UNIVERSAL
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# PRELIMINARY GEOTECHNICAL EXPLORATION

**Proposed AB9 Building**
**Florida Gulf Coast University**
**Fort Myers, Lee County, Florida**

**PROJECT NO. 0530.1900154.0000**

**Prepared For:**

RG Architects, PA
2070 McGregor Blvd, Suite 3
Fort Myers, FL 33901

**Prepared By:**

Universal Engineering Sciences, Inc.
5971 Country Lakes Drive
Fort Myers, Florida 33905
(239) 995-1997

**September 16, 2019**

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September 16, 2019

RG Architects, PA
2070 McGregor Blvd, Suite 3
Fort Myers, FL 33901

Attention: Mr. Javier Salazar, Principal, AIA
jes@rgarchitectspa.com

Reference: **Preliminary Geotechnical Exploration**
**Proposed AB9 Building**
Florida Gulf Coast University
Fort Myers, Lee County, Florida
UES Project No. 0530.1900154.0000

Dear Mr. Salazar:

Universal Engineering Sciences, Inc. (UES) has completed a geotechnical exploration on the above-referenced site in Fort Myers, Florida. Our scope of services was in general accordance with UES Proposal dated July 15, 2019.

This report contains the results of our study, an engineering interpretation of the subsurface data obtained with respect to the project characteristics described to us, geotechnical design recommendations, and general construction and site preparation considerations.

We appreciate the opportunity to have worked with you on this project and look forward to a continued association with your firm. Please contact us if you have any questions, or if we may further assist you as your plans proceed.

*Respectfully Submitted,*
***UNIVERSAL ENGINEERING SCIENCES, INC.***
*Certificate of Authorization No. 549*

Digitally signed by Robert Gomez
DN: cn=Robert Gomez, o, ou, email=rgomez@universalengineering.com, c=US
Date: 2019.09.16 15:05:26 -04'00'
Adobe Acrobat version: 11.0.23

Ashok Neela
Staff Engineer

Robert Gomez, P.E.
Sarasota Branch Manager
Florida Registration #58348

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## EXECUTIVE SUMMARY

The following summary was prepared to provide a quick overview of UES's findings. Please review, and rely on the full report for recommendations and other considerations.

### Project Description

It is understood that the project consists of proposed AB9 building located at Florida Gulf Coast University in Fort Myers, Lee County, Florida. We understand the building will be a four story residence hall with a footprint of an approximately 32,000 SF.

### Soil and Groundwater Conditions

The soils found consist of brown, gray, light brown and light gray fine sand with trace of roots, silt fines, varying amounts of clay fines, rock and shell fragments in very loose, loose, medium dense, dense and very dense states to around 15 feet below ground surface. Hard rock was encountered at various depths ranging from 10 feet to 23 feet below ground surface. Stiff and soft light brown, light gray fine sandy silt with trace of shell and varying rock fragments and loose to medium dense light brown, light gray and gray fine sand with clay and silt fines, rock and shell fragments were encountered from around 16 feet to 23 feet below ground surface underlain by stiff to medium stiff light gray, gray and light green fine sandy clay and loose to medium dense light gray, green and gray fine sand with varying clay and silt fines, rock and shell fragments to the maximum depth explored of 50 feet below ground surface.

The groundwater was measured at depths of around 2.1 to 4.3 feet below existing grades. Estimated seasonal high groundwater levels could be at or near existing ground surface to around 2 feet below ground surface at the boring locations.

### Foundation Design

Based on our exploration and analyses the foundations may consist of conventional shallow continuous and spread footings in conjunction with vibro-replacement ground modification. The floor slabs may be ground supported.

### Site Preparation

A normal earthwork practice is envisioned to prepare the subgrade and place and compact fill soils in the proposed building pad.

### Excavation Considerations

Very dense and dense fine sands with rock fragments was encountered from the surface to 6 feet below ground surface at the boring locations. Difficulty may be encountered excavating below this depth particularly in a confined space such as utility trench

# 1.0 INTRODUCTION

## 1.1 GENERAL

This report includes the results of the geotechnical exploration conducted on the site of the Proposed AB9 building located at Florida Gulf Coast University in Fort Myers, Lee County, Florida. This report contains the results of our study, an engineering interpretation of the subsurface data obtained with respect to the project characteristics described to us, and our recommendations for geotechnical design and general site preparation. Our scope of services was in general accordance with the UES Standard Fee Proposal dated July 15, 2019.

# 2.0 SCOPE OF SERVICES

## 2.1 PROJECT DESCRIPTION

It is understood that the project consists of proposed AB9 building located at Florida Gulf Coast University in Fort Myers, Lee County, Florida. We understand the building will be a four story residence hall with a footprint of an approximately 32,000 SF.

We understand maximum column loads are on the order of 750 kips and maximum wall loads are on the order of 20 kips/foot. Further, we understand there will be more lightly loaded structural elements planned with column loads less than 50 kips and wall loads less than 5 kips/feet.

Based on current site grades, we anticipate nominal amounts of fill (0 to 2 feet) will be required to raise site grades to finished levels.

***No site or project facilities/improvements, other than those described herein, should be designed using the soil information presented in this report. Moreover, UES will not be responsible for the performance of any site improvement so designed and constructed.***

We were provided with site plan depicting the location of the proposed improvements along with proposed boring locations. We used this information to perform our exploration

Our geotechnical recommendations are based upon the above provided information, assumptions and considerations. ***If UES is not informed of changes to final design information, the recommendations contained herein are not considered valid as we cannot be responsible for the consequences of changes of which we were not informed.***

A general location map of the project area appears in Appendix A: Site Location Map

## 2.2 PURPOSE

The purpose of our services was:

- to generally characterize the shallow subsurface conditions at the site using a limited amount of Standard Penetration Test (SPT) borings;
- to evaluate the soil/structure relationships using subsurface information interpreted from the borings and project information described to us or assumed by us; and
- to provide geotechnical engineering design information and recommendations for building foundations and general recommendations for building pad subgrade preparation.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards.

Our study was confined to the zone of soil likely to be influenced by the proposed structural foundation systems. Our scope of services did not address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity.

## 2.3 FIELD EXPLORATION

The subsurface conditions at the site were explored with seven (7) borings completed to depths of 50 feet below ground surface. These borings were advanced using the rotary wash method, and samples were collected while performing the Standard Penetration Test (SPT) at regular intervals.

We performed the Standard Penetration Test in each of the borings according to the procedures of ASTM D-1586, with continuous sampling performed above a depth of 10 feet, to detect slight variations in the soil profile at shallow depths. The basic procedure for the Standard Penetration Test is as follows: A standard split-barrel sampler is driven into the soil by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler 1-foot, after seating 6 inches, is designated the penetration resistance, or N-value; this value is an index to soil strength and consistency.

Consider the boring depths and locations to be approximate. Our drilling crew located the borings based upon estimated distances and spatial relationships to natural features and landmarks.

The soil samples recovered from the soil test borings were returned to our laboratory, where a member of our geotechnical staff visually examined and reviewed the field descriptions according to the procedures of ASTM D-2487.

Jar samples of the soils encountered will be held in our laboratory for your inspection for 60 days and then discarded, unless we are notified otherwise.

## 2.4 LABORATORY TESTING

The soil samples recovered from the test borings were returned to our laboratory and visually classified by our technical staff. No laboratory testing was included in our scope of services or

deemed necessary at this time.

## 3.0 FINDINGS

### 3.1 SURFACE CONDITIONS

The site currently consists of an existing parking lot. It is relatively flat. We did not note any debris or rock outcrops on site at the time of our field exploration. Parking Garage 1 borders the site to the North. At the start of our geotechnical exploration, we reviewed aerial photographs available from the Lee County Property Appraiser's office and USGS topographic quadrangle maps. According to USGS topographic information, the elevation across the property is on the order of +20 to +22 feet NGVD.

We also reviewed current USDA Soil Conservation Service (SCS) data for Lee County. According to SCS, there is one native, surficial soil group underlying this site. A summary of selected properties for the identified soil group on the site is included below in Table 1

**Table 1: Summary of Lee County Soil Survey Information**

| Map Unit | Soil Map Unit | Location | Presence of Shallow Rock | Seasonal High-Water Levels |
|---|---|---|---|---|
| 129 | Pineda fine sand – Urban land complex, 0 to 2 percent slopes | Entire Site | > 80 inches | 3 to18 inches |

### 3.2 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix B: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are based upon visual characterizations of the recovered soil samples. Refer to Appendix B: Soils Classification Chart, for further explanation of the symbols and placement of data on the Boring Logs. A generalized profile of the soils encountered at our boring locations is presented below in Table 2. For detailed soil profiles, please refer to the attached boring logs.



**TABLE 2: RESIDENTIAL DEVELOPMENT AREA GENERAL SOIL PROFILE**

| Typical Depth (ft) | Soil Descriptions |
|---|---|
| 0 to 15 | Very Loose, Loose, Medium Dense, Dense and Very Dense Brown, Gray, Light Brown and Light Gray Fine Sand with trace of Roots, Silt Fines, varying Clay Fines, Rock and Shell fragments, Hard Rock. [SP, SP-SC, SC, SP-SM] |
| 16 to 23 | Hard Rock, Soft to Stiff Light Gray, Light Brown Sandy Silt with varying Rock Fragments and trace of Shell Fragments and Loose to Medium Dense Light Brown, Light Gray and Gray Fine Sand with Silt and Clay Fines, Rock and Shell Fragments. [SP, SM, ML] |
| 23 to 50* | Loose and Medium Dense Brown, Gray, Green, Light Brown, Light Gray and Light Green Fine Sand with Silt Fines, varying Clay Fines, Shell Fragments and trace of Phosphates. Medium Stiff to Stiff Gray, Light Green and Green Fine Sandy Clay. [SP, SP-SC, SC, SM, CL] |

*** Termination of Deepest Boring**
**[ ] Bracketed Text Indicates: Unified Soil Classification.**

Hard rock was encountered at different depths ranging from 10 feet to 23 feet below ground surface.

Significant variations in the depth, thickness, and consistency of the soil strata occurred at the individual test boring locations.

The shallow water table was encountered at depths of around 2.1 to 4.3 feet below existing grade below existing grades at the boring locations, measured during geotechnical exploration. These readings are unstabilized and are subject to fluctuation. Fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff and other factors that may vary from the time the borings were conducted.

The boring logs and related information included in this report are indicators of subsurface conditions only at the specific locations and times noted. Our field exploration did not find unsuitable or unexpected materials at the time of occurrence. However, borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information to negate presence of anomalous materials or for estimation of material quantities unless our contracted services ***specifically*** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect such anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

## 4.0 RECOMMENDATIONS

### 4.1 GENERAL

The following preliminary recommendations and evaluations are made based upon a review of the attached soil test data, our understanding of the proposed construction and experience with

similar projects and subsurface conditions. If the project characteristics or conceptual site plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

Our field exploratory program consisted of performing seven (7) relatively shallow test borings within the anticipated building area. The actual subsurface conditions may differ between test boring locations. The following recommendations should be considered general in nature and are intended to aid in a due diligence evaluation of the site soil conditions and are not specific to the earthwork related design of the individual components (foundations, etc.) of the planned development.

In this section of the report, the following represents the final recommendations for groundwater control, building foundations, site preparation, other design considerations and construction related services.

### 4.2 GROUNDWATER

Based upon our visual review of the recovered soil samples, review of information obtained from SWFWMD and the USDA Soil Survey of Lee County, and our general knowledge of local and regional hydrogeology, our estimated seasonal high groundwater level could be at or near ground surface to around 2 feet below the ground surface at the test boring locations, on average. Water may be ponded at ground surface during periods of heavy rainfall.

Several factors influence the determination of the seasonal high water table (SHWT). Over time natural, undisturbed soils are subjected to alternating cycles of saturation and drying, resulting in discoloration or staining that is not part of the dominant soil color occurs. This is called mottling, and manifests itself in various shades of gray, brown, red or yellow. There are numerous processes that lead to this discoloration, including mineral accretions, oxidation, and bacteria growth within the soil. The presence of this discoloration indicates that groundwater has repetitively reached that elevation and remained there long enough to cause any or all of these processes to occur. The SHWT elevation is assumed to be the highest level at which mottling is observed in the natural soil profile, regardless of whether water is present at the time of observation. This estimate is independent of the actual location of the groundwater table. Because the mottling process takes time and repetitive episodes, man-made soil fills do not exhibit such mottling and seasonal high estimates cannot be made in this manner.

It should be noted that the estimated SHWT does not provide any assurance that groundwater levels will not exceed this level in the future. Should impediments to surface water drainage exist on the site, or should rainfall intensity and duration exceed the normally anticipated amounts, groundwater levels may exceed our seasonal high estimate. Also, future development around the site could alter surface runoff and drainage characteristics, and cause our seasonal high estimate to be exceeded. We therefore recommend positive drainage be established and maintained on the site during construction. Further, we recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project. Finally, we recommend all foundation and pavement grades account for the seasonal high groundwater conditions.

Temporary dewatering will likely be required for some parts of this site if construction proceeds during the wet season, particularly if deep excavations are necessary or if pumping of the surficial materials is experienced during earthwork operations. Where present, sands with silts (SP-SM), silty fine sands (SM), and clayey sands (SC) near the surface may be prone to pumping in



response to normal construction vehicular traffic and earthwork operations. Therefore, we recommend that the contract documents provide for determining the depth to the groundwater table just prior to construction, and for any required remedial dewatering. Further, we recommend that the groundwater table be maintained at least 24 inches below all earthwork and compaction surfaces.

Dependent upon local jurisdictional requirements, a dewatering plan may be required; UES can assist you with required dewatering plans if desired. The dewatering means and methods are the sole responsibility of the contractor.

### 4.3 BUILDING FOUNDATION AND FLOOR SLAB

Based on the estimated structural loads provided for the 4-story structure we do not believe the hotel building can be supported on conventional shallow foundations without some type of improvement or modification being performed on the soils. In order to reduce both total and differential settlements to tolerable limits, we recommend the soils beneath the foundations be improved using vibro-replacement with stone columns. We have assumed foundation bearing depths near existing grade and fill heights and approximately 0 to 2 feet of fill material to achieve the planned subgrade elevation in the proposed building area.

**Differing fill amounts and/or foundation embedment depths may deem different recommendations. UES must review the preliminary and final site and grading plans, and structural design loads to validate all recommendations rendered herein. Without such review our recommendations should not be relied upon for final design or construction of any site improvements.**

Briefly, the vibro-replacement process using stone columns involves inserting a large oscillating metal probe into the soil by water jetting techniques. The vibration of the probe device densifies the surrounding soil. Crushed stone, placed on the ground surface around the device migrates downward and fills the voids created by the vibrating probe. Thus as the probe is withdrawn from the soil, the stone is compacted into the surrounding loose material as a continuous stone column is formed. Normal good practice site preparation procedures are recommended in conjunction with the ground improvement below the foundations to provide for slab-on-grade support.

A more detailed synopsis of these procedures is as follows:

1. Strip the proposed construction limits of any existing trees, grass, roots, topsoil, construction debris, and other deleterious materials within and 5 feet beyond the perimeter of the proposed building areas or other areas receiving improvements. Expect clearing and grubbing to depths of 12 inches, on average. Deeper clearing and grubbing depths may be required where major vegetation root systems are encountered.

2. If required, perform remedial temporary dewatering prior to any earthwork operations to reduce the likelihood of pumping of the shallow subgrade soils during normal construction operations. Maintain groundwater levels at least 24 inches below the lowest anticipated cut and/or all compaction surfaces.

3. Subsequent to vibro replacement, fill the building site to above the bottom of the footing elevation in uniform 10 to 12 inch lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density. The fill should consist of clean fine sand with less than 5 percent soil fines. You may use fill material with soil fines between 5

and 10 percent when the excavation is sufficiently above the groundwater level, but strict moisture control may be required.

4. As required, pre-drill through any rock layers.

5. Perform vibro-replacement with stone column ground improvement procedures below all foundations for the building. Typically, the soils below the base of the foundation are treated to a depth equal to twice the width of isolated column footings or four times the width of continuous strip footings. With the assumed loading conditions, we recommend a minimum treatment depth of 25 feet below the base of the foundations. Typically center-to-center spacing of about 4 to 6 feet is required to achieve the desired level of improvement.

6. Some wet and loose soil will be created and left on the surface of the pad area during the vibro-replacement process. This material would need to be bladed off the pad areas prior to placing any remaining fill. The foundations should be excavated to bear directly on top of the stone columns. Further, the vibro-replacement process is not as effective at shallow depths. As such, the upper two feet of soil should be proof-compacted and densified subsequent to vibro-replacement operation using a large vibratory roller.

Subsequent to the successful completion of the aforementioned ground improvement procedure, we believe that the structure can be supported on conventional, shallow spread foundations sized for an allowable bearing pressure of 5,000 p.s.f. All foundations should be embedded at least 1.5 feet below lowest adjacent grade (finished surrounding grade for example). Further, maintain minimum foundation widths of 4 feet for strip footings and 12.5 feet for square footings respectively. Further, for light loaded structures, maintain foundation widths of 18 inches for strip footings and 3.2 feet for square footings respectively, even though the maximum allowable soil bearing pressure may not be developed in all cases.

It should be noted, using vibratory compaction equipment at this site may disturb nearby structures. Vibratory compaction within 50 feet of existing structures is not recommended. Furthermore, we recommend you monitor nearby structures before and during any compaction operations on-site. If disturbance is noted, halt vibratory compaction and inform Universal Engineering Sciences immediately. We will review the compaction procedures and evaluate if the compactive effort results in a satisfactory subgrade complying with our original design assumptions.

### 4.3.1 GROUND LEVEL SLABS

Any ground level slabs may be supported upon compacted fill or the existing site soils and should be structurally isolated from other foundation elements or adequately reinforced to prevent distress due to differential movements. For building design, we recommend using a subgrade reaction modulus of 80 pounds per cubic inch (pci) which can be achieved by compacting the subgrade soils as recommended in the site preparation procedure. Per 2004 Florida Building Code requirements, we recommend the use of a sheet vapor barrier such as visqeen beneath the building slab on grade to help control moisture migration through the slab. The performance of the vapor barrier is ultimately dependent upon its proper installation, including lapping and sealing plus repair of tears and punctures prior to placement of concrete.



### 4.4 EXCAVATION CONSIDERATIONS

Very dense and dense fine sands with rock fragments was encountered from the surface to 6 feet below ground surface at the boring locations. Specialized procedures such as pneumatic rams, headache balls, etc. will likely be necessary to excavate into or through this layer particularly when present in a confined space such as a utility trench.

### 4.5 CONSTRUCTION RELATED SERVICES

Universal Engineering Sciences (UES) operates and maintains an in-house, Florida Department of Transportation certified Construction Materials Testing laboratory. Our technicians are highly trained and experienced, and our engineering staff is already familiar with the details of your project. Therefore, we recommend the owner retain UES to perform construction materials testing, post vibro-replacement SPT verification borings, vibro-replacement monitoring procedures and field observations on this project. Please note that proper quality control is an important aspect for success of a Vibro-Replacement project. We recommend the final stone column installation specifications (shop drawings) for this project be reviewed by us to verify if these meet our foundation design recommendations. We recommend standard penetration test borings be performed between the stone columns at locations selected by the Geotechnical Engineer to verify the improvement in density of the soils between the stone columns. It should be noted that significant improvement in the density of the silty and clayey sands encountered may not occur due to the higher fines content. For vibro-replacement field tests and observations include monitoring vibro-replacement with stone columns procedures and performing post-treatment test borings and verification that the foundations are placed over the stone columns. Field tests and observations for the project include verification of foundations by observing proof-compacting operations and performing quality assurance tests on the existing subgrade, backfilled soils, compacted structural fill and foundation soils.

The geotechnical engineering design does not end with the advertisement of the construction documents. It is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, our engineers are the most qualified to address problems that might arise during construction in a timely and cost-effective manner.

## 5.0 LIMITATIONS

This report has been prepared to aid the architect/engineer in the design of the proposed development. The scopes of services provided were limited to the specific project and locations described herein. The description of the project's design parameters represents our understanding of significant aspects relevant to soil and foundation characteristics.

The recommendations submitted in this report are based upon the data obtained from the limited number of soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations or unexplored areas of the site. This report should not be used for estimating such items as cut and fill quantities.

Our field exploration did find not unsuitable or unexpected materials at our boring location at the time of occurrence. However, borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information to negate presence of anomalous materials or for estimation of material quantities unless our contracted services ***specifically*** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect such anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

All users of this report are cautioned that there was no requirement for Universal to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore no attempt was made by Universal to locate or identify such concerns. Universal cannot be responsible for any buried man-made objects or environmental hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested.

For a further description of the scope and limitations of this report please review the document attached within Appendix D "Important Information About Your Geotechnical Engineering Report" prepared by ASFE, an association of firms practicing in the geosciences.

## 6.0 GEOTECHNICAL DESIGN SUMMARY

| | |
|---|---|
| Project Name: | Proposed AB9 Building |
| Project No: | 0530.1900154.0000 |
| Project Location: | Florida Gulf Coast University, Fort Myers, Lee County, Florida |

**Foundation Design**:

| | | | | |
|---|---|---|---|---|
| Foundation Type: | Shallow Conventional (in conjunction with vibro-replacement ground modification) | | | |
| Allowable bearing pressure: | 5,000 psf | | | |
| Minimum footing dimensions: | Individual: | 12.5' | Continuous: | 4' |
| Minimum footing dimensions: (Lightly loaded structural elements) | Individual: | 3.2' | Continuous: | 18" |
| Minimum footing Embedment: | Exterior: | 18" | Interior: | 18" |

**Field Observation/Testing:**

| | |
|---|---|
| Depth of Stripping: | Estimate 6 inches |
| Native Ground Compaction: | 95% ASTM D1557 to 2 feet below base of foundation or 2 feet below stripped grade, whichever is deeper |
| Recommended Compaction Tests: | |
| Building Area: | 1 Test for Each 2,500 Sq. Ft. each foot of Improvement |
| Fill Material Composition: | Recommend less than 5% fines, 5-12% fines w/strict moisture (+/- 2% optimum) |
| Fill Material Compaction: | 95% ASTM D1557 8 inch max loose lifts |
| Building Area: | 1 Test for Each 2,500 Sq. Ft. each Lift |
| Foundation Bottom Compaction: | 1 Test per 50 LF, test every column footing |

APPENDIX A

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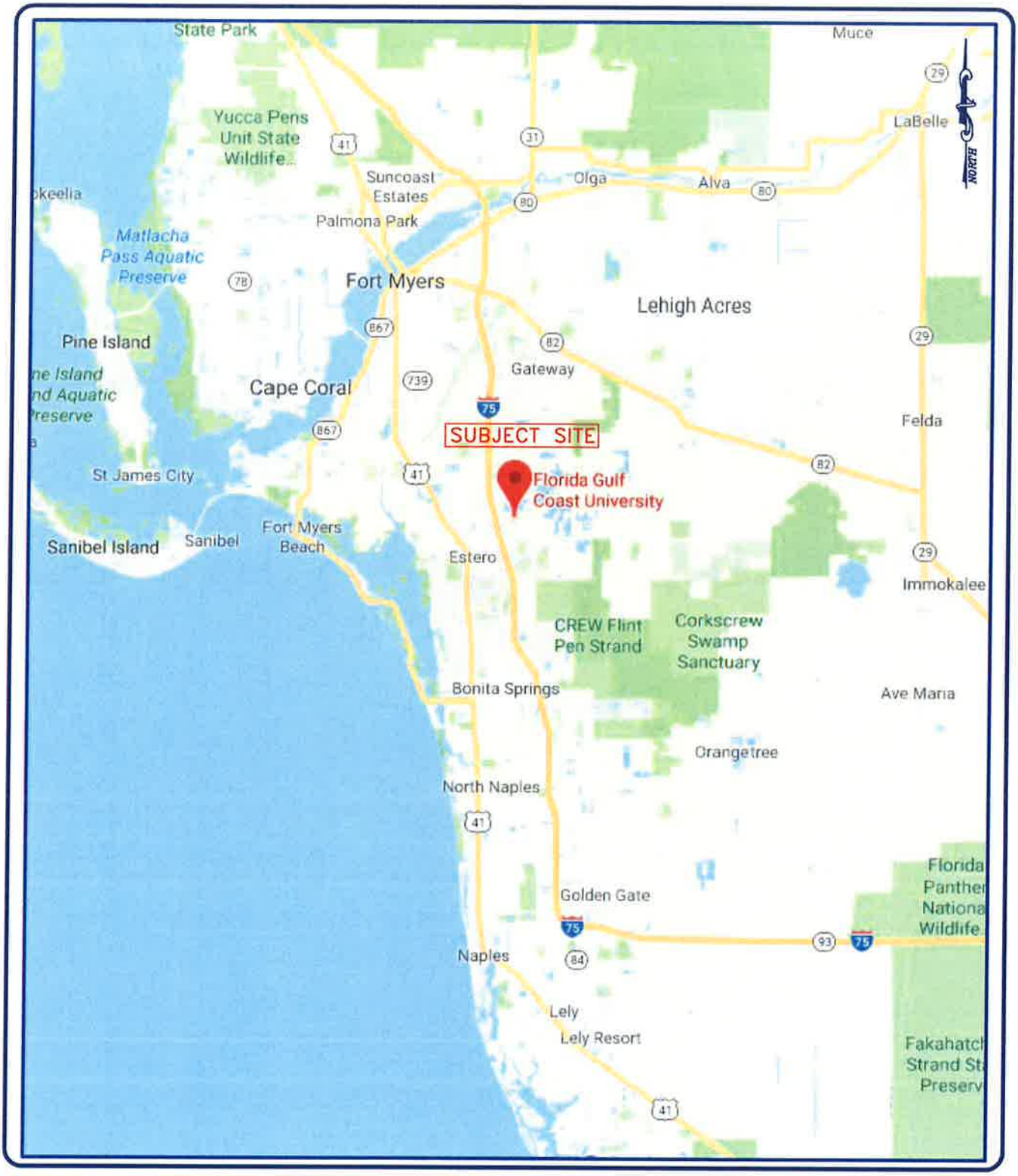


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# PROPOSED AB9 BUILDING
# FLORIDA GULF COAST UNIVERSITY
# FORT MYERS, LEE COUNTY, FLORIDA

## SITE LOCATION MAP

| | | | |
|---|---|---|---|
| CLIENT: RG ARCHITECTS, PA | | DRAWN BY: AN | DATE: 09/04/2019 |
| SCALE: NOT TO SCALE | PROJECT NO: 0530.1900154 | REVIEWED BY: LW | APPENDIX: A |

# APPENDIX B

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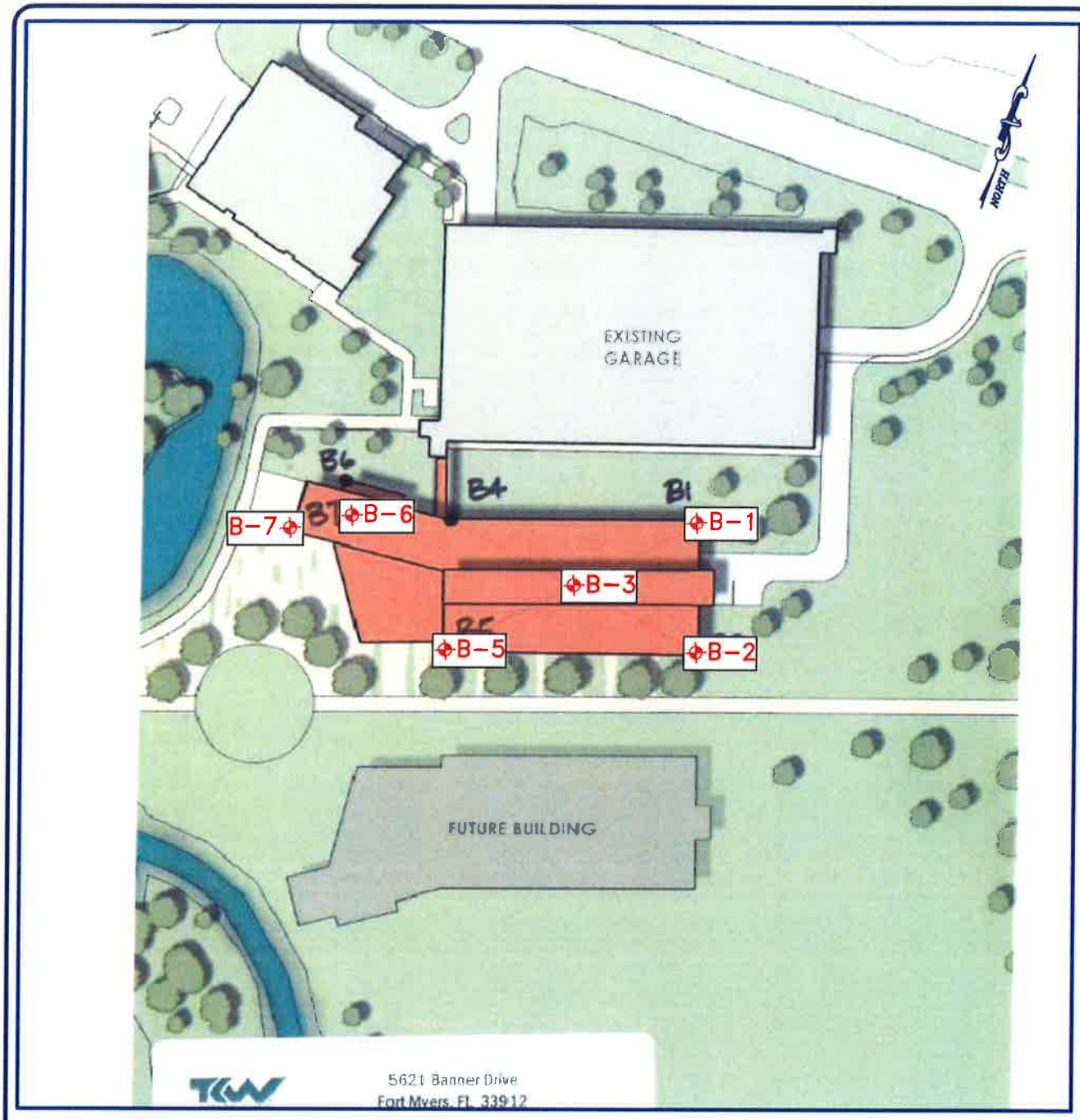


LEGEND:

⌖B-1 Approximate SPT boring location

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PROPOSED AB9 BUILDING
FLORIDA GULF COAST UNIVERSITY
FORT MYERS, LEE COUNTY, FLORIDA

BORING LOCATION PLAN

| | | | |
|---|---|---|---|
| CLIENT: RG ARCHITECTS, PA | | DRAWN BY: AN | DATE: 09/04/2019 |
| SCALE: NOT TO SCALE | PROJECT NO: 0530.1900154 | REVIEWED BY: LW | APPENDIX: B |

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

| | |
|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 1 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-1** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 2.1
DATE OF READING: 08/29/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/29/19
DATE FINISHED: 8/29/19
DRILLED BY: LU/ED
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/ FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | |
| | X | 5-6-4 | 10 | ▼ | | Loose Brown Fine Sand with trace of Roots (SP) | | | | | | |
| | X | 7-11-13 | 24 | | | Loose Brown Fine Sand with Clay Fines (SP-SC) | | | | | | |
| | X | 14-17-20 | 37 | | | Medium Dense Brown Fine Sand with trace of Rock Fragments (SP) | | | | | | |
| 5 | X | 13-13-15 | 28 | | | Dense to Medium Dense Gray, Light Brown and Light Gray Fine Sand (SP) | | | | | | |
| | X | 9-14-15 | 29 | | | | | | | | | |
| | X | 6-11-17 | 28 | | | | | | | | | |
| 10 | X | 5-7-10 | 17 | | | | | | | | | |
| | | | | | | Hard Rock | | | | | | |
| 15 | X | 3-4-21 | 25 | | | Medium Dense Light Gray Fine Sand with trace of Rock and Shell Fragments (SP) | | | | | | |
| 20 | X | 5-8-5 | 13 | | | Medium Dense Light Gray Silty Sand with Rock Fragments (SM) | | | | | | |
| 25 | X | 2-3-1 | 4 | | | Loose Gray and Green Clayey Sand (SC) | | | | | | |
| 30 | X | 1-2-3 | 5 | | | | | | | | | |
| 35 | X | 2-2-2 | 4 | | | | | | | | | |
| 40 | X | 2-2-3 | 5 | | | | | | | | | |
| 45 | X | 3-2-4 | 6 | | | | | | | | | |
| 50 | X | 1-3-4 | 7 | | | | | | | | | |
| | | | | | | BORING TERMINATED | | | | | | |

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

| | |
|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 2 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-2** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 4.3
DATE OF READING: 08/30/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/30/19
DATE FINISHED: 8/30/19
DRILLED BY: LU/ED
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/ FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | |
| | X | 20-23-23 | 46 | | | Dense Aggregate Base | | | | | | |
| | X | 11-18-13 | 31 | | | Medium Dense Light Brown Clayey Sand with trace of Shell Fragments (SC) | | | | | | |
| | X | 17-17-15 | 32 | ▼ | | Dense Brown and Light Brown Fine Sand with trace of Rock Fragments (SP) | | | | | | |
| 5 | X | 13-11-16 | 27 | | | Medium Dense and Dense Brown, Gray, Light Brown and Light Gray Fine Sand with trace of Roots (SP) | | | | | | |
| | X | 20-22-18 | 40 | | | | | | | | | |
| | X | 9-11-14 | 25 | | | | | | | | | |
| 10 | X | 12-13-20 | 33 | | | | | | | | | |
| | | | | | | Loose Light Gray Fine Sand (SP) | | | | | | |
| 15 | X | 4-3-2 | 5 | | | | | | | | | |
| | | | | | | Hard Rock | | | | | | |
| 20 | X | 50/3" | 50+ | | | | | | | | | |
| | | | | | | Loose and Medium Dense Light Gray, Light Brown and Light Green Clayey Sand (SC) | | | | | | |
| 25 | X | 2-3-3 | 6 | | | | | | | | | |
| 30 | X | 3-4-3 | 7 | | | | | | | | | |
| 35 | X | 4-3-4 | 7 | | | | | | | | | |
| 40 | X | 5-6-6 | 12 | | | | | | | | | |
| | | | | | | Stiff Light Green Fine Sandy Clay (CL) | | | | | | |
| 45 | X | 4-4-6 | 10 | | | | | | | | | |
| 50 | X | 5-6-6 | 12 | | | | | | | | | |
| | | | | | | BORING TERMINATED | | | | | | |

BORING LOG 0530.1900154.0000.GPJ UNIENGSC.GDT 9/5/19

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

| | |
|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 3 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-3** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 3.0
DATE OF READING: 08/31/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/31/19
DATE FINISHED: 8/31/19
DRILLED BY: LU/ED
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/ FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | |
| | X | 17-24-26 | 50 | | | Dense Aggregate Base | | | | | | |
| | X | 30-25-26 | 51 | ▼ | | Very Dense Light Brown and Light Gray Fine Sand with Rock Fragments (SP) | | | | | | |
| | X | 15-20-22 | 42 | | | Dense to Very Dense Brown, Gray and Light Brown Fine Sand with trace of Clay Fines (SP) | | | | | | |
| 5 | X | 21-40-15 | 55 | | | | | | | | | |
| | X | 6-11-11 | 22 | | | Medium Dense Light Gray Fine Sand (SP) | | | | | | |
| | X | 9-8-8 | 16 | | | | | | | | | |
| 10 | X | 7-6-6 | 12 | | | | | | | | | |
| | X | 2-0-0 | 0 | | | Very Loose Light Gray Fine Sand (SP) | | | | | | |
| 15 | | | | | | Hard Rock | | | | | | |
| | X | 50-2-1 | 3 | | | Soft Light Gray Fine Sandy Silt with Rock Fragments (ML) | | | | | | |
| 20 | | | | | | Loose Light Gray Silty Sand with trace of Shell Fragments (SM) | | | | | | |
| | X | 3-3-4 | 7 | | | | | | | | | |
| 25 | | | | | | Loose Gray Fine Sand with Shell Fragments (SP) | | | | | | |
| | X | 3-4-6 | 10 | | | | | | | | | |
| 30 | | | | | | Medium Stiff Light Gray Fine Sandy Clay (CL) | | | | | | |
| | X | 4-2-5 | 7 | | | | | | | | | |
| 35 | | | | | | Loose Light Gray Clayey Sand (SC) | | | | | | |
| | X | 3-3-5 | 8 | | | | | | | | | |
| 40 | | | | | | Medium Stiff to Stiff Light Green Fine Sandy Clay (CL) | | | | | | |
| | X | 3-4-4 | 8 | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| | X | 2-3-6 | 9 | | | | | | | | | |
| 50 | | | | | | BORING TERMINATED | | | | | | |

BORING_LOG 0530.1900154.0000.GPJ UNIENGSC.GDT 9/5/19

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

| | |
|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 5 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-5** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 3.6
DATE OF READING: 08/30/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/30/19
DATE FINISHED: 8/30/19
DRILLED BY: LU/ED
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | |
| | X | 18-16-27 | 43 | | | Dense Aggregate Base | | | | | | |
| | X | 19-21-13 | 34 | ▼ | | Dense Brown, Gray and Light Brown Fine Sand with Rock Fragments and trace of Roots (SP) | | | | | | |
| | X | 12-23-24 | 47 | | | | | | | | | |
| 5 | X | 13-15-18 | 33 | | | Dense Gray and Light Brown Fine Sand with Clay Fines (SP-SC) | | | | | | |
| | X | 12-13-17 | 30 | | | Medium Dense Light Brown and Light Gray Fine Sand with trace of Silt Fines (SP) | | | | | | |
| | X | 7-9-14 | 23 | | | | | | | | | |
| 10 | X | 7-8-7 | 15 | | | Medium Dense Light Gray Fine Sand with trace of Roots (SP) | | | | | | |
| 15 | X | 50/4" | 50+ | | | Hard Rock | | | | | | |
| 20 | X | 3-2-2 | 4 | | | Soft Light Brown and Light Gray Fine Sandy Silt with Rock Fragments (ML) | | | | | | |
| | | | | | | Loose Gray Clayey Sand (SC) | | | | | | |
| 25 | X | 2-3-4 | 7 | | | | | | | | | |
| 30 | X | 3-2-4 | 6 | | | | | | | | | |
| 35 | X | 4-4-5 | 9 | | | Loose Gray Silty Sand (SM) | | | | | | |
| 40 | X | 5-5-5 | 10 | | | Stiff Gray Fine Sandy Clay (CL) | | | | | | |
| | | | | | | Loose Gray Clayey Sand (SC) | | | | | | |
| 45 | X | 7-5-4 | 9 | | | | | | | | | |
| 50 | X | 5-6-4 | 10 | | | BORING TERMINATED | | | | | | |

BORING_LOG 0530.1900154.0000.GPJ UNIENGSC.GDT 9/5/19

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

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|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 6 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-6** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 2.1
DATE OF READING: 08/26/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/26/19
DATE FINISHED: 8/26/19
DRILLED BY: LU/MA/MT
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/ FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | ▼ | | Brown, Gray and Light Gray Fine Sand (SP) | | | | | | |
| 5 | | 8-9-11 | 20 | | | Medium Dense Brown Fine Sand with trace of Roots (SP) | | | | | | |
| | | 5-4-9 | 13 | | | | | | | | | |
| | | 6-6-8 | 14 | | | Medium Dense and Loose Light Brown Fine Sand with Varying Shell Fragments (SP) | | | | | | |
| 10 | | 4-3-50 | 53 | | | Hard Rock | | | | | | |
| 15 | | 50/0" | 50+ | | | | | | | | | |
| 20 | | 6-5-6 | 11 | | | Stiff Light Gray Fine Sandy Silt with trace of Shell and Rock Fragments (ML) | | | | | | |
| 25 | | 3-2-3 | 5 | | | Loose Light Brown and Light Gray Silty Sand with trace of Rock Fragments (SM) | | | | | | |
| 30 | | 2-2-3 | 5 | | | Loose Gray and Green Clayey Sand with trace of Phosphate Fragments (SC) | | | | | | |
| 35 | | 3-4-4 | 8 | | | | | | | | | |
| 40 | | 4-3-3 | 6 | | | | | | | | | |
| 45 | | 4-6-4 | 10 | | | | | | | | | |
| 50 | | 4-3-5 | 8 | | | BORING TERMINATED | | | | | | |

BORING_LOG 0530.1900154.0000.GPJ UNIENGSC.GDT 9/5/19

# UNIVERSAL ENGINEERING SCIENCES
# BORING LOG

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|---|---|
| PROJECT NO.: | 0530.1900154.0000 |
| REPORT NO.: | |
| PAGE: | 7 |

PROJECT: Proposed AB9 Building
Florida Gulf Coast University
Fort Myers, Lee County, FL

CLIENT: RG Architects, PA

LOCATION: See Boring Locaton Plan

REMARKS:

BORING DESIGNATION: **B-7** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

G.S. ELEVATION (ft):
WATER TABLE (ft): 2.5
DATE OF READING: 08/26/2019
EST. W.S.W.T. (ft):

DATE STARTED: 8/26/19
DATE FINISHED: 8/26/19
DRILLED BY: LU/MA/MT
TYPE OF SAMPLING: ASTM 1586

| DEPTH (FT.) | SAMPLE | BLOWS PER 6" INCREMENT | N (BLOWS/ FT.) | W.T. | SYMBOL | DESCRIPTION | -200 (%) | MC (%) | ATTERBERG LIMITS LL | ATTERBERG LIMITS PI | UCS (tsf) | ORG. CONT. (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | ▼ | | Aggregate Base | | | | | | |
| | | | | | | Brown, Gray and Light Brown Fine Sand with trace of Clay Fines and Rock Fragments (SP) | | | | | | |
| 5 | | 9-9-11 | 20 | | | Medium Dense Light Gray Fine Sand with trace of Roots and Rock Fragments (SP) | | | | | | |
| | | 10-9-8 | 17 | | | | | | | | | |
| | | 39-12-5 | 17 | | | Medium Dense Light Gray Fine Sand with Silt Fines and Rock Fragments (SP-SM) | | | | | | |
| 10 | | 1-1-1 | 2 | | | Very Loose to Loose Gray and Light Gray Fine Sand with trace of Rock and Shell Fragments (SP) | | | | | | |
| 15 | | 3-2-2 | 4 | | | Hard Rock | | | | | | |
| | | | | | | Stiff Light Gray Fine Sandy Silt with Rock Fragments (ML) | | | | | | |
| 20 | | 4-5-5 | 10 | | | | | | | | | |
| | | | | | | Loose Gray Silty Sand (SM) | | | | | | |
| 25 | | 3-3-4 | 7 | | | | | | | | | |
| | | | | | | Medium Dense and Loose Gray and Light Green Clayey Sand (SC) | | | | | | |
| 30 | | 4-5-6 | 11 | | | | | | | | | |
| 35 | | 2-4-3 | 7 | | | | | | | | | |
| | | | | | | Loose Gray and Green Clayey Sand (SC) | | | | | | |
| 40 | | 4-3-3 | 6 | | | | | | | | | |
| 45 | | 3-3-5 | 8 | | | | | | | | | |
| | | | | | | Loose Gray Fine Sand with Clay Fines and trace of Phopshate Fragments (SP-SC) | | | | | | |
| 50 | | 3-3-4 | 7 | | | BORING TERMINATED | | | | | | |

BORING_LOG 0530.1900154.0000.GPJ UNIENGSC.GDT 9/5/19

UNIVERSAL ENGINEERING SCIENCES

# KEY TO BORING LOGS

## TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portions retained on No. 200 sieve): includes (1) clean gravel and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density as determined by laboratory tests or standard penetration resistance tests.

| Descriptive Terms | Relative Density | SPT Blow Count |
|---|---|---|
| Very loose | 0 to 15 % | < 4 |
| Loose | 15 to 35 % | 4 to 10 |
| Medium dense | 35 to 65 % | 10 to 30 |
| Dense | 65 to 85 % | 30 to 50 |
| Very dense | 85 to 100 % | > 50 |

FINE-GRAINED SOILS (major portions passing on No. 200 sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings, SPT blow count, or unconfined compression tests.

| Descriptive Terms | Unconfined Compressive Strength kPa | SPT Blow Count |
|---|---|---|
| Very soft | < 25 | < 2 |
| Soft | 25 to 50 | 2 to 4 |
| Medium stiff | 50 to 100 | 4 to 8 |
| Stiff | 100 to 200 | 8 to 15 |
| Very stiff | 200 to 400 | 15 to 30 |
| Hard | > 400 | > 30 |

## GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Surface elevations are based on topographic maps and estimated locations.

3. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not guaranteed to be representative of subsurface conditions at other locations or times.

SYMBOLS

▼ Measured Water Table Level ▽ Estimated Seasonal High Water Table

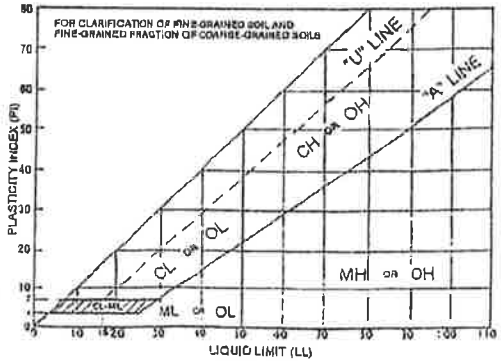
| Major Divisions | | | Group Symbols | Typical Names | Laboratory Classification Criteria |
|---|---|---|---|---|---|
| Coarse-Grained soils (More than half the material is larger than No. 200 sieve size) | Gravels (More than half of coarse fraction is larger than No. 4 sieve size) | Clean gravel (Little or no fines) | GW | Well-graded gravels, gravel-sand mixtures, little or no fines | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 |
| | | | GP | Poorly-graded gravels, gravel-sand mixtures, little or no fines | Not meeting all gradation requirements for GW |
| | | Gravel with fines (Appreciable amount of fines) | GM | Silty gravels, gravel-sand-silt mixtures | Atterberg limits below "A" line or P.I. less than 4 |
| | | | GC | Clayey gravels, gravel-sand-silt mixtures | Atterberg limits above "A" line or P.I. greater than 7 |
| | Sands (More than half of coarse fraction is smaller than No. 4 sieve size) | Clean sands (Little or no fines) | SW | Well-graded sands, gravelly sands, little or no fines | $C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3 |
| | | | SP | Poorly-graded sands, gravelly sands, little or no fines | Not meeting all gradation requirements for SW |
| | | Sands with fines (Appreciable amount of fines) | SM | Silty sands, sand-silt mixtures | Atterberg limits below "A" line or P.I. less than 4 |
| | | | SC | Clayey sands, sand-clay mixtures | Atterberg limits above "A" line or P.I. greater than 7 |
| Fine-Grained soils (More than half the material is smaller than No. 200 sieve size) | Silts and Clays (Liquid limit less than 50) | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity | |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays | |
| | | | OL | Organic silts and organic silty clays of low plasticity | |
| | Silts and Clays (Liquid limit greater than 50) | | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, organic silts | |
| | | | CH | Inorganic clays of high plasticity, fat clays | |
| | | | OH | Organic clays of medium to high plasticity, organic silts | |
| | Highly Organic Soils | | Pt | Peat and other highly organic soils | |

Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows:
Less than 5 percent..... GW, GP, SW, SP
More than 12 percent..... GM, GC, SM, SC
5 to 12 percent..... Borderline cases requiring dual symbols*

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

| Particle Size | Sieve sizes | mm |
|---|---|---|
| Material | | |
| Silt or clay | < #200 | < 0.074 |
| Sand | #200 to #40 | 0.074 to 0.42 |
| Fine | #40 to #10 | 0.42 to 2.00 |
| Medium | #10 to #4 | 2.00 to 4.76 |
| Coarse | #4 to 3/4 in. | 4.76 to 19.1 |
| Gravel | 3/4 in. to 3 in. | 19.1 to 76.2 |
| Fine | 3 in. to 12 in. | 76.2 to 304.8 |
| Coarse | 12 in. to 36 in. | 304.8 to 914.4 |
| Cobble | | |
| Boulders | | |




Plasticity Chart

* When the percent passing a No. 200 sieve is between 5% and 12%, a dual symbol is used to denote the soil. For example: SP-SC, poorly-graded sand with clay content between 5% and 12%.

# APPENDIX C

UNIVERSAL
ENGINEERING SCIENCES

# Important Information about Your

# Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*While you cannot eliminate all such risks, you can manage them. The following information is provided to help.*

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

## A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

## Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

## Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

## Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

## Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

## Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

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## CONSTRAINTS AND RESTRICTIONS

### WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

### UNANTICIPATED SOIL

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

### CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

### MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinion contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

### CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

## USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

## STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

## OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative east or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

## WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicated normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuation in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions and variations.

## LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects which are subsequently encountered during construction that are not discussed within the text of this report.

## TIME

This report reflects the soil conditions at the time of investigation. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.