Andreyev Engineering, Inc.

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▼ Groundwater ▼ Environmental ▼ Geotechnical ▼ Construction Materials Testing

March 24, 2023
GPGT-22-148

To: **CPH, LLC**
500 West Fulton Street
Sanford, Florida 32771

Attention: **Mr. Kurt R. Luman, Jr., P.E.**

Subject: **Geotechnical Investigation, Proposed Roundabout at Jalarmy Road & Lake Minneola Shores, Clermont, Lake County, Florida**

Dear Mr. Luman:

Andreyev Engineering, Inc. (AEI) has completed a geotechnical investigation for the above referenced project location. We understand that the proposed site improvements include a new roundabout and connecting roadway improvements at the intersection of Jalarmy Road & Lake Minneola Shores. We additionally understand that the planned improvements will route stormwater runoff into one (1) proposed stormwater retention pond. A site plan with proposed boring locations was provided by you.

This report presents the results of our geotechnical investigation along with an evaluation of the soil and groundwater conditions encountered. In addition, it provides geotechnical engineering recommendations for proper site preparation, pavement section design, and aquifer parameters for the stormwater retention system.

SITE LOCATION AND DESCRIPTION

The subject site is located in the vicinity of the intersection of Jalarmy Road & Lake Minneola Shores in Clermont, Lake County, Florida, Section 12, Township 22 South, and Range 25 East. We have included the U.S.G.S. Topographic Map, which depicts the location of the site, on the attached **Figure 1**. In addition, the Natural Resources Conservation Service (NRCS) Soil Map, which depicts the location and general soil types of the subject site, is presented on **Figure 2**.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to explore subsurface soil and groundwater conditions within the proposed roadway improvement areas and stormwater retention pond and provide recommendations for proper site preparation, pavement section design, and evaluation of the stormwater retention system.

The scope of this investigation included:

- Drilled five (5) machine auger borings, designated as AB-1, AB-2, and AB-4 through AB-6, to depths ranging from 5 to 25 feet below ground surface, within the proposed roadway improvement areas, for pavement section design evaluation.

- Drilled one (1) machine auger boring, designated as AB-3, to a depth of 20 feet below ground surface, within the proposed stormwater retention area, for stormwater system evaluation.

- Collected one (1) undisturbed tube sample, at a depth of 3 feet below ground surface from the immediate vicinity of AB-3, and conducted laboratory permeability testing on the undisturbed sample, to estimate soil hydraulic conductivity.

- Performed moisture content, fines content, and organic content laboratory tests on selected samples, to assist with soil classification and stratification.

- Estimated normal seasonal high groundwater table levels.

Samples were recovered from the borings and returned to AEI's laboratory for visual classification and stratification. Soil strata were classified according to the Unified Soil Classification System (USCS). Approximate boring locations are shown on **Figure 4**. Results of the auger borings, in profile form, are presented on **Figure 5**. On the profiles, horizontal lines designating the interface between differing materials represent approximate boundaries. The actual transition between layers is typically gradual.

NATURAL RESOURCES CONSERVATION SERVICE SOIL SURVEY

The publication titled "Soil Survey of Lake County, Florida" published by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) was reviewed. For your reference, we have included a portion of the NRCS Soil Map which depicts the location of the subject site on the attached **Figure 2**. The two soil map units identified to exist for the subject site are identified as:

Soil Map Unit 8:* ***Candler Sand, 0 to 5 Percent Slopes*

Brief Description: "This soil is nearly level to gently sloping and is excessively drained. It is on ridges, knolls, and broad uplands. The slopes range from smooth to broken. Typically, the surface layer is dark grayish brown sand about 6 inches thick. The subsurface layer, to a depth of about 63 inches is light yellowish brown and yellowish brown sand. The next layers to a depth of 80 inches or more are yellow sand that has thin strong textural bands. This soil does not have a high water table within 80 inches of the surface. The available water capacity is very low throughout. Permeability is high to very high."

Soil Map Unit 9:* ***Candler Sand, 5 to 12 Percent Slopes*

Brief Description: "This soil is a sloping to strongly sloping, excessively drained soil found on rolling uplands of the central ridge. Typically, the surface layer of this soil type consists of sand about 5 inches thick. The next layer is sand about 62 inches thick followed by a layer of sand about 13 inches thick. The water table for this soil type is at a depth of more than 80 inches.

Available water capacity is very low and permeability is considered to be rapid to very rapid throughout the profile of this soil type."

* This soil map unit description is not presented in the 1975 NRCS "Soil Survey of Lake County, Florida" publication including revisions made to soil descriptions in 2004. These soil descriptions are interpreted from corresponding soil survey map units published for nearby counties.

SOIL AND GROUNDWATER CONDITIONS

The soil types encountered at the boring locations are presented in the form of soil profiles on the attached **Figure 5**. The stratification presented is based on visual examination of the recovered soil samples and the interpretation of the field logs by a geotechnical engineer.

In general, the borings encountered the following soil Strata:

- Grayish Brown Fine Sand with Organic Debris (Stratum 1)
- Light Brown to Brown Fine Sand (Stratum 2)
- White Fine Sand (Stratum 3)
- Orangish Brown Slightly Clayey Fine Sand (Stratum 4)
- Orangish Brown Clayey Fine Sand (Stratum 5)

Please refer to **Figures 4** and **5** for boring locations, strata depths, and encountered soil conditions. Ground surface elevations at the boring locations were not able to be recorded using GPS equipment due to inclement weather and/or tree cover. The stratification lines represent the approximate boundaries between soil types, the actual transition may be gradual. Minor variations not considered important to our engineering evaluations may have been abbreviated or omitted for clarity.

Groundwater Conditions

Groundwater was not encountered at the time of drilling at any of the boring locations. Due to the site topography and proximity of Lake Minneola, natural groundwater levels are expected to exist well below the termination depths of the respective boring locations.

Based on the encountered subsurface conditions, our local experience, antecedent rainfall conditions, and review of the NRCS Soil Survey, the normal seasonal high groundwater levels are estimated to exist in a temporary "perched" condition above the Stratum 5 clayey soils during and after periods of extended and/or heavy rainfall, at the locations of borings AB-3, AB-4, and AB-5. At borings AB-1, AB-2, and AB-6 where no confining soils were encountered, the normal seasonal high groundwater levels are estimated to exist at or below the termination depth of 5 feet.

Laboratory Test Results

Laboratory moisture content tests (ASTM D2216) and fines content (percent soil passing ASTM Standard Sieve No.200) tests (ASTM D1140) were performed on two (2) selected samples. One (1) sample was selected for moisture content testing and organic content testing (ASTM D2974). The results of these laboratory tests are presented next to the corresponding depths and soil profiles on **Figure 5**.

EVALUATION AND RECOMMENDATIONS

General

Based on the results of this investigation and our evaluation of the encountered subsurface conditions, it our opinion that the soils encountered throughout the site are generally suitable to support conventionally designed pavement sections, provided that proper site soil preparation & densification are carried out. It is critical that site preparation and soil densification procedures are thorough to ensure consistent and uniform support conditions for the proposed site improvements.

The encountered soil and groundwater conditions generally will not present any limitations to the design or construction of the proposed roadway improvements. Stratum 1 sandy soils containing organic debris were encountered in 5 of the 6 borings, some of which occur near the proposed grade elevation. The sample selected for testing from AB-6 was shown to contain about 4.4% organic material by weight. Strata 4 and 5 slightly clayey to clayey soils were encountered at boring AB-4 near the grade elevation of the proposed new roadway.

Due to the amount of organics encountered in the Stratum 1 soils, extra care should be taken to ensure any tree and root material or other organic debris is removed from all pavement areas, plus a 5-foot buffer. Due to the site topography and proximity of Lake Minneola, close attention should also be given to ensure adequate separation is maintained between the pavement base courses and any Strata 4 or 5 clayey soils in all pavement areas. If these confining-type soils are not adequately separated from the pavement section, water intrusion may cause construction difficulties and/or premature pavement failure. In general, we recommend 2 feet of separation.

Based on the results of boring AB-3, dry stormwater retention should be possible at the proposed location. Dependent upon the grading of the proposed retention area, the presence of deeper Stratum 5 clayey soils may impact design. However, the surficial sandy soils were shown to have relatively high hydraulic conductivity values. Also, site topography is expected to facilitate the flow of stormwater toward the lake to the south. To achieve proper recovery of stormwater in a dry retention system, adequate separation should be maintained between the pond bottom and any Strata 4 or 5 clayey soils.

On-site Strata 2 and 3 sandy soils, excavated from the proposed retention pond and pavement cut areas during construction, are considered suitable for use as general fill with minimal soil preparation efforts, provided that there is minimal root content and that the soils moisture content is maintained near optimum prior to fill placement and compaction. Stratum 1 soils containing organic debris are expected to be excavated in certain areas due to the proposed cut depths. We would also recommend during clearing, grubbing and rough grading that all Stratum 1 soils with organics be separated and stockpiled separately. If these Stratum 1 soils are to be used for

backfill in structural areas, filtering or sifting of the organic debris is recommended. Further, unfiltered Stratum 1 soils may be used for the upper few inches of backfill in landscape areas where vegetation will be present.

More specific recommendations for the proposed site improvements are provided below.

Site Preparation

The roadway improvement areas, plus a minimum margin of 5 feet beyond their outer lines, should be cleared and stripped to remove all surface vegetation, roots, topsoil, organic debris, concrete/asphalt debris, or any other encountered deleterious materials. Any encountered type(s) of debris will need to be properly removed from beneath all paved areas, plus a five-foot perimeter. Additionally, a minimum two-foot separation should be maintained between the bottom of pavement base courses and the top of the Strata 4 and 5 clayey soils.

After clearing, grubbing, and any necessary additional site preparation efforts, the exposed soils in the pavement areas, plus a minimum margin of 5 feet beyond building lines, should be proof rolled and compacted to a minimum of 95% of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557 to a depth of 2 feet before any fill material is placed. All fill required to bring the site to final grade should be inorganic, non-plastic, granular soil (clean sands) with less that 10% passing a U.S. #200 sieve.

All fill should be placed in level lifts not to exceed 12 inches loose and should be compacted to a minimum of 95% of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557. In-place density tests should be performed on each lift by an experienced engineering technician working under the direction of a registered geotechnical engineer to verify that the recommended degree of compaction has been achieved. We suggest a minimum testing frequency of one (1) test per lift per 10,000 square feet in pavement areas. This fill should extend a minimum of 5 feet beyond building lines to prevent possible erosion or undermining of footing bearing soils. Further, fill slopes should not exceed 2 horizontal to 1 vertical (2H:1V).

All fill placed in utility line trenches and adjacent to existing structures should also be properly placed and compacted to the specifications stated above. However, in these restricted working areas, compaction should be accomplished with lightweight, hand-guided compaction equipment and lift thickness should be limited to a maximum of 4 inches loose thickness.

Paved Areas

As previously mentioned, care should be taken to ensure that soils containing organic debris are removed from the pavement areas. If excavated Stratum 1 soils are to be used as backfill in pavement areas, it is our recommendation that these soils should be sifted or filtered to remove the organic debris. Strata 2 and 3 fine sands are considered suitable for use as general fill with minimal soil preparation efforts.

In general, the compacted subsurface soils will be suitable for support of a flexible (limerock) or semi-flexible (crushed concrete or soil cement) type pavement base after subgrade preparation. The use of one system over another is normally governed by the depth to the encountered and/or seasonal high groundwater table. For limerock, a two-foot separation should be maintained between the bottom of the pavement base course and the estimated seasonal high groundwater levels and/or any Strata 4 and 5 clayey soils to prevent perched groundwater from affecting the

pavement section and causing roadway construction issues and/or premature pavement section failure.

Typical flexible and semi-flexible pavement sections are as follows:

Limerock Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" limerock base course, quality of limerock to be in accordance with current Florida Department of Transportation specifications and compacted to a minimum density equivalent to 98% of the modified Proctor maximum density (AASHTO T-180).

12" stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40%. The subbase should be compacted to a minimum density equivalent to 98% of the modified Proctor maximum density (AASHTO T-180). The subgrade material, below the subbase, shall be compacted to a minimum density of 98% of the modified Proctor maximum density of the soil.

Soil-Cement Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" soil-cement base designed and constructed in accordance with current Portland Cement Association recommended methods.

12" subgrade consisting of free draining natural fine sand or fine sand fill with less than 7% passing a U.S. #200 sieve. Subgrade to be compacted to a minimum density of 98% of the modified Proctor maximum density (AASHTO T-180).

Crushed Concrete Base

1-1/2" to 2-1/2" asphaltic concrete wearing surface

6" to 8" crushed concrete base with the quality of crushed concrete to be in accordance with current Florida Department of Transportation specifications and should have a minimum Limerock Bearing Ratio (LBR) of 150% and be compacted to at least 98% of the modified Proctor maximum dry density per ASTM D-1557.

12" stabilized subbase with minimum Limerock Bearing Ratio (LBR) of 40%. The subbase should be compacted to a minimum density equivalent to 98% of the modified Proctor maximum density per ASTM D-1557. The subgrade material, below the subbase, shall be compacted to a minimum density of 98% of the modified Proctor maximum density of the soil per ASTM D-1557.

Type of Development	ADT (average daily traffic)	Base Thickness	Wearing Surface Thickness
Roundabout	< 1,500	6"	1 ½"
	>1,500	8"	2 ½"

The pavement section should be designed based on expected traffic including truck loads. Traffic should not be allowed on the subgrade prior to placement of the base to avoid rutting. The final pavement thickness design should be checked by the project civil engineer using data contained in this report and anticipated traffic conditions.

Stormwater Retention Evaluations

The encountered soil and groundwater conditions in the proposed stormwater system area appear suitable for dry retention design and construction. Stratum 2 fine sands extend to a depth of about 6 feet below existing ground surface, with an approximate 0.5-foot-thick layer of Stratum 1 fine sands containing organic debris at the surface. Below these sands are Stratum 5 clayey soils extending to the termination depth.

The pond bottom should be adequately separated from the Stratum 5 clayey soils and the estimated normal seasonal high groundwater table to achieve proper recovery of stormwater and maintain a dry pond bottom. Dependent upon planned pond grading, over-excavation and replacement of unsuitable soil materials may become necessary to achieve proper separation.

For dry retention stormwater system design, the following normal seasonal high groundwater levels, average hydraulic conductivities, and soil storage coefficients may be used:

Boring Location	Bottom of Aquifer (ft)*	Avg. Unsat. Vertical Hydraulic Conductivity (ft/day)	Avg. Horizontal Hydraulic Conductivity (ft/day)	Seasonal High Groundwater Level (ft)*	Soil Storage Coefficient
AB-3	6.0	12.4	27.8	5.5	0.25

*-feet below existing ground surface

For a pond depth exceeding 6 feet below existing grade, the following alternative aquifer parameters are provided. These aquifer parameters assume a very low permeability rate for the Stratum 5 soil and a SHGWL just above the termination depth of the boring:

Boring Location	Bottom of Aquifer (ft)*	Avg. Unsat. Vertical Hydraulic Conductivity (ft/day)	Avg. Horizontal Hydraulic Conductivity (ft/day)	Seasonal High Groundwater Level (ft)*	Soil Storage Coefficient
AB-3**	20.0	0.5	8.9	19.5	0.25

*-feet below existing ground surface
**-Assumes entire pond bottom to be over-excavated by 2 feet and replaced with clean fine sand having in-place vertical conductivity of 20 ft/day or greater

Due to the soil conditions encountered at this site, additional investigations may become necessary to design and construct a stormwater system meeting regulatory requirements. We further recommend that final design of the stormwater retention system at this site be reviewed by AEI to ensure the data provided in this report has been properly interpreted for the selected stormwater system design, prior to construction. AEI will be glad to assist if further evaluations or groundwater modeling to document stormwater system recovery are needed.

Excavations

Any and all excavations should be constructed in accordance with applicable local, state and federal regulation including those outlined by the Occupational Safety and Health Administration (OSHA). It is the contractor's sole responsibility for designing and constructing safe and stable excavations. Excavations should be sloped, benched or braced as required to maintain stability of the excavation sides and bottoms. Excavations should take into account loads resulting from equipment, fill stockpiles and existing construction. Any shoring needed to maintain a safe excavation should be designed by a professional engineer registered in the State of Florida in accordance with local, state and federal guidelines.

LIMITATIONS

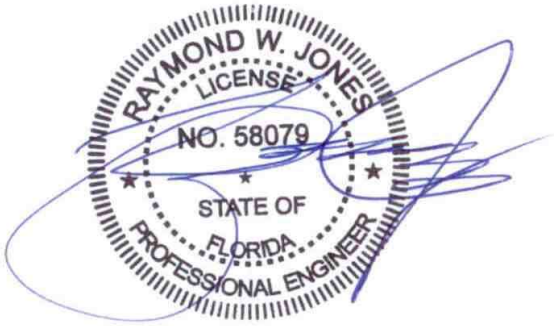
This report has been prepared for the exclusive use of CPH, LLC, and their designers, based on our understanding of the project as stated in this report. Any modifications in design concepts from the description stated in this report should be made known to AEI for possible modification of recommendations presented in this report. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made as to the professional advice presented herein. Statements regarding all geotechnical recommendations are for use by the designers and are not intended for use by potential contractors. The geotechnical exploration and recommendations submitted herein are based on the data obtained from the soil borings presented on **Figure 5**. The report does not reflect any variations which may occur adjacent to, between, or away from the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report. An on-site visit may be required by a geotechnical engineer to note the characteristics of the variations during the construction period. This geotechnical study investigated the soil conditions within the proposed roadway improvement and stormwater retention areas to drilled depths of 5 to 25 feet below ground surface and was not intended to investigate deeper soil conditions with regard to the presence or absence of Karst activity.

CLOSURE

AEI appreciates the opportunity to participate in this project, and we trust that the information herein is sufficient for your immediate needs. If you have any questions or comments concerning the contents of this report, please do not hesitate to contact the undersigned.

Sincerely,

ANDREYEV ENGINEERING, INC.



Frank Moschette, E.I.
Project Engineer

Raymond W. Jones, P.E.
Vice President
Florida Registration No.58079

FIGURES

REFERENCE:
U.S.G.S. CLERMONT WEST, FLA.
QUADRANGLE MAP
DATED 2021
SECTION 12
TOWNSHIP 22 SOUTH
RANGE 25 EAST

0 1000 2000 4000

GRAPHIC SCALE: 1"=2000'

Andreyev Engineering, Inc.

APPROXIMATE SCALE: 1"=2000'	DATE: 03/23/23	ENGINEER: RJ
	PN: GPGT-22-148	DRAWN BY: DLS

GEOTECHNICAL INVESTIGATION

ROUNDABOUT AT JARLARMY RD & LAKE MINNEOLA SHORES

CLERMONT, LAKE COUNTY, FL

U.S.G.S. TOPOGRAPHIC MAP

FIGURE 1

LEGEND:

8 CANDLER SAND, 0 TO 5% SLOPES

9 CANDLER SAND, 5 TO 12% SLOPES

Andreyev Engineering, Inc.

APPROXIMATE SCALE:	DATE: 03/23/23	ENGINEER: RJ
1"=300'	PN: GPGT-22-148	DRAWN BY: DLS

GEOTECHNICAL INVESTIGATION

ROUNDABOUT AT JARLARMY RD & LAKE MINNEOLA SHORES

CLERMONT, LAKE COUNTY, FL

N.R.C.S. SOIL SURVEY MAP

FIGURE 2

0 100 200 400

GRAPHIC SCALE: 1"=200'

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION

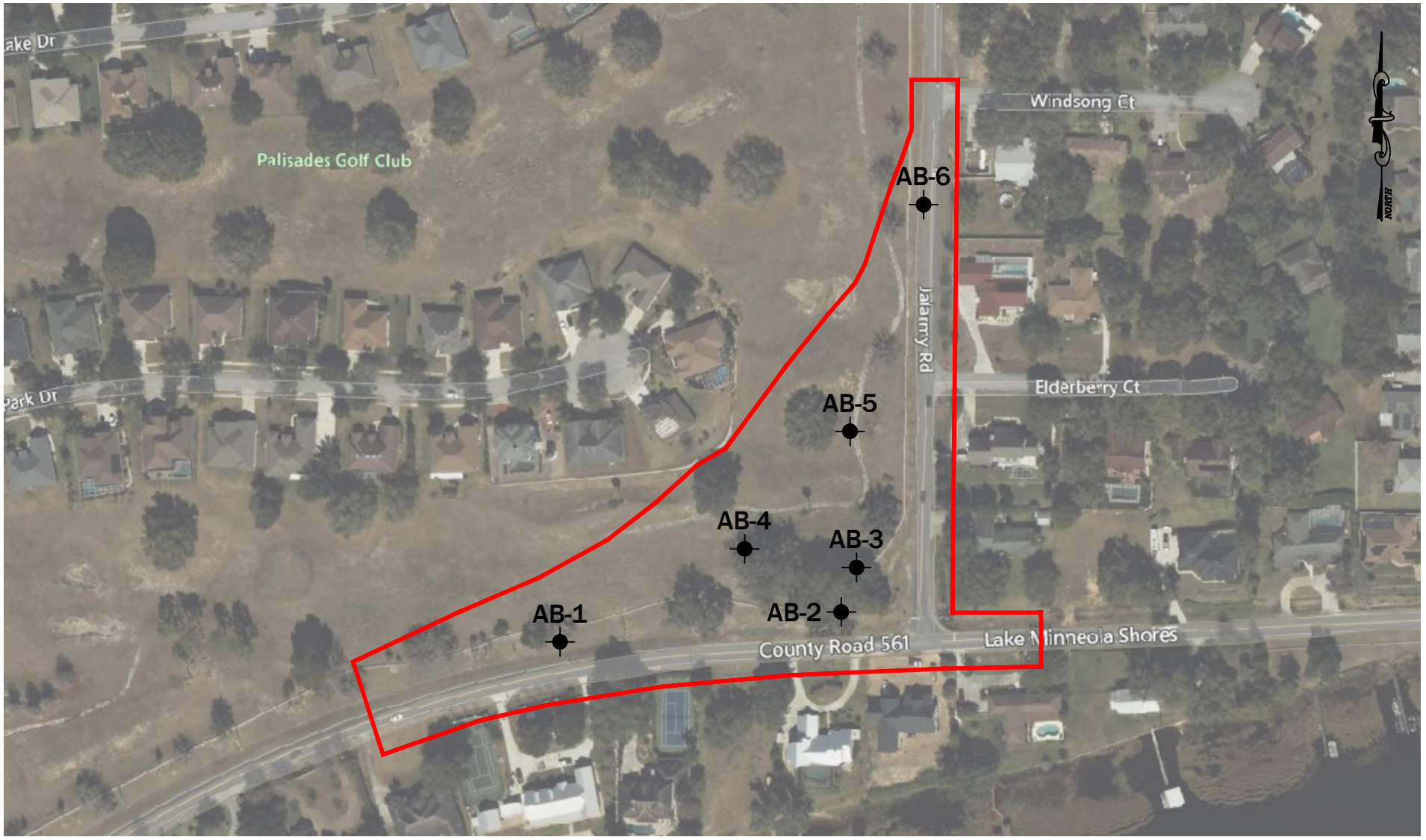
ROUNDABOUT AT JARLARMY RD & LAKE MINNEOLA SHORES

CLERMONT, LAKE COUNTY, FL

SITE PLAN WITH PROPOSED BORING LOCATIONS

FIGURE 3

APPROXIMATE SCALE:	DATE: 03/23/23	ENGINEER: RJ
1"=200'	PN: GPGT-22-148	DRAWN BY: DLS



0 100 200 400

GRAPHIC SCALE: 1"=200'

LEGEND:

APPROXIMATE PROJECT AREA BOUNDARY

APPROXIMATE LOCATION OF AUGER BORING

Andreyev Engineering, Inc.

APPROXIMATE SCALE:	DATE: 03/23/23	ENGINEER: RJ
1"=200'	PN: GPGT-22-148	DRAWN BY: DLS

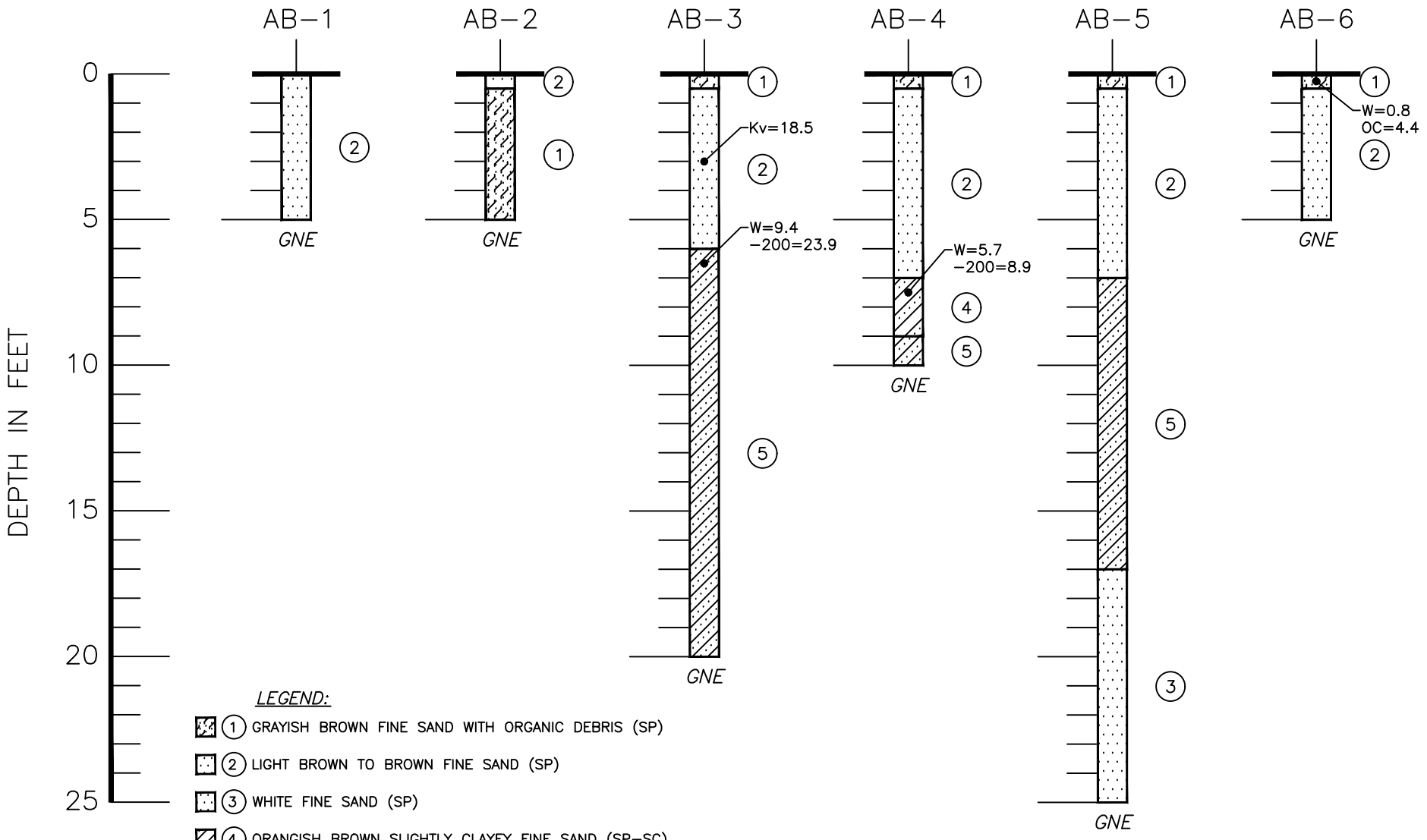
GEOTECHNICAL INVESTIGATION

ROUNDABOUT AT JARLARMY RD & LAKE MINNEOLA SHORES

CLERMONT, LAKE COUNTY, FL

BORING LOCATION PLAN

FIGURE 4



LEGEND:

1. GRAYISH BROWN FINE SAND WITH ORGANIC DEBRIS (SP)
2. LIGHT BROWN TO BROWN FINE SAND (SP)
3. WHITE FINE SAND (SP)
4. ORANGISH BROWN SLIGHTLY CLAYEY FINE SAND (SP–SC)
5. ORANGISH BROWN CLAYEY FINE SAND (SC)

GNE GROUNDWATER NOT ENCOUNTERED

W MOISTURE CONTENT, IN PERCENT

–200 PERCENT OF FINES PASSING THE U.S. No. 200 SIEVE

OC ORGANIC CONTENT, IN PERCENT

Kv VERTICAL COEFFICIENT OF PERMEABILITY, IN FEET PER DAY

Andreyev Engineering, Inc.

GEOTECHNICAL INVESTIGATION

ROUNDABOUT AT JARLARMY RD & LAKE MINNEOLA SHORES

CLERMONT, LAKE COUNTY, FL

SOIL PROFILES

APPROXIMATE SCALE:	DATE: 03/23/23	ENGINEER: RJ
1"=5'	PN: GPGT–22–148	DRAWN BY: DLS

FIGURE 5