INTERIM
GEOTECHNICAL INVESTIGATION REPORT
REAMS ROAD ROADWAY CONCEPTUAL ANALYSIS
ORANGE COUNTY, FLORIDA

AEA PROJECT No. 201617

Antillian Engineering Associates, Inc.
3331 Bartlett Boulevard
Orlando, Florida 32811
(407) 422-1441

March 9, 2018

Inwood Consulting Engineers, Inc.
3000 Dovera Drive, Suite 200
Oviedo, Florida 32765

Attention: Alex Hull, P.E.

Reference: Interim Geotechnical Investigation Report
Reams Road Roadway Conceptual Analysis
Orange County, Florida
AEA Project No. 201617

Dear Mr. Hull:

Antillian Engineering Associates, Inc. has conducted parts of a geotechnical investigation to support the Roadway Conceptual Analysis for Reams Road in southwestern Orange County, Florida. The work was done in general accordance with the scope of services in our itemized fee proposal dated December 6, 2016. This report contains the results of our desk study, field investigations, and limited laboratory testing program, and a general discussion of those results as they relate to this roadway conceptual analysis. The complete will be submitted when the planned pavement coring program has been completed.

It has been our pleasure to serve Inwood Consulting Engineers and the Orange County Department of Public Works on this project. Please contact our office if you have questions or if you need additional information.

Very truly yours,
ANTILLIAN ENGINEERING ASSOCIATES, INC.
Certificate of Authorization No. EB6685

Peter G. Suah, P.E.
Florida Registration No. 46910
Principal Engineer

Attachments: Figures
Appendix A: Field and Laboratory Investigations
Appendix B: Important Information About This Geotechnical-Engineering Report
Appendix C: Constraints and Restrictions

PROJECT DESCRIPTION

Orange County Department of Public Works ("OCDPW") selected Inwood Consulting Engineers, Inc. ("ICE") to conduct a Roadway Conceptual Analysis ("RCA") of the Reams Road corridor between Summerlake Park Boulevard (also known as "Ficquette Road") and Taborfield Avenue. The approximate location is shown on Figure 1. ICE retained Antillian Engineering Associates, Inc. to conduct a preliminary, geotechnical-engineering investigation to support the RCA.

AVAILABLE INFORMATION

We reviewed the United States Geological Survey (USGS) map "Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida," the USGS quadrangle-topographic map for the area and the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey of Orange County, Florida to obtain general information about the project vicinity. We also reviewed copies of preliminary plans furnished by ICE ("ICE plans") for project-specific information.

The USGS recharge map showed the Reams Road corridor in an area designated as "low to moderate recharge." The general consensus among geotechnical engineers currently practicing in central Florida is that areas of high sinkhole risk are usually associated with areas of high recharge potential. As a result, we concluded that the risk of sinkhole activity in the Reams Road area should be low compared to the average risk across central Florida.

The USGS quadrangle-topographic map showed the terrain in the project area as a series of low knolls separated by broad areas of wetlands and marsh. The existing roadway could be identified on the map. It appeared to follow higher places on the terrain for the most part, and was conveyed across natural drainage courses and narrow sections of wetlands on short bridges. The ground surface in the vicinity was mapped near the Elevation 100 feet NGVD (El. 100) contour. The portion of the USGS map that covered the project area is reproduced as Figure 1.

The NRCS Soil Survey reported the predominant soil units in the area as Immokalee fine sand, St. Johns fine sand, and Smyrna fine sand. Pomello fine sand, Zolfo fine sand, and Tavares-Millhopper fine sand were mapped in areas corresponding to slightly higher elevations on the USGS topographic map, and Basinger fine sand, Samsula-Hontoon-Basinger association, and Sanibel muck in areas mapped as wetlands and marsh. A broad area of Urban land was mapped in an area between Reams Road and Walt Disney World. A portion of the NRCS Soil Survey sheet that covered the project area is reproduced as Figure 2.

Immokalee fine sand, St. Johns fine sand, and Smyrna fine sand are found on broad, wooded plains at lower elevations throughout Orange County. These soils are reported to be nearly level to level and poorly drained, with seasonal high groundwater levels within a foot of the ground surface in natural, undisturbed, typically rural areas.

Pomello fine sand, Zolfo fine sand and Tavares-Millhopper fine sand are found on low knolls and ridges on the low-lying plains. These soils are reported to be nearly level to gently sloping, and moderately well drained to well drained, with seasonal high groundwater levels between two feet and more than six feet below the natural ground surface.

Basinger fine sand, Samsula-Hontoon-Basinger association, and Sanibel muck are found in wetlands, marshes, broad drainage areas, natural depressions and other localized, low-lying areas on the terrain. These soils are nearly level to level, and poorly drained. They are often submerged for most of the year, sometimes by as much as two feet of water during the rainy season. These soils often have a surficial layer of organic material that may be more than six feet deep in places.

Urban land is land that is covered by streets, buildings, or other surfaces or has otherwise been modified by human activity to the point that so that the natural soils are barely discernible. These soils are often variants of the natural soil units that are mapped in adjoining areas. Characteristics of the reported soils are summarized below in Table 1.

TABLE 1
USDA NRCS SOIL SURVEY MAP UNITS IN PROJECT AREA

SOIL UNIT		DESCRIPTION	AASHTO GROUP	ESTIMATED SEASONAL HIGH WATER DEPTH (feet)	HYDRO-LOGIC SOIL GROUP
No.	NAME				
3	Basinger fine sand, depressional	Fine sand	A-3, A-2-4	+2 - 1.0	D
20	Immokalee fine sand	Fine sand	A-3, A-2-4	0 - 1.0	B/D
34	Pomello fine sand	Fine sand	A-3, A-2-4	2.0 - 3.5	C
37	St Johns fine sand	Fine sand	A-3	0 - 1.0	B/D
41	Samsula-Hontoon-Basinger association	Fine sand	A-8	+2 - 1.0	B/D, D
42	Sanibel muck	Muck, fine sand	A-8	+2 - 1.0	B/D
44	Smryna fine sand	Fine sand	A-3, A-2-4	0 - 1.0	B/D
47	Tavares-Millhopper fine sand	Fine sand, sandy loam	A-3, A-2-4, A-4	3.5 - 6.0	A
50	Urban land	-	-	-	-
54	Zolfo fine sand	Fine sand	A-3, A-2-4	2.0 - 3.5	C

The ICE plans showed the proposed roadway improvements and a survey baseline superimposed on aerial images of the existing roadway and adjoining properties. Proposed pond locations were shown on a separate, preliminary layout sheet.

FIELD INVESTIGATION

We developed location plans for the roadway borings, pond borings, and pavement cores using the ICE plans and readily available digital aerial imagery as references. We selected 29 auger-boring locations spaced about 600 feet apart as requested by County staff, and established them along the existing roadway shoulders near the stations shown on the baseline survey. We selected one auger-boring location for each of the seven pond sites, and selected seven core locations in collaboration with ICE staff along the existing roadway pavement.

We conducted a series of field reconnaissances to set out the boring locations, which we marked with paint for underground utility location in accordance with Florida statutes, and staked them for later identification by the drill crew. Our field crew drilled the roadway borings to five feet by hand using a bucket auger, and the pond borings to seven feet by the same method. We designated the roadway boring locations using approximate roadway stationing and position relative to the baseline survey; for example boring "104L" was on the left side of the alignment near Sta. 104+00, and boring "128R" was on the right shoulder of the road near Sta. 128+00. We designated the pond borings "PB-1A" to "PB-7A."

The field crew logged the soils recovered in the auger bucket; selected representative samples; sealed them in clean, airtight containers; measured the depth to groundwater in each borehole when encountered; and recorded their observations and measurement on the field logs. They backfilled the boreholes with soil. We cannot confirm that the boring locations were surveyed, so the locations presented and discussed in this report should be considered as approximate.

LABORATORY TESTING

A geotechnical engineer examined the recovered soil samples in our laboratory, confirmed the descriptions on the field logs, classified the soils visually in accordance with ASTM D 1452, and developed a representation of the soil stratigraphy at each boring location. The engineer selected representative specimens for laboratory testing, which consisted of 22 soil gradation analyses, five natural moisture content tests, five organic content tests, and one Atterberg limits test series. We conducted the tests in accordance with the applicable ASTM, AASHTO, and Florida Standard Test methods. Test results are presented on the Report of Tests sheet, the Summary of Laboratory Test Results sheets and the graphs in Appendix A.

[END OF SECTION]

GENERAL ASSESSMENT OF ENCOUNTERED SOILS

The following assessments are based upon a review of the available information, the attached field and laboratory test results, our understanding of the proposed improvements and our experience with similar projects and subsurface conditions. Soils are natural materials, so variations in composition and other physical characteristics are normal and should be expected.

Five different, mostly sandy soils were encountered by the auger boreholes. Some near-surface soils contained fragments of concrete, asphalt pavement, gravel, and cemented sand. Organic soils were encountered near the ground surface at two roadway-boring locations and two pond-boring locations. We designated the encountered soils as "Stratum 1" through Stratum 5," and classified them using AASHTO Designation M-145 as "A-3," "A-2-4," "A-4," and "A-8." Descriptions and AASHTO designations for each stratum are presented on the Report of Tests Sheet, while stratifications at each location are presented on the Report of Auger Borings sheets in Appendix A.

A-3 and A-2-4 materials are defined as "select" materials by FDOT Standard Index 505 Utilization of Embankment. "A-4" materials are defined as "plastic" and "A-8"materials are defined as "muck." Stratum 5 soils contained the fragments of concrete, asphalt pavement, gravel, and cemented sand, so we characterized them as "possible fill." Based on the encountered groundwater levels, road-embankment construction should be anticipated in low-lying locations.

The soils encountered in the pond borings were similar in composition to the roadway borings. Hydrologic properties are summarized below in Table 2.

TABLE 2
HYDROLOGIC PROPERTIES OF SOILS IN POND AUGER-BORINGS

POND SITE	BORING No.	USDA SOIL UNIT NAME	ESTIMATED SHGWL	HYDROLOGIC GROUP
1	PB-1A	Tavares-Millhopper fine sand	2.0 - 3.5	A
2	PB-2A	Smyrna fine sand	0 - 1.0	B/D
3	PB-3A	Pomello fine sand	2.0 - 3.5	C
4	PB-4A	Smyrna fine sand	0 - 1.0	B/D
5	PB-5A	Smyrna fine sand	0 - 1.0	B/D
6	PB-6A	Zolfo fine sand	2.0 - 3.5	C
7	PB-7A	Smyrna fine sand	0 - 1.0	B/D

In our opinion, the soils encountered during this investigation should not adversely affect the design and construction of the proposed improvements, provided they are utilized in accordance with the guidelines presented on FDOT Standard Index 505 and related references.

PAVEMENT CORES

The asphalt-concrete surface course in the cores was between XX inches and XX inches thick. The asphalt concrete was underlain by a base of ~~compacted, crushed limestone ("limerock")~~ between XX inches and XX inches thick. The soils beneath the base were ~~mostly fine sands~~. Asphalt pavement core characteristics are presented below in Table 3.

TABLE 3
PAVEMENT THICKNESSES ENCOUNTERED IN CORES

LOCATION	PAVEMENT THICKNESS (inches)		REMARKS
	ASPHALT CONCRETE	LIMEROCK BASE	
C-1			
C-2			
C-3			
C-4			
C-5			
C-6			
C-7			

We recommend checking these pavement sections for structural adequacy under current and future traffic loads, especially if the pavement was designed more than 20 years ago. Traffic loads can change to the point that pavement life-cycle projections used for the original design are no longer accurate. In addition, we observed recent patches in some pavements, indicating that some type of distress had occurred. We recommend a pavement condition survey (if one has not been done already) to assess the condition of the pavement and identify mechanisms that may be causing distress, such as, but not limited to, structural inadequacy under current loading, or water intrusion into the base. We also recommend that OCDPW consider monitoring the drainage of this road closely, particularly immediately after (or even during) heavy or prolonged rainfall to verify whether or not water intrusion is occurring. and if so, to what degree.

[END OF SECTION]

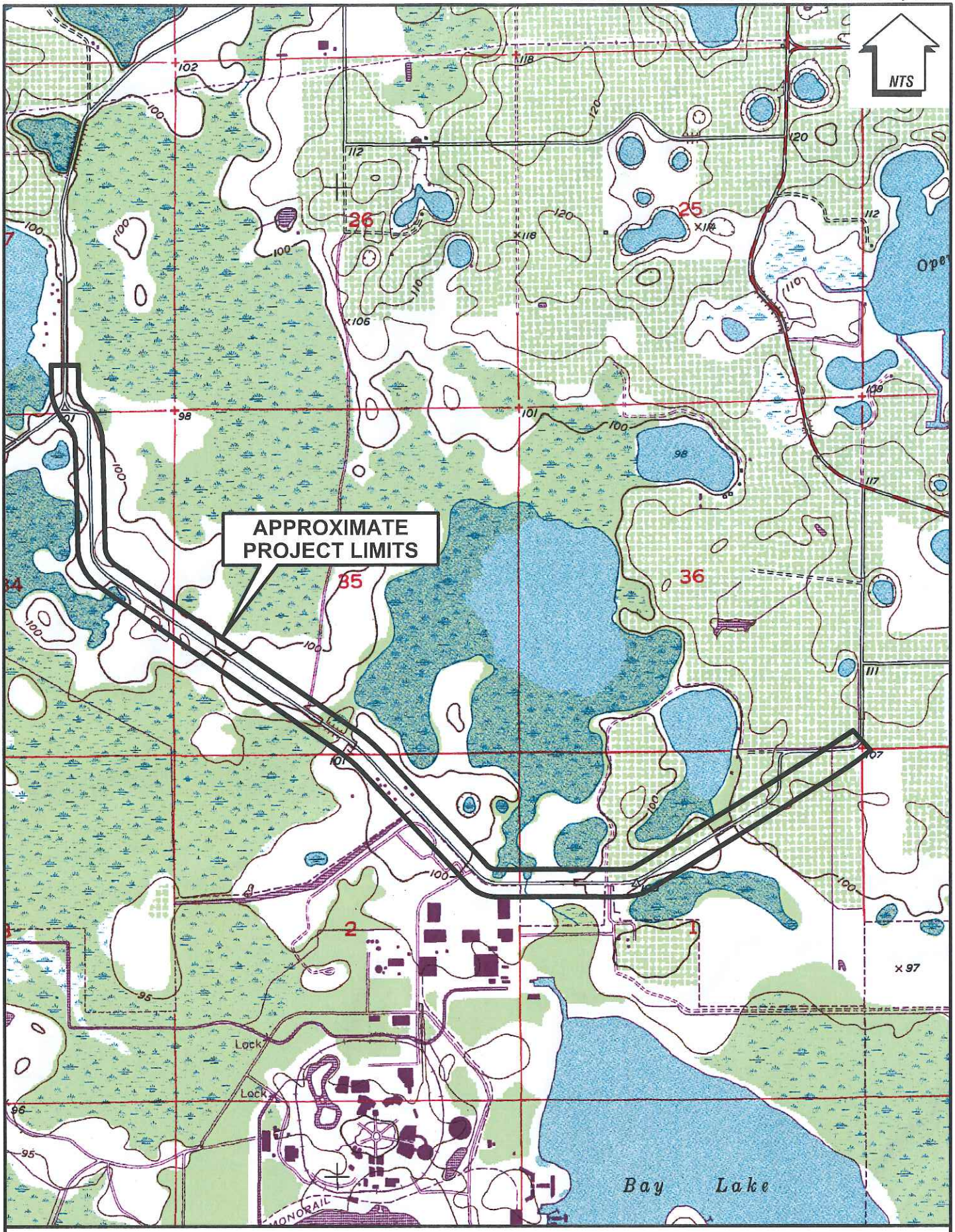
LIMITATIONS

This data report presents a preliminary assessment of the encountered subsurface conditions on the basis of accepted geotechnical-engineering procedures for site characterization. It should not be used for any other purpose. The recovered soil samples were not examined nor tested in any way for chemical content or environmental hazards.

This preliminary investigation was confined to the zone of soil which is likely to be affected by the planned improvements, and did not address the potential of surface expression of deep geologic activity such as sinkholes. That type of evaluation requires a more extensive scope of services than those provided for this study.

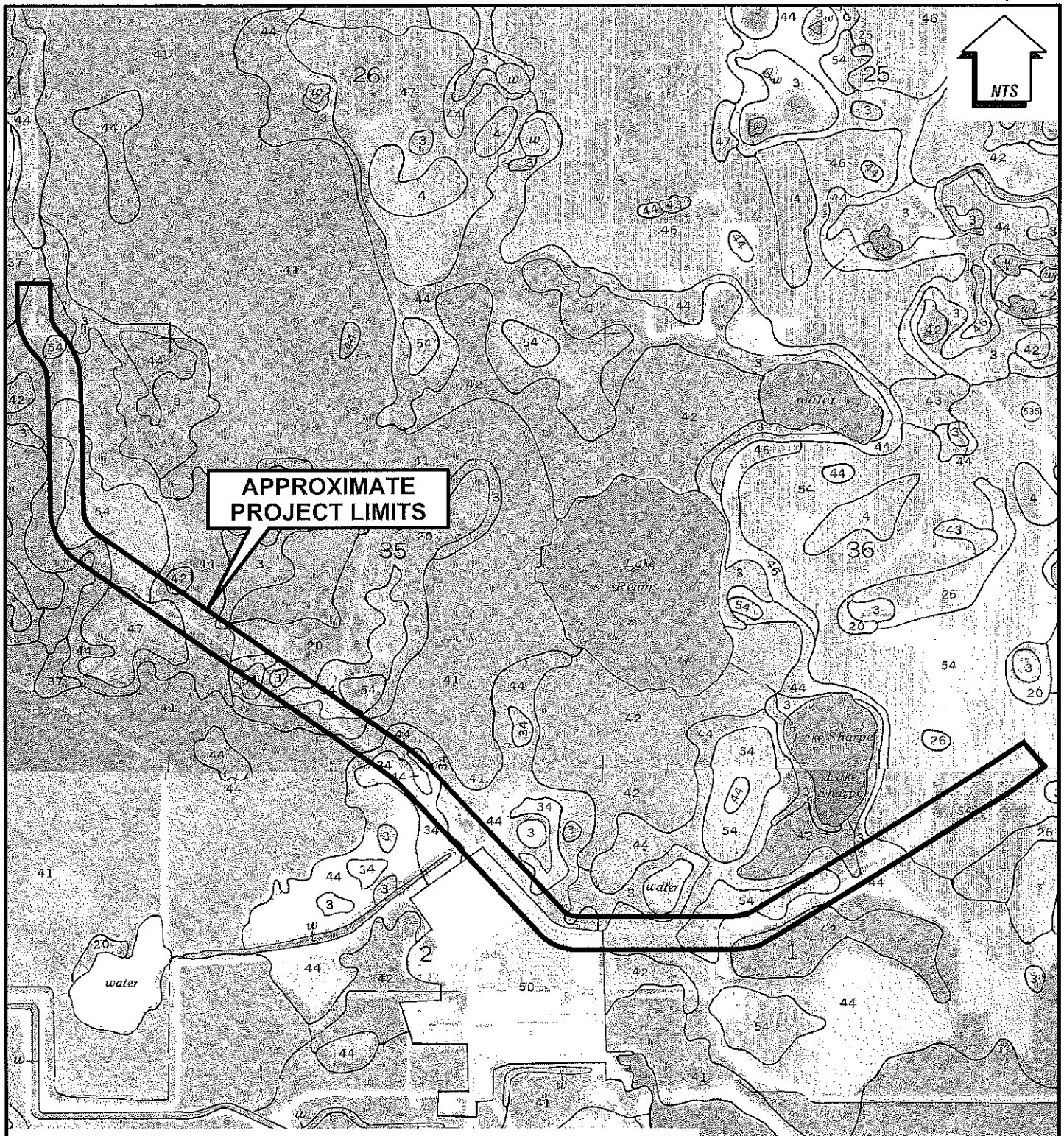
Because of the natural limitations inherent in working below the ground surface, a geotechnical engineer cannot predict and address all possible problems. The bulletin "Important Information About This Geotechnical Engineering Report" published by the Geoprofessional Business Association is presented in Appendix B to help explain the nature of geotechnical issues. Additional information is presented in Appendix C to discuss the potential concerns and the basic limitations of a typical geotechnical investigation report.

FIGURES



SITE LOCATION MAP

201617	REAMS ROAD RCA	FIG. 1



SOIL LEGEND

- 3 – BASINGER FINE SAND, DEPRESSIONAL
- 34 – POMELLO FINE SAND, 0 TO 5 PERCENT SLOPES
- 37 – ST. JOHNS FINE SAND
- 41 – SAMSULA–HONTOON–BASINGER ASSOCIATION, DEPRESSIONAL
- 42 – SANIBEL MUCK
- 44 – SMYRNA FINE SAND
- 47 – TAVARES–MILLHOPPER FINE SANDS, 0 TO 5 PERCENT SLOPES
- 50 – URBAN LAND
- 54 – ZOLFO FINE SAND

Figure developed from UDSA SCS Soil Survey of Orange County, Florida, issued August, 1989

USDA SCS SOIL SURVEY MAP

201617	REAMS ROAD RCA	FIG. 2

APPENDIX A

ROADWAY SOILS SURVEY
REPORT OF TESTS

TOWNSHIPS: 23, 24 SOUTH
RANGE: 27 EAST
SECTIONS: 27,34,35,1,2

PROJECT NO.: AEA PROJ. NO. 201617
ROAD NO.: REAMS ROAD RCA
SUBMITTED BY: ANTILLIAN ENGINEERING ASSOCIATES, INC.

DATE OF SURVEY: 08/01/17 – 02/13/18
SURVEYED BY: ANTILLIAN ENGINEERING ASSOCIATES, INC.
SURVEY BEGINS STA. NO.: 104+00
SURVEY ENDS STA. NO.: 272+00
DATE REPORTED: 02/13/18

		ORGANIC CONTENT			SIEVE ANALYSIS RESULTS (% PASSING)						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS				ENVIRONMENTAL CLASSIFICATION (SUBSTRUCTURE)	
STRATUM NO.	LBR VALUE	NO. OF TESTS	% ORGANIC	MOISTURE CONTENT %	NO. OF TESTS	#10 MESH	#40 MESH	#60 MESH	#100 MESH	#200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTICITY INDEX	AASHTO GROUP	DESCRIPTION	RESISTIVITY ohm-cm	CHLORIDES ppm	SULFATES ppm	pH	CONCRETE	STEEL
1	--	–	--	--	15	99-100	88-96	62-80	21-39	5-10	--	--	--	A-3	BROWN, GRAY, LIGHT GRAY, LIGHT BROWNISH GRAY, GRAYISH BROWN, VERY DARK GRAYISH BROWN, PALE BROWN, DARK YELLOWISH BROWN, VERY DARK BROWN, LIGHT YELLOWISH BROWN, DARK BROWN, VERY DARK GRAY AND DARK GRAY FINE SAND, OCCASIONALLY WITH ROOTS	--	--	--	--	--	--
2	--	2	3	28	14	99-100	88-95	59-76	27-47	9-21	--	--	--	A-2-4	DARK GRAYISH BROWN, GRAYISH BROWN, VERY DARK GRAY, VERY DARK BROWN, REDDISH BROWN, GRAY, DARK GRAY AND VERY DARK GRAYISH BROWN, SILTY FINE SAND, OCCASIONALLY WITH ROOTS	--	--	--	--	--	--
3	--	1	6	17	4	100	89-91	71-74	46-49	24-39	1	21	6	A-2-4, A-4	LIGHT GRAY CLAYEY FINE SAND, OCCASIONALLY WITH ROOTS	--	--	--	--	--	--
4	--	2	10-21	34-48	1	100	94	72	32	10	--	--	--	A-8	BLACK, VERY DARK BROWN, FINE SAND AND SILTY FINE SAND WITH ORGANIC MATTER AND ABUNDANT ROOTS	--	--	--	--	--	--
5	--	–	--	--	–	--	--	--	–	–	--	--	--	A-3, A-2-4	DARK GRAYISH BROWN, BROWN, DARK GRAY, DARK YELLOWISH BROWN, FINE SAND TO SILTY FINE SAND, OCCASIONALLY WITH FRAGMENTS OF CONCRETE, ASPHALT PAVEMENT, GRAVEL, CEMENTED SAND AND ROOTS (POSSIBLE FILL)	--	--	--	--	--	--

NOTES

1. THE SYMBOL "--", IF PRESENT, REPRESENTS UNMEASURED SOIL PARAMETERS.
2. SOIL BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH BORING LOCATION ONLY. ANY SUBSOIL CONNECTING LINES SHOWN ARE FOR ESTIMATING EARTHWORK ONLY AND DO NOT INDICATE ACTUAL STRATUM LIMITS. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE FDOT STANDARD SPECIFICATIONS.
3. ▼ - ENCOUNTERED GROUNDWATER LEVEL AT THE TIME OF SURVEY
4. ▽ - ESTIMATED HIGH GROUNDWATER LEVEL FOR PAVEMENT DESIGN PURPOSES ONLY
5. GNE - GROUNDWATER NOT ENCOUNTERED
6. STRATUM 4 AND ORGANIC MATERIAL SHALL BE REMOVED IN ACCORDANCE WITH FDOT STANDARD INDEX 500.
7. PLASTIC MATERIAL SHALL BE REMOVED IF ENCOUNTERED, IN ACCORDANCE WITH FDOT STANDARD INDEX 500.
8. ALL MATERIAL USED IN EMBANKMENT CONSTRUCTION SHALL BE IN ACCORDANCE WITH FDOT STANDARD INDEX 505.
9. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE FDOT STANDARD SPECIFICATIONS.

REVISIONS

Date	By	Description	Date	By	Description

	Names	Dates
Drawn by	K.A.S.	02/13/18
Checked by	P.G.S.	02/13/18
Designed by		
Checked by		
Approved by		

ENGINEER OF RECORD:
PETER G. SUAH, P.E.
FLORIDA REG. NO. 46910

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LOGO: ANTILLIAN ENGINEERING ASSOCIATES, INC. GEOTECHNICAL ENGINEERS
CERTIFICATE OF AUTHORIZATION EB6685

SEAL:

ORANGE COUNTY PUBLIC WORKS DEPT.
ENGINEERING DIVISION
4200 S. JOHN YOUNG PKWY. ORLANDO, FLORIDA 32839-9205 (407) 836-7950

PROJECT NAME	PROJECT NUMBER
REAMS ROAD RCA	XX

SHEET TITLE: REPORT OF TESTS
Drawing No.
PROJECT NAME: REAMS ROAD RCA
Index No. XX

BORING:	104L	110L	116L	122L	128R	134R	140R	146L	152R	158L
STATION:	104+00	110+00	116+00	122+00	128+00	134+00	140+00	146+00	152+00	158+00
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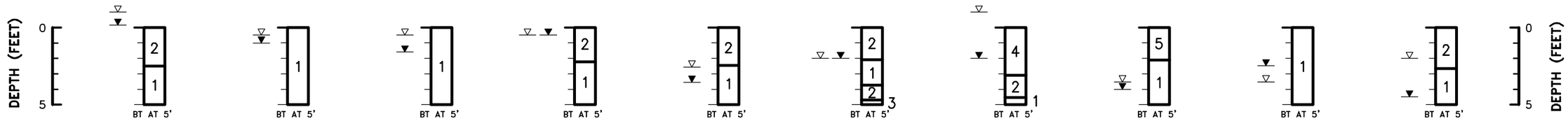

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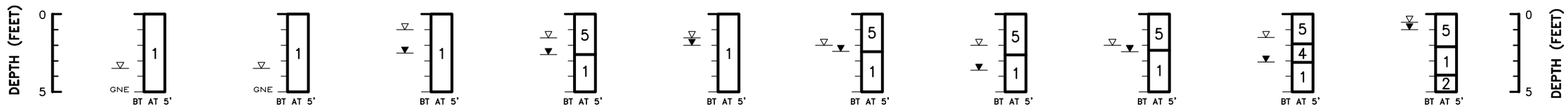
OFFSET:	20' RIGHT	50' LEFT	20' RIGHT	65' LEFT	35' RIGHT	6 LEFT	70' RIGHT	40' LEFT	40' LEFT	25' LEFT
DATE DRILLED:	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17



BORING:	224R	230L	236R	242R	248R	254L	260R	266L	272R
STATION:	224+00	230+00	236+00	242+00	248+00	254+00	260+00	266+00	272+00
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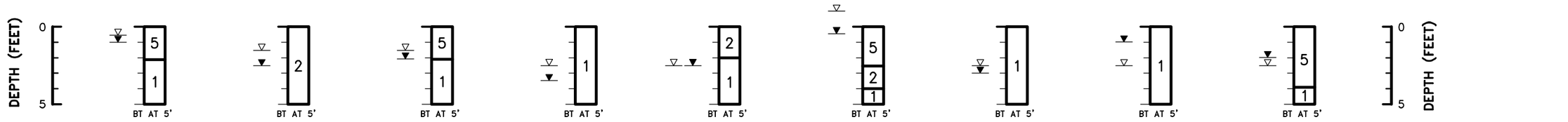
DATE DRILLED:	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17	07/18/17



STRATUM NO.	AASHTO SOIL CLASSIFICATION SYMBOL	DESCRIPTION
1	A-3	BROWN, GRAY, LIGHT GRAY, LIGHT BROWNISH GRAY, GRAYISH BROWN, VERY DARK GRAYISH BROWN, PALE BROWN, DARK YELLOWISH BROWN, VERY DARK BROWN, LIGHT YELLOWISH BROWN, DARK BROWN, VERY DARK GRAY AND DARK GRAY FINE SAND, OCCASIONALLY WITH ROOTS
2	A-2-4	DARK GRAYISH BROWN, GRAYISH BROWN, VERY DARK GRAY, VERY DARK BROWN, REDDISH BROWN, GRAY, DARK GRAY AND VERY DARK GRAYISH BROWN, SILTY FINE SAND, OCCASIONALLY WITH ROOTS
3	A-2-4, A-4	LIGHT GRAY CLAYEY FINE SAND, OCCASIONALLY WITH ROOTS
4	A-8	BLACK, VERY DARK BROWN, FINE SAND AND SILTY FINE SAND WITH ORGANIC MATTER AND ABUNDANT ROOTS
5	A-3, A-2-4	DARK GRAYISH BROWN, BROWN, DARK GRAY, DARK YELLOWISH BROWN, FINE SAND TO SILTY FINE SAND, OCCASIONALLY WITH FRAGMENTS OF CONCRETE, ASPHALT PAVEMENT, GRAVEL, CEMENTED SAND AND ROOTS (POSSIBLE FILL)

REVISIONS

Date	By	Description	Date	By	Description

	Names	Dates
Drawn by	K.A.S.	02/13/18
Checked by	P.G.S.	02/13/18
Designed by		
Checked by		
Approved by		

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PROJECT NAME	PROJECT NUMBER
REAMS ROAD RCA	XX

SHEET TITLE: REPORT OF ROADWAY AUGER BORINGS

PROJECT NAME: REAMS ROAD RCA

Drawing No.

Index No. XX

BORING:	PB–1A	PB–2A	PB–3A	PB–4A	PB–5A	PB–6A	PB–7A	BORING:
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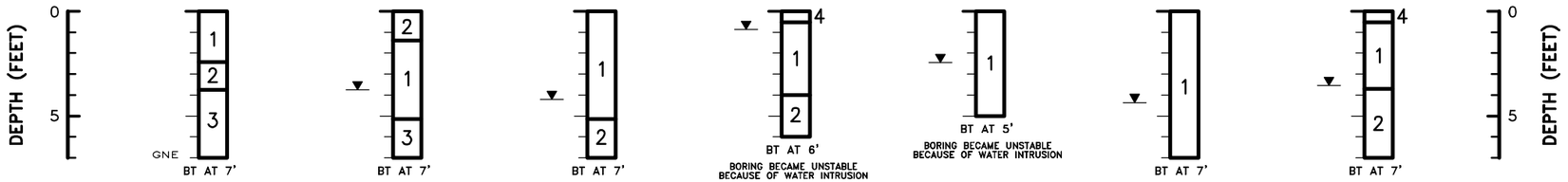
DATE DRILLED:	02/13/18	02/13/18	02/13/18	02/13/18	02/13/18	02/13/18	02/13/18	DATE DRILLED:



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2	A-2-4	DARK GRAYISH BROWN, GRAYISH BROWN, VERY DARK GRAY, VERY DARK BROWN, REDDISH BROWN, GRAY, DARK GRAY AND VERY DARK GRAYISH BROWN, SILTY FINE SAND, OCCASIONALLY WITH ROOTS
3	A-2-4, A-4	LIGHT GRAY CLAYEY FINE SAND, OCCASIONALLY WITH ROOTS
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ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS
CERTIFICATE OF AUTHORIZATION EB6685

SEAL:

ORANGE COUNTY PUBLIC WORKS DEPT.
ENGINEERING DIVISION
4200 S. JOHN YOUNG PKWY. ORLANDO, FLORIDA 32839-9205 (407) 836-7950

PROJECT NAME	PROJECT NUMBER
REAMS ROAD RCA	XX

SHEET TITLE: **REPORT OF POND AUGER BORINGS**

PROJECT NAME: **REAMS ROAD RCA**

Drawing No.

Index No. **XX**

Project: **Reams Road RCA** Job Number: **201617** **Sheet 1 of 2**

Manager: _____ Client: _____ Project Description: _____

Location: _____

Boring / Depth	Sample Description	#4	#10	#40	#60	#100	Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)	Stratum Number	AASHTO	USCS
104L	Dark grayish brown silty sand														
1.0		99.4	99.3	94.0	76.3	40.5	11.1						2	A-2-4	
122L	Light brownish gray sand														
2.5		100.0	99.9	93.9	74.5	38.5	9.9						1	A-3	
134R	Light gray clayey sand														
4.7		100.0	100.0	89.2	70.5	48.9	38.7	17	21	6	6		3	A-4	
140R	Black organic silty sand														
1.0								47			21		4	A-8	
140R	Very dark brown silty sand														
3.5		100.0	100.0	94.9	73.7	31.5	9.3	28			3		1	A-3	
158L	Reddish brown silty sand														
3.0		99.8	99.6	88.0	58.6	26.6	11.2						2	A-2-4	
164R	Light brownish gray sand														
1.0		100.0	100.0	91.8	66.4	25.3	6.6						1	A-3	
164R	Brown sand														
3.0		100.0	100.0	92.2	67.6	27.4	8.0						1	A-3	
170L	Dark yellowish brown sand														
4.0		100.0	100.0	92.8	67.9	24.4	6.5						1	A-3	
182L	Very dark brown sand														
4.8		100.0	100.0	90.3	61.5	21.4	6.2						1	A-3	
188R	Light gray sand														
2.0		100.0	100.0	91.7	65.0	21.7	4.9						1	A-3	
212L	Very dark brown silty sand with organics														
2.0		100.0	100.0	94.4	72.1	32.4	9.9	33			10		1	A-3	
212L	Dark brown sand														
3.1		100.0	100.0	93.5	72.2	32.7	9.5						1	A-3	
218L	Very dark brown silty sand														
4.0		100.0	100.0	93.0	68.4	30.8	11.2	27			3		2	A-2-4	
230L	Gray silty sand														
1.0		100.0	100.0	94.4	74.7	38.3	11.7						2	A-2-4	
230L	Grayish brown silty sand														
2.5		100.0	99.9	94.4	75.1	38.1	10.6						2	A-2-4	
236R	Very dark gray sand														
2.5		100.0	100.0	95.7	79.9	38.2	8.7						1	A-3	
242R	Brown sand with roots														
1.0		98.8	98.6	93.1	72.0	33.7	9.4						1	A-3	
248R	Dark brown silty sand														
1.0		100.0	100.0	94.9	76.4	47.4	15.1						2	A-2-4	

Summary Of Laboratory Test Results

ANTILLIAN
ENGINEERING ASSOCIATES, INC.

Project: **Reams Road RCA** Job Number: **201617** **Sheet 2 of 2**

Manager: _____ Client: _____ Project Description: _____

Location: _____

Boring / Depth	Sample Description	#4	#10	#40	#60	#100	Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)	Stratum Number	AASHTO	USCS
254L 3.0	Very dark gray silty sand	100.0	100.0	95.2	72.6	35.7	13.0						2	A-2-4	
260R 4.0	Pale brown sand	100.0	100.0	95.6	76.2	33.0	6.9						1	A-3	
272R 3.9	Very dark brown sand	100.0	100.0	88.4	63.4	25.8	9.2						1	A-3	
PB-1A 2.5	Very dark brown silty sand						15.0						2	A-2-4	
PB-1A 4.0	Pale brown clayey sand	100.0	100.0	90.6	74.2	45.8	23.6						3	A-2-4	
PB-2A 1.0	Dark grayish brown silty sand						10.5						2	A-2-4	
PB-2A 7.0	Dark grayish brown clayey sand						37.4						3	A-4	
PB-3A 5.5	Very dark brown silty sand						13.9						2	A-2-4	
PB-4A 4.0	Very dark brown silty sand						7.5						2	A-2-4	
PB-4A 5.5	Very dark brown silty sand						14.5						2	A-2-4	
PB-5A 3.5	Pale brown sand with silt						6.8						1	A-3	
PB-6A 2.5	Dark grayish brown sand with silt						8.5						1	A-3	
PB-6A 3.5	Brown sand with silt						6.9						1	A-3	
PB-7A 4.0	Dark brown silty sand						21.3						2	A-2-4	

Summary Of Laboratory Test Results

ANTILLIAN
ENGINEERING ASSOCIATES, INC.

APPENDIX B

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
of the Geoprofessional Business Association

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Telephone: 301/565-2733 Facsimile: 301/589-2017
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APPENDIX C

ANTILLIAN ENGINEERING ASSOCIATES, INC.
CONSTRAINTS AND RESTRICTIONS

WARRANTY

Antillian Engineering Associates, Inc. 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.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Antillian Engineering Associates, Inc., 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 Antillian Engineering Associates, Inc. of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Antillian Engineering Associates, Inc. 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

Antillian Engineering Associates, Inc. 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 Antillian Engineering Associates, Inc..

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 Antillian Engineering Associates, Inc..

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. Antillian Engineering Associates, Inc. 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 Antillian Engineering Associates, Inc. to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Antillian Engineering Associates, Inc. to locate any such buried objects. Antillian Engineering Associates, Inc. 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.