Geotechnical Engineering Report

Consolidated Communications Facility
MacDill Air Force Base
Hillsborough County, Florida
October 12, 2010
Project No. 37105045

Prepared for:
STOA Architects
Pensacola, Florida

Prepared by:
Terracon Consultants, Inc.
Orlando, Florida

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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

October 12, 2010

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Attention: Mr. Michael C. Werner, Jr., AIA
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Regarding: Geotechnical Engineering Report
Consolidated Communications Facility
MacDill Air Force Base
Hillsborough County, Florida
Terracon Project Number: 37105045

Dear Mr. Werner:

Terracon Consultants, Inc. (Terracon) has completed geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number P37100288, dated July 28, 2010 and authorized August 10, 2010. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, the design and construction of pavement sections, foundations, floor slabs, and the proposed stormwater management areas for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
Certificate of Authorization Number 8830

No 56022
10/12/10

Andrew T. Schmid, P.E.
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Principal

Enclosures
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EXECUTIVE SUMMARY

A geotechnical exploration and evaluation has been performed for the proposed Consolidated Communications Facility building planned to be constructed at MacDill Air Force Base in Hillsborough County, Florida. Fourteen (14) borings, designated B-1 through B-14, were performed to depths of approximately 15 to 40 feet below the existing ground surface in the proposed building, pavement, and stormwater management areas.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The proposed structure may be supported on shallow footings bearing on the existing site soil or on newly placed engineered fill.

- Assuming proper site preparation and any necessary subgrade repair, total and differential settlement should be within anticipated client/owner specifications.

- In-place soil typically appears suitable for re-use as general engineered fill; however, if the fines content of the soil exceeds the preferred criteria within this report (less than 7 percent), extended drying times and more stringent moisture control may be necessary.

- This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
CONSOLIDATED COMMUNICATIONS FACILITY
MACDILL AIR FORCE BASE
MACDILL AFB, HILLSBOROUGH COUNTY, FLORIDA

Project No. 37105045
October 12, 2010

1.0 INTRODUCTION

A geotechnical engineering report has been completed for the proposed Consolidated Communications Facility, which will be located at MacDill Air Force Base in Hillsborough County, Florida as shown on the Site Vicinity Map included as Exhibit A-1 in Appendix A. Fourteen (14) soil borings, designated B-1 through B-14, were performed to depths of approximately 15 to 40 feet below the existing ground surface within the areas of the proposed building, pavement, and stormwater management areas. Logs of the borings along with a Boring Location Diagram (Exhibit A-2) are included in Appendix A of this report. A description of the field exploration procedures (Exhibit A-14) is included in Appendix A. For this project, Terracon performed laboratory testing including natural moisture content tests, fines content tests (#200 sieve wash), pH and resistivity tests, organic content, atterberg limits (liquid limit and plastic limit), and limerock bearing ratio test. Laboratory testing procedures and results are included in Exhibit B in Appendix B.

Double Ring Infiltrometer (DRI) Testing

Terracon performed three double ring infiltrometer (DRI) tests within the proposed stormwater management areas east, south, and west of the proposed building. The site soil was excavated to the test depth of about 18 inches. The DRI test was conducted by driving two concentric metal rings into the soil, the outer ring being 24 inches in diameter and the inner ring being 12 inches in diameter. Once the metal rings were properly seated into the soil, both rings were partially filled with water. The water level was maintained for approximately 4 hours, allowing the flow rate to stabilize.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- stormwater management design parameters
- floor slab design and construction
- pavement design and construction
- foundation design and construction

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Appendix A, Exhibit A-2: Boring Location Diagram
Structures	The project will include the demolition of the existing building (Building 265) and the construction of a new two-story building with a proposed footprint of approximately 170 feet by 70 feet.
Building construction	Structural masonry block walls and steel components.
Finished floor elevations	+15.00 feet (proposed)
Maximum loads	Columns: 50 kips (assumed) Walls: 5 klf (assumed) Slabs: 125 psf (assumed)
Maximum allowable settlement	Total: 1-inch (assumed) Differential: ½ inch (assumed)
Grading	Fill – Estimated between 3 to 4 feet.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	The project will be located on MacDill AFB property, at the southeast corner of Florida Keys Avenue and Cypress Stand Street in Hillsborough County, Florida.
Existing improvements	Existing parking lots and driveway pavement, also assumed to be removed prior to proposed construction.
Current ground cover	Building and pavement over portions of the site followed by areas covered with grass.
Existing topography	Site appears nearly level, with elevations ranging from 8 to 12 feet, sloping to the east. The USGS quadrangle map St. Petersburg, Florida depicts slightly rolling terrain with no discernable ground slope trend around the project vicinity, with ground surface elevations are on the order of 5 to 10 feet (National Geodetic Vertical Datum of 1988 – NGVD88).

3.0 SUBSURFACE CONDITIONS

3.1 Geology

3.1.1 Regional Geology

C. Wythe Cooke (Geology of Florida, Florida Geologic Survey Bulletin 29) defines two physiographic regions in Hillsborough County: the Coastal Lowlands which encompasses the western and southern portions of the county and the Central Highlands which encompasses the northeastern part of the county. The Coastal Lowlands consist of low, nearly level plains lying near Tampa Bay. The Central Highlands exist as gently undulating and rolling terrain.

Beneath the surficial soils defined by the Soil Survey of Hillsborough County typically lie unclassified sandy soils, in turn underlain by the Hawthorn Group. The Hawthorn Group acts as a confining layer, typically separating the surficial groundwater regime from the underlying Floridan Aquifer. The Hawthorn Group is generally composed of gray to green, clayey sands to sandy clays, and frequently contains a variable fraction of phosphate. The Floridan Aquifer is the principal source of drinking water for the majority of the State of Florida and lies within the layers of limestone typically, though not always, blanketed by the Hawthorn Group.

The northern majority of the Florida Peninsula is located in an area of karst topography. Karst topography is characterized by the aforementioned limestone, the surface of which is frequently uneven. The limestone is subject to dissolution, creating voids into which overlying soil ravels and frequently washes. As this process continues, the overlying soil loses support and collapses, forming a sinkhole. Where it exists, the Hawthorn Group typically provides a barrier that keeps overlying soil from washing into voids forming the underlying limestone.

3.1.2 General Potential for Sinkhole Development

The USGS has prepared a map which identifies areas of sinkhole occurrence in Florida. This map, the Sinkhole Type, Development, and Distribution in Florida map (prepared by the USGS, in cooperation with state agencies, 1985), divides Florida into four areas based on the type and thickness of cover overlying soluble rock. These areas, designated I through IV, have varying potentials for sinkhole development as follows:

Area I – Sinkholes are few.
Area II – Sinkholes are few.
Area III – Sinkholes are numerous.
Area IV – Sinkholes are very few.

Review of the map listed above indicates site is within Area III.

Area III typically has soil cover between 30 and 200 feet thick overlying limestone. The soil cover is generally cohesive clayey sediments of low permeability. Sinkholes are most numerous, of varying size, and develop abruptly. Cover-collapse sinkholes dominate in Area III.

Certain potential sinkhole indicators, such as loss of circulation of drilling fluid and particularly loose/soft soils, were encountered within the boreholes. A consistent confining layer (significantly clayey soils), typically associated with a lower sinkhole development potential, was encountered at this site, with the exceptions of soil boring no. B-1, where a confining layer was absent, and soil boring no.'s B-5 and B-9, where a minimal confining layer was encountered above the limestone strata. Although the limestone generally appeared weathered, the SPT N-values indicated consistently dense/stiff conditions – generally a sign of lower sinkhole development potential.

If a more definitive estimation of sinkhole potential of the site is to be determined, additional site-specific data must be obtained. This might include using geophysical methods such as Electrical Resistivity tests or Ground Penetrating Radar and additional geotechnical tests such as Cone Penetrometer Test (CPT) soundings and/or more/deeper Standard Penetration Test borings. Interpretation of the test data should be done by a professional geologist/engineer familiar with the use of these tests under local conditions. If requested, Terracon can assist in assessing the sinkhole potential of the location of the proposed construction.

3.2 USDA – NRCS Soil Survey

The Soil Survey of Hillsborough County, Florida, as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), dated May 1989, identifies the following soil type at the subject site. It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate.

56 – Urban land. This map unit consists of miscellaneous areas that are covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so identification is not feasible. Most of the areas of Urban land are artificially drained by sewer systems, gutters, tile drains, and surface ditches.

3.3 Typical Profile

The ground surface elevation was estimated at each soil boring location based on the site topographic information on the provided Proposed Soil Boring Location plan. Based on the results of the soil borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Existing Pavement [1]	0.5	Asphalt (2 to 3 inches) over limerock base (2 to 3 inches)	Not applicable
Stratum 1	0 to 7	Sand to Sand with silt (SP, SP-SM)	Very Loose to Medium dense (3 to 16 bpf) [2]
Stratum 2	7 to 10	Sand with trace organics (SP)	Loose to Medium dense (9 to 25 bpf) [2]
Stratum 3	10 to 18	Silty to Clayey Sand (SM, SM-SC, SC)	Loose to Medium dense (5 to 13 bpf) [2]
Stratum 4	18 to 23	Clay (CH) with some mottling and trace shell fragments [3.4]	Firm to Very Stiff (7 to 33 bpf) [2]
Stratum 5	23 to 40 (Maximum boring termination depth)	Weathered Limestone	Medium dense to Very dense (10 to 50+ bpf) [2]

[1] Borings B-3 and B-11 were located within existing pavement. The remaining Borings encountered grass over topsoil at corresponding depths.

[2] Range of Standard Penetration Test (SPT) resistance values or "N-values", blows per foot.

[3] Mottling is irregular spots of color, different than the prevailing soil color. Mottling is indicative of poor aeration and impeded drainage.

[4] Boring B-1 did not encounter stratum 4 and Borings B-5 and B-9 encountered a thickness of stratum 4 of 1 to 1.5 feet.

Conditions encountered at each soil boring location are indicated on the individual soil boring logs. Stratification boundaries on the soil boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the soil borings can be found on the soil boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-14 in Appendix A. Descriptions of our laboratory testing procedures are included as Exhibit B-1 in Appendix B. Laboratory test results are included in Exhibits B-2, B-3, and B-4 in Appendix B.

Limited laboratory testing indicates Stratum 1 should be classified as fine sand to fine sand with silt (SP, SP-SM) per the Unified Soil Classification System (USCS, description included as Exhibit C-2 in Appendix C). These soils may be suitable for reuse as general engineered fill or pavement stabilized subbase material; this is discussed in greater detail in the Section 4.2 and 4.7 (Earthwork and Pavements, respectively) of this report.

The upper surface of the clayey sand, based on our visual-manual review of the soil samples and the results of our laboratory testing, should be considered a confining layer. Laboratory testing (Liquid Limit and Plastic Limit) also suggests the clayey sand has relatively low shrink/swell potential.

A sample was taken from Soil Borings B-1, B-3, and B-9 at the location of the proposed development. These samples were submitted to corrosion series testing including measurements of pH and resistivity. The pH of the soil was measured by saturating it and then using a hand held pH meter. The resistivity of the soil was measured by placing it in a plexiglass box and gradually increasing the moisture content of the soil sample while passing an electric current through it until the lowest electrical resistance reading was obtained. Laboratory testing indicates the soils at the proposed development location should be classified as “slightly aggressive” per FDOT Structural Design Guidelines.

3.4 Groundwater

The boreholes were observed while drilling for the presence and level of groundwater. Groundwater was observed in the borings during drilling at depths of approximately 2 ½ to 3 ½ feet below existing grade, prior to the addition of bentonite drilling slurry.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, ocean tide levels, runoff, and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the June through August peak of the wet season, with rainfall and recharge at a maximum, groundwater levels will be about 1½ to 2 ½ feet below the existing grade, at the Boring Locations. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, USGS topographic data, the provided site topographic data, the encountered soil types, the encountered soil colors, and the encountered water levels. As often required for permitting, the estimated seasonal high water tables are included on the stormwater management area borings.

Estimates of the seasonal high water table presented in this report are based on and limited by the data collected during our geotechnical exploration, the referenced published documents, and the lack of site survey data. Estimates of the seasonal high assume normal precipitation volumes and distribution. The seasonal high water table in any particular year will vary depending upon whether that year is a “wet” year, a “dry” year, or a “normal” year. These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high water table will be affected by any extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on our around the site following the date of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

It is our opinion that the proposed Consolidated Communications Facility building could be supported on shallow spread footings if the recommended site preparation procedures are implemented at the site. The site also appears suitable for support of concrete and asphalt pavements.

The sandy site soils generally appear acceptable for reuse as structural fill. Depending on their fines (silt) contents, extended drying times and greater moisture control may be necessary when reusing excavated soils as new fill. We anticipate stabilizing material or off-site borrow fill may be necessary for the construction of stabilized pavement subbase/subgrade courses where asphalt sections are used.

Our recommendations regarding design and construction of foundations, floor slabs, pavements, and stormwater management areas are provided in the following sections.

4.2 Earthwork

Though free groundwater was encountered in the soil borings, the potential for perching groundwater exists. Therefore, we recommend that the contractor verify the groundwater conditions/depth immediately prior to construction. If signs of perching groundwater are encountered, any dewatering necessary should commence prior to earthwork. The design of a dewatering system falls under the contractor’s choice of “means and methods”, and should be designed by a qualified contractor. Dewatering should maintain a separation of at least 2 feet between the groundwater and all compaction surfaces.

We anticipate construction will be initiated by razing the existing site improvements, including the existing pavement and buried utilities. These materials should be removed from the entire construction area. Stripping depths between our boring locations and across the site could vary and we recommend actual stripping depths be evaluated by a representative of Terracon during construction. All existing grassed areas within proposed construction areas should be stripped.

Once stripping (including removal of existing construction) is complete, the exposed subgrade should be observed, tested and proofrolled with a minimum of 10 overlapping passes of a medium or heavy weight roller (minimum 10,000 pounds static weight) operating in static mode. Prior to proofrolling, the subgrade soils should be moisture conditioned to within ±2 percent of the optimum moisture content. Proofrolling aids in providing a firm base for compaction of new fill and delineating soft or disturbed areas that may exist at or near the exposed subgrade level as well overall densification of the upper very loose to loose sands. Proofrolling should be performed in the presence of a Terracon representative in order to aid in evaluating unstable subgrade areas. Unstable areas observed at this time should be improved as recommended by the engineer based on field conditions and typically includes scarification and recompaction or by undercutting and replacement with suitable compacted fill.

Engineered fill should meet the following material property requirements:

Fill Type	USCS Classification	Acceptable Location for Placement
General [1]	SP to SP-SM (fines content < 7 percent)	All locations and elevations

[1] The in-place upper sands appear to generally meet this criterion. The underlying clayey sands do not meet this criterion.

4.2.1 Compaction Requirements

ITEM	DESCRIPTION
Fill Lift Thickness	12 inches or less in loose thickness when heavy vibratory compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density (ASTM D 1557)
Moisture Content [1]	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction
Minimum Testing Frequency	One field density test per 2,500 square feet (or fraction thereof) per lift

[1] We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

4.2.2 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.2.3 Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height. Installation of landscape drains should be considered around the back sides of curbs to collect and control landscape irrigation and other water entering through landscaping from entering the sides of the pavement sections, reducing the potential for water-related damage. Landscape drains should be routed to the stormwater collection or other positive outfall, away from the pavement.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon Consultants, Inc. should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

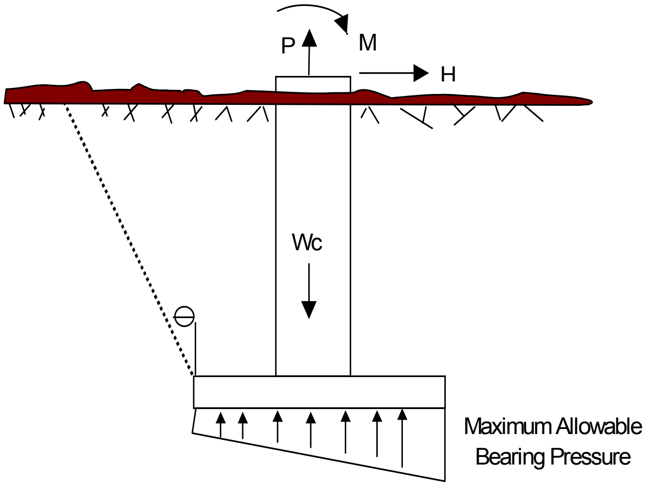
4.3 Foundations

In our opinion, the proposed structure can be supported by shallow, spread footing foundation systems bearing within the in place soil. Design recommendations for shallow foundations for the proposed structure are presented in the following paragraphs.

4.3.1 Design Recommendations

DESCRIPTION	Column Footings	Wall Footings
Net allowable bearing pressure [1]	2,500 psf	2,500 psf
Minimum footing width	30 inches	18 inches
Minimum embedment depth below finished grade [2]	24 inches	24 inches
Approximate total settlement [3]	<1 inch	<1 inch
Estimated differential settlement	<½ inch between columns	<½ inch over 40 feet
Ultimate coefficient of sliding friction [4]	0.35	0.35
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density (ASTM D 1557)	95 percent of the materials maximum Modified Proctor dry density (ASTM D 1557)
Minimum Testing Frequency	One field density test per footing to 24 inches below footing subgrade	One field density test per 100 linear feet to 24 inches below footing subgrade

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill. Based upon a Factor of Safety of 3.
2. Relative to lowest adjacent finished grade, typically exterior grade.
3. The above settlement estimates have assumed that the maximum footing size is 4.5 feet for column footings and 2 feet for continuous footings.
4. Sliding friction along the base of the footings will not develop where net uplift conditions exist.

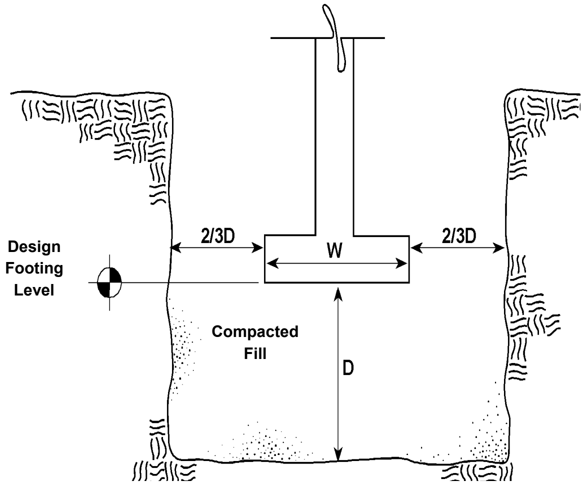


Uplift resistance can be developed from the weight of the footings, the effective weight of any overlying soil, and the weight of the supported structure itself. The effective unit weight of the soil can be assumed to be 105 pcf above the highest possible groundwater level and 43 pcf below. Soil uplift resistance may be calculated as the weight of the soil prism defined by a diagonal line extending from the perimeter of the foundation to the ground surface at an angle θ equal to 20 degrees from the vertical. Under large moment and/or shear loading, the effective size of the uplift soil prism may be reduced. An appropriate safety factor should be applied.

4.3.2 Construction Considerations

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed prior to placing concrete. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

Terracon anticipates hand-operated compaction equipment will be utilized, as necessary, in footing cuts, following any mass grading. If unsuitable bearing soils are encountered in footing excavations, the excavation should be extended deeper to suitable soils and the footing could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation per the preceding general earthwork specifications, using hand operated compaction equipment in footing cuts. The overexcavation and backfill procedure is described in the previous figure.



Note: Excavation in sketch is shown vertical for convenience. Excavations should be sloped as necessary for safety and the angle of repose of the soil.

4.3.3 Below Grade Facilities

Based upon the proposed finished floor elevation of the building and encountered groundwater levels, it is our understanding that a below grade communication vault will be not be constructed beneath the seasonal high water level for the site. However, due to surface water runoff, it is recommended that all protrusions through the vault walls are sealed to prevent the possibility of surface water intrusion.

Further, based upon the corrosion testing results, we recommend that all external concrete surfaces cast against earth or for concrete surfaces in contact with water have a minimum 4-inch cover on all reinforcing steel. If structural steel is placed against earth, we recommend providing a minimum of ¼-inch of sacrificial steel thickness or cathodic protection to that member.

4.4 Seismic Considerations

Florida is under the jurisdiction of its own building code as opposed to the International Building Code. The Florida Building Code does not have a requirement or provision for evaluating seismic potential. Florida is generally regarded to be in a zone of low seismic risk. Therefore, we do not consider seismic effects to be a concern at this site.

4.5 Floor Slab

4.5.1 Design Recommendations

ITEM	DESCRIPTION
Floor Slab Support	Free draining granular material meeting the general fill specification [1]
Modulus of Subgrade Reaction	125 pounds per square inch per inch (psi/in) for point loading conditions
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density (ASTM D 1557)
Minimum Testing Frequency	One field density test per 500 square feet (or fraction thereof)

1. The in-place sandy soil appears to meet this criterion.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

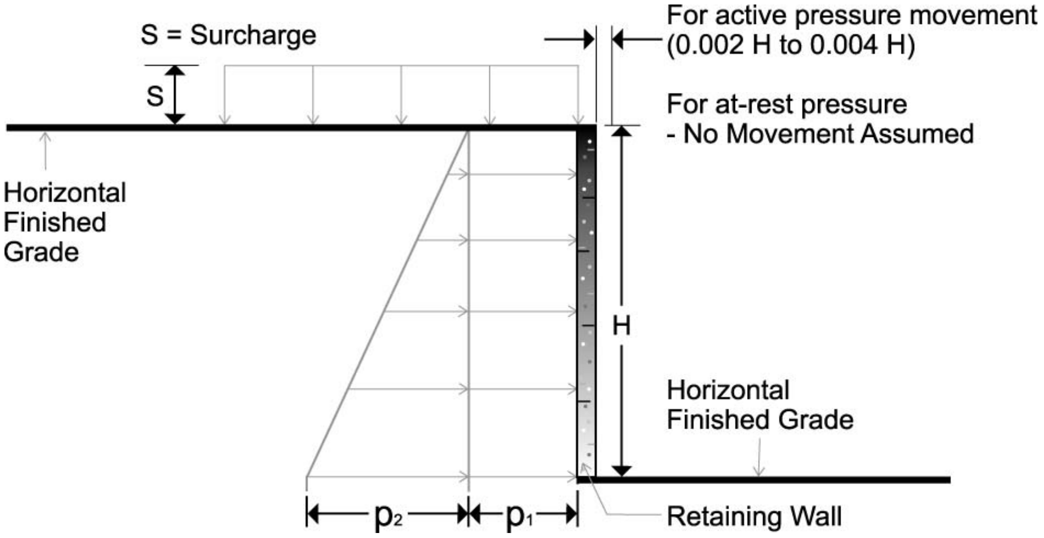
The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302, ACI 360, and Florida Building Code (FBC) Section 1807 for procedures and cautions regarding the use and placement of a vapor retarder. We note that FBC Section 1807 requires a minimum of 6-mil polyethylene, which is typically used in Florida. However, local requirements that might affect what moisture barrier may use should also be consulted.

4.6 Lateral Earth Pressures

The lateral earth pressure recommendations given in the following paragraphs are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls and walls not subject to rotation, such as building stemwalls around sunken loading docks, supply pits, or truck wells. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls.

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the following diagram. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for hydrostatic pressure on the walls.

If heavy equipment will be operated near the wall, an additional 2 feet of soil surcharge should be considered in the wall analysis. Also, we recommend using only small rollers or walk-behind compaction equipment adjacent to unsupported walls.



Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Pressure (pcf)	Surcharge Pressure, P_1	Earth Pressure, P_2
Active (K_a), no hydrostatic pressure	Granular – 0.35	35	(0.35)S	(35)H
At rest (K_0), no hydrostatic pressure	Granular – 0.52	55	(0.52)S	(55)H
Active (K_a), full hydrostatic pressure	Granular – 0.35	75	(0.35)S	(75)H
At rest (K_0), full hydrostatic pressure	Granular – 0.52	85	(0.52)S	(85)H
Passive (K_p), assumes equal hydrostatic pressure	Granular – 2.88	303	---	---

Conditions applicable to the above coefficients include:

- For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height.
- For passive earth pressure, wall must move horizontally to mobilize resistance.
- Uniform surcharge, where S is surcharge pressure.
- In-situ soil backfill moist unit weight a maximum of 105 pcf.
- Horizontal backfill compacted to at least 95 percent of Modified Proctor maximum dry density.
- Loading from heavy compaction equipment not included.
- No safety factor included.
- Ignore passive pressure within 3 feet of lowest adjacent grade.
- Parameters listed are for clean sands.

The values in the preceding table are based on the on-site soils or granular soil containing less than 7 percent fines being used as backfill behind retaining walls. Resistance to sliding could be developed through friction between the foundation and underlying soils. We recommend an ultimate coefficient of friction of 0.3 be used when calculating sliding resistance. We have assumed an angle of internal friction (Φ) equal to 29 degrees for compacted sand soils.

4.7 Pavements

It is our understanding that pavement for the proposed Consolidated Communications Facility is being designed as flexible asphaltic-concrete pavement. In order for a conventional flexible pavement to perform satisfactorily, the subgrade soils should have sufficient strength and stability to support construction traffic loading and design traffic loading

The in-place subgrade soil tested had a peak LBR value of 26. According to the FDOT Flexible Pavement Design Manual, an LBR value of 26 is equivalent to a Resilient Modulus of approximately 7,500 psi.

However, the provided Grading Plan indicates several feet of fill will be added to the site. Accordingly, the majority of the actual pavement subgrade soils will likely be new fill. Once the fill source(s) has/have been identified and tested, Terracon requests the opportunity to review the test data to determine whether adjustments should be made to our pavement section design recommendations.

The following sections present our recommendations for both flexible (asphalt) and rigid (concrete) pavement sections.

4.7.1 Flexible Pavements

The following items are applicable to flexible asphalt pavement sections, and should meet or exceed the requirements of the

- The upper 12 inches of soil beneath the base course should be selected to meet a minimum LBR value of 40. The tested sample of in-place soil meets this criterion; however, due to site soil variability, other site soils may not meet this criterion. If the base course is to bear on new fill, the new fill should be selected to meet this criterion. The intent of this item is to provide a stabilized subbase course as part of the design pavement section.

- The subbase course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density.

- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote effective surface drainage.

- Adequate separation must be provided between the bottom of the base course and the seasonal high water table. Section 5.2.2 of the FDOT Flexible Pavement Design Manual states that where less than 3 feet of separation is provided, pavement designers should reduce the design Resilient Modulus (or LBR value) as appropriate, based on the provided separation. Terracon recommends that in no case should less than 1 foot of separation be provided.

- The base course should be either limerock or an approved alternate such as washed crushed concrete. Washed crushed concrete base should meet the same LBR and density specifications as limerock base. The base thicknesses included in the following table assume the use of limerock. If a different material is used for the base course, that information should be furnished to Terracon so that we may revise our base course thickness accordingly.

- Limerock base courses should be mined from a Florida Department of Transportation (FDOT) approved source, should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness.

- The asphalt surface course may be either Marshall mix or Superpave unless restricted by USACE or other local jurisdiction.

- Marshall mix asphalt surface courses (structural) should have a minimum stability of 1,500 pounds. Asphalt should be compacted to a minimum of 96 percent of the Marshall design density. Asphalt surface courses should be Type S-I, S-II, or S-III or combination thereof as appropriate. FDOT specifications on allowable layer thickness ranges and placement sequence should be adhered to. For example, Type S-II should not be placed as the uppermost layer of asphalt. However, it may be preferable to place Type S-II beneath the uppermost asphalt layer, particularly in heavy truck volume sections.

- Based on the assumed traffic volumes, light duty sections fall under Superpave Traffic Level A, medium duty sections fall under Superpave Traffic Level B, and heavy duty and extra heavy duty sections fall under Superpave Traffic Level D. Superpave asphalt surface courses may be any type allowed by FDOT unless otherwise restricted by USACE or other local municipality. Individual layer thicknesses should be within allowable ranges as specified by FDOT. FDOT specifications on layer sequencing should be adhered to. Superpave asphalt should be compacted to a minimum of 93.5 percent of the Maximum Specific Gravity (G_{mm}) for coarse mixes, 92 percent for fine mixes. It is preferable to use a coarse mix for sections subject primarily to truck traffic; light duty sections (subject primarily to passenger vehicle traffic) may be coarse or fine mixes.

- After placement and compaction of the pavement courses, the wearing surface should be cored to evaluate material thickness and composition at a minimum frequency of one per 3,000 square feet or two locations per day's production.

- All curbing should be full depth to the bottom of base course. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

- Underdrains should be considered around all landscape islands and all other irrigated areas within or adjacent to pavements to control groundwater intrusion into the pavement base.

- All surface water should be directed away from the edges of the pavement.

Detailed vehicle loading information was not available at the time this report was prepared. However we have assumed that flexible pavement traffic will consist of only cars in light duty areas and cars, light delivery trucks and garbage trucks in heavy duty areas. The following table presents our pavement thickness recommendations for light duty (Cars only - 30,000 E_{18}SALs) and heavy duty (50,000 E_{18}SALs) sections.

Pavement Layer	**Light Duty Section[1]**	**Heavy Duty Section**	**FDOT Specification[2]**
Asphalt Surface Course	2 in	2½ in	Section 330, 331 (Marshall), 334 (Superpave)
Base Course	6 in	8 in	Section 200
Stabilized Subbase Course	12 in	12 in	Section 160
Pavement Total Thickness	20 in	22½ in	

1 Passenger car and light truck traffic only, includes 10 percent pick-up trucks/vans as well as five daily package delivery and five daily beverage delivery trucks.

2 Standard Specifications for Road and Bridge Construction, 2010 edition.

We note that Type S mixes (Section 331) are addressed in the 2000 edition (and earlier editions) of the FDOT Standards Specifications for Road and Bridge Construction. Type S mixes are still used in many non-FDOT projects. Current FDOT asphalt surface courses are typically Superpave mixes. Additionally, testing type and frequency during the construction phase shall conform to FDOT specifications as well as any local municipal requirements.

4.7.2 Rigid Pavements

For areas subject to concentrated and repetitive loading conditions such as dumpster pads and ingress/egress aprons, we recommend using a reinforced concrete pad at least 8 inches thick. For areas subject to car parking only, we recommend placing a concrete pad at least 6 inches thick. Prior to concrete placement, the subgrade should be compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test. Subgrade supporting concrete pavement should be free draining sand, which generally means restricting the fines content to less than 7 percent. The concrete pad should have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing per ASTM C-31. All concrete pavements should have proper reinforcement, jointing, and sawcutting per American Concrete Institute (ACI) standards. Any deviations from these recommendations should be in accordance with Section 350 of the FDOT Standard Specifications for Road and Bridge Construction.

The following items are applicable to rigid concrete pavement sections.

- At least one foot of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements presented in Section 4.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose. This item should not be misinterpreted to mean that only 1 foot of a granular soil buffer is necessary between the pavement and potential swelling clays.

- The tested sample of in-place soil has a Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 26. Free-draining material meeting the fill composition recommended in Section 4.2 of this report will likely have an LBR value of less than 40. Accordingly, for the purpose of calculating the required thicknesses of rigid concrete pavement for the specified traffic levels, we have assumed the fill to be placed will have an LBR value of 26. Do not stabilize rigid pavement subgrade soils with a lean clay fraction as this will tend to inhibit drainage and may lead to pavement distress.

- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 95 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557).

- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage.

- Adequate separation must be provided between the bottom of the concrete and the seasonal high water table. Terracon recommends that in no case should less than 1 foot of separation be provided.

- Concrete pavement sections should include adequate sawcuts, expansion joints, and reinforcement in accordance with Portland Cement Association (PCA) design guidelines for rigid pavements. Sawcut patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high water table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

- All surface water should be directed away from the edges of the pavement.

Listed below are rigid portland cement concrete (PCC) pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. It should be noted that these systems were derived based on general characterization of the subgrade and the assumption that concrete with a compressive strength of at least 4,000 psi will be utilized for all concrete pavements at the project. Further, we assume the concrete has a modulus of rupture of at least 580 psi. The following table does not include the thickness of the compacted subgrade because the compacted subgrade is assumed to be in-place soils rather than a pavement structural layer.

Pavement Layer	**Light Duty Section**[1]	**Heavy Duty Section**	**FDOT Specification**[2]
Reinforced Concrete	6 in	8 in	Section 350

1 Passenger car and light truck traffic only, includes 10 percent pick-up trucks/vans as well as five daily package delivery and five daily beverage delivery trucks.

2 Standard Specifications for Road and Bridge Construction, 2010 edition.

4.8 Stormwater Management Design Parameters

Only basic anticipated stormwater management system details have been provided to Terracon as of the date of this report (dry retention versus wet detention, depth, shape, location, etc.). Once the civil/drainage engineer has begun design of the proposed stormwater management areas, we recommend that the civil/drainage engineer verify the proper design parameters with Terracon, particularly because of the variability of parameters based on location.

Field permeability testing yielded a measured permeability rate of 11 to 18 feet/day. The measured permeability rate should be considered a vertical permeability rate. Based on our experience with similar soils, we estimate the corresponding horizontal permeability rate is 17 to 27 feet/day, based on a ratio of the horizontal permeability to the vertical permeability of approximately 1.5. We recommend applying a factor of safety of 2 to these values for design and recovery analysis of the proposed stormwater management areas. This translates to design values of 8 to 13 feet/day and 5 to 9 feet/day, respectively, for the horizontal saturated hydraulic conductivity rate (k_H) and the vertical unsaturated infiltration rate (k_V).

The SPT borings at the proposed stormwater management area locations and throughout the site encountered fine sands with a moderate amount of fines (silt), underlain by medium dense to dense clayey sands. The clayey sand should be considered a confining layer for purposed of stormwater management area design. Groundwater was encountered at a depth of approximately 2.5 to 3 feet below existing grade or approximate elevation +5.5 to +6.0 feet NGVD. Using the provided site survey and topographic information, we estimate seasonal high water table depth of 1.5 to 2 feet at the Boring Locations, corresponding to an elevation of +6.5 to +7.0 feet NGVD. Based upon our visual review and laboratory testing of the surficial sands, and our experience with similar projects, we recommend that you consider the surficial aquifer (the site sands) to have a fillable porosity (η) of 25 percent. The following table summarizes our recommended stormwater management system design parameters.

Parameter	**SMA – West (Boring Locations B-9 and B-10)**	**SMA – South (Boring Locations B-6 and B-8)**	**SMA – East (Boring Location B-14)**
Estimated Confining Layer Elevation, B	-15 feet	-10 feet	-15 feet
Estimated Seasonal High Water Table Elevation, WT	+6.0 feet	+6.5 feet	+6.5 feet
Vertical Unsaturated Infiltration Rate, k_V	5 feet/day	6 feet/day	9 feet/day
Horizontal Saturated Hydraulic Conductivity, k_H	8 feet/day	9 feet/day	13 feet/day
Fillable Porosity, η	25 percent	25 percent	25 percent

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

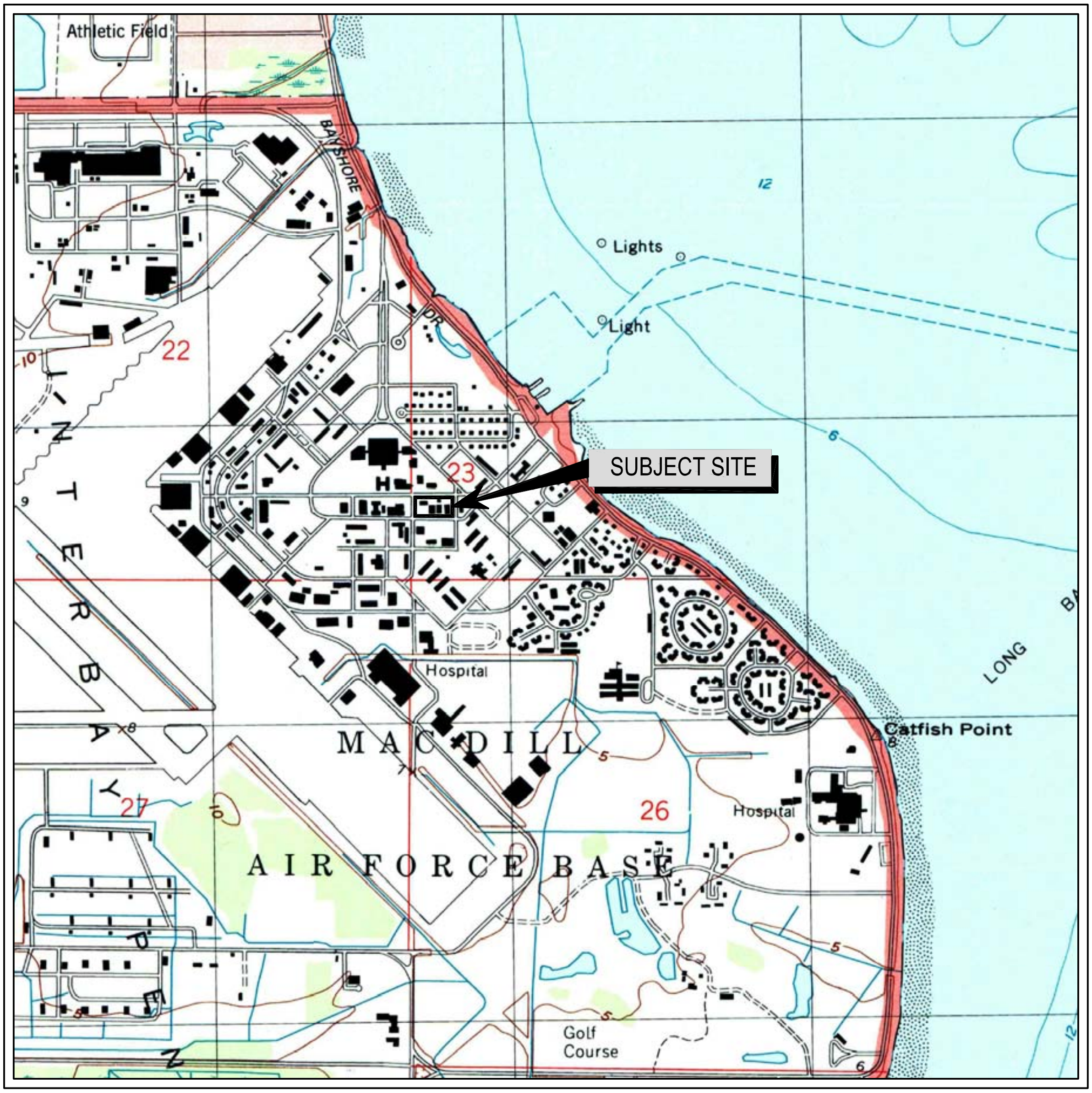
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

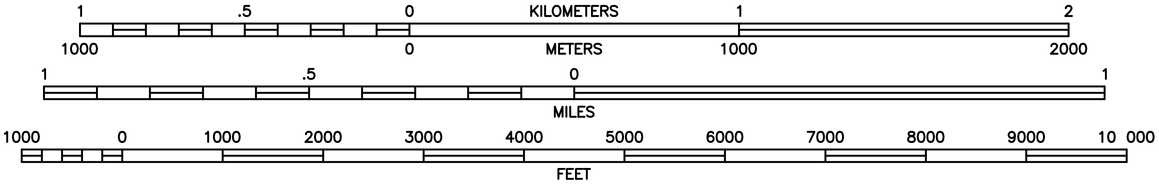
APPENDIX A

FIELD EXPLORATION

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



SCALE 1:24 000



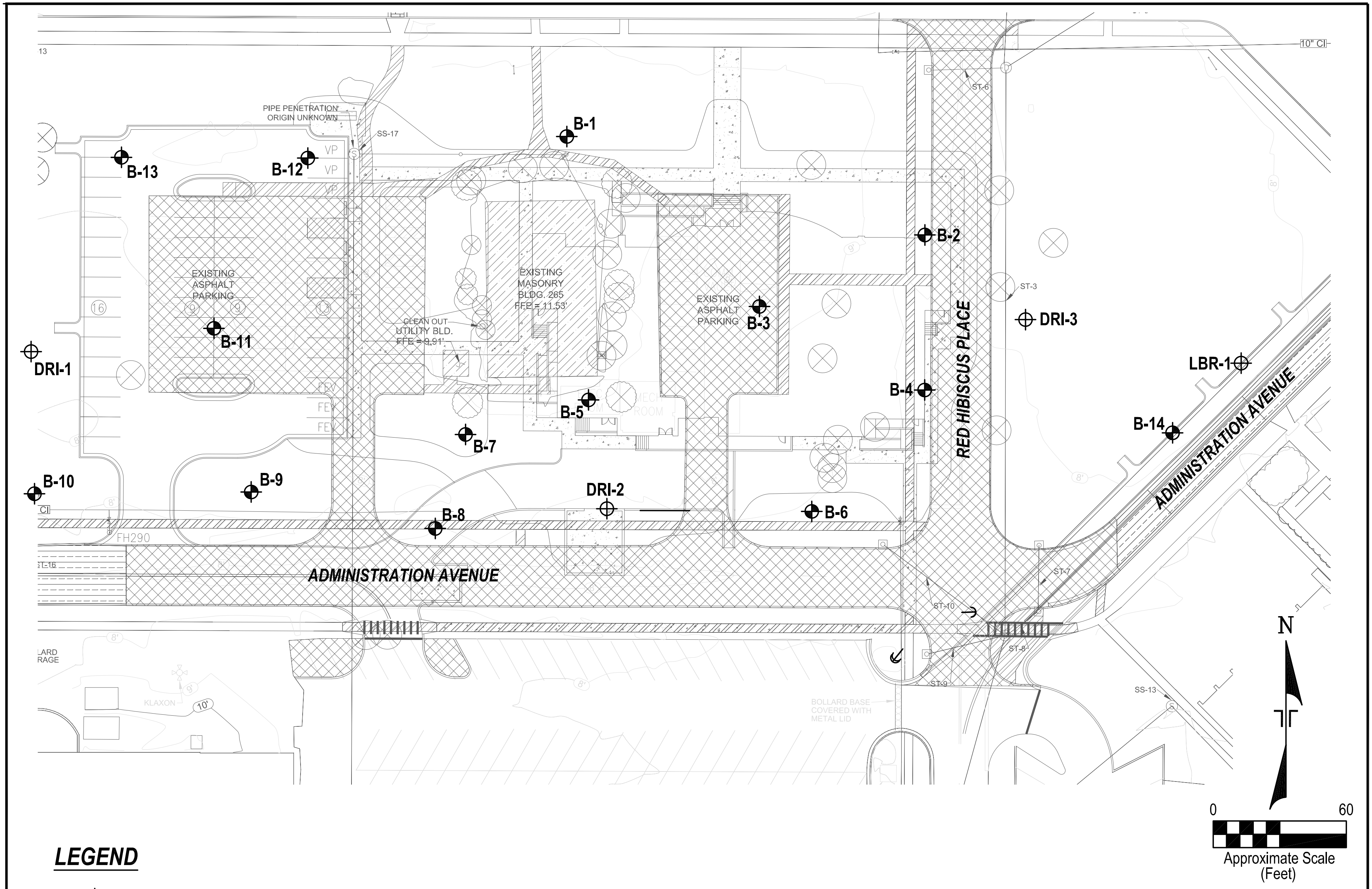
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
TOPO LINES REPRESENT 5–FOOT CONTOURS

QUADRANGLE
GIBSONTON, FL
1998

7.5 MINUTE SERIES (TOPOGRAPHIC)

N

Project Mngr: ATS	Project No. 37105045	Terracon Consulting Engineers and Scientists	SITE VICINITY MAP	EXHIBIT
Drawn By: TLY	Scale: AS SHOWN		GEOTECHNICAL ENGINEERING REPORT CONSOLIDATED COMMUNICATIONS FACILITY ADMINISTRATION AVENUE MACDILL AIR FORCE BASE, HILLSBOROUGH COUNTY, FL	A-1
Checked By: ATS/MRF	File No. GEO37105045-1			
Approved By: ATS	Date: SEPTEMBER 2010	503 W. Central Boulevard Orlando, Florida 32801 (407) 843-1311 (407) 843-1317		



LEGEND

● APPROXIMATE BORING LOCATION

⊕ APPROXIMATE TEST LOCATION

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: ATS
Drawn By: TLY
Checked By: ATS/MRF
Approved By: ATS

Project No. 37105045
Scale: AS SHOWN
File No. GEO37105045-2
Date: SEPTEMBER 2010

Terracon
Consulting Engineers and Scientists
503 W. Central Boulevard Orlando, Florida 32801
(407) 843-1311 (407) 843-1317

BORING LOCATION DIAGRAM

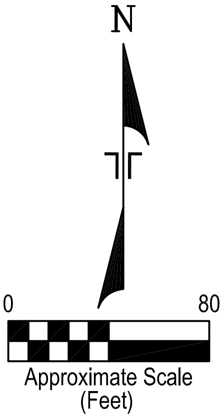
GEOTECHNICAL ENGINEERING REPORT
CONSOLIDATED COMMUNICATIONS FACILITY
ADMINISTRATION AVENUE
MACDILL AIR FORCE BASE, HILLSBOROUGH COUNTY, FL

EXHIBIT
A-2

SOIL SURVEY MAP

LEGEND

🟥	SUBJECT SITE
56	URBAN LAND



* SITE BOUNDARIES ARE APPROXIMATE

Project Mngr:	ATS
Drawn By:	TLY
Checked By:	ATS/MRF
Approved By:	ATS
Project No.	37105045
Scale:	AS SHOWN
File No.	GEO37105045-3
Date:	SEPTEMBER 2010

Terracon
Consulting Engineers and Scientists
503 W. Central Boulevard Orlando, Florida 32801
(407) 843-1311 (407) 843-1317

SOIL SURVEY MAP
GEOTECHNICAL ENGINEERING REPORT
CONSOLIDATED COMMUNICATIONS FACILITY
ADMINISTRATION AVENUE
MACDILL AIR FORCE BASE, HILLSBOROUGH COUNTY, FL

EXHIBIT
A-3

LOG OF BORING NO. B-1

Page 1 of 2

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N * BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: FINES CONTENT %	TESTS: ORGANIC CONTENT, %
SAND, fine, dark brown		SP	1	SS		10			
▽		SP	2	SS		9	19	3	
5	5	SP SM	3	SS		13			
SAND WITH SILT, fine, dark gray		SP SM	4	SS		20			
9		SP	5	SS		24			
SAND, fine, with trace organics, dark red-brown	10								
- light brown		SP	6	SS		11			
	15								
		SP	7	SS		9			
	20								
24.5			8	SS		27			
LIMESTONE, light gray	25								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 3	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-7-10		
BORING COMPLETED	9-7-10		
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-1

Page 2 of 2

CLIENT **STOA Architects**

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT **Consolidated Communications Facility**

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
LIMESTONE, light gray			9	SS		50+			
	30								
			10	SS		39			
	35								
			11	SS		47			
40	40								
BORING TERMINATED AT 40 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 3	WD ▼
WL	▼	▽
WL		

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-2

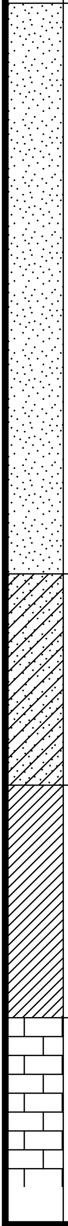
Page 1 of 2

CLIENT
STOA Architects

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG



DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS			
			NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %	
SAND, fine, dark brown - brown		SP	1	SS		9				
- dark gray ∇		SP	2	SS		9				
- brown	5	SP	3	SS		13				
		SP	4	SS		14	19	4		
- fine, dark red-brown, trace organics		SP	5	SS		15				
13.5	10									
CLAYEY SAND, gray		SC	6	SS		8	23	27		LL - 43 PI - 26
18.5	15									
CLAY, with shell fragments, gray		CL	7	SS		10				
24	20									
LIMESTONE, light gray			8	SS		47				
	25									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 3	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-2

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	LIMESTONE, light gray - light gray			9	SS		50+			
		30								
				10	SS		40			
		35								
				11	SS		43			
	40	40								
	BORING TERMINATED AT 40 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 3	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-7-10		
BORING COMPLETED	9-7-10		
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-3

Page 1 of 2

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	TESTS FINES CONTENT %	TESTS ORGANIC CONTENT, %
	Asphalt: 3 inches, Base: 2 inches **SAND**, fine, brown - light brown ∇		SP	1	SS		9			
			SP	2	SS		9			
5		5	SP SM	3	SS		10	20	1	3
	SAND WITH SILT, fine, dark gray		SP SM	4	SS		10			
9			SP	5	SS		17			
13.5	**SAND**, fine, with trace organics, dark red-brown	10								
	SILTY SAND, fine, light brown		SM	6	SS		8			
18.5		15								
	SANDY CLAY, light gray		CL	7	SS		11			
		20								
24.5				8	SS		23			
	LIMESTONE, light gray	25								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 3	WD ▼
WL	▼	▼
WL		

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-3

Page 2 of 2

CLIENT **STOA Architects**

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	TESTS FINES CONTENT %	TESTS ORGANIC CONTENT, %
	LIMESTONE, light gray									
				9	SS		39			
		30								
				10	SS		51			
		35								
				11	SS		50+			
	40	40								
	BORING TERMINATED AT 40 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 3	WD ▼
WL	▼	▼
WL		

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-4

Page 1 of 2

CLIENT
STOA Architects

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N * BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: FINES CONTENT %	TESTS: ORGANIC CONTENT, %	
	SAND, fine, brown - dark brown		SP	1	SS		12				
	▽		SP	2	SS		10				
	- gray	5	SP	3	SS		12				
	- light gray		SP	4	SS		20				
	- fine, with trace organics, dark red-brown	10	SP	5	SS		18				
13.5											
	SILTY CLAYEY SAND, fine, light brown	15	SC SM	6	SS		5	23	14		LL - 25 PI - 7
18.5											
	CLAYEY SAND, fine, with limestone fragments, light gray	20	SC	7	SS		7				
24											
	LIMESTONE, light gray	25		8	SS		47				

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 2.5	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-4

Page 2 of 2

CLIENT
STOA Architects

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	TESTS FINES CONTENT %	TESTS ORGANIC CONTENT, %
	LIMESTONE, light gray			9	SS		39			
		30								
				10	SS		50+			
		35								
				11	SS		46			
	40	40								
	BORING TERMINATED AT 40 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft

WL	∇ 2.5	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-5

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CLIENT
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SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	TESTS FINES CONTENT %	TESTS ORGANIC CONTENT, %
	SAND, fine, dark gray - dark brown		SP	1	SS		6			
	▽ - with trace organics, dark red, brown,		SP	2	SS		3			
		5	SP	3	SS		4			
	- brown		SP	4	SS		12			
			SP	5	SS		12			
		10								
	- light brown		SP	6	SS		7			
		15								
	18.5									
	SILTY SAND, fine, light brown		SM	7	SS		6			
		20								
	23.5									
	CLAY, light gray		CL	8	SS		33			
	25	25								
	LIMESTONE,									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 3	WD	▼
WL	▼		▼
WL			

BORING STARTED	9-7-10		
BORING COMPLETED	9-7-10		
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-5

Page 2 of 2

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	LIMESTONE, - light gray			9	SS		50+			
		30								
				10	SS		49			
		35								
				11	SS		41			
	40	40								
	BORING TERMINATED AT 40 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 3	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-6

Page 1 of 1

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
░	**SAND**, fine, gray - with trace organics, dark red, brown		SP	1	SS		6			
░	▽		SP	2	SS		10			
░			SP	3	SS		9			
░	- fine, brown	5								
░			SP	4	SS		12			
░			SP	5	SS		10			
░		10								
░	13.5									
▥	**SAND WITH SILT**, fine, light gray		SP SM	6	SS		9	18	7	
▥		15								
▥	18.5									
▨	**CLAY**, light gray		CL	7	SS		11			
▨		20								
▨	24			8	SS		35			
▦	**LIMESTONE**, light gray									
▦	25	25								
	BORING TERMINATED AT 25 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 2.5	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-7

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CLIENT
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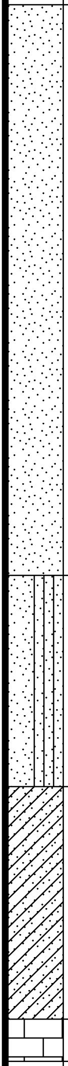
SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility



GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %	
	SAND, fine, dark brown, gray		SP	1	SS		4				
	▽ - brown		SP	2	SS		8				
	- with trace organics, dark red-brown	5	SP	3	SS		12				
	- brown		SP	4	SS		14				
	- light brown		SP	5	SS		15				
13.5		10									
	SAND WITH SILT, fine, light brown		SP SM	6	SS		8				
18.5		15									
	CLAYEY SAND, fine, light gray		SC	7	SS		8	23	23		LL - 29 PI - 11
24		20									
25	**LIMESTONE**, light gray			8	SS		10				
	BORING TERMINATED AT 25 FEET **GROUTED UPON COMPLETION**	25									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 2.5	WD	▼
WL	▼		▼
WL			

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-8

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CLIENT
STOA Architects

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	SAMPLES				TESTS			
			USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
░	**SAND**, fine, dark gray - brown		SP	1	SS		7			
░	▽ - light brown		SP	2	SS		8			
░	- fine, with trace organics, dark red, brown	5	SP	3	SS		6			
░			SP	4	SS		10			
░	- brown	10	SP	5	SS		10			
░										
░	- light brown 15	15	SP	6	SS		12			
	BORING TERMINATED AT 15 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 2.5	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-9

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CLIENT **STOA Architects**

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	SAND, fine, gray - dark brown		SP	1	SS		11			
	∇		SP	2	SS		9			
	- fine, with trace organics, dark red, brown	5	SP	3	SS		13	26	4	3
			SP	4	SS		18			
	- fine, brown	10	SP	5	SS		17			
		15	SP	6	SS		10			
18.5	**SAND WITH SILT**, fine, brown	20	SP SM	7	SS		7			
23.5	**CLAY**, with shell, light gray		CL	8	SS		17			
24.5 25	**LIMESTONE**	25								
	BORING TERMINATED AT 25 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 3 WD	▼
WL	▼	▼
WL		

Terracon

BORING STARTED	9-7-10
BORING COMPLETED	9-7-10
RIG MUD BUG	FOREMAN Gary
APPROVED ATS	JOB # 37105045

LOG OF BORING NO. B-10

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CLIENT
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SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	SAND, fine, gray		SP	1	SS		9			
	∇ - brown		SP	2	SS		13			
	- with trace organics, dark gray	5	SP	3	SS		12	25	4	2
	- brown		SP	4	SS		15			
			SP	5	SS		20			
13.5		10								
15	**SAND WITH SILT**, fine, light gray	15	SP SM	6	SS		9			
	BORING TERMINATED AT 15 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 3	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-7-10		
BORING COMPLETED	9-7-10		
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-11

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CLIENT
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SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	Asphalt: 2 inches, Base: 3 inches **SAND**, fine, brown		SP	1	SS		8			
	- dark brown ▽		SP	2	SS		11			
	- with trace organics, dark red-brown	5	SP	3	SS		10			
	- brown		SP	4	SS		9			
	- with trace organics, dark red-brown		SP	5	SS		17			
		10								
	- light brown 15		SP	6	SS		9			
	BORING TERMINATED AT 15 FEET **GROUTED UPON COMPLETION**	15								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 3.5	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-7-10		
BORING COMPLETED	9-7-10		
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-12

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SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N * BLOWS / ft.	TESTS WATER CONTENT, %	TESTS FINES CONTENT %	TESTS ORGANIC CONTENT, %
	SAND, fine, brown		SP	1	SS		9			
	- dark brown ∇		SP	2	SS		13	10	3	
	- dark gray	5	SP	3	SS		13			
	- with trace organics, dark red, brown		SP	4	SS		15			
	- brown		SP	5	SS		18			
		10								
	- light brown		SP	6	SS		11			
15	**BORING TERMINATED AT 15 FEET** **GROUTED UPON COMPLETION**	15								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 3.5 WD	▼
WL	▼	▼
WL		

Terracon

BORING STARTED	9-7-10
BORING COMPLETED	9-7-10
RIG MUD BUG	FOREMAN Gary
APPROVED ATS	JOB # 37105045

LOG OF BORING NO. B-13

Page 1 of 1

CLIENT **STOA Architects**	
SITE **MacDill Air Force Base** **Hillsborough County, Florida**	PROJECT **Consolidated Communications Facility**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	SAND, fine, dark gray		SP	1	SS		9			
	∇		SP	2	SS		11	18	4	
	- light gray to gray	5	SP	3	SS		13			
			SP	4	SS		18			
	- with trace organics, dark red, brown		SP	5	SS		16			
		10								
	- light brown		SP	6	SS		11			
	15	15								
	BORING TERMINATED AT 15 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 3	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

LOG OF BORING NO. B-14

Page 1 of 1

CLIENT
STOA Architects

SITE **MacDill Air Force Base**
Hillsborough County, Florida

PROJECT
Consolidated Communications Facility

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N * BLOWS / ft.	WATER CONTENT, %	FINES CONTENT %	ORGANIC CONTENT, %
	SAND, fine, dark gray - light brown		SP	1	SS		9			
	▽ - dark gray		SP	2	SS		13			
	- dark brown	5	SP	3	SS		16			
	- with trace organics, dark red, brown		SP	4	SS		17			
			SP	5	SS		13			
	- light brown 13.5	10								
	SILTY SAND, fine, light brown 15	15	SP SM	6	SS		8			
	BORING TERMINATED AT 15 FEET **GROUTED UPON COMPLETION**									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Safety Hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 3	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-7-10
BORING COMPLETED			9-7-10
RIG	MUD BUG	FOREMAN	Gary
APPROVED	ATS	JOB #	37105045

Field Exploration Description

The field exploration consisted of performing fourteen SPT borings (Borings B-1 through B-14) to approximate depths of between 15 and 40 feet below the existing ground surface. The boring locations were laid out at the project site by Terracon personnel. The locations indicated on the attached diagram are approximate and were measured by pacing distances and estimating right angles. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The SPT soil borings were drilled with an ATV-mounted, rotary drilling rig equipped with a rope and cathead-operated safety hammer. The boreholes were advanced with a cutting head and stabilized with the use of bentonite (drillers' mud). Soil samples were obtained by the split spoon sampling procedure in general accordance with the Standard Penetration Test (SPT) procedure. In the split spoon sampling procedure, the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch penetration or the middle 12 inches of a 24-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the site soil.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.

Double Ring Infiltrometer (DRI) Testing

Terracon performed three double ring infiltrometer (DRI) tests within the proposed stormwater management areas east, south, and west of the proposed building. The site soil was excavated to the test depth of about 18 inches. The DRI test was conducted by driving two concentric metal rings into the soil, the outer ring being 24 inches in diameter and the inner ring being 12 inches in diameter. Once the metal rings were properly seated into the soil, both rings were partially filled with water. The water level was maintained for approximately 4 hours, allowing the flow rate to stabilize.

Soil Survey Descriptions

56 – Urban land. This map unit consists of miscellaneous areas that are covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils so identification is not feasible. Most of the areas of Urban land are artificially drained by sewer systems, gutters, tile drains, and surface ditches.

APPENDIX B

SUPPORTING INFORMATION

Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, fines content (soil passing a US standard #200 sieve), sieve analysis (grain size distribution), organic content, and Atterberg Limits (Liquid Limit and Plastic Limit). Those results are included in this report and on the respective boring logs, except for the full sieve analysis results. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix B. The results of our laboratory testing are presented in the Laboratory Test Results section of this report and on the corresponding borings logs.

A bulk sample of in-place subgrade soils was collected from the vicinity of soil boring B-14, as indicated on Exhibit A-2. In addition to classification testing, a Limerock Bearing Ration (LBR – Florida Method of Test FM 5-515) test was performed on this sample. The LBR test measures the bearing value of soils and their resistance to deformation under pavement loading conditions. To conduct an LBR test, a Modified Proctor test first must be conducted using a minimum of four specimens prepared at varying moisture contents ranging from the dry to the wet side of the optimum moisture content. After compaction, a 2.5-pound swell plate is placed on top of the specimens and the specimens are soaked for a period of 48 hours. After the specimens have been removed from the soak tank and allowed to drain, a 20-pound surcharge was placed on top of the specimens to evaluate their use as pavement subgrade; a 15-pound surcharge is used for evaluation of stabilized subbase course material and no surcharge is used for evaluation of base course material. Each sample is then loaded with a 1.95-inch diameter piston at a constant rate of strain of 0.05 inches per minute. Load readings are taken at standard penetration intervals. For each specimen, the corrected load obtained at 0.1 inches of penetration is divided by 800 psi (the standard strength of limerock), then multiplied by 100 which yields the LBR value in percent. The LBR value for each specimen is then plotted versus its corresponding moisture content and a best fit curve is drawn through the points, and the peak LBR value is obtained from the peak of this curve.

A sample was taken from soil borings at the location of the proposed communications vault. These samples were submitted to corrosion series testing including measurements of pH and resistivity. The pH of the soil was measured by saturating it and then using a hand held pH meter. The resistivity of the soil was measured by placing it in a plexiglass box and gradually increasing the moisture content of the soil sample while passing an electric current through it until the lowest electrical resistance reading was obtained.

Laboratory Classification Test Results

Boring #	Sample #	Depth, feet	Moisture Content, %	Fines Content, %	Liquid Limit	Plasticity Index	Organic Content %	USCS Classification
B-1	2	1 to 3	19	3.0	-	-	-	SP
B-2	6	9 to 10	19	4.1	-	-	-	SP
B-2	7	13½ to18½	25	27	43	26	-	SC
B-3	4	5 to 7	20	3.1	-	-	1.1	SP
B-4	7	13½ to 18½	20	14	28	7	-	SM-SC
B-6	7	13½ to 18½	18	7.1	-	-	-	SP-SM
B-7	8	18½ to 23½	23	23	29	11	-	SC
B-9	4	5 to 7	26	3.8	-	-	3.4	SP
B-10	4	5 to 7	26	3.5	-	-	2.4	SP
B-12	3	3 to 5	10	3.0	-	-	-	SP
B-13	2	1 to 3	18	3.6	-	-	-	SP

Exhibit B-2

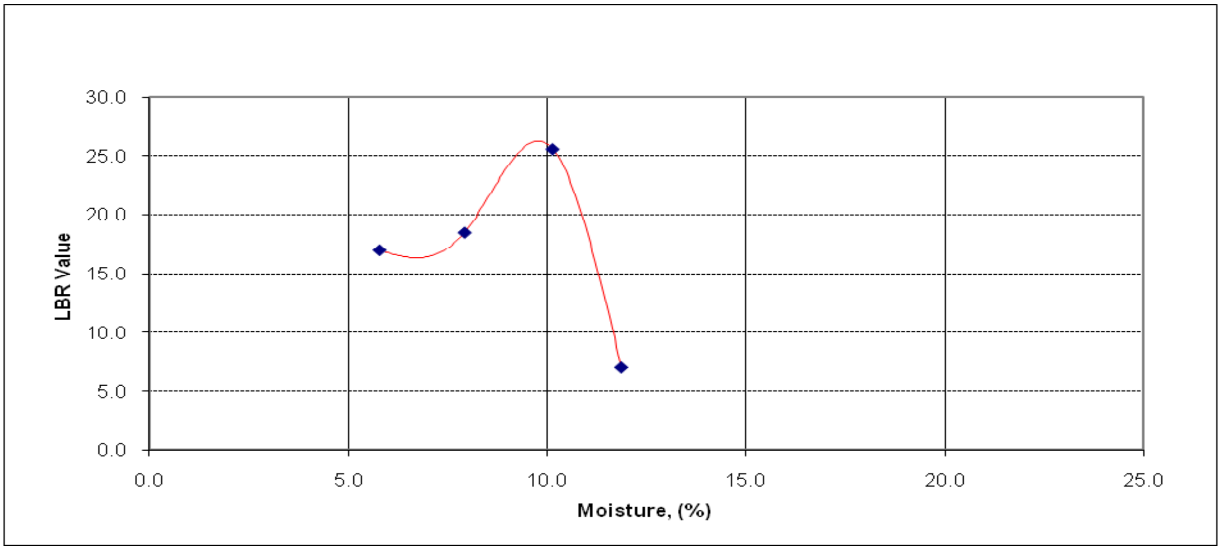
Limerock Bearing Ratio (LBR) Test Results

FM 5-515

Project: MacDill COCOMM Building
Location: B-14
Client: STOA Architects
Sample Description: Gray Fine Sand with Trace Limerock

Project No.: 37105045
Date: 9/10/2010
Engineer: A. Schmid
Soaked

Sample No.	B-14
Maximum Dry Density, (pcf)	106.9
Optimum Moisture Content, (%)	9.5
Maximum LBR Value	26



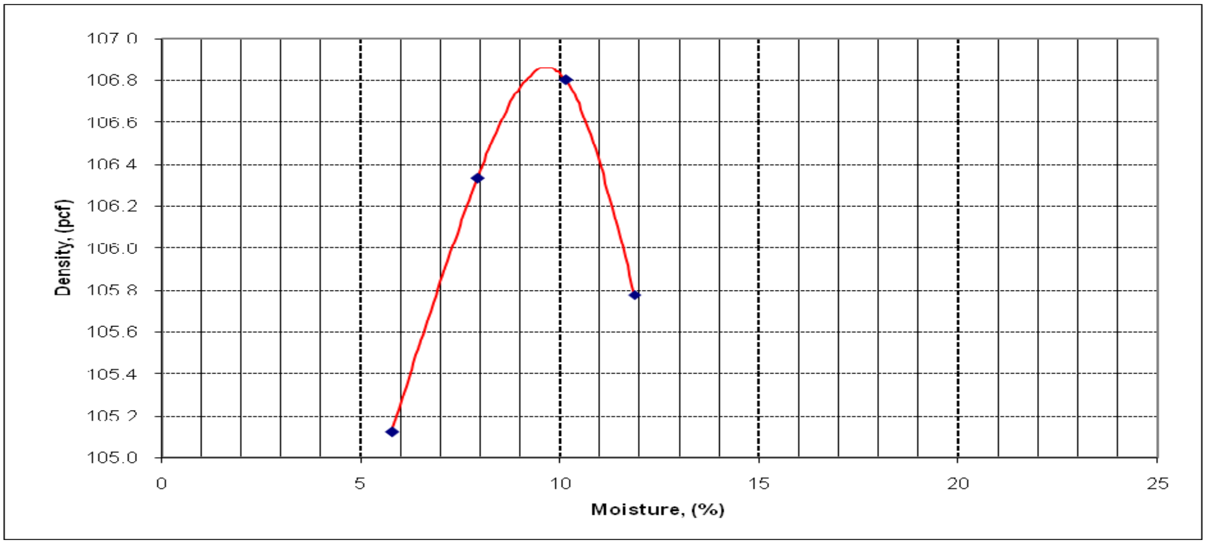


Exhibit B-3

Corrosion Series Test Results

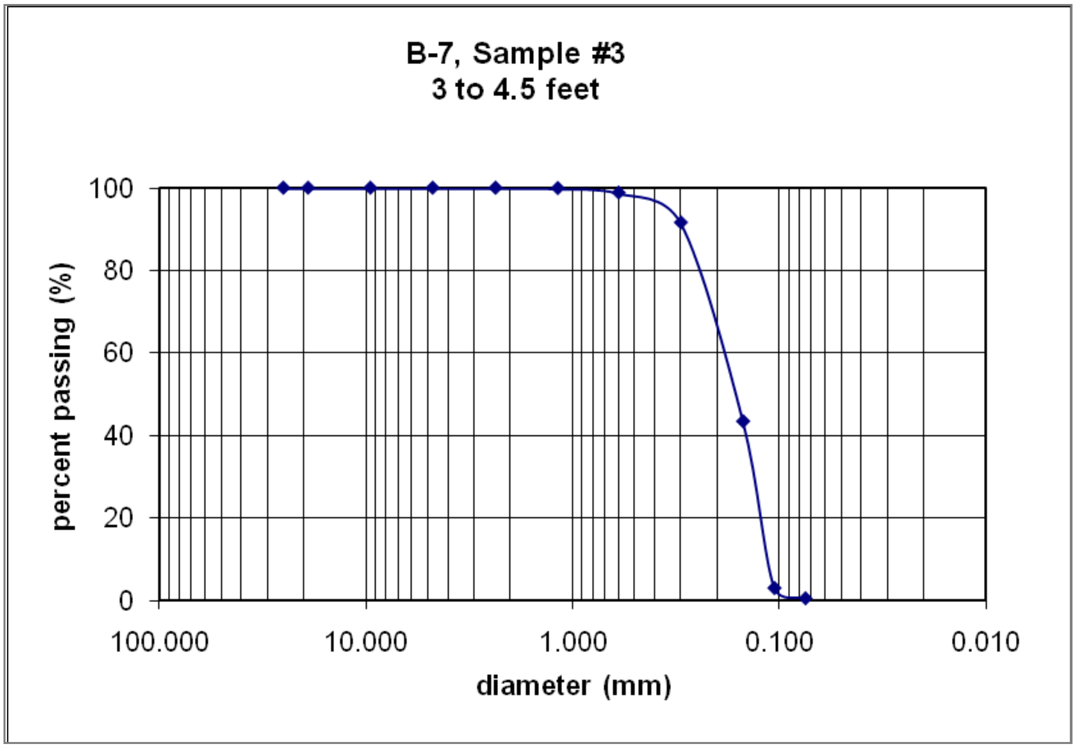
Soil Boring #	Sample Depth, feet	pH	Resistivity (ohm*cm)	Environmental Classification for Substructures	
				Concrete	Steel
B-1 and B-3	9 to 10	6.6	11,000	Slightly Aggressive	Slightly Aggressive
B-9	1 to 3	6.9	20,000	Slightly Aggressive	Slightly Aggressive
Criteria, Concrete and Steel	-	>6.6	>3,000	Slightly Aggressive[1]	Slightly Aggressive[1]
Criteria, Concrete	-	5.0	<500	Extremely Aggressive[2]	-
Criteria, Steel	-	6.0	<500	-	Extremely Aggressive[2]

1 All of the listed conditions must be met for sample to be classified as slightly aggressive.

2 If any of the listed conditions are met, the sample is classified as extremely aggressive. All samples not meeting criteria for slightly or extremely aggressive are classified as moderately aggressive.

Exhibit B-4

Soil Analytical Test Results



APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the “Standard Penetration” or “N-value”.

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling	ESH	Estimated Seasonal High Groundwater
DCI:	Dry Cave in	BCR:	Before Casing Removal	ESL	Estimated Seasonal Low Groundwater
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 – 1	Very Soft
500 – 1,000	2 – 4	Soft
1,001 – 2,000	4 – 8	Medium Stiff
2,001 – 4,000	8 – 15	Stiff
4,001 – 8,000	15 – 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 – 10
Medium	11 – 30
High	> 30

Exhibit C-1

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					**Soil Classification**	
					Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

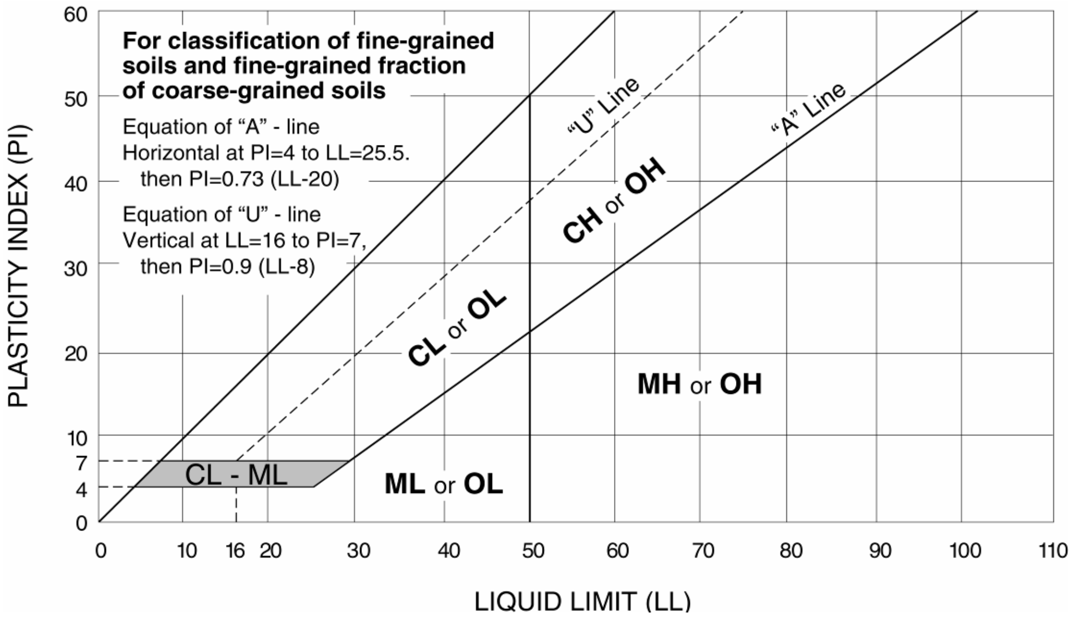

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Exhibit C-2