Report of Geotechnical Exploration

For

JEA Springfield Plant Emergency Generator

MAE Project No. 0054-0002A
October 22, 2018

Prepared for:

JACOBS

Jacobs Engineering Group Inc.
200 W. Forsyth Street, Suite 1520
Jacksonville, Florida 32202

JEA
Building Community

Prepared by:

MAE
Meskel & Associates Engineering
Geotechnical · Environmental · Inspection · Testing

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Meskel & Associates Engineering
Geotechnical • Environmental • Inspection • Testing

October 22, 2018

Christine Ellenberger, P.E.
Jacobs Engineering Group Inc.
200 W. Forsyth Street, Suite 1520
Jacksonville, Florida 32202

Brett Harbison, State of Florida, Professional Engineer, License No. 74679. This item has been electronically signed and sealed by Brett Harbison, P.E. on 10/22/2018 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.

Reference: Report of Geotechnical Exploration
JEA Springfield Plant Emergency Generator
Jacksonville, Florida
MAE Project No. 0054-0002A

Dear Ms. Ellenberger:

Meskel & Associates Engineering, PLLC has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our proposal dated March 24, 2017. The geotechnical exploration was performed to evaluate the general subsurface conditions within the locations of the proposed generator and fuel tank pads, and to provide recommendations for foundation support and design, and site preparation. A summary of our findings and related recommendations are presented below; however, we recommend that you consider this report in its entirety.

As further discussed in this report, our borings encountered a surficial pavement structure (asphalt/limerock base course), underlain by fine sands (SP), fine sands with silt (SP-SM), and silty fine sands (SM) to a depth of about 48.5 feet, and then terminated into the apparent regional limestone strata at approximately 50 feet beneath the existing grade. The relative densities of the soils encountered ranged from loose to dense, and the limestone encountered ranged from soft to hard. Groundwater was encountered at both boring locations and measured between 5 feet 8 inches and 6 feet 3 inches.

Based on our evaluation of the encountered subsurface conditions, it is our opinion that the proposed generator and tank may be supported on conventional pad shallow foundation systems, provided the site preparations provided in this report are followed.

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

Brett H Harbison
Digitally signed by Brett H Harbison
Date: 2018.11.06 16:54:10 -05'00'

W. Josh Mele, E.I.
Staff Engineer

Brett H. Harbison, P.E.
Director, Geotechnical Services
Registered, Florida No. 74679

Distribution: Christine Ellenberger, P.E. – Jacobs Engineering Group Inc. 1 pdf

TABLE OF CONTENTS

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FIGURES

APPENDICES

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1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Christine Ellenberger, P.E. with Jacobs Engineering Group Inc. (Jacobs), via several electronic mail correspondences and telephone conversations. We were provided with the following project documents for review and reference:

- A set of plans titled *JEA Shands Chilled Water Plant* prepared by Stellar Power and Utilities (Stellar), last dated August 27, 2004.
- *Electrical Site Plan* sheet prepared by Stellar, last dated April 5, 2006.
- *Bore Plan* sheet prepared by Jacobs, dated May 2018.
- A detail titled *Concrete Equipment Pad – Type 'D'*, dated June 7, 2018.

1.2 Project Description

The site for the subject project is the existing JEA Chilled Water Plant, located east of Boulevard Street, west of Perry Street, south of West 12th Street, and north of West 11th Street in Jacksonville, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Ms. Ellenberger, it is our understanding the proposed project includes the construction of a new generator at the project site. In addition, a new fuel tank will be constructed to support the facility. We understand the planned equipment will be supported on concrete pads with a minimum thickness of 2 feet, designed to carry between 1.5 to 2 kips per square foot (ksf). Grading plans were not provided at the time of our evaluation; however, we have assumed grading of the generator and fuel tank pads will roughly match those currently existing at the site.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on July 5 and 6, 2018. A copy of the Bore Plan provided to us, which shows the approximate requested boring locations, is included as the *Boring Location Plan*, Figure 2. The boring locations were determined in the field by our personnel referencing the provided plan, and then using taped measurements from existing light pole structures adjacent to the proposed pad locations. Therefore, the boring locations shown on Figure 2 should be considered accurate only to the degree implied by the method of measurement used.

2.1 SPT Borings

Two Standard Penetration Test (SPT) borings were performed at the locations shown on Figure 2. The borings were initially advanced using a hand-held bucket auger to a depth of 4 feet below existing grade to avoid potential utility conflicts. The portion of the borings performed using a hand auger were performed in general accordance with the methodology outlined in ASTM D 1452. The borings were then continued as an SPT boring to a depth of 50 feet below the existing ground surface. The SPT portion of each boring was continuously sampled to a depth of 10 feet, and thereafter sampled every 5 feet in general accordance with the methodology outlined in ASTM D-1586. The bucket auger and split-spoon soil samples recovered during performance of the borings were visually described in the field by the field crew, and representative portions of the samples were transported to our laboratory for classification and testing. Each borehole was backfilled with a cementitious grout upon completion. A summary of the field procedures is included in Appendix A.

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 and the percent passing a U.S. No. 200 sieve (percent fines) of selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* included in Appendix B. Also, these results are shown on the *Generalized Soil Profiles* on Figure 3, and on the *Log of Boring* records at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on Figure 3. Detailed boring records are included in Appendix A. When reviewing these 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: Generator and Tank Pad Areas			
TYPICAL DEPTH [1] (ft)			
FROM	TO	SOIL DESCRIPTION	USCS [2]
0	0.75	Surficial pavement structure (2-inch asphalt/5.5 to 7-inch limerock Base Course)	---
0.75	5	Loose to medium dense fine SAND to fine SAND with silt	SP, SP-SM
5	12	Medium dense silty fine SAND	SM
12	48.5	Medium dense to dense fine SAND to fine SAND with silt	SP, SP-SM
48.5	50	Soft to hard LIMESTONE with varying degrees of weathering	---

1. Relative to the existing ground surface
2. Unified Soil Classification System

4.2 Groundwater Level

The groundwater level was encountered at both of the boring locations (B-1 and B-2) and recorded at the time of drilling at depths of 6 feet 3 inches and 5 feet 8 inches (respectively) below the existing ground surface. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be verified prior to construction. Measured groundwater levels are shown the boring profiles and 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 Duval County are shown in the table below. There is one predominant soil map unit at the project site: Urban land-Hurricane-Albany complex. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Web Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[1] (inches)
75	Urban land-Hurricane-Albany complex, 0 to 5 percent slopes	Somewhat Poorly Drained	A, A/D	12 to 42

[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.

[2] The term "complex", as defined by the USDA, refers to a map unit consisting of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the map.

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, effects of development, 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 2 to 3 feet above the water levels measured at the time of our field work.

It is possible that higher groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains. 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 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the described project conditions are incorrect or changed after this report, or subsurface conditions encountered during construction are different from those reported, MAE should be notified so these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Foundation Design Recommendations: Generator & Fuel Pad

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structure when constructed on a properly designed concrete shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in design of the generator and fuel tank foundations should not exceed 2,500 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.

5.2.2 Bearing Depth

The foundations should bear at a depth of at least 12 inches below the exterior final grades. It is recommended that stormwater be diverted away from these foundation elements to reduce the possibility of erosion beneath the slabs.

5.2.3 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of at least one foot below the foundation bearing levels.

5.2.4 Settlement Estimates

Post-construction settlements of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structure.

Due to the sandy nature of the near-surface soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, the supplied/assumed maximum structural loads, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structure could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we anticipate that differential settlements of the structure should be within tolerable magnitudes.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structure(s) and to maintain the integrity of a flexible pavement section.

6.1 Clearing and Stripping

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

The "footprint" of the proposed generator and fuel tank pads, plus a minimum additional margin of 5 feet, should be stripped of all pavement structure (asphalt/limerock base course) materials, including the stabilized subgrade layer up to a minimum of two feet below the bottom of the base course layer, and replaced with suitable fill material and compacted as outlined in Section 6.3 below. The demolished pavement structure and excavated subgrade materials should be stockpiled a safe distance from the construction area and removed from the site. Soils containing debris (asphalt and limerock fragments) are not considered suitable for reuse as fill material.

6.2 Temporary Groundwater Control

Because of the need for densification of the soils within the upper 2 feet below the stripped surface, temporary groundwater control measures may be required if the groundwater level is within 2 feet below the stripped surface at the time of construction. Should groundwater control measures become necessary, dewatering methods should be determined by the contractor. We recommend the groundwater control measures, if necessary, remain in place until compaction of the existing soils is completed. The dewatering method should be maintained until backfilling has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed a *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Compaction

After completing the clearing and stripping operations and installing the temporary groundwater control measures (if required), the exposed surface area should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 3 to 5 tons. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 1-foot of the compacted natural soils at the site.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The disturbed soils should be removed and backfilled with dry structural fill soils, which are then compacted, or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and Meskel & Associates Engineering should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer or a vibratory roller, operating in the static mode, is recommended.

6.4 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and slightly silty or clayey fine sand, without roots, as encountered in the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with more than 10 to 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

6.5 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of one foot below the bearing level. For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed at a minimum of one location within the footprint area of each pad foundation.

8.0 REPORT LIMITATIONS

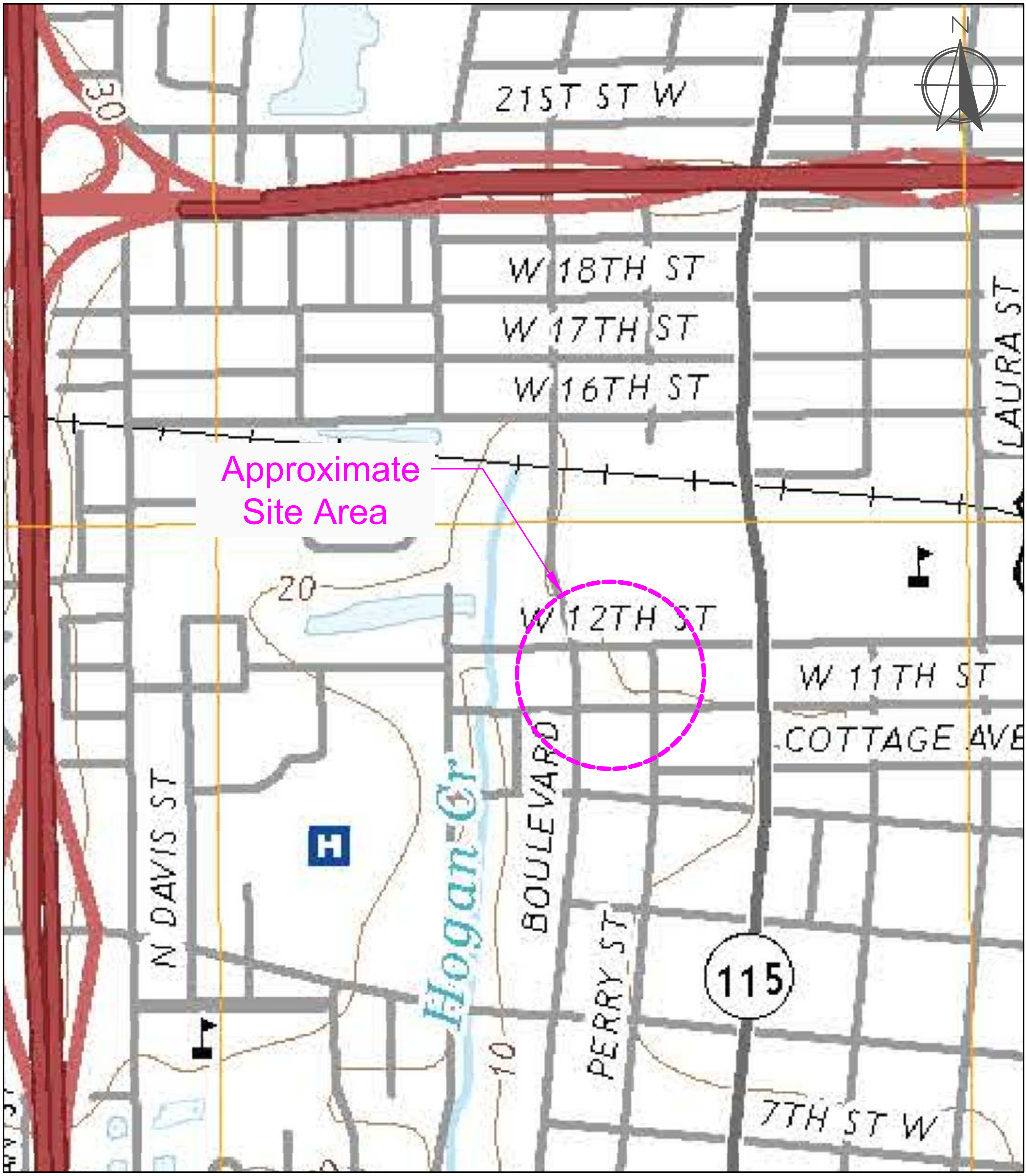
This report has been prepared for the exclusive use of Jacobs Engineering Group and the JEA for specific application to the design and construction of the JEA Springfield Plant Emergency Generator project. An electronically signed and sealed version, and a version of our report that is signed and sealed 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 analyses and recommendations contained in this report are based on the data obtained from this project. 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 occurring 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. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

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.

If changes in the design or location of the structures occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

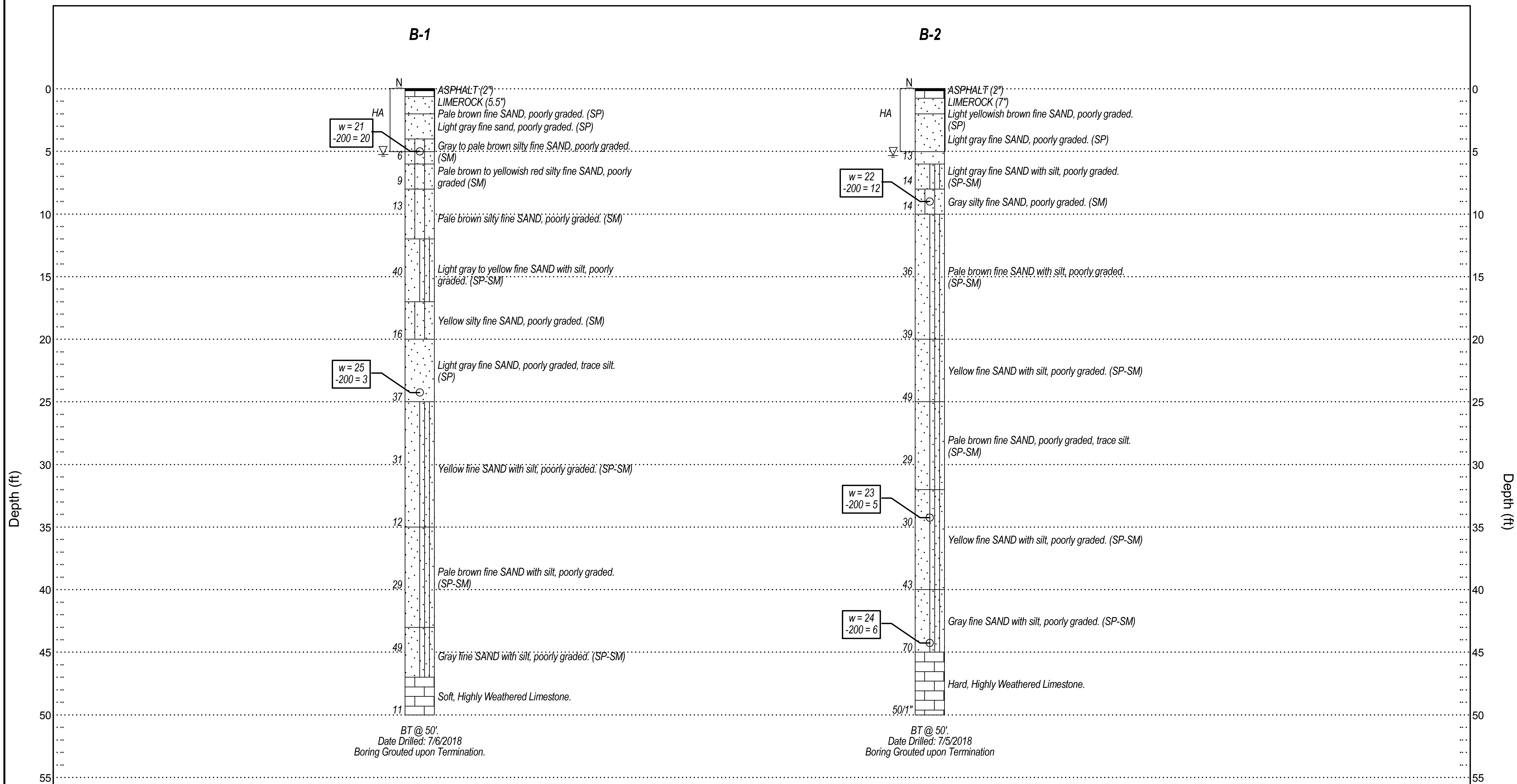
PREPARED BY	PROJECT NAME	
Meskel & Associates Engineering, PLLC FL Certificate of Authorization No. 28142 8936 Western Way, Suite 12, Jacksonville, FL 32256	*JEA Springfield Plant Emergency Generator* *Jacksonville, Florida*	
	REFERENCE	*SCALE*
	USGS Jacksonville, FL Quadrangle	*NTS*
PREPARED FOR	*MAE PROJECT NO.*	*FIGURE NO.*
Jacobs Engineering Group, Inc.	*0054-0002A*	*1*

NOTE: CADD Drawing Provided by Jacobs Engineering Group, Inc.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

MAE
Meskel & Associates Engineering, PLLC
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

CLIENT:		SHEET TITLE:	
Jacobs Engineering Group, Inc.		BORING LOCATION PLAN	
DATE:	MAE PROJECT NO.	PROJECT NAME:	FIGURE NO.
07/19/2018	0054-0002A	*JEA Springfield Plant Emergency Generator* Jacksonville, Florida	2



Legend

Asphalt

Silty Fine Sand

Limestone

Fine Sand with Silt

Fine Sand

N Standard Penetration Resistance, Blows/Foot

BT Boring Terminated at Depth Below Existing Grade

(SP) Unified Soil Classification System (USCS)

∇ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

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

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986

MAE

Meskel & Associates Engineering

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Jacobs

DATE:	MAE PROJECT NO.
7/31/2018	0054-0002A

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: Springfirled Plant Emergency Generator

FIGURE NO. 3

Appendix A

Meskel & Associates Engineering, PLLC
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Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0054-0002A

PROJECT NAME Springfirled Plant Emergency Generator
PROJECT LOCATION
CLIENT Jacobs
DATE STARTED 7/6/18 **COMPLETED** 7/6/18
LATITUDE **LONGITUDE**
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		ASPHALT (2")												* Hand Cone Penetrometer 0" - 6" : 70 6" - 12" : 70 12" - 18" : 70 18" - 24" : 70 24" - 30" : 70 30" - 36" : 30 36" - 42" : 10 42" - 48" : 70
		LIMEROCK (5.5")												
		Pale brown fine SAND, poorly graded.	SP											
		Light gray fine sand, poorly graded.	SP											
5		▽ Gray to pale brown silty fine SAND, poorly graded.	SM		4 3 3 3	6	21	20						
		Pale brown to yellowish red silty fine SAND, poorly graded	SM		2 4 5 7	9								
10		Pale brown silty fine SAND, poorly graded.	SM		4 6 7 8	13								
15		Light gray to yellow fine SAND with silt, poorly graded.	SP-SM		7 16 24	40								
20		Yellow silty fine SAND, poorly graded.	SM		7 7 9	16								
25		Light gray fine SAND, poorly graded, trace silt.	SP		14 17 20	37	25	3						

NOTES

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 5.25 ft *▽ **END OF DAY** ---

(Continued Next Page)

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MAE
Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0054-0002A

PROJECT NAME Springfirled Plant Emergency Generator

PROJECT LOCATION

CLIENT Jacobs

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
25														
30		Yellow fine SAND with silt, poorly graded.	SP-SM		12 16 15	31								
35					4 5 7	12								
40		Pale brown fine SAND with silt, poorly graded.	SP-SM		6 14 15	29								
45		Gray fine SAND with silt, poorly graded.	SP-SM		20 26 23	49								
50		Soft, Highly Weathered Limestone.			16 4 7	11								

Bottom of borehole at 50 feet.

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 5.25 ft

*END OF DAY ---

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MAE Meskel & Associates Engineering

BORING B-2

PROJECT NO. 0054-0002A

PROJECT NAME Springfirled Plant Emergency Generator
PROJECT LOCATION
CLIENT Jacobs
DATE STARTED 7/5/18 **COMPLETED** 7/5/18
LATITUDE **LONGITUDE**
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)	MATERIAL DESCRIPTION	USCS	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	ASPHALT (2")											* Hand Cone Penetrometer 12" - 18" : 70 18" - 24" : 70 24" - 30" : 70 30" - 36" : 65 36" - 42" : 70 42" - 48" : 70
	LIMEROCK (7")											
	Light yellowish brown fine SAND, poorly graded.	SP										
5	Light gray fine SAND, poorly graded. ▽	SP	4-6-7-10	13								
	Light gray fine SAND with silt, poorly graded.	SP-SM	4-6-8-10	14								
10	Gray silty fine SAND, poorly graded.	SM	5-6-8-8	14	22	12						
15	Pale brown fine SAND with silt, poorly graded.	SP-SM	7-15-21	36								
20			11-16-23	39								
25	Yellow fine SAND with silt, poorly graded.	SP-SM	13-23-26	49								

NOTES

GROUND WATER LEVELS
▽ **AT TIME OF DRILLING** 5.33 ft *▽ **END OF DAY** ---

(Continued Next Page)

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Meskel & Associates Engineering

BORING B-2

PROJECT NO. 0054-0002A

PROJECT NAME Springfirled Plant Emergency Generator

PROJECT LOCATION

CLIENT Jacobs

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
25														
30		Pale brown fine SAND, poorly graded, trace silt.	SP-SM		9 14 15	29								
35		Yellow fine SAND with silt, poorly graded.	SP-SM		10 14 16	30	23	5						
40					10 18 25	43								
45		Gray fine SAND with silt, poorly graded.	SP-SM		13 30 40	70	24	6						
50		Hard, Highly Weathered Limestone.			0 0 50	50								

Bottom of borehole at 50 feet.

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 5.33 ft

*END OF DAY ---

NEW MAE LOG LAT/LONG-EOD - NEW TEMPLATE 7-30-12.GDT - 8/1/18 13:55 - F:\GINT\GINT FILES\PROJECTS\0054-0002A\JEA CHILLER PLANT.GPJ

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.

Hand Auger Boring

The auger boring(s) were performed manually by the use of a hand-held bucket auger in general accordance with the latest revision of ASTM D 1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings." Representative samples of the soils brought to the ground surface by the auger were placed in sealed containers and transported to our 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	Less than 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

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 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

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%

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Appendix B

Summary of Laboratory Test Data
JEA Springfield Plant Emergency Generator
MAE Project No.: 0054-0002A

Boring No	Sample No.	Approx. Depth (ft)	Percent Fines (-200)	Natural Moisture Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
B-1	3	6	20	21	---	---	---	---	SM
B-1	8	25	3	25	---	---	---	---	SP
B-2	5	10	12	22	---	---	---	---	SM
B-2	9	30	5	23	---	---	---	---	SP-SM
B-2	12	45	6	24	---	---	---	---	SP-SM

Note: "---" Untested Parameter

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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.

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