January 12, 2017
BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
Addendum No. 1 / IFB Y17-729-CC
East Orange Regional Park

Bid Opening Date: January 24, 2017

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 remains January 24, 2017 at 2:00 P.M.

B. Additions, Deletions, and Clarifications:

1. **Revision**: In Part D of the IFB, delete page D-2 of the Official Bid Form in its entirety and replace with the attached **REVISED PAGE D-2.**

   FAILURE TO SUBMIT THE REVISED OFFICIAL BID FORM INCLUDED IN THIS ADDENDUM WITH YOUR BID SUBMITTAL SHALL RESULT IN YOUR BID BEING DETEREMINED NON-RESPONSIVE.

2. **Revision:** Make the following change to Part C of the IFB, Paragraph 28, "References" and to first paragraph of Part D of the IFB, Attachment E.

   Bidder should supply (with the bid form) a list of three (3) similar projects successfully completed by the **Bidder, as a Prime or Sub Contractor** within the last ten (10) years. **The Contractor may also use their subcontractor's experience to meet the requirements of the similar projects. However, the subcontractor must be listed on Attachment C-2 of Part D, PRIME CONTRACTOR/SUBCONTRACTOR/SUPPLIER INFORMATION and the project shall be submitted on Attachment E of the IFB to include all required information**. Failure to provide this information may be cause for rejection of the bid. For the purposes of the Invitation for Bids, a similar project is described as a commercial project (can be a parking lot, park, shopping center, school, office building) in which the contractor (as a prime or subcontractor) must have performed sitework/earthwork operations along with new building construction of at least 5,000 sf.

   Additionally, at least one (1) of the projects submitted must meet the following requirements:

A project that included the installation of rolled Bermuda grass, OR a project that included the installation of underdrains on athletic fields, OR a project that included the installation of athletic field lighting.

EACH SIMILAR PROJECT LISTED SHALL BE LISTED WITH COMPLETE INFORMATION AS SPECIFICALLY PROVIDED ON THE REFERENCE FORM (ATTACHMENT E). THE SPECIFIC INFORMATION ON REFERENCES MUST BE PROVIDED ON THE REFERENCE FORM. DO NOT ATTACH LISTINGS OF REFERENCE INFORMATION.

FAILURE TO PROVIDE REFERENCE INFORMATION AS REQUESTED MAY RESULT IN THE REJECTION OF YOUR BID.

3. **Revision**: Make the following change to Part D, Page D3 and Part E, Paragraph VI - Time and Commencement and Final Completion:

   - Substantially complete in ~~270~~ **240** calendar days from date of Official Notice to Proceed.
   - Final completion in ~~300~~ **270** consecutive calendar days from date of Official Notice to Proceed.

4. **Addition:** 'Exhibit 1' Geotechnical Report to be included as part of contract documents. See attached Exhibit 1.

5. **Addition**: Electronic CAD files of civil grading and drainage sheets **are provided for information purposes only**. They can be downloaded from the following site:

   ftp://ftp.ocfl.net/divisions/AdminServices/pub/CapitalProjects/

   1. Click on link above.
   2. Click the View tab at the top tool bar and in the subcategory, select "Open FTP site in File Explorer"
   3. Select a file called "Parks_East Orange Regional Park"
   4. Inside the file, you should see the documents.

C. Questions and Answers:

1. **Question:** Our company meets the qualification as a prime noted on page C-19 regarding construction of a new building at least 5,000 sf along with associated site work/earthwork operations. I don't believe however that we meet the requirement of rolled Bermuda grass, underdrains for an athletic field or athletic field lighting.
   Would parking lot lighting installation substitute as well? Would it be possible that we would qualify using a site contractor with that experience or an electrician with the athletic field lighting experience?
   Answer: Please refer to Part B, No. 2 of this addendum.

2. **Question**: On the Civil Drawings it calls out for New Light Poles LP around the Soccer Fields but the details/specs/plans aren't provided. Please advise.
   Answer: Plans/Specs for sports lighting to be included in future addendum.

3. **Question**: Can you please provide the Geo Technical report for the Site?
   Answer: Please reference 'Exhibit 1' included in this addendum.

4. **Question**: For the Concession/Storage/Restroom building there are no Fire Protection specifications provided. Please advise.
   Answer: Fire Protection plans/specs to be included in future addendum.

5. **Question**: Can you please provide the CAD files for the site?
   Answer: Please reference 'Exhibit 2' included in this addendum.

6. **Question**: Will the Reciprocal Local Preference section in the Bid Docs on sheet C-13 be applied to this bid?
   Answer: Yes.

7. **Question**: On the Civil Sheets it does not show any grass parking locations or details, but on A102 of the Recreation Building and sheet C100 of the Concession/Storage/Restroom Building it shows a grass parking area. Are we responsible for the Grass Parking Lot? If so please provide plans/details.
   Answer: Grass parking will be deleted in a future addendum.

8. **Question**: On the Civil Sheets and in the Bid Documents it only talks about constructing 2 Multi-Purpose Sports Field, but on sheet C100 of the Concession/Storage/Restroom Building it shows 3 Multi-Purpose Fields. Please advise on how many Fields will needed to be constructed for this project.
   Answer: Only two multipurpose fields will be constructed. Plans will be corrected in future addendum.

9. **Question**: On Sheet C101 of the Civil Plans it calls for a new 8' x 12' Prefabricated building for the Fire Pump but no specs/details are provided. Please advise.
   Answer: Specifications for pump house will be included in future addendum.

10. **Question**: In lieu of Soil Cement Base can we use any of the items listed in FDOT Optional Base Group 5 listed on FDOT Index 514 Sheet 2?
    Answer: No, OC Public Works has requested the soil cement.

11. **Question**: Is Laser Grading required for the Soccer Fields? If so please provide the spec.
    Answer: Yes, specification will be included in future addendum.

12. **Question**: Is any Soil fumigation required for the Soccer Fields? If so please provide the spec.
    Answer: Yes, specification will be included in future addendum.

13. **Question**: For the Rec Center, Can you please confirm that Doors #102A, 111A, 111B, 111C are hollow metal not aluminum.
    Answer: The listed doors will be aluminum. The change to the plans & specs will be in a future addendum.

14. **Question**: Our firm is interested in submitting a Division 7 substitution request for the Fiber Cement Siding on the East Orange Regional Park project, currently set to bid on 1/24/17. Is there a suggested contact person (with email address) that we can send our request to? Are there any particular forms needed for substitution requests?
    Answer: Substitution requests are covered in Part C of the General Conditions and are not allowed until after contract award.

15. **Question**: GE- Momentive Performance Materials, Inc. would like to propose a substitution request for your review and approval on the above referenced project.
    Answer: Substitution requests are covered in Part C of the General Conditions and are not allowed until after contract award.

16. **Question**: I have downloaded all four volumes of the specs, but I don't see the turf information. In the docs it says "DIVISION 32 – EXTERIOR IMPROVMENTS (NOT USED)". Please advise if there will be a spec issued.
    Answer: Turf specs will be provided in a future addendum.

17. **Question**: We have all 3 sets downloaded but did not see a spec for the actual turf itself. We've done a fair amount of parks and sports fields and there is usually a very stringent spec for the turf.
    Answer: Turf specs will be provided in a future addendum.

18. **Question**: Regarding the Minority requirements; we are looking at State Certified M/WBE correct? I want to be sure the vendors don't need separate City or County certification.
    Answer: Yes. For this solicitation, the County will accept State certified MWBE's. See Part C, Paragraph No. 3 of the IFB.

D. Another addendum is forthcoming.

E. 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 than the date and time for receipt of the bid or proposal.

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

c. Receipt acknowledged by:

_____ _____
Authorized Signature Date Signed

_____
Title

_____
Name of Firm

To the Board of County Commissioners
Orange County, Florida

The Undersigned, hereinafter called "Bidder", having visited the site of the proposed project and familiarized himself with the local conditions, nature and extent of the work, and having examined carefully the Contract Form, General Conditions, Supplementary Conditions, Plans and Specifications and other Contract Documents, with the Bond requirements herein, proposes to furnish all labor, materials, equipment and other items, facilities and services for the proper execution and completion of: **EAST ORANGE REGIONAL PARK** in full accordance with the drawings and specifications prepared in accordance with the Contract Documents and, if awarded the Contract, to complete the said work within the time limits specified for the following LUMP SUM.

001 BASE BID: (**Substantial Completion in 240 consecutive calendar days and Final Completion in 270 consecutive calendar days from date of Official Notice to Proceed**).

_____DOLLARS
(In Words)

$_____

002 ALTERNATE BID: (**Substantial Completion in 210 consecutive calendar days and Final Completion in 240 consecutive calendar days from date of Official Notice to Proceed**).

_____DOLLARS
(In Words)

$_____

The Base Bid Amount and Alternate Bid Amount are considered two separate bids with the only difference being the Substantial and Final Completion dates.

In the event the Contract is awarded to this Bidder, he/she will enter into a formal written agreement with the County in accordance with the accepted bid within ten (10) calendar days after said Contract is submitted to him/her and will furnish to the County a Contract Payment and Performance Bond with good and sufficient sureties, satisfactory to the County, in the amount of 100% of the accepted bid. The Bidder further agrees that in the event of the Bidder's default or breach of any of the agreements of this proposal, the said bid deposit shall be forfeited as liquidated damages.

Failure of the Bidder to provide pricing for all unit priced items and/or the Base Bid and ALL requested additive/deductive bid items, or alternate bids shall be cause for rejection of the bid as non-responsive.

EXHIBIT 1
GEOTECHNICAL REPORT

Y17-729-CC
Addendum No. 1
January 12, 2017

EXHIBIT 1

Geotechnical Engineering Report

East Orange Multi-Purpose Fields
State Road 50
Christmas, Orange County, Florida

October 25, 2016
PO # C14908C003-1
Terracon Project No. H1165273

Prepared for:
Orange County Capital Projects Division
Orlando, Florida

Prepared by:
Terracon Consultants, Inc.
Winter Park, Florida

October 25, 2016

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

Attn: Mr. Scott Reekie
E: scott.reekie@ocfl.net

Re: Geotechnical Engineering Report
East Orange Multi-Purpose Fields
State Road 50, Orange County, Florida
PO # C14908C003-1
Terracon Project Number: H1165273

Dear Mr. Reekie:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above-referenced project. This study was performed in general accordance with our proposal dated August 31, 2016 and authorized by PO C14908C003, Change Order No. 1. Previous geotechnical engineering reports for the site development were prepared by Nodarse/Page One Joint Venture, LLC (Nodarse/Page One) and Terracon in 2014 and 2015. Due to site plan modifications, an additional geotechnical engineering exploration was required. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the design/construction of the proposed playfields, structures, pavements, and stormwater treatment system.

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
Terracon Consultants, Inc.
Certificate of Authorization Number 8830

SHENNA L. MCMASTER LICENSE No 57537 STATE OF FLORIDA PROFESSIONAL ENGINEER 10/25/16

Shenna McMaster, P.E.
Senior Geotechnical Engineer
FL Registration No. 57537

Jay W. Casper, P.E.
Principal

This report has been electronically signed and sealed by Shenna McMaster, P.E. on 10/25/16 using a Digital Signature.

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

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EXECUTIVE SUMMARY

Geotechnical exploration has been performed for the proposed multi-purpose fields and recreation facility on State Road 50 in Christmas, Orange County, Florida. Previous geotechnical engineering reports were prepared by Nodarse/Page One and Terracon in 2014 and 2015. Since the previous reports, the proposed site plans have changed. Ten additional borings have been performed to depths of 5 and 15 feet below the existing ground surface in the proposed stormwater pond, structure, pavement, and septic drainfield locations.

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 across the site were mostly fine sand with varying amounts of silt. Organic silty sand and sandy muck/peat was observed in a few locations.

- Groundwater was found at depths ranging from about 1.3 to 5 feet below existing grade during the recent exploration (late September 2016). During previous exploration (September of 2014 and May of 2015), groundwater was found at 2 to 4 feet below existing grade across the site. Normal seasonal high groundwater levels are expected to be 1 foot or less below existing grade.

- The site is suitable for the use of conventional shallow foundations systems for support of the small structures planned. Normal site preparation including stripping and proofrolling will be required for adequate support of the foundation elements.

- Careful consideration of the relatively high groundwater conditions will be required in site and pavement grading design.

- Due to relatively high groundwater levels at the site, the use of a wet stormwater pond appears most feasible. Soils excavated from the stormwater pond area are expected to be generally suitable for use as borrow material following removal of surficial roots and vegetation.

- Due to relatively high groundwater levels at the site, a mounded drainfield system is anticipated.

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
EAST ORANGE MULTI-PURPOSE FIELDS
STATE ROAD 50
CHRISTMAS, ORANGE COUNTY, FLORIDA

Terracon Project No. H1165273
October 25, 2016

1.0 INTRODUCTION

This geotechnical engineering report has been performed for the proposed multi-purpose fields and recreation facility on State Road 50 in Christmas, Orange County, Florida as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. Previous geotechnical engineering reports dated October 9, 2014 and May 21, 2015 were prepared by Nodarse/Page One and Terracon. Since the previous report, the site plan has been changed. Ten additional borings have been performed to depths of 5 and 15 feet below the existing ground surface in the proposed stormwater pond, structure, pavement, and septic drainfield locations. Logs of all borings performed along with a Boring Location Plan are included in Appendix A of this report. Laboratory testing procedures are included in Exhibit B-1 in Appendix B.

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

- subsurface soil conditions
- groundwater conditions
- site preparation
- foundation design considerations
- pavement design considerations
- stormwater management design parameters
- septic drainfield design.

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout and Proposed Construction	See Appendix A, Exhibit A-4: Boring Location Plan. The southern portion of the site will be developed into soccer playfields on the western side. Paved parking and driveway areas as well as small restroom and maintenance buildings will be constructed on the southeastern portion of the site. A stormwater pond is planned in the southeastern portion of the site. A septic tank and drainfield will be utilized for on-site disposal of wastewater.
Grading	Due to high groundwater conditions at the site, final grades are assumed to be above current grades in the proposed development areas.

2.2 Site Location and Description

Item	Description
Location	The project is located on East Colonial Drive (SR 50), just west of the Town of Christmas in Orange County, Florida.
Current ground cover	The site is mostly cleared with scattered trees along the perimeter. A low-lying feature is noted on the quadrangle map in the northwestern portion of the site. However, much of this area has been cleared.
Existing topography	The USGS topographic quadrangle maps “Bithlo, Florida” depicts the site and surrounding area with a ground surface elevations near +55 to +60 feet referencing the National Geodetic Vertical Datum of 1929 (NGVD29). Multiple low-lying areas are mapped in the vicinity of the site. A tributary of the St. Johns River is located south of the site.

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), identifies the soil type at the subject site as *Immokalee fine sand (20) 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 map 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:

- Generally, soils observed across the site consisted of sands with varying amounts of silt (SP, SP-SM, SM) from the existing ground surface to the explored depths of 10 to 20 feet. SPT blow counts measured in the sands indicated relative densities generally loose in the upper 2 feet then medium dense to the boring termination depths of 15 feet.
- Organic silty sand (organic content of 8 percent) was observed in Boring NB-4 at a depth of about 6.5 to 8.5 feet below existing grade.
- Sandy muck/peat (organic content of 14 percent) was found in Boring NAB-3 at a depth of about 2.5 to 3 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. The in-situ transitions between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. For completeness, the results of borings performed during the previous exploration are also included. 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 the borings between depths of 2 to 4 feet below existing grade during the previous explorations (September of 2014 and May of 2015). During the recent exploration (September of 2016), groundwater levels were found at depths of 1.3 to 5.4 feet below existing grade. In addition, very soggy conditions were noted in many areas of the site during the previous and recent explorations.

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 normal wet season, with rainfall and recharge at a maximum, groundwater levels will be at or within 1 foot of existing grade across 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:

Boring #	Approximate Ground Surface Elevation (feet)*	Depth to Encountered Water Table (feet)	Encountered Groundwater Elevation (feet)	Approximate Estimated Normal Seasonal High Groundwater Elevation (feet)
NB-1	+57.0	1.7	+55.3	+56.0
NB-2	+57.5	1.5	+56.0	+56.5
NB-3	+57.5	1.5	+56.0	+57.0
NB-4	+58.0	1.3	+56.7	+57.5
ND-1	+58.0	2.0	+56.0	+57.0
ND-2	+57.0	2.0	+55.0	+56.5
NAB-1	+58.0	2.0	+56.0	+57.5
NAB-2	+56.5	2.0	+54.5	+56.0
NAB-3	+62.5	5.4	+57.1	+61.5
NAB-4	+55.0	1.3	+53.7	+54.5
B-1	+61.5	3.0	+58.5	+60.5
B-2	+59.7	3.0	+56.7	+58.0
B-3	+57.7	2.0	+55.7	+57.5
B-4	+56.2	3.0	+53.2	+55.5
B-5	+55.7	3.0	+52.7	+55.5
B-6	+55.4	3.0	+52.4	+55.0
B-7	+57.8	3.0	+54.8	+55.5
B-8	+56.4	3.0	+53.4	+55.5
B-9	+55.0	4.0	+51.0	+54.5
B-10	+56.7	2.0	+55.7	+56.0
B-11	+56.2	2.0	+54.2	+56.0
C-1	+58.5	4.0	+54.5	+57.5
C-2	+58.3	4.0	+54.3	+57.5
C-3	+57.0	4.0	+53.0	+57.0
C-4	+58.5	4.0	+54.5	+57.5

Boring #	Approximate Ground Surface Elevation (feet)*	Depth to Encountered Water Table (feet)	Encountered Groundwater Elevation (feet)	Approximate Estimated Normal Seasonal High Groundwater Elevation (feet)
D-1	+57.5	4.0	+53.5	+57.0
D-2	+57.0	4.0	+53.0	+57.0

* Ground surface elevations estimated from topographic information provided.

These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high water table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on or around the site following the date of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Normal site preparation and conventional shallow foundation systems are appropriate for support of the proposed restroom/concession/maintenance buildings.

Potential limitations to be considered during site grading design are the relatively shallow groundwater levels. Use of a wet bottom stormwater pond appears most appropriate. Underdrains may be required to provide adequate recovery of a dry system.

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

4.2 Earthwork

We anticipate construction will be initiated by clearing any surface vegetation and other deleterious material and stripping the topsoil. Once stripping is complete, the exposed subgrade should be observed and proofrolled with a medium or heavy weight roller (minimum 10,000 pounds static weight). Proofrolling should be avoided in dry stormwater system areas, where stormwater infiltration is required to provide recovery. When the prevailing groundwater table is high, proofrolling should be performed in static mode. Proofrolling aids in providing a firm base for compaction of new fill and delineating soft or disturbed areas that may exist at or near the exposed subgrade level as well as overall densification of the upper loose sands. Proofrolling should be performed in the presence of a Terracon representative in order to aid in evaluating

unstable subgrade areas. Unstable areas observed at this time should be improved as recommended by the engineer based on field conditions and typically includes scarification and recompaction or by undercutting and replacement with suitable compacted fill.

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface. Furthermore, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face.

4.2.1 Material Requirements

Compacted 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[2]
	SP-SM (fines content between 5 and 12%)	All locations and elevations, except strict moisture control will be required during placement, particularly during the rainy season. These soils are not as permeable as SP materials.	8 to 12[2]
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[2,3]

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. 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.
3. Static equipment should be used.

Soils observed in the stormwater pond were mostly fine sand (SP) and fine sand with silt (SP-SM). These materials are generally suitable for use as structural fill following removal of surficial vegetation and topsoil. These materials are suitable for placement where drainage may be a concern (i.e. soccer fields and below the pavement base). However, we recommend the cleanest of these materials (SP material; less than 5 percent fines) be used as the upper lift or two of fill placed in the soccer fields and below the pavement base to provide better drainage.

Although not observed in the borings performed within the pond area, silty sand (SM) was observed in other borings across the site. The silty sand is also generally acceptable for use as

fill, but tends to retain moisture and requires more handling to dry, place and compact. Thinner lifts (8 to 12 inches loose thickness) may be required for placement and compaction of these soils. Due to the relatively high moisture content of these soils, it may be necessary to mix these soils with drier, cleaner granular soils prior to placement to increase the workability of these soils. Use of silty sand within 1 foot of final grades is not recommended due to the relatively poor drainage characteristics of this material. This material is also not recommended within 18 inches of the pavement base or final grades in the playfields.

4.2.2 Compaction Requirements

Item	Description
Fill Lift Thickness	12 inches or less in 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. 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.
Compaction Requirements [1]	95% of the material's maximum modified Proctor dry density (ASTM D 1557). Care should be taken so that playfields are not over-compacted in order to maintain permeability of soils.
Moisture Content	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction. Depending on rainfall at the time and immediately prior to construction, the Contractor may need to add water to bring the moisture content closer to optimum. When adding water, care must be exercised so that erosion is not a concern.

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.

4.2.3 Grading and Drainage

Final surrounding grades should be sloped away from the structure and playfields on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

Playfields are relatively flat and generally have little positive drainage of stormwater runoff. Infiltration is required to prevent the play surface from being soggy for prolonged periods after heavy rains. To prevent soggy conditions for prolonged periods in the playfields following heavy rain events, fill placed in the playfields should consist of clean sands with less than 5 percent fines content and a minimum in-place permeability rate of 20 feet per day. Sod placed in the playfields should be appropriate for growth in clean sand. Use of a heavy organic sod blanket and/or loamy surficial soils should be avoided, as this would increase the potential for standing water and/or soggy conditions following heavy rains. Over-irrigation in the playfields should be avoided. Placement of an underdrain grid below the playfields should be considered to keep the playfields dry during the rainy season and following heavy rains, especially if final grades are within 1.5 feet of the estimated seasonal high groundwater table and/or if a minimum of 2 feet of clean sand with less than 5 percent fines and a minimum in-place permeability rate of 20 feet per day is not provided.

It is recommended that all exposed earth slopes be seeded to provide protection against erosion. Seeded slopes should be protected with erosion mats until the vegetation is established.

4.2.4 Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of static compaction and/or light construction equipment would aid in reducing subgrade disturbance.

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.

Depending on groundwater levels at the time of construction, temporary lowering of the groundwater level (dewatering) at the site may be necessary. The purposes of dewatering are to facilitate compaction of the subgrade soils during proofrolling and to provide dry, stable footing excavations. Dewatering can probably be accomplished at this site by a system of temporary drainage ditches graded to drain to sumps which can be pumped sufficiently to maintain water levels at the ditch bottoms. However, dewatering methods should be determined by the contractor.

4.3 Foundations

In our opinion, the proposed small structures can be supported by shallow foundation systems following adequate site preparation and placement of properly compacted structural fill. The organic silty sand (organic content of 8%) observed in Boring NB-4 is deep enough (6.5 to 8.5 feet below existing grade) and dense enough that it can support lightly loaded structures without removal and replacement. However, this material should be removed and replaced if exposed in foundation excavations.

4.3.1 Foundation Design Recommendations

Description	Column	Wall	Monolithic Slab Foundation[3]
Net allowable bearing pressure [1] on Compacted structural fill or native soils	2,500 psf	2,500 psf	2,500 psf
Minimum dimensions	30 inches	18 inches	12 inches
Minimum embedment below finished grade [2]	18 inches	24 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

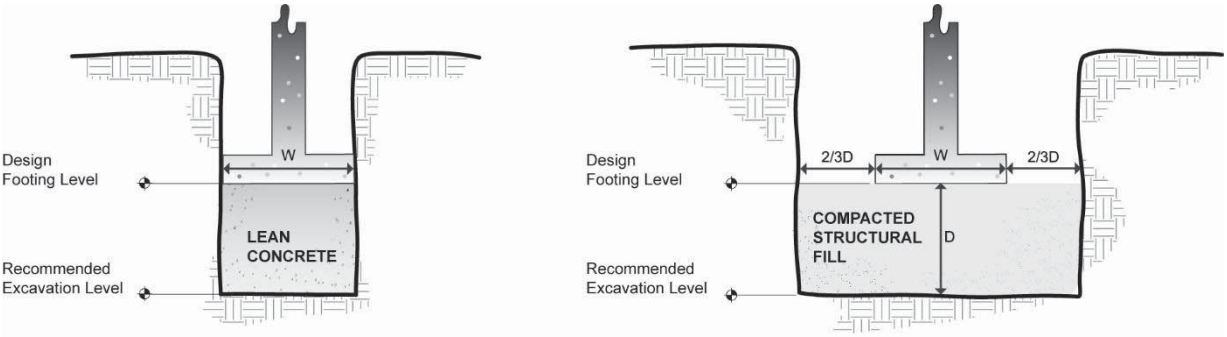
1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable existing fill or soft soils will be undercut and replaced with compacted structural fill. Based upon a minimum Factor of Safety of 3.
2. Relative to lowest adjacent finished grade, typically exterior grade.
3. Turned down portion of slab. For slab requirements, see Section 4.4.1.

4.3.2 Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavation and subgrade soil compaction 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

recompacted prior to placing concrete. It is recommended that the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

Terracon anticipates hand-operated compaction equipment will be utilized, as necessary, in footing cuts, following any mass grading. If unsuitable bearing soils are encountered in footing excavations, the excavation should be extended deeper to suitable soils and the footing could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted backfill extending down to the suitable soils. Over-excavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over-excavation depth below footing base elevation. The over-excavation should then be backfilled up to the footing base elevation per the preceding general earthwork specifications, using hand operated compaction equipment in footing cuts. The over-excavation and backfill procedure is illustrated in the following figure.



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.
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 (ASTM D 1557).
Minimum Testing Frequency	One field density test per 500 square feet (or fraction thereof)

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. Joints

or any cracks that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

4.4.2 Floor Slab Construction Considerations

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. We note that FBC Section 1807 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.

4.5 Pavements

The near surface soil throughout most of the site consisted of fine sand with varying amounts of silt. Stabilizing material will likely be necessary for the construction of pavement subgrades.

4.5.1 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.

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.

4.5.2 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. Terracon 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.

4.5.3 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.

4.5.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Terracon recommends a minimum separation of 12 inches between the bottom of the base course and the seasonal high water table, if a soil cement or crushed concrete base is used. If a limerock base is used, a minimum separation of 18 inches between the bottom of the base course and the estimated seasonal high groundwater table is recommended.

- 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 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.

- Crushed (recycled) concrete base should meet the FDOT specification 911.

- 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.

4.5.5 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 of "General Fill" 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. Terracon 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.

4.5.6 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.

4.5.7 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. However, even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

4.6 Stormwater Pond

The groundwater level observed in the stormwater pond area during the recent exploration (September of 2016) was 1.3 feet below existing grade. Normal Seasonal high groundwater levels are expected to be within 1 foot of existing grade, near elevation +54.5 feet. Normal low groundwater levels are anticipated to be near elevation +51.0 feet in the pond location. An average wet season groundwater elevation of +53.0 feet is recommended for design of the wet bottom stormwater pond.

4.7 Septic Drainfield

Borings encountered fine sand (SP) in the upper 3.5 feet below existing grade, underlain by sand with silt (SP-SM) to the boring termination depths of 5 feet. These materials are generally considered slightly limited soils for design and construction of septic drainfield systems. Based on the subsurface conditions observed in the borings, loading rates of 0.8 gallons per day/square foot of drainfield in a trench configuration and 0.6 gallons per day/square foot of drainfield in a bed configuration are recommended for design.

Seasonal high groundwater levels should be considered in the septic drainfield design. At the locations of the borings performed, seasonal high groundwater levels are expected to be about 1

foot below existing grade. Drainfields should be designed so that a minimum separation of 2 feet is provided between the bottom of the drainfield and the estimated seasonal high groundwater table.

The building pads should be elevated sufficiently to allow proper drainage. Unobstructed area requirements and setbacks in accordance with Chapter 64E-6 of the Florida Administrative Code and/or Orange County Ordinances will be applicable. Allowable sewage flow rates should be estimated in accordance with Chapter 64E-6 of the Florida Administrative Code. Once flow rates are known, required septic tank and drainfield sizes can be determined. Additional borings may be required if the borings performed are not within the limits of the proposed drainfields. Loading rates may vary depending on the subsurface conditions observed at actual drainfield locations.

5.0 GENERAL COMMENTS

Terracon 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. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

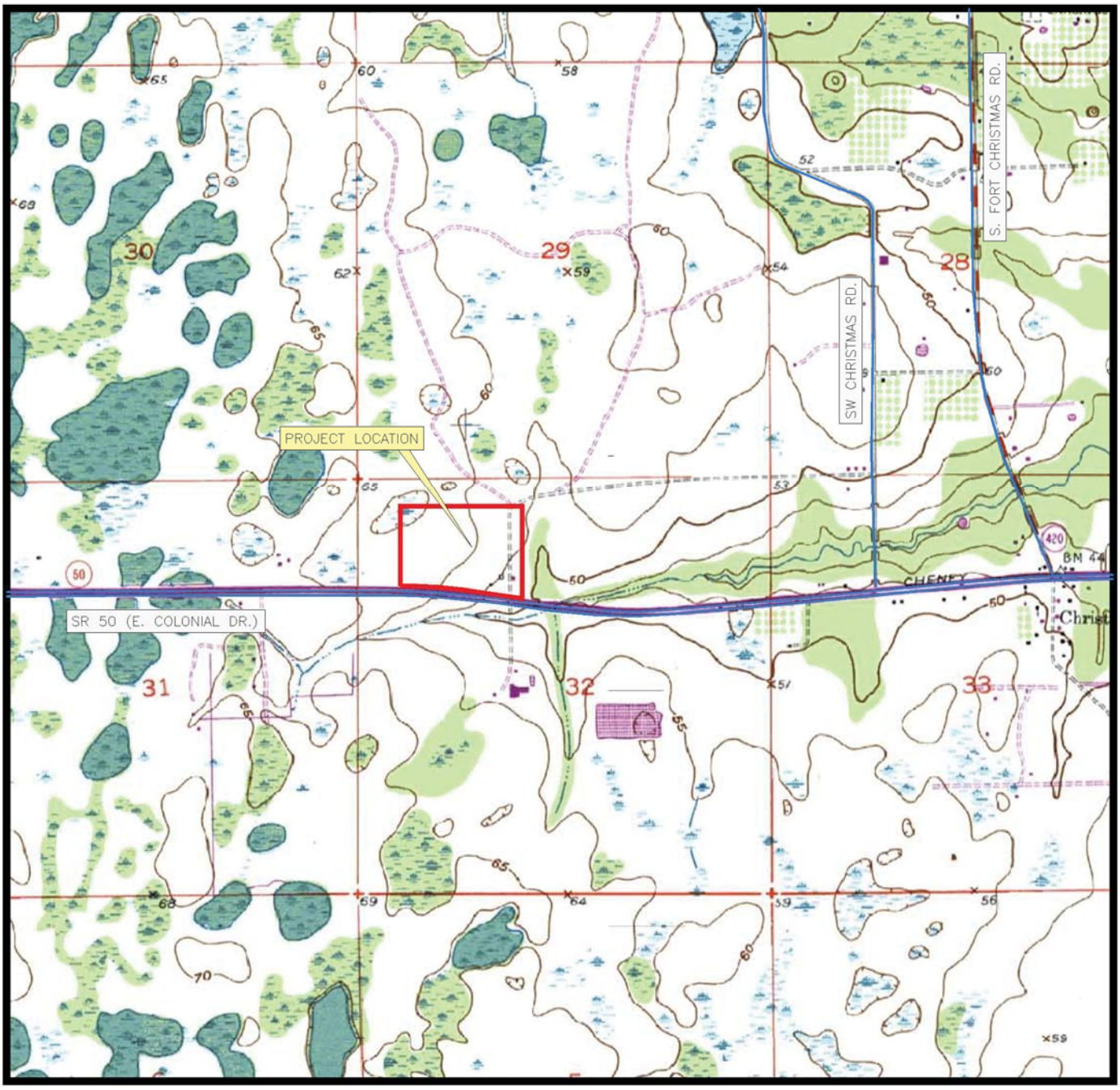
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the 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 express 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 Terracon 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

KILOMETERS 1 .5 0 1 2

MILES 1000 0 1000 2000

FEET 1 .5 0 1

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

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

SECTION: 32
TOWNSHIP: 22 SOUTH
RANGE: 33 EAST

BITHLO, FLORIDA
ISSUED: 1953 REVISED: 1980
7.5 MINUTE SERIES (QUADRANGLE)

N:\Projects\2016\H1165273\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\5273-usgs.dwg
Oct24, 2016-5:36pm

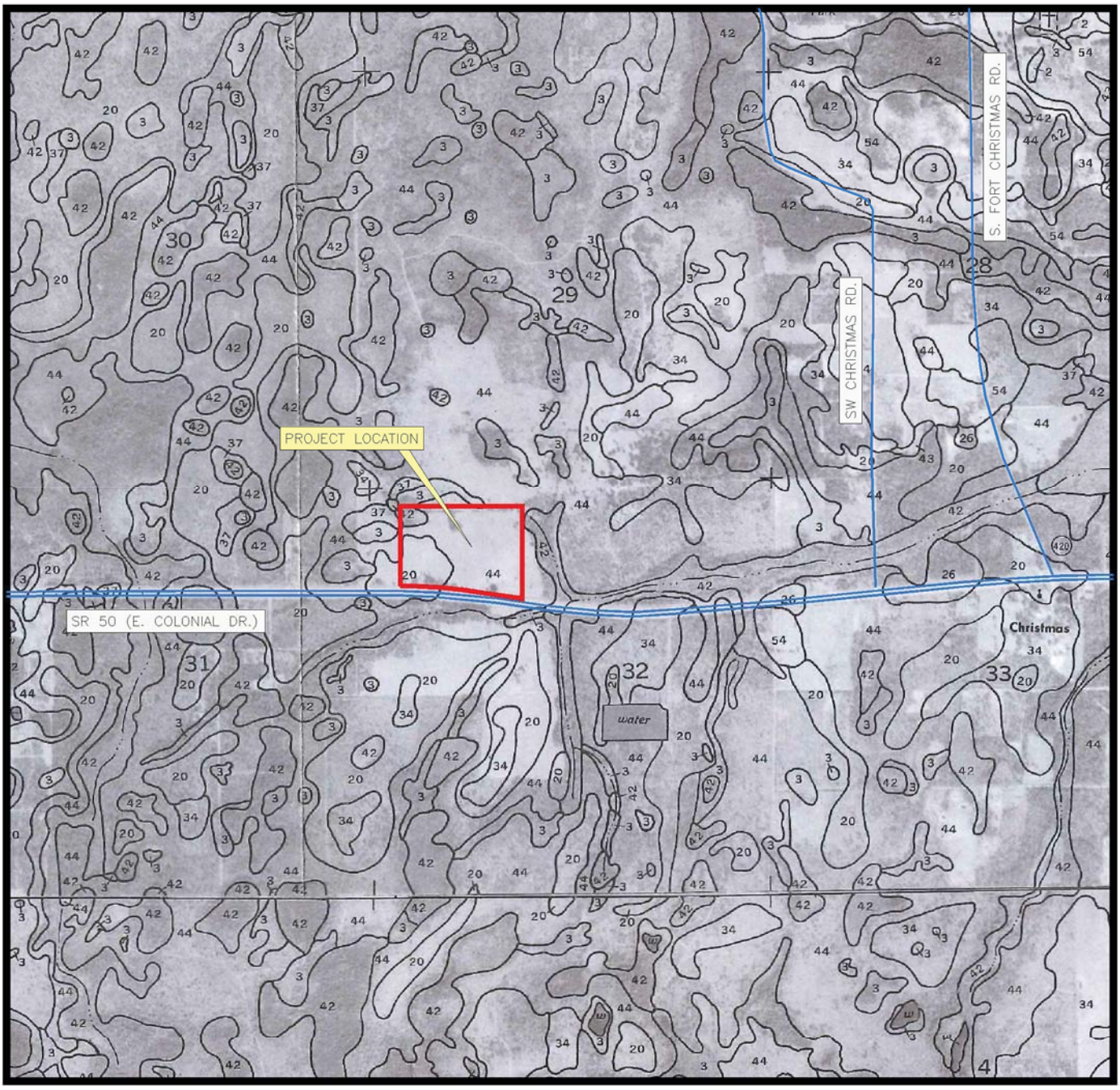
Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC

Project No.	H1165273
Scale:	AS SHOWN
File No.	H1165273-1
Date:	10-24-16

Terracon
Consulting Engineers and Scientists
1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

USGS TOPOGRAPHIC MAP
GEOTECHNICAL ENGINEERING EVALUATION
EAST ORANGE PARK - MULTI-PURPOSE FIELDS
STATE ROAD 50
CHRISTMAS, ORANGE COUNTY, FLORIDA

EXHIBIT
A-1



SCALE 1" = 2000'

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

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

ORANGE COUNTY SOILS MAP INDEX

3	BASINGER FINE SAND, DEPRESSIONAL
20	IMMOKALEE FINE SAND
44	SMYRNA FINE SAND

SECTION: 32
TOWNSHIP: 22 SOUTH
RANGE: 33 EAST

N

Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC
Project No.	H1165273
Scale:	AS SHOWN
File No.	H1165273-2
Date:	10-24-16

Terracon
Consulting Engineers and Scientists
1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

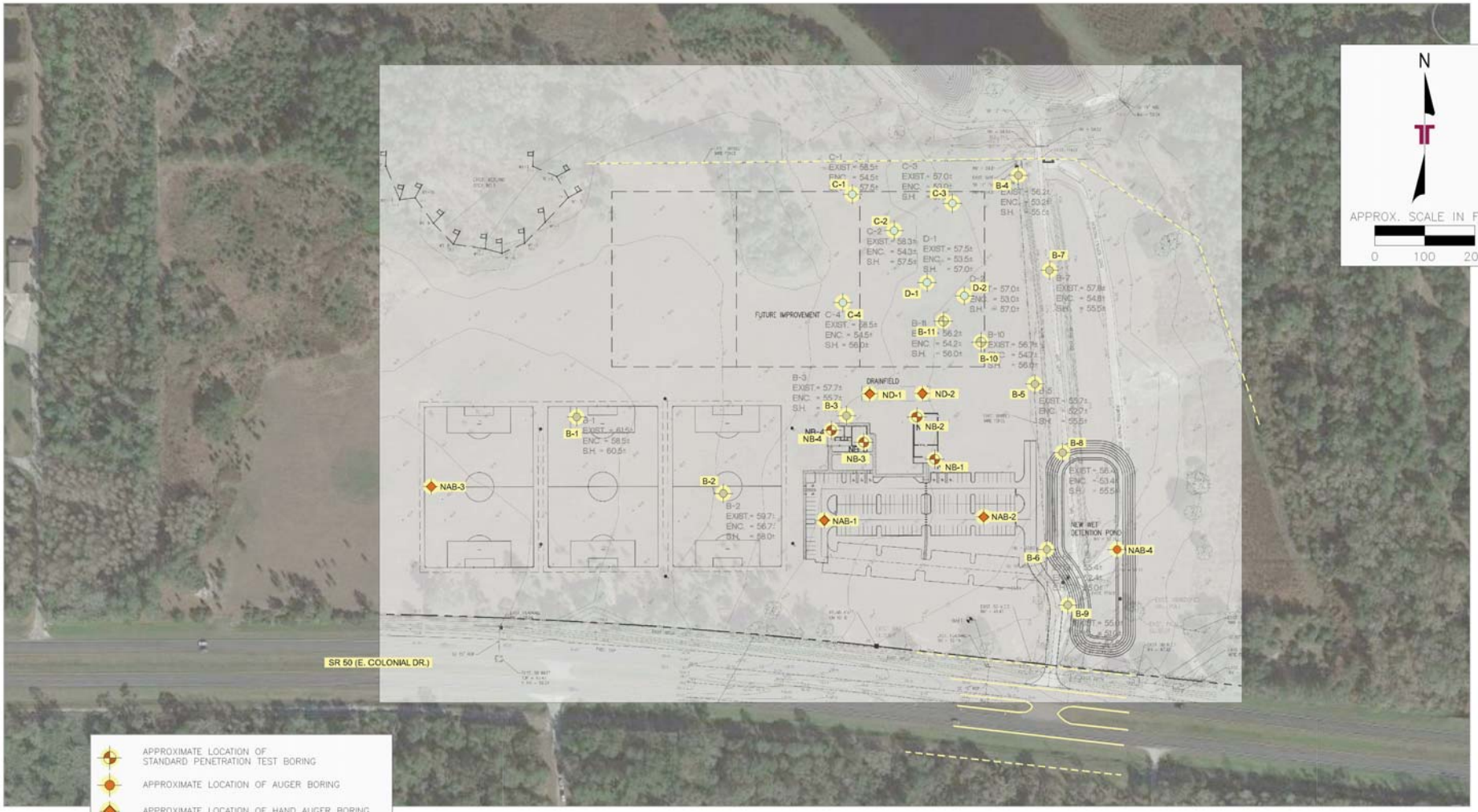
U.S.D.A. SOILS MAP
GEOTECHNICAL ENGINEERING EVALUATION
EAST ORANGE PARK - MULTI-PURPOSE FIELDS
STATE ROAD 50
CHRISTMAS, ORANGE COUNTY, FLORIDA

EXHIBIT
A-2

Soil Survey Descriptions

20 – Immokalee fine sand. This soil type is nearly level and poorly drained. It is typically found on broad flatwoods. During years of normal precipitation, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface for 1 to 3 months, receding to a depth of between 10 and 40 inches (0.8 and 3.3 feet) for more than 6 months. This soil type is predominantly sandy between the surface and a depth of 35 inches (2.9 feet) and also from a depth of 58 inches (4.8 feet) to the maximum defined depth of 80 inches (6.7 feet). Between these depths, this soil type is typically composed of sand with silt to silty sand.

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.



Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC
Project No.	H1165273
Scale:	AS SHOWN
File No.	H1165273-4
Date:	10-24-16

Terracon
Consulting Engineers and Scientists
1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH: (407) 740-8110 FAX: (407) 740-8112

SOIL BORING LOCATION PLAN
GEOTECHNICAL ENGINEERING EVALUATION
EAST ORANGE PARK - MULTI-PURPOSE FIELDS
STATE ROAD 50
CHRISTMAS, ORANGE COUNTY, FLORIDA

EXHIBIT
A-4

Field Exploration Description

The boring locations were laid out at the project site by Terracon personnel. The locations indicated on the attached diagram are approximate and were measured by pacing distances and estimating right angles, across vegetated/wooded terrain. 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 an ATV-mounted, rotary drilling rig equipped with an automatic 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.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The machine auger borings were performed by hydraulically turning a 4 inch diameter continuous flight auger into the ground in 5 foot increments. Additional flights are added until the desired termination depth was achieved. The auger is then extracted without further rotation and representative soil samples are retrieved from the auger. Samples are visually classified in the field and are then packaged and returned to our soils laboratory for further classification and testing.

The hand auger boring procedure consisted of manually turning a 3 inch diameter, 6 inch long sampler into the soil until it is full. The sampler was then retrieved and the soils in the sampler were visually examined and classified. The procedure was repeated until the desired termination depth was achieved or shallow groundwater levels cause collapse of the borehole. Samples of representative strata were obtained for further visual examination and classification in our laboratory.

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: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.573573° Longitude: -81.043185°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light brown to gray to gray-brown								
	2.0								
	SAND WITH SILT (SP-SM), fine grained, dark brown		▽					32	10
	6.0	5							
	SILTY SAND (SM), fine grained, dark brown								
	10.0	10							
	Boring Terminated at 10 Feet	15							
		20							
		25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE AK145001-NEW BORINGS GINT.GPJ TERRACON2012.GDT 5/21/15

BORING LOG NO. B-2

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537092° Longitude: -81.042229°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light brown to gray to gray-brown	▽						
							28	3
10.0								
	Boring Terminated at 10 Feet							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-7

BORING LOG NO. B-3

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537562° Longitude: -81.041325°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
SAND (SP), fine grained, light brown to gray to gray-brown		5	▽						
7.0									
SAND (SP), fine grained, dark brown								27	3
10.0		10							
Boring Terminated at 10 Feet		15							
		20							
		25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 2.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-8

BORING LOG NO. B-4

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.538908° Longitude: -81.040437°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, dark brown					3		20	2
6.0	**SILTY SAND (SM)**, fine grained, dark brown	5							
13.5	**SAND (SP)**, fine grained, light brown to gray to gray-brown	10							
15.0	***Boring Terminated at 15 Feet***	15							
		20							
		25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-9

BORING LOG NO. B-5

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537808° Longitude: -81.040336°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
								24	3
10.0		10							

SAND (SP), fine grained, light brown to gray to gray-brown

Boring Terminated at 10 Feet

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-10

BORING LOG NO. B-6

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.536782° Longitude: -81.040267°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light brown to gray to gray-brown					11		20	4
2.0									
	SAND (SP), fine grained, dark brown	5	▽						
								32	4
11.0		10							
	SILTY SAND (SM), fine grained, dark brown								
15.0		15							
	Boring Terminated at 15 Feet	20							
		25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-11

BORING LOG NO. B-7

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.538368° Longitude: -81.040195°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light brown to gray to gray-brown	5	▽						
	10.0	10							
	Boring Terminated at 10 Feet	15							
		20							
		25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-12

BORING LOG NO. B-8

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537301° Longitude: -81.040103°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
0	**SAND WITH SILT (SP-SM)**, trace limerock at surface, fine grained, dark brown	▽					26	6
8.0	**SAND (SP)**, fine grained, light brown to gray to gray-brown							
10.0	***Boring Terminated at 10 Feet***							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 3.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-13

BORING LOG NO. B-9

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.536443° Longitude: -81.040133°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
								9	21
SILTY SAND (SM), trace clay (stabilized sub base), fine grained, light brown									
2.0									
SAND (SP), fine grained, light brown to gray to gray-brown		5	▽						
10.0		10							
Boring Terminated at 10 Feet		15							
		20							
		25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO LOG-DEPTH TO BOTTOM OF PAGE AK145001-NEW BORINGS GINT.GPJ TERRACON2012.GDT 5/21/15

BORING LOG NO. B-10

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.538021° Longitude: -81.04055°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
			▽						
					2-2-3-4 N=5				
					6-6-7-9 N=13				
		5			7-10-13-15 N=23				
					11-11-11-17 N=22			18	4
8.0									
					13-15-14-17 N=29				
		10							
13.5									
					11-14-15 N=29				
15.0		15							
		20							
		25							

SAND (SP), fine grained, light brown to gray to gray-brown, loose to medium dense

SAND WITH SILT (SP-SM), fine grained, gray-brown, medium dense

SAND WITH SILT (SP-SM), fine grained, dark brown, medium dense

Boring Terminated at 15 Feet

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

▽ *Observed Groundwater Level at 2.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: BR-2500 Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-15

BORING LOG NO. B-11

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.538173° Longitude: -81.040748°

DEPTH	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light brown to gray to gray-brown, loose to medium dense	▽		1-1-2-3 N=3				
				4-4-6-8 N=10				
5				7-8-10-13 N=18				
				10-12-13-16 N=25				
8.0								
	SAND (SP), fine grained, dark brown, medium dense			11-12-15-17 N=27				
10								
13.5								
	SAND WITH SILT (SP-SM), fine grained, dark brown, medium dense			11-14-12 N=26			19	7
15.0								
15	***Boring Terminated at 15 Feet***							
20								
25								

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

▽ *Observed Groundwater Level at 2.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 9/16/2014 Boring Completed: 9/16/2014

Drill Rig: BR-2500 Driller: Terracon

Project No.: AK 14 5001 Exhibit: A-16

BORING LOG NO. C-1

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, gray								
	3.5								
	SAND WITH SILT (SP-SM), fine grained, dark reddish-brown		▽					22	8
		5							
		10							
		15						30	10
	20.0	20							
	Boring Terminated at 20 Feet								
		25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-17

BORING LOG NO. C-2

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), fine grained, dark gray-brown								
	2.5								
	SAND (SP), fine grained, gray to dark brown		▽					23	2
	11.0	5							
	SAND WITH SILT (SP-SM), fine grained, dark reddish-brown	10						27	8
	20.0	15							
	Boring Terminated at 20 Feet	20							
		25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-18

BORING LOG NO. C-3

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SILTY SAND (SM), trace organics, fine grained, dark brown						3	15	
	2.0								
	SAND (SP), fine grained, dark gray-brown		▽						
	4.0								
	SAND WITH SILT (SP-SM), fine grained, dark reddish-brown	5				14		22	8
		10							
		15							
	20.0	20							
	Boring Terminated at 20 Feet	25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-19

BORING LOG NO. C-4

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

LOCATION See Exhibit A-4

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), fine grained, dark gray-brown								
	1.0								
	SAND (SP), fine grained, gray		▽						
	6.0	5							
	SAND WITH SILT (SP-SM), fine grained, dark brown	10						24	6
		15							
	20.0	20							
	Boring Terminated at 20 Feet	25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-20

BORING LOG NO. D-1

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

GRAPHIC LOG	LOCATION See Exhibit A-4 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND WITH SILT (SP-SM), trace organics, fine grained, black (5YR 2.5/1) 1.0								
	SAND (SP), fine grained, gray (7.5YR 6/1) 4.5		▽						
	SAND WITH SILT (SP-SM), fine grained, black (10YR 2/1) 7.5	5						24	7
	SILTY SAND (SM), fine grained, black (7.5YR 2.5/1) 10.0	10							
	Boring Terminated at 10 Feet	15							
		20							
		25							

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

Advancement Method:
Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-21

BORING LOG NO. D-2

PROJECT: EAST ORANGE PARK - MULTI PURPOSE FIELDS

CLIENT: Orange County Capital Projects

SITE: State Road 50
Christmas, Orange County, Florida

GRAPHIC LOG	LOCATION See Exhibit A-4 / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	VERTICAL PERMEABILITY (feet/day)	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SILTY SAND (SM), some organics, fine grained, black (2.5Y 2.5/1) 1.0						8	28	
	SAND WITH SILT (SP-SM), fine grained, very dark brown (10YR 2/2) 4.5		▽						
	SAND WITH SILT (SP-SM), fine grained, black (10YR 2/1) 7.5	5							
	SILTY SAND (SM), fine grained, black (10YR 2/1) 10.0								
	Boring Terminated at 10 Feet	10							
		15							
		20							
		25							

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

Advancement Method: Auger

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

▽ *Observed Groundwater Level at 4.0' Depth*

Terracon
1675 Lee Road
Winter Park, Florida

Boring Started: 5/1/2015 | Boring Completed: 5/1/2015

Drill Rig: D-50 | Driller: Terracon

Project No.: AK 14 5001 | Exhibit: A-22

BORING LOG NO. NB-1

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537325° Longitude: -81.04096°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, gray, medium dense		▽		4-5-6-5 N=11			
2.5	**SAND WITH SILT (SP-SM)**, fine grained, gray-brown, medium dense				7-6-8-8 N=14			
5.5	**SAND (SP)**, fine grained, brown, medium dense	5			8-7-8-8 N=15			
7.5	**SAND WITH SILT (SP-SM)**, fine grained, dark brown, medium dense to dense				7-8-8-8 N=16		22	11
					10-12-13-13 N=25			
12.0	**SAND (SP)**, fine grained, reddish-brown, medium dense	10						
15.0					4-4-6 N=10			
	Boring Terminated at 15 Feet	15						

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 1.7'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/30/2016 Boring Completed: 9/30/2016

Drill Rig: BR-2500 Driller:

Project No.: H1165273 Exhibit: A-23

BORING LOG NO. NB-2

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537564° Longitude: -81.041069°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
		SILTY SAND (SM), trace organics and roots, fine grained, dark brown, loose to medium dense		▽		3-3-4-4 N=7			
2.5		**SAND WITH SILT (SP-SM)**, fine grained, dark reddish-brown, medium dense				7-6-6-4 N=12			
5.5		**SAND (SP)**, fine grained, brown to gray, medium dense	5			7-9-8-9 N=17			
						5-7-7-7 N=14			
						8-7-6-6 N=13			
			10						
13.5		**SAND WITH SILT (SP-SM)**, fine grained, reddish-brown, medium dense				9-8-11 N=19			
15.0		***Boring Terminated at 15 Feet***	15						

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 1.5'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/30/2016 Boring Completed: 9/30/2016

Drill Rig: BR-2500 Driller:

Project No.: H1165273 Exhibit: A-24

BORING LOG NO. NB-3

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537411° Longitude: -81.041412°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
0	**ORGANIC SILTY SAND (SM)**, fine grained, dark gray, loose		▽		3-2-2-4 N=4			
1.5	**SAND WITH SILT (SP-SM)**, fine grained, dark brown, medium dense				4-5-7-7 N=12			
		5			6-9-8-8 N=17			
					12-11-11-10 N=22		30	11
9.0	**SAND (SP)**, fine grained, reddish-brown, medium dense				9-8-8-8 N=16			
		10						
					7-9-8 N=17			
15.0	***Boring Terminated at 15 Feet***	15						

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 1.5'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/30/2016 Boring Completed: 9/30/2016

Drill Rig: BR-2500 Driller:

Project No.: H1165273 Exhibit: A-25

BORING LOG NO. NB-4

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537479° Longitude: -81.041632°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
1.5		**SILTY SAND (SM)**, (topsoil) trace organics, fine grained, gray, very loose		▽		1-1-2-4 N=3			
3.5		**SAND (SP)**, fine grained, gray, loose				3-3-4-3 N=7			
6.5		**SAND WITH SILT (SP-SM)**, fine grained, gray-brown, loose to medium dense	5			5-7-9-9 N=16			
8.5		**ORGANIC SILTY SAND (SM)**, fine grained, dark brown, medium dense				10-11-10-9 N=21	8	41	
13.5		**SAND (SP)**, fine grained, brown, medium dense	10			9-9-9-9 N=18			
15.0		**SAND WITH SILT (SP-SM)**, fine grained, dark brown, medium dense				6-5-5 N=10			
		Boring Terminated at 15 Feet	15						

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 1.3'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/30/2016 Boring Completed: 9/30/2016

Drill Rig: BR-2500 Driller:

Project No.: H1165273 Exhibit: A-26

BORING LOG NO. ND-1

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537685° Longitude: -81.041382°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
		SAND (SP), fine grained, gray to light gray							
	3.5			▽					
		SAND WITH SILT (SP-SM), fine grained, dark reddish-brown							
	5.0		5						
		Boring Terminated at 5 Feet							

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

Advancement Method:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 2.0'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/26/2016 Boring Completed: 9/26/2016

Drill Rig: Driller:

Project No.: H1165273 Exhibit: A-27

BORING LOG NO. ND-2

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537687° Longitude: -81.041036°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, gray							
	3.5		▽					
	SAND WITH SILT (SP-SM), fine grained, dark reddish-brown							
	5.0							
	Boring Terminated at 5 Feet	5						

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

Advancement Method:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 2.0'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/26/2016 Boring Completed: 9/26/2016

Drill Rig: Driller:

Project No.: H1165273 Exhibit: A-28

BORING LOG NO. NAB-1

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.536958° Longitude: -81.041682°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
		SAND (SP), fine grained, light gray							
	2.0			▽					
		SAND WITH SILT (SP-SM), fine grained, dark brown to reddish-brown						30	8
	5.0		5						
		Boring Terminated at 5 Feet							

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

Advancement Method:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 2.0'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/26/2016 Boring Completed: 9/26/2016

Drill Rig: Driller:

Project No.: H1165273 Exhibit: A-29

BORING LOG NO. NAB-2

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.536978° Longitude: -81.040634°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
		SAND (SP), (topsoil) trace roots, organics, fine grained, gray							
	1.5								
	2.0	**SAND (SP)**, fine grained, light gray		▽					2
		SILTY SAND (SM), fine grained, dark reddish-brown						17	
	5.0		5						
		Boring Terminated at 5 Feet							

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

Advancement Method:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 2.0'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/26/2016 Boring Completed: 9/26/2016

Drill Rig: Driller:

Project No.: H1165273 Exhibit: A-30

BORING LOG NO. NAB-3

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.537154° Longitude: -81.044267°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
		SAND (SP), fine grained, light gray							
	2.5								
	3.0	**SANDY MUCK/PEAT (PT)**, dark brown					14	48	
	3.5	**SILTY SAND (SM)**, fine grained, reddish-brown							
		SAND WITH SILT (SP-SM), cemented, fine grained, reddish-brown							
	5.0		5						
		SAND (SP), cemented, fine grained, reddish-brown		▽					
	7.0								
		Boring Terminated at 7 Feet							

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

Advancement Method:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

▽ *Water Initially Observed at 5.4'*

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/26/2016 Boring Completed: 9/26/2016

Drill Rig: Driller:

Project No.: H1165273 Exhibit: A-31

BORING LOG NO. NAB-4

PROJECT: East Orange Soccer Fields

CLIENT: Orange County Capital Projects Division
Orlando, Florida

SITE: East Colonial Drive
Orange County, Florida

LOCATION See Exhibit A-4

Latitude: 28.536789° Longitude: -81.039758°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	ORGANIC CONTENT (%)	WATER CONTENT (%)	PERCENT FINES
	SAND (SP), fine grained, light gray to gray-brown							
		5					19	2
		10						
	15.0	15						
	Boring Terminated at 15 Feet							

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

Hammer Type: Automatic

Advancement Method:
Mud Rotary

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

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

Water Initially Observed at 1.3'

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 9/30/2016 Boring Completed: 9/30/2016

Drill Rig: BR-2500 Driller:

Project No.: H1165273 Exhibit: A-32

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 organic content. Those results are included in this report and 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.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

- Auger Cuttings
- Rock Core
- Grab Sample
- No Recovery
- Shelby Tube
- Standard Penetration Test

WATER LEVEL

- **Water Initially Encountered**
- **Water Level After a Specified Period of Time**
- **Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

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.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Automatic Hammer SPT N-Value (Blows/Ft.)**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (psf)**	**Automatic Hammer SPT N-Value (Blows/Ft.)**
Very Loose	< 3	Very Soft	less than 500	< 1
Loose	3 - 8	Soft	500 to 1,000	1 - 3
Medium Dense	8 - 24	Medium Stiff	1,000 to 2,000	3 - 6
Dense	24 - 40	Stiff	2,000 to 4,000	6 - 12
Very Dense	> 40	Very Stiff	4,000 to 8,000	12 - 24
		Hard	> 8,000	> 24

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. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm 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

Terracon

Exhibit: C-1

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.

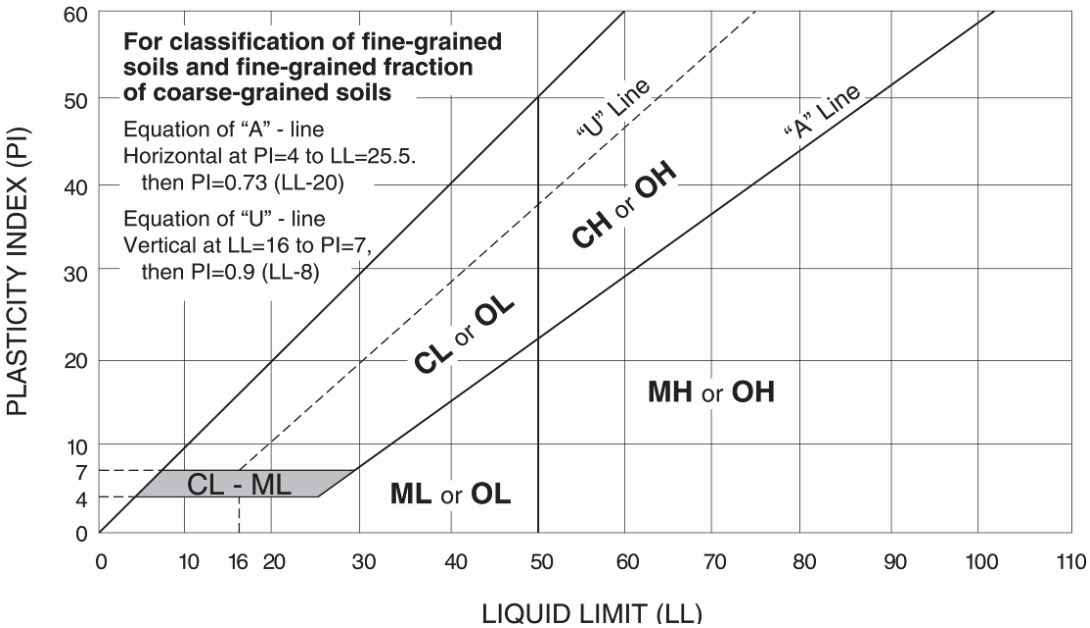
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



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