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GEOTECHNICAL EXPLORATION

MULBERRY MIDDLE - MAJOR CAMPUS RENOVATIONS
500 MARTIN LUTHER KING AVENUE
MULBERRY, POLK COUNTY, FLORIDA
PROJECT #C - 00276

UES PROJECT NO. 0130.1000102.0000
UES REPORT NO. 839965

PREPARED FOR:

PREPARED BY:

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May 28, 2010

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Attention:

Reference: **Geotechnical Exploration**
Mulberry Middle - Major Campus Renovations (C-00276)
500 Martin Luther King Avenue
Mulberry, Polk County, Florida
UES Project No. 0130.1000102.0000
UES Report No. 839965

Universal Engineering Sciences, Inc. (Universal) has completed a geotechnical exploration at the above referenced site in Polk County, Florida. The scope of our exploration was planned in conjunction with Furr & Wegman Architects, P.A. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

The following report presents the results of our field exploration with a geotechnical engineering interpretation of those results with respect to the project characteristics as provided to us. We have included geotechnical recommendations for site preparation, foundation design, and stormwater management design.

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

David Wilshaw M.S. (Eng), P.G.
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4 – School Board of Polk County

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1.0 PROJECT DESCRIPTION

We understand from review of partial site plans provided by the client that the proposed project will include the renovations to the Mulberry Middle School campus in Polk County, Florida. The majority of the existing buildings will be demolished and new one to two-story buildings will be constructed. A total of 5 new buildings (gymnasium, cafeteria, classroom, administration/media, and music auditorium) along with new recreational areas are proposed. The stormwater management will be collected within stormwater ponds which we understand will be located within the confines of boring locations SB-1 through SB-6.

UES must review the final site and grading plans, and structural design loads to validate all recommendations rendered herein. Without such a review, our recommendations may not be applicable, resulting in potentially unacceptable performance of site improvements for which UES will not be responsible or liable.

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

2.0 PURPOSE

The purposes of this exploration were:

- to explore and evaluate the subsurface conditions at the site with special attention to potential problems that may impact the proposed development,
- to provide our estimates of the seasonal high groundwater level at the boring locations and
- to provide geotechnical engineering recommendations for site preparation procedures foundation design and stormwater management design

This report presents an evaluation of site conditions on the basis of geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. We would be glad to provide you with a proposal for these services at your request.

Our exploration was not designed to specifically address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. This evaluation requires a more extensive range of field services than those performed in this study. We would be pleased to conduct an exploration to evaluate the probable effect of the regional geology upon the proposed construction, if you so desire.

3.0 SITE DESCRIPTION

The subject site is located within Section 12, Township 30 South, Range 23 East in Polk County, Florida. More specifically, the site is located at the south end of Martin Luther King Avenue (SE 9th Avenue), as shown on the attached Figure A-1. At the time of drilling, the site was occupied by an existing middle school. Heavily vegetated, low, wet areas (part of the Alafia

River basin) are situated to the south and east of the property. The property further east was used for phosphate mining.

3.1 SOIL SURVEY

There are four (4) native soil types mapped within the general area of the site according to the USDA NRCS Soil Survey of Polk County. A brief summary of the mapped surficial soil type(s) is presented in Table I.

TABLE I
SUMMARY OF PUBLISHED SOIL DATA [1]

Soil Symbol	Soil Type	Hydrologic Group	Drainage Characteristics	Depth of Published Seasonal High GWT (feet)
8	Hydraquents, clayey	D	Very poorly drained	+1 to 0
12	Neilhurst sand, 1 to 5 percent slopes	A	Excessively drained	>6
64	Neilhurst-Urban land complex, 1 to 5 percent slopes	A	Excessively drained	>6
68	Arents, 0 to 5 percent slopes	B	Moderately well drained	2 to 4

[1] Data obtained from the NRCS online webpage, accessed on 5/27/10

3.2 TOPOGRAPHY

According to information obtained from the United States Geologic Survey (USGS) Mulberry, and partial topographic information provided by the client, the ground surface elevation across the site area ranges from approximately +115 feet National Geodetic Vertical Datum (NGVD) within the northeastern portion of the property to +100 feet NGVD along the southern property line. A copy of a portion of the USGS Map is included in Appendix A.

4.0 SCOPE OF SERVICES

The services conducted by Universal during our geotechnical exploration are as follows:

- Drill fourteen (14) Standard Penetration Test (SPT) borings, eight (8) within the accessible areas of the proposed building footprints to a depth of 50 feet below existing grade and six (6) within the proposed stormwater management areas to a depth of 15 feet below existing grades.

- Secure samples of representative soils encountered in the soil borings for review, laboratory analysis and classification by a Geotechnical Engineer.

- Measure the existing site groundwater levels and provide an estimate of the seasonal high groundwater level at the boring locations.

- Conduct laboratory testing on selected soil samples obtained in the field to determine their engineering properties.

- Assess the existing soil conditions with respect to the proposed construction.

- Prepare a report which documents the results of our exploration and analysis with geotechnical engineering recommendations.

5.0 FIELD EXPLORATION

The SPT soil borings were performed with a truck mounted drilling rig. Universal located the test borings by using the provided site plan and measuring from existing on-site landmarks shown on an aerial photograph. No survey control was provided at our boring locations. The approximate boring locations are shown in Appendix B.

The fourteen (14) SPT borings, designated SB-1 through SB-14 on the attached Boring Location Plan in Appendix B, were performed in general accordance with the procedures of ASTM D 1586 "Standard Method for Penetration Test and Split-Barrel Sampling of Soils". SPT sampling was performed continuously to 10 feet to detect variations in the near surface soil profile and on approximate 5 feet centers thereafter.

6.0 LABORATORY TESTING

The soil samples recovered from the test borings were returned to our laboratory and visually classified in general accordance with ASTM D 2487 "Standard Classification of Soils for Engineering Purposes" (Unified Soil Classification System). We selected representative soil samples from the borings for laboratory testing to aid in classifying the soils and to help to evaluate the general engineering characteristics of the site soils. The results of these tests are shown on the boring logs in Appendix B. A summary of the tests performed is shown in Table II.

TABLE II
LABORATORY METHODOLOGIES

Test Performed	Number Performed	Reference
Grain Size Analysis (#200 wash only)	17	ASTM D 1140 "Amount of Material in Soils Finer than the No. 200 (75 - µm) sieve"
Moisture Content	17	ASTM D 2216 "Laboratory Determination of Water (Moisture) Content of Soil by Mass"
Permeability Tests	3	Constant Head Laboratory Permeability Test

7.0 SUBSURFACE CONDITIONS

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the SPT borings, such as soil profiles, penetration resistance and groundwater levels are shown on the boring logs included in Appendix B. The Key to Boring Logs, Soil Classification Chart is also included in Appendix B. The soil profiles were prepared from field logs after the recovered soil samples were examined by a Geotechnical Engineer. The stratification lines shown on the boring logs represent the approximate boundaries between soil types, and may not depict exact subsurface soil conditions. The actual soil boundaries may be

more transitional than depicted. A generalized profile of the soils encountered at our boring locations is presented in Table III. For detailed soil profiles, please refer to the attached boring logs.

TABLE III
GENERALIZED SOIL PROFILE

Typical Depth (feet, bls)		Soil Description
From	To	
Surface	13 to 28	Interlayered strata of very loose to medium dense fine sands [SP], fine sands with silt [SP-SM], silty fine sands [SM] and clayey fine sands [SC]. The upper 3 to 6 feet of surficial soils often include varying amounts of gravel/rock and clayey nodules/pockets.
13 to 28	50*	Interlayered strata of loose/stiff to very dense/hard fine sands with silt [SP-SM], silty/clayey fine sands [SM, SC] and sandy clays with varying quantities of phosphate nodules and limestone fragments.

* denotes maximum termination depth of the borings

A noted exception to this general profile was encountered at SB-11 where a layer of mixed silty sands with root mats and wood (organic debris) was found from roughly 2½ to 4½ feet below grade. These organic laden soils may require removal and replacement prior to construction, depending upon the extent/degree of the organic content. Additional exploration should be performed within this area (along the "wetland" line) to help determine the extent of buried organic materials.

8.0 GROUNDWATER CONDITIONS

8.1 EXISTING GROUNDWATER LEVEL

We measured the water levels in the boreholes on May 19 through 22, 2010 after the completion of drilling operations. The groundwater level depths ranged from approximately 2.1 to 7.3 feet below existing grade at the boring locations. The encountered groundwater level depths are shown on the attached boring logs. Fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff, and other factors that may vary from the time the borings were conducted.

8.2 SEASONAL HIGH GROUNDWATER LEVEL

Based on historical data, the rainy season in Central Florida is between June and September of the year. In order to estimate the seasonal high water level at the boring locations, many factors are examined, including the following:

- Measured groundwater level
- Drainage characteristics of existing soil types
- Current & historical rainfall data
- Natural relief points (such as lakes, rivers, wetlands, etc.)
- Man-made drainage systems (ditches, canals, retention basins, etc.)
- On-site types of vegetation
- Review of available data (soil surveys, USGS maps, etc.)

Based on the results of our field exploration and the factors listed above, we estimate that the seasonal high groundwater level at the boring locations may form roughly 1 to 5 feet below grade, depending upon location. The estimated seasonal high groundwater levels are shown on the attached boring logs.

It should be noted that the estimated seasonal high water levels do not provide any assurance that groundwater levels 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 exceed our seasonal high estimates. Further, it should be understood that changes in the surface hydrology and subsurface drainage from on-site and/or off-site improvements could have significant effects on the normal and seasonal high groundwater levels.

9.0 FOUNDATION DESIGN RECOMMENDATIONS

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. **The applicability of geotechnical recommendations is very dependent upon project characteristics such as improvement locations, and grade alterations. UES must review the final site and grading plans to validate all recommendations rendered herein.**

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

9.1 STRUCTURAL AND GRADING INFORMATION

It is our understanding that the project will include the construction of new one to two-story classroom/educational buildings at the Mulberry Middle School in Polk County, Florida. Based on information provided by the client, we understand that the maximum loadings for the proposed buildings will not exceed 125 kips for individual columns and 8.5 kips per linear foot for structural walls. We assume that the finished floor elevation of the new buildings will be 0 to 2 feet above existing grades.

Prior to finalizing any design, the structural/grading information outlined above should be confirmed by a structural/civil engineer. This is crucial to our evaluation and estimates of settlements. If any of this information is incorrect or if you anticipate any changes, please inform Universal Engineering Sciences, Inc. immediately so that we may review and modify our recommendations as appropriate.

9.2 ANALYSIS

Based on the results of the soil borings, the near surface soils within the proposed building areas appear to be mostly relatively loose to dense sands [SP, SP-SM] and silty-clayey sands [SM, SC] to a depth of 20 feet below grade. In order to provide a homogeneous, compacted, sandy soil system underneath the proposed foundations and floor slabs, densification of the loose subgrade soils will be necessary.

9.3 BEARING PRESSURE

Provided our suggested site preparation procedures are followed, we recommend designing conventional, shallow footing foundations for a **maximum allowable bearing pressure of 2,500 pounds per square foot (psf).** Per Section 1805.4.1 of the Florida Building Code (FLBC), the foundations should be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605.3 of the FLBC.

9.4 FOUNDATION SIZE

The minimum widths recommended for any isolated column footing and continuous wall footings are 24 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.

9.5 BEARING DEPTH

The base of all footings should be at least 18 inches below finished grade elevation. 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.

9.6 BEARING MATERIAL

The bearing level soils should exhibit a density of at least 100 percent of the maximum dry density as determined by ASTM D-698 (Standard Proctor) **to a depth of at least 2 feet below foundation level** as described in this report. In addition to compaction, the bearing soils must exhibit stability and be free of "pumping" conditions.

9.7 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 to a depth of approximately twice the width of the footing; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundation; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from off site 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 adherence to our recommended site preparation procedures presented in this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlement of the structures. Furthermore, should building loads change from those assumed by us, greater settlements may be expected.

Due to the sandy nature of the surficial soils following the compaction operations, we expect the majority of settlement to be elastic in nature and occur relatively quickly, on application of the loads, during and immediately following construction. Using the recommended maximum allowable bearing pressure, the assumed maximum structural loads, and the field and laboratory test data which we have correlated into the strength and compressibility characteristics of the subsurface soils, **we estimate the total vertical settlement of the proposed structures to be on the order of 1 inch or less.**

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. Assuming our site preparation recommendations are followed, **we anticipate differential settlement of less than ½ inch.**

9.8 Floor Slabs

Conventional floor slabs may be supported upon the compacted subgrade and should be structurally isolated from other foundation elements or adequately reinforced to prevent distress due to differential movements. We recommend using a sheet vapor barrier (in accordance with Florida Building Code requirements) beneath the building slab-on-grade to help control moisture migration through the slab.

9.9 Site Preparation for Building Area

Following is a list of our recommended site preparation procedures to prepare the building areas for the proposed construction.

1. Lower the groundwater table to a depth of at least 2 feet below the bottom of any excavation or compacted surface.

2. Demolish existing structures and strip the construction limits of any old foundations, pavements, utilities, vegetation, roots, **buried organics**, debris, rubble, etc. Stripping should be performed at least 10 feet beyond foundation lines. We strongly recommend that the stripped surface be observed and probed by representatives of Universal.

   Please note that a layer of silty sands with root mats and wood (organic debris) was encountered from roughly 2½ to 4½ feet below grade at boring location SB-11. In order to help determine the degree/extent of organic material, additional borings should be performed around the building areas adjacent to the "wetland" line (specifically adjacent to and between SB-11 and SB-13). Based on the results of the additional exploration, these organic laden soils may require removal and replacement with select compacted backfill.

3. Compact the exposed subgrade soils (including the 10 feet margin) to at least 100 percent of the Standard Proctor test maximum dry density (ASTM D 698). **Subgrade compaction should be achieved to a depth of at least 2 feet below the bottom of foundation level.**

4. Prior to placing fill, perform compliance tests at a frequency of not less than one (1) test per 2,500 square feet of compacted increment, or at a minimum of 3 test locations, whichever is greater.

5. Place fill as necessary. Any structural fill/backfill should consist of clean fine sands [SP] (less than 5 percent fines) placed in maximum 12 inch uniform loose lifts. Fill soils containing between 5 and 12 percent fines (SP-SM or SP-SC) may be also be used, however, strict moisture control may be required. Each lift of structural fill should be densified to at least 100 percent of the Standard Proctor test maximum dry density of the soil (ASTM D 698) and tested for compaction (as described above) and approved before the placement of subsequent lifts.

6. Prior to the placement of reinforcing steel and concrete, **verify compaction within the footing trenches to a depth of at least 2 feet below bottom of footing level.** We recommend that every column footing be tested and at least one test every 100 feet for walls.

Stability of the compacted soils is essential and independent of compaction and density control. If the near surface soils or the structural fill experience "pumping" conditions, terminate all earthwork activities in that area. Pumping conditions occur when there is too much water present in the soil-water matrix. Earthwork activities are actually attempting to compact the water and not the soil. The disturbed soils should be dried in place by scarification and aeration prior to any additional earthwork activities.

Vibrations produced during vibratory compaction operations at the site may be significantly noticeable within 100 feet and may cause distress to adjacent structures if not properly regulated. Provisions should be made to monitor these vibrations so that any necessary modifications in the compaction operations can be made in the field before potential damages occur. Universal Engineering Sciences can provide vibration monitoring services to help document and evaluate the effects of the surface compaction operation on existing structures. It is recommended that large vibratory rollers remain a minimum of 50 feet from existing structures. Within this zone, the use of a static roller or small hand guided plate compactors is recommended.

10.0 PRELIMINARY STORMWATER MANAGEMENT DESIGN

We understand that the proposed project may include stormwater management ponds to be located within the confines of borings SB-1 through SB-6. Our preliminary design parameters at each of these borings are summarized in Table IV.

TABLE IV
PRELIMINARY STORMWATER MANAGEMENT DESIGN PARAMETERS

Design Parameter	Estimated Values					
Relevant Boring Logs	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6
Estimated Depth to Base of Surficial Aquifer (feet)	13	6	7	4½	13**	5
Estimated Fillable Porosity of Surficial in-situ sands (percent)	20	20	20	20	20	20
Estimated Seasonal High Groundwater Level (feet)	3	3	3	4	4	4
Estimated Horizontal Saturated Hydraulic Conductivity (feet per day) *	~~	9	~~	3	~~	3
Tested Zone (feet)	~~	2 to 5	~~	1 to 4	~~	1 to 4
Estimated Vertical Unsaturated Hydraulic Conductivity (feet per day) *	~~	3	~~	1	~~	1

* Values were estimated from remolded laboratory permeability tests and are not factored.
** This assumes that the surficial silty-clayey soils are undercut.

Due to the variability of the surficial soils at this site, we believe that the permeability results may not be representative of the overall surficial soil matrix within the pond areas. Therefore, we recommend that additional borings and testing be performed within the proposed stormwater areas, once pond locations and depths have been determined, to formulate final design parameters for use in stormwater modeling. UES can provide a drawdown recovery analysis once the additional testing has been performed and the system configurations have been established.

Please note that survey control was not provided at our boring locations. The estimated depths in the table above are referenced to the existing ground surface at the time of our exploration.

11.0 DEWATERING AND EXCAVATION CONSIDERATIONS

Based on the water level conditions encountered, control of the groundwater may be required to achieve the necessary excavation, construction, backfilling and compaction requirements presented in the preceding sections. If dewatering becomes necessary, we suggest drawing down the water level at least 2 feet below the bottom of the excavations. The actual method(s) of dewatering should be determined by the contractor.

Excavations should be sloped as necessary to prevent slope failure and to allow backfilling. As a minimum, temporary excavations below 4-foot depth should be sloped in accordance with OSHA regulations. Where lateral confinement will not permit slopes to be laid back, the excavation should be shored in accordance with OSHA requirements. During excavation, excavated material should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth. Provisions for maintaining workman safety within excavations is the sole responsibility of the contractor.

12.0 CONSTRUCTION RELATED SERVICES

We recommend the owner retain Universal to provide inspection services during the site preparation procedures for confirmation of the adequacy of the earthwork operations. Field tests and observations include verification of foundation and pavement subgrades by monitoring earthwork operations and performing quality assurance tests of the placement of compacted structural fill courses.

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 site problems or construction changes, which may arise during construction, in a timely and cost-effective manner.

13.0 LIMITATIONS

The recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations. The nature and extent of such variations may not become evident until the course of construction. If variations become evident, it will then be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of the variations.

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

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

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.

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