



# ECS Florida, LLC

## Geotechnical Engineering Report

### River Landing Lot 11

335 River Breeze Drive  
Nocatee, Florida

ECS Project Number 35:35675

June 24, 2024





**ECS FLORIDA, LLC**

Geotechnical • Construction Materials • Environmental • Facilities

June 24, 2024

Mr. Maurice Rudolph  
HYDRY Company, LLC  
4314 Pablo Oaks Court  
Jacksonville, Florida 32224

ECS Project No. 35:35675

Reference: Geotechnical Engineering Report  
**River Landing Lot 11**  
335 River Breeze Drive  
Nocatee, Florida

Dear Mr. Rudolph:

ECS Florida, LLC. (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration conducted, and our design and construction recommendations.

It has been our pleasure to be of service to you during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,  
**ECS Florida, LLC.**

Chris Egan, P.E.  
**Principal Engineer**  
Registered, Florida No. 79645  
[Cegan@ecslimited.com](mailto:Cegan@ecslimited.com)

Robert W. Clark, P.E.  
**Senior Project Engineer**  
Registered Florida No. 52210  
[Rwclark@ecslimited.com](mailto:Rwclark@ecslimited.com)

**11554 DAVIS CREEK COURT, JACKSONVILLE, FL 32256 • T: 904-880-0960**

ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Pacific, Inc. • ECS Southeast, LLC • ECS Southwest, LLP  
ECS New York Engineering, PLLC - An Associate of ECS Group of Companies • [www.ecslimited.com](http://www.ecslimited.com)

"ONE FIRM. ONE MISSION."

---

## **TABLE OF CONTENTS**

<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>1.0 INTRODUCTION .....</b>	<b>2</b>
<b>2.0 PROJECT INFORMATION .....</b>	<b>2</b>
2.1 Project Location/Current Site Use.....	2
2.2 Proposed Construction.....	3
<b>3.0 FIELD EXPLORATION .....</b>	<b>4</b>
3.1 Subsurface Characterization .....	4
3.2 Groundwater Observations.....	4
3.2.1 Encountered Groundwater.....	4
3.2.2 Estimated Seasonal High Groundwater .....	4
3.3 Laboratory Testing .....	5
<b>4.0 DESIGN RECOMMENDATIONS .....</b>	<b>5</b>
4.1 Over-Excavation and Shallow Foundations.....	5
4.1.1 Foundations .....	5
4.2 Slabs On Grade .....	6
<b>5.0 SITE CONSTRUCTION RECOMMENDATIONS .....</b>	<b>7</b>
5.1 Subgrade Preparation .....	7
5.1.1 Stripping and Grubbing.....	7
5.1.2 Over-Excavation.....	7
5.1.3 Temporary Groundwater Control.....	7
5.2 Earthwork Operations .....	8
5.2.1 Engineered Backfill and Fill Soils.....	8
5.2.2 Foundation Areas.....	8
5.3 General Construction Considerations .....	9
<b>6.0 CLOSING .....</b>	<b>9</b>

## **APPENDICES**

### **Appendix A – Drawings & Reports**

- Figure 1 - Site Location Diagram
- Figure 2 - Field Exploration Diagram
- Figure 3 - Generalized Subsurface Profiles

### **Appendix B – Field Operations**

- Reference Notes for Boring Logs
- Subsurface Exploration Procedure: Standard Penetration Testing (SPT)
- Boring Logs

### **Appendix C – Laboratory Testing**

- Laboratory Testing Summary

---

## EXECUTIVE SUMMARY

This Executive Summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- Four of the borings encountered sands with trace to some organics at depths of about 6 to 10 feet below the existing ground surface. Removal of the material by over excavation will be required.
- Subsequent to the over-excavation and replacement of these materials, the planned structure can be supported by a conventional shallow foundation system with a maximum allowable bearing pressure of 2,500 psf. Provided the site preparation and earthwork construction recommendations outlined in Section 5.0 of this report are performed, the parameters presented in Section 4.0 of this report may be used for foundation design.
- The borings encountered groundwater at depths varying from about 5 to 7 feet below the existing ground surface at the time of our exploration. Dewatering will probably be required to remove and replace the underlying organic soils.
- We recommend that ECS be provided the opportunity to review the foundation plans and earthwork specifications to verify that our recommendations have been properly interpreted and implemented. ECS should also be retained to perform the construction materials testing and observations required for this project, to verify that our recommendations have been implemented.

---

## 1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of foundations for the single-family residential structure. The recommendations developed for this report are based on project information supplied by you.

Our services were provided in accordance with our Proposal No. 22250-GP, dated May 21, 2024, and the work agreement dated May 23, 2024.

This report contains the procedures and results of our subsurface exploration program, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items:

- A brief review and description of our field procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- Final copies of our soil boring logs.
- Recommendations for foundation design.
- Evaluation and recommendations relative to groundwater control.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.

## 2.0 PROJECT INFORMATION

### 2.1 PROJECT LOCATION/CURRENT SITE USE

The project site is located north of River Breeze Drive in Nocatee, St. Johns County, Florida. The site is bordered to the east and west by undeveloped lots, to the north by undeveloped wooded land, and to the south by a paved road. The general site location is shown on Figure 1 in Appendix A and in Figure 2.1.1 below.



**Figure 2.1.1. Site Location**

At the time of our exploration, the site was cleared and undeveloped, with surface cover consisting mostly of exposed sandy soils. A site survey was not available to our office at the time of this report preparation. However, based on publicly available information, we understand that the site generally slopes downward to the north. Surface water was not observed near planned structural areas at the time of our exploration.

## 2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed buildings and related infrastructure.

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
# of Stories	1 to 3 stories above grade
Usage	Residential
Framing	Reinforced concrete block or wood with interior columns
Column Loads <sup>(1)</sup>	40 kips (Full Dead and Factored Live)
Wall Loads <sup>(1)</sup>	4 kips per linear foot (klf) maximum
Floor Loads <sup>(1)</sup>	150 pounds per square foot (psf) maximum
Fill and Cut Heights	Assumed a maximum of 3 feet of fill and only minor cuts, from existing site grades

(1) If actual structural loads differ from these estimated loads ECS must be contacted immediately in order to revise building foundation recommendations and settlement calculations, as needed.



If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. We should be contacted if any of the above project information is incorrect so that we may reevaluate our recommendations.

### 3.0 FIELD EXPLORATION

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedures. Our scope of work included drilling five Standard Penetration Test (SPT) borings. Our borings were located using our handheld GPS units and their approximate locations are shown on the Field Exploration Diagram (Figure 2) in Appendix A.

#### 3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil strata. Please refer to the boring logs in Appendix B.

Typical Depth (ft)		Stratum	Description
From	To		
Existing Ground Surface	6 -8	I	Loose to Medium Dense Fine SAND (SP)
6 - 8	8 - 10	II	Loose Fine SAND with Silt or Clay (SP-SM, SP-SC) and Silty Fine SAND (SM) <sup>(1)</sup>
8 - 10	15	III	Loose to Medium Dense Fine SAND (SP), Fine SAND with Clay (SP-SC), and Clayey Fine SAND (SC)

(1) Borings B1, B2, B4 and B5 encountered fine sands with few to some organic fines at depths of about 6 to 10 feet.

A graphical presentation of the subsurface conditions is shown on the Generalized Subsurface Profiles included in Appendix A.

#### 3.2 GROUNDWATER OBSERVATIONS

##### 3.2.1 Encountered Groundwater

Water levels were measured during our field exploration and are presented in our boring logs in Appendix B. Groundwater depths measured at the time of drilling ranged from about 5 to 7 feet below the ground surface. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

##### 3.2.2 Estimated Seasonal High Groundwater

The normal seasonal high groundwater level is affected by a number of factors. The drainage characteristics of the soils, land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the seasonal high groundwater level.

Based on our interpretation of the site conditions, including the boring logs and Web Soil Survey, we estimate the normal seasonal high groundwater level at the boring locations to be approximately 1½ feet above the groundwater levels measured at the time of our field exploration. It is possible that groundwater levels may exceed the estimated normal seasonal high groundwater level as a result of significant or prolonged rains.

### **3.3 LABORATORY TESTING**

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples. The laboratory testing determined the moisture, fines, and organic contents of selected soil samples. The results of the laboratory testing are summarized in Appendix C.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols, and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS)). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

## **4.0 DESIGN RECOMMENDATIONS**

The recommendations presented in this report are based on the project information provided to us, the results of the soil test borings, and our engineering analyses. Considering the results of our field exploration, we do not consider the subsurface conditions at the site suitable for support of the house on traditional shallow foundations without over-excavation of the underlying organic material.

### **4.1 OVER-EXCAVATION AND SHALLOW FOUNDATIONS**

As encountered in the borings, organic soils are present at depths between approximately 6 feet and 10 feet below existing grades. We recommend the organic soils will be completely over-excavated within and to a distance of at least 10 feet beyond the building and pavement areas. The replacement soils should be placed and compacted in accordance with Section 5.2.1. Excavation and replacement operations will probably encounter groundwater. Therefore, temporary dewatering will be required to properly remove the material.

#### **4.1.1 Foundations**

Provided the organic materials are over-excavated and the subgrade is prepared as outline in Section 5.0, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:



Design Parameter	Column Footing	Wall Footing
Minimum Width	24 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade)	12 inches	12 inches
Estimated Maximum Total Settlement <sup>1</sup>	1 inch	1 inch
Estimated Maximum Differential Settlement <sup>2</sup>	Less than ½ inch between columns	Less than ½ inch over 50 feet
Maximum Net Allowable Soil Bearing Pressure <sup>3</sup>	2,500 psf	
Acceptable Bearing Soil Material	Compacted Stratum I or Compacted Fill	

1. Based on estimated structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
2. Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.
3. Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

Depending on the final floor elevations of the building, we anticipate that most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure, after prepared in accordance with Section 5.0 of this report. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557) to a depth of at least one foot below foundation bearing levels.

For turn down slabs and interior wall footings the minimum width should also be 18 inches, however the sloped transition portion of the turn-down may be included when determining the footing width. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

## 4.2 SLABS ON GRADE

The floor slabs can be constructed as a slab-on-ground, provided the site is prepared as outlined in Section 5.0. A minimum clearance of 2 feet is recommended between the estimated seasonal high groundwater table and the bottom of the floor slab. It is recommended the floor slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness. A 6-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete.

**Subgrade Modulus:** Provided the placement of engineered fill per the recommendations discussed herein, the slab may be designed assuming a modulus of subgrade reaction,  $k_1$  of 150 pci (lbs/cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

---

## 5.0 SITE CONSTRUCTION RECOMMENDATIONS

### 5.1 SUBGRADE PREPARATION

#### 5.1.1 Stripping and Grubbing

Prior to construction, the location of existing underground utilities within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. Underground pipes that are not properly removed or plugged may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

Site preparation should consist of clearing any remaining vegetation and near surface organic topsoil. The clearing/stripping operations should extend within and to a distance of at least five feet beyond the perimeter of the proposed building areas and three feet beyond pavement areas. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

#### 5.1.2 Over-Excavation

As discussed in Section 3.1, soils containing organics will need to be removed within the proposed building and hardscaped areas and should be over-excavated in their entirety from below the proposed construction, plus a horizontal margin of approximately 10 feet beyond the building "footprint" plan areas and pavement areas. The over-excavated unsuitable soils should be replaced with compacted structural fill soils as discussed below in Section 5.2.1. Removal and backfilling operations should be monitored continuously to verify all unsuitable materials are removed to the required depth and that backfill soils are suitable and compacted. Excavation and replacement operations will likely encounter groundwater. Therefore, temporary dewatering will be required to check that deleterious materials are satisfactorily removed and also to achieve proper compaction of backfill soils.

Excavation side slopes should be in accordance with OSHA requirements for loose sandy soils. Temporary slopes cut back at 1.5 horizontal to 1 vertical (1.5H:1V) may be used. The 1.5H:1V slopes are contingent upon the dewatering system adequately controlling slope groundwater seepage.

#### 5.1.3 Temporary Groundwater Control

The borings encountered groundwater at depths of approximately 5 to 7 feet below the existing ground surface at the time of our exploration. Because of the need for over-excavation, it will be necessary to install temporary groundwater control measures to dewater the area.

Dewatering methods should be determined by the contractor. We recommend the groundwater control measures, if necessary; remain in place until compaction of the existing soils is completed. The dewatering method should be maintained until backfilling has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

## 5.2 EARTHWORK OPERATIONS

### 5.2.1 Engineered Backfill and Fill Soils

Engineered fill is defined as a non-plastic, inorganic, granular soil having less than 15 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The near surface fine sands and fine sands with silt, without roots, as encountered in the borings, are acceptable for use as fill materials and, with proper moisture control, should densify using conventional compaction methods. Soils with more than 10 to 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying.

**Engineered Fill Compaction Requirements:** Materials satisfactory for use as engineered fill should consist of soils with the following compaction requirements.

ENGINEERED FILL COMPACTION REQUIREMENTS	
Subject	Requirement
Compaction Standard	Modified Proctor, ASTM D1557
Required Compaction	95% of Max. Dry Density (general engineered fill)
Loose Thickness prior to compaction	12 inches if vibratory drum roller compaction equipment is used 8 inches if vibratory drum roller is used in static mode 8 inches if track-mounted compaction equipment is used 6 inches if hand-held compaction equipment is used

Fill materials should not be placed on excessively wet soils. Excessively wet soils should be moisture conditioned, which may include scarifying and aerating. Proper drainage should be maintained during the earthwork phases of construction in an attempt to prevent ponding of water which has a tendency to degrade subgrade soils. The contractor should minimize dusting or implement dust control measures, as required.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. Moisture control may be difficult during extended periods of rain. The control of moisture content of soils containing more than 10% fines may be difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

### 5.2.2 Foundation Areas

After satisfactory placement and compaction of the required engineered fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) to a depth of one foot below the bearing level. For confined areas, such as the footing excavations, any compactive effort should be provided by a lightweight vibratory sled or roller having a total weight on the order of 500 to 2,000 pounds.

---

### 5.3 GENERAL CONSTRUCTION CONSIDERATIONS

**Moisture Conditioning:** We anticipate that typical moisture conditioning for soils in this area should be anticipated. The sandy surface soils may require wetting during dry periods or periods of high heat. Drying of soils containing more than 10% fines or excavated from below the water table may be required to be within  $\pm 2$  percentage points of the modified Proctor optimum moisture content (ASTM D 1557).

**Subgrade Protection:** Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and can likely be used in pavement areas.

**Surface Drainage:** Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of at least 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to limit infiltration of surface water.

**Excavation Safety:** All excavations and slopes should be made and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing and constructing stable, temporary excavations and slopes and should shore, slope, or bench the sides of the excavations and slopes as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

**Erosion Control:** The surface soils may be erodible. Therefore, the Contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. All erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

### 6.0 CLOSING

Our geotechnical exploration has been performed, our findings presented, and our recommendations prepared, in accordance with generally accepted geotechnical engineering principles and practices. ECS is not responsible for any independent conclusions, interpretation, opinions, or recommendations made by others based on the data contained in this report.

Our scope of services was intended to evaluate the soil conditions within the zone of soil influenced by the foundation system. Our scope of services does not address geologic conditions, such as sinkholes or soil conditions existing below the depth of the soil borings.

---

If any of the project description information discussed in this report is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately in order that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend that ECS be retained to review the project's plans and specifications pertaining to our work so that we may ascertain consistency of those plans/specifications with the intent of the geotechnical report.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be retained to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

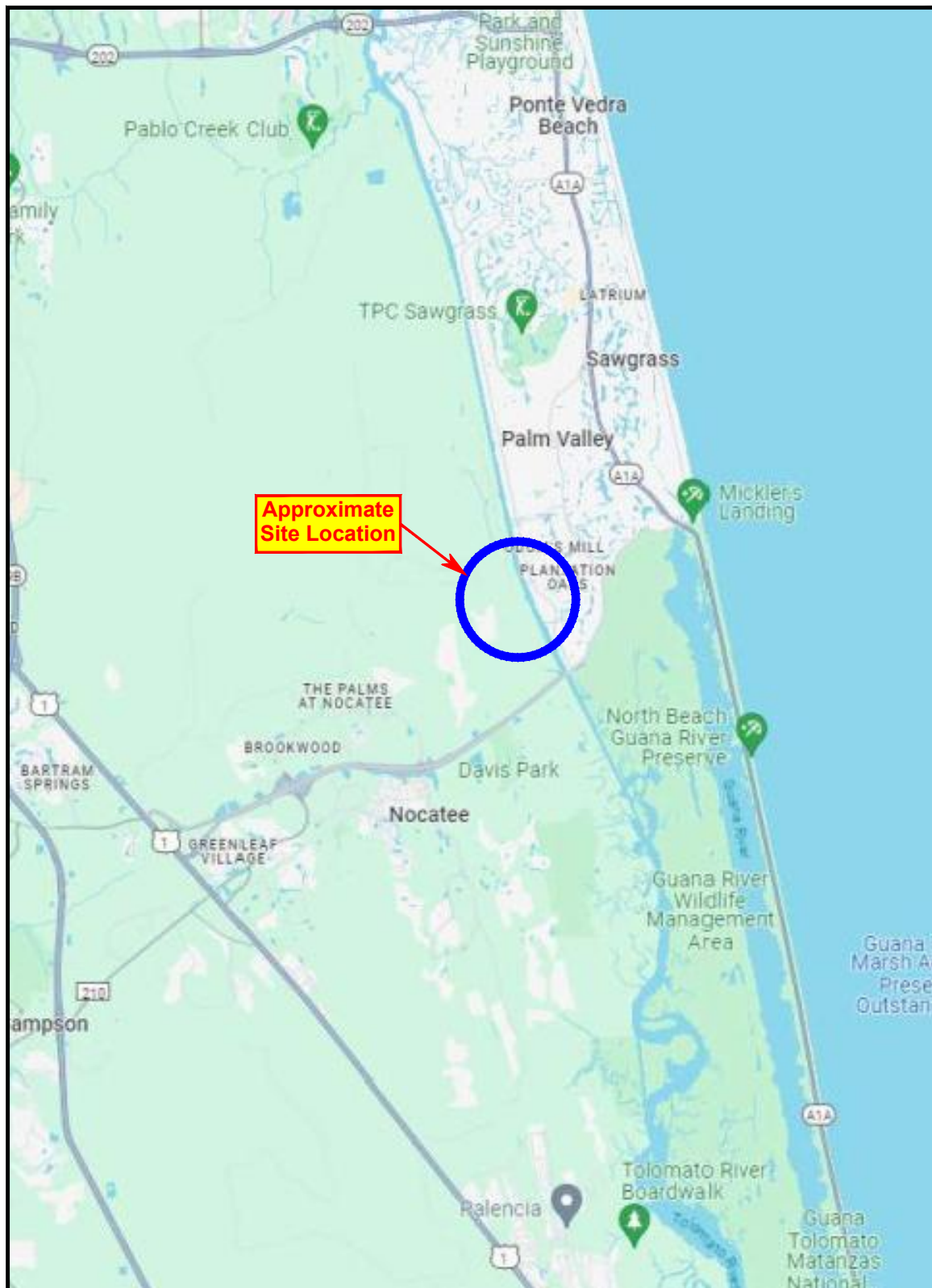
## **APPENDIX A – Diagrams & Reports**

Figure 1 - Site Location Diagram

Figure 2 - Field Exploration Diagram

Figure 3 – Generalized Subsurface Profiles





**ECS Florida, LLC**

Geotechnical ■ Construction Materials ■ Environmental ■ Facilities  
 11554 Davis Creek Court, Jacksonville, FL 32256  
 T: (904) 880-0960 • F: (904) 880-0970  
[www.ecslimited.com](http://www.ecslimited.com)

Site Location Diagram  
**River Landing Remaining Lots**

Nocatee, Florida



Date: 06/21/24

Project No.: 35-35675

Figure 1

JAS - 35-35675



## LEGEND



Approximate Location of Standard Penetration Test (SPT) Boring

**Lot 11**



**ECS Florida, LLC**

Geotechnical ■ Construction Materials ■ Environmental ■ Facilities  
11554 Davis Creek Court, Jacksonville, FL 32256  
T: (904) 880-0960 • F: (904) 880-0970  
[www.ecslimited.com](http://www.ecslimited.com)

Field Exploration Diagram  
**River Landing Remaining Lots**  
Nocatee, Florida

Date: 06/21/24

Project No.: 35-35675

Figure 2

JAS - 35-35675





## **APPENDIX B – Field Operations**

Reference Notes for Boring Logs

Subsurface Exploration Procedure: Standard Penetration Testing (SPT)

Boring Logs



# REFERENCE NOTES FOR BORING LOGS

## MATERIAL<sup>1,2</sup>

	<b>ASPHALT</b>
	<b>CONCRETE</b>
	<b>GRAVEL</b>
	<b>TOPSOIL</b>
	<b>VOID</b>
	<b>BRICK</b>
	<b>AGGREGATE BASE COURSE</b>
	<b>GW WELL-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GP POORLY-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GM SILTY GRAVEL</b> gravel-sand-silt mixtures
	<b>GC CLAYEY GRAVEL</b> gravel-sand-clay mixtures
	<b>SW WELL-GRADED SAND</b> gravelly sand, little or no fines
	<b>SP POORLY-GRADED SAND</b> gravelly sand, little or no fines
	<b>SM SILTY SAND</b> sand-silt mixtures
	<b>SC CLAYEY SAND</b> sand-clay mixtures
	<b>ML SILT</b> non-plastic to medium plasticity
	<b>MH ELASTIC SILT</b> high plasticity
	<b>CL LEAN CLAY</b> low to medium plasticity
	<b>CH FAT CLAY</b> high plasticity
	<b>OL ORGANIC SILT or CLAY</b> non-plastic to low plasticity
	<b>OH ORGANIC SILT or CLAY</b> high plasticity
	<b>PT PEAT</b> highly organic soils

## DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

## PARTICLE SIZE IDENTIFICATION

DESIGNATION	PARTICLE SIZES
Boulders	12 inches (300 mm) or larger
Cobbles	3 inches to 12 inches (75 mm to 300 mm)
Gravel: Coarse	¾ inch to 3 inches (19 mm to 75 mm)
Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand: Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")	<0.074 mm (smaller than a No. 200 sieve)

## COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP <sup>4</sup>	SPT <sup>5</sup> (BPF)	CONSISTENCY <sup>7</sup> (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT <sup>7</sup>	COARSE GRAINED (%) <sup>8</sup>	FINE GRAINED (%) <sup>8</sup>
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

## GRAVELS, SANDS & NON-COHESIVE SILTS

SPT <sup>5</sup>	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

## WATER LEVELS<sup>6</sup>

	WL (First Encountered)
	WL (Completion)
	WL (Seasonal High Water)
	WL (Stabilized)

## FILL AND ROCK

FILL	POSSIBLE FILL	PROBABLE FILL	ROCK

<sup>1</sup>Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

<sup>2</sup>To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

<sup>3</sup>Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

<sup>4</sup>Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

<sup>5</sup>Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

<sup>6</sup>The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

<sup>7</sup>Minor deviation from ASTM D 2488-17 Note 14.

<sup>8</sup>Percentages are estimated to the nearest 5% per ASTM D 2488-17.



## SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

### SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)
- Auger is advanced\* and an additional SPT is performed
- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.



*\*Drilling Methods May Vary—* The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.









## LOG OF BORING

Project No.: 35-35675  
Boring No.: Lot 11 - B3  
Sheet 1 of 1

Project: River Landing Remaining Lots Client: HyDry Company  
Boring Location: See Field Exploration Plan Drill Rig: 100A Driller: M. Letchworth  
Groundwater Depth: 7 ft Time: Drilling Date: 6/18/24 Hammer Type: Safety Drill Rod: AWJ  
Casing Size: Length of Casing:  
Boring Begun: 6/18/24 Boring Completed: 6/18/24

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT +	LIQUID LIMIT	SHEAR STRENGTH (ksf)
1	0		MEDIUM DENSE Gray Brown to Light Gray Brown Fine SAND (SP)	3	20						
	1		10								
			10								
			11								
			8								
	2		17								
			11								
			28								
			10								
			10								
	3		10								
	5		10								
			10								
			8								
	4		7								
	5										
	12										
	6										
	2										
5		LOOSE Gray Brown Fine SAND With Clay, Trace Small Roots (SP-SC)	3	8							
		5									
		5									
	10	LOOSE Brown Fine SAND (SP)	5	20							
6		MEDIUM DENSE Gray Fine SAND With Clay (SP-SC)	6	20							
			10								
			10								
	15	Boring Terminated @ 15 ft.									
Remarks											



## LOG OF BORING

Project No.: 35-35675  
Boring No.: Lot 11 - B4  
Sheet 1 of 1

Project: River Landing Remaining Lots Client: HyDry Company  
Drill Rig: 100A Driller: M. Letchworth  
Boring Location: See Field Exploration Plan Hammer Type: Safety Drill Rod: AWJ  
Casing Size: Length of Casing:  
Groundwater Depth: 5 ft Time: Drilling Date: 6/18/24 Boring Begun: 6/18/24 Boring Completed: 6/18/24

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)	
											POCKET PENETROMETER UNDISTURBED SAMPLE	POCKET PENETROMETER DISTURBED SAMPLE
1	0		LOOSE to MEDIUM DENSE Gray Brown Fine SAND (SP)	2	9							
	1			4								
	2			4								
	3			4								
	4			4								
	5			4								
	6			4								
	7			4								
	8			4								
	9			4								
2	5		LOOSE Dark Brown Fine SAND With Silt, Trace Organic Fines (SP-SM)	6	10							
	6			7								
	7			4								
	8			4								
	9			4								
	10			4								
	11			4								
	12			4								
	13			4								
	14			4								
3	10		LOOSE Brown Fine SAND (SP)	1	5	1	9					
	11			1								
	12			1								
	13			4								
	14			4								
	15			4								
	16			4								
	17			4								
	18			4								
	19			4								
4	15		MEDIUM DENSE Gray Brown Fine SAND With Clay (SP-SC)	6	11							
	16			6								
	17			6								
	18			6								
	19			6								
	20			6								
	21			6								
	22			6								
	23			6								
	24			6								
5	20		Boring Terminated @ 15 ft.		12							
	21											
	22											
	23											
	24											
	25											
	26											
	27											
	28											
	29											

Remarks



## LOG OF BORING

Project No.: 35-35675  
Boring No.: Lot 11 - B5  
Sheet 1 of 1

Project: River Landing Remaining Lots Client: HyDry Company  
Boring Location: See Field Exploration Plan Drill Rig: 100A Driller: M. Letchworth  
Groundwater Depth: 5 ft Time: Drilling Date: 6/18/24 Hammer Type: Safety Drill Rod: AWJ  
Casing Size: Length of Casing:  
Boring Begun: 6/18/24 Boring Completed: 6/18/24

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)	
											POCKET PENETROMETER UNDISTURBED SAMPLE	POCKET PENETROMETER DISTURBED SAMPLE
1	0		LOOSE to MEDIUM DENSE Gray Brown Fine SAND (SP)	3	14							
	1			9								
	2			5								
	3			5								
	4			5								
	5			2								
	6			3								
	7			3								
	8			6								
	9			17								
2	5			6	8	4	24					
	6			2								
	7			6								
	8			6								
	9			6								
	10			5								
	11			6								
	12			6								
	13			6								
	14			6								
3	10		LOOSE Gray Brown Silty Fine SAND, Few Organic Fines (SM)	2	11							
	11			6								
	12			6								
	13			6								
	14			5								
	15			6								
	16			6								
	17			6								
	18			6								
	19			6								
4	15		MEDIUM DENSE Brown Fine SAND (SP)	6	19							
	16			5								
	17			6								
	18			6								
	19			6								
	20			6								
	21			6								
	22			6								
	23			6								
	24			6								
5	20		MEDIUM DENSE Gray Brown Clayey Fine SAND (SC)	6	19							
	21			5								
	22			10								
	23			9								
	24			9								
	25			9								
	26			9								
	27			9								
	28			9								
	29			9								
6	25		MEDIUM DENSE Gray Fine SAND With Clay (SP-SC)	5	19							
	26			10								
	27			9								
	28			9								
	29			9								
	30			9								
	31			9								
	32			9								
	33			9								
	34			9								
7	30		Boring Terminated @ 15 ft.		19							
	31											
	32											
	33											
	34											
	35											
	36											
	37											
	38											
	39											

## **APPENDIX C – Laboratory Testing**

Laboratory Test Results Summary



**Project No.:** 35675[illegible]