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GEOTECHNICAL EVALUATION

Proposed Sunset Lake Apartments
Flagler Beach, Florida

UES Project No. 0430.1800287.0000
UES Report No. 134233

January 14, 2019

Prepared for:

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January 14, 2019

Mr. Sami El-Behiri
Urban Comfort, PLC
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Longwood, FL 32779

Reference: **GEOTECHNICAL EVALUATION**
Proposed Sunset Lake Apartments
Flagler Beach, Florida
UES Project No. 0430.1800287.0000 and UES Report No. 134233

Dear Mr. Speaks:

Universal Engineering Sciences, Inc. has completed the geotechnical evaluation for the subject project. This report contains the results of our evaluation, an engineering interpretation of these with respect to the project characteristics described to us, and recommendations for foundation, pavement support, stormwater management design and site preparation

We appreciate the opportunity to have worked with you on this project and look forward to a continued association. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES

Michael Mohney
Project Engineer

Brian C. Pohl, P.E.
Branch Manager
P.E. Number 60216

BRIAN C. POHL
LICENSE
NO. 60216
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Cc: Mr. Jack Speaks
Mr. Brett Markovitz – CPH, Inc.

Attachments

PC/BCP/cme

1.0 INTRODUCTION

1.1 GENERAL

In this report we present the results of the subsurface evaluation for the proposed construction in Flagler Beach, Florida. We have divided this report into the following sections:

- SECTION 2.0 - SCOPE OF SERVICES
- SECTION 3.0 - FINDINGS
- SECTION 4.0 - FOUNDATION AREA RECOMMENDATIONS
- SECTION 5.0 - PAVEMENT AREA RECOMMENDATIONS
- SECTION 6.0 - STORMWATER DESIGN RECOMMENDATIONS
- SECTION 7.0 - CONSTRUCTION RELATED SERVICE
- SECTION 8.0 - LIMITATIONS

2.0 SCOPE OF SERVICES

2.1 PROJECT DESCRIPTION

Project information has been provided to us by Mr. Brett Markovitz with CPH, Inc. We understand that the proposed project will consist of constructing two (2) three-story apartment buildings with associated stormwater management facilities and flexible asphalt pavement areas. We assume the column and wall loads will not exceed 75 kips and 8 kips/foot, respectively. We anticipate that approximately no greater than one to three feet of fill be placed within the roadway and building areas

Our recommendations are based upon the above considerations. If any of this information is incorrect, or if you anticipate any changes, inform Universal Engineering Sciences so that we may review our recommendations.

2.2 PURPOSE

The purposes of this investigation were:

- to investigate the general subsurface conditions at the site;
- to interpret and review the subsurface conditions with respect to the proposed construction;
- to provide geotechnical engineering recommendations for site preparation, pavement and foundation support; and
- to provide recommendations for stormwater facility design.

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. Universal Engineering Sciences would be pleased to perform these services, at your request.

Our investigation was confined to the zone of soil likely to be influenced by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. A deep geological evaluation requires a more extensive range of field services than performed in this study.

2.3 FIELD INVESTIGATION

2.3.1 Borings

Due to the presence of several deep intersecting canals/ditches, we were unable to traverse to all the proposed boring locations with our all terrain vehicle (ATV) drilling equipment. Instead, hand auger borings (designated B-2, B-3, B-4, and P-2) were performed in-place of these borings. It should be noted that the hand auger borings could not be drilled past 6 feet below existing grade due to the presence of dense soil conditions.

The subsurface conditions within the proposed structure areas were investigated with one (1) Standard Penetration Test (SPT) borings (designated B-1) advanced to a depth of approximately 25 feet below existing grade and three (3) auger borings (designated B-2 through B-4) advanced to a depth of approximately 5 feet below existing grade. In addition, one (1) Dynamic Cone Penetration (DCP) test was performed at boring location B-4. In the proposed stormwater area, we performed two (2) auger borings (designated P-1 and P-2) advanced to approximately 20 and 6 feet below existing grade. In the proposed pavement areas, we performed two (2) SPT borings (designated B-5 and B-6) advanced to approximately 10 feet each below existing grade. We performed the Standard Penetration Tests and auger borings according to the procedures of ASTM D-1586 and ASTM D-1452, respectively

The borings were located by our field personnel using taped measurements, and should be considered accurate only to the degree implied by the method of measurement used. The approximate locations and elevations of the borings are presented on the attached Boring Location Plan and Subsurface Profiles in Appendix A.

Samples obtained from the borings were transported to our laboratory for further evaluation. Samples of the soils encountered will be held in our laboratory for your inspection for 60 days unless we are notified otherwise.

2.4 LABORATORY INVESTIGATION

2.4.1 Index Testing

The soil samples recovered from the soil borings were returned to our laboratory and then a UES Engineer visually examined and reviewed the field descriptions. The soils were classified in accordance with the Unified Soil Classification System (USCS). Tests consisting of percent passing a No. 200 sieve and natural moisture content determinations were performed to aide in classification of the soils.

3.0 FINDINGS

3.1 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix A: Boring Location Plan and Subsurface Profiles. The classifications and descriptions shown on the profiles are based upon visual characterizations of the recovered soil samples. Also, see Appendix A: Key to Boring Log, for further explanation of the symbols and placement of data on the Subsurface Profiles. The following discussion summarizes the soil conditions encountered.

The results of the SPT borings generally indicate the presence of intermittent layers of very loose to very dense fine sand (SP), fine sand with silt (SP-SM) and sandy shell to the deepest borings' termination depth of approximately 25 feet below existing grade. As an exception loose to medium dense silty fine sand (SM) was encountered from approximately 3 to 6 feet below existing grade at boring location B-1 and very dense sandy shell with some pieces of cemented shell (COQUINA) was encountered from approximately 6 to 8 feet below existing grade at boring location B-5.

The results of the auger borings generally indicated the presence of fine sand (SP) and fine sand with silt (SP-SM) to the deepest borings' termination depth of approximately 20 feet below existing grade.

3.2 GROUNDWATER

We recorded groundwater subsequent to drilling, at depths varying between 4.0 and 7.5 feet below the ground surface. Based on available published literature, existing site features, and the results of the borings, we estimate the normal seasonal high groundwater level to be approximately one feet above the measured levels. It should be noted that the water table is being drawdown at some boring locations due to multiple adjacent wet retention ponds and drainage canals. Our estimated seasonal high water level does not provide any assurance groundwater level will not exceed these estimated levels during any given year in the future. Should impediments to surface water drainage be present, or should rainfall intensity and duration, or total rainfall quantities, exceed the normally anticipated rainfall quantities, groundwater levels might once again exceed our seasonal high estimates. The depths of the groundwater levels encountered at the boring locations are presented on the Subsurface Profiles.

We recommend positive drainage be established and maintained on the site during construction. We further recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project.

4.0 FOUNDATION AREA RECOMMENDATIONS

4.1 GENERAL

The following recommendations 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 structural loadings, construction locations, or grading information changes from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

Additionally, if subsurface conditions are encountered during construction which was not encountered in the borings, report those conditions immediately to us for observation and recommendations.

Based on the results of our exploration, and the understood fill heights, it is our opinion that the subsurface conditions at the project site are acceptable for support of the proposed structures on a properly designed and constructed conventional shallow foundation system, provided the site preparation and earthwork construction recommendations outlined in Section 4.3 of this report are performed. Provided the improvements and specific site preparation procedures are carefully followed, the parameters outlined below may be used for foundation design.

4.2 STRUCTURE FOUNDATIONS

4.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for shallow foundations should not exceed 3,000 pounds per square foot (psf). Net bearing pressure is defined as the soil bearing pressure at the base of the foundation in excess of the natural overburden pressure. The foundations should be designed based upon the maximum load that could be imposed by all loading conditions.

4.2.2 Foundation Size

The minimum widths recommended for any isolated column footing and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

4.2.3 Bearing Depth

The exterior foundations should bear at a depth of at least 12 inches below the exterior final grades and the interior footings should bear at a depth of at least 12 inches below the finish floor elevation to provide confinement to the bearing level soils. We recommend stormwater and surface water be diverted away from the building exterior, both during and after construction, to reduce the possibility of erosion beneath the exterior footings.

4.2.4 Bearing Material

The foundations may bear on either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities of at least 95 percent of the maximum dry density of the bearing soils as determined by ASTM D-1557 (Modified Proctor), to the depth described subsequently in the Site Preparation section of the report. In addition to compaction, the bearing soils must exhibit stability and be free of “pumping” conditions.

4.2.5 Settlement Estimates

Post-construction settlement of the structures will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to

vibration from offsite sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimates for the structures are based upon the use of successful adherence to the site preparation recommendations presented later in this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlement of the structures.

Due to the nature of the surficial soils, following the compaction operations, we expect a significant portion of settlement to be elastic in nature. This settlement is expected to occur relatively quickly, upon application of the loads, during and immediately following construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads, and the field test data which we have correlated to the strength and compressibility characteristics of the subsurface soils, we estimate the total settlements of the structures to be less than one inch.

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. Based on the subsurface conditions as determined by our borings, it is anticipated that differential settlements will be within tolerable limits.

4.3 SITE PREPARATION FOR SHALLOW FOUNDATIONS

We recommend the following site preparation procedures for the structure areas:

1. Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which may subsequently lead to excessive settlement of the overlying structures.

2. Strip the proposed construction limits of all grass, roots, topsoil, and other deleterious materials within and 5 feet beyond the perimeter of the proposed structures. Expect initial clearing and grubbing to depths of approximately 6 to 12 inches. In addition, we recommend any necessary excavation of cemented shell (COQUINA) to maintain an approximate 1 foot separation from the proposed building foundation bearing level and the tops of coquina. We recommend replacing any excavated soils with fill consisting of “clean”, fine sand with less than 5 percent soil fines to achieve this separation. Likely this separation will be achieved with the addition of fill soils.

3. Based on the ground water levels and anticipated fill, dewatering for foundation excavation and compaction may be required. We recommend implementing temporary groundwater control measures if the groundwater is within two feet of the required depth of excavation at the time of construction. Dewatering measures should be the responsibility of the contractor. We recommend the groundwater control measures remain in-place until compaction of the existing soils is completed and backfilling has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

4. Compact the exposed surface using tracked dozer or vibratory equipment. We recommend that vibratory equipment be operated in static mode within 75 feet of any existing structures. The upper two feet of soils below the exposed surface within the building area should be improved to achieve a minimum compaction requirement of 95% of the Modified Proctor Test (ASTM D-1557). We recommend the compacted soils exhibit moisture content within 2 percent of the soils optimum moisture content as determined by the Modified Proctor Test (ASTM D-1557). Should the soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

5. Test the compacted surface for compliance at a minimum of one location per 2,500 square feet within the building area, or at a minimum of four locations per building area.

6. Place fill material, as required. The fill should consist of "clean," fine sand with less than 5 percent soil fines. You may use fill materials with soil fines between 5 percent and 10 percent, but strict moisture control may be required. Place fill in uniform 8 to 12-inch loose lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density. We recommend the compacted soils exhibit moisture content within 2 percent of the soils optimum moisture content as determined by the Modified Proctor Test (ASTM D-1557). If light compaction equipment is used, we recommend the lift thickness be reduced to 8 inch thick lifts.

7. Perform compliance tests within the backfill and fill soils at a minimum of one location per 2,500 square feet per lift (minimum four locations per building area).

8. Compact and test footing cuts for compaction to a depth of one foot below bearing level. We recommend that you test one out of every four (25 percent) column footings and perform one test per every 50 linear feet of wall footing. Compaction operations in confined areas, such as footing excavations, can best be performed with a lightweight vibratory sled or other hand-held compaction equipment.

5.0 PAVEMENT AREA RECOMMENDATIONS

5.1 GENERAL

As discussed, it is anticipated a flexible asphaltic pavement section may be utilized for the subject project.

5.2 FLEXIBLE ASPHALTIC PAVEMENT

Because traffic loadings are commonly unavailable, we have generalized our pavement design into two groups. The group descriptions and the recommended component thicknesses are presented in Table 1 below.

Table 1: Pavement Component Recommendations			
Traffic Group	**Component Thickness (Inches)**		
	Stabilized Subgrade	**Base Course**	**Surface Course**
Roadway - light duty	12	6	1.5
Roadway - heavy duty	12	8	2.0

5.3 STABILIZED SUBGRADE

We recommend that subgrade materials be compacted in place according to the requirements in the "Site Preparation" section of this report. Further, stabilize the subgrade materials to a minimum Limerock Bearing Ratio (LBR) of 40 percent as specified by Florida Department of Transportation (FDOT) requirements for Type B Stabilized Subgrade.

Further, the stabilized subgrade can be imported material or a blend of on-site soils and imported materials. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions.

The primary function of stabilized subgrade beneath the base course is to provide a stable and firm subgrade so that the base course can be properly placed and compacted. Depending upon the soil type, the subgrade material may have sufficient stability to provide the needed support without additional stabilizing material. Generally speaking, sands with silt or clay typically have sufficient stability and may not require additional stabilizing material. Conversely, relatively "clean" sands may not provide sufficient stability in order to adequately construct the base course.

5.4 BASE COURSE

We recommend that the base course consist of either limerock or graded crushed aggregate (crushed concrete).

5.4.1 Limerock

Limerock should have a minimum LBR of 100 percent and should be mined from an FDOT approved source. Place limerock in maximum 6-inch lifts and compact each lift to a minimum density of 98 percent of the Modified Proctor maximum dry density.

5.4.2 Crushed Concrete Base

Crushed concrete should be supplied by an approved plant with quality control procedures. The crushed concrete stockpiled should be free of sandy pockets, foreign materials, and uncrushed particles. We recommend the following specifications be enforced.

a) Crushed concrete shall not contain lumps, balls or pockets of sand or clay sized material in sufficient quantity as to be detrimental to the proper binding, finishing or strength of the crushed concrete base.

b) Samples of base course materials shall be supplied to the engineer prior to use in the work. Additional samples shall be furnished during construction, as necessary.

c) At least 97 percent (by weight) of the material shall pass a 3-1/2 inch sieve and the material shall be graded uniformly down to dust. The fine material shall consist entirely of dust or fracture. All crushing or breaking-up which might be necessary in order to meet such size requirements shall be done before the material is placed on the road.

d) The base shall be bladed and shaped to conform to the typical sections as shown on the plans. Then the base shall be compacted by rolling with a combination of steel wheel and rubber tired rollers until an average density of 98 percent of the maximum density obtainable under AASHTO Method T-180 is reached. The base shall have an average LBR of not less than 130. The LBR value of material produced at a particular source shall be determined in accordance with an approved quality control procedure.

Testing shall be performed at the following frequency:

1) Perform in-place density tests on crushed concrete base at a frequency of 2 tests per pavement area or 1 test per 300 linear feet whichever is greater

2) Perform Limerock Bearing Ratio tests at a frequency of 1 test per visual change in material and a minimum of 1 test per pavement area or every 15,000 square feet whichever is greater.

3) Engineer should perform a final visual base inspection prior to placement of prime or tack coat and paving.

5.5 SURFACE COURSE

In light duty areas where there is occasional truck traffic, but primarily passenger cars, we recommend using an asphaltic concrete, FDOT Type SP 9.5. In heavy duty areas where truck traffic is predominant, we recommend using an asphaltic concrete, FDOT Type SP 12.5.

It should be noted if a more aesthetically pleasing asphalt surface (finer aggregate) is required a layer of FC-9.5 or FC-12.5 asphalt can be placed. A ½ inch of FC asphalt can be placed above the SP asphaltic concrete. However this may result in increased costs.

Asphaltic concrete mixes should be a current FDOT approved design of the materials actually used. Samples of the materials delivered to the project should be tested to verify that the aggregate gradation and asphalt content satisfies the mix design requirements. Compact the asphalt to a minimum of 90 percent of the Gmm (maximum voidless specific gravity).

After placement and field compaction, core the wearing surface to evaluate material thickness and to perform laboratory densities. Obtain cores at frequencies of at least one core per 3,000 square feet of placed pavement or a minimum of two cores per day's production.

In parking lots, for extended life expectancy of the surface course, we recommend applying a coal tar emulsion sealer at least six months after placement of the surface course. The seal coat will help to patch cracks and voids, and protect the surface from damaging ultraviolet light and automobile liquid spillage. Please note that applying the seal coat prior to six

months after placement may hinder the "curing" of the surface course, leading to its early deterioration.

5.6 CURBING

We recommend that curbing around landscaped sections adjacent to the parking lots and driveways be constructed with full-depth curb sections. Using extruded curb sections which lie directly on top of the final asphalt level, or eliminating the curbing entirely, may not significantly impede the migration of irrigation water from the landscape areas to the interface between the asphalt and the base. This migration often causes separation of the wearing surface from the base and subsequent rippling and pavement deterioration. It is recommended that the subgrade below the curbing be stabilized to a minimum LBR of 40.

5.7 CONSTRUCTION TRAFFIC

Light duty roadways and incomplete pavement sections will not perform satisfactorily under construction traffic loadings. We recommend that construction traffic (construction equipment, concrete trucks, sod trucks, garbage trucks, dump trucks, etc.) be re-routed away from these roadways or that the pavement section be designed for these loadings.

5.8 EFFECTS OF GROUNDWATER

We recommend that all pavement sections analyses incorporate the seasonal high groundwater conditions. We recommend that the groundwater table be maintained, by permanent dewatering means if necessary, below the bottom of the base course of any pavement construction per the following table:

Table 2
Recommended Minimum Clearance Between Pavement Base and Wet Season Water Table

Type of Base	Separation (inches)
Limerock	18
Crushed Concrete	12

One of the most critical influences on the pavement performance in Central Florida is the relationship between the pavement subgrade and the seasonal high groundwater level. Many roadways and parking areas have been destroyed as a result of deterioration of the base and the base/surface course bond resulting from a high water table. **Regardless of the type of base selected, we recommend that the seasonal high groundwater and the bottom of the base course be separated by at least the amount presented in Table 2 above.**

5.9 SITE PREPARATION FOR PAVEMENTS

We recommend the following site preparation procedures:

1. Strip the proposed construction limits of all grass, roots, topsoil and other deleterious materials within, and 3 feet beyond, the proposed pavement limits. Expect initial clearing and grubbing to depths of approximately 6 to12-inches.

2. Proof-compact the exposed surface with the light to medium roller until you maintain density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) to a depth of two feet below the exposed surface, with the exception that

densities of at least 98 percent should be obtained in the upper 12 inches below base course. We recommend the compacted soils exhibit moisture content within 2 percent of the soils optimum moisture content as determined by the Modified Proctor Test (ASTM D-1557). In addition, we recommend any necessary excavation of surficial sands containing cemented coquina (COQUINA) to maintain an approximate 2 feet separation from the proposed roadway foundation and the tops of these soil layers. We recommend replacing any excavated soils with fill consisting of “clean”, fine sand with less than 5 percent soil fines to achieve this separation. **Vibratory equipment should be operated in static mode within 100 feet of adjacent structures.**

3. Should the soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils which are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

4. Test the compacted surface for density at a frequency of not less than one test per 300 linear feet of roadway area (minimum three locations per pavement area).

5. Place and compact backfill and fill material, as required. The fill should consist of "clean," fine sand with less than 5 percent soil fines. You may use fill materials with soil fines between 5 percent and 10 percent, but strict moisture control may be required. Place fill in uniform 10 to 12-inch loose lifts and compact each lift to a minimum density of 95 percent of the Modified Proctor maximum dry density with the exception that densities of at least 98 percent should be obtained within the upper one foot below base course. We recommend the compacted soils exhibit moisture content within 2 percent of the soils optimum moisture content as determined by the Modified Proctor Test (ASTM D-1557).

6. Perform compliance tests within each lift of fill at a frequency of not less than one test per 300 linear feet of roadway area.

6.0 STORMWATER DESIGN RECOMMENDATIONS

6.1 GENERAL

For a dry bottom retention facility, performance will be significantly influenced by the soil permeability and the vertical separation between the bottom and the seasonal high groundwater level. A wet retention facility should be excavated to a depth necessary to obtain a sufficient water depth to limit growth of aquatic vegetation.

If requested, UES can assist in evaluating the facility design exfiltration rates, underdrains and/or groundwater baseflow as pond geometry and stormwater volume requirements become available.

6.2 SOIL PERMABILITY

Three (3) Laboratory Falling-head Saturated Vertical Permeability Test were performed on a relatively undisturbed soil sample. The samples were obtained using thin-walled tube sampling techniques (Shelby Tube). The results of the tests, in feet per day, describe the coefficient of hydraulic conductivity (Permeability) of the soils and are presented on the

attached Subsurface Profiles. The measured permeability rates should not be construed to represent the actual pond exfiltration rates.

Upon evaluation of regional and local geology, we have evaluated that the characteristics of the soils within the vicinity of this project are comprised of sedimentary soils which often exhibit thin, alternating layers. Generally, in relatively homogeneous natural deposits where stratification may result from particle orientation, the Permeability in the Horizontal direction can be somewhat greater than that in the Vertical direction. Based on our experience, the estimated coefficient of Horizontal Permeability typically is on the order of 1.5 and 2 times greater than the Vertical Permeability for SP-SM and SP soil types, respectively. The results of the permeability test are located in Appendix A.

6.3 BORROW SUITABILITY

The stromwater borings were performed, in part, to provide an indication of the suitability of excavated soils from the proposed borrow areas for use as structural fill soil. Based on the boring results and classification of the soil samples, the fine sand (SP) and the fine sand with silt (SP-SM) as encountered at the boring locations, are suitable for use as structural fill soil. Because the fine sand with silt (SP-SM) significantly retains moisture, strict moisture control may be required during placement and compaction operations to avoid moisture related instability

It should be anticipated the soils in the proposed borrow pit area that are below the groundwater level will have moisture contents in excess of the Modified Proctor optimum moisture content and will require stockpiling or spreading to bring the moisture content within 2 percent of the soil’s optimum moisture content corresponding to the required degree of compaction.

7.0 CONSTRUCTION RELATED SERVICES

We recommend the owner retain Universal Engineering Sciences to perform construction materials tests and observations on this project. Field tests and observations include verification of foundation subgrades by monitoring filling operations and performing quality assurance tests on the placement of compacted natural soils and structural fill. We can also perform concrete testing, pavement section testing, structural steel testing and other construction materials testing services.

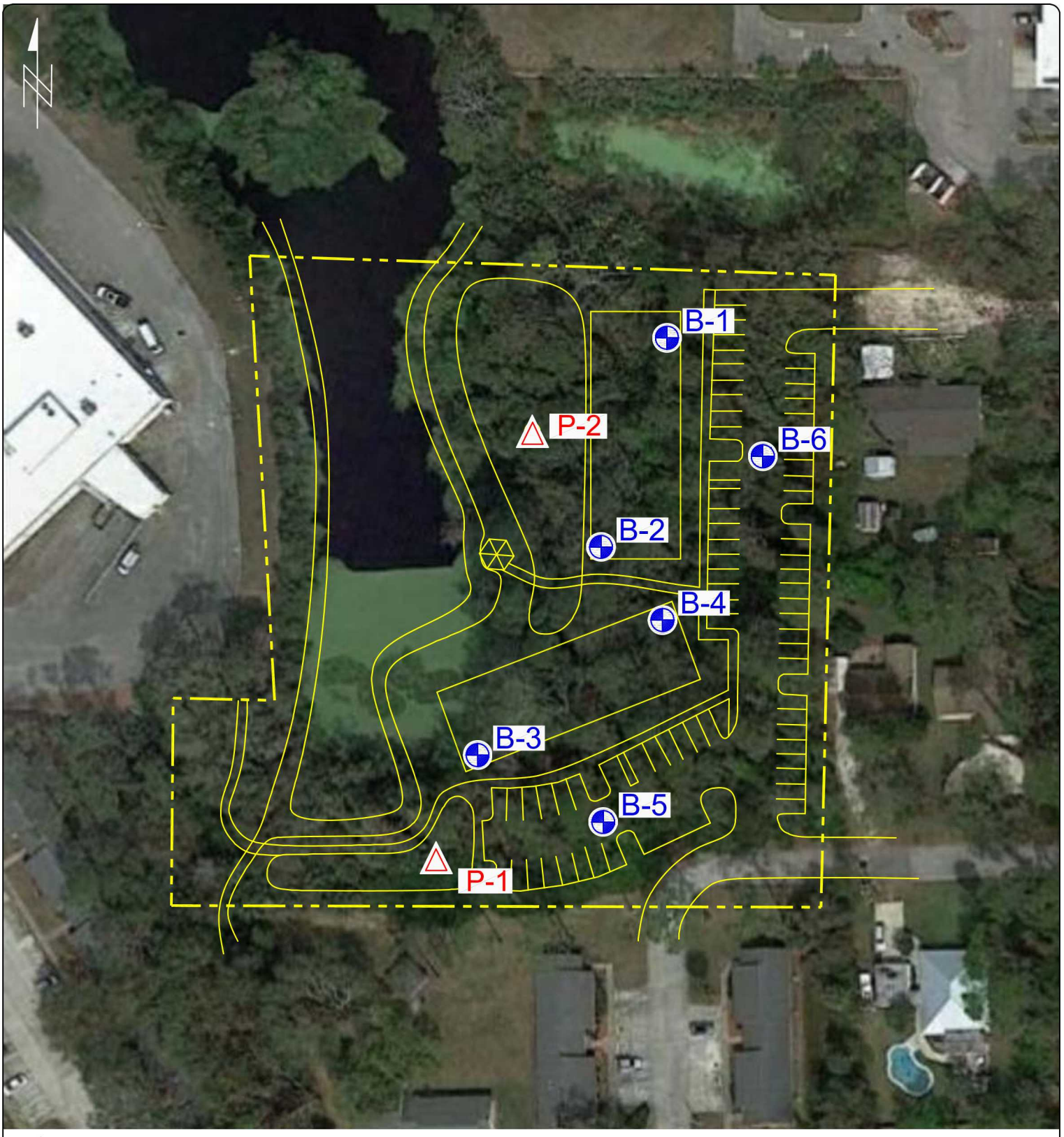
The geotechnical engineering design does not end with the advertisement of the construction documents. The design is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, we are most qualified to address problems that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

8.0 LIMITATIONS

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. An Association of Engineering Firms Practicing in the Geosciences (ASFE) publication, "Important Information about Your Geotechnical Engineering Report" appears in Appendix C, and will help explain the nature of geotechnical issues. Further, we present documents in Appendix C: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

APPENDIX A

BORING LOCATION PLAN
SUBSURFACE PROFILES
SOILS CLASSIFICATION CHART



LEGEND

△ APPROXIMATE LOCATION OF AUGER BORING

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST (SPT) BORING

GRAPHIC SCALE

0 40 80

(IN FEET)

1 INCH ≈ 80 ft.

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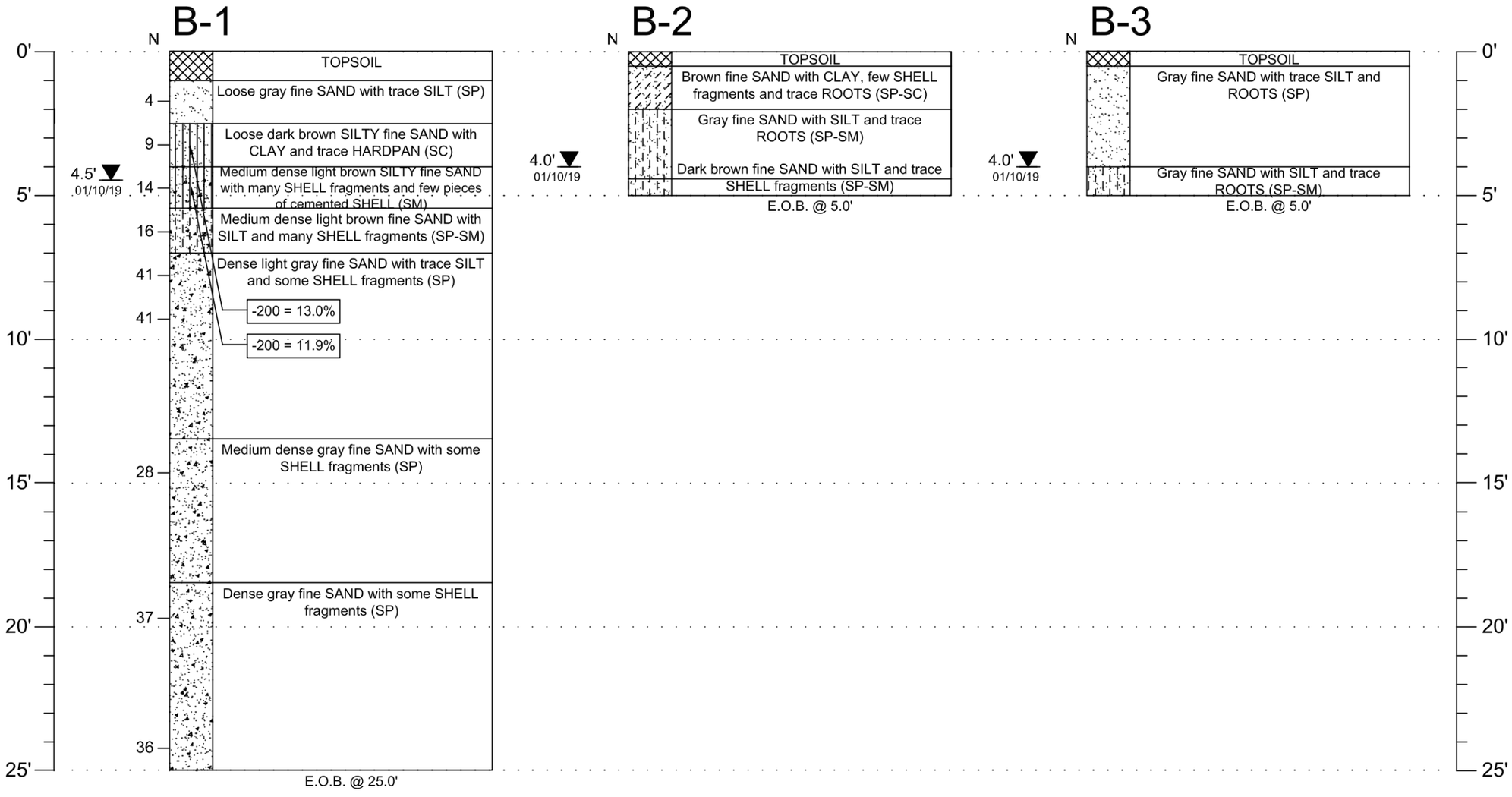
TITLE: BORING LOCATION PLAN			SCALE: 1" ≈ 80'
PROJECT: GEOTECHNICAL EVALUATION SUNSET LAKES FLAGLER BEACH, FLORIDA			PAGE/FIG. NO.: A-1
DRAWN BY: MKL	DATE: 01/12/19	PROJECT NO.: 0430.1800287.0000	
CHECKED BY: BP	DATE: 01/12/19	REPORT NO.: 134233	



Fine SAND (SP)

Fine SAND with some to many SHELL fragments (SP)

SHELL

Fine SAND with SILT (SP-SM)

SILTY fine SAND (SM)

Fine SAND with CLAY (SP-SC)

CLAYEY fine SAND (SC)

CLAY (CH)

TOPSOIL

NOTES:

▼ Measured Groundwater Level 24 (+) Hours Subsequent to Time of Drilling

(SP) Unified Soil Classification System

EOB End of Boring

N Penetr. Resistance, Blows/ft.

-200 % Passing No. 200 Sieve

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PROJECT:
GEOTECHNICAL EVALUATION
SUNSET LAKES
FLAGLER BEACH, FLORIDA

TITLE:
SUBSURFACE PROFILES

DRAWN BY:	DATE:	PROJECT NO.:	SCALE:	PAGE/FIG. NO.:
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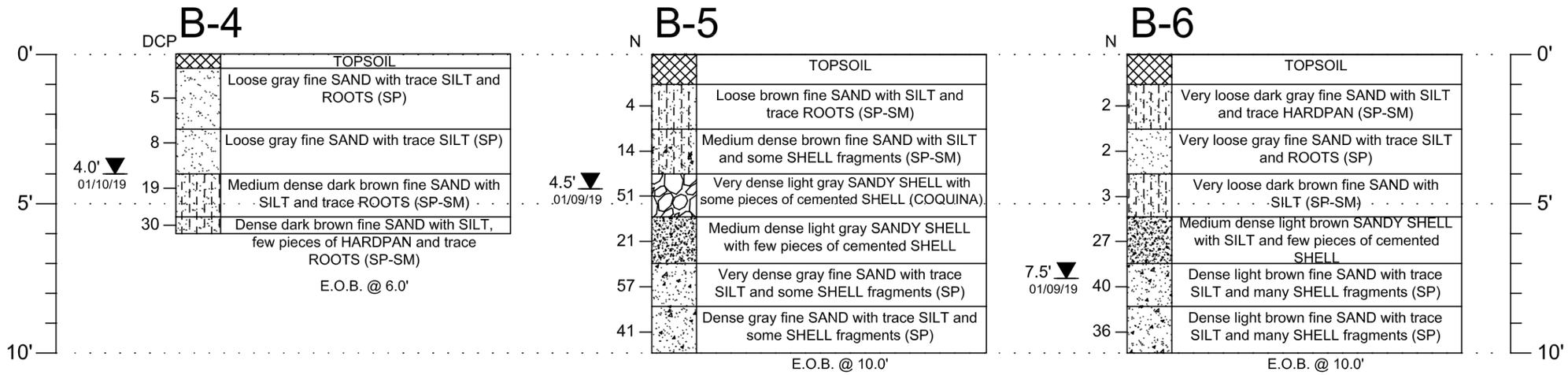
CHECKED BY: BP	DATE: 01/14/19	REPORT NO.: 134233		



Fine SAND (SP)

Fine SAND with some to many SHELL fragments (SP)

SHELL

Fine SAND with SILT (SP-SM)

SILTY fine SAND (SM)

Fine SAND with CLAY (SP-SC)

CLAYEY fine SAND (SC)

CLAY (CH)

TOPSOIL

COQUINA

NOTES:

▼	Measured Groundwater Level 24 (+) Hours Subsequent to Time of Drilling
(SP)	Unified Soil Classification System
EOB	End of Boring
N	Penetr. Resistance, Blows/ft.
DCP	Dynamic Cone Penetrometer
-200	% Passing No. 200 Sieve

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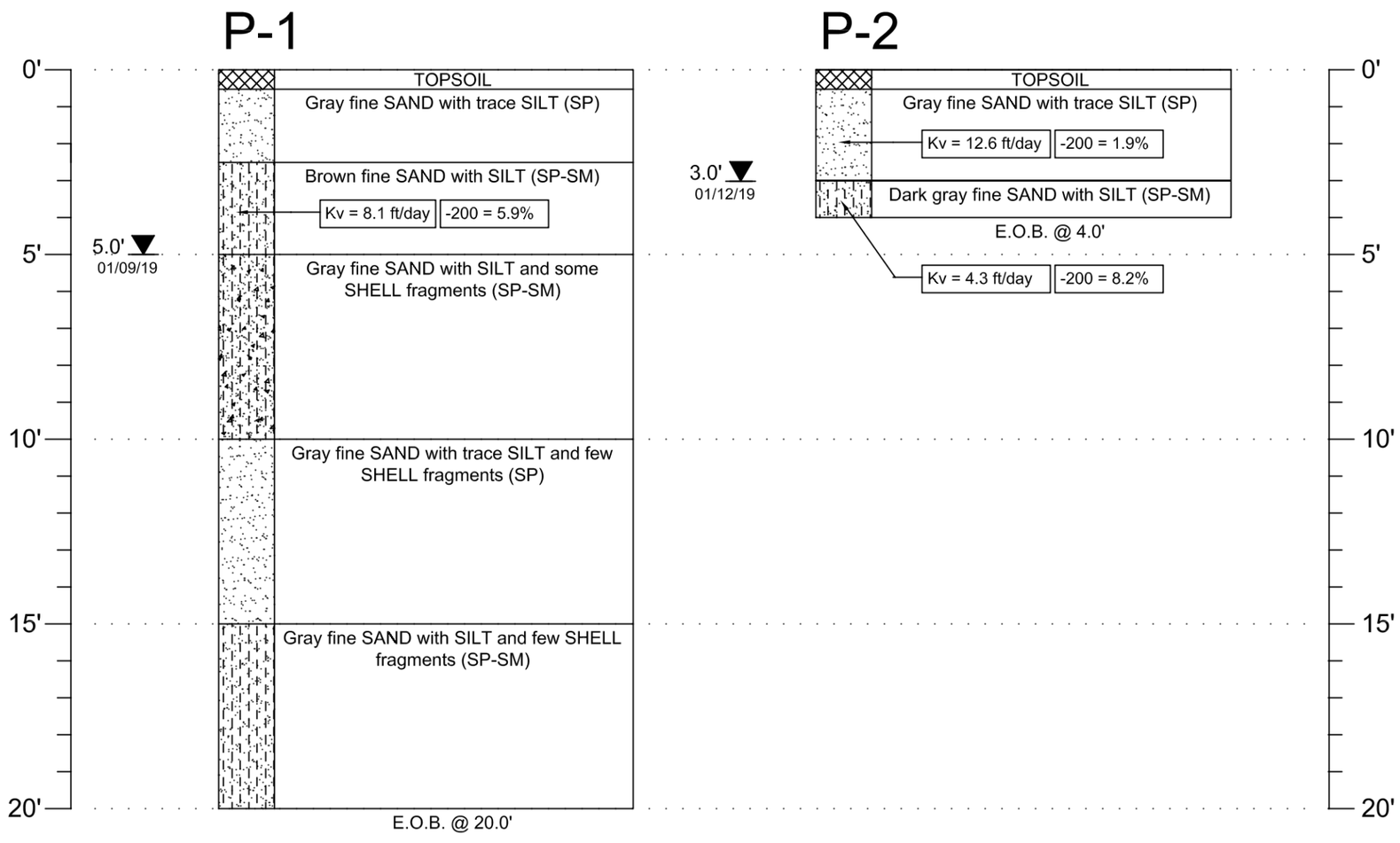
PROJECT:
GEOTECHNICAL EVALUATION
SUNSET LAKES
FLAGLER BEACH, FLORIDA

TITLE:
SUBSURFACE PROFILES

DRAWN BY:	MKL	DATE:	01/14/19	PROJECT NO.:	0430.1800287.0000	SCALE: NA (in feet)	PAGE/FIG. NO.: A-3
CHECKED BY:	BP	DATE:	01/14/19	REPORT NO.:	134233		



Fine SAND (SP)

Fine SAND with some to many SHELL fragments (SP)

Fine SAND with SILT (SP-SM)

TOPSOIL

NOTES:

▼	Measured Groundwater Level 24 (+) Hours Subsequent to Time of Drilling
(SP)	Unified Soil Classification System
EOB	End of Boring
N	Penetr. Resistance, Blows/ft.
Kv	Coefficient of Permeability, (ft/day)
-200	% Passing No. 200 Sieve

UNIVERSAL ENGINEERING SCIENCES

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KEY TO BORING LOGS

SYMBOLS

SYMBOL	DESCRIPTION
N	No. of blows of a 140-lb weight falling 30 inches required to drive standard spoon 1 foot.
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
% REC	Percent Core Recovery from Rock Core Drilling
RQD	Rock Quality Designation
EOB	End Of Boring
BT	Boring Terminated
-200	Fines Content or % Passing NO. 200 Sieve
MC	Moisture Content
LL	Liquid Limit
PI	Plasticity Index
K	Coefficient of Permeability
O.C.	Organic Content
▽	Estimated seasonal high groundwater level
▼	Measured groundwater level at time of drilling

UNIFIED CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Well-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW**	Well-graded sands and gravelly sands, little or no fines
			SP**	Well-graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM**	Silty sands, sand-silt mixtures
			SC**	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			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 sands or silts, elastic silts
			CH	Organic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
			PT	Peat, muck and other highly organic soils

* Based on the material passing the 3-in. (75 mm) sieve.
** Use dual symbol (such as, SP-SM and SP-SC) for soil with more than 5% but less than 12% passing through No. 200 sieve.

RELATIVE DENSITY
(sand-silt)

Very Loose - Less Than 4 Blows/Ft.
Loose - 4 to 10 Blows/Ft.
Medium - 11 to 30 Blows/Ft.
Dense - 31 to 50 Blows/Ft.
Very Dense - More Than 50 Blows/Ft.

CONSISTENCY
(clay)

Very Soft - Less than 2 Blows/Ft.
Soft - 2 to 4 Blows/Ft.
Medium - 5 to 8 Blows/Ft.
Stiff - 9 to 15 Blows/Ft.
Very Stiff - 16 to 30 Blows/Ft.
Hard - More Than 30 Blows/Ft.

RELATIVE HARDNESS
(Limestone)

Soft - 100 Blows for more than 2"
Hard - 100 Blows for less than 2"

MODIFIERS

These modifiers provide our estimate of the amount of minor constituents (SILT or CLAY sized particles) in the soil sample.
Trace - 5% or less
With SILT or with CLAY - 6% to 11%
SILTY or CLAYEY - 12% to 30%
Very SILTY or Very CLAYEY - 31% to 50%

These modifiers provide our estimate of the amount of organic components in the soil sample.
Trace - 1% to 2%
Few - 3% to 4%
Some - 5% to 8%
Many - Greater than 8%

These modifiers provide our estimate of the amount of other components (Shell, Gravel, Etc.) in the soil sample
Trace - 5% or less
Few - 6% to 12%
Some - 13% to 30%
Many - 31% to 50%

APPENDIX B

LABORATORY TESTING PROCEDURES

DESCRIPTION OF LABORATORY TESTING PROCEDURES

LABORATORY PERMEABILITY TEST

The laboratory permeability test is a Falling Head Test that is performed on soil samples recovered from this site. The data recovered from this test are used to calculate Darcy's Coefficient of Permeability (k) of the soil.

WASH 200 TEST

The Wash 200 test is performed by passing a representative soil sample over a No. 200 sieve and rinsing with water. The percentage of the soil grains passing this sieve is then calculated.

ORGANIC CONTENT TESTS

The organic content test is performed by weighing a sample before and after placing in a high temperature oven which burns the organic material in the sample. The percent of organic material by weight is then calculated.

MOISTURE CONTENT DETERMINATION ASTM D-2216

Moisture content is the ratio of the weight of water to the dry weight of soil. Moisture content is measured by drying a sample at 105 degrees Celsius. The moisture content is expressed as a percent of the oven dried soil mass.

ATTERBERG LIMITS

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D-4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by as the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D-2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

CONSOLIDATION TESTING

A single selected portion of the undisturbed sample was extruded from the 3-inch diameter sample tube for consolidation testing. The selected sample was trimmed and confined into a stainless steel disc having a diameter of 2.5 inches and a height of 1 inch. The disc was then "sandwiched" between 2 porous stones, saturated and subjected to incrementally increasing loads. The resulting deformation of the sample within the steel disc was measured using a micrometer gauge.

APPENDIX C

GENERAL CONDITIONS
CONSTRAINTS AND RESTRICTIONS AND
IMPORTANT INFORMATION ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

Universal Engineering Sciences, Inc.
GENERAL CONDITIONS

SECTION 1: RESPONSIBILITIES

1.1 *Universal Engineering Sciences, Inc*., ("UES"), has the responsibility for providing the services described under the Scope of Services section. The work is to be performed according to accepted standards of care and is to be completed in a timely manner. The term "UES" as used herein includes all of *Universal Engineering Sciences, Inc's* agents, employees, professional staff, and subcontractors.

1.2 The Client or a duly authorized representative is responsible for providing UES with a clear understanding of the project nature and scope. The Client shall supply UES with sufficient and adequate information, including, but not limited to, maps, site plans, reports, surveys and designs, to allow UES to properly complete the specified services. The Client shall also communicate changes in the nature and scope of the project as soon as possible during performance of the work so that the changes can be incorporated into the work product.

1.3 The Client acknowledges that UES's responsibilities in providing the services described under the Scope of Services section is limited to those services described therein, and the Client hereby assumes any collateral or affiliated duties necessitated by or for those services. Such duties may include, but are not limited to, reporting requirements imposed by any third party such as federal, state, or local entities, the provision of any required notices to any third party, or the securing of necessary permits or permissions from any third parties required for UES's provision of the services so described, unless otherwise agreed upon by both parties.

1.4 Universal will not be responsible for scheduling our services and will not be responsible for tests or inspections that are not performed due to a failure to schedule our services on the project or any resulting damages.

1.5 **PURSUANT TO FLORIDA STATUTES §558.0035, ANY INDIVIDUAL EMPLOYEE OR AGENT OF UES MAY NOT BE HELD INDIVIDUALLY LIABLE FOR NEGLIGENCE.**

SECTION 2: STANDARD OF CARE

2.1 Services performed by UES under this Agreement will be conducted in a manner consistent with the level of care and skill ordinarily exercised by members of UES's profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty, express or implied, is made.

2.2 The Client recognizes that subsurface conditions may vary from those observed at locations where borings, surveys, or other explorations are made, and that site conditions may change with time. Data, interpretations, and recommendations by UES will be based solely on information available to UES at the time of service. UES is responsible for those data, interpretations, and recommendations, but will not be responsible for other parties' interpretations or use of the information developed.

2.3 Execution of this document by UES is not a representation that UES has visited the site, become generally familiar with local conditions under which the services are to be performed, or correlated personal observations with the requirements of the Scope of Services. It is the Client's responsibility to provide UES with all information necessary for UES to provide the services described under the Scope of Services, and the Client assumes all liability for information not provided to UES that may affect the quality or sufficiency of the services so described.

2.4 Should UES be retained to provide threshold inspection services under Florida Statutes §553.79, Client acknowledges that UES's services thereunder do not constitute a guarantee that the construction in question has been properly designed or constructed, and UES's services do not replace any of the obligations or liabilities associated with any architect, contractor, or structural engineer. Therefore it is explicitly agreed that the Client will not hold UES responsible for the proper performance of service by any architect, contractor, structural engineer or any other entity associated with the project.

SECTION 3: SITE ACCESS AND SITE CONDITIONS

3.1 Client will grant or obtain free access to the site for all equipment and personnel necessary for UES to perform the work set forth in this Agreement. The Client will notify any and all possessors of the project site that Client has granted UES free access to the site. UES will take reasonable precautions to minimize damage to the site, but it is understood by Client that, in the normal course of work, some damage may occur, and the correction of such damage is not part of this Agreement unless so specified in the Proposal.

3.2 The Client is responsible for the accuracy of locations for all subterranean structures and utilities. UES will take reasonable precautions to avoid known subterranean structures, and the Client waives any claim against UES, and agrees to defend, indemnify, and hold UES harmless from any claim or liability for injury or loss, including costs of defense, arising from damage done to subterranean structures and utilities not identified or accurately located. In addition, Client agrees to compensate UES for any time spent or expenses incurred by UES in defense of any such claim with compensation to be based upon UES's prevailing fee schedule and expense reimbursement policy.

SECTION 4: SAMPLE OWNERSHIP AND DISPOSAL

4.1 Soil or water samples obtained from the project during performance of the work shall remain the property of the Client.

4.2 UES will dispose of or return to Client all remaining soils and rock samples 60 days after submission of report covering those samples. Further storage or transfer of samples can be made at Client's expense upon Client's prior written request.

4.3 Samples which are contaminated by petroleum products or other chemical waste will be returned to Client for treatment or disposal, consistent with all appropriate federal, state, or local regulations.

SECTION 5: BILLING AND PAYMENT

5.1 UES will submit invoices to Client monthly or upon completion of services. Invoices will show charges for different personnel and expense classifications.

5.2 Payment is due 30 days after presentation of invoice and is past due 31 days from invoice date. Client agrees to pay a finance charge of one and one-half percent (1 ½ %) per month, or the maximum rate allowed by law, on past due accounts.

5.3 If UES incurs any expenses to collect overdue billings on invoices, the sums paid by UES for reasonable attorneys' fees, court costs, UES's time, UES's expenses, and interest will be due and owing by the Client.

SECTION 6: OWNERSHIP AND USE OF DOCUMENTS

6.1 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, as instruments of service, shall remain the property of UES.

6.2 Client agrees that all reports and other work furnished to the Client or his agents, which are not paid for, will be returned upon demand and will not be used by the Client for any purpose.

6.3 UES will retain all pertinent records relating to the services performed for a period of five years following submission of the report, during which period the records will be made available to the Client at all reasonable times.

6.4 All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by UES, are prepared for the sole and exclusive use of Client, and may not be given to any other party or used or relied upon by any such party without the express written consent of UES.

SECTION 7: DISCOVERY OF UNANTICIPATED HAZARDOUS MATERIALS

7.1 Client warrants that a reasonable effort has been made to inform UES of known or suspected hazardous materials on or near the project site.

7.2 Under this agreement, the term hazardous materials include hazardous materials (40 CFR 172.01), hazardous wastes (40 CFR 261.2), hazardous substances (40 CFR 300.6), petroleum products, polychlorinated biphenyls, and asbestos.

7.3 Hazardous materials may exist at a site where there is no reason to believe they could or should be present. UES and Client agree that the discovery of unanticipated hazardous materials constitutes a changed condition mandating a renegotiation of the scope of work. UES and Client also agree that the discovery of unanticipated hazardous materials may make it necessary for UES to take immediate measures to protect health and safety. Client agrees to compensate UES for any equipment decontamination or other costs incident to the discovery of unanticipated hazardous waste.

7.4 UES agrees to notify Client when unanticipated hazardous materials or suspected hazardous materials are encountered. Client agrees to make any disclosures required by law to the appropriate governing agencies. Client also agrees to hold UES harmless for any and all consequences of disclosures made by UES which are required by governing law. In the event the project site is not owned by Client, Client recognizes that it is the Client's responsibility to inform the property owner of the discovery of unanticipated hazardous materials or suspected hazardous materials.

7.5 Notwithstanding any other provision of the Agreement, Client waives any claim against UES, and to the maximum extent permitted by law, agrees to defend, indemnify, and save UES harmless from any claim, liability, and/or defense costs for injury or loss arising from UES's discovery of unanticipated hazardous materials or suspected hazardous materials including any costs created by delay of the project and any cost associated with possible reduction of the property's value. Client will be responsible for ultimate disposal of any samples secured by UES which are found to be contaminated.

SECTION 8: RISK ALLOCATION

8.1 Client agrees that UES's liability for any damage on account of any breach of contract, error, omission or other professional negligence will be limited to a sum not to exceed $50,000 or UES's fee, whichever is greater. If Client prefers to have higher limits on contractual or professional liability, UES agrees to increase the limits up to a maximum of $1,000,000.00 upon Client's written request at the time of accepting our proposal provided that Client agrees to pay an additional consideration of four percent of the total fee, or $400.00, whichever is greater. The additional charge for the higher liability limits is because of the greater risk assumed and is not strictly a charge for additional professional liability insurance.

SECTION 9: INSURANCE

9.1 UES represents and warrants that it and its agents, staff and consultants employed by it, is and are protected by worker's compensation insurance and that UES has such coverage under public liability and property damage insurance policies which UES deems to be adequate. Certificates for all such policies of insurance shall be provided to Client upon request in writing. Within the limits and conditions of such insurance, UES agrees to indemnify and save Client harmless from and against loss, damage, or liability arising from negligent acts by UES, its agents, staff, and consultants employed by it. UES shall not be responsible for any loss, damage or liability beyond the amounts, limits, and conditions of such insurance or the limits described in Section 8, whichever is less. The Client agrees to defend, indemnify and save UES harmless for loss, damage or liability arising from acts by Client, Client's agent, staff, and other UESs employed by Client.

SECTION 10: DISPUTE RESOLUTION

10.1 All claims, disputes, and other matters in controversy between UES and Client arising out of or in any way related to this Agreement will be submitted to alternative dispute resolution (ADR) such as mediation or arbitration, before and as a condition precedent to other remedies provided by law, including the commencement of litigation.

10.2 If a dispute arises related to the services provided under this Agreement and that dispute requires litigation instead of ADR as provided above, then:

(a) the claim will be brought and tried in judicial jurisdiction of the court of the county where UES's principal place of business is located and Client waives the right to remove the action to any other county or judicial jurisdiction, and

(b) The prevailing party will be entitled to recovery of all reasonable costs incurred, including staff time, court costs, attorneys' fees, and other claim related expenses.

SECTION 11: TERMINATION

11.1 This agreement may be terminated by either party upon seven (7) days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if that substantial failure has been remedied before expiration of the period specified in the written notice. In the event of termination, UES shall be paid for services performed to the termination notice date plus reasonable termination expenses.

11.2 In the event of termination, or suspension for more than three (3) months, prior to completion of all reports contemplated by the Agreement, UES may complete such analyses and records as are necessary to complete its files and may also complete a report on the services performed to the date of notice of termination or suspension. The expense of termination or suspension shall include all direct costs of UES in completing such analyses, records and reports.

SECTION 12: ASSIGNS

12.1 Neither the Client nor UES may delegate, assign, sublet or transfer their duties or interest in this Agreement without the written consent of the other party.

SECTION 13. GOVERNING LAW AND SURVIVAL

13.1 The laws of the State of Florida will govern the validity of these Terms, their interpretation and performance.

13.2 If any of the provisions contained in this Agreement are held illegal, invalid, or unenforceable, the enforceability of the remaining provisions will not be impaired. Limitations of liability and indemnities will survive termination of this Agreement for any cause.

SECTION 14. INTEGRATION CLAUSE

14.1 This Agreement represents and contains the entire and only agreement and understanding among the parties with respect to the subject matter of this Agreement, and supersedes any and all prior and contemporaneous oral and written agreements, understandings, representations, inducements, promises, warranties, and conditions among the parties. No agreement, understanding, representation, inducement, promise, warranty, or condition of any kind with respect to the subject matter of this Agreement shall be relied upon by the parties unless expressly incorporated herein.

14.2 This Agreement may not be amended or modified except by an agreement in writing signed by the party against whom the enforcement of any modification or amendment is sought.

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 CONDITIONS
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 opinions 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 to 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 ease 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 indicate 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 fluctuations 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 of 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. Universal Engineering Sciences cannot be responsible for any buried man-made 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.

Important Information about This

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 constructor — 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 this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this 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.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many 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;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the 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 geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this 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 geotechnical-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 confirmation-dependent recommendations included in your report. *Confirmation-dependent 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 confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront 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. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical 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 Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors 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 constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors 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 constructors fail to 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.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental 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 environmental 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, many 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 GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
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