

Attachment 3.2

DRAFT

**SUBSURFACE SOIL EXPLORATION
FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT - PHASE I
FIDDLESTICKS COUNTRY CLUB
FORT MYERS, LEE COUNTY, FLORIDA**



Ardaman & Associates, Inc.

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

Ardaman Project No. 17-33-4601
May 24, 2018

WESTON & SAMPSON ENGINEERING, INC.
1520 Royal Palm Square Boulevard, Suite 260
Fort Myers, FL 33919

Attention: Mr. Jeffrey A. Wilson, P.E. PWLF

SUBJECT: Subsurface Soil Exploration
Fiddlesticks Water Main Replacement Project – Phase I
Fiddlesticks Country Club
Fort Myers, Lee County, Florida

Gentlemen:

As requested and authorized by **Weston & Sampson Engineers, Inc.**, Ardaman & Associates, Inc. (Ardaman) has completed the subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions in the project study area and discuss our findings.

This report documents our findings and conclusions. It has been prepared for the exclusive use of **Weston & Sampson Engineers, Inc.** for specific application to the subject project in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducting 21 Standard Penetration Test (SPT) borings to 15 feet to determine the nature and condition of the subsurface soils along the route of the proposed water main.
2. Reviewing each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performing the appropriate laboratory tests on selected samples.
4. Analyzing the existing soil conditions with respect to the proposed construction.

5. Preparing this report to document the results of our field exploration and laboratory testing programs, and discuss our findings.

SITE LOCATION AND PROJECT DESCRIPTION

The Fiddlesticks Water Main Replacement project includes design, permitting and installation of a new water main in the right-of-way of all streets within the Fiddlesticks Country Club development in Fort Myers, Lee County, Florida. The proposed project has been split up into two phases. This report is only for Phase I, which encompasses Kilbirnie Drive, Kilmarnock Drive, Carberry Court, Fiddlesticks Boulevard from the entrance to Glenfinnan Circle and Glenlyon Court from Kilmarnock Drive east to the end of the cul-de-sac. Phase I includes an estimated total of 10,450 lineal feet of water main installation. Most of the water main replacement will be installed by directional drill. In general, the soil borings along the water main route were performed on approximately 500-foot centers. Due to access limitations all borings (with the exception to SPT-21) were performed on the existing road surface.

FIELD EXPLORATION PROGRAM

Our field exploration consisted of performing 21 Standard Penetration Test (SPT) borings. The SPT borings were drilled to a depth of 15 feet below the existing ground surface. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in the **Appendix**.

The locations of the borings are shown on the attached **Figure 1–Boring Location Plan**. They were located by measurement from the site features shown on an aerial photograph of the site shown on the preliminary subsurface utility engineering and geotechnical investigation sheet G-1 provided by Weston & Sampson Engineers, Inc. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If a more precise location of the borings is desired, then we recommend that a registered land surveyor be employed to locate the borings on site. GPS coordinates of each boring location are provided on the boring logs.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil boring logs. Soil stratification is based on examination of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types, the actual transitions may be gradual.

The borings, except SPT-21, were performed in the asphalt pavement. In general, below the asphalt and base, the borings typically encountered very loose to very dense fine sands (SP and SP-SM) extending to depths ranging from 7.5 to the termination of the borings at 15 feet below the existing ground surface. Below the fine sands, 15 of the 21 borings encountered very loose to dense silty sands (SM), silty clayey sands (SC-SM) or clayey sands (SC) with varying amounts (if any) of gravel consisting of rock fragments, cemented sands or shell fragments typically extending to the termination of the borings at a depth of 15 feet below the existing ground surface. Also, borings SPT-19 and SPT-21 encountered a 1-1/2-foot thick stratum of very loose to medium dense sandy silt (ML) at depths of 10.5 and 12 feet. In addition, boring SPT-14 encountered soft weathered limestone at 13.5 feet extending to the termination of the boring and boring SPT-15 encountered hard limestone at a depth of 9 feet extending to a depth of 12 feet.

Groundwater was encountered in the boreholes a depth ranging from 5 to 7 feet below the existing ground surface at the time of our field exploration (April 24 through 27 and May 11, 2018). The groundwater depths shown on the boring logs represent the groundwater surface encountered on the dates shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office and, thereafter, examined by a geotechnical engineer to obtain more accurate descriptions of the existing soil strata. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests included Natural Moisture Content, Organic Content and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented on the attached soil boring logs at the depths from which the samples were recovered. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

In addition, soil samples from the borings were obtained on approximately 1,500-foot centers for environmental corrosion tests and conducted in accordance with Florida test methods FM 5-550, FM 5-551, FM 5-552 and FM 5-553. The environmental corrosion test parameters include pH, resistivity, sulfate content and chloride content. The summarized results are presented below.

Boring No.	Depth (ft.)	pH	Resistivity (ohms-cm)	Chlorides (ppm)	Sulfates (ppm)
SPT-1	3 – 4.5	8.6	14,000	15	63
SPT-5	3 – 4.5	8.5	16,000	15	54
SPT-5	5 – 9	8.1	46,000	25	12
SPT-8	3 – 4.5	8.0	5,400	20	15
SPT-11	3 – 7.5	8.2	13,000	5	45
SPT-14	3 – 7.5	7.4	9,000	15	30
SPT-17	3 – 4.5	7.9	24,000	30	93
SPT-20	3 – 4.5	8.0	35,000	25	114

In accordance with the Florida Department of Transportation (FDOT) Structures Manual, the substructure environmental classification for all the above test results is Slightly Aggressive for steel and concrete.

DISCUSSION

Most of the borings performed along the proposed route encountered fine sands (SP and SP-SM) from the directly below the pavement section extending to depths ranging from 10.5 feet to the termination of the borings at 15 feet below the existing ground surface. The few exceptions were encountered in borings SPT-14, SPT-15 and SPT-21, where the fine sands were encountered to depths of 7.5 and 9 feet below the existing ground surface. The fine sands were generally underlain by silty sands (SM), silty clayey fine sands (SC-SM), clayey fine sands (SC) and sandy silts (ML) typically extending to the termination of the soil borings at a depth of 15 feet. Note that borings SPT-14 and SPT-15 encountered soft weathered or hard limestone at depths of 9 and 13.5 feet extending to depths of 12 feet and to the termination of the boring at a depth of 15 feet below the existing ground surface.

The fine sands (SP/SP-SM) are suitable for use as backfill materials and suitable for pipe bedding. However, the pipe should be bedded in gravel such as FDOT No. 89 stone if rock occurs within 6 inches of the pipe bottom, or if unsuitable silty and clayey sands (SM, SC-SM and SC) or sandy silts (ML) are encountered at pipe invert.

Typically, heavy excavators can remove soft limestone and boulders; however, dynamic methods using hydraulic hammers or hoes will be needed to remove hard limestone or large boulders where they occur. Use of excavated rock as a fill material will require further processing (crushing and screening) to reduce particle size to mostly sand and gravel size.

GENERAL COMMENTS

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual examination of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

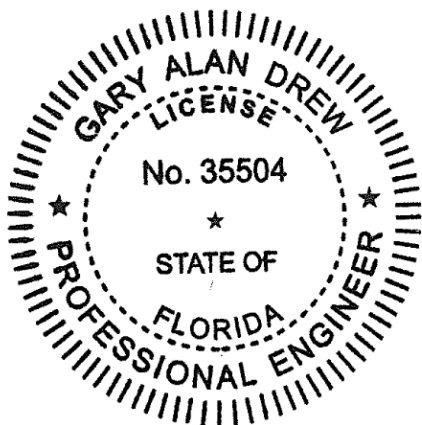
If you have any questions about this report, please contact this office.

Very truly yours,

Ardaman & Associates, Inc.
Florida Certificate of Authorization No. 00005950



Matthew R. Elmore, E.I.
Project Engineer



*This document has been digitally
signed and sealed by:*

*Printed copies of this document are not
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The signature must be verified on the
electronic documents.*

Gary A. Drew, P.E. No. 35504
Vice President/Branch Manager

MRE/GAD:mre

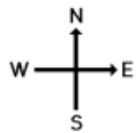
ATTACHMENTS


- **BORING LOCATION PLAN (FIGURE 1)**
- **BORING LOGS – SPT-1 THROUGH SPT- 21**



FIGURE 1
BORING LOCATION PLAN

SOURCE: LEEPA.ORG



 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
Proposed Fiddlesticks Water Main Replacement Project – Phase I Fiddlesticks Country Club Fort Myers, Lee County, FL		
Drawn By: ME	Checked By: GD	Date: 5/23/18
File No.: 17-33-4601	Approved By: Gary Drew, P.E.	Figure No: 1

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°30.807' **LONGITUDE:** W 81°48.612'
DATE DRILLED: 24-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 5' **DATE:** 24-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** CLOUDS / SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
35-26-16	42	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
8-12-14	26	2			SP	Poorly Graded Sand - Brown fine sand.						
8-8-8	16	3			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6-7-6	13	4			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
7-6-6	12	5			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).		20.3	7.8			
4-1-3	4	6			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
9-5-8	13	7			SP-SM	Poorly Graded Sand with Silt and Gravel - Brown slightly silty fine sand, some gravel (rock fragments).						
9-9-22	31	8			SP-SM	Poorly Graded Sand with Silt and Gravel - Brown slightly silty fine sand, some gravel (rock fragments).						
11-5-2	7	9			SP-SM	Poorly Graded Sand with Silt and Gravel - Brown slightly silty fine sand, some gravel (rock fragments).						
1-1-4	5	10			SP	Poorly Graded Sand - Brown fine sand, trace gravel (rock fragments).						
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°30.848' **LONGITUDE:** W 81°48.522'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6.5' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
47-25-12	37	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
10-11-15	26	2			SP-SM	Poorly Graded Sand with Silt - Brown to dark brown slightly silty fine sand.						
3	10-10-7	17	3					22.0		2.0		
	6-7-8	15	4									
6	8-9-10	19	5		SP	Poorly Graded Sand - Brown fine sand.						
	4-4-5	9	6									
9	3-2-3	5	7		SP-SM	Poorly Graded Sand with Silt - Dark brown slightly silty fine sand.						
	3-3-4	7	8									
12	5-5-4	9	9									
	1-1-0	1	10		SP	Poorly Graded Sand - Gray fine sand.						
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°30.879' **LONGITUDE:** W 81°48.582'
DATE DRILLED: 24-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 5.5' **DATE:** 24-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** CLOUDS / RAIN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
46-32-26	58	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
21-16-13	29	2										
3												
11-13-14	27	3			SP	Poorly Graded Sand - Brown fine sand.						
10-10-7	17	4										
6												
4-3-3	6	5			SP-SM	Poorly Graded Sand with Silt - Dark brown slightly silty fine sand.						
1-2-1	3	6			SP	Poorly Graded Sand - Brown fine sand.		25.5	1.4			
9												
1-1-1	2	7										
1-0-1	1	8										
12												
1-0-0	0	9										
0-0-0	0	10										
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°30.956' **LONGITUDE:** W 81°48.635'
DATE DRILLED: 24-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 5' **DATE:** 24-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
49-33-15	48	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
13-14-15	29	2			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
8-8-7	15	3			SP	Poorly Graded Sand - Brown to light gray fine sand.						
3-2-2	4	4						22.7	2.9			
3-4-5	9	5										
3-5-6	11	6										
4-7-6	13	7										
4-8-7	15	8										
4-5-4	9	9										
2-1-0	1	10			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.012' **LONGITUDE:** W 81°48.696'
DATE DRILLED: 24-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 5' **DATE:** 24-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
41-16-12	28	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
11-8-9	17	2			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
9-9-10	19	3										
8-8-8	16	4										
6-3-4	7	5										
1-1-2	3	6										
2-1-2	3	7			SP	Poorly Graded Sand - Brown fine sand.						
1-1-1	2	8			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
1-2-7	9	9			SM	Silty Sand - Gray silty fine sand.		21.9	20.8		21	NP
6-4-4	8	10			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.074' **LONGITUDE:** W 81°48.707'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
38-30-24	54	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
11-13-12	25	2			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6-6-4	10	3										
1-1-2	3	4										
6												
1-1-3	4	5			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (rock fragments).						
2-1-2	3	6						17.0	10.8			
2-3-1	4	7										
1-2-3	5	8			SP	Poorly Graded Sand - Brown and gray fine sand.						
12												
3-4-7	11	9			SM	Silty Sand - Gray to light brown silty fine sand, trace to some gravel (rock fragments).						
8-9-9	18	10										
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.149' **LONGITUDE:** W 81°48.709'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
29-18-17	35	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
12-12-15	27	2			SP	Poorly Graded Sand - Gray to brown fine sand.						
14-15-14	29	3			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
7-6-6	12	4			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
4-3-3	6	5			SP-SM							
1-2-2	4	6			SP-SM							
1-0-1	1	7			SP-SM							
5-7-10	17	8			SM	Silty Sand - Light brown partially cemented silty medium to fine sand, trace to some gravel (cemented sands and rock fragments).						
8-11-8	19	9			SM							
8-7-4	11	10			SM							
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.184' **LONGITUDE:** W 81°48.630'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6.5' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
33-19-9	28	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
7-7-9	16	2			SP	Poorly Graded Sand - Gray to dark brown fine sand.						
6-5-6	11	3										
3-1-1	2	4						27.5	1.8			
1-0-1	1	5										
1-1-2	3	6										
1-1-1	2	7			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand, trace gravel (shell fragments).						
3-3-2	5	8										
2-4-5	9	9			SC	Clayey Sand - Gray clayey fine sand, trace to some gravel (rock fragments and shell fragments).						
5-9-6	15	10										
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.050' **LONGITUDE:** W 81°48.634'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6.5' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
40-24-14	38	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
11-12-13	25	2			SP	Poorly Graded Sand - Brown fine sand.						
7-7-7	14	3										
4-5-3	8	4										
2-3-4	7	5										
2-2-2	4	6										
1-1-5	6	7										
6-4-4	8	8			SM	Silty Sand - Light brown to light gray partially cemented silty medium to fine sand, trace to some gravel (cemented sands and rock fragments).		25.6	34.9			
2-3-2	5	9										
2-3-5	8	10										
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.109' **LONGITUDE:** W 81°48.604'
DATE DRILLED: 25-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 25-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / SKEWIS **LOGGED BY:** M. ELMORE, E.I.











DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
48-20-17	37	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
15-17-14	31	2			SP	Poorly Graded Sand - Brown fine sand.						
9-8-7	15	3			SP	Poorly Graded Sand - Brown fine sand.						
3-3-2	5	4			SP	Poorly Graded Sand - Brown fine sand.						
1-0-0	0	5			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.		21.4	6.4			
0-0-0	0	6			SP	Poorly Graded Sand - Brown fine sand.						
1-0-0	0	7			SM	Silty Sand - Brown silty fine sand, trace to some gravel (rock fragments).						
0-1-1	2	8			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
2-1-0	1											
1-3-4	7											
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.235' **LONGITUDE:** W 81°48.474'
DATE DRILLED: 11-MAY-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 8' **DATE:** 11-MAY-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
40-22-11	33	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
13-11-18	29	2			SP	Poorly Graded Sand - Brown fine sand.						
11-10-10	20	3										
5-5-5	10	4										
5-7-6	13	5										
5-4-7	11	6			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
3-2-5	7	7			SP	Poorly Graded Sand - Brown fine sand.						
2-2-2	4	8			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.		19.0	12.0			
1-1-3	4	9			SM	Silty Sand - Gray to light brown silty fine sand, trace gravel (rock fragments).						
4-4-7	11	10			SM	Silty Sand with Gravel - Light brown partially cemented silty medium to fine sands, some gravel (cemented sands).						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.299' **LONGITUDE:** W 81°48.502'
DATE DRILLED: 11-MAY-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 8' **DATE:** 11-MAY-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
28-12-8	20	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
7-7-7	14	2			SP	Poorly Graded Sand - Brown fine sand.						
4-3-4	7	3			SP-SM	Poorly Graded Sand with Silt - Dark brown to brown slightly silty fine sand.						
6-6-4	10	4										
1-2-3	5	5			SP	Poorly Graded Sand - Brown fine sand.						
2-3-4	7	6										
1-2-2	4	7										
1-1-2	3	8			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
1--	0	9										
1--3	3	10			SM	Silty Sand - Gray silty fine sand.						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.389' **LONGITUDE:** W 81°48.491'
DATE DRILLED: 11-MAY-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 8' **DATE:** 11-MAY-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.







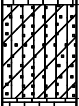
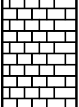




DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
31-11-9	20	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
5-8-10	18	2			SP	Poorly Graded Sand - Brown to light brown fine sand.						
4-4-3	7	3										
3-3-4	7	4										
3-4-6	10	5										
5-6-7	13	6										
4-6-7	13	7			SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
4-3-2	5	8			SC	Clayey Sand - Gray clayey fine sand.						
1-10-16	26	9			SM	Silty Sand with Gravel - Light gray and light brown partially cemented silty medium to fine sand, some gravel (cemented sands and rock fragments).						
10-18-16	34	10				Soft Weathered Limestone						
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.446' **LONGITUDE:** W 81°48.437'
DATE DRILLED: 11-MAY-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 8' **DATE:** 11-MAY-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
34-18-13	31	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
6-10-7	17	2										
5-4-5	9	3			SP-SM	Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
8-8-5	13	4										
3-7-8	15	5					23.5	6.2				
2-1-3	4	6			SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
9						Hard Limestone						
9-13-47	60	7										
41-44-10	54	8										
12					SC-SM	Silty Clayey Sand - Gray silty clayey fine sand.						
12-6-9	15	9										
4-2-1	3	10			SM	Silty Sand with Gravel - Light gray and light brown partially cemented silty medium to fine sand, some gravel (cemented sands and rock fragments).						
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.428' **LONGITUDE:** W 81°48.908'
DATE DRILLED: 27-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 27-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
47-30-18	48	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
18-17-16	33	2			SP	Poorly Graded Sand - Brown to dark brown fine sand.						
18-24-23	47	3										
14-12-9	21	4										
3-2-2	4	5						26.1	0.9			
1-1-2	3	6										
3-4-4	8	7										
3-3-3	6	8										
1-1-0	0	9			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
WOH--	WOH											
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.438' **LONGITUDE:** W 81°48.840'
DATE DRILLED: 27-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 27-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
40-31-18	49	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
16-14-12	26	2			SP-SM	Poorly Graded Sand with Silt - Brown to dark brown slightly silty fine sand.						
6-6-5	11	3										
4-4-3	7	4										
1-1-1	2	5			SP	Poorly Graded Sand - Brown to gray fine sand.		23.2		0.9		
2-3-4	7	6										
2-2-1	3	7										
1-2-1	3	8			SP-SM	Poorly Graded Sand with Silt - Gray slightly silty fine sand.						
1-3-6	9	9										
4-7-10	17	10			SM	Silty Sand - Gray to light gray silty fine sand.						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.445' **LONGITUDE:** W 81°48.739'
DATE DRILLED: 27-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 27-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
39-27-14	41	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
11-11-11	22	2			SP	Poorly Graded Sand - Light brown to brown fine sand.						
10-9-10	19	3										
6-5-4	9	4										
1-1-2	3	5			SP-SM	Poorly Graded Sand with Silt - Dark brown slightly silty fine sand.						
1-1-1	2	6						28.9		1.8		
1-1-2	3	7										
1--	0											
WOH--	WOH	8										
3-6-3	9	9			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace gravel (shell fragments).						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.482' **LONGITUDE:** W 81°48.624'
DATE DRILLED: 27-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 27-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
42-31-22	53	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
19-16-16	32	2			SP-SM	Poorly Graded Sand with Silt - Brown to dark brown slightly silty fine sand.						
13-12-8	20	3										
3-2-2	4	4										
6												
1-1-2	3	5			SP	Poorly Graded Sand - Brown fine sand.						
2-2-4	6	6			SP-SM	Poorly Graded Sand with Silt - Brown to gray slightly silty fine sand.						
9												
4-1-2	3	7										
1-1-1	2	8			ML	Sandy Silt - Light gray sandy silt.		34.4	74.3			
12												
1-1-2	2	9			SM	Silty Sand - Light brown partially cemented silty medium to fine sand, trace to some gravel (cemented sands).						
2-4-6	10	10			SP-SM	Poorly Graded Sand with Silt - Light brown slightly silty fine sand.						
15						TERMINATED AT 15'						
18												
21												

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.488' **LONGITUDE:** W 81°48.577'
DATE DRILLED: 26-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 7' **DATE:** 26-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0						Pavement and Rock Base.						
41-28-21	49	1			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand, trace to some gravel (rock fragments).						
18-16-15	31	2			SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
11-13-10	23	3										
7-5-3	8	4			SP	Poorly Graded Sand - Brown to gray fine sand.						
1-2-2	4	5										
4-4-4	8	6										
2-2-4	6	7						18.9	4.4			
4-2-1	3	8										
1--	0	9										
1-4-5	9	10			SM	Silty Sand - Light gray silty fine sand, trace to some gravel (rock fragments).						
						TERMINATED AT 15'						

BORING LOCATION: SEE BORING LOCATION PLAN
LATITUDE: N 26°31.476' **LONGITUDE:** W 81°48.466'
DATE DRILLED: 26-APR-18 **START:** **FINISH:**
GROUND SURFACE ELEVATION: **TIME:**
WATER TABLE DEPTH (ft): 6.5' **DATE:** 26-APR-18

CLIENT: WESTON & SAMPSON ENGINEERS, INC.
PROJECT: FIDDLESTICKS WATER MAIN REPLACEMENT PROJECT
 PHASE 1
LOCATION: FORT MYERS, LEE COUNTY, FLORIDA
DRILL CREW: LOCKLEY / BENAVIDES / SKEWIS **LOGGED BY:** M. ELMORE, E.I.

DRILL MAKE & MODEL: MOBILE B-57 W/AUTO **BIT:** 2-15/16" DIA. TRICONE ROLLER **DRILLING RODS:** AW
DRILLING METHOD: ROTARY WASH WITH DRILLING FLUID **WEATHER CONDITIONS:** SUN

DEPTH, FT.	BLOWS	SPT N-VALUE	SAMPLE NO.	GRAPHIC LOG	USCS	SOIL DESCRIPTION	REMARKS	% WATER CONTENT	PERCENT FINES	% ORGANIC CONTENT	LIQUID LIMIT	PLAST. INDEX
0	2-2-3	5	1		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	3-3-4	7	2		SP	Poorly Graded Sand - Brown fine sand.						
3	2-2-1	3	3		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
	1--	0	4		SP-SM	Poorly Graded Sand with Silt - Brown slightly silty fine sand.						
6	2-5-5	10	5		SC-SM	Silty Clayey Sand - Brown to gray silty clayey fine sand.		20.6	19.0			
	4-4-3	7	6		SC-SM	Silty Clayey Sand - Brown to gray silty clayey fine sand.						
9	2-2-2	4	7		SC-SM	Silty Clayey Sand - Brown to gray silty clayey fine sand.						
	1--6	6	8		SC-SM	Silty Clayey Sand - Brown to gray silty clayey fine sand.						
12	5-5-4	9	9		ML	Sandy Silt - Light gray sandy silt.						
	2-1-2	3	10		SM	Silty Sand with Gravel - Light gray and light brown partially cemented silty medium to fine sand, some gravel (cemented sands).						
15						TERMINATED AT 15'						
18												
21												

APPENDIX

- **SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED**

SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6 m) long, 2-inch (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches (0.45 m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76 m). The number of blows needed for each 6 inches (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Q_u):

Cohesionless Soils:	N-Value Safety Hammer	N-Value Auto Hammer	Description	Relative Density
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	15 - 35%
	10 - 30	8 - 24	Medium dense	35 - 65%
	30 - 50	24 - 40	Dense	65 - 85%
	> 50	> 40	Very dense	85 - 100%

Cohesive Soils:	N-Value Safety Hammer	N-Value Auto Hammer	Description	Unconfined Compressive Strength, Q_u
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	4 - 8	3 - 6	Firm	0.50 - 1.0 tsf (50 - 100 kPa)
	8 - 15	6 - 12	Stiff	1.0 - 2.0 tsf (100 - 200 kPa)
	15 - 30	12 - 24	Very stiff	2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5-foot (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5 m]) depth or when access is not available to power drilling equipment. A 3-inch (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 feet (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in-situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in-situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stroke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed. Undisturbed sampling is noted on the boring logs as thus "U-".

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures. Following is a list of abbreviations that may appear in the Remarks column on the boring logs indicating additional laboratory testing was performed, the results of which will usually be located in an Appendix.

- DD:** Unit Weight/Classification of Undisturbed "Shelby Tube" samples
- PP:** Pocket Penetrometer reading on cohesive samples in tons per sq. ft. (tsf)
- k:** Hydraulic Conductivity
- Qu:** Unconfined Compression Strength; ASTM D-2166
- UU:** Unconsolidated-Undrained Triaxial Test; ASTM D 2850
- Consol:** One-Dimensional Consolidation test performed on subsample from undisturbed sample; ASTM D-2435

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12" [300 mm]) and COBBLES (3" [75 mm] TO 12" [300 mm]):

GRAVEL: Coarse Gravel: 3/4" (19 mm) to 3" (75 mm)
 Fine Gravel: No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 – 5% --- no mention of gravel in description
 5 – 15% --- trace
 15 – 29% --- some
 30 – 49% --- gravelly (shell, limerock, cemented sands)

SANDS

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
 MEDIUM SAND: No. 40 (425 μ m) Sieve to No. 10 (2 mm) Sieve
 FINE SAND: No. 200 (75 μ m) Sieve to No. 40 (425 μ m) Sieve

Descriptive adjectives:

0 – 5% --- no mention of sand in description
 5 – 15% --- trace
 15 – 29% --- some
 30 – 49% --- sandy

SILT/CLAY: < #200 (75 μ m) sieve

SILTY OR SILT: PI < 4
 SILTY CLAYEY OR SILTY CLAY: 4 ≤ PI ≤ 7
 CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

0 – 5% --- clean (no mention of silt or clay in description)
 5 – 12% to 15% --- slightly
 16 – 35% --- clayey, silty, or silty clayey
 36 – 49% --- very

ORGANIC SOILS

<u>Organic Content</u>	<u>Descriptive adjectives</u>	<u>Classification</u>
0 – 2.5%	no mention of organics in description	See above
2.6 – 5%	slightly organic	See above
5 – 20%	organic	Add "with organic fines" to group name

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA⁽¹⁾
For use with the ASTM D 2487 Unified Soil Classification System
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

HIGHLY ORGANIC SOILS AND MATTER

<u>Organic Content</u>	<u>Description</u>	<u>Classification</u>
20-75%	highly organic sand or muck sandy peat	Peat (PT) Peat (PT)
>75%	amorphous or fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE

<u>Descriptive Term</u>	<u>Thickness</u>
with interbedded	
seam:	less than 1/2-inch (13 mm) thick
layer:	1/2 to 12-inches (13 to 300 mm) thick
stratum:	more than 12-inches (300 mm) thick
pocket:	small, erratic deposit, usually less than 1-foot
occasional:	one or less per foot of thickness
frequent:	more than one per foot of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION

Description

Hard Limestone or Caprock – N-values >50 bpf

Soft Weathered Limestone – N values <50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D 2488. BY: G.A. DREW, P.E. (1995) (Revised 2016).

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

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

^A Based on the material passing the 3-in. (75-mm) sieve

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

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

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

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

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

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

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

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

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

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

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

