Final Report of Geotechnical Exploration
For

JEA North Liberty Street Trunk Sewer Replacement
Jacksonville, Florida

MAE Project No. 0103-0012
May 3, 2019

Prepared for:

MOTT MACDONALD

JEA
Building Community®

Prepared by:

TEN YEARS 10 MAE
Meskel & Associates Engineering
Geotechnical • Environmental • Inspection • Testing

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

May 3, 2019

Meskel & Associates Engineering
Geotechnical ⌜ Environmental
Inspection ⌜ Testing

Mr. Bruce A. Neu, P.E.
Mott MacDonald Florida, LLC
10245 Centurion Parkway, Suite 320
Jacksonville, Florida 32256

Reference: Final Report of Geotechnical Exploration
JEA North Liberty Street Trunk Sewer Replacement
Jacksonville, Florida
MAE Project No. 0103-0012

Dear Mr. Neu:

Meskel & Associates Engineering, PLLC has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our revised proposal dated June 14, 2018. The purpose of the exploration was to evaluate the general subsurface conditions encountered along the proposed underground pipeline route, and to provide recommendations for pipe bedding and backfilling, 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.

In general, the borings encountered fine sands, fine sands with silt, and silty fine sands (A-3, A-2-4) to the boring termination depths. The relative densities of the soils encountered ranged from very loose to very dense and typically increased with depth. Groundwater was encountered at all the boring locations and varied in depths ranging from 3 feet 8 inches to 7 feet 9 inches below the existing grade.

Based on our evaluation of the encountered subsurface conditions, it is our opinion that the soils encountered are adaptable to support the proposed pipeline and associated manhole structures provided the site preparation recommendations 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

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 05/03/2019 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.

Philip R Mank Digitally signed by Philip R Mank
Date: 2019.05.03 13:41:20 -04'00'

W. Josh Mele, E.I.
Staff Engineer

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

Distribution: Mr. Bruce A. Neu, P.E. – Mott MacDonald Florida, LLC. 1 pdf

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1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Mr. Bruce Neu, P.E., with Mott MacDonald of Florida, LLC. We were provided with the following project documents for review and reference:

- A pdf copy of the As-Builts titled, *1958 Sewerage Program – Trunk Sewers – Section E*, created by Metcalf & Eddy, signed October 18, 1960.
- The Solicitation for Participation in Engineering Services for Walnut Street 60" Trunk Sewer Replacement, outlining the scope of services for the project.
- Appendix A: Technical Specifications – 112-17 Engineering Services for Walnut Street 60" Trunk Sewer Replacement, Project Summary.
- Several Google Maps pdfs that show the planned 36-inch gravity trunk sewer alignment along North Liberty Street between just north of East 21st Street to its intersection with East 16th Street. These Maps also showed the requested soil boring and pavement core locations.
- The 60 percent plan sheets showing the proposed 36-inch gravity trunk sewer along North Liberty Street dated December 2018.

1.2 Project Description

The site for the subject project is located along North Liberty Street, between just north of its intersection with East 21st Street to its intersection with East 16th Street in Jacksonville, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Mr. Neu, it is our understanding the proposed project includes the construction of approximately 3,350 linear feet (LF) of 36-inch gravity trunk sewer along North Liberty Street and 2,720 LF of replacement 10-inch PVC water main on North Liberty Street, between E. 27th and E. 16th Streets. The south terminus of the new trunk sewer is at a proposed connection with an existing 72-inch trunk sewer on East 16th Street. The north terminus is at a proposed connection to the existing 20-inch force main along the JEA easement north of the Duval County Public Schools Maintenance facility. We understand that the south connection may require deep sheeted or braced excavation. This alignment includes a 54-inch and a 20-inch jack-and-bore crossing below Martin Luther King (MLK), Jr. Parkway (FDOT SR-115 at Bridge 720054). We understand the excavation in this area will be approximately 17 feet deep and will be supported with either sheet piles or a trench box.

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 during the period of August 15 through 27, 2018. GPS coordinates for the requested boring and pavement core locations were obtained from Google Earth by referencing the provided Google Maps PDFs. Images borrowed from Google Earth are included as the *Boring and Core Location Plan*, Figures 2 and 2A, and show the approximate boring and pavement core locations.

Prior to starting our field exploration, a utility locate request was submitted to the Sunshine State One Call Center (SSOC). Once the utility locations were marked and/or cleared by SSOC, we mobilized to begin our field exploration. Our field personnel located each boring and pavement core location using a Garmin GPSMAP 78 hand-held GPS receiver; therefore, the boring and pavement core locations as shown on Figures 2 and 2A should be considered accurate only to the degree implied by the method of measurement used.

2.1 SPT Borings

To explore the subsurface conditions within the area of the proposed pipeline, we located and performed 10 Standard Penetration Test (SPT) borings, drilled to depths of approximately 15, 20, and 40 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 further evaluation.

It should be noted that boring B-1 was intended to be advanced to a depth of 40 feet but terminated early due to an unknown obstruction at approximately 15 feet below the existing grade. Boring B-1A was located approximately 100 feet from B-1 along the proposed pipeline route with the assistance of JEA.

2.2 Bulk Soil Sampling

Two bulk soil samples were obtained along the planned trunk sewer alignment for corrosivity testing. These samples were collected at depths between 2 and 6 feet below existing grade and were then transported to our laboratory for classification and testing.

2.3 Pavement Cores

Six core samples of the existing pavement structure (asphalt surface and base course) were obtained. Each core location was drilled using a 4-inch diameter diamond coated core barrel connected to free standing mechanical drill equipment. Water was used during core sampling to cool the core barrel and to limit dust and debris generated from the coring process. The thickness of the asphalt surface course and underlying base course were measured at each core location. A bucket auger was then used to advance the cores to a depth of approximately 2 feet below the base material to explore the pavement subgrade conditions. The borings were conducted in general accordance with the methodology outlined in ASTM D 1452. Once the cores were complete, the holes were backfilled with native soil cuttings and then capped with an asphalt cold-patch material in compacted lifts. Representative samples of the subgrade soils and the asphalt core samples were transported to our laboratory. Photographs of the recovered asphalt core samples are included in Appendix D.

3.0 LABORATORY TESTING

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the AASHTO Soil Classification System in general accordance with ASTM D 3282. A *Key to the Soil Classification System* is included in Appendix A.

3.1 Soil Index Testing

Quantitative laboratory testing was run 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

Atterberg Limits, the natural moisture and organic contents, and the percent of material finer than the US Sieve No. 200 (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, on the *Generalized Soil Profiles* (Figures 3 through 6), and on the Log of Boring records at the respective depths from which the tested samples were recovered. A description of the laboratory test procedures is included in Appendix B.

3.2 Corrosion Series Tests

Two bulk soil samples were selected for corrosion potential testing. These samples were obtained from hand auger borings advanced adjacent to boring locations B-6 and B-9 at depths from 2 to 4 feet below the existing ground surface. The testing included soil pH, resistivity, and chloride and sulfate contents. The test results are included in Section 5.4 and on the *Summary of Corrosion Series Test Results* in Appendix B.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions encountered in the SPT borings is presented on the *Generalized Soil Profiles* sheets (Figures 3 through 5). 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.

In general, the borings encountered fine sands, fine sands with silt, and silty fine sands (A-3, A-2-4) to the boring termination depths. The relative densities of the soils encountered ranged from very loose to very dense and typically increased with depth. As an exception, boring B-9 encountered silty clayey sands (A-2-6) between approximate depths of 33.5 to 38.5 feet below the existing grade.

4.2 Groundwater Level

The groundwater level was encountered at each of the SPT boring locations and recorded at the time of drilling at depths varying from 3 feet 8 inches to 7 feet 9 inches below the existing ground surface. The measured groundwater levels are shown on the *Generalized Soil Profiles* sheets (Figures 3 through 5) and on the soil boring logs. Groundwater was not encountered within the vertical reaches of the pavement core hand auger borings. However, that does not mean that groundwater does not exist at these locations, or that groundwater may not be encountered within the vertical reaches of the pavement core borings at another date. 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 re-measured prior to construction.

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. 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)
69	Urban land[2]	---	---	---
73	Urban land – Mascotte – Sapelo complex[3], 0 to 2 percent slopes	Poorly Drained	C/D, B/D	6 to 18
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 Urban land classification does not have an associated soil type, drainage class, hydrologic group, and estimated seasonal high groundwater levels typically reported in the Soil Survey.

[3] 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 1 to 2 feet above the water levels measured at the time of our field work. 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 stormwater drainage patterns due to construction in the vicinity of this project may cause seasonal high water levels to be higher or lower than historical patterns. The project design engineer should be consulted to evaluate the influence of these changes on groundwater levels along the proposed pipeline alignment. In addition, we recommend that piezometers be installed along the pipeline alignment to measure groundwater fluctuations over time.

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.

4.5 Pavement and Subgrade Descriptions

The existing pavement structure and the underlying subgrade conditions as encountered along the proposed force main route were measured at 6 pavement core locations. The pavement core results are

shown on the *Pavement Core Profiles* sheet, Figure 6. The encountered pavement and subgrade conditions are shown in the following table.

Pavement Core Number	GPS Coordinates Latitude, Longitude (Street)	Asphalt/ Concrete Layer Thickness (in.)	Base Course Type[(1)]/ Thickness (in.)	Core Condition/Subgrade [(2)]
PC-1	30°21'40.56"N, 81°38'56.74"W (N. Liberty St)	9	---	Pavement core consisted of three apparent layers. The top and middle layers were asphalt with fine to coarse aggregate and measured at ½ and 1 ¾ inches, respectively. The bottom layer was concrete with coarse aggregate and measured at 5 ¾ inches. No cracks or voids observed in asphalt layers, but concrete layer showed small voids. The subgrade consisted of fine sand (A-3).
PC-2	30°21'39.29"N, 81°38'55.54"W (E. 27th St)	3	Limerock / 6 ½	Pavement core consisted of one apparent asphalt layer with fine aggregate measured at 3 inches. No cracks or voids observed along the top, bottom or sides of the core. The subgrade consisted of fine sand (A-3).
PC-3	30°21'28.09"N, 81°38'57.31"W (N. Liberty St)	11 ½	---	Pavement core consisted of four apparent layers. The top, 2nd and 3rd layers were asphalt with fine to coarse aggregate, each measured at 1 ¾ inches. The 4th layer was concrete with coarse aggregate and measured at 6 ½ inches. No cracks or voids observed in asphalt layers, but concrete layer showed small voids. The subgrade consisted of fine sand (A-3).
PC-4	30°21'26.07"N, 81°38'52.61"W (E. 24th St)	6 ½	Concrete Fragments / 6	Pavement core consisted of four apparent layers of asphalt with fine to coarse aggregate. Top, middle and bottom layers measured at 1 ½, 2 and 3 inches, respectively. No cracks or voids observed along the top, bottom or sides of the core. The subgrade consisted of fine sand (A-3).
PC-5	30°21'19.67"N, 81°38'57.36"W (E. 19th St)	9 ¾	---	Pavement core consisted of three apparent layers. The top and middle layers were asphalt with fine to coarse aggregate and measured at 1 ½ and 2 ¼ inches, respectively. The bottom layer was concrete with coarse aggregate and measured at 6 inches. No cracks or voids observed in asphalt layers, but concrete layer showed small voids. The subgrade consisted of fine sand (A-3).

Pavement Core Number	GPS Coordinates Latitude, Longitude (Street)	Asphalt/ Concrete Layer Thickness (in.)	Base Course Type[(1)]/ Thickness (in.)	Core Condition/Subgrade [(2)]
PC-6	30°21'13.43"N, 81°38'56.78"W (E. 16th St)	11 ¼	---	Pavement core consisted of four apparent layers. The top, 2nd and 3rd layers were asphalt with fine to coarse aggregate, measured at 1 ¾, 1 ¼, and 2 inches, respectively. The 4th layer was concrete with coarse aggregate and measured at 6 inches. No cracks or voids observed in asphalt layers, but concrete layer showed small voids. The subgrade consisted of fine sand (A-3).

(1) No discernable base course was encountered at locations where pavement cores had a bottom concrete layer.
(2) Subgrade was explored via hand auger to a depth of 2 feet below the existing base course.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following geotechnical engineering evaluation and recommendations are based on the results of the field and laboratory testing performed, our experience with similar soil conditions, and our understanding of the provided project information as presented in this report. If the project information presented in this report is incorrect, please contact us so that these recommendations can be reviewed. Also, the discovery of any site or subsurface conditions during construction that deviate from the data presented herein should be reported to us for evaluation. We recommend that we be provided the opportunity to review the plans and earthwork specifications before construction to verify that our recommendations have been properly interpreted and implemented.

5.2 Pipeline and Manhole Support Recommendations

Based on the results of the subsurface exploration and laboratory testing as discussed in this report, we consider the subsurface conditions along the trunk sewer route adaptable for supporting the proposed pipeline and manhole structures when constructed upon properly prepared subgrade soils.

As discussed earlier in the report, the borings primarily encountered fine sands and fine sands with silt (A-3), silty fine sands (A-2-4) to the boring termination depths. As an exception, boring B-9 encountered clayey sands (A-2-6) between depths of about 33.5 to 48.5 below the existing grade. The A-3 soils are suitable for use as backfill and pipe and manhole bedding soils, and these soils should be placed and compacted as discussed in Section 6.0 below.

The A-2-4 and A-2-6 soils are not considered suitable for support of the pipeline at the invert elevation (pipe bedding) or at the manhole structure bottom elevation, nor as backfill of the pipe or manhole excavation. It should be expected that these soils will be encountered during excavation for the pipeline and manhole structures, as well as at or near the planned pipe invert and manhole structure bottom elevations. The silty (A-2-4) soils should be removed to a depth of at least 12 inches below the pipe invert or manhole bottom elevation and should be replaced with suitable structural fill soil as described in Section 6.0 below. The clayey (A-2-6) soils should be excavated to a depth of at least 24 inches below the

pipe invert or manhole bottom elevation and should be replaced with suitable structural fill soil as described in Section 6.0 below. The silty and clayey soils should be separated from the other soils during excavation and stockpiled for removal from the site.

Assuming the project information as understood at the beginning of this report is correct and 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 design.

5.2.1 Lateral Pressure Design Parameters

Walls for any underground structures that are backfilled on one side and restrained against rotation at the top, should be designed to resist lateral pressures from soil and groundwater based on the following equivalent fluid unit weights:

- Above Water Table - Equivalent Fluid Density 60 lb/ ft^3
- Below Water Table - Equivalent Fluid Density 90 lb/ ft^3

For the design of lateral loads on underground walls, we recommend that the groundwater level be assumed to be at the ground surface. Lateral pressure distributions in accordance with the above do not take into account forces from construction equipment, wheel loads or other surcharge loads. To account for this loading, a pressure equal to 0.5 times the anticipated surface surcharge should be applied over the full height of all walls.

5.2.2 Resisting Lateral Forces

Horizontal forces that act on pipeline structures such as thrust and anchor blocks can be resisted to some extent by the earth pressures that develop in contact with the buried perpendicular face of the block structure, and by shearing resistance mobilized along the block structures base and subgrade interface. Allowable passive earth pressure resistance may be determined using the following equivalent fluid densities:

- Above Water Table - Equivalent Fluid Density 100 lb/ft^3
- Below Water Table - Equivalent Fluid Density 60 lb/ft^3

A factor of safety of 3 was used for the above values. It is assumed the block structures are surrounded by well compacted structural backfill, as described in Section 6.4 below, extending at least 5 feet horizontally beyond the vertical bearing face. In addition, it is presumed that the block structures can withstand horizontal movements on the order of 0.5-inch before mobilizing full passive resistance.

The allowable sliding shearing resistance mobilized along the base of the block structure may be determined by the following formula:

$$P = 1/3V \tan (2/3\ \phi)$$

Where: P = Allowable shearing resistance force
V = Net vertical force (total weight of block and soil overlying the structure minus hydrostatic uplift forces)
ϕ = Angle of internal friction = 30°

The following unit weights can be used to calculate the weight of the overburden soil:

- Compacted Moist Soil 110 lb/ ft^3
- Saturated Soil 120 lb/ ft^3

5.2.3 Hydrostatic Uplift Resistance

It is anticipated that the buried structures will exert little or no net downward pressure on the soils; rather, the structures may be subject to hydrostatic uplift pressure when empty. Underground structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below final grade and the seasonal high groundwater table. Hydrostatic uplift forces can be resisted in several ways including:

1. Addition of dead weight to the structure.
2. Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft^3 may be used in designing structures to resist buoyancy.

5.2.4 Thrust Block Soil Bearing Pressure

The maximum allowable net soil bearing pressure for use in design of thrust blocks should not exceed 2,000 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 structure should be designed based on the maximum load that could be imposed by all loading conditions.

The structure should bear in either 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 (AASHTO T-180), to a depth of at least one foot below the bearing level.

5.3 Geotechnical Soil Parameters – Deep Excavations

As discussed in Section 1.2 above, connections at the south end of the pipeline to existing pipe network will require a deep sheeted or braced excavation. In addition, sheet piles or a trench box will be needed to brace the sidewalls for the launching and receiving pits of the jack-and-bore below Martin Luther King, Jr. Parkway (FDOT SR-115 at Bridge 720054).

Based on the subsurface conditions encountered at the deep borings B-1A, B-6, B-7 and B-9, the estimated soil parameters that can be used for design of the sheet pile walls are shown on the Tables located in Appendix C. These parameters are based on the subsurface conditions encountered at both boring locations, and on empirical correlations between N-values and various soil properties. In each case, N-values were averaged over the zone of interest. We have assumed for design purposes that the groundwater level is at the existing ground surface at all boring locations.

It should be noted that dense to very dense subsurface conditions were encountered at all four of the deep boring locations. These conditions began at a depth of about 13 feet below existing grade and ended at a depth of about 33 to 38 feet. The encountered soils were fine sands (A-3), fine sands with silt (A-3) and silty fine sands (A-2-4). As a result, hard driving of the steel sheet piles should be anticipated at these locations between these depths.

5.4 Environmental Classification

Two bulk soil samples were obtained from borings performed within the planned trunk sewer alignment. The purpose of these samples was to run soil corrosion potential tests to determine the environmental classification of the soils for ductile iron valve and fitting instillation. The samples were classified in accordance with FDOT procedures contained in Chapter 1.3.2.1 of the January 2018 edition of the FDOT *Structures Design Guidelines*. Based on the results of these tests, the encountered soils were classified as Slightly Aggressive. Sample locations and test results are shown on the *Summary of Corrosion Series Test Results in* Appendix B.

5.5 Jack-And-Bore Considerations (FDOT SR-115 at Bridge 720054)

We understand that the excavation for the jack-and-bore launching and receiving pits will be approximately 17 feet below existing grade. Based on the soil boring results (B-6 and B-7), dense to very dense sand soils (A-3, A-2-4) were encountered beginning at a depth of approximately 13 feet below existing grade. Therefore, difficult excavation of these soils should be anticipated. In addition, hard drilling for the jack-and-bore pipe casing should also be anticipated if the planned casing depth is greater than about 13 feet below existing grade.

The contractor should be prepared to monitor the bridge and adjacent approach embankments for any settlement during the jack-and-bore process. This includes settlement caused by dewatering of the jacking and receiving pits.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions and to reduce the potential for post-construction settlements of the planned pipelines and associated structures.

6.1 Clearing

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.

Although not recorded in our field logs, through observation it should be anticipated that up to about 6 inches of topsoil and soils containing significant amounts of organic materials may be encountered along the planned pipeline route. The actual depths of topsoil and surficial organic soils should be determined by MAE using visual observation and judgment during earthwork operations. The topsoil and surficial organic soils should not be reused as backfill material within the pipeline or structure excavations. However, they may be stockpiled and used subsequently in areas to be grassed.

6.2 Temporary Groundwater Control

The groundwater level was encountered at the boring locations at depths varying 3 feet 8 inches to 7 feet 9 inches below the existing ground surface at the time of our exploration. Because of the need for excavation to the pipeline invert and manhole bottom elevations, followed by compaction of the bedding and backfill soils, it may be necessary to install temporary groundwater control measures to dewater the

area to facilitate the excavation and compaction processes. In addition, dewatering should be anticipated for the deep excavations for the pipe connections at the north and south ends of the pipeline and the jack-and-bore operation at MLK Jr. Parkway.

The groundwater control measures should be determined by the contractor but can consist of sumps or well points (or a combination of these or other methods) capable of lowering the groundwater level to at least 2 feet below the required depth of excavation. The dewatering system should not be decommissioned until excavation, compaction, and fill placement is complete, and sufficient deadweight exists on the structures to prevent uplift. It should be anticipated that well point installation into the dense to very dense soils encountered at several of the borings may be difficult, and additional efforts may be necessary to adequately dewater excavations in these soils.

6.3 Preparation of Foundation Soils

As discussed earlier in the report, silty sands (A-2-4) were encountered at most of the boring locations at varying levels throughout the vertical reached of the depths explored. It should be expected that these soils will be encountered during excavation for the pipeline, as well as at or near the planned pipe and manhole structure invert elevations. These soils are not considered suitable for support of the pipeline or manhole structures at the invert elevation (pipe bedding) or at the structure bottom elevation, respectively, nor as backfill of the pipe or manhole excavation. The silty sands as encountered in the borings that are within 12 inches of the pipe invert or manhole bottom should be removed to a depth of at least 12 inches below the pipe invert or manhole bottom elevation and should be replaced with compacted structural fill soil as described in Section 6.6 below. The purpose of these recommendations is to provide more uniform bearing conditions, and to reduce the potential for post construction settlements of the pipeline and structures.

Where the pipeline or manhole structures bear in sand soils (A-3), these soils should be excavated to the proposed bearing elevation and the exposed excavation surface should be compacted as outlined in Section 6.4 below. The soils with a fines content of 10 percent or greater should be over excavated to a depth of 12 inches below the pipe invert elevation, and then replaced with suitable structural fill that is placed and compacted as recommended in Section 6.7 below.

6.4 Compaction of Excavation Bottom Soils for Pipe and Manhole Structures

After installing the temporary groundwater control measures, and achieving the required depth of excavation, the exposed sand soil surface should be compacted using hand-operated equipment. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (AASHTO T-180) during the compaction operations. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (AASHTO T-180) have been achieved within the upper one foot below the exposed surface within the pipeline excavation.

In areas where the existing silty soils (or clayey soils, if encountered) are over-excavated and backfilled with sand soils or aggregate, this initial compaction of the excavation bottom soils is not necessary.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils that are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operations are underway. Compaction should cease if deemed detrimental to adjacent structures.

6.5 Compaction of Deep Excavation Bottom Soils

As discussed earlier, it should be anticipated that dense to very dense sand soils will be encountered at the excavation bottom elevation if the excavation is deeper than about 13 feet below existing grade. Within these soils, difficult excavation may cause the bottom to be uneven and of variable soil density. Any required structural fill should be placed and compacted as discussed in section 6.7 below. Alternatively, the excavation can be continued at least 6 inches below the planned bottom elevation and backfilled with a graded aggregate conforming to ASTM No. 67 stone as noted in the JEA Water and Wastewater Standards Manual, latest edition. The gravel should be placed in equal lifts not greater than 6 inches in thickness and compacted to form a stable working surface.

6.6 Excavation Protection

Excavation work for the trunk sewer construction, including any manhole structures, will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation. In addition, it should be anticipated that an excavation support system may be necessary to protect adjacent existing structures, pavement and/or utilities that are located along the proposed pipeline alignment.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida licensed Professional Engineer. Where pipeline excavations and the construction of excavation support systems are within 50 feet of existing structures, the existing structures should be monitored for adverse reactions to construction vibrations and dewatering activities.

6.7 Structural Backfill and Compaction of Structural Backfill

Structural backfill placed within the pipeline excavation, and in areas in which over-excavation of unsuitable soils is required below the pipeline elevation, should be placed in loose lifts not exceeding six inches in thickness and compacted using hand-operated compaction equipment. This procedure should continue until the backfill elevation is 12 inches above the top of the pipe. At backfill elevations greater than 12 inches above the top of pipe, structural backfill may be placed in loose lifts not exceeding 12 inches in thickness and compacted by hand-operated compaction equipment.

Structural backfill placed around structures should be placed in 6-inch lifts and compacted with hand-operated compaction equipment. Heavy compaction equipment should not be used within 5 feet of structures to prevent overstressing of the structure walls.

Structural backfill is defined as a non-plastic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The sandy soils (A-3) meeting the properties given above, as encountered in the borings, may be used as backfill.

The backfill soils should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (AASHTO T-180) during the compaction operations. Compaction should continue until

densities of at least 98 percent of the modified Proctor maximum dry density (AASHTO T-180) have been achieved within each lift of compacted structural backfill.

We recommend that soil excavated from the pipeline trenches that will be reused as backfill be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the excavated soil.

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 pipeline and manhole 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 for every 300 feet of pipeline, and on alternating sides of each manhole structure.

8.0 REPORT LIMITATIONS

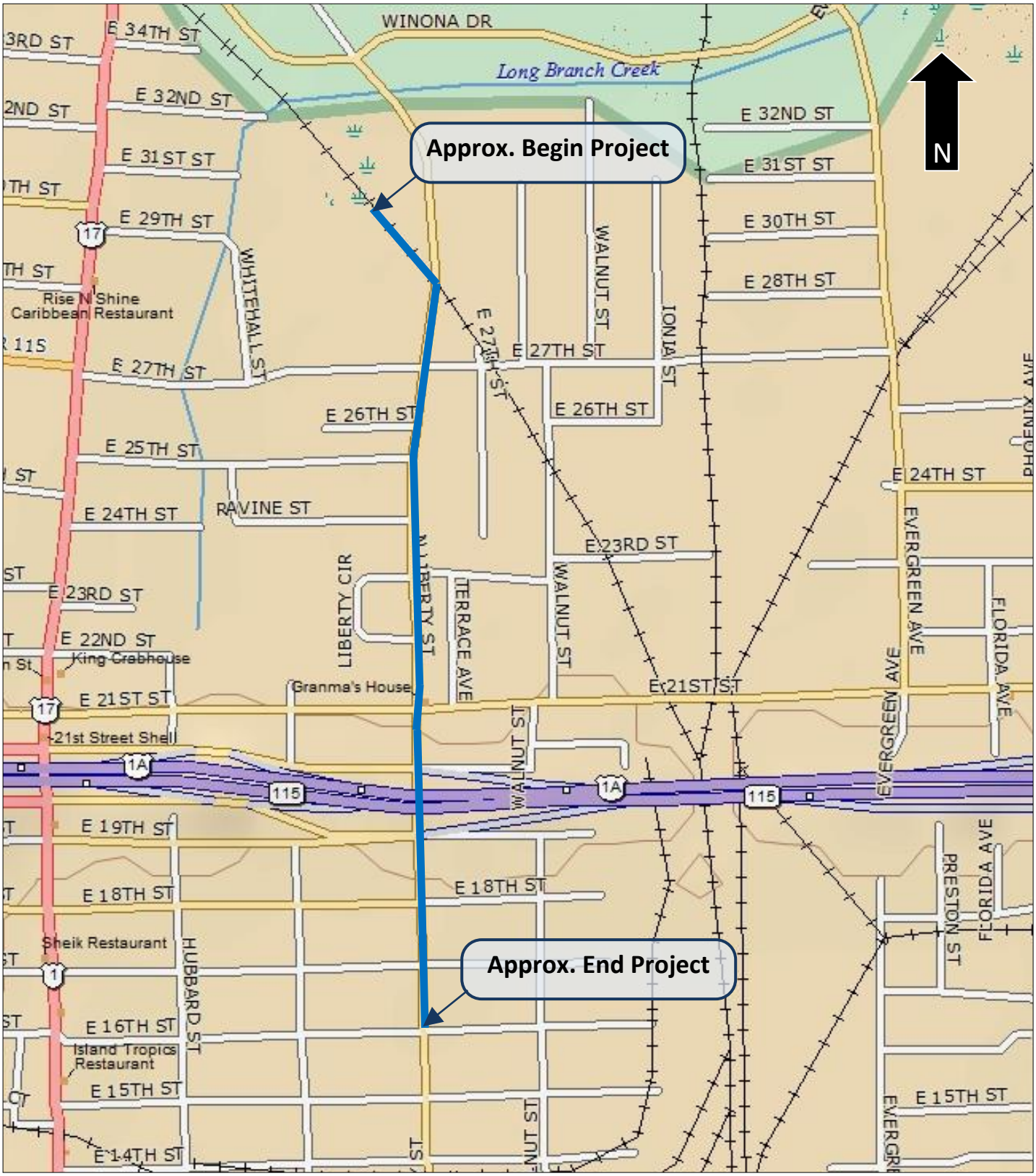
This report has been prepared for the exclusive use of Mott MacDonald Florida, LLC and the JEA for specific application to the design and construction of the Walnut Street Trunk Sewer Replacement project as described in this report. A version of our report that is signed and sealed in blue ink may be 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 the borings and cores located along the proposed force main route. This exploration shows 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 between the boring/core locations and/or at depths below the termination depths. Subsurface conditions and water levels at other locations may differ from conditions encountered at the tested locations. In addition, the passage of time may result in a change in the conditions at the explored 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.

As part of our comprehensive services on this project, MAE is in the process of completing a groundwater sampling and testing program along the proposed trunk sewer alignment. The scope of work and results of that program will be provided in a separate report.

If changes in the design or location of the trunk sewer 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	JEA North Liberty Street Trunk Sewer Replacement Jacksonville, Florida	
	REFERERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	**FIGURE NO.**
Mott MacDonald Florida, LLC	0103-0012	1

Project Manager:	PRM
Drawn by:	MCV
Checked by:	MCV
Approved by:	PRM

Project No.	0103-0012
Scale:	AS SHOWN
File Name:	0103-0012.BLP
Date:	5/2/2018

Meskel & Associates Engineering

8936 WESTERN WAY. – SUITE 12 • JACKSONVILLE, FLORIDA 32256

PH. (904) 519-6990 • FAX (904) 519-6992 • www.MeskelEngineering.com

BORING AND CORE LOCATION PLAN

JEA NORTH LIBERTY STREET TRUNK SEWER REPLACEMENT
JACKSONVILLE, FLORIDA

FIG NO. 2

Project Manager:	PRM
Drawn by:	MCV
Checked by:	MCV
Approved by:	PRM

Project No.	0103-0012
Scale:	AS SHOWN
File Name:	0103-0012.BLP
Date:	5/2/2019

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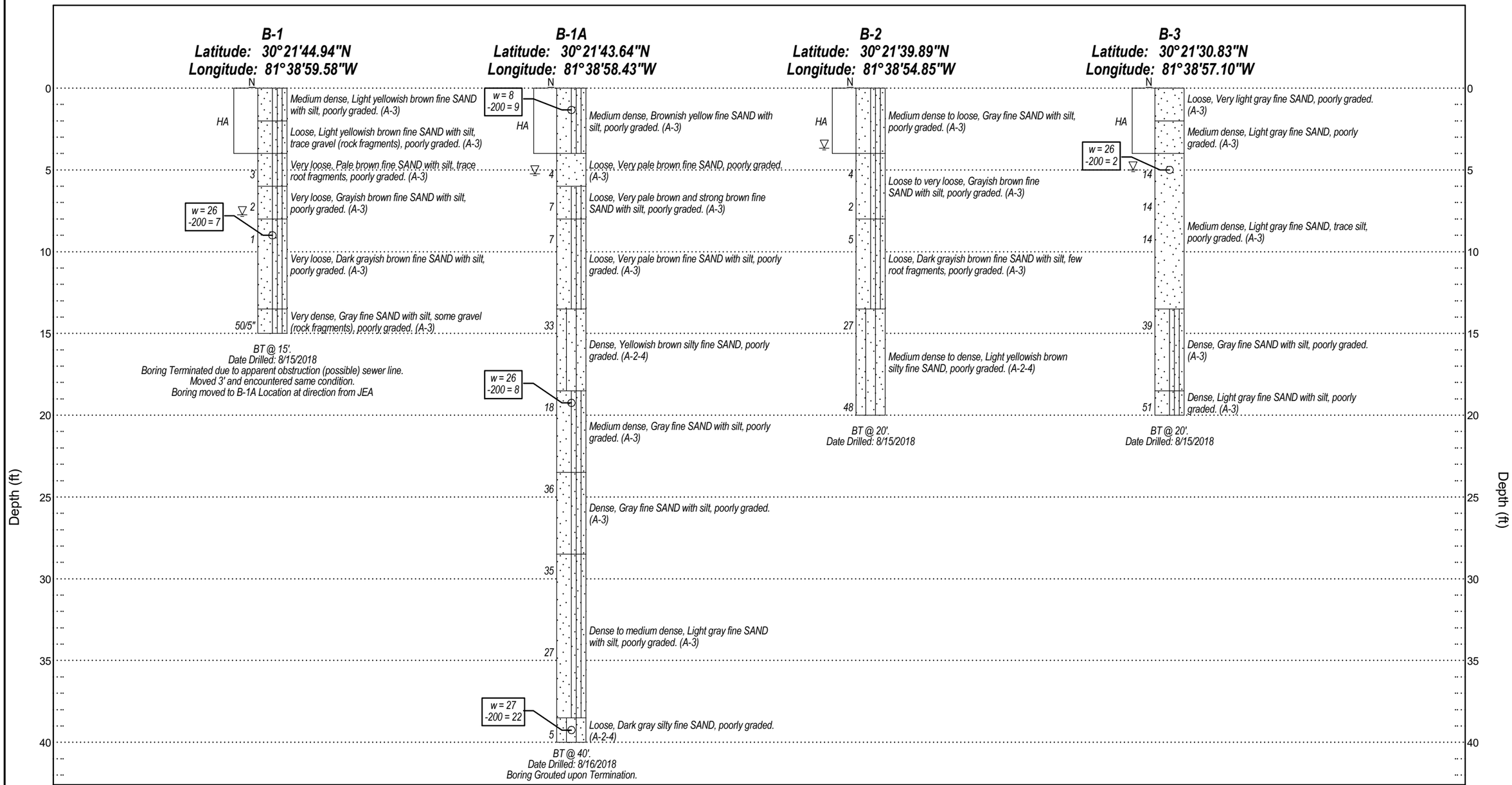
PH. (904) 519-6990 • FAX (904) 519-6992 • www.MeskelEngineering.com

BORING AND CORE LOCATION PLAN

JEA NORTH LIBERTY STREET TRUNK SEWER REPLACEMENT
JACKSONVILLE, FLORIDA

FIG NO. 2A



Legend

Fine Sand with Silt

Silty Fine Sand

Fine Sand

N — *Standard Penetration Resistance, Blows/Foot*

BT — *Boring Terminated at Depth Below Existing Grade*

(A-3) — *AASHTO Soil Classification System*

▽ — *Depth to Groundwater at Time of Drilling*

w — *Natural Moisture Content (%)*

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

50/5" — *Indicates 50 Hammer blows drove split spoon sampler 5 inches.*

HA — *Boring Advanced by hand-held bucket auger to 4 ft. due to possible underground utilities. Static Cone Penetrometer used to measure relative density, values shown on boring logs.*

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
TEN YEARS
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

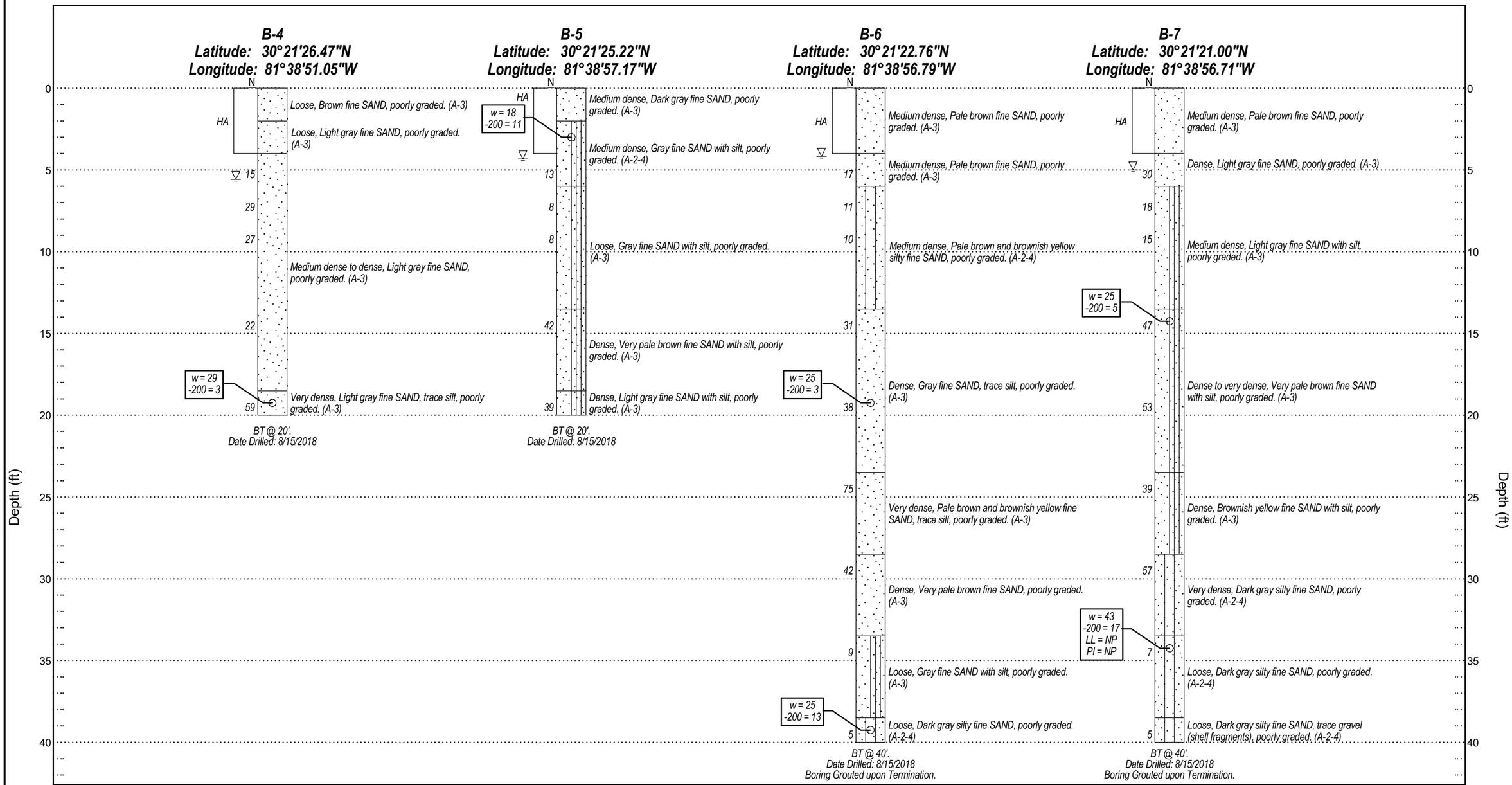
Mott MacDonald Florida, LLC

DATE:	MAE PROJECT NO.
5/2/2019	0103-0012

SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *JEA North Liberty Street Trunk Sewer Replacement*
Jacksonville, Florida

FIGURE NO. 3



Legend

Fine Sand

Fine Sand with Silt

Silty Fine Sand

N — Standard Penetration Resistance, Blows/Foot

BT — Boring Terminated at Depth Below Existing Grade

(A-3) — AASHTO Soil Classification System

▽ — Depth to Groundwater at Time of Drilling

LL — Liquid Limit

w — Natural Moisture Content (%)

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

PI — Plasticity Index

HA — Boring Advanced by hand-held bucket auger to 4 ft. due to possible underground utilities. Static Cone Penetrometer used to measure relative density, values shown on boring logs.

NP — Non-Plastic

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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8936 Western Way, Suite 12, Jacksonville, FL 32256

Mott MacDonald Florida, LLC

DATE:	MAE PROJECT NO.
5/2/2019	0103-0012

SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *JEA North Liberty Street Trunk Sewer Replacement*
Jacksonville, Florida

FIGURE NO. 4

B-8
Latitude: 30°21'15.05"N
Longitude: 81°38'56.77"W

N

HA

w = 26
-200 = 12

4 — Loose, Grayish brown fine SAND, poorly graded. (A-3)

18 — Very loose, Brown fine SAND, poorly graded. (A-3)

18 — Loose, Brown fine SAND with silt, poorly graded. (A-2-4)

23 — Medium dense, Light brown silty fine SAND, poorly graded. (A-2-4)

40 — Medium dense to dense, Gray fine SAND with silt, poorly graded. (A-3)

BT @ 20'.
Date Drilled: 8/16/2018

B-9
Latitude: 30°21'13.31"N
Longitude: 81°38'57.18"W

N

w = 23
-200 = 26
OC = 2.5

HA

24 — Loose, Dark brown silty fine SAND, trace organic fines and small root fragments, poorly graded. (A-2-4)

24 — Loose, Pale brown fine SAND with silt, poorly graded. (A-3)

w = 25
-200 = 8

24 — Medium dense to dense, Pale brown fine SAND with silt, poorly graded. (A-3)

30 — Medium dense, Dark gray fine SAND with silt, poorly graded. (A-3)

21 — Dense, Dark gray fine SAND with silt, poorly graded. (A-3)

26 — Loose, Dark gray clayey silty SAND, poorly graded. (A-2-6)

33 — Loose, Grayish brown fine SAND with silt, poorly graded. (A-2-4)

4

7

BT @ 40'.
Date Drilled: 8/16/2018
Boring Grouted upon Termination.

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40

Fine Sand
Fine Sand with Silt
Silty Fine Sand
Clayey Fine Sand

Legend

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(A-3) — AASHTO Soil Classification System
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
OC — Organic Content (%)
HA — Boring Advanced by hand-held bucket auger to 4 ft. due to possible underground utilities. Static Cone Penetrometer used to measure relative density, values shown on boring logs.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
TEN YEARS
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

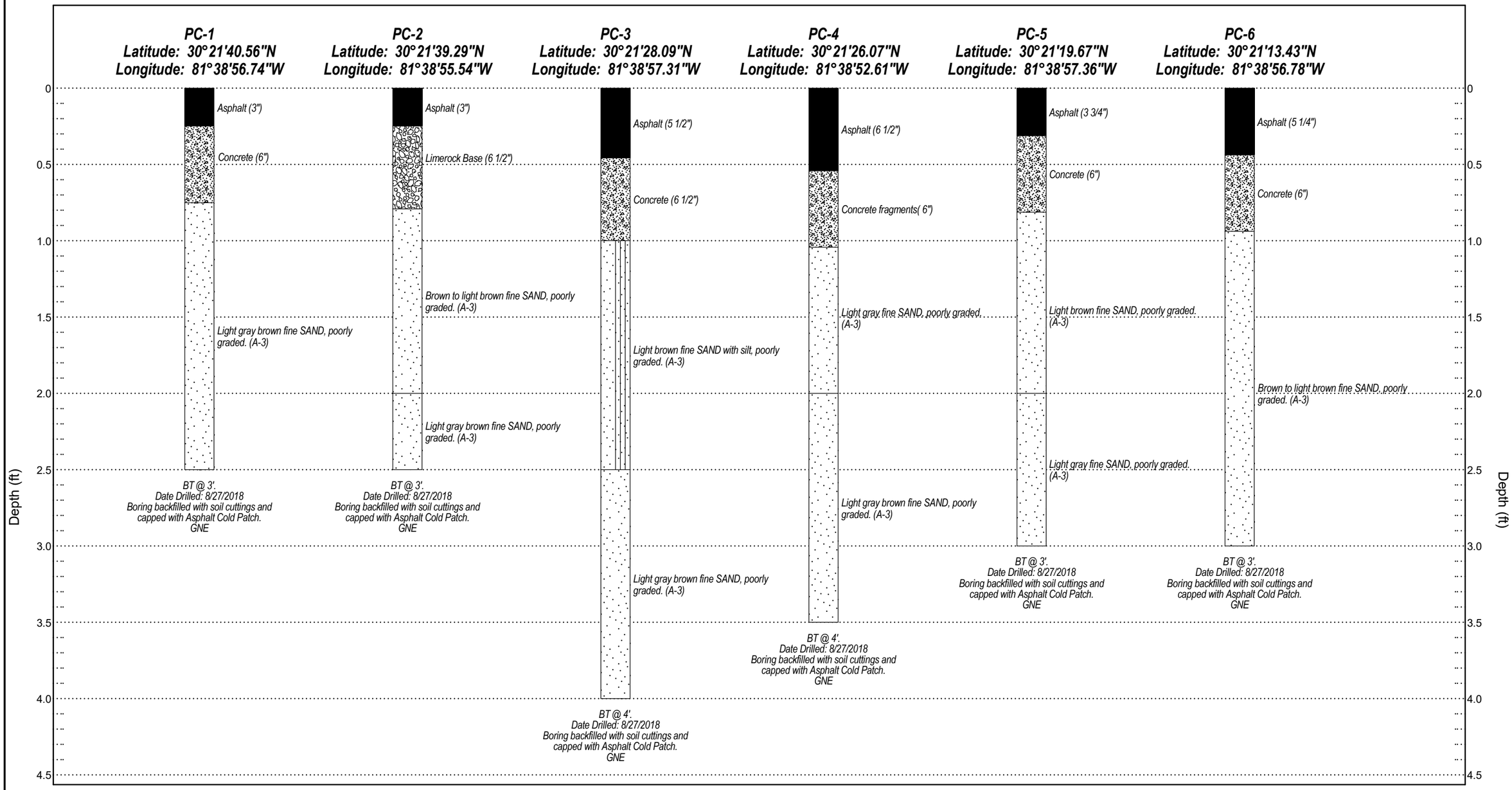
Mott MacDonald Florida, LLC

DATE:	MAE PROJECT NO.
5/2/2019	0103-0012

SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *JEA North Liberty Street Trunk Sewer Replacement Jacksonville, Florida*

FIGURE NO. 5



Legend

- Asphalt
- Concrete
- Fine Sand
- Fine Sand with Silt
- Limerock Base
- (A-3) AASHTO Soil Classification System
- BT Boring Terminated at Depth Below Existing Grade
- GNE Groundwater Level Not Encountered at Time of Drilling

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
Meskel & Associates Engineering
FL Certificate of Authorization No. 28142
8936 Western Way, Suite 12, Jacksonville, FL 32256

Mott MacDonald Florida, LLC

DATE:	MAE PROJECT NO.
5/2/2019	0103-0012

SHEET TITLE: *Pavement Core Profiles*

PROJECT NAME: *JEA North Liberty Street Trunk Sewer Replacement*
Jacksonville, Florida

FIGURE NO. 6

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

Meskel & Associates Engineering

BORING B-1

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'44.94"N **LONGITUDE** 81°38'59.58"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Light yellowish brown fine SAND with silt, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 30 24" - 36" : 23 36" - 48" : 18
	2	Loose, Light yellowish brown fine SAND with silt, trace gravel (rock fragments), poorly graded.	A-3											
5	3	Very loose, Pale brown fine SAND with silt, trace root fragments, poorly graded.	A-3		2 1 2 2	3								
	4	Very loose, Grayish brown fine SAND with silt, poorly graded. ▽	A-3		2 1 1 1	2								
10	5	Very loose, Dark grayish brown fine SAND with silt, poorly graded.	A-3		1/12" ↓ 1/12" ↓	1/12"	26	7						
15	6	Very dense, Gray fine SAND with silt, some gravel (rock fragments), poorly graded.	A-3		50/5"	50/5"								
		Bottom of borehole at 15 feet. Boring Terminated due to apparent obstruction (possible) sewer line. Moved 3' and encountered same condition. Boring moved to B-1A location at direction from JEA												

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 7 ft 9 in *▽ **AFTER DRILLING** ---

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BORING B-1A

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/16/18 **COMPLETED** 8/16/18 **LATITUDE** 30°21'43.64"N **LONGITUDE** 81°38'58.43"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Brownish yellow fine SAND with silt, poorly graded.	A-3		*		8	9						* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 30 24" - 36" : 22 36" - 48" : 9
	2													
5	3	▽ Loose, Very pale brown fine SAND, poorly graded.	A-3		1 2 2 3	4								
	4	Loose, Very pale brown and strong brown fine SAND with silt, poorly graded.	A-3		5 3 4 4	7								
10	5	Loose, Very pale brown fine SAND with silt, poorly graded.	A-3		3 4 3 4	7								
15	6	Dense, Yellowish brown silty fine SAND, poorly graded.	A-2-4		15 17 16	33								
20	7	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		10 8 10	18	26	8						

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 3 in *▽ **AFTER DRILLING** ---

(Continued Next Page)

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BORING B-1A

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Medium dense, Gray fine SAND with silt, poorly graded. *(continued)*	A-3											
25	8	Dense, Gray fine SAND with silt, poorly graded.	A-3		16 18 18	36								
30	9	Dense to medium dense, Light gray fine SAND with silt, poorly graded.	A-3		14 17 18	35								
35	10				7 10 17	27								
40	11	Loose, Dark gray silty fine SAND, poorly graded.	A-2-4		2 2 3	5	27	22						

Bottom of borehole at 40 feet.
Boring Grouted upon Termination.

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 3 in *▽ **AFTER DRILLING** ---

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Jacksonville, FL 32256
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BORING B-2

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'39.89"N **LONGITUDE** 81°38'54.85"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense to loose, Gray fine SAND with silt, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 30 24" - 36" : 15 36" - 48" : 5
	2 ▽													
5	3	Loose to very loose, Grayish brown fine SAND with silt, poorly graded.	A-3		3 2 2 2	4								
	4				2 1 1 1	2								
10	5	Loose, Dark grayish brown fine SAND with silt, few root fragments, poorly graded.	A-3		1 3 2 2	5								
15	6	Medium dense to dense, Light yellowish brown silty fine SAND, poorly graded.	A-2-4		12 12 15	27								
20	7				17 23 25	48								

Bottom of borehole at 20 feet.

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 8 in *▽ **AFTER DRILLING** ---

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BORING B-3

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'30.83"N **LONGITUDE** 81°38'57.10"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Very light gray fine SAND, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 16 12" - 24" : 27 24" - 36" : 30 36" - 48" : 30
	2	Medium dense, Light gray fine SAND, poorly graded.	A-3											
5	3	▽			4 6 8 8	14	26	2						
	4				6 7 7 9	14								
10	5	Medium dense, Light gray fine SAND, trace silt, poorly graded.	A-3		7 7 7 7	14								
15	6	Dense, Gray fine SAND with silt, poorly graded.	A-3		12 18 21	39								
20	7	Dense, Light gray fine SAND with silt, poorly graded.	A-3		11 21 30	51								

Bottom of borehole at 20 feet.

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 0 in *▽ **AFTER DRILLING** ---

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Meskel & Associates Engineering

BORING B-4

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'26.47"N **LONGITUDE** 81°38'51.05"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Brown fine SAND, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 25 12" - 24" : 16 24" - 36" : 12 36" - 48" : 20
	2	Loose, Light gray fine SAND, poorly graded.	A-3											
5	3	▽			5 7 8 7	15								
	4				9 13 16 13	29								
10	5				10 12 15 15	27								
		Medium dense to dense, Light gray fine SAND, poorly graded.	A-3											
15	6				13 12 10	22								
20	7	Very dense, Light gray fine SAND, trace silt, poorly graded.	A-3		15 26 33	59	29	3						

Bottom of borehole at 20 feet.

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 7 in *▽ **AFTER DRILLING** ---

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BORING B-5

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'25.22"N **LONGITUDE** 81°38'57.17"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Dark gray fine SAND, poorly graded.	A-3		*		18	11						* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 30 24" - 36" : 27 36" - 48" : 30
	2													
5	3	▽ Medium dense, Gray fine SAND with silt, poorly graded.	A-2-4		5 6 7	13								
	4				5 4 4 3	8								
10	5	Loose, Gray fine SAND with silt, poorly graded.	A-3		4 4 4 7	8								
	6				16 18 24	42								
15		Dense, Very pale brown fine SAND with silt, poorly graded.	A-3											
20	7	Dense, Light gray fine SAND with silt, poorly graded.	A-3		8 17 22	39								

Bottom of borehole at 20 feet.

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 4 in *▽ **AFTER DRILLING** ---

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8936 Western Way, Suite 12
Jacksonville, FL 32256
P: (904)519-6990 F: (904)519-6992

Meskel & Associates Engineering

BORING B-6

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'22.76"N **LONGITUDE** 81°38'56.79"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Pale brown fine SAND, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 30 24" - 36" : 30 36" - 48" : 30
	2													
5	3	▽ Medium dense, Pale brown fine SAND, poorly graded.	A-3		8 10 7 4	17								
	4				4 5 6 5	11								
10	5	Medium dense, Pale brown and brownish yellow silty fine SAND, poorly graded.	A-2-4		4 5 5 6	10								
15	6				15 18 13	31								
		Dense, Gray fine SAND, trace silt, poorly graded.	A-3											
20	7				11 17 21	38	25	3						

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 2 in *▽ **AFTER DRILLING** ---

(Continued Next Page)

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

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BORING B-6

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Dense, Gray fine SAND, trace silt, poorly graded. *(continued)*	A-3											
25	8	Very dense, Pale brown and brownish yellow fine SAND, trace silt, poorly graded.	A-3		24 34 41	75								
30	9	Dense, Very pale brown fine SAND, poorly graded.	A-3		13 19 23	42								
35	10	Loose, Gray fine SAND with silt, poorly graded.	A-3		13 6 3	9								
40	11	Loose, Dark gray silty fine SAND, poorly graded.	A-2-4		2 2 3	5	25	13						

Bottom of borehole at 40 feet.
Boring Grouted upon Termination.

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 2 in *▽ **AFTER DRILLING** ---

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

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BORING B-7

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/15/18 **COMPLETED** 8/15/18 **LATITUDE** 30°21'21.00"N **LONGITUDE** 81°38'56.71"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Pale brown fine SAND, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 27 24" - 36" : 28 36" - 48" : 30
	2													
5	3	▽ Dense, Light gray fine SAND, poorly graded.	A-3		8 14 16 15	30								
	4				6 9 9 9	18								
	5	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		7 7 8 8	15								
10														
	6				20 22 25	47	25	5						
15		Dense to very dense, Very pale brown fine SAND with silt, poorly graded.	A-3											
	7				16 23 30	53								
20														

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5.00ftn *▽ **END OF DRILLING** ---

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Jacksonville, FL 32256
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BORING B-7

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Dense to very dense, Very pale brown fine SAND with silt, poorly graded. *(continued)*	A-3											
25	8	Dense, Brownish yellow fine SAND with silt, poorly graded.	A-3		15 18 21	39								
30	9	Very dense, Dark gray silty fine SAND, poorly graded.	A-2-4		17 24 33	57								
35	10	Loose, Dark gray silty fine SAND, poorly graded.	A-2-4		7 4 3	7	43	17		NP	NP			
40	11	Loose, Dark gray silty fine SAND, trace gravel (shell fragments), poorly graded.	A-2-4		1 2 3	5								

Bottom of borehole at 40 feet.
Boring Grouted upon Termination.

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 5 ft 0 in ***AFTER DRILLING** ---

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8936 Western Way, Suite 12
Jacksonville, FL 32256
P: (904)519-6990 F: (904)519-6992

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BORING B-8

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/16/18 **COMPLETED** 8/16/18 **LATITUDE** 30°21'15.05"N **LONGITUDE** 81°38'56.77"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Grayish brown fine SAND, poorly graded.	A-3		*									* Hand Cone Penetrometer 0" - 12" : 11 12" - 24" : 13 24" - 36" : 8 36" - 48" : 6
	2	Very loose, Brown fine SAND, poorly graded.	A-3											
5	3	▽ Loose, Brown fine SAND with silt, poorly graded.	A-2-4		2 2 2 3	4	26	12						
	4	Medium dense, Light brown silty fine SAND, poorly graded.	A-2-4		5 8 10 10	18								
10	5				6 9 9 10	18								
15	6	Medium dense to dense, Gray fine SAND with silt, poorly graded.	A-3		10 12 11	23								
20	7				11 19 21	40								

Bottom of borehole at 20 feet.

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **AFTER DRILLING** ---

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8936 Western Way, Suite 12
Jacksonville, FL 32256
P: (904)519-6990 F: (904)519-6992

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BORING B-9

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/16/18 **COMPLETED** 8/16/18 **LATITUDE** 30°21'13.31"N **LONGITUDE** 81°38'57.18"W

DRILLING CONTRACTOR Independent Drilling, Inc. **DRILLING METHOD** Standard Penetration Test

LOGGED BY B.Yocum **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Safety

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Dark brown silty fine SAND, trace organic fines and small root fragments, poorly graded.	A-2-4		*		23	26	2.5					* Hand Cone Penetrometer 0" - 12" : 30 12" - 24" : 15 24" - 36" : 19 36" - 48" : 6
	2	Loose, Pale brown fine SAND with silt, poorly graded. ▽	A-3											
5	3				9 13 11 7	24								
	4				8 11 13 11	24								
10	5				9 12 12 10	24	25	8						
		Medium dense to dense, Pale brown fine SAND with silt, poorly graded.	A-3											
15	6				11 13 17	30								
20	7	Medium dense, Dark gray fine SAND with silt, poorly graded.	A-3		14 8 13	21								

NOTES *Boring Advanced by hand-held bucket auger to 4 feet due to possible underground utilities. Soil Relative density estimated from hand held static cone penetrometer measurements.*

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 0 in *▽ **AFTER DRILLING** ---

(Continued Next Page)

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Jacksonville, FL 32256
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BORING B-9

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
25	8	Medium dense, Dark gray fine SAND with silt, poorly graded. *(continued)*	A-3		12 12 14	26								
30	9	Dense, Dark gray fine SAND with silt, poorly graded.	A-3		9 16 17	33								
35	10	Loose, Dark gray clayey silty SAND, poorly graded.	A-2-6		2 2 2	4								
40		Loose, Grayish brown fine SAND with silt, poorly graded.	A-2-4		4 2 5	7								

Bottom of borehole at 40 feet.
Boring Grouted upon Termination.

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 4 ft 0 in ***AFTER DRILLING** ---

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

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BORING PC-1

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'40.56"N **LONGITUDE** 81°38'56.74"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (3")												
		Concrete (6")												
	1	Light gray brown fine SAND, poorly graded.	A-3											
2.5	2													
		Bottom of borehole at 2.5 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

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

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BORING PC-2

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'39.29"N **LONGITUDE** 81°38'55.54"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (3")												
		Limerock Base (6 1/2")												
	1	Brown to light brown fine SAND, poorly graded.	A-3											
	2													
2.5	3	Light gray brown fine SAND, poorly graded.	A-3											
		Bottom of borehole at 2.5 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

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

Meskel & Associates Engineering

BORING PC-3

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'28.09"N **LONGITUDE** 81°38'57.31"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (5 1/2")												
		Concrete (6 1/2")												
	1	Light brown fine SAND with silt, poorly graded.	A-3											
2.5	2	Light gray brown fine SAND, poorly graded.	A-3											
		Bottom of borehole at 4 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

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

Meskel & Associates Engineering

BORING PC-4

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'26.07"N **LONGITUDE** 81°38'52.61"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (6 1/2")												
		Concrete fragments(6")												
	1	Light gray fine SAND, poorly graded.	A-3											
2.5	2	Light gray brown fine SAND, poorly graded.	A-3											
	3													
		Bottom of borehole at 3.5 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

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

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BORING PC-5

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'19.67"N **LONGITUDE** 81°38'57.36"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (3 3/4")												
		Concrete (6")												
	1	Light brown fine SAND, poorly graded.	A-3											
2.5	2	Light gray fine SAND, poorly graded.	A-3											
		Bottom of borehole at 3 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

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Jacksonville, FL 32256
P: (904)519-6990 F: (904)519-6992

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BORING PC-6

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

DATE STARTED 8/27/18 **COMPLETED** 8/27/18 **LATITUDE** 30°21'13.43"N **LONGITUDE** 81°38'56.78"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Core/Hand Auger

LOGGED BY P.R.Young **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0.0		Asphalt (5 1/4")												
		Concrete (6")												
	1	Brown to light brown fine SAND, poorly graded.	A-3											
2.5	2													
		Bottom of borehole at 3 feet. Boring backfilled with soil cuttings and capped with Asphalt Cold Patch.												

NOTES GNE-Groundwater Level Not Encountered at Time of Drilling.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) are performed in general accordance with the latest revision of ASTM D1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." In some cases, the borings are advanced manually from the ground surface using a hand-held bucket auger to a depth of approximately 5 feet if there are possible shallow utility conflicts. Otherwise, the borings are advanced using rotary drilling techniques. A split-barrel sampler is inserted to the bottom of the borehole at each sampling interval. The sampler is driven 18 to 24 inches into the soil using a 140-pound hammer falling an average height 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 our engineer in order to verify the field descriptions.

Once the boring is complete and the groundwater level is measured, the borehole is backfilled with soil, or it is backfilled from bottom to top with a lean cementitious grout.

KEY TO BORING LOGS – AASHTO

Soil Classification

Soil classification of samples obtained at the boring locations is based on the American Association of State Highway and Transportation Officials (AASHTO) Classification System. 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”.
(A-3)	AASHTO 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%
Organic Soil	5% to 20%
Highly Organic Soil (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 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

- Using Safety Hammer

AASHTO Soil Classification System
(from AASHTO M 145 or ASTM D 3282)

General Classification	***Granular Materials*** *(35% or less passing the 0.075 mm sieve)*							***Silt-Clay Materials*** *(>35% passing the 0.075 mm sieve)*			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6*
Sieve Analysis, % passing:											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40):											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General ***local*** rating as a subgrade	excellent to good			fair to poor							

* Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

** *Northeast Florida*

Appendix B

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

Meskel & Associates Engineering

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO. 0103-0012

PROJECT NAME JEA North Liberty Street Trunk Sewer Replacement **DATE.** 9/20/2018

PROJECT LOCATION Jacksonville, Florida **CLIENT** Mott MacDonald Florida, LLC

Borehole	Sample No.	Approx. Depth (ft)	%<#200 Sieve	Water Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	AASHTO Classification	Comments
B-1	5	9	7	26	---	---	---	---	A-3	
B-1A	1	1	9	8	---	---	---	---	A-3	
B-1A	7	19	8	26	---	---	---	---	A-3	
B-1A	11	39	22	27	---	---	---	---	A-2-4	
B-3	3	5	2	26	---	---	---	---	A-3	
B-4	7	19	3	29	---	---	---	---	A-3	
B-5	2	3	11	18	---	---	---	---	A-2-4	
B-6	7	19	3	25	---	---	---	---	A-3	
B-6	11	39	13	25	---	---	---	---	A-2-4	
B-7	6	19	5	25	---	NP	NP	NP	A-3	
B-7	10	34	17	43	---	---	---	---	A-2-4	
B-8	3	5	12	26	---	---	---	---	A-2-4	
B-9	1	1	26	26	2.5	---	---	---	A-2-4	
B-9	10	34	8	25	---	---	---	---	A-3	

Note: "---" Untested Parameter

Summary of Corrosion Series Test Results
North Liberty Street Trunk Sewer Replacement
Duval County, Florida
MAE Project No.: 0103-0012

Boring No.	GPS Coordinates Latitude/Longitude		Approximate Test Depth (ft)	pH	Resistivity (ohm-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification	
								Steel Substructure	Concrete Substructure
B-6	30° 21'22.76" N	81° 38'56.79" W	2 to 4	8.25	51,000	15	3.0	Slightly Aggressive	Slightly Aggressive
B-9	30° 21'13.31" N	81° 38'57.18" W	2 to 4	8.00	28,100	0	3.0	Slightly Aggressive	Slightly Aggressive

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.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ration 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.

Appendix C

Table of Recommended Soil Design Parameters
JEA North Liberty Street Trunk Sewer Replacement
MAE Project No. 0103-0012

Boring: B-1A

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o)[2]	Active (K_a)[3]	Passive (K_p)[4]
A-3	0	13.5	6	43	29	0	0.52	0.35	2.9
A-2-4	13.5	18.5	33	59	36	0	0.41	0.26	3.9
A-3	18.5	23.5	18	51	33	0	0.46	0.29	3.4
A-3	23.5	23.5	33	59	36	0	0.41	0.26	3.9
A-2-4	38.5	40	5	42	28	0	0.53	0.36	2.8

Notes:

1. The groundwater level was assumed to be at the existing ground surface for design purposes.
2. $K_o = 1 - \sin(\phi)$
3. $K_a = \tan^2(45 - \phi / 2)$
4. $K_p = \tan^2(45 + \phi / 2)$

Table of Recommended Soil Design Parameters
JEA North Liberty Street Trunk Sewer Replacement
MAE Project No. 0103-0012

Borings: B-6, B-7

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o) [2]	Active (K_a) [3]	Passive (K_p) [4]
A-3	0	6	20	53	33	0	0.46	0.29	3.4
A-3, A-2-4	6	13.5	14	49	32	0	0.47	0.31	3.3
A-3, A-2-4	13.5	33.5	43	63	38	0	0.38	0.24	4.2
A-3, A-2-4	33.5	40	7	44	29	0	0.52	0.35	2.9

Notes:

1. The groundwater level was assumed to be at the existing ground surface for design purposes.
2. $K_o = 1 - \sin(\phi)$
3. $K_a = \tan^2(45 - \phi / 2)$
4. $K_p = \tan^2(45 + \phi / 2)$

Table of Recommended Soil Design Parameters
JEA North Liberty Street Trunk Sewer Replacement
MAE Project No. 0103-0012

Boring: B-9

Soil Type	Typical Depth (ft)		Average N-Value	Effective Unit Weight (pcf) [1]	Friction Angle, ϕ (Degrees)	Cohesion (psf)	Recommended Earth Pressure Coefficients		
	From	To					At Rest (K_o) [2]	Active (K_a) [3]	Passive (K_p) [4]
A-2-4, A-3	0	5	10	48	30	0	0.50	0.33	3.0
A-3	5	18.5	30	58	35	0	0.43	0.27	3.7
A-3	18.5	28.5	24	55	34	0	0.44	0.28	3.5
A-3	28.5	33.5	33	59	36	0	0.41	0.26	3.9
A-2-6	33.5	38.5	4	41	28	0	0.53	0.36	2.8
A-2-4	38.5	40	7	44	29	0	0.52	0.35	2.9

Notes:

1. The groundwater level was assumed to be at the existing ground surface for design purposes.
2. $K_o = 1 - \sin(\phi)$
3. $K_a = \tan^2(45 - \phi / 2)$
4. $K_p = \tan^2(45 + \phi / 2)$

Appendix D

Core 1

Core 2

Core 3

Core 4

Core 5

Core 6