SR 400 (I-4) Project Development and Environment (PD&E) Study
FM No.: 201210-2-22-01

Report of Preliminary Geotechnical Engineering Investigation for Ponds

Segment 5: State Road 400 (SR 400)/Interstate 4 (I-4) from West of SR 25/US 27 to West of CR 532 (Polk/Osceola County Line)

Polk County (16320)

March 3, 2016

Geotechnical and Environmental Consultants, Inc.
919 Lake Baldwin Lane
Orlando, FL 32814

HNTB Corporation
610 Crescent Executive Court
Suite 400
Lake Mary, FL 32746

TABLE OF CONTENTS

October 10, 2014
Revised October 30, 2014
Revised March 27, 2015
Revised September 17, 2015
Revised March 3, 2016

HNTB
610 Crescent Executive Court, Suite 400
Lake Mary, Florida 32746

Attention: Mr. Luis Diaz, P.E.

Subject: Report of Preliminary Geotechnical Engineering Investigation for Ponds
SR 400 (I-4) PD&E STUDY FROM US 27 TO KIRKMAN ROAD AND FROM E OF SR 434 TO SR 472
SEGMENT 5: WEST OF SR 25 (US 27) TO WEST OF CR 532
Polk County, Florida
FPN: 432100-1-22-01
GEC Project No. 3492G

Dear Mr. Diaz:

Geotechnical and Environmental Consultants, Inc. (GEC) is pleased to provide this Report of Preliminary Geotechnical Engineering Investigation for Ponds for the above-referenced project. The purpose of this investigation was to evaluate soil and groundwater conditions at the proposed pond locations and develop preliminary geotechnical engineering recommendations to aid in the initial planning and design of the ponds. This report describes our exploration procedures, exhibits the data obtained and presents our preliminary conclusions and recommendations regarding the geotechnical engineering aspects of this project. This revised report includes approximate soil boring elevations requested per FDOT comments..

GEC appreciates the opportunity to be of service to you on this project and trusts that the information contained herein is sufficient for your needs. Should you have any questions concerning the contents of this report, or if we may be of further assistance, please contact us.

Very truly yours,

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC.
Certificate of Authorization No. 5882

3/3/16
V. Eugene Williford IV, E.I.
Geotechnical Engineer

CHRISTOPHER PAUL MEYER
LICENSE
No. 49328
STATE OF FLORIDA
PROFESSIONAL ENGINEER

3/3/16
Christopher P. Meyer, P.E.
Geotechnical Services Manager
Florida License No. 49328

VEW/CPM/dbj

1.0 Project Description and Purpose

The Florida Department of Transportation (FDOT) is proposing to reconstruct and widen I-4 as part of the I-4 Ultimate concept. This involves the build-out of I-4 to its ultimate condition through Central Florida, including segments in Polk, Osceola, Orange, Seminole, and Volusia Counties. The concept design proposed the addition of two (2) new express lanes in each direction giving it a total of ten (10) dedicated lanes.

This Report of Preliminary Geotechnical Investigation has been prepared as a part of the SR 400 (I-4) Project Development and Environment (PD&E) Study. The PD&E Study is being performed for the proposed improvements to an approximately 40 mile long stretch of SR 400 (I-4) from US 27 to Kirkman Road and from east of SR 434 to SR 472. This PD&E project is divided into five separate segments (Segment 1, 2, 3, 4 and 5).

Segment 5 of the project is located in northeast Polk County, Florida and is approximately 3 miles in length. The approximate Segment 5 project limits begin west of SR 25 (also known as US 27) and extend to west of CR 532 (also known as Osceola Polk Line Road). The typical section for this segment includes a 6-lane divided grassed median interstate with grassed right-of-way and stormwater ponds/roadside swales within the right-of-way. This Report of Preliminary Geotechnical Investigation includes the results of the geotechnical investigation and analyses at eight alternative stormwater pond locations (at which soil borings were requested) within Segment 5. We understand that the remaining pond alternatives did not require borings or seasonal high groundwater tables due to existing ponds and/or permits.

The Segment 5 project alignment is bordered mainly by sections of undeveloped land consisting of pine flatwoods and palmetto bushes. The project study area is shown on a United States Geological Society (USGS) Quadrangle Map and the United States Department of Agriculture (USDA) National Resource Conservation Services (NRCS) Soil Survey Map provided on **Figure 1**.

2.0 Review of Available Information

GEC reviewed available data including the USGS Quadrangle map and USDA NRCS Soil Survey map to obtain information on soil and groundwater conditions along the proposed alignment. The results of our review are presented in the following report sections.

2.1 USGS Quadrangle Map

The pond locations for Segment 5 are depicted on the USGS Gum Lake, Florida Quadrangle map shown on **Figure 1.** Review of the USGS Quadrangle maps indicates that the natural ground surface elevation for the Segment 5 ponds range from approximately +120 to +140 feet NGVD.

2.2 NRCS Soil Survey Review

The Natural Resources Conservation Service (NRCS) (formerly SCS) Soil Survey of Polk County, Florida was reviewed for near-surface soil and groundwater information at the site. The NRCS Soil Survey map of the site vicinity is shown on **Figure 1** in the **Appendix**. The NRCS soil units at the project site are summarized in **Table 1** below:

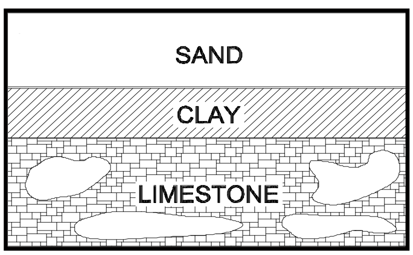
Table 1
Polk County NRCS Soil Survey Review

Map Symbol	Soil Name	Depth (in)	Soil Description	AASHTO Soil Classification	Seasonal High Groundwater Depth (ft)	Hydrologic Group
3	Candler sand, 0 to 5 percent slopes	0 - 63 63 - 80	Sand, fine sand Sand, fine sand	A-3 A-2-4, A-3	> 6.0	A
4	Candler sand, 5 to 8 percent slopes	0 - 63 63 - 80	Sand, fine sand Sand, fine sand	A-3 A-2-4, A-3	> 6.0	A
6	Eaton mucky fine sand, depressional	0 - 6 6 - 29 29 - 33 33 - 80	Mucky fine sand Fine sand, sand Sandy clay loam Sandy clay	A-2-4, A-3 A-2-4, A-3 A-7, A-4, A-6 A-7	+2.0 - 0.0	C/D
7	Pomona fine sand	0 - 21 21 - 26 26 - 48 48 - 73 73 - 80	Sand, fine sand Fine sand, sand, loamy fine sand Sand, fine sand Sandy clay loam, fine sandy loam, sandy clay Sandy loam, fine sand, loamy sand	A-2-4, A-3 A-2-4, A-3 A-2-4, A-3 A-2, A-4, A-6 A-2-4, A-3	0.5 - 1.5	A/D
13	Samsula muck	0 - 31 31 - 80	Muck Sand, fine sand, loamy sand	A-8 A-2-4, A-3	+2.0 - 0	B/D
15	Tavares fine sand, 0 to 5 percent slopes	0 - 80	Fine sand, sand	A-3	3.5 - 6.0	A
17	Myakka fine sand	0 - 25 25 - 36 36 - 80	Fine sand, sand Sand, fine sand Sand, fine sand	A-3 A-2-4, A-3 A-3	0.5 - 1.5	B/D
	Smyrna fine sand	0 - 12 12 - 25 25 - 42 42 - 80	Fine sand, sand Sand, fine sand, loamy fine sand Sand, fine sand Sand, fine sand, loamy fine sand	A-2-4, A-3 A-2-4, A-3 A-3 A-2-4, A-3		
22	Pomello fine sand	0 - 48 48 - 63 63 - 80	Fine sand, sand Sand, fine sand Sand, fine sand	A-3 A-2-4, A-3 A-3	2.0 - 3.5	C
31	Adamsville fine sand, 0 to 2 percent slopes	0 - 80	Fine sand, sand	A-2-4, A-3	1.5 - 3.5	A/D
36	Basinger mucky fine sand, depressional	0 - 7 7 - 80	Mucky fine sand Fine sand	A-2-4, A-3 A-2-4, A-3	+2.0 - 0	D
42	Felda fine sand	0 - 22 22 - 50 50 - 80	Fine sand, sand Sandy loam, fine sandy loam, sandy clay loam Sandy loam, fine sand, loamy sand	A-3 A-2-4, A-2-6 A-2-4, A-3	0.0 - 1.0	A/D

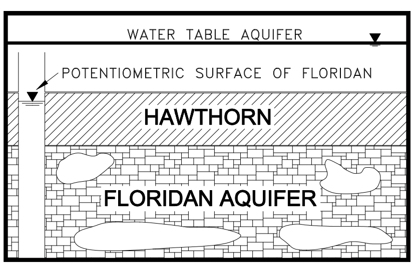
Based on review of the NRCS soil survey maps, the majority of the soils within the area of the proposed ponds in Segment 5 are characterized as sands with variable silt content (A-3, A-2-4). However, the NRCS depicts Samsula muck (Soil Unit 13) and Basinger mucky fine sand, depressional (Soil Unit 36) within two of the pond footprints. These soil units may contain shallow, high organic content soils, classified as A-8 in AASHTO. For the majority of the soils within the pond footprints the soil survey lists seasonal high water table levels at depths ranging from 2 feet above the ground surface to greater than 6 feet below the existing ground surface. However, the estimated seasonal high groundwater levels do not account for changes in groundwater due to development and are only relevant for the soil's natural, undisturbed condition.

Information contained in the NRCS Soil Survey should be considered general and may be outdated. Therefore, it may not be reflective of actual soil and groundwater conditions, particularly if recent development in the site vicinity has modified soil conditions or surface/subsurface drainage. The information obtained from the soil borings presented in this report should be considered a more current and accurate characterization of actual site conditions.

2.3 Geology/Hydrology

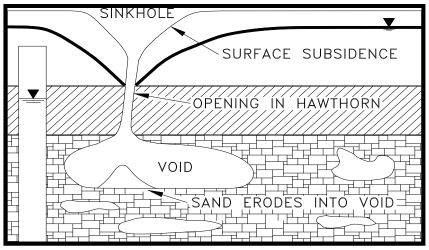


Central Florida geologic conditions can generally be described in terms of three basic sedimentary layers. The upper layer is primarily comprised of sands containing varying amounts of silt and clay. These sands are underlain by a layer of clay, clayey sand, phosphate and limestone which is locally referred to as the Hawthorn formation. The third layer underlies the Hawthorn formation and is comprised of limestone. The thickness of these three strata varies throughout Central Florida. In general, the surficial sands typically extend to depths of 40 to 70 feet, while the Hawthorn formation ranges from nearly absent in some locations to thicknesses greater than 100 feet. The groundwater hydrogeology of Central Florida can be described in terms of the nature and relationship of the three basic geologic strata. The near-surface sand stratum is fairly permeable and comprises the water table (unconfined) aquifer.



The limestone formation, known as the Floridan aquifer, is highly permeable due to the presence of large interconnected channels and cavities throughout the rock. The Floridan aquifer is the primary source of drinking water in Central Florida. These two permeable strata are separated by the relatively low permeability clays of the Hawthorn formation. The amount of groundwater flow between the two aquifer systems is dependent on the thickness and consistency of the Hawthorn clay confining beds which, as previously stated, varies widely throughout Central Florida.

The geology and hydrogeology described above can be conducive to collapses of the ground surface resulting in circular depressions known as "sinkholes." Sinkholes usually occur due to the downward movement of the near surface sands through openings in the Hawthorn formation into the limestone cavities. This process can be likened to the movement of sand through an hourglass. Sinkholes are most likely to occur in areas where the Hawthorn formation is thin or absent, allowing free downward movement of sands into the limestone.



Groundwater also flows freely from the surficial aquifer into the Floridan aquifer in areas where the Hawthorn formation is thin or breached. This phenomenon is called recharge. Therefore, high recharge areas are typically prone to sinkhole activity. An evaluation of sinkhole risk would include performing deep borings to evaluate the nature and thickness of the surficial sands and Hawthorn formation. *No method of geological, geotechnical, or geophysical exploration is known that can accurately predict the occurrence of sinkholes.* It is common geotechnical practice in Central Florida to make a qualitative prediction of sinkhole risk on the basis of local geological conditions in the vicinity of a particular site.

Based on the U.S. Geological Survey Map entitled "Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida," 1984, the project lies in an area of high recharge and, therefore, we can conclude based solely on this data that it also lies in an area where the relative risk of sinkhole formation is high compared to the overall risk across Central Florida.

2.4 Potentiometric Surface

The potentiometric level of the Floridan Aquifer in the vicinity of the project alignment ranges from about +110 to +126 feet NGVD. Ground surface elevations vary approximately between +120 and +140 feet NGVD; therefore, artesian flow conditions will likely not exist, unless there are any deep excavations and any underlying confining layer(s) are penetrated during construction. No artesian conditions were encountered in any of our borings performed.

3.0 Subsurface Exploration

In addition to consulting the sources of information previously discussed for regional and site-specific soils data, GEC conducted a subsurface exploration to evaluate soil and groundwater conditions at the pond locations requested by HNTB. The subsurface exploration for this study generally consisted of performing a total of 25 auger borings to a depth of 20 feet and 18 hand auger borings to depths of 1.5 to 5 feet below the existing ground surface at the proposed pond locations requested by HNTB, as well as a total of 12 field permeability tests. Due to project schedule constraints hand auger borings and laboratory permeability tests were conducted at Pond 505B2, FPC 506 and Pond 506 (instead of machine auger borings and field permeability tests) to aid the drainage engineer during the preliminary design of the PD&E study. Several pond "footprints" were removed or moved slightly after we drilled our borings.

The approximate locations of the borings performed for this study are shown on **Figures 2A and 2B** in the **Appendix**. These locations were not surveyed, but rather by using a handheld, sub-meter accuracy global positioning satellite (GPS) unit (Trimble Geo XH Series). Although these locations are given only approximately, the methods used to locate them are, in GEC's opinion, sufficient to meet the intent of our study. If greater accuracy is desired, a registered Professional Land Surveyor should be retained to survey these locations. Estimated ground surface elevations at the approximate boring locations were provided by HNTB, Inc. However, GEC estimated ground surface elevations at boring locations PB-15, PB-16 and PB-18 based on available topographic information.

3.1 Machine Auger Borings

Machine auger borings were performed in general accordance with ASTM Procedure D-4700. Machine auger borings were performed by hydraulically turning continuous flight, solid-stem, auger into the ground in 5-foot increments until the desired boring termination depth was achieved. The auger flights were retrieved in 5-foot increments, without further rotation of the auger, and the retrieved soil was examined by our technician prior to collection of representative samples. A field auger boring log was prepared that detailed the soils penetrated, records the groundwater depth at the time of drilling, if encountered, and includes other details of the boring, methods used, and selected other boring and/or site conditions at the time of drilling. The samples were placed in sealed jars and transported to GEC's laboratory for further examination and limited laboratory testing as needed.

3.2 Hand Auger Borings

Our engineering technician performed standard barrel manual auger borings in general accordance with ASTM D-4700, by manually turning a 3-inch diameter, 6-inch long sampler into the soil until it was full. He then retrieved the sampler and visually examined and classified the soil. This procedure was repeated until the desired termination depth was achieved. A field manual auger boring log was completed by the technician that described the soils penetrated, recorded depth to groundwater, if encountered, and described other details of the boring, methods used, and selected other site conditions at the time of drilling. Our technician collected representative samples for further visual examination and classification in our laboratory.

3.3 Field Permeability Tests

Falling head permeability tests were performed in the field at this site. The field permeability tests were performed by driving a 3-inch diameter casing into the ground to the desired test depth and washing the soil out of the casing with water. The casing was backfilled with quartz gravel to 24 inches above the bottom of the casing and was then raised a distance of 18 inches.

When a falling head permeability test was conducted, water was added to the casing to achieve a stable water level. Once the water level stabilized, the water source was taken away and the drop in water level in the casing with respect to time was recorded.

These relationships were used to calculate the permeability of the soil. Field permeability tests and calculations were performed in general conformance with NAVFAC DM-7.1-108.

3.4 Groundwater Measurement

A GEC engineering technician measured the depth to the groundwater in the boreholes at the time of drilling and again after approximately 24 hours. Once the groundwater measurements were recorded, the boreholes were backfilled with soil cuttings to prevailing ground surface.

4.0 Laboratory Testing

Selected soil samples retrieved from the borings were tested in accordance with Florida Standard Testing Methods (FM). Florida Standard Testing Methods are adaptations of recognized standard methods, e.g., ASTM and AASHTO, which have been modified to accommodate Florida's geological conditions. The laboratory testing program for this project is summarized on the following table:

Table 2
Summary of Laboratory Testing Program

Type of Test	Number of Tests
Grain size analysis (FM 1-T 088)	27
Percent Fines (FM 1-T 88)	0
Natural Moisture Content (FM 1-T 265)	4
Atterberg limits (FM 1 -T 89/90)	1
Organic Content (FM 1-T 267)	3
Laboratory Soil Permeability (FM 1-T 215)	4

The results of our testing are summarized on the **Pond Soil Survey Sheet** (**Figure 3**) and the summary of Laboratory Testing Results (**Table 5**) in the **Appendix.** Constant head laboratory soil permeability tests were conducted on soil samples from some of the pond borings. The results of the permeability tests are shown in the Summary of Permeability Test Results **Table 4** later in this report.

5.0 Description of Subsurface Conditions

The results of our borings are presented on the **Auger Boring Results For Ponds** sheets (**Figures 4** and **5**). The soils encountered in the auger borings were classified using the AASHTO Soil Classification System (A-3, A-2-4, etc.). All soils were described using the ASTM soil descriptions (e.g., sand with silt). GEC based the soil classifications on visual examination and the limited laboratory test results shown on **Table 5**.

The boring logs indicate subsurface conditions only at the specific boring locations at the time of our field exploration. Subsurface conditions, including groundwater levels, at other locations of the project site may differ from conditions we encountered at the boring locations. Moreover, conditions at the boring locations can change over time. Groundwater levels fluctuate seasonally, and soil conditions can be altered by earthmoving operations.

The depths and thicknesses of the subsurface strata indicated on the boring logs were interpolated between samples obtained at different depths in the borings. The actual transition between soil layers may be different than indicated. *These stratification lines were used for our analytical purposes and actual earthwork quantities measured during construction should be expected to vary from quantities calculated based on the information in this report.*

5.1 Auger Boring Results

The soil description and stratum numbers used for the pond auger borings are summarized as follows:

Table 3
Soil Stratigraphy

Stratum No.	Soil Description	AASHTO Classification
1	Light brown to brown to light gray to gray fine sand and fine sand with silt	A-3
2	Brown to dark brown to dark gray fine sand with silt to silty fine sand, occasional trace organic material	A-2-4
3	Light brown clayey fine sand to sandy clay to sandy silt	A-2-6, A-7-6, A-4
4	Dark brown mucky fine sand to organic clay	A-8
5	Light brown sandy clay	A-7-6

The auger borings conducted in the ponds predominantly encountered fine sand to fine sand with silt (Stratum 1)(A-3) with occasional fine sand with silt to silty fine sand (Stratum 2)(A-2-4) to the typical boring termination depths of 3 to 20 feet below the existing ground surface. Borings PB-34, PB-40, PB-41 and PB-43 (Pond 506 and FPC 506) encountered mucky fine sand (Stratum 4)(A-8) from the ground surface to depths of 0.5 to 1-foot below the existing ground surface. Additionally, boring PB-12 (old pond) encountered clayey fine sand (Stratum 3) from 16 to 18.5 feet below the existing ground surface.

Please refer to the **Auger Boring Results For Ponds** sheets (**Figures 4** and **5**) for detailed soil and groundwater information at a specific boring location.

5.2 Groundwater Levels

Groundwater levels were typically measured at least 24 hours after completion of the borings. Encountered groundwater depths at the pond boring locations generally ranged from 0.1 to 14.6 feet below the existing ground surface. However, borings PB-28 and PB-29 (Regional Pond 1) did not encounter groundwater to the boring termination depths of 20 feet below the existing ground surface indicated by “GNE” shown adjacent to the boring profiles. Borings PB-33 and PB-34 (FPC 506) encountered groundwater from 0.5 to 1.3 feet above the existing ground surface.

Groundwater levels can vary seasonally and with changes in subsurface conditions between boring locations. Alterations in surface and/or subsurface drainage brought about by site development can also affect groundwater levels. *Therefore, groundwater depths measured at different times or at different locations on the site can be expected to vary from those measured by GEC during this investigation.*

For purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season during a “normal rainfall” year under pre-development site conditions. We define a “normal rainfall” year as a year in which rainfall quantity and distribution were at or near historical averages.

We estimate that seasonal high groundwater elevations will range from +116 to +129.7 ft. NAVD88. However, for multiple borings we estimate that the seasonal high groundwater will be above the ground surface, indicated by "AGS" shown adjacent to the boring profiles. Our encountered and estimated seasonal high groundwater levels are presented on the **Auger Boring Results For Stormwater Ponds** sheets (**Figures 4** and **5**) and **Table 6 i**n the **Appendix**

6.0 Preliminary Geotechnical Recommendations

The preliminary analyses and recommendations contained in this report are based in part on the data obtained from a limited number of soil samples and groundwater measurements obtained from widely-spaced borings. The investigation methods used indicate subsurface conditions only at the specific boring locations, only at the time they were performed, and only to the depths penetrated. Borings cannot be relied upon to accurately reflect the variations that usually exist between boring locations and these variations may not become evident until construction. These recommendations are provided to aid in alignment selection and preliminary construction costs. A final geotechnical engineering evaluation will be required after the alignment, ponds and typical section have been selected.

6.1 Stormwater Ponds

The pond borings generally encountered fine sands with varying amounts of silt (A-3, A-2-4) to the typical boring termination depths (3 to 20 feet deep). The majority of the soils encountered in the pond borings appear suitable for use as roadway embankment in accordance with Index 505 of the FDOT Standard. The clayey fine sand soils (Stratum 3: A-2-6) have limitations for their use in accordance with Index 505. Sands excavated below the water table will need to be dried to moisture content near optimum to achieve the required degree of compaction.

GEC performed field and laboratory permeability tests at the proposed pond locations. The following table summarizes the result of our laboratory permeability tests.

Table 4
Summary of Permeability Tests Results

Pond No.	Boring No.	Depth (ft)	Encountered Water Table (ft)	Soil Type (AASHTO)	Horizontal Permeability, K (ft/day)	Permeability Type	Soil Stratum No.
Regional Pond 1	PB-28	10 - 12	GNE @ 20	A-3	56.4	Falling Head	1
505 A3/ Regional Pond 2	PB-2	7 - 9	14.6	A-3	57.4	Falling Head	1
505 A3/ Regional Pond 2	PB-24	8 - 10	7.3	A-3	73.3	Falling Head	1
505 A3/ Regional Pond 2	PB-27	10 - 12	9.9	A-3	5.2	Falling Head	1
FPC 500D	PB-4	10 - 12	5.6	A-3	9.7	Falling Head	1
FPC 500D	PB-21	10 - 12	6.6	A-2-4	4.7	Falling Head	2
FPC 500C	PB-31	6 - 8	4.1	A-3	1.1	Constant Head	1
505 B2	PB-14	0 - 4	2.3	A-3	26.6	Constant Head*	1
505 B2	PB-18	0 - 3	0.7	A-3	25.2	Constant Head*	1
506	PB-41	1 - 3	0.5	A-3	26.9	Constant Head*	1
506	PB-43	1 - 3	0.5	A-3	23.1	Constant Head*	1
---	PB-5	7 - 9	3.9	A-3	45.3	Falling Head	1

Pond No.	Boring No.	Depth (ft)	Encountered Water Table (ft)	Soil Type (AASHTO)	Horizontal Permeability, K (ft/day)	Permeability Type	Soil Stratum No.
---	PB-9	5 - 7	3.7	A-3	55.8	Falling Head	1
---	PB-11	3 - 5	0.6	A-3	17.0	Falling Head	1
---	PB-13	6 - 8	3.7	A-3	52.7	Falling Head	1
---	PB-23	8 - 10	7.6	A-3	39.0	Falling Head	1

* Laboratory permeability test

These permeability tests should be used to aid in evaluating the ponds' suitability during the PD&E Study. During final design, additional testing and evaluation will be necessary for final stormwater pond design.

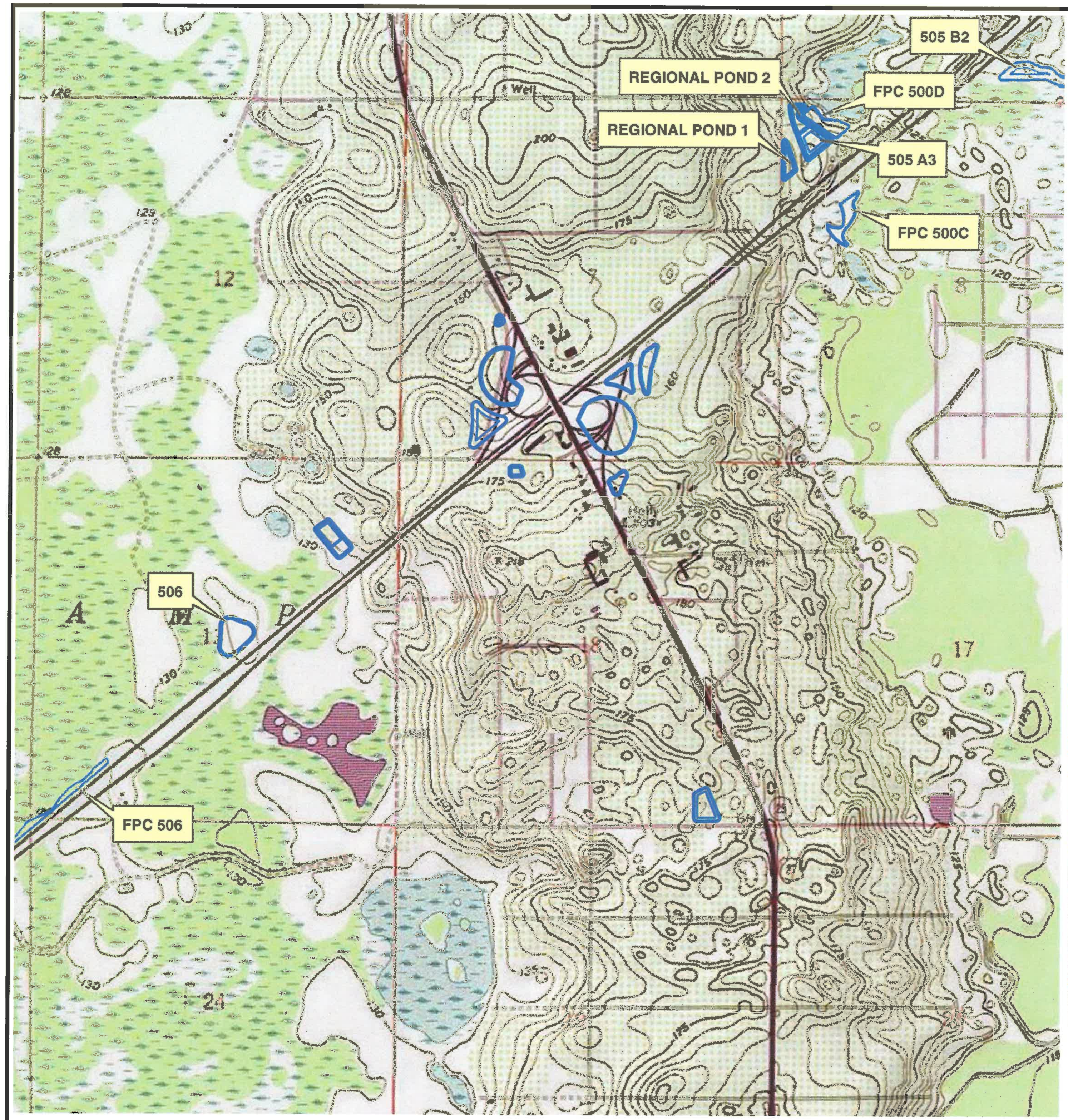
7.0 Use of This Report

GEC has prepared this preliminary report for the exclusive use of HNTB, and FDOT, and for specific application to our client's project. GEC will not be held responsible for any third party's interpretation or use of this report's subsurface data or engineering analysis without our written authorization.

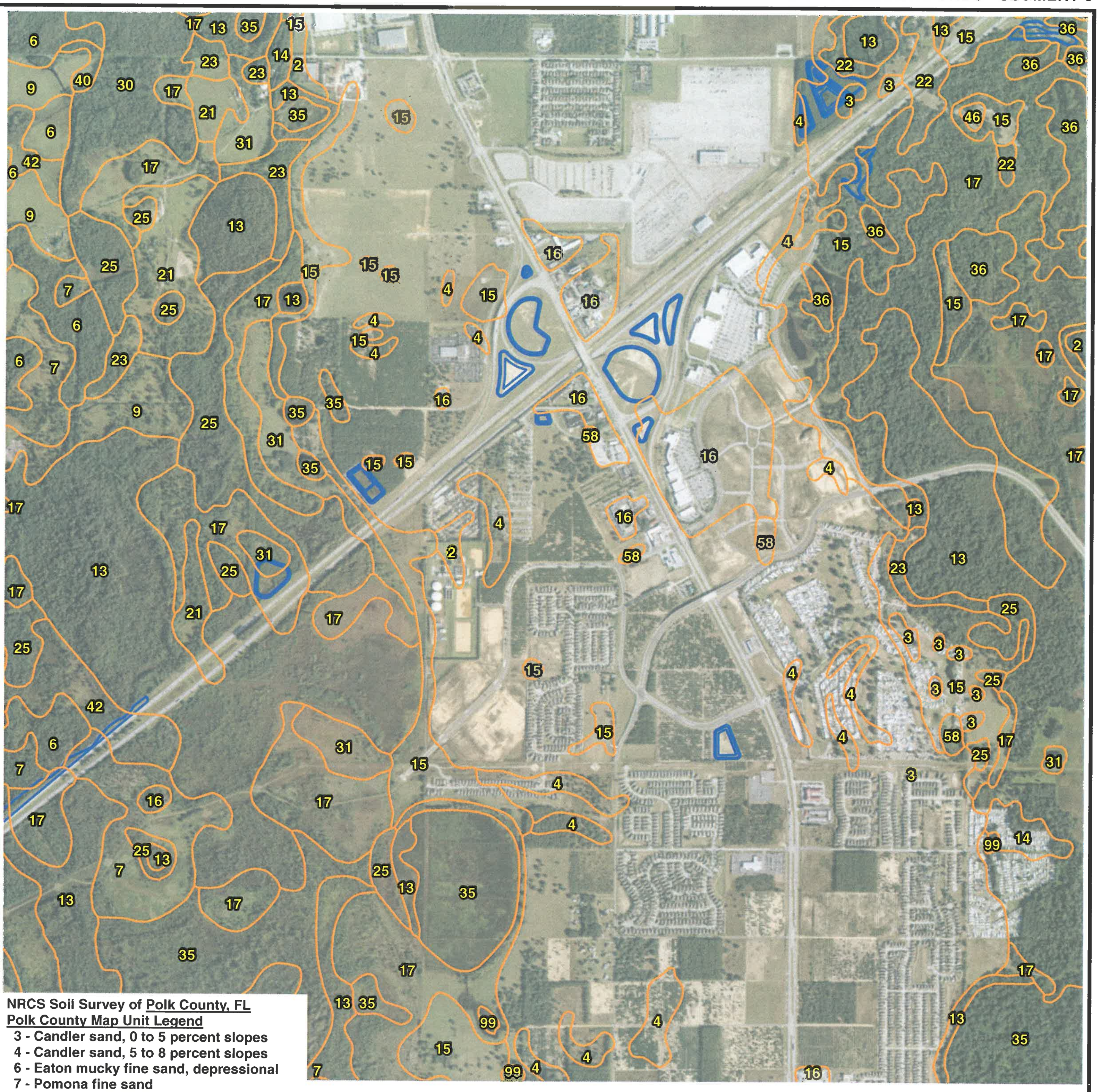
The sole purpose of the borings performed by GEC at this site was to obtain indications of subsurface conditions as part of a geotechnical exploration program. GEC has not evaluated the site for the potential presence of contaminated soil or groundwater, nor have we subjected any soil samples to analysis for contaminants.

GEC has strived to provide the services described in this report in a manner consistent with that level of care and skill ordinarily exercised by members of our profession currently practicing in Central Florida. No other representation is made or implied in this document.

The preliminary conclusions or recommendations of this report should be disregarded if the nature, design, or location of the facilities is changed. If such changes are contemplated, GEC should be retained to review the new plans to assess the applicability of this report in light of proposed changes.



USGS Gum Lake, FL Quadrangle Map
Sections: 5, 8, 13, 23
Township: 26 South
Range: 26, 27 East



NRCS Soil Survey of Polk County, FL
Polk County Map Unit Legend
3 - Candler sand, 0 to 5 percent slopes
4 - Candler sand, 5 to 8 percent slopes
6 - Eaton mucky fine sand, depressional
7 - Pomona fine sand
13 - Samsula muck
15 - Tavares fine sand, 0 to 5 percent slopes
17 - Smyrna and Myakka fine sands
22 - Pomello fine sand
30 - Pompano fine sand
31 - Adamsville fine sand
36 - Basinger mucky fine sand, depressional
42 - Felda fine sand

N W E S

0 1,000 2,000
Feet

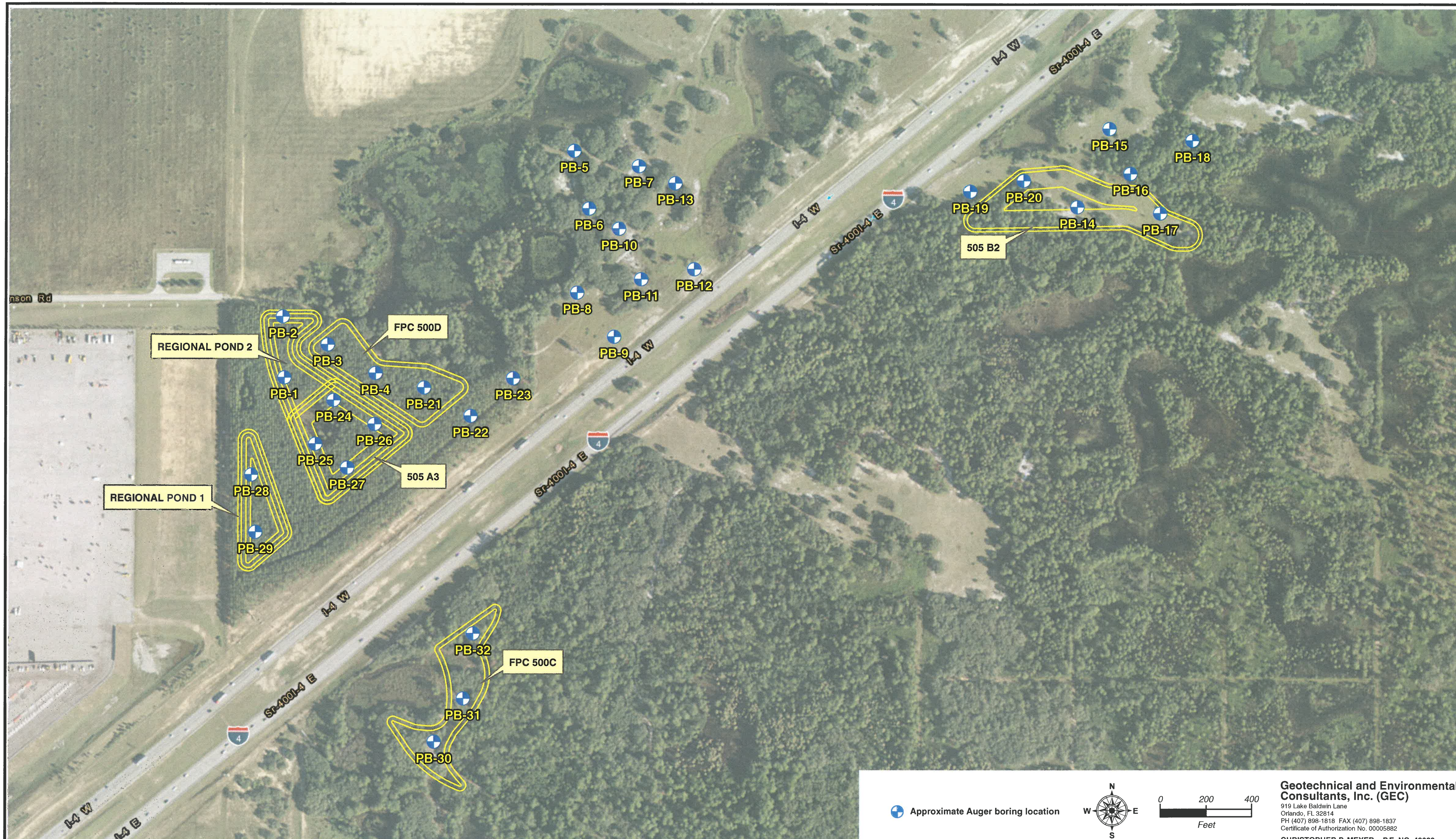
Geotechnical and Environmental Consultants, Inc. (GEC)
919 Lake Baldwin Lane
Orlando, FL 32814
PH (407) 898-1818 FAX (407) 898-1837
Certificate of Authorization No. 00005882
CHRISTOPHER P. MEYER P.E. NO. 49328

J:\D109\3492G Segment 1 Pond\10-8-14\3492G_Segment 5 QUAD.mxd 9/17/2015

FIGURE 1 - USGS QUADRANGLE AND NRCS SOIL SURVEY MAPS

J:\D109\3492G Segment 1 Pond\10-8-14\3492G_Segment 5 pondsA.mxd 9/17/2015

FIGURE 2A - BORING LOCATION PLAN



J:\D10\13492G Segment 1 Pond\10-8-14\13492G_Segment 5 ponds.mxd 9/17/2015

FIGURE 2B - BORING LOCATION PLAN

DATE OF SURVEY: SEPTEMBER 2014, MARCH 2015, SEPTEMBER 2015
SURVEY MADE BY: GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC.
SUBMITTED BY: CHRISTOPHER P. MEYER, P.E.

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH

DISTRICT: 5
ROAD NO.: SR 400
COUNTY: POLK

FINANCIAL PROJECT ID : 201210-2-22-01
PROJECT NAME: SR 400 (I-4) PROJECT DEVELOPMENT AND ENVIRONMENTAL (PD&E) STUDY
CROSS SECTION SOIL SURVEY FOR THE DESIGN OF PONDS - SEGMENT 5

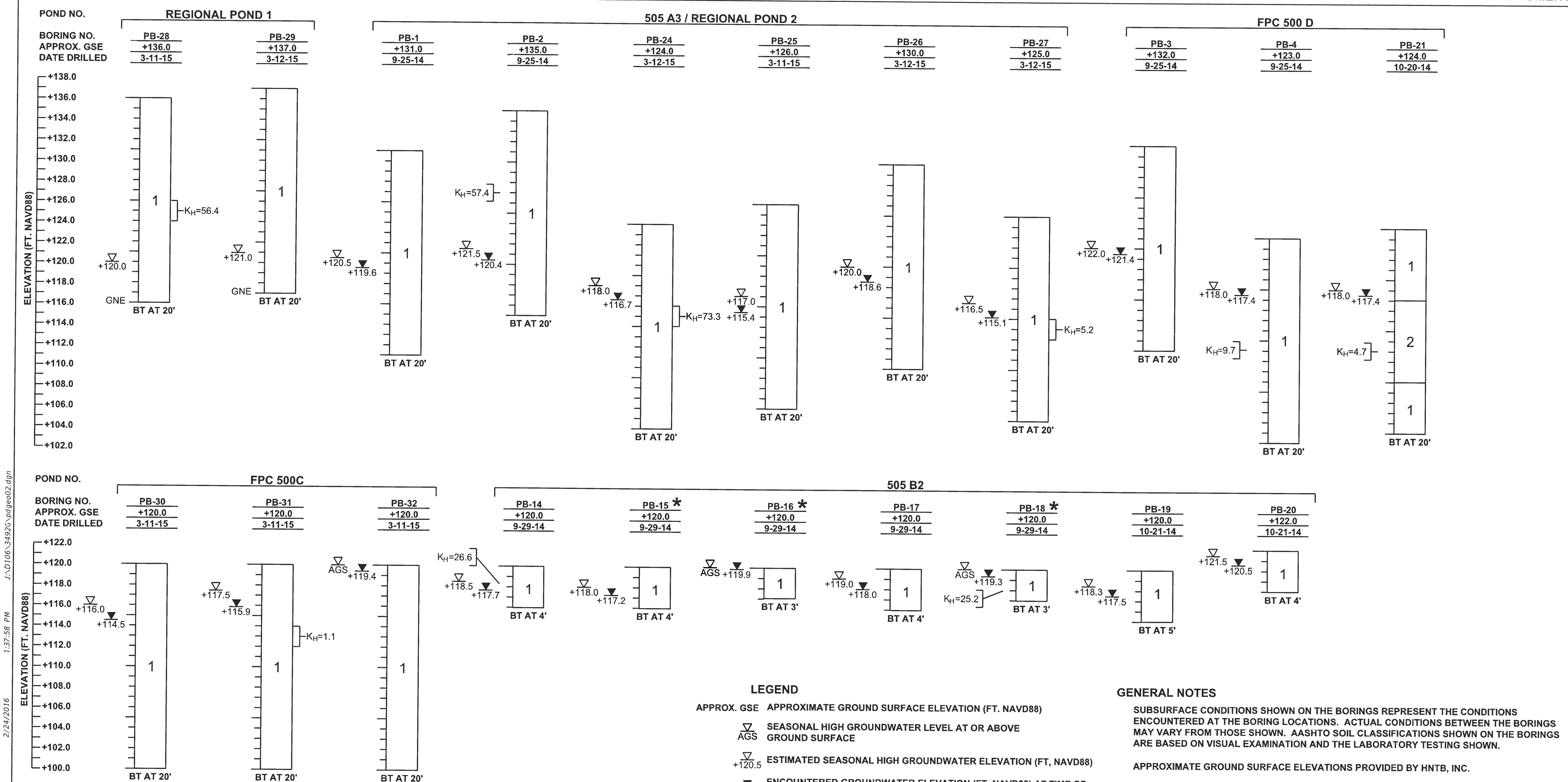
	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS PERCENT PASS (%)						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS				
STRATUM NO.	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX	AASHTO GROUP	DESCRIPTION	NO. OF TESTS	RESISTIVITY ohm-cm	CHLORIDE ppm	SULFATES ppm	pH
1	3	1-4	3	22-27	21	100	78-91	31-59	5-22	1-8	0	-	-	A-3	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY FINE SAND TO FINE SAND WITH SILT	0	-	-	-	-
2	0	-	0	-	5	100	80-94	52-73	26-33	11-21	0	-	-	A-2-4	BROWN TO DARK BROWN TO DARK GRAY FINE SAND WITH SILT TO SILTY FINE SAND, OCCASIONAL TRACE ORGANIC MATERIAL	0	-	-	-	-
3	0	-	1	24	1	100	91	75	58	51	1	29	11	A-2-6, A-7-6, A-4	LIGHT BROWN CLAYEY FINE SAND TO SANDY CLAY TO SANDY SILT	0	-	-	-	-
4	0	-	0	-	0	-	-	-	-	-	0	-	-	A-8	DARK BROWN MUCKY FINE SAND TO ORGANIC CLAY	0	-	-	-	-
5	0	-	0	-	0	-	-	-	-	-	0	-	-	A-7-6	LIGHT BROWN SANDY CLAY	0	-	-	-	-

NOTES
1. STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH BORING LOCATION ONLY. ANY STRATUM CONNECTING LINES THAT ARE 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 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION. FOR FURTHER DETAILS SEE SECTION 120-3.
2. WATER TABLE SHOWN AS ▼ WHERE ENCOUNTERED AT TIME OF SURVEY. ESTIMATED SEASONAL HIGH GROUNDWATER SHOWN AS ▽. ESTIMATED SEASONAL HIGH GROUNDWATER LEVEL AT OR ABOVE GROUND SURFACE SHOWN AS ▽ AGS.
3. THE SYMBOL "-" REPRESENTS AN UNMEASURED PARAMETER.
4. STRATA 1 AND 2 SHALL BE TREATED AS SELECT (S) MATERIAL IN ACCORDANCE WITH FDOT INDEX NO. 505.
5. STRATUM 3 SHALL BE TREATED AS PLASTIC (P) MATERIAL IN ACCORDANCE WITH FDOT INDEX NO. 505.
6. STRATUM 4 SHALL BE TREATED AS MUCK (M) IN ACCORDANCE WITH FDOT INDEX NO. 505.
7. STRATUM 5 SHALL BE TREATED AS HIGH PLASTIC (H) MATERIAL IN ACCORDANCE WITH FDOT INDEX NO. 505.
8. STRATUM 2 MAY RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. (GEC)
919 Lake Baldwin Lane
Orlando, FL. 32814
T 407-898-1818 F 407-898-1837
Certificate of Authorization No. 5882
CHRISTOPHER P. MEYER PE NO. 49328

scott 9/17/2015 9:03:13 AM J:\D106\34920\rdssgeo06.dgn

FIGURE 3 - POND SOIL SURVEY



STRATUM NO.	AASHTO CLASSIFICATION	SOIL DESCRIPTION
1	A-3	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY FINE SAND TO FINE SAND WITH SILT
2	A-2-4	BROWN TO DARK BROWN TO DARK GRAY FINE SAND WITH SILT TO SILTY FINE SAND, OCCASIONAL TRACE ORGANIC MATERIAL
3	A-2-6	LIGHT BROWN CLAYEY FINE SAND
4	A-8	DARK BROWN MUCKY FINE SAND

LEGEND

- APPROX. GSE — APPROXIMATE GROUND SURFACE ELEVATION (FT. NAVD88)
- ▽ AGS — SEASONAL HIGH GROUNDWATER LEVEL AT OR ABOVE GROUND SURFACE
- ▽ +120.5 — ESTIMATED SEASONAL HIGH GROUNDWATER ELEVATION (FT, NAVD88)
- ▼ +119.6 — ENCOUNTERED GROUNDWATER ELEVATION (FT. NAVD88) AT TIME OF DRILLING BORING
- GNE — GROUNDWATER NOT ENCOUNTERED
- BT — BORING TERMINATED AT DEPTH INDICATED
- K_H= — HORIZONTAL PERMEABILITY RATE (FT./DAY)

GENERAL NOTES

SUBSURFACE CONDITIONS SHOWN ON THE BORINGS REPRESENT THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN THE BORINGS MAY VARY FROM THOSE SHOWN. AASHTO SOIL CLASSIFICATIONS SHOWN ON THE BORINGS ARE BASED ON VISUAL EXAMINATION AND THE LABORATORY TESTING SHOWN.

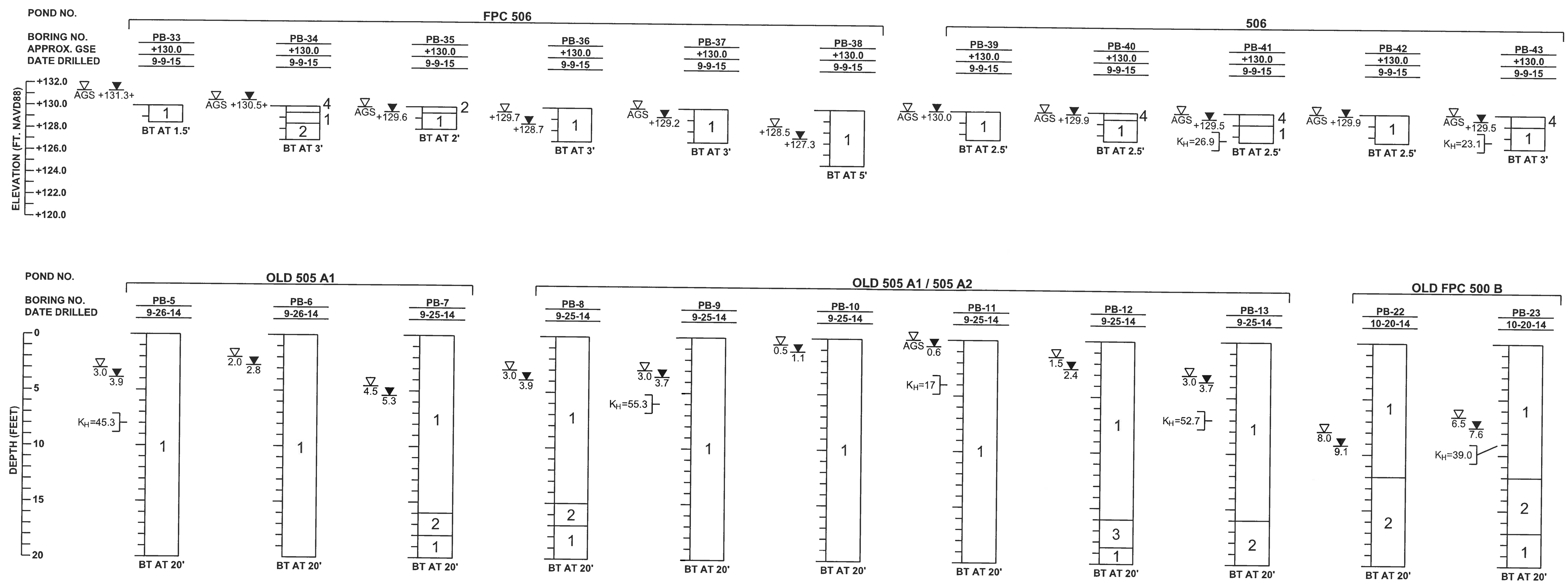
APPROXIMATE GROUND SURFACE ELEVATIONS PROVIDED BY HNTB, INC.

* GEC ESTIMATED GROUND SURFACE ELEVATIONS BASED ON AVAILABLE TOPOGRAPHIC INFORMATION.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. (GEC)
919 Lake Baldwin Lane
Orlando, FL. 32814
T 407-898-1818 F 407-898-1837
Certificate of Authorization No. 5882
CHRISTOPHER P. MEYER PE NO. 49328

FIGURE 5 - AUGER BORING RESULTS FOR STORMWATER PONDS

J:\D106\3492G\pdgeo02.dgn 2/24/2016 1:37:58 PM Scott



LEGEND

APPROX. GSE APPROXIMATE GROUND SURFACE ELEVATION (FT. NAVD88)

AGS SEASONAL HIGH GROUNDWATER LEVEL AT OR ABOVE GROUND SURFACE

+129.7 ESTIMATED SEASONAL HIGH GROUNDWATER ELEVATION (FT. NAVD88)

+131.3+ ENCOUNTERED GROUNDWATER ELEVATION (FT. NAVD88) ABOVE GROUND SURFACE AT TIME OF DRILLING BORING

+128.7 ENCOUNTERED GROUNDWATER ELEVATION (FT. NAVD88) AT TIME OF DRILLING BORING

3.0 ESTIMATED SEASONAL HIGH GROUNDWATER DEPTH (FT.)

3.9 ENCOUNTERED GROUNDWATER DEPTH (FT.) AT TIME OF DRILLING BORING

BT BORING TERMINATED AT DEPTH INDICATED

K_H= HORIZONTAL PERMEABILITY RATE (FT./DAY)

GENERAL NOTES

SUBSURFACE CONDITIONS SHOWN ON THE BORINGS REPRESENT THE CONDITIONS ENCOUNTERED AT THE BORING LOCATIONS. ACTUAL CONDITIONS BETWEN THE BORINGS MAY VARY FROM THOSE SHOWN. AASHTO SOIL CLASSIFICATIONS SHOWN ON THE BORINGS ARE BASED ON VISUAL EXAMINATION AND THE LABORATORY TESTING SHOWN.

APPROXIMATE GROUND SURFACE ELEVATIONS PROVIDED BY HNTB, INC.

STRATUM NO.	AASHTO CLASSIFICATION	SOIL DESCRIPTION
1	A-3	LIGHT BROWN TO BROWN TO LIGHT GRAY TO GRAY FINE SAND TO FINE SAND WITH SILT
2	A-2-4	BROWN TO DARK BROWN TO DARK GRAY FINE SAND WITH SILT TO SILTY FINE SAND, OCCASIONAL TRACE ORGANIC MATERIAL
3	A-2-6	LIGHT BROWN CLAYEY FINE SAND
4	A-8	DARK BROWN MUCKY FINE SAND

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, INC. (GEC)
919 Lake Baldwin Lane
Orlando, FL. 32814
T 407-898-1818 F 407-898-1837
Certificate of Authorization No. 5882
CHRISTOPHER P. MEYER PE NO. 49328

Scott 2/26/2016 3:17:24 PM J:\D106\34926\pdgeo02.dgn

FIGURE 5 - AUGER BORING RESULTS FOR STORMWATER PONDS

Table 5
Summary of Laboratory Test Results
SR 400 (I-4) PD&E Study – Segment 5
West of SR 25 (US 27) to West of CR 532
FPID No. 201210-2-22-01
GEC Project No. 3492G

Pond/Swale No.	Stratum No.	Boring No.	Sample Depth (feet)	Percent Passing by Weight					Moisture Content (%)	Atterberg Limits		Organic Content (%)	AASHTO Class.
				#10 Sieve	#40 Sieve	#60 Sieve	#100 Sieve	#200 Sieve		Liquid Limit	Plasticity Index		
Regional Pond 2	1	PB-2	5 - 10	100	86	40	6	2	---	---	---	---	A-3
FPC 500D	1	PB-4	10 - 15	100	79	46	12	4	---	---	---	---	A-3
---	1	PB-5	5 - 10	100	89	44	7	2	---	---	---	---	A-3
---	1	PB-9	5 - 8	100	86	42	6	2	---	---	---	---	A-3
---	1	PB-10	1 - 2	100	82	31	7	5	22	---	---	2	A-3
---	1	PB-11	0 - 5	100	84	32	5	2	---	---	---	---	A-3
---	1	PB-13	5 - 10	100	89	48	16	5	---	---	---	---	A-3
505B2	1	PB-14	0 - 4	100	88	44	10	2	---	---	---	---	A-3
505B2	1	PB-17	0 - 4	100	87	38	5	1	---	---	---	---	A-3
505B2	1	PB-18	0 - 3	100	83	48	9	2	---	---	---	---	A-3
---	1	PB-23	5 - 10	100	96	54	7	2	---	---	---	---	A-3
505 A3/Regional Pond 2	1	PB-24	5 - 10	100	89	39	6	3	---	---	---	---	A-3
505 A3/Regional Pond 2	1	PB-27	10 - 15	100	90	48	8	2	---	---	---	---	A-3
Regional Pond 1	1	PB-28	10 - 15	100	87	40	7	4	---	---	---	---	A-3
FPC 500C	1	PB-31	5 - 10	100	90	46	6	2	---	---	---	---	A-3
FPC 500C	1	PB-32	1.5 - 3	100	86	39	9	7	27	---	---	4	A-3
506	1	PB-33	0 - 1	100	78	41	15	8	---	---	---	---	A-3
506	1	PB-38	2.5 - 3.5	100	91	59	22	5	22	---	---	1	A-3
FPC 506	1	PB-41	0 - 1	100	86	33	9	5	---	---	---	---	A-3
FPC 506	1	PB-41	1 - 3	100	87	34	7	3	---	---	---	---	A-3
FPC 506	1	PB-43	1 - 3	100	88	35	7	2	---	---	---	---	A-3
---	2	PB-7	16 - 18	100	94	67	28	21	---	---	---	---	A-2-4
---	2	PB-8	15 - 17	100	87	57	27	17	---	---	---	---	A-2-4
---	2	PB-13	16 - 20	100	80	73	29	19	---	---	---	---	A-2-4
FPC 500D	2	PB-21	10 - 15	100	91	66	33	11	---	---	---	---	A-2-4
506	2	PB-34	1.5 - 2.5	100	85	52	26	17	---	---	---	---	A-2-4
---	3	PB-12	16 - 18.5	100	91	75	58	51	24	29	11	---	A-2-6

Table 6
Summary of Groundwater Tables and Permeability Results
SR 400 (I-4) PD&E Study – Segment 5
West of SR 25 (US 27) to West of CR 532
FPID No. 201210-2-22-01
GEC Project No. 3492G

Pond No.	Boring No.	Date of Groundwater Measurement	Encountered Groundwater Elevation (ft NAVD88)	* Estimated Seasonal High Groundwater Elevation (ft NAVD88)	NRCS Soil Survey Unit No.	NRCS Soil Survey Seasonal High Groundwater Depth Range (feet)	Permeability Test Results		
							Horizontal Permeability Rate (ft/day)	Test Depth (ft)	Soil Type
Regional Pond 1	PB-28	3/11/2015	GNE @ +116.0	+120.0	4	> 6.0	56.4	10 - 12	A-3
	PB-29	3/12/2015	GNE @ +117.0	+121.0	4	> 6.0	---	---	---
505A3/Regional Pond 2	PB-1	9/29/2014	+119.6	+120.5	3	> 6.0	---	---	---
	PB-2	9/29/2014	+120.4	+121.5	3	> 6.0	57.4	7 - 9	A-3
	PB-24	3/12/2015	+116.7	+118.0	15	3.5 - 6.0	73.3	8 - 10	A-3
	PB-25	3/11/2015	+115.4	+117.0	15	3.5 - 6.0	---	---	---
	PB-26	3/12/2015	+118.6	+120.0	3	> 6.0	---	---	---
	PB-27	3/12/2015	+115.1	+116.5	15	3.5 - 6.0	5.2	10 - 12	A-3
FPC 500D	PB-3	9/29/2014	+121.4	+122.0	15	3.5 - 6.0	---	---	---
	PB-4	9/29/2014	+117.4	+118.0	15	3.5 - 6.0	9.7	10 - 12	A-3
	PB-21	10/21/2014	+117.4	+118.0	3	> 6.0	4.7	10 - 12	A-2-4
FPC 500C	PB-30	3/11/2015	+114.5	+116.0	15	3.5 - 6.0	---	---	---
	PB-31	3/11/2015	+115.9	+117.5	15	3.5 - 6.0	1.1	6 - 8	A-3
	PB-32	3/11/2015	+119.4	AGS	17	0.5 - 1.5	---	---	---
505B2	PB-14	9/30/2014	+117.7	+118.5	15	3.5 - 6.0	26.6**	0 - 4	A-3
	PB-15	9/30/2014	+117.2	+118.0	15	3.5 - 6.0	---	---	---
	PB-16	9/30/2014	+119.9	AGS	36	+2.0 - 0.0	---	---	---
	PB-17	9/30/2014	+118	+119.0	15	3.5 - 6.0	---	---	---
	PB-18	9/30/2014	+119.3	AGS	22	2.0 - 3.5	25.2**	0 - 3	A-3
	PB-19	10/21/2014	+117.5	+118.3	15	3.5 - 6.0	---	---	---
	PB-20	10/21/2014	+120.5	+121.5	15	3.5 - 6.0	---	---	---
506	PB-33	9/10/2015	+131.3+	AGS	13	+2.0 - 0.0	---	---	---
	PB-34	9/10/2015	+130.5+	AGS	17	0.5 - 1.5	---	---	---
	PB-35	9/10/2015	+129.6	AGS	17	0.5 - 1.5	---	---	---
	PB-36	9/10/2015	+128.7	+129.7	7	0.5 - 1.5	---	---	---
	PB-37	9/10/2015	+129.2	AGS	42	0.0 - 1.0	---	---	---
	PB-38	9/10/2015	+127.3	+128.5	13	+2.0 - 0.0	---	---	---
FPC 506	PB-39	9/10/2015	+130.0	AGS	17	0.5 - 1.5	---	---	---
	PB-40	9/10/2015	+129.9	AGS	17	0.5 - 1.5	---	---	---
	PB-41	9/10/2015	+129.5	AGS	17	0.5 - 1.5	26.9**	1 - 3	A-3
	PB-42	9/10/2015	+129.9	AGS	31	1.5 - 3.5	---	---	---
	PB-43	9/10/2015	+129.5	AGS	31	1.5 - 3.5	23.1**	1 - 3	A-3

Pond No.	Boring No.	Date of Groundwater Measurement	Encountered Groundwater Depth (feet)	* Estimated Seasonal High Groundwater Depth (feet)	NRCS Soil Survey Unit No.	NRCS Soil Survey Seasonal High Groundwater Depth Range (feet)	Permeability Test Results		
							Horizontal Permeability Rate (ft/day)	Test Depth (ft)	Soil Type
Old Pond 505A1/A2	PB-5	9/29/2014	3.9	3.0	15	3.5 - 6.0	45.3	7 - 9	A-3
	PB-6	9/29/2014	2.8	2.0	15	3.5 - 6.0	---	---	---
	PB-7	9/29/2014	5.3	4.5	22	2.0 - 3.5	---	---	---
	PB-8	9/29/2014	3.9	3.0	15	3.5 - 6.0	---	---	---
	PB-9	9/29/2014	3.7	3.0	22	2.0 - 3.5	55.8	5 - 7	A-3
	PB-10	9/29/2014	1.1	0.5	15	3.5 - 6.0	---	---	---
	PB-11	9/29/2014	0.6	AGS	22	2.0 - 3.5	17.0	3 - 5	A-3
	PB-12	9/29/2014	2.4	1.5	22	2.0 - 3.5	---	---	---
	PB-13	9/29/2014	3.7	3.0	22	2.0 - 3.5	52.7	6 - 8	A-3
Old Pond FPC 500B	PB-22	10/21/2014	9.1	8.0	15	3.5 - 6.0	---	---	---
	PB-23	10/21/2014	7.6	6.5	15	3.5 - 6.0	39.0	8 - 10	A-3

* AGS denotes the groundwater level is estimated to be above the existing ground surface. The height to which water may rise above the ground surface should be determined by the drainage engineer.

** Constant head laboratory permeability test