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REPORT OF A PRELIMINARY GEOTECHNICAL EXPLORATION

Pelican Reef – Block 9, Lots 6-11
St. Augustine, Florida

March 23, 2006

PROJECT NO. 92051-002-01
REPORT NO. 456794

Prepared For:

Thompson Bailey Baker Reality, Inc.
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March 23, 2006

Thompson Bailey Baker Realty, Inc.
P.O. Drawer 70
St. Augustine, Florida 32085-0070

Attention: Mr. Paul Thompson

Reference: **REPORT OF A PRELIMINARY GEOTECHNICAL EXPLORATION**
Pelican Reef – Block 9, Lots 6-11
St. Augustine, Florida
UES Project No. 92051-002-01 and Report No. 456794

Dear Mr. Thompson:

Universal Engineering Sciences, Inc. has completed a preliminary subsurface exploration at the sites of the proposed residential structures located at Block 9 on Lots 6 through 11 in Pelican Reef Subdivision in St. Augustine, Florida. These services were provided in general accordance with our Proposal No. 2006J-115 dated January 29, 2006. This summary contains the results of our exploration, an engineering evaluation with respect to the project characteristics described to us, and recommendations for groundwater control, foundation design, and site preparation. A summary of our findings is as follows:

- The borings generally encountered very loose to medium dense sand (SP) and sand with clay (SP-SC) to depths of 3 to 6 feet followed by very soft to firm clay (CH) and very loose clayey sand (SC) to depths of 17.5 to 27.5 feet below the existing ground surface. The borings then encountered very loose to loose sand (SP), sand with clay (SP-SC), and clayey sand (SC) to depths of 27.5 to 32.5 feet below the existing ground surface. The borings then encountered medium dense sand (SP), sand with clay (SP-SC), and clayey sand (SC) to depths of 47.5 feet below the existing ground surface. From 47.5 feet to 52.5 feet below the ground surface, the borings encountered loose to dense sand with clay (SP-SC) and clayey sand (SC), followed by very loose to loose sand with clay (SP-SC), clayey sand (SC), and stiff clay (CH) to a depth of 57.5 feet below the ground surface. The borings then encountered medium dense sand with clay (SP-SC) and clayey sand (SC) to the boring termination depths of 60 feet.

- We measured the stabilized groundwater level at depths ranging from 0.8 to 2.3 feet below the ground surface. We estimate the normal seasonal high groundwater levels will typically occur at a depth of 0.5 to 1.0 foot below the existing ground surface elevation at the time of our exploration.

- Assuming the building areas will be constructed in accordance with our Site Preparation Recommendations, we have recommended the proposed structures be supported on either an auger cast pile or timber pile foundation system.

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- We estimate 12- to 16-inch diameter auger-grouted concrete piles can achieve allowable compressive capacities of approximately 6 to 25 tons for lots 6, 8, and 9, 4 to 10 tons for lots 10 and 11, and 5 to 23 tons for lot 7 when installed to tip bearing depths of approximately 30 to 50 feet below the existing ground surface. Eight to 10-inch diameter timber piles can achieve allowable compressive capacities in the range of 3 to 15 tons for lots 6, 8, and 9, 4 to 15 tons for lots 10 and 11, and 3 to 19 tons for lot 7 when installed to tip bearing depths of approximately 30 to 50 feet below the existing ground surface.

- We recommend only normal, good practice site preparation techniques to prepare the existing subgrades to support the proposed structures. These techniques include stripping the construction areas of topsoils and vegetation, compacting the subgrade to densify the subsurface to depths of at least 2 feet, and placing engineered fill to the desired grades.

We trust this report meets yours needs and addresses the geotechnical issues associated with the proposed construction. 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, INC.
Certificate of Authorization No. 549

4/13/06

Joel B. Wood, Jr., E.I.
Project Engineer

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FL P.E. Number 37389

JBW/SRW

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1.0 INTRODUCTION

1.1 GENERAL

In this report, we present the results of the subsurface exploration of the sites for the proposed residential structures located at Block 9 on Lots 6 through 11 in Pelican Reef Subdivision in St. Augustine, Florida. We have divided this report into the following sections:

- SCOPE OF SERVICES - Defines what we did
- FINDINGS - Describes what we encountered
- RECOMMENDATIONS - Describes what we encourage you to do
- LIMITATIONS - Describes the restrictions inherent in this report
- APPENDICES - Presents support materials referenced in this report

2.0 SCOPE OF SERVICES

2.1 PROJECT DESCRIPTION

Project information was provided to us in recent telephone discussions. We understand the project will consist of a single-family residential structure on each of the six subject lots. It is anticipated the structures will be supported on a deep foundation system consisting of either timber piles or auger cast piles. A faxed copy of the block layout has been provided to us. This plan shows the lot layouts for Block 9, Fiddler Crab Lane off of Pelican Reef Drive. Structural loading requirements had not been provided to us at the time of this report, therefore, we have assumed maximum column and wall loads of 50 kips and 3 klf, respectively. Additionally, we have assumed that elevating fill heights, on each lot, will not exceed 2 feet.

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

2.2 PURPOSE

The purposes of this exploration were:

- to explore the general subsurface conditions at the site;
- to interpret and evaluate the subsurface conditions with respect to the proposed construction; and
- to provide geotechnical engineering recommendations for groundwater control, foundation design, and site 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. Universal Engineering Sciences would be pleased to perform these services, if you desire.

Our exploration was confined to the zone of soil likely to be stressed by the proposed construction. Our work did not address the potential for surface expression of deep geological conditions. This evaluation requires a more extensive range of field services than performed in this study. We will be pleased to conduct an investigation to evaluate the probable effect of the regional geology upon the proposed construction, if you desire.

2.3 PRELIMINARY FIELD EXPLORATION

A field exploration was performed on February 1 and 2, 2005. The approximate boring locations are shown on the attached Field Exploration Plan in Appendix A. The approximate boring locations were determined in the field by our personnel using taped measurements from existing features at the site, and should be considered accurate only to the degree implied by the method of measurement used. Samples of the soils encountered will be held in our laboratory for your inspection for 60 days unless we are notified otherwise.

2.3.1 SPT Borings

To explore the subsurface conditions within the areas of the proposed structures, we located and drilled six (6) Standard Penetration Test (SPT) borings to a depth of approximately 60 feet below the existing ground surface in general accordance with the methodology outlined in ASTM D 1586. A summary of this field procedure is included in Appendix A. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

2.4 LABORATORY TESTING

Representative soil samples obtained during our field exploration were returned to our office and examined by a geotechnical engineer. The samples were visually classified in general accordance with ASTM D 2488 (Unified Soil Classification System).

Ten (10) fines content tests, ten (10) moisture content tests, and two (2) Atterberg limits test were conducted in the laboratory on representative soil samples obtained from the borings. These tests were performed to aid in classifying the soils and to help quantify and correlate engineering properties. The results of these tests are presented on the

Boring Logs in Appendix A. A brief description of the laboratory procedures used is also provided in Appendix A.

3.0 FINDINGS

3.1 SOIL SURVEY

Based on the 1983 Soil Survey for St. Johns County, Florida, as prepared by the US Department of Agriculture Soil Conservation Service, the predominant predevelopment soil type at the site is identified as St. Augustine fine sand, clayey substratum.

A summary of characteristics of this soil series was obtained from the Soil Survey and is included in Table 1.

TABLE 1
Summary of Soil Survey Information

Soil Type	Constituents		Hydrologic Group	Natural Drainage	Soil Permeability (Inches/Hr)		Seasonal High Water Table
St. Augustine Fine Sand, Clayey Substratum (45)	0-21"	Fine sand	C	Somewhat Poorly Drained	0-21"	6.0 – 20	1.5 – 3.0
	21-48"	Sand, fine sand, loamy fine sand			21-48"	2.0 – 20	
	48-53"	Sandy loam, fine sandy loam			48-53"	0.2 – 0.6	
	53-80"	Sandy clay, clay			53-80"	<0.06	

3.2 SURFACE CONDITIONS

The sites of the proposed residential structures are located at Block 9 on Lots 6 through 11 in Pelican Reef Subdivision in St. Augustine, Florida. At the time of our visit, the site was sparsely wooded, with some grass and underbrush areas. No topographic information was provided for the site; however, lots 6 and 7 appeared to slope down to the north toward a drainage ditch at the rear of the sites. Lots 8 through 11 gently sloped to the south towards the wetland area located at the rear of the properties.

3.3 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix A: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered soil samples and a limited number of laboratory tests. Also, see Appendix A: Key to Boring Logs, for further explanation of the symbols and placement of data on the Boring Logs. Table 2: General Soil Profile summarizes the soil conditions encountered.

TABLE 2 General Soil Profile		
Typical depth (ft)		Soil Descriptions
From	To	
0	3 to 6	Very loose to medium dense sand (SP) and sand with clay (SP-SC)
3 to 6	17.5 to 27.5	Very soft to firm clay (CH) and very loose clayey sand (SC)
17.5 to 27.5	27.5 to 32.5	Very loose to loose sand (SP), sand with clay (SP-SC), and clayey sand (SC)
27.5 to 32.5	42.5	Medium dense sand (SP), sand with clay (SP-SC) and clayey sand (SC)
42.5	47.5	Soft clay (CH) and very loose clayey sand (SC)
47.5	52.5	Loose to dense sand with clay (SP-SC) and clayey sand (SC)
52.5	57.5	Very loose to loose sand with clay (SP-SC), clayey sand (SC), and stiff clay (CH)
57.5	60	Medium dense sand with clay (SP-SC) and clayey sand (SC)
* Termination Depth of Deepest Boring ( ) Indicates Unified Soil Classification		

The stabilized groundwater level was encountered at each of the boring locations and recorded approximately 24 hours after drilling at depths of 0.8 to 2.3 feet below the existing ground surface.

4.0 PRELIMINARY RECOMMENDATIONS

4.1 GENERAL

In this section of the report, we present our preliminary recommendations for groundwater control, building foundation, site preparation, and construction related services. 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. We recommend that we be provided the opportunity to review the project plans and specifications to confirm that our recommendations have been properly interpreted and implemented. The discovery of any subsurface conditions during construction which deviate from those encountered in the borings should be reported to us immediately for observation, evaluation and recommendations. **Once building locations are determined, we recommend a minimum of one additional boring, on each lot, to determine the consistency of the soil conditions across the lot.**

4.2 GROUNDWATER CONTROL

The groundwater table will fluctuate seasonally depending upon local rainfall. The rainy season in Northeast Florida is normally between June and September. Based upon our review of U.S.G.S. data, St. Johns County Soil Survey, and regional hydrogeology, it is our opinion the seasonal high water level will occur at a depth of 0.5 to 1.0 foot below the existing ground surface elevation at the time of our exploration.

Note: it is possible the estimated seasonal high groundwater levels will temporarily exceed these estimated levels during any given year in the future. Should impediments to surface water drainage exist on the site, or should rainfall intensity and duration, or total rainfall quantities exceed the normally anticipated rainfall quantities, groundwater levels may exceed our seasonal high estimates. 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.

We recommend all foundation designs be based on the seasonal high groundwater conditions.

4.3 BUILDING FOUNDATIONS

4.3.1 General

Our geotechnical engineering evaluation of the sites and subsurface conditions at the properties with respect to the anticipated maximum loads are based on (1) our site observations, (2) the field data obtained, and (3) our understanding of the project information as presented in this report. Should the project information be changed, please contact us so that we can review our evaluation.

Based on the results of our exploration, deep foundation systems are recommended. It is our opinion that both auger cast piles and timber piles are feasible deep foundation systems. The following paragraphs present our recommendations for each foundation system.

4.3.2 Preliminary Pile Design Recommendations

As requested, auger cast piles and timber piles were evaluated for a foundation system to support the proposed structures. It is our opinion that 12, 14 and 16-inch diameter auger-cast piles installed to tip bearing depths of 30 to 50 feet below the existing ground surface could provide preliminary allowable compressive capacities as shown below in Tables 3A through 3C. The allowable compressive capacities incorporate factors of safety against failure on the order of 2.0 or more.

TABLE 3A
ALLOWABLE AUGER CAST PILE CAPACITIES (PRELIMINARY)
For Lots 6 (boring B-1), 8 (B-3), & 9 (B-4)

Embedment Depth Below Existing Grade (Feet)	Auger Cast Pile Diameter (inches)	Allowable Compressive Capacity (tons)
30	12	6
	14	7
	16	9
35	12	8
	14	10
	16	12
40	12	10
	14	13
	16	16
45	12	10
	14	12
	16	14
50	12	15
	14	20
	16	25

TABLE 3B
ALLOWABLE AUGER CAST PILE CAPACITIES (PRELIMINARY)
For Lots 10 (B-5) & 11 (B-6)

Embedment Depth Below Existing Grade (Feet)	Auger Cast Pile Diameter (inches)	Allowable Compressive Capacity (tons)
35	12	4
	14	6
	16	7
40	12	7
	14	8
	16	10

TABLE 3B ALLOWABLE AUGER CAST PILE CAPACITIES (PRELIMINARY) For Lots 10 (B-5) & 11 (B-6)		
Embedment Depth Below Existing Grade (Feet)	Auger Cast Pile Diameter (inches)	Allowable Compressive Capacity (tons)
50	12	7
	14	8
	16	10

TABLE 3C ALLOWABLE AUGER CAST PILE CAPACITIES (PRELIMINARY) For Lot 7 (B-2)		
Embedment Depth Below Existing Grade (Feet)	Auger Cast Pile Diameter (inches)	Allowable Compressive Capacity (tons)
30	12	5
	14	6
	16	7
35	12	7
	14	9
	16	10
40	12	8
	14	10
	16	12
45	12	9
	14	11
	16	12
50	12	15
	14	18
	16	23

To evaluate a timber pile foundation system, static pile capacities were estimated following Federal Highway Administration (FHWA) procedures utilizing SPT N-values from the borings for this study and using the computer program "SPILE". It is our opinion that 8 and 10-inch tip diameter timber piles installed to tip bearing depths of 30 to 50 feet below the existing ground surface could provide preliminary allowable compressive pile capacities as shown in Table 4 below. The allowable capacities incorporate factors of safety against failure on the order of 2.0 or more.

TABLE 4A
ALLOWABLE TIMBER PILE CAPACITIES (PRELIMINARY)
For Lots 6 (B-1), 8 (B-3), & 9 (B-4)

Embedment Depth Below Existing Grade (Feet)	Timber Pile Tip Diameter (inches)	Allowable Compressive Capacity (tons)
30	8	3
	10	5
35	8	5
	10	7
40	8	6
	10	10
45	8	6
	10	10
50	8	10
	10	15

TABLE 4B
ALLOWABLE TIMBER PILE CAPACITIES (PRELIMINARY)
For Lots 10 (B-5) & 11 (B-6)

Embedment Depth Below Existing Grade (Feet)	Timber Pile Tip Diameter (inches)	Allowable Compressive Capacity (tons)
35	8	6
	10	9
40	8	8
	10	12
45	8	8
	10	12
50	8	10
	10	15

TABLE 4C ALLOWABLE TIMBER PILE CAPACITIES (PRELIMINARY) For Lot 7 (B-2)		
Embedment Depth Below Existing Grade (Feet)	Timber Pile Tip Diameter (inches)	Allowable Compressive Capacity (tons)
30	8	3
	10	5
35	8	5
	10	7
40	8	5
	10	9
45	8	6
	10	9
50	8	10
	10	19

These capacities assume that a maximum of 2 feet of fill will be placed on the site. If fill depths exceed 2 feet, downdrag or negative skin friction will likely result. Therefore, we suggest that we be provided proposed grading information and that our recommendations be re-evaluated if more than 2 feet of fill will be placed across the site.

4.3.2.1 Pile Group Effects

We recommend the minimum pile spacing to pile diameter ratio (S/D) be on the order of 2.5 to 3.0. Using a minimum S/D ratio on this order, we anticipate that any capacity reductions due to nearby piles should be small and therefore, should be considered insignificant in the design of the foundation system. If S/D ratios will be less than 2.5 to 3.0, a reduction in group efficiency will result in reduced allowable group pile capacities.

4.3.2.2 Settlement

With the deep foundation systems properly installed to bear at the depths noted above, assuming the minimum S/D ratios are maintained as discussed above, we estimate the settlement of the piles to be within tolerable limits (estimated on the order of 0.5 to 0.75 inches or less). The settlement estimates have been based upon the use of (1) the field test data obtained during our geotechnical exploration, which has been correlated to geotechnical strength and compressibility characteristics of the subsurface soils beneath the sites, and (2) published theoretical and empirical methods of settlement analysis for deep foundations bearing soils similar to those at the sites.

4.3.3 Lateral Capacity

Vertically aligned deep foundations, embedded in subsurface conditions similar to those at these sites, can typically support horizontal and lateral loads on the order of 5 percent of their compressive capacity without experiencing lateral deflections greater than about ½ inch. If the design horizontal loads on the deep foundations exceed the allowable compressive capacity by more than 5 percent, we recommend that a detailed lateral capacity analysis be performed. If requested, we can provide the additional lateral capacity analysis.

4.3.4 Floor Slabs

The floor slabs can be constructed as a slab-on-grade member using a coefficient of subgrade reaction (K) of 150 pci provided the backfill and the subgrade materials are compacted as outlined in Section 4.5. It should be noted, however, that the addition of more than 2 feet of elevating fill could result in floor slab settlements. It is recommended the floor slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness. A 10-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete.

4.4 DEEP FOUNDATION CONSTRUCTION RECOMMENDATIONS

4.4.1 Auger Cast Pile Construction Techniques

Auger-grouted concrete piles should be formed by rotating a continuous, hollow-flight auger to the desired pile tip level followed by slow withdrawal of the auger while pumping a mortar grout under pressure through the auger. The pressure of the pumped mortar grout at the auger tip or injection point should be sufficient to (1) fill the pile shaft created by the augering process and withdrawal, (2) prevent "necking" or shaft area reductions due to lateral inward squeezing of any adjacent soft soils, and (3) cause an outward flow of mortar into the adjacent soils. A pressure head within the hollow auger stem equivalent to approximately 10 feet of mortar above the auger tip or injection point should be maintained to help verify that a proper mortar pressure exists at the injection point.

A sudden drop in the sustained pressure head often indicates that a soft zone or void has been encountered and, therefore, continued mortar injection at this level should be performed until the pressure head has been re-established. Pre-augering and withdrawal of the auger before concreting may result in a reduction of the in-place shear strength characteristics of the adjacent soils and thus may require additional pile embedment upon re-augering and grouting.

4.4.1.1 Installation Sequence

Construction of auger-grouted piles located within six pile diameters, center-to-center, should not be performed until the adjacent pile has achieved its initial set, which typically occurs approximately 24 hours after pile construction. This time delay allows the "green" cement grout in the adjacent recently constructed pile to harden, and helps reduce (if not completely eliminate) the possible loss of grout into the adjacent pile during its augering process.

4.4.1.2 Steel Placement

Due to the possibility of some uplift and/or lateral loads which could be exerted upon the piles, a certain amount of steel reinforcement may be required within the piles. We recommend that each pile be reinforced with a full length piece of rebar for uplift resistance. The rebar should be placed in the freshly grouted pile while the grout is in a fluid state. The full length rebar serves to confirm the pile continuity and aids in the quality control process. Rebar should not be forced into the grout column. Simply rotating the rebar or rebar cage and allowing the steel to fall under its weight with only manual assistance should be sufficient to affect placement in a pile of continuous cross section.

For lateral resistance, a 4 bar cage is typically placed in the upper 20 to 25 feet of the pile. This cage should also be equipped with spacers to assure sufficient steel embedment and coverage. The rebar cage should be carefully threaded over the single rebar and lowered into place.

4.4.2 Timber Pile Construction Techniques

Timber piles should be driven with a small air or diesel hammer, or a drop hammer delivering a minimum energy per blow as determined in accordance with the latest edition of the FDOT Standard Specification for Road and Bridge Construction (Section 455). The hammer should be operated according to manufacturer's recommendations at all times. Pile driving should be as continuous as possible and should proceed without stopping over the last 10 feet of penetration. The hammer acceptance criteria should be established prior to construction once the type and size of hammer are furnished by the contractor.

4.4.2.1 Hammer Selection

To help prevent over-driving, we recommend the final driving criteria be carefully specified with respect to the pile type, pile size, and hammer size. The pile driving

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BORING LOCATION PLAN
BORING LOGS
KEY TO BORING LOGS
FIELD EXPLORATION PROCEDURES
LABORATORY TESTING PROCEDURES

APPENDIX B

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT
CONSTRAINTS AND RESTRICTIONS

1.0 INTRODUCTION

1.1 GENERAL

In this report, we present the results of the subsurface exploration of the sites for the proposed residential structures located at Block 9 on Lots 6 through 11 in Pelican Reef Subdivision in St. Augustine, Florida. We have divided this report into the following sections:

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