Nadic Engineering Services, Inc.

Geotechnical Report
I-95 Interchange @ Ellis Road
PD&E Study
Brevard County, Florida
FPID No. 426905-1-22-01
Federal Aid Project No. SF T1 251 R
NES Project No. R10012

Prepared for:

Reynolds Smith & Hills, Inc. (RS&H)
10748 Deerwood Park Blvd South
Jacksonville, Florida 32256

Prepared by:

Nadic Engineering Services, Inc.
601 N. Hart Blvd
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Consultants in: Civil · Environmental · Geotechnical Engineering
Offices in: Orlando · Miami

NADIC ENGINEERING SERVICES, INC.
Civil, Environmental, and Geotechnical Consultants

July 24, 2011

Reynolds, Smith & Hills (RS&H)
10748 Deerwood Park Boulevard South
Jacksonville, Florida 32256

Attention: Ms. Tanya Kristoff, P.E.

Re: Geotechnical Report
I-95 Interchange @ Ellis Road
PD&E Study
Brevard County, Florida
FPID No. 426905-1-22-01
NES Project No. R10012

Dear Ms. Kristoff:

Nadic Engineering Services, Inc. (NES) is pleased to submit this preliminary subsurface exploration and geotechnical engineering evaluation for the above referenced project. The purpose of this exploration was to evaluate subsurface conditions at the proposed alternate stormwater pond sites, canal, box culvert and arch bridge for the I-95 Interchange @ Ellis Road PD&E Study. This report presents the results of our limited field and laboratory investigations and includes our preliminary recommendations regarding the geotechnical engineering aspects of the project.

NES appreciates the opportunity to work with you, RS&H and the Florida Department of Transportation (FDOT) on this project and look forward to a continued association. Please contact us if you have any questions, or if we may be of further assistance to you as this project proceeds.

Sincerely,
NADIC ENGINEERING SERVICES, INC.

Jason M. Neal, E.I.
Project Engineer

Godwin N. Nnadi, P.E.
Principal Engineer
FL Registration No. 50637

GNN/jmn: (Roadways) I-95Interchange @ Ellis Rd Geotechnical Report(072411)

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PROJECT DESCRIPTION

The FDOT is proposing to construct an Interchange at I-95 and Ellis Road in Brevard County. The new Interchange will provide direct access between I-95 and Melbourne International Airport… Ellis Road improvement from I-95 to Wickham Road.

The FDOT is proposing to construct an Interchange at I-95 and Ellis Road in Brevard County. The new interchange will provide direct access between I-95 and Melbourne International Airport. The Project Development and Environmental (PD&E) Study is for the I-95/Ellis Road interchange and Ellis Road improvement from I-95 to Wickham Road. The project site is located in Sections 25 through 27 and 34 through 36, Township 27 South, Range 36 East and Sections 30 and 31, Township 27 South, Range 37 East in Brevard County, Florida.

The Project Location Map is shown on **Figure 1** in **Appendix A**.

REVIEW OF AVAILABLE PUBLISHED DATA

General

To obtain general information on soil and groundwater conditions along the project alignment, **NES** reviewed available data including aerial maps, United States Geological Survey (USGS) Quadrangle Topographic Maps and the United States Department of Agriculture (USDA) Soil conservation Service (SCS) Soil Survey for Brevard County and other published sources. An Aerial Map of the project area is presented on **Figure 2** in **Appendix A**.

USGS Topographic Map

The "Melbourne West, Florida" USGS Topographic Map issued in 1949, photo revised in 1988, in the vicinity of the subject alignment was reviewed. The alignment is shown on an excerpt of the USGS Topographic Map and presented on **Figure 3** in **Appendix A**. The map shows the ground surface elevation in the project vicinity to range from approximately +19 to +24 feet, North American Vertical Datum of 1988 (NAVD-88).

USDA, SCS Soil Survey

The "Soil Survey of Brevard County, Florida" published by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS) was reviewed. The USDA soil survey indicates 11 primary mapping soil units within the project vicinity. These soil units are presented on the following page in **Table 1**. Refer to **Figure 4** in **Appendix A** for a reproduction of the SCS map for the project area.

Table 1: Soil Survey Summary

Soil Series	Depth (Inches)	Soil Description	AASHTO Classification	USDA SHGWT* (inches)	Risk of Corrosion	
					Uncoated Steel	Concrete
Basinger (Ba)	0-80	Sand	A-3	0-10	High	Moderate
Copeland (Cp)	0-15	Loamy fine sand	A-3	0-10	High	Low
	15-22	Sandy clay loam, sandy loam	A-2			
	22-30	Marl	--			
Chobee (Ch)	0-14	Sandy loam	A-2	0-10	Moderate	Low
	14-38	Sandy clay loam, sandy loam	A-2, A-6			
	38-63	Sandy clay loam, sandy loam, loamy sand	A-2, A-6			
Eau Gallie (Eg)	0-22	Sand	A-3	0-10	High	High
	22-35	Sand	A-2, A-3			Moderate
	35-55	Sand	A-3			Moderate
	55-61	Sandy clay loam, sandy loam, fine sandy loam	A-2			Low
	61-84	Loamy sand, sandy loam, loamy fine sand, fine sandy loam,	A-2			Low
Felda (Fa)	0-30	Sand	A-3	0-10	High	Low
	30-49	Sandy loam, sandy clay loam	A-2			
	49-62	Sandy loam, loamy sand, sand	A-2			
Chobee part of Fo	0-14	Sandy loam	A-2	0-10	Moderate	Low
	14-38	Sandy clay loam, sandy loam	A-2, A-6			
	38-63	Sandy clay loam, sandy loam, loamy sand	A-2, A-6			
Felda part of Fo	0-30	Sand	A-3	0-10	High	Low
	30-49	Sandy loam, sandy clay loam	A-2			
	49-62	Sandy loam, loamy sand, sand	A-2			
Malabar (Ma)	0-45	Sand	A-3	0-10	High	Low
	45-61	Sandy loam, sandy clay loam	A-2, A-6			
	61-65	Sand	A-3, A-2			
Myakka (Mk)	0-22	Sand	A-3	0-10	High	High
	22-35	Sand	A-2, A-3			
	35-46	Sand	A-2, A-3			
	46-63	Sand	A-3			

Table 1: Soil Survey Summary (Continued)

Soil Series	Depth (Inches)	Soil Description	AASHTO Classification	USDA SHGWT* (inches)	Risk of Corrosion	
					Uncoated Steel	Concrete
Quartzipsamments, smoothed (Qr)	--	--	--	--	--	--
Tomoka (Tw)	0-27	Muck	A-8	0-10	High	Low
	27-35	Sand	A-3		Low	Low
	35-55	Sandy clay loam, sandy loam	A-2		Moderate	Low
Valkaria (Va)	0-15	Sand	A-3	0-10	High	Low
	15-80	Sand	A-3			
Winder (Wn)	0-12	Loamy sand	A-2	0-10	High	Low
	12-17	Sandy loam	A-2			
	17-31	Sandy clay loam	A-2, A-6			
	31-47	Sandy clay loam, sandy loam	A-2			
	47-65	Sandy clay loam, sandy loam	A-2			

Information from the USDA Soil Survey is very general and may be outdated due to recent developments in the project site vicinity. Therefore, it may not reflect the actual soil and groundwater conditions, particularly where development has modified the natural soil conditions or surface and near surface drainage.

Potentiometric Surface Map

Based on review of the "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, May 2009" map, published by the USGS, the elevation of the potentiometric surface in the vicinity of the project alignment appears to be approximately +32 to +33 feet, NAVD-88. A portion of this map is presented on **Figure 5** in **Appendix A**.

AREA GEOLOGY

The geology of Brevard County is characterized by sedimentary strata. The county is underlain by a series of limestone formations having a total thickness of several thousand feet. The upper several hundred feet of the limestone formations constitute the Floridan aquifer, which generally includes the Avon Park Limestone and the overlying Ocala Group of limestone formations, all of the Eocene age. The Floridan aquifer is one of the most productive aquifers in the world. The extremely high productivity of this aquifer is directly related to its numerous cavities and interconnected channels. The top of the artesian aquifer is approximately 75 feet below sea level in the northwestern corner of the county and more than 300 feet below sea level in the

southeastern corner. In Brevard County, the direction of movement of the artesian water is generally northeastward, except under the barrier islands.

Overlying the artesian aquifer are beds of sandy clay, shells and clay of the Hawthorn Formation of Early and Middle Miocene Age and deposits of Late Miocene or Pliocene Age. These beds serve to confine water under pressure in the underlying artesian aquifer. The confining beds are overlain by unconsolidated deposits of sand and sandy coquina of Pleistocene and Recent Age which completely cover all of Brevard County. The sediments of Pleistocene and Recent Age average approximately 50 feet in thickness in the coastal ridge area but are less than 20 feet thick in the vicinity of the St. Johns River. Non-artesian water saturates approximately 40 feet of these sediments in the coastal ridge area and the zone of saturation thins toward the St. Johns and Indian Rivers.

FIELD INVESTIGATION

General

To evaluate the subsurface conditions along the proposed project corridor, power auger borings and Standard Penetration Test (SPT) borings were performed. Power auger borings were performed at the stormwater pond and canal sites to maximum depths of 20 feet. Permeability tests were performed at selected pond sites. Two (2) SPT borings were performed to depths of 30 and 120 feet below the existing grade.

A total of 11 power auger borings for stormwater ponds and canals and two (2) SPT borings for structures (box culvert and arch bridge) were completed for the proposed project corridor. The locations of the borings were determined by **NES** based on information provided by RS&H. All borings were located, staked and logged in the field by a representative of **NES** with a Global Positioning System (GPS). After staking, the borings were then surveyed in the field by Dyer, Riddle, Mills & Precourt, Inc. (DRMP), utilizing an RTK GPS referenced to previously set control points in the local area.

Upon completion and after groundwater measurements were taken, all borings were backfilled for safety. The approximate boring locations are presented on **Figure 2** in **Appendix A**. The results of the boring program in the form of soil profiles are shown on **Sheets 1** and **2** in **Appendix B**.

Power Auger Borings

A Machine Auger was utilized for auger borings to a depth of 20 feet below the existing grade. The borings were performed by advancing a 4 inch diameter continuous flight auger slowly into the ground in a "corkscrew" fashion in 5 foot increments. Additional flights are added until the desired termination depth was achieved. These borings were performed in general accordance with the American Society for Testing of Materials (ASTM) test designation D-1452. The flight auger was then retrieved and representative samples were obtained. The soil samples were

visually classified in the field and placed in air-tight jars for transportation to our laboratory for further classification and testing. After groundwater level measurement, the borings were backfilled for safety.

Standard Penetration Test Borings

The Standard Penetration Test (SPT) borings were performed at locations where structures are proposed for the roadway improvement. The borings were drilled in general accordance with ASTM test designation D-1586. Soil sampling using a 1⅜-inch inside diameter (I.D.) split-barrel sampler was performed at closely spaced intervals from the ground surface to 10 feet below existing grade and at 5 foot intervals thereafter. After seating the sampler 6 inches, the number of successive blows required to drive the sampler 12 inches into the soil constitutes the test result commonly referred to as the "N" value. The "N" value has been empirically correlated with various soil properties and is considered indicative of the relative density of non-cohesive soils and the consistency of cohesive soils. The recovered split-barrel samples were described in the field with representative portions of the samples placed in airtight jars and transported to our laboratory for further visual classification and testing by a geotechnical engineer. Following completion, the SPT borings were grouted for safety.

Field Permeability Tests

In-situ falling head permeability tests were performed by **NES** personnel at selected pond locations (Borings AB-1, AB-7 and AB-10). The field permeability tests were performed by placing a 3 inch diameter casing into an augered hole to the desired depth and washing the soils out of the casing with water. The casing was backfilled with silica quartz sand to about 12 inches above the bottom of the casing. The casing was then raised to an average distance of about 12 inches.

Falling head permeability was performed by adding water to the casing to achieve a stable water level. When the water level is stabilized, the water source was removed and the drop in water level in the casing with respect to time was recorded. This relationship was used to calculate the permeability of the soil. The results of the falling head permeability tests are included in the Field Permeability Results section of this Report and on **Sheet 2** in **Appendix B**.

LABORATORY TESING

Laboratory classification tests consisting of sieve analysis, Atterberg limits, natural moisture content, corrosion series and organic content were performed on selected soil samples. The results of these tests are presented on **Tables 2** and **3** in **Appendix C**. The results of environmental corrosion series tests are shown on **Table 4** in **Appendix C**. The types of tests performed with their associated test designations are presented on the following page in **Table 5**.

Table 5: Laboratory Testing Performed

Test Type	Testing Designation	
	FDOT	ASTM
Grain Size Analysis	FM 1-T088	D-422
Atterberg Limits	FM 1-T089/FM 1-T090	D-4318
Natural Moisture Content	FM 1-T265	D-2216
Corrosion Series	FM 5-550/FM 5-551/FM 5-552/FM 5-553	G-162
Organic Content	FM 1-T267	D-2974

GENERALIZED SUBSURFACE SOIL CONDITIONS

Stratification of the explored soil/rock was based upon observation… Stratification lines represent approximate boundaries between soil types…actual transition between layers may be…

Stratification of the explored soil was based upon observation of the recovered samples and interpretation of the field boring logs. Stratification lines represent approximate boundaries between soil types of significantly different engineering properties; however, the actual transition between layers may be gradual. The boring logs indicate subsurface conditions only at the specific boring location at the time of our field exploration.

Structures Borings

Boring TB-1 was completed for the Arch Bridge. TB-1 encountered fine sand followed by clayey sand and fine sand with varying amounts of fines to boring termination depth of 120 feet. A five-foot thick layer of clay was encountered between depths of 29 and 34 feet and between 114 and 119 feet. In general, the boring revealed loose to dense sandy soils from the ground surface to boring termination depth.

Boring TB-2 was completed for the Box Culvert. The boring generally consisted of fine sand, clayey sand, fine sand with shell and clay with shell fragments. The sandy soils are generally loose to medium dense form the ground surface to the boring termination depth.

For specific details concerning subsurface conditions and materials encountered at each test location, please refer to the Report of SPT Borings located on **Sheet 1** in **Appendix B** of this report.

Drilling fluid losses were not encountered in the borings drilled for this study.

Pond and Canal Borings

The soil conditions encountered in the pond and canal borings are shown on **Sheet 2** in **Appendix B**. The soil survey encountered three (3) generalized strata within the survey limits to the maximum depths explored in the borings. Descriptions and stratum numbers shown on our boring logs are summarized in **Table 6** on the following page.

Table 6: Soil Stratigraphy

Stratum	Soil Description	AASHTO Classification	FDOT Index 505 Classification
1	Brown to gray fine SAND with shell fragments	A-1	Select (S)
2	Dark brown to orangish brown clayey SAND, occasional organics	A-2-6	Plastic (P)
3	Brown to gray fine SAND to fine SAND, occasional clay/silt and shell fragments	A-3	Select (S)

Groundwater levels

Groundwater was encountered at depths ranging from 6 to 8 feet below the existing grade in the borings performed at the site. Depths to estimated seasonal high groundwater depths are presented in the Report of SPT Borings and Report of Pond/Canal Auger Borings on **Sheets 1** and **2** in **Appendix B**. Groundwater levels can vary seasonally and with changes in subsurface conditions between boring locations. Alterations in subsurface and/or subsurface drainage pattern brought about by site development, surface water runoff and/or other specific factors can also affect groundwater levels.

For the purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season of a "normal rainfall" year under current site conditions. A "normal rainfall" year is defined as a year in which rainfall quantity and distribution were at or near historical rainfall averages.

Field Permeability Results

Field permeability tests were performed at pond site alternate borings AB-1, AB-7 and AB-10. Estimated coefficient of horizontal permeability (K_h) results for the representative samples are presented on **Table 7** below.

Table 7: Field Permeability Test Results

Boring No.	Permeability Test Depth (ft)	Encountered GWT[A] (ft)	ESHGWT[B] (ft)	Horizontal Permeability (K_h)(ft/day)	Fillable Porosity (%)	Base of Aquifer (ft)
AB-1	5	6	3	1.3	25	20
AB-7	5	7	5	1.1	30	20
AB-10	5	8	5	4.5	30	20

A: Groundwater table, B: Estimated seasonal high groundwater table

RECOMMENDATIONS

General

The preliminary analyses and recommendations within this report are based in part on the data obtained from a limited number of soil samples and groundwater measurements 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. If variations from the conditions described in this report do become evident during construction, or if project characteristics described in this report change, **NES** should be retained so that the report's conclusions and recommendations can be re-evaluated in light of such changes.

Stormwater Ponds

Generally, the soils (A-1, A-3) classified as Select (S), encountered at the proposed stormwater pond locations are suitable for construction of stormwater ponds and use as embankment fill because they drain freely. The A-2-6 soil encountered is classified as Plastic (P) soil. This soil may be placed above the existing water level at the time of construction to within four (4) feet of the proposed base.

All soils encountered from the pond sites should be utilized in accordance with Index 505 of the FDOT Design Standards.

Canals

The canal borings (AB-6 and AB-8) revealed brown to gray fine sand with shell fragments (A-1) to brown to gray fine sand, occasional clay/silt and shell fragments (A-3). These soils are classified as Select (S) materials and generally have fine contents of less than 10 percent. They are highly desirable for use as fill because they drain freely.

All soils encountered from the canal sites should be utilized in accordance with Index 505 of the FDOT Design Standards.

Box Culvert

Based on the result of a limited soil exploration, it is our opinion that the soil encountered (SPT TB-2) at the location of the box culvert is generally suitable for construction after normal clearing, grubbing and compaction. The subsoil should be prepared in accordance with the following provisions of the FDOT Standard Specifications for Road and Bridge Construction Sections 125, 410 and 455. The following soil parameters are provided on **Table 8** below for box culvert analysis.

Table 8: Box Culvert Geotechnical Information

Boring No.	Location[A]		Material Type	Environmental Classification		Moist Density (pcf)	Saturated Denisty (pcf)	Subgrade Modulus (K)(pci) (moist)	Subgrade Modulus (K)(pci) (saturated)	Allowable Bearing Capacity[B] (psf)	Friction Angle (degrees)
	Northing	Easting		Steel	Concrete						
TB-2	1368873.073	752719.539	Soil	SA	SA	110	120	55	28	3600	30

[A]NAD83(90) State Plane-Florida East Zone, [B]Factor of Safety = 2.5, SA = Slightly Aggressive

Arch Bridge

Based on the results of the field exploration, several driven pile foundation types were considered. The foundation types include:

1. Pre-stressed square concrete piles (18 and 24 inch)

2. Open-end steel pipe piles (18 and 20 inch)

3. Closed-end steel pipe piles (14 inch)

The foundation alternatives were evaluated using the software program FB-Deep developed by the Bridge Software Institute (BSI). Estimated pile capacity versus pile tip depth for each foundation type is included on **Plates 1** through **5** in **Appendix C**. Once preliminary design loads become available **NES** will further evaluate the foundation alternatives.

REPORT LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. We are not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of the exploration was intended to evaluate soil and groundwater conditions within the influence of shallow spread foundations, which does not include evaluations of deep potential soil problems such as sinkholes. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated and does

not reflect any variations which may occur among these borings. If any variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had the opportunity to observe the characteristics of the conditions encountered. The applicability of the report should be reviewed in the event significant changes occur in the design, nature or location of the proposed structures.

The scope of services of this project, included herein, did not include any environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, and groundwater, air on the site, below and around the site. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items and conditions are strictly for the information of the client.

APPENDIX A

REFERENCE: ArcGIS Street Map

PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS	S25-27 & 34-36, T27S, R36E	MELBOURNE WEST, FLA.	1949	1988
ENDS	S30-31, T27S, R37E	MELBOURNE WEST, FLA.	1949	1988

NES Civil Geotechnical Environmental Consulting Engineering

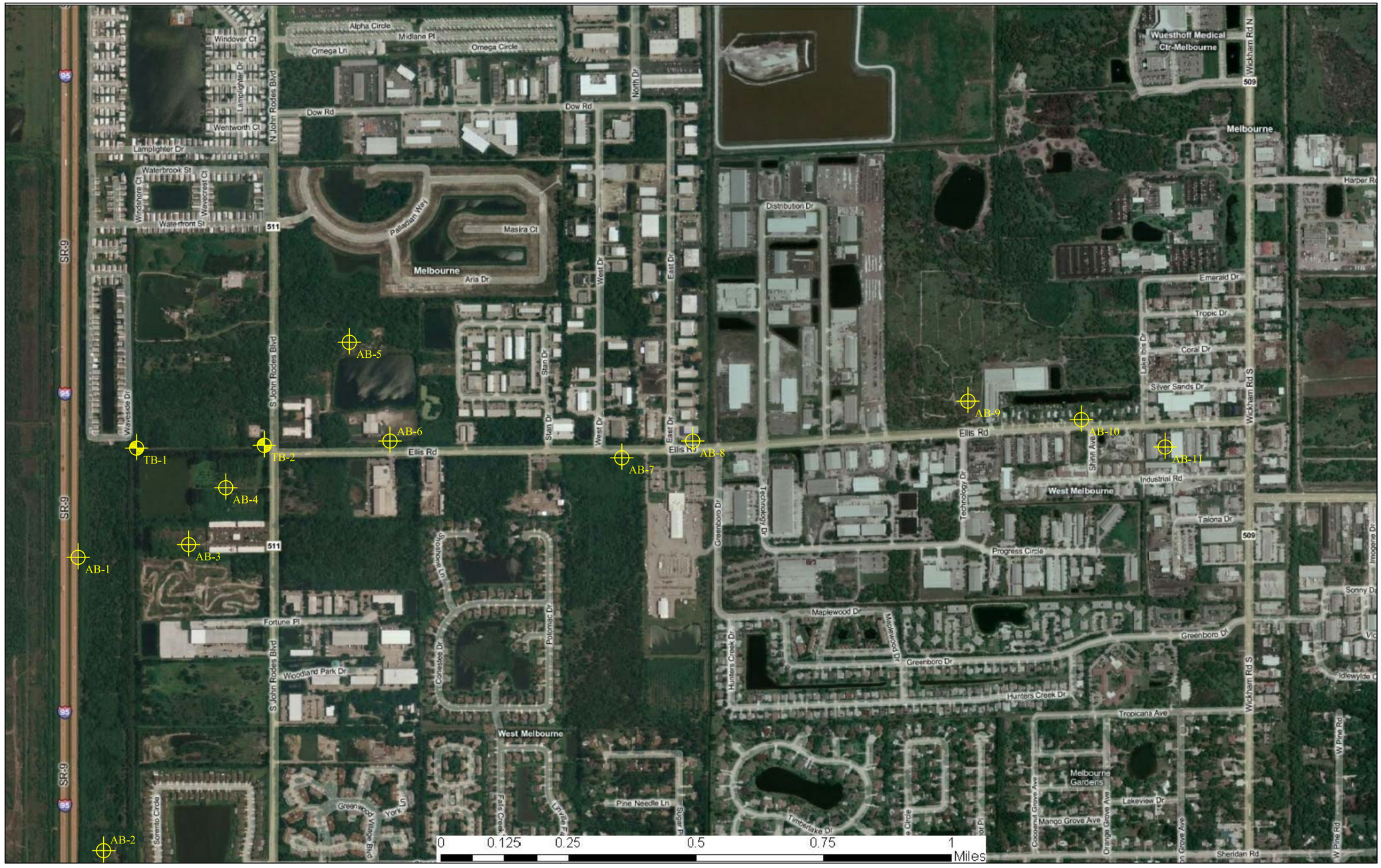
SCALE: AS NOTED
DATE: 04-12-2011
DRAWN: JMN

FLORIDA DEPARTMENT OF TRANSPORTATION-DISTRICT 5

PROJECT NAME:
PROJECT LOCATION MAP
I-95 INTERCHANGE @ ELLIS ROAD
PD&E STUDY

NES PROJECT NO.
R10012

COUNTY	FPID NO.	FIGURE 1
BREVARD	426905-1-22-01	



LEGEND:

TB-1 **SPT Boring Location**

AB-1 **Auger Boring Location**

REFERENCE: Bing Aerial Maps

LOCATION			U.S.G.S QUADRANGLE MAP	ISSUED	PHOTO REVISED
SECTION	TOWNSHIP	RANGE			
11, 12, 13, 14	16 SOUTH	18 EAST	DUNNELLON, FLA	1991	

SCALE: AS NOTED

DATE: 05-06-11

DRAWN: JMN

CHECKED: GNN

NES *Civil Geotechnical Environmental Consulting Engineering*

FLORIDA DEPARTMENT OF TRANSPORTATION-DISTRICT 5

AERIAL MAP

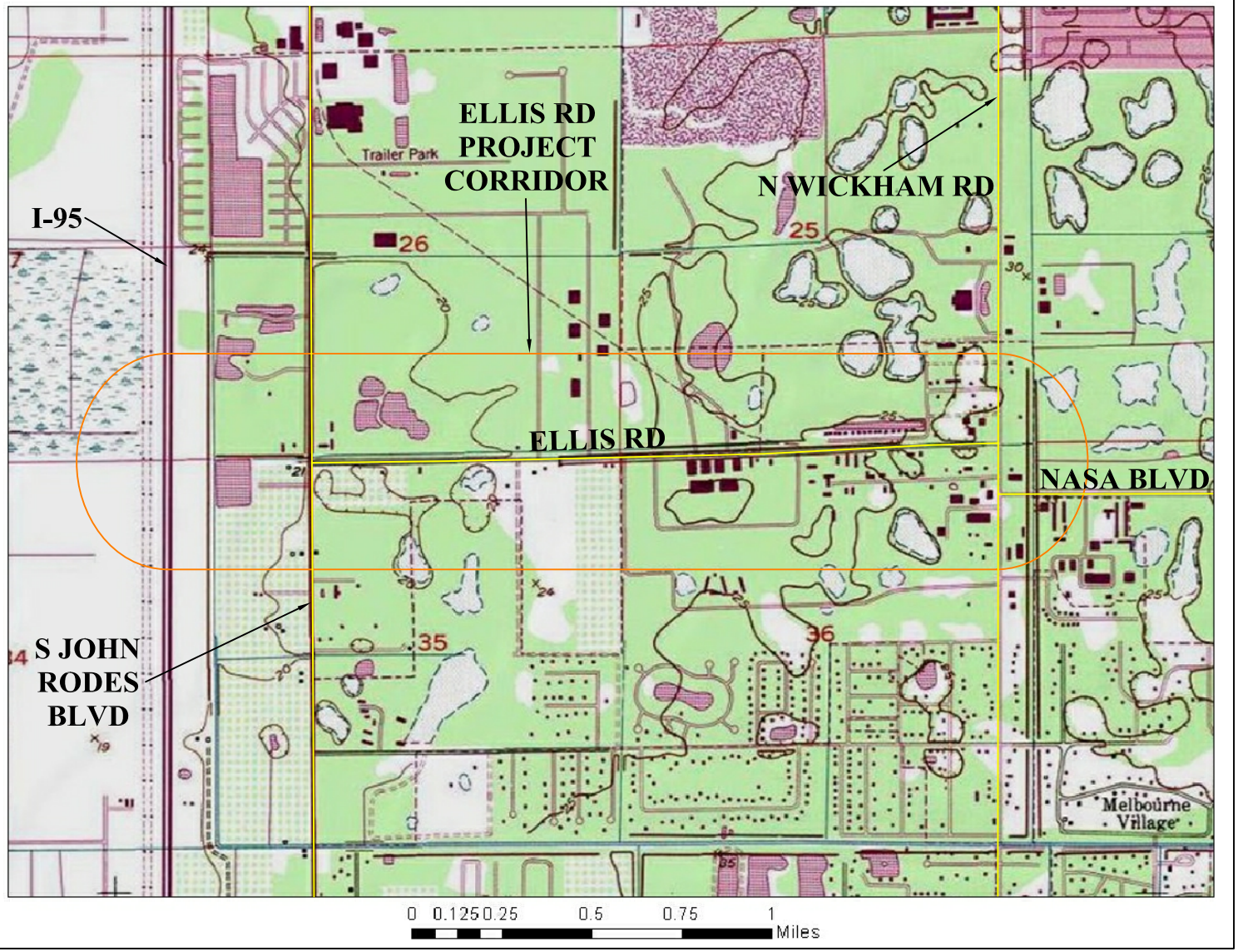
PROJECT NAME:

I-95 INTERCHANGE @ ELLIS ROAD PD&E STUDY

FPID NO. 238648-1-22-01/ 02

NES PROJECT NO. R10012

FIGURE: 2



REFERENCE: United States Geological Survey (USGS)

PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS	S25-27 & 34-36, T27S, R36E	MELBOURNE WEST, FLA.	1949	1988
ENDS	S30-31, T27S, R37E	MELBOURNE WEST, FLA.	1949	1988

NES *Civil Geotechnical Environmental Consulting Engineering*

SCALE: AS NOTED
DATE: 04-12-2011
DRAWN: JMN

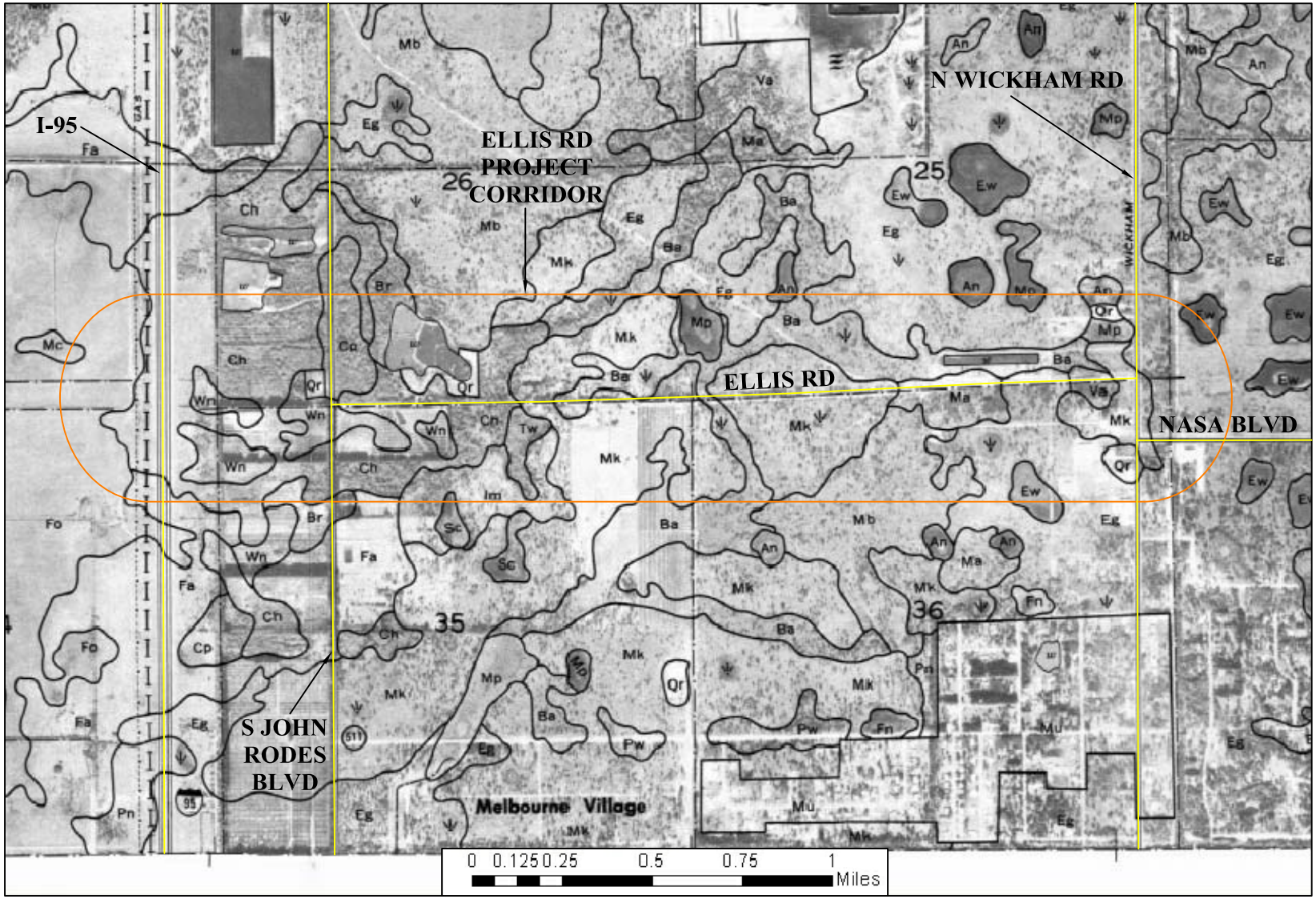
FLORIDA DEPARTMENT OF TRANSPORTATION-DISTRICT 5

PROJECT NAME:
TOPOGPAPHIC MAP
I-95 INTERCHANGE @ ELLIS ROAD
PD&E STUDY

NES PROJECT NO.
R10012

COUNTY	FPID NO.
BREVARD	426905-1-22-01

FIGURE 3



REFERENCE: United States Department of Agriculture (USDA) Soil Conservation Service (SCS)

LEGEND:

Ba	Basinger	Eg	Eau Gallie	Ma	Malabar	Tw	Tomoka
Cp	Copeland	Fa	Felda	Mk	Myakka	Va	Valkaria
Ch	Chobee	Fo	Floridina, Chobee & Felda Soil	Qr	Quartzipsamments, smoothed		

PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS	S25-27 & 34-36, T27S, R36E	MELBOURNE WEST, FLA.	1949	1988
ENDS	S30-31, T27S, R37E	MELBOURNE WEST, FLA.	1949	1988

NES Civil Geotechnical Environmental Consulting Engineering

SCALE: AS NOTED
DATE: 04-12-2011
DRAWN: JMN

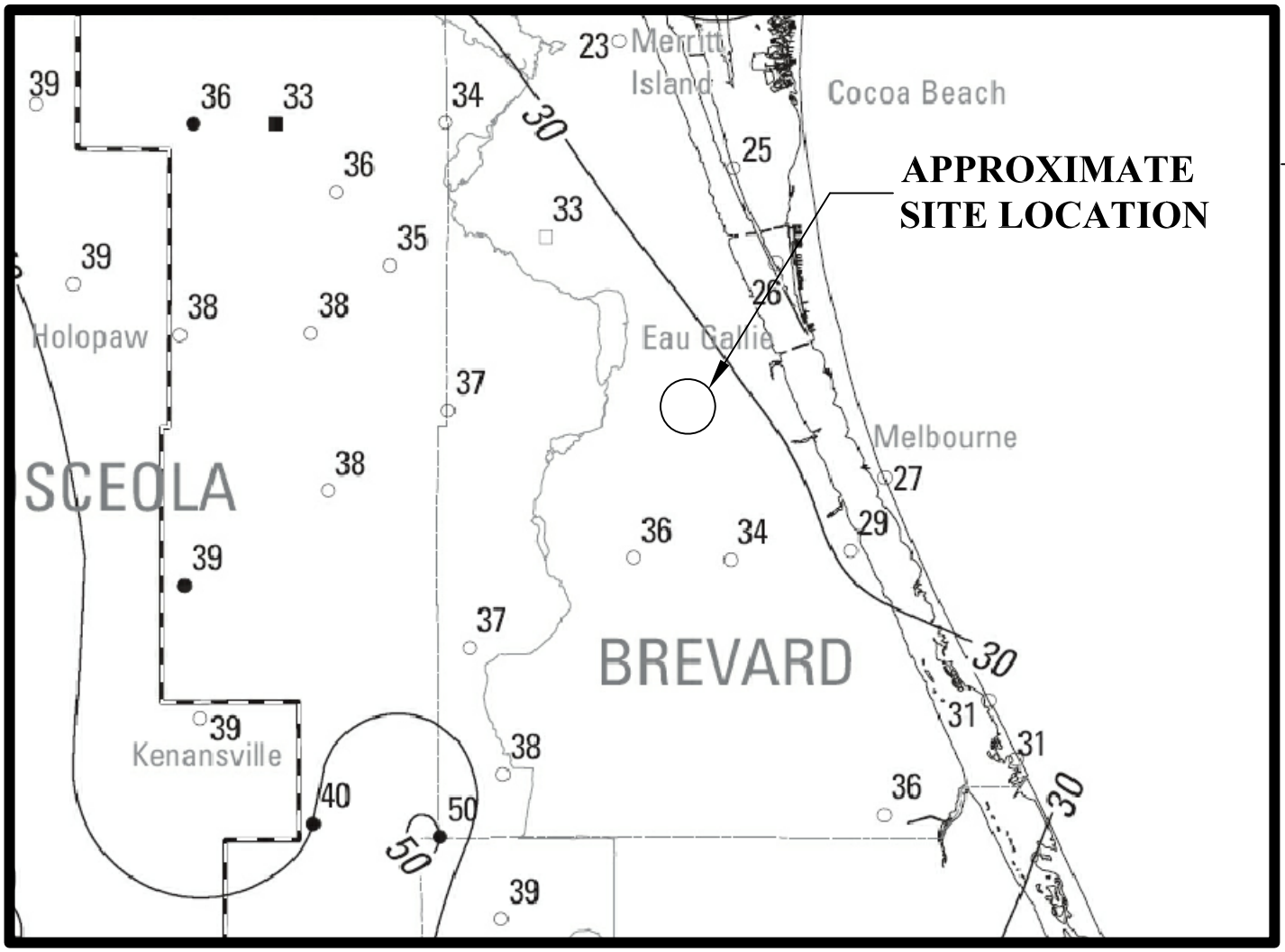
FLORIDA DEPARTMENT OF TRANSPORTATION-DISTRICT 5

PROJECT NAME:
SOILS MAP
I-95 INTERCHANGE @ ELLIS ROAD
PD&E STUDY

NES PROJECT NO.
R10012

COUNTY	FPID NO.
BREVARD	426905-1-22-01

FIGURE 4



FLORDIA DEPARTMENT OF
TRANSPORTATION-DISTRICT 5

REFERENCE: "Potentiometric Surface of the Upper Floridan Aquifer in the St. Johns River Water Management District and Vicinity, Florida, 2009," published by the United States Geological Survey (USGS).

QUAD: MELBOURNE WEST, FLORIDA (issued 1949)

SECTION: 25, 26, 27, 34, 35, 36 & 30, 31

TOWNSHIP: 27 SOUTH

RANGE: 36 & 37 EAST

LEGEND

— 40 — POTENTIOMETRIC CONTOUR-Shows altitude at which water level would have stood in tightly cased wells. Contour interval is 10 feet.

Note: Elevations shown on map are in feet, NGVD-29

POTENTIOMETRIC SURFACE MAP

I-95 INTERCHANGE @ ELLIS ROAD
PD&E STUDY
BREVARD COUNTY, FLORIDA

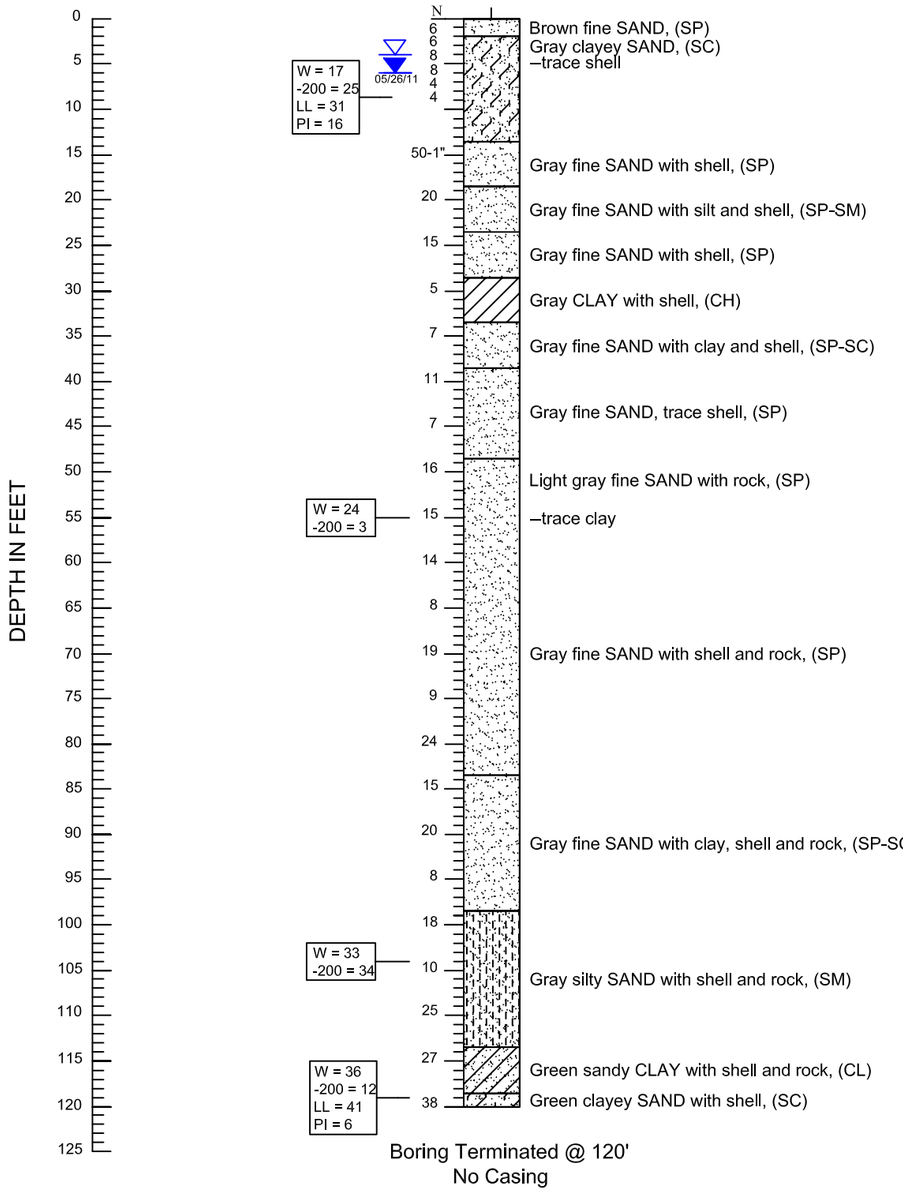
NES *Civil Geotechnical Environmental Consulting Engineering*

DRAWN: JMN	SCALE: NTS	PROJECT NO. R10012
CHKD: GNN	DATE: 06-03-11	FIGURE 5

APPENDIX B

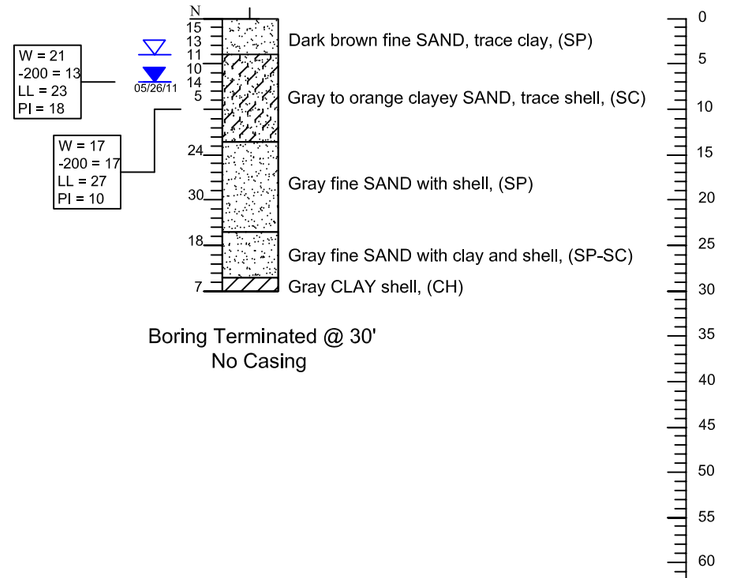
Sheet 1 — Report of SPT Borings
Sheet 2 — Report of Pond/Canal Auger Borings

Boring No.: TB-1
Northing*: 1368836.268
Easting*: 751581.176
Elevation (NAVD-88): 17.32'
Date Drilled: 05/26/2011
*NAD83(90) State Plane, Florida East Zone



Boring Terminated @ 120'
No Casing

Boring No.: TB-2
Northing*: 1368873.073
Easting*: 752719.539
Elevation (NAVD-88): 15.97'
Date Drilled: 05/26/2011
*NAD83(90) State Plane, Florida East Zone



Boring Terminated @ 30'
No Casing

LEGEND

SANDY CLAY | SAND | SILTY SAND
CLAY | CLAYEY SAND

(SP) Unified soil classification group symbol
05/26/11 Groundwater level on date shown
Estimated seasonal high groundwater level

W = Natural moisture content (%) (FM 1-T 265)
-200 = Percent passing no. 200 U.S. standard sieve (%)(FM 1-T 088)
LL = Liquid Limit (%) (FM 1-T 089)
PI = Plasticity Index (%) (FM 1-T 090)

N Standard penetration resistance in blows per foot

Standard Penetration Test Data

Spoon Inside Diameter	1 3/8 in.
Spoon Outside Diameter	2 in.
ASTM Standard Drop Safety Hammer (Rope-Cathead)	
Average Hammer Drop	30 in.
Hammer Weight	140 lbs.

NOTES

1. Plan view is preliminary for showing boring locations only and may not be indicative of final plans.
2. Subsurface variations between borings should be anticipated as indicated in Section 2-4 of the Standard Specifications.
3. Borings were located by NES based on existing landmarks.

GRANULAR MATERIALS

RELATIVE DENSITY	SPT (BLOWS/FT.)
Very loose	Less than 4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Greater than 50

SILTS AND CLAYS

CONSISTENCY	SPT (BLOWS/FT.)
Very soft	Less than 2
Soft	2-4
Firm	4-8
Stiff	8-15
Very Stiff	15-30
Hard	Greater than 30

ENVIRONMENTAL CLASSIFICATION

	Substructure	Superstructure
Concrete:	Slightly Aggressive	Slightly Aggressive
Steel:	Slightly Aggressive	Slightly Aggressive

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
Drawn by:	JMN	05-31-11
Checked by:	GNN	06-01-11
Designed by:	N/A	N/A
Checked by:	N/A	N/A
Approved by:	GNN	

ENGINEER OF RECORD:
NES
NADIC ENGINEERING SERVICES, INC.
601 N. HART BLVD.
ORLANDO, FL 32818
CERTIFICATE OF AUTHORIZATION NO. 00008214
DR. GODWIN N. NNADI, P.E. NO. 50637

FLORIDA DEPARTMENT OF TRANSPORTATION-DISTRICT 5

COUNTY	FPID NO.
BREVARD	426905-1-22-01

SHEET TITLE: REPORT OF SPT BORINGS
PROJECT NAME: I-95 INTERCHANGE @ ELLIS ROAD PD&E STUDY
SHEET NO.

NES SHEET 1

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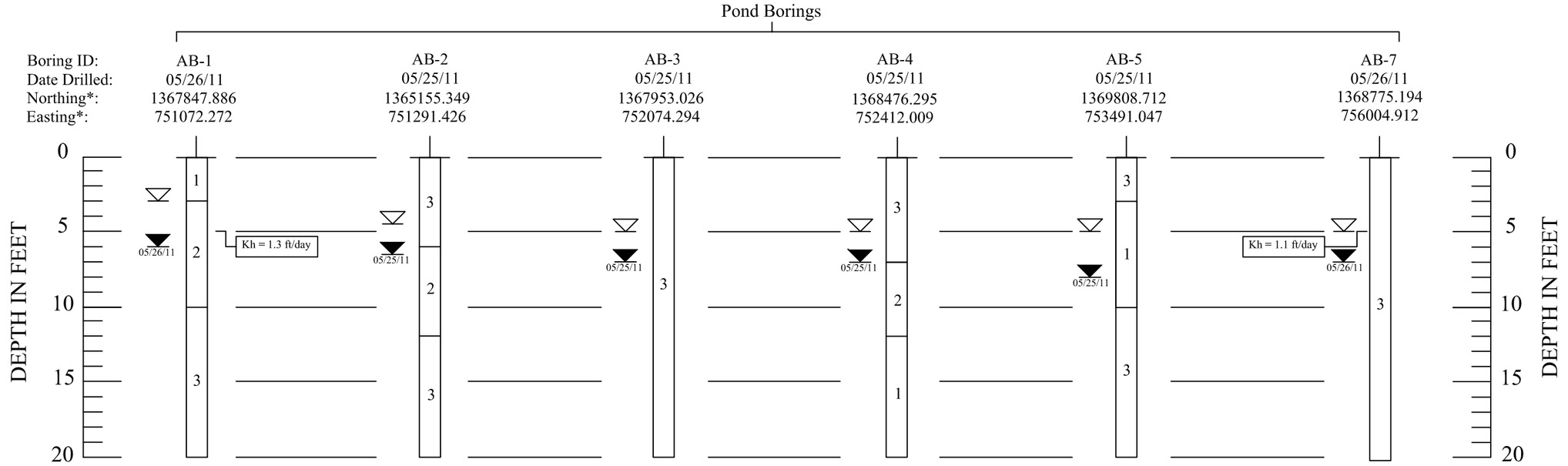
NOTICE: The official record of this plan sheet is the electronic file signed and sealed under rule 61G15-23.003, F.A.C.



*NAD83(90) State Plane, Florida East Zone

LEGEND

1 Brown to gray fine SAND with shell fragments, (A-1)

2 Dark brown to orangish brown clayey SAND, occasional organics, (A-2-6)

3 Brown to gray fine SAND to fine SAND, occasional clay/silt and shell fragments, (A-3)

(A-3) A.A.S.H.T.O. soil classification group symbol

05/25/11 Encountered groundwater level on date shown

Estimated seasonal high groundwater level

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	06-01-11
CHECKED BY:	GNN	06-01-11
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

ENGINEER OF RECORD:
NES
NADIC ENGINEERING SERVICES, INC.
601 NORTH HART BOULEVARD
ORLANDO, FLORIDA 32818
CERTIFICATE OF AUTHORIZATION NO. 00008214
DR. GODWIN N. NNADI, P.E. NO. 50637

FLORIDA DEPARTMENT OF TRANSPORTATION - DISTRICT 5

SHEET TITLE: REPORT OF POND/CANAL AUGER BORINGS

PROJECT NAME: I-95 INTERCHANGE @ ELLIS ROAD PD&E STUDY

SHEET NO.

NES PROJECT NO. R10012

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APPENDIX C

Table 2
Summary of Stormwater Pond and Canal Laboratory Test Results
I-95 Interchange @ Ellis Road; PD&E Study
NES Project No. R10012

Boring Number	Northing*	Easting*	Sample Depth (feet)	Stratum No.	Moisture Content (%)	Organic Content (%)	Sieve Analysis (Percent Passing)						Atterberg Limits (%)		AASHTO Classif.
							#10	#20	#40	#60	#100	#200	Liquid Limit	Plasticity Index	
AB-1	1367847.886	751072.272	2	1	18	--	92	75	49	26	13	2	--	--	A-1
AB-4	1368476.295	752412.009	16	1	20	--	94	74	37	16	7	3	--	--	A-1
AB-5	1369808.712	753491.047	6	1	16	--	90	71	44	22	10	3	--	--	A-1
AB-6	1368873.245	753903.633	5	1	16	--	86	67	40	19	9	3	--	--	A-1
AB-1	1367847.886	751072.272	4	2	26	5	--	--	--	--	--	--	--	--	A-2-6
AB-2	1365155.349	751291.426	1	3	1	--	100	96	66	23	6	0	--	--	A-3
AB-2	1365155.349	751291.426	4	3	9	2	--	--	--	--	--	--	--	--	A-3
AB-3	1367953.026	752074.294	4	3	13	--	98	90	52	20	7	1	--	--	A-3
AB-7	1368775.194	756004.912	7	3	14	--	100	98	82	51	16	0	--	--	A-3
AB-8	1368873.399	756650.187	5	3	12	4	--	--	--	--	--	--	--	--	A-3
AB-8	1368873.399	756650.187	9	3	19	--	100	98	81	51	13	0	--	--	A-3
AB-9	1369279.719	759170.185	5	3	5	--	99	98	83	48	18	1	--	--	A-3
AB-10	1369063.514	760175.739	2	3	7	--	98	95	72	36	14	1	--	--	A-3
AB-10	1369063.514	760175.739	8	3	19	1	--	--	--	--	--	--	--	--	A-3
AB-11	1368877.496	760955.559	4	3	17	8	--	--	--	--	--	--	--	--	A-3
AB-11	1368877.496	760955.559	11	3	18	--	94	83	62	29	11	2	--	--	A-3

*NAD83(90) State Plane, Florida East Zone

Table 3
Summary of Box Culvert and Arch Bridge Laboratory Test Results
I-95 Interchange @ Ellis Road; PD&E Study
NES Project No. R10012

Boring Number	Northing*	Easting*	Sample Depth (feet)	Stratum No.	Moisture Content (%)	Organic Content (%)	Sieve Analysis (Percent Passing)						Atterberg Limits (%)		USCS Classif.
							#10	#20	#40	#60	#100	#200	Liquid Limit	Plasticity Index	
TB-1	1368836.268	751581.176	55	1	24	--	60	45	31	13	7	3	--	--	SP
TB-1	1368836.268	751581.176	9	2	17	--	--	--	--	--	--	25	31	16	SC
TB-1	1368836.268	751581.176	119	5	36	--	--	--	--	--	--	12	41	6	SC
TB-2	1368873.073	752719.539	7	2	21	--	--	--	--	--	--	13	23	18	SC
TB-2	1368873.073	752719.539	10	4	17	--	--	--	--	--	--	17	27	10	SC
TB-1	1368836.268	751581.176	104	4	33	--	--	--	--	--	--	34	NP	NP	SM

*NAD83(90) State Plane, Florida East Zone, NP = Non-plastic

Table 4
Corrosion Series Test Results
I-95 Interchange @ Ellis Road; PD&E Study
NES Project No. R10012

Boring No.	Northing*	Easting*	Stratum	Sample Depth (feet)	pH	Resistivity (Ohm-cm)	Chlorides** (ppm)	Sulfate (ppm)	Substructure Environmental Classification	
									Steel	Concrete
TB-1	1368836.268	751581.176	3	1	7.0	9,900	U	41	Slightly Aggressive	Slightly Aggressive
TB-2	1368873.073	752719.539	3	1	7.4	5,290	18.4	120	Slightly Aggressive	Slightly Aggressive

*NAD83(90) State Plane, Florida East Zone
**U: Undetected

I-95 Interchange @ Ellis Road-PD&E Study

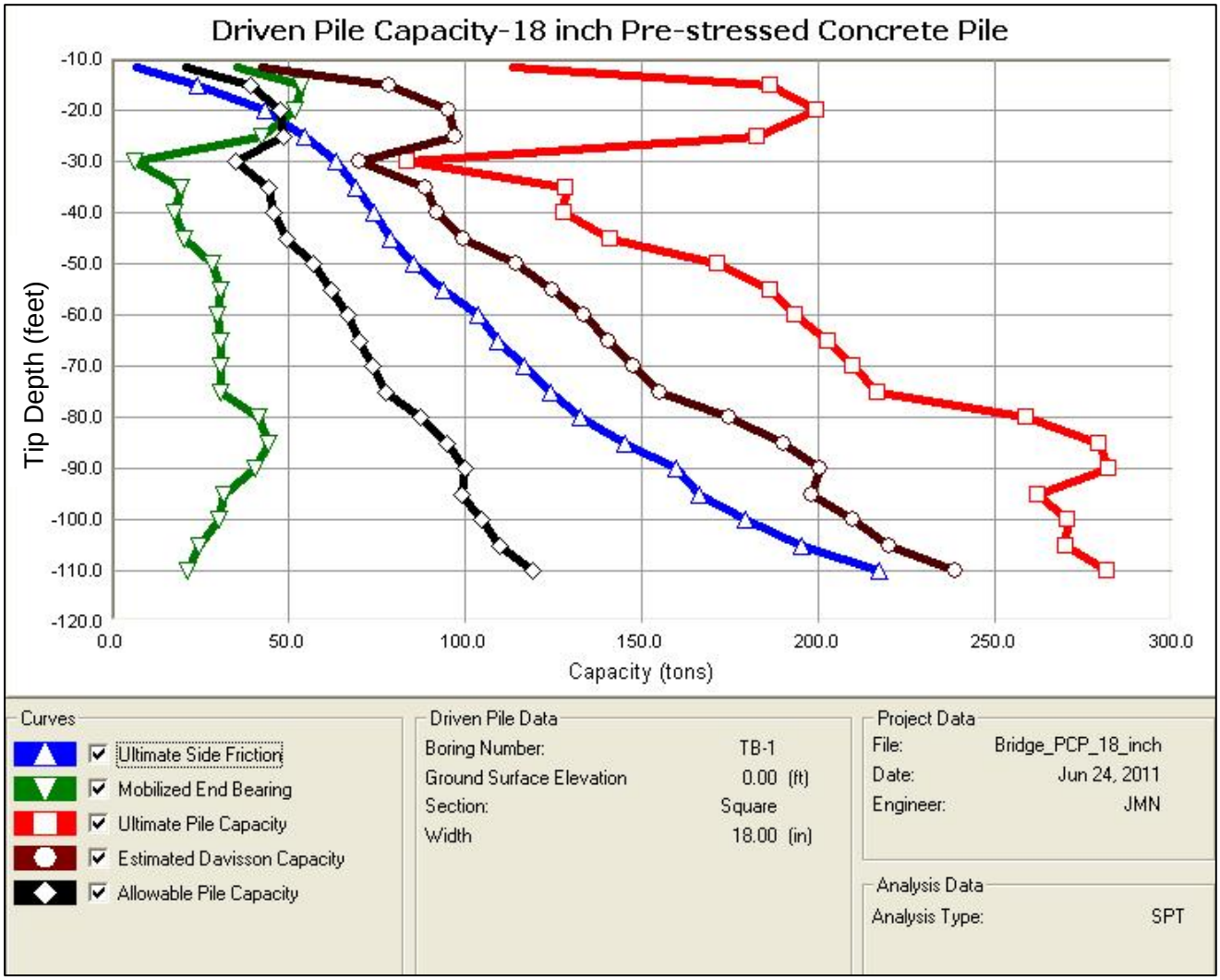

Plate 1

I-95 Interchange @ Ellis Road-PD&E Study

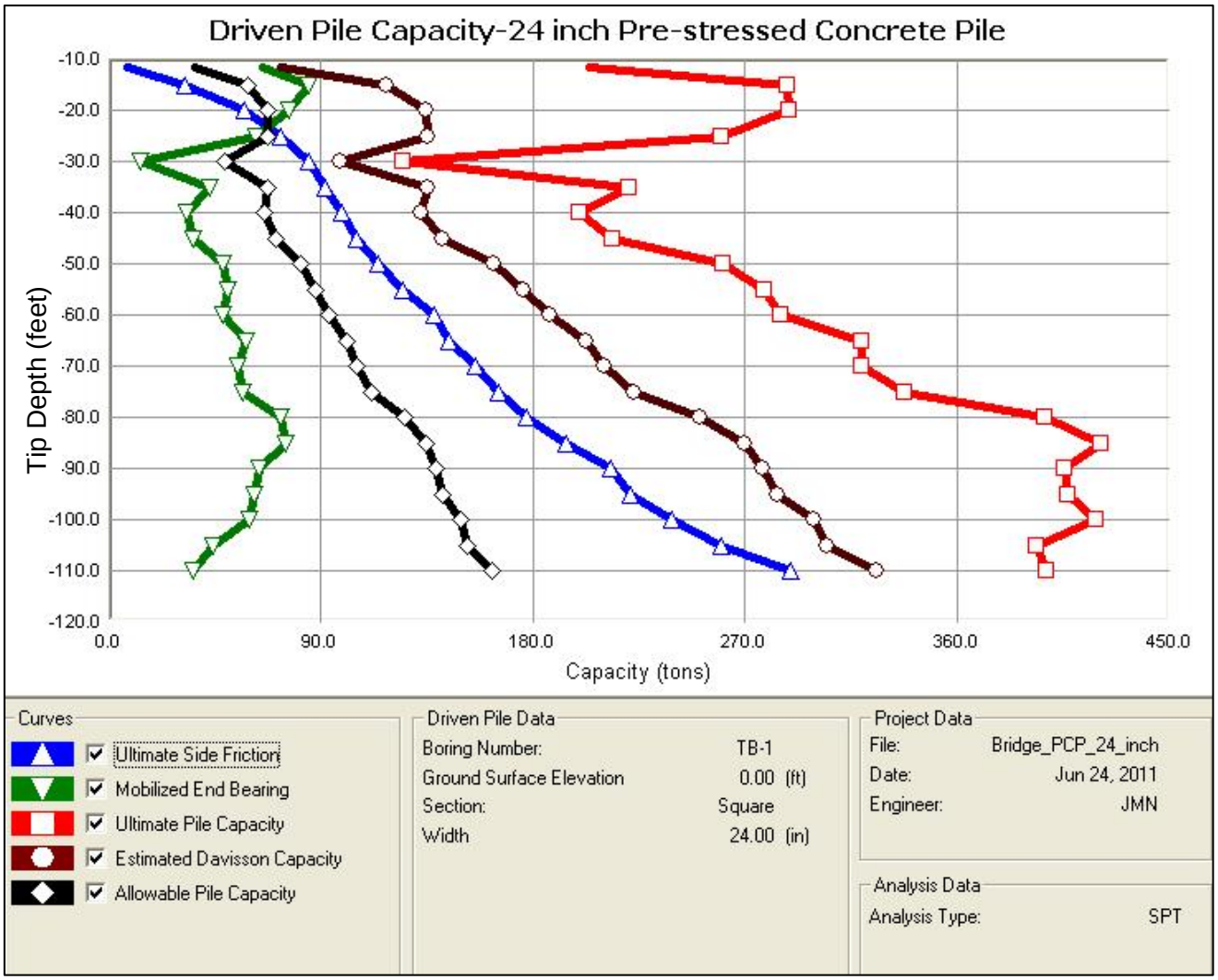

Plate 2

I-95 Interchange @ Ellis Road-PD&E Study

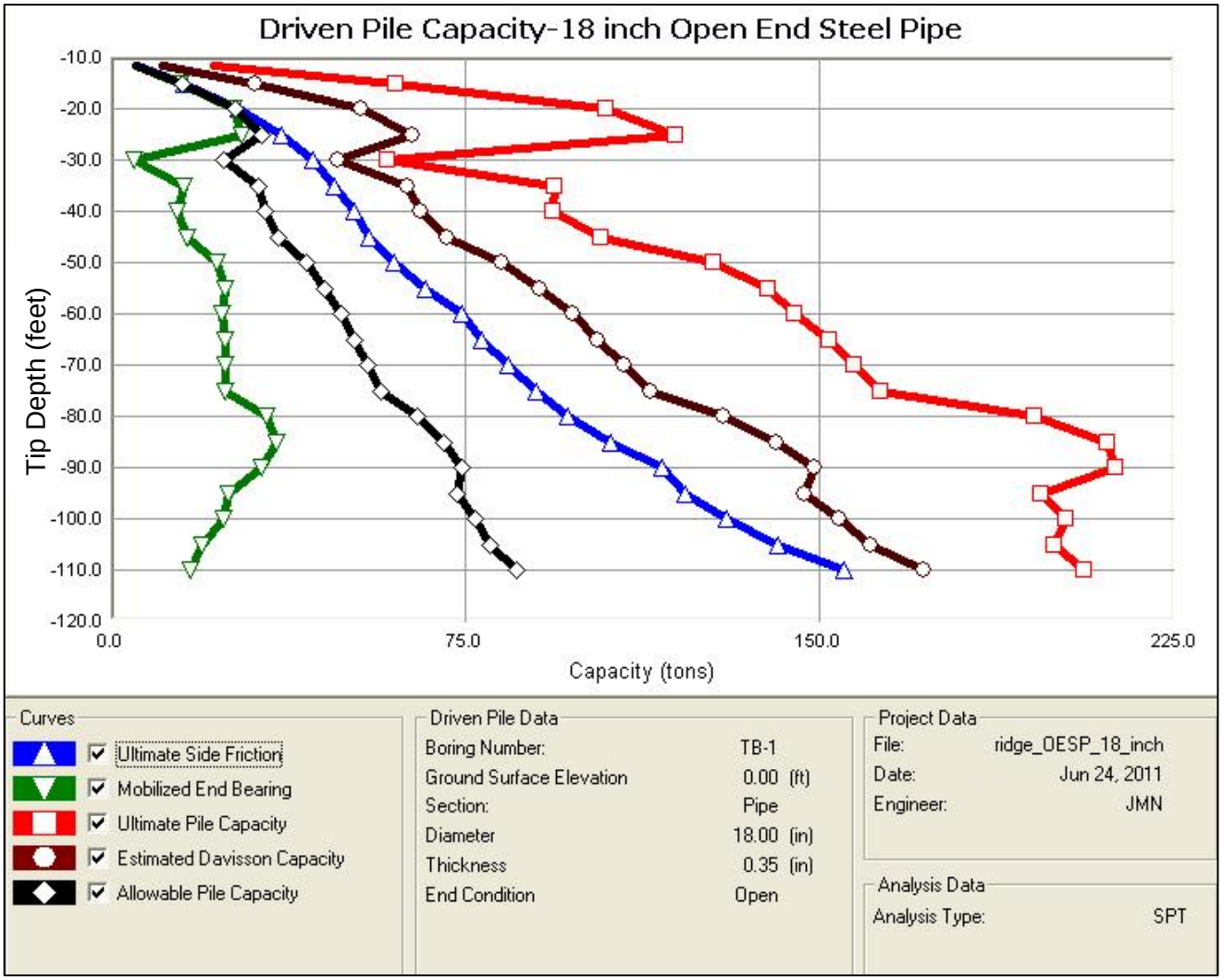

Plate 3

I-95 Interchange @ Ellis Road-PD&E Study

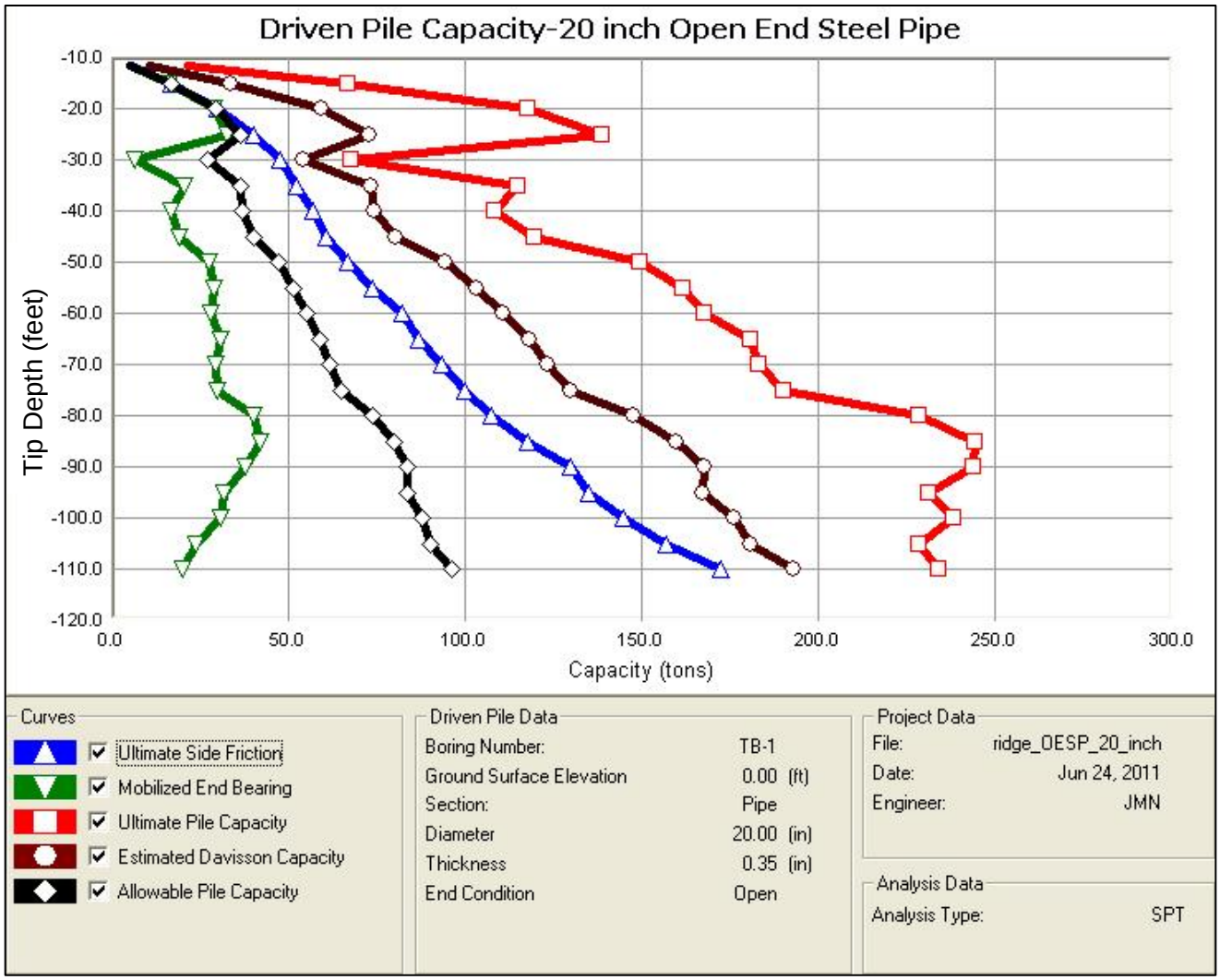

Plate 4

I-95 Interchange @ Ellis Road-PD&E Study

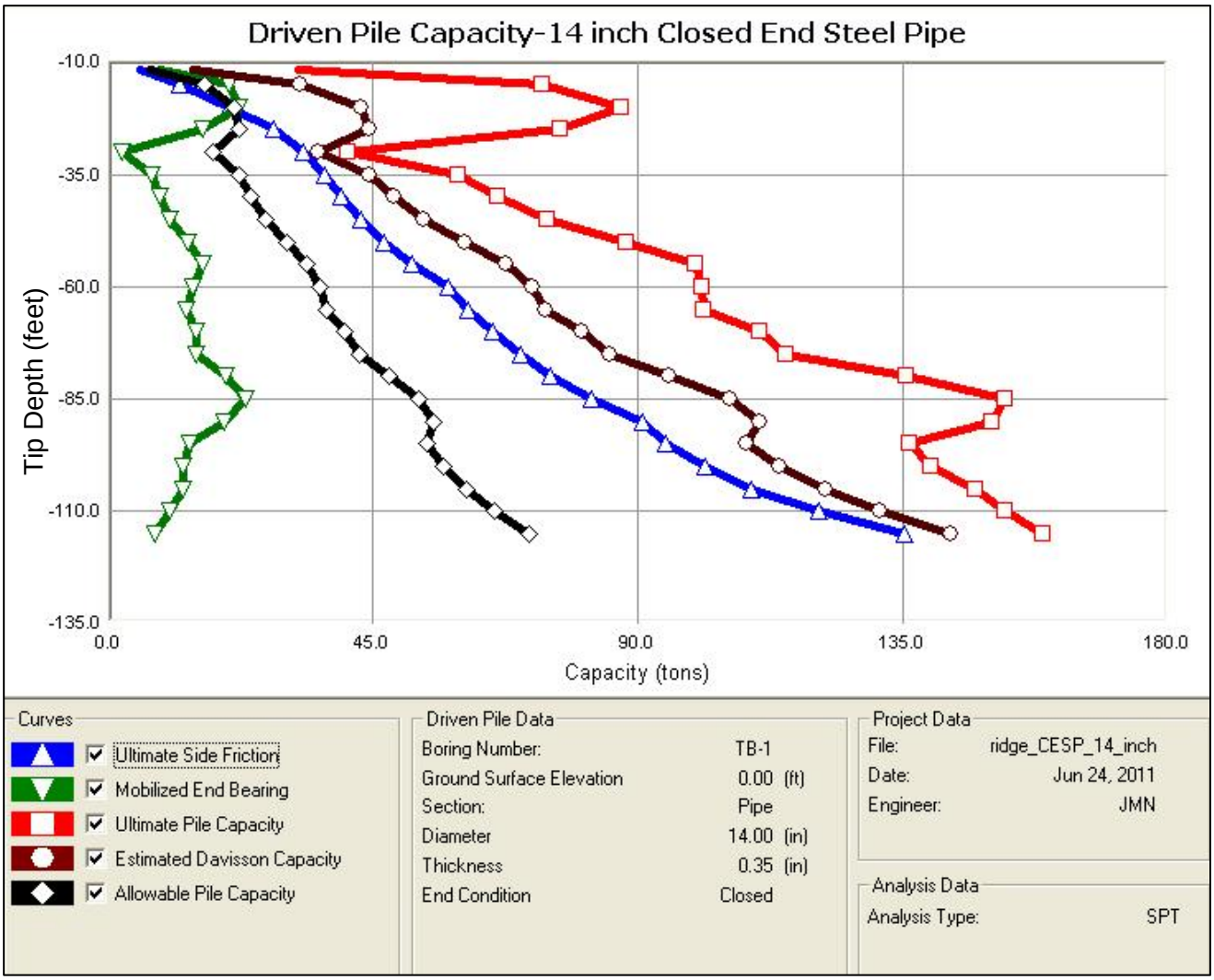

Plate 5