

**Report of Preliminary Geotechnical Exploration
For**

**Nassau WRF Improvements
Phase 1B**

***MAE Project No. 0110-0003D
July 19, 2018***

Prepared for:

Hazen

***Hazen and Sawyer
6675 Corporate Center Parkway, Suite 330
Jacksonville, Florida 32216***



Prepared by:



8936 Western Way, Suite 12
Jacksonville, Florida 32256
Phone (904) 519-6990
Fax (904) 519-6992



July 19, 2018

Hazen and Sawyer
6675 Corporate Center Parkway, Suite 330
Jacksonville, Florida 32216

Attention: Ms. Caitlin Klug, P.E.
Reference: Report of Preliminary Geotechnical Exploration
Nassau WRF Improvements – Phase 1B
Nassau County, Florida
MAE Project No. 0110-0003D

Dear Ms. Klug:

Meskel & Associates Engineering, PLLC (MAE) has completed a preliminary geotechnical exploration for the referenced project. Our work was performed in general accordance with our Subcontract Agreement for Professional Services dated June 4, 2018. The purpose of this exploration was to evaluate the subsurface conditions encountered across the project site to provide preliminary recommendations for foundation design and construction and general site preparation. A summary of our findings and recommendations are presented below; however, we recommend that this report be considered in its entirety.

As further discussed in this report, the borings generally encountered a surficial topsoil layer 4 to 7 inches thick, underlain by fine sands (SP) and fine sands with silt (SP-SM) to the boring termination depth of 20 feet below the existing ground surface. Trace to few amounts of organic fines were noted in many of the recovered samples. Groundwater was encountered at all the boring locations and measured at depths varying from 1 foot to 2 feet 7 inches below the existing ground surface. Based on our preliminary exploration, the encountered soils are suitable for support of the planned construction on conventional shallow foundation systems provided a program of site preparation is followed. The encountered soils are suitable to be reused as general site development fill across the site. However, some samples contained organic contents that would make them unsuitable for use as structural fill. In addition, the moisture content will need to be strictly controlled to achieve the required level of compaction below proposed structures. This will likely require dewatering of excavations or stockpiling of soils excavated below the groundwater level to dry before placement and compaction.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,

MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Certificate of Authorization No. 28142

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 07/19/2018 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

W. Josh Mele, E.I.
Staff Engineer

P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Ms. Caitlin Klug, P.E. – Hazen and Sawyer, PC

1 pdf

TABLE OF CONTENTS

Subject	Page No.
1.0 PROJECT INFORMATION	1
1.1 General	1
1.2 Project Description	1
2.0 FIELD EXPLORATION	1
2.1 SPT Borings	2
3.0 LABORATORY TESTING	2
4.0 GENERAL SUBSURFACE CONDITIONS	2
4.1 General Soil Profile	2
4.2 Groundwater Level	3
4.3 Review of the USDA Web Soil Survey Map	3
4.4 Seasonal High Groundwater Level.....	3
5.0 PRELIMINARY DESIGN RECOMMENDATIONS	4
5.1 General	4
5.2 Structures	4
5.3 Borrow Considerations	4
6.0 REPORT LIMITATIONS	5

FIGURES

- Figure 1. Site Location Map
- Figure 2. Boring Location Plan
- Figures 3, 4. Generalized Soil Profiles

APPENDICES

- Appendix A. Soil Boring Logs
- Field Exploration Procedures
- Key to Boring Logs
- Key to Soil Classification
- Appendix B. Summary of Laboratory Test Results
- Laboratory Test Procedures

1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Ms. Caitlin Klug, P.E., with Hazen and Sawyer, PC via several electronic correspondence and telephone conversations. We were also provided with the JEA Solicitation document No. 071-17 titled *Engineering Services for Nassau Regional Water Reclamation Facility Projects*, and several Addendum and Appendix documents associated with the comprehensive projects. In addition, we were provided with a *Wetland and Gopher Tortoise Map* prepared by Onsite Environmental Consulting, LLC, dated June 2018 for our review and reference.

1.2 Project Description

The site for the subject project is an undeveloped 3.5-acre parcel, located east of Art Wilson Lane and north of Radio Avenue in Nassau County, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Ms. Klug, we understand that JEA will construct a remote pump station and storage tank to act as an intermediate storage and repump for the nearby Nassau Regional Water Reclamation Facility (WRF) and to accommodate peak demands for the expected growth and development of the East Nassau Community Planning Area. Detailed structural design, loading, and grading information were not available. Therefore, for the purpose of this preliminary report, we have assumed the proposed pump station equipment will be supported on a concrete slab-on-grade with a cast-in-place slab at the base of the wet well structure. Any support equipment has been assumed to also be supported on cast-in-place grade supported slabs that are relatively lightly loaded. We have assumed the proposed water storage tank will be a precast concrete tank supported on a monolithic, turned-down edge slab-on-grade. We have assumed construction areas will be supported on less than three feet of fill above the presently existing ground surface.

Our preliminary evaluations and recommendations provided in this report are based on the site information and structure assumptions as noted above. Once the final site design is complete, further geotechnical explorations should be carried out to re-evaluate site specific conditions based on final construction plans.

2.0 FIELD EXPLORATION

A field exploration was performed on June 15 and 16, 2018. An aerial taken from Google Earth which shows the approximate boring locations, is included as the *Boring Location Plan*, Figure 2. The boring locations were determined by us and were sent by email to you for review and approval. Once approval was granted, the GPS coordinates for each boring were obtained by overlaying the provided plan in Google Earth.

Prior to mobilizing our equipment, a Utility Locate Request was submitted to the Sunshine State One-Call Center (SSOC). Once the site utilities were located and marked, we mobilized our ATV-mounted drilling equipment. Our field personnel located each boring using a Garmin GPSMAP 78 hand-held GPS receiver; therefore, the boring locations should be considered accurate only to the degree implied by the method of layout used.

2.1 SPT Borings

A total of 8 Standard Penetration Test (SPT) borings were located across the site, each drilled to a depth of approximately 20 feet below the existing ground surface in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during performance of the borings were visually described in the field and representative portions of the samples were transported to our laboratory for classification and testing.

3.0 LABORATORY TESTING

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A *Key to the Soil Classification System* is included in Appendix A.

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content, the percent passing the U.S. No. 200 sieve (percent fines), and the organic content of the selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* table included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles*, Figures 3 and 4, and on the *Log of Boring* records at the respective depths from which the tested samples were recovered. A description of the laboratory testing procedures is included in Appendix B.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on the *Generalized Soil Profiles*, Figures 3 and 4. Detailed boring records are included in Appendix A. When reviewing the soil profiles and boring records, it should be understood that the soil conditions will vary between the boring locations. The following table summarizes the soil conditions encountered.

GENERAL SOIL PROFILE			
APPROXIMATE DEPTH (ft)		SOIL DESCRIPTION	USCS ⁽¹⁾
FROM	TO		
0	0.5	Topsoil	--- ⁽²⁾
0.5	8	Very loose to medium dense fine SAND and fine SAND with silt, poorly graded, occasionally with trace to few organic fines.	SP, SP-SM
8	13	Medium dense to very dense fine SAND with silt, poorly graded, often with few amounts of organic fines.	SP-SM
13	20	Loose to very dense fine SAND to fine SAND with silt, poorly graded.	SP, SP-SM
(1) Unified Soil Classification System			
(2) Topsoil does not have an associated USCS classification			

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from 1 foot to 2 feet 7 inches below the existing ground surface. However, it should be anticipated that groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be measured prior to construction. Measured groundwater levels are shown on the *Generalized Soil Profiles*, Figures 3 and 4, and on the soil boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Nassau County are shown in the table below. There are two predominant soil map units at the project sight: Hurricane-Pottsburg and Mandarin fine sands. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table ⁽¹⁾ (inches)
6	Hurricane-Pottsburg fine sands, 0 to 5 percent slopes	Somewhat Poorly Drained to Poorly Drained	A, A/D	12 to 42
10	Mandarin fine sand, 0 to 2 percent slopes	Somewhat Poorly Drained	A	18 to 30

⁽¹⁾ The “Water Table” above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, and relief points such as drainage ditches, low-lying areas, etc.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, we estimate the seasonal high groundwater levels at the site to be generally 6 to 18 inches below the ground surface at the time of our exploration. However, it should be understood that this seasonal high estimate is based on site observations and measurements at the time of our field work and on historical data on the site soil conditions. Changes in onsite stormwater drainage patterns caused by off-site development may cause seasonal high water levels to be higher or lower than historical patterns. The project drainage engineer should be consulted to evaluate the influence of these changes on groundwater levels at the site. In addition, we recommend that piezometers be installed across the site to measure groundwater fluctuations over time.

It is possible that groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains, which may result in ponded water in areas of the site. Therefore,

we recommend that design drawings and specifications account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

5.0 PRELIMINARY DESIGN RECOMMENDATIONS

5.1 General

The following preliminary evaluation and recommendations are based on the provided and assumed project information as presented in this report, and on the results of the field exploration described in this report. Once final site design is complete, we recommend a more site-specific field exploration to confirm our preliminary findings, and to develop more specific foundation and site preparation recommendations.

5.2 Structures

Based on the results of our field exploration, it is our opinion that the encountered subsurface conditions are adaptable to support the proposed slab-on-grade structures. The planned wet well structure can bear on the fine sands and fine sands with silt as encountered in the borings. However, very dense sands were encountered between depths of approximately 8 and 15 feet below existing grades. Therefore, difficult excavation of these sands should be expected at these depths.

We recommend an allowable net soil contact pressure of 2,000 pounds per square foot (psf) be used for shallow foundation design of the slab-on-grade structures. The wet well structure bottom slab can be designed for a net soil contact pressure of 1,000 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

A program of site preparation is recommended to provide a consistent soil subgrade, which will improve the load bearing capability of the subgrade soils and reduce the potential of total and differential settlements. A typical site preparation program would consist of stripping the organic topsoils within the construction area plus a 5-foot margin for each structure, then compacting the subgrade soils with vibratory equipment. Fill placed for structure support should consist of structural fill, which typically consist of fine sands and fine sands with silt. The fill should be placed in 12-inch thick loose lifts with each lift compacted to at least 95 to 98 percent of the soil's modified Proctor maximum dry density.

Small diameter tanks (i.e. tanks with diameters of 30 feet or less) and with water heights of 20 feet or less, can be supported on the existing site soils as encountered in the borings, assuming that a program of site preparation as discussed above is implemented. Larger diameter structures and structures with higher water storage heights will need additional borings within the tank structure footprint. These borings would need to continue to greater depths as their loads will impact deeper subsurface soils.

5.3 Borrow Considerations

Based on the subsurface soil conditions as encountered in the borings, the fine sands (SP) and fine sands with silt (SP-SM) are considered suitable for use as fill soil for general site development and as structural fill placed below proposed structures. However, it should be noted that several borings encountered soils with greater than 4 percent organic fines content. These soils are not considered suitable for use as

structural fill due to their relatively high organic content. These soils will need to be stockpiled separately from other structural fill soils and can be used as embankment fill for pavements and in landscape areas. In addition, the soils containing surficial organic material (topsoil) will require removal and are also considered unsuitable for use as structural fill. They could be used in landscape berms.

It should be anticipated that soils excavated below the groundwater level at the time of construction will have moisture contents in excess of the modified Proctor optimum moisture content. Thus, the excavations will need to be dewatered prior to excavation, or the excavated soils will need to be stockpiled or spread to bring the moisture content to within 2 percent of the soil's optimum moisture content corresponding to the required degree of compaction.

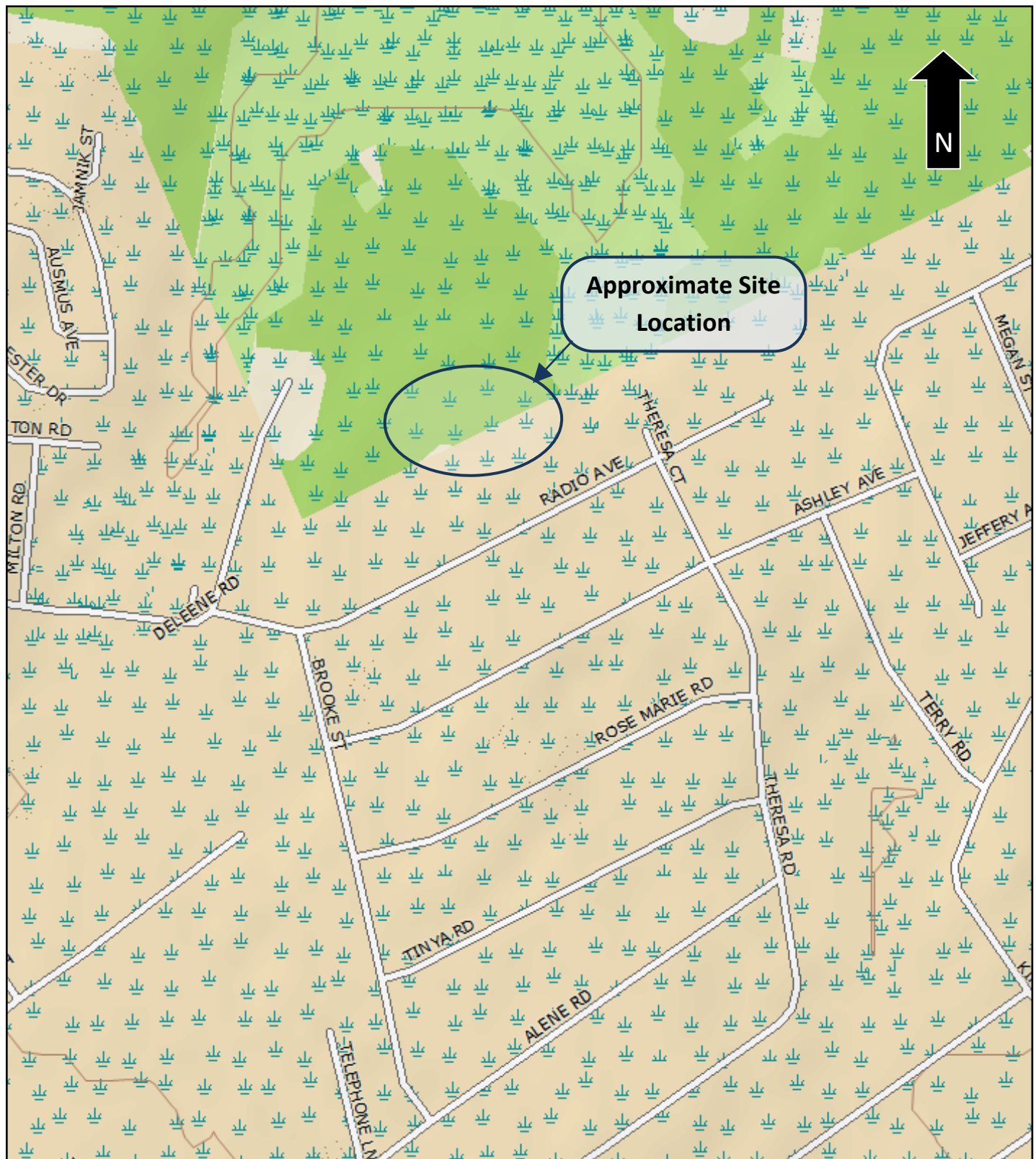
6.0 REPORT LIMITATIONS

This report has been prepared for the exclusive use of Hazen and Sawyer, PC and the JEA for specific application to the design and construction of the Nassau WRF Improvements – Phase 1B project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

The preliminary analyses and recommendations contained in this report are based on the data obtained from the borings performed for the proposed development. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions encountered at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. Once final site design is complete, we recommend a more site-specific field exploration program to confirm our preliminary findings and recommendations. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this preliminary report.

Figures



Site Location Map

PREPARED BY



PREPARED FOR

Hazen & Sawyer

PROJECT NAME

**Nassau WRF Improvements-Phase 1B Preliminary
Nassau County, Florida**

REFERENCE

Delorme XMap 7.0

MAE PROJECT NO.

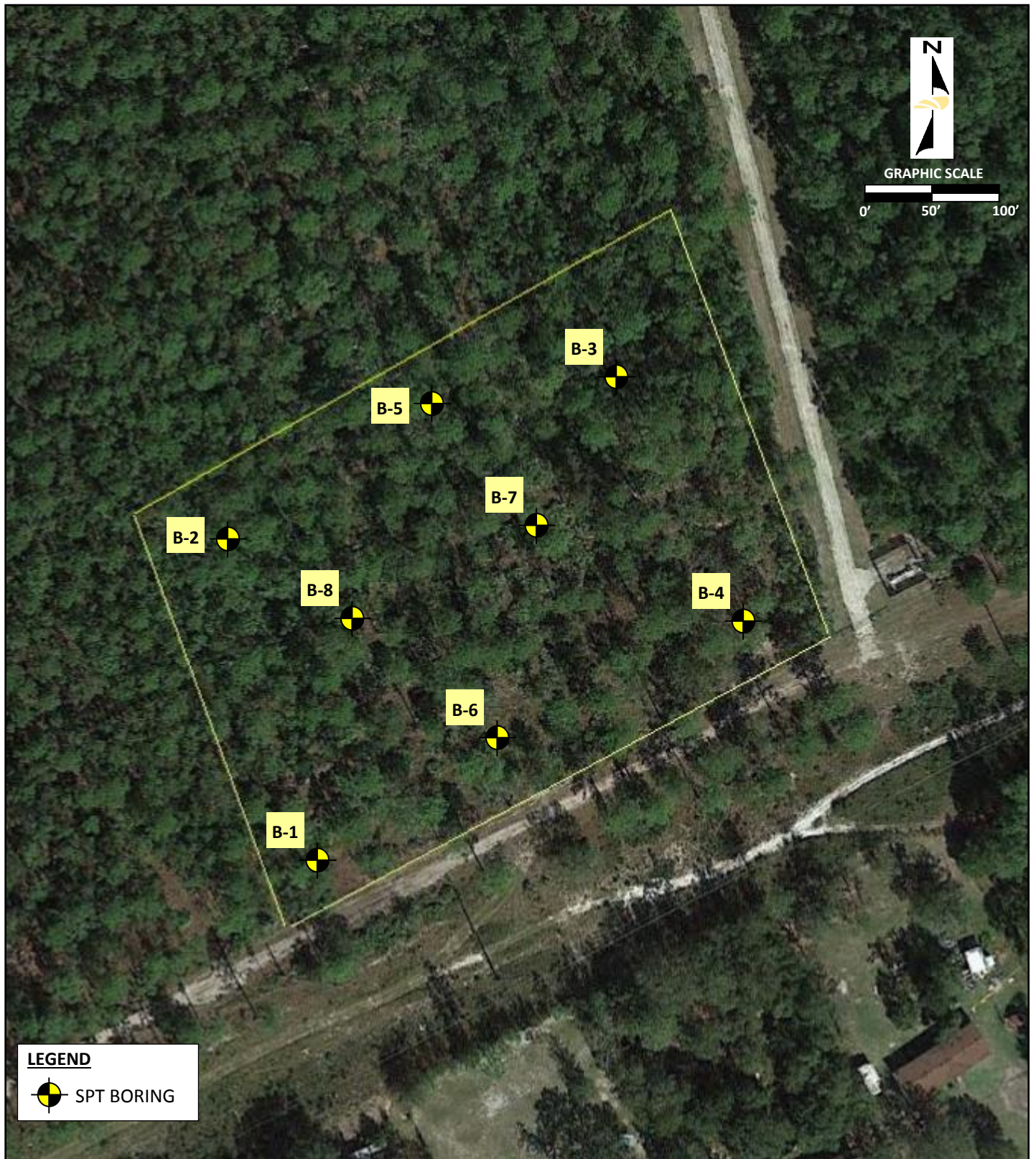
0110-0003D

SCALE


NTS

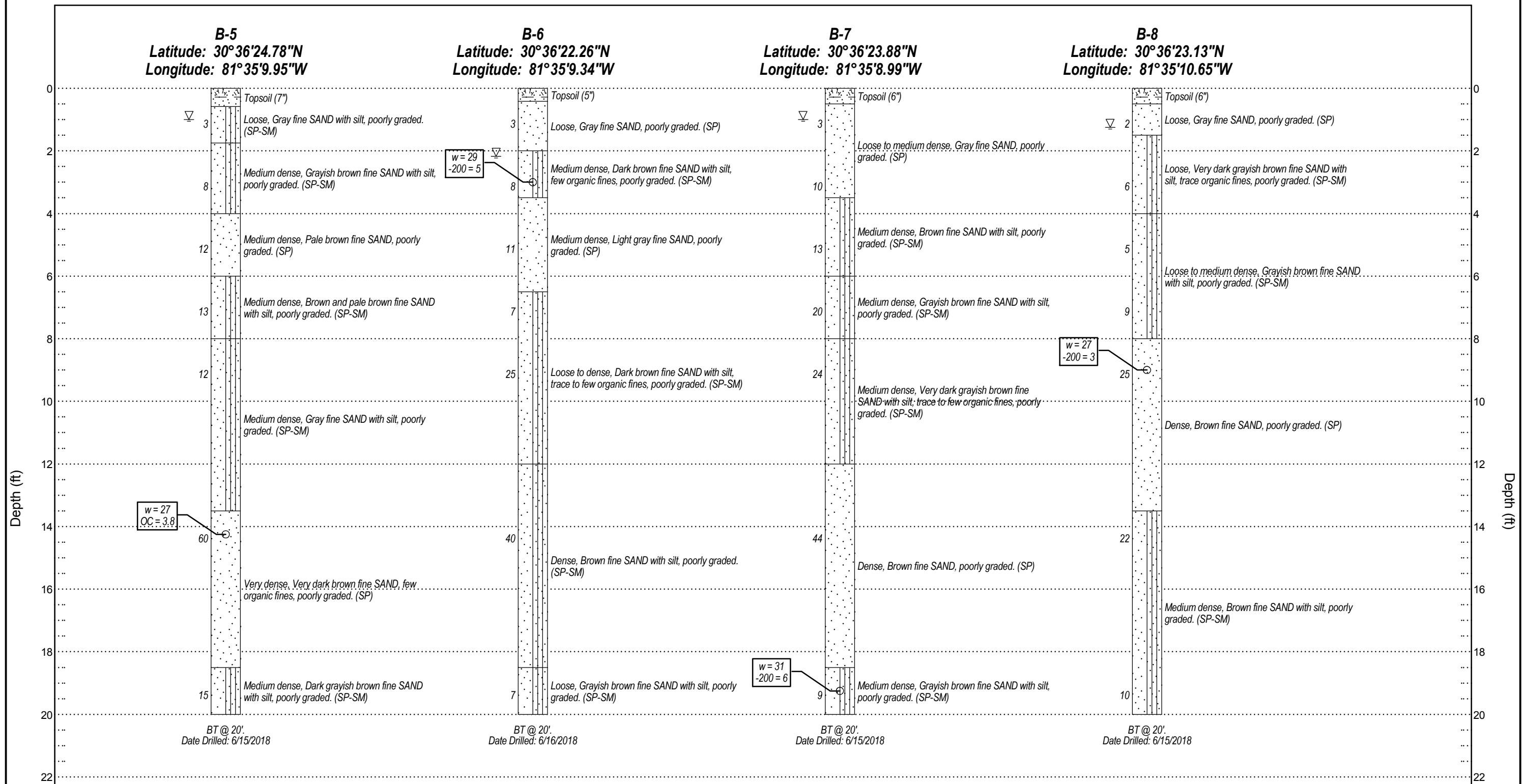
FIGURE NO.

1

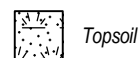


Boring Location Plan

PREPARED BY		PROJECT NAME	
		Nassau WRF Improvements-Phase 1B Preliminary	
		Nassau County, Florida	
PREPARED FOR		REFERENCE	SCALE
Hazen & Sawyer		Google Earth	AS SHOWN
		MAE PROJECT NO.	FIGURE NO.
		0110-0003D	2



Legend



Topsoil



Fine Sand with Silt



Fine Sand

(SP) Unified Soil Classification System (USCS)

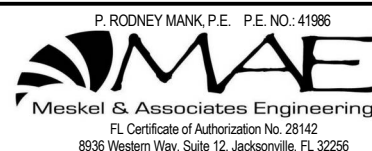
▽ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

BT Boring Terminated at Depth Below Existing Grade

-200 % Passing No. 200 U.S. Standard Sieve

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION



Hazen & Sawyer	
DATE:	MAE PROJECT NO.
6/20/2018	0110-0003D

SHEET TITLE:	
Generalized Soil Profile	
PROJECT NAME:	FIGURE NO.
Nassau WRF Improvements-Phase 1B Preliminary Nassau County, Florida	4

Appendix A

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-1

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/15/18 **COMPLETED** 6/15/18 **LATITUDE** 30°36'21.39"N **LONGITUDE** 81°35'10.89"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	Loose, Gray fine SAND with silt, trace small root fragments, poorly graded.	SP-SM		2 3 3	5								
	2				2 4 6 8	10								
5	3	Medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2 5 6 6	11								
	4				3 6 7 9	13								
	5				13 21 27 34	48	26							
10		Very dense, Very dark brown fine SAND, few organic fines, poorly graded.	SP											
	6				20 23 33	56								
15		Very dense, Dark yellowish brown fine SAND, poorly graded.	SP											
	7	Medium dense, Gray fine SAND with silt, poorly graded.	SP-SM		3 5 7	12	32	9						
20		Bottom of borehole at 20 feet.												

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1.75 ft *▽ END OF DAY ---



Meskel & Associates Engineering

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT LOCATION Nassau County, Florida

CLIENT Hazen & Sawyer

DATE STARTED 6/15/18

COMPLETED 6/15/18

LATITUDE 30°36'23.79"N

LONGITUDE 81°35'11.70"W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY P.R.Young

CHECKED BY W. Josh Mele

GROUND ELEVATION

HAMMER TYPE Automatic

[illegible]

NOTES

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1.58 ft *▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12 GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003\DI\PHASE 1B-PRELIMINARY.GPJ

Meskel & Associates Engineering, PLLC

FL Certificate of Authorization No. 28142

8936 Western Way, Suite 12

Jacksonville, FL 32256

P: (904)519-6990 F: (904)519-6992

**BORING B-3**

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary**PROJECT LOCATION** Nassau County, Florida**CLIENT** Hazen & Sawyer**DATE STARTED** 6/15/18**COMPLETED** 6/15/18**LATITUDE** 30°36'24.94"N**LONGITUDE** 81°35'8.34"W**DRILLING CONTRACTOR** MAE, PLLC**DRILLING METHOD** Standard Penetration Test**LOGGED BY** P.R.Young**CHECKED BY** W. Josh Mele**GROUND ELEVATION** —**HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	Very loose, Dark gray fine SAND, poorly graded.	SP		0	2								
	2				2									
					3									
	2	Medium dense, Brown fine SAND with silt, poorly graded.	SP-SM		4	12								
					8									
					9									
5	3				3									
					5									
					5									
					8	10								
	4	Medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		4									
					6									
					7									
					8									
	5				5									
					11									
					26	37	31		4.3					
					28									
10		Dense, Very dark brown fine SAND with silt, few organic fines, poorly graded.	SP-SM											
	6				17									
					11									
15					13	24	29	4						
		Medium dense, Brown fine SAND, trace silt, poorly graded.	SP											
	7	Medium dense, Gray fine SAND with silt, poorly graded.	SP-SM		4									
					6									
					9	15								
20														
		Bottom of borehole at 20 feet.												

NOTES**GROUND WATER LEVELS**

∇ AT TIME OF DRILLING 0.67 ft * ∇ END OF DAY ---

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-4

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/16/18 **COMPLETED** 6/16/18 **LATITUDE** 30°36'23.13"N **LONGITUDE** 81°35'7.25"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (4")			1010	1								
1	1	Very loose, Grayish brown fine SAND with silt, poorly graded.	SP-SM		1023	2								
2	2				2453	9	26	1						
3	3	Medium dense, Light gray fine SAND, poorly graded.	SP		3655	11								
4	4				2364	9	31							
5	5	Medium dense, Very dark brown fine SAND with silt, few organic fines, poorly graded.	SP-SM											
10	6				164029	69								
15		Very dense, Brown fine SAND, poorly graded.	SP											
20	7				488	16								
		Bottom of borehole at 20 feet.												

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 2.58 ft *▽ END OF DAY ---

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-5

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/15/18 **COMPLETED** 6/15/18 **LATITUDE** 30°36'24.78"N **LONGITUDE** 81°35'9.95"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINTGINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (7")			1									
	1	Loose, Gray fine SAND with silt, poorly graded.	SP-SM		1 1 2 3	3								
	2	Medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2 4 4 8	8								
5	3	Medium dense, Pale brown fine SAND, poorly graded.	SP		8 5 7 8	12								
	4	Medium dense, Brown and pale brown fine SAND with silt, poorly graded.	SP-SM		4 6 7 9	13								
	5				4 6 6 6	12								
10		Medium dense, Gray fine SAND with silt, poorly graded.	SP-SM											
	6				22 29 31	60	27		3.8					
15		Very dense, Very dark brown fine SAND, few organic fines, poorly graded.	SP											
	7	Medium dense, Dark grayish brown fine SAND with silt, poorly graded.	SP-SM		4 7 8	15								
20		Bottom of borehole at 20 feet.												

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1.00 ft *▽ END OF DAY ---

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-6

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/16/18 **COMPLETED** 6/16/18 **LATITUDE** 30°36'22.26"N **LONGITUDE** 81°35'9.34"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINTGINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (5")			1									
	1	Loose, Gray fine SAND, poorly graded.	SP		1 1 2 2	3								
	2	Medium dense, Dark brown fine SAND with silt, few organic fines, poorly graded.	SP-SM		2 3 5 6	8	29	5						
5	3	Medium dense, Light gray fine SAND, poorly graded.	SP		3 5 6 6	11								
	4				3 3 4 3	7								
	5	Loose to dense, Dark brown fine SAND with silt, trace to few organic fines, poorly graded.	SP-SM		4 10 15 18	25								
10														
	6	Dense, Brown fine SAND with silt, poorly graded.	SP-SM		15 22 18	40								
15														
	7	Loose, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2 3 4	7								
20		Bottom of borehole at 20 feet.												

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 2.17 ft *▽ END OF DAY ---

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-7

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/15/18 **COMPLETED** 6/15/18 **LATITUDE** 30°36'23.88"N **LONGITUDE** 81°35'8.99"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	Loose to medium dense, Gray fine SAND, poorly graded.	SP		1 1 2 2	3								
	2				2 4 6 7	10								
5	3	Medium dense, Brown fine SAND with silt, poorly graded.	SP-SM		3 5 8 10	13								
	4	Medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		6 9 11 14	20								
10	5	Medium dense, Very dark grayish brown fine SAND with silt, trace to few organic fines, poorly graded.	SP-SM		9 9 15 21	24								
	6	Dense, Brown fine SAND, poorly graded.	SP		10 21 23	44								
15														
	7	Medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		3 3 6	9	31	6						
20		Bottom of borehole at 20 feet.												

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1.00 ft *▽ END OF DAY ---

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

Meskel & Associates Engineering, PLLC
 FL Certificate of Authorization No. 28142
 8936 Western Way, Suite 12
 Jacksonville, FL 32256
 P: (904)519-6990 F: (904)519-6992



BORING B-8

PAGE 1 OF 1

PROJECT NO. 0110-0003D

PROJECT NAME Nassau WRF Improvements-Phase 1B Preliminary
PROJECT LOCATION Nassau County, Florida **CLIENT** Hazen & Sawyer
DATE STARTED 6/15/18 **COMPLETED** 6/15/18 **LATITUDE** 30°36'23.13"N **LONGITUDE** 81°35'10.65"W
DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test
LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

NEW MAE LOG LAT/LONG-EOD-HA - NEW TEMPLATE 7-30-12.GDT - 7/19/18 13:58 - F:\GINT\GINT FILES\PROJECTS\0110-0003D\PHASE 1B-PRELIMINARY.GPJ

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (6")			1									
	1	▽ Loose, Gray fine SAND, poorly graded.	SP		0	2								
	2	Loose, Very dark grayish brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		2	6								
5	3	Loose to medium dense, Grayish brown fine SAND with silt, poorly graded.	SP-SM		2	5								
	4				2									
	5	Dense, Brown fine SAND, poorly graded.	SP		4	9								
10					7									
	6				10									
		Medium dense, Brown fine SAND with silt, poorly graded.	SP-SM		15	22								
15					17									
	7				4									
20		Bottom of borehole at 20 feet.			5	10								

NOTES _____

GROUND WATER LEVELS

▽ AT TIME OF DRILLING 1.25 ft *▽ END OF DAY ---

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) were performed in general accordance with the latest revision of ASTM D 1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." The borings were advanced by rotary drilling techniques. A split-barrel sampler was inserted to the borehole bottom and driven 18 to 24 inches into the soil using a 140-pound hammer falling an average of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by a geotechnical engineer to verify the field descriptions and classify the soil, and to select samples for laboratory testing.

KEY TO BORING LOGS – USCS

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS). Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND	
Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2"	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered "Refusal".
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS	
SECONDARY CONSTITUENTS (Sand, Silt or Clay)	
Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%
ORGANIC CONTENT	
Trace	2% or less
Few	3% to 5%
Little	5% to 10%
With	Greater than 10%
MINOR COMPONENTS (Shell, Rock, Debris, Roots, etc.)	
Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)	
Relative Density	N-Value
Very Loose	Less than 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Greater than 50
CONSISTENCY (Fine-Grained Soils)	
Consistency	N-Value
Very Soft	Less than 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	Greater than 30
RELATIVE HARDNESS (Limestone)	
Relative Hardness	N-Value
Soft	Less than 50
Hard	Greater than 50

Unified Soil Classification System (USCS)

(from ASTM D 2487)

Major Divisions			Group Symbol	Typical Names
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	Gravels 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	Silts and Clays Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic

Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

Meskel & Associates Engineering, PLLC

FL Certificate of Authorization No. 28142

8936 Western Way, Suite 12

Jacksonville, FL 32256

P: (904)519-6990 F: (904)519-6992

**SUMMARY OF LABORATORY
TEST RESULTS****PROJECT NO.** 0110-0003D**PROJECT NAME** Nassau WRF Improvements-Phase 1B Preliminary**DATE.** 6/25/2018**PROJECT LOCATION** Nassau County, Florida**CLIENT** Hazen & Sawyer

Borehole	Sample No.	Approx. Depth (ft)	%<#200 Sieve	Water Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification	Comments
B-1	5	9	---	26	---	---	---	---	SP	
B-1	7	19	9	32	---	---	---	---	SP-SM	
B-2	2	3	3	26	---	---	---	---	SP	
B-3	9	9	---	31	4.3	---	---	---	SP-SM	
B-3	14	14	4	29	---	---	---	---	SP	
B-4	3	5	1	26	---	---	---	---	SP	
B-4	5	9	---	31	---	---	---	---	SP-SM	
B-5	6	14	---	27	3.8	---	---	---	SP	
B-6	2	3	5	29	---	---	---	---	SP-SM	
B-7	7	19	6	31	---	---	---	---	SP-SM	
B-8	5	9	3	27	---	---	---	---	SP	

Note: "---" Untested Parameter

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of “pore” or “free” water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455 ± 10 degrees Celsius.