November 10, 2014
BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
Addendum No. 5, IFB Y15-719-SB

JOHN YOUNG COMMUNITY PARK

Revised Bid Opening Date: November 18, 2014 at 2:00 P.M.

This addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to, and shall take precedence over, the original documents. Underlining indicates additions, deletions are indicated by ~~strikethrough~~.

A. The bid opening date is changed from ~~November 13, 2014 at 2:00 P.M~~. to November 18, 2014 at 2:00 P.M.

B. Additions, Deletions and Clarifications:

1. **Question:** Is the Ditch Paving in the swale shown in the swale on sheet C201, at cross-section B3, to be concrete, fabriform, or some other material, and how thick is it supposed to be?

   Answer: Fabriform (or equal) erosion control revetment mat with min. 4-inch thickness.

2. **Question:** Please provide Exhibits A-1, A-2, A-4A, A-4B, A-6 thru A-34 of the Nodarse Geotechnical Engineering Report provided in Addendum 1. Those exhibits were missing.

   Answer: See attached revised Specification Section 02010 Geotechnical Report and Recommendations that includes all exhibits.

3. **Question:** Part H of the technical specifications Section 01010-1, Paragraph 1.03 Building\Site Security, subparagraph A- specifies that an armed security guard is to be on-site during non–work hours. Also states "This cost will be shown as a separate line item under part A of the project" . Where in part A of the project is this cost to be separated?

   Answer: In Volume II, Part H of the specifications, Section 01010, SUMMARY OF WORK delete Paragraph 1.03,BUILDING/SITE SECURITY in its entirety and replace with the following revised paragraph 1.03:

1.03 BUILDING/SITE SECURITY

A. The site shall be secured by the General Contractor from unwarranted entry at the end of each day.

B. The construction site shall be secured by means of fencing, located around the perimeter of the project site. This fencing shall be required to secure the site from unwarranted entry at the end of each day. The construction site currently has a 6' chain link & other fences around the most of the perimeter of the construction site. Modifications may be made by the contractor as needed to this existing fence in order to secure the entire project perimeter, including use of temporary fencing. Contractor shall restore such modified fencing, as required, so that is corresponds with the permanent fencing required per the documents for the completion of the project.

4. **Question**: Do all the gravel walks require GEOWEB ? there appear to be conflicting requirements, such as on sheet C201 that show section D/C201 that ***has WG 30V4 GEOWEB specified*** however on the same page there is a callout for (6" gravel road w/6" base AND 8" sub base (typ) see detail 4/C401 ***that does not have*** GEOWEB.

   Answer: Please follow the cross-section detail D/C201. All gravel roadways to have Geoweb matrix to hold in gravel. Detail 4/C401 is incorrect in that it is missing the Geoweb confinement matrix.

C. ACKNOWLEDGEMENT OF ADDENDA

a. The Bidder/Proposer shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later that the date and time for receipt of the bid or proposal.

b. **Receipt acknowledged by:**

c. All other terms and conditions of the IFB remain the same.

_____ _____

Authorized Signature Date Signed

_____

Title

_____

Name of Firm

Geotechnical Engineering Report

Deerfield/SR 417 Community Park
Orange County, Florida

September 19, 2013
PO No. C11903A026
Nodarse / Page One Project No. AK135004

Prepared for:
Orange County Capital Projects Division
Orlando, Florida

Prepared by:
Nodarse / Page One Joint Venture, LLC
Winter Park, Florida

1675 Lee Road, Winter Park, Fl 32789, (407) 740-6110, (407) 740-6112 [fax]

September 19, 2013

Orange County Capital Projects Division
400 East South Street, 5th Floor
Orlando, Florida 32801

Attn: Mr. Guysen Bohler
P: [407] 836 0044
E: guysen.bohler@occc.net

Re: Geotechnical Engineering Report
Deerfield/SR 417 Community Park
Orange County, Florida
PO No. C11903A026
Nodarse / Page One Project Number: AK135004

Dear Mr. Bohler:

Nodarse/Page One Joint Venture, LLC (Nodarse/Page One) has completed the geotechnical engineering services for the above-referenced project. This study was performed in general accordance with our proposal number PH1130366.2 dated June 6, 2013, authorized by Purchase Order C11903A026.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning geotechnical earthwork and the design and construction of pavements, stormwater management facilities, and foundations for small structures at the subject site.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Nodarse / Page One Joint Venture, LLC

SHENNA LUU McMASTER
LICENSE
No 57537
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Shenna McMaster, P.E. 9/19/13
Senior Geotechnical Engineer
Florida PE #57537

Bruce H. Woloshin

Bruce H. Woloshin, P.E.
Principal

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EXECUTIVE SUMMARY

A geotechnical investigation has been performed for the approximate 30-acre site located immediately north of State Road 417, between John Young Parkway and US Hwy 441 in Orange County, Florida. Twenty-seven (27) borings, designated as B-1 through B-29 (Borings B-9 and B-14 were not performed due to excessive standing water at the time of exploration prohibiting access to our ATV drill rig), were performed to depths between 10 and 15 feet below the existing ground surface throughout the site. This report provides geotechnical engineering recommendations regarding development of the site into a community park.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Soil conditions observed generally consisted of sands with varying amounts of silt. Clayey sands were observed in a few borings performed in the east-central and western portions of the site. Lenses of very dense sands were also observed in some locations.

- Groundwater levels found during the field exploration ranged from about 4 to 7 feet below existing grade. Standing water was observed in the central portion of the site during the field exploration (August of 2013). Seasonal high groundwater levels above existing grade to a few feet below existing grade are expected.

- The proposed structures may be supported on shallow footings bearing on the existing site soil or on newly placed engineered fill.

- Site grading should consider relatively high seasonal high groundwater conditions on the site. In addition, the presence of standing water on site following periods of heavy rainfall should be considered.

- Due to relatively high groundwater levels at the site, the use of wet bottom stormwater ponds for treatment of stormwater runoff appears most feasible at this site.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
DEERFIELD/SR 417 COMMUNITY PARK
ORANGE COUNTY, FLORIDA

Nodarse / Page One Project No. AK135004
September 19, 2013

1.0 INTRODUCTION

A geotechnical investigation has been performed for the approximate 30-acre site located immediately north of State Road 417, between John Young Parkway and US Hwy 441 in Orange County, Florida as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. A total of twenty-seven (27) borings, designated as B-1 through B-29 (Borings B-9 and B-14 were not performed due to excessive standing water at the time of exploration prohibiting access to our ATV drill rig), were performed to depths between 10 and 15 feet below the existing ground surface throughout the site. Logs of the borings along with a site location plan, geologic map and boring location plans are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- foundation design
- stormwater pond design
- pavement design

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Proposed Improvements	A conceptual site plan was provided to us. Based on this plan, we understand a driveway is planned along the entire northern portion of the site. On the eastern-most portion of the site, a skate park and possibly a concession area are planned. In the wider portion of the site (east-central portion), multi-use open fields are planned, with parking areas on the east and west side of the fields. Playgrounds, picnic pavilions, exercise course, and volleyball court are planned to the west of the multi-purpose fields. The western portion of the site will include walking paths.

2.2 Site Location and Description

Item	Description
Location	Immediately north of SR 417 in the Deerfield area of South Orange County between SR 441 and John Young Parkway
Current Ground Cover	The area is currently undeveloped with grasses and limited trees.
Existing Topography	The USGS topographic quadrangle maps "Lake Jessamine and Kissimmee, Florida" depicts the site and surrounding area as relatively flat with a ground surface elevation near +90 feet referencing the National Geodetic Vertical Datum of 1929 (NGVD29).
Surface Water	The quadrangle map indicates multiple wetland features in the vicinity of the site at ground surface elevations at or just below +85 feet NGVD29.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Survey

The Soil Survey of Orange County, Florida, as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), dated August 1989, identifies the soil type at the subject site as *Basinger fine sand, depressional (3), Pomello fine sand, 0 to 5 percent slopes (34), St. Johns fine sand (37), and Smyrna fine sand (44).* It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate (included in Appendix as Exhibit A-2). Descriptions of the mapped soil units are included in Appendix A as Exhibit A-3.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
1	10 to 15	Fine sand (SP), fine sand with silt (SP-SM), and silty fine sand (SM)[1]	Loose to medium dense[2,3]

1. Silty fine sand with clay and/or clayey fine sand (SC) was found in many borings performed in the east-central and western portions of the site.
2. Very dense sands were observed in Boring B-2, performed in the eastern portion of the site at a depth of about 6 to 8 feet below existing grade.
3. Lenses of very loose sands were observed in Borings B-4, B-18, B-22, and B-23 at depths of 4 to 10 feet below existing grade.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-5 in Appendix A. A description of our laboratory testing procedures is included as Exhibit B-1 in Appendix B.

3.3 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was observed in all of the borings, between depths of 4 to 7 feet below existing grade. Longer term monitoring in cased holes or piezometers, possibly installed to greater depths than explored under this project scope, would be required to better define groundwater conditions at the site.

Standing water in excess in a foot or so was observed in the east-central portion of the site during the field exploration (August of 2012). Borings B-9 and B-14 could not be performed due to the depth of the standing water limiting access to our ATV mounted drill rig. During our site reconnaissance in late July, much of the central portion of the site had standing water present.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the June through October wet season, with rainfall and recharge at a maximum, groundwater levels will be above existing grade to about 4 feet below existing grade throughout most of the site. Our estimates of the normal seasonal groundwater conditions are based on the USDA Soil Survey, the encountered soil types, and the encountered water levels. The estimated normal seasonal high groundwater tables are included in the following table and on the boring logs.

Boring #	Approximate depth to encountered water table (feet)	Approximate depth to estimated normal seasonal high groundwater table (feet)
B-1	6.0	4.0
B-2	5.0	4.0
B-3	6.0	4.0
B-4	5.0	4.0
B-5	5.0	4.0
B-6	6.0	4.0
B-7	5.0	4.0
B-8	5.0	4.0
B-9	Above the Ground Surface	0+
B-10	4.0	0+
B-11	0.0	0+
B-12	5.0	3.0
B-13	4.0	3.0
B-14	Above the Ground Surface	0+
B-15	4.0	3.0
B-16	4.0	3.0
B-17	5.0	4.0
B-18	6.0	4.0
B-19	6.0	4.0
B-20	5.0	4.0
B-21	5.0	4.0
B-22	7.0	4.0
B-23	4.0	3.0
B-24	4.0	3.0

Boring #	Approximate depth to encountered water table (feet)	Approximate depth to estimated normal seasonal high groundwater table (feet)
B-25	4.0	3.0
B-26	4.0	3.0
B-27	5.0	4.0
B-28	5.0	4.0
B-29	4.0	3.0

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Based on the information available to date, it is our opinion that the site is suitable for supporting small structures on shallow spread footings if the recommended site preparation procedures are implemented at the site. Normal site preparation and conventional shallow foundation systems are appropriate for support of structures and pavements.

The cleaner sands observed (SP, SP-SM) are generally suitable for reuse as structural fill. Due to the higher fines (silt) content in the silty sands (SM), extended drying times and greater moisture control may be necessary when reusing these excavated soils as new fill. Also, due to their higher fines content, these soils have lower permeability and should not be used where drainage is a concern, i.e. in the vicinity of stormwater management systems, beneath concrete pavements, beneath floor slabs, etc.

We anticipate stabilizing material or off-site borrow fill may be necessary for the construction of stabilized pavement subbase/subgrade courses where asphalt sections are used. Based on the relatively shallow groundwater levels, we anticipate up to a few feet of fill may be added to portions of the site.

Potential limitations to be considered during stormwater management design are the relatively shallow groundwater levels and the relatively shallow semi-confining soils (silty and clayey sands) over many areas of the site.

Our geotechnical recommendations regarding design and construction of foundations, pavements, and stormwater management are provided in the following sections.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation, topsoil, and any otherwise unsuitable material should be removed from the construction areas. Wet or dry material should either be removed or moisture conditioned and re-compacted. After stripping and grubbing and achieving cut grades, the exposed surface should be proofrolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with appropriate heavy equipment to obtain a minimum compaction as defined in Section 4.2.3. Unstable soil (pumping) should be removed or moisture conditioned and compacted in place prior to placing fill.

Where fill is placed on existing slopes, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face. Slopes should be provided with appropriate erosion protection.

4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
General [1]	SP (fines content < 5%)	All locations and elevations	12[3]
	SP-SM (fines content between 5 and 12%)[2]	All locations and elevations, except strict moisture control will be required during placement, particularly during the rainy season.	8 to 12[3]
Limited	SM, SC (fines content >12%)	Limited to mass fill greater than 2 feet below final grade; strict moisture control will be required during placement.	6 to 8[4]

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. If fines contents are greater than 12 percent, special design and construction procedures may be necessary.
3. Loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. Use 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is required.
4. Static equipment should be used.

4.2.3 Compaction Requirements-Mass Fill Areas

Item	Description
Minimum Compaction Requirements [1]	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
Moisture Content [2]	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
Minimum Testing Frequency	One field density test per 20,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be backfilled with native soils to avoid creating a preferred flow path through the trenches.

4.2.5 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. Site grades should be set considering the estimated seasonal high groundwater presented in Section 3.4.

4.2.6 Earthwork Construction Considerations

After initial proofrolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Nodarse/Page One should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

4.3 Foundations

In our opinion, the proposed structures (restrooms, concession building, etc.) can be supported by shallow foundation systems bearing on native soil or newly placed fill extending to native soil. Design recommendations for shallow foundations for the proposed structure are presented in the following sections.

4.3.1 Foundation Design Recommendations

Description	Column Footing	Wall Footing	Monolithic Slab Foundation [4]
Net Allowable Bearing Pressure [1]	2,000 psf	2,000 psf	2,000 psf
Minimum Width	30 inches	18 inches	12 inches
Minimum Embedment Below Finished Grade [2]	18 inches	18 inches	12 inches
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density for a depth of 12 inches below footing.		
Minimum Testing Frequency	One field density test per footing for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.
Approximate Total Settlement [3]	<1 inch	<1 inch	<1 inch
Estimated Differential Settlement [3]	<¾ inch between columns	<¾ inch over 40 feet	<¾ inch over 40 feet

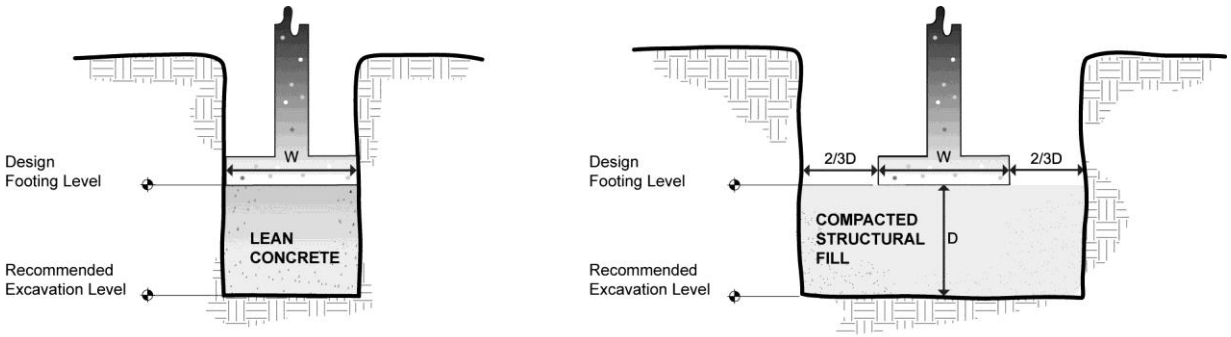
1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 5 feet for column footings and 1.5 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see Section 4.5.1.

4.3.2 Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil and debris prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed or moisture conditioned and re-compacted prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with granular material placed in lifts of 6 inches or less in loose thickness and compacted to at least 95 percent of the material's modified effort maximum dry density (ASTM D-1557). The overexcavation and backfill procedures are described in the figures below. Compaction tests should be performed at a frequency of 1 test per footing per 1-foot lift for square footings, and 1 test per 50 linear feet per 1-foot lift for wall or continuous footings.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed prior to placing concrete. It is recommended that Nodarse/Page One be retained to observe and test the soil foundation bearing materials.



Lean Concrete Backfill **Overexcavation / Backfill**

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.4 Floor Slabs

4.4.1 Floor Slab Design Recommendations

Item	Description
Floor Slab Support	Free draining granular material meeting the general fill specification [1]
Modulus of Subgrade Reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density
Minimum Testing Frequency	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches. [2]

1. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
2. Density should be re-checked after utility construction.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI and Florida Building Code (FBC) regarding moisture and radon for procedures and cautions regarding the use and placement of a vapor retarder. We note that FBC requires a minimum of 6-mil polyethylene, which is typically used in Florida. However, local requirements that might affect what moisture barrier may use should also be consulted.

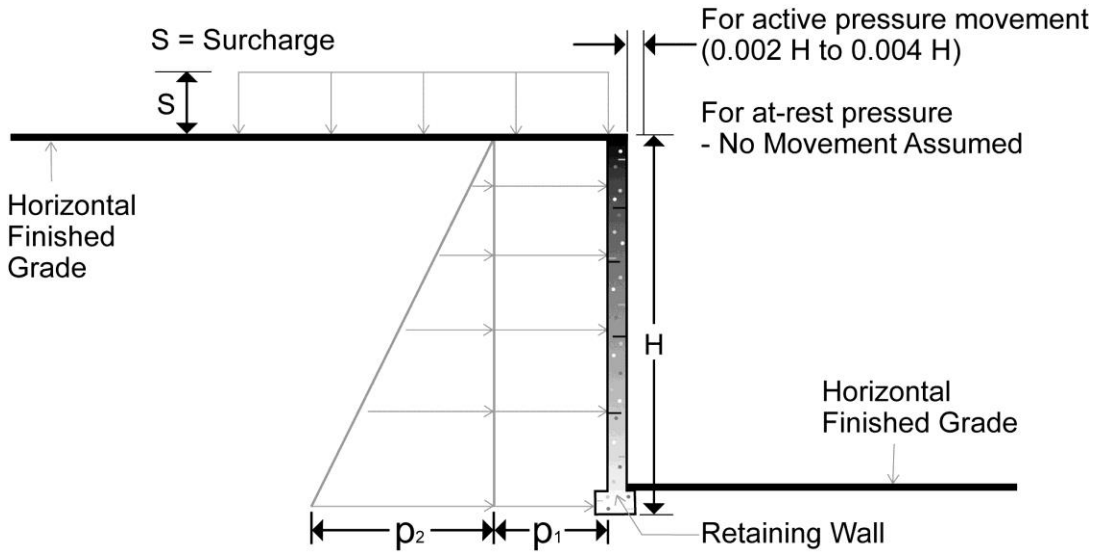
4.4.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled prior to final grading. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of concrete and corrective action will be required.

Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of concrete.

4.5 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement, such as a basement wall that is structurally confined at both the top and bottom of the wall. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.33	40	(0.33)S	(40)H
At-Rest (Ko)	Granular - 0.46	55	(0.46)S	(55)H
Passive (Kp)	Granular - 3.0	360	---	---

Applicable conditions to the above include:

- Uniform surcharge, where S is surcharge pressure.
- In-situ soil backfill weight a maximum of 120 pcf.
- Horizontal backfill, compacted between 95 and 98 percent of modified Proctor maximum dry density.
- Loading from heavy compaction equipment not included.
- No hydrostatic pressures acting on wall.
- No dynamic loading.
- No safety factor included in soil parameters.

Backfill placed against structures should consist of granular soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.32 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall we recommend that a drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

4.6 Pavements

4.6.1 Subgrade Preparation

Site grading is typically accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve ride comfort. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled and tested within two days prior to commencement of actual paving operations. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are found should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and prepared as recommended in Section **4.2** of the **Earthwork** section this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.6.2 Design Considerations

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute, PCA, and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Nodarse/Page One can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided. However, absent that data, we recommend the following minimum typical sections.

4.6.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section (inches)						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course**	**Limerock, Soil-Cement or Crushed Concrete Base Course**	**Stabilized Subbase Course[2,3,4]**	**Portland Cement Concrete**	**Free Draining Subgrade**
Car Parking	PCC	--	--		5.0	18.0
	AC	1.5	6.0	12.0	--	--
Truck and Drive Areas	PCC	--	--		6.0	18.0
	AC	2.5	8.0	12.0	--	--
Trash Container Pad [1]	PCC	--	--		6.0	18.0

1. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.
2. Often referred to as Stabilized Subgrade.
3. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Clay stabilization is acceptable with deeper seasonal high groundwater.
4. Some municipalities do not require stabilized subbase beneath soil-cement base.

4.6.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Nodarse/Page One recommends a minimum separation of 12 inches between the bottom of the base course and the seasonal high water table.
- Natural or fill subgrade soils to a depth of 18 inches below the base should be clean, free draining sands with a fines content passing a No. 200 sieve of 7 percent or less.
- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion, or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.

- The stabilized subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.

- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.

- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.

- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 95 percent of the material's maximum dry density as determined by the Modified Proctor Test (AASHTO T-134). Higher design strengths may result in increased cracking.

- Crushed (recycled) concrete base should meet the current FDOT specification 204 for recycled materials.

- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.

- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.

- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot

- All curbing should be full depth. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

4.6.5 Portland Cement Concrete Design Recommendations

The following items are applicable to rigid concrete pavement sections.

- At least 18 inches of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements presented in Section 4.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose.

- The PCC should be a minimum of 4,000 psi at 28 days. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.

- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.

- Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.

- Adequate separation should be provided between the bottom of the concrete and the seasonal high water table. Nodarse/Page One recommends that in no case should less than 1 foot of separation be provided.

- Sawcut patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high water table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

4.6.6 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

4.6.7 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

4.7 Stormwater Management

Based on the conceptual site plan provided, it is anticipated that four (4) stormwater ponds will be constructed as part of this project. One (1) pond will be constructed in the far eastern portion of the site. Three (3) ponds are planned in the southern portion of the site. Borings could not be performed in the two western most pond areas due to significant standing water on the site prohibiting access to our ATV drill rig. Design of the stormwater ponds has not been finalized yet.

Seasonal high groundwater levels at the boring locations are presented above in Section 3.3. Average wet season groundwater levels are expected to be near those observed during the field exploration. Seasonal low groundwater levels are expected to be 1 to 2 feet below observed levels. Standing water was present over much of the central portion of the site in late summer of 2013 (July and August of 2013). Much of this standing water is believed to be perched water over lower permeable silty and clayey soils. However, once topographic information is available, Nodarse/Page One should be provided an opportunity to re-evaluate seasonal high groundwater conditions at the site.

Composite samples of anticipated pond subgrade soils from Borings B-1 and B-6, performed in the two eastern most pond locations were testing for permeability in our laboratory. The measured permeability rate for the relatively clean fine sands with silt (SP-SM) tested were 9 to 13 feet per day. We consider this permeability rate to be indicative of a saturated vertical permeability. Experience with the observed soil types has shown that horizontal permeability may be on the order of 1.5 to 2 times the saturated vertical permeability in undisturbed materials. We recommend using an unsaturated vertical infiltration rate, k_V, of 5 feet/day and a horizontal saturated hydraulic conductivity rate, k_H, of 10 feet/day for the purpose of designing the proposed underground exfiltration system.

Due to relatively high groundwater levels at the site, the use of wet bottom ponds appears most feasible. Use of shallow dry-bottom swales may also be feasible if the site is adequately filled.

5.0 GENERAL COMMENTS

Nodarse/Page One should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Nodarse/Page One also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

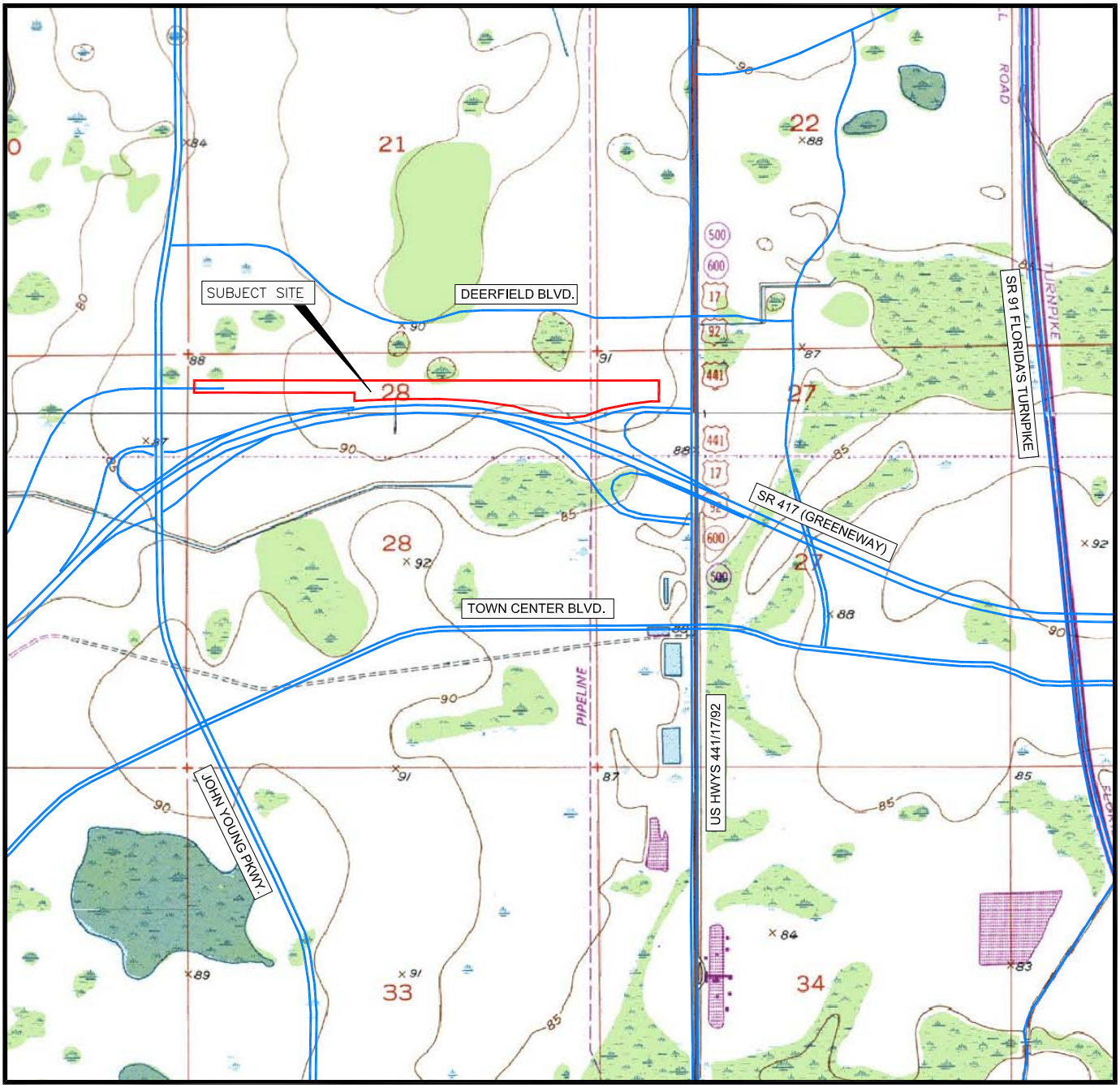
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Nodarse/Page One reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION

UNITED STATES – DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY



SCALE 1:24 000

1 .5 0 KILOMETERS 1 2

1000 0 1000 2000

MILES

1 .5 0 1

FEET

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

SECTION: 28
TOWNSHIP: 24 SOUTH
RANGE: 29 EAST

LAKE JESSAMINE, FLORIDA ISSUED: 1953 REVISED: 1980
KISSIMMEE, FLORIDA ISSUED: 1953 REVISED: 1987
7.5 MINUTE SERIES (QUADRANGLE)

Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC

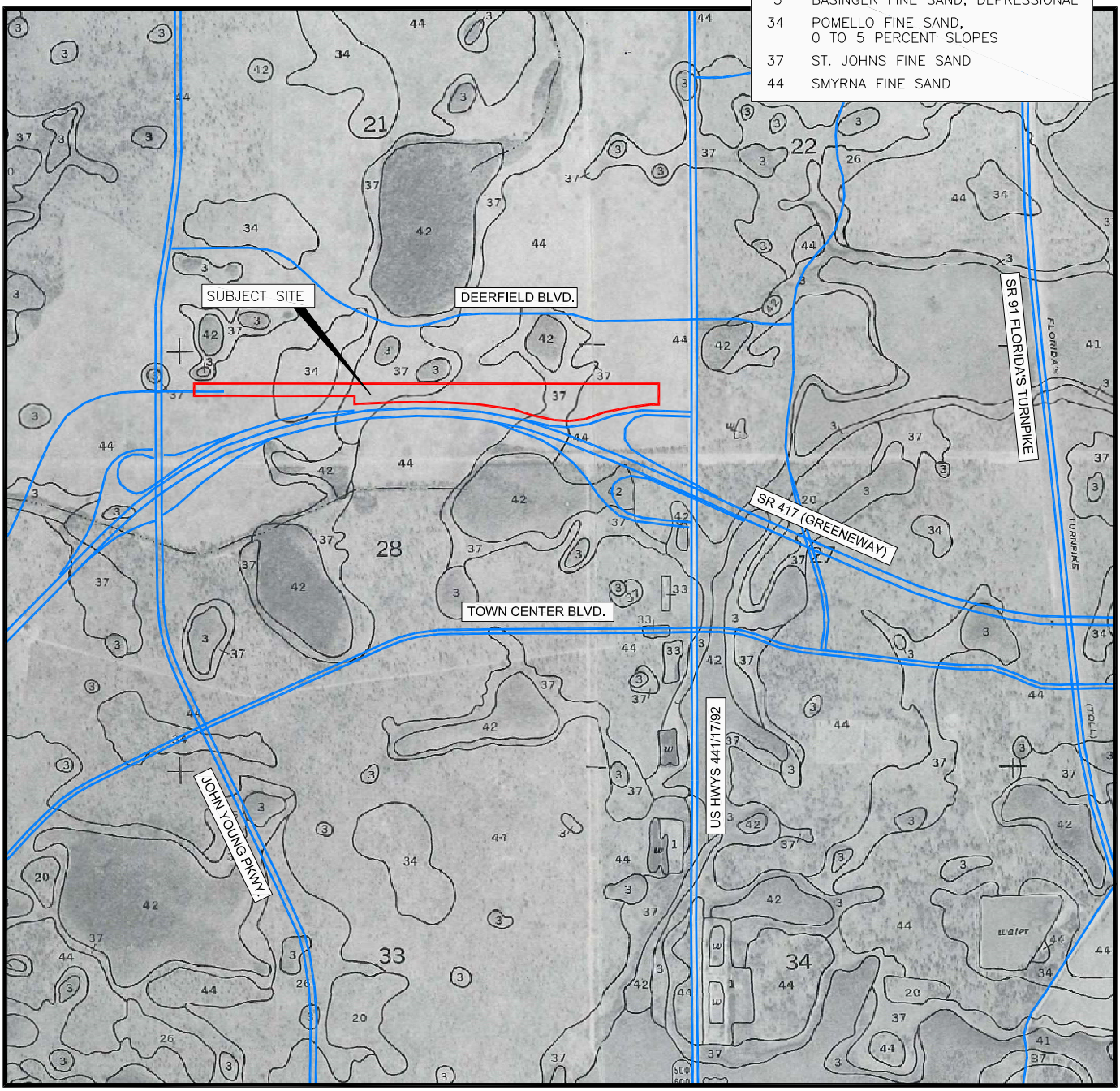
Project No.	AK135004
Scale:	AS SHOWN
File No.	AK135004-1
Date:	8-22-13

Nodarse/Page One Joint Venture

TOPOGRAPHIC VICINITY MAP
GEOTECHNICAL ENGINEERING EVALUATION
JOHN YOUNG COMMUNITY PARK
DEERFIELD AND SR 417
ORLANDO,ORANGE COUNTY, FLORIDA

EXHIBIT
A-1

Aug23, 2013–10:07am N:\Projects\2013\AK135004\PROJECT DOCUMENTS (Reports–Letters–Drafts to Clients)\cad\5004–usgs.dwg



SCALE 1" = 2000'

FEET

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

U.S.D.A. SOIL SURVEY FOR ORANGE COUNTY, FLORIDA
ISSUED: 1989

N

SECTION: 28
TOWNSHIP: 24 SOUTH
RANGE: 29 EAST

Project Mngr: SM	Project No. AK135004	Nodarse/Page One Joint Venture	U.S.D.A. SOILS MAP GEOTECHNICAL ENGINEERING EVALUATION JOHN YOUNG COMMUNITY PARK DEERFIELD AND SR 417 ORLANDO,ORANGE COUNTY, FLORIDA
Drawn By: SW	Scale: AS SHOWN		
Checked By: SM	File No. AK135004-2		
Approved By: JWC	Date: 8-22-13		EXHIBIT A-2

Soil Survey Descriptions

3 – Basinger fine sand, depressional. This soil type is nearly level and poorly drained. It is typically found in shallow depressions and sloughs along edges of freshwater marshes and swamps. In its natural state, water stands on the surface of this soil type for 6 to 9 months during most years and is within 12 inches of the surface for the rest of the year. This soil type is sometimes associated with a surficial organic layer, typical thickness of 7 inches, typical organic contents of between 1 and 8 percent.

37 – St. Johns fine sand. This soil type is nearly level and poorly drained. It is typically found on broad flats on the flatwoods. In its natural state and during years of normal rainfall, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface for 6 to 12 months, receding to a depth of 10 to 40 inches (0.8 to 3.3 feet) for more than six months. This soil type is predominantly sandy from the surface to a depth of 24 inches (2.0 feet), and again from a depth of 44 inches (3.7 feet) to the maximum defined depth of 80 inches (6.7 feet). Between depths of 24 and 44 inches (2.0 and 3.7 feet), this soil type exists as fine sand with silt to silty sand.

42 –Sanibel muck. This soil type is nearly level and very poorly drained. It is typically found in depressions, freshwater swamps and marshes, and poorly defined drainageways. In its natural state, groundwater is ponded atop this soil type for 6 to 9 months of years with normal rainfall; the groundwater table fluctuates between the surface and a depth of 10 inches (0.8 feet) for 2 to 6 months. A surficial organic layer is normally associated with this soil type, approximately 11 inches (0.9 feet) thick. Typical organic contents of the organic layer range from 20 to 50 percent. Beneath the surficial organic layer, Sanibel soils are predominantly sandy to the maximum defined depth of 80 inches (6.7 feet).

44 – Smyrna fine sand. This soil type is nearly level and poorly drained. It is typically found on broad flatwoods. In its natural state and during years of normal rainfall, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface, receding to a depth of 10 to 40 inches (0.8 to 3.3 feet) for more than six months.

N

APPROX. SCALE IN FEET

0 150 300

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC

Project No.	AK135004
Scale:	AS SHOWN
File No.	AK135004-4
Date:	8-22-13

Nodarse / Page One
Joint Venture

BORING LOCATION PLAN
GEOTECHNICAL ENGINEERING EVALUATION
JOHN YOUNG COMMUNITY PARK
DEERFIELD AND SR 417
ORLANDO,ORANGE COUNTY, FLORIDA

EXHIBIT
A-4A

N

APPROX. SCALE IN FEET

0 150 300

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC

Project No.	AK135004
Scale:	AS SHOWN
File No.	AK135004-4
Date:	8-22-13

Nodarse / Page One
Joint Venture

BORING LOCATION PLAN
GEOTECHNICAL ENGINEERING EVALUATION
JOHN YOUNG COMMUNITY PARK
DEERFIELD AND SR 417
ORLANDO,ORANGE COUNTY, FLORIDA

EXHIBIT
A-4B

Field Exploration Description

The boring locations were laid out at the project site by Nodarse/Page One personnel. The borings were located with a hand held GPS device using longitude and latitude coordinates obtained from on-line Google Earth imagery. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The SPT soil borings were drilled with a truck-mounted, rotary drilling rig equipped with a rope and cathead manual hammer. The boreholes were advanced with a cutting head and stabilized with the use of bentonite (drillers' mud). Soil samples were obtained by the split spoon sampling procedure in general accordance with the Standard Penetration Test (SPT) procedure. In the split spoon sampling procedure, the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch penetration or the middle 12 inches of a 24-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the site soil.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.

BORING LOG NO. B-1

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light gray to light brown, loose				2-4-5-4 N=9				
	2.0 **SAND WITH SILT (SP-SM)**, fine grained, light brown, loose				7-5-5-6 N=10	13	17		7
		5	▽		6-5-3-3 N=8				
	8.0 **SAND (SP)**, fine grained, light brown, medium dense				2-3-5-9 N=8				
		10			6-8-8-11 N=16				
	13.5 **SILTY SAND (SM)**, fine grained, light gray, loose				5-2-4-6 N=6				
	15.0 ***Boring Terminated at 15 Feet***	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 6.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-6

BORING LOG NO. B-2

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark gray, medium dense				4-6-5-5 N=11				
	2.0 **SAND (SP)**, fine grained, light gray, medium dense				8-8-9-8 N=17				
	4.0 **SILTY SAND (SM)**, fine grained, dark brown, loose	5	▽		4-2-3-12 N=5		22		16
	6.0 **SAND (SP)**, fine grained, dark brown to light gray, very dense to medium dense				16-12-63-55 N=75				
		10			6-10-10-9 N=20				
	15.0 ***Boring Terminated at 15 Feet***	15			5-8-8 N=16				
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-7

BORING LOG NO. B-3

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND WITH SILT (SP-SM), fine grained, light gray to brown, medium dense				3-5-6-6 N=11				
	2.0 **SILTY SAND (SM)**, fine grained, dark brown to light gray, medium dense to loose				10-9-7-7 N=16				
		5	▽		9-6-7-6 N=13				
					2-3-5-10 N=8				
					10-14-13-14 N=27				
		10							
	15.0				3-4-5 N=9				
	Boring Terminated at 15 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 6.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-8

BORING LOG NO. B-4

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, gray, medium dense				2-5-6-5 N=11				
	2.0 **SAND (SP)**, fine grained, gray, medium dense				7-8-8-6 N=16				
	4.0 **SILTY SAND (SM)**, fine grained, dark gray, very loose	5	▽		1-1-1-5 N=2				
	6.0 **SAND (SP)**, fine grained, gray, medium dense				9-11-11-6 N=22				
	8.0 **SILTY SAND (SM)**, fine grained, dark gray, medium dense	10			2-5-9-10 N=14				
	15.0 ***Boring Terminated at 15 Feet***	15			3-5-7 N=12				
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-9

BORING LOG NO. B-5

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, dark gray, loose				1-3-4-6 N=7				
					5-5-5-5 N=10		18		5
	4.0 **SILTY SAND (SM)**, fine grained, dark brown, loose to medium dense	5	▽		4-4-1-3 N=5				
					2-3-4-6 N=7				
	10.0				3-4-9-16 N=13				
	Boring Terminated at 10 Feet	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-10

BORING LOG NO. B-6

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), trace clay, fine grained, light gray, medium dense 2.0				2-4-7-7 N=11		12		20
	SAND WITH SILT (SP-SM), fine grained, light gray to dark brown, medium dense 6.0				6-8-7-6 N=15	9	20		8
		5			5-8-7-7 N=15				
	SAND (SP), fine grained, dark brown, medium dense 13.5				8-11-8-9 N=19				
		10			10-8-10-28 N=18				
	SILTY SAND (SM), fine grained, brown, loose 15.0				4-3-4 N=7				
	Boring Terminated at 15 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 6.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-11

BORING LOG NO. B-7

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), trace clay, fine grained, dark brown, loose to medium dense				1-2-3-3 N=5				
					4-5-5-5 N=10				
		5	▽		2-2-3-9 N=5				
					5-7-6-7 N=13				
	8.0 **SAND (SP)**, fine grained, dark brown, medium dense				4-6-8-10 N=14				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-12

BORING LOG NO. B-8

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), trace clay, fine grained, light gray, loose 2.0				1-4-4-4 N=8		13		21
	SILTY SAND (SM), fine grained, dark brown, loose 4.0				3-7-3-6 N=10				
	SAND (SP), fine grained, light gray, medium dense to loose 8.0	5	▽		6-9-9-9 N=18				
					5-3-5-6 N=8				
	SILTY SAND (SM), fine grained, dark brown, loose 10.0				5-4-6-6 N=10				
	Boring Terminated at 10 Feet	10 15 20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-13

BORING LOG NO. B-9

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	NO DATA ***Boring Terminated at 0 Foot***	5 10 15 20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Boring Not Performed Due To Excessive Standing Water

WATER LEVEL OBSERVATIONS

Standing Water

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-14

BORING LOG NO. B-10

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark brown to light brown, loose to medium dense				1-3-3-3 N=6				
			▽		4-4-9-7 N=13				
		5			7-7-6-5 N=13		23		12
					2-3-6-8 N=9				
	8.0 **SAND (SP)**, fine grained, light gray, medium dense				4-6-6-6 N=12				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-15

BORING LOG NO. B-11

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light brown, medium dense				2-7-3-6 N=10				
	2.0 **SILTY SAND (SM)**, fine grained, brown to light gray, medium dense				5-6-8-10 N=14				
		5			8-7-8-13 N=15				
	6.0 **SAND (SP)**, fine grained, light gray, medium dense				12-14-12-14 N=26				
	10.0				10-13-14-16 N=27				
	Boring Terminated at 10 Feet	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater Level Observed at 0.0' Depth

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-16

BORING LOG NO. B-12

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, gray to dark brown, loose to medium dense to dense				1-2-3-9 N=5				
					10-10-12-17 N=22		15		7
		5	▽		23-15-18-17 N=33				
	6.0 **SILTY SAND (SM)**, fine grained, gray, medium dense				17-14-15-19 N=29				
	8.0 **SAND (SP)**, fine grained, gray, medium dense				9-9-9-9 N=18				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-17

BORING LOG NO. B-13

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark gray, loose				1-2-3-3 N=5				
	2.0								
	SAND (SP), fine grained, light gray, loose		▽		2-5-4-3 N=9				
	4.0								
	SILTY SAND (SM), fine grained, brown, loose to medium dense	5			1-2-3-9 N=5				
					8-11-10-9 N=21				
	8.0								
	SAND (SP), fine grained, dark gray, medium dense				11-10-11-13 N=21				
	10.0	10							
	Boring Terminated at 10 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-18

BORING LOG NO. B-14

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	NO DATA ***Boring Terminated at 0 Foot***	5 10 15 20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Boring Not Performed Due To Excessive Standing Water

WATER LEVEL OBSERVATIONS

Standing Water

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-19

BORING LOG NO. B-15

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light gray, medium dense				2-4-7-10 N=11				
			▽		8-7-6-4 N=13				
		5			4-7-8-11 N=15				
	6.0 **SILTY SAND (SM)**, fine grained, dark brown, medium dense				6-9-11-14 N=20				
	8.0 **SAND (SP)**, fine grained, light brown, medium dense				8-12-12-14 N=24				
		10							
	13.5 **SILTY SAND (SM)**, fine grained, gray, medium dense				6-8-10 N=18				
	15.0 ***Boring Terminated at 15 Feet***	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-20

BORING LOG NO. B-16

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, gray, loose to medium dense				2-3-6-14 N=9				
					8-13-13-10 N=26				
	4.0 **SILTY SAND (SM)**, fine grained, dark brown, medium dense	5	▽		6-8-9-13 N=17				
					7-10-13-16 N=23				
	8.0 **SAND WITH SILT (SP-SM)**, fine grained, dark brown, medium dense	10			7-6-7-10 N=13		18		8
	13.5 **SAND (SP)**, fine grained, gray, medium dense				6-10-16 N=26				
	15.0 ***Boring Terminated at 15 Feet***	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-21

BORING LOG NO. B-17

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light gray, loose				1-2-6-10 N=8				
	2.0 **SILTY SAND (SM)**, fine grained, light gray to dark brown, medium dense to loose				9-12-13-11 N=25				
		5	▽		2-3-4-5 N=7				
					2-3-3-8 N=6				
		10			5-8-10-15 N=18				
	15.0				2-3-4-9 N=7				
	Boring Terminated at 15 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-22

BORING LOG NO. B-18

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark brown, medium dense				6-13-11-11 N=24				
	2.0 **SAND (SP)**, fine grained, light gray, medium dense to very loose				12-12-10-19 N=22				
		5	▽		16-14-16-17 N=30				
					11-6-4-3 N=10				
					1-WH-WH-2 N=WH				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 6.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/14/2013 | Boring Completed: 8/14/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-23

BORING LOG NO. B-19

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, brown, loose 2.0				1-2-2-2 N=4				
	SILTY SAND (SM), fine grained, dark gray to dark brown, loose to medium dense				2-2-2-1 N=4				
		5	▽		1-3-3-3 N=6				
					3-5-8-8 N=13				
	10.0				6-7-6-7 N=13				
	Boring Terminated at 10 Feet	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 6.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-24

BORING LOG NO. B-20

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light gray to dark brown, loose				1-3-3-8 N=6				
	2.0 **SAND WITH SILT (SP-SM)**, fine grained, light gray to dark brown, loose				4-5-5-6 N=10		17		8
		5	▽		3-2-2-2 N=4				
					1-2-3-6 N=5				
	8.0 **SILTY SAND (SM)**, fine grained, dark brown, medium dense				4-6-8-10 N=14				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-25

BORING LOG NO. B-21

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark brown, loose				2-3-3-4 N=6				
	2.0								
	SAND (SP), fine grained, light brown, medium dense				3-5-6-6 N=11				
	4.0								
	SILTY SAND (SM), fine grained, dark brown, loose	5	▽		2-2-2-3 N=4				
					3-3-3-4 N=6				
					4-3-6-9 N=9				
	10.0	10							
	Boring Terminated at 10 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-26

BORING LOG NO. B-22

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine grained, dark brown, loose 2.0				1-3-3-3 N=6				
	SAND (SP), fine grained, light gray, medium dense 4.0				4-5-6-6 N=11				
	SAND WITH SILT (SP-SM), fine grained, dark gray, very loose 6.0	5			2-1-WH-4 N=1				
	SILTY SAND (SM), fine grained, dark brown, loose 8.0		▽		2-3-4-7 N=7				
	SAND WITH SILT (SP-SM), fine grained, light brown, medium dense 10.0				4-5-7-8 N=12				
	Boring Terminated at 10 Feet	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 7.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/12/2013 | Boring Completed: 8/12/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-27

BORING LOG NO. B-23

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, brown, loose to medium dense				3-4-3-6 N=7				
			▽		7-7-7-5 N=14				
	4.0 **SILTY SAND (SM)**, fine grained, brown to light gray, very loose to medium dense	5			1-1-1-1 N=2				
					1-1-1-2 N=2				
					3-4-7-7 N=11				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-28

BORING LOG NO. B-24

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND WITH SILT (SP-SM), fine grained, gray to brown, loose to medium dense				1-3-4-6 N=7		16		6
			▽		7-7-9-8 N=16				
	4.0 **SAND (SP)**, fine grained, light brown, medium dense	5			6-5-5-6 N=10				
					5-5-8-9 N=13				
	10.0 ***Boring Terminated at 10 Feet***	10			8-9-13-20 N=22				
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-29

BORING LOG NO. B-25

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, light gray, loose				2-3-5-7 N=8				
	2.0 **SILTY SAND (SM)**, fine grained, dark brown to light brown, medium dense		▽		5-5-6-7 N=11				
		5			5-6-10-16 N=16				
					9-6-7-13 N=13				
	10.0 ***Boring Terminated at 10 Feet***	10			6-12-17-15 N=29				
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-30

BORING LOG NO. B-26

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND WITH SILT (SP-SM), fine grained, dark gray to light brown, medium dense				4-5-7-8 N=12				
			▽		5-6-6-5 N=12		17		9
	4.0 **SILTY SAND (SM)**, fine grained, dark brown to light brown, medium dense	5			5-4-7-7 N=11				
					5-6-7-8 N=13				
					5-8-9-13 N=17				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-31

BORING LOG NO. B-27

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAYEY SAND (SC), fine grained, gray, loose				1-2-4-8 N=6		15	50-18-32	43
	2.0 **SILTY SAND (SM)**, fine grained, dark brown, medium dense				7-9-11-15 N=20				
		5	▽		6-7-7-5 N=14				
					3-4-8-11 N=12				
					4-7-9-11 N=16				
	10.0 ***Boring Terminated at 10 Feet***	10							
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-32

BORING LOG NO. B-28

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, brown 2.0								
	CLAYEY SAND (SC), fine grained, light gray 4.0						17	30-22-8	30
	SAND (SP), fine grained, light brown, medium dense 6.0	5	▽		4-6-7-9 N=13				
	SILTY SAND (SM), fine grained, dark brown, loose 10.0				5-3-5-8 N=8				
	Boring Terminated at 10 Feet	10			3-3-5-10 N=8				
		15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 5.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-33

BORING LOG NO. B-29

PROJECT: JOHN YOUNG COMMUNITY PARK

CLIENT: Orange County Capital Improvements

SITE: Deerfield and SR 417
Orange County, Fla.

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), fine grained, brown								
	4.0		▽						
	SILTY SAND (SM), fine grained, dark brown, loose to medium dense	5			2-2-2-7 N=4				
					4-9-13-12 N=22				
		10			7-6-5-5 N=11				
	10.0								
	Boring Terminated at 10 Feet	15							
		20							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-5 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Groundwater Level Observed at 4.0' Depth*

NODARSE
A Terracon COMPANY
1675 Lee Road
Winter Park, Florida

Boring Started: 8/13/2013 | Boring Completed: 8/13/2013

Drill Rig: Mud Bug | Driller: IDI - Jonathon

Project No.: AK 13 5004 | Exhibit: A-34

APPENDIX B

LABORATORY TESTING

Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, fines content (soil passing a US standard #200 sieve), and Atterberg Limits. Those results are included in this report on the respective boring logs. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix C. The results of our laboratory testing are presented on the corresponding borings logs.

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-$^3/_8$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling	ESH:	Estimated Seasonal High Groundwater
DCI:	Dry Cave in	BCR:	Before Casing Removal	ESL:	Estimated Seasonal Low Groundwater
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 – 1	Very Soft
500 – 1,000	2 – 3	Soft
1,000 – 2,000	4 – 6	Medium Stiff
2,000 – 4,000	7 – 12	Stiff
4,000 – 8,000	13 – 26	Very Stiff
8,000+	> 26	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 – 10
Medium	11 – 30
High	> 30

Rev. 4/10

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.