AREHNA | Engineering, Inc.

REPORT OF GEOTECHNICAL EXPLORATION

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FLORIDA

AREHNA PROJECT NO. B-18-054

August 3, 2018

Prepared For:
Ayres Associates
5802 Benjamin Center Drive, Suite 101
Tampa, Florida 33634

Prepared By:
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August 3, 2018

Mr. Christopher Martin, P.E.
Ayres Associates
5802 Benjamin Center Drive, Suite 101
Tampa, FL 33634

Email: MartinC@AyresAssociates.com

Subject: **Report of Geotechnical Exploration**
Palmetto Point Water Main Replacement
Manatee County, Florida
AREHNA Project B-18-054

Dear Mr. Martin,

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with AREHNA Proposal B.Prop-18-017 dated May 21, 2018. The purpose of our geotechnical study was to obtain information on the general subsurface conditions for a proposed water main replacement project. The project is located within the Palmetto Point Neighborhood which is bounded by US-19 to the east, and Terra Ceia Bay to the North and West.

This report presents our understanding of the project, outlines our exploratory procedures, documents the field data obtained, and provides our recommendations for general site preparation.

AREHNA appreciates the opportunity to have assisted Ayres Associates on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

AREHNA ENGINEERING, INC.
FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION NO. 28410

Digitally signed by
Amy L Guisinger
Date: 2018.08.03
17:12:56 -04'00'

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Senior Geotechnical Engineer
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1.0 PROJECT INFORMATION AND SCOPE OF WORK

1.1 Site Description and Project Characteristics

The proposed project consists of the replacement of the existing watermain. The project is located within the Palmetto Point Neighborhood which is bounded by US-19 to the east, and Terra Ceia Bay to the North and West in Manatee County, Florida, as indicated on the Project Site Location Map, **Figure 1** in **Appendix A**.

1.2 Scope of Work

The purpose of our geotechnical study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface materials encountered were evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

- Identification of the existing ground water levels and estimated normal seasonal high ground water fluctuations.
- General location and description of potentially deleterious materials encountered in the borings which may have impact on the proposed construction.
- General site preparation recommendations including the suitability of excavated soils for use as backfill.

The following services were performed to achieve the above-outlined objectives:

- Requested utility location services from Sunshine811.
- Performed a total of 39 Standard Penetration Test (SPT) borings, 34 SPT borings to a depth of 10 feet and 5 SPT borings to a depth of 20 feet along the proposed water main alignment. Locations were coordinated with the design team. Samples were collected, and Standard Penetration Test resistances measured in the SPT borings, at approximate intervals of two feet for the top ten feet, and at approximate intervals of five feet, thereafter. The boreholes were backfilled upon completion.
- Visually classified and stratified the soil samples in the laboratory using the Unified Soil Classification System.
- Conducted a laboratory testing program on representative samples.
- Reported the results of the field exploration and engineering analysis. The results of the subsurface exploration are presented in this report signed and sealed by a professional engineer specializing in geotechnical engineering.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our scope included a total of 39 SPT borings, 34 SPT borings to a depth of 10 feet and 5 SPT borings to a depth of 20 feet below existing ground surface, along the proposed pipe alignment.

The borings were performed with the use of a Power Drill Rig using Bentonite "Mud" drilling procedures. Samples were collected, and Standard Penetration Test resistances measured at approximate intervals of two feet for the top ten feet, and at approximate intervals of five feet, thereafter. The borings were manually augered to a depth of approximately 4 feet to avoid possible underground utilities. The soil sampling was performed in general accordance with ASTM Test Designation D-1586, entitled "Penetration Test and Split-Barrel Sampling of Soils."

Representative portions of these soil samples were sealed in glass jars, labeled and transferred for appropriate classification.

The approximate locations of the soil borings are shown in **Figure 2** in **Appendix A**. The borings were located in the field using GPS coordinates.

2.2 Laboratory Testing

The laboratory testing program consisted of natural moisture content, fines content, organic content and Atterberg (plasticity) limits. To determine the environmental classification, corrosion parameters of representative soil samples were evaluated based on pH, chlorides, sulfates and resistivity testing.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 USGS Topographic Data

The topographic survey map published by the United States Geological Survey was reviewed for ground surface features at the proposed project location (**Figure 3**). Based on this review, natural ground surface elevations at the project site range from approximately +2 to +15 feet.

3.2 USDA Natural Resources Conservation Service Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) survey for Manatee County indicates that the soils at the project site consist of the following soil unit:

Soil Unit Number	Soil Name	Depth Below Natural Grade to High Water Table (feet)
5	Bradenton fine sand, limestone substratum	0 - 1.0
7	Canova, Anclote, and Okeelanta soils	+2 - 0
10	Canaveral sand, organic substratum	2.5 - 5
13	Chobee loamy fine sand, frequently ponded, 0 to 1 percent slopes	0 - 1.0
16	Delray complex	0 - 1.0
20	EauGallie fine sand, 0 to 2 percent slopes	0 - 1.0
29	Manatee mucky loamy fine sand	0 - 1.0
48	Wabasso fine sand	0 - 1.0
53	Wulfert-Kesson association	0 - 0.5

The soil survey also indicates that the average annual precipitation is 48 to 56 inches. The soils encountered are consistent with the soil unit described above. The USDA Soil Survey map for the project site is attached as **Figure 4**.

3.3 Subsurface Conditions

A pictorial representation of the subsurface conditions encountered by the borings is shown on the General Subsurface Profile, **Figure 5** in **Appendix B**. These profiles and the following soil conditions highlight the general subsurface stratification. The Soil Test Boring Records in **Appendix B** should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the

boring records and the subsurface profiles, soil conditions may vary between, and away from, boring locations.

The Standard Penetration Test borings in the northern portion of the site generally encountered very loose to loose fine sands (SP-SM, SM, SP, SP-SC, SC-SM, and SC) from the ground surface to the boring termination depths of 10 to 20 feet below existing grades. Standard penetration test resistance values (N-values) for the sands ranged from 2 to 18 blows per foot. The soils generally transitioned, in the southern portion of the site, to very soft to very hard clay with limestone (CH) or weathered limestone, encountered at depths of 5 to 13 feet below existing ground surface, with N-values ranging from 2 blows per foot to 50 blows for 2 inches.

A page defining the terms and classification symbols used in the boring profiles is included in **Appendix B** of this report.

3.4 Ground Water Conditions

The ground water level was encountered in the borings at depths between approximately 1.5 to 4.5 feet below the existing ground surface. Fluctuation in ground water levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, tidal influences and other site-specific factors. Since ground water level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should assume that variations will occur.

3.5 Estimated Seasonal High Ground Water Level

Based on the mapping performed by the USDA, soils information obtained from the site and our experience in the area, we estimate that the seasonal high ground water level will be encountered at depths of approximately 1 foot to 4 feet below existing grades.

4.0 GENERAL SITE PREPARATION

4.1 General

The results of this exploration indicate that the soils encountered are generally suitable for the planned water main improvements, except for the clayey soils (SP-SC, SC-SM, SC, CH) noted previously. Construction activities should be accomplished in the "dry" with ground water levels maintained at least 1 foot below the deepest portion of any excavation. Dewatering may be required for excavations deeper than 1 foot. Actual dewatering means and methods should be the responsibility of the contractor.

4.2 Excavation Slopes

Generally, for excavations less than 3 feet deep, the sides of the excavation can temporarily stand with vertical cut slopes because of the apparent cohesion from soil moisture. For excavations greater than 3 feet deep, temporary side slopes in the sandy soils of 2:1 (H:V) or flatter should be maintained or the excavation properly braced or shored. OSHA standards, assuming Type C cohesionless soils, should be used to protect workers. Large soil stockpiles should not be kept adjacent to open trenches.

4.3 Bedding and Backfilling

Bedding and backfill materials shall consist of clean sands free from silt and clay and containing no more than 12 percent material passing the No. 200 sieve. Bedding and backfill shall be compacted to 98 percent of the modified Proctor maximum dry density (ASTM D-1557). Backfill should be placed in lifts 6 to 12 inches in loose thickness and compacted as needed to achieve the required density. A moisture content within 3 percentage points of the optimum indicated by the modified Proctor test (ASTM D-1557) is recommended prior to compaction of the backfill.

As per the recommendations, the pipeline will be surrounded by compacted granular soils. Values for the soil modulus (E') range from approximately 30 pounds per cubic inch (pci) for a loose wet sand to 1,160 pci for a dense sand. A value of 1,000 pci may be used for pipeline design, if compaction recommendations provided in this report are followed.

4.4 On-Site Soil Suitability

The borings indicate that sandy soils classified as SP and SP-SM are present at the site to depths of 4 feet and are suitable for use as backfill material. Clayey soils encountered on site classified as SM, SP-SC, SC-SM, SC, and CH are not suitable as bedding and backfill material. Suitable structural fill materials should consist of fine to medium sand with less than 12 percent passing the No. 200 sieve and be free of rubble, organics, clay, debris and other unsuitable material. Some of the excavated soils may require drying prior to placing and compacting, especially during the wetter times of the year. Any off-site materials used as fill should be approved by AREHNA prior to acquisition.

4.5 General Construction Monitoring and Testing Guidelines

Prior to initiating compaction operations, we recommend that representative samples of the structural fill material to be used and acceptable exposed in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill and existing soils and to determine if the fill material is acceptable.

A representative number of in-place field density tests should be performed in the compacted existing soils and in each lift of structural fill or backfill to confirm that the required degree of compaction has been obtained. We recommend that at least one density test be performed for every lift of backfill and for every 100 lineal feet of trench.

5.0 BASIS FOR RECOMMENDATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the location indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions across site will be different from those encountered where the boring was drilled, and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.

APPENDIX A

Project Site Location Map – Figure 1
Field Exploration Plan – Figure 2
USGS Topographic Survey – Figure 3
USDA Soil Survey – Figure 4

N

Palmetto Point Water Main Replacement
Manatee County, Florida

Client: Ayres Associates
Project: B-18-054
Date: July 26, 2018

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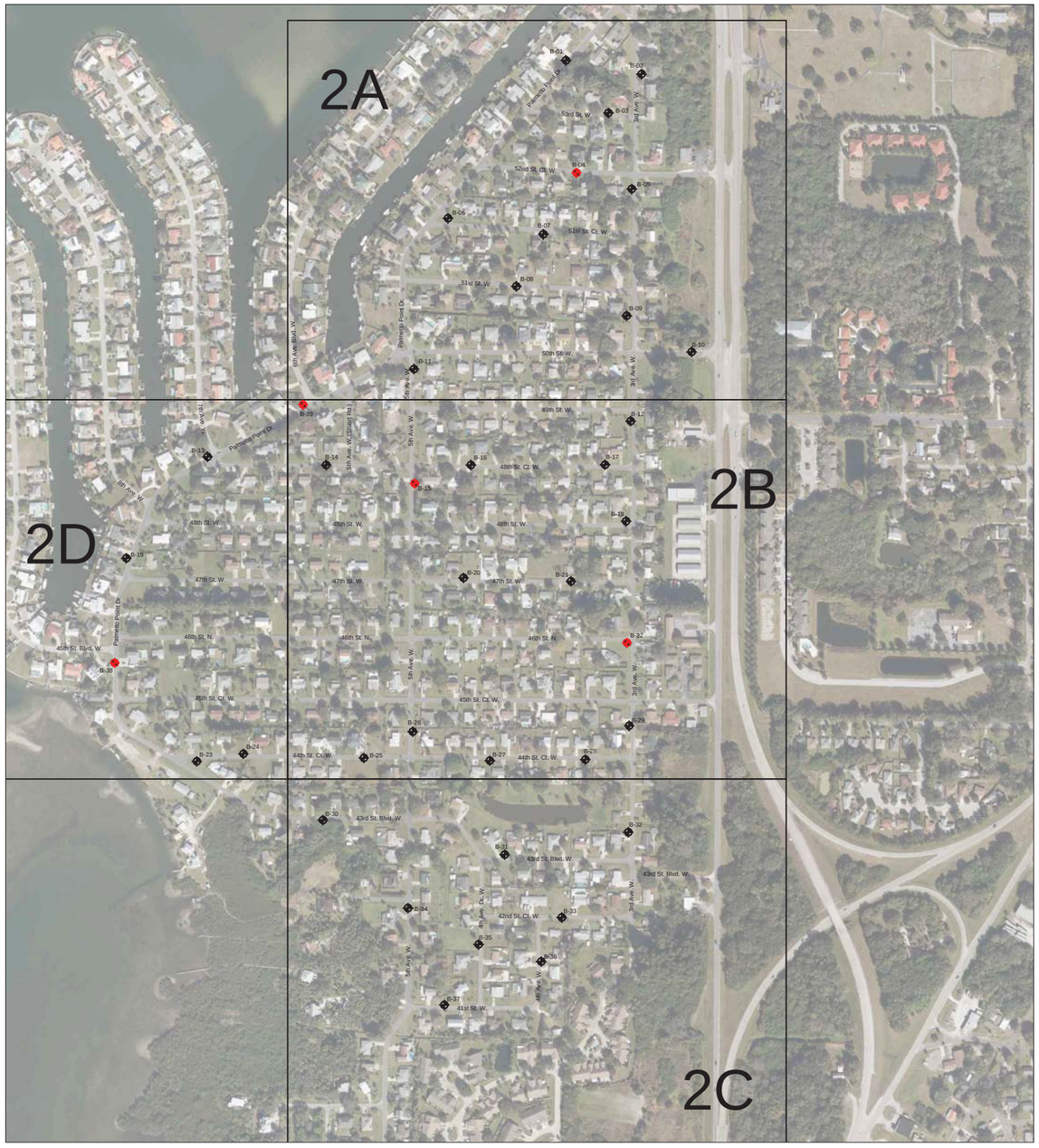
PROJECT SITE
LOCATION MAP

Designed By: JEP
Checked By: AG
Drawn By: AT

FIGURE
1

KEY SHEET



N

0 600'

APPROXIMATE PLAN SCALE

LEGEND

- Approximate Location of Standard Penetration Test (SPT) Boring (10')
- Approximate Location of Standard Penetration Test (SPT) Boring (20')

1. The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

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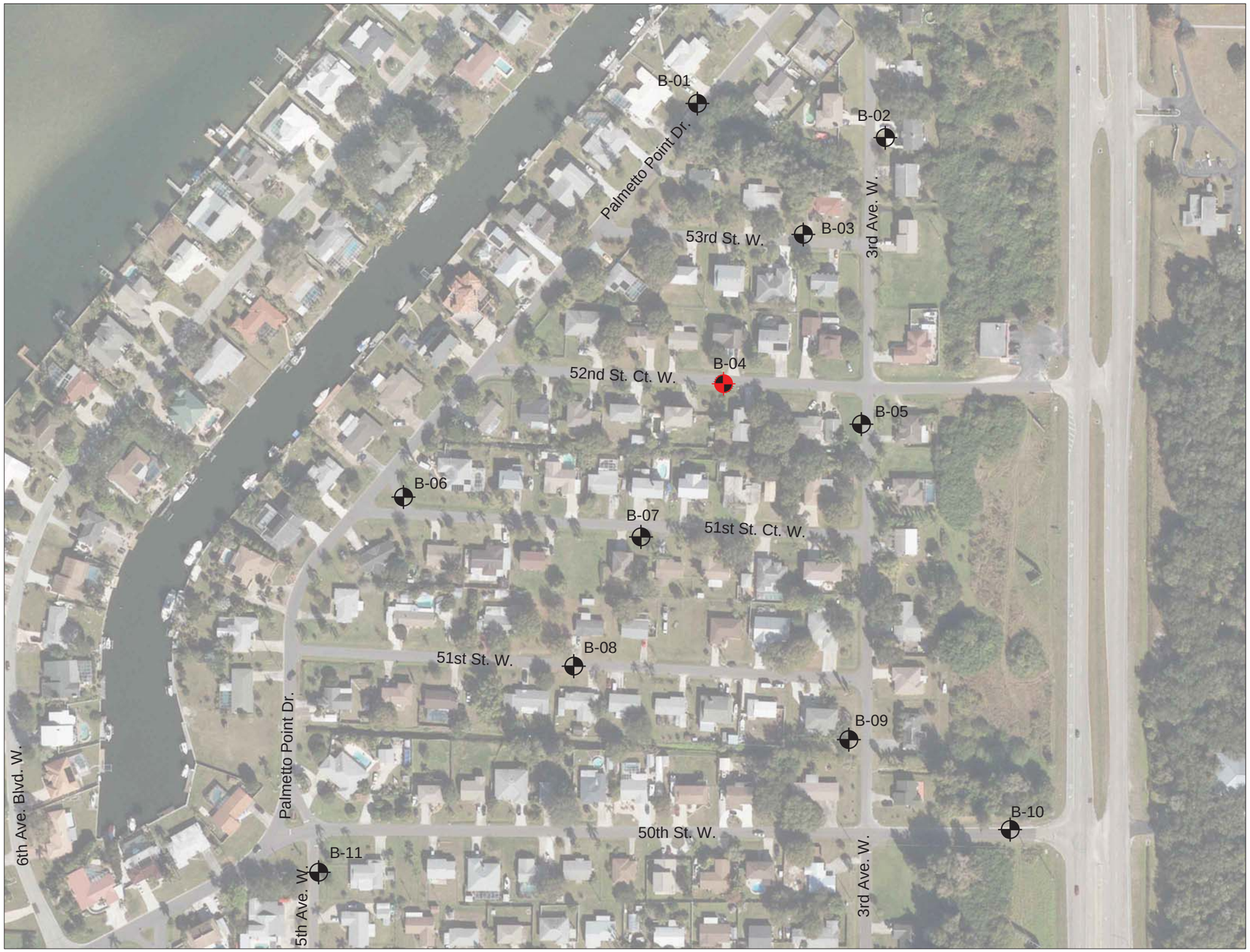
	NAME	DATE
DESIGNED BY:	LMC	08/2018
DRAWN BY:	LMC	08/2018
CHECKED BY:	AG	08/2018
SUPERVISED BY:	Amy Guisinger, P.E.	

Palmetto Point Water Main Replacement
Manatee County, Florida

PROJECT NO.	FIGURE NO.
B-18-054	2

Z:\Projects\B – Geotechnical\2018\B-18-054 Palmetto Point WM – Ayres\11 – CADD\B-18-054 Palmetto Point.dwg

BORING LOCATION PLAN



N

0 200'

APPROXIMATE PLAN SCALE

LEGEND

- Approximate Location of Standard Penetration Test (SPT) Boring (10')
- Approximate Location of Standard Penetration Test (SPT) Boring (20')

1. The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

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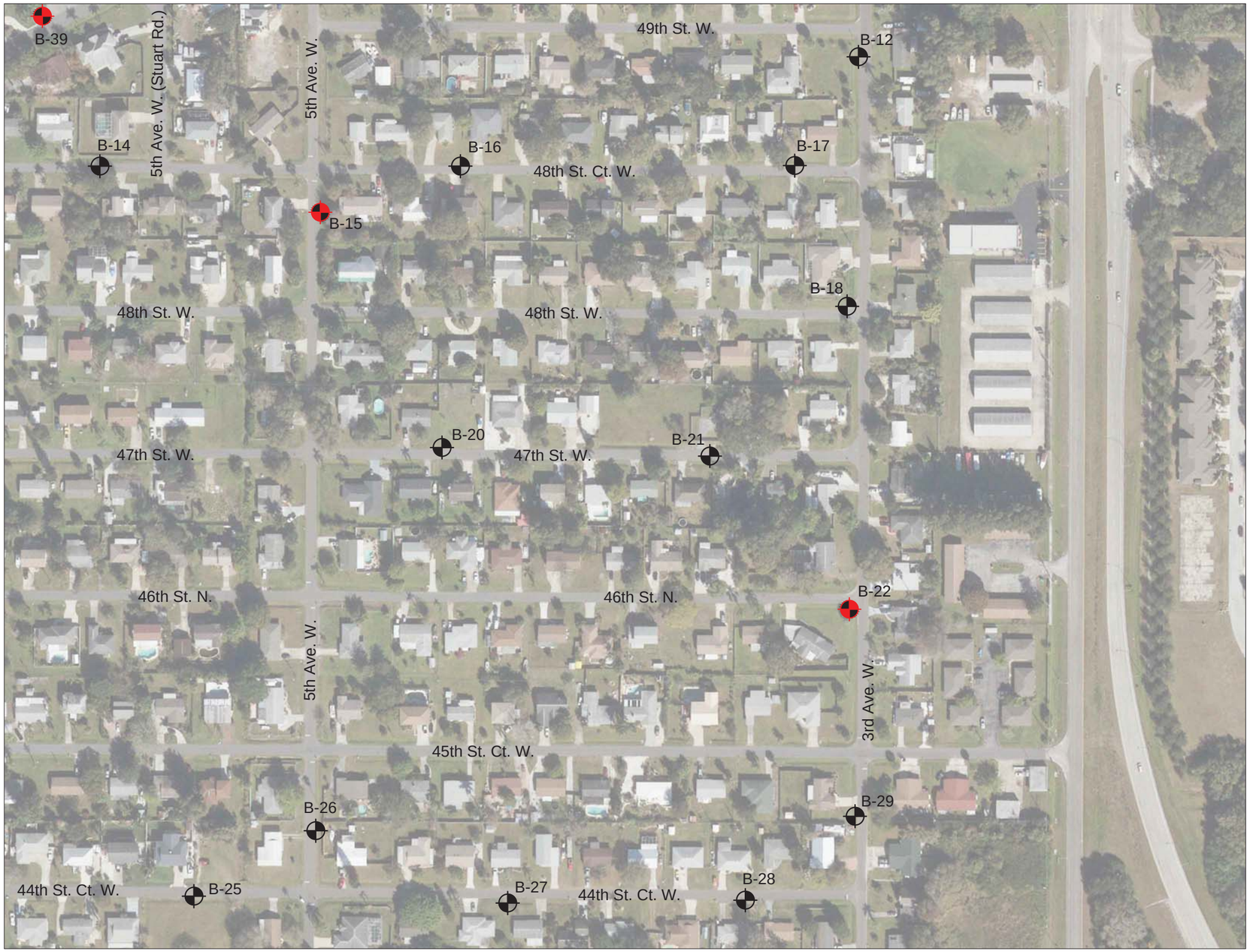
Palmetto Point Water Main Replacement
Manatee County, Florida

PROJECT NO.	FIGURE NO.
B-18-054	2A

Z:\Projects\B - Geotechnical\2018\B-18-054 Palmetto Point WM - Ayres\11 - CADD\B-18-054 Palmetto Point.dwg

BORING LOCATION PLAN



N

0 200'

APPROXIMATE PLAN SCALE

LEGEND

- Approximate Location of Standard Penetration Test (SPT) Boring (10')
- Approximate Location of Standard Penetration Test (SPT) Boring (20')

1. The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

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CHECKED BY:	AG	08/2018
SUPERVISED BY:	Amy Guisinger, P.E.	

Palmetto Point Water Main Replacement
Manatee County, Florida

PROJECT NO.	FIGURE NO.
B-18-054	2B

Z:\Projects\B – Geotechnical\2018\B-18-054 Palmetto Point WM – Ayres\11 – CADD\B-18-054 Palmetto Point.dwg

BORING LOCATION PLAN

N

0 200'

APPROXIMATE PLAN SCALE

LEGEND

- Approximate Location of Standard Penetration Test (SPT) Boring (10')
- Approximate Location of Standard Penetration Test (SPT) Boring (20')

1. The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

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CHECKED BY:	AG	08/2018
SUPERVISED BY:	Amy Guisinger, P.E.	

Palmetto Point Water Main Replacement
Manatee County, Florida

PROJECT NO.	FIGURE NO.
B-18-054	2C

Z:\Projects\B – Geotechnical\2018\B-18-054 Palmetto Point WM – Ayres\11 – CADD\B-18-054 Palmetto Point.dwg

BORING LOCATION PLAN

LEGEND

Approximate Location of Standard Penetration Test (SPT) Boring (10')

Approximate Location of Standard Penetration Test (SPT) Boring (20')

1. The Boring Locations Presented are Approximate and Based on Hand Held GPS with an Accuracy of +/- 10 Feet.

REVISIONS			
NO.	DATE	DESCRIPTIONS	APPROVED

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Palmetto Point Water Main Replacement
Manatee County, Florida

PROJECT NO.	FIGURE NO.
B-18-054	2D

Z:\Projects\B - Geotechnical\2018\B-18-054 Palmetto Point WM - Ayres\11 - CADD\B-18-054 Palmetto Point.dwg

Palmetto Point Water Main Replacement
Manatee County, Florida

Client: Ayres Associates
Project: B-18-054
Date: July 26, 2018

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USGS TOPOGRAPHIC SURVEY

Designed By: JEP
Checked By: AG
Drawn By: AT

FIGURE 3

*Refer to Section 3.2 for the soil survey summary table.

N

Palmetto Point Water Main Replacement Manatee County, Florida	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959	USDA SOIL SURVEY
Client: Ayres Associates Project: B-18-054 Date: July 26, 2018	Designed By: JEP Checked By: AG Drawn By: AT	FIGURE 4

APPENDIX B

Generalized Subsurface Profile – Figure 5A to 5D
Soil Boring Records
Key to Soil Classification Symbols
Laboratory Test Results
Corrosion Test Results
Field and Laboratory Procedure

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Date: 7/27/2018
Drawn By: ASC
Checked By: ALG

Palmetto Point Water Main Replacement
Manatee County, FL

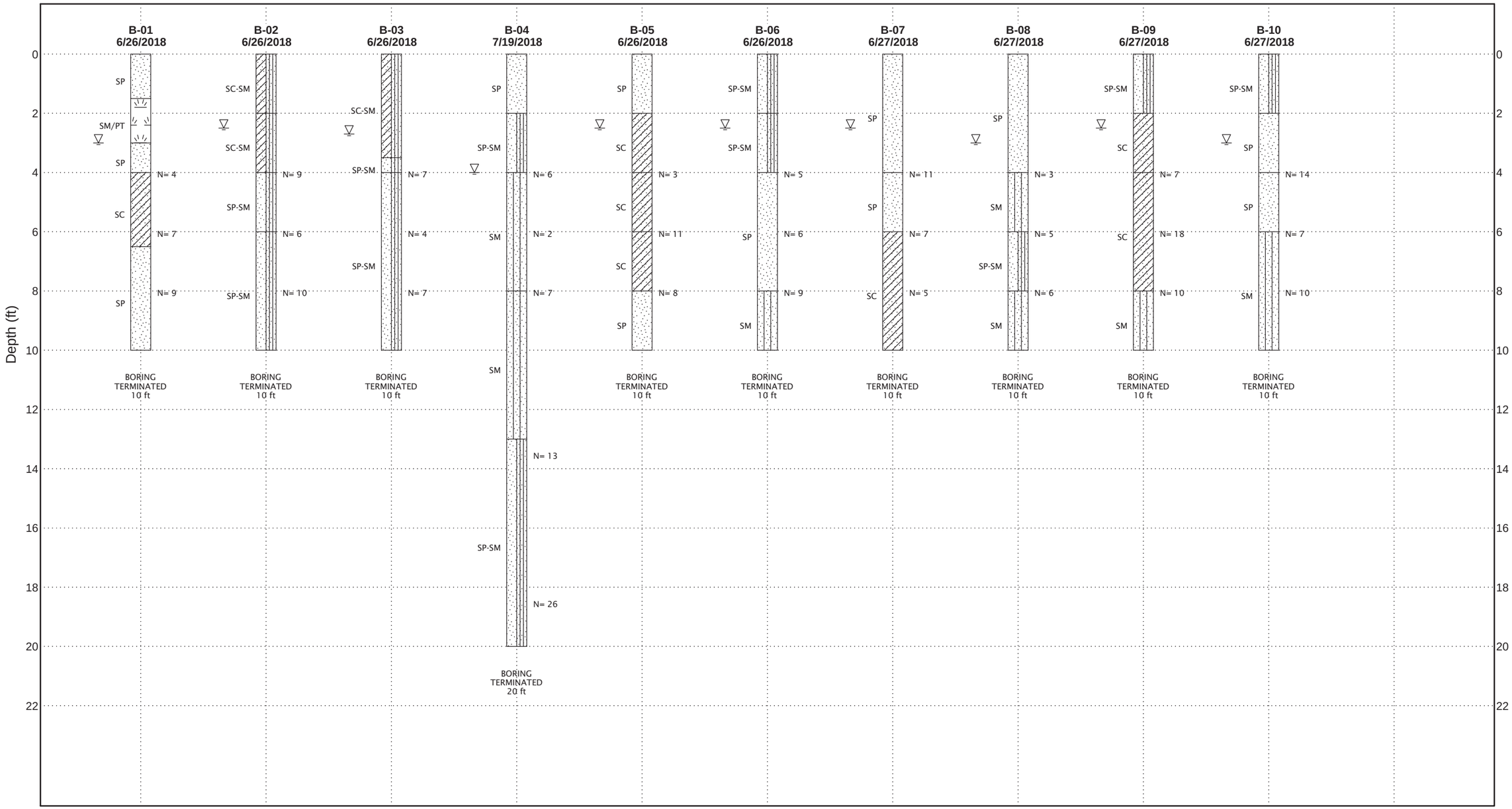
Prepared for
Ayres

Project No.: B-18-054

GENERALIZED SUBSURFACE PROFILE
Figure 5A

Poorly-graded Sand
Clayey Silty Sand
Silty Sand with Organics to Peat
Poorly-graded Sand with Silt
Clayey Sand
Silty Sand

Soil Classification Key



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Palmetto Point Water Main Replacement
Manatee County, FL

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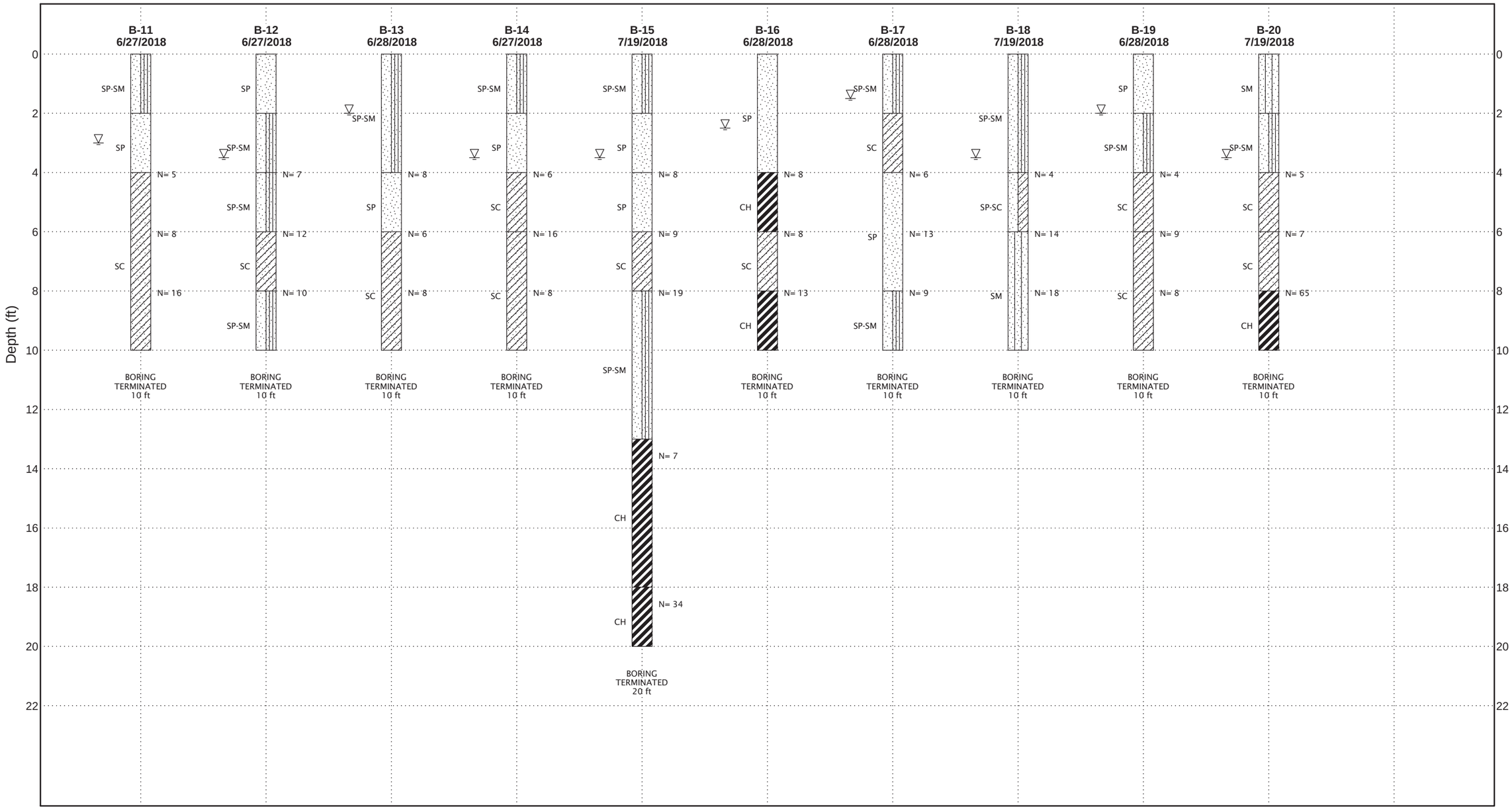
Project No.: B-18-054

GENERALIZED SUBSURFACE PROFILE
Figure 5B

Poorly-graded Sand with Silt
Poorly-graded Sand
Clayey Sand
High Plasticity Clay
Poorly-graded Sand with Clay
Silty Sand

Soil Classification Key



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Checked By: ALG

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Manatee County, FL

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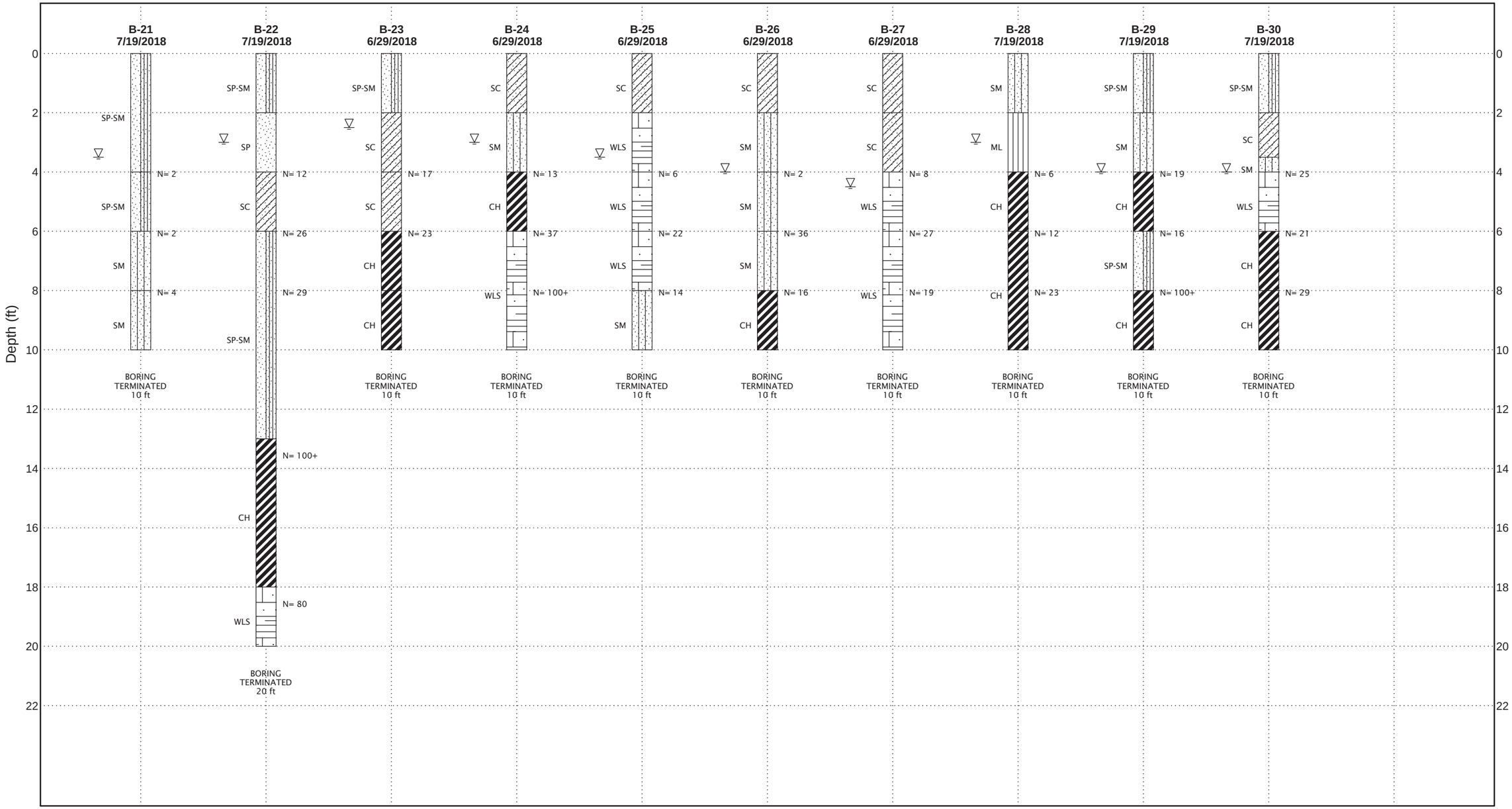
Project No.: B-18-054

GENERALIZED SUBSURFACE PROFILE
Figure 5C

Poorly-graded Sand with Silt
Silty Sand
Poorly-graded Sand
Clayey Sand
High Plasticity Clay
Weathered Limestone
Silt

Soil Classification Key



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Checked By: ALG

Palmetto Point Water Main Replacement
Manatee County, FL

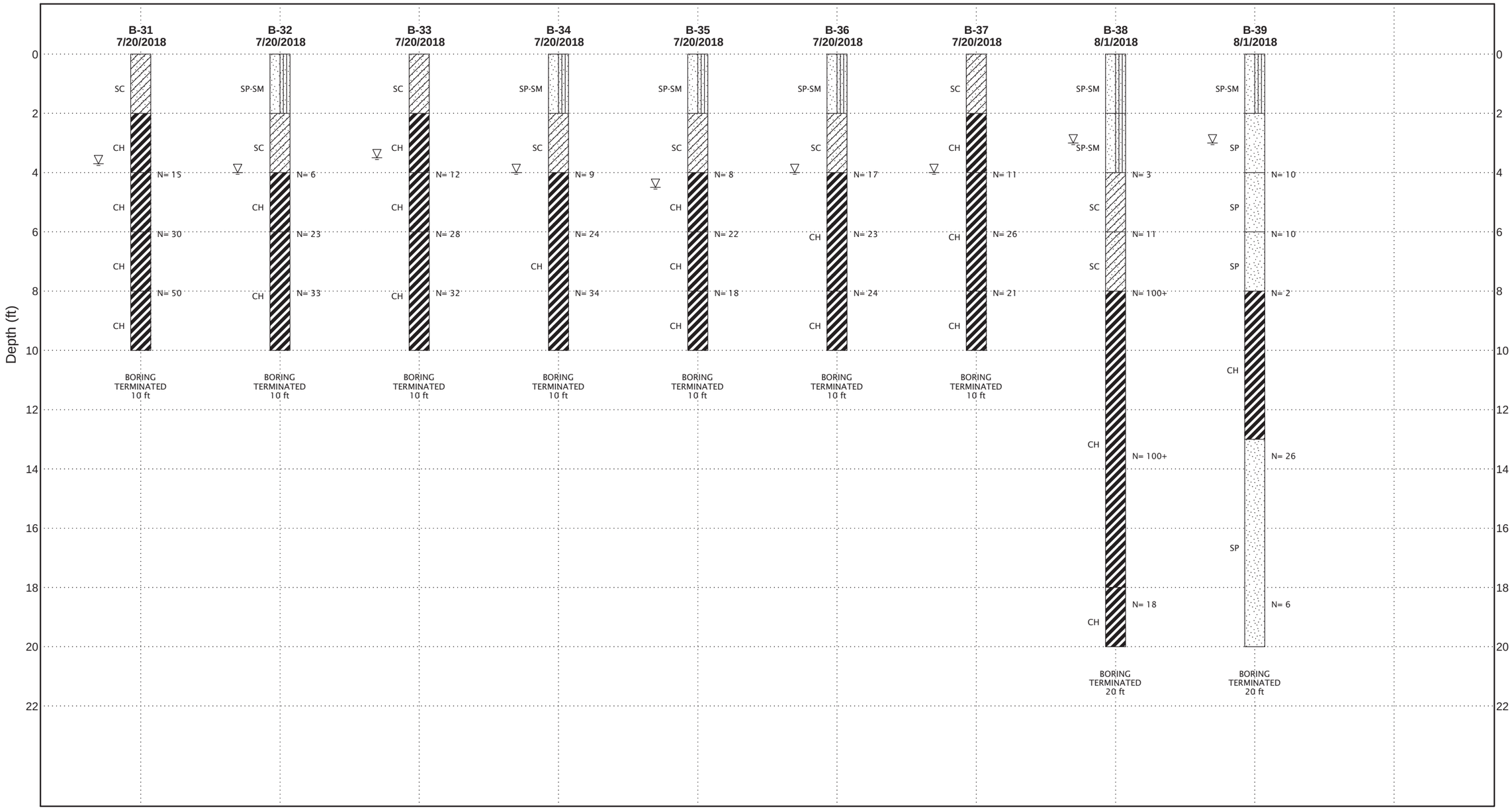
Prepared for
Ayres

Project No.: B-18-054

GENERALIZED SUBSURFACE PROFILE
Figure 5D

Clayey Sand
High Plasticity Clay
Poorly-graded Sand with Silt
Poorly-graded Sand

Soil Classification Key



DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown fine SAND with Trace Shell (SP)			HA			
	Dark Gray Silty Fine SAND with Organics to PEAT (SM/PT)	▽		HA			
	Dark Gray Fine SAND (SP)						
	Very Loose Dark Gray Clayey Fine SAND (SC)			SPT	2-2-2-2	4	
	Loose Light Gray Fine SAND with Some Shell (SP)			SPT	2-4-3-4	7	
10				SPT	4-4-5-4	9	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/26/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-01

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Clayey Fine SAND with Silt (SC-SM)			HA			
	Dark Gray Clayey fine SAND with Silt and Trace shell (SC-SM)	▽		HA			
	Loose Light Gray Fine SAND with Silt and Few Shell and Trace Limerock (SP-SM)			SPT	3-5-4-2	9	
	Loose Light Gray Fine SAND with Silt and Some Shell and Trace Limerock (SP-SM)			SPT	2-2-4-7	6	
10				SPT	4-5-5-7	10	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/26/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-02

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Brown to Light Brown Clayey Fine SAND with Silt (SC-SM)	▽		HA			
				HA			
	Light Gray Fine SAND with Silt (SP-SM)						
	Very Loose to Loose Light Gray Fine SAND with Silt and Some Shell (SP-SM)			SPT	4-3-4-4	7	
				SPT	4-2-2-3	4	
10				SPT	3-4-3-3	7	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/26/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.7 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

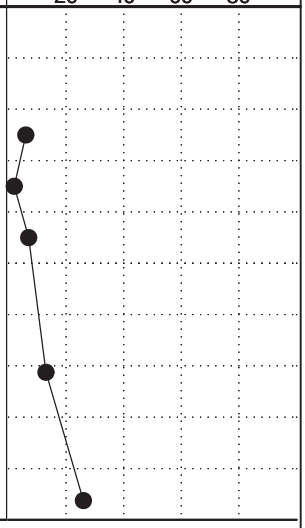
SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-03

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE
0	Gray fine SAND (SP)			HA		
	Dark Brown Fine SAND with Silt and Trace Organics (SP-SM)	▽		HA		
	Very Loose to Loose Light Brown to Gray Silty Fine SAND (SM)			SPT	2-4-2-2	6
				SPT	2-1-1-1	2
	Loose Gray Silty Fine SAND with Trace Shell Fragments (SM)			SPT	2-2-5-6	7
10						
	Medium Dense Gray Fine SAND with Trace Phosphate Fragments (SP-SM)			SPT	3-6-7	13
20				SPT	6-10-16	26

● SPT N VALUE ●
20 40 60 80
PL MC LL
20 40 60 80
▲ FINES CONTENT (%) ▲
20 40 60 80



Bottom of borehole at 20.0 feet.

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-04

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND (SP)			HA			
	Brown Clayey Fine SAND (SC)	▽		HA			
	Very Loose Brown Clayey Fine SAND (SC)			SPT	1-1-2-3	3	
	Medium Dense Brown Clayey Fine SAND (SC)			SPT	3-4-7-4	11	
10	Loose Gray Fine SAND (SP)			SPT	5-5-3-4	8	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/26/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-05

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Brown Fine SAND with Silt and Trace Organics (SP-SM)			HA			
	Dark Brown Fine SAND with Silt (SP-SM)	▽		HA			
	Loose Gray Fine SAND (SP)			SPT	1-2-3-4	5	
				SPT	3-3-3-4	6	
10	Loose Gray Silty Fine SAND (SM)			SPT	3-4-5-4	9	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/26/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-06

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown to Gray Fine SAND (SP)	▽		HA			
				HA			
	Medium Dense Light Gray Fine SAND (SP)			SPT	2-5-6-3	11	
	Loose Gray Clayey Fine SAND (SC)			SPT	2-3-4-4	7	
10				SPT	3-2-3-2	5	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-07

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray to Brown Fine SAND (SP)	▽		HA			
				HA			
	Very Loose Light Gray Silty Fine SAND (SM)			SPT	3-2-1-2	3	
	Loose Light Gray Fine SAND with Silt and Trace Rock Fragments (SP-SM)			SPT	1-2-3-3	5	
10	Loose Light Gray Silty Fine SAND (SM)			SPT	3-4-2-4	6	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-08

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND with Silt and Trace Clay Pockets (SP-SM)			HA			
	Light Gray Clayey Fine SAND (SC)	▽		HA			
	Loose to Medium Dense Light Gray Clayey Fine SAND (SC)			SPT	2-3-4-8	7	
				SPT	7-10-8-9	18	
10	Loose Light Gray Silty Fine SAND (SM)			SPT	7-5-5-4	10	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-09

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Fine SAND with Silt (SP-SM)			HA			
	Light Gray Fine SAND (SP)	▽		HA			
	Medium Dense Gray Fine SAND (SP)			SPT	4-7-7-8	14	
	Loose Gray Silty Fine SAND (SM)			SPT	5-3-4-4	7	
10				SPT	5-4-6-5	10	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-10

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Fine SAND ith Silt (SP-SM)			HA			
	Brown Fine SAND (SP)	▽		HA			
	Loose to Medium Dense Light Gray Clayey Fine SAND (SC)			SPT	2-3-2-2	5	
				SPT	3-3-5-6	8	
10				SPT	5-7-9-10	16	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-11

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Light Gray Fine SAND (SP)			HA			
	Gray Fine SAND with Silt and Trace Shell (SP-SM)	▽		HA			
	Loose Gray Fine SAND with Silt and Trace Shale (SP-SM)			SPT	2-3-4-4	7	
	Medium Dense Gray Clayey Fine SAND (SC)			SPT	3-5-7-5	12	
10	Loose Gray Fine SAND with Silt (SP-SM)			SPT	6-5-5-5	10	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-12

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Brown Fine SAND with Silt (SP-SM)	▽		HA			
				HA			
	Loose Brown Fine SAND (SP)			SPT	1-2-6-5	8	
	Loose Gray Clayey Fine SAND with Trace Phosphate Fragments (SC)			SPT	4-3-3-5	6	
10				SPT	3-4-4-5	8	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/28/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-13

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Brown Fine SAND with Silt (SP-SM)			HA			
	Brown Fine SAND (SP)	▽		HA			
	Loose Gray Clayey Fine SAND with Few Roots (SC)			SPT	2-3-3-5	6	
	Loose to Medium Dense Brown to Gray Clayey Fine SAND (SC)			SPT	6-6-10-8	16	
10				SPT	7-5-3-3	8	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/27/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

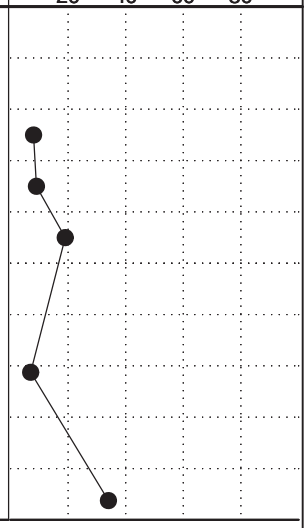
SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-14

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE
0	Light Brown Fine SAND with Silt (SP-SM)			HA		
	Light Brown Fine SAND (SP)	▽		HA		
	Loose Light Brown Fine SAND (SP)			SPT	2-4-4-5	8
	Loose Gray Clayey Fine SAND with Trace Phosphate Fragments (SC)			SPT	2-4-5-5	9
10	Medium Dense Gray Fine SAND with Silt and Trace Phosphate Fragments (SP-SM)			SPT	4-10-9-6	19
	Firm Light Brown CLAY with Trace Limestone Fragments (CH)			SPT	2-2-5	7
20	Hard Light Brown CLAY with Trace Limestone Fragments (CH)			SPT	26-16-18	34

● SPT N VALUE ●
20 40 60 80
PL MC LL
20 40 60 80
▲ FINES CONTENT (%) ▲
20 40 60 80



Bottom of borehole at 20.0 feet.

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-15

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown to Gray Fine SAND (SP)	▽		HA			
				HA			
	Loose Gray Clayey Fine SAND with Trace Roots (CH)			SPT	4-5-3-3	8	
	Loose Gray Clayey Fine SAND (SC)			SPT	3-4-4-7	8	
10	Stiff Gray CLAY (CH)			SPT	7-5-8-10	13	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/28/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-16

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND with Silt (SP-SM)	▽		HA			
	Gray Clayey Fine SAND (SC)			HA			
	Loose to Medium Dense Gray Fine SAND (SP)			SPT	2-3-3-4	6	
				SPT	5-6-7-7	13	
10	Loose Gray Fine SAND with Silt and trace phosphate (SP-SM)			SPT	6-5-4-4	9	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/28/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 1.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-17

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray to Dark Gray to Brown Fine SAND with Silt (SP-SM)	▽		HA			
				HA			
	Very Loose Gray Fine SAND with Clay (SP-SC)			SPT	1-1-3-3	4	
	Medium Dense Gray Silty Fine SAND with trace phosphate (SM)			SPT	5-5-9-12	14	
10				SPT	7-7-11	18	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-18

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Fine SAND (SP)	▽		HA			
	Dark Brown Fine SAND with Silt (SP-SM)			HA			
	Very Loose Gray Clayey Fine SAND with Trace Roots (SC)			SPT	1-2-2-3	4	
	Loose Gray Clayey Fine SAND with Trace Roots (SC)			SPT	3-4-5-5	9	
10				SPT	3-4-4-6	8	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/28/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-19

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Silty Fine SAND (SM)			HA			
	Brown Fine SAND with Silt (SP-SM)	▽		HA			
	Loose Gray Clayey Fine SAND with Trace Phosphate Fragments and Roots (SC)			SPT	2-3-2-2	5	
	Loose Gray Clayey Fine SAND with Trace Phosphate Fragments (SC)			SPT	3-3-4-4	7	
10	Very Hard Light Gray CLAY with Trace Limestone Fragments (CH)			SPT	26-41-24-36	65	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-20

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Fine SAND with Silt and Trace Shell (SP-SM)	▽		HA			
				HA			
	Very Loose Dark Gray Fine SAND with Silt and Trace Shell (SP-SM) 1 Blow for 12-Inches @ 4'			SPT	1-0-2-1	2	
	Very Loose Dark Gray Silty Fine SAND With Trace Shell (SM) 1 Blow for 12-Inches @ 6'			SPT	1-1-1-0	2	
10	Very Loose Gray Silty Fine SAND with Few Limerock and Trace Clay Pockets (SM) Weight-of-Hammer for 6-Inches @ 8'			SPT	WOH-2-2-2	4	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

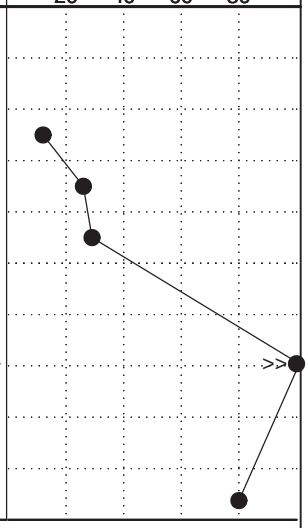
AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-21

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE
0	Dark Gray Fine SAND with Silt (SP-SM)			HA		
	Light Brown Fine SAND (SP)	▽		HA		
	Medium Dense Light Brown Clayey Fine SAND (SC)			SPT	3-5-7-10	12
	Medium Dense Gray Fine SAND with Silt and Trace Phosphate Fragments (SP-SM)			SPT	9-14-12-13	26
10				SPT	14-14-15-14	29
	Very Hard Gray CLAY with Some Indurated Fragments (CH) 50 Blows for 4-Inches of Penetration			SPT	26-50/4"	100+
	Hard Gray Highly Weathered LIMESTONE with Trace Phosphate Fragments (WLS)			SPT	16-30-50	80
20	Bottom of borehole at 20.0 feet.					



Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-22

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Fine SAND with Silt (SP-SM)			HA			
	Gray Clayey Fine SAND (SC)	▽		HA			
	Medium Dense Light Gray Clayey Fine SAND with Trace Limestone Fragments (SC)			SPT	2-9-8-8	17	
	Very Stiff Light Gray CLAY with Few Limestone Fragments (CH)			SPT	7-10-13-10	23	
10	Gray CLAY with Trace Limestone Fragments (CH) Note: Blow Counts Were Not Recorded From 8 to 10 feet						
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/29/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 2.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-23

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Clayey Fine SAND (SC)			HA			
	Gray Silty Fine SAND with Little Limerock (SM)	▽		HA			
	Stiff Light Gray CLAY with Some LIMESTONE Fragmets (CH)			SPT	2-6-7-7	13	
	Medium Hard to Hard Light Gray Weathered LIMESTONE (WLS)			SPT	5-15-22-20	37	
10				SPT	28-50/5"	100+	>>

Bottom of borehole at 10.0 feet.

Date Drilled: 6/29/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-24

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Clayey Fine SAND (SC)			HA			
	Gray Highly Weathered LIMESTONE (WLS)	▽		HA			
	Very Soft Light Gray Highly Weathered LIMESTONE (WLS)			SPT	2-3-3-5	6	
	Medium Hard Light Gray Highly Weathered LIMESTONE (WLS)			SPT	22-11-11-11	22	
10	Medium Dense Light Brown Silty Fine SAND (SM)			SPT	10-9-5-7	14	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 6/29/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-25

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Clayey Fine SAND (SC)			HA			
	Gray Silty Fine SAND (SM)	▽		HA			
	Very Loose Gray Silty Fine SAND with Trace Roots (SM) Weight-of-Hammer for 6-Inches @ 4'			SPT	WOH-1-1-1	2	
	Dense Gray Silty Fine SAND with Some Indurated Fragments (SM)			SPT	3-8-28-30	36	
10	Very Stiff Light Brown CLAY (CH)			SPT	9-8-8-8	16	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/29/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-26

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Clayey Fine SAND with Few Roots (SC)			HA			
	Gray Clayey Fine SAND with Some Limerock (SC)			HA			
	Very Soft Light Gray Highly Weathered LIMESTONE (WLS)	▽		SPT	1-2-6-2	8	
	Soft to Medium Hard Light Gray Highly Weathered LIMESTONE (WLS)			SPT	4-11-16-19	27	
10				SPT	21-9-10-5	19	

Bottom of borehole at 10.0 feet.

Date Drilled: 6/29/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-27

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Silty Fine SAND (SM)			HA			
	Light Brown SILT with Trace Limerock and Shell Fragments (ML)	▽		HA			
	Firm Light Brown CLAY with Trace Indurated Fragments (CH)			SPT	2-2-4-6	6	
	Stiff to Very Stiff Light Gray CLAY (CH)			SPT	2-4-8-13	12	
10				SPT	10-10-13-13	23	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-28

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Dark Gray Fine SAND with Trace Limerock (SP-SM)			HA			
	Brown Fine SAND with Silt and Some Limerock (SM)	▽		HA			
	Very Stiff Gray CLAY (CH)			SPT	5-6-13-14	19	
	Medium Dense Gray Fine SAND with Clay and Trace Phosphate Fragments (SP-SC)			SPT	10-8-8-10	16	
10	Very Hard Gray CLAY with Trace Phosphate Fragments (CH) 50 Blows for 2-Inches of Penetration			SPT	13-23-50/2"	100+	
	Bottom of borehole at 10.0 feet.						

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-29

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Fine SAND with Silt (SP-SM)			HA			
	Brown Clayey Fine SAND (SC)			HA			
	Very Light Gray Silty Fine SAND With Shell (SM)	▽					
	Medium Hard Light Gray Highly Weathered Limestone (WLS)			SPT	6-10-15-10	25	
	Very Stiff CLAY with Trace Limestone and Shell Fragments (CH)			SPT	6-9-12-14	21	
10	Very Stiff CLAY with Trace Limestone Fragments (CH)			SPT	12-12-17-14	29	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/19/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-30

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Clayey Fine SAND with Trace Limestone and Shell Fragments (SC)			HA			
	Light Gray CLAY with Trace Limestone and Shell Fragments (CH)	▽		HA			
	Stiff Light Gray CLAY (CH)			SPT	4-4-11-13	15	
	Very Stiff Light Gray CLAY with Some Limestone Fragments (CH)			SPT	8-14-16-20	30	
10	Hard Light Brown CLAY (CH)			SPT	11-20-30-27	50	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.7 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-31

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND with Silt (SP-SM)			HA			
	Gray Clayey fine SAND (SC)	▽		HA			
	Firm Light Gray CLAY (CH)			SPT	2-3-3-4	6	
	Hard Light Gray CLAY with Few Limestone Fragments (CH)			SPT	3-10-13-16	23	
10				SPT	11-15-18-20	33	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-32

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Clayey fine SAND (SC)			HA			
	Gray CLAY (CH)	▽		HA			
	Stiff Gray CLAY with Few Limestone Fragments (CH)			SPT	3-5-7-12	12	
	Very Stiff to Hard Light Gray CLAY with Some Limestone Fragments (CH)			SPT	7-14-14-17	28	
10				SPT	7-14-18-24	32	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-33

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Light Brown Fine SAND with Silt and Few Clay Pockets (SP-SM)			HA			
	Brown Clayey SAND (SC)	▽		HA			
	Stiff to Very Stiff CLAY with Trace Limestone Fragments (CH)			SPT	2-3-6-8	9	
				SPT	6-10-14-17	24	
10				SPT	11-16-18-19	34	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-34

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND with Silt (SP-SM)			HA			
	Gray Clayey Fine SAND (SC)			HA			
	Firm Light Gray CLAY with Trace Limestone Fragments (CH)	▽		SPT	1-3-5-9	8	
	Very Stiff Light Gray CLAY with Trace Limestone Fragments (CH)			SPT	6-10-12-12	22	
10	Very Stiff Light Brown Clay (CH)			SPT	6-6-12-17	18	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4.5 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-35

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Gray Fine SAND with Silt (SP-SM)			HA			
	Gray Clayey fine SAND (SC)	▽		HA			
	Very Stiff Gray to Light Gray CLAY with Some Limestone Fragments (CH)			SPT	4-7-10-12	17	
				SPT	9-7-16-17	23	
10	Very Stiff Light Brown Clay (CH)			SPT	7-11-13-17	24	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-36

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE	● SPT N VALUE ● 20 40 60 80 / PL MC LL 20 40 60 80 / ▲ FINES CONTENT (%) ▲ 20 40 60 80
0	Brown Clayey Fine SAND (SC)			HA			
	Gray Sandy CLAY (CH)	▽		HA			
	Stiff to Very Stiff Gray to Light Gray CLAY with Trace Limestone Fragments (CH)			SPT	3-5-6-7	11	
				SPT	9-11-15-20	26	
10	Very Stiff Light Gray CLAY with Some Limestone Fragments (CH)			SPT	9-10-11-14	21	

Bottom of borehole at 10.0 feet.

Date Drilled: 7/20/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 4 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

AREHNA | Engineering, Inc.

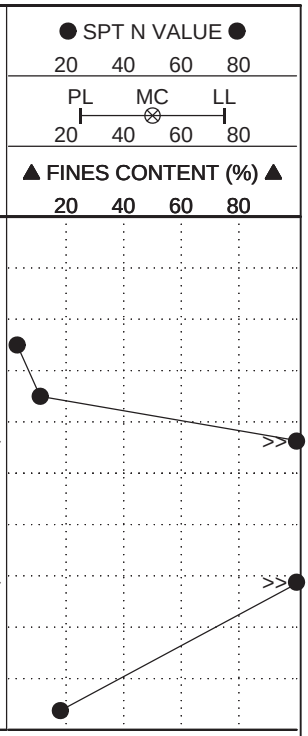
SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-37

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE
0	Dark Brown Fine SAND with Silt and Trace Limerock (SP-SM)			AU		
	Dark Brown Fine SAND with Silt (SP-SM)	▽		AU		
	Very Loose Gray Clayey Fine SAND with trace roots (SC)			SPT	2-1-2-3	3
	Medium Dense Clayey Fine SAND (SC)			SPT	5-5-6-8	11
10	Very Hard Light Gray CLAY With Indurated Clay Fragments (CH)			SPT	1-8-50/6"	100+
	50 Blows for 6-Inches at 11 Feet					
	50 Blows for 6-Inches at 14.5 Feet			SPT	6-20-50/6"	100+
20	Very Stiff Dark Gray CLAY With Indurated Clay Fragments (CH)			SPT	4-7-11	18

Bottom of borehole at 20.0 feet.



Date Drilled: 8/1/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT
MANATEE COUNTY, FL
AREHNA Project No.: B-18-054
Ayres

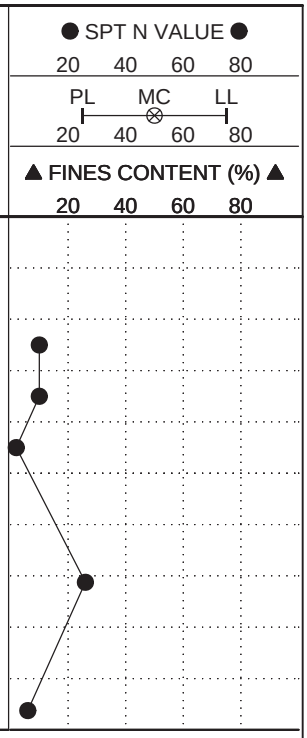
AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-38

DEPTH (ft)	SOIL DESCRIPTION AND REMARKS	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	SPT BLOW COUNTS	N-VALUE
0	Dark Gray Fine SAND with Silt and Trace Organics (SP-SM)			AU		
	Dark Brown Fine SAND (SP)	▽		AU		
	Loose Brown Fine SAND with Trace Roots (SP)			SPT	3-4-6-7	10
	Loose Light Brown Fine SAND (SP)			SPT	6-6-4-7	10
	Very Soft Light Brown CLAY (CH)			SPT	1-1-1-2	2
10						
	Medium Dense to Loose Gray fine SAND (SP)			SPT	8-12-14	26
20				SPT	6-3-3	6



Bottom of borehole at 20.0 feet.

Date Drilled: 8/1/18
Drilled By: AREHNA
Method: ASTM D-1586, Standard Penetration Test Boring

Ground Water Level:

▽ At Time of Drilling: 3 ft below existing grade

Remarks:

PALMETTO POINT WATER MAIN REPLACEMENT MANATEE COUNTY, FL

AREHNA Project No.: B-18-054

Ayres

AREHNA | Engineering, Inc.

SOIL BORING LOG

Drawn By: ASC
Checked By: ALG
Date: 7/27/2018

Boring B-39

KEY TO SYMBOLS

AREHNA | Engineering, Inc.

CLIENT Ayres **PROJECT NAME** Palmetto Point Water Main Replacement

PROJECT NUMBER B-18-054 **PROJECT LOCATION** Manatee County, FL

LITHOLOGIC SYMBOLS (Unified Soil Classification System)


SP: Poorly-graded Sand


SM/PT: Silty Sand with Trace Organics to Peat


SC: Clayey Sand


SC-SM: Clayey Silty Sand


SP-SM: Poorly-graded Sand with Silt


SM: Silty Sand


CH: High Plasticity Clay


SP-SC: Poorly-graded Sand with Clay


WLS: Weathered Limestone


ML: Silt

SAMPLER SYMBOLS


Standard Penetration Test


Hand Auger

Standard Penetration Resistances

SAND & GRAVEL

No. of Blows	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
Greater than 50	Very Dense

SILT & CLAY

No. of Blows	Consistency
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very Stiff
Greater than 30	Hard

LIMESTONE

No. of Blows	Consistency
10 - 20	Soft
21 - 50	Medium
51 - 50/3"	Hard
Greater than 50/3"	Very Hard

WOR = Weight of Rod
WOH = Weight of Hammer

Ground Water Level Measurements

▽ Water Level at Time Drilling, or as Shown

▼ Water Level After 24 Hours, or as Shown

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTICITY INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200- PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

SOIL BOUNDARY CLASSIFICATIONS

FINE GRAINED SOILS | **COARSE GRAINED SOILS**

SILT or CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

200 Sieve | #40 Sieve | #10 Sieve | #4 Sieve | 3/4-inch | 3-inch | 12-inch

TABLE 1
SUMMARY OF LABORATORY TEST DATA
Palmetto Point Water Main Replacement
Manatee County, Florida
AREHNA Project B-18-054

Boring No.	Sample Depth (feet)	USCS Classification	Percent Moisture Content	Percent Finer (-200 sieve)	Percent Organic Content	Atterberg Limits		
						LL	PL	PI
B-1 (1)	0 – 2.0	SM/PT	153	23	15	-	-	-
B-2 (1)	0 – 2.0	SC-SM	24	13	-	-	-	-
B-3 (1)	0 – 2.0	SC-SM	25	17	3	26	19	7
B-6 (1)	0 – 2.0	SP-SM	38	7	-	-	-	-
B-16 (3)	4.0 - 6.0	SC	26	32	-	52	19	33
B-19 (4)	6.0 – 8.0	SC	27	36	-	46	20	26
B-23 (5)	8.0 – 10.0	CH	31	80	-	79	35	44
B-34 (2)	2.0 – 4.0	SC	26	25	-	38	20	18
B-36 (5)	8.0 – 10.0	CH	49	100	-	146	49	97

TABLE 1B
SUMMARY OF CORROSION TESTING

Project: Palmetto Point Water Main Replacement
Date: August 1, 2018
AREHNA Proj. No.: B-18-054

Sample ID	Depth Range (ft)	pH FM5-550	Resistivity (ohm-cm) FM5-551	Chlorides (ppm) FM5-552	Sulfates (ppm) FM5-553	Environmental Classification for Soils and Water*	
						Steel	Concrete
B-3	4.0 - 10.0	8.2	2,100	75	171	Moderately Aggressive	Moderately Aggressive
B-7	4.0 – 8.0	7	12,000	45	69	Slightly Aggressive	Slightly Aggressive
B-10	4.0 – 10.0	7.8	10,000	45	45	Slightly Aggressive	Slightly Aggressive

***Classification based on FDOT Structures Design Guidelines, Table 1.3.2-1, January 2018**

FIELD PROCEDURES

Standard Penetration Test (SPT) Borings

The SPT borings are performed in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils." A rotary drilling process is used and bentonite drilling fluid is circulated in the boreholes to stabilize the sides and flush the cuttings. At regular intervals, the drilling tools are removed and soil samples are obtained with a standard 2-feet long, 2-inch diameter split-tube sampler. The sampler is first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling under its own weight a distance of 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance." The penetration resistance, when properly interpreted, is an index to the soil strength and density.

LABORATORY PROCEDURES

Water Content

The water content is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. This test is conducted in general accordance with FM 1-T265.

Percent Organics (Organic Loss on Ignition)

The amount of organic material in a sample is determined in this test. The sample is first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage of the total dry weight of the sample prior to ignition. This test is conducted in general accordance with FM 1-T267.

Atterberg Limits (Plasticity)

A soil's Plasticity Index (PI) is the numerical difference between the Liquid Limit (LL) and the Plastic limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in general accordance with ASTM D-4318. The PL is the moisture content at which the soil begins to crumble when rolled into a small thread and is also determined in general accordance with FM 1-T 90.

Fines Content

In this test, the sample is dried and then washed over a No. 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test is conducted in general accordance with ASTM D-1140.

pH

The pH is an expression of the concentration of dissociated hydrogen ions present in aqueous solution. pH values range from 1 to 14 with values below 7 indicating acidic conditions and values above 7 indicating alkaline conditions. This test is performed using a calibrated electronic pH meter with a sensing probe. The meter is calibrated by immersing the probe in a solution with a known pH. The soil pH is determined by mixing equal weights soil and distilled water and testing the supernatant solution with the pH probe. These tests were conducted in general accordance with FM 5-550.

Electrical Resistivity

Resistivity is a measure of the resistance to flow of electrical current through the soil. Resistive, the inverse of conductivity is measured in units of ohms-centimeters. This test was conducted using a soil box and a resistance meter. These tests were performed in general accordance with FM 5-551.

Chloride Content

The chloride content of the soil sample was determined by titration with silver nitrate. The soil was rinsed with an amount of distilled water equal in weight to the dry soil. The soil was then removed from the water (which consisted of distilled water and natural soil moisture) and the silver nitrate titration was performed on the water. These tests were performed in general accordance with FM 5-552.

Sulfate Content

The sulfate content of the soil sample was determined turbid metrically. The soil was rinsed with an amount of distilled water equal to the weight of the dry soil. The soil was then removed from the water (which consisted of distilled water and natural soil moisture) and the turbidity of the water was determined using a spectrophotometer. The turbidity gives an indirect indication of the sulfate content. This test was conducted in general accordance with FM 5-553.