of the boring and sounding locations for this particular project. This report does not include any environmental assessment of soils, surface water or groundwater, the determination of wetlands, the determination of noise impact, the assessment of air quality, the identification of cultural resources, and the identification of endangered species. These services are beyond the scope of services of a geotechnical exploration.

PROJECT INFORMATION

Proposed Development

We understand the proposed development will consist of the revitalization of the existing Roost Complex, presently consisting of Sarge Frye Field, The Sam Daniel Tennis Center, the under construction Academic Enrichment Center, a golf practice facility, Athletic dormitories, and associated paved parking and drives. Additionally, we understand that the proposed development is to include the construction of a new Tennis Complex with associated athletic lighting structures. Furthermore, we understand the proposed tennis complex will be constructed utilizing typical asphalt tennis court construction, while the surrounding access areas and viewing stands are assumed to be constructed utilizing cast-in-place concrete construction. Furthermore It has been assumed, through our knowledge of similar structures, that the proposed athletic lighting will be steel structures that will house lighting and that the axial, lateral, and overturning moment loads of the proposed structures are to be supported utilizing a caisson deep foundation system.

Additionally, no grading or finished floor elevations for the development were available at the time of our exploration. Therefore, based on our understanding of the existing site grades and from our experience with similar developments, we have assumed that cuts and fills on the order of 2 to 3 feet will be required to level the building pad.

Furthermore, we have assumed that the design and construction of the proposed structure will be governed by the International Building Code, Edition 2003 and 2006 (IBC2003 and 2006).

SITE SETTING

Site Location

The site of the existing Roost Complex is located along the southern side of Heyward Street, west of its intersection with Marion Street, in downtown Columbia, South Carolina. More specifically, the subject site is located within the area presently developed with the existing Sarge Frye Field, south of the existing parking lot for the Roost and Sarge Frye Field, within the existing University of South Carolina campus. The location of the site relative to the nearby streets is shown in the "Site Location Map", Figure 1 in Appendix A.

Site Description

The subject site was noted to be generally rectangular in shape, and, at the time of our visit, was noted to be developed with the existing Sarge Frye Field. In general, the existing facility appeared to be in good to fair working order.

The site was further noted to be bordered by the existing parking lot and drives for the Roost Complex to the north, athletic student housing to the east, the existing softball field and golf practice facility to the south, and railroad tracks to the west. Access to the site was gained via paved drives emanating from Heyward Street.

Site Topography

Topographically, the site is located on the western side slope of a broad ridge in the Upper Coastal Plain Physiographic Province that is noted to be sloping from east to west, with surface runoff in the vicinity of the site appearing to drain primarily into the surrounding, in-place infrastructure, leading to Rocky Branch and eventually into the Congaree River. Ground surface elevations across the site appear to range from 232 to 215 feet above mean sea level. More specifically, the ground surface elevations across the proposed building pad area appear to range from 225 to 220 feet above mean sea level. General topographic information was obtained from the USGS Southwest Columbia topographic quadrangle, Figure 2 in Appendix A.

SUMMARY OF FIELD EXPLORATION

The subsurface conditions within the area of the ***proposed tennis complex*** were explored with 9 mechanically-augered soil borings, with Standard Penetration Tests (SPT) taken at regular intervals, extended to the termination depths of 10 feet, below the existing ground surface.

Additionally, the subsurface conditions within the areas of the ***proposed athletic lighting structures*** were explored with 4 mechanically-augered soil borings, with Standard Penetration Tests (SPT) taken at regular intervals, extended to the termination depths of 20 feet below the existing ground surface.

The approximate soil boring locations are shown on the attached Boring Location Plan, Figure 3 in Appendix A. The borings were located in the field by measuring from estimated property and building corners.

SITE SOIL CONDITIONS

Site Geology

The site is located in an old river terrace formed in the Upper Coastal Plain Physiographic Province of South Carolina, in downtown Columbia. The soils of this terrace are composed of a mixture of re-deposited material washed from upstream sources of ancient rivers, and are typically mixed with rocks that vary in size and depth which have been rounded through years of exposure to flowing water. The deposits in these areas are highly variable and may cover areas of the river bed and associated flood plains, which when deposited were established in very loose and wet conditions. Ultimately these terraces are underlain by firmer materials of the Piedmont Physiographic Province.

More specifically, the geology and geomorphology of the city of Columbia are dictated by several key factors of which the Fall Line and the local River Systems are the most dominant. Upstream from the Fall Line rivers and streams typically have very small floodplains, while downstream these floodplains widen greatly. T. Frank Johnson's 1972 mapping of the Columbia quadrangles depicts the near surface soil composition for areas along the east banks of the Broad River, to about Assembly Street, and west of the Broad River to consist of material that weathered from Phyllites and Granite, with the coastal plain sediments in this area typically 35 to 50 feet thick. Additionally, geological mapping of the Columbia quadrangles depicts the near surface soil composition for areas of Columbia east of Assembly Street to consist of coastal plain and river terrace sediments on the order of 80 to 90 feet thick. In both cases the coastal plain sediments are underlain by several feet of weathered rock and Potassium Feldsparrich Granite. The granite underlying the surface deposits is known to be metamorphic in nature, and relatively weathered.

Soil Conditions

The subsurface conditions encountered at the boring locations are detailed on the attached "Soil Test Boring Logs". These logs represent our interpretation of the subsurface conditions at the boring locations based on our visual and textural examination of the recovered soil samples. The horizontal lines in the Soil Description column of the boring logs represent an approximate interface between various soil strata. It is important to understand that these horizontal lines represent an estimated depth of soil variance where as the actual soil change may be gradual.

The borings encountered roughly 3 inches of topsoil at the ground surface across the site with the exception of borings B-13 and B-18.

Proposed Tennis Complex: Beneath the surface materials, the borings within the proposed tennis complex (B-11, B-12, B-14, B-15, B-16, B-17, B-19, B-20, and B-21) generally encountered fill soils consisting of clean sands (SP), clayey sands (SC), and clayey sands with organics (SC-OL) within the upper roughly 3 to 10 feet across the site. Beneath the fill soils, with the exception of borings B-17 and B-21, the borings encountered native Coastal Plain deposits, consisting of silty clayey sands (SM-SC), to termination depths of 10 feet below the existing ground surface.

The fill soils exhibited SPT N-values noted to range from 6 to 12 blows per foot (bpf), indicating loose to firm relative densities, while the native sandy soils exhibited SPT N-values noted to range from 15 to 100+ bpf, indicating firm to very dense relative densities.

Proposed Athletic Lighting Structures: Beneath the surface materials, the borings within the proposed athletic lighting structures (B-10, B-13, B-18, and B-22) generally encountered fill soils consisting of clean sands (SP), clayey sands (SC), and clayey sands with organics (SC-OL) within the upper roughly 3 to 20 feet across the site. Beneath the fill soils, with the exception of boring B-22, the borings encountered native Coastal Plain deposits, consisting of silty clayey sands (SM-SC), to termination depths of 20 feet below the existing ground surface.

The fill soils exhibited SPT N-values noted to range from Weight Of Hammer (W O H) to 18 blows per foot (bpf), indicating very loose to firm relative densities, while the native sandy soils exhibited SPT N-values noted to range from 20 to 100+ bpf, indicating firm to very dense relative densities.

Groundwater

Free groundwater was encountered in boring B-10 at the time of drilling at a depth of approximately 6 feet below the existing ground surface. Due to safety concerns, the boreholes were backfilled upon completion and therefore 24-hour groundwater depths were not recorded. Groundwater levels are dependent on many factors and can experience seasonal fluctuations and various other fluctuations due to precipitation, construction activities, and many other factors.

SEISMIC CONSIDERATIONS

Regional Seismic Conditions

This site is situated approximately 110 miles northwest of Charleston, South Carolina, which is the most prominent area of seismicity along the Atlantic Seaboard. The Charleston earthquake of 1886 was the largest seismic event that has occurred in this region and damage was extensive throughout the Charleston area. The epicenter was located approximately 15 miles northwest of Charleston between the town of Summerville and Middleton Place Plantation.

Recent discoveries of relict liquefaction in the Low Country region of South Carolina have expanded knowledge about seismicity in the area. Evidence indicates that at least five episodes of strong prehistoric ground shaking large enough to produce widespread liquefaction have occurred within the Charleston area within the last 7500 years. The Charleston region continues to experience earthquakes of smaller magnitudes yearly.

IBC2003 and 2006 Seismic Site Class

Our analysis of the soil seismic conditions was based on the information obtained from our current SPT borings, previous CPT sounding with Shear Wave velocities, known site and vicinity geological conditions, known regional seismic conditions, and seismic design parameters established in data published in the International Building Code 2003 and 2006 (IBC 2003 and 2006), section 1615 and 1613, respectively. Therefore, from the known regional conditions, the SPT N-values measured, and the parameters established in the IBC2003 and IBC2006, we have preliminarily estimated that the site is best defined to have a seismic **Site Class C**.

Earthquake Ground Motion

Earthquake ground motion parameters at the bedrock for this site were obtained from the International Building Code (IBC2003) section 1615 and International Building Code (IBC2006) section 1613. The values for this site are presented in Table 1. Ground motions were obtained utilizing the mapped accelerations, with the design responses for both ground motions represented in the following sections. As both, methods are understood to be accepted; it will be the structural designer's determination as to which is appropriate for the design of the structure.

Table 1: Probabilistic Ground Motion Values

Spectral Response Acceleration	***Ground Motion Values for Recurrence Period (g)***	
	2% in 50 Years (2003)	***2% in 50 Years (2006)***
0.2 sec Sa[1]	0.610	0.550
1.0 sec Sa	0.200	0.150

Note: 1. Sa is the Spectral Response Acceleration at the noted period.

Based on the information presented in the preceding table, and the IBC2003 section 1615.1.2 and IBC2006 section 1613.5.3, the corresponding site coefficients for the site are calculated to be:

Table 2: Seismic Site Coefficients

	2003	***2006***
F_a	1.144	1.180
F_v	1.600	1.650

Design Spectral Response

Based on the information presented in the preceding table, and the corresponding site coefficients for the site, we have calculated the Design Spectral Response Acceleration Parameters, according to IBC2003 section 1615.1.3 and IBC2006 section 1613.5.4, for this site to be:

Table 3: Design Spectral Response

	2003	***2006***
S_{DS}	0.470	0.430
S_{D1}	0.210	0.170

CONCLUSIONS AND RECOMMENDATIONS

The borings performed during this exploration indicate that the existing sandy soils (SP, SC and SM-SC) are ***suitable***, while the clayey sands with organics (SC-OL) are ***unsuitable***, for support of the proposed structures as well as for use as structural fill due to their inherent characteristics.

These conclusions, and the associated recommendations, are provided in the assumption that the soil conditions at the site do not vary greatly from those encountered in our borings and that our recommendations presented in the following sections of this report are followed.

Suitability of Soils

As previously stated, the near-surface soils at the site have been identified to have an ***SP***, ***SC***, ***SC-OL****,* and ***SM-SC*** USCS soil classification. Most text includes soils with Unified Soil Classifications of SW, SP, SM, SC, SM-SC, ML and CL as suitable for support of structure or for use as structural fill, while soils with classifications of MH, CH, OL and OH are considered unsuitable. Therefore, it is important to note the site contains soils that are considered in the industry to be *suitable* (SP, SC and SM-SC) to *unsuitable* (SC-OL). The following sections provide more insight into each soil classification, with emphasis placed on their workability and preferred structural loading.

Fine-grained soils (SC (with high PIs), are typically sensitive to variations in moisture content with a relatively narrow range of workable moisture contents. Therefore, close control of moisture content will probably be necessary during grading and fill placement operations, where these soils are involved. In addition, these soils may become difficult to work during periods of wet weather. Grading operations under wet conditions may result in the deterioration of otherwise suitable soil conditions, or of previously placed and properly compacted fill.

Fine-grained soils (SC (with high PIs) are typically sensitive to variations in moisture content with a relatively narrow range of workable moisture contents. Therefore, close control of moisture content will probably be necessary during grading and fill placement operations, where these soils are involved. In addition, these soils may become difficult to work during periods of wet weather. Grading operations under wet conditions may result in the deterioration of otherwise suitable soil conditions, or of previously placed and properly compacted fill.

Site Preparation

General Clearing, Stripping, & Grubbing: Any vegetation and organic laden soils should be removed from beneath, and within a 5 foot perimeter, of structurally loaded or fill areas, and wasted off site or in areas to be landscaped prior to placement of structural fills. This should include the roughly 3 inches of topsoil encountered in the borings.

Additionally, as this site is to be developed on a previously developed property, it is ***probable*** that surface/buried debris and utilities will be encountered during excavation activities. Therefore, any surface/buried debris, or underground utilities encountered will need to be removed from beneath and within a 5 foot perimeter of structures, and wasted off site or in areas to be landscaped prior to placement of structural fills.

Building Pad and Pavement Subgrade Recommendations: Upon achieving finished grade, or prior to fill placement, the proposed fill and exposed cut areas of the building pad and pavement subgrade areas should be carefully inspected and proofrolled in order to detect locally yielding soils. Proofrolling should be performed with a twenty-ton rubber-tired tandem axle vehicle or similarly loaded vehicles or construction equipment, and should be observed by a qualified geotechnical engineer. The designated vehicle should make at least four passes over each section of the exposed soils with the last two passes perpendicular to the first two.

Any localized areas of yielding, soft/loose and/or saturated soils identified during proofrolling will need to be densified in-place, or undercut and the removed soil replaced with properly compacted fill. All fill should be monitored and placed in general accordance with the recommendations presented in the *Structural Fill* section of this report.

Stormwater and Groundwater Management

As stated previously, shallow groundwater was encountered in boring B-10 at a depth of approximately 6 feet below the ground surface. Therefore, it appears to be at a sufficient depth as to not inhibit grading and construction activities at the site. If groundwater is encountered the contractor should be prepared to dewater the site by ditching or pumping in order to stabilize soils that may be impacted by the groundwater's presence during grading activities.

Additionally, as previously mentioned, the existing near-surface soils are sensitive to variations in moisture content, therefore, any exposed subgrade soils and recently placed fill soils should be well drained to minimize the accumulation of stormwater runoff. If the exposed subgrade soils are not as anticipated, or become excessively wet, the geotechnical engineer should be consulted.

Structural Fill

On-site Sands: The on-site sandy soils (SP, SC, and SM-SC) encountered appear ***suitable,*** while the on-site clayey sands with organics (SC-OL) appear ***unsuitable***, for support of the proposed structures as well as for use as structural fill due to their inherent characteristics.

General Fill Recommendations: Prior to the placement of fill soils, representative soil samples should be obtained and tested to determine their classification and compaction characteristics. Optimum fill material should be free of debris and any fibrous organic material or organic soils and should have a Plasticity Index (PI) less than 15. We recommend that fibrous organic material found in the fill materials be no more than 5 percent by weight. Compaction characteristics of the fill soils should be determined using the laboratory Standard Proctor density test, ASTM D698, "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. Rammer and 12-in. Drop".

Fill material should be placed in no more than 8-inch thick lifts, loose measurement, and within +1 to -3 percent of the optimum moisture content determined by ASTM D698. Fills placed beneath the area of the structure and five feet beyond the building perimeter should be compacted to a minimum of **95** percent of the laboratory Standard Proctor maximum dry density (ASTM D698).

Furthermore, placement of the fill material should be observed and tested by a geotechnical engineer or qualified engineering technician as placement of the fill progresses. For grading beneath structures, compaction testing should be performed at a minimum frequency of one test per lift per 2000 square feet of fill placed. For utility trench backfill, compaction testing should be performed at a minimum frequency of one test per lift per 200 feet of fill placed within utility trenches, where these trenches are extended beneath structure or pavement. Upon completion of the mass grading and the installation of buried utilities and/or conduits, it will be necessary to retest the compaction of the structural fill placed within all backfilled utility trenches, where they have been buried within a previously tested and approved grade slab or pavements. Failure to re-inspect and retest these trenches beneath grade slabs and pavements may result in varying soil support of the loaded subgrade soils.

Additionally, where fill will be placed along the existing slope embankments, we recommend that the areas to receive fill be benched into terraces and slightly over-built, in order to minimize the presence of a loose zone of poorly compacted soils near the slope face. Large terraces are recommended for the compaction activities along the slope in order to allow large earth moving and compacting equipment access to the work area, ultimately aiding in the ability and speeding the time required to achieve compaction.

Soil Retainage Structures

We understand that retaining wall structures ***will*** be necessary at the site to support lateral soils forces, and we understand that other soil retainage systems ***may*** be required during excavation and foundation construction activities conducted on-site.

Therefore, we have estimated the earth pressure coefficients for each support condition in a drained situation, for the soils encountered at the site. The estimated values are dependent on the soil type, and the unit weight of the soil, as determined from laboratory testing, for the type of material actually used, and should be verified upon fill selection.

Table 4: Earth Pressure Coefficients

Support Condition	***Pressure Coefficient (existing sandy soils)***
Active (Wall deflects laterally away from retained soil).	Ka = 0.36
At-rest (Wall is restrained from movement).	Ko = 0.53
Passive (Wall deflects laterally toward retained soil).	Kp = 2.77

A design unit weight of 120.0 pounds per cubic foot, cohesion of 50 psf, and a phi angle of 28 degrees are assumed for the existing site soils.

The design of the retainage structures should include an allowance for positive gravity drainage of the retained soils either using permanent toe drains or weep holes.

Additionally, compaction of fills behind retainage structures should be conducted with light, hand-held compactors. Heavy equipment, such as rollers or grading equipment should not be allowed to operate within 10 feet of the retaining wall during construction in order to avoid developing additional excessive lateral earth pressures.

We caution against the installation of structures, drop inlets or storm sewer lines within a proper offset zone of the retaining wall, where possible over stressing and leakage may create maintenance problems or possible wall failure. Proper offsets for construction behind and at the base of retaining walls should be established prior to construction. Minimum offset for the edge of structure or infrastructure should be at least 1 to 1½ times the height of the wall, with distances measured perpendicular and away from the top of the wall, starting at the crest and toe of the wall.

Excavation Considerations and Precautions

The excavations required at the site ***may*** be extensive. We therefore recommend that when conducting excavation activities at the site, special care should be taken to not undermine, or disturb, in-place bearing subgrades associated with portions of the existing parking lot and adjacent roadways that are supported by the near-surface soils. In addition, if excavation depths conducted adjacent to any existing foundations is to exceed the existing bearing elevations, it will be necessary to temporarily underpin any existing foundations or to shore the excavation walls in such a manner as to preserve the integrity of the structures. Additionally, we recommend that any footings excavated adjacent to any existing structure be evaluated and poured as soon as possible after the excavations are completed, in order to minimize the potential for the undermining of the existing adjacent foundations that may be incurred from inclement weather.

Furthermore, the extensive excavations will likely require that the excavation sidewalls be properly sloped or shored. The contractor selected for this project should account for these safety precautions, and should insure that all excavations and other work activities that result from our recommendations be conducted in accordance with OSHA regulations. Furthermore, the recommendations presented in this report and our presence during work activities should not be construed as the acceptance of the responsibility of insuring a safe work environment or the safety of other personnel. This responsibility is the contractors, solely.

We strongly recommend that the over-excavation activities are observed by a qualified geotechnical engineer or engineering technician in order to confirm that stable bearing soils have been achieved and that they are acceptable for the recommended bearing pressure, prior to backfilling or concreting operations.

Slope Construction Recommendations

Permanent compacted fill and exposed cut slopes should be inclined no steeper than 2H:1V, for slopes greater than a height of 4 feet. Furthermore, we recommend that any compacted fill slopes be benched and slightly over-built, (in order to minimize the presence of a loose zone of poorly compacted soils near the slope face), and then cut back to firm, well compacted soils prior to the placement of structure or vegetative cover. Cut slopes may require some reworking of the near surface soils in order to achieve a more sound slope surface. Upon construction of a competent slope face, it is critical that the slope face be protected from erosion, through the installation of a geotextile fabric or the application of a vegetative cover.

We caution against the installation of foundation, drop inlets or storm sewer lines within a proper embedment zone of the slope face, where possible over stressing and leakage may create maintenance problems or possible isolated slope failure. In general these structures need to be installed a minimum distance of 1½ times the height of the embankment, as measured from the crest and/or toe of the slope. Furthermore, proper embedment of foundations or buried utilities beneath slope faces should be established prior to construction, with a minimum embedment for foundation recommended to be 5 feet below the down gradient portion of the slope, while a minimum embedment for buried utilities is recommended to be 3 feet below the down gradient portion of the slope.

Shallow Foundation and Construction Recommendations

Provided that any soft or non-performing near-surface soils have been densified in-place and/or undercut in general accordance with the *Site Preparation* section of this report, and that fill has been placed in accordance with the *Structural Fill* section of this report, the footings may be proportioned for an allowable bearing pressure of **2,500** pounds per square foot.

Furthermore, it appears that the ***tennis complex structures*** at the site may be supported with a conventional system of shallow spread foundations. We recommend that the continuous foundations have a minimum width of 1-1/2 feet and the spread foundations have a minimum width of 3 feet, to avoid localized punching failure. The foundations should bear at a minimum depth of 12 inches below the final ground surface in order to ensure that the bearing surfaces are below the maximum frost depth.

The actual depth of embedment of the foundations should be dictated by the ability to achieve the foundation and soil forces required to adequately resist up-lift and overturning for the subject structure. Soil forces reacting with embedded shallow foundations may be used to aid in the resistance of both uplift and overturn for this structure. The weight of the soil "wedge" above the footing may be used to aid in the resistance of uplift forces. We recommend that a unit weight of 120 pcf be used to compute the resisting soil weight. This unit weight has been estimated assuming select fill will be used as backfill and that the fill will be compacted to at least 95 percent of the Standard Proctor maximum dry density. The volume of the soil wedge may be calculated by assuming that the resisting soil section extends 45 degrees vertically from the outside top edge of the foundation to the ground surface. Additionally, passive earth pressure of the soils adjacent to the foundations, as well as soil friction at the foundation base and sides, may be used to develop shear to aid in the resistance of uplift and overturn. An ultimate friction coefficient between the foundation concrete and adjacent soil can be assumed to be on the order of 0.40.

The footings should be properly benched and the bearing soils free of loose debris or ponded water. If excavated bearing soils are exposed to the environment for extended periods of time or varying weather conditions, they may weaken. Foundation concrete should not be placed on bearing soils that have been weakened from the effects of the environment. Therefore, we recommend that the footings be concreted shortly after excavation. If the footing excavation should remain open overnight, or if rain becomes imminent, we recommend that the bearing soils be covered with a 2 to 4 inch mud-mat of 2000 psi concrete.

We strongly recommend that the footing excavations are observed and Dynamic Cone Penetrometer (DCP) values obtained by a qualified geotechnical engineer or engineering technician in order to confirm that the bearing soils are acceptable for the recommended bearing pressure. DCP testing should be conducted at a minimum frequency of 50 linear feet for continuous footings and at every pier footing, to minimum depths of twice the excavated foundation width. Unsuitable bearing soils, if encountered, will likely be required to be overexcavated and the resulting excavation to be backfilled with properly compacted fill, washed No. 57 stone or concrete.

Provided the site preparation and construction recommendations presented in this report are followed, the total estimated settlement for these structures will likely be on the order of ¾ of an inch for structures constructed in cut sections, and on the order of 1 inch for structures constructed in fill sections. Therefore, the differential settlement could be expected to be ½ of the total settlement for the soils encountered at the site for similar bearing conditions, (i.e. between foundations extended in fill or in cut), and up to ¾ of an inch between foundations extended in dissimilar bearing conditions. The structural engineer of record should account for the anticipated total and differential settlements, and design and reinforce the foundations, especially in the areas of the cut/fill line, in such a manner as to accommodate any excessive differential settlements.

Deep Foundation Construction and Recommendations

As previously mentioned the proposed ***athletic lighting structures*** at the site are assumed to be supported by a drilled shaft (caisson) deep foundation system. The drilled shaft foundations should be designed to accommodate the structures' axial, up-lift and overturning loads and moments. From our understanding of the project and industry standards, the structures are to be designed by others at a later date. Therefore, we recommend that a copy of this report be provided to the firm at the time of awarding the design, for their use in the design process.

Table 5: Design Parameters for Structure 1/Boring B-10

Layer	Unit Weight (psf)	Cohesion (ksf)	Comp. Strength (ksf)	Rankine Earth Pressure Coefficients		
				Active	Passive	At-Rest
0 to 6’	120	50	0.10	0.36	2.77	0.53
6’ to 20’	120	50	0.50	0.36	2.77	0.53

Table 6: Design Parameters for Structure 2/Boring B-13

Layer	Unit Weight (psf)	Cohesion (ksf)	Comp. Strength (ksf)	Rankine Earth Pressure Coefficients		
				Active	Passive	At-Rest
0 to 3’	120	50	0.20	0.36	2.77	0.53
3’ to 6’	115	0	0.05	0.36	2.77	0.53
6’ to 13’	120	50	0.50	0.36	2.77	0.53
13’ to 18’	120	50	0.70	0.36	2.77	0.53
18’ to 20’	120	50	0.50	0.36	2.77	0.53

Table 7: Design Parameters for Structure 3/Boring B-18

Layer	Unit Weight (psf)	Cohesion (ksf)	Comp. Strength (ksf)	Rankine Earth Pressure Coefficients		
				Active	Passive	At-Rest
0 to 13’	120	50	0.10	0.36	2.77	0.53
13’ to 20’	120	50	0.30	0.36	2.77	0.53

Table 8: Design Parameters for Structure 4/Boring B-22

Layer	Unit Weight (psf)	Cohesion (ksf)	Comp. Strength (ksf)	Rankine Earth Pressure Coefficients		
				Active	Passive	At-Rest
0 to 6’	120	50	0.20	0.36	2.77	0.53
6’ to 8’	115	0	0.10	0.36	2.77	0.53
8’ to 13’	120	0	0.00	0.36	2.77	0.53
13’ to 20’	120	50	0.20	0.36	2.77	0.53

Grade Slabs

We understand that the slab of the structures at this site will be a soil supported cast-in-place concrete, grade-slab. We therefore recommend that slabs be jointed, reinforced and/or doweled in appropriate locations in order to allow differential and rotational movement between parts of the slab without uncontrolled cracking or sharp vertical displacements.

We further recommend that a re-compacted modulus of subgrade reaction of **140** pounds per cubic inch be used for the *on-site sandy soils* for design of slab reinforcement at this site. In addition, an underslab vapor barrier should be included where finished areas will receive floor coverings. Slab design and construction using vapor barriers should be performed using methods detailed in the ACI Manual of Concrete Practice.
Construction activities and exposure to the environment can cause deterioration of the prepared subgrades. Therefore, we recommend that the subgrades be observed and compaction tests performed by a qualified geotechnical engineer or engineering technician in order to confirm suitability of the soil subgrades.

BASIS FOR RECOMMENDATIONS

The recommendations presented in this report are based on our understanding of the project information, our interpretation of the data obtained during our investigation and provided to us, as well as our experience with similar soil and project conditions. The Standard Penetration Tests (SPT) values obtained at the boring locations have been used to estimate existing soil conditions at this specific site. Regardless of the thoroughness of this investigation, it is possible that the soil conditions intermediate of the borings and sounding vary from the soil conditions encountered at the boring and sounding locations. Therefore, it will be necessary for a geotechnical engineer or qualified engineering technician to be present during grading operations in order to evaluate and document that the anticipated design conditions actually exist.

CLOSING

Once again we appreciate the opportunity to provide our services for your geotechnical consulting needs. If there are any questions concerning our recommendations or if additional information becomes available please contact us at 803.750.1510.

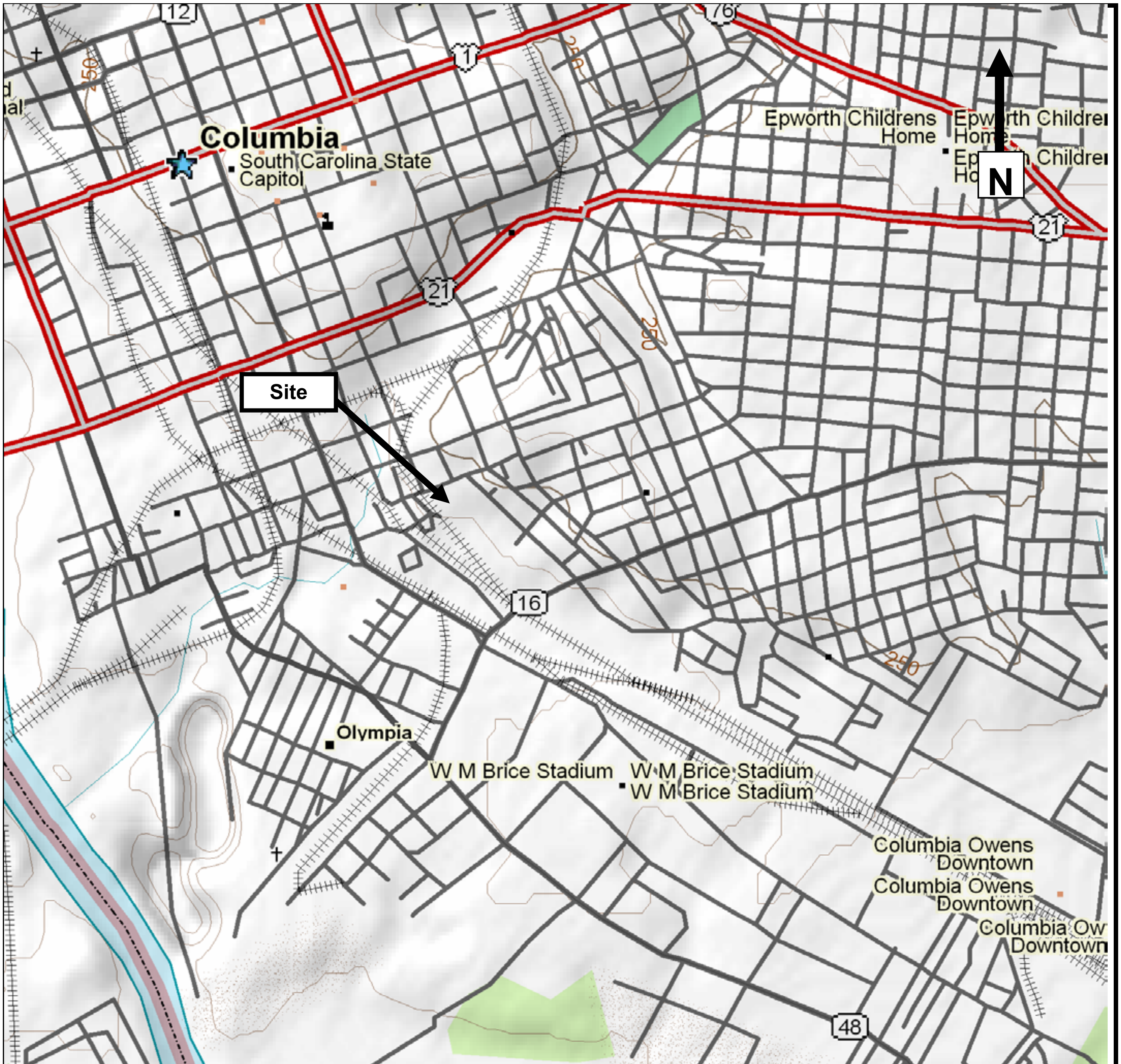
Sincerely,
GS2 ENGINEERING & ENVIRONMENTAL CONSULTANTS, INC.

Mark W. King
Staff Geotechnical Professional

Ryan Macdonald
Operations Manager

Robert C. Bruorton, P.E.
Chief Geotechnical Engineer, AVP

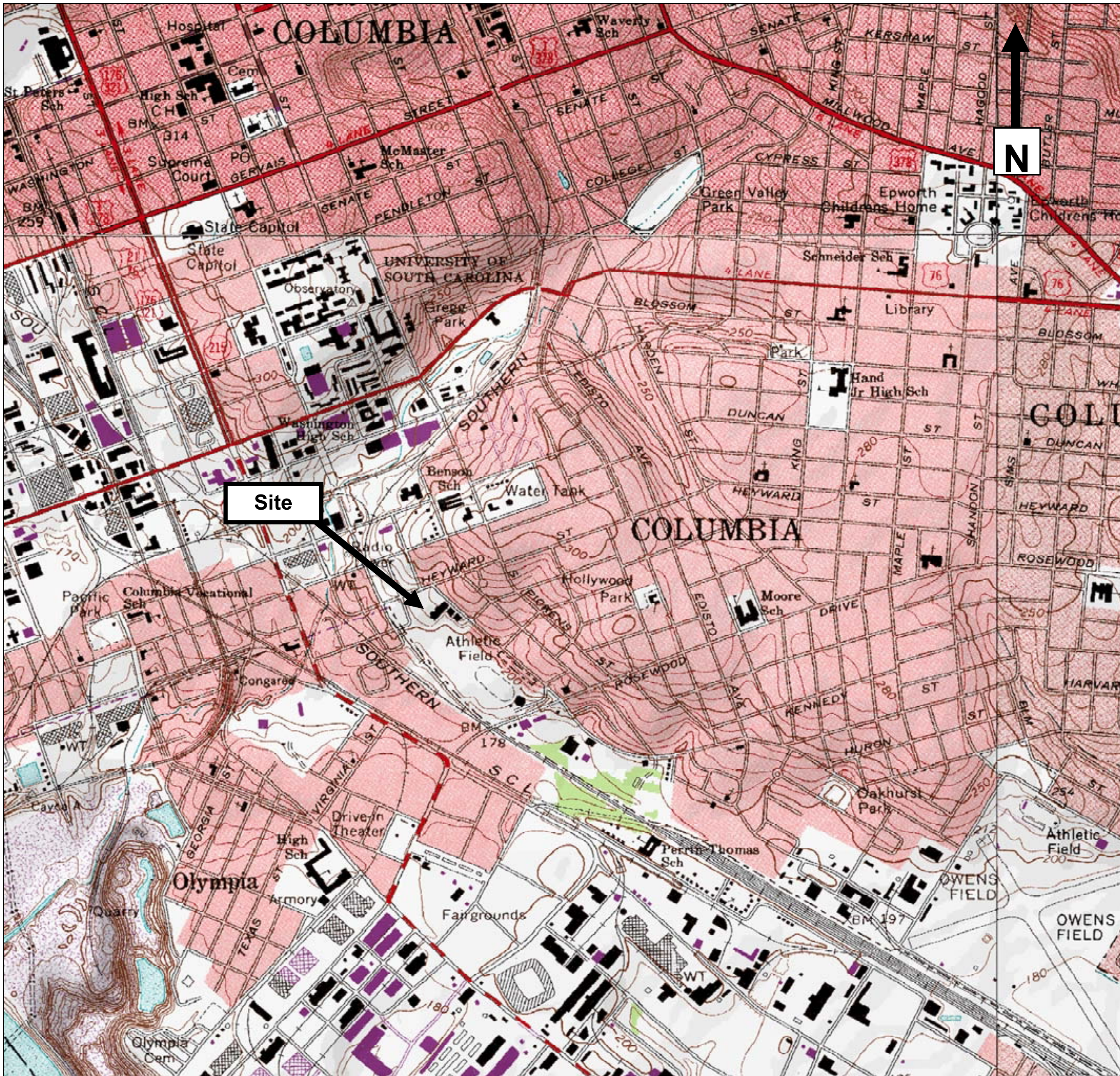
APPENDIX A



Source: Presented by DeLorme, dated 1999.

Prepared By\Date: MK\03/09
Checked By\Date: CB\03/09

GS2 ENGINEERING & ENVIRONMENTAL CONSULTANTS, INC.	**Site Location Map** Proposed Tennis Complex Heyward Street Columbia, South Carolina
The University of South Carolina Campus Planning and Construction 743 Greene Street Columbia, South Carolina	**Scale** 1 inch = 2300 feet **Figure 1**



Source: Southwest Columbia USGS Topographic Quadrangle, dated 1999.

Prepared By\Date: MK\03/09
Checked By\Date: CB\03/09

GS2
ENGINEERING & ENVIRONMENTAL CONSULTANTS, INC.

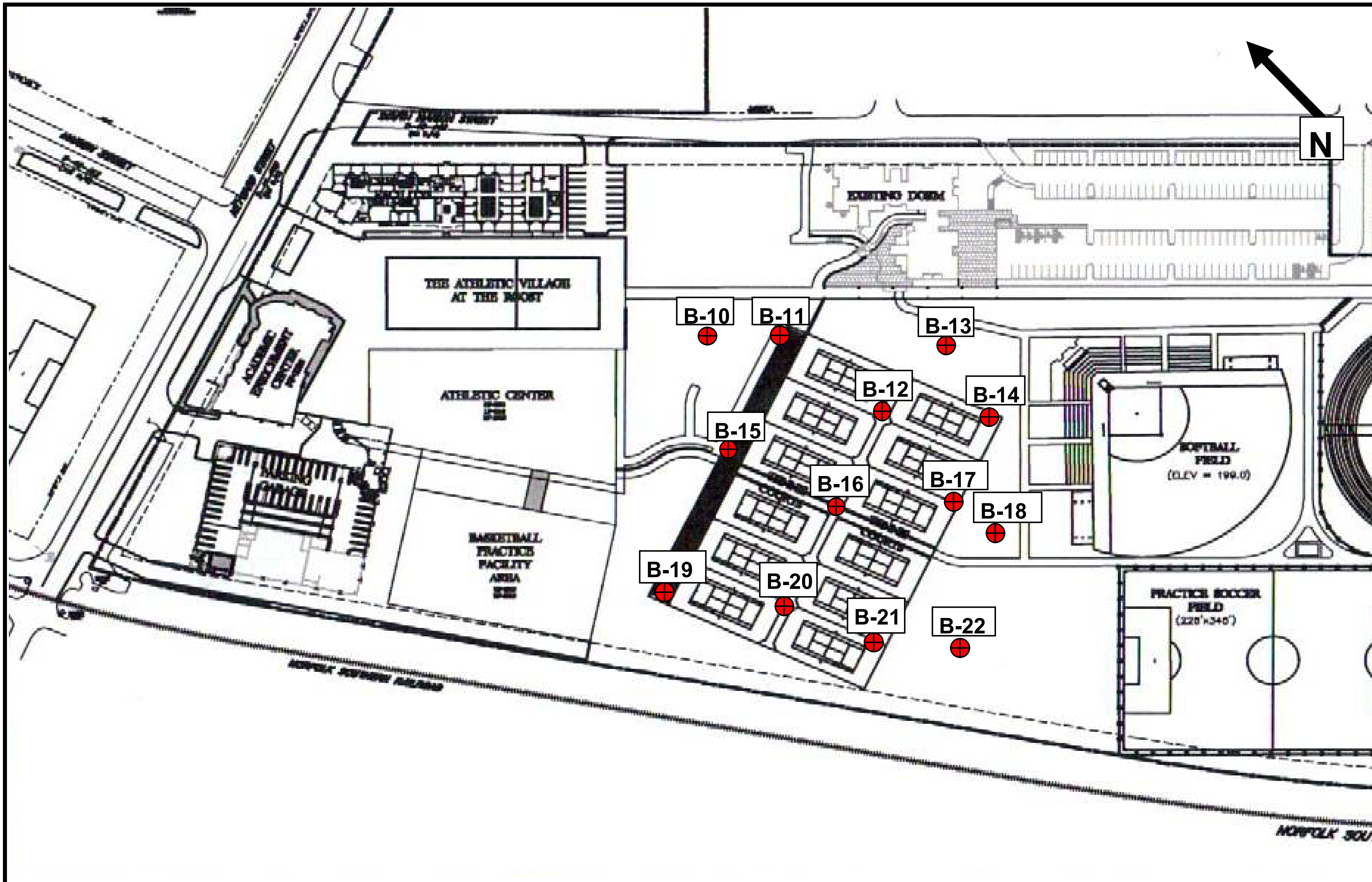
USGS Topographic Map
Proposed Tennis Complex
Heyward Street
Columbia, South Carolina

The University of South Carolina
Campus Planning and Construction
743 Greene Street
Columbia, South Carolina

Scale

1 inch = 2000 feet

Figure 2



Source: Overall Site Plan, produced by BP Barber, Dated January 7, 2008

GS2 ENGINEERING & ENVIRONMENTAL CONSULTANTS, INC.

Boring Location Plan
Proposed Tennis Complex
Heyward Street
Columbia, South Carolina

Prepared By\Date: **MK \03/09**
Checked By\Date: **CB \03/09**

Scale
AS SHOWN

Figure 3

APPENDIX B

Soil Test Boring Log Key

Soil Test Boring Logs

SOIL TEST BORING LOG KEY

The color/pattern soil description detailed below appears in the remarks section of the SOIL TEST BORING LOGS in the Appendix of this report.

COLOR/PATTERN	PRIMARY SOIL TYPE	DESCRIPTION
	SURFACE MATERIALS	Surface Materials include: topsoil, gravel, asphalt GAB, concrete, etc. Topsoils typically combine a mixture of soils and organic materials. Topsoils are typically recognized through texture and odor.
	SANDS	Sands are considered to be a granular soil type with no cohesive properties. Grain sizes are categorized as fine (falls between 0.075 and 0.420 mm. in diameter), medium (falls between 0.420 and 2 mm. in diameter) or coarse (falls between 2 and 4.75 mm. in diameter).
	SILTS	Silt grain sizes typically fall between 0.002 and 0.075 mm. in diameter. The Atterberg's limits for silts typically plot below the A-Line on a Plasticity Chart. Silts are typically distinguished as having a Low Plasticity (P.I. is between 0 and 22) or as having a High Plasticity (P.I. is between 22 and 59). Silts exhibit some cohesive properties.
	CLAYS	Clay grain sizes typically are smaller 0.002 mm. in diameter. The Atterberg's limits for clays typically plot on or above the A-Line on a Plasticity Chart. Clays are typically distinguished as having a Low Plasticity (P.I. is between 0 and 22) or as having a High Plasticity (P.I. is between 22 and 59). Clays exhibit strong cohesive properties.

Note: The above detailed colors/patterns are indicative of the predominant soil type observed in the indicated soil strata at the Boring locations for the subject site. Secondary soil types are touched upon in the Soil Description column of the BORING LOGS. All soil descriptions are based on visual and textural properties observed in the recovered soils. No laboratory tests were performed on the soils described in this report, unless noted within the remarks column of the logs.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** **Boring Number:** **B-10**

Project Number: **09-3093-G** **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	13	
3				
4	FILL: Loose Grey and Tan Clayey Fine to Medium SAND. (SC)			
5		3-1/2' to 5'	6	
6				
7	COASTAL PLAIN: Very Firm Orange and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	26	
9	Firm Yellow and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	20	
11				
12				
13				
14	Very Firm Orange and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
15		13-1/2' to 15'	25	
16				
17				
18				
19	Firm Grey and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
20		18-1/2' to 20'	20	

Depth of Boring (feet): 20 feet

Depth of Groundwater T.O.B.(feet): 6 feet

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-11**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FiLL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	12	
3				
4	COASTAL PLAIN: Dense to Very Dense Orange and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
5		3-1/2' to 5'	36	
6				
7				
8		6' to 7-1/2'	50/5"	
9	Very Dense Yellow and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	64	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-12**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Loose Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	9	
3				
4				
5		3-1/2' to 5'	9	
6				
7	COASTAL PLAIN: Very Firm Brown, Orange, and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	25	
9	Very Firm Grey and Orange Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	27	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet | Location of Boring: See Boring Location Plan

Depth of Groundwater T.O.B.(feet): Not Encountered | Method of drilling: Hollow Stem Auger

Depth of Groundwater 24 hrs.(feet): Not Available | Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-13**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
1	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	18	
3				
4	FILL: Loose Brown and Tan Fine to Medium SAND. (SP)			
5		3-1/2' to 5'	8	
6				
7	COASTAL PLAIN: Very Firm Orange and Tan Clayey Fine to Medium SAND. (SC)			
8		6' to 7-1/2'	26	
9	Very Firm Yellow and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	29	
11				
12				
13				
14	Very Dense Orange and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
15		13-1/2' to 15'	50/5"	
16				
17				
18				
19	Very Firm Grey and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
20		18-1/2' to 20'	30	

Depth of Boring (feet): 20 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** — **Boring Number:** **B-14**

Project Number: **09-3093-G** — **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	12	
3				
4				
5		3-1/2' to 5'		
6			11	
7	FILL: Loose Dark Grey and Black Clayey Fine to Medium SAND with organics. (SC-OL)			
8		6' to 7-1/2'	6	
9	COASTAL PLAIN: Firm Grey and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	15	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **<u>Proposed Tennis Complex</u>** **Boring Number:** **<u>B-15</u>**

Project Number: **<u>09-3093-G</u>** **Date of Test:** **<u>February 12, 2009</u>**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Loose Brown and Orange Clayey Fine to Medium SAND. (SC)	0 to 1-1/2'	7	
2				
3				
4	COASTAL PLAIN: Very Firm Yellow and Pink Silty, Clayey Fine to Medium SAND. (SM-SC)			
5		3-1/2' to 5'	30	
6				
7	Very Firm Yellow and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	20	
9				
10		8-1/2' to 10'	27	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): <u>10 feet</u>

Depth of Groundwater T.O.B.(feet): <u>Not Encountered</u>

Depth of Groundwater 24 hrs.(feet): <u>Not Available</u>

Location of Boring: <u>See Boring Location Plan</u>

Method of drilling: <u>Hollow Stem Auger</u>

Performed By: <u>GS2 Engineering</u>

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex**

Boring Number: **B-16**

Project Number: **09-3093-G**

Date of Test: **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Loose Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	9	
3				
4	COASTAL PLAIN: Dense Orange and Brown Silty, Clayey Fiine to Medium SAND. (SM-SC)			
5		3-1/2' to 5'	42	
6				
7	Dense Orange and Grey Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	36	
9				
10		8-1/2' to 10'	39	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Location of Boring: See Boring Location Plan

Depth of Groundwater T.O.B.(feet): Not Encountered

Method of drilling: Hollow Stem Auger

Depth of Groundwater 24 hrs.(feet): Not Available

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** **Boring Number:** **B-17**

Project Number: **09-3093-G** **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Firm Brown and Tan Clayey Fine to Medium SAND. (SC)	0 to 1-1/2'	11	
2				
3				
4	FILL: Loose Brown and Tan Clayey Fine to Medium SAND. (SC)			
5		3-1/2' to 5'	9	
6				
7				
8		6' to 7-1/2'	6	
9				
10		8-1/2' to 10'	7	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-18**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
1	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)	0 to 1-1/2'	13	
2				
3				
4	FILL: Loose Grey and Tan Clayey Fine to Medium SAND. (SC)			
5		3-1/2' to 5'	7	
6				
7	FILL: Loose Orange and Tan Clayey Fine to Medium SAND. (SC)	6' to 7-1/2'	5	
8				
9	FILL: Loose Yellow and Tan Clayey Fine to Medium SAND. (SC)			
10		8-1/2' to 10'	8	
11				
12				
13				
14	FILL: Firm Dark Grey and Black Clayey Fine to Medium SAND with orgaincs. (SC-OL)			
15		13-1/2' to 15'	18	
16				
17				
18				
19	COASTAL PLAIN: Firm Grey and Tan Silty, Clayey Fine to Medium SAND. (SM-SC)			
20		18-1/2' to 20'	26	

Depth of Boring (feet): 20 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-19**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Firm Brown and Tan Clayey Fine to Medium SAND. (SC)	0 to 1-1/2'	20	
2				
3				
4	COASTAL PLAIN: Very Dense Grey and Yellow Silty, Clayey Fine to Medium SAND. (SM-SC)			
5		3-1/2' to 5'	50/5"	
6				
7	Very Dense Orange, Brown, and Yellow Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	79	
9	Dense Orange and Tan Silty Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	37	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Location of Boring: See Boring Location Plan

Depth of Groundwater T.O.B.(feet): Not Encountered

Method of drilling: Hollow Stem Auger

Depth of Groundwater 24 hrs.(feet): Not Available

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex**

Boring Number: **B-20**

Project Number: **09-3093-G**

Date of Test: **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Loose Orange and Brown Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	10	
3				
4	FILL: Loose Tan Fine to Medium SAND. (SP)			
5		3-1/2' to 5'	9	
6				
7	COASTAL PLAIN: Dense Orange, Red, and Yellow Silty, Clayey Fine to Medium SAND. (SM-SC)			
8		6' to 7-1/2'	39	
9	Dense Orange and Red Silty, Clayey Fine to Medium SAND. (SM-SC)			
10		8-1/2' to 10'	34	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex**

Boring Number: **B-21**

Project Number: **09-3093-G**

Date of Test: **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Very Firm Brown Fine to Medium SAND. (SP)	0 to 1-1/2'	23	
2				
3				
4	FILL: Loose Brown and Orange Clayey Fine to Medium SAND. (SC)			
5		3-1/2' to 5'	6	
6				
7	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
8		6' to 7-1/2'	20	
9	FILL: Firm Brown and Tan Fine to Medium SAND. (SP)			
10		8-1/2' to 10'	13	
11	Boring Terminated at 10 Feet.			
12				
13				
14				
15				
16				
17				
18				
19				
20				

Depth of Boring (feet): 10 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.

SOIL TEST BORING LOG

Project Name: **Proposed Tennis Complex** | **Boring Number:** **B-22**

Project Number: **09-3093-G** | **Date of Test:** **February 12, 2009**

Depth (feet)	Soil Description	Sample Interval	Blow Counts*	Remarks
	SURFACE MATERIAL: 3 Inches ofTopsoil.			
1	FILL: Firm Brown and Orange Clayey Fine to Medium SAND. (SC)			
2		0 to 1-1/2'	13	
3				
4	FILL: Firm Brown, Red, and Tan Clayey Fine to Medium SAND. (SC)			
5		3-1/2' to 5'	12	
6				
7	FILL: Loose Brown and Tan Fine to Medium SAND. (SP)			
8		6' to 7-1/2'	7	
9	FILL: Very Loose Brown and Orange Clayey Fine to Medium SAND. (SC)			
10		8-1/2' to 10'	W O H	
11				
12				
13				
14	FILL: Loose Brown and Orange Clayey Fine to Medium SAND. (SC)			
15		13-1/2' to 15'	6	
16				
17				
18				
19	FILL: Firm Dark Grey and Black Clayey Fine to Medium SAND with organics. (SC-OL)			
20		18-1/2' to 20'	15	

Depth of Boring (feet): 20 feet

Depth of Groundwater T.O.B.(feet): Not Encountered

Depth of Groundwater 24 hrs.(feet): Not Available

Location of Boring: See Boring Location Plan

Method of drilling: Hollow Stem Auger

Performed By: GS2 Engineering

* The Blow Counts given above are recorded for a 140 pound hammer (falling 30 inches/blow) to drive a 2 inch O.D., 1.375 inch I.D. split-barrel sampler 12 inches, after an initial 6 inch seating increment.