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Geotechnical Exploration and Evaluation Report

JEA Bernita Street Force Main Replacement
Jacksonville, Florida

CSI Geo Project No.: 71-18-329-05
Client Project No.: 95205-438-17
Contract No.: JEA #153003

Prepared by

CSI Geo, Inc.
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Prepared for

Jones Edmunds & Associates, Inc.

March 22, 2018

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March 22, 2018

Mr. Harold R. Bridges, PhD, PE
Jones Edmunds & Associates, Inc.
8657 Baypine Road, Suite 300
Jacksonville, FL 32256-8634

RE: JEA Bernita Street Force Main Replacement
Jacksonville, Florida

Subject: Geotechnical Exploration and Evaluation Report
CSI Geo Project No.: 71-18-329-05
Client Project No.: 95205-438-17
Contract No.: JEA #153003

Dear Mr. Bridges:

CSI Geo, Inc. has performed the authorized geotechnical exploration and laboratory testing program for the proposed JEA Bernita Street force main replacement in Jacksonville, Florida. This geotechnical exploration and evaluation report presents our understanding of the subsurface conditions along with our engineering evaluation and recommendations.

We have enjoyed working with you on this project and look forward to working with you on future projects. If you have any questions concerning this report, please contact our office.

Sincerely,

CSI Geo, Inc.

Nader Amer, Ph.D
Geotechnical Engineer

Digitally signed by Bruce Khosrozadeh
Date: 2018.03.22 12:51:08-04'00'

Bruce Khosrozadeh, P.E.
Senior Geotechnical and Materials Engineer
Registered, Florida No. 45273

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1.0 PROJECT INFORMATION

1.1 General Project Information

The purpose of this geotechnical exploration program was to develop information concerning the subsurface conditions in order to evaluate the site with respect to the proposed force main pipe replacement along Bernita Street in Jacksonville, Florida. This report describes the field and laboratory testing activities performed and presents the findings. The subsurface soil and groundwater conditions are presented in this report along with general site preparation recommendations and soil parameters for the proposed construction.

Information regarding this project was provided to CSI Geo, Inc. (CSI Geo) by Mr. Harold Bridges, P.E. of Jones Edmunds & Associates, Inc. (Jones Edmunds), which consisted of the following:

Document: Bernita Street Force Main Map, Exhibit 1, Sheet S-02
Dated: January 25, 2018
Provided By: Jones Edmunds

1.2 Project Description and Existing Conditions

We understand that the existing 18-inch diameter force main will be replaced with a new 20-inch diameter PVC pipe force main along Bernita Street, and along Harris Avenue from Macy Avenue to the Monterey Wastewater Treatment Plant (WWTP). A site location map is included in the **Appendix**. We understand that the replacement force main will be installed by open-cut method of construction. The existing site conditions within the project limits consists of two-lane asphalt paved roadway with grass shoulders, and commercial and residential buildings on both sides of the roadways. The topography along the pipe alignment is rapidly sloping downward from north to south along Bernita and gently sloping to flat along Harris Avenue.

2.0 GEOTECHNICAL EXPLORATION

2.1 Field Exploration

The project was explored by means of a total of six (6) auger borings (A-1 through A-6) drilled to depths of 15 feet below the existing ground surface. All auger borings were performed within the existing pavement. The pavement was cored and the existing pavement system thicknesses were measured and recorded.

The boring locations were spaced at approximately 500 feet along the proposed pipeline route, as per JEA requirements, and located in the field by personnel from CSI Geo. Soil samples collected were visually classified in the field and then transported to our laboratory for re-classification and testing. Representative soil samples obtained during our field exploration program were visually classified using the American Association of State Highway and Transportation Officials (AASHTO) Soil Classification System. The approximate locations of the soil borings are shown on the Field Exploration Plan sheets included in the **Appendix**.

2.2 Laboratory Testing

Quantitative laboratory testing was performed on representative soil samples to better define their composition. Laboratory tests performed were percent fines and natural moisture content. A Summary of Laboratory Test Results, and Field and Laboratory Test Procedures are included in the **Appendix**.

3.0 GENERAL SUBSURFACE CONDITIONS

3.1 General

An illustrated representation of the subsurface conditions encountered in the proposed construction areas are shown on the Report of Core Borings sheet presented in the **Appendix**. The Report of Core Borings and the soil conditions outlined below highlight the major subsurface stratification. The Report of Core Borings in the **Appendix** should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the Report of Core Borings, it should be understood that soil conditions may vary outside of the explored area.

3.2 Soil Conditions

Review of test borings A-1 through A-6 indicates that the force main alignment is generally underlain by sands and slightly silty sands (A-3, AASHTO) and silty sands (A-2-4) until the boring termination depth of 15 feet below the existing ground surface.

3.3 Groundwater Conditions

The groundwater level was measured and recorded as encountered at the time of drilling. The depths of the groundwater level and estimated seasonal high water level at the test locations are marked on the Report of Core Borings sheets presented in the **Appendix**. The depth of groundwater level measured at the time of drilling ranged from 6 to 12 feet below the existing ground surface. The estimated seasonal high groundwater level for the borings performed ranged from 4 to 8 feet below the existing ground surface. Determination of the estimated seasonal high groundwater table was made using the methodology described by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS). In sandy soils the method involves examining soil cuttings from the borings for subtle changes in root content and soil coloration. These subtle changes are indicators of the highest level the groundwater level has been for a prolonged period.

Groundwater was not encountered at the time of drilling at auger boring A-1. It should be anticipated that the groundwater level will fluctuate due to seasonal climate variations, surface water runoff patterns, construction operations, tidal effects, and other related factors.

3.4 Existing Pavement System Thickness

Pavement cores were performed at each of the auger borings locations to determine the thickness of the existing pavement system. Generally, the existing pavement system was found to consist of 2 to 7 ½ inches of asphalt pavement underlain by 4 inches of limerock base course. Limerock base was not encountered in the pavement cores at auger borings A-1, A-2 and A-4. The results of the pavement cores are included in the **Appendix**.

4.0 DESIGN RECOMMENDATIONS

4.1 General

Our geotechnical evaluation of the site and the subsurface conditions is based on our understanding of the proposed project, our observations, and results of field and laboratory testing. The recommendations provided in this report present construction methods and techniques that are appropriate for the proposed construction. If the project location is changed or if field conditions encountered during construction are different from those presented in this report, the information should be provided to CSI Geo for evaluation. We also recommend that CSI Geo be given the opportunity to review the design plans and specifications to ensure that our recommendations have been properly included and implemented.

In general, we consider the subsurface soil conditions at the site to be favorable for support of the proposed pipe replacement over a properly prepared and compacted subgrade, provided that the site preparation and earthwork construction recommendations in this report are performed.

4.2 Open-Cut Excavations

Review of test borings A-1 through A-6 indicates that the force main alignment is generally underlain by sands and slightly silty sands (A-3) and silty sands (A-2-4). The A-3 type soils are considered select material. Silty sands (A-2-4) should be treated as select material, however, they may contain excess moisture and may be difficult to dry and to compact. If clayey sands (A-2-6) and sandy clays (A-6/A-7) are encountered during construction, they should be considered as plastic materials, and should be excavated to a minimum depth of one foot below the design invert elevations and replaced with suitable A-3 fill material. Organic soils (A-8) should be considered as muck and not suitable for use as backfill. If A-8 materials are encountered beneath the force main or other proposed structures they should be removed in their entirety.

We anticipate that the buried pipe lines will exert little downward pressure on the subgrade soils. In areas where the surrounding groundwater level is above the pipe invert elevation, the line should be designed to resist lateral earth pressures and hydrostatic uplift pressures appropriate to its depth below the existing grade and the seasonal high water level.

5.0 SITE PREPARATION & EARTHWORK RECOMMENDATIONS

5.1 Existing Utilities

The locations of existing utilities should be established prior to construction. Provisions should be made to relocate utilities interfering with the proposed alignments and construction, as needed. Underground pipes that are not operational should be either removed or plugged otherwise they may become conduits for subsurface erosion and cause settlements.

5.2 Temporary Groundwater Control

Groundwater level was encountered at the time of drilling at a depth ranging from 6 to 12 feet below the existing ground surface, and was not encountered in auger boring A-1. The groundwater level should be maintained at a minimum of two feet below the subgrade of the proposed inverts. Dewatering may be achieved by conventional open pumping using ditches graded to a sump or by using a well point system. Dewatering should continue until sufficient weight is placed over the proposed pipes to resist uplift.

5.3 Excavation Protection

All excavations should meet OSHA Excavation Standard Subpart P regulations for Type C soils. If needed, trench box or braced sheet pile structures may be used where deep installation is required. The soil support system should be designed by a Florida registered Professional Engineer.

5.4 Pipe Backfill and Compaction of Pipe Backfill

The backfill material within the excavation should be placed in thin loose lifts not exceeding 6 or 12 inches in thickness. The backfill material should be compacted by the use of hand-operated equipment. The backfill material should be granular (A-3) fill with less than 10 percent material passing the no. 200 mesh sieve and containing less than 3 percent organic matter. The backfill material should be compacted to a minimum density of 98% or 95% of maximum dry density obtained from the Modified Proctor compaction test (ASTM D1557). The moisture content during compaction should be maintained within $\pm$ 3 percent of the optimum moisture content as obtained from the Modified Proctor compaction test.

Hand held compaction equipment should be used for the backfill placed around the pipe and to a height of 2 feet above the pipe. Heavier equipment may be used on the remaining backfill lifts placed above the 2 feet above the pipe. However, care should be taken not to damage the pipe below. The pipe should be designed to withstand the anticipated dead (overburden) and live loads.

6.0 REPORT LIMITATIONS

The subsurface exploration program including our evaluation and recommendations was performed in general accordance of accepted geotechnical engineering principles and standard practices. CSI Geo is not responsible for any independent conclusions, opinions, or interpretations made by others based on the data presented in this report.

This report does not reflect any variations that may occur adjacent or between soil borings. The discovery of any site or subsurface condition during construction that deviates from the findings and data as presented in this report should be reported to CSI Geo for evaluation. If the project location is changed, our office should be contacted so our recommendations can be re-evaluated. We recommend that CSI Geo be given the opportunity to review the final design drawings and specifications to ensure that our recommendations are properly included and implemented.

APPENDIX

Site Location Map

Field Exploration Plan

Report of Core Borings

Summary of Laboratory Testing Results

Existing Pavement System Thickness

Key to Soil Classification

Field and Laboratory Test Procedures

Site Location Map

CSI GEO, INC.
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JACKSONVILLE, FLORIDA 32246

SITE LOCATION MAP

JEA BERNITA STREET FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

Field Exploration Plan

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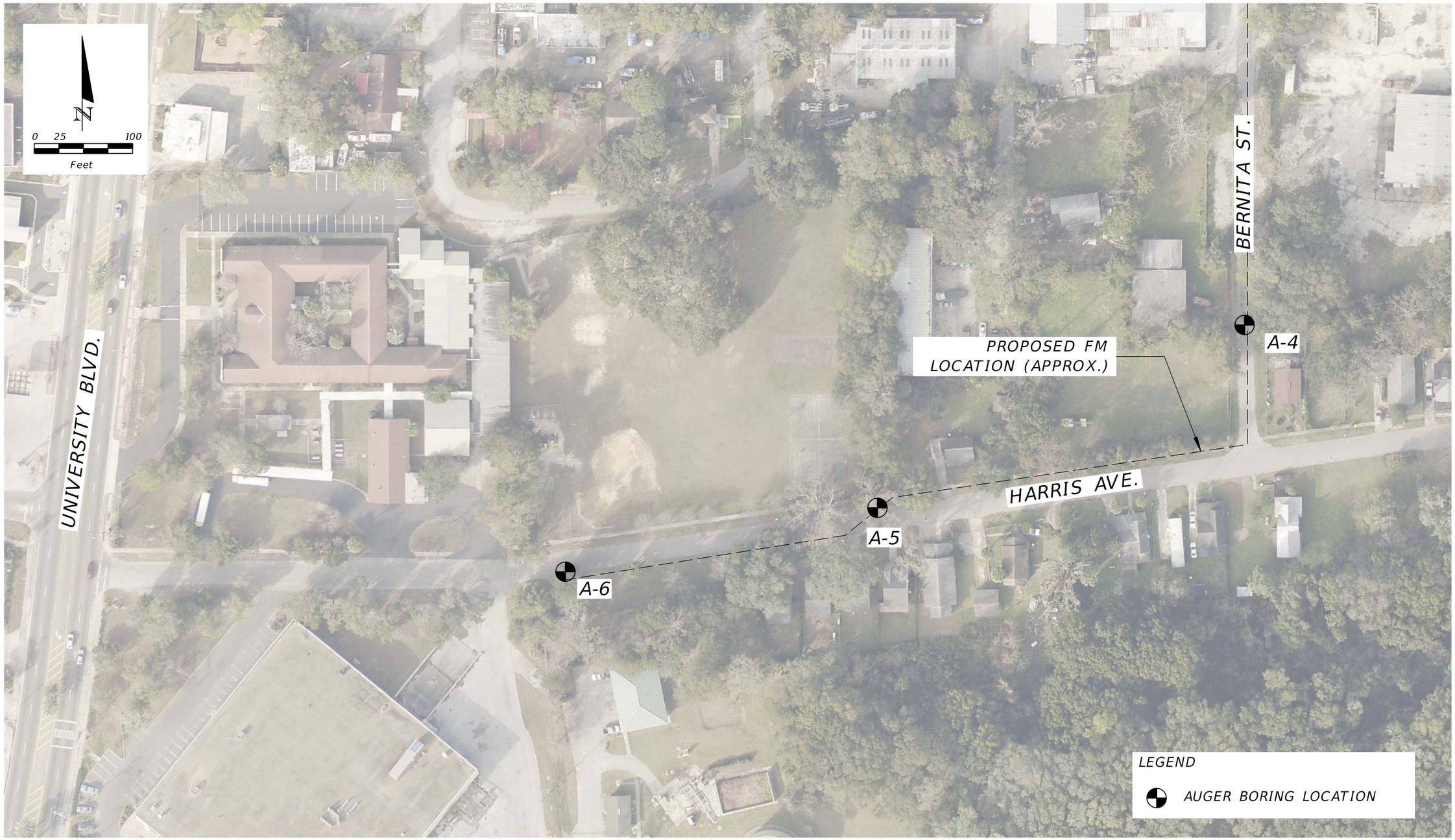
CONSTRUCTION MATERIAL TESTING
CONSTRUCTION ENGINEERING INSPECTION

FIELD EXPLORATION PLAN

JEA BERNITA STREET FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA



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CONSTRUCTION MATERIAL TESTING
CONSTRUCTION ENGINEERING INSPECTION

FIELD EXPLORATION PLAN

JEA BERNITA STREET FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

Report of Core Borings

LEGEND

FINE SAND;
SLIGHTLY SILTY FINE SAND (A–3)

SILTY FINE SAND (A–2–4)

ASPHALT

LIMEROCK

(A–3) AASHTO SOIL CLASSIFICATION SYSTEM

ESTIMATED SEASONAL HIGH GROUND WATER LEVEL

GROUND WATER LEVEL AT TIME OF DRILLING

A.T. AUGER TERMINATION

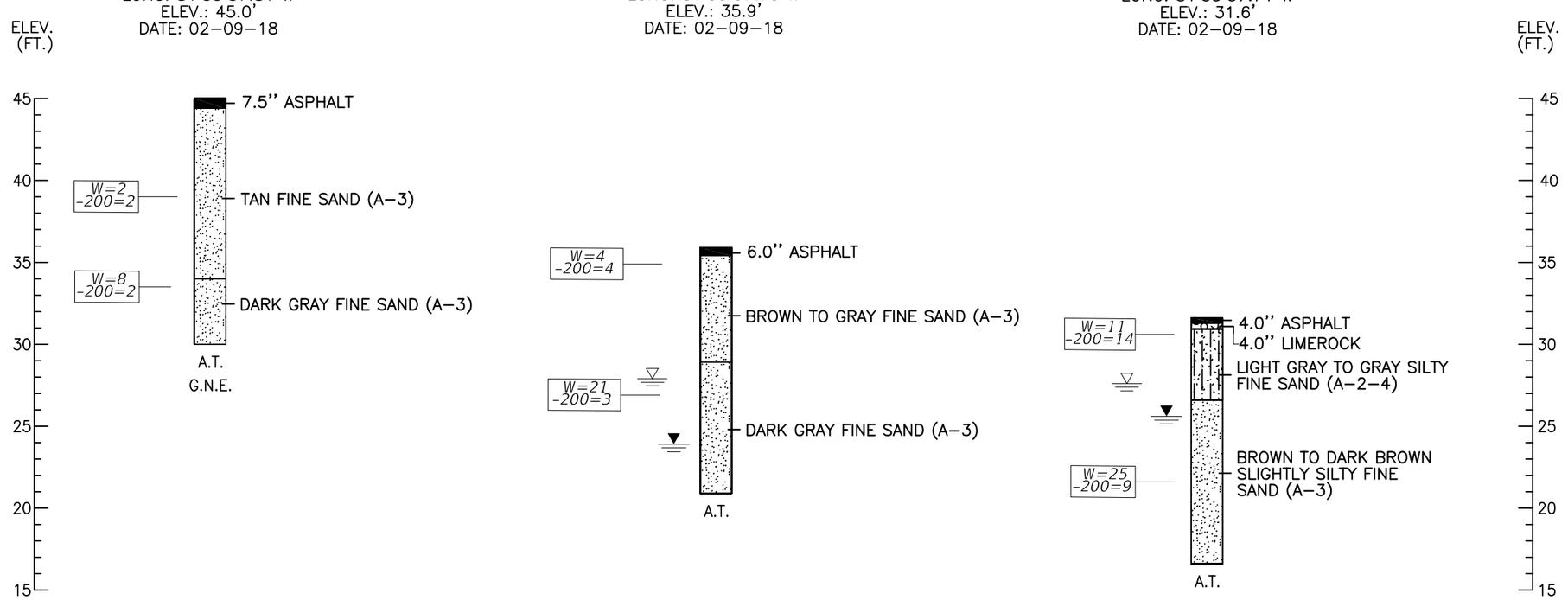
G.N.E. GROUND WATER NOT ENCOUNTERED AT THE TIME OF DRILLING

W
–200

NATURAL MOISTURE CONTENT (%)
FINES PASSING NO. 200 SIEVE (%)

NOTES:

LAYER BOUNDARIES ARE APPROXIMATE AND MAY VARY BETWEEN OR AWAY FROM BORING LOCATIONS.



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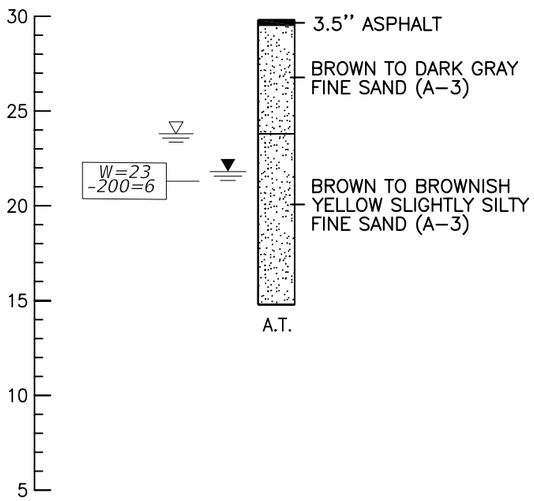
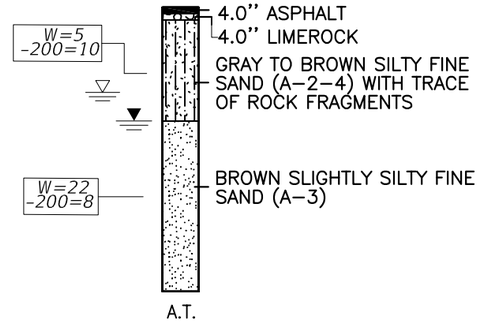
REPORT OF CORE BORINGS

JEA BERNITA STREET FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

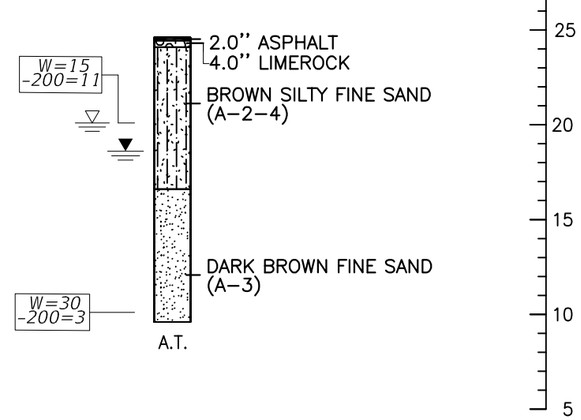
A–4
LAT: 30°19'55.54"N
LONG: 81°35'57.75"W
ELEV.: 29.8'
DATE: 02–09–18



A–5
LAT: 30°19'53.70"N
LONG: 81°36'2.55"W
ELEV.: 26.1'
DATE: 02–09–18



A–6
LAT: 30°19'53.07"N
LONG: 81°36'05.86"W
ELEV.: 24.6'
DATE: 02–09–18



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CONSTRUCTION ENGINEERING INSPECTION

REPORT OF CORE BORINGS

JEA BERNITA STREET FORCE MAIN REPLACEMENT
JACKSONVILLE, FLORIDA

Summary of Laboratory Testing Results

SUMMARY OF LABORATORY TEST RESULTS

JEA Bernita Street Force Main Replacement
Jacksonville, Florida

Boring No.	Sample No.	Approximate Depth (ft)	Natural Moisture Content (%)	Organic Content (%)	Percent Passing Sieve Size (%)						Atterberg Limits		AASHTO Soil Classification Symbol
					#4	#10	#40	#60	#100	#200	LL	PI	
A-1	3	5.0 - 7.0	2							2			A-3
A-1	5	11.0 - 12.0	8							2			A-3
A-2	1	0.0 - 2.0	4							4			A-3
A-2	3	8.0 - 10.0	21							3			A-3
A-3	2	0.5 - 1.5	11							14			A-2-4
A-3	6	9.0 - 11.0	25							9			A-3
A-4	5	7.0 - 10.0	23							6			A-3
A-5	2	2.0 - 5.0	5							10			A-2-4
A-5	5	8.0 - 12.0	22							8			A-3
A-6	3	3.0 - 6.0	15							11			A-2-4
A-6	5	14.0 - 15.0	30							3			A-3

Existing Pavement System Thickness

EXISTING PAVEMENT SYSTEM THICKNESS

JEA Bernita Street Force Main Replacement
Jacksonville, Florida

Road Name	Core No.	Location		Material Layer Thickness		Description & AASHTO Classification of Soil Beneath Pavement / Base
		Lat.	Long.	Asphalt (in)	Limerock (in)	
Bernita Street & Macy Avenue	A-1	30° 20' 9.75" N	81° 35' 57.84" W	7 1/2	-	Tan Fine SAND (A-3)
Bernita Street & Commerce Street	A-2	30° 20' 4.51" N	81° 35' 57.81" W	6	-	Brown to Gray Fine SAND (A-3)
Bernita Street & Arlington Road	A-3	30° 20' 0.03" N	81° 35' 57.76" W	4	4	Light Gray to Gray Silty Fine SAND (A-2-4)
Bernita Street & Harris Avenue	A-4	30° 19' 55.61" N	81° 35' 57.77" W	3 1/2	-	Brown to Dark Gray Fine SAND (A-3)
Harris Avenue	A-5	30° 19' 53.78" N	81° 36' 2.07" W	4	4	Gray to Brown Silty Fine SAND (A-2-4)
Harris Avenue	A-6	30° 19' 53.17" N	81° 36' 5.74" W	2	4	Brown Silty Fine SAND (A-2-4)

Key to Soil Classification

KEY TO SOIL CLASSIFICATION

Particle Size Identification (Unified Soil Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	Coarse - 3/4 to 3 inches in diameter
	Fine - 4.76 mm to 3/4 inch in diameter
Sand:	Coarse - 2.0 mm to 4.76 mm in diameter
	Medium - 0.42 mm to 2.0 mm in diameter
	Fine - 0.074 mm to 0.42 mm in diameter

Modifiers

These modifiers provide our estimate of the amount of fines (silt or clay size particles) in soil samples.

Approximate Fines Content	Modifiers
5% Fines 12%	Slightly silty or slightly clayey
12% Fines 30%	Silty or clayey
30% Fines 50%	Very silty or very clayey

These modifiers provide our estimate of shell, rock fragments, or roots in the soil sample.

Approximate Content, By Weight	Modifiers
< 5%	Trace
5% to 10%	Few
15% to 25%	Little
30% to 45%	Some
50% to 100%	Mostly

These modifiers provide our estimate of organic content in the soil sample.

Organic Content	Modifiers
1% to 3%	Trace
3% to 5%	Slightly Organic
5% to 20%	Organic
20% to 75%	Highly Organic (Muck)
> 75%	Peat

Field and Laboratory Test Procedures

FIELD AND LABORATORY TEST PROCEDURES

FIELD TEST PROCEDURES

Auger Borings – The auger borings were advanced by the use of a truck mounted auger drill rig. The soils encountered were identified in the field from the cuttings brought to the surface by the augering process. Representative soil samples were placed in glass jars and transported to our laboratory where they were examined by a geotechnical engineer to confirm field classifications.

LABORATORY TEST PROCEDURES

Percent Fines Content – To determine the percentage of soils finer than No. 200 sieve, the dried samples were washed over a 200 mesh sieve. The material retained on the sieve was oven dried and then weighed and compared with the unwashed dry weight in order to determine the weight of the fines. The percentage of fines in the soil sample was then determined as the percentage of weight of fines in the sample to the weight of the unwashed sample. This test was conducted in accordance with ASTM D1140.

Natural Moisture Content – The water content is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the solid particles. This test was conducted in the general accordance with ASTM D2216.