TECHNICAL REPORT COVERSHEET

PRELIMINARY ROADWAY SOIL SURVEY

Florida Department of Transportation

District One

State Road (SR) 70 PD&E Study

Limits of Project: County Road (CR) 29 to Lonesome Island Road

Highlands County, Florida

Financial Management Number: 414506-5-22-01

ETDM Number: 14364

Date: August 2019

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding dated May 26, 2022 and executed by the Federal Highway Administration and FDOT.

PRELIMINARY ROADWAY SOIL SURVEY
SR 70 RECONSTRUCTION FROM
CR 29 TO JC DURRANCE RD
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35 – TWO #76
FPID NO. 414506-6-52-01

Ardaman Project No. 19-51-9041
August 5, 2019

Florida Department of Transportation
District One
Post Office Box 1249
Bartow, FL 33831-1249

Attention: Mr. Keith Ellis, P.E.

Subject: **Preliminary Roadway Soil Survey**
S.R. 70 Reconstruction from
C.R. 29 to J C Durrance Rd.
Highlands County, Florida
Contract C9G35-TWO-#76
Financial Project No. 414506-6-52-01

Dear Mr. Ellis:

As requested, we have completed the Preliminary Roadway Soil Survey Report for the subject project. This report documents the results of our field and laboratory testing programs and presents our engineering recommendations. It has been prepared for specific application to the reconstruction of the segment of S.R. 70 from C.R. 29 to J C Durrance Road in Highlands County, Florida, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The nature and extent of the variations between the borings may not become evident until construction.

If you have any questions about this report, please contact the undersigned.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950

JERRY H. KUEHN LICENSE No. 35557 STATE OF FLORIDA PROFESSIONAL ENGINEER

This document has been digitally signed and sealed by:

Jerry H Kuehn 2019.08.05 15:32:39 -04'00'

Printed copies of this document are not considered signed and sealed The signature must be verified on electronic documents.

Jerry H. Kuehn, P.E.
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Project Manager
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JHK/ABH:ly

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1.0 INTRODUCTION

1.1 Site Location and Project Description

FDOT – District One is planning to reconstruct S.R. 70 to the south of the existing alignment between C.R. 29 and J C Durrance Road in Highlands County, Florida. The project site is shown superimposed onto an aerial photograph obtained from Google Earth Pro© presented as **Site Location Map** (**Figure 1**).

1.2 Review of Soil Survey Maps

The United States Department of Agriculture Natural Resources Conservation Services, **Soil Survey of Highlands County, Florida** was reviewed for major shallow soil types within the project study area. The Soil Survey identified six major soil types within the area of interest and these are described in the following paragraphs.

8—Immokalee fine sand. This is a nearly level, poorly drained and very poorly drained soil on flatwoods and in lower areas. Slopes range from 0 to 2 percent.

Typically, the surface layer is black sand about 6 inches thick. The subsurface layer, to a depth of 37 inches, is gray and white sand. The subsoil to a depth of 80 inches is black sand.

In most years, under natural conditions, the seasonal high water table is within 12 inches of the surface during the summer rainy season. Generally, it is between 12 and 40 inches for the rest of the year. The available water capacity of this soil is low. The permeability is moderate.

12—Basinger fine sand. This is a nearly level, poorly drained to very poorly drained soil on low flatwoods and sloughs and poorly defined drainageways. Slopes range from 0 to 2 percent.

Typically, the surface layer is dark gray fine sand about 6 inches thick. The subsurface layer, to a depth of 21 inches, is light gray and light brownish gray fine sand. The subsoil, to a depth of 52 inches, is brown fine sand. The upper part of the substratum, to a depth of 62 inches, is light brownish gray fine sand. The lower part to a depth of 80 inches is grayish brown loamy fine sand.

In most years, under natural conditions, the seasonal high water table is within 12 inches of the surface for 2 to 5 months during the summer rainy season. Generally, it is between 12 and 40 inches for 6 months or more but may recede to a lower depth during extended dry periods. The available water capacity of this soil is low. The permeability is rapid.

13—Felda fine sand. This is a nearly level, poorly drained soil on broad low flats and in large drainageways in the flatwoods. Slopes range from 0 to 1 percent.

Typically, the surface layer is gray fine sand about 7 inches thick. The subsurface layer, to a depth of 24 inches, is light gray and dark grayish brown fine sand. The subsoil, to a depth of 36 inches, is gray very fine sandy loam. The upper part of the substratum, to a depth of 68 inches, is light gray fine sand. The lower part to a depth of more than 80 inches is dark grayish brown fine sand.

In most years, under natural conditions, the seasonal high water table is within 12 inches of the surface during the summer rainy season. During the rest of the year, the water table is between 12 and 40 inches except during dry periods when it may recede to a lower depth. The available water capacity of this soil is low. The permeability is moderate to moderately rapid.

18—Kaliga muck, frequently ponded. This is a nearly level, very poorly drained, organic soil in swamps and marches. This soil is mainly in large, irregularly shaped areas in a marsh south of Lake Istokpoga. Slopes range from 0 to 1 percent.

Typically, the upper part of the surface layer is black muck about 6 inches thick. The lower part, to a depth of 39 inches is dark brown muck. The underlying material, to a depth of 45 inches is grayish brown very fine sand. Below that layer, to a depth of 68 inches, is dark gray very fine sandy loam. The lower part to a depth of 80 inches is grayish brown very fine sand.

In most years, under natural conditions, this soil is ponded for 6 to 9 months. The water table is generally within 10 inches of the surface for the rest of the year. The available water capacity of this soil is very high. The permeability is slow or very slow.

26—Tequesta muck, frequently ponded. This is a nearly level, very poorly drained soil in marshes and depressions. Slopes range from 0 to 2 percent.

Typically, the organic surface layer is black muck about 12 inches thick. Below that layer, to a depth of 17 inches, is black fine sand. The subsurface layer, to a depth 32 inches, is light brownish gray fine. The subsoil, to a depth 77 inches, is dark gray fine sandy loam. The substratum to a depth of 80 inches or more is light gray fine sand.

Under natural conditions, this soil is ponded for most of the year. The water table is within 10 inches of the surface for the rest of the year. The available water capacity of this soil is moderate. The permeability is moderately slow.

35—Sanibel muck. This is a nearly level, very poorly drained soil in marshes, swamps and poorly defined drainageways. Slopes range from 0 to 2 percent.

Typically, the organic surface layer is black muck about 8 inches thick. Below that layer, to a depth of 15 inches, is black mucky fine sand. The upper port of the underlying material, to a depth of 63 inches, is gray sand. The lower part to a depth of 80 inches of more is light brownish gray sand.

In most years, under natural conditions, the water table is above the surface for 2 to 6 months during the wet seasons. During the rest of the year, it is at a depth of less than 10 inches. The available water capacity of this soil is low. The permeability is rapid.

Note that three of the six soil units describe a muck surface layer that is approximately 8 to 39 inches thick. The majority of the borings performed along the route encountered organic muck extending to varying depths below the existing ground surface.

A summary of the six soil units is presented below:

USDA Map Symbol And Soil Name	Soil Classification				pH	Seasonal High Water Table		Risk of Corrosion	
	Depth (inches)	USCS	AASHTO	Permeability (in./hr.)		Depth (feet)	Months	Uncoated Steel	Concrete
(8) Immokalee fine sand	0 – 6	SP, SP-SM	A-3	6.0 – 20	3.6 – 6.0	0 – 1.0	JUN – NOV	High	High
	6 - 37	SP, SP-SM	A-3	6.0 – 20	3.6 – 6.0				
	37 – 80	SP-SM, SM	A-3, A-2-4	0.6 – 2.0	3.6 – 6.0				
(12) Basinger fine sand	0 – 6	SP	A-3	6.0 – 20	3.6 – 8.4	0 – 1.0	JUN – FEB	High	Moderate
	6 – 80	SP, SP-SM	A-3, A-2-4	6.0 – 20	3.6 – 7.3				
(13) Felda fine sand	0 – 24	SP, SP-SM	A-3	6.0 – 20	4.5 – 7.3	0 – 1.0	JUL – MAR	High	Moderate
	24 – 36	SM, SC-SM, SC	A-2-4, A-2-6	0.6 – 6.0	6.1 – 7.8				
	36 – 80	SP, SP-SM	A-3, A-2-4	6.0 – 20	6.1 – 8.4				
(18) Kaliga muck, frequently ponded	0 – 39	PT	A-8	6.0 – 20	3.6 – 4.4	+2 – 0	JUN – APR	High	High
	39 – 45	SM, SC-SM, SC	A-2-4, A-2-6, A-4, A-6	0.6 – 6.0	4.5 – 7.3				
	45 – 68	SC, CL, CH	A-7, A-4, A-6	<0.2	4.5 – 7.3				
	68 – 80	SM, SC-SM	A-2-4	2.0 – 20	4.5 – 7.3				
(26) Tequesta muck, frequently ponded	0 – 12	PT	A-8	6.0 – 20	5.1 – 7.3	+2 – 0	JAN – DEC	High	Low
	12 – 32	SP, SP-SM	A-3, A-2-4	6.0 – 20	5.1 – 7.3				
	32 – 77	SM, SC-SM, SC	A-2-4, A-2-6	0.2 – 0.6	6.1 – 8.4				
	77 – 80	SP, SP-SM, SM	A-3, A-2-4, A-1-b	6.0 – 20	6.1 – 8.4				
(35) Sanibel muck	0 – 8	PT	A-8	6.0 – 20	3.6 – 7.3	+1 – 0	JUN – FEB	High	Low
	8 – 15	SP, SP-SM	A-3	6.0 – 20	3.6 – 7.3				
	15 – 80	SP, SP-SM	A-3	6.0 – 20	3.6 – 7.3				

2.0 SCOPE OF SERVICES

Our services for this project consisted of providing geotechnical engineering services in general accordance with the **Florida Department of Transportation (FDOT)** "**Soils and Foundation Handbook 2016**" and the scope of services as defined in the Task Work Order No. 76 under Ardaman's District-Wide Geotechnical Design Support – Contract C 9G35.

2.1 Purpose and Scope of Services

The purpose of this report was to identify the subsurface conditions along in the project study area to develop design parameters and to make engineering recommendations in each of the following areas:

1. Soil stratigraphy at the boring locations. Development of a general soil profile within the project study area.

2. Assessment of the existing soil subgrade and groundwater conditions in the project study area for suitability of pavement support.

3. General location and description of the potential deleterious materials encountered in the borings that may interfere with construction progress or pavement performance, including existing fills or surficial organics.

4. Groundwater levels and seasonal high groundwater level estimates in the borings.

The scope of services from this Roadway Soil Survey project included the following

1. Conducted a general visual reconnaissance of the site.

2. Reviewed readily available published geologic information. Reviewed the "**Soil Survey of Highlands County, Florida**" published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).

3. Performed a roadway soil survey consisting of auger soil borings extending 5 feet deep below the existing ground section and SPT borings extending to a depth of 20 feet. The borings were generally staggered on 500-foot centers along the proposed route.

4. Visually examined and classified the sampled soils according to the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System.

5. Conducted a limited laboratory testing program consisting of percent fines analyses, Atterberg limit tests, organic content tests and natural moisture content tests to assist in classification and determine selected soil properties. In addition, collected bulk samples, generally at a frequency of three per mile, and transported to the Gainesville FDOT laboratories for Resilient Modulus (M_R) testing.

6. Measured the groundwater levels in the borings.

7. Estimated seasonal high groundwater levels at each boring location.

8. Prepared this roadway soil survey report summarizing the field and laboratory testing program results, and the subsurface soil and groundwater condition encountered. Developed engineering recommendations for the design and construction of the embankment and pavement for the proposed roadway improvements.

3.0 FIELD EXPLORATION PROGRAM

3.1 Auger Borings

The field exploration program for the Roadway Soil Survey consisted of performing a total of 36 auger borings. The borings were generally staggered on 500-foot centers at specific locations as indicated by FDOT along the alignment. The locations of the individual borings are given on the **Report of Core Boring Profile sheets** included in Section 8.0 of this report. The borings were located in the field by using a hand-held WAAS enabled GPS unit to locate boring coordinates provided by the FDOT. A limited number of borings were offset due to conflicts. Any GPS coordinates that were revised from those requested are provided along with the non revised GPS coordinates in the **Report of Core Boring Profile sheets** at the head of each boring.

Shallow hand auger borings were conducted using a hand-held bucket auger. The auger borings were advanced to a depth of 5 feet below the existing ground surface. The soil sampling was performed in general accordance with ASTM test designation D-1452 titled Practice for Soil Investigation and Sampling by Auger Borings. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our Sarasota laboratory for classification and analysis.

The results of the auger borings are summarized on soil profiles presented as **Report of Core Boring Profile sheets.** The stratum numbers are shown on the **Roadway Soil Survey sheet**.

3.2 Standard Penetration Test (SPT) Borings

A total of 11 SPT borings were performed on staggered 2,500-foot centers at specific locations as indicated by FDOT along the alignment, except for one SPT boring which could not be accessed due to site limitations. The locations of the individual borings are given on the **Report of Core Boring Profile sheets** included in Section 8.0 of this report.

The borings were located in the field by using a hand-held WAAS enabled GPS unit to locate boring coordinates provided by FDOT.

The SPT borings were performed with the use of a truck-mounted CME-45 drill rig using bentonite mud drilling procedures. The soil sampling was performed in general accordance with ASTM test designation D-1586 titled Penetration Test and Split-Barrel Sampling of Soils. SPT resistance N-Values were taken continuously in the initial 10 feet and at 5 feet intervals thereafter. Representative portions of these soil samples were sealed in glass jars, labeled and transferred to our Sarasota laboratory for classification and analysis.

The results of the SPT borings are summarized on the soil profiles presented as **Report of Core Boring Profile sheets.** The stratum numbers are shown on the **Roadway Soil Survey sheet.**

3.3 Bulk Sampling for Resilient Modulus (M_R)

Bulk samples of the surficial soils were obtained at a frequency of three per mile (11 in total) and transported to the Gainesville FDOT laboratories for Resilient Modulus (M_R) testing. It is noted that some locations did not contain select materials within the top few feet of the soil profile, so soil samples were not collected from these areas. The samples were obtained within the top 4 feet of Select soil materials. The M_R sample locations were performed adjacent to the respective boring locations (usually within 5 to 10 feet of the respective borehole).

3.4 Measured Groundwater Levels

The groundwater level was measured in the boreholes after stabilization of the downhole water level on the same day that the holes were drilled. As shown on the soil profiles, several of the hand auger borings did not encounter groundwater within their vertical reaches. Where groundwater was encountered, it was measured at depths ranging from 2.2 to 8 feet below the ground surface. Fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

4.0 LABORATORY TESTING PROGRAM

4.1 Visual Examination, Natural Moisture Content, Organic Content, Percent Fines Analysis and Atterberg Limits

Representative soil samples obtained during the field exploration program were packaged and transferred to our laboratory for further visual examination and testing. Natural moisture content, organic content, percent fines analysis and Atterberg limits tests were performed on selected soil samples to aid in soil classification. Percent fines analysis tests were performed in accordance with AASHTO T-88. Natural moisture content tests were performed in accordance with AASHTO T265. Atterberg limits were performed in accordance with AASHTO T-89 and AASHTO T-90. Organic content tests were performed in accordance with AASHTO T-267.

The test results are summarized in graphical form on **Table 1**.

The **Roadway Soil Survey sheet** is a summary of all laboratory test data presented in table form corresponding to the generalized soil strata identified for this project. Soil descriptions were based on visual-manual procedures in accordance with local practice. Descriptions of these procedures are in **Appendix B.**

4.2 Resilient Modulus (M_R)Tests

A total of 11 M_R tests were performed on selected soil samples representing the surficial soils within the project study area. The location of the M_R sampling points are stated on the test report sheets relative to the boring location and GPS coordinates included in **Appendix A**. M_R tests were performed by the FDOT out of the Gainesville laboratories. The test results are also summarized on **Table 1**.

4.3 Environmental Corrosion Tests

A total of three soil samples from the project alignment area were selected for environmental corrosion tests consisting of soil pH (FM 5-550), resistivity (FM 5-551), chlorides (FM 5-552) and sulfates (FM 5-553). Based on the laboratory test results and the 2018 FDOT Structures Design Guidelines, the environmental classification is extremely aggressive for steel (pH of 5.2 and 5.1) and moderately aggressive for concrete. The test results are summarized in graphical form on **Table 2**.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 General Soil Stratigraphy

The soils encountered within the project area are primarily organic soils underlain by significantly varying sandy to clayey soils. The results of the borings are presented on the **Report of Core Borings sheets** in the form of soil profiles, along with the profile legend and other pertinent information such as measured groundwater levels and estimated seasonal high groundwater levels. Soil stratification is based on an examination of the recovered soil samples, the laboratory testing and interpretation of field boring logs by a geotechnical engineer. The actual transition between strata may be gradual. In some cases, small variations in properties, not considered pertinent to the engineering evaluation, may have been abbreviated for clarity. The profiles represent the conditions at the boring locations only, and variations may occur between the borings. In general, the auger borings performed within the project area encountered the following strata.

Soil Stratum Descriptions and AASHTO Classifications		
Stratum	Soil Description	AASHTO Soil Classification
1	Brown, light gray, gray and brownish gray fine SAND	A-3
2	Brown fine SAND with silt	A-3
3	Brown fine SAND with clay	A-3
4	Brown to dark brown silty fine SAND	A-2-4
5	Brown to dark brown clayey fine SAND	A-2-6
6	Gray CLAY	A-6
7	Dark brown organic MUCK to organic CLAY	A-8

5.2 On-Site Soil Suitability

Based on the soil information obtained from the field exploration and laboratory testing program, and the engineering evaluations, a **Roadway Soil Survey sheet** is presented. Material use should be completed in accordance with FDOT Standard Plans, Index Nos. 120-001 and 120-002. Materials directly beneath the base should be select materials. The following summarizes the generalized use of the soils and materials that will most likely be encountered during construction:

1. The material from Stratum 1, 2 and 3 are Select (A-3) material and appear satisfactory for use in the embankment when utilized in accordance with Index 120-001.

2. The material from Stratum 4 is Select (A-2-4) material and appears satisfactory for use in the embankment when utilized in accordance with Index 120-001. However, this material is likely to retain excess moisture and may be difficult to dry and compact. It should be used in the embankment above the water level existing at the time of construction.

3. The materials from Stratum 5 and 6 are Plastic (A-2-6 / A-6) materials and shall be removed in accordance with Index 120-002. It may be placed above the existing water level (at time of construction) to within 4 feet of the proposed base. It should be placed uniformly in the lower portion of the embankment for some distance along the project rather than full depth for short distances.

4. The material from Stratum 8 is high organic (A-8) material and shall not be used within the portion of the embankment inside the control line. The material shall be removed in accordance with Index 120-002.

5.3 Limits of Unsuitable Materials

Existing soil conditions included significant amounts of deleterious organic materials (A-8 material) that will need to be removed prior to embankment construction. We anticipate the removal and replacement of significant amounts of existing soils for embankment stability. All Stratum 7 materials encountered during construction should be removed in accordance with Index 500. This index defines an organic material as any soil that has an average organic content greater than 5 percent or an individual organic content test result that exceeds 7 percent.

5.4 Estimated Seasonal High Groundwater Level

The seasonal high groundwater table at 46 boring locations were estimated by reviewing the Highlands County Soil Survey as published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and by examining the soil profile for features that typically mark the seasonal high groundwater table. A summary of the USDA Soil Survey information listing the USDA map symbols and soil names within the area of the proposed SR 70 reconstruction project is presented in Section 1.2 (page 3 of this report). All USDA map symbols and soil names along the project alignment are illustrated on the attached **Soil Survey Map** (**Figure 2**). **Table 3 (pages 1 through 4)** presents a summary of the seasonal high groundwater table estimates for the 46 SHWT borings performed.

The groundwater level at the subject site (and subsequently the seasonal high groundwater levels) appeared to be controlled by artificial drainage throughout the site. Any changes to these drainage levels would result in disruption of the established seasonal high groundwater levels. This occurrence is common to the agricultural lowlands of Florida in the south/central portion of the state.

The existing and seasonal high groundwater table elevations (NAVD88) were based upon the estimated ground surface elevation at each boring location. The ground surface elevations were estimated by using the GEOPAK survey data via MicroStation, referencing file name 414506.tin, provided by the FDOT. These elevations should be considered accurately only to the degree implied by the method used.

5.5 Groundwater Control

Depending upon groundwater levels at the time of construction, some form of dewatering will be required throughout extensive portions of the project to achieve the required compaction. Sump pumping from shallow excavations is only typically effective for lowering the water table 1 to 2 feet.

5.6 Design Resilient Modulus (M_R)

The results of the laboratory tests indicate a 90th percentile resilient modulus average of 8,200 psi, which represents the design resilient modulus for the embankment according to the FDOT Flexible Pavement Design Manual and Soils and Foundations Handbook.

6.0 REPORT LIMITATIONS

The evaluation and recommendations submitted in this report are based upon the anticipated construction and the data obtained from the soil borings performed at the locations indicated and does not reflect any variations that may occur between these borings. If any variations become evident during the course of construction, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. When final design plans and specifications are available, a general review by our office is made to check that the assumptions made in preparation of this report are correct and that the recommendations are properly interpreted and implemented.

7.0 TABLE(S)

TABLE 1 – SUMMARY OF LAB TEST RESULTS – ROADWAY

TABLE 2 – SUMMARY OF ENVIRONMENTAL CLASSIFICATION – ROADWAY

TABLE 3 – SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS
PRELIMINARY ROADWAY SOIL SURVEY
S.R. 70 RECONSTRCUTION FROM
C.R. 29 TO JC DURRANCE RD.
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35-TWO-#76 – FINANCIAL PROJECT NO. 414506-6-52-01

LATITUDE	LONGITUDE	BORING NO.	DEPTH (Feet)	STRATUM NO.	Percent Passing U.S. STANDARD SIEVES									ATTERBERG LIMITS		MOISTURE CONTENT (%)	AASHTO CLASS.	ORGANIC CONTENT (%)
					3/4-in.	1/2-in	3/8-in.	#4	#10	#40	#60	#100	#200	LL	PI			
27°12'29.42"	81°16'53.74"	AB-1*	1.5 - 2.5	4	100	100	100	100	99.8	87.9	60.3	31.5	14.3	0	0	--	A-2-4	1.9
27°12'29.23"	81°16'47.98"	B-1	0.5 - 1.5	7	--	--	--	--	--	--	--	--	--	--	--	21	A-8	12
27°12'29.18"	81°16'37.15"	AB-3*	2 - 3	2	100	100	100	100	100	83.2	51.5	26.6	8.2	0	0	--	A-3	1.9
27°12'29.18"	81°16'37.15"	AB-4	0 - 1	1	--	--	--	--	--	--	--	--	3.8	--	--	2	A-3	--
27°12'29.18"	81°16'37.15"	AB-4	4 - 4.75	2	--	--	--	--	--	--	--	--	--	--	--	16	A-3	3.7
27°12'29.20"	81°16'26.41"	AB-5	1 - 2	2	--	--	--	--	--	--	--	--	6.8	--	--	14	A-3	--
27°12'29.42"	81°16'15.40"	AB-6*	2 - 3	4	100	100	100	99.9	99.4	80.2	49.2	26.5	13.1	0	0	--	A-2-4	0.5
27°12'29.42"	81°16'15.40"	AB-6	2.5 - 3.5	1	--	--	--	--	--	--	--	--	3.8	--	--	15	A-3	--
27°12'28.58"	81°15'59.00"	AB-9	0.5 - 1.5	1	--	--	--	--	--	--	--	--	4.3	--	--	--	A-3	0.3
27°12'28.58"	81°15'59.00"	AB-9*	0.7 - 2	2	100	100	100	99.9	99.9	83.1	52.7	28.7	5.3	0	0	--	A-3	0.2
27°12'28.66"	81°15'47.98"	AB-10	2.5 - 4	4	--	--	--	--	--	--	--	--	22	27	6	--	A-2-4	--
27°12'28.75"	81°15'26.80"	B-4	0 - 1	7	--	--	--	--	--	--	--	--	--	--	--	143	A-8	66
27°12'28.75"	81°15'26.80"	B-4	3 - 4.5	4	--	--	--	--	--	--	--	--	32	--	--	32	A-2-4	1.8
27°12'28.73"	81°15'37.77"	AB-12*	0.8 - 1.5	4	100	100	100	100	97.0	88.0	68.9	49.3	16.6	0	0	--	A-2-4	0.7
27°12'29.26"	81°15'21.45"	AB-14	4 - 5	5	--	--	--	--	--	--	--	--	--	--	--	29	A-2-6	1.8
27°12'28.91"	81°15'16.03"	AB-15	2.5 - 3.5	6	--	--	--	--	--	--	--	--	43	--	--	27	A-6	2.0
27°12'28.91"	81°15'16.03"	AB-15	4 - 5	6	--	--	--	--	--	--	--	--	39	--	--	23	A-6	1.6
27°12'29.56"	81°15'10.45"	AB-16	2 - 3	7	--	--	--	--	--	--	--	--	--	--	--	147	A-8	50

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS
PRELIMINARY ROADWAY SOIL SURVEY
S.R. 70 RECONSTRCUTION FROM
C.R. 29 TO JC DURRANCE RD.
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					3/4-in.	1/2-in	3/8-in.	#4	#10	#40	#60	#100	#200	LL	PI			
27°12'29.56"	81°15'10.45"	AB-16	4.5 - 5	6	--	--	--	--	--	--	--	--	--	--	--	30	A-6	2.2
27°12'29.67"	81°14'48.46"	AB-19	2.5 - 3	7	--	--	--	--	--	--	--	--	--	--	--	227	A-8	48
27°12'29.67"	81°14'48.46"	AB-19	4.5 5	5	--	--	--	--	--	--	--	--	--	--	--	31	A-2-6	2.7
27°12'29.24"	81°14'43.01"	AB-20	1.5 - 2.5	7	--	--	--	--	--	--	--	--	--	--	--	38	A-8	73
27°12'29.24"	81°14'43.01"	AB-20	2 - 3	5	--	--	--	--	--	--	--	--	--	--	--	--	A-2-6	2.9
27°12'29.46"	81°14'31.88"	B-6	5 - 6	6	--	--	--	--	--	--	--	--	39	--	--	--	A-6	2.0
27°12'30.17"	81°14'26.37"	AB-22	4 - 4.5	7	--	--	--	--	--	--	--	--	32	--	--	34	A-8	4.5
27°12'29.60"	81°14'20.76"	AB-23	1 - 2	7	--	--	--	--	--	--	--	--	--	--	--	390	A-8	57
27°12'30.44"	81°14'4.18"	B-7*	2 - 3	4	100	100	100	100	99.9	94.9	75.6	53.6	15.5	0	0	--	A-2-4	0.8
27°12'30.03"	81°13'47.82"	AB-28	2.5 - 3.5	5	--	--	--	--	--	--	--	--	--	--	--	27	A-2-6	1.8
27°12'30.21"	81°13'36.73"	B-8*	2.5 - 3.5	4	100	100	100	100	100	94.3	74.4	53	19.5	0	0	--	A-2-4	0.8
27°12'30.21"	81°13'36.73"	B-8	18 - 20	6	--	--	--	--	--	--	--	--	97	--	--	90	A-6	--
27°12'30.83"	81°13'4.14"	B-10*	0.8 - 1.5	4	100	100	100	100	99.8	91.7	62.1	38.2	11.6	0	0	--	A-2-4	2.3
27°12'30.83"	81°13'4.14"	B-10*	2.5 - 3.5	2	100	100	100	100	100	90.2	58.1	33.6	6.3	0	0	--	A-3	0.2
27°12'30.51"	81°13'15.17"	AB-33*	0.5 - 1	4	100	100	100	100	100	93.1	69.7	45.7	12.7	0	0	--	A-2-4	0.9
27°12'30.51"	81°13'15.17"	AB-33	3 - 4	4	--	--	--	--	--	--	--	--	13	--	--	17	A-2-4	--
27°12'31.89"	81°12'53.62"	AB-35	0.5 - 1.5	1	--	--	--	--	--	--	--	--	4.4	--	--	2	A-3	--
27°12'31.94"	81°12'44.69"	AB-36*	0.5 - 1.5	2	100	100	100	100	100	90.2	58.1	33.6	6.3	0	0	--	A-3	0.8

* Bulk sample obtained adjacent to boring and tested by State FDOT Laboratory. In some cases, the bulk sample varied from the adjacent soil boring sample

TABLE 2
SUMMARY OF ENVIRONMENTAL CLASSIFICIATION
PRELIMINARY ROADWAY SOIL SURVEY
S.R. 70 RECONSTRCUTION FROM
C.R. 29 TO JC DURRANCE RD.
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35-TWO-#76 – FINANCIAL PROJECT NO. 414506-6-52-01

BORING NO.	LATITUDE	LONGITUDE	DEPTH (Feet)	STRATUM NO.	pH	RESISTIVITY (Ohms-cm)	CHLORIDE (ppm)	SULFATE (ppm)	ENVIRONMENTAL CLASSIFICATION	
									STEEL	CONCRETE
AB-2	27°12'28.80"	81°16'42.72"	3 - 4	1	5.2	12,570	15	54	EXTREMELY AGRESSIVE	MODERATELY AGRESSIVE
AB-28	27°12'30.03"	81°13'47.82"	1.5 - 2.5	4	5.1	3,375	60	123	EXTREMELY AGRESSIVE	MODERATELY AGRESSIVE
AB-35	27°12'31.89"	81°12'53.62"	1 - 2	1	6.8	48,400	30	<12	MODERATELY AGGRESSIVE	SLIGHTLY AGGRESSIVE

TABLE 3 (Page 1 of 4)

SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES
SR 70 RECONSTRUCTION FROM CR 29 TO JC DURRANCE RD
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35 – TWO #76
FPID: 414506-6-52-01

Boring No.[1]	Boring Depth[3] (feet)	Ground Surface Elevation[7] (feet, NAVD 88)	Date Recorded	Approximate Horizontal Coordinates[2]		Measured Groundwater Table Depth[3] (feet)	Groundwater Table Elevation[7] (feet, NAVD 88)	USDA Soil Survey		Estimated SHGWT[5] Depth[3] (feet)	Estimated SHGWT Elevation[7] (feet, NAVD 88)
				Latitude (Deg Min Sec)	Longitude (Deg Min Sec)			Map Symbol[8]	Estimated SHGWT[4] Depth (feet)		
AB-1	5.0	38.5	2-Apr-19	27° 12' 29.42" N	81° 16' 53.74" W	GNE[6]	GNE[6]	13	0 – 1.0	3.5	35.0
B-1	20.0	36.8	3-Apr-19	27° 12' 29.23" N	81° 16' 47.98" W	5.7	31.1	13	0 – 1.0	3.8	33.0
AB-2	5.0	43.5	2-Apr-19	27° 12' 28.80" N	81° 16' 42.72" W	GNE[6]	GNE[6]	8	0 – 1.0	3.0	40.5
AB-3	5.0	42.9	2-Apr-19	27° 12' 29.18" N	81° 16' 37.15" W	GNE[6]	GNE[6]	8	0 – 1.0	3.0	39.9
AB-4	5.0	42.1	2-Apr-19	27° 12' 28.34" N	81° 16' 31.79" W	4.8	37.4	8	0 – 1.0	2.8	39.3
AB-5	5.0	40.7	2-Apr-19	27° 12' 29.20" N	81° 16' 26.41" W	2.8	37.9	8	0 – 1.0	0.5	40.2
B-2	20.0	38.6	5-Apr-19	27° 12' 28.51" N	81° 16' 20.96" W	3.2	35.4	13	0 – 1.0	1.0	37.6
AB-6	5.0	38.9	2-Apr-19	27° 12' 29.42" N	81° 16' 15.40" W	3.6	35.3	13	0 – 1.0	1.5	37.4
AB-7	5.0	36.3	2-Apr-19	27° 12' 28.50" N	81° 16' 10.00" W	4.7	31.6	13	0 – 1.0	2.0	34.3
AB-8	5.0	34.3	2-Apr-19	27° 12' 29.36" N	81° 16' 4.28" W	2.1	32.2	13	0 – 1.0	0.1	34.2
AB-9	5.0	33.6	5-Apr-19	27° 12' 28.58" N	81° 15' 59.00" W	5.0	28.6	13	0 – 1.0	1.5	32.1
B-3	Test boring could not be performed due to overhead power lines and deep organic soils										

(1) Boring locations shown on Report of Core Borings presented as Sheets 4 through 11
(2) Geographical GPS coordinate were determined using a four satellite minimum autonomous solution from WASS enabled hand-held GPS unit
(3) Depth below existing grades at time of augering/drilling
(4) Seasonal high groundwater table depth reported in the Highlands County, Florida USDA Soil Survey
(5) SHGWT: Seasonal high groundwater table estimated based on soil stratigraphy, measured groundwater level from the borings, the Highlands County, Florida USDA Soil Survey information and past experience with similar soil conditions
(6) GNE: Groundwater Not Encountered
(7) Elevations determined using location information (station & offset) in MicroStation and GEOPAK survey data provided by FDOT referencing file name 414506.tin
(8) SCS Soil Type

8 – Immokalee sand	18 – Kaliga muck, frequently ponded
12 – Basinger fine sand	26 – Tequesta muck, frequently ponded
13 – Felda fine sand	35 – Sanibel muck

TABLE 3 (Page 2 of 4)

SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES
SR 70 RECONSTRUCTION FROM CR 29 TO JC DURRANCE RD
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35 – TWO #76
FPID: 414506-6-52-01

Boring No.[1]	Boring Depth[3] (feet)	Ground Surface Elevation[7] (feet, NAVD 88)	Date Recorded	Approximate Horizontal Coordinates[2]		Measured Groundwater Table Depth[3] (feet)	Groundwater Table Elevation[7] (feet, NAVD 88)	USDA Soil Survey		Estimated SHGWT[5] Depth[3] (feet)	Estimated SHGWT Elevation[7] (feet, NAVD 88)
				Latitude (Deg Min Sec)	Longitude (Deg Min Sec)			Map Symbol[8]	Estimated SHGWT[4] Depth (feet)		
AB-10	5.0	30.6	5-Apr-19	27° 12' 28.66" N	81° 15' 47.98" W	4.2	26.4	26	+2.0 – 0	1.5	29.1
AB-11	5.0	33.5	5-Apr-19	27° 12' 29.21" N	81° 15' 43.46" W	4.9	28.6	26	+2.0 – 0	2.0	31.5
AB-12	5.0	30.9	5-Apr-19	27° 12' 28.73" N	81° 15' 37.77" W	3.4	27.5	26	+2.0 – 0	1.4	29.5
AB-13	5.0	31.7	5-Apr-19	27° 12' 29.25" N	81° 15' 32.41" W	4.7	27.0	26	+2.0 – 0	2.0	29.7
B-4	20.0	28.5	1-Apr-19	27° 12' 28.75" N	81° 15' 26.80" W	4.8	23.7	26	+2.0 – 0	2.0	26.5
AB-14	5.0	30.4	5-Apr-19	27° 12' 29.26" N	81° 15' 21.45" W	4.6	25.8	18	+2.0 – 0	2.5	27.9
AB-15	5.0	29.3	4-Apr-19	27° 12' 28.91" N	81° 15' 16.03" W	3.3	26.1	18	+2.0 – 0	1.2	28.1
AB-16	5.0	30.7	4-Apr-19	27° 12' 29.56" N	81° 15' 10.45" W	GNE[6]	GNE[6]	18	+2.0 – 0	3.0	27.7
AB-17	5.0	27.6	4-Apr-19	27° 12' 28.96" N	81° 15' 5.01" W	2.3	25.4	18	+2.0 – 0	0.2	27.4
B-5	20.0	32.5	1-Apr-19	27° 12' 29.63" N	81° 14' 59.45" W	3.6	28.9	18	+2.0 – 0	1.5	31.0
AB-18	5.0	26.8	4-Apr-19	27° 12' 29.06" N	81° 14' 54.02" W	1.8	25.0	18	+2.0 – 0	0.0	26.8
AB-19	5.0	30.8	4-Apr-19	27° 12' 29.67" N	81° 14' 48.46" W	4.3	26.5	18	+2.0 – 0	2.0	28.8

(1) Boring locations shown on Report of Core Borings presented as Sheets 4 through 11
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35 – Sanibel muck

TABLE 3 (Page 3 of 4)

SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES
SR 70 RECONSTRUCTION FROM CR 29 TO JC DURRANCE RD
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35 – TWO #76
FPID: 414506-6-52-01

Boring No.[1]	Boring Depth[3] (feet)	Ground Surface Elevation[7] (feet, NAVD 88)	Date Recorded	Approximate Horizontal Coordinates[2]		Measured Groundwater Table Depth[3] (feet)	Groundwater Table Elevation[7] (feet, NAVD 88)	USDA Soil Survey		Estimated SHGWT[5] Depth[3] (feet)	Estimated SHGWT Elevation[7] (feet, NAVD 88)
				Latitude (Deg Min Sec)	Longitude (Deg Min Sec)			Map Symbol[8]	Estimated SHGWT[4] Depth (feet)		
AB-20	5.0	26.8	4-Apr-19	27° 12' 29.24" N	81° 14' 43.01" W	1.6	25.2	18	+2.0 – 0	0.0	26.8
AB-21	5.0	31.1	4-Apr-19	27° 12' 31.94" N	81° 14' 44.69" W	GNE[6]	GNE[6]	18	+2.0 – 0	2.9	28.2
B-6	20.0	27.2	1-Apr-19	27° 12' 29.46" N	81° 14' 31.88" W	3.3	24.0	18	+2.0 – 0	1.5	25.7
AB-22	5.0	30.3	5-Apr-19	27° 12' 30.17" N	81° 14' 26.37" W	5.0	25.3	18	+2.0 – 0	2.9	27.4
AB-23	5.0	26.4	5-Apr-19	27° 12' 29.60" N	81° 14' 20.76" W	3.3	23.1	18	+2.0 – 0	1.0	25.4
AB-24	5.0	29.9	29-Mar-19	27° 12' 30.32" N	81° 14' 15.26" W	GNE[6]	GNE[6]	18	+2.0 – 0	3.0	26.9
AB-25	5.0	26.5	29-Mar-19	27° 12' 29.76" N	81° 14' 9.75" W	2.4	24.1	18	+2.0 – 0	0.5	26.0
B-7	20.0	29.6	1-Apr-19	27° 12' 30.44" N	81° 14' 4.18" W	3.5	26.1	18	+2.0 – 0	1.0	28.6
AB-26	5.0	27.2	29-Mar-19	27° 12' 30.32" N	81° 13' 58.70" W	2.7	24.5	18	+2.0 – 0	0.8	26.4
AB-27	5.0	31.1	29-Mar-19	27° 12' 29.89" N	81° 13' 53.24" W	GNE[6]	GNE[6]	18	+2.0 – 0	3.0	28.1
AB-28	5.0	25.0	28-Mar-19	27° 12' 30.58" N	81° 13' 47.82" W	2.4	22.6	18	+2.0 – 0	0.5	24.5
AB-29	5.0	27.8	28-Mar-19	27° 12' 30.03" N	81° 13' 41.62" W	2.3	25.5	18	+2.0 – 0	0.4	27.4

(1) Boring locations shown on Report of Core Borings presented as Sheets 4 through 11
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TABLE 3 (Page 4 of 4)

SUMMARY OF SEASONAL HIGH GROUNDWATER TABLE ESTIMATES
SR 70 RECONSTRUCTION FROM CR 29 TO JC DURRANCE RD
HIGHLANDS COUNTY, FLORIDA
CONTRACT C9G35 – TWO #76
FPID: 414506-6-52-01

Boring No.[1]	Boring Depth[3] (feet)	Ground Surface Elevation[7] (feet, NAVD 88)	Date Recorded	Approximate Horizontal Coordinates[2]		Measured Groundwater Table Depth[3] (feet)	Groundwater Table Elevation[7] (feet, NAVD 88)	USDA Soil Survey		Estimated SHGWT[5] Depth[3] (feet)	Estimated SHGWT Elevation[7] (feet, NAVD 88)
				Latitude (Deg Min Sec)	Longitude (Deg Min Sec)			Map Symbol[8]	Estimated SHGWT[4] Depth (feet)		
B-8	20.0	27.2	29-Mar-19	27° 12' 30.21" N	81° 13' 36.73" W	7.0	20.2	18	+2.0 – 0	5.0	22.2
AB-30	5.0	24.6	28-Mar-19	27° 12' 30.63" N	81° 13' 31.16" W	4.6	20.0	13	0 – 1.0	2.5	22.1
AB-31	5.0	27.2	28-Mar-19	27° 12' 30.36" N	81° 13' 25.68" W	3.8	23.4	13	0 – 1.0	1.9	25.3
AB-32	5.0	33.4	28-Mar-19	27° 12' 31.05" N	81° 13' 20.68" W	GNE[6]	GNE[6]	13	0 – 1.0	3.0	30.4
AB-33	5.0	29.8	3-Apr-19	27° 12' 30.51" N	81° 13' 15.17" W	4.8	25.1	13	0 – 1.0	2.5	27.3
B-9	20.0	30.1	2-Apr-19	27° 12' 31.29" N	81° 13' 9.71" W	4.3	25.8	26	+2.0 – 0	2.9	27.2
B-10	20.0	31.2	2-Apr-19	27° 12' 30.83" N	81° 13' 4.14" W	3.2	28.0	8	0 – 1.0	2.0	29.2
AB-34	5.0	31.4	4-Apr-19	27° 12' 31.73" N	81° 12' 59.18" W	4.9	26.5	8	0 – 1.0	2.5	28.9
AB-35	5.0	32.7	4-Apr-19	27° 12' 31.89" N	81° 12' 53.62" W	GNE[6]	GNE[6]	8	0 – 1.0	4.0	28.7
B-11	20.0	34.7	29-Mar-19	27° 12' 32.06" N	81° 12' 48.11" W	8.1	26.6	8	0 – 1.0	5.5	29.2
AB-36	5.0	32.8	4-Apr-19	27° 12' 31.94" N	81° 12' 44.69" W	GNE[6]	GNE[6]	8	0 – 1.0	4.0	28.8

(1) Boring locations shown on Report of Core Borings presented as Sheets 4 through 11
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8.0 FIGURE(S)

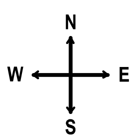
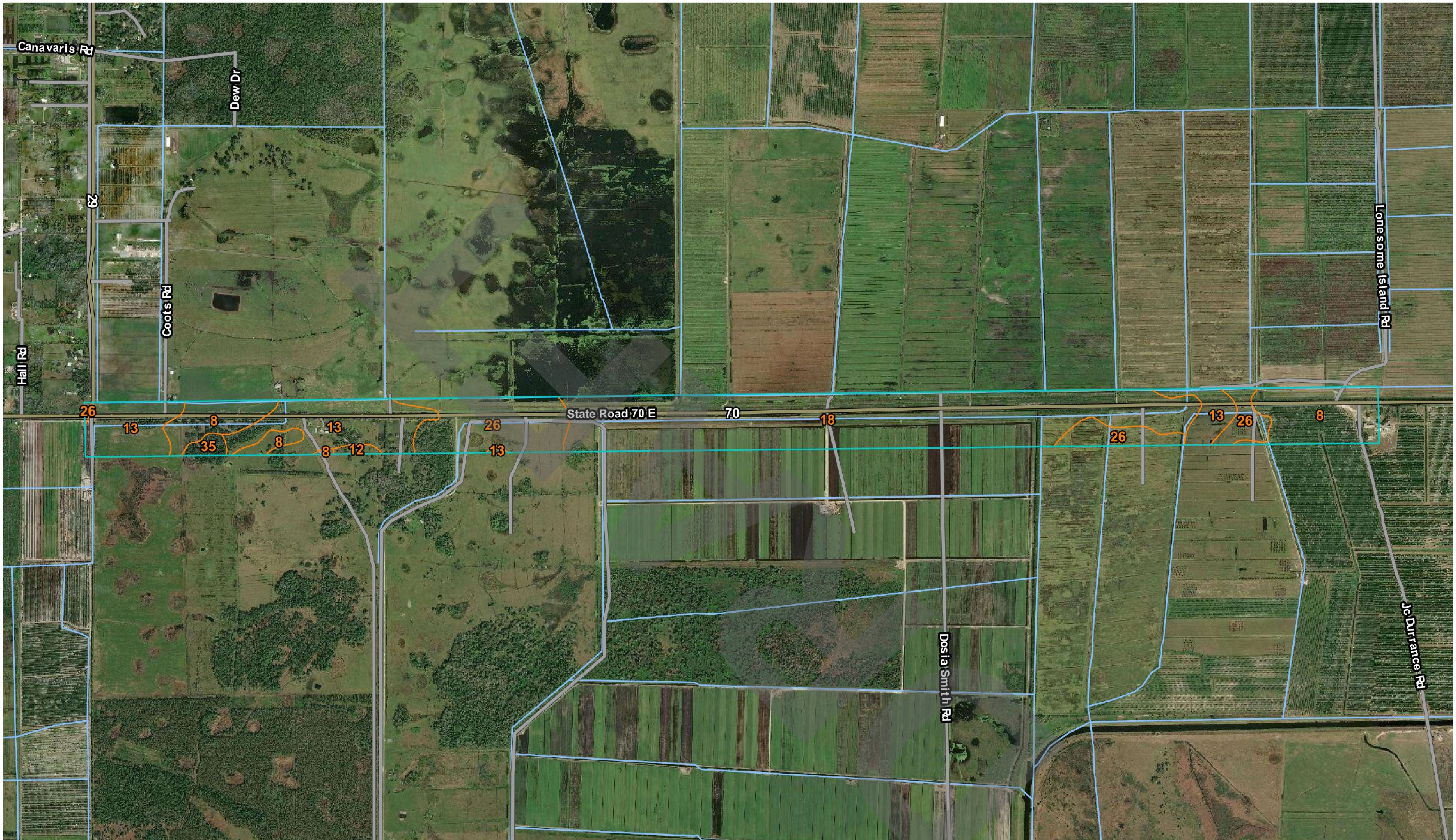


FIGURE 1
SITE LOCATION MAP

SOURCE: GOOGLE EARTH PRO

Roadway Soil Survey
S.R. 70 from
C.R. 29 to J C Durrance Rd.
Highlands County, FL
Contract C9G35 - TWO #76
FPID No. 414506-6-52-01

Drawn By: ME	Checked By: GD	Date: 4/3/19
File No. 19-51-9041	Approved By: Gary Drew, P.E.	Figure No. 1



8 - Immokalee sand
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26 - Tequesta muck, frequently ponded
35 - Sanibel muck

N
W E
S

FIGURE 2
SOIL SURVEY MAP

SOURCE: USDA.GOV

Roadway Soil Survey
S.R. 70 from
C.R. 29 to J C Durrance Rd.
Highlands County, FL
Contract C9G35 - TWO #76
FPID No. 414506-6-52-01

Drawn By: ME	Checked By: GD	Date: 4/3/19
File No. 19-51-9041	Approved By: Gary Drew, P.E.	Figure No. 2

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

DATE OF SURVEY: 3/27/2019 - 4/3/2019
SURVEY MADE BY: D. PEACE
SUBMITTED BY: JERRY H. KUEHN, P.E.

DISTRICT: One
ROAD NO.: SR 70
COUNTY: HIGHLANDS

FINANCIAL PROJECT ID: 414506-6-52-01

PROJECT NAME: SR 70

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADS

SURVEY BEGINS MP.: 17.255 SURVEY ENDS MP.: 21.573

	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS PERCENT PASS(%)						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS				
STRATUM NO.	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX	AASHTO GROUP	DESCRIPTION	NO. OF TESTS	RESISTIVITY ohms-cm	CHLORIDE ppm	SULFATES ppm	pH
1	1	0.3	3	2-15	4	--	--	--	--	3.8-4.4	--	--	--	A-3	Brown, light gray, gray and brownish gray fine sand (A-3)	2	12,500-48,400	15-30	<12-54	5.2-6.8
2	1	3.7	2	14-16	1	--	--	--	--	6.8	--	--	--	A-3	Brown fine sand with silt (A-3)	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--	--	A-3	Brown fine sand with clay (A-3)	--	--	--	--	--
4	2	1.8-2.9	3	17-25	3	--	--	--	--	13-32	1	27	6	A-2-4	Brown to dark brown silty fine sand (A-2-4)	1	3,375	60	123	5.1
5	4	1.8-2.9	3	27-31	--	--	--	--	--	--	--	--	--	A-2-6	Brown to dark brown clayey fine sand (A-2-6)	--	--	--	--	--
6	3	2-2.21	5	23-90	5	--	--	--	--	39-97	--	--	--	A-6	Gray clay (A-6)	--	--	--	--	--
7	7	4.5-73	7	21-390	1	--	--	--	--	34	--	--	--	A-8	Dark brown organic muck to organic clay (A-8)	--	--	--	--	--

EMBANKMENT AND SUBGRADE MATERIAL

STRATA BOUNDARIES ARE APPROXIMATE. MAKE FINAL CHECK AFTER GRADING.

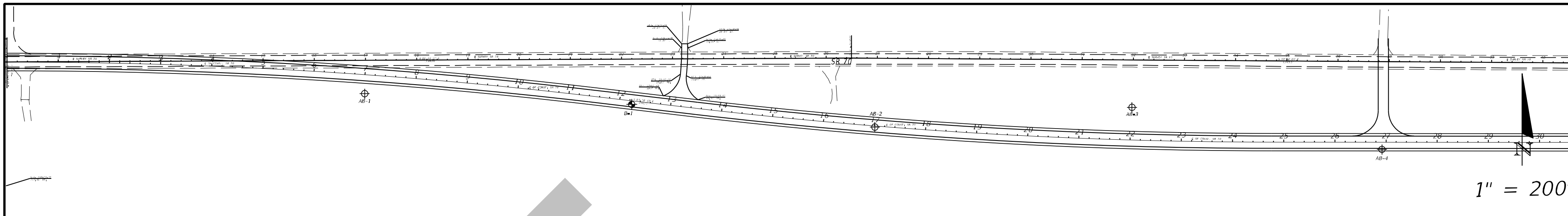
▽ - WATER TABLE ENCOUNTERED AT TIME OF BORING
▼ - ESTIMATED SEASONAL HIGH GROUNDWATER TABLE
GNE - GROUNDWATER NOT ENCOUNTERED
NP - NON PLASTIC

THE MATERIAL FROM STRATA 1 AND 2 ARE SELECT (A-3/A-2-4) MATERIAL AND APPEAR SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH INDEX 120-001.

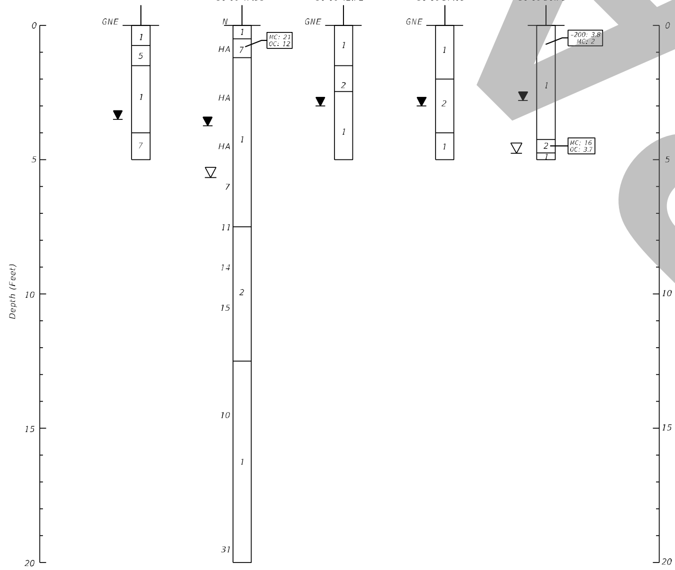
THE MATERIAL FROM STRATA 3 AND 4 ARE SELECT (A-3/A-2-4) MATERIAL AND APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH INDEX 120-001. HOWEVER, THIS MATERIAL IS LIKELY TO RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT. IT SHOULD BE USED IN THE EMBANKMENT ABOVE THE WATER LEVEL EXISTING AT THE TIME OF CONSTRUCTION.

THE MATERIALS FROM STRATA 5 AND 6 ARE PLASTIC (A-2-6/A-6) MATERIALS AND SHALL BE REMOVED IN ACCORDANCE WITH INDEX 120-002. IT MAY BE PLACED ABOVE THE EXISTING WATER LEVEL (AT TIME OF CONSTRUCTION) TO WITHIN 4 FEET OF THE PROPOSED BASE. IT SHOULD BE PLACED UNIFORMLY IN THE LOWER PORTION OF THE EMBANKMENT FOR SOME DISTANCE ALONG THE PROJECT RATHER THAN FULL DEPTH FOR SHORT DISTANCES.

THE MATERIAL FROM STRATUM 7 IS HIGH ORGANIC (A-8) MATERIAL AND SHALL NOT BE USED WITHIN THE PORTION OF THE EMBANKMENT INSIDE THE CONTROL LINE. THE MATERIAL SHALL BE REMOVED IN ACCORDANCE WITH INDEX 120-002.



BORING:	AB-1	B-1	AB-2	AB-3	AB-4
DATE:	4/2/19	4/3/19	4/2/19	4/2/19	4/2/19
STATION:	7+02 ℄ CONST.	12+24 ℄ CONST.	17+01 ℄ CONST.	22+02 ℄ CONST.	26+92 ℄ CONST.
OFFSET:	37RT	7RT	2RT	64LT	14RT
ELEVATION:	38.5'	36.8'	43.5'	42.9'	42.1'
LATITUDE:	27°12'29.42"	27°12'29.23"	27°12'28.80"	27°12'29.18"	27°12'28.34"
LONGITUDE:	81°16'53.74"	81°16'47.98"	81°16'42.72"	81°16'37.15"	81°16'31.79"



LEGEND

1 Brown, light gray, gray and brownish gray fine sand (A-3)
2 Brown fine sand with silt (A-3)
3 Brown fine sand with clay (A-3)
4 Brown to dark brown silty fine sand (A-2-4)
5 Brown to dark brown clayey fine sand (A-2-6)
6 Gray clay (A-6)
7 Dark brown organic muck to organic clay (A-8)

Numbers to the left of borings indicate SPT values for 12" penetration (unless otherwise noted).

- ⊕ = APPROXIMATE AUGER BORING LOCATION LABELED AB-#
- ⊕ = APPROXIMATE SPT BORING LOCATION LABELED B-#
- ▽ = GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
- ▼ = ESTIMATED SEASONAL HIGH GROUNDWATER TABLE
- -200 = PERCENT PASSING THE NO. 200 STANDARD SIEVE
- MC = PERCENT MOISTURE CONTENT
- OC = PERCENT ORGANIC CONTENT
- N = SPT N-VALUE IN BLOWS
- HA = HAND AUGERED TO THE DEPTH BELOW GROUND SURFACE

NOTES:

Geographical GPS coordinate locations were determined using a four satellite minimum autonomous solution from a WAAS enabled hand-held GPS unit.

Boring elevations were determined using GEOPAK survey data via MiroStation referencing file name 414506.tin

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REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
JERRY H. KUEHN, P.E. NO. 35557
ARDAMAN AND ASSOCIATES, INC.
78 SARASOTA CENTER BOULEVARD
SARASOTA, FLORIDA 34240
CERTIFICATE OF AUTHORIZATION NO. 5950

DRAWN BY:
CHECKED BY:
DESIGNED BY:
CHECKED BY:

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 4

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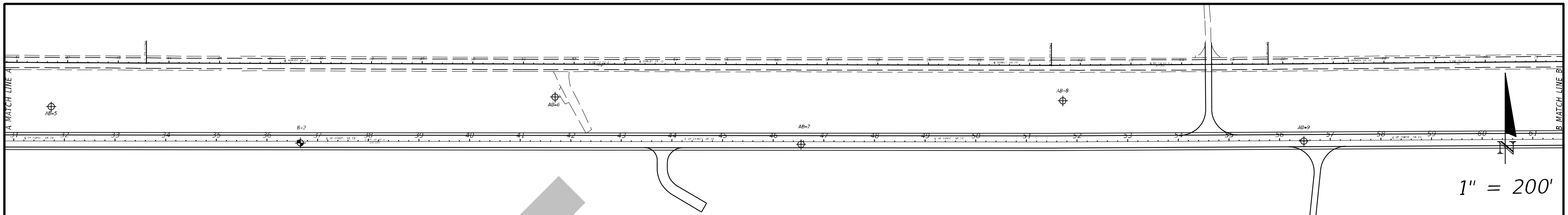
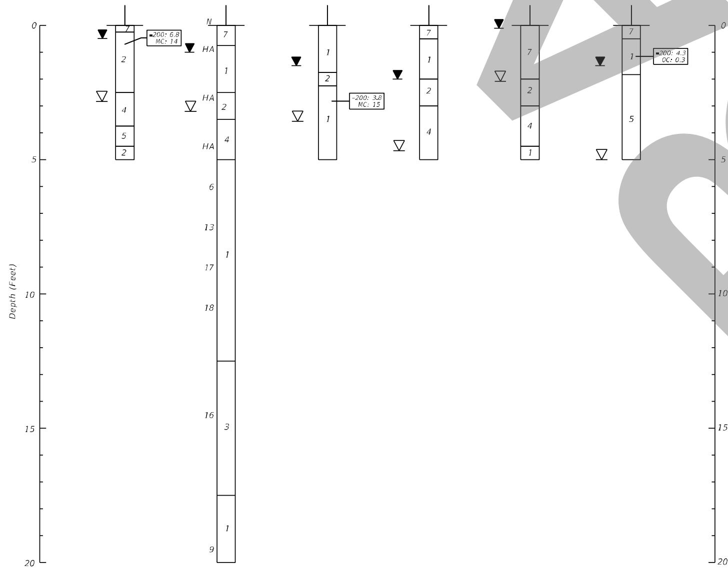


1" = 200'

BORING:	AB-5	B-2	AB-6	AB-7	AB-8	AB-9
DATE:	4/2/19	4/5/19	4/2/19	4/2/19	4/2/19	4/5/19
STATION:	31+74 ℄ CONST.	36+66 ℄ CONST.	41+69 ℄ CONST.	46+55 ℄ CONST.	51+72 ℄ CONST.	56+48 ℄ CONST.
OFFSET:	68RT	3RT	88LT	5RT	81LT	1RT
ELEVATION:	40.7'	38.6'	38.9'	36.3'	34.3'	33.6'
LATITUDE:	27°12'29.20"	27°12'28.51"	27°12'29.42"	27°12'28.50"	27°12'29.36"	27°12'28.58"
LONGITUDE:	81°16'26.41"	81°16'20.96"	81°16'15.40"	81°16'10.00"	81°16'4.28"	81°15'59.00"



LEGEND

1 Brown, light gray, gray and brownish gray fine sand (A-3)
2 Brown fine sand with silt (A-3)
3 Brown fine sand with clay (A-3)
4 Brown to dark brown silty fine sand (A-2-4)
5 Brown to dark brown clayey fine sand (A-2-6)
6 Gray clay (A-6)
7 Dark brown organic muck to organic clay (A-8)

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▼ = ESTIMATED SEASONAL HIGH GROUNDWATER TABLE
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N = SPT N-VALUE IN BLOWS
HA = HAND AUGERED TO THE DEPTH BELOW GROUND SURFACE

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DRAFT

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78 SARASOTA CENTER BOULEVARD
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

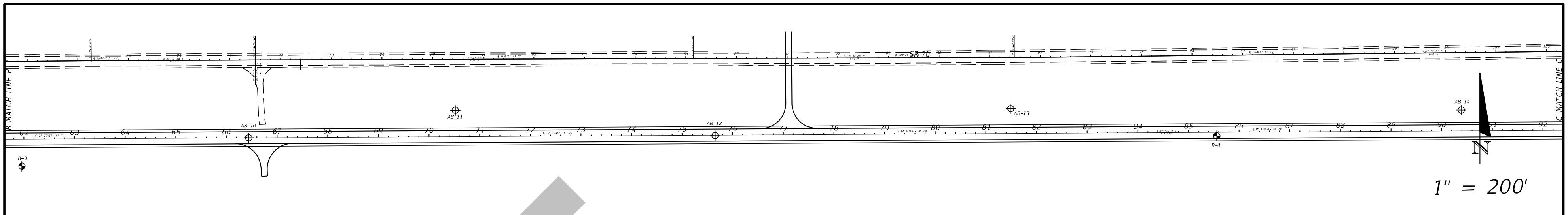
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

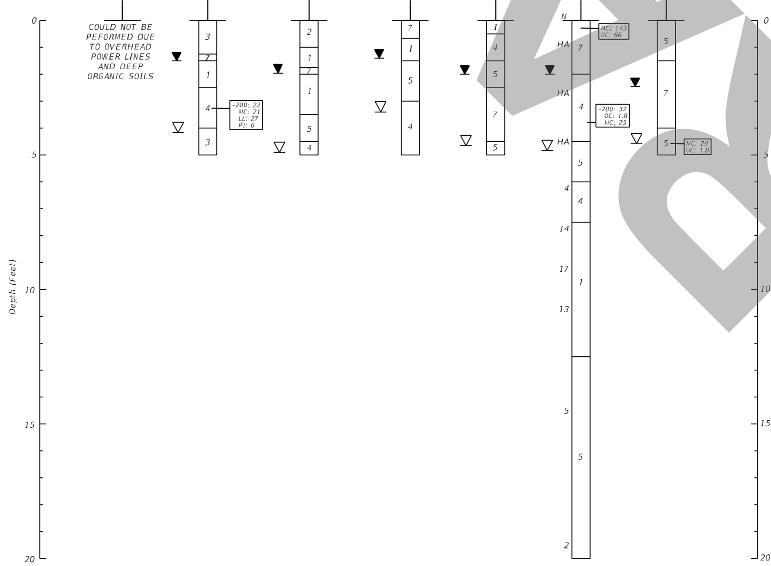
PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 5



BORING:	B-3	AB-10	AB-11	AB-12	AB-13	B-4	AB-14
DATE:	--	4/5/19	4/5/19	4/5/19	4/5/19	4/1/19	4/5/19
STATION:	61+69 ℄ CONST.	66+44 ℄ CONST.	70+52 ℄ CONST.	75+65 ℄ CONST.	80+49 ℄ CONST.	85+56 ℄ CONST.	90+39 ℄ CONST.
OFFSET:	54RT	CL	52LT	1RT	49LT	7RT	41LT
ELEVATION:	32.4'	30.6'	33.5'	30.9'	31.7'	28.5'	30.4'
LATITUDE:	27°12'29.07"	27°12'28.66"	27°12'29.21"	27°12'28.73"	27°12'29.25"	27°12'28.75"	27°12'29.26"
LONGITUDE:	81°15'53.32"	81°15'47.98"	81°15'43.46"	81°15'37.77"	81°15'32.41"	81°15'26.80"	81°15'21.45"



LEGEND

1 Brown, light gray, gray and brownish gray fine sand (A-3)
2 Brown fine sand with silt (A-3)
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4 Brown to dark brown silty fine sand (A-2-4)
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6 Gray clay (A-6)
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DEPARTMENT OF TRANSPORTATION

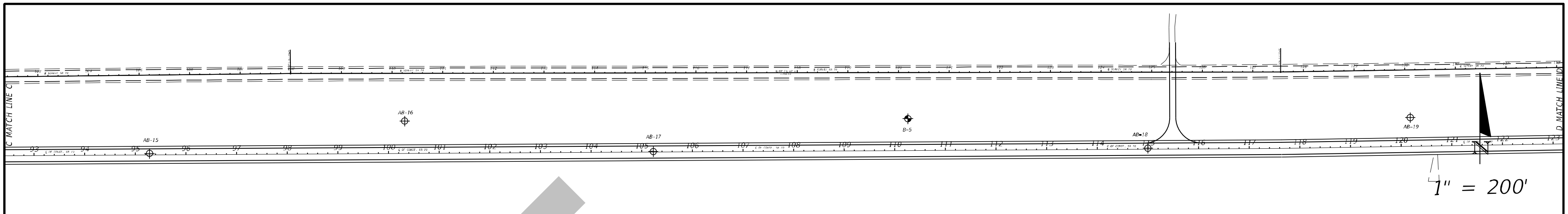
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

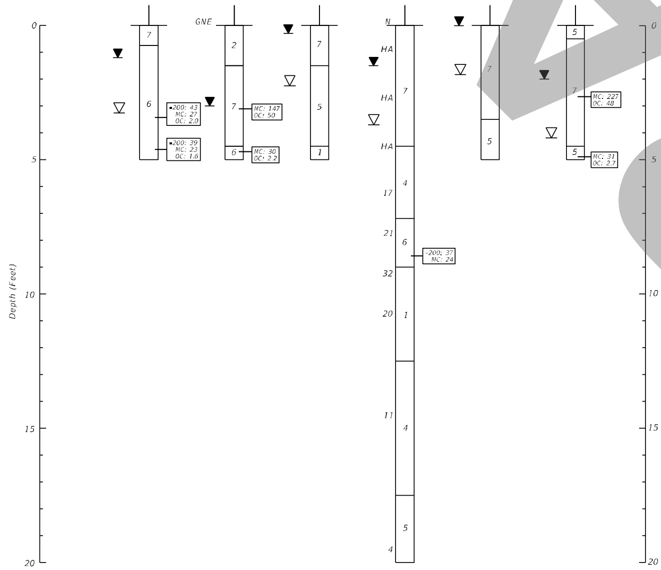
PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 6



BORING:	AB-15	AB-16	AB-17	B-5	AB-18	AB-19
DATE:	4/4/19	4/4/19	4/4/19	4/1/19	4/4/19	4/4/19
STATION:	95+28 ℄ CONST.	100+32 ℄ CONST.	105+23 ℄ CONST.	110+26 ℄ CONST.	115+00 ℄ CONST.	120+18 ℄ CONST.
OFFSET:	3LT	64LT	1LT	63LT	2LT	57LT
ELEVATION:	29.3'	30.7'	27.6'	32.5'	26.8'	30.8'
LATITUDE:	27°12'28.91"	27°12'29.56"	27°12'28.96"	27°12'29.63"	27°12'29.06"	27°12'29.67"
LONGITUDE:	81°15'16.03"	81°15'10.45"	81°15'5.01"	81°14'59.45"	81°14'54.02"	81°14'48.46"



LEGEND

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2 Brown fine sand with silt (A-3)
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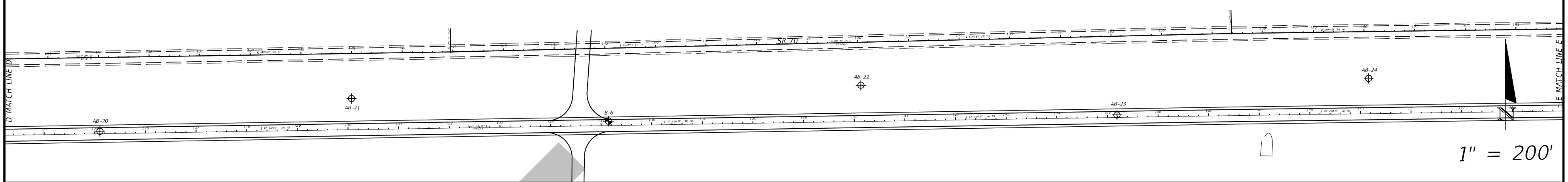
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

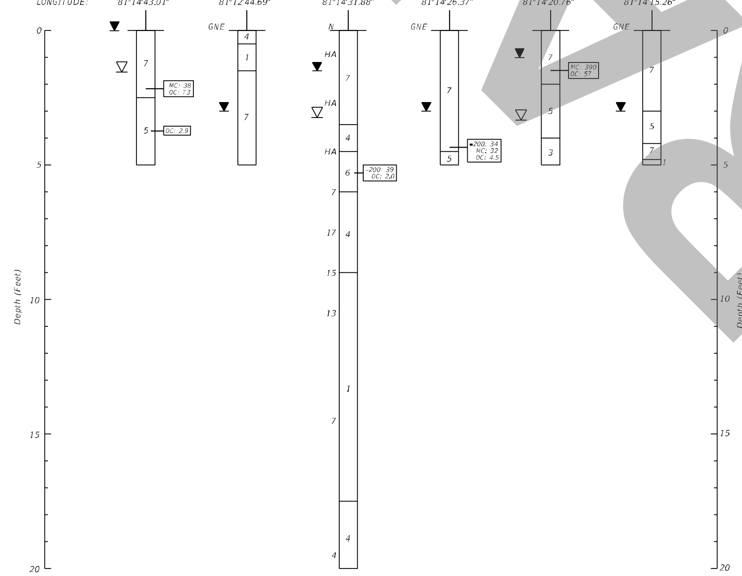
PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 7



BORING:	AB-20	AB-21	B-6	AB-22	AB-23	AB-24
DATE:	4/4/19	4/4/19	4/1/19	4/5/19	4/5/19	3/29/19
STATION:	125+10 ℄ CONST.	130+07 ℄ CONST.	135+15 ℄ CONST.	140+13 ℄ CONST.	145+19 ℄ CONST.	150+16 ℄ CONST.
OFFSET:	5LT	64LT	9LT	72LT	5LT	70LT
ELEVATION:	26.8'	31.1'	27.2'	30.3'	26.4'	29.9'
LATITUDE:	27°12'29.24"	27°12'31.94"	27°12'29.46"	27°12'30.17"	27°12'29.60"	27°12'30.32"
LONGITUDE:	81°14'43.01"	81°12'44.69"	81°14'31.88"	81°14'26.37"	81°14'20.76"	81°14'15.26"



LEGEND

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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 8

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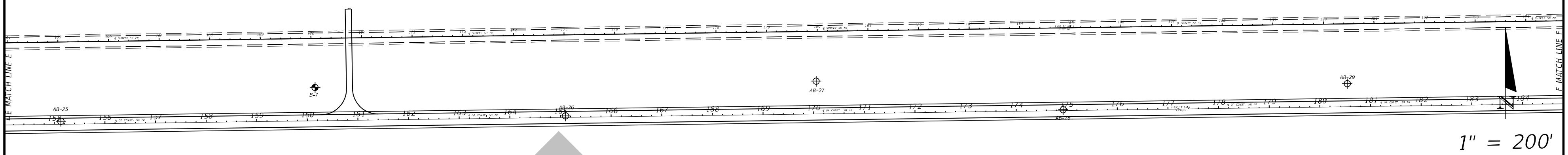
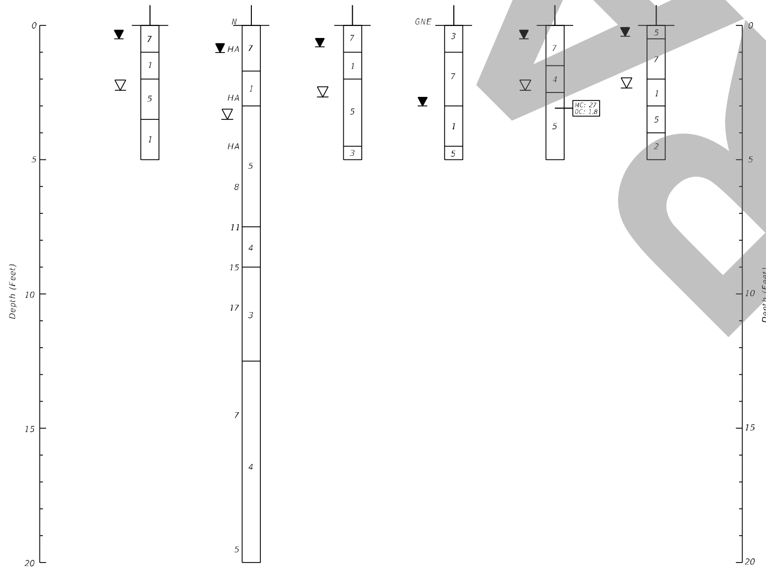


F MATCH LINE F

BORING:	AB-25	B-7	AB-26	AB-27	AB-28	AB-29
DATE:	3/29/19	4/1/19	3/29/19	3/29/19	3/28/19	3/28/19
STATION:	155+13 ℄ CONST.	160+16	165+10 ℄ CONST.	170+05 ℄ CONST.	174+93 ℄ CONST.	180+54 ℄ CONST.
OFFSET:	6LT	66LT	31LT	65LT	2LT	46LT
ELEVATION:	26.5'	29.6'	27.2'	31.1'	25.0'	27.8'
LATITUDE:	27°12'29.76"	27°12'30.44"	27°12'29.89	27°12'30.58"	27°12'30.03"	27°12'30.55"
LONGITUDE:	81°14'9.75"	81°14'4.18"	81°13'58.70"	81°13'53.24"	81°13'47.82"	81°13'41.62"



LEGEND

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2 Brown fine sand with silt (A-3)
3 Brown fine sand with clay (A-3)
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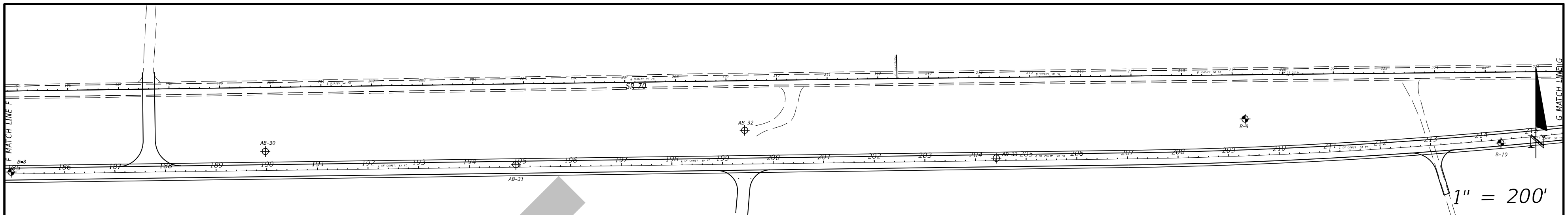
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

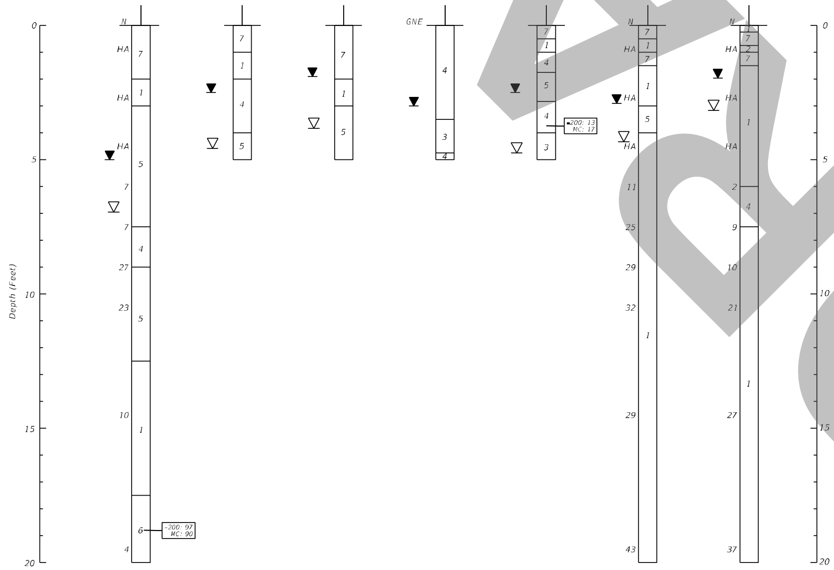
PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 9



BORING:	B-8	AB-30	AB-31	AB-32	AB-33	B-9	B-10
DATE:	3/29/19	3/28/19	3/28/19	3/28/19	4/3/19	4/2/19	4/2/19
STATION:	184+95 ℄ CONST.	189+98 ℄ CONST.	194+92 ℄ CONST.	199+44 ℄ CONST.	204+41 ℄ CONST.	209+35 ℄ CONST.	214+38 ℄ CONST.
OFFSET:	4LT	38LT	5LT	67LT	5LT	73LT	6RT
ELEVATION:	27.2'	24.6'	27.2'	33.4'	29.8'	30.1'	31.2'
LATITUDE:	27°12'30.21"	27°12'30.63"	27°12'30.36"	27°12'31.05"	27°12'30.51"	27°12'31.29"	27°12'30.83"
LONGITUDE:	81°13'36.73"	81°13'31.16"	81°13'25.68"	81°13'20.68"	81°13'15.17"	81°13'9.71"	81°13'4.14"



DRAFT

LEGEND

1 Brown, light gray, gray and brownish gray fine sand (A-3)
2 Brown fine sand with silt (A-3)
3 Brown fine sand with clay (A-3)
4 Brown to dark brown silty fine sand (A-2-4)
5 Brown to dark brown clayey fine sand (A-2-6)
6 Gray clay (A-6)
7 Dark brown organic muck to organic clay (A-8)

Numbers to the left of borings indicate SPT values for 12" penetration (unless otherwise noted).
⌖ = APPROXIMATE AUGER BORING LOCATION LABELED AB-#
⌖ = APPROXIMATE SPT BORING LOCATION LABELED B-#
▽ = GROUNDWATER LEVEL ENCOUNTERED DURING FIELD EXPLORATIONS
▼ = ESTIMATED SEASONAL HIGH GROUNDWATER TABLE
-200 = PERCENT PASSING THE NO. 200 STANDARD SIEVE
MC = PERCENT MOISTURE CONTENT
OC = PERCENT ORGANIC CONTENT
N = SPT N-VALUE IN BLOWS
HA = HAND AUGERED TO THE DEPTH BELOW GROUND SURFACE

NOTES:

Geographical GPS coordinate locations were determined using a four satellite minimum autonomous solution from a WAAS enabled hand-held GPS unit.

Boring elevations were determined using GEOPAK survey data via MiroStation referencing file name 414506.tin

The boring logs shown represent subsurface conditions within the borehole at the time of drilling. No warranty as to the subsurface conditions, strata depth or soil consistency between or outside boring location is expressed or implied by this drawing.

Groundwater depths shown on the boring logs represent groundwater surfaces encountered on the dates shown. Fluctuations in the water table levels should be anticipated throughout the year. Absence of water data on certain borings implies that no groundwater data is available, but does not necessarily mean that groundwater will not be encountered at those locations or within the vertical reaches of these borings in the future.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
JERRY H. KUEHN, P.E. NO. 35557
ARDAMAN AND ASSOCIATES, INC.
78 SARASOTA CENTER BOULEVARD
SARASOTA, FLORIDA 34240
CERTIFICATE OF AUTHORIZATION NO. 5950

DRAWN BY:
CHECKED BY:
DESIGNED BY:
CHECKED BY:

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 10

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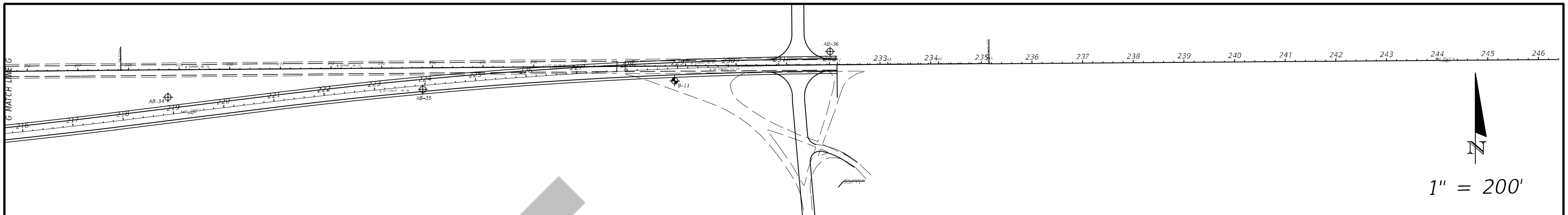
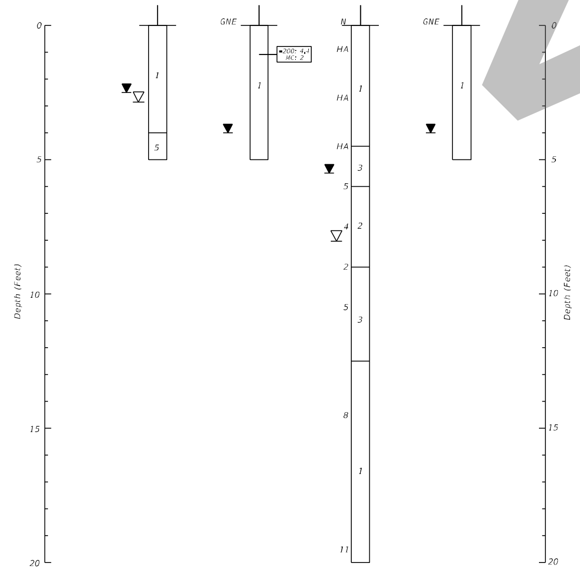


BORING:	AB-34	AB-35	B-11	AB-36
DATE:	4/4/19	4/4/19	3/29/19	4/4/19
STATION:	218+93 ℄ CONST.	223+94 ℄ CONST.	228+92 ℄ CONST.	232+01 ℄ CONST.
OFFSET:	34LT	8RT	24RT	26LT
ELEVATION:	31.4'	32.7'	34.7'	32.8'
LATITUDE:	27°12'31.73"	27°12'31.89"	27°12'32.06"	27°12'31.94"
LONGITUDE:	81°12'59.18"	81°12'53.62"	81°12'48.11"	81°12'44.69"



LEGEND

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The boring logs shown represent subsurface conditions within the borehole at the time of drilling. No warranty as to the subsurface conditions, strata depth or soil consistency between or outside boring location is expressed or implied by this drawing.

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REVISIONS

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ENGINEER OF RECORD:
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DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 70	HIGHLANDS	414506-6-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: SR 70, HIGHLANDS COUNTY

REF. DWG. NO.

SHEET NO. 11

APPENDIX A

RESILIENT MODULUS TEST REPORT SHEETS

Florida Department of Transportation

RON DESANTIS
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

KEVIN J. THIBAULT
SECRETARY

MEMORANDUM

DATE: May 8, 2019

TO: Teresa Puckett, District Geotechnical Materials Engineer

FROM: David Horhota, State Geotechnical Materials Engineer

SUBJECT: Embankment Resilient Modulus Pavement Design
District 1, Highlands County
FPN 414506-6: SR-70 Arcadia Widening

Eleven (11), 2-bag samples were received by the State Materials Office (SMO) for determination of an embankment (roadbed) resilient modulus for pavement design. After visual observation of the eleven samples, it was determined that the material from each 2-bag sample looked visually similar and the material from each of the bags were combined to form one sample from each location. After combining materials from the bags, samples from each location were obtained for classification tests (Atterberg limits, particle size analysis, and organic content), Proctor density, and resilient modulus. The classification test results are reported in Tables 1 and 2. Information provided for this project by Ardaman and Associates indicated all samples were collected from between 0.5 and 3.5 feet in depth.

Table 1. Summary of Gradation Results

Sample ID	Passing 3/4" (%)	Passing 1/2" (%)	Passing 3/8" (%)	Passing No. 4 (%)	Passing No. 10 (%)	Passing No. 40 (%)	Passing No. 60 (%)	Passing No. 100 (%)	Passing No. 200 (%)
AB-1	100.0	100.0	100.0	100.0	99.8	87.9	60.3	31.5	14.3
AB-3	100.0	100.0	100.0	100.0	100.0	83.2	51.5	26.6	8.2
AB-6	100.0	100.0	100.0	99.9	99.4	80.2	49.2	26.5	13.1
AB-9	100.0	100.0	100.0	99.9	99.9	83.1	52.7	28.7	5.3
AB-12	100.0	100.0	100.0	100.0	97.0	88.0	68.9	49.3	16.6
SPT-7	100.0	100.0	100.0	100.0	99.9	94.9	75.6	53.6	15.5
SPT-8	100.0	100.0	100.0	100.0	100.0	94.3	74.4	53.0	19.5
SPT-10-D	100.0	100.0	100.0	100.0	99.8	91.7	62.1	38.2	11.6
AB-33	100.0	100.0	100.0	100.0	100.0	93.1	69.7	45.7	12.7
AB-36	100.0	100.0	100.0	99.9	99.7	90.9	55.1	27.5	6.8
SPT-10-L	100.0	100.0	100.0	100.0	100.0	90.2	58.1	33.6	6.3

Table 2. Summary of Classification Results

Sample ID	Soil Class.	Organic Content (%)	LL/PI
AB-1	A-2-4	1.9	N.P.
AB-3	A-3	1.9	N.P.
AB-6	A-2-4	0.5	N.P.
AB-9	A-3	0.2	N.P.
AB-12	A-2-4	0.7	N.P.
SPT-7	A-2-4	0.8	N.P.
SPT-8	A-2-4	0.8	N.P.
SPT-10-D	A-2-4	2.3	N.P.
AB-33	A-2-4	0.9	N.P.
AB-36	A-3	0.8	N.P.
SPT-10-L	A-3	0.2	N.P.

In addition to the classification testing, the following test program was conducted:

(1) Standard Proctor, AASHTO T 99
(2) Resilient Modulus (M_R), AASHTO T 307.

A summary of laboratory test results is included in Table 3. The resilient modulus values listed in this table were obtained using the relationship developed from each individual test (resilient modulus versus bulk stress - with bulk stress, **Θ,** defined as $\boldsymbol{\Theta = \sigma_1 + \sigma_2 + \sigma_3}$), and using a bulk stress of 11 psi, which is the recommendation from Dr. Ping's research work in modeling the embankment in-situ stresses for Florida pavement conditions. The resilient modulus samples were compacted to within 1 pound per cubic foot (pcf) of the maximum density and 0.5 percent of the optimum moisture content as determined by AASHTO T99.

Table 3. Summary of T-99 and M_R Test Results

Sample ID	Passing No. 200 (%)	Standard Proctor Density (pcf)	Optimum Moisture Content (%)	Resilient Modulus @ Θ=11psi (psi)
AB-1	14.3	110.8	11.9	9,370
AB-3	8.2	111.3	11.2	8,399
AB-6	13.1	110.4	12.6	9,104
AB-9	5.3	104.4	12.4	8,137
AB-12	16.6	116.4	11.0	9,505
SPT-7	15.5	109.5	12.6	8,291
SPT-8	19.5	106.6	13.8	9,408
SPT-10-D	11.6	111.0	12.8	8,689
AB-33	12.7	113.0	11.3	8,111
AB-36	6.8	111.8	12.2	9,965
SPT-10-L	6.3	106.3	13.1	9,282

To obtain a design embankment resilient modulus, a 90 percent method was used as outlined in both the Flexible Pavement Design Manual and Soils and Foundations Handbook. The resilient modulus values were ranked in ascending order and the percentage of values which were greater than or equal to the individual value were determined. The results of this analysis are recorded in Table 4 and the corresponding graph of these results is included as Figure 1.

Table 4. Ranked M_R Test Results for 90 Percent Method

Rank	Sample ID	% ≥	M_R (psi)
1	AB-33	100	8,111
2	AB-9	91	8,137
3	SPT-7	82	8,291
4	AB-3	73	8,399
5	SPT-10-D	64	8,689
6	AB-6	55	9,104
7	SPT-10-L	45	9,282
8	AB-1	36	9,370
9	SPT-8	27	9,408
10	AB-12	18	9,505
11	AB-36	9	9,965

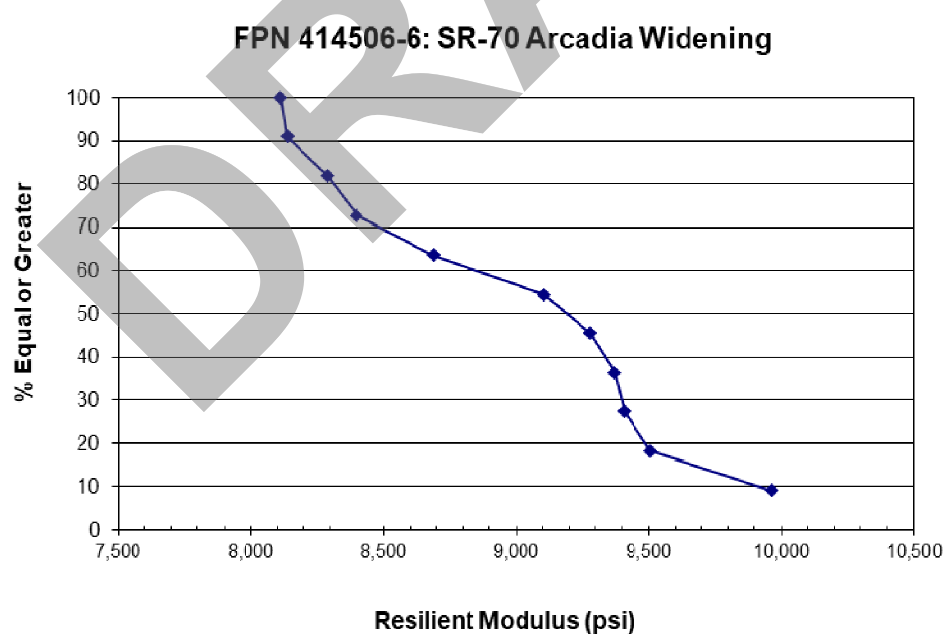

Figure 1. Ranked M_R Test Results for 90% Method

Based on the results shown in Table 4 and Figure 1, the resilient modulus corresponding to a 90^{th} percentile is **8,200 psi**, which would represent the design embankment M_R value.

APPENDIX B

SAMPLING AND TESTING METHODS SOIL CLASSIFICATION (AASHTO)

SOIL BORING, SAMPLING AND TESTING METHODS

Standard Penetration Test

The Standard Penetration Test (SPT) is a widely accepted method of in situ testing of foundation soils (ASTM D-1586). A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	Description
	0 to 4	Very loose
	4 to 10	Loose
	10 to 30	Medium dense
	30 to 50	Dense
	Above 50	Very dense

Cohesive Soils:	N-Value	Description	Qu (ton/ft^2)
	0 to 2	Very soft	Below 1/4
	2 to 4	Soft	1/4 to 1/2
	4 to 8	Medium stiff	1/2 to 1
	8 to 15	Stiff	1 to 2
	15 to 30	Very stiff	2 to 4
	Above 30	Hard	Above 4

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, NX-size flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

Representative split-spoon samples from each sampling interval and from every different stratum are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. After thorough examination and testing of the samples, the samples are discarded unless prior arrangements have been made. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed, if necessary, and backfilled.

A hammer with an automatic drop release (auto-hammer) is sometimes used. In this case, a correction factor is applied to the raw blow counts, since the energy efficiency of the auto-hammer is greater than that of the safety hammer. Based upon calibration of the auto-hammer (per ASTM D4633) and standard practice, we use a multiplier of 1.24 to correct the auto-hammer blow counts to equivalent safety hammer "N" values.

Hand Auger Borings

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5 to 9 feet) depth or when access is not available to power drilling equipment. A 3-inch diameter, hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved to the surface at approximately 6-inch intervals and its contents emptied for inspection. The soil sample so obtained is classified and representative samples put in bags or jars and transported to the laboratory for further classification and testing.

Laboratory Test Methods

Soil samples returned to our laboratory are examined by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to further define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain size distributions or selected other test results may be presented on separate tables, figures or plates as described in this report. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with AASHTO M-145 or ASTM D-3282: The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes and is also based on visual-manual procedures.

CLASSIFICATION OF SOILS AND SOIL-AGGREGATE MIXTURES FOR HIGHWAY CONSTRUCTION PURPOSES (AASHTO M145/ASTM D3282)

TABLE 2 Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 % or less passing No. 200 (75 µm))							Silt-Clay Materials (More than 35 % passing No. 200 (75 µm))			
Group classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6
Sieve analysis, % passing:											
No. 10 (2.00 mm)	50 max	...	...	...	...	...	...	...	...	...	...
No. 40 (425 µm)	30 max	50 max	51 min	...	...	...	...	...	...	...	...
No. 200 (75 µm)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing No. 40 (425 µm):											
Liquid limit	...		...	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[A]
Usual types of significant constituent materials	Stone Fragments, Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General rating as subgrade	Excellent to Good							Fair to Poor			

[A] Plasticity index of A-7-5 subgroup is equal to or less than *LL* minus 30. Plasticity index of A-7-6 subgroup is greater than *LL* minus 30 (see Fig. 1).

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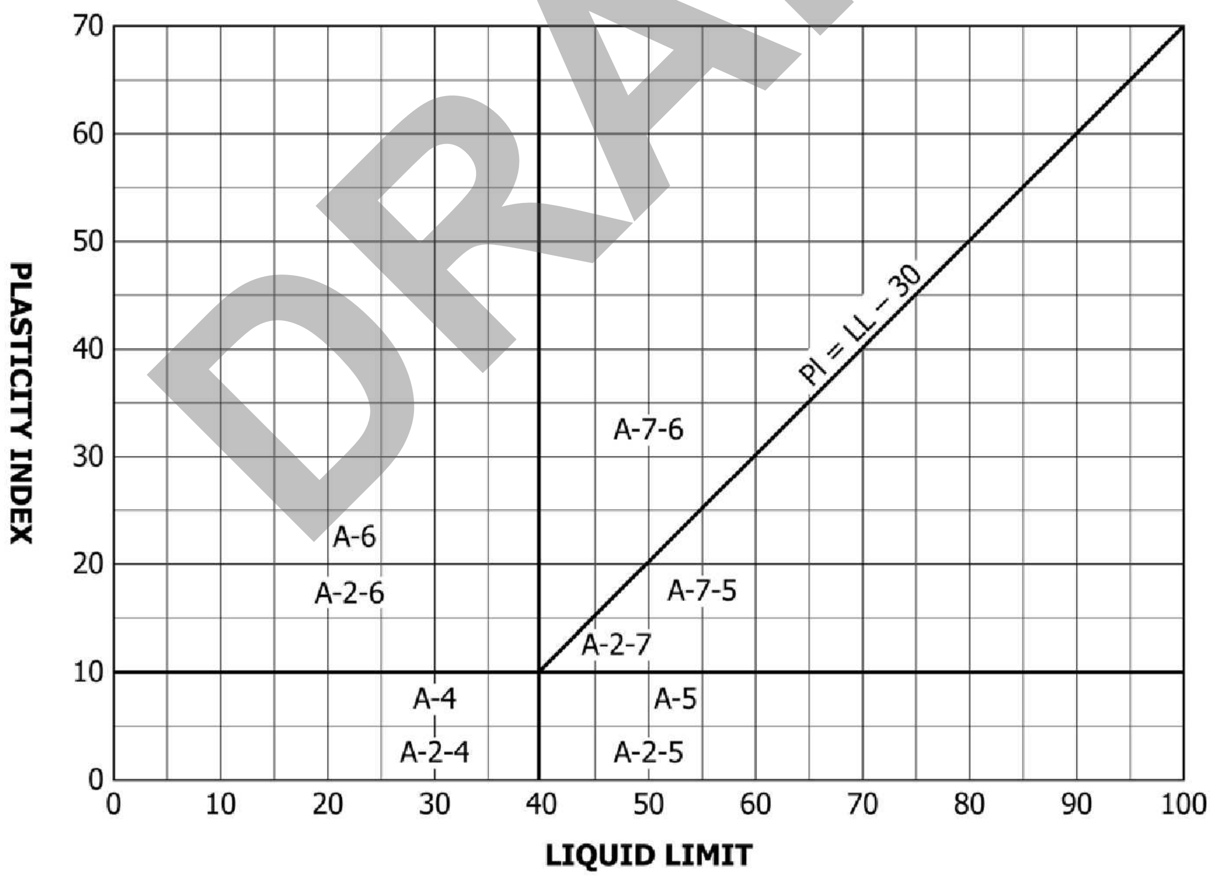

NOTE 1—A-2 soils contain less than 35 % finer than 200 sieve.

FIG. 1 Liquid Limit and Plasticity Index Ranges for Silt-Clay Materials