FLORIDA INLAND NAVIGATION DISTRICT
DREDGED MATERIAL MANAGEMENT AREA DU-9 EXPANSION
ST. JOHNS COUNTY, FLORIDA

APPENDIX D
Geotechnical Information

FLORIDA INLAND NAVIGATION DISTRICT
DREDGED MATERIAL MANAGEMENT AREA DU-9 EXPANSION
ST. JOHNS COUNTY, FLORIDA

APPENDIX D
1999 Report of Geotechnical Exploration; DMMA DU-9; Dee Dot Ranch Property; St. Johns County, Florida; E&A Project No. 99-1018

Note: All information provided in these reports are representative of the soils at the date when the samples were collected. The data do not reflect any variations that may occur adjacent to or between the soil borings. The material taken from these core borings is not available for inspection.

REPORT OF
GEOTECHNICAL EXPLORATION
DMMA DU-9
DEE DOT RANCH PROPERTY
ST. JOHNS COUNTY, FLORIDA
E&A PROJECT NO. 99-1018

for

TAYLOR ENGINEERING, INC.

by

Ellis & Associates, Inc.
7064 Davis Creek Road
Jacksonville, Florida

March 10, 1999

7064 DAVIS CREEK ROAD
JACKSONVILLE, FLORIDA 32256
PHONE: 904/880-0960
FAX: 904/880-0970

Ellis & Associates inc.

March 10, 1999

Taylor Engineering, Inc.
9000 Cypress Green Drive, Suite 200
Jacksonville, Florida 32256

Attention: Mr. Michael Cochrane, P.E.

Subject: Report of Geotechnical Exploration
DMMA DU-9, Dee Dot Ranch Property
St. Johns County, Florida
E&A Project No. 99-1018

Dear Mr. Cochrane:

As requested by you, Ellis & Associates, Inc. has completed a geotechnical exploration for the subject project. This report briefly describes the field exploration and presents the data obtained.

Project/Site Information

The site for the subject project is located within the Dee Dot Ranch property located south of J. Turner Butler Boulevard in St. Johns County, Florida. The general site location map is included on Figure 1.

The topography of the site is currently relatively level. The site is currently heavily wooded with some sparsely wooded areas. At the time of our field exploration, dirt and trail roads were located throughout the site area. The site perimeter was fenced.

Project information has been provided to us in discussions with you and Mr. Bryan Kyker. We have been provided with copies of a conceptual site plan and a boundary and topographic survey for the subject site prepared by Taylor Engineering, Inc., last dated November, 1993. These plans show the boundary limits for the property, the existing roadways at and adjacent to the site, the site topographical information, the layout of the proposed construction and the requested boring location. In addition, we were provided with a set of plans titled Disposal Area DU-9, P&S Survey (Sheets 1 to 7, last dated January, 1993), boring logs (CB-DU-9-1 to CB-DU-9-7, last dated December 2 to 8, 1992) and gradation curves (Work Order 6877, last dated February 2, 1993) prepared by the U.S. Army Corps of Engineers.

Based on the provided plans and our discussions, it is our understanding the proposed project will consist of the construction of a dredge material management area. We understand the construction will include a 353,300 cubic yard earthen dike and a weir discharge structure.

Review Of Soil Survey Map

A review of the USDA Soil Conservation Service (SCS) Soil Survey of St. Johns County indicated that the soils at the site include a variety of somewhat poorly to very poorly drained fine sands. The soil types with estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Soil No.	Soil Type	Hydrology	Estimated Seasonal High Groundwater Level (feet)
3	Myakka Fine Sand, 0 to 2 percent Slopes	Very Poorly Drained	0 - 1.0
8	Zolfo Fine Sand, 0 to 2 percent Slopes	Somewhat Poorly Drained	2.0 - 3.5
30	Wesconnett Fine Sand, 0 to 2 percent Slopes	Very Poorly Drained	0 - 1.0
36	Riviera Fine Sand, Frequently Flooded, 0 to 2 percent Slopes	Poorly Drained	0 - 1.0
61	Riviera Fine Sand, Depressional Less than 1 percent Slopes	Very Poorly Drained	+2.0 - 1.0

The proposed project area with respect to the USDA-SCS Soil Survey map is presented on the attached Soil Survey Map, Figure 2.

Field Exploration

A field exploration was performed on January 25, 1998. A digitized copy of the site plan provided to us, which shows the approximate boring locations, is included as the Field Exploration Plan, Figure 3. The approximate boring location was determined in the field by our personnel using taped measurements from existing roadways and survey controls adjacent to the site, and should be considered accurate only to the degree implied by the method of measurement used.

To explore the subsurface conditions within the project area, we located and performed 1 Standard Penetration Test (SPT) boring, drilled to a depth of approximately 35 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 boring were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

In addition, 3 bulk soil samples were collected within the designated bulk sample areas between depths of 1 and 4 feet below ground surface. These samples were transported to our laboratory for moisture-density relationship (Proctor), permeability and triaxial testing. A summary of the field procedures is included in Appendix A.

Laboratory Testing

The soil samples obtained during our field exploration were visually classified in general accordance with ASTM D 2488. Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define their composition. The testing included percent fines, grain size distribution and natural moisture content tests. The results of the laboratory testing are shown on Summary of Laboratory Test Results (Appendix B), on the Generalized Subsurface Profile, Figure 3, and on the Log of Boring record (Appendix A) at the respective depths from which the tested samples were recovered. The grain size distribution curves are also included in Appendix B.

Six Modified Proctor Tests were performed on bulk soil samples collected at the site. The tests were performed in general accordance with ASTM D 1557 method. The moisture-density relationship of the soils is presented graphically in Appendix B.

In addition, two 3-point consolidated, drained (CD) triaxial compression tests were run on composite soil samples prepared from the bulk soil samples obtained at the site. The tested samples were remolded at the approximate maximum dry density and optimum moisture content as determined by the Modified Proctor Tests.

One constant head permeability test was also performed on a composite sample prepared from the bulk soil samples obtained at the site. The sample was prepared and tested in the modified proctor mold after being remolded to the approximate maximum dry density and optimum moisture content as determined by the Modified Proctor Tests performed. Results of the CD and permeability tests are also included in Appendix B.

General Subsurface Conditions

Graphical presentation of the generalized subsurface conditions are presented on Figure 3. A detailed boring record is included in Appendix A. The ground surface elevation shown at the boring location was determined from the provide site plan and should be considered accurate only to the degree implied by the method of measurement used to locate the boring. When reviewing these records, it should be understood that the soil conditions will vary adjacent to the boring location.

Generally, loose to medium dense fine sand (SP) was encountered at the boring location between ground surface a depth of 6.5 feet below existing grade. This material was underlain by medium dense

to very dense fine sand with silt (Hardpan) extending to a depth of 13.5 feet below ground surface. Loose to medium dense fine sand and fine sand with silt was then encountered extending to the termination depths of the boring at 35 feet below existing grade.

The groundwater level was encountered at the boring location and recorded, at the time of drilling, at a depth of 3 feet below the existing ground surface. However, it should be anticipated the groundwater level will fluctuate due to seasonal climatic variations, surface water runoff patterns, construction operations, and other interrelated factors. The depth to the groundwater level at the boring location is noted on the Generalized Subsurface Profile and on the Log of Boring record.

Report Limitations

Our geotechnical exploration has been performed and our findings obtained in accordance with generally accepted geotechnical engineering principles and practices. Ellis & Associates is not responsible for any independent conclusions, interpretation, opinions or recommendations made by others based on the data contained in this report. This report does not reflect any variations which may occur adjacent to or between soil borings.

Our scope of services was intended to evaluate the soil conditions within the zone of soil influenced by the proposed construction. Our scope of services does not address geologic conditions such as sinkholes nor soil conditions existing below the depth of the soil borings.

Closure

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

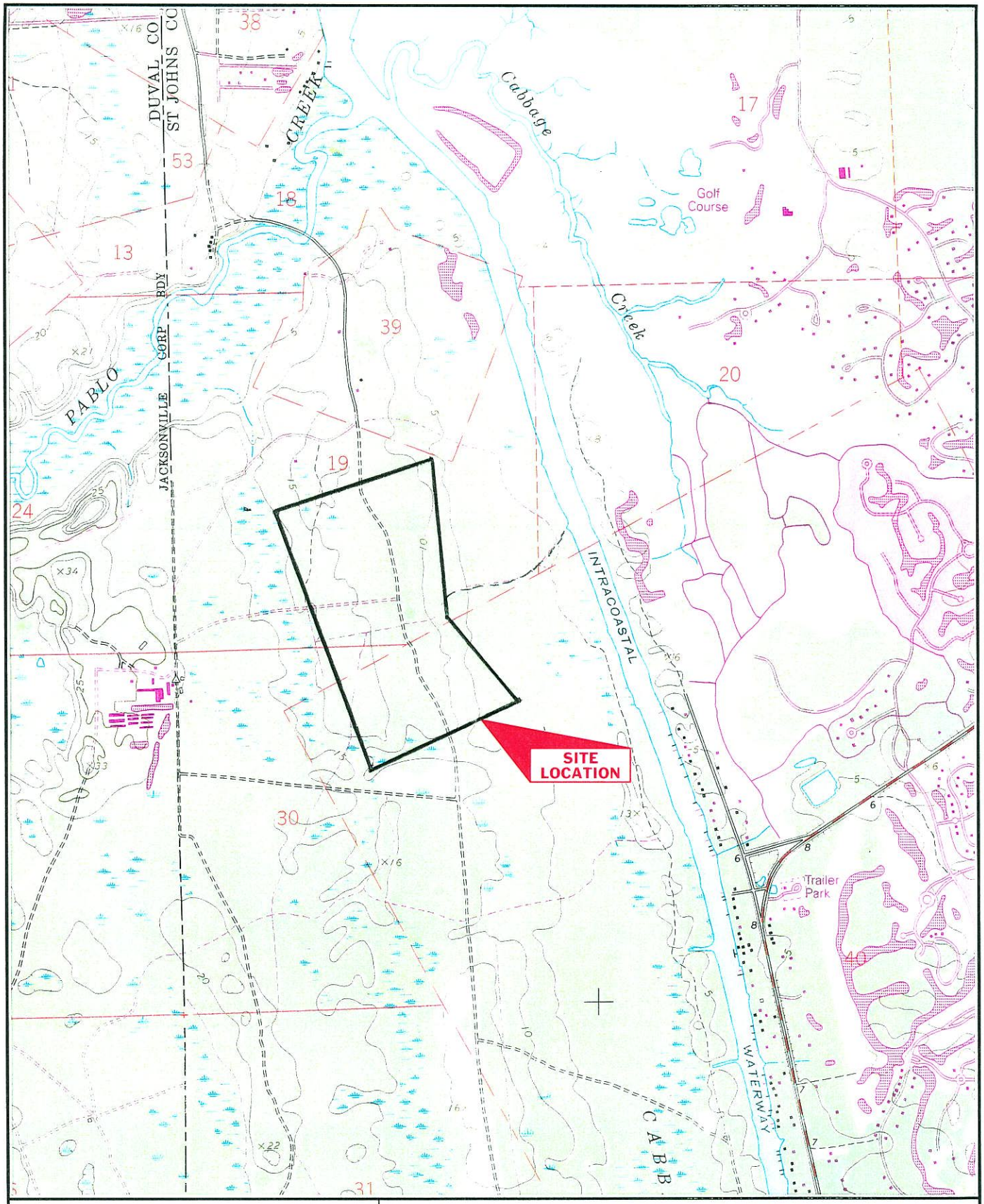
Very truly yours,

ELLIS & ASSOCIATES, INC.

Antoinette D. Meskel, E.I.
Project Engineer

Nemer (Nick) Y. Abdulla Oweis, P.E.
Sr. Geotechnical Engineer
Registered, Florida No. 44755

FIGURES



Project No. 99-1018	**Site Vicinity/Topographic Map**
Revision Date: 3/10/99	DMMA DU-9
Scale: 1"=2,000'	U.S. Geological Survey 7.5 Minute – Topographic Map Palm Valley, Florida Quadrangle Revised 1992 Site boundaries depicted are approximate
Ellis & Associates Inc. GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES CONSTRUCTION MATERIALS ENGINEERING AND TESTING	**Figure No. 1**

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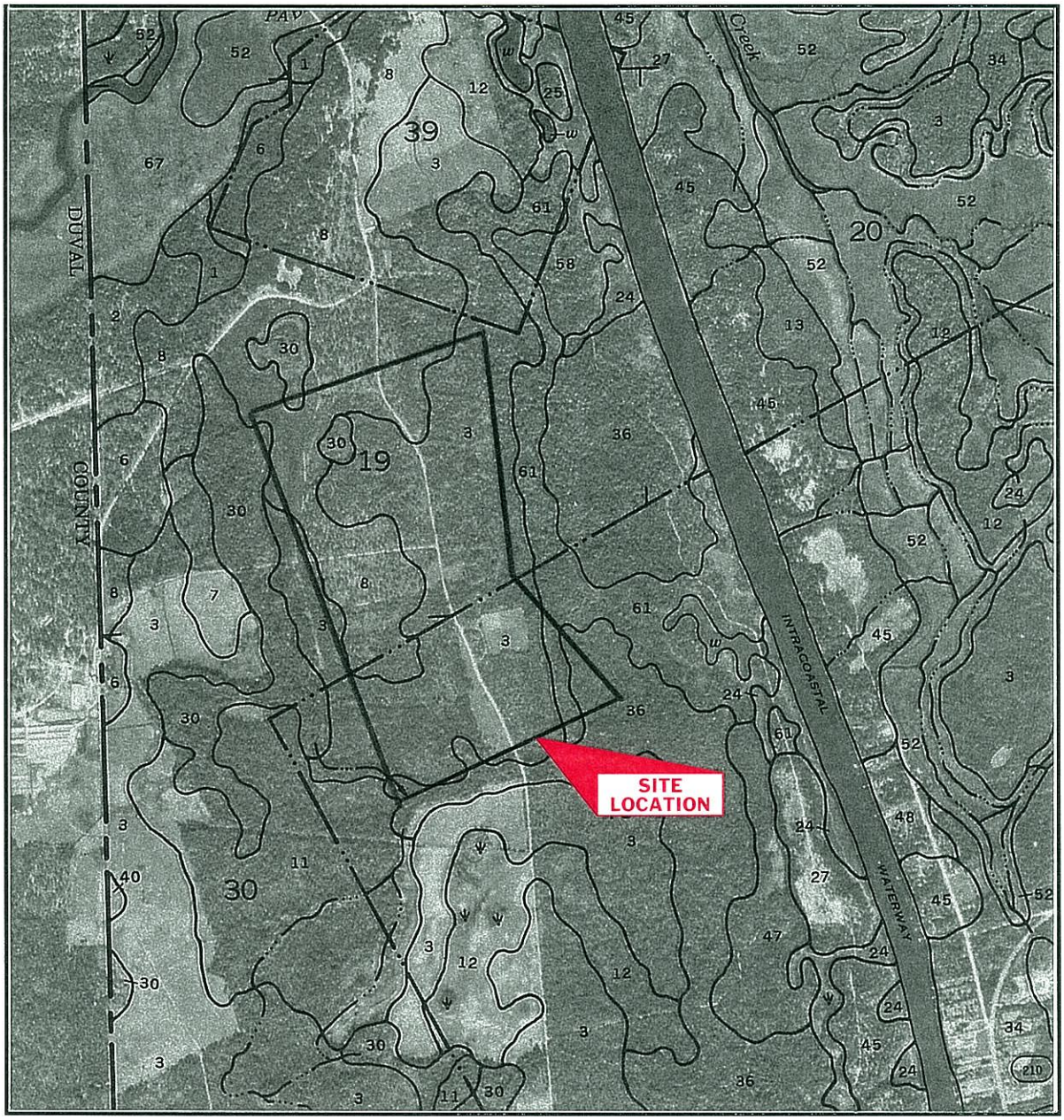

LEGEND

3	Myakka Fine SAND, 0 to 2 Percent Slopes
8	Zolfo Fine SAND, 0 to 2 Percent Slopes
30	Wesconnett Fine SAND, 0 to 2 Percent Slopes
36	Riviera Fine SAND, Frequently Flooded, 0 to 2 Percent Slopes
61	Riviera Fine SAND, Depressional Less Than 1 Percent Slopes

Project No. 99-1018

Revision Date: 3/10/99

Scale: 1:20,000

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CONSTRUCTION MATERIALS ENGINEERING AND TESTING

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Soil Survey Map

DMMA DU-9

Soil Survey of St. Johns County

Sheet Number 1

Issued October 1983

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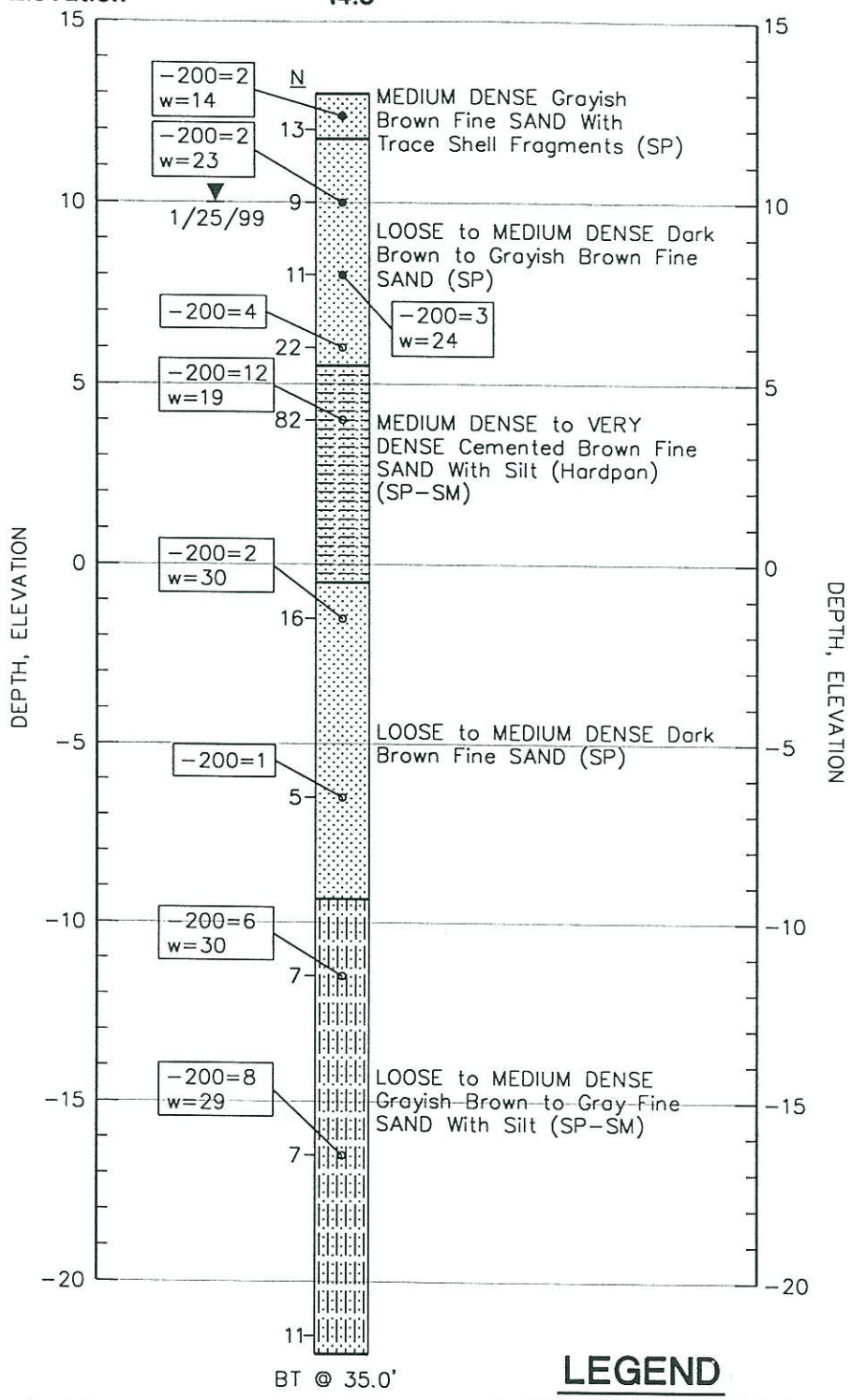
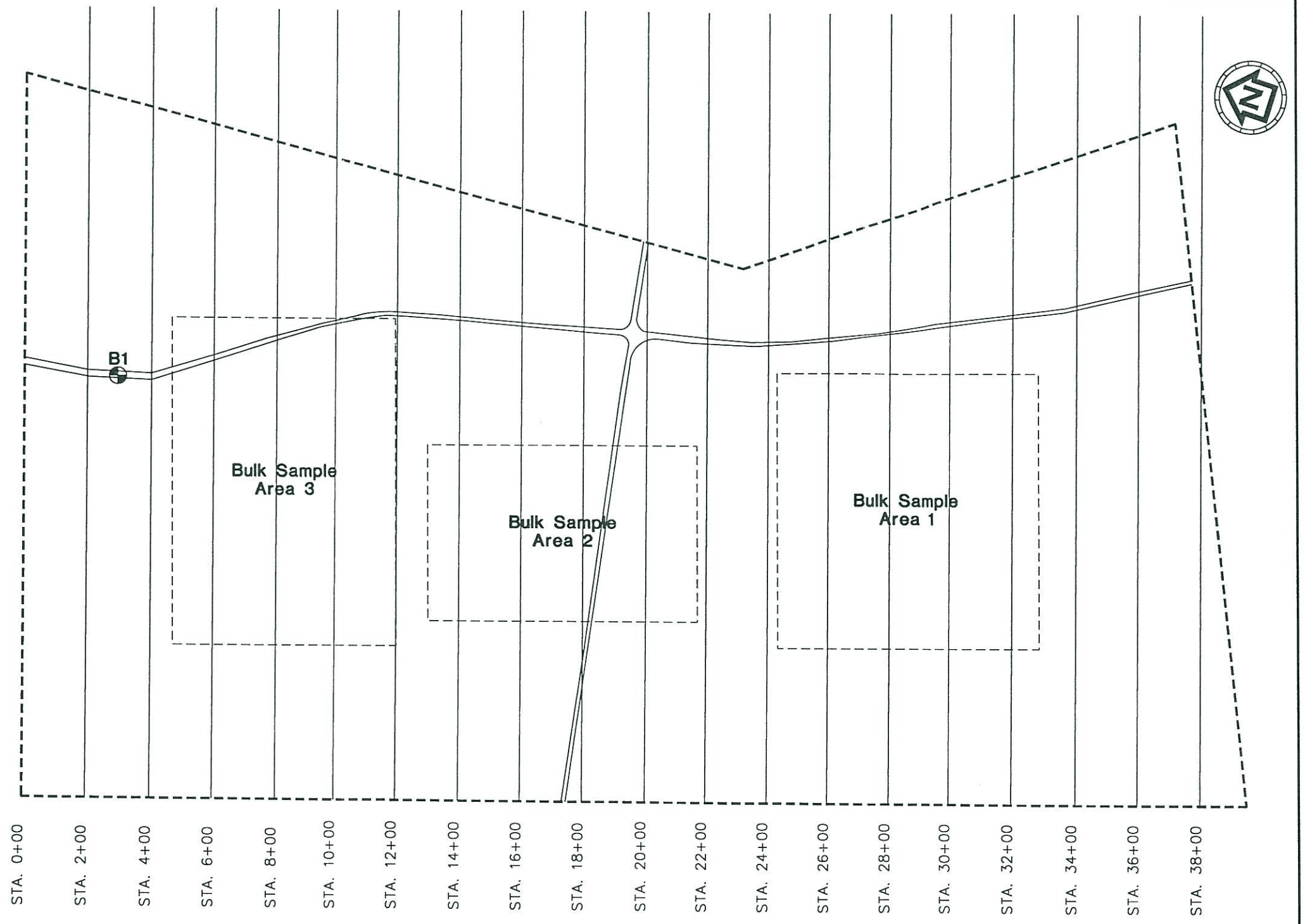
Figure No. 2





LEGEND

- Fine SAND (SP)
- Fine SAND With Silt (SP−SM)
- Cemented Fine SAND With Silt (Hardpan) (SP−SM)
- Groundwater Level at Time of Drilling
- BT Boring Terminated
- N Penetration Resistance, Blows/Foot
- −200 Percent Passing No. 200 U.S. Standard Sieve
- w Natural Moisture Content (%)
- Approximate Location of Standard Penetration Test (SPT) Boring

FIELD EXPLORATION PLAN

Graphical Scale
0' 400' 800'

Reference:
Site plan prepared by Department of the Army
Jacksonville District, Corps of Engineers
(Last Dated January, 1993)

Field Exploration Plan/Generalized Subsurface Profile
DMMA DU-9
St. Johns County, Florida

Ellis & Associates Inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/11/99 | PROJ. NO: 99−1018 | Figure 3

991018s

APPENDIX A

SOIL BORINGS

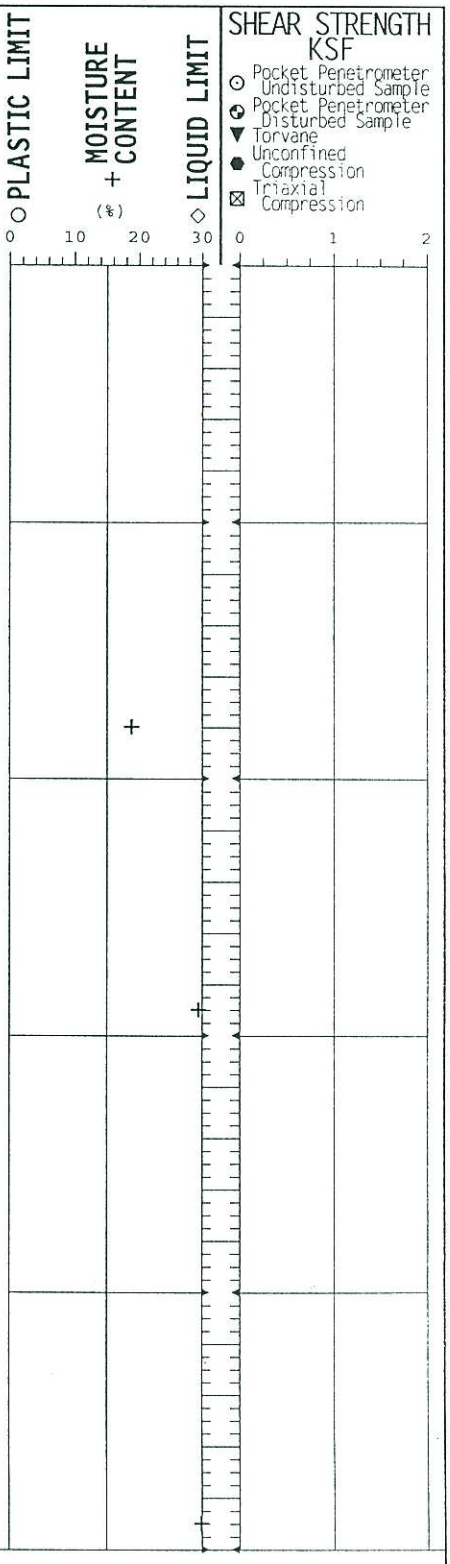
Ellis & Associates inc.

Project No.: 99-1018
Boring No.: B1
Sheet 1 of 2

LOG OF BORING

Project: DMMA DU-9, Dee Dot Ranch Property
Client: Taylor Engineering, Inc.
Boring Location: See Field Exploration Plan
Drill Rig: BK 81 Driller: D. Francis
Drill Rod: AW Drill Mud: Super Gel-X
Casing Size: HW Length of Casing:
Groundwater Depth: 3.0' Time: Drilling Date: 1/25/99
Boring Begun: 1/25/99 Boring Completed: 1/25/99

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE
	0					
1			MEDIUM DENSE Grayish Brown Fine SAND With Trace Shell Fragments (SP)	13		
2			MEDIUM DENSE to LOOSE Gray to Dark Brown Fine SAND (SP)	9		
3	5		LOOSE to MEDIUM DENSE Grayish Brown Fine SAND (SP)	11		
4			MEDIUM DENSE Dark Brown Fine SAND (SP)	22		3.8
5			MEDIUM DENSE to VERY DENSE Brown Fine SAND With Silt (Hardpan) (SP-SM)	82		11.6
	10					
6			MEDIUM DENSE Dark Brown Fine SAND (SP)	16		2.2
	15					
7			LOOSE Grayish Brown Fine SAND (SP)	5		1.1
	20					
8			LOOSE Gray Fine SAND With Silt (SP-SM)	7		5.5
	25					



Ellis & Associates inc.

LOG OF BORING

Project No.: 99-1018
Boring No.: B1
Sheet 2 of 2

Project: DMMA DU-9, Dee Dot Ranch Property
Client: Taylor Engineering, Inc.
Boring Location: See Field Exploration Plan
Drill Rig: BK 81 Driller: D. Francis
Drill Rod: AW Drill Mud: Super Gel-X
Casing Size: HW Length of Casing:
Groundwater Depth: 3.0' Time: Drilling Date: 1/25/99
Boring Begun: 1/25/99 Boring Completed: 1/25/99

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER FOOT	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT ○ / MOISTURE + CONTENT (%) / LIQUID LIMIT ◇	SHEAR STRENGTH KSF
	25		LOOSE Gray Fine SAND With Silt (SP-SM)				0 10 20 30	0 1 2
9	30			7		8.4	+	
			MEDIUM DENSE Gray Fine SAND With Silt (SP-SM)					
10	35			11				
			Boring Terminated At 35'					
	40							
	45							
	50							

SHEAR STRENGTH KSF
○ Pocket Penetrometer Undisturbed Sample
◒ Pocket Penetrometer Disturbed Sample
▼ Torvane
● Unconfined Compression
⊠ Triaxial Compression

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) borings were made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by rotary (or "wash-n-chop") drilling techniques. At 2 1/2 to 5 foot intervals, a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler 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 our laboratory where they were examined by our engineer in order to verify the driller's field classification. The retrieved samples will be kept in our facility for a period of six (6) months unless directed otherwise.

APPENDIX B

LABORATORY DATA

SUMMARY OF LABORATORY TEST RESULTS
DMMA DU-9, DEE-DOT RANCH PROPERTY
ST. JOHNS COUNTY, FLORIDA

E&A Project No.: 99-1018
DATE: Mar-99

Boring No.	Sample No.	Sample Depth (ft.)	USCS	Moisture Content, %	GRADATION TEST Percent Passing							
					No. 10	No. 20	No. 40	No. 60	No. 80	No. 100	No. 140	No. 200
B1	1	1 - 1.5	SP	13.8	--	--	--	--	--	--	--	4
B1	2	3 - 3.5	SP	22.9	--	--	--	--	--	--	--	2
B1	3	5 - 5.5	SP	24.2	--	--	--	--	--	--	--	3
B1	4	7 - 7.5	SP	--	--	--	--	--	--	--	--	4
B1	5	9 - 9.5	SP-SM	19	100	100	100	99	65	46	16	12
B1	6	14 - 14.5	SP	30	100	100	98	95	57	41	6	2
B1	7	19 - 19.5	SP	--	--	--	--	--	--	--	--	1
B1	8	24 - 24.5	SP-SM	30	100	100	99	99	97	80	26	6
B1	9	29 - 29.5	SP-SM	29	100	100	100	99	81	59	20	8

COMPOSIT BULK SOIL SAMPLES

	AREA 1	1 - 4	SP		100	100	99	96	67	42	5	2
	AREA 2	1 - 4	SP		100	100	99	96	61	37	5	3
	AREA 3	1 - 4	SP		100	100	99	96	59	37	5	3

TRIAXIAL REMOLDED SAMPLE

	CD1	1 - 4	SP	15.6*	100	100	99	96	72	50	5	2
	CD2	1 - 4	SP	15.6*	100	100	99	96	59	38	5	3

* Remolded Water Content

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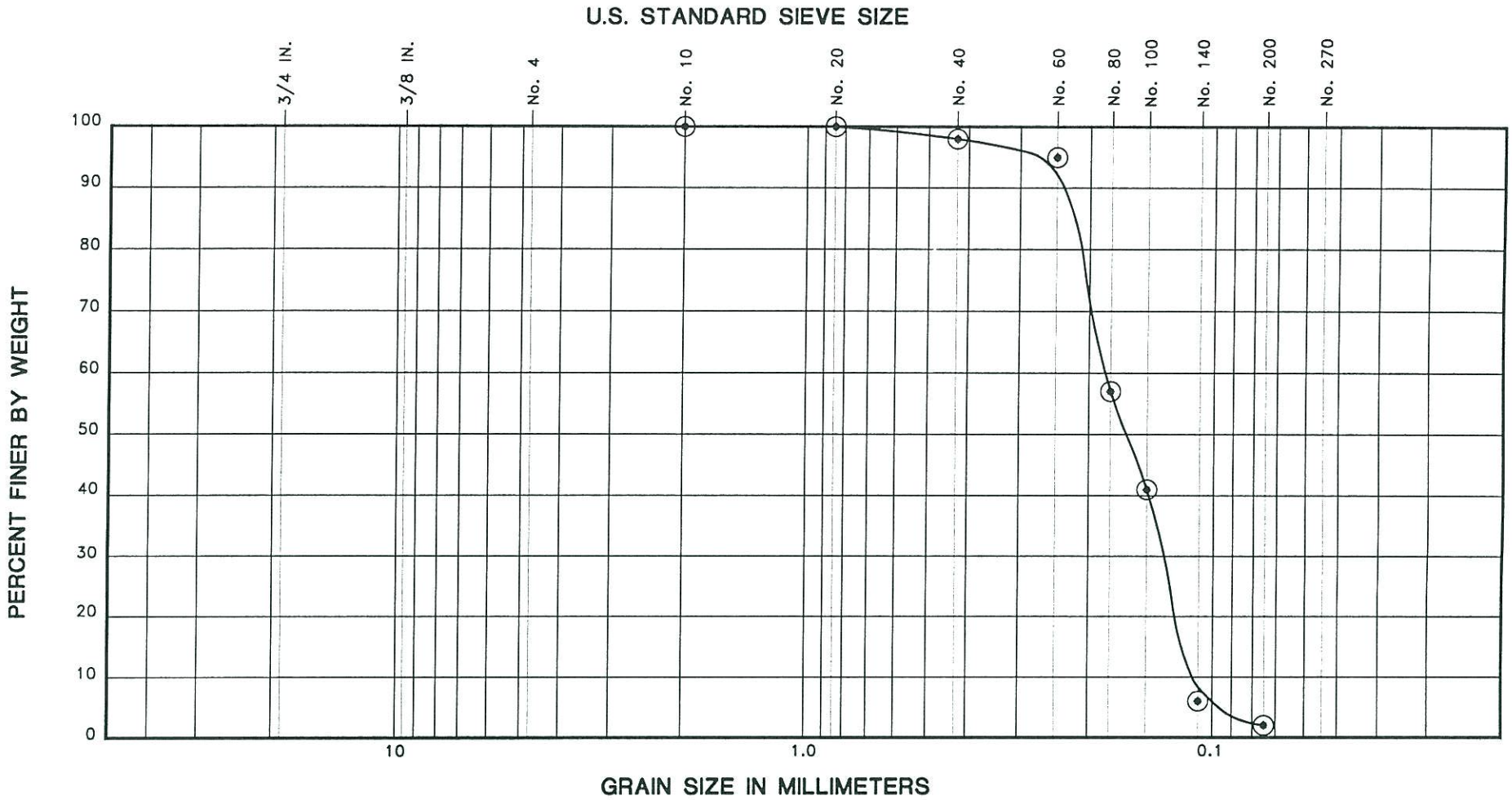

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth (ft)	USCS
B1	6	14.0–14.5'	SP

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99–1018

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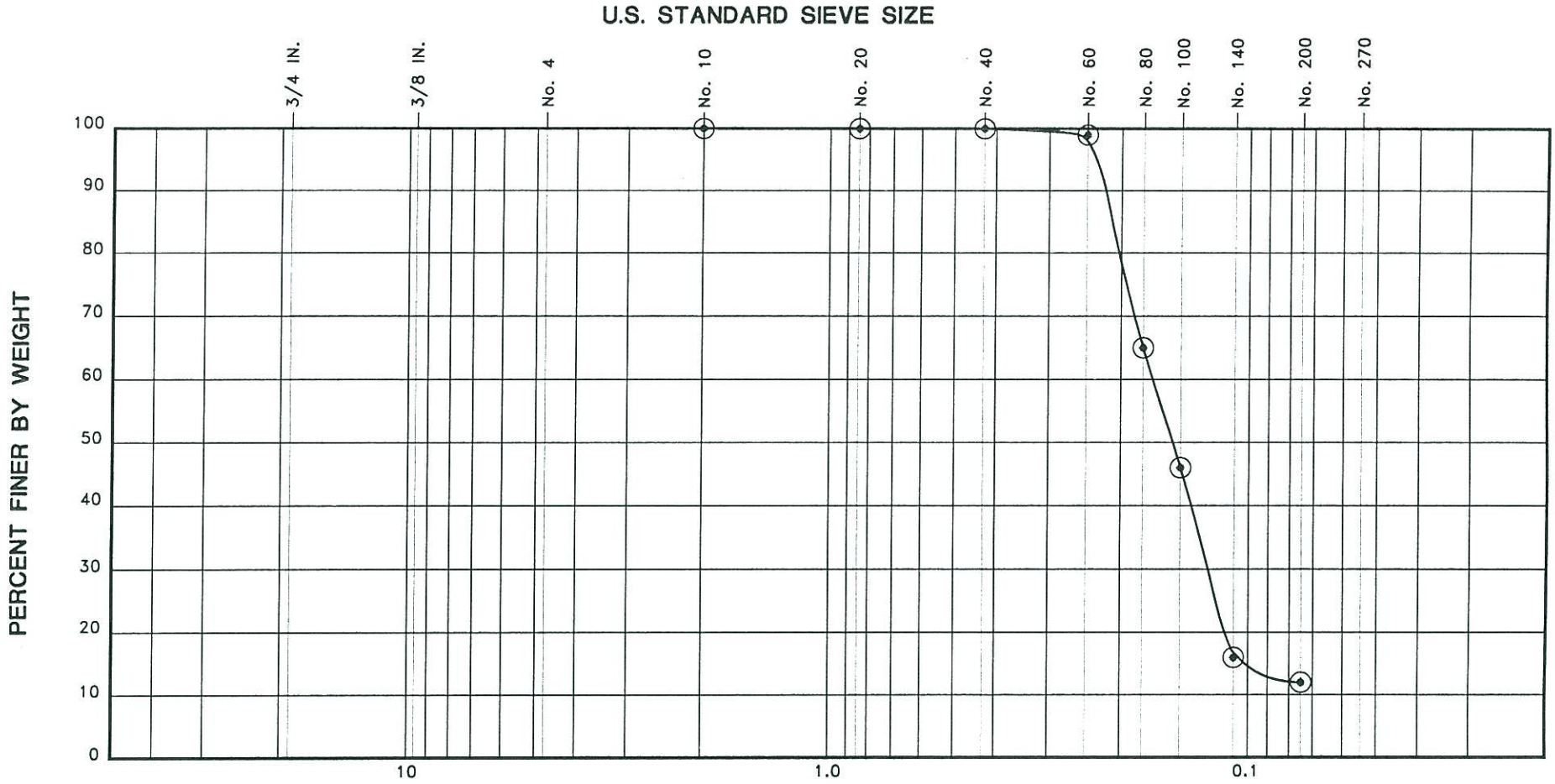

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth (ft)	USCS
B1	5	9.0-9.5'	SP-SM

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99-1018

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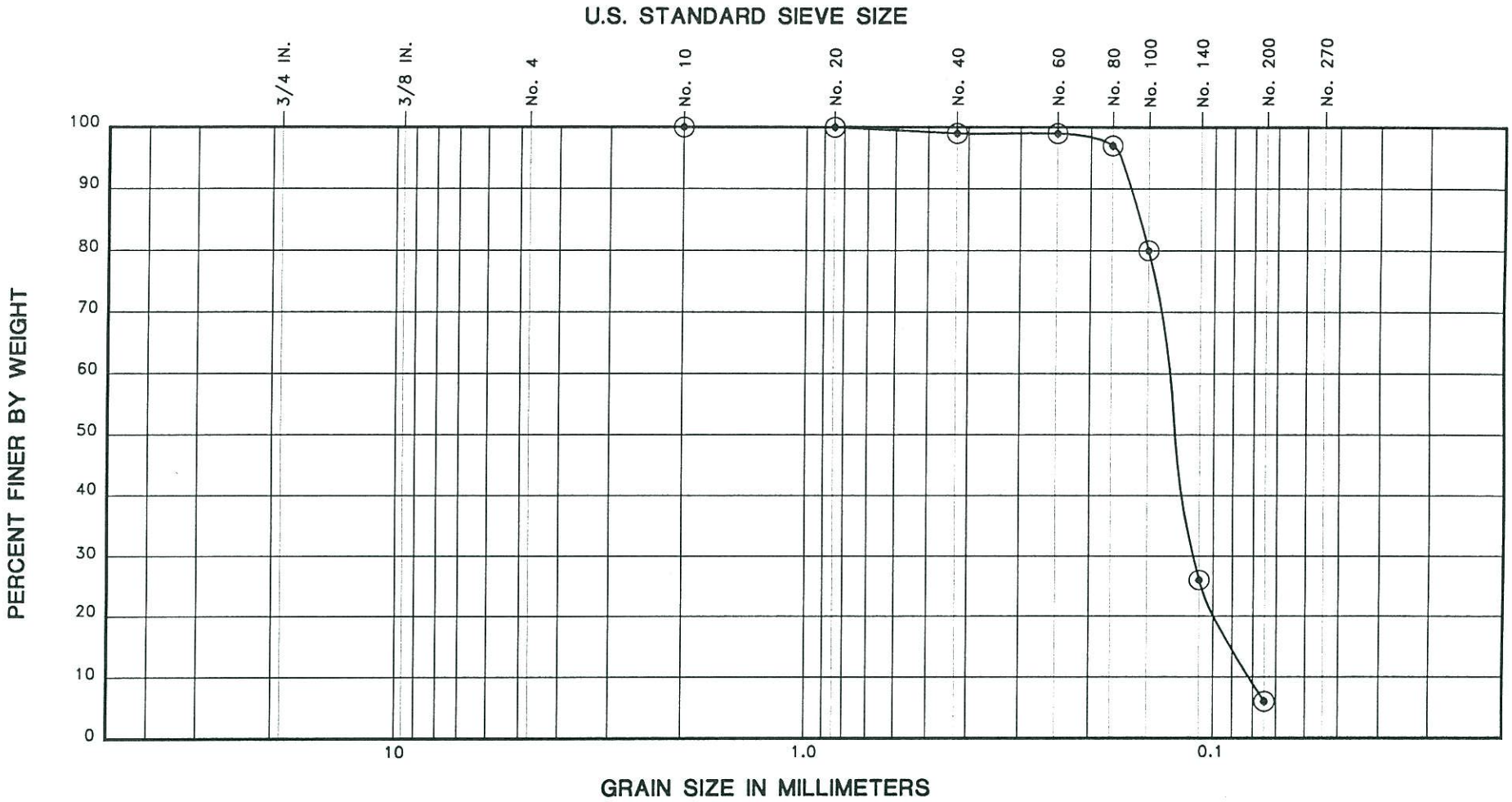

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth (ft)	USCS
B1	8	24.0–24.5'	SP–SM

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99–1018

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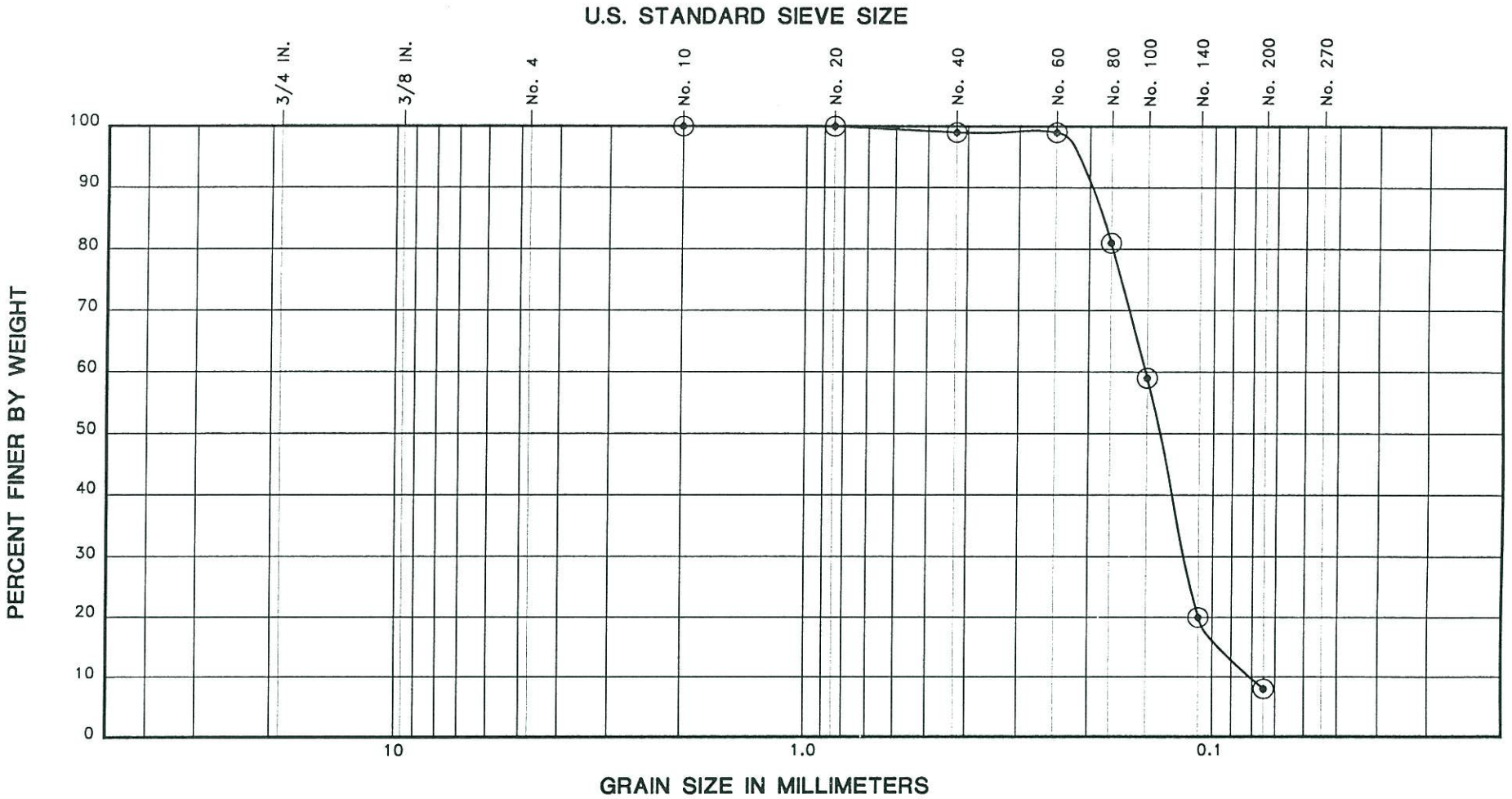

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth (ft)	USCS
B1	9	29.0–29.5'	SP–SM

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99–1018

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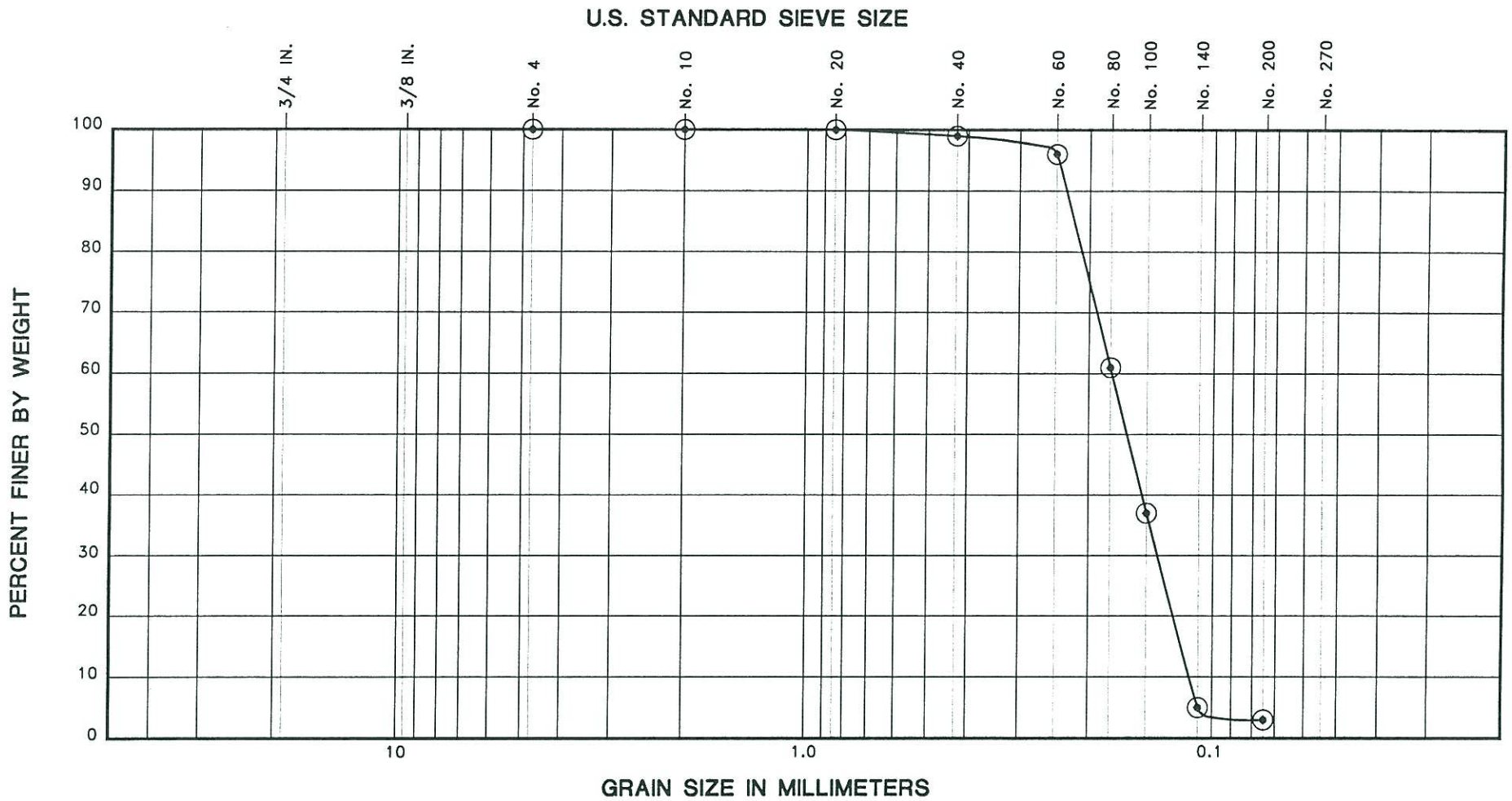

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

LBR Sample	Depth (ft)	USCS
Area 2	0-2.0'	SP

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99-1018

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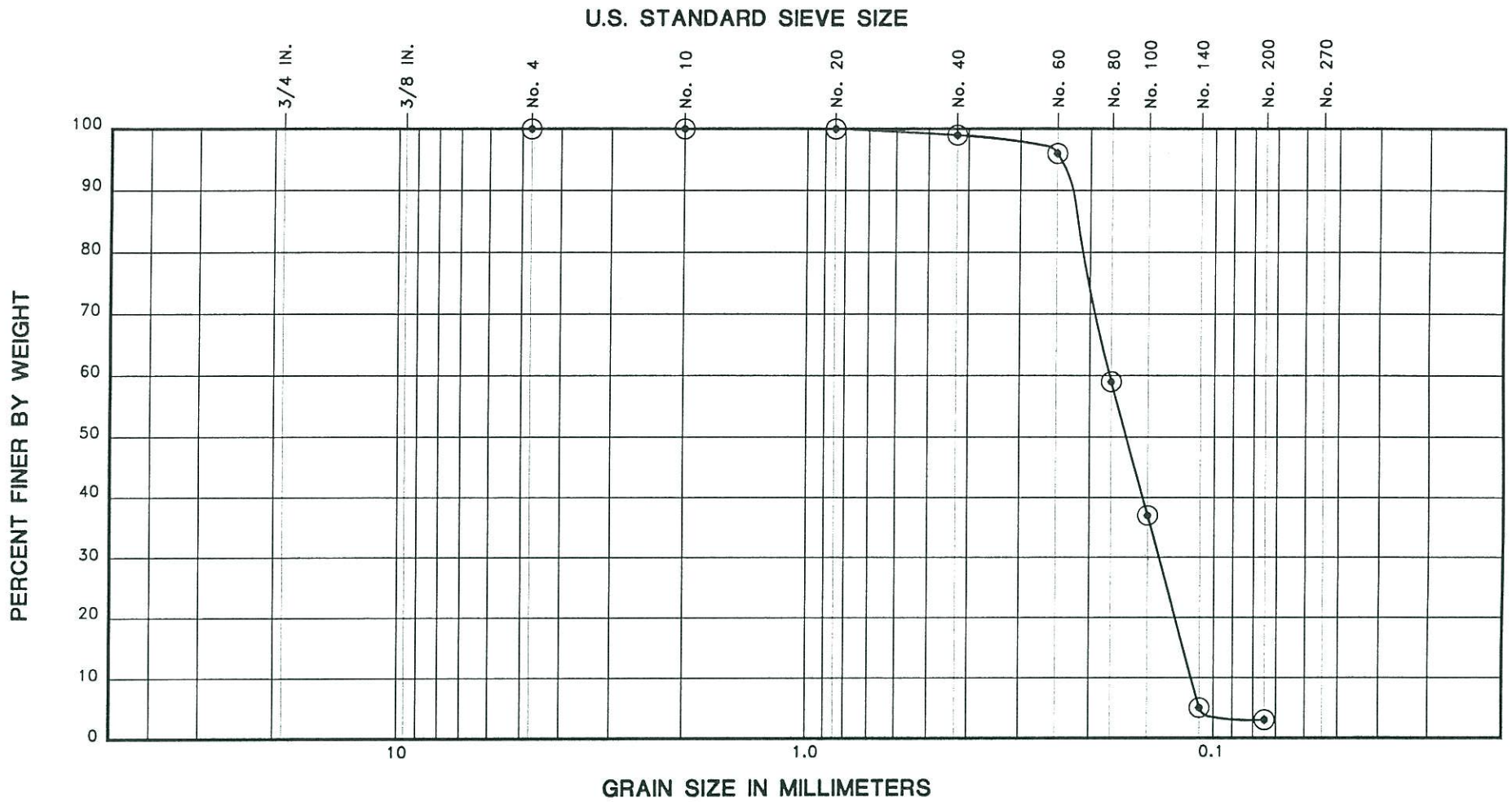

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

LBR Sample	Depth (ft)	USCS
Area 3	0–2'	SP

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99–1018

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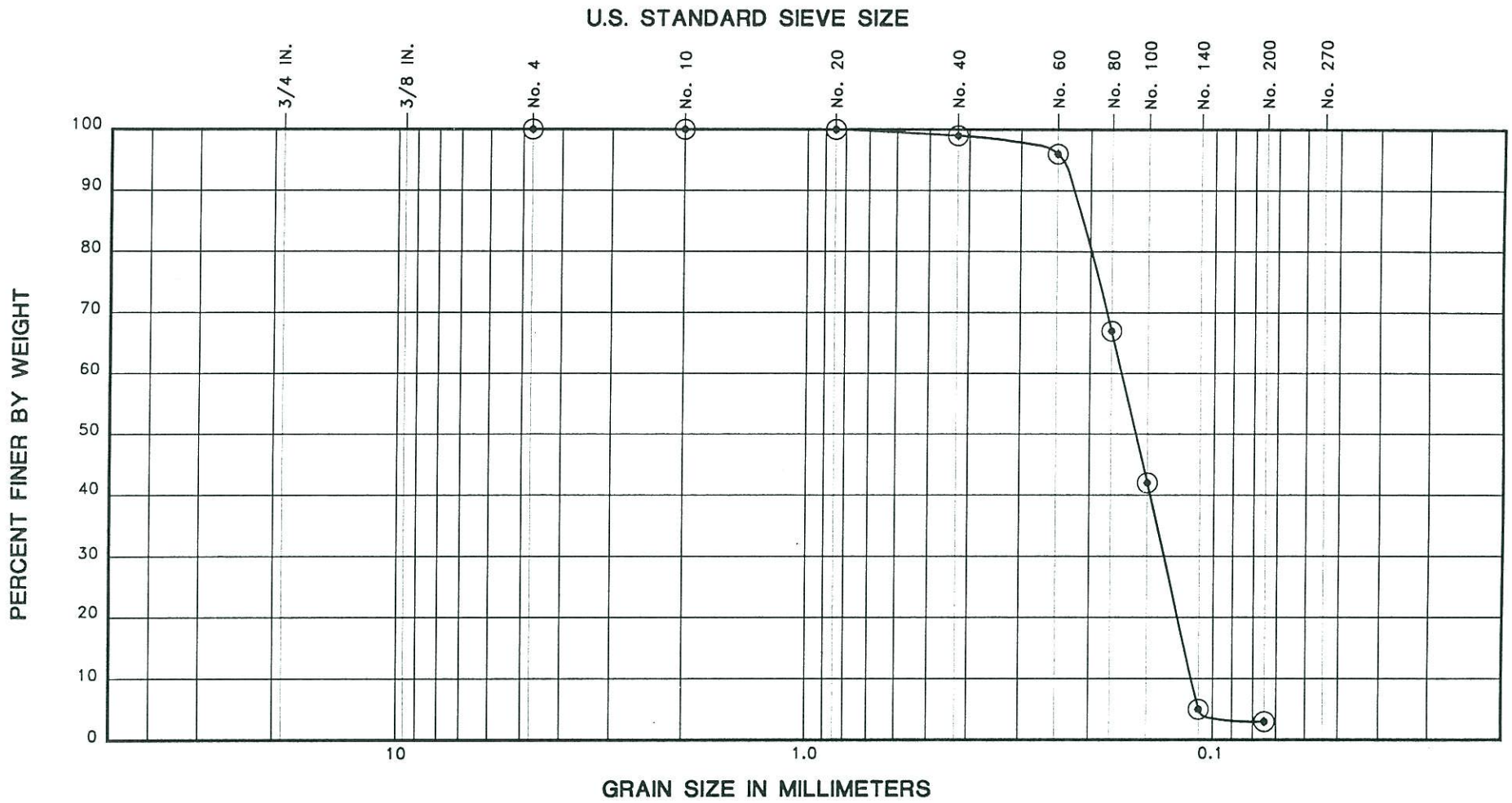

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

LBR Sample	Depth (ft)	USCS
Area 1	0–2'	SP

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99–1018

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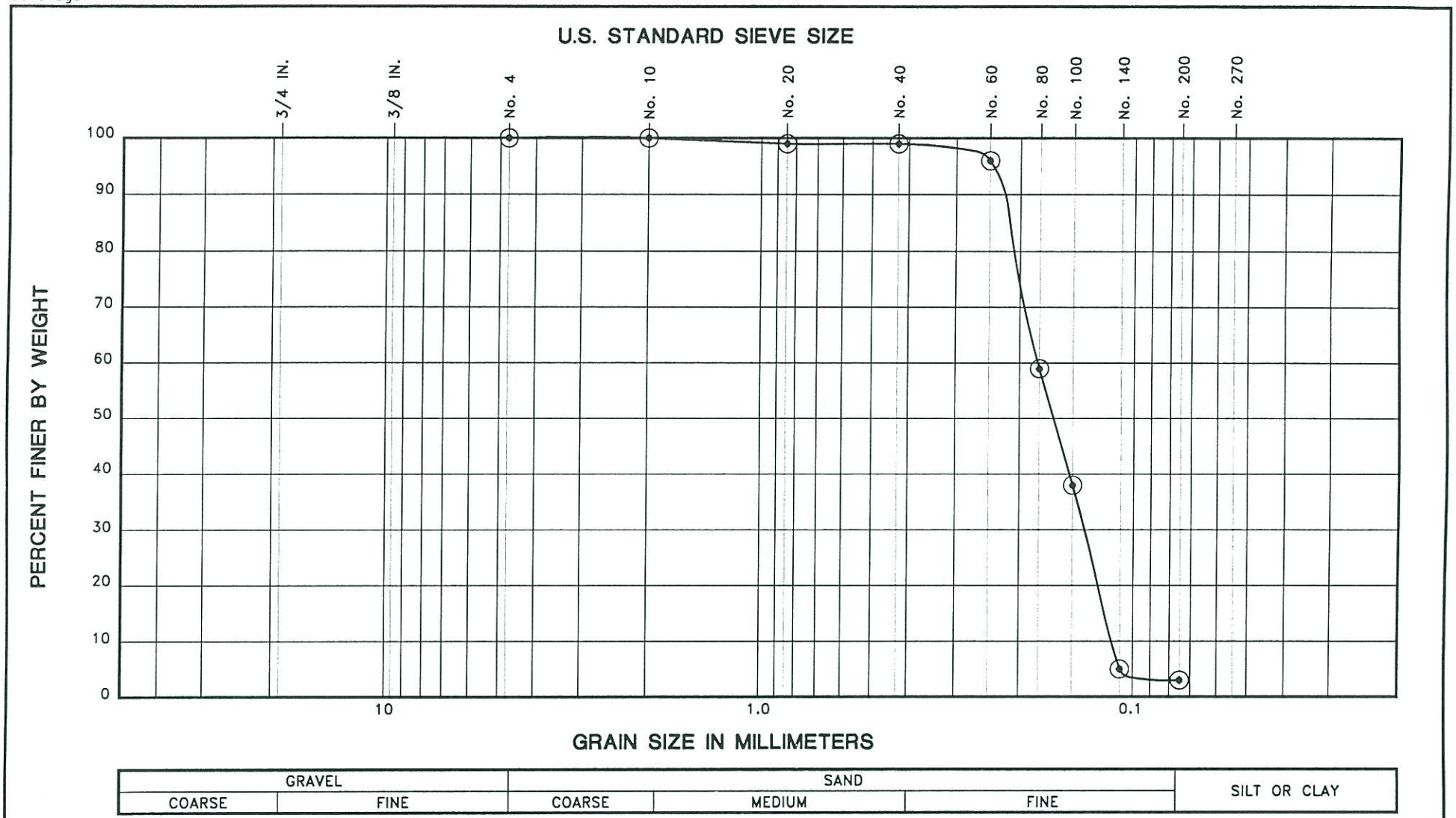


GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Triaxial Test Sample	USCS
CD2 (Remolded)	SP

USCS Unified Soil Classification System

Grain Size Analysis

DUMMA DU-9

St. Johns County, Florida

Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

DATE: 2/24/99 PROJ. NO: 99-1018

Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 1
LOCATION: SEE FIGURE 2

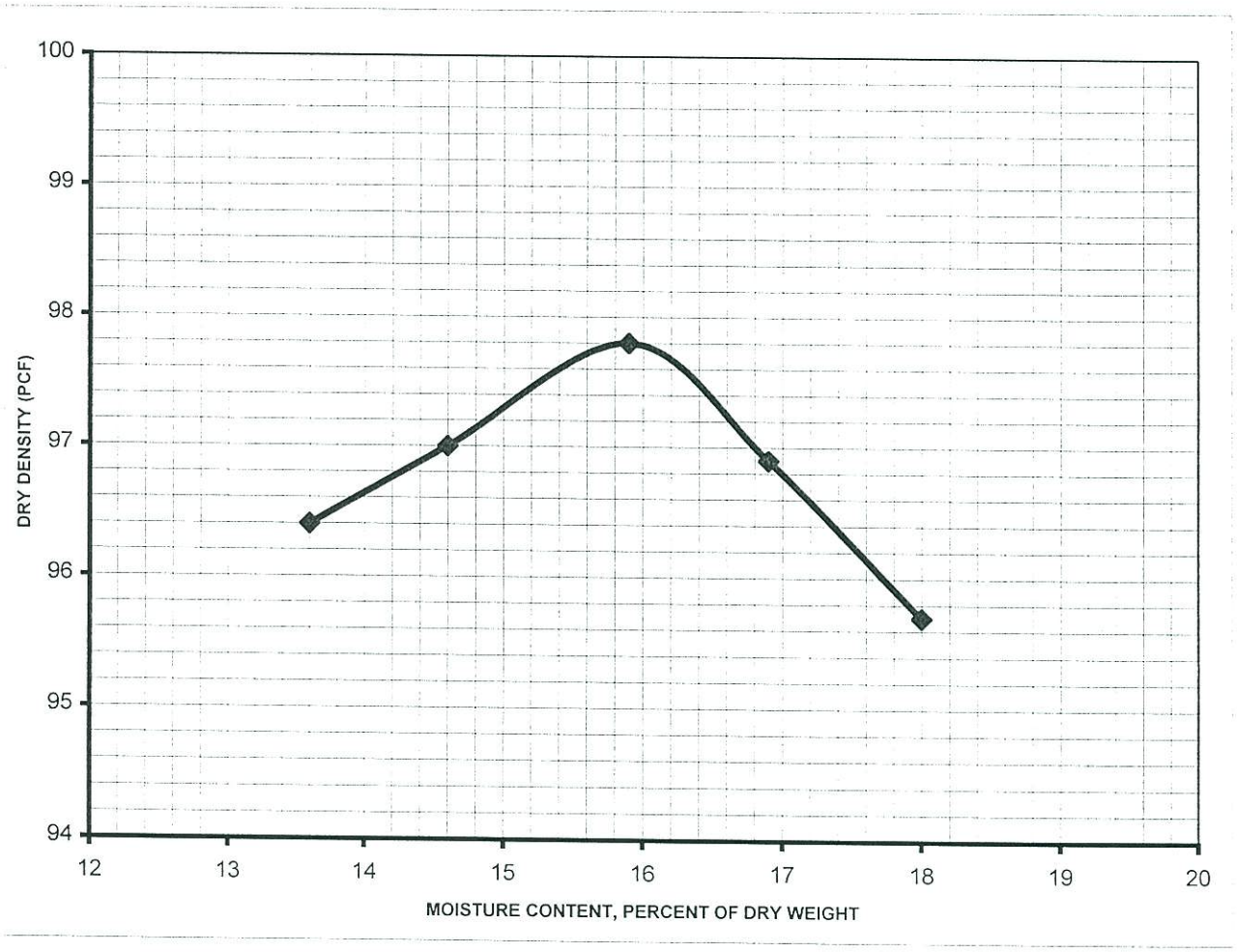
MATERIAL: Gray Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: January 26, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 97.8 pcf
OPTIMUM MOISTURE CONTENT: 15.9 %



Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 1
LOCATION: SEE FIGURE 2

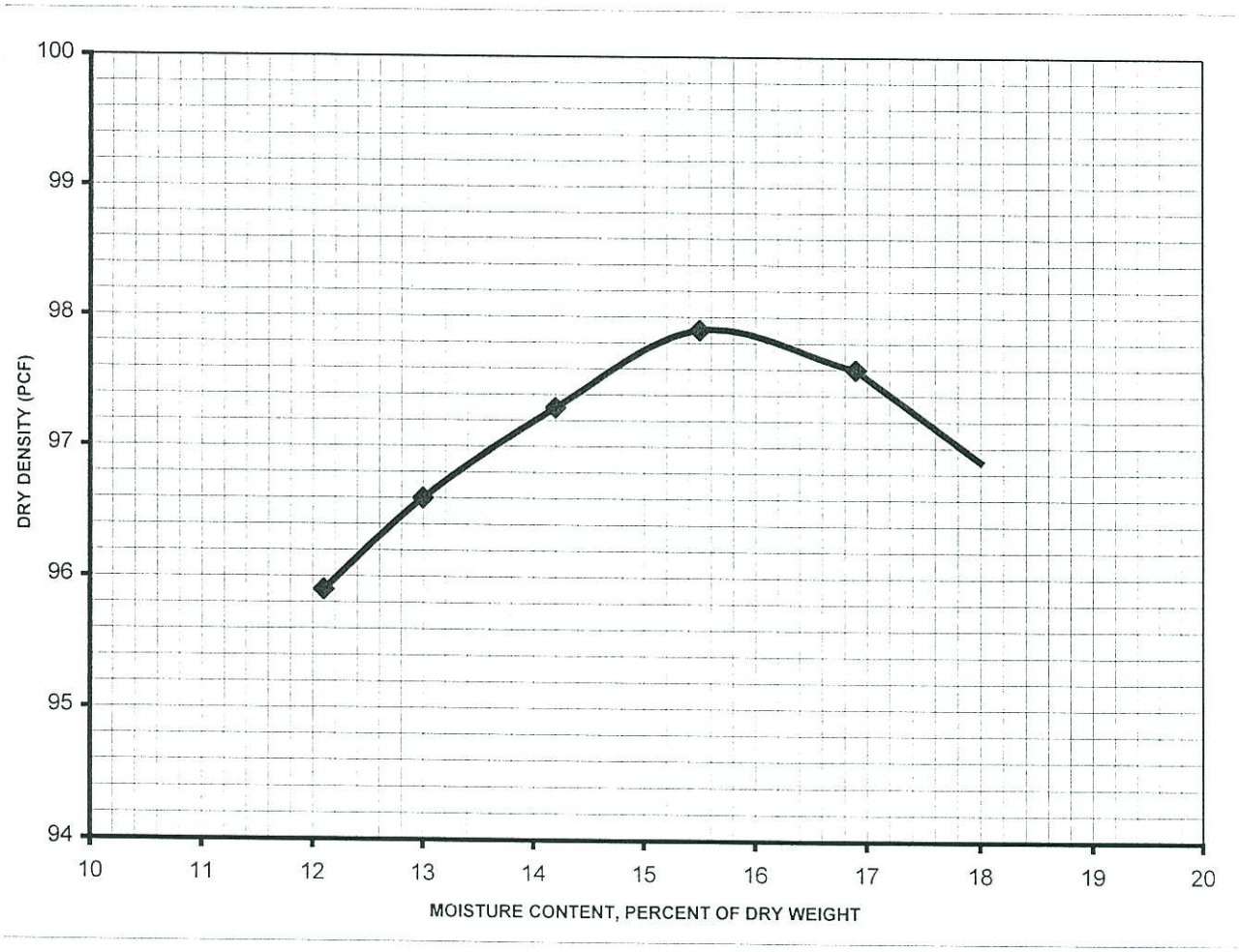
MATERIAL: Tan Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: January 26, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 97.9 pcf
OPTIMUM MOISTURE CONTENT: 15.5 %



Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 2
LOCATION: SEE FIGURE 2

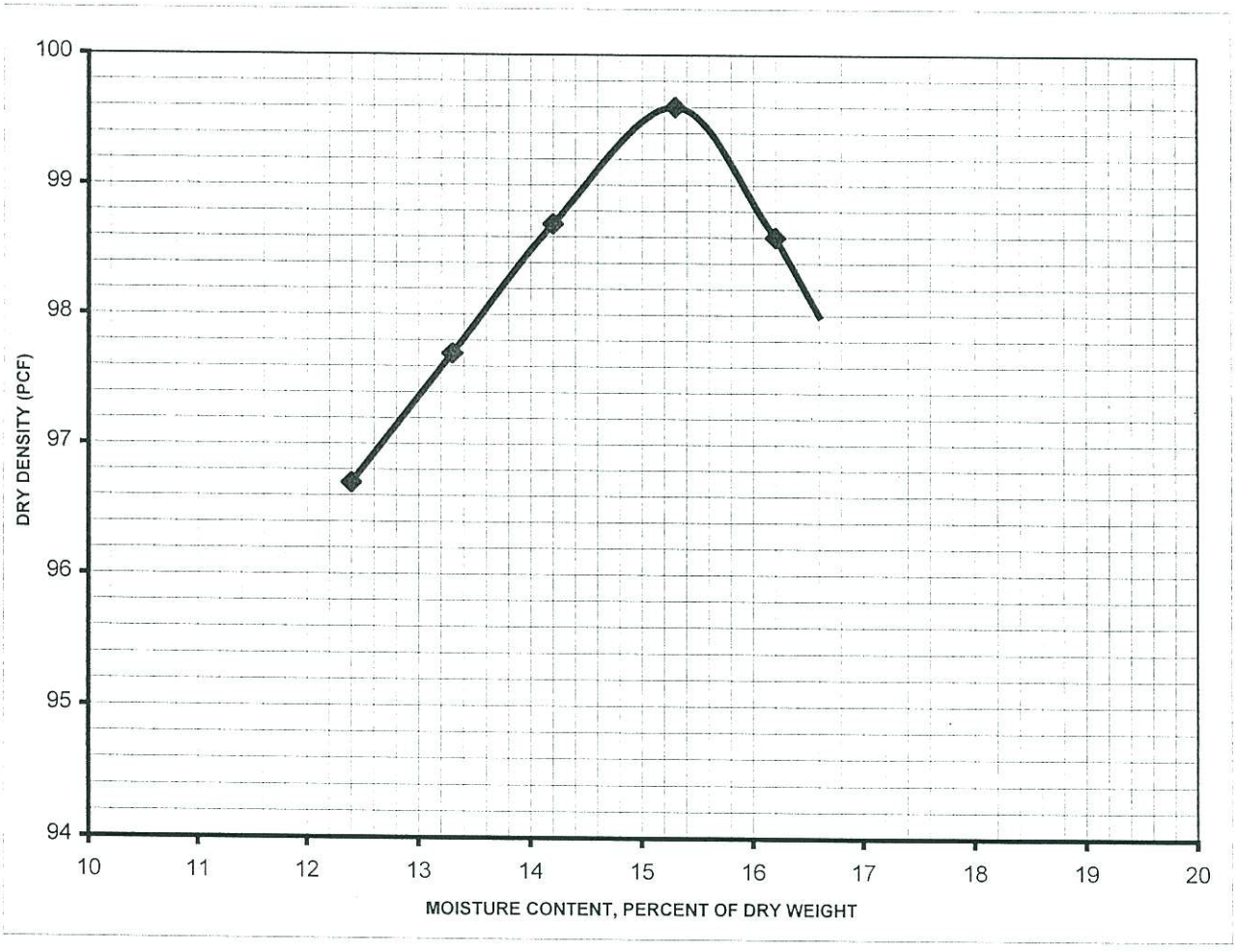
MATERIAL: Gray Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: February 1, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 99.6 pcf
OPTIMUM MOISTURE CONTENT: 15.3 %



Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 3
LOCATION: SEE FIGURE 2

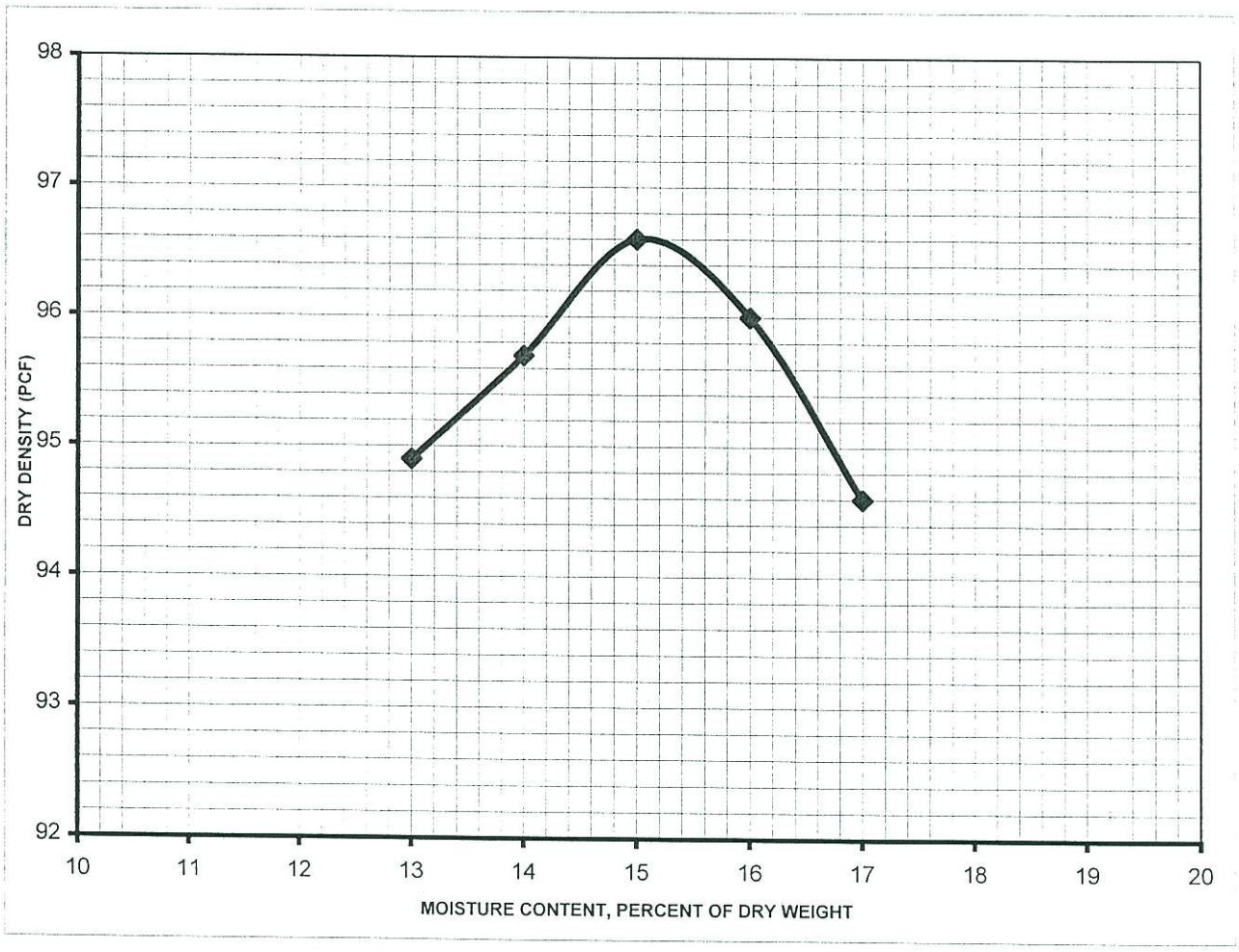
MATERIAL: Grayish Brown Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: February 1, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 96.6 pcf
OPTIMUM MOISTURE CONTENT: 15.0 %



Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 2
LOCATION: SEE FIGURE 2

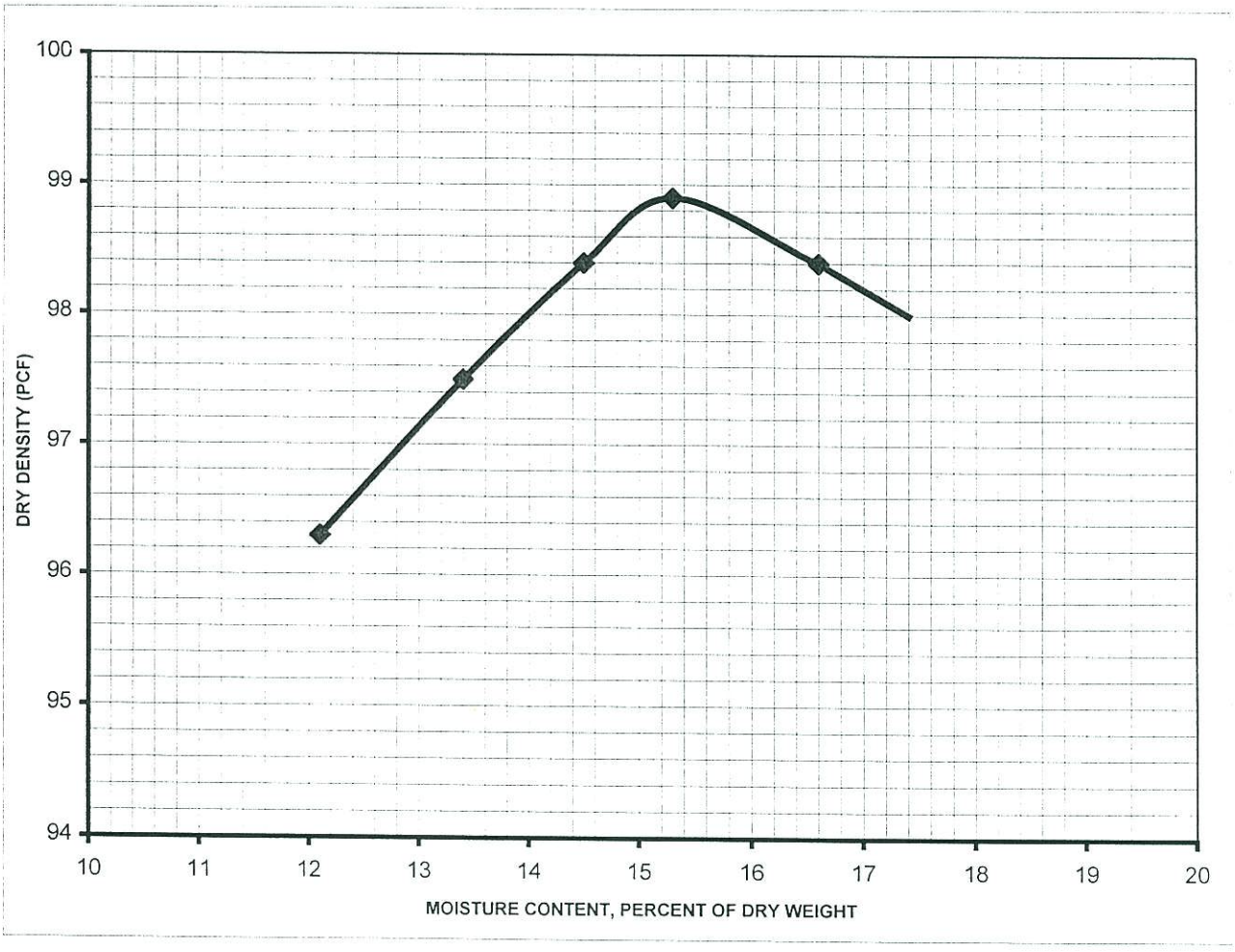
MATERIAL: Tan Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: January 27, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 98.9 pcf
OPTIMUM MOISTURE CONTENT: 15.3 %



Ellis & Associates, Inc.

MOISTURE DENSITY RELATIONSHIP OF SOILS

PROJECT: DMMA DU-9, DEE-DOT RANCH PROPERTY

E&A PROJECT NO.: 99-1018

SAMPLE NO: AREA 3
LOCATION: SEE FIGURE 2

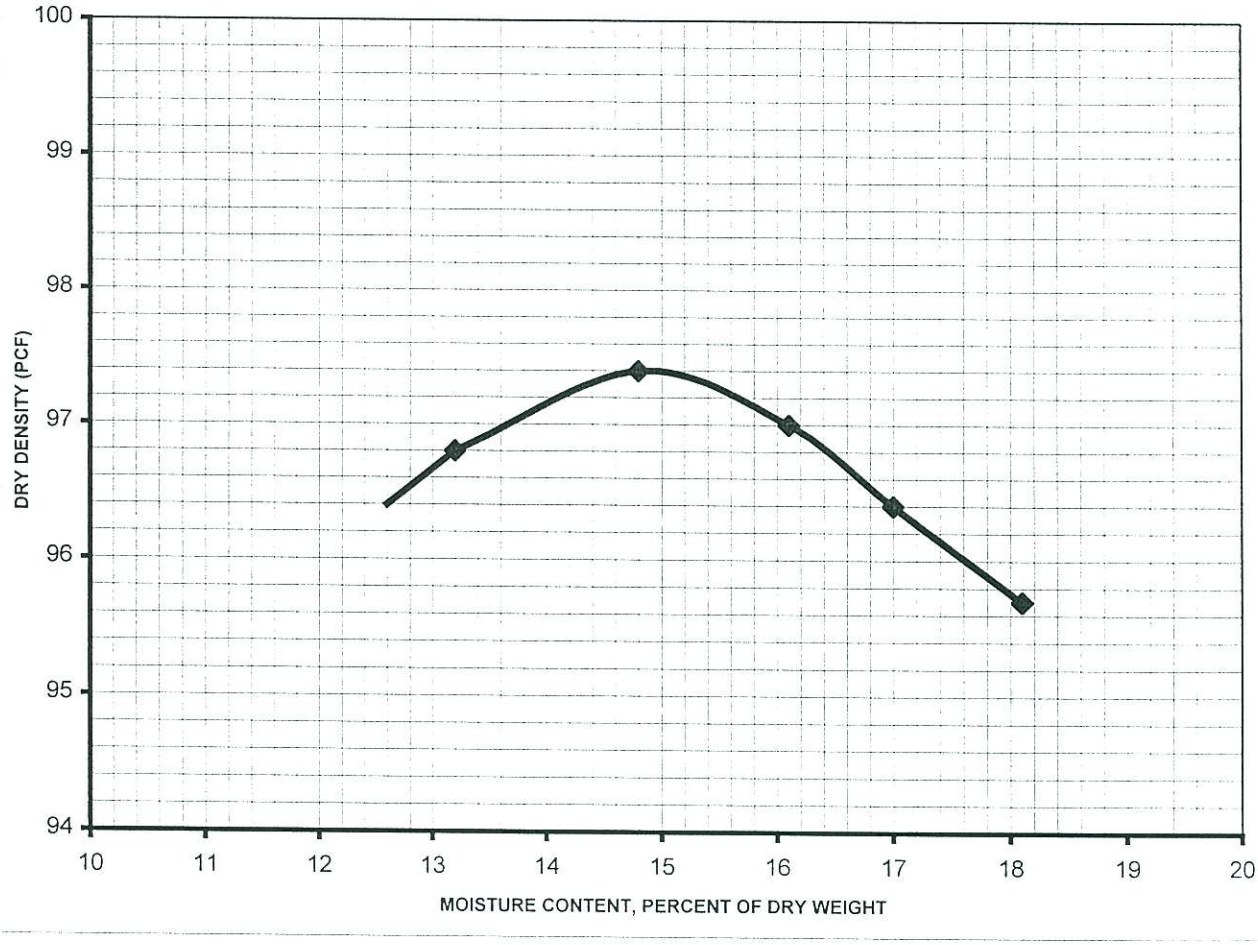
MATERIAL: Grayish Brown Fine Sand, SP
SPECIFICATIONS: ASTM D 1557

DATE SAMPLED: January 25, 1999
DATE TESTED: January 27, 1999

SAMPLED BY: D. Francis
INSPECTED BY: M. Gruber

TEST RESULTS

MAXIMUM DRY DENSITY: 97.4 pcf
OPTIMUM MOISTURE CONTENT: 14.8 %



Ellis & Associates inc.
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL SERVICES
CONSTRUCTION MATERIALS ENGINEERING AND TESTING

TRIAXIAL COMPRESSION TEST
GRAPH OF MOHR'S CIRCLES

Project: DMMA DU-9 Project No.: 99-1018

Sample No.: CD1 Depth: Remolded

Soil Description: Light Gray Fine SAND (SP)

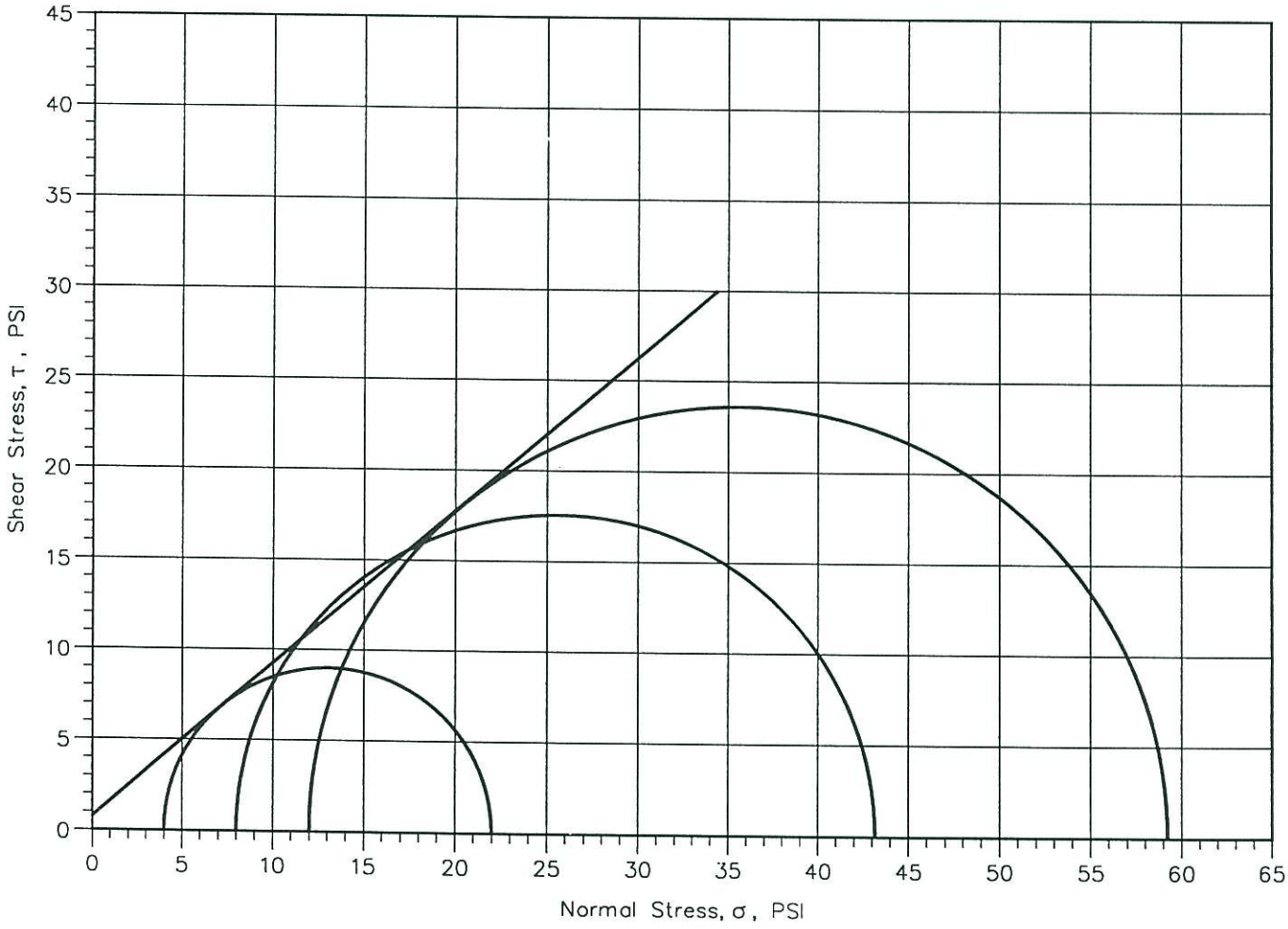
Cohesion C = 0 PSF

Internal Friction Angle $\phi = 40$ DEGREES

Wet Unit Weight 115.5 PCF

Dry Unit Weight 99.9 PCF

Moisture Content 15.6 %



991018tri

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CONSTRUCTION MATERIALS ENGINEERING AND TESTING

TRIAXIAL COMPRESSION TEST
GRAPH OF MOHR'S CIRCLES

Project: DMMA DU-9 Project No.: 99-1018

Sample No.: CD2 Depth: Remolded

Soil Description: Light Gray Fine SAND (SP)

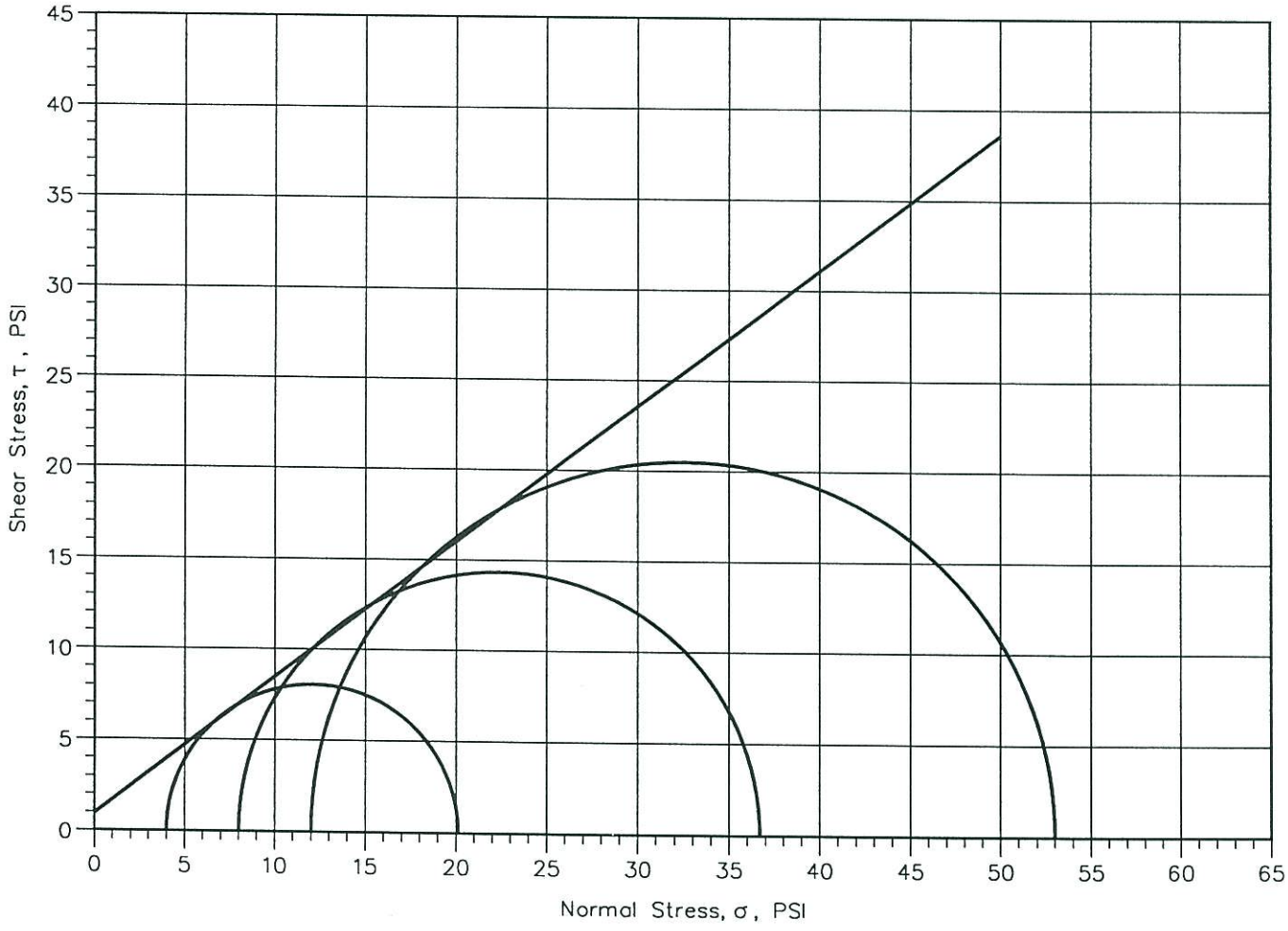
Cohesion C = 0 PSF

Internal Friction Angle $\phi = 37$ DEGREES

Wet Unit Weight 113.6 PCF

Dry Unit Weight 98.3 PCF

Moisture Content 15.6 %



991018tri2

Ellis & Associates, Inc.

CONSTANT-HEAD PERMEABILITY TEST

Project: DMMA DU-9, DEE DOT PROPERTY

Sample No: Composite Samples of Areas 1, 2 and 3

Soil Description: Light Gray Fine Sand (SP)

SPECIMEN DATA:

Wet Unit Weight, pcf =	113.1
Dry Unit Weight, pcf =	97.8
Natural Moisture Content, % =	15.6
Fines Content, % =	2.2

Average Permeability, k, cm/sec = 3.698E-03

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 sample testes 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.

Consolidated-Drained Triaxial Shear Test

Consolidated-drained triaxial shear tests (CD Tests) with low back pressure saturation were performed on selected samples of soil remolded to predetermined densities. These tests were used to determine the shear strength of the soil samples. Cylindrical specimens about 1.5 inches in diameter and 2.9 inches high were trimmed from the compacted specimen and placed into a triaxial compression chamber. Each specimen was then saturated under a low back pressure. Once the specimen has been saturated, it was then consolidated with a predetermined cell pressure by allowing drainage of the pore water from the sample. When consolidation was essentially complete, the drainage valve was left open and axial load was increased until the specimen failed in drained shear. An applied strain rate of approximately 2 percent per hour was used to load the specimen to assure that no pore water pressure would be developed during the application of axial load.

LABORATORY TEST PROCEDURES

Gradation

The particle-size analysis or gradation of the sample tested was determined in general accordance with latest revision of ASTM D 422. This test procedure determines the grain size distribution of the tested sample by passing the sample through a standard set of nested sieves.

Constant Head Permeability Test

The coefficient of permeability for the laminar flow of water through granular soils was determined in general accordance with the latest revision of ASTM D 2434. The constant head permeability test is a measure of the quantity of water that flows through a sample contained in a cylinder of known height and diameter in a measured time while maintaining a constant head of water on the sample. The coefficient of permeability is determined by application of the Darcy's Law shown below:

$$k = \frac{Q\,L}{hAt}$$

k = Coefficient of permeability

Q = Quantity of water discharge

L = Length of specimen

h = Constant head of water

A = Cross-sectional area of specimen

t = Total time of discharge

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CONSTRUCTION MATERIALS ENGINEERING AND TESTING

KEY TO SOIL CLASSIFICATION

Description of Compactness or Consistency in Relation To Standard Penetration Resistance

COARSE GRAINED SOILS (Sands and Gravels)	
N-Value	**Compactness**
0 - 3	Very Loose
4 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
51 and Greater	Very Dense

FINE GRAINED SOILS (Silts and Clays)	
N-Value	**Compactness**
0 - 1	Very Soft
2 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very Stiff
31 and Greater	Hard

DESCRIPTION OF SOIL COMPOSITION**

(Unified Soil Classification System)

MAJOR DIVISION		Group Symbol	LABORATORY CLASSIFICATION CRITERIA: FINER THAN 200 SIEVE %	LABORATORY CLASSIFICATION CRITERIA: SUPPLEMENTARY REQUIREMENTS	SOIL DESCRIPTION
Coarse grained (over 50% by weight coarser than No. 200 sieve)	Gravelly soils (over half of coarse fraction larger than No. 4)	GW	0 - 5*	D_{60}/D_{10} greater than 4, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded gravels, sandy gravels
		GP	0 - 5*	Not meeting above gradation for GW	Gap graded or uniform gravels, sandy gravels
		GM	12 or more*	PI less than 4 or below A-line	Silty gravels, silty sandy gravels
		GC	12 or more*	PI over 7 above A-line	Clayey gravels, clayey sandy gravels
	Sandy soils (over half of coarse fraction finer than No. 4)	SW	0 - 5*	D_{60}/D_{10} greater than 6, $D_{30}^2/(D_{60} \times D_{10})$ between 1 & 3	Well graded sands, gravelly sands
		SP	0 - 5*	Not meeting above gradation requirements	Gap graded or uniform sands, gravelly sands
		SM	12 or more*	PI less than 4 or below A-line	Silty sands, silty gravelly sands
		SC	12 or more*	PI over 7 and above A-line	Clayey sands, clayey gravelly sands
Fine grained (over 50% by weight finer than No. 200 sieve)	Low compressibility (liquid limit less than 50)	ML	Plasticity chart		Silts, very fine sands, silty or clayey fine sands, micaceous silts
		CL	Plasticity chart		Low plasticity clays, sandy or silty clays
		OL	Plasticity chart, organic odor or color		Organic silts and clays of low plasticity
	High compressibility (liquid limit more than 50)	MH	Plasticity chart		Micaceous silts, diatomaceous silts, volcanic ash
		CH	Plasticity chart		Highly plastic clays and sandy clays
		OH	Plasticity chart, organic odor or color		Organic silts and clays of high plasticity
Soils with fibrous organic matter		Pt	Fibrous organic matter; will char, burn or glow		Peat, sandy peats, and clayey peat

* For soils having 5 to 12 percent passing the No. 200 sieve, use a dual symbol such as GW-GC.

** Standard Classification of Soils for Engineering Purposes (ASTM D 2487)

SAND DESCRIPTION MODIFIERS	
Modifier	**Fines Content**
With	5% to 12%
(No Modifier)	13% to 30%
Very	31% to 50%

ORGANIC MATERIAL MODIFIERS	
Modifier	**Organic Content**
Trace	1% to 2%
Few	2% to 4%
Some	4% to 8%
Many	>8%

FLORIDA INLAND NAVIGATION DISTRICT
DREDGED MATERIAL MANAGEMENT AREA DU-9 EXPANSION
ST. JOHNS COUNTY, FLORIDA

APPENDIX D
2003 Preliminary Report of Geotechnical Exploration
DU-9 Dredged Material Management Area
MACTEC Project No. 6734-8695

Note: All information provided in these reports are representative of the soils at the date when the samples were collected. The data do not reflect any variations that may occur adjacent to or between the soil borings. The material taken from these core borings is not available for inspection.

PRELIMINARY REPORT OF GEOTECHNICAL EXPLORATION

DU-9 Dredged Material Management Area

Florida Inland Navigation District

St. Johns County, Florida

MACTEC Project No. 6734-03-8695

- Prepared For -

Taylor Engineering, Inc.

- Prepared By -

MACTEC Engineering and Consulting, Inc.
3901 Carmichael Avenue
Jacksonville, Florida 32207

MACTEC

MACTEC

August 11, 2003

Mr. Darrell M. Setser, P.E.
Taylor Engineering, Inc.
9000 Cypress Green Drive, Suite 200
Jacksonville, Florida 32256

Subject: **Preliminary Report of Geotechnical Exploration**
DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida
MACTEC Project No. 6734-03-8695

Dear Mr. Setser:

MACTEC Engineering and Consulting, Inc. (MACTEC), f/k/a Law Engineering and Environmental Services, Inc. (LAW), has completed field and laboratory testing for the subject project in general accordance with our Proposal No. 40599-0-0000-2433 dated March 7, 2003. Authorization for our services was provided by a Subcontract Agreement signed by Mr. Steven Schropp on April 15, 2003. This report summarizes the results of field and laboratory testing performed to date.

Project Information

The purpose of this exploration was to develop information concerning the site and subsurface conditions in order to evaluate the proposed dike located in northern St. Johns County, Florida. This report briefly describes the field and laboratory testing activities and presents the findings. We understand that an engineering analysis of the data obtained is not desired at this time, but may be requested at a later date.

Project information was provided by you during the period of December 11, 2002, to August 8, 2003. We have been provided with a set of Preliminary Drawings, prepared by Taylor Engineering, Inc. (TEI) and dated February, 2000. In addition, a geotechnical exploration report, prepared by Ellis and Associates, Inc., dated March 10, 1999, was furnished. Field and laboratory test data acquired by the U.S. Army Corps of Engineers, dated December, 1992, and field data from Aerostar Environmental Services, Inc. in August of 2001, were also provided. Plans showing Alternative 3 location and a typical cross section (dated April, 2003) were prepared by your office and provided to us.

The subject site is located approximately 1½ miles south of J. Turner Butler Boulevard, and approximately ¼ mile west of the Intracoastal Waterway in northeastern St. Johns County, Florida. We understand that a dike and a sludge disposal area are being constructed as part of the subject project. The sludge disposal area is beyond the scope of this report. The interior of the proposed dike will be used to store dredge material. We understand that Alternative 3 (as depicted on the furnished drawings) is being considered for construction. Alternative 3 for the planned Dredged Material Management Area (DMMA) dike will have approximate plan dimensions of 1,000 to 1,200 feet (north-south direction) by 1,200 to 1,500 feet (east-west direction), with a total plan area of approximately 35 acres. We understand that, due to soil contamination issues, only the northern approximate half of the DMMA will initially be constructed.

We understand that the final berm geometry has not been established at this time; however, based on the furnished preliminary drawings, we understand that the dike crest elevation will be constructed at

approximately +33.0 feet, NGVD. The top-of-dike width will be 15 feet. The interior and exterior dike side slopes will be 3:1 (H:V). The final average basin bottom elevation is estimated at +11.0 feet, NGVD. A shellrock stabilized perimeter road will be constructed. The maximum dike height will be 22 feet. The borrow material for the dikes will be excavated from the interior of the DMMA. TEI anticipates a maximum depth of excavation of about two feet.

The dredged material will come from the nearby Intracoastal Waterway, and will consist of sand and silt. This material will then be hydraulically deposited inside the DMMA. We understand that a geomembrane liner is no longer being considered for use on the proposed dike.

Field Exploration

In order to explore the subsurface conditions in the proposed dike area, four Standard Penetration Test (SPT) borings (designated B-1 through B-4) were drilled to depths of 45 to 65 feet each. We note that the number of SPT borings was reduced by you from 11 in our original proposal to 4. The borings were located in the field based on available drill rig access. In addition, a total of 15 backhoe-excavated observation pits were excavated in the interior of the proposed berm. These pits were generally excavated to depths of 6 to 8 feet below the existing ground surface. We note that several of the observation pits were omitted because the backhoe could not mobilize to the desired locations due to heavily wooded site conditions. Bulk samples (consisting of soil placed into five-gallon buckets) were collected at two separate observation pit locations at depths of generally four feet and shallower. An estimate of the depth to the seasonal high groundwater level was recorded at several observation pit locations. Please refer to the Observation Pit Record sheets in the Appendix for these seasonal high groundwater depth estimates. State plane coordinates of the SPT boring and observation pit locations were recorded by your office after the completion of each boring or pit.

We note that our field exploration was generally performed to explore the subsurface conditions in the area of the dike for Alternative 3, as discussed with you. The SPT boring, observation pit, and bulk sample locations are shown on the Field Exploration Plan in the Appendix. These locations were selected by representatives from our office based on drill rig and backhoe accessibility considerations. Ground surface elevations at the boring/pit locations were neither determined by us nor furnished to us. State Plane Coordinates for the boring and observation pit locations were determined by representatives from your office, and are shown on the Boring and Observation Pit Coordinates sheet in the Appendix. The coordinates provided to us are in State Plane FL East NAD 27, NGVD 29.

The Soil Test Boring Records, in the Appendix, graphically show the penetration resistances and, along with the Observation Pit Records, present the soil descriptions for each SPT boring and observation pit. The stratification lines and depth designations on the boring and observation pit records represent the approximate boundaries between soil types. In some instances, the transition between soil types may be gradual. Brief descriptions of the exploratory drilling and sampling techniques used are presented in the Field and Laboratory Procedures section of the Appendix.

Laboratory Testing

In order to aid in classifying the soils and to help quantify and correlate engineering properties, laboratory index property and classification tests were performed on representative soil samples obtained from the SPT borings and bulk samples. The laboratory testing on samples taken from the SPT borings included the following:

- Five water content tests
- Four fines content (percent material passing the No. 200 sieve) tests

- Six grain size distribution tests
- Two Atterberg limits (plasticity) tests

The results of these tests are presented on the Summary of Laboratory Test Results and Grain Size Distribution Report sheets in the Appendix. Brief descriptions of the laboratory test procedures used are presented in the Field and Laboratory Procedures section in the Appendix.

In addition, laboratory testing was also performed on two of the bulk samples (Samples BS-1 and BS-2). The testing consisted of two Modified Proctor tests to determine the maximum dry density and optimum water content of the samples, two grain size distribution tests, and two consolidated, drained (CD) triaxial tests. The two triaxial tests were performed on bulk samples remolded to a dry density of approximately 95 percent of the Modified Proctor maximum dry density. The results of these tests are presented on the Compaction Test Report, Triaxial Shear Test Report, and Grain Size Distribution Report sheets in the Appendix.

Site Conditions

The existing site conditions were observed by representatives from our office during the period of April 24 to May 7, 2003. The site conditions at the time of our visits generally consisted of heavily wooded areas and areas that had recently been cleared. The heavily wooded area was generally located at the northern end of the property. The cleared area was located at the southern end of the site. The boundary between the cleared and wooded areas was generally located approximately 100 to 115 feet north of the proposed southern dike edge for Alternative 3.

In general, the wooded area consisted of scattered (mature) pine trees and heavy underbrush. The underbrush was primarily palmetto bushes, with various other weeds and shrubs also present. The cleared area had the majority of the underbrush and pine trees removed; however, the pine tree and palmetto bush stumps remained in place. Several dirt access roads were observed near the east and west edges of the proposed dike. The topography was generally flat and level. Standing surface water was not observed on the property at the time of our visits. The surrounding area was undeveloped.

Subsurface Conditions

General - An illustrated representation of the subsurface conditions encountered in the proposed construction area is shown on the Generalized Subsurface Profile presented in the Appendix. The profiles and the soil conditions outlined below highlight the major subsurface stratification. The Soil Test Boring Records and Observation Pit Records in the Appendix should be consulted for detailed descriptions of the subsurface conditions encountered at each boring and observation pit location. When reviewing the boring and observation pit records and the subsurface profile, it should be understood that soil conditions may vary between and away from boring and observation pit locations.

Soils – In general, the borings encountered topsoils (organic sands mixed with pine tree and palmetto roots) in the upper one to two feet. The soil conditions encountered beneath the topsoils are outlined in Table 1.

Table 1: Summary of Subsurface Conditions			
Layer No.	**Depth Range (feet)**	**Soil Type (USCS Classification)**	**SPT N-value* Range (bpf)**
1	0 – (5 to 6)	Very loose to loose fine SAND (SP); slightly silty fine SAND (SP-SM); slightly clayey fine SAND (SP-SC)	2 to 10
2	(5 to 6) – 14	Firm to dense weakly-cemented, organically stained slightly silty fine sand (SP) (Probable Hardpan)	11 to 41
3	14 – 27	Very loose to firm fine SAND (SP)	2 to 14
4	27 – 32	Very loose to loose fine SAND (SP) to silty fine SAND (SM); clayey fine SAND (SC)	2 to 6
5	32 – 37	Loose to firm fine SAND (SP); slightly silty fine SAND (SP-SM)	6 to 15
6	37 – (57 to 62)	Very loose to dense fine to coarse SAND (SP); silty fine to coarse SAND (SM); clayey fine SAND (SC) with many shell fragments; some soft to firm sandy CLAY (CH) – Boring B-4	3 to 46
7	(57 to 62) – 65	Loose to very dense fine to medium SAND (SP); slightly silty fine to medium SAND (SP-SM); slightly clayey fine to medium SAND (SP-SC)	10 to 100+

* Standard Penetration Resistance (ASTM D1586) – automatic hammer system.

We note that the soils encountered in the depth range of Layer 2 in Boring B-2 and several of the observation pits exhibited no appreciable degree of consistent cementation, and were not designated as "hardpan."

Groundwater – The groundwater level was measured at the boring and observation pit locations at the time of drilling, and, in several of the observation pits, up to a period of approximately 5 hours after excavation. The groundwater table was encountered at depths ranging from approximately 2 to 4 feet below the existing ground surface. Fluctuation in the observed groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, tidal fluctuations in the nearby Intracoastal Waterway, and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

We have enjoyed assisting you and look forward to serving as your geotechnical and environmental consultant on the remainder of this project and on future projects. If you have any questions concerning this report, please contact us.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Steven E. Kiser

Steven E. Kiser, E.I.
Engineering Intern
BY ___ WITH PERMISSION

Kirk A. McIntosh

Kirk A. McIntosh, P.E.
Senior Principal
Registered, Florida 33703

Distribution: Taylor Engineering, Inc. (2)
File (1)

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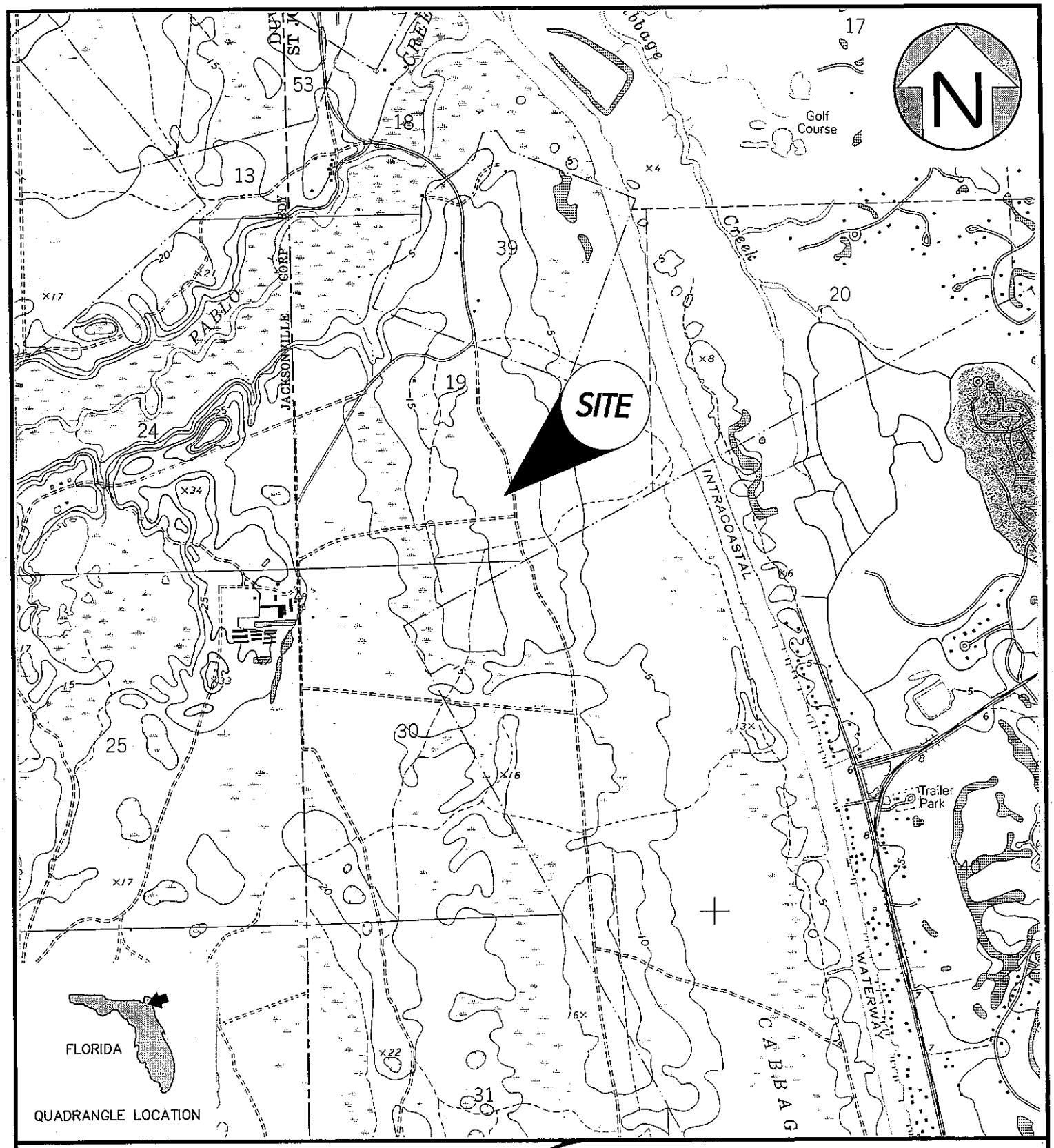
APPENDIX



REFERENCE:
PALM VALLEY QUADRANGLE; FLORIDA
TOPOGRAPHIC MAP
DATED: 1964; PHOTOREVISED: 1992
U.S. GEOLOGICAL SURVEY

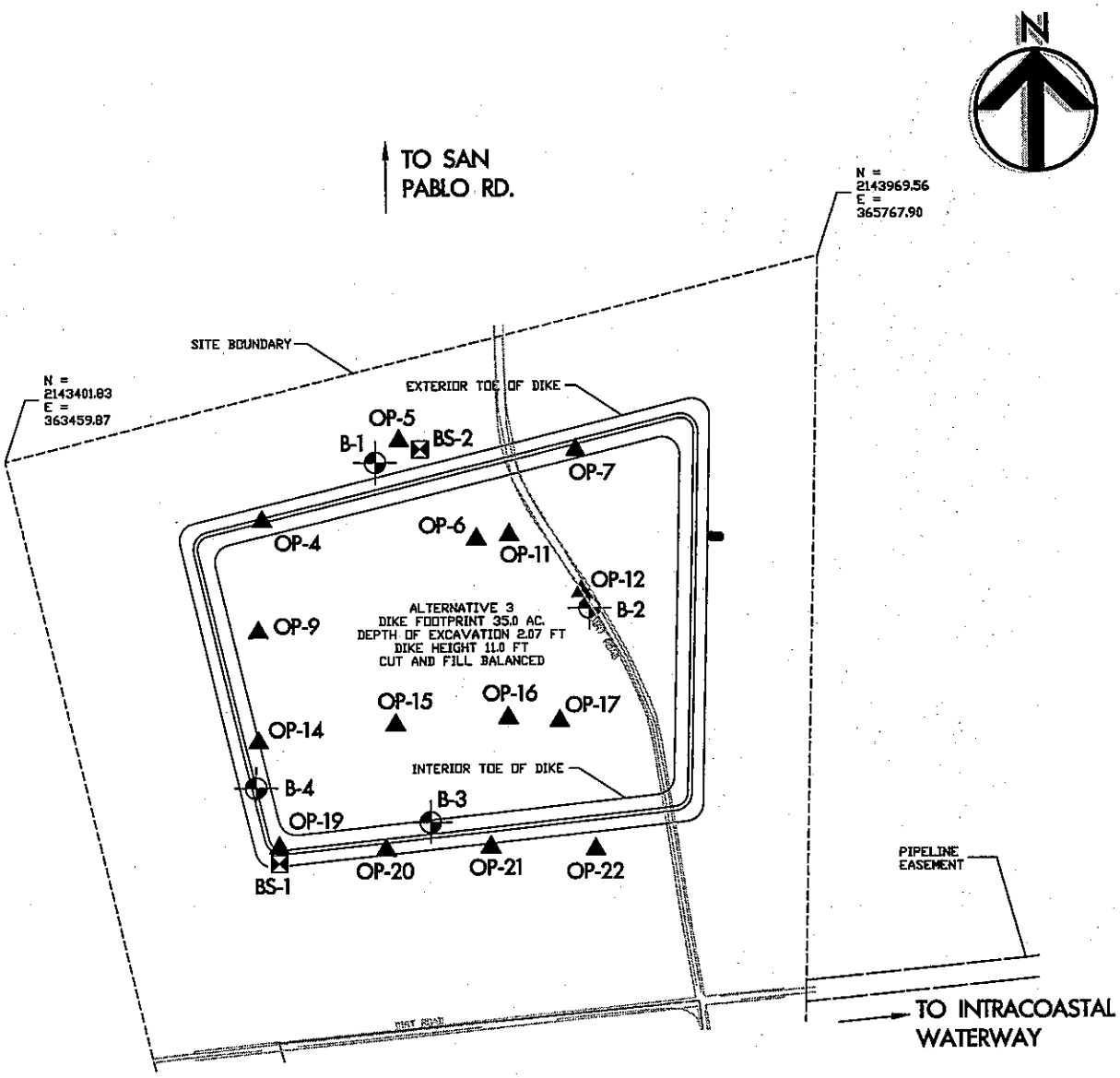
0 1000' 2000'
GRAPHIC SCALE

MACTEC
ENGINEERING & CONSULTING, INC.
3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

SITE LOCATION MAP

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida

DRAWN: JP	DATE: 8/6/03	SCALE: 1"=2000'
CHECKED:	PROJ. NO. 6734-03-8695	APPROX.



NOTE: Observation Pits OP-1, OP-2, OP-3, OP-8, OP-10, OP-13, OP-18, and OP-23 were not excavated due to access constraints.

0 250' 500'

GRAPHIC SCALE

LEGEND

- SOIL TEST BORING LOCATION
- OBSERVATION PIT LOCATION
- BULK SOIL SAMPLING LOCATION

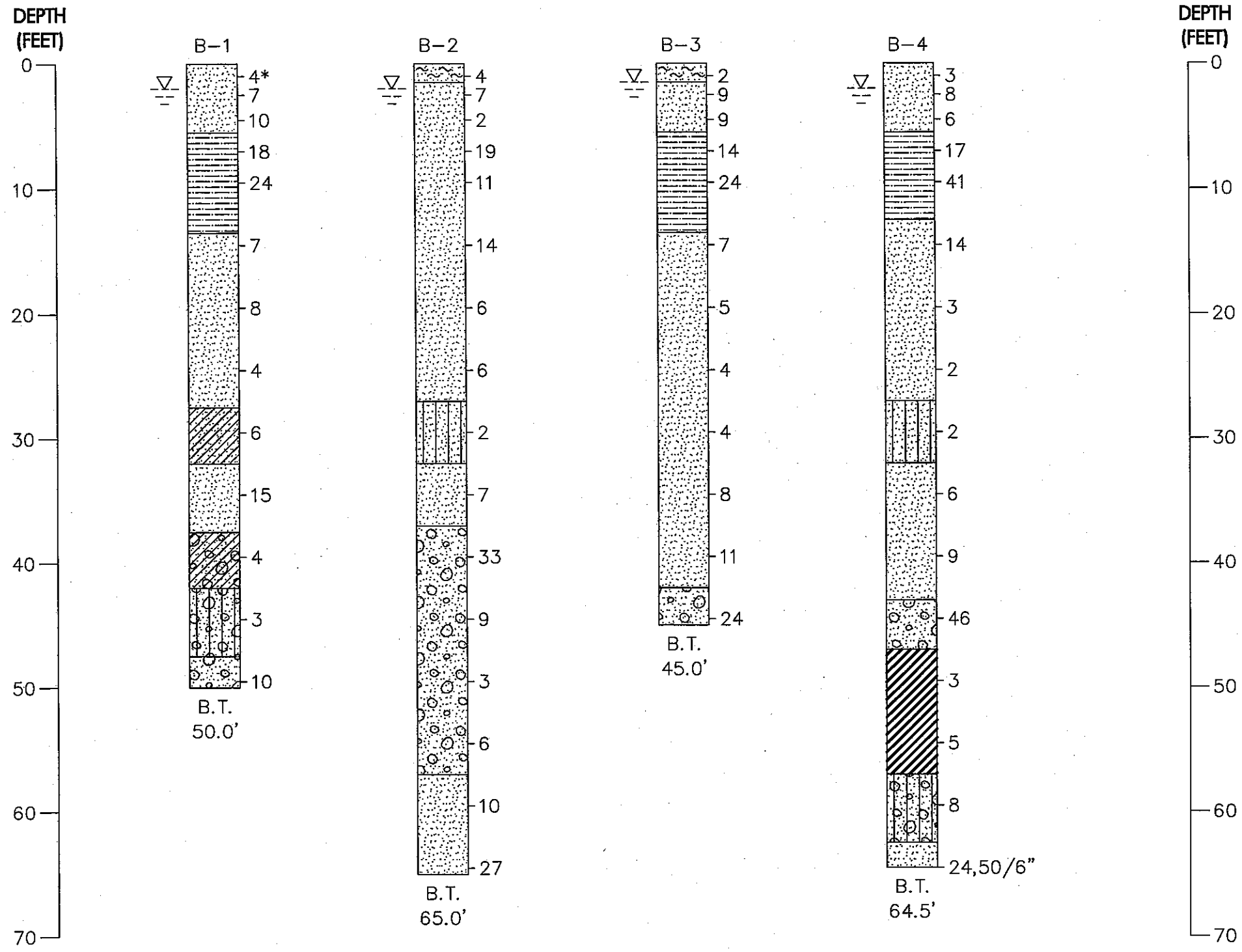
REFERENCE: Site Plan
Provided by: Taylor Engineering
on May 30, 2003

MACTEC
ENGINEERING & CONSULTING, INC.
3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

FIELD EXPLORATION PLAN

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida

DRAWN: JP	DATE: 8/6/03	SCALE: 1"=500'
CHECKED:	PROJ. NO. 6734-03-8695	APPROX.



NOTE: Please refer to text of report for additional information relative to groundwater conditions and potential fluctuations which could occur.

LEGEND

- Fine SAND (SP); Slightly Silty Fine to Medium SAND (SP–SM); Slightly Clayey Fine to Medium SAND (SP–SC)
- Organic Slightly Silty Fine SAND (SP–SM) With Many Roots
- Weakly Cemented Organically Stained Slightly Silty Fine SAND (SP–SM) (Probable Hardpan)
- Clayey Fine to Medium SAND (SC)
- Clayey to Very Clayey Fine SAND (SC) with Some Shell Fragments
- Sandy to Very Sandy CLAY (CH) With Some Shell Fragments and Roots
- Silty to Very Silty Fine to Medium SAND (SM)
- Silty Fine to Coarse SAND (SM) With Some to Many Shell Fragments
- Fine to Coarse SAND (SP); Slightly Silty Fine to Coarse SAND (SP–SM); With Many Shell Fragments

* Standard Penetration Resistance (Blows/ft.) Measured Using an Automatic Hammer System

Groundwater Level @ Time of Drilling

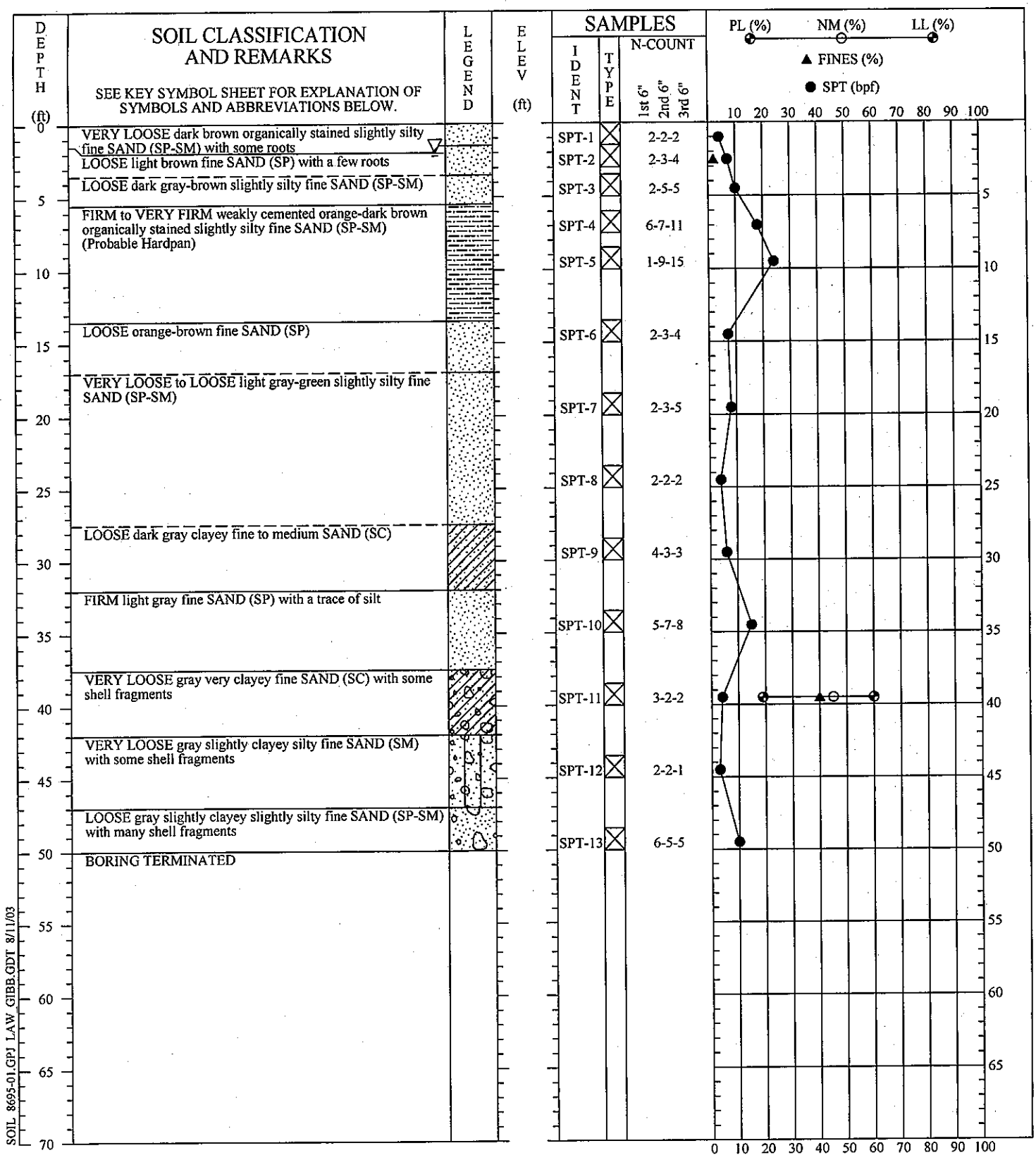
B.T. Boring Terminated

50.0' Depth Terminated

MACTEC ENGINEERING & CONSULTING
3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

GENERALIZED SUBSURFACE PROFILE
DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida

DRAWN: JP	DATE: 8/6/03	SCALE: AS SHOWN
CHECKED:	PROJ. NO. 6734-03-8695	



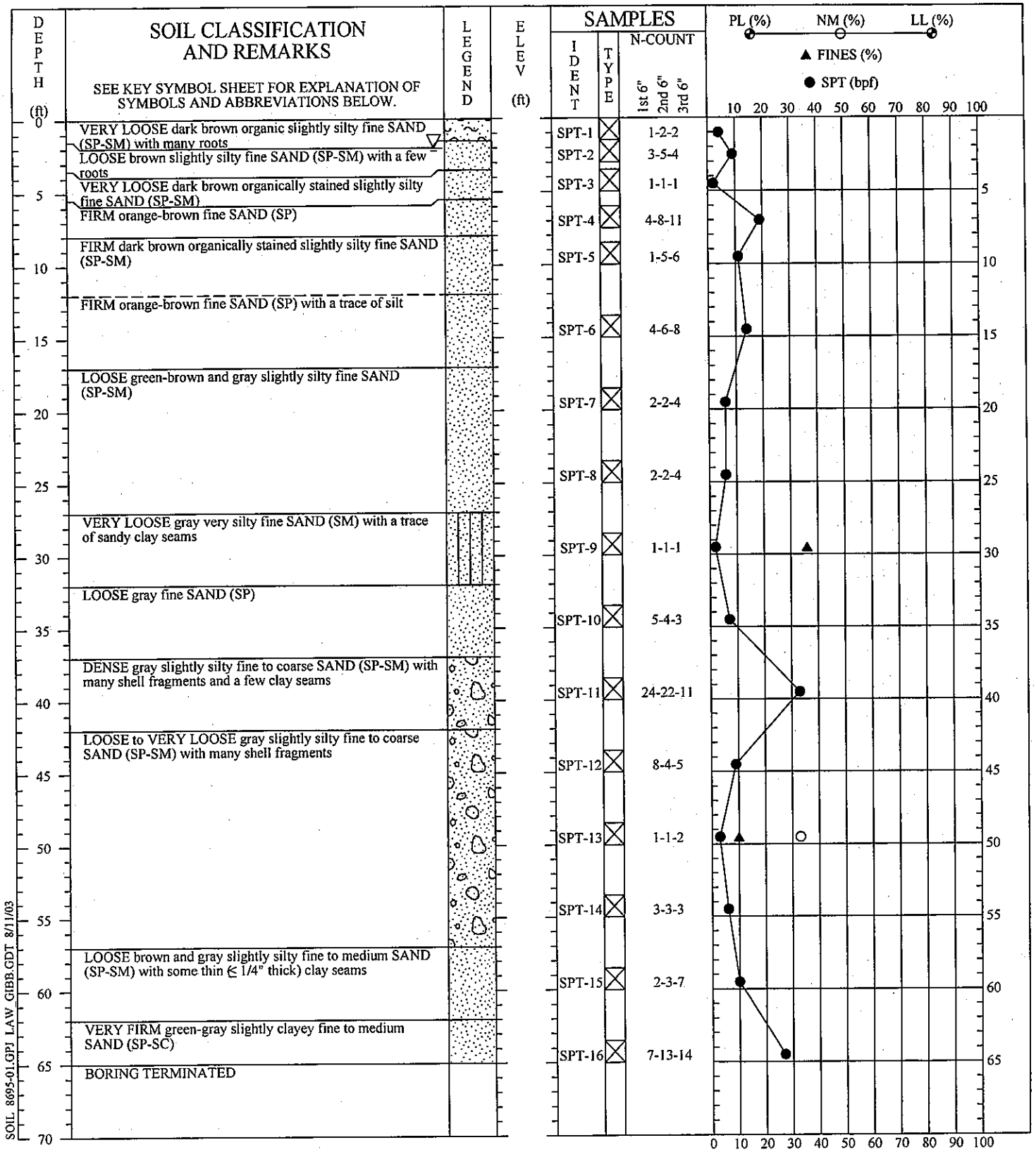
CONTRACTOR:	MACTEC
DRILLER:	DJ/CT/RA
EQUIPMENT:	ATV 550 - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: DU-9 Dredged Material Management Area
Coord N:
Coord E:
Boring No.: B-1
Checked By:
Drilled: April 28, 2003
Proj. No.: 6734-03-8695

MACTEC



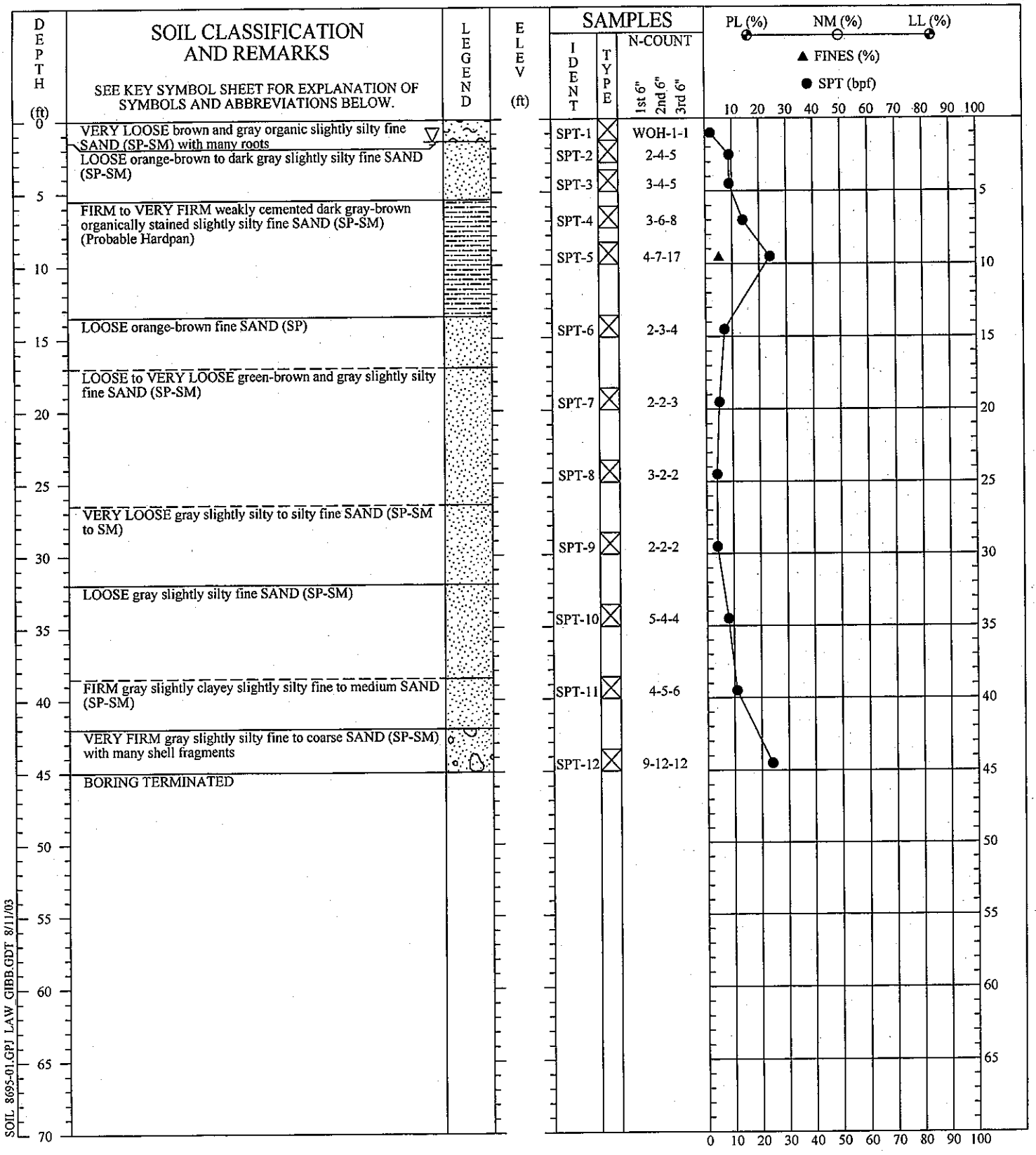
CONTRACTOR:	MACTEC
DRILLER:	DJ/CT/RA
EQUIPMENT:	ATV 550 - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: DU-9 Dredged Material Management Area
Coord N:
Coord E:
Boring No.: B-2
Checked By:
Drilled: April 28, 2003
Proj. No.: 6734-03-8695

MACTEC



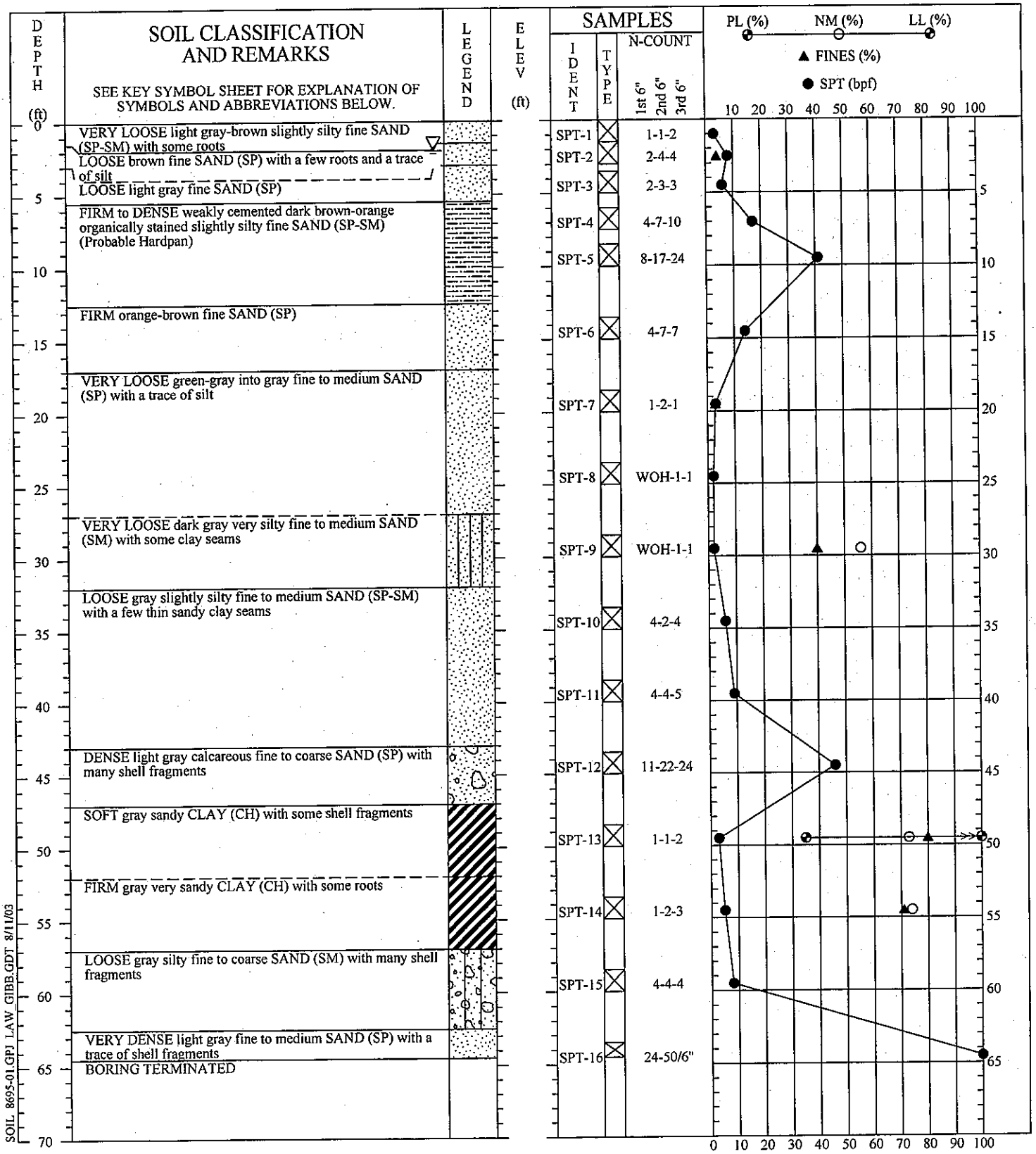
CONTRACTOR:	MACTEC
DRILLER:	DJ/CT/RA
EQUIPMENT:	ATV 550 - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: DU-9 Dredged Material Management Area
Coord N:
Coord E:
Drilled: April 24, 2003
Proj. No.: 6734-03-8695
Boring No.: B-3
Checked By:

MACTEC



CONTRACTOR:	MACTEC
DRILLER:	DJ/CT/RA
EQUIPMENT:	ATV 550 - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: DU-9 Dredged Material Management Area
Coord N:
Coord E:
Boring No.: B-4
Checked By:
Drilled: April 24, 2003
Proj. No.: 6734-03-8695

MACTEC

OBSERVATION PIT RECORDS

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida
MACTEC Project No. 6734-03-8695

Date Performed: May 7, 2003

Observation Pit No.	Depth (Feet)	Material Description
OP-4	0.0 - 1.6	Gray slightly organic slightly silty fine SAND (SP-SM) with many roots and pine needles
	1.6 - 5.8	Gray-tan fine SAND (SP) with a trace of limbs at approximately 4' depth
	5.8 - 6.3	Dark brown slightly silty fine SAND (SP-SM)
	O.P.T.[1]	GWL[2]: 3.1 feet @ 3 hours
		SHWT[3]: 2.1 feet
OP-5	0.0 - 1.7	Gray slightly silty fine SAND (SP-SM) with many roots
	1.7 - 5.2	Tan-brown-gray fine SAND (SP) with trace silt
	5.2 - 7.3	Dark brown slightly cemented slightly silty fine SAND (SP-SM) (probable hardpan) with many slightly silty fine sand seams
	O.P.T.	GWL: 2.9 feet @ 3 hours
OP-6	0.0 - 2.7	Gray slightly silty fine SAND (SP-SM) with many roots
	2.7 - 4.4	Tan-brown slightly silty fine SAND (SP-SM) with some cemented sand fragments
	4.4 - 6.7	Dark brown organically stained slightly silty fine SAND (SP-SM) with many seams of brown slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 3.7' @ 4 hours
OP-7	0.0 - 1.5	Gray slightly silty fine SAND (SP-SM) with many roots
	1.5 - 3.5	Gray-tan fine SAND (SP) with a trace of silt
	3.5 - 4.5	Dark brown slightly silty fine SAND (SP-SM) with some cemented sand fragments
	4.5 - 5.5	Brown slightly silty fine SAND (SP-SM)
	5.5 - 8.0	Dark brown slightly silty fine SAND (SP-SM) with some cemented sand fragments
	O.P.T.	GWL: 2.7 feet @ 2 hours
OP-9	0.0 - 1.4	Dark brown organic silty fine SAND (SM) with many roots
	1.4 - 3.7	Gray-light gray fine SAND (SP)
	3.7 - 5.7	Dark brown slightly cemented slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 3.0 feet @ 3 hours
OP-11	0.0 - 2.1	Gray slightly silty fine SAND (SP-SM) with many roots
	2.1 - 4.4	Dark brown-tan slightly silty fine SAND (SP-SM) with trace slightly silty cemented sand fragments
	4.4 - 6.7	Tan-brown slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 3.2 feet @ 3 hours
OP-12	0.0 - 2.4	Dark gray organic slightly silty fine SAND (SP0SM) with many roots and pine needles
	2.4 - 6.6	Dark brown-gray slightly cemented slightly silty fine SAND (SP-SM) (probable hardpan) with some dark brown slightly silty fine sand seams
	O.P.T.	GWL: 2.8 feet @ 2 hours
		SHWT: 2.1 feet

OBSERVATION PIT RECORDS

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida
MACTEC Project No. 6734-03-8695

Date Performed: May 7, 2003

Observation Pit No.	Depth (Feet)	Material Description
OP-14	0.0 - 1.4	Gray slightly silty fine SAND (SP-SM) with some roots
	1.4 - 5.7	Gray-tan fine SAND (SP) with trace roots
	5.7 - 6.7	Dark brown slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 3.4 feet @ 3 hours
OP-15	0.0 - 2.0	Gray-brown slightly silty fine SAND (SP-SM) with trace organics and some roots
	2.0 - 4.7	Tan-gray fine SAND (SP) with trace silt and slightly cemented sandy fragments (SP-SM)
	4.7 - 6.4	Dark brown-gray slightly silty fine SAND (SP-SM) with trace to some slightly cemented sand fragments
	O.P.T.	3.2 feet @ 30 minutes
OP-16	0.0 - 2.0	Gray fine SAND (SP) with some silt and many roots
	2.0 - 3.7	Tan-gray fine SAND (SP) with trace cemented sand fragments
	3.7 - 5.8	Dark brown organically stained slightly cemented slightly silty fine SAND (SP-SM) (probable hardpan) with trace slightly silty fine sand seams
	5.8 - 7.1	Dark brown-brown slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: Not Recorded
OP-17	0.0 - 2.1	Gray slightly organic slightly silty fine SAND (SP-SM) with some roots
	2.1 - 3.7	Brown-tan fine SAND (SP) with trace silt
	3.7 - 5.5	Dark brown slightly organic slightly silty fine SAND (SP-SM) (hardpan)
	5.5 - 7.0	Brown slightly silty fine SAND (SP-SM) with cemented sand fragments
	O.P.T.	GWL: Not Recorded
OP-19	0.0 - 0.7	Gray-brown slightly silty fine SAND (SP-SM) with some roots
	0.7 - 5.9	Light gray-tan fine SAND (SP)
	5.9 - 6.5	Dark brown slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 3.7 feet @ 3 hours
		SHWT: 3.1 feet
OP-20	0.0 - 0.5	Dark brown slightly organic slightly silty fine SAND (SP-SM) with some to many roots
	0.5 - 2.3	Gray fine SAND (SP)
	2.3 - 3.4	Dark brown slightly cemented slightly silty fine SAND (SP-SM) (probable hardpan seam)
	3.4 - 6.9	Tan fine SAND (SP)
	O.P.T.	GWL: 2.5 feet @ 3 hours

OBSERVATION PIT RECORDS

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida
MACTEC Project No. 6734-03-8695

Date Performed: May 7, 2003

Observation Pit No.	Depth (Feet)	Material Description
OP-21	0.0 - 0.7	Dark brown slightly organic silty fine SAND (SP) with some roots
	0.7 - 2.9	Gray fine SAND (SP)
	2.9 - 3.5	Dark brown slightly silty slightly cemented fine SAND (SP-SM) (possible hardpan seam)
	3.5 - 7.1	Tan-brown slightly silty fine SAND (SP-SM) with one 6" diameter tree limb at 4.5' depth
	O.P.T.	GWL: 2.3 feet @ 4 hours
OP-22	0.0 - 1.1	Dark brown organic silty fine SAND (SM) with many roots and tree limbs
	1.1 - 3.2	Gray fine SAND (SP)
	3.2 - 7.0	Dark gray slightly silty fine SAND (SP-SM)
	O.P.T.	GWL: 2.1 feet @ 5 hours
		SHWT: 1.9 feet

Notes:

[1]O.P.T. - Observation Pit Terminated
[2]GWL - Groundwater Level (depth below existing ground surface)
[3]SHWT - Seasonal High Water Table

Note: Observation Pits OP-1 through OP-3, OP-8, OP-10, OP-13, OP-18 were not performed.

Boring and Observation Pit Coordinates

DU-9 Dredged Material Management Area
Florida Inland Navigation District
St. Johns County, Florida
MACTEC Project No. 6734-03-8695

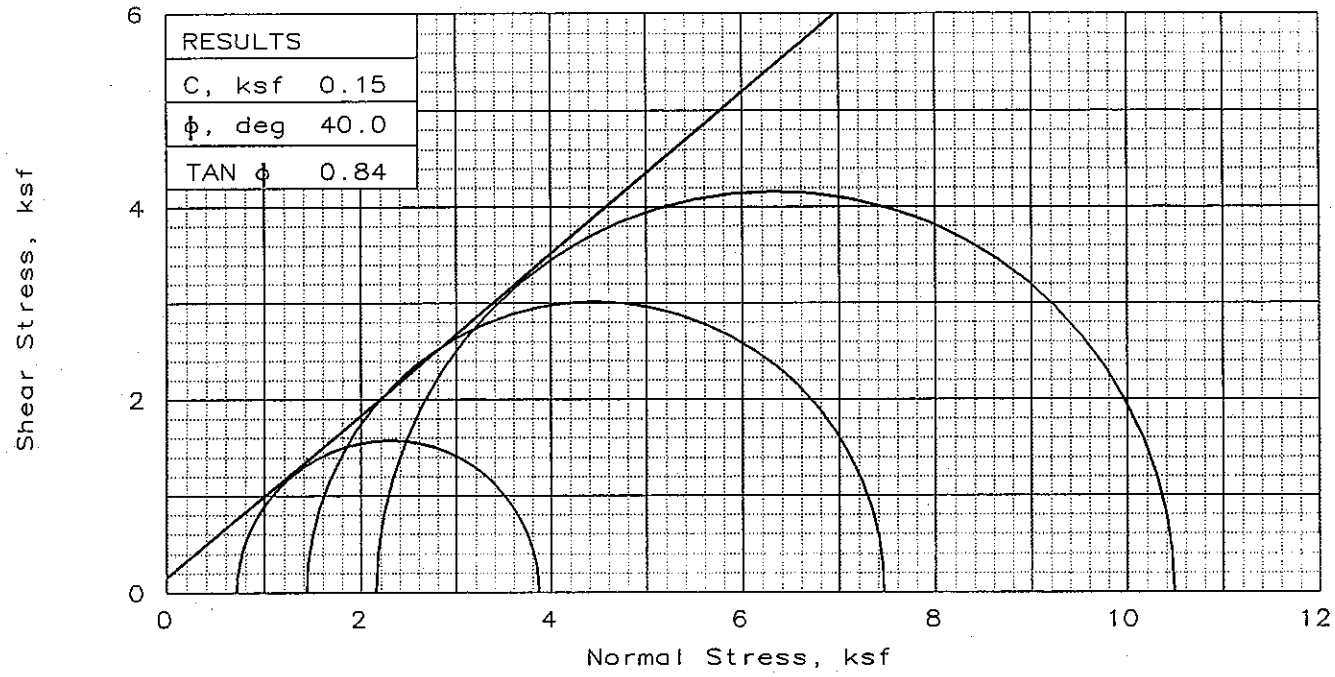
Location	Coordinates	
	Northing	Easting
B-1	2143394	364509
B-2	2142981	365113
B-3	2142380	364661
B-4	2142474	364170
OP-4	2143229	364190
OP-5	2143456	364576
OP-6	2143175	364793
OP-7	2143427	365077
OP-9	2142915	364180
OP-11	2143003	364810
OP-12	2143003	365110
OP-14	2142602	364179
OP-15	2142651	364565
OP-16	2142670	364881
OP-17	2142660	365030
OP-19	2142305	364236
OP-20	2142300	364538
OP-21	2142305	364832
OP-22	2142298	365129

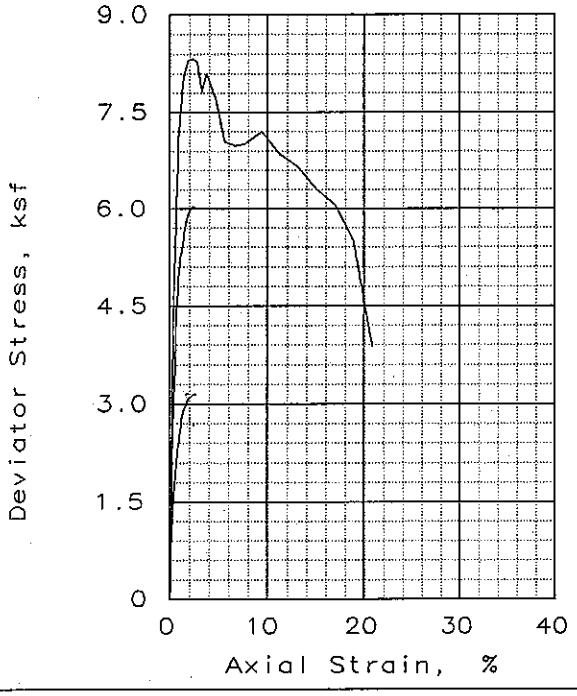
SUMMARY OF LABORATORY TEST RESULTS

DU-9 Dredged Material Disposal Area
Florida Inland Navigation District
St. Johns County, Florida

Boring No.	Sample No.	Depth Range (Feet)	Unified Soil Classification System Symbol	Water Content W_n (%)	Liquid Limit LL (%)	Plastic Limit PL (%)	Plasticity Index PI (%)	Water Plasticity Ratio, R_w (%)	Specific Gravity G_s	Organic Loss on Ignition O (%)	Dry Unit Weight g_d (pcf)	Grain Size		
												Gravel (%)	Sand (%)	Fines (%)
B-1	2	1.5 3.0	SP									0	97	3
B-1	11	38.5 40.0	SC	45	60	19	41	+63						40
B-2	9	28.5 30.0	SM									0	64	36
B-2	13	48.5 50.0	SP-SM	33								3	87	10
B-3	5	8.5 10.0	SP-SM									0	95	5
B-4	2	1.5 3.0	SP									0	96	4
B-4	7	18.5 20.0	SP									0	97	3
B-4	9	28.5 30.0	SM	56										40
B-4	13	48.5 50.0	CH	73	111	35	76	+50						80
B-4	14	53.5 55.0	CH	74										71

MACTEC Engineering and Consulting, Inc. Jacksonville, Florida	**MACTEC Project No. 6734-03-8695**	**Table No. 1 of 1**





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	17.5	17.5	17.5
	DRY DENSITY, pcf	95.4	95.3	95.4
	SATURATION, %	63.2	63.1	63.2
	VOID RATIO	0.735	0.735	0.735
	DIAMETER, in	2.80	2.83	2.86
	HEIGHT, in	5.53	5.41	5.30
AT TEST	WATER CONTENT, %	26.7	26.7	26.2
	DRY DENSITY, pcf	96.8	96.9	97.6
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.709	0.706	0.695
	DIAMETER, in	2.79	2.82	2.84
	HEIGHT, in	5.52	5.40	5.28
Strain rate, %/min		0.05	0.05	0.05
BACK PRESSURE, ksf		7.2	7.2	7.2
CELL PRESSURE, ksf		7.9	8.6	9.4
FAILURE STRESS, ksf		3.2	6.0	8.3
ULTIMATE STRESS, ksf		3.1	6.0	8.3
σ_1 FAILURE, ksf		3.9	7.5	10.5
σ_3 FAILURE, ksf		0.7	1.4	2.2

TYPE OF TEST:
Consolidated Drained
SAMPLE TYPE: bulk, remolded
DESCRIPTION: Brown and Gray
Fine SAND

SPECIFIC GRAVITY= 2.65
REMARKS: Molded to 95% modified
proctor
Depth: 3.5'

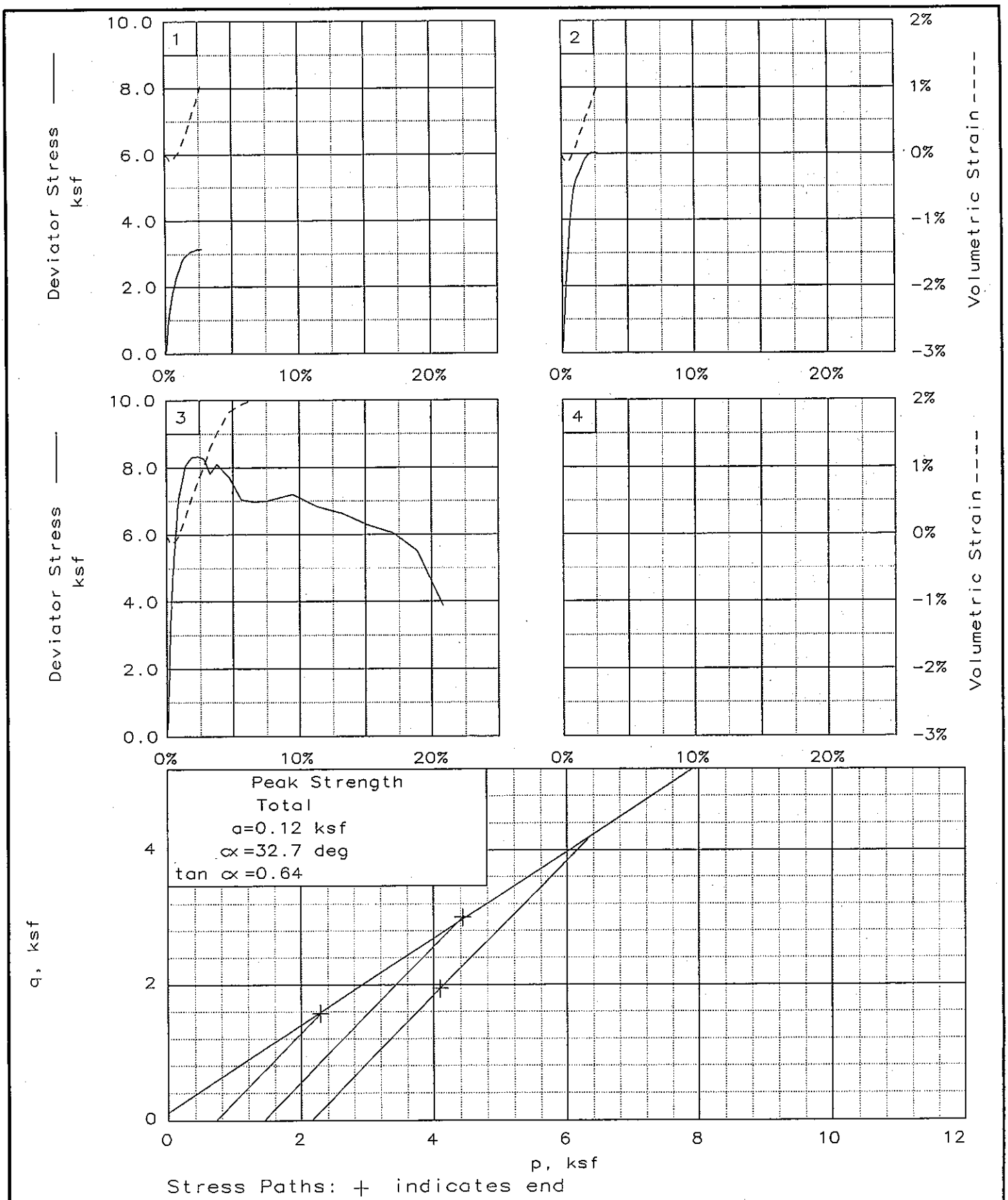
CLIENT: Taylor Engineering, Inc.

PROJECT: DU-9 Dredged Material Management
Area
SAMPLE LOCATION: Bulk Sample BS-1

PROJ. NO.: 6734038695 DATE: 5-28-03

TRIAXIAL SHEAR TEST REPORT

LAW ENGINEERING INC.

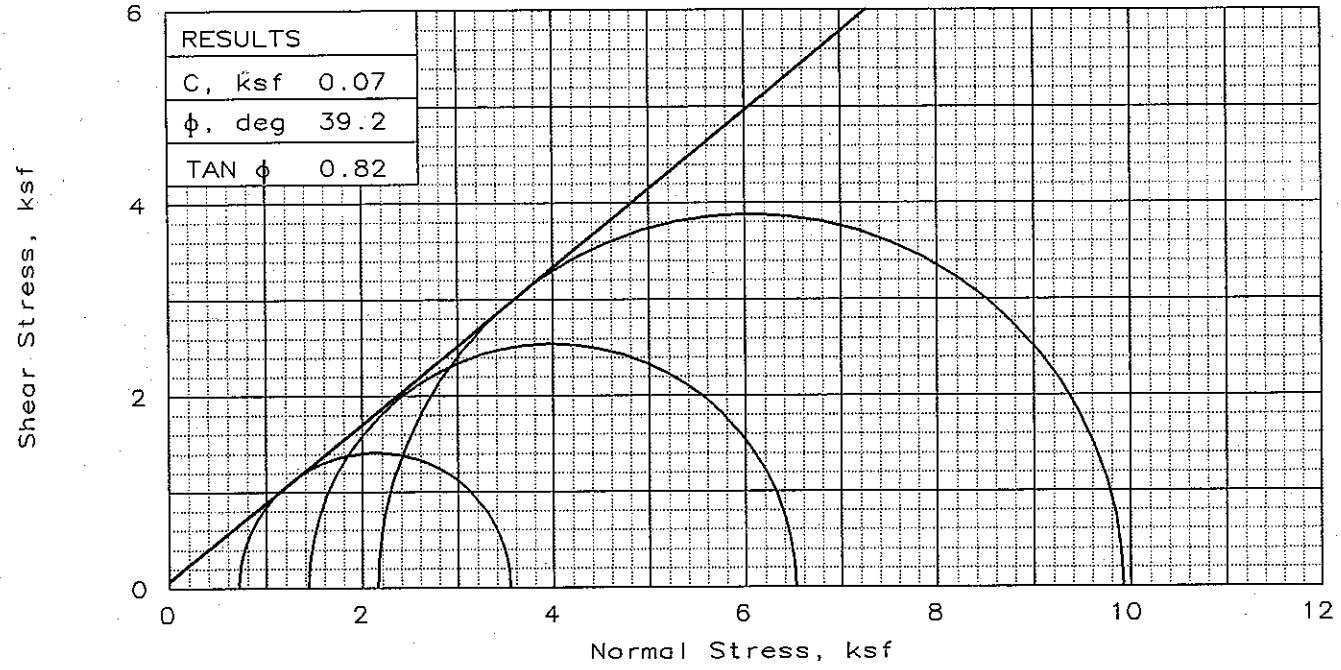


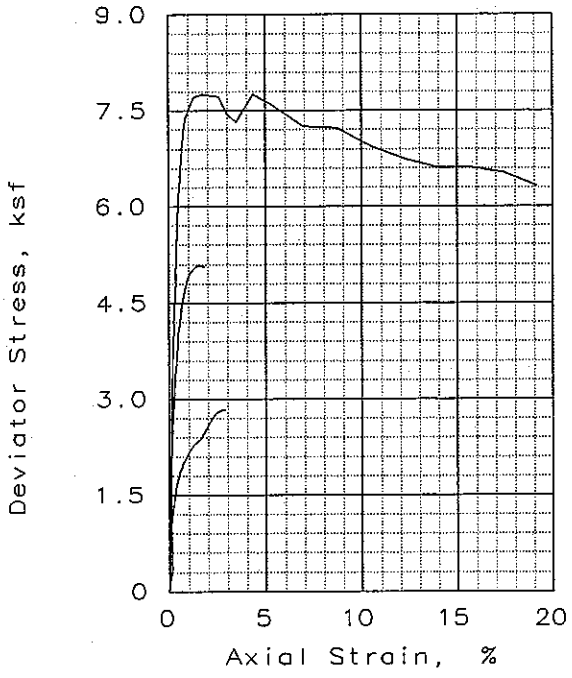
Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area

Location: Bulk Sample BS-1

File: DU-9-BS1 Project No.: 6734038695





SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	14.8	14.8	14.8
	DRY DENSITY, pcf	96.4	96.4	96.4
	SATURATION, %	54.9	54.9	54.9
	VOID RATIO	0.715	0.716	0.715
	DIAMETER, in	2.80	2.84	2.85
	HEIGHT, in	6.16	6.01	5.74
AT TEST	WATER CONTENT, %	26.0	25.8	20.2
	DRY DENSITY, pcf	98.0	98.3	107.7
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.689	0.683	0.536
	DIAMETER, in	2.79	2.82	2.75
	HEIGHT, in	6.15	5.99	5.74
Strain rate, %/min		0.05	0.05	0.05
BACK PRESSURE, ksf		7.20	7.20	7.20
CELL PRESSURE, ksf		7.92	8.64	9.36
FAILURE STRESS, ksf		2.83	5.08	7.76
ULTIMATE STRESS, ksf		2.83	5.08	7.74
σ_1 FAILURE, ksf		3.55	6.52	9.92
σ_3 FAILURE, ksf		0.72	1.44	2.16

TYPE OF TEST:
Consolidated Drained
SAMPLE TYPE: bulk, remolded
DESCRIPTION: Light Brown Fine SAND

SPECIFIC GRAVITY= 2.65
REMARKS: Molded to 95% of a modified proctor
Depth: 2.0'

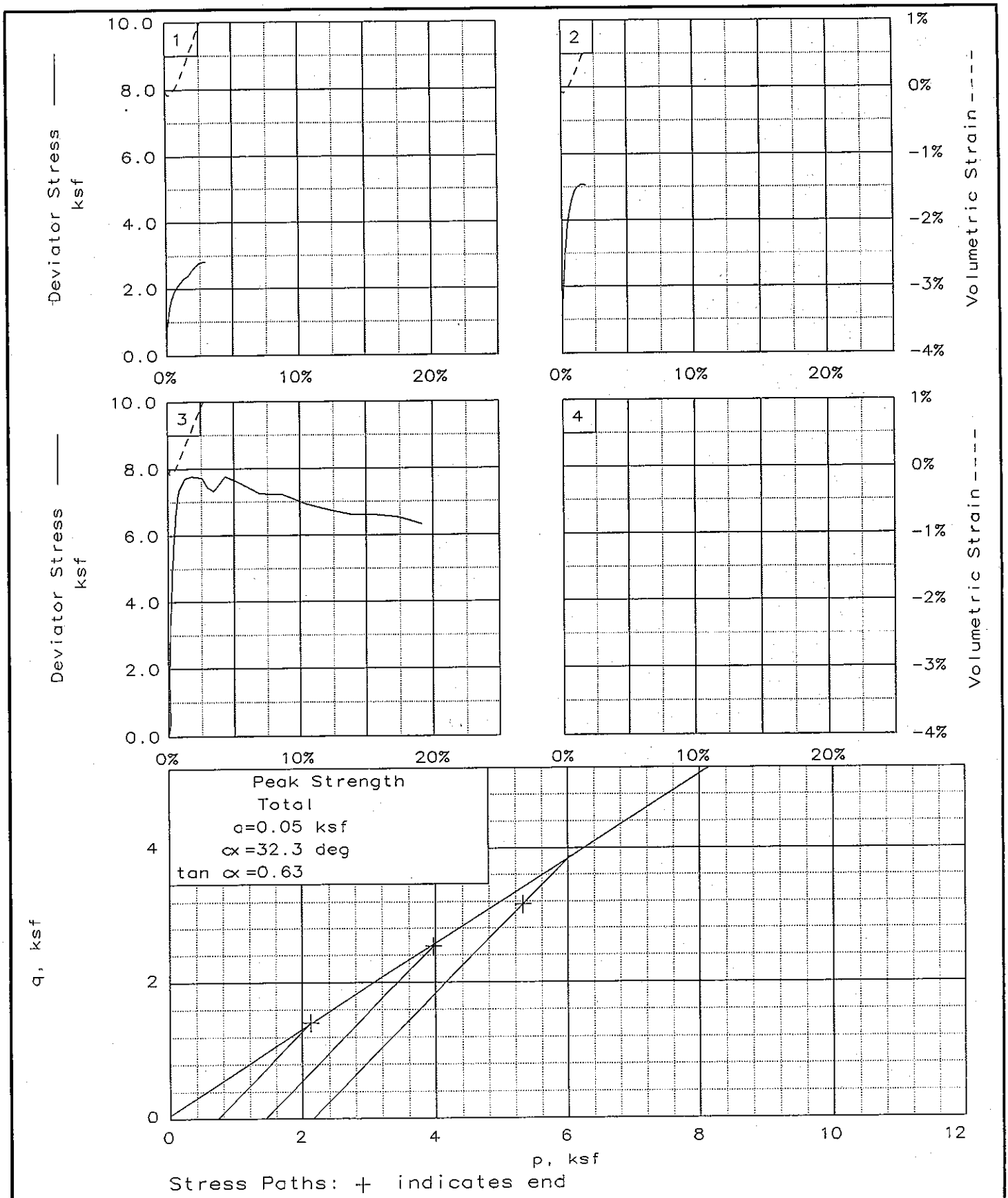
CLIENT: Taylor Engineering, Inc.

PROJECT: DU-9 Dredged Material Management Area
SAMPLE LOCATION: Bulk Sample BS-2

PROJ. NO.: 6734038695 DATE: 5-28-03

TRIAXIAL SHEAR TEST REPORT

LAW ENGINEERING INC.



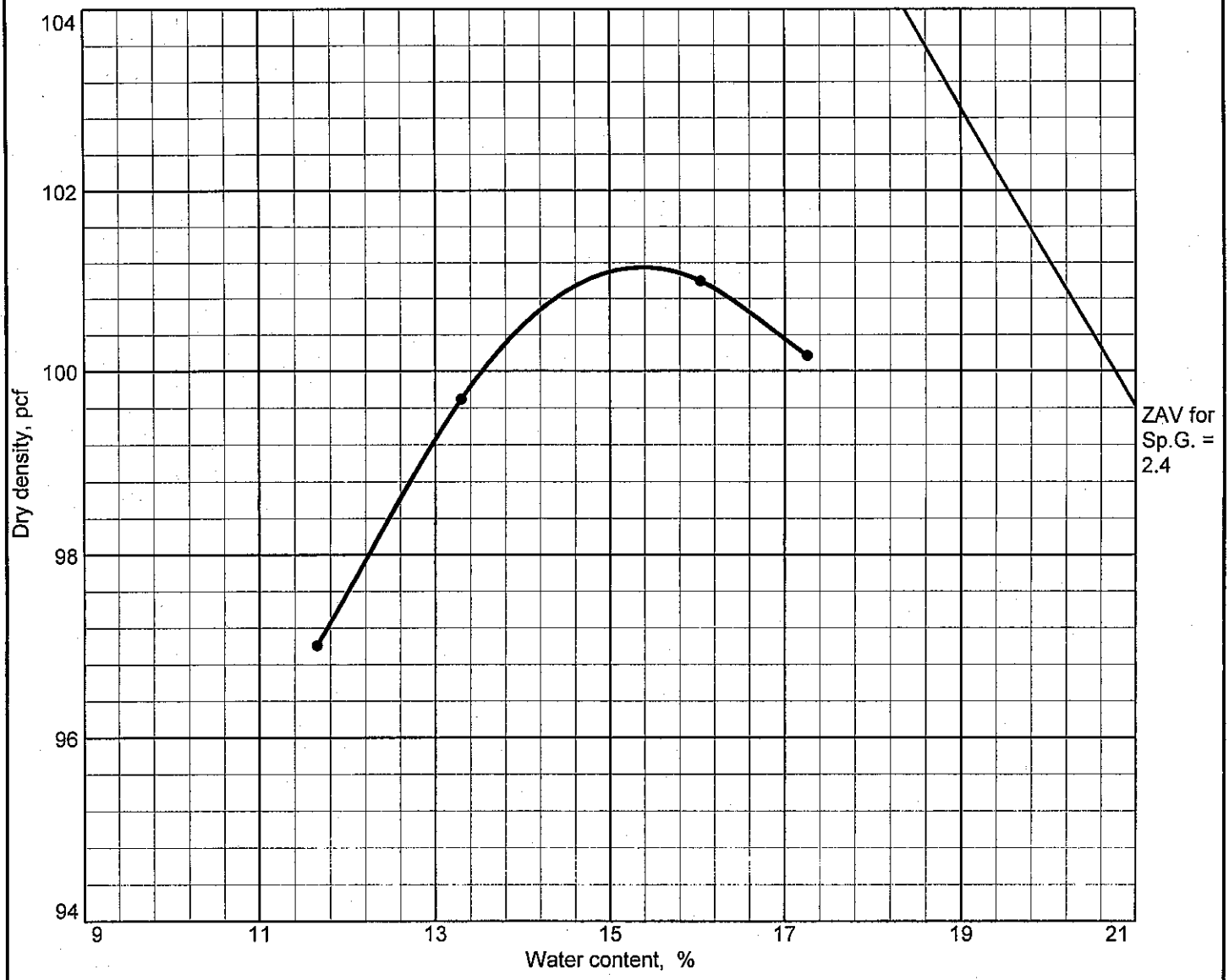
Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area

Location: Bulk Sample BS-2

File: DU-9-BS2 Project No.: 6734038695

COMPACTION TEST REPORT



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SP	A-3					0.0	3.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 101 pcf Optimum moisture = 15 %	Brown-Gray Fine SAND with Trace Organics

Project No.: 6734-03-8695 **Client:** Taylor Engineering, Inc.
Project: DU-9 Dredged Material Management Area
St. Johns County, Florida
● **Source:** N/A **Sample No.:** BS-1

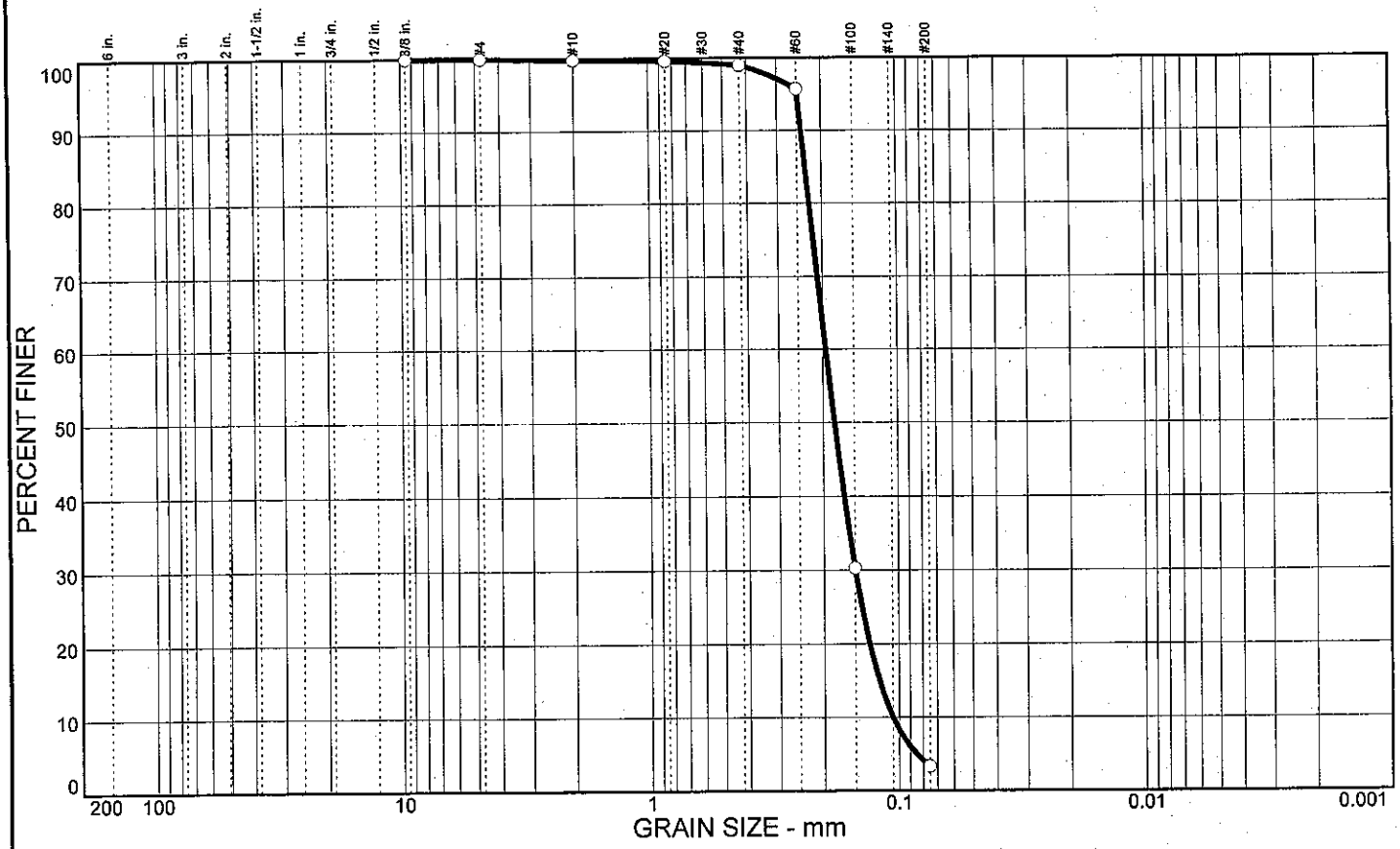
Remarks:

COMPACTION TEST REPORT

Law Engineering and Environmental Services, Inc.

Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			96.7	3.3		SP	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.194		
D_{30}	0.150		
D_{10}	0.106		
	COEFFICIENTS		
C_c	1.09		
C_u	1.84		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	99.8		
#20	99.6		
#40	99.0		
#60	95.7		
#100	30.3		
#200	3.3		

SOIL DESCRIPTION

○ Brown-Gray Fine SAND with Trace Organics

REMARKS:

○

○ Source: N/A

Sample No.: BS-1

Law Engineering and Environmental Services, Inc.

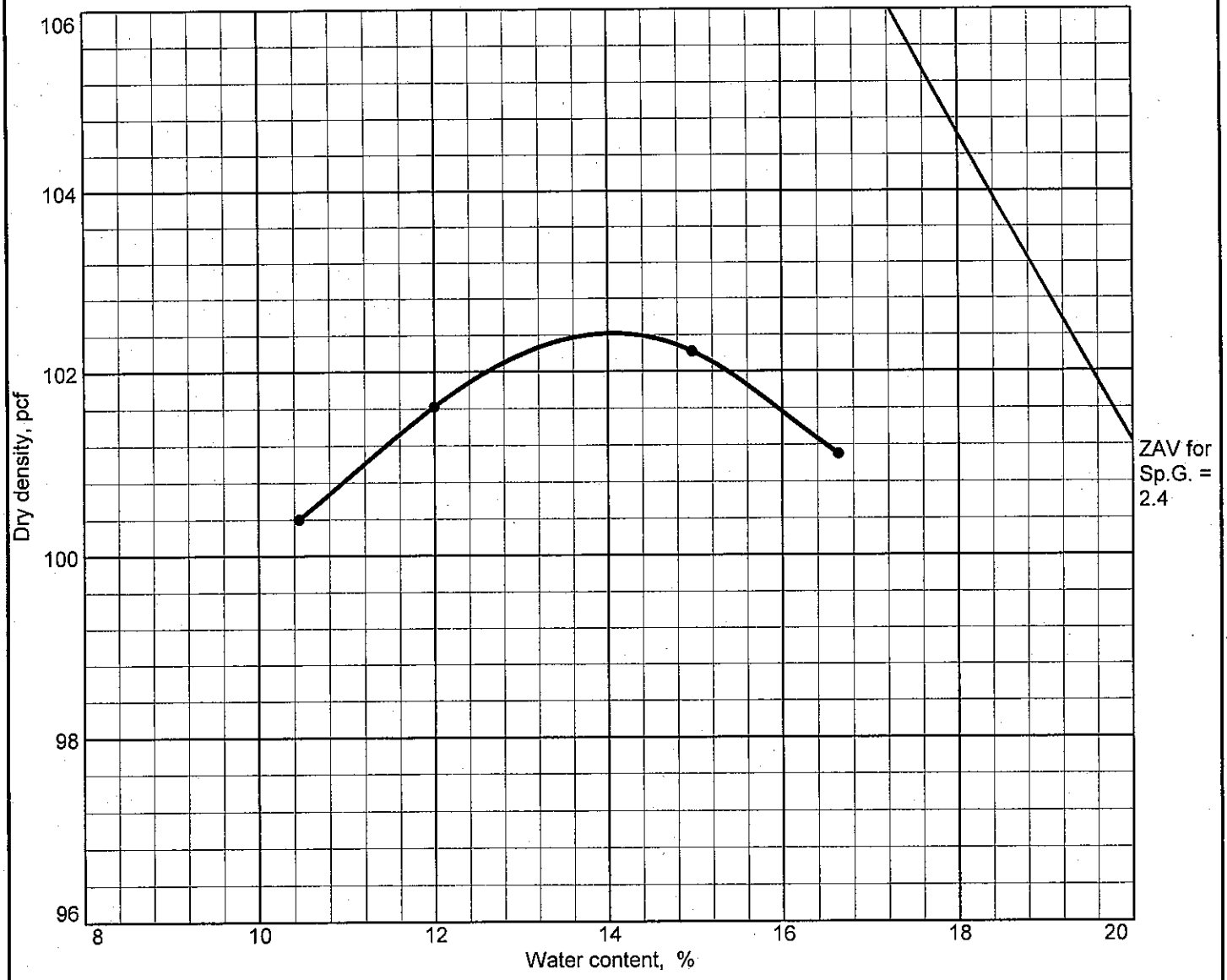
Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695

Plate

COMPACTION TEST REPORT



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SP	A-3					0.1	2.9

TEST RESULTS

Maximum dry density = 102 pcf

Optimum moisture = 14 %

MATERIAL DESCRIPTION

Brown Fine SAND with Trace Organics

Project No.: 6734-03-8695 **Client:** Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area

St. Johns County, Florida

● **Source:** N/A **Sample No.:** BS-2

Remarks:

COMPACTION TEST REPORT

Law Engineering and Environmental Services, Inc.

Plate

Particle Size Distribution Report

	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		0.1	97.0	2.9		SP	A-3		

SIEVE inches size	PERCENT FINER ○		
.375	100.0		
GRAIN SIZE			
D_{60}	0.193		
D_{30}	0.147		
D_{10}	0.104		
COEFFICIENTS			
C_C	1.09		
C_U	1.86		

SIEVE number size	PERCENT FINER ○
#4	99.9
#10	99.8
#20	99.6
#40	99.1
#60	96.7
#100	31.6
#200	2.9

SOIL DESCRIPTION

○ Brown Fine SAND with Trace Organics

REMARKS:

○

○ Source: N/A

Sample No.: BS-2

Law Engineering and Environmental Services, Inc.

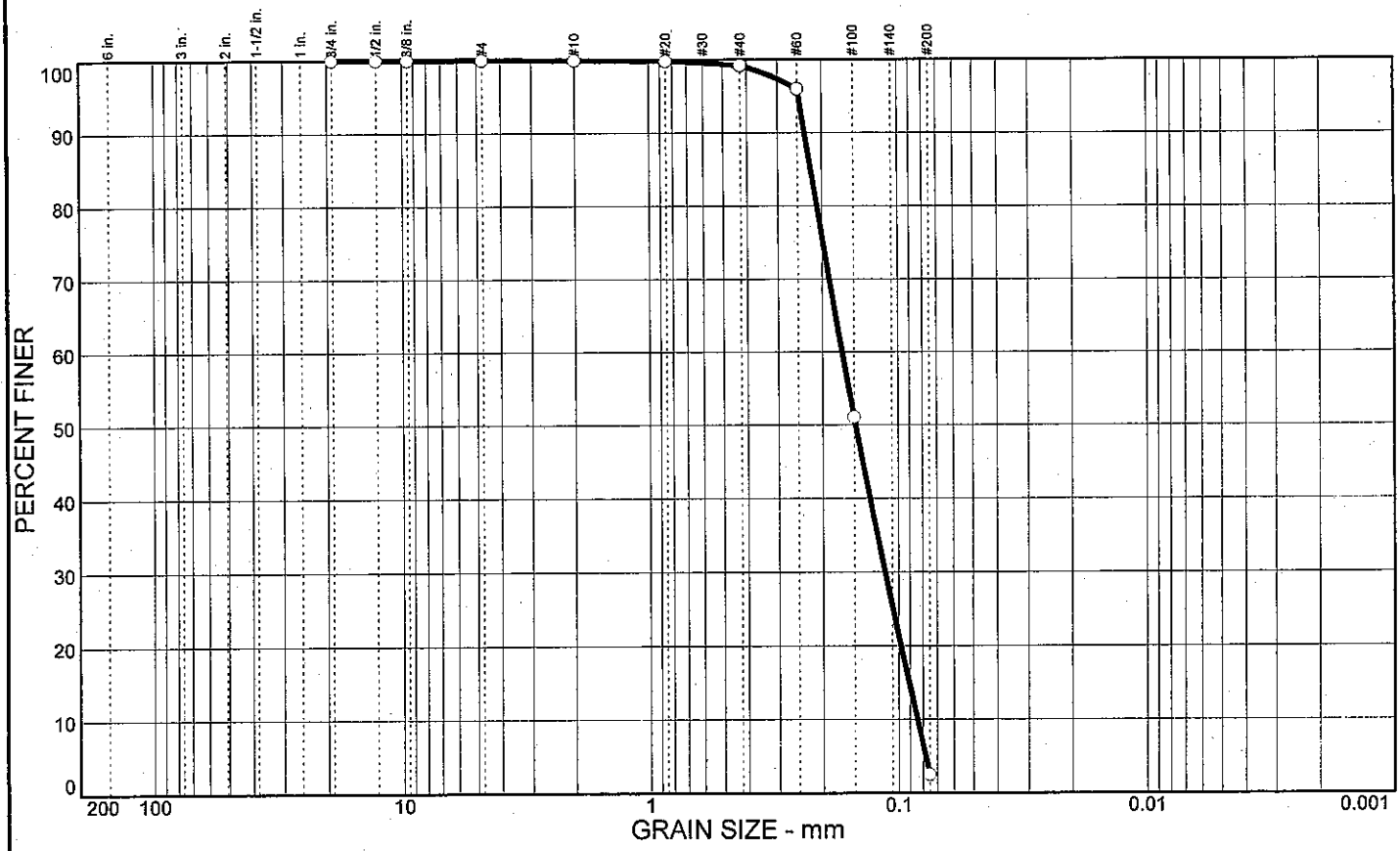
Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695

Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			97.5	2.5		SP	A-3		

SIEVE inches size	PERCENT FINER ○		
.750	100.0		
.50	100.0		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.167		
D_{30}	0.113		
D_{10}	0.0842		
	COEFFICIENTS		
C_C	0.91		
C_u	1.98		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.2		
#60	96.0		
#100	51.1		
#200	2.5		

SOIL DESCRIPTION

○ Light brown fine SAND with traces of silt and roots

REMARKS:

○

Source: Boring B-1 Sample No.: 2 Depth: 1.5'-3.0'

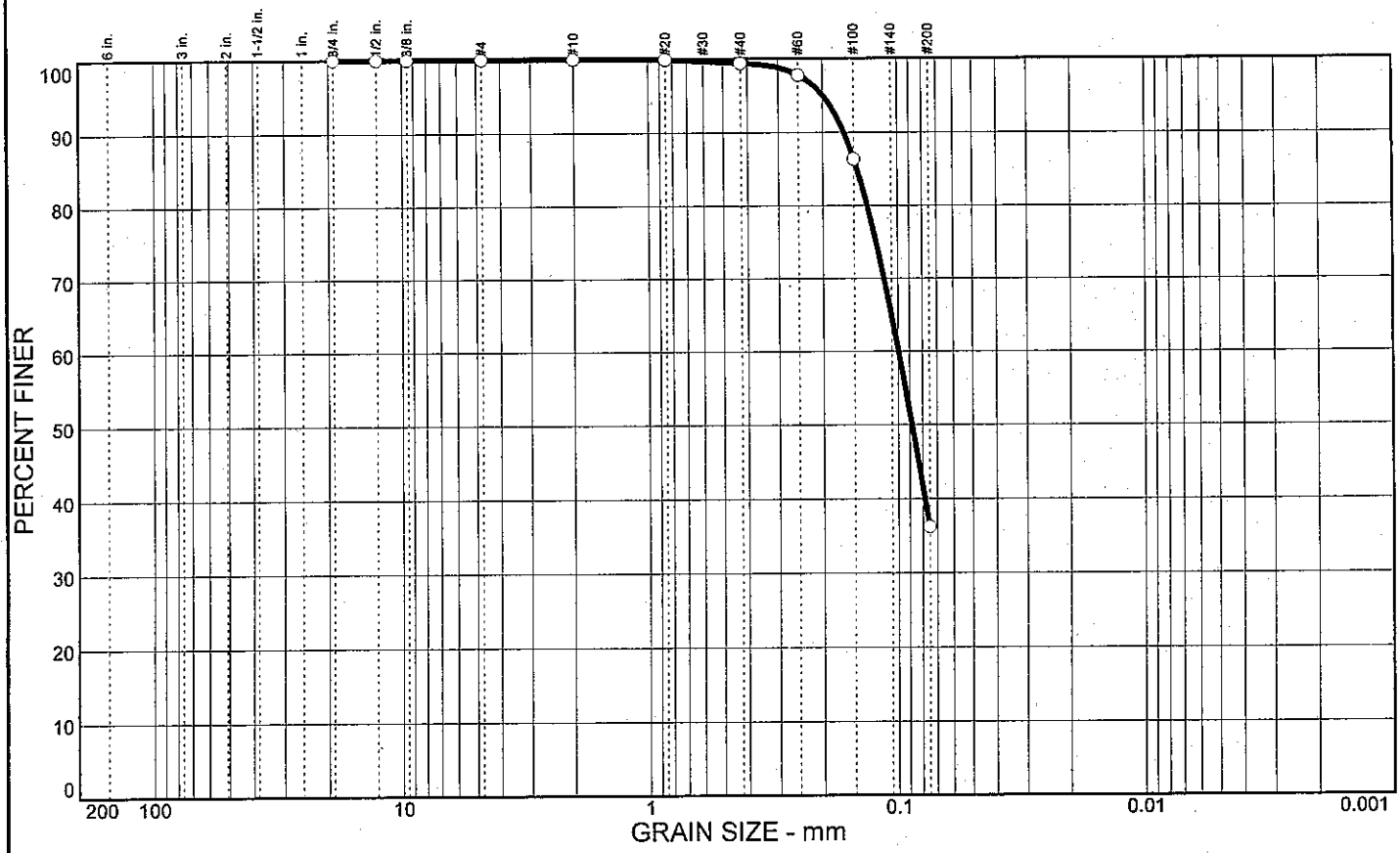
Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			63.8	36.2		SM	A-4(0)		

SIEVE inches size	PERCENT FINER ○		
.750	100.0		
.50	100.0		
.375	100.0		
GRAIN SIZE			
D_{60}	0.0996		
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.4		
#60	97.8		
#100	86.4		
#200	36.2		

SOIL DESCRIPTION

○ **Gray very silty fine SAND with traces of mica and sandy clay seams**

REMARKS:

○

○ Source: Boring B-2 Sample No.: 9 Depth: 28.5'-30.0'

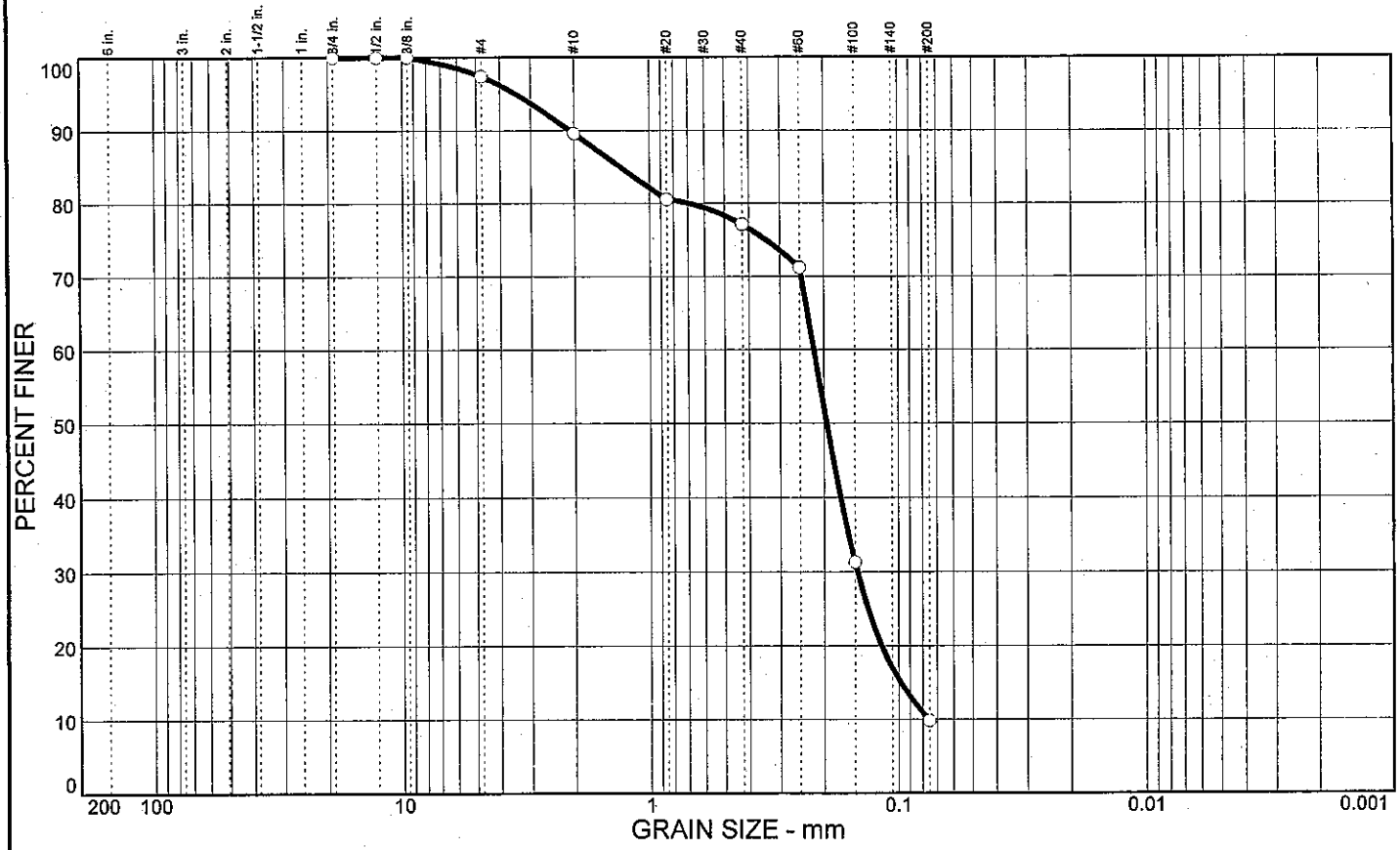
Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		2.6	87.6	9.8		SP-SM	A-3		

SIEVE inches size	PERCENT FINER ○		
.750	100.0		
.50	100.0		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.220		
D_{30}	0.147		
D_{10}	0.0759		
	COEFFICIENTS		
C_c	1.29		
C_u	2.89		

SIEVE number size	PERCENT FINER ○		
#4	97.4		
#10	89.6		
#20	80.5		
#40	77.1		
#60	71.2		
#100	31.3		
#200	9.8		

SOIL DESCRIPTION

○ Gray slightly silty fine to coarse SAND with many shell fragments

REMARKS:

○ Water Content: 32.8%

○ Source: Boring B-2 Sample No.: 13 Depth: 48.5'-50.0'

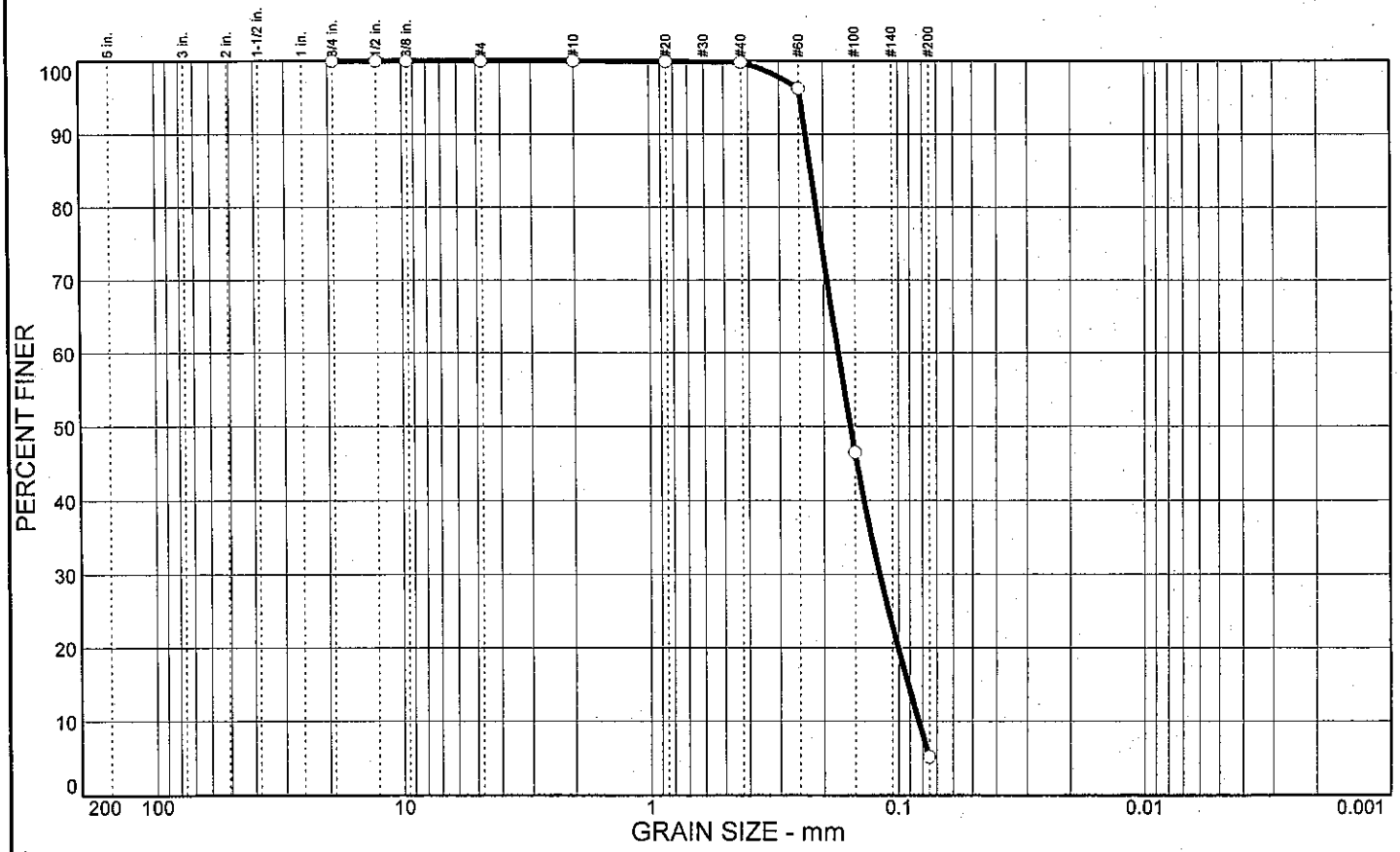
Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			94.8	5.2		SP-SM	A-3		

SIEVE inches size	○ PERCENT FINER		
.750	100.0		
.50	100.0		
.375	100.0		

	GRAIN SIZE		
D_{60}	0.175		
D_{30}	0.119		
D_{10}	0.0828		
	COEFFICIENTS		
C_c	0.98		
C_u	2.11		

SIEVE number size	○ PERCENT FINER		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	96.2		
#100	46.5		
#200	5.2		

SOIL DESCRIPTION

○ Dark brown weakly cemented organically-stained slightly silty fine SAND

REMARKS:

○

○ Source: Boring B-3 Sample No.: 5 Depth: 8.5'-10.0'

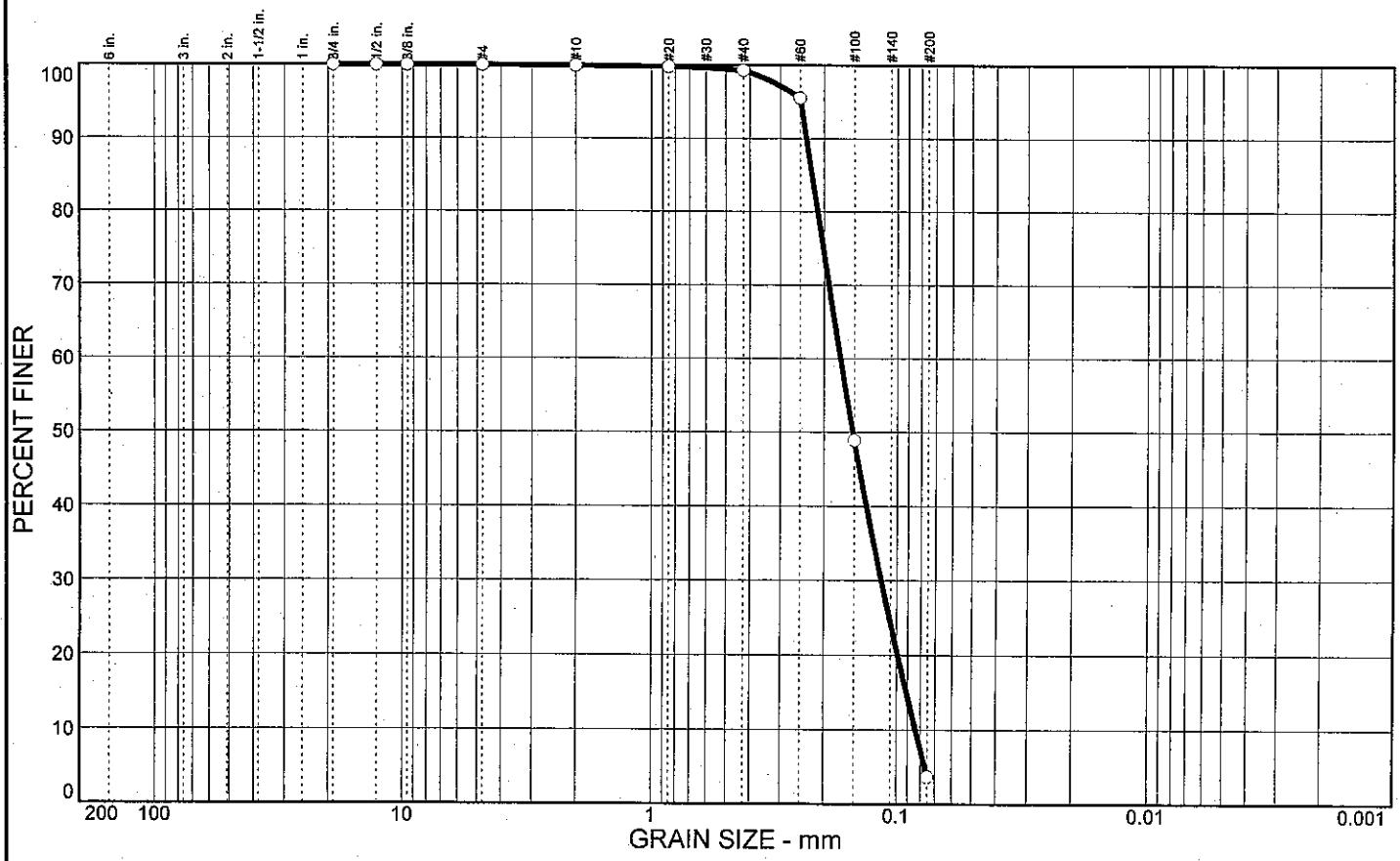
Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			96.3	3.7		SP	A-3		

SIEVE inches size	PERCENT FINER ○		
.750	100.0		
.50	100.0		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.171		
D_{30}	0.116		
D_{10}	0.0837		
	COEFFICIENTS		
C_C	0.94		
C_u	2.04		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.3		
#60	95.6		
#100	48.9		
#200	3.7		

SOIL DESCRIPTION

○ Brown fine SAND with a trace of silt and a few roots

REMARKS:

○

○ Source: Boring B-4 Sample No.: 2 Depth: 1.5'-3.0'

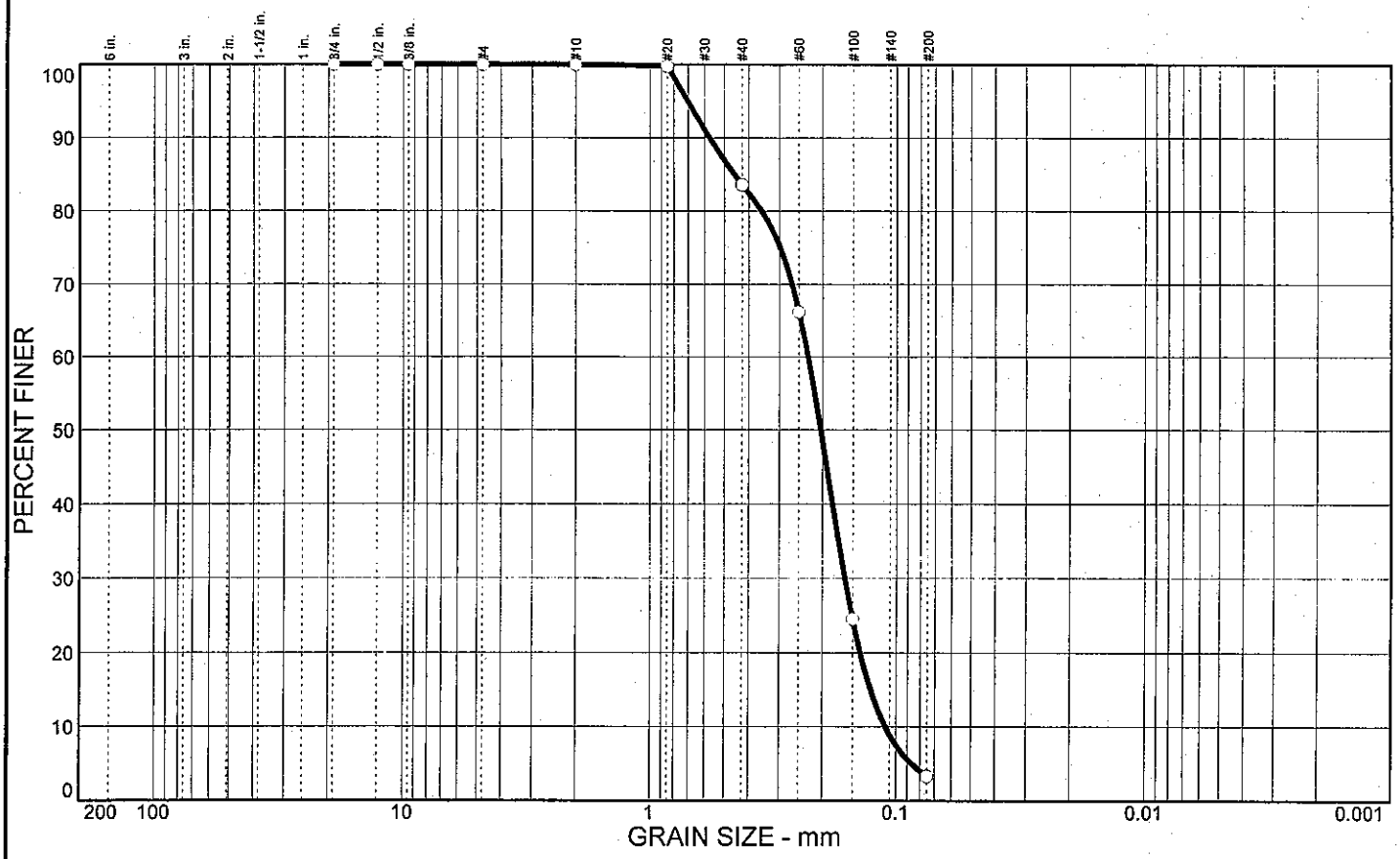
Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○			96.7	3.3		SP	A-3		

SIEVE inches size	PERCENT FINER ○		
.750	100.0		
.50	100.0		
.375	100.0		
	GRAIN SIZE		
D_{60}	0.229		
D_{30}	0.161		
D_{10}	0.110		
	COEFFICIENTS		
C_c	1.03		
C_u	2.08		

SIEVE number size	PERCENT FINER ○		
#4	100.0		
#10	100.0		
#20	99.8		
#40	83.6		
#60	66.2		
#100	24.5		
#200	3.3		

SOIL DESCRIPTION

○ Gray-green fine to medium SAND with a trace of silt

REMARKS:

○

○ Source: Boring B-4 Sample No.: 7 Depth: 18.5'-20.0'

Law Engineering and Environmental Services, Inc.

Client: Taylor Engineering, Inc.

Project: DU-9 Dredged Material Management Area
St. Johns County, Florida

Project No.: 6734-03-8695 Plate

FIELD AND LABORATORY PROCEDURES

Field Procedures

Soil Test Borings - The soil test borings were performed in general accordance with ASTM D-1586, "Penetration Test and Split-Barrel Sampling of Soils." The borings were initially advanced by augering. A rotary drilling process was subsequently used and bentonite drilling fluid was circulated in the boreholes to stabilize the sides and flush the cuttings. At regular intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. The sampler was first seated 6 inches and then driven an additional foot with blows of a 140-pound automatically tripped hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance." The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Representative portions of the soil samples, obtained from the sampler, were placed in glass jars and transported to our laboratory. The samples were then examined by a geotechnical engineer in order to confirm the field classifications.

Observation Pits and Bulk Samples - Observation pits were excavated by means of a rubber-tired backhoe. The subsurface conditions were recorded by a geotechnical engineer as they were encountered. On occasion, a bulk sample was collected by filling a five-gallon bucket with spoils excavated by the backhoe.

Seasonal High Groundwater Level - An attempt was made to estimate the seasonal high groundwater level at selected observation pit locations. The soil cuttings were closely observed for changes in root and organic content, soil stratification and subtle changes in soil coloration or mottling or the presence of a polychromatic matrix (two or more colors arranged in a splotchy pattern) which are indicative of the seasonal high groundwater level. The method used to estimate the seasonal high groundwater level is similar to that prescribed by the United States Department of Agriculture Soil Conservation Service. It should be noted that this methodology does not consider recent or future site drainage improvements or man-induced activities which may impact the groundwater level at the site.

Laboratory Procedures

Water 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 general accordance with ASTM D-2216.

Fines Content - In this test, the sample is dried and then washed over a No. 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in general accordance with ASTM D-1140.

Atterberg Limits (Plasticity) - A soil's Plasticity Index (PI) is the numerical difference between the Liquid Limit (LL) and the Plastic Limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in general accordance with ASTM D-4318. The PL is the moisture content at which the soil begins to crumble when rolled into a small thread and is also determined in general accordance with ASTM D-4318.

The water-plasticity ratio was computed from the above test data. This ratio is an expression which compares the relative natural moisture state of the soil with its liquid and plastic limits and is an indicator of various other physical properties such as strength and preconsolidation characteristics.

Grain Size Distribution - The grain size tests were performed to determine the particle size and distribution of each sample tested. The sample was dried, weighed, and washed over a No. 200 mesh sieve. The dried sample was then passed through a standard set of nested sieves to determine the grain size distribution of the soil particles coarser than the No. 200 sieve. This test is similar to that described by ASTM D-422.

Modified Proctor Tests - A Modified Proctor compaction test (ASTM D-1557) was performed on each of the bulk samples collected during the observation pit excavation operations. These soils were tested to determine their compaction characteristics, including their maximum dry density and optimum moisture content. The Modified Proctor test is performed by placing soil into a container of a known volume (1/30 ft^3) in five separate, equal height lifts. Each lift is compacted by 25 drops of a special 10 pound hammer dropped from a height of 18 inches. Since the volume of the soil is known, the density of the soil is then determined by weighing the compacted sample and subtracting the weight of the container. This process is repeated for various moisture contents of the sample. A plot of moisture content versus soil dry density is generated, and the Modified Proctor maximum dry density is then

determined from the resulting curve. The moisture-density relationships are presented on the Compaction Test Report sheets.

Consolidated-Drained Triaxial Shear - The strength and compression parameters of the bulk samples tested were obtained by triaxial shear testing. The cohesionless soils were remolded to a density equivalent to approximately 95 percent of the Modified Proctor maximum dry density. The test samples were approximately 2.8 inches in diameter, with the height of each sample approximately twice the diameter. The test samples, after preparation, were encased in rubber membranes, placed in a compression chamber, and saturated with water using back pressure saturation techniques. An all-round net confining pressure of 5 psi was then applied to the sample. Drainage paths to the sample were kept open during back pressure saturation, which allowed the sample to consolidate. An axial load was then applied until the sample failed in shear. During the axial load application, the increased pore water pressures within the sample were allowed to dissipate (i.e. drain) so that these pressures did not affect the test result. The test procedures were then repeated on the same soil sample at net confining pressures of 10 psi and 15 psi (i.e. the sample was "Dutch loaded"). The test results are presented in the form of Mohr circle diagrams and stress-strain curves on the Triaxial Shear Test Report sheets in the Appendix.

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

Undisturbed Sample (UD)	Auger Cuttings
Split Spoon Sample (SS)	Bulk Sample
Rock Core (RC)	Crandall Sampler
Dilatometer	Pressure Meter
Packer	No Recovery
Water Table at time of drilling	Water Table after 24 hours
WOH - Weight of Hammer	◀100% - Percent Loss of Drilling Fluid
WOR - Weight of Drill Rods	c - cohesion (tsf) estimated from pocket penetrometer
SCP - Static Cone Penetrometer Tip Resistance (kg/sq. cm)	qu - unconfined compressive strength (tsf) estimated from pocket penetrometer

Correlation of Penetration Resistance (N) with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31- 50	Hard
		Over 50	Very Hard

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC

FLORIDA INLAND NAVIGATION DISTRICT DREDGED MATERIAL MANAGEMENT AREA DU-9 EXPANSION

ST. JOHNS COUNTY, FLORIDA

APPENDIX D

2015 Revised Report of Geotechnical Engineering Services; FIND DU-9 Dredged Material Management Area; AMEC Foster Wheeler Project No. 6734-15-9829

Note: All information provided in these reports are representative of the soils at the date when the samples were collected. The data do not reflect any variations that may occur adjacent to or between the soil borings. The material taken from these core borings is not available for inspection.

October 23, 2015

Ms. Lori S. Brownell, P.E.
Director, Waterfront Engineering
Taylor Engineering, Inc.
10151 Deerwood Park Boulevard
Building 300, Suite 300
Jacksonville, Florida 32256

Subject: **Revised Report of Geotechnical Exploration and Engineering Services**
FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida
Amec Foster Wheeler Project No. 6734-15-9829

Dear Ms. Brownell:

Amec Foster Wheeler Environment & Infrastructure, Inc., has performed geotechnical exploration and engineering services for the subject project in general accordance with our Revised Proposal No. 15PROPJAXV.031.R1 dated April 21, 2015. Authorization for our services was provided through the Subcontract Agreement (Taylor Engineering Contract No. C2014-075-01) between our firms dated June 4, 2014.

In summary, the sandy soils encountered by the borings appear to be suitable for re-use as structural fill material for construction of the dike expansion. The fine-grained soils (silts, clays, and peats) are extremely weak and will be difficult to handle. Our evaluations of these materials, and recommendations for their use, are presented in Section 4.0 of this report.

We have enjoyed assisting you and look forward to serving as your geotechnical and construction materials testing consultant on the remainder of this project and on future projects. If you have any questions concerning this report, please contact us.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.
Florida Board of Professional Engineers Certificate of Authorization No. 5392

MICHAEL B. WOODWARD LICENSE No. 42814 STATE OF FLORIDA PROFESSIONAL ENGINEER

10/23/15

Michael B. Woodward, P.E.
Principal Geotechnical Engineer
Florida License No. 42814

Kirk A. McIntosh, P.E., D.GE
Senior Principal
Florida License No. 33703

Distribution: Taylor Engineering, Inc. (2)
File (1)

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APPENDIX A

APPENDIX B

1.0 PROJECT INFORMATION

The purpose of this exploration was to develop information concerning the site and subsurface conditions in order to evaluate re-use and handling of the materials inside the existing dredge spoil containment basin at the Florida Inland Navigation District (FIND) DU-9 Dredged Material Management Area (DMMA) site in northeastern St. Johns County, Florida. This report briefly describes the field and laboratory testing activities and presents the findings. The enclosed guideline recommendations for handling, storing, dewatering, and stacking of the fine-grained materials inside the basin represent approaches we feel would be appropriate for the planned construction.

Project information was provided by Ms. Lori Brownell, P.E. of Taylor Engineering, Inc. during the period of January 7 to April 21, 2015. We were furnished with the following project-related items:

Table 1-1: Furnished Documents

Title	Author	Date
Summary of Desired Scope of Work - Geotechnical Investigation	Taylor Engineering, Inc.	Undated, received on 1/7/2015
Topographic & Specific Purpose Survey (4 sheets)	Arc Surveying & Mapping, Inc.	4/7/2010
Figure 4.11, DMMA DU-9 Plan View	Taylor Engineering, Inc.	6/2014
Figure 4.12, DMMA DU-9 Section View	Taylor Engineering, Inc.	6/2014
Groundwater Mounding Evaluation Report (MACTEC Project No. 6734-03-8695)	MACTEC Engineering & Consulting, Inc.*	10/1/2003
Preliminary Report of Geotechnical Exploration (MACTEC Project No. 6734-03-8695)	MACTEC Engineering & Consulting, Inc.*	8/11/2003
Report of Geotechnical Exploration (E&A Project No. 99-1018)	Ellis & Associates, Inc.	3/10/1999
Figure A-1, DMMA DU-9 Plan View, Site Reconnaissance Features	Taylor Engineering, Inc.	12/2014
Supplemental Groundwater Sampling Results and Evaluation, Dee Dot Sludge Disposal Area No. 2	CH2M Hill	11/25/2013
DU-9 Management Plan Figures	Taylor Engineering, Inc.	7/2000
DU-9 USACE Record Drawings	Taylor Engineering, Inc.	9/2004
DU-9 Plans	Taylor Engineering, Inc.	2/2000
Pre-Application Meeting Minutes	Florida Inland Navigation District (FIND)	11/19/2014

Table 1-1: Furnished Documents

Title	Author	Date
Florida Department of Environmental Protection (FDEP) files – Estuary Corp. (59 documents)	Various	Various
Groundwater Modeling Report, Consent Order No. 01-0219, Dee Dot Sludge Land Farm Disposal Area No. 2	CH2M Hill	3/3/2014
Response to CH2M HILL's Groundwater Modeling Report	Taylor Engineering, Inc.	3/13/2014
Response to CH2M HILL's Groundwater Modeling Report	FDEP	3/17/2014

*Predecessor company to Amec Foster Wheeler

As shown on the Site Location Map in Appendix A, the existing DU-9 DMMA site is located approximately ½ mile west of the Intracoastal Waterway and 2 miles south of J. Turner Butler Boulevard (S.R. 202) in northeastern St. Johns County, Florida, on the Dee Dot Ranch property. The design for this DMMA was performed in 2000, and called for a basin with overall plan dimensions of approximately 3,200 feet in the north-south direction by 1,100 to 1,500 feet in the east-west direction. Due to contamination found within the center of the site during preliminary construction activities in 2001, we understand a smaller basin was designed and constructed north of the contaminated area (referred to as Dee Dot Sludge Disposal Area No. 2) in 2006. This basin has overall plan dimensions of approximately 1,150 feet in the north-south direction by 1,200 to 1,500 feet in the east-west direction. The existing dike is approximately 6½ feet lower than the full design height and occupies approximately one-third of the full design footprint. We understand the U.S. Army Corps of Engineers (USACE) deposited approximately 260,000 cubic yards of material into the DMMA in 2006.

The DMMA currently has a perimeter dike with a crest elevation of +26.5 feet (NGVD29), an interior dike bottom elevation of +11.0 feet, an exterior dike bottom elevation that varies from about +13 to +20 feet, a dike crest width of 12 feet, and side slopes of 3:1 (H:V). The surface elevation of the dredge spoil material ranges from about +23 to +29 feet in the southwestern quadrant, where sandy soils are exposed, to +17 to +18.5 feet in the remainder of the basin, where the soils are periodically under a few feet of water during periods of wet climatic conditions. Note that at this site, elevations given for the NGVD 29 datum are 1.1 feet greater than those using the NAVD 88 datum.

We understand it is desired to utilize the existing suitable materials within the DMMA as an on-site fill source to build out the DU-9 site to the full design height and footprint. As such, geotechnical exploration of the soils within the basin has been requested to assist Taylor Engineering with their estimate of the quantity of material that is suitable for dike construction.

We understand that since 2000, the owner of Dee Dot Ranch (Estuary Corporation) and its engineering consultant, CH2M Hill, have worked to remediate the contaminated area. As of March 2014, the Florida Department of Environmental Protection (FDEP) had granted conditional closure (i.e., no further cleanup required) pending the FIND acceptance of institutional controls. At this point, FIND is investigating and moving forward with the expansion of the existing cell to its original 2000 design.

The area of the existing basin reportedly does not contain contaminated groundwater. We understand, however, that contamination still exists in the surficial aquifer south of the existing basin based on the results of testing performed on groundwater samples from Well No. TPOC-1, which is located about 1,000 feet south of the southwest corner of the existing basin.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our original scope was to consist of performing 31 Standard Penetration Test (SPT) borings to a depth of 20 feet each throughout the inside of the existing DMMA. That scope was predicated on being able to float an amphibious drill rig on the surface water in the lower portions of the dredge spoil area, which appeared to be feasible during a visit to the site in January of 2015. However, at the time of the field exploration (June of 2015), the surface water had substantially evaporated, and the amphibious drill rig was unable to access the areas north and east of the area of the exposed sands, since the tracks sunk into the soft soil (please refer to Photo Nos. 4, 5, and 8 in Appendix A). As such, we converted 10 of the proposed boring locations to manual probe soundings to determine the thickness of the relatively soft soils. These locations were accessed by a senior engineering technician from our office who used wooden planks to provide stable footing on the soft ground. Thin-walled (Shelby) tube samples of the soft soils were obtained at some of the boring and probe sounding locations for subsequent laboratory testing. Bulk soil samples of the sandy soils located in the southwestern portion of the site were obtained by augering to depths of 13.5 to 15.5 feet below the existing grade adjacent to four of the boring locations for subsequent laboratory testing (these depths roughly correlate with the bottom of the basin). A geotechnical engineer from this office selected the boring locations, and a survey crew from our Orlando office staked these locations in the field. The surveyors determined the state plane coordinates and ground surface elevation at each boring location, and this information was provided to us. The coordinates and ground surface elevations are presented in Table A.1 in Appendix A.

The boring and probe sounding locations are shown on the Field Exploration Plan in Appendix A. The borings were performed by Independent Drilling, Inc. (IDI), working under subcontract to Amec Foster Wheeler. A senior engineering technician from our office was present during all of IDI's field activities to monitor and document their work and log the borings, and to obtain the bulk and thin-walled tube samples.

The Soil Test Boring Records, in Appendix A, graphically show the penetration resistances and groundwater levels, and present the soil descriptions as well as the estimated seasonal high groundwater levels for each boring. The stratification lines and depth designations on the boring records represent the approximate boundaries between soil types. In some instances, the transition between soil types may be gradual. Brief descriptions of the exploratory drilling, testing, and sampling techniques used are presented in the Field Procedures section of Appendix A.

2.2 Laboratory Testing

In order to aid in classifying the soils and to help quantify and correlate engineering properties, laboratory index property and classification tests were performed on representative soil samples obtained from the SPT borings as well as from the shallow bulk samples. Table 2.2 presents the types and quantities of laboratory tests that were conducted.

Table 2-1: Laboratory Test Types and Quantities

Test	Quantity
Moisture Content	23
Fines Content	23
Organic Content	10
Grain Size Distribution	26
Atterberg Limits (plasticity)	7
Modified Proctor Compaction[1]	4
Minimum Density	1
Hydraulic Conductivity[1]	4
Direct Shear[1]	4
Unconsolidated-Undrained (UU) Triaxial Shear[2]	4

[1]Bulk samples
[2]Thin-walled tube samples

The bulk samples were remolded and compacted to dry densities equal to approximately 95% of the Modified Proctor maximum dry density for the hydraulic conductivity and direct shear tests. The results of the laboratory tests are presented on the Summary of Laboratory Test Results sheets, the Grain Size Distribution Report sheets, the Compaction Test Report sheets, the Direct Shear Test Report sheets, and the Triaxial Shear Test Report sheets in Appendix B. A pocket penetrometer was used to estimate the undrained shear strength (s_u)

of representative thin-walled tube samples. This information is included on the Soil Test Boring Records in Appendix A. Brief descriptions of the laboratory test procedures utilized are presented in the Laboratory Procedures section in Appendix B.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site conditions were observed by a senior engineering technician from our office who observed and documented the drilling operations. At the time of the drilling operations (late June of 2015), the southwestern quadrant of the DMMA contained exposed sandy soils with vegetation consisting of sparse to dense growths of pine trees and grass. The topography in this area sloped downward gently from the sandy area toward the north, northeast, and east, with an approximate elevation differential of approximately 8 to 9 feet across the site. The lower areas outside of the southwestern quadrant contained exposed fine-grained silts, clays, and peats, which showed evidence of surficial desiccation cracking in most areas. Shallow standing surface water was observed in some of the lower areas at the time of our visit. It was not possible to walk on the surface of the exposed fine-grained materials in most areas. Please refer to the photographs included in Appendix A.

3.2 Subsurface Conditions

3.2.1 General

Pictorial representations of the subsurface conditions encountered in the dredged material management area are shown on the Generalized Subsurface Profile sheets presented in Appendix A. The profiles and the subsurface conditions outlined below highlight the major subsurface stratification. The Soil Test Boring Records in Appendix A should be consulted for detailed descriptions of the subsurface conditions encountered at each boring and probe sounding location. When reviewing the boring records and the subsurface profiles, it should be understood that soil conditions may vary between and away from the boring/probe sounding locations.

3.2.2 Soils

From the existing ground surface (elevations of approximately +22 to +25 feet, NAVD88) to depths of approximately 14 to 18 feet (approximate elevations of +5 to +12 feet, NAVD88) the borings drilled in the southwestern quadrant generally encountered very loose to loose light gray to light brown fine sands (Unified Soil Classification of SP) and slightly silty to silty

fine sands (SP-SM to SM). The borings drilled in the lower areas containing exposed fine-grained soils generally encountered very soft gray to dark gray silt to clayey silt (MH) and silty clay (CH), with occasional zones of dark gray-brown organic silt (OH) or sandy peat (PT), to depths of approximately 1½ to 6½ feet below the surface (elevations of approximately +14 to +10 feet (NAVD 88). Below these upper relatively loose sands in the southwestern quadrant, and below the very soft fine-grained soils in the remaining portions of the basin, very firm to very dense dark brown organically stained fine sand to slightly silty fine sand (SP to SP-SM) with some weak cementation (locally termed "hardpan") was then encountered either to the boring termination depth of 20 feet, or to elevations of approximately +5 to 0 feet (NAVD 88) in borings located in lower areas. Beneath the hardpan, loose to firm orange-brown slightly silty fine sands (SP-SM) were penetrated to the boring termination depth of 20 feet (elevations of approximately -2 to -3 feet, NAVD 88).

3.2.3 Groundwater

The depth to groundwater was measured at the boring locations at the time of drilling. The groundwater table was encountered at depths ranging from about 3 to 12½ feet below the existing ground surface in the areas of the exposed sandy soils, corresponding to elevations of approximately +12 to +21 feet (NAVD 88). In the areas containing exposed fine-grained soils, the groundwater level was encountered at depths ranging from approximately 0 to 4 feet below grade, corresponding to elevations of approximately +13.5 to +17.5 feet (NAVD 88). Surface water will perch on the fine-grained soils during periods of wet climatic conditions.

Fluctuation in groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, and other site-specific factors. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 Basis

The following evaluations (and subsequent recommendations) are based upon the previously presented project information along with the data obtained in this exploration. The field and laboratory test data have been compared with previous performances of similar materials to those encountered at this site. If the proposed usage of the materials inside the basin is changed, please contact us so that our evaluations and recommendations may be reviewed for continued applicability. The discovery of any site or subsurface conditions during construction that deviate from the data obtained in this exploration should also be reported to us for our evaluation.

Our proposed scope of services excluded the following:

1. The assessment of site environmental conditions or the presence of pollutants in the soil, rock or groundwater of the site.
2. The preparation of design drawings or specifications for the proposed dike construction.
3. Analyses of dike bearing capacity, settlement, seepage, and stability.
4. Recommendations for dike construction.
5. Analysis of pile capacity and settlement, as well as recommendations for pile design, installation, load testing, and installation monitoring.
6. Evaluations of productive uses of the fine-grained materials.
7. Estimation of quantities of suitable sandy soils and of fine-grained materials.

4.2 Evaluation of Existing Soils for Use as Fill

Based on the results of the borings and laboratory testing, the soils located in the southwestern quadrant of the basin that are available for build-out of the DU-9 site to the full design height and footprint will generally consist of fine sands (SP and SP-SM) with fines contents (percent material finer than the No. 200 mesh sieve) of about 1 to 6% and organic contents of less than 2%. When compacted to densities on the order of 95% of the Modified

Proctor maximum dry density (ASTM D1557), the tested soil samples exhibited hydraulic conductivity (k) values ranging from $6.2x10^{-4}$ to $2.0x10^{-3}$ cm/sec, and had friction angles (ϕ) ranging from 33.0 to 34.6 degrees. These soils are considered acceptable for re-use as dike fill material.

In order to estimate the density of the in-place sandy soils, the maximum and minimum dry densities of these soils, as well as their relative density (D_r), are required. As presented in Table B.1 in Appendix B, the Modified Proctor compaction testing conducted on the bulk samples of the sandy soils indicated maximum dry densities ranging from 100.6 to 104.5 pcf, with an average value of 103.4 pcf. When compacted to densities of 95 percent of the Modified Proctor maximum dry density, these soils will have an average dry density of approximately 98 pcf. The minimum dry density, also presented in Table B.1, is 80 pcf. Based on the SPT N-values of these soils, their current soil state (with respect to relative density) is "loose" to "very loose." Based on published correlations between SPT N-values and D_r of cohesionless soils, the in-place D_r of the sandy soils at this site is estimated to be on the order of 20 to 40 percent. Based on these values, we estimate that the insitu sands have an average dry density of approximately 85 pcf. Utilizing this value together with the compacted dry density, we estimate the insitu soils will experience shrinkage of approximately 12% when compacted.

The fine-grained materials (MH, CH, OH, and PT) encountered outside of the southwestern quadrant are considered to be unsuitable for re-use as structural fill. The sandy soils underlying the fine-grained materials are considered to be acceptable; however, the fine-grained materials would need to be removed and stockpiled elsewhere to gain access to the sandy soils. Note that some of the borings in the southwestern quadrant encountered relatively thin seams of fine-grained materials within the sand matrix. These materials will need to be segregated from the sandy soils, since they are not considered to be acceptable for re-use. Silty sands encountered within the sand matrix may be re-used if properly mixed with the cleaner sands to produce a fines content of 12% or less.

4.3 Recommendations for Fine-Grained Materials

The fine-grained dredge spoil materials (Unified Soil Classification System symbols of MH, CH, OH, and PT) are very soft as indicated by the SPT N-values. As indicated by the laboratory pocket penetrometer and UU triaxial shear test results, these materials vary somewhat in shear strength but are very weak, with undrained shear strength (s_u) values ranging from approximately 12 to 150 psf. In some cases these materials behaved more as a liquid (Photo 18 in Appendix A), whereas in other cases these materials behaved more as a solid or normal soil (Photo 19). The tested samples had moisture contents ranging from 65% to 262%.

Earth-moving equipment is likely to sink into the softer zones of these soils, as was the case with the track-mounted amphibious drill rig used to drill the borings for this project (refer to Photo 7 and 8). Excavations into these materials are unlikely to be able to stand stable for cuts more than a few feet deep, as they could behave more as a liquid than as a solid or normal soil (Photo 18). Furthermore, placing these materials into dump trucks to move them to a different part of the site will create additional disturbance, thus weakening them further. Published correlations between liquidity index and sensitivity (defined as the ratio of the undisturbed strength to the remolded strength) indicate that these soils have sensitivity values on the order of 2 to 7, which means their strengths after handling (remolding) could be reduced by 50 to 85%.

Based on the above discussion, attempting to stockpile these materials could therefore be unsuccessful due to the low strengths. We recommend that consideration be given to having an earthwork contractor use a track hoe with a relatively long reach perform some test excavations into the soft, fine-grained materials from the edge of the sandy soils inside the basin, and from around the perimeter dikes prior to construction (and possibly prior to finalizing the design for this project). Such test excavations should be performed in areas exhibiting desiccation at the surface, and in areas of standing water. The excavated materials could be placed in piles, which would help evaluate the performance of these materials during earthwork operations.

Due to the relatively high fines contents of these materials (74% to 98%), these materials will have relatively low permeabilities, and therefore will be very difficult to dewater. As indicated in Photos 3 through 9, the exposed surface of the fine-grained materials can become desiccated; however, this desiccation process does not extend very deep below the surface, and extended periods of rainfall could undo the desiccation process, softening the soils. In our opinion, attempting to dewater these materials will likely be ineffective.

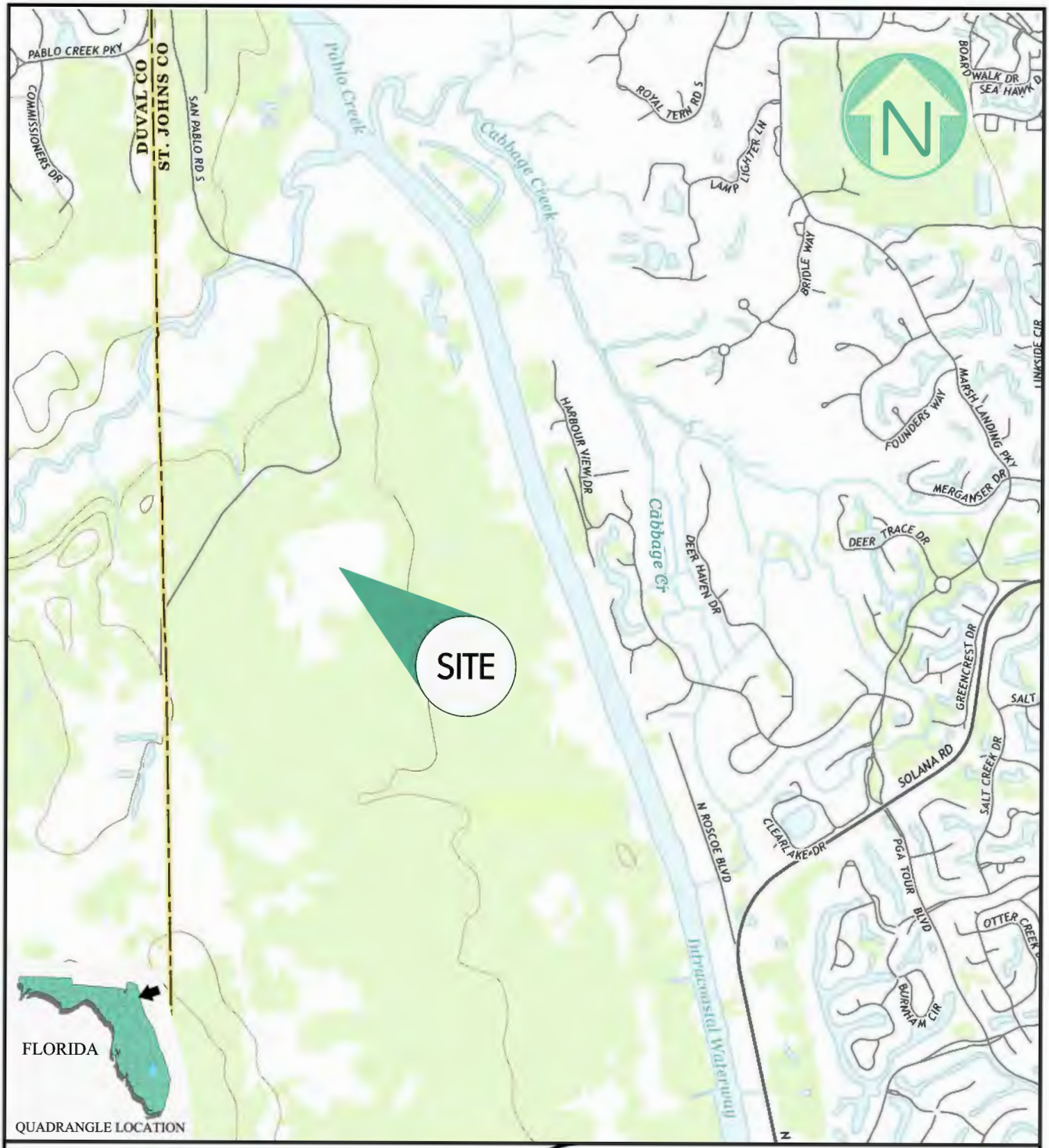
Depending on the volume of suitable sandy material available for re-use, consideration should be given to avoiding the fine-grained materials, if possible, since these materials will be quite difficult to handle using traditional earth-moving techniques. If the excavation is limited to the sandy soils in the southwestern quadrant, the excavation should not extend into the fine-grained materials, leaving a berm of sandy soils to retain the fine-grained materials. Side slopes of this remaining berm should be no steeper than 3:1 (H:V).

Dredging of the fine-grained materials and pumping them into the basin addition area to the south following construction of the dikes that will be used to complete the full design footprint would also be feasible. The existing southern dike could then possibly be mined for its sand that could be used to help complete the overall dike construction. The costs associated with moving the fine-grained materials to gain access to the underlying sandy soils would have to be weighed against utilizing either more readily available on-site borrow materials or off-site borrow materials.

4.4 Construction Plans and Specifications Review

We recommend that this office be provided the opportunity to make a general review of any earthwork plans and specifications prepared from the recommendations presented in this report. We would then suggest any modifications such that our recommendations are properly interpreted and implemented. Our report has been written in a guideline recommendation format and is not appropriate for use as a specification without in-part being reworded into a specification-type format. We recommend that this report not be made a part of the contract documents; however, it should be made available to prospective contractors for information purposes.

APPENDIX A



REFERENCE:
PALM VALLEY QUADRANGLE; FLORIDA
TOPOGRAPHIC MAP
DATED: 2015
U.S. GEOLOGICAL SURVEY

0 1000' 2000'
GRAPHIC SCALE

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SITE LOCATION MAP
FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida

DRAWN: JP	DATE: 9/28/15	SCALE: 1"=2000'
CHECKED: MBW	PROJ. NO. 6734-15-9829	APPROX.

N

0 100' 200'

GRAPHIC SCALE

REFERENCE: Aerial Photograph
Obtained from Google Earth Pro
Dated: 2014

LEGEND

- SOIL TEST BORING LOCATION
- PROBE SOUNDING LOCATION

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FIELD EXPLORATION PLAN

FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida

DRAWN: JP	DATE: 8/12/15	SCALE: 1"=200'
CHECKED: MBW	PROJ. NO. 6734-15-9829	APPROX.

TABLE A.1: BORING SURVEY INFORMATION

FIND DU-9 DMMA

St. Johns County, Florida

Amec Foster Wheeler Project No. 6734-15-9829

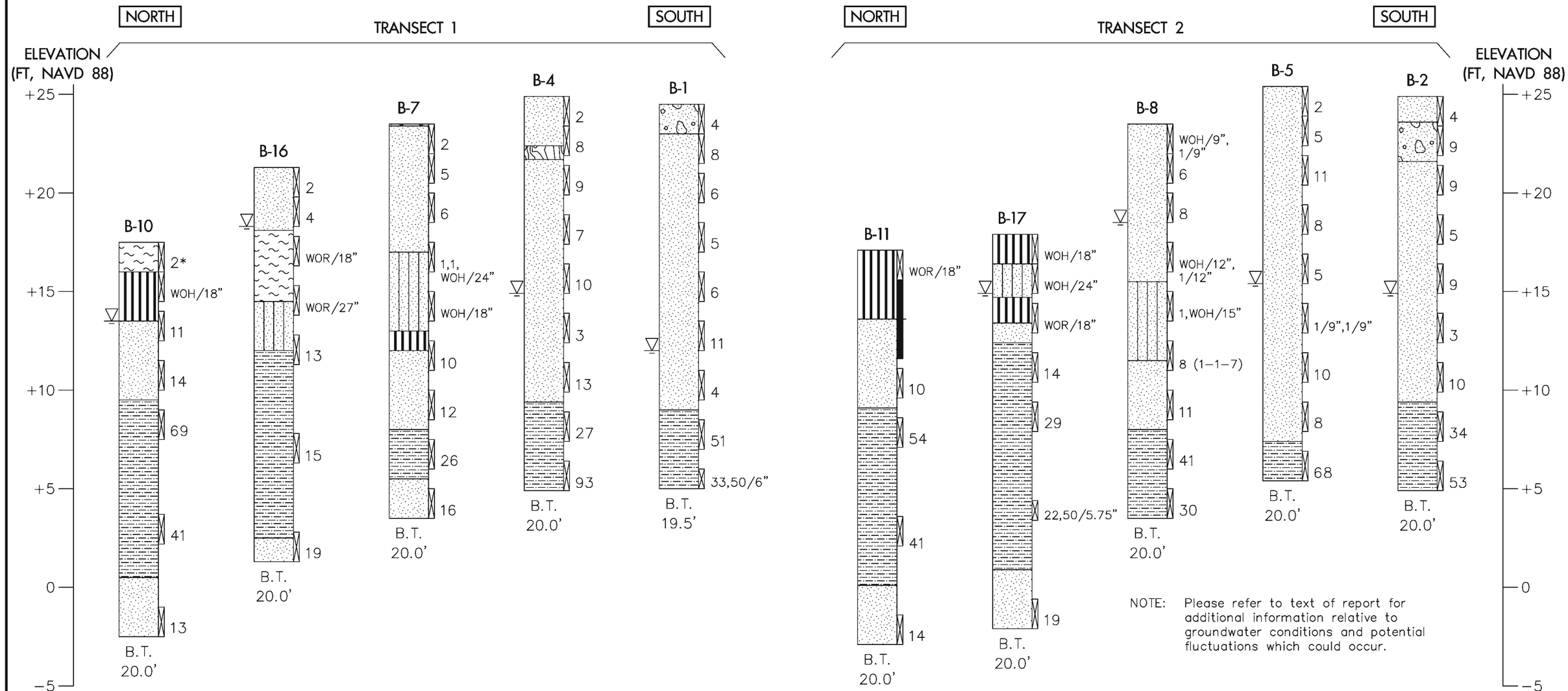
Field Data Obtained by: Amec Foster Wheeler Orlando Survey Crew

Date Obtained: June 16, 2015*

Boring No.	State Plane Coordinates, FL East, U.S. Survey (ft)		Ground Surface Elevation (ft)	
	Northing	Easting	NAVD 88	NGVD 29
B-1	2142461.3	520513.2	24.5	25.6
B-2	2142482.6	520712.2	24.9	26.0
B-3	2142503.9	520911.2	24.0	25.1
B-4	2142694.4	520461.7	24.9	26.0
B-5	2142715.7	520660.5	25.4	26.5
B-6	2142700.2	520867.5	23.8	24.9
B-7	2142927.5	520409.5	23.5	24.6
B-8	2142948.7	520608.5	23.5	24.6
B-9	2142821.3	520765.6	23.7	24.8
B-10	2143291.6	520353.1	17.5	18.6
B-11	2143336.5	520582.2	17.1	18.2
B-12	2143381.6	520811.0	17.2	18.3
B-13	2143427.6	521039.9	16.9	18.0
B-14	2143472.1	521269.0	16.4	17.5
B-15	2143517.7	521497.7	16.2	17.3
B-16	2143080.0	520383.7	21.3	22.4
B-17	2143118.7	520594.8	17.9	19.0
B-18	2143158.4	520810.4	17.1	18.2
B-19**	2143183.8	520953.1	16.2	17.3
B-20	2143241.9	521268.3	16.6	17.7
B-21	2143274.5	521446.2	16.1	17.2
B-22	2142938.3	520809.8	21.6	22.7
B-23	2142975.8	521038.6	17.4	18.5
B-24	2143012.9	521267.6	16.5	17.6
B-25	2143050.5	521496.3	16.0	17.1
B-26	2142750.8	521037.9	18.9	20.0
B-27	2142784.0	521267.0	17.0	18.1
B-28	2142816.8	521494.8	16.6	17.7
B-29	2142523.0	521037.4	22.6	23.7
B-30	2142553.1	521266.2	17.8	18.9
B-31	2142583.9	521494.9	16.8	17.9

* Borings were staked and surveyed prior to drilling.

** Values for Boring B-19 were estimated, since the boring was moved from the surveyed location due to access constraints.



NOTE: Please refer to text of report for additional information relative to groundwater conditions and potential fluctuations which could occur.

LEGEND

- SILT to Clayey SILT (MH), Organic SILT (OH), Silty CLAY (CH)
- PEAT (PT)
- Fine SAND (SP), Slightly Silty Fine SAND (SP−SM)
- Fine SAND (SP), Slightly Silty Fine SAND (SP−SM) With Some Shell Fragments
- Silty Fine SAND (SM)
- HARDPAN
- Slightly Silty Fine SAND (SP−SM) With Many Roots
- Tree Stump

	Standard Penetration Test Sample
*	Standard Penetration Resistance (Blows/ft.) Measured Using an Automatic Hammer System
▽	Groundwater Level @ Time of Drilling
WOH	Weight of Hammer and Drill Rods
WOR	Weight of Drill Rods
▮	Thin−walled tube sample attempt
B.T.	Boring Terminated
20.0'	Depth Terminated
P.S.R.	Probe Sounding Refusal

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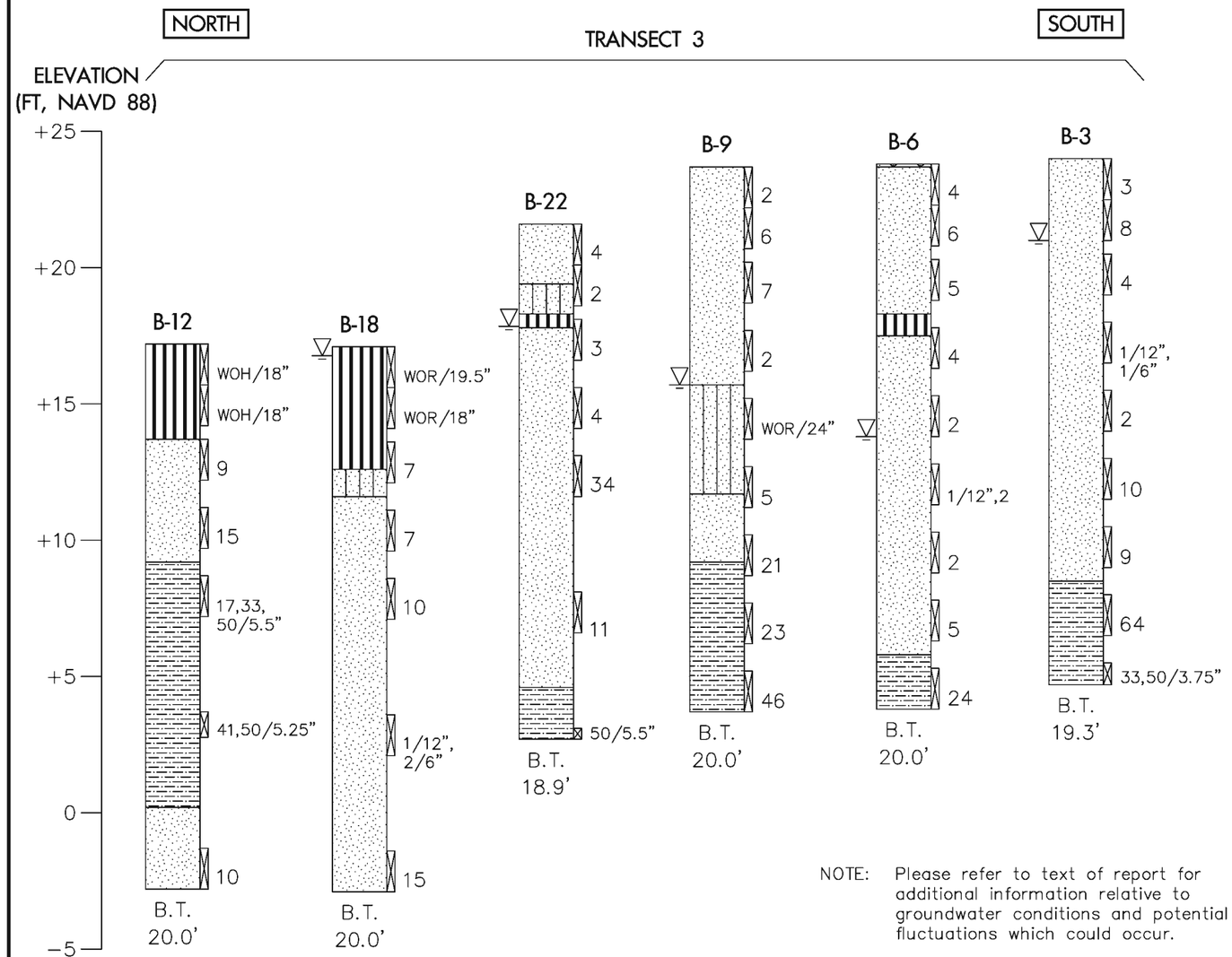
GENERALIZED SUBSURFACE PROFILE (1 OF 3)

FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida

DRAWN: JP	DATE: 8/12/15	SCALE: AS SHOWN
CHECKED: MBW	PROJ. NO. 6734-15-9829	



LEGEND

- SILT to Clayey SILT (MH), Organic SILT (OH), Silty CLAY (CH)
- PEAT (PT)
- Fine SAND (SP), Slightly Silty Fine SAND (SP−SM)
- Fine SAND (SP) With Some Shell Fragments
- Silty Fine SAND (SM)
- HARDPAN
- Slightly Silty Fine SAND (SP−SM) With Many Roots
- Tree Stump

- Standard Penetration Test Sample
- * Standard Penetration Resistance (Blows/ft.) Measured Using an Automatic Hammer System
- Groundwater Level @ Time of Drilling
- WOH Weight of Hammer and Drill Rods
- WOR Weight of Drill Rods
- Thin−walled tube sample attempt
- B.T. Boring Terminated
- 20.0' Depth Terminated
- P.S.R. Probe Sounding Refusal

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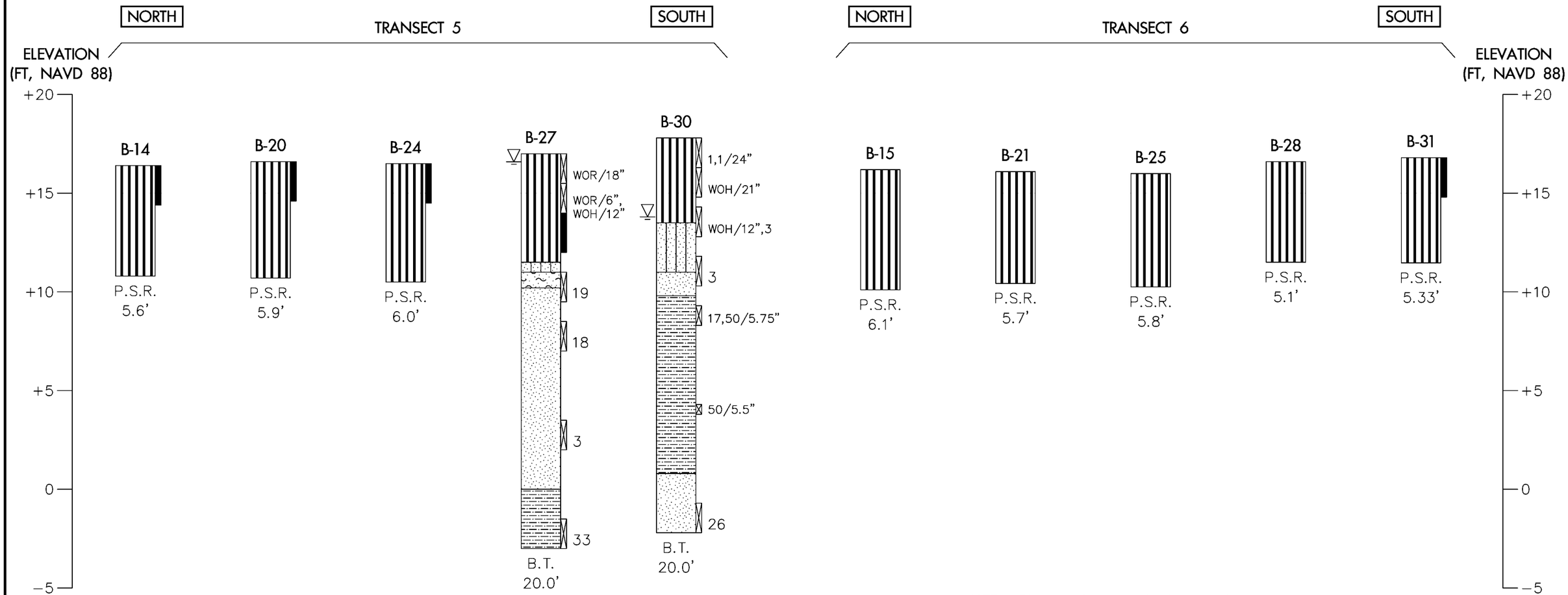
GENERALIZED SUBSURFACE PROFILE (2 OF 3)

FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida

DRAWN: JP	DATE: 8/12/15	SCALE: AS SHOWN
CHECKED: MBW	PROJ. NO. 6734-15-9829	



NOTE: Please refer to text of report for additional information relative to groundwater conditions and potential fluctuations which could occur.

MW

LEGEND

- SILT to Clayey SILT (MH), Organic SILT (OH), Silty CLAY (CH)
- Silty Fine SAND (SM)
- PEAT (PT)
- HARDPAN
- Fine SAND (SP), Slightly Silty Fine SAND (SP–SM)
- Slightly Silty Fine SAND (SP–SM) With Many Roots
- Fine SAND (SP) With Some Shell Fragments
- Tree Stump

	Standard Penetration Test Sample
*	Standard Penetration Resistance (Blows/ft.) Measured Using an Automatic Hammer System
▽	Groundwater Level @ Time of Drilling
WOH	Weight of Hammer and Drill Rods
WOR	Weight of Drill Rods
▮	Thin–walled tube sample attempt
B.T.	Boring Terminated
20.0'	Depth Terminated
P.S.R.	Probe Sounding Refusal

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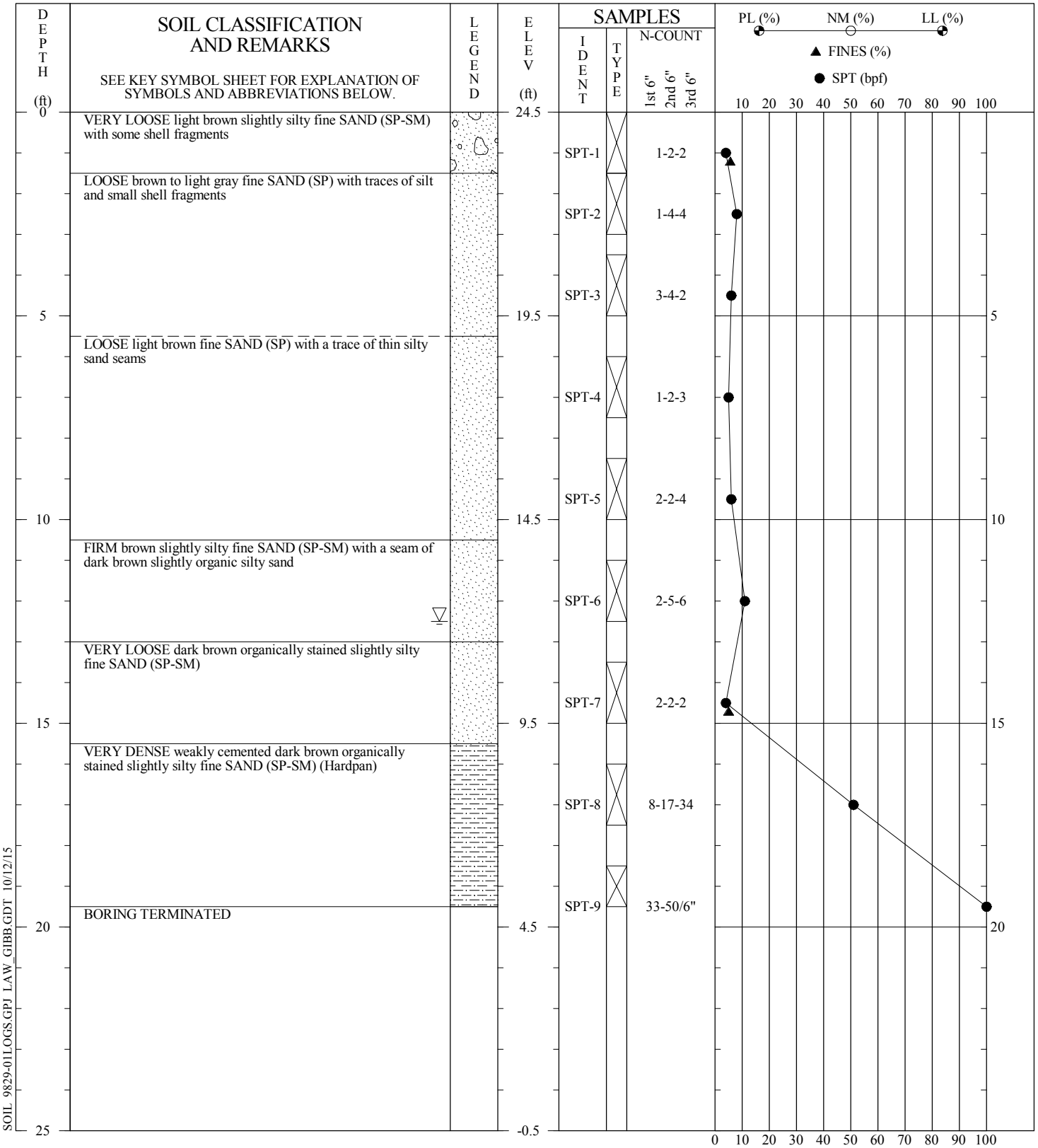
GENERALIZED SUBSURFACE PROFILE (3 OF 3)
FIND DU-9 Dredged Material Management Area (DMMA)
St. Johns County, Florida

DRAWN: JP	DATE: 8/12/15	SCALE: AS SHOWN
CHECKED: MBW	PROJ. NO. 6734-15-9829	



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 22, 2015
Proj. No.: 6734-15-9829

Boring No.: B-1
Checked By: MBW

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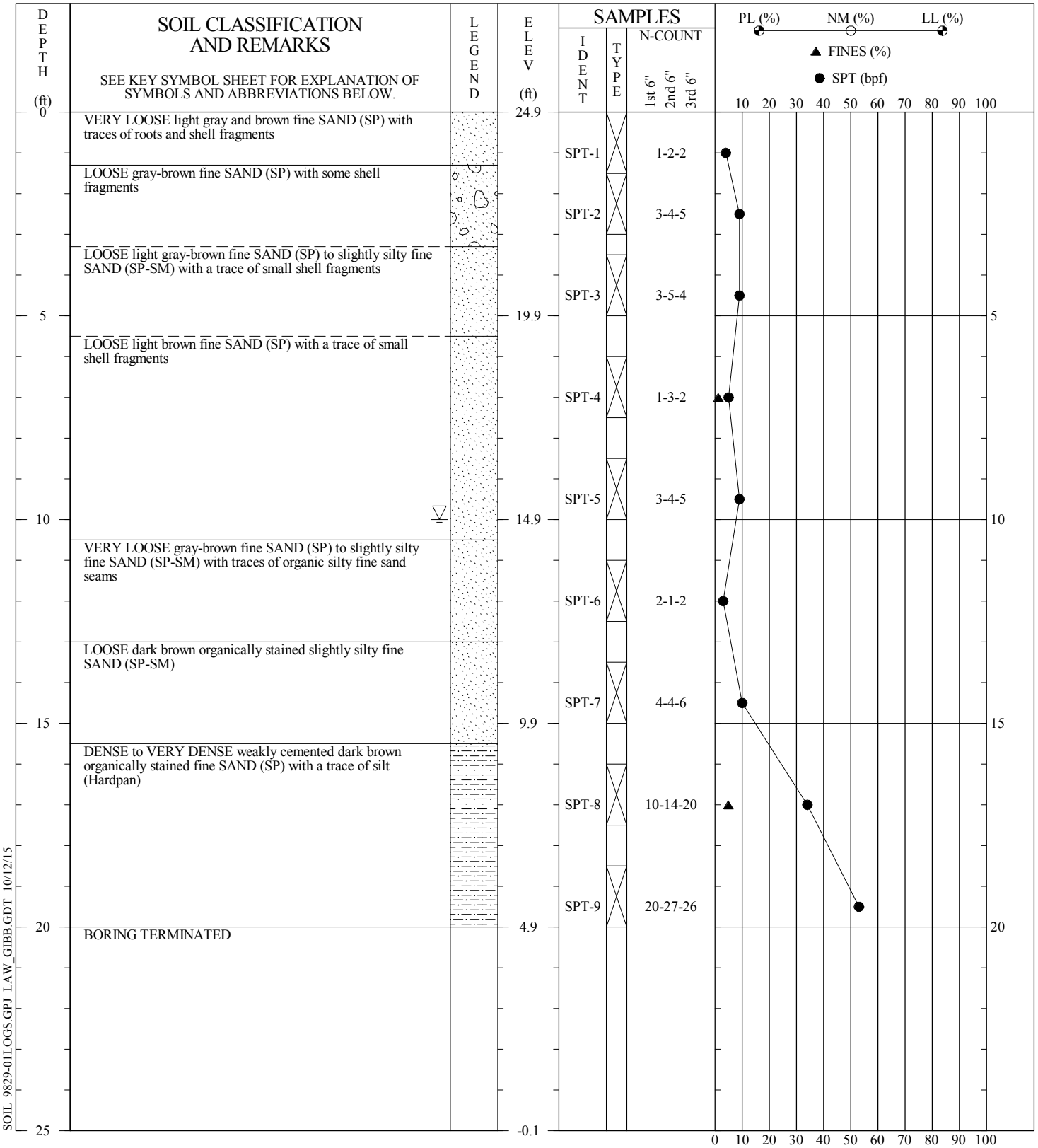


CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

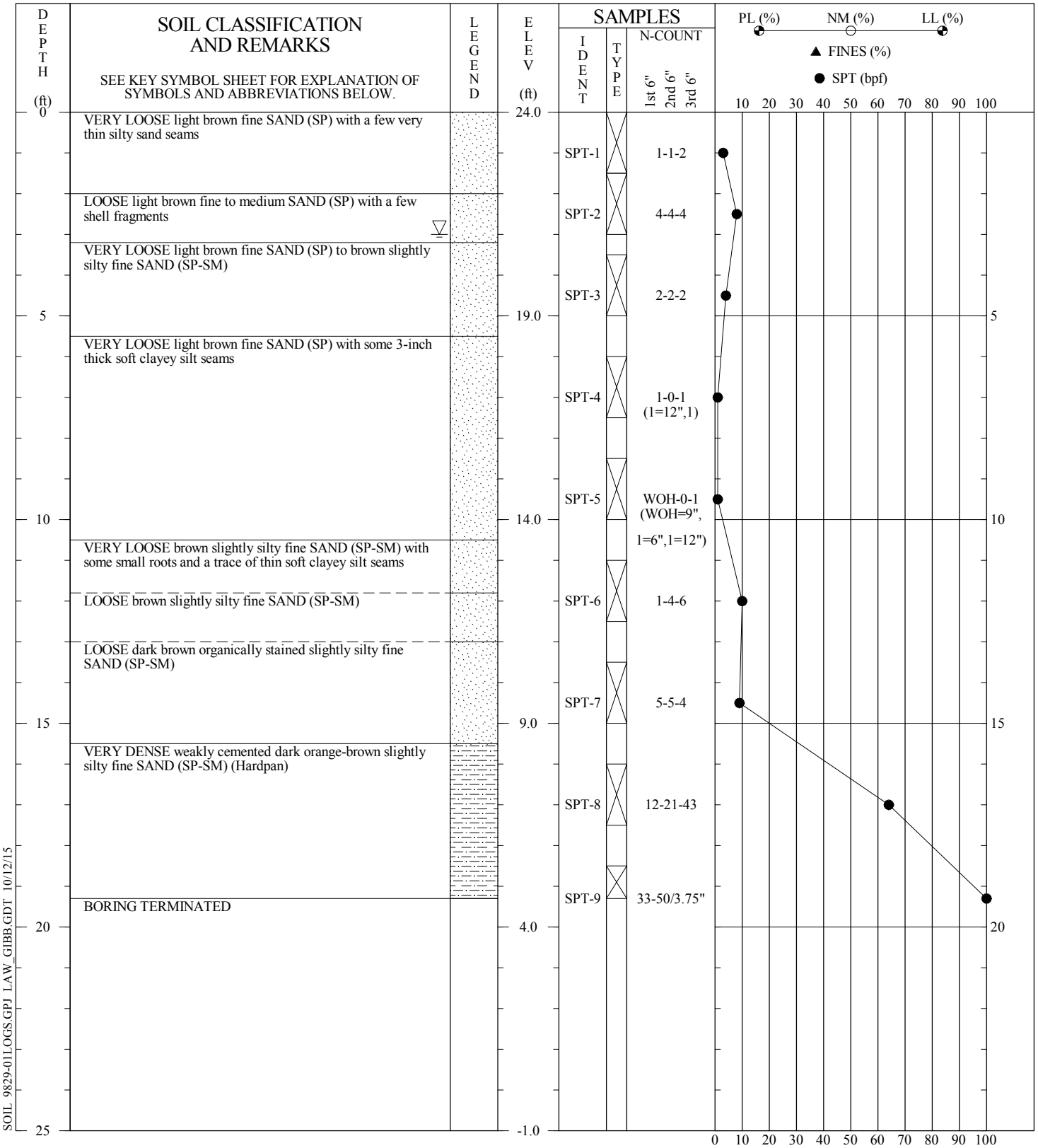
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 22, 2015
Proj. No.: 6734-15-9829

Boring No.: B-2
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

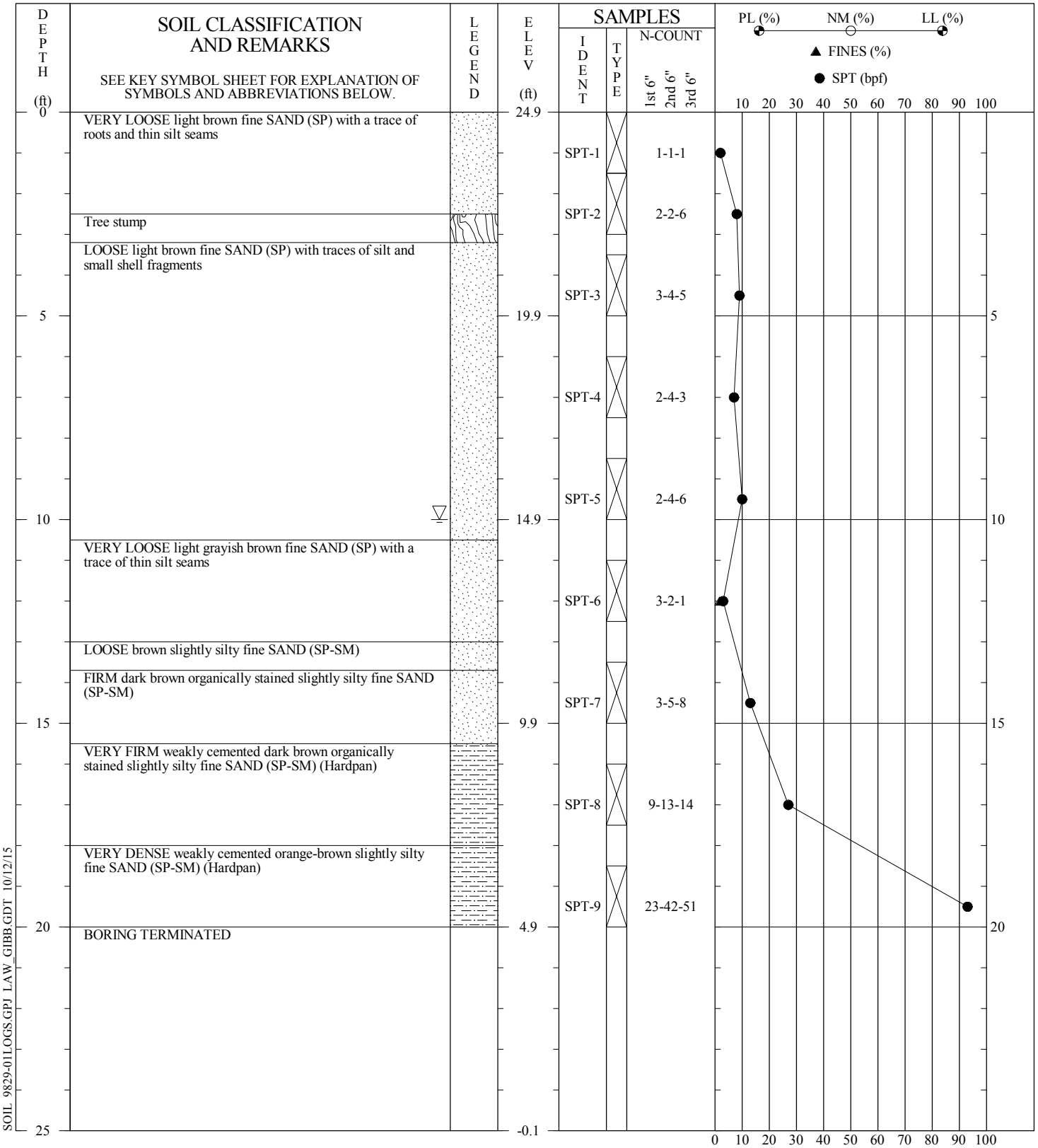
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-3
Checked By: MBW

amec foster wheeler



CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-4
Checked By: MBW

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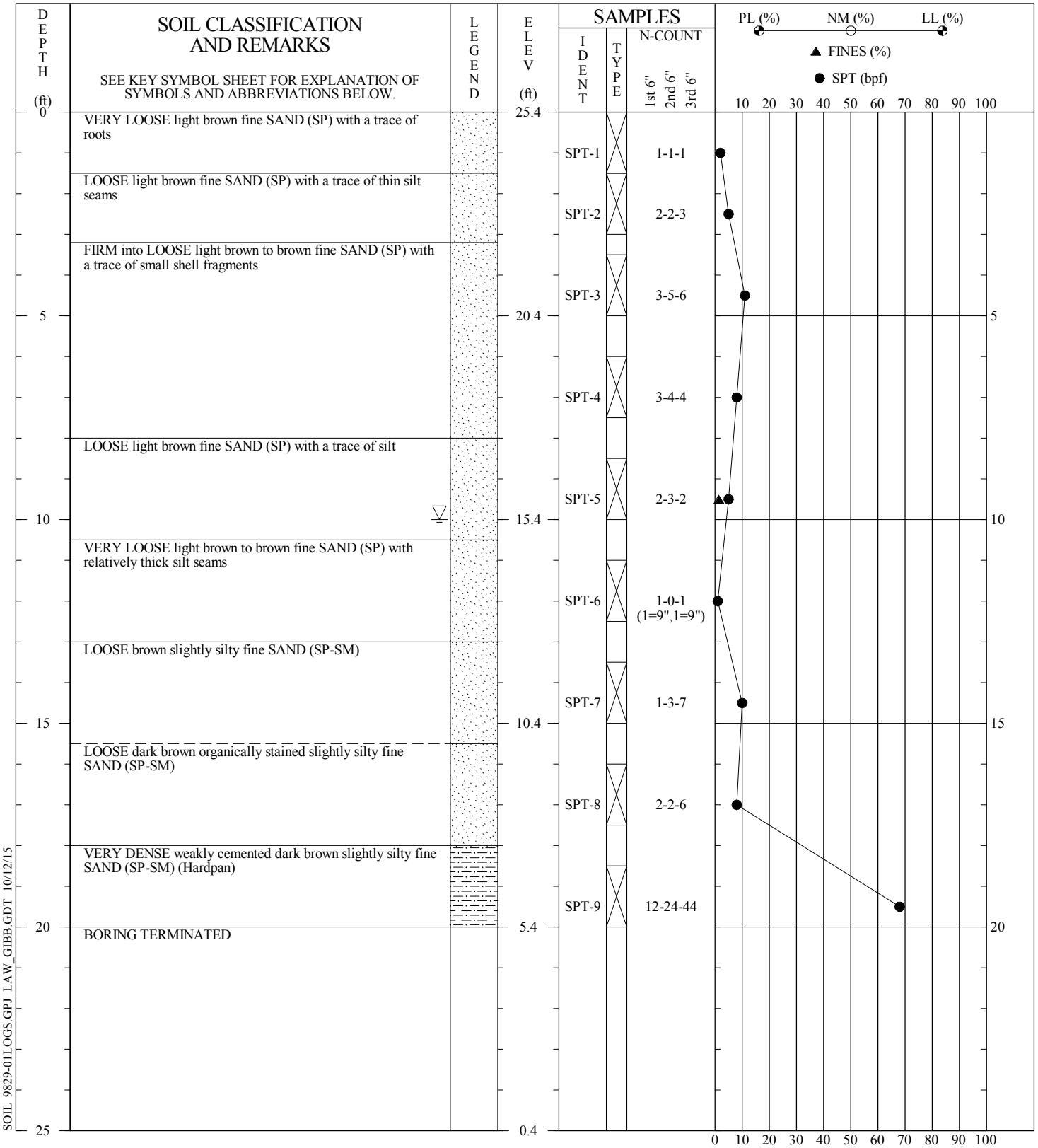


SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

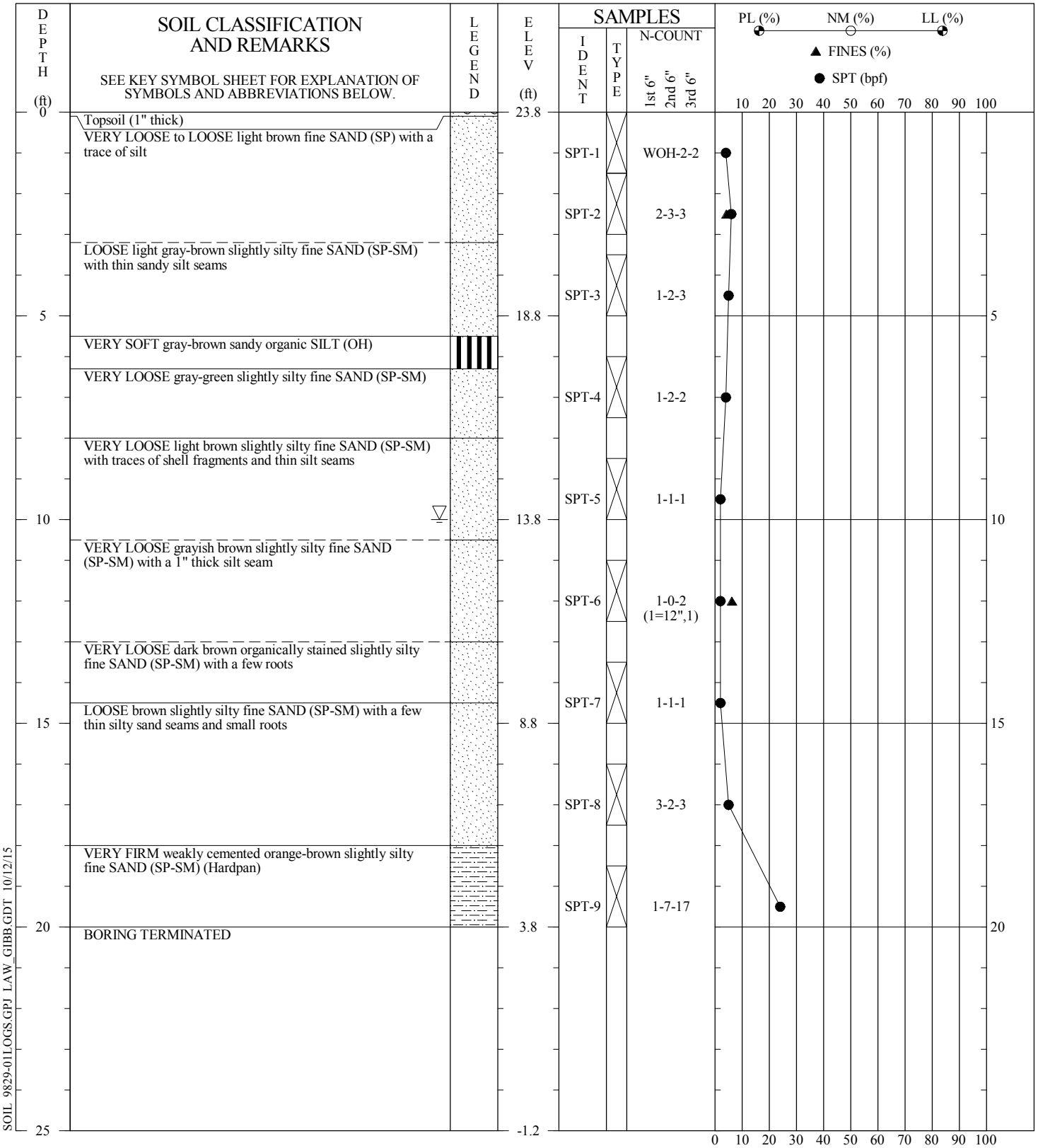
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-5
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

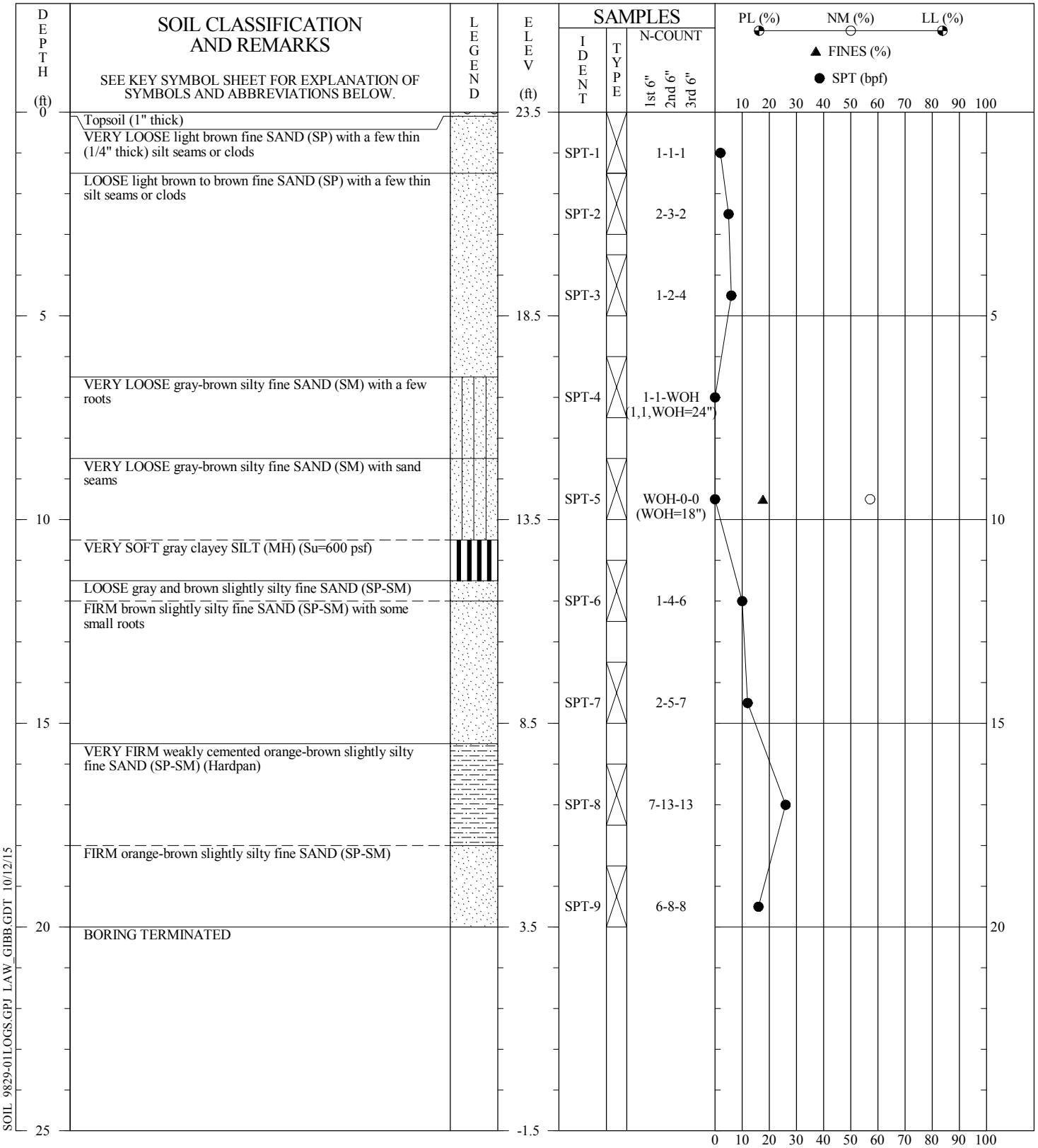
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-6
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	Groundwater encountered but not measured at time of drilling.

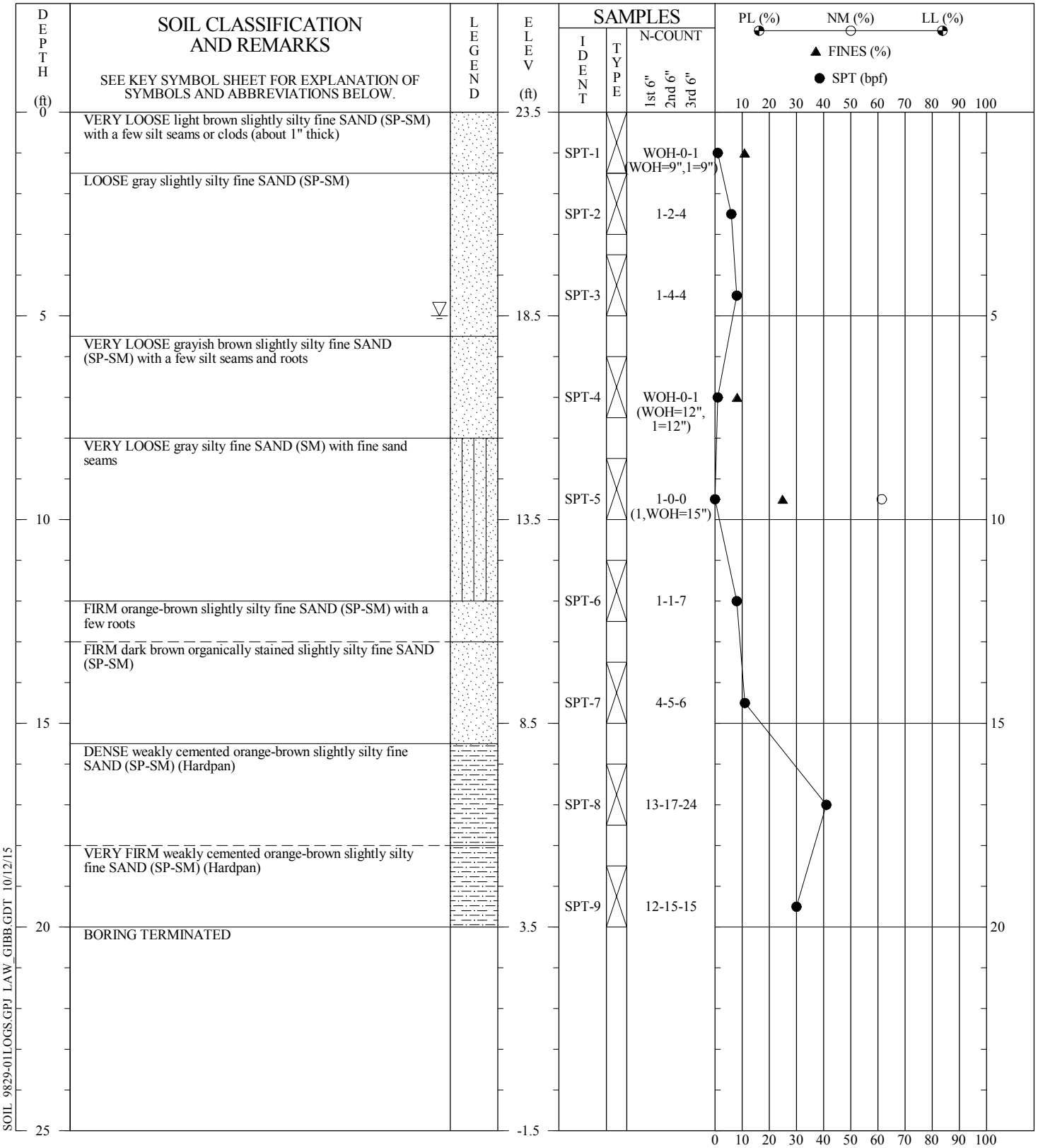
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-7
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

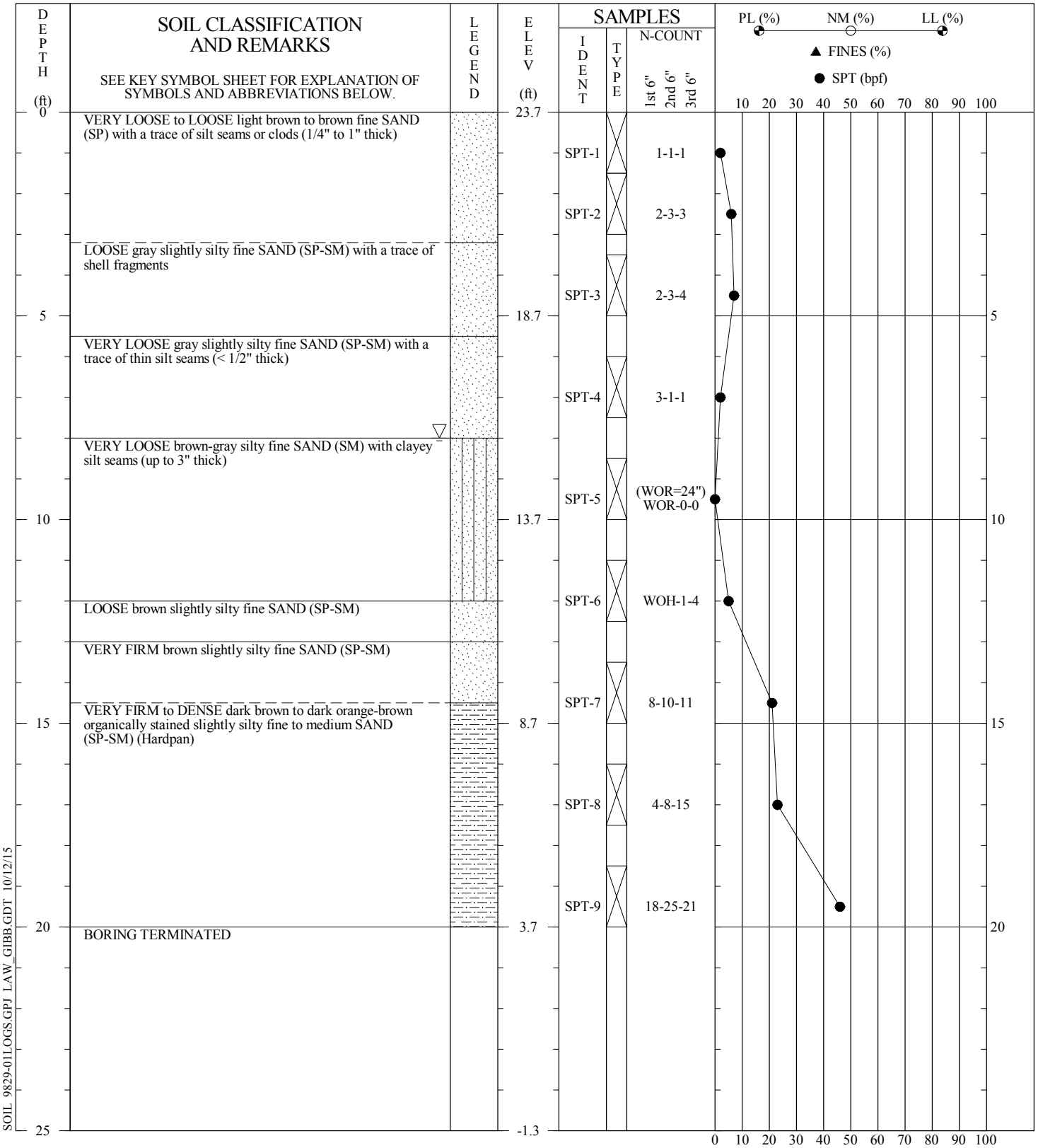
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-8
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

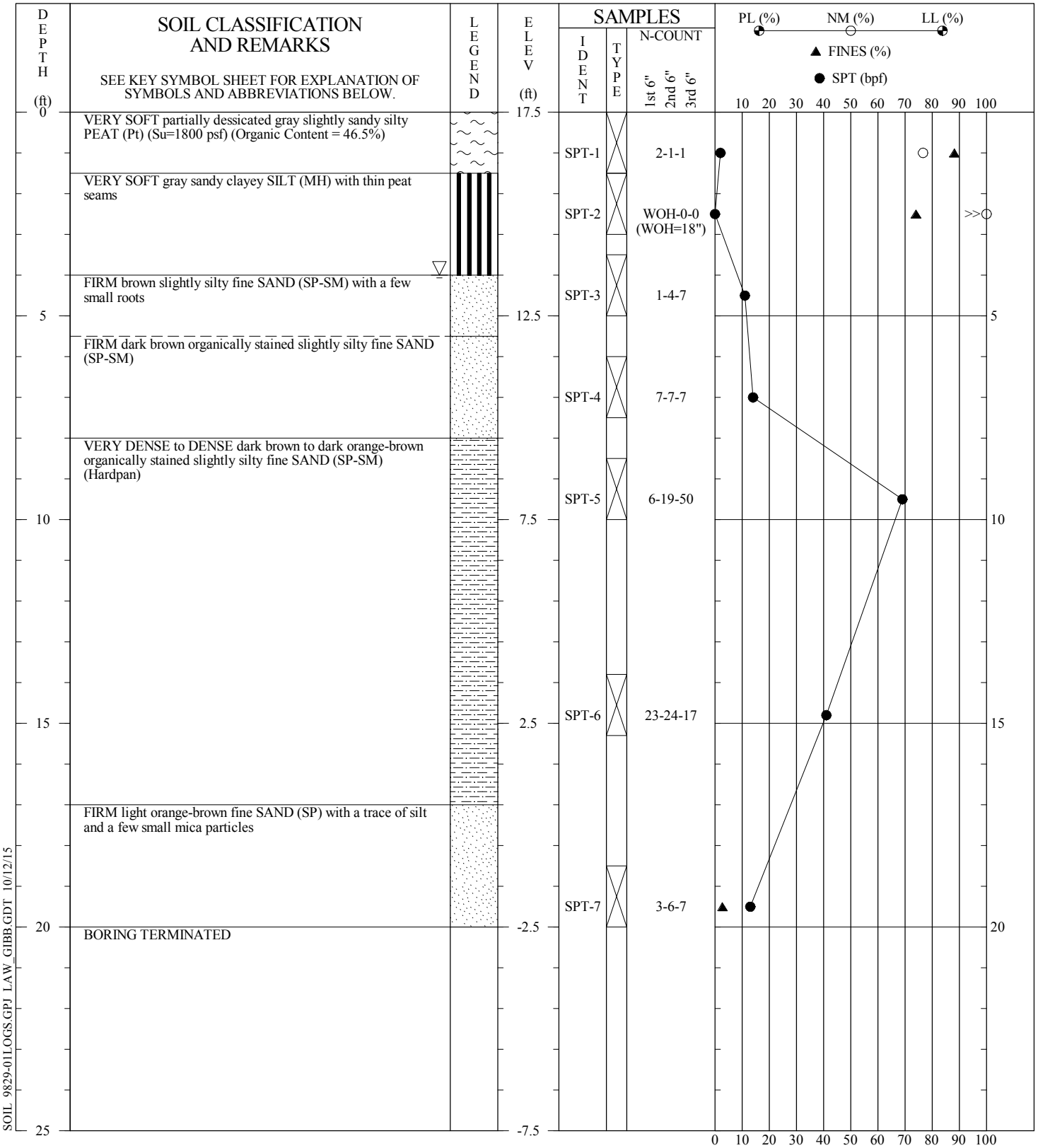
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-9
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

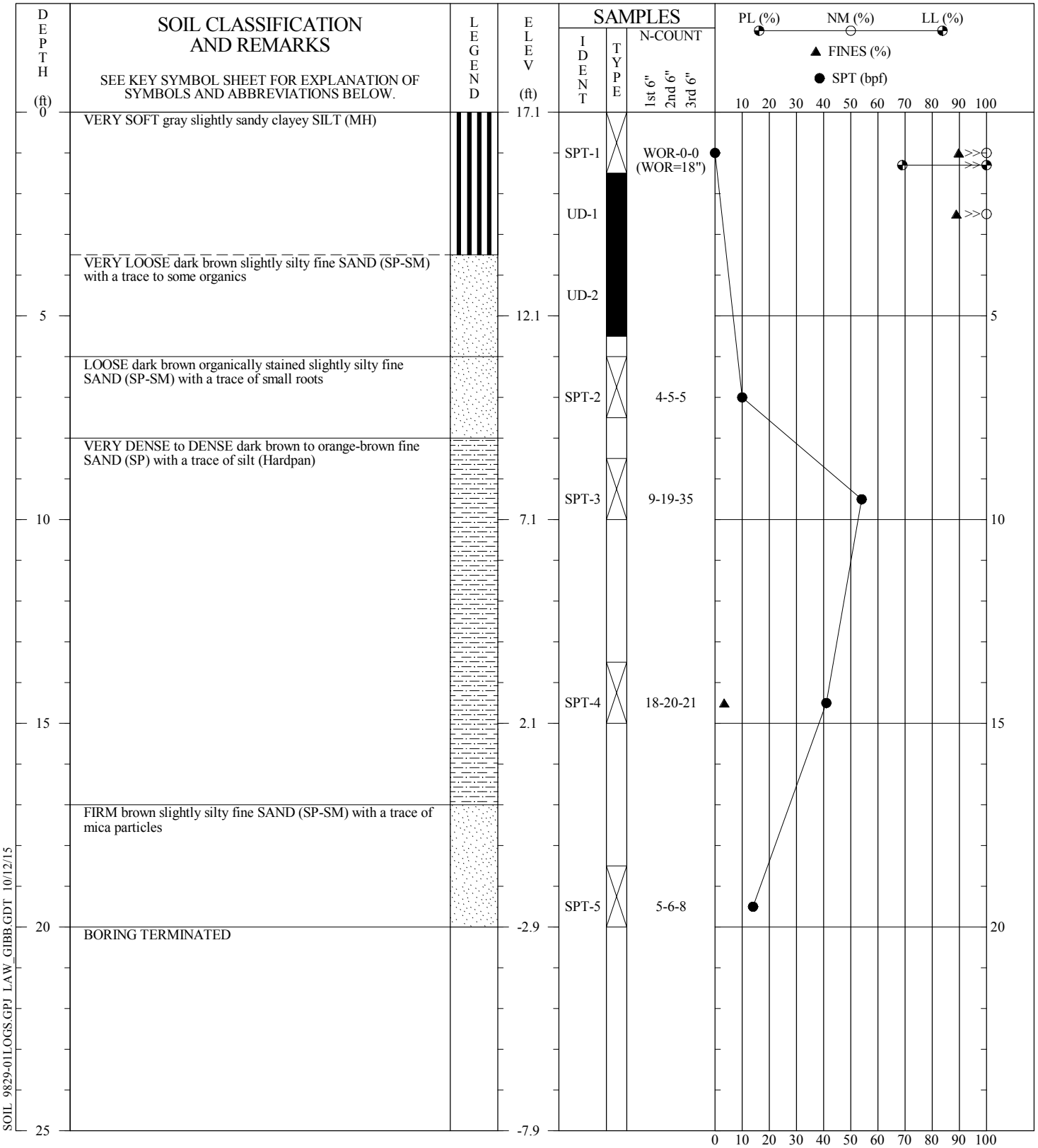
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 25, 2015
Proj. No.: 6734-15-9829

Boring No.: B-10
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	Groundwater encountered but not measured at time of drilling.

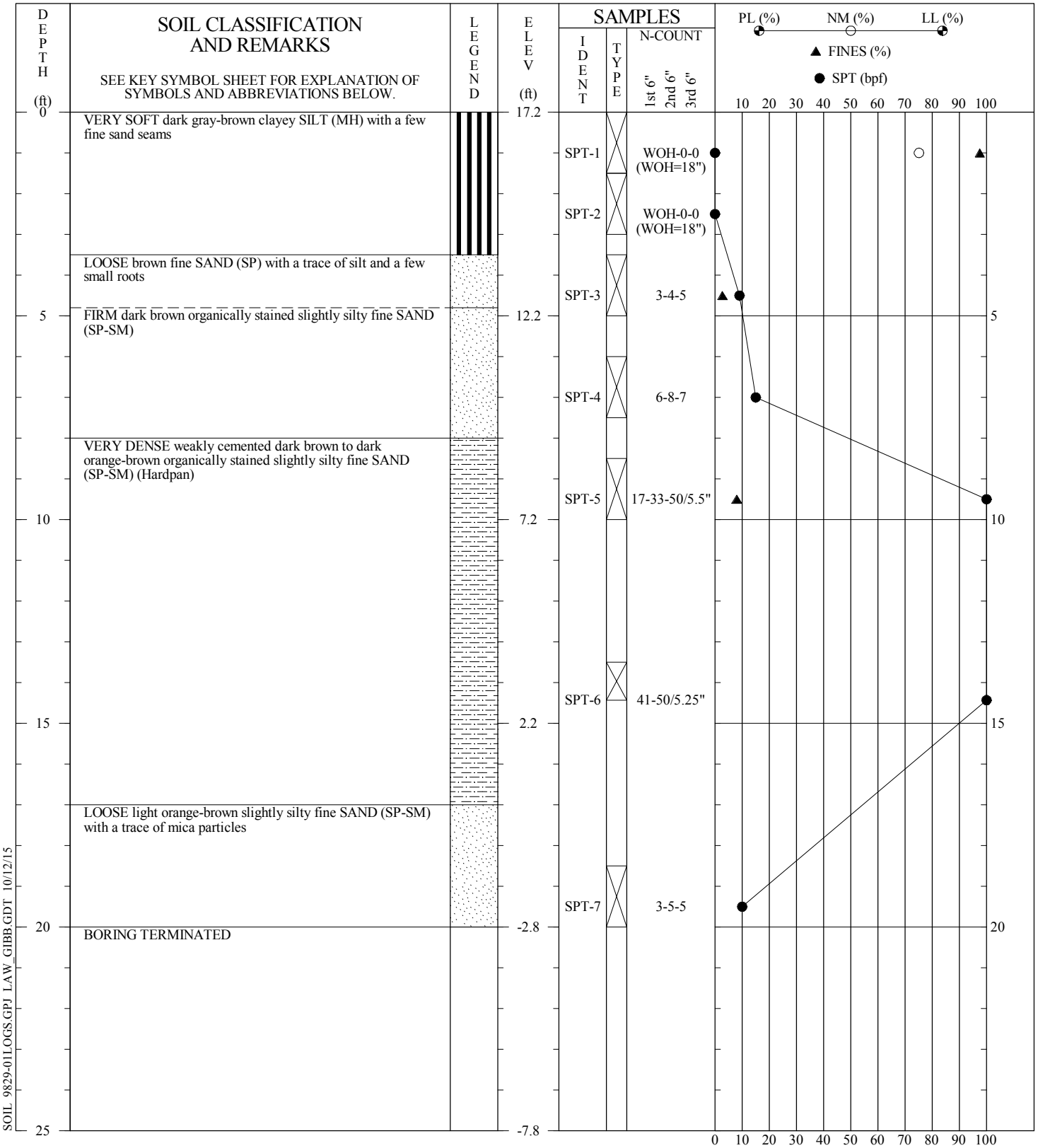
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 26, 2015
Proj. No.: 6734-15-9829

Boring No.: B-11
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	Groundwater encountered but not measured at time of drilling.

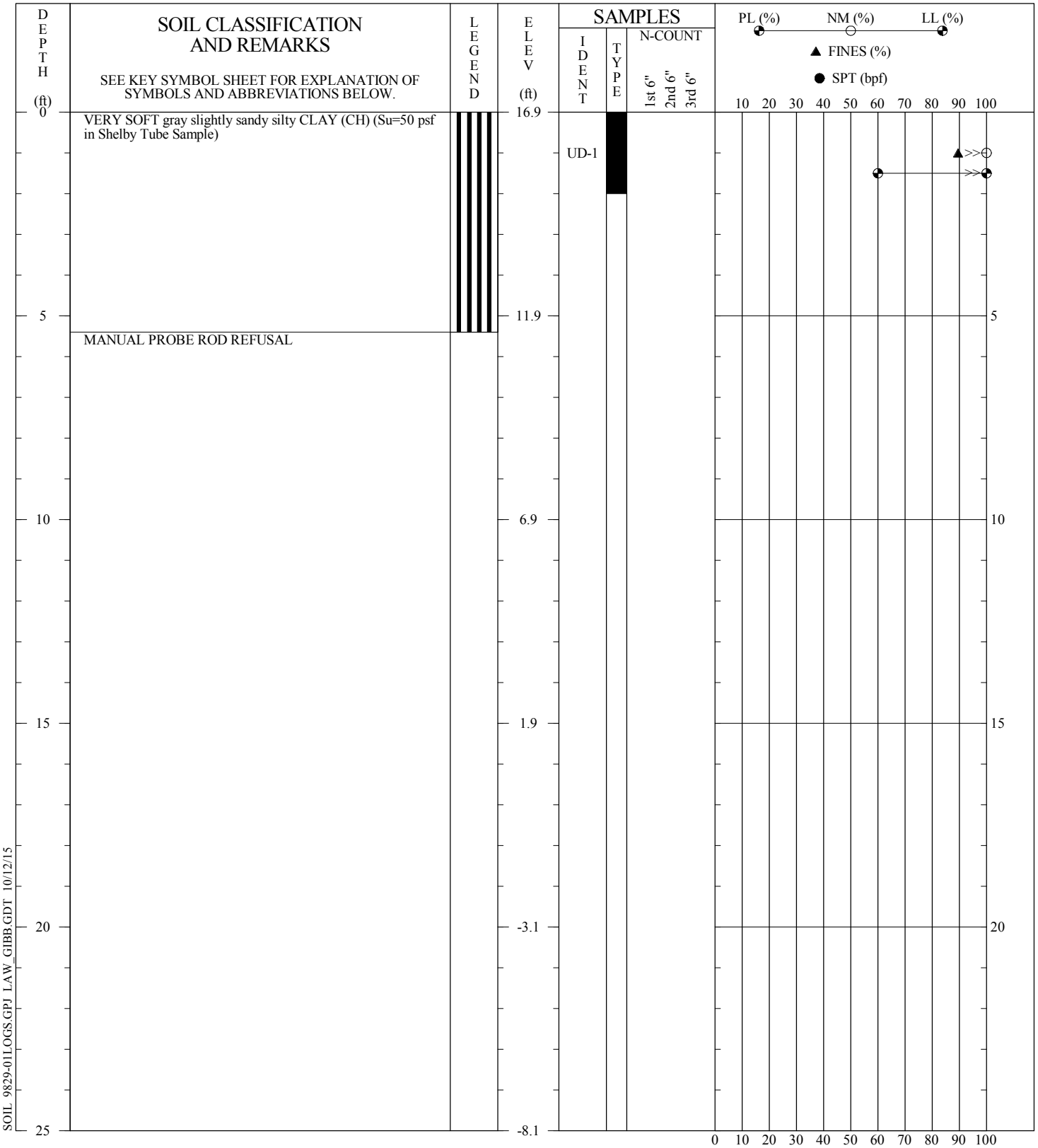
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 26, 2015
Proj. No.: 6734-15-9829

Boring No.: B-12
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	
DRILLER:	J. Teague
EQUIPMENT:	Steel probe rod
METHOD:	Manual
HOLE DIA.:	
REMARKS:	Shelby tube pushed manually into upper 2' of sediment

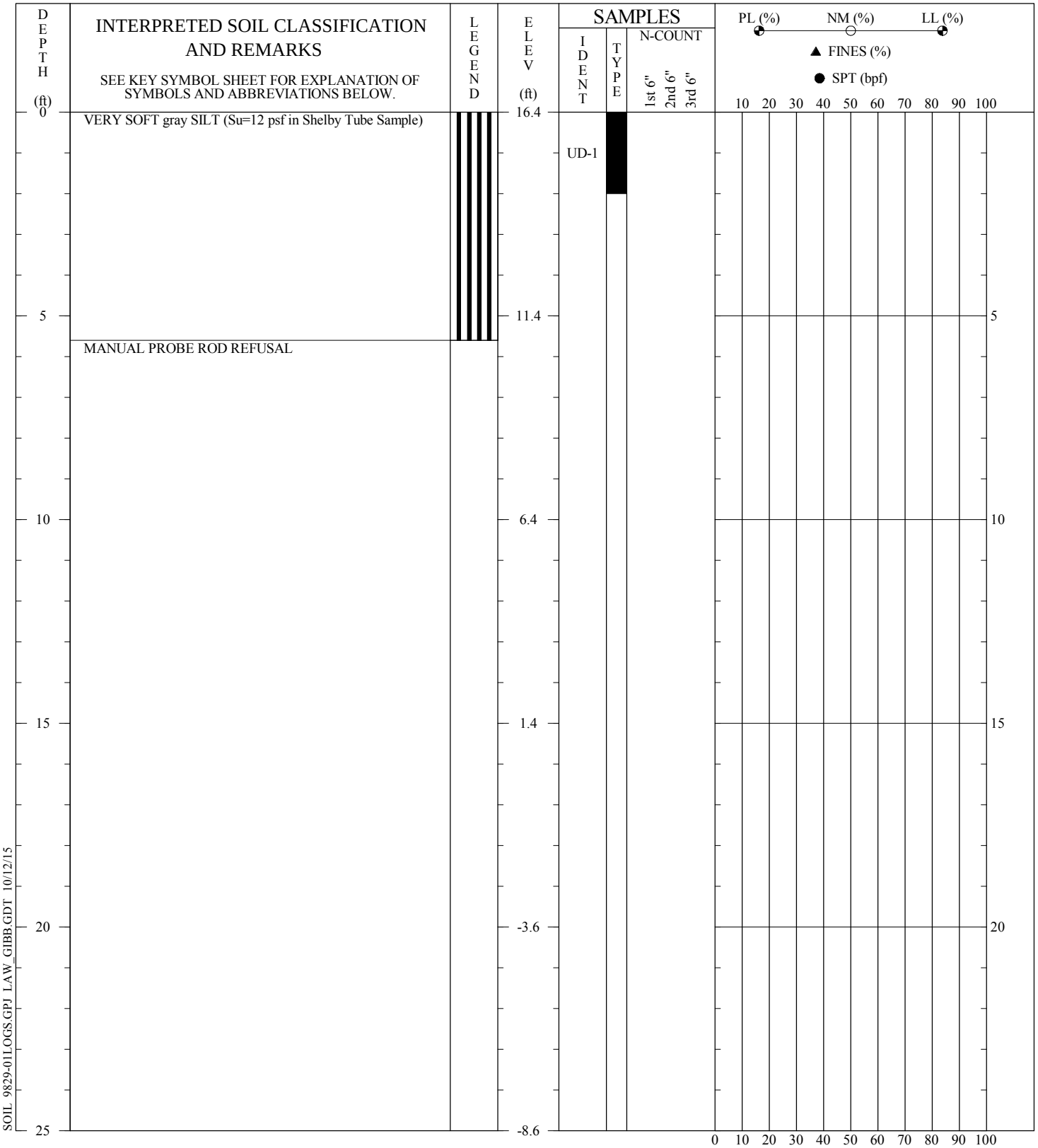
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-13
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS: Shelby tube pushed manually into upper 2' of sediment

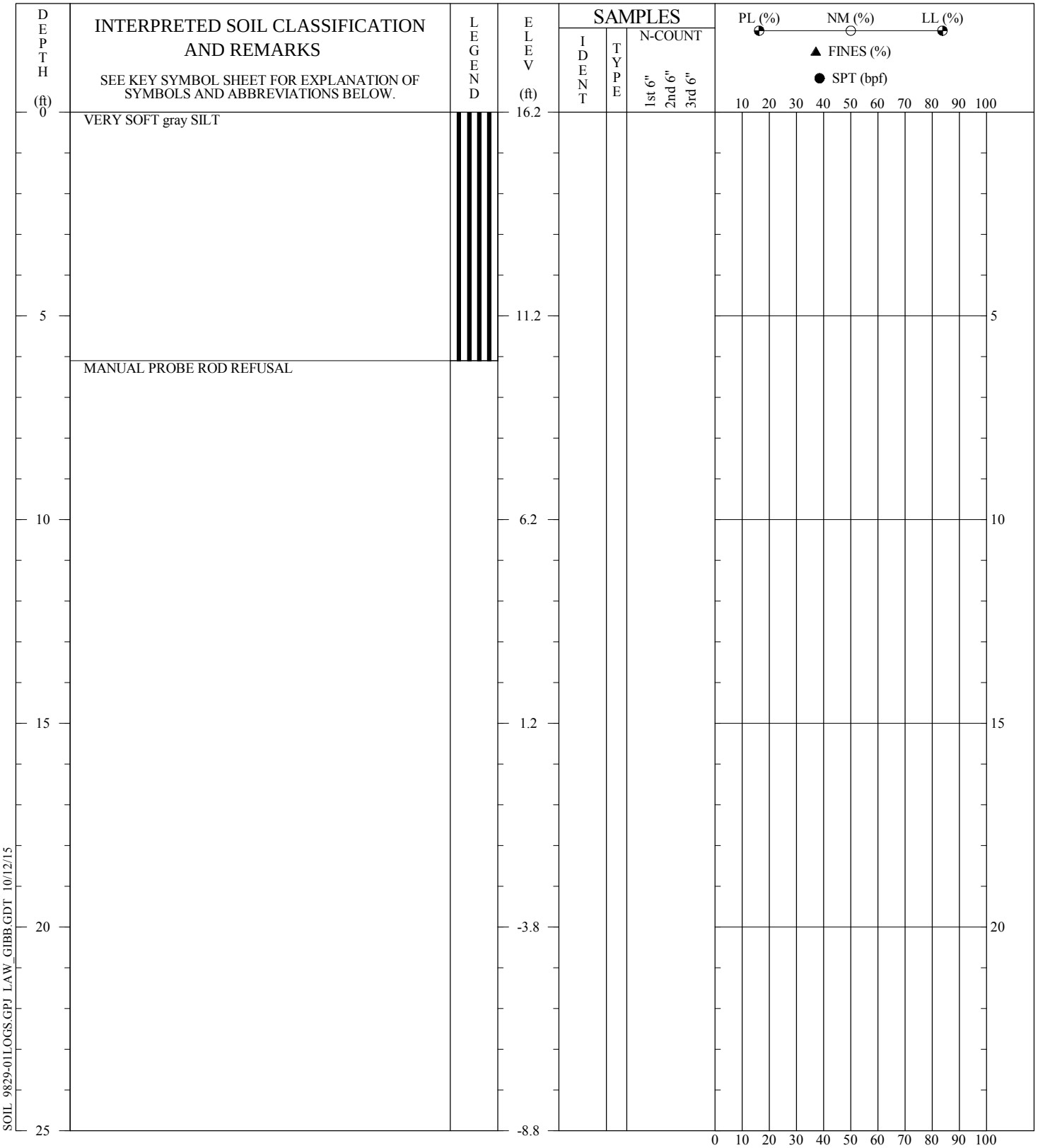
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-14
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS:

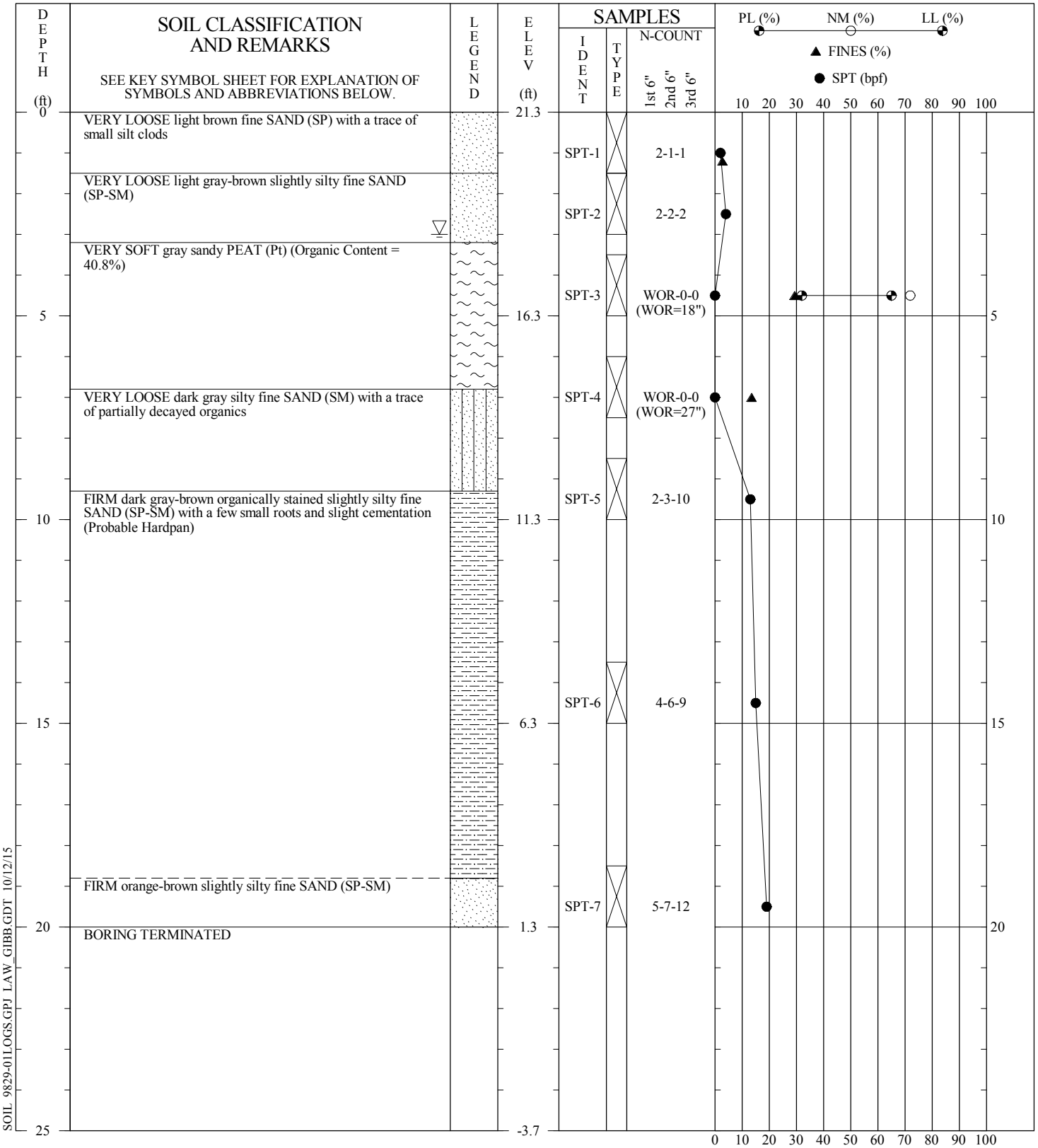
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-15
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

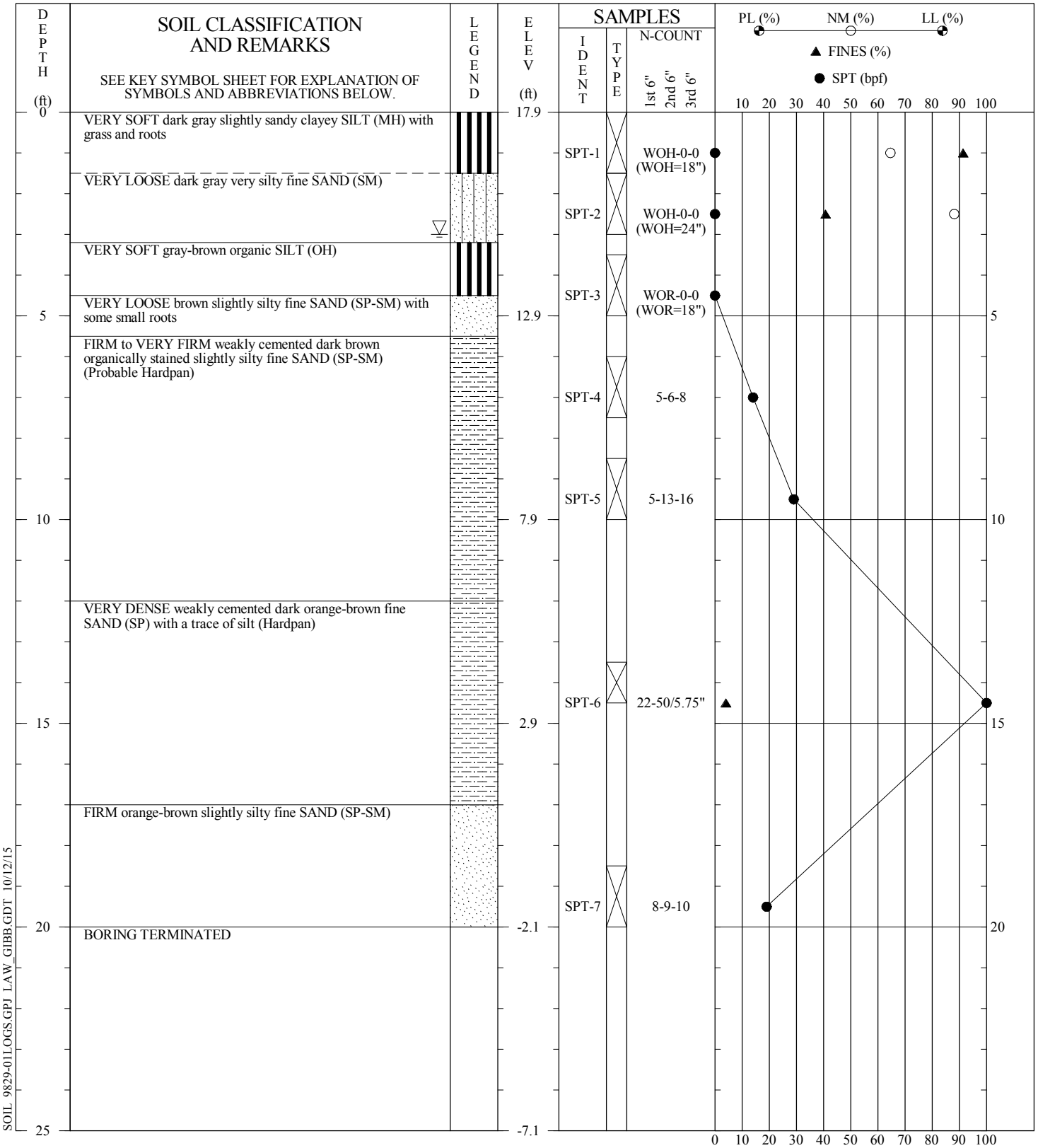
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 24, 2015
Proj. No.: 6734-15-9829

Boring No.: B-16
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

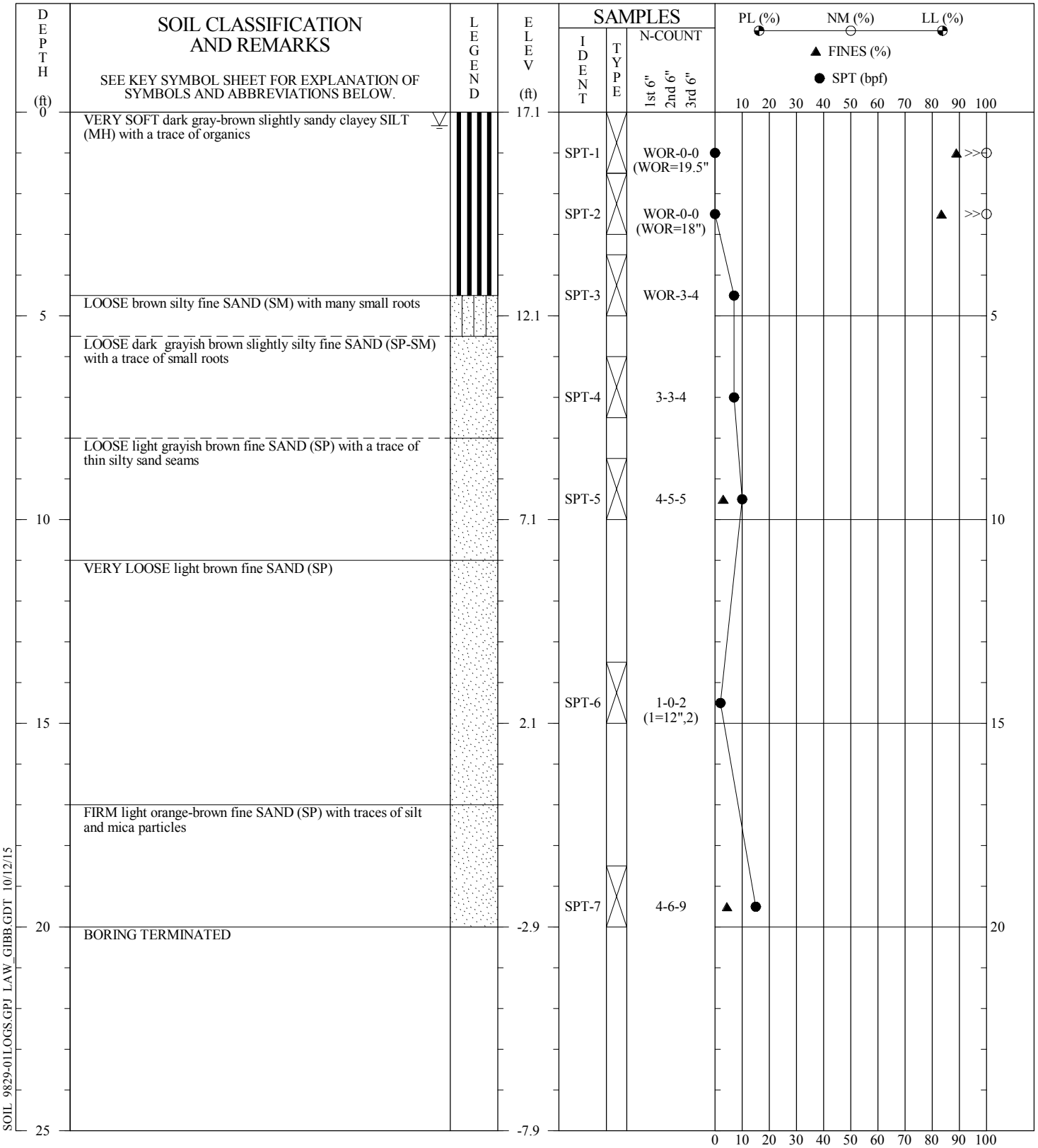
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 24, 2015
Proj. No.: 6734-15-9829

Boring No.: B-17
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

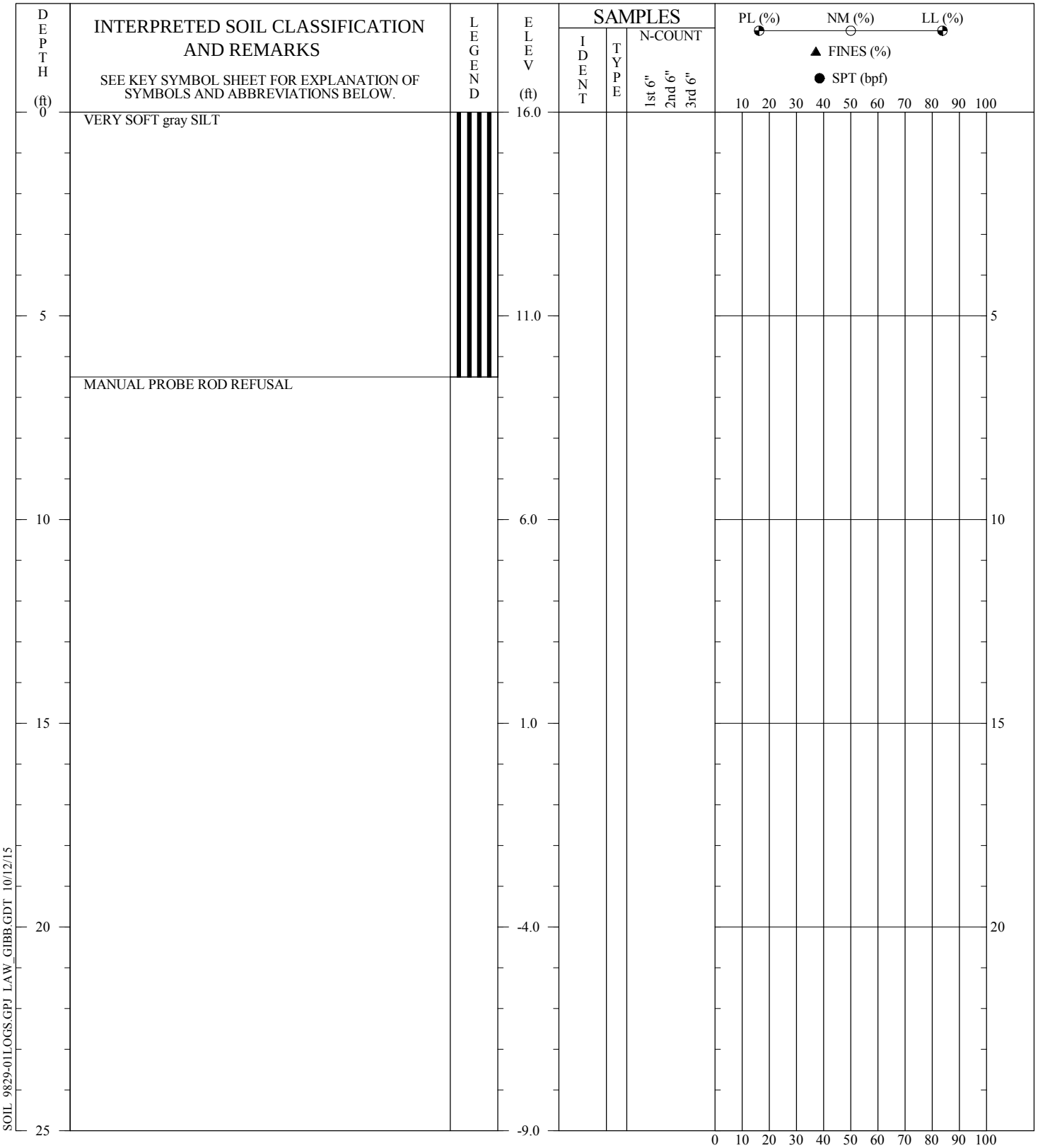
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 26, 2015
Proj. No.: 6734-15-9829

Boring No.: B-18
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS:

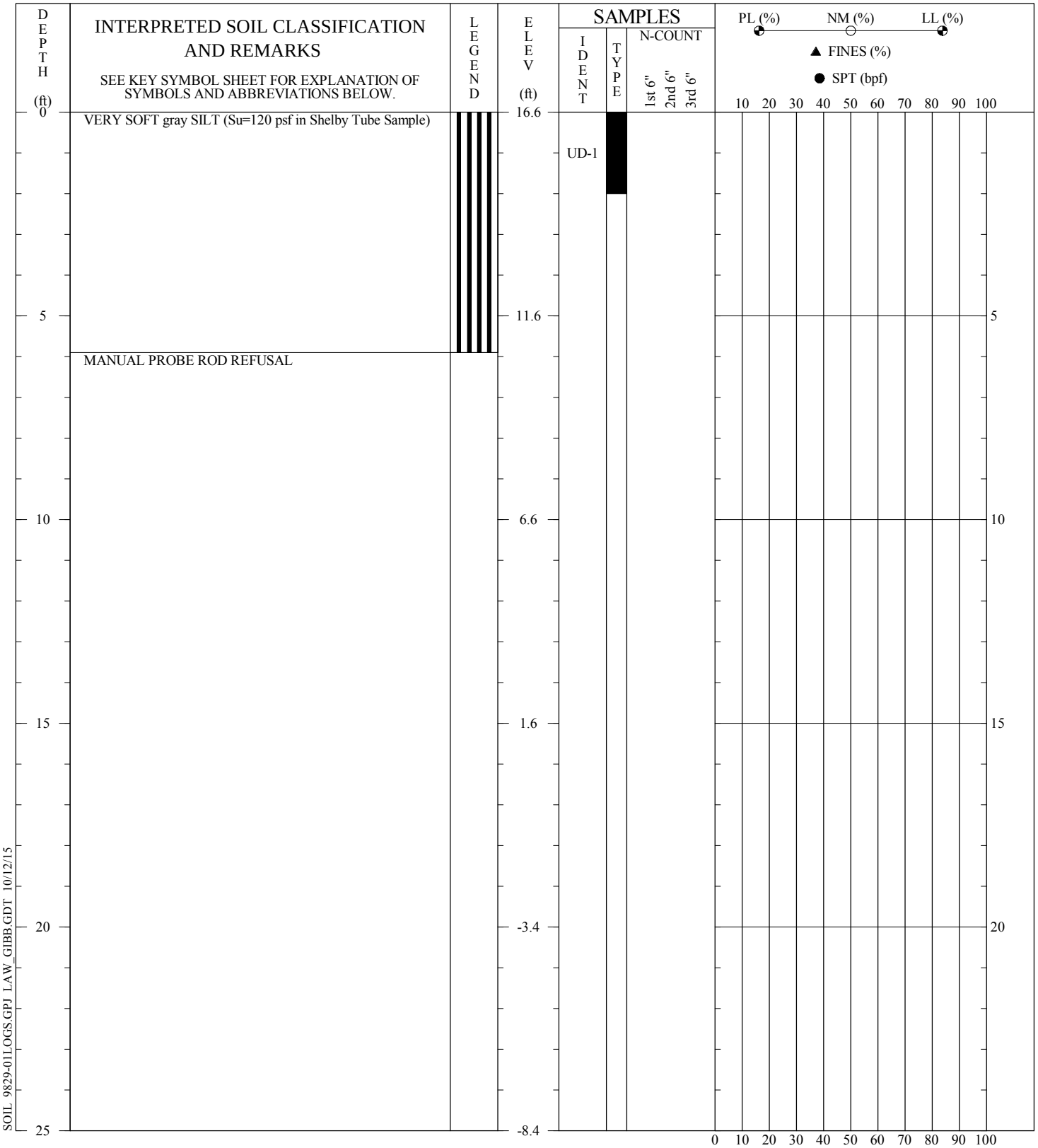
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 30, 2015
Proj. No.: 6734-15-9829

Boring No.: B-19
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS: Shelby tube pushed manually into upper 2' of sediment

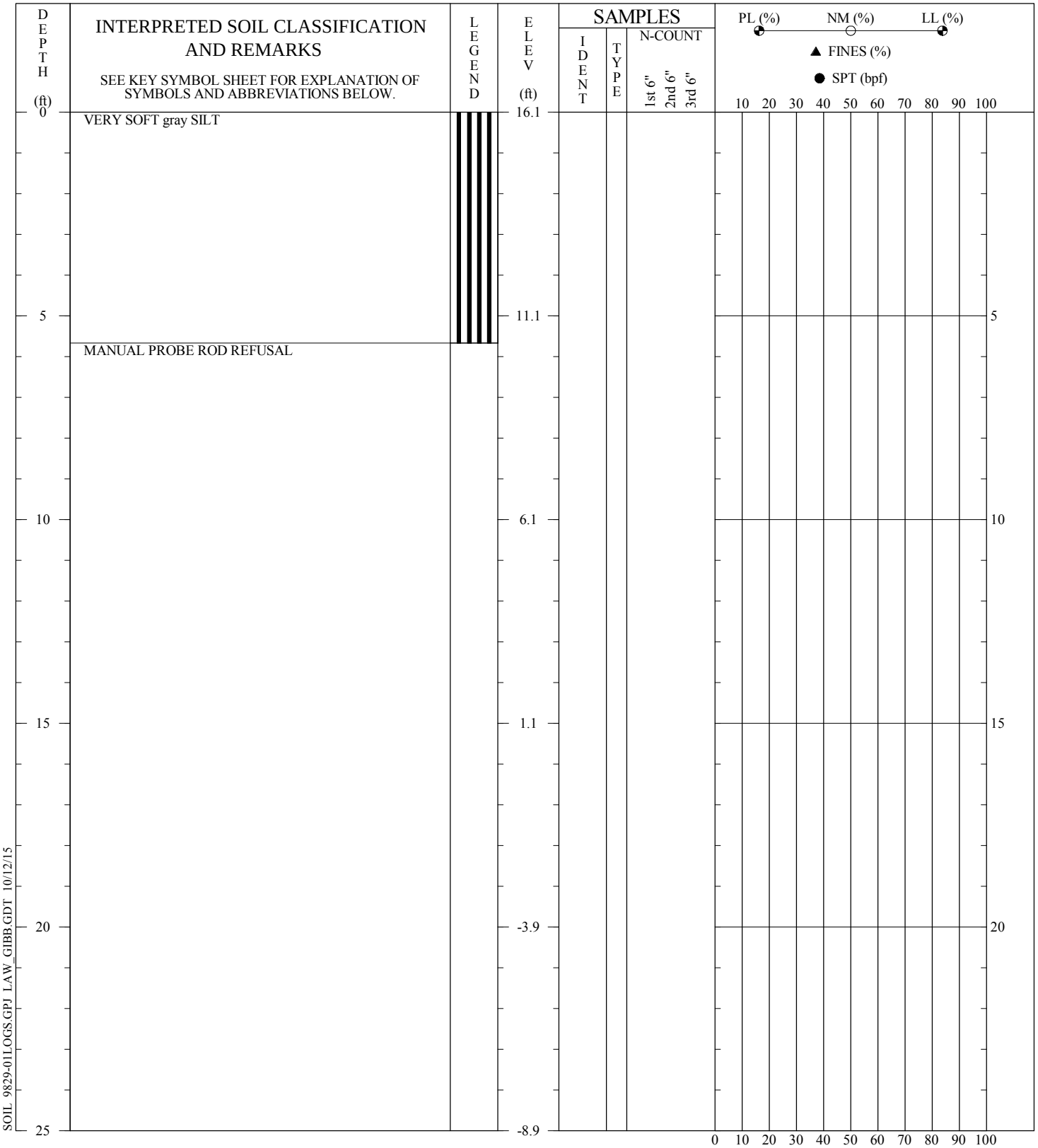
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-20
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS:

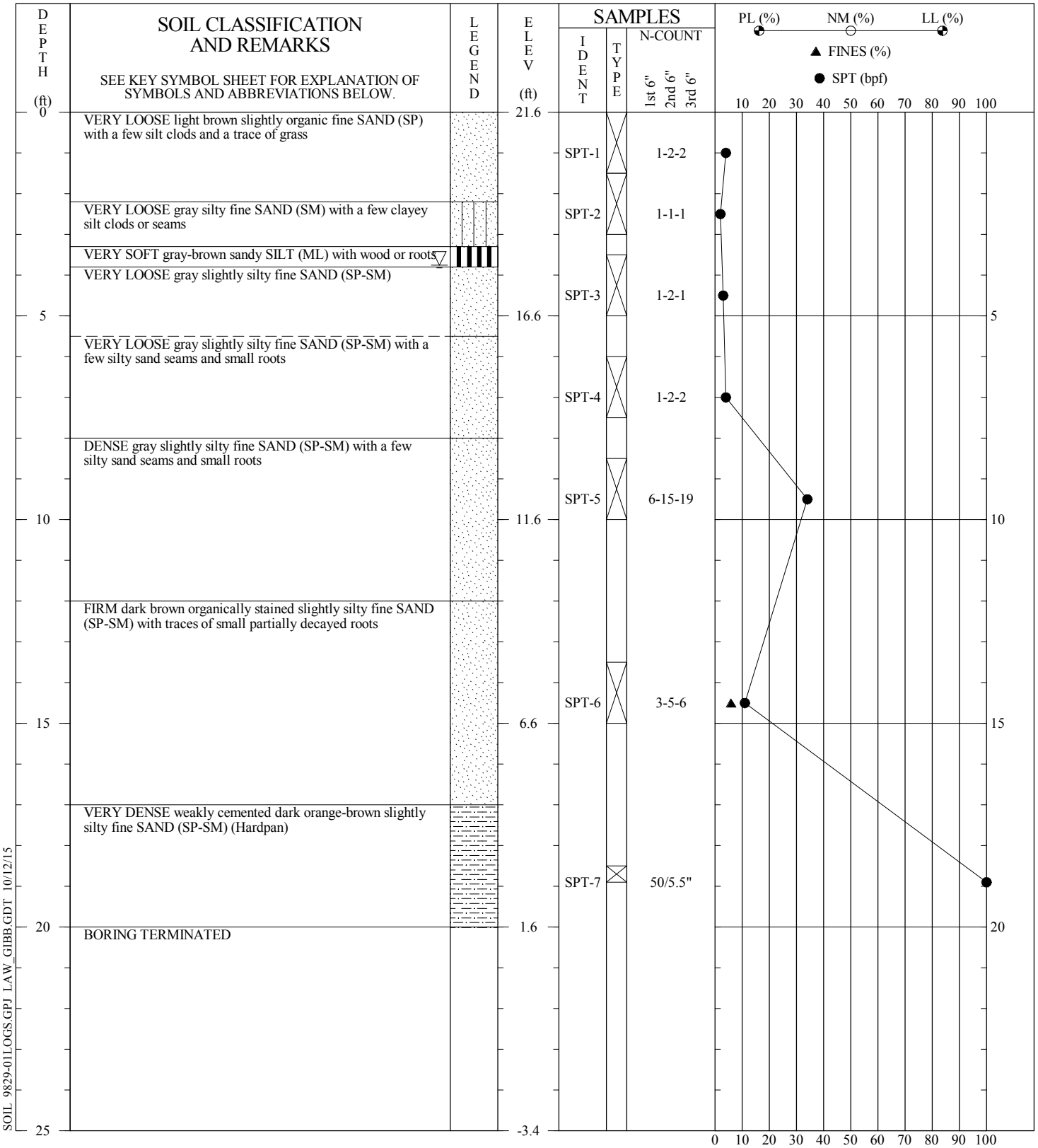
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-21
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

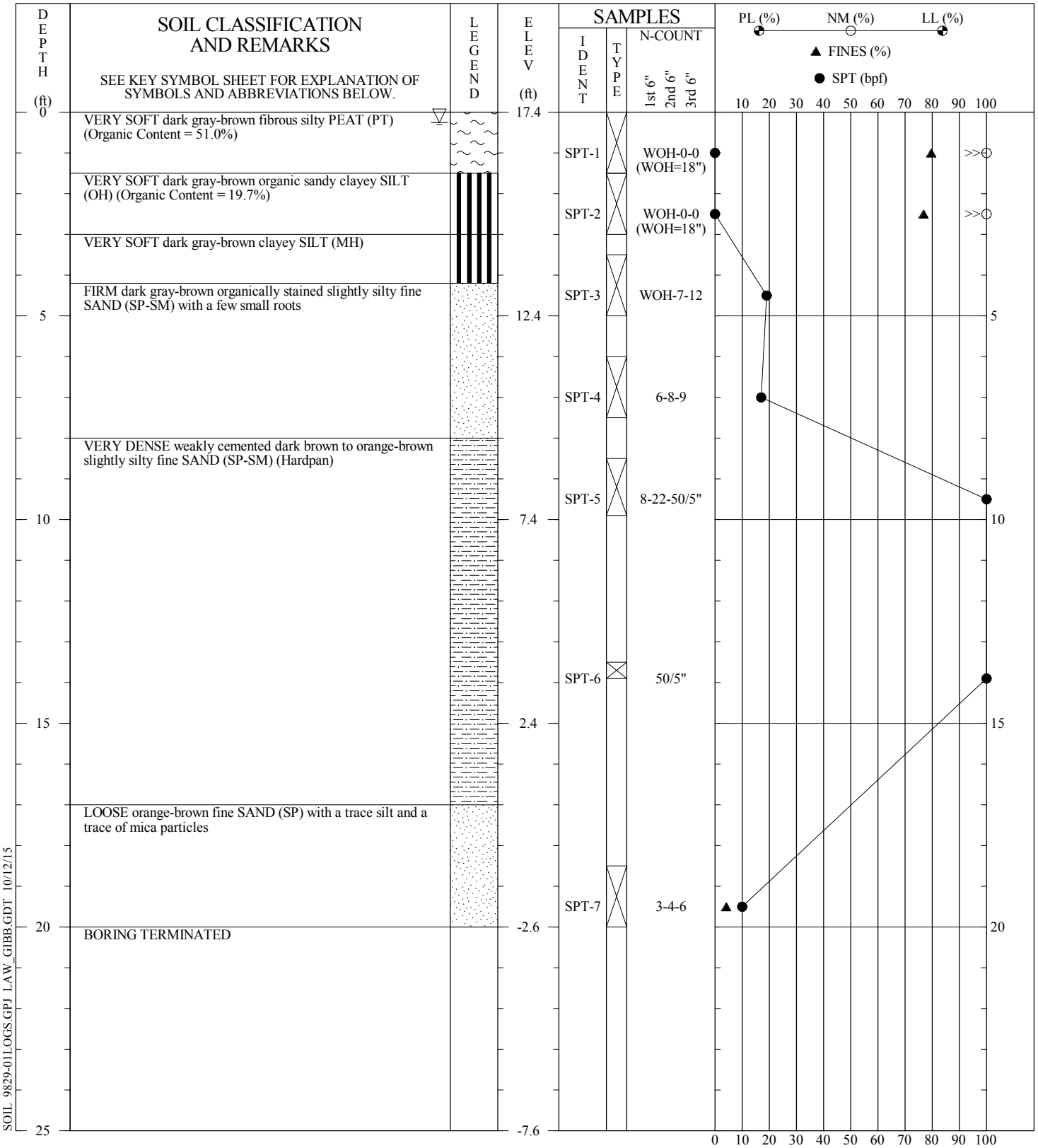
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 24, 2015
Proj. No.: 6734-15-9829

Boring No.: B-22
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

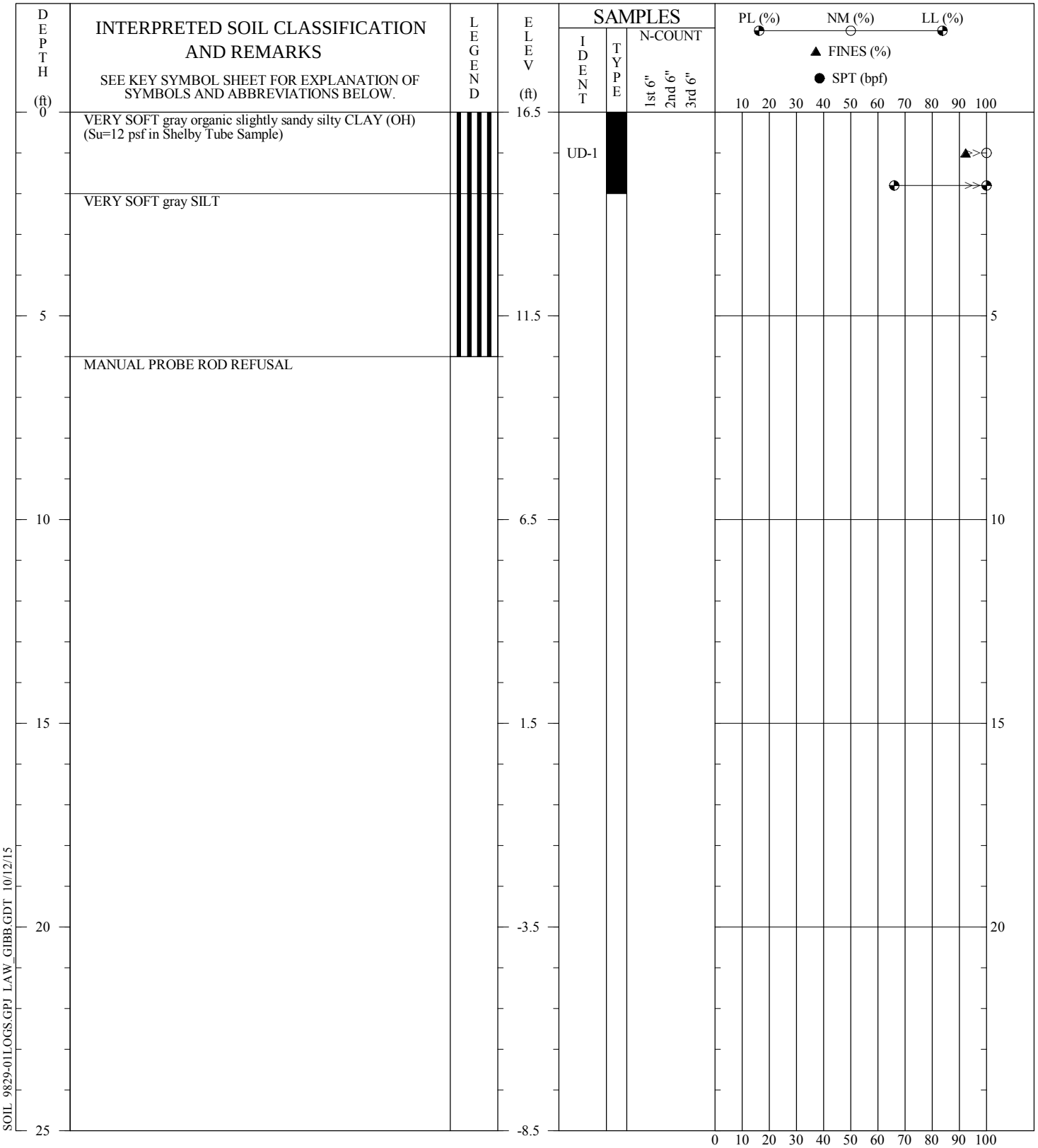
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 26, 2015
Proj. No.: 6734-15-9829

Boring No.: B-23
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	
DRILLER:	J. Teague
EQUIPMENT:	Steel probe rod
METHOD:	Manual
HOLE DIA.:	
REMARKS:	Shelby tube pushed manually into upper 2' of sediment

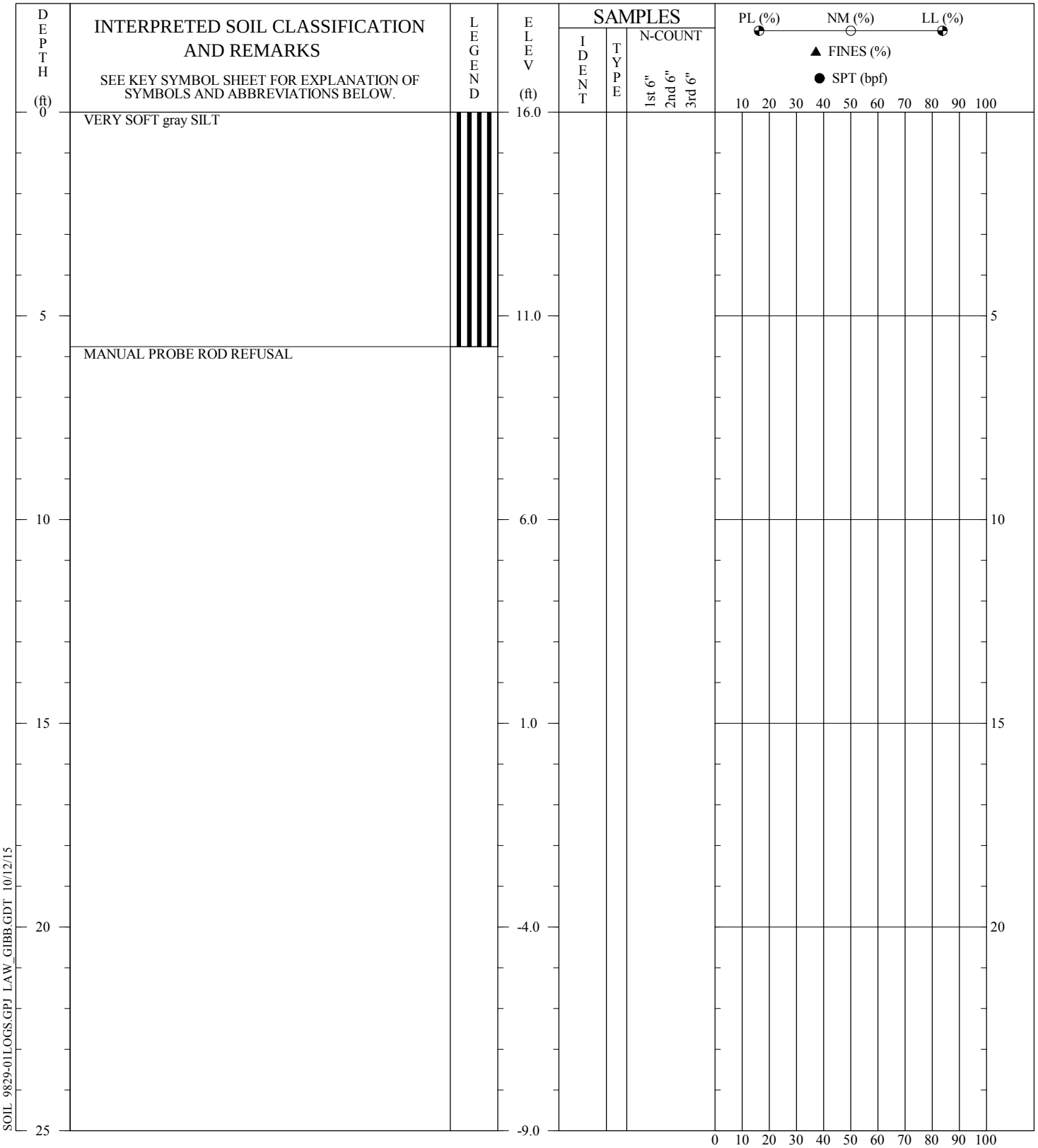
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-24
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS:

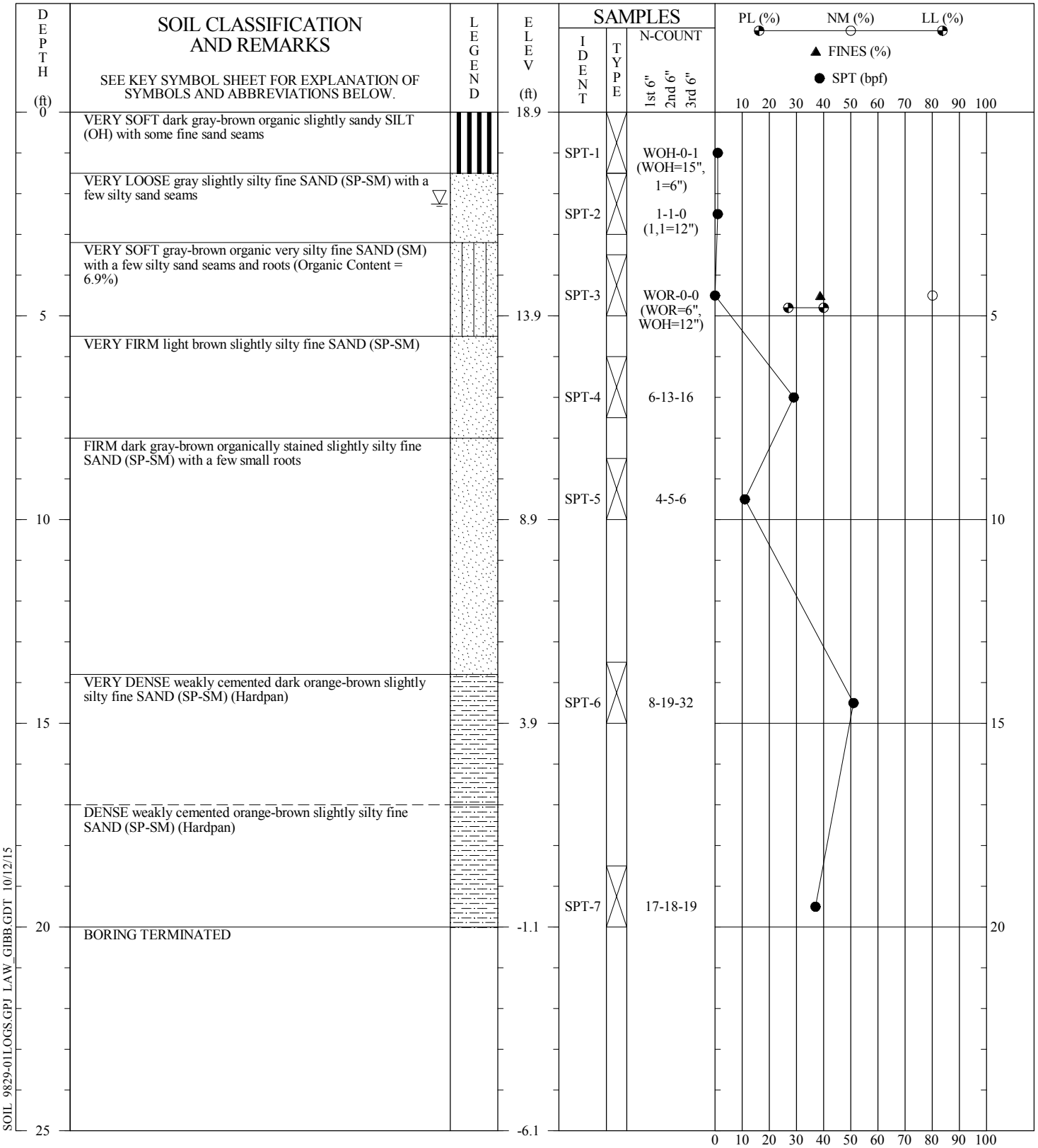
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-25
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

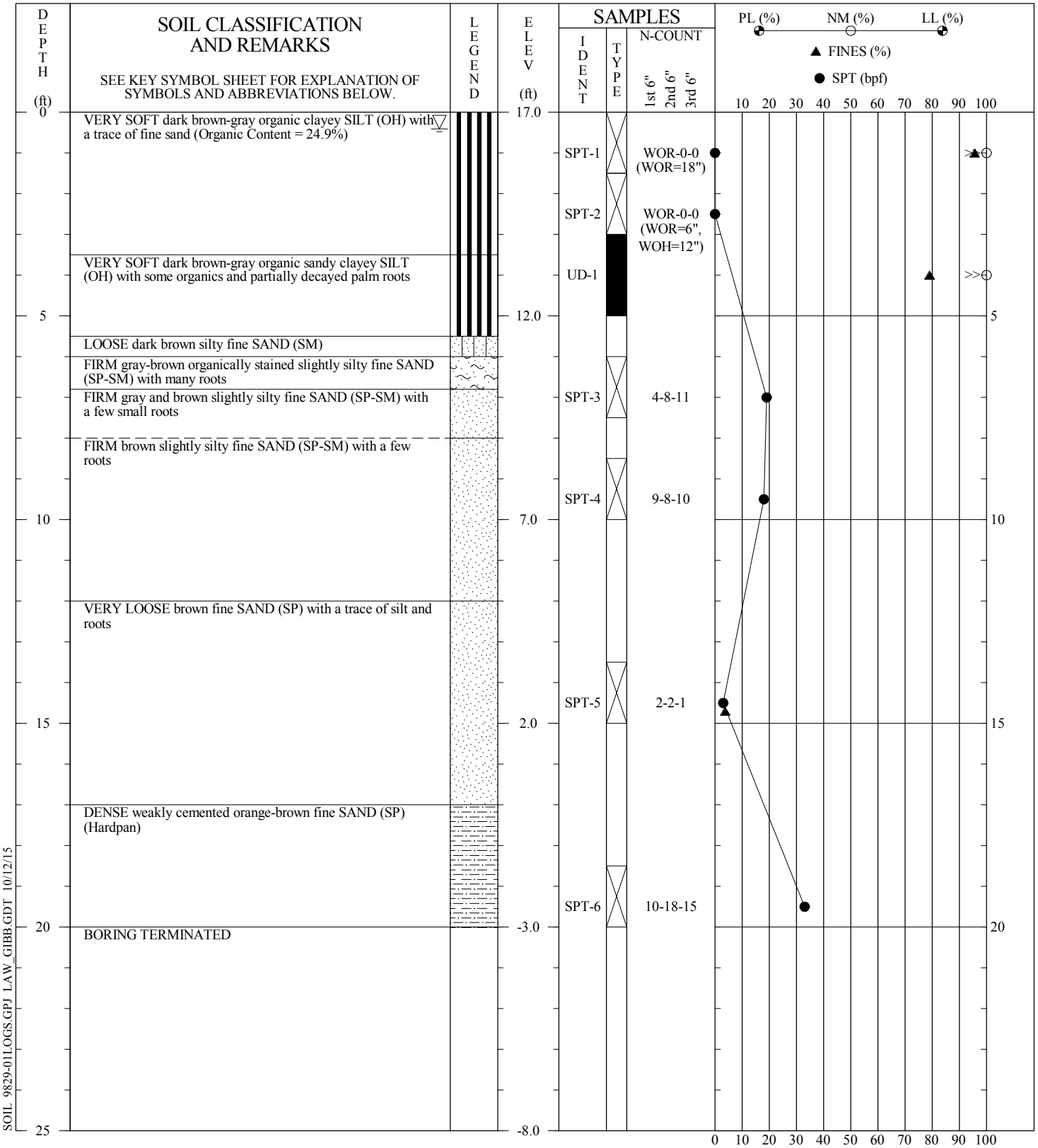
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 25, 2015
Proj. No.: 6734-15-9829

Boring No.: B-26
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

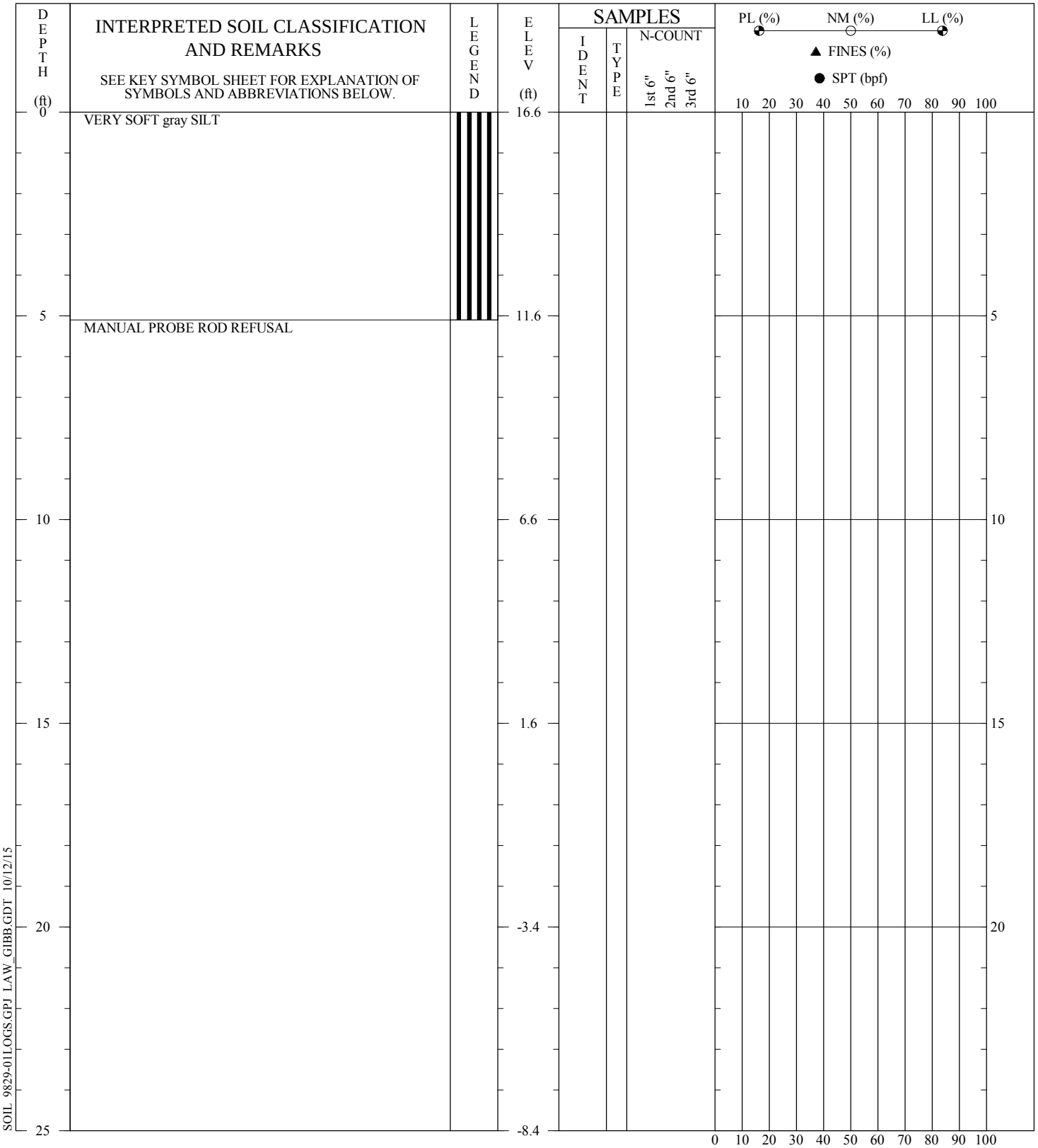
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 26, 2015
Proj. No.: 6734-15-9829

Boring No.: B-27
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS:

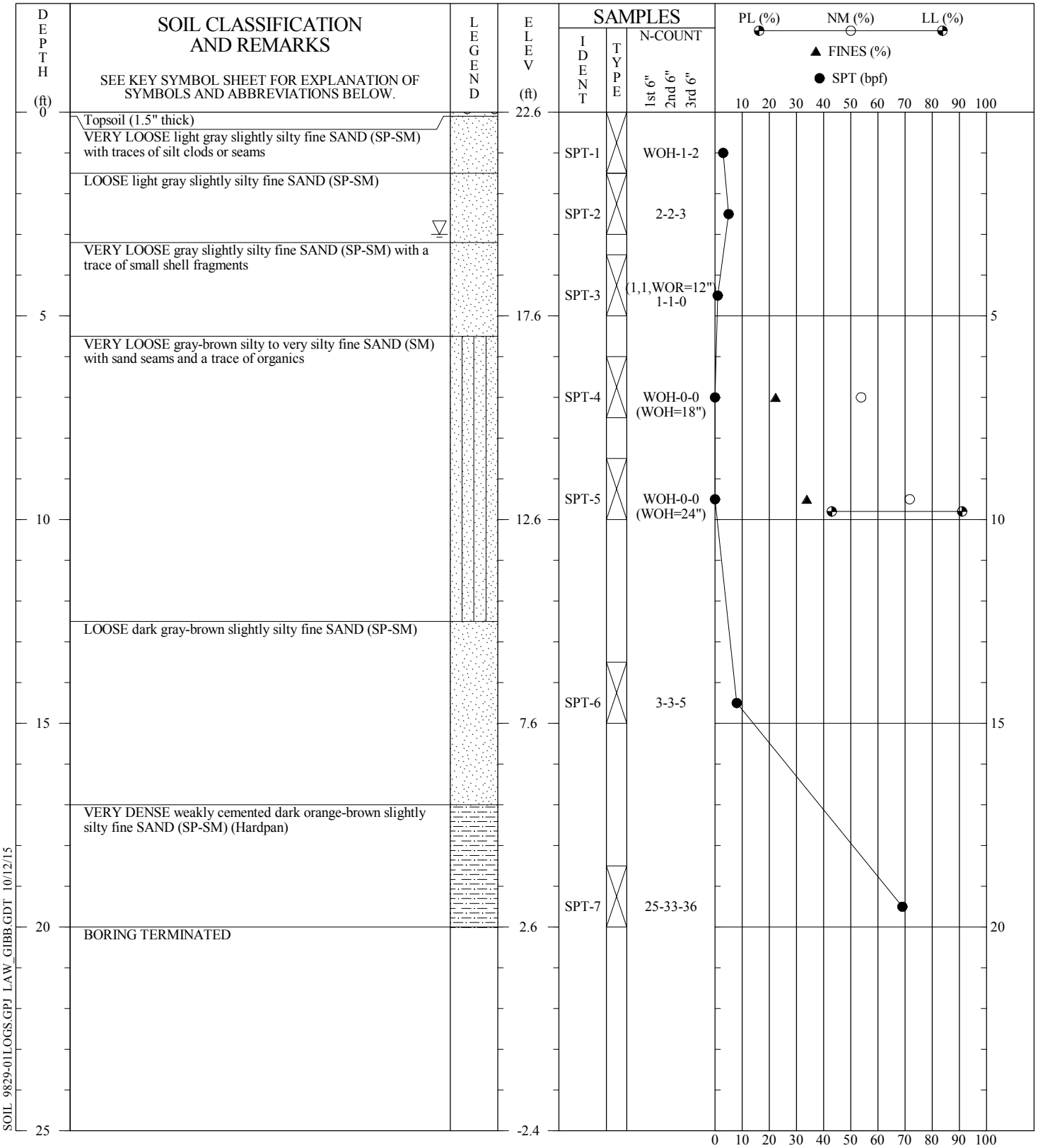
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-28
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	CME 850 (DR-7) - Automatic Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

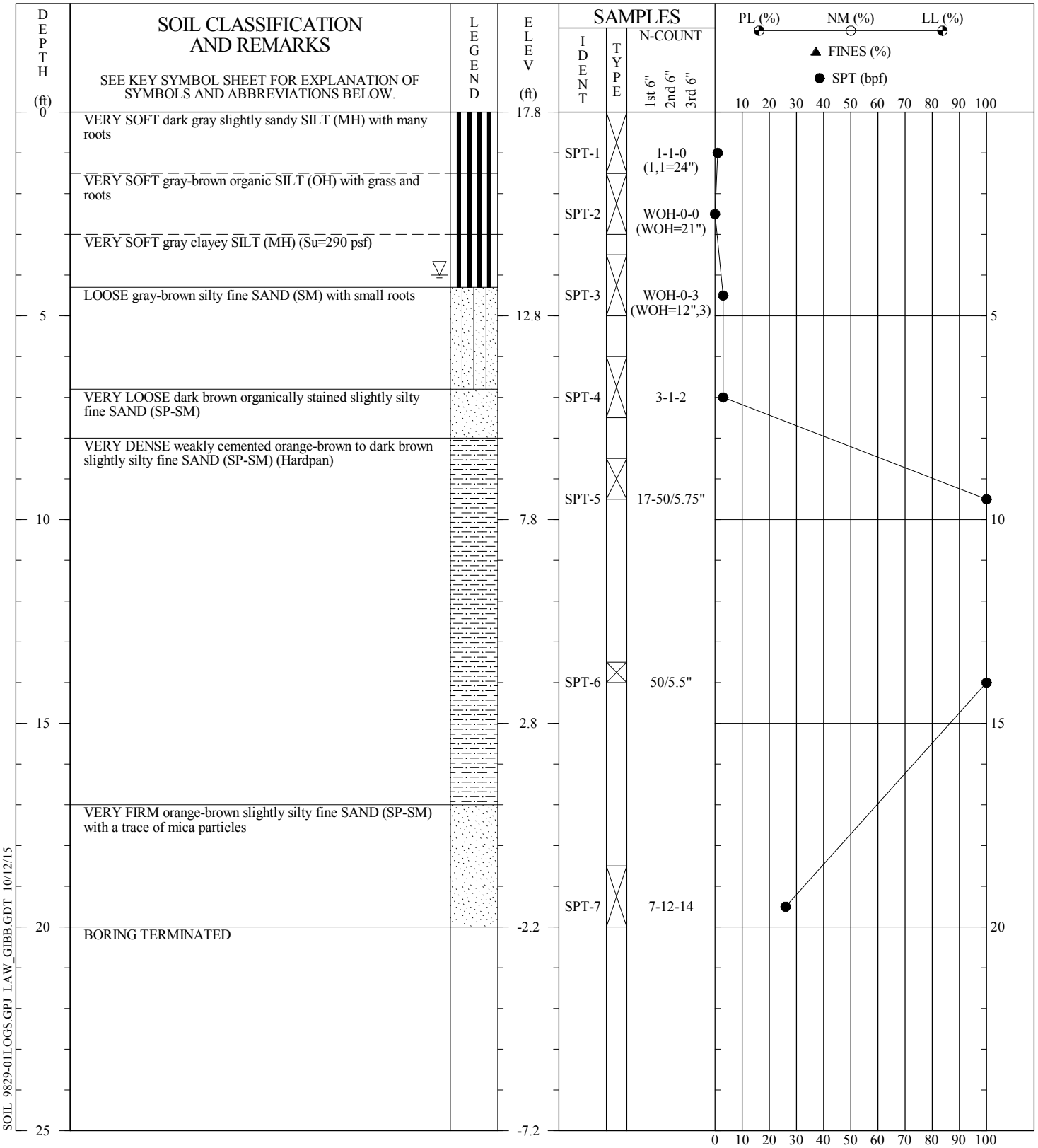
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 23, 2015
Proj. No.: 6734-15-9829

Boring No.: B-29
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:	Independent Drilling, Inc.
DRILLER:	B. Cannon (Amec field rep.: J. Teague)
EQUIPMENT:	Amphibious (DR-1) - Manual Hammer
METHOD:	Auger/Mud Rotary
HOLE DIA.:	4"
REMARKS:	

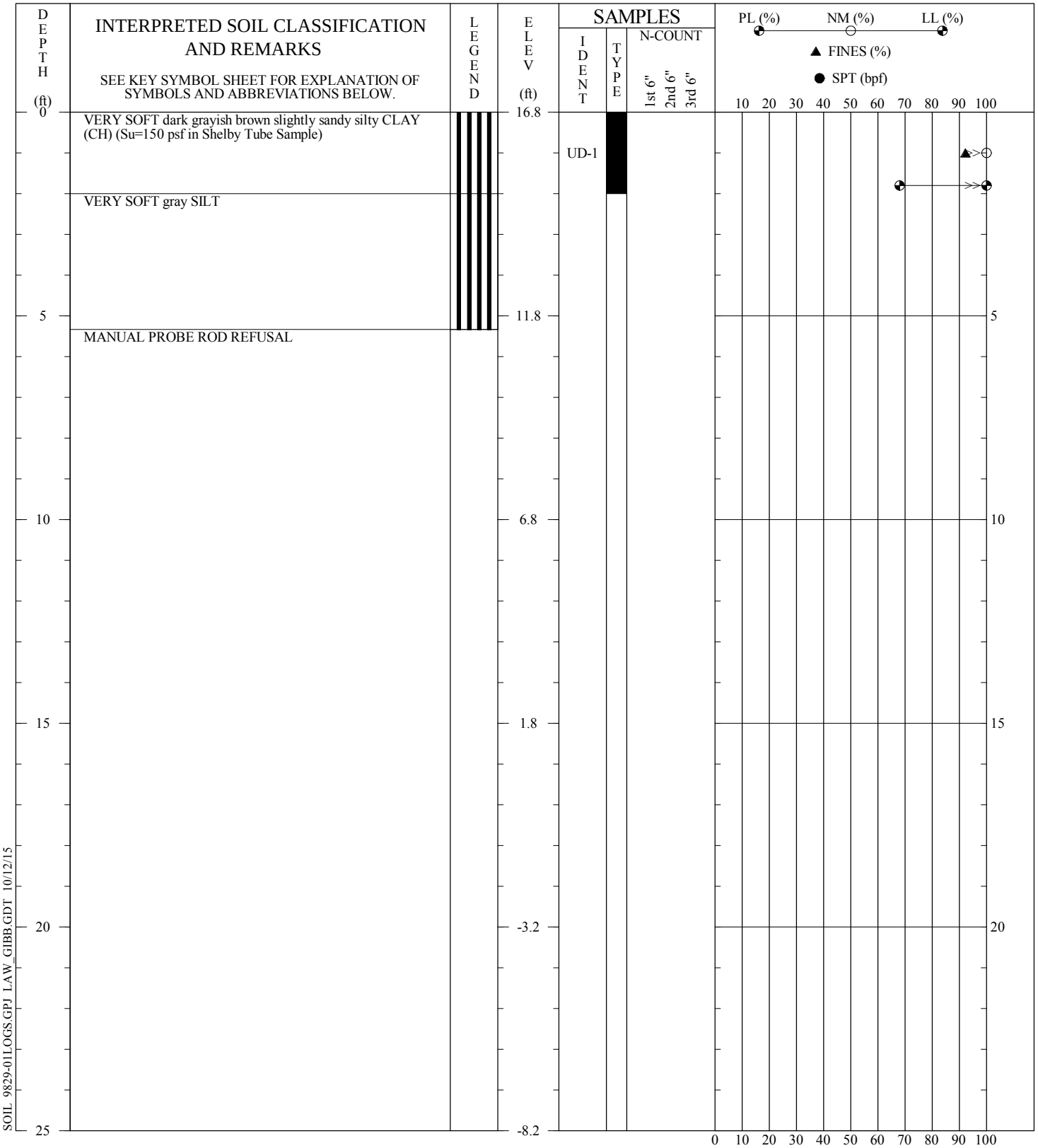
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 25, 2015
Proj. No.: 6734-15-9829

Boring No.: B-30
Checked By: MBW

amec foster wheeler



SOIL 9829-01LOGS.GPJ LAW_GIBB.GDT 10/12/15

CONTRACTOR:
DRILLER: J. Teague
EQUIPMENT: Steel probe rod
METHOD: Manual
HOLE DIA.:
REMARKS: Shelby tube pushed manually into upper 2' of sediment

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: FIND DU-9 DMMA
Coord N:
Coord E:
Drilled: June 29, 2015
Proj. No.: 6734-15-9829

Boring No.: B-31
Checked By: MBW

amec foster wheeler

FIELD PROCEDURES

Standard Penetration Test (SPT) Borings - The SPT borings were performed in general accordance with ASTM D1586, "Penetration Test and Split-Barrel Sampling of Soils." A land-based, track-mounted drill rig with an automatic hammer was used to drill Borings B-1 through B-9, and a track-mounted amphibious drill rig with a manually operated hammer (rope-cathead system) was used to drill the remainder of the SPT borings. The borings were initially advanced by augering. A rotary drilling process was subsequently used and bentonite drilling fluid was circulated in the boreholes to stabilize the sides and flush the cuttings. At regular intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. An internal liner was not utilized in the sampler. The sampler was first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance." The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Representative portions of the soil samples, obtained from the sampler, were placed in plastic jars and transported to our laboratory. The samples were then examined by a geotechnical engineer in order to confirm the field classifications.

Probe Soundings - The probe soundings were performed by manually pushing an approximately 1/2-inch diameter solid steel rod into the soil. The solid probe rod could not be manually pushed into firm soils; therefore, the depth of the overlying soft or very loose soils could be estimated. Our technician who performed the probe soundings used wooden planks to provide access and stable footing on the soft ground.

Thin-Walled (Shelby) Tube Sampling - The relatively undisturbed samples were obtained by pushing a section of 3-inch O.D., 16-gauge steel tubing (Shelby tube) into the soil at the desired sampling level. The sampling procedure is described by ASTM D1587. The tube, together with the encased soil, was carefully removed from the ground, sealed air-tight, and transported to our laboratory. At the locations that were inaccessible to the drill rig, the tube samples were obtained by our technician by manually pushing the tubes into the ground. Wooden planks were used to provide stable footing.

Bulk Soil Samples - At representative locations, bulk samples of potential dike soils were obtained for subsequent laboratory testing. The soil was obtained using a continuous-flight auger attached to the drill rig, which was screwed into the ground to a depth corresponding to the approximate bottom of the dredge spoil basin at each location. The auger was then extracted, and the soils were removed from the auger and placed into bags for transport to our laboratory.

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands, sand - silt mixtures
				SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts and with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

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KEY TO SYMBOLS AND DESCRIPTIONS

Undisturbed Sample (UD)	Auger Cuttings
Split Spoon Sample (SS)	Bulk Sample
Rock Core (RC)	
▽ Water Table at time of drilling	▼ Water Table after 24 hours
WOH - Weight of Hammer	◀100% - Percent Loss of Drilling Fluid
WOR - Weight of Drill Rods	Su - undrained shear strength estimated from pocket penetrometer
SCP - Static Cone Penetrometer Tip Resistance (kg/sq. cm)	qu - unconfined compressive strength estimated from pocket penetrometer

Correlation of Penetration Resistance (N) with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11-30	Medium Dense	5 - 8	Firm
31-50	Dense	9 - 15	Stiff
Over 50	Very Dense	16-32	Very Stiff
		Over 32	Hard

Modifiers

These Modifiers Provide Our Estimate of The Amount of Fines (Silt or Clay Size Particles) in The Soil Sample

APPROX. FINES CONTENT	MODIFIERS	UNIFIED SOIL CLASSIFICATION SYMBOL
5% TO 12%	SLIGHTLY SILTY / SLIGHTLY CLAYEY	SP-SM OR SP-SC
12% TO 30%	SILTY / CLAYEY	SM OR SC
30% TO 50%	VERY SILTY / VERY CLAYEY	SM OR SC

These Modifiers Provide Our Estimate of Shell, Rock Fragments, or Roots in The Soil Sample

APPROXIMATE CONTENT, BY WEIGHT	MODIFIERS
1% to 5%	TRACE
5% to 12%	FEW
12% to 30%	SOME
30% to 50%	MANY

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 30%	ORGANIC
> 30%	PEAT

Photo 1: Southwestern portion of basin, looking northeastward during initial site reconnaissance.

Photo 2: From northeastern portion of basin, looking southwestward during initial site reconnaissance.

Photo 3: Surveyor staking a boring.

Photo 4: Back of rig near Boring B-19

Photo 5: Looking eastward at weirs, near Boring B-19.

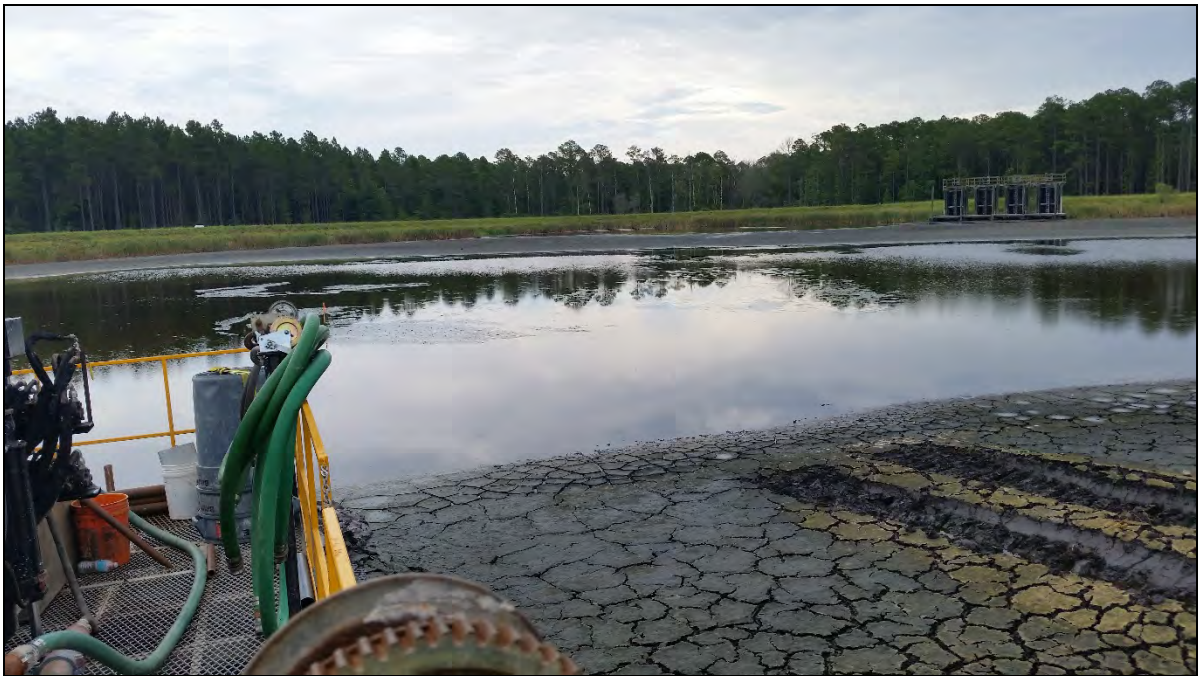


Photo 6: Looking northeastward at weirs, near Boring B-19 (see stake in water).

Photo 7: Looking from back of rig, northeastward toward Boring B-20.

Photo 8: Amphibious drill rig.

Photo 9: Looking northwestward from southeastern corner of basin, near Boring B-31

Photo 10: Looking north from eastern berm, near Boring B-28.

Photo 11: Looking west from northeastern corner of basin.

Photo 12: Looking south from northeastern corner of basin.

Photo 13: Looking southwestward toward B-19 from northern berm.

Photo 14: From northeastern corner of basin looking in at wading birds in shallow pool.

Photo 15: South side of weir structure, showing depth gauge.

Photo 16: South side of weir structure, showing depth gauge.

Photo 17: Looking southward toward Boring B-19 from northern berm (B-13 stake in the foreground).

Photo 18: Thin-walled tube sample from Boring B-11, depth range of 1.5 to 3.5 ft.

Photo 19: Thin-walled tube sample from Boring B-27, depth range of 3.0 to 5.0 ft.

APPENDIX B

TABLE B.1: SUMMARY OF LABORATORY TEST RESULTS

FIND DU-9 Dredged Material Management Area (DMMA) Expansion
St. Johns County, Florida

Boring No.	Sample No.	Depth Range (ft)	Unified Soil Classification System Symbol	Water Content, w_n (%)	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Liquidity Index, LI	Organic Content (%)	Grain Size			Modified Proctor Compaction Tests		Minimum Dry Density, $\gamma_{d(min)}$ (pcf)	UU Triaxial Shear Tests		Hydraulic Conductivity Tests			Direct Shear Tests			
										Gravel	Sand	Fines	Maximum Dry Density, $\gamma_{d(max)}$ (pcf)	Optimum Moisture Content, w_{opt} (%)		Dry Density, γ_d (pcf)	Undrained Shear Strength, s_u (psf)	Compacted Dry Density, γ_d (pcf)	Percent of Modified Proctor Max. Dry Density (%)	Hydraulic Conductivity, k (cm/sec)	Average Compacted Dry Density, γ_d (pcf)	Percent of Modified Proctor Max. Dry Density (%)	Angle of Internal Friction, ϕ (deg)	Undrained Shear Strength, s_u (psf)
										(%)	(%)	(%)												
B - 1	SPT - 1	0.0 1.5	SP-SM							3.0	91.4	5.6												
B - 1	SPT - 7	13.5 15.0	SP-SM							0.0	95.0	5.0												
B - 2	SPT - 4	6.0 7.5	SP							0.1	98.7	1.2												
B - 2	SPT - 8	16.0 17.5	SP							0.0	95.1	4.9												
B - 4	SPT - 6	11.0 12.5	SP							0.0	98.3	1.7												
B - 5	SPT - 5	8.5 10.0	SP							0.0	98.6	1.4												
B - 6	SPT - 2	1.5 3.0	SP							0.0	95.8	4.2												
B - 6	SPT - 6	11.0 12.5	SP-SM							0.0	93.8	6.2												
B - 7	SPT - 5	8.5 10.0	SM	57.1								17.6												
B - 8	SPT - 1	0.0 1.5	SP-SM							0.0	89.1	10.9												
B - 8	SPT - 4	6.0 7.5	SP-SM							0.2	91.7	8.1												
B - 8	SPT - 5	8.5 10.0	SM	61.4								24.9												
B - 10	SPT - 1	0.0 1.5	PT	76.6					46.5			88.1												
B - 10	SPT - 2	1.5 3.0	MH	138.1								74.0												
B - 10	SPT - 7	18.5 20.0	SP							0.0	97.3	2.7												
B - 11	SPT - 1	0.0 1.5	MH	124.9	188	69	119	0.5				89.7												
B - 11	UD - 1	1.5 3.5	MH	179.5								88.9				29.8	115							
B - 11	SPT - 4	13.5 15.0	SP							0.0	96.6	3.4												
B - 12	SPT - 1	0.0 1.5	MH	75.1								97.5												
B - 12	SPT - 3	3.5 5.0	SP							0.0	97.3	2.7												
B - 12	SPT - 5	8.5 10.0	SP-SM							0.0	92.0	8.0												
B - 13	UD - 1	0.0 2.0	CH	208.5	220	60	160	0.9				89.5				24.3	40							
B - 16	SPT - 1	0.0 1.5	SP							0.0	97.3	2.7												
B - 16	SPT - 3	3.5 5.0	PT	71.9	65	32	33	1.2	40.8			29.3												
B - 16	SPT - 4	6.0 7.5	SM							0.0	86.5	13.5												

Reviewed By: _____
Date: 10/21/15

TABLE B.1: SUMMARY OF LABORATORY TEST RESULTS

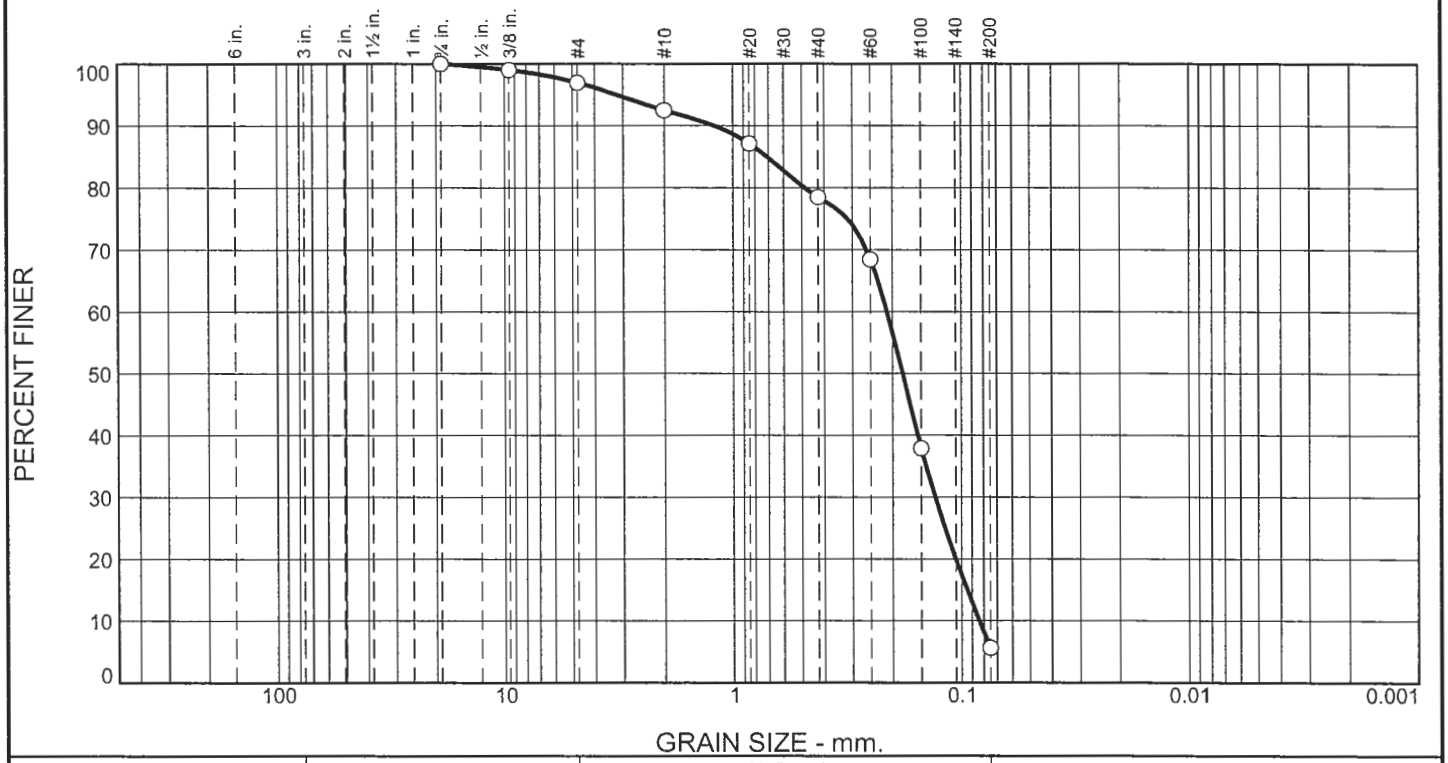
FIND DU-9 Dredged Material Management Area (DMMA) Expansion
St. Johns County, Florida

Boring No.	Sample No.	Depth Range (ft)	Unified Soil Classification System Symbol	Water Content, w_n (%)	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Liquidity Index, LI	Organic Content (%)	Grain Size			Modified Proctor Compaction Tests		Minimum Dry Density, $\gamma_{d(min)}$ (pcf)	UU Triaxial Shear Tests		Hydraulic Conductivity Tests			Direct Shear Tests			
										Gravel (%)	Sand (%)	Fines (%)	Maximum Dry Density, $\gamma_{d(max)}$ (pcf)	Optimum Moisture Content, w_{opt} (%)		Dry Density, γ_d (pcf)	Undrained Shear Strength, s_u (psf)	Compacted Dry Density, γ_d (pcf)	Percent of Modified Proctor Max. Dry Density (%)	Hydraulic Conductivity, k (cm/sec)	Average Compacted Dry Density, γ_d (pcf)	Percent of Modified Proctor Max. Dry Density (%)	Angle of Internal Friction, ϕ (deg)	Undrained Shear Strength, s_u (psf)
B - 17	SPT - 1	0.0 / 1.5	MH	64.6								91.4												
B - 17	SPT - 2	1.5 / 3.0	SM	88.1								40.7												
B - 17	SPT - 6	13.5 / 15.0	SP							0.0	96.0	4.0												
B - 18	SPT - 1	0.0 / 1.5	MH	131.7								88.9												
B - 18	SPT - 2	1.5 / 3.0	MH	195.0								83.4												
B - 18	SPT - 5	8.5 / 10.0	SP							0.0	97.0	3.0												
B - 18	SPT - 7	18.5 / 20.0	SP							0.0	95.6	4.4												
B - 22	SPT - 6	13.5 / 15.0	SP-SM							0.0	94.1	5.9												
B - 23	SPT - 1	0.0 / 1.5	PT	100.6					51.0			79.6												
B - 23	SPT - 2	1.5 / 3.0	OH	120.7					19.7			76.8												
B - 23	SPT - 7	18.5 / 20.0	SP							0.0	95.9	4.1												
B - 24	UD - 1	0.0 / 2.0	CH	210.6	223	66	157	0.9				92.3				24.3	35							
B - 26	SPT- 3	3.5 / 5.0	SM	80.1	40	27	13	4.1	6.9			38.7												
B - 27	SPT - 1	0.0 / 1.5	OH	132.9					24.9			95.6												
B - 27	UD - 1	3.0 / 5.0	OH	261.7								79.0												
B - 27	SPT - 5	13.5 / 15.0	SP							0.0	96.3	3.7												
B - 29	SPT - 4	6.0 / 7.5	SM	53.8								22.3												
B - 29	SPT - 5	8.5 / 10.0	SM	71.7	91	43	48	0.6				33.8												
B - 31	UD- 1	0.0 / 2.0	CH	220.3	249	68	181	0.8				92.2				23.0	60							
Bulk Samples	B - 1	Bulk	0.0 / 14.5	SP						0.7	0.0	95.9	4.1	104.5	13.9	80*			98.3	94.1	$2.0x10^{-3}$	99.7	95.4	34.6	0.0
	B - 3	Bulk	0.0 / 14.0	SP-SM						0.5	0.6	93.5	5.9	104.4	14.4				98.1	94.0	$1.1x10^{-3}$	98.3	94.2	34.6	0.0
	B - 5	Bulk	0.0 / 15.5	SP						0.3	0.0	95.1	4.9	103.9	14.6				97.4	93.7	$6.2x10^{-4}$	98.7	95.0	33.0	0.0
	B - 7	Bulk	0.0 / 13.5	SP-SM						1.6	0.0	93.5	6.5	100.6	16.3				93.9	93.3	$1.5x10^{-3}$	96.2	95.7	33.8	0.0

* Test conducted on a combined bulk sample, consisting of equal volumes from each of the four bulk samples.

Reviewed By: MGW
Date: 10/21/15

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	4.5	14.0	72.9	5.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	99.0		
#4	97.0		
#10	92.5		
#20	87.1		
#40	78.5		
#60	68.4		
#100	37.9		
#200	5.6		

* (no specification provided)

Material Description

Light Brown Slightly Silty Fine SAND with some Shell Fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 1.2102 D_{85}= 0.7103 D_{60}= 0.2120
D_{50}= 0.1810 D_{30}= 0.1305 D_{15}= 0.0947
D_{10}= 0.0837 C_u= 2.53 C_c= 0.96

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-1 **Depth:** 0.0'- 1.5' **Date Sampled:** 6-22-15

Sample Number: SPT-1

AMEC E&I

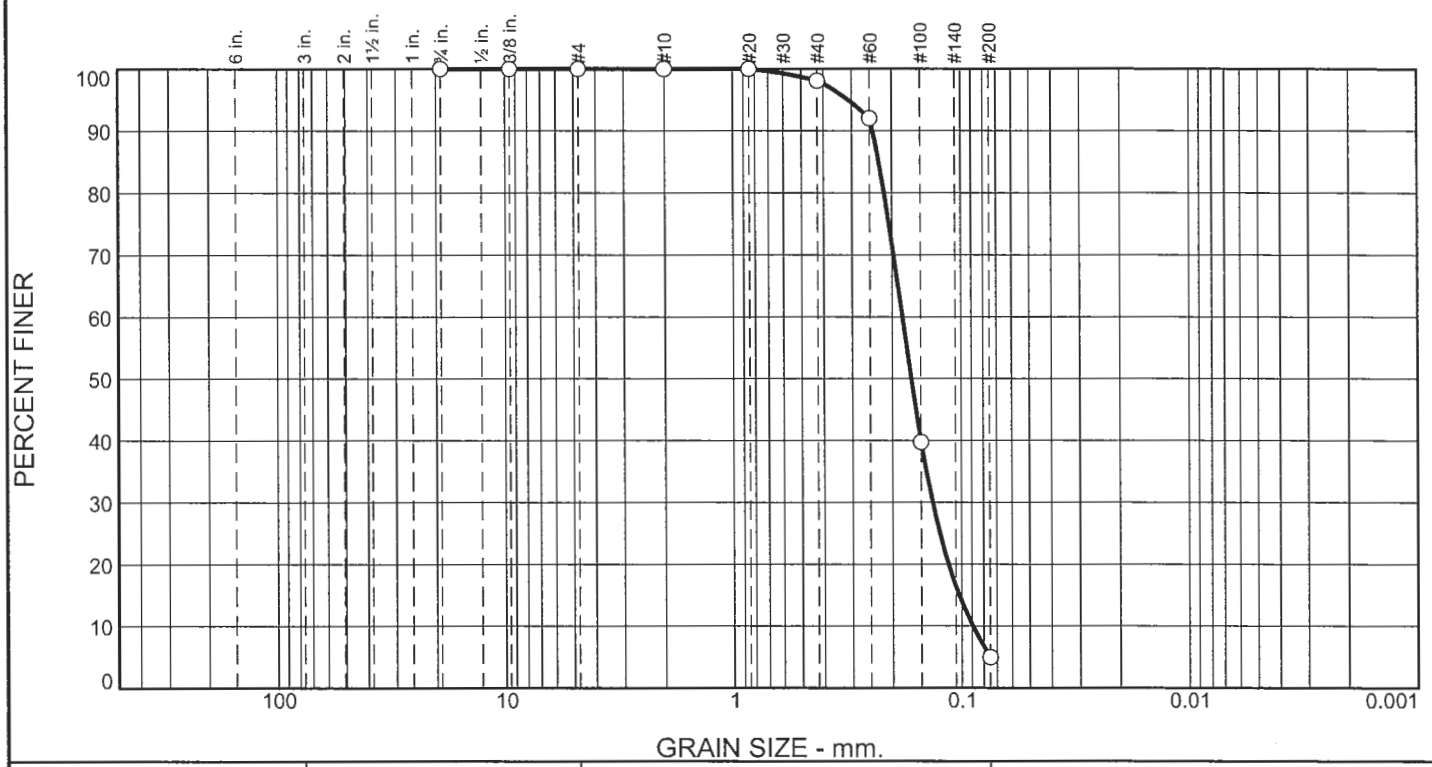
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.9	93.1	5.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	98.1		
#60	92.0		
#100	39.7		
#200	5.0		

* (no specification provided)

Material Description

Dark Brown Organically Stained Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2428 D_{85}= 0.2283 D_{60}= 0.1807
D_{50}= 0.1655 D_{30}= 0.1338 D_{15}= 0.1027
D_{10}= 0.0894 C_u= 2.02 C_c= 1.11

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-1 **Depth:** 13.5'- 15.0' **Date Sampled:** 6-22-15

Sample Number: SPT-7

AMEC E&I

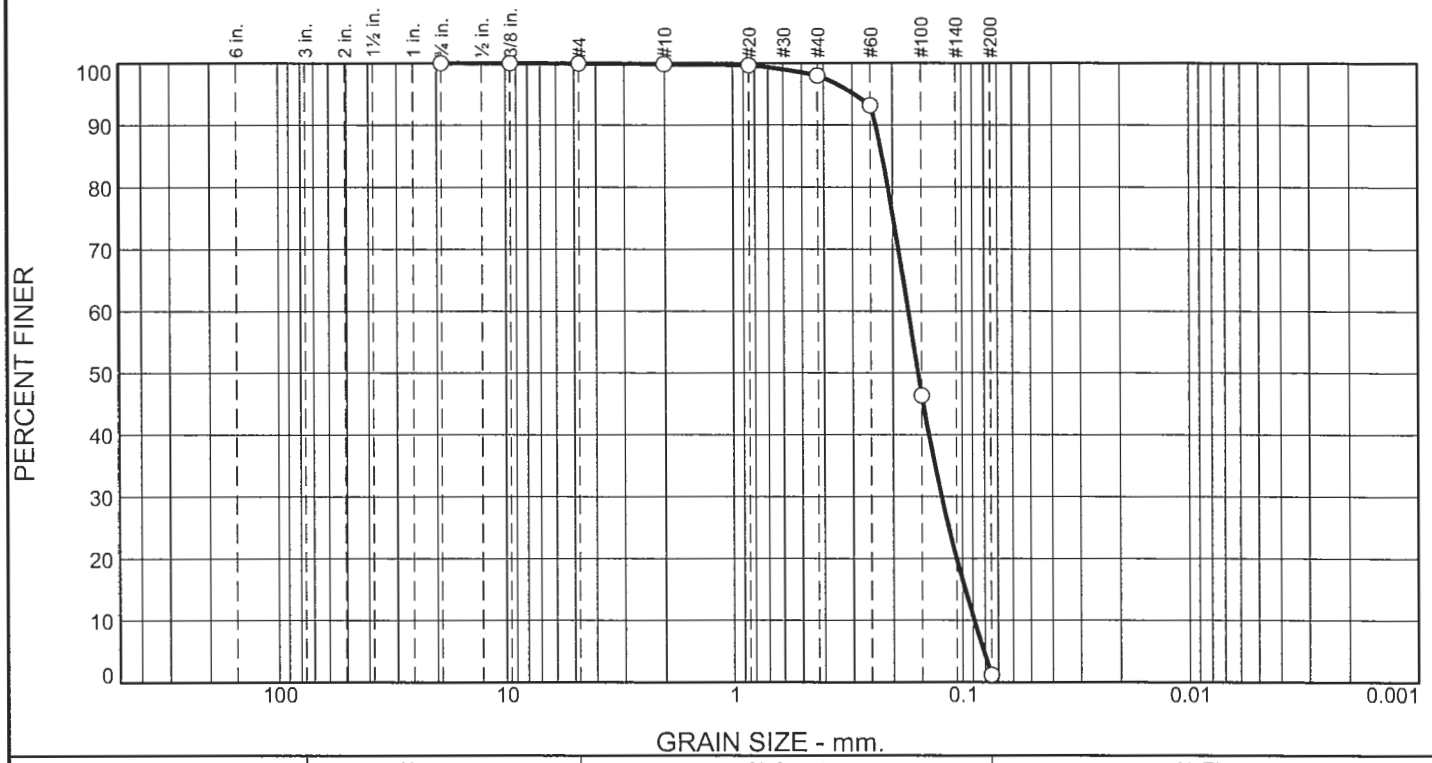
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.1	1.8	96.8	1.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	99.9		
#10	99.8		
#20	99.6		
#40	98.0		
#60	93.2		
#100	46.3		
#200	1.2		

* (no specification provided)

Material Description

Light Brown Fine SAND with a Trace of Small Shell Fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2374 D_{85}= 0.2222 D_{60}= 0.1719
D_{50}= 0.1558 D_{30}= 0.1232 D_{15}= 0.0975
D_{10}= 0.0890 C_u= 1.93 C_c= 0.99

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-2 **Depth:** 6.0'- 7.5' **Date Sampled:** 6-22-15

Sample Number: SPT-4

AMEC E&I

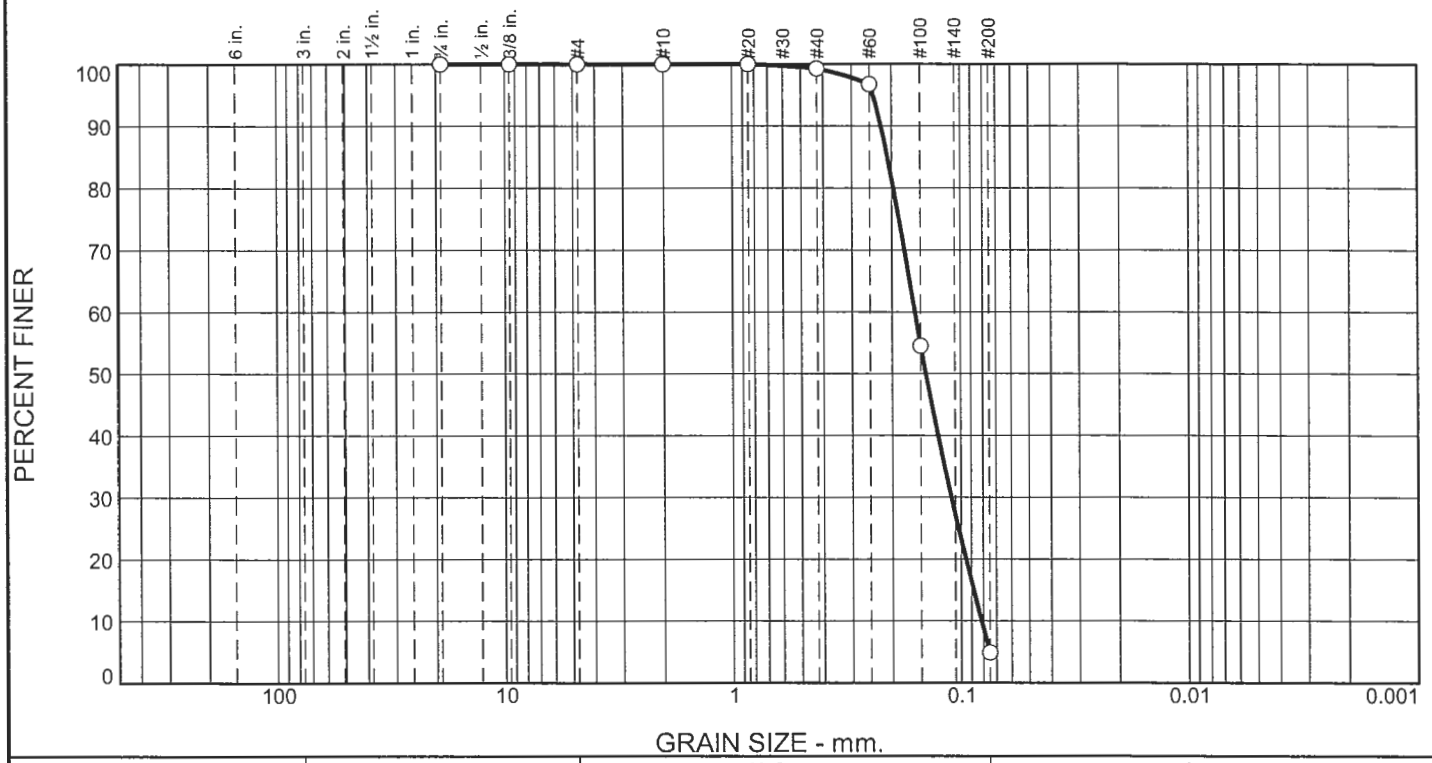
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.7	94.4	4.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.3		
#60	96.7		
#100	54.5		
#200	4.9		

* (no specification provided)

Material Description

Dark Brown Organically Stained Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2231 D_{85}= 0.2089 D_{60}= 0.1591
D_{50}= 0.1425 D_{30}= 0.1103 D_{15}= 0.0881
D_{10}= 0.0814 C_u= 1.96 C_c= 0.94

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-2 **Depth:** 16.0'- 17.5' **Date Sampled:** 6-22-15

Sample Number: SPT-8

AMEC E&I

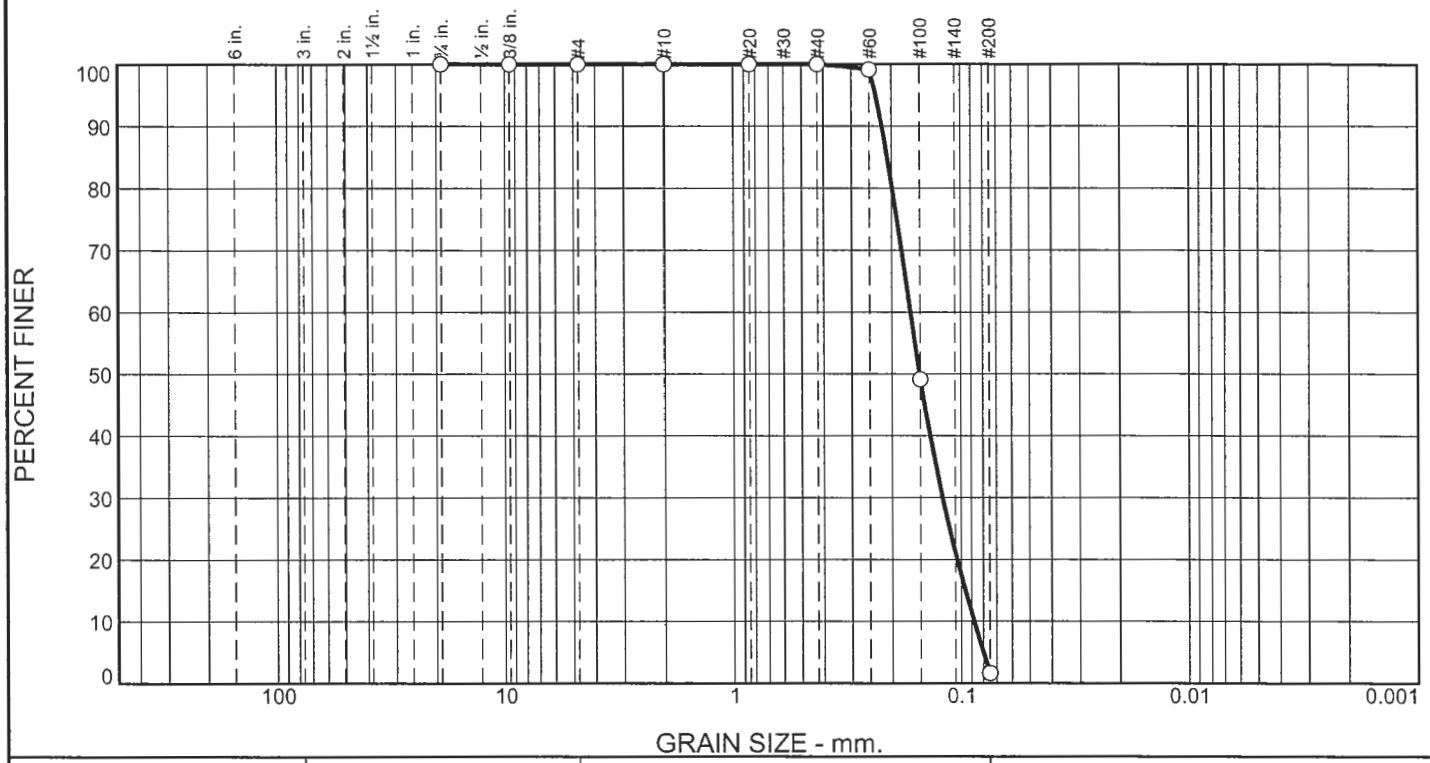
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	98.3	1.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.1		
#100	49.2		
#200	1.7		

* (no specification provided)

Material Description

Light Grayish Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2203 D_{85}= 0.2088 D_{60}= 0.1660
D_{50}= 0.1512 D_{30}= 0.1205 D_{15}= 0.0960
D_{10}= 0.0878 C_u= 1.89 C_c= 1.00

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-4 **Depth:** 11.0'- 12.5' **Date Sampled:** 6-23-15

Sample Number: SPT-6

AMEC E&I

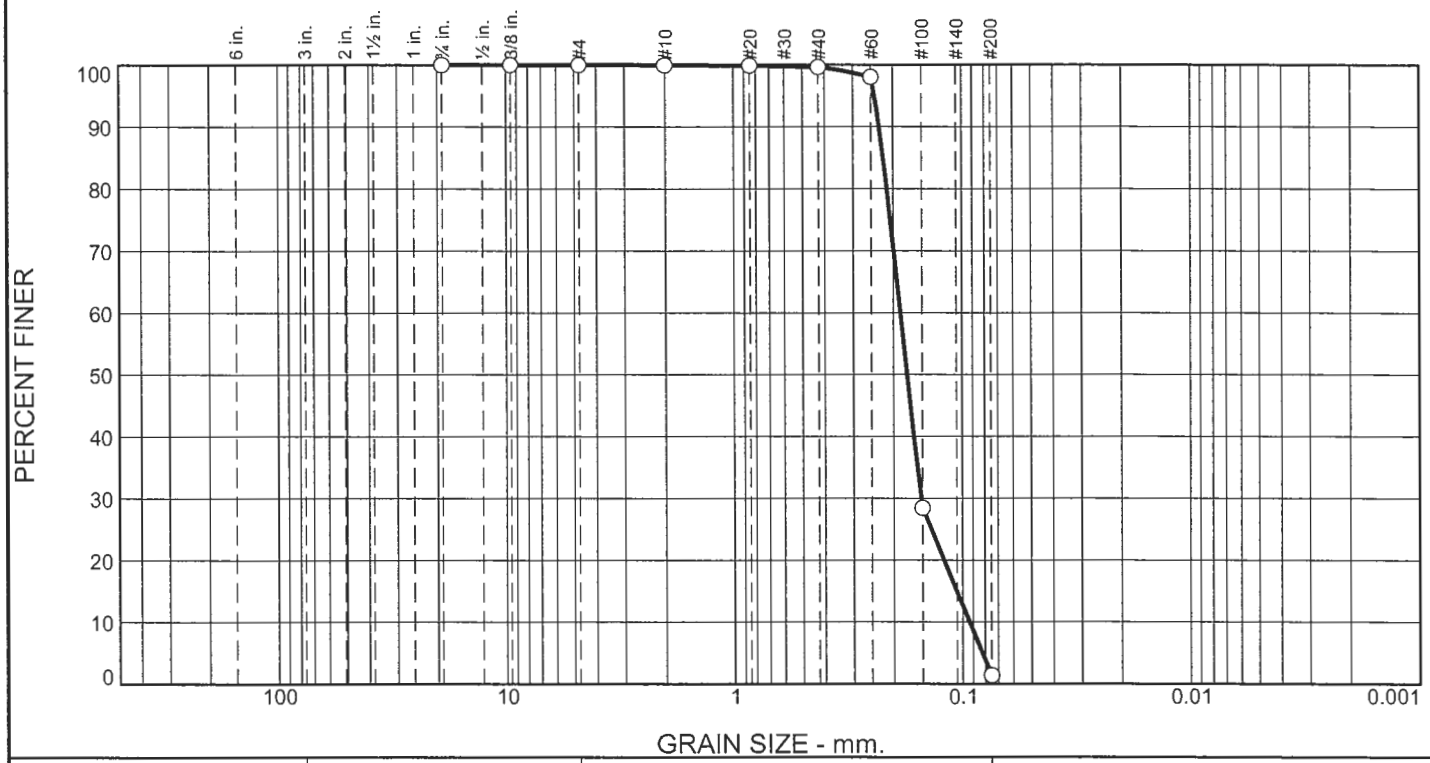
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.3	98.2	1.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.6		
#60	98.0		
#100	28.5		
#200	1.4		

* (no specification provided)

Material Description

Light Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2306 D_{85}= 0.2214 D_{60}= 0.1867
D_{50}= 0.1750 D_{30}= 0.1519 D_{15}= 0.1062
D_{10}= 0.0935 C_u= 2.00 C_c= 1.32

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-5 **Depth:** 8.5'- 10.0' **Date Sampled:** 6-23-15

Sample Number: SPT-5

AMEC E&I

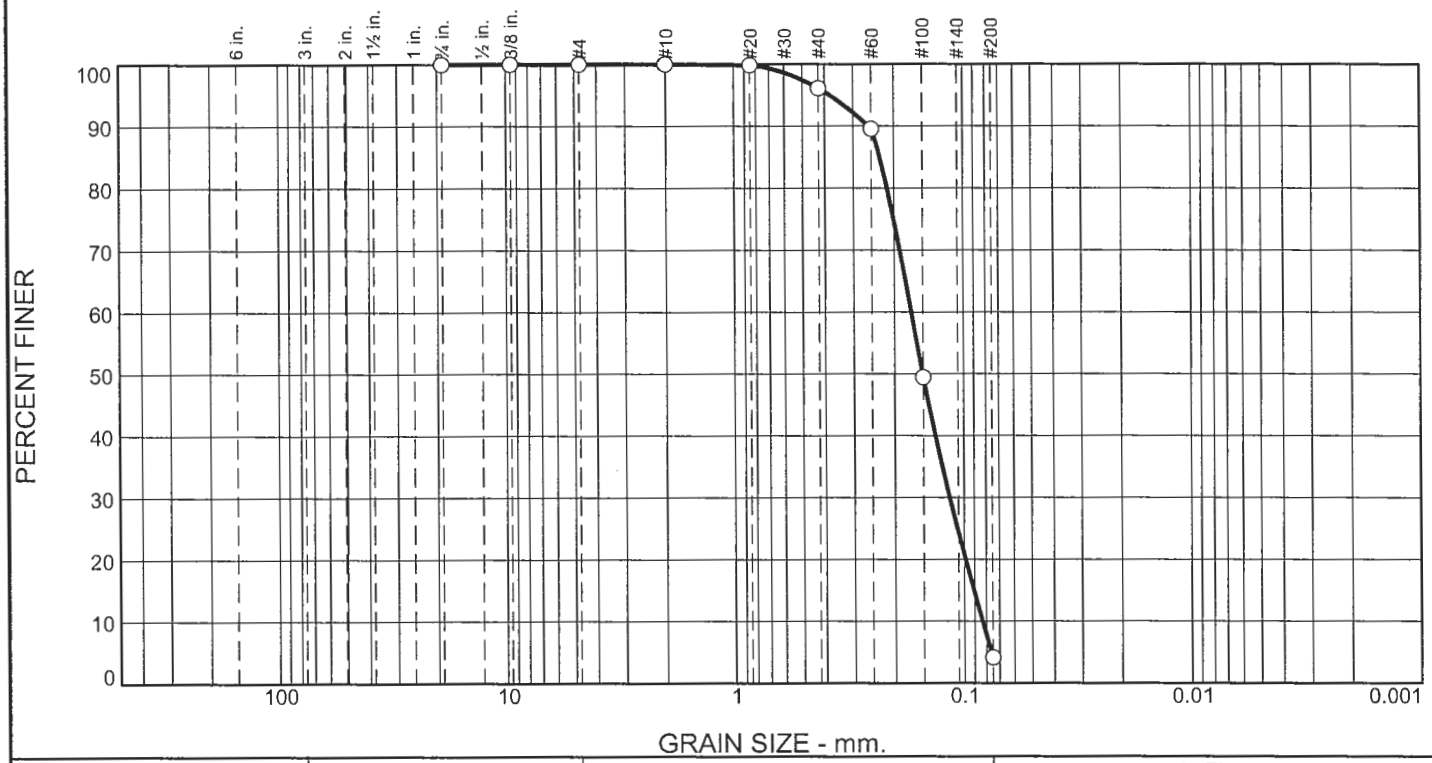
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.9	91.9	4.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	96.1		
#60	89.5		
#100	49.4		
#200	4.2		

* (no specification provided)

Material Description

Light Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2576 D_{85}= 0.2306 D_{60}= 0.1694
D_{50}= 0.1510 D_{30}= 0.1156 D_{15}= 0.0908
D_{10}= 0.0832 C_u= 2.04 C_c= 0.95

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-6 **Depth:** 1.5'- 3.0' **Date Sampled:** 6-23-15

Sample Number: SPT-2

AMEC E&I

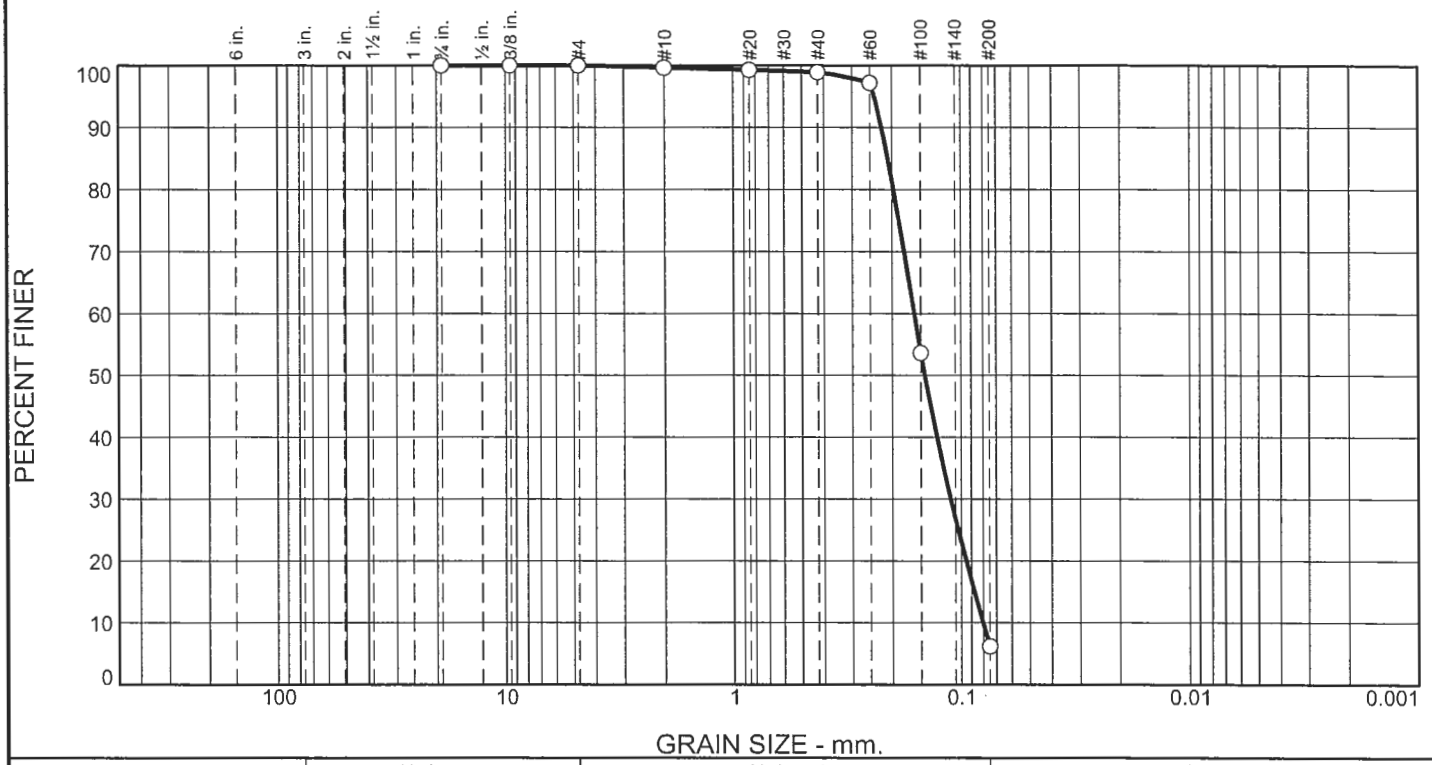
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	0.7	92.7	6.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.6		
#20	99.3		
#40	98.9		
#60	97.2		
#100	53.6		
#200	6.2		

* (no specification provided)

Material Description

Dark Grayish Brown Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2223 D_{85}= 0.2088 D_{60}= 0.1605
D_{50}= 0.1441 D_{30}= 0.1111 D_{15}= 0.0874
D_{10}= 0.0802 C_u= 2.00 C_c= 0.96

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-6 **Depth:** 11.0'- 12.5' **Date Sampled:** 6-23-15

Sample Number: SPT-6

AMEC E&I

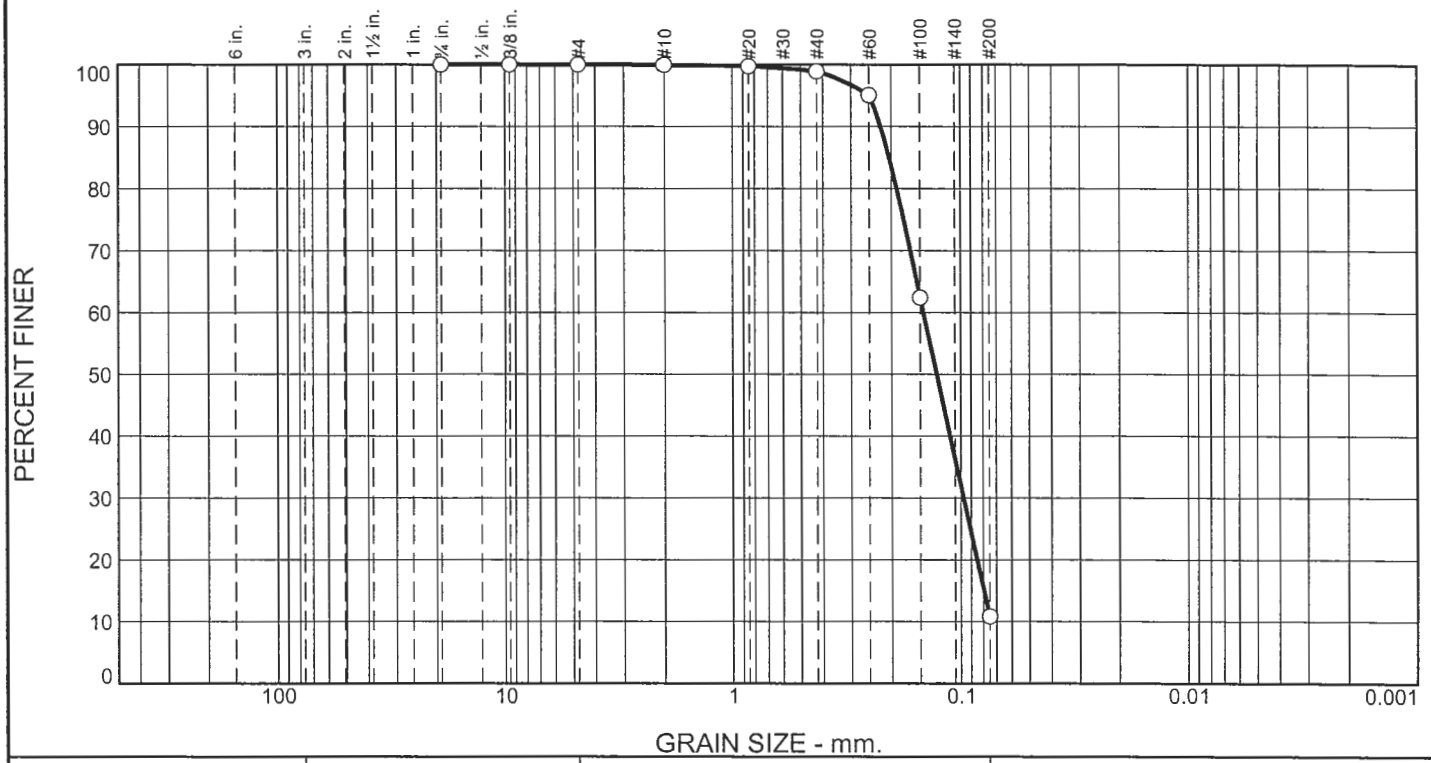
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.0	88.0	10.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.9		
#20	99.7		
#40	98.9		
#60	95.1		
#100	62.4		
#200	10.9		

* (no specification provided)

Material Description

Light Brown Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2230 D_{85}= 0.2046 D_{60}= 0.1453
D_{50}= 0.1274 D_{30}= 0.0974 D_{15}= 0.0794
D_{10}= C_u= C_c=

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-8 **Depth:** 0.0'- 1.5' **Date Sampled:** 6-23-15

Sample Number: SPT-1

AMEC E&I

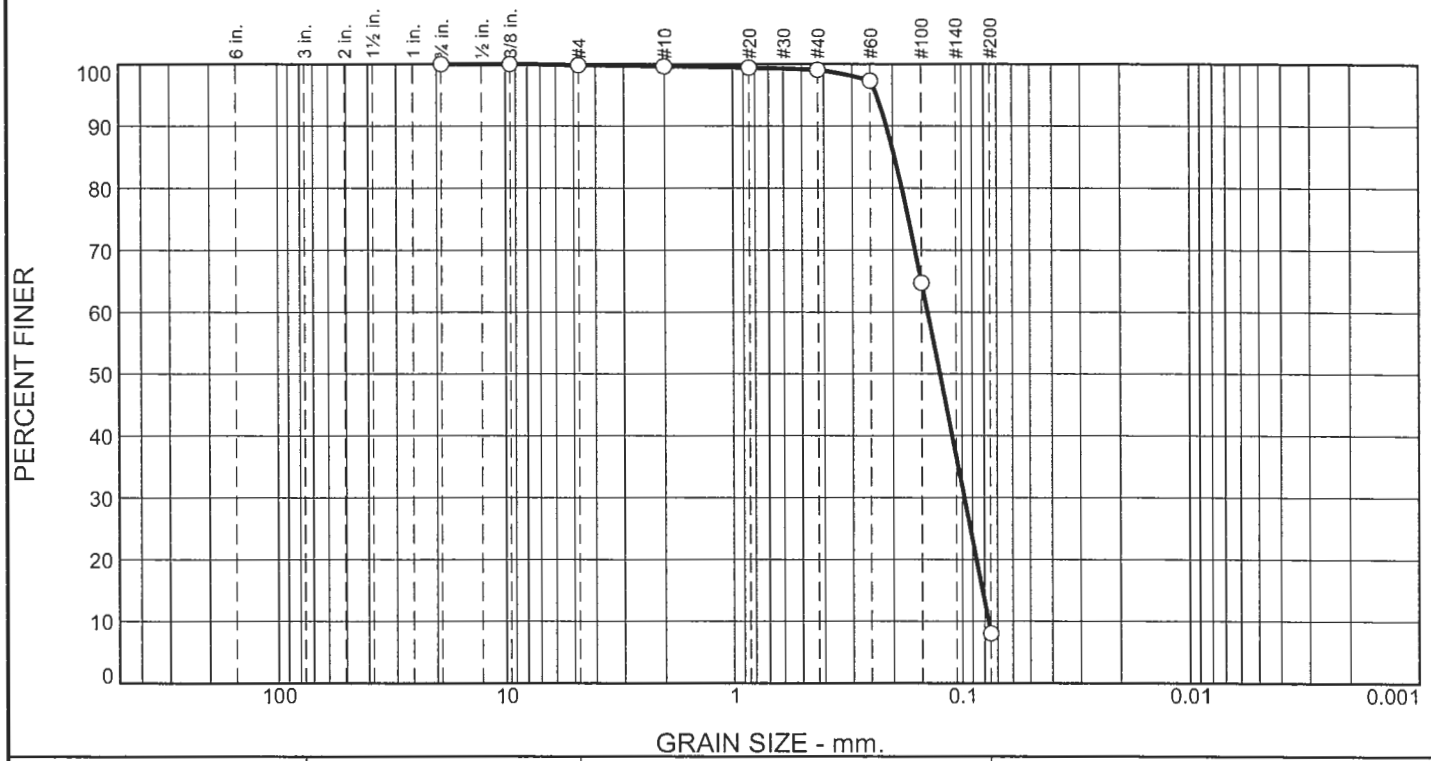
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.2	0.5	91.0	8.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	99.8		
#10	99.6		
#20	99.4		
#40	99.1		
#60	97.3		
#100	64.8		
#200	8.1		

* (no specification provided)

Material Description

Grayish Brown Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2129 D_{85}= 0.1963 D_{60}= 0.1414
D_{50}= 0.1250 D_{30}= 0.0979 D_{15}= 0.0816
D_{10}= 0.0768 C_u= 1.84 C_c= 0.88

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-8 **Depth:** 6.0'- 7.5' **Date Sampled:** 6-23-15

Sample Number: SPT-4

AMEC E&I

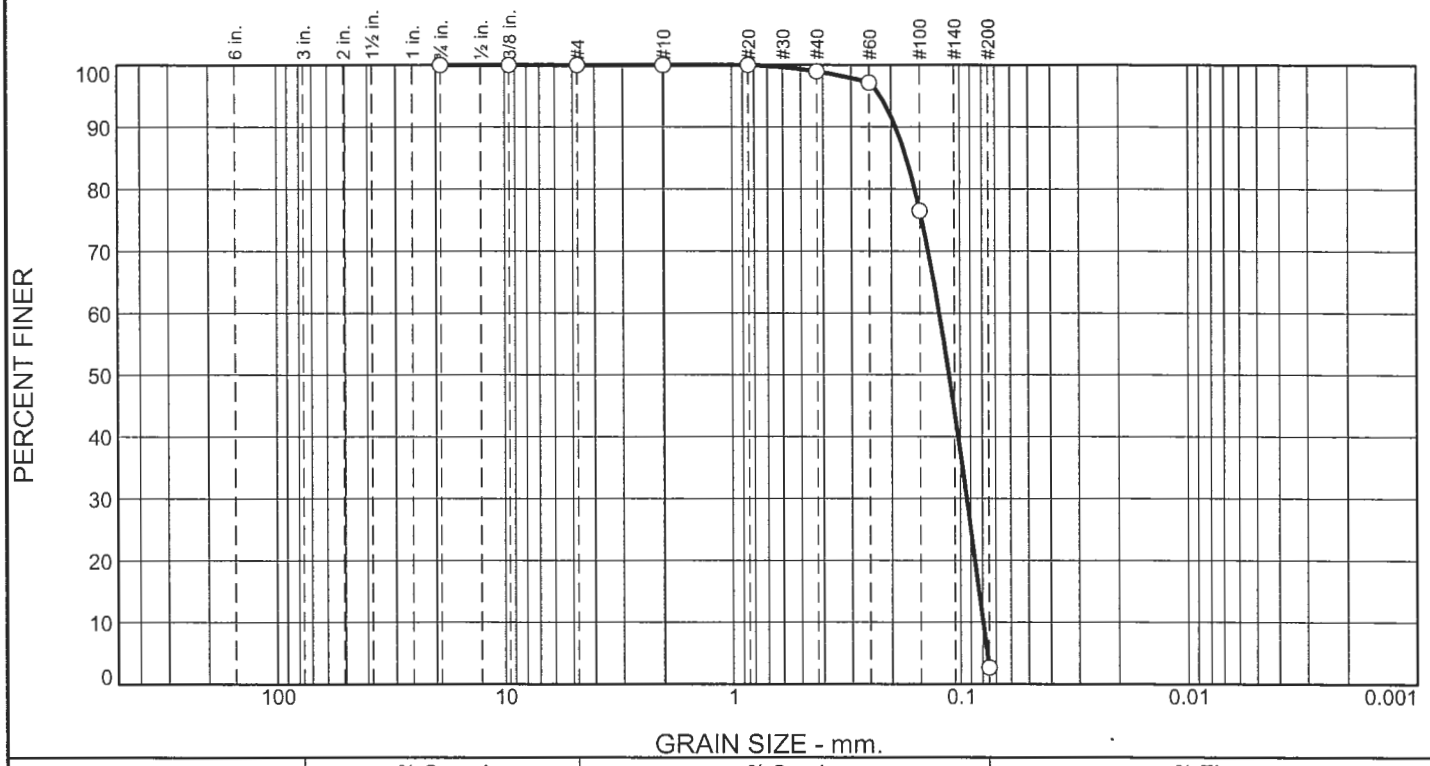
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.1	96.2	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	98.9		
#60	97.2		
#100	76.5		
#200	2.7		

* (no specification provided)

Material Description

Light Orange Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.1914 D_{85}= 0.1719 D_{60}= 0.1236
D_{50}= 0.1120 D_{30}= 0.0938 D_{15}= 0.0829
D_{10}= 0.0796 C_u= 1.55 C_c= 0.90

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-10 **Depth:** 18.5'- 20.0' **Date Sampled:** 6-25-15

Sample Number: SPT-7

AMEC E&I

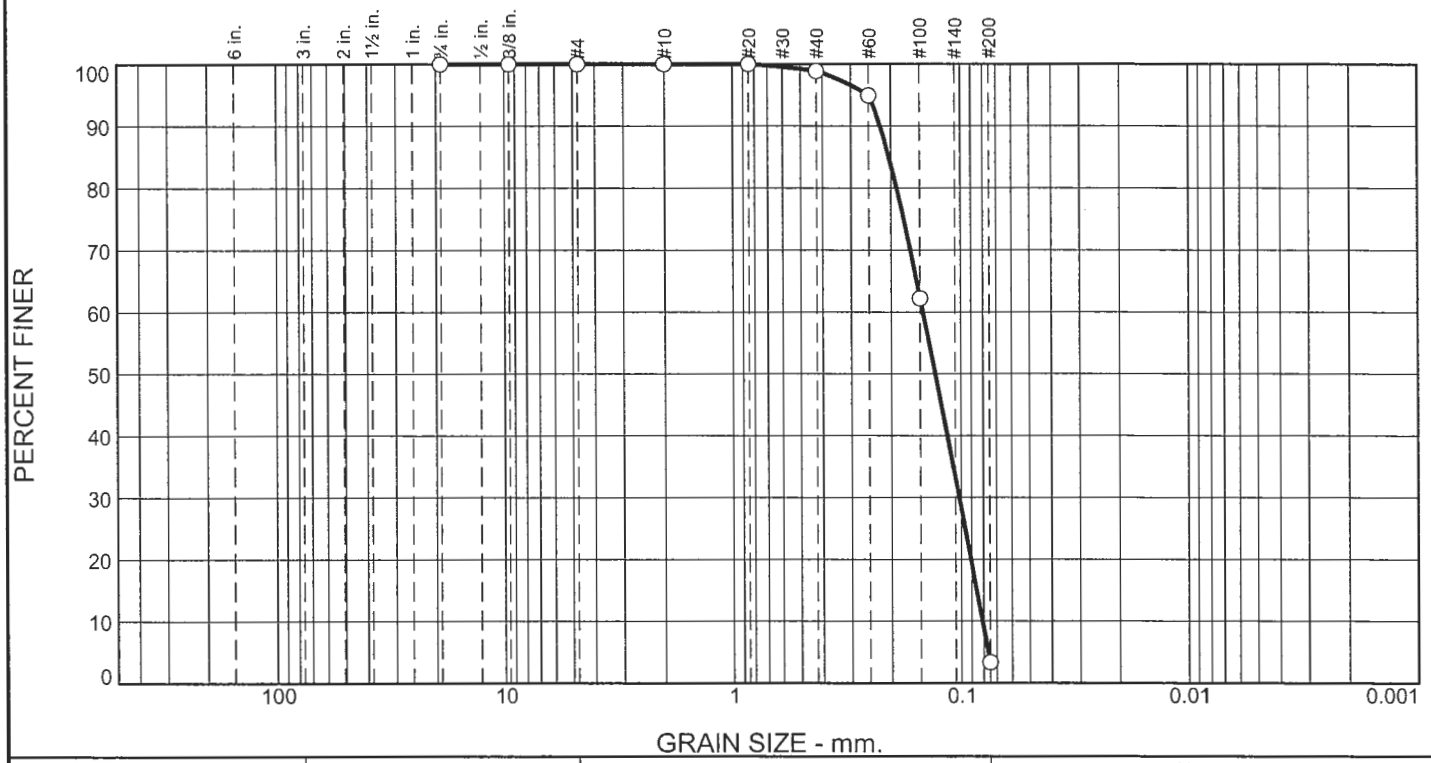
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.2	95.4	3.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	98.8		
#60	94.9		
#100	62.2		
#200	3.4		

* (no specification provided)

Material Description

Dark Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2231 D_{85}= 0.2043 D_{60}= 0.1460
D_{50}= 0.1293 D_{30}= 0.1021 D_{15}= 0.0858
D_{10}= 0.0809 C_u= 1.80 C_c= 0.88

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-11 **Depth:** 13.5'- 15.0' **Date Sampled:** 6-26-15

Sample Number: SPT-4

AMEC E&I

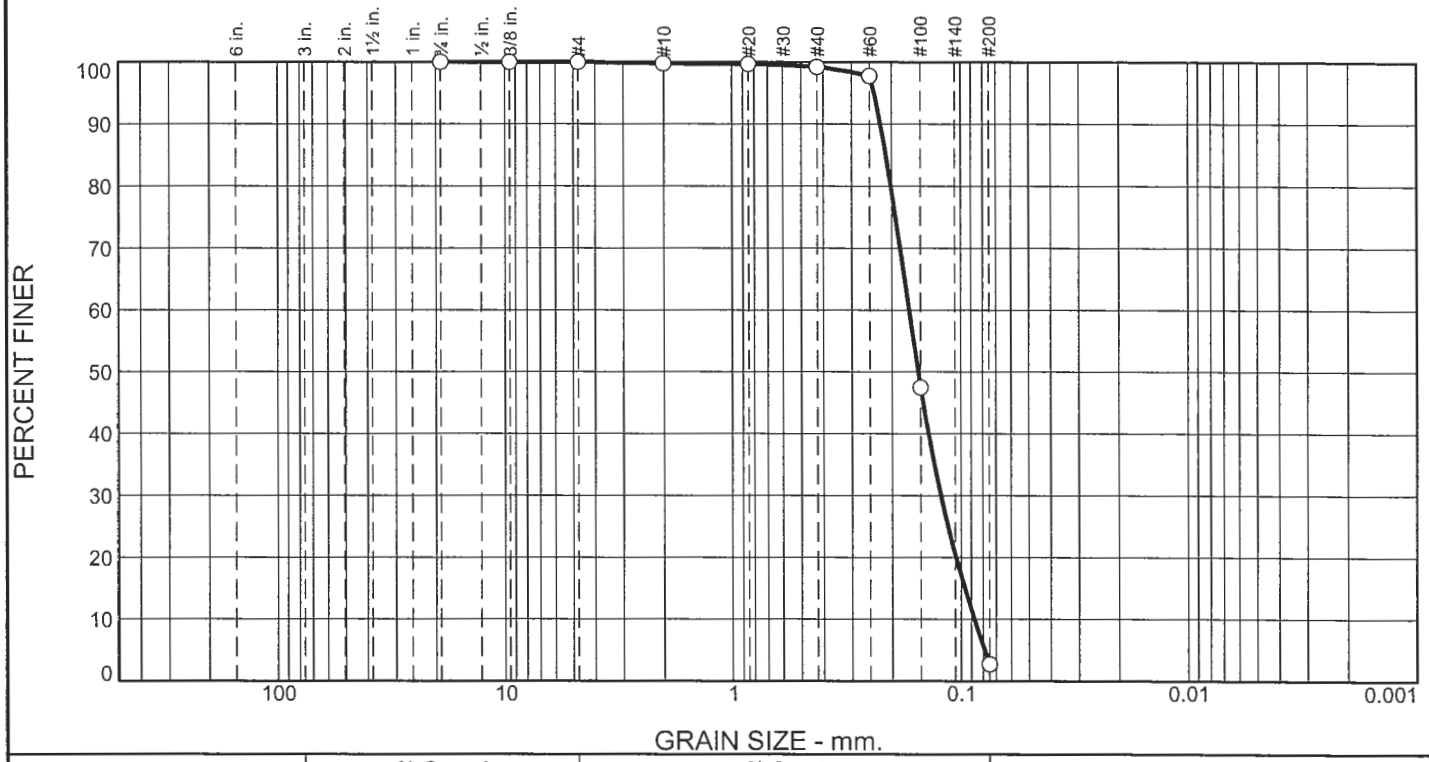
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.6	96.5	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.8		
#20	99.7		
#40	99.2		
#60	97.7		
#100	47.5		
#200	2.7		

* (no specification provided)

Material Description

Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2243 D_{85}= 0.2123 D_{60}= 0.1686
D_{50}= 0.1537 D_{30}= 0.1224 D_{15}= 0.0963
D_{10}= 0.0874 C_u= 1.93 C_c= 1.02

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-12 **Depth:** 3.5'- 5.0' **Date Sampled:** 6-26-15

Sample Number: SPT-3

AMEC E&I

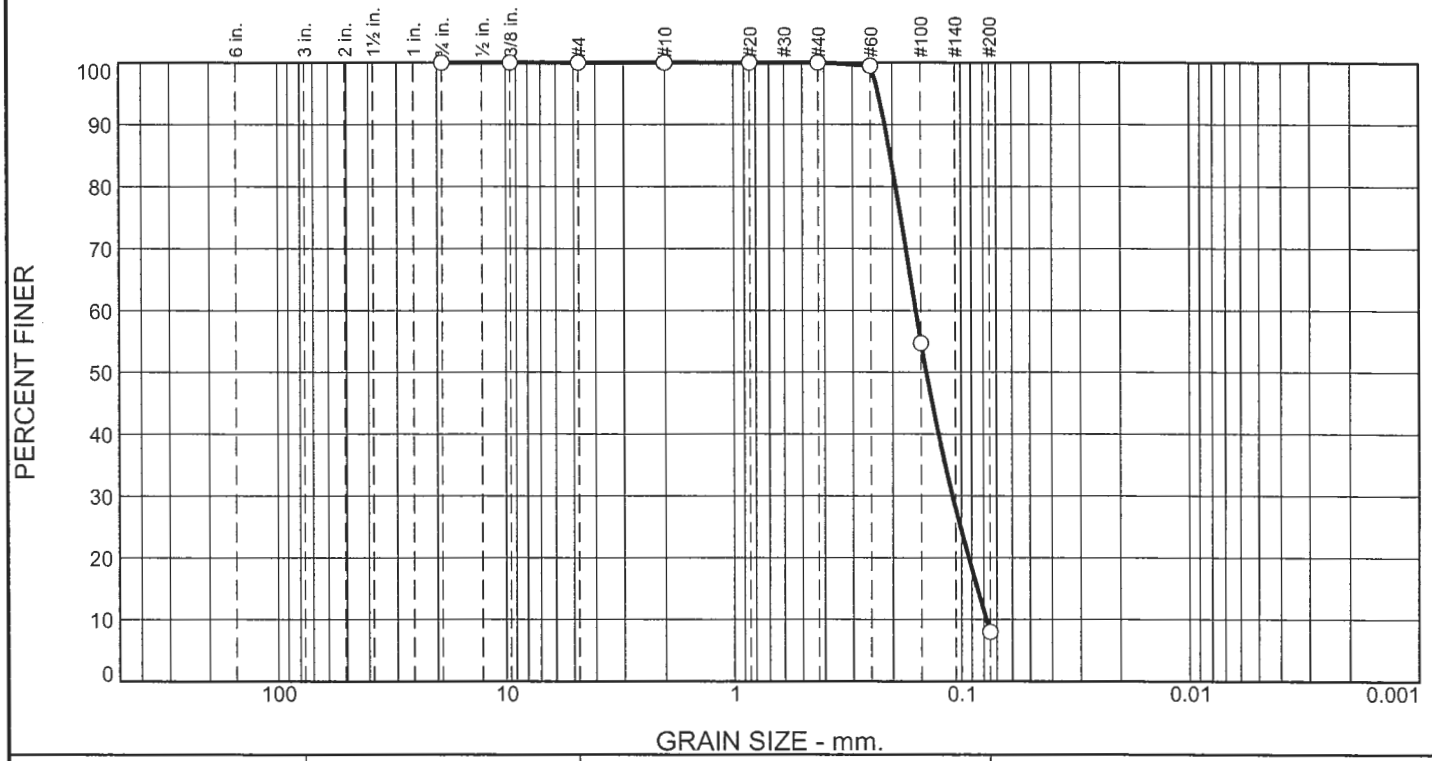
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	92.0	8.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.5		
#100	54.7		
#200	8.0		

* (no specification provided)

Material Description

Dark Brown Organically Stained Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2164 D_{85}= 0.2042 D_{60}= 0.1584
D_{50}= 0.1424 D_{30}= 0.1094 D_{15}= 0.0852
D_{10}= 0.0778 C_u= 2.04 C_c= 0.97

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-12 **Depth:** 8.5'- 10.0' **Date Sampled:** 6-26-15

Sample Number: SPT-5

AMEC E&I

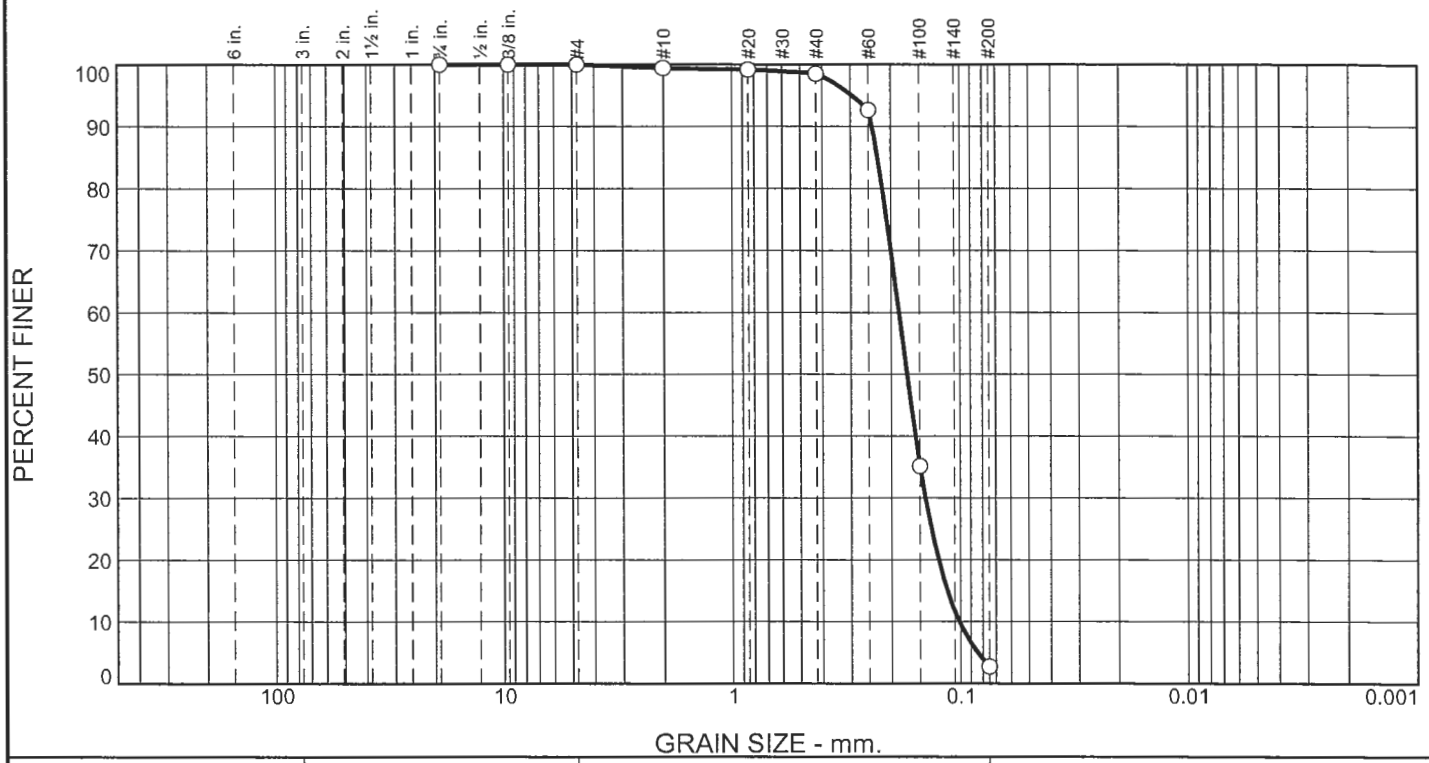
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	0.9	95.8	2.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.4		
#20	99.2		
#40	98.5		
#60	92.6		
#100	35.1		
#200	2.7		

* (no specification provided)

Material Description

Light Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2416 D_{85}= 0.2286 D_{60}= 0.1848
D_{50}= 0.1707 D_{30}= 0.1422 D_{15}= 0.1143
D_{10}= 0.1014 C_u= 1.82 C_c= 1.08

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical MBW

Source of Sample: B-16 **Depth:** 0.0'- 1.5' **Date Sampled:** 6-24-15

Sample Number: SPT-1

AMEC E&I

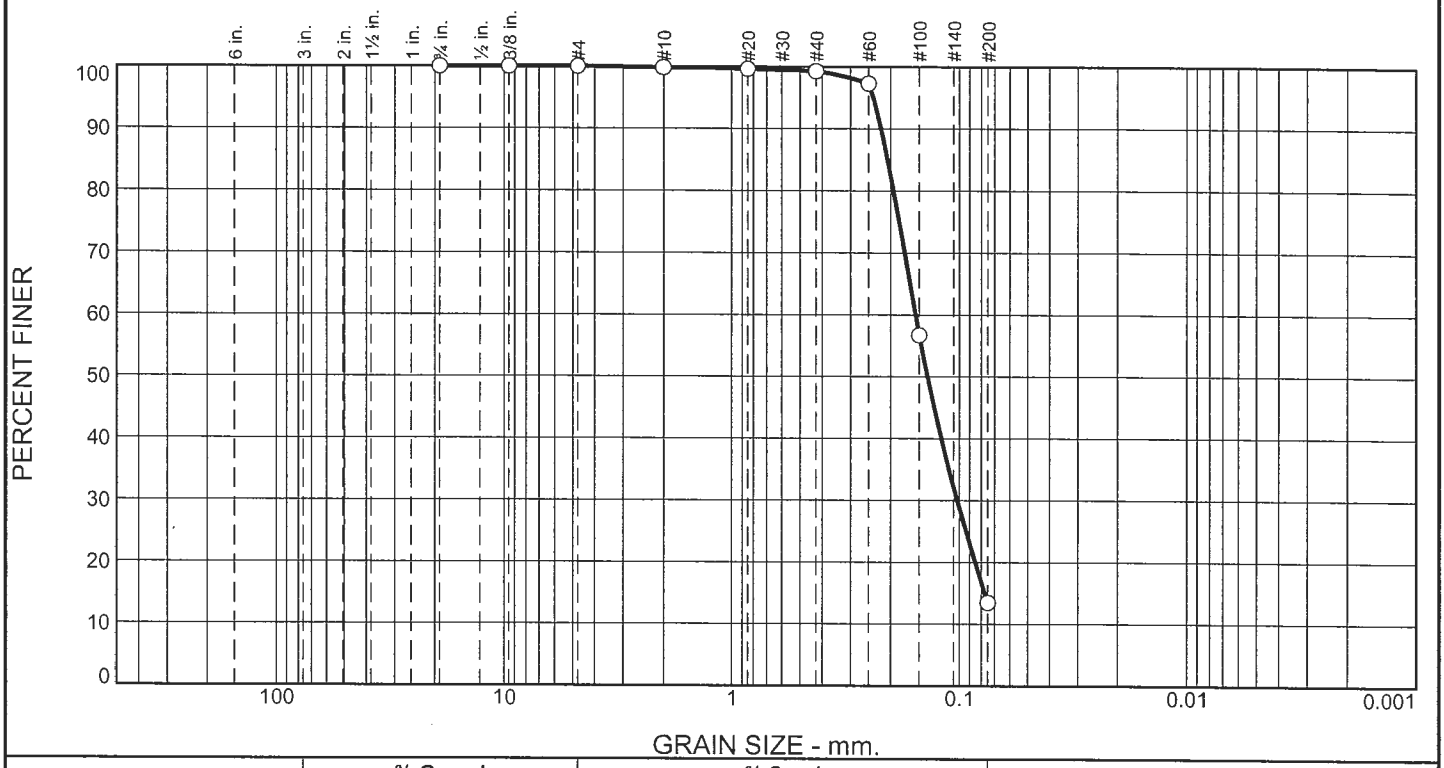
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.5	85.8	13.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.8		
#20	99.6		
#40	99.3		
#60	97.3		
#100	56.7		
#200	13.5		

* (no specification provided)

Material Description

Dark Gray Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.2206 D_{85}= 0.2065 D_{60}= 0.1558
D_{50}= 0.1380 D_{30}= 0.1022 D_{15}= 0.0773
D_{10}= C_u= C_c=

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-16 **Depth:** 6.0'- 7.5' **Date Sampled:** 6-24-15

Sample Number: SPT-4

AMEC E&I

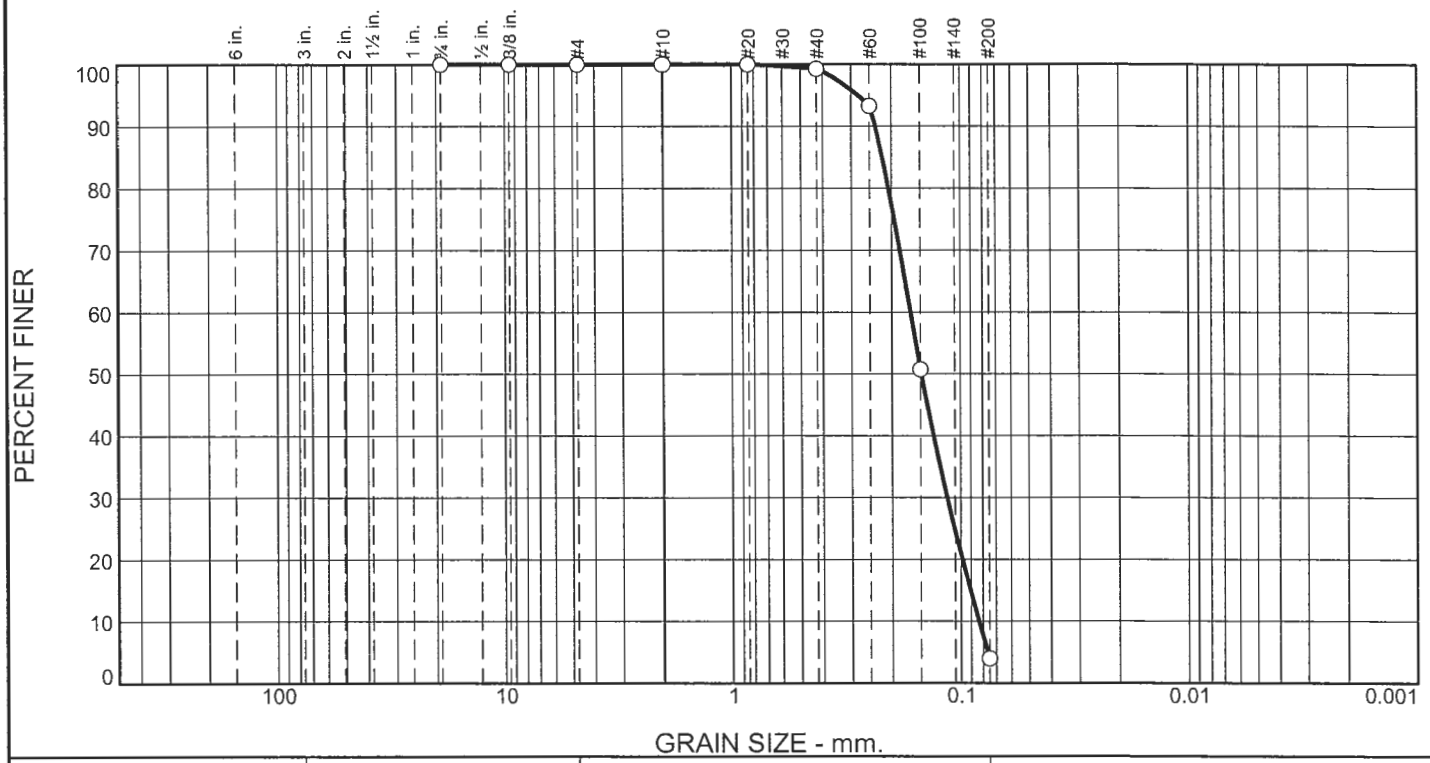
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.7	95.3	4.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.3		
#60	93.3		
#100	50.7		
#200	4.0		

* (no specification provided)

Material Description

Dark Orange Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2361 D_{85}= 0.2197 D_{60}= 0.1660
D_{50}= 0.1488 D_{30}= 0.1149 D_{15}= 0.0907
D_{10}= 0.0833 C_u= 1.99 C_c= 0.95

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-17 **Depth:** 13.5'- 15.0' **Date Sampled:** 6-24-15

Sample Number: SPT-6

AMEC E&I

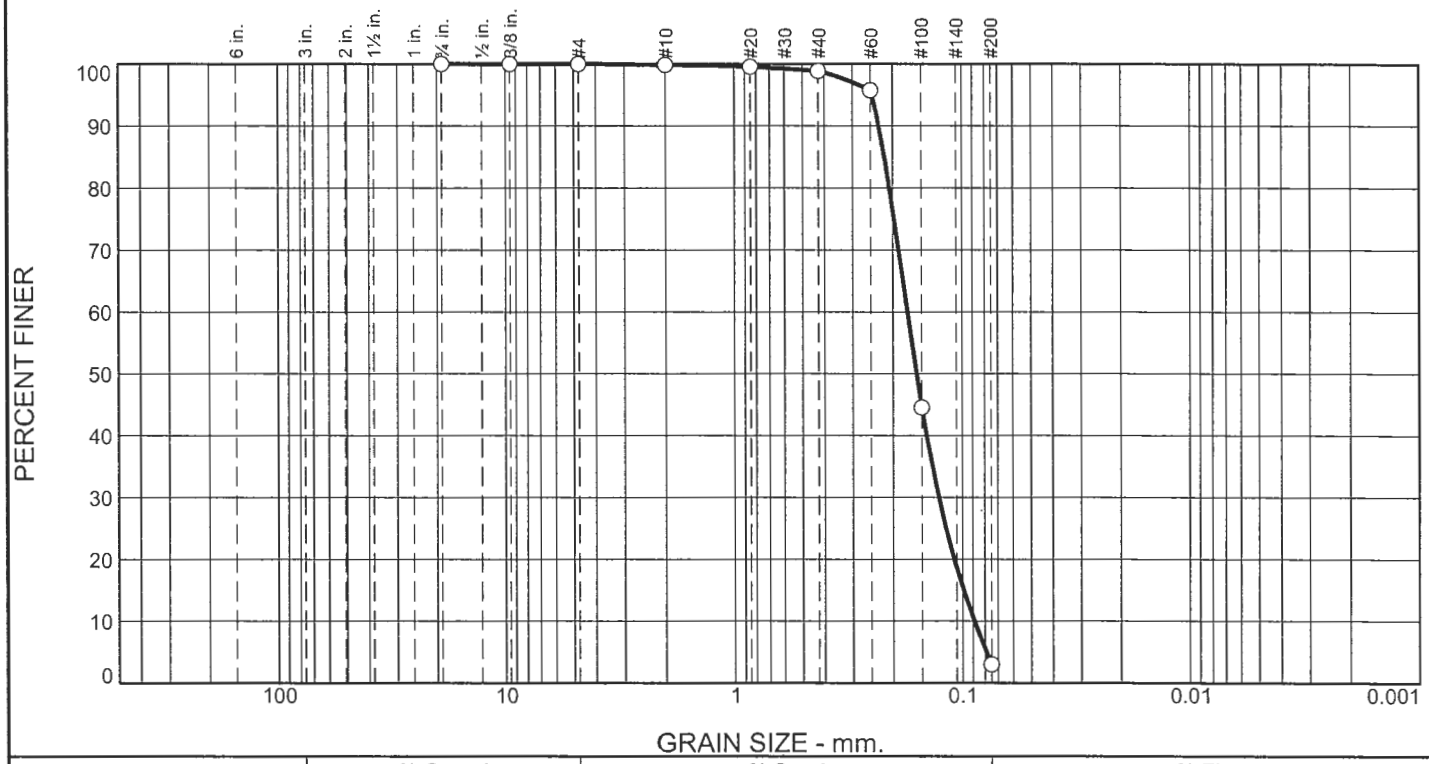
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	1.0	95.8	3.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.8		
#20	99.5		
#40	98.8		
#60	95.7		
#100	44.6		
#200	3.0		

* (no specification provided)

Material Description

Light Gray-Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2305 D_{85}= 0.2179 D_{60}= 0.1730
D_{50}= 0.1581 D_{30}= 0.1266 D_{15}= 0.0989
D_{10}= 0.0888 C_u= 1.95 C_c= 1.04

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-18 **Depth:** 8.5'- 10.0' **Date Sampled:** 6-26-15

Sample Number: SPT-5

AMEC E&I

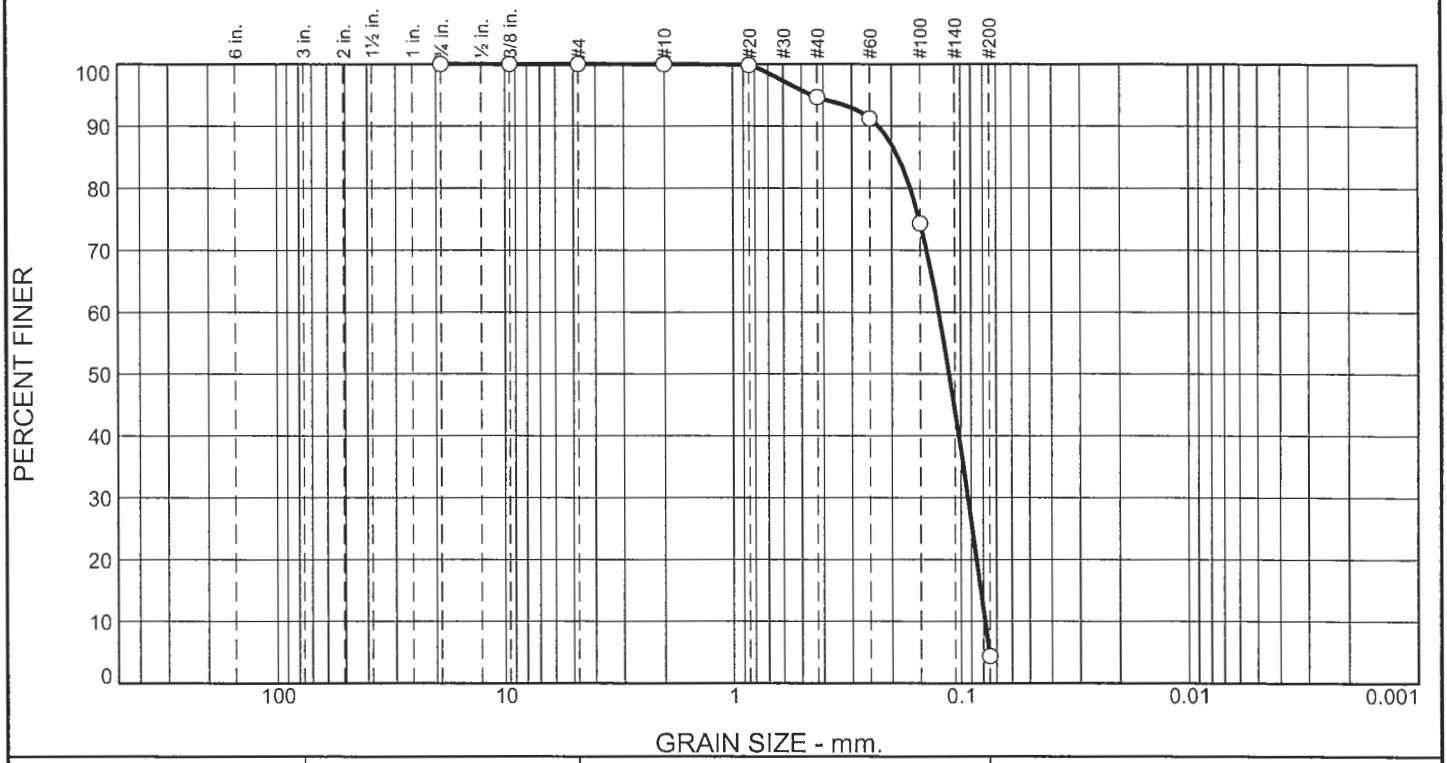
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	5.3	90.3	4.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	94.7		
#60	91.3		
#100	74.3		
#200	4.4		

* (no specification provided)

Material Description

Light Orange-Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2290 D_{85}= 0.1873 D_{60}= 0.1247
D_{50}= 0.1123 D_{30}= 0.0933 D_{15}= 0.0820
D_{10}= 0.0786 C_u= 1.59 C_c= 0.89

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-18 **Depth:** 18.5'- 20.0' **Date Sampled:** 6-26-15

Sample Number: SPT-7

AMEC E&I

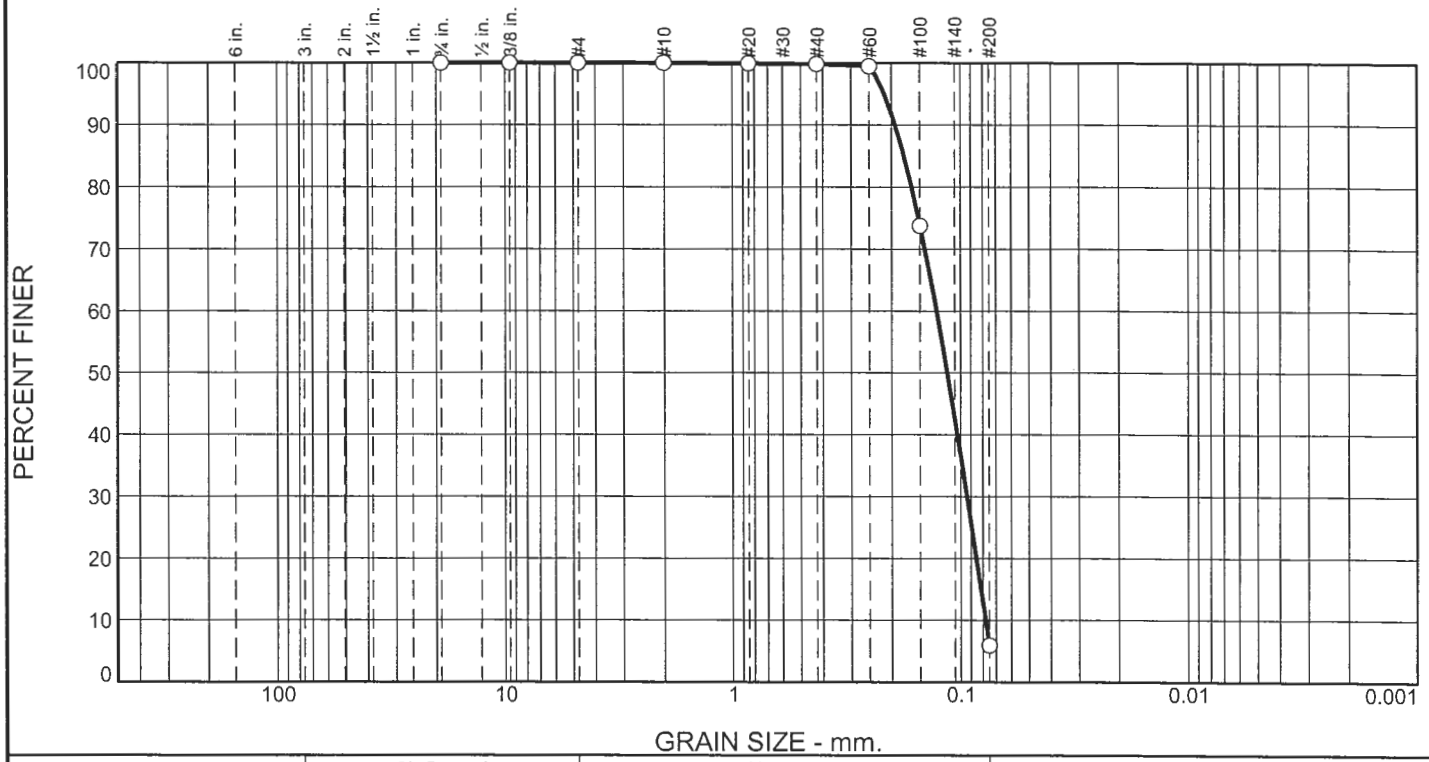
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	93.9	5.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.8		
#60	99.5		
#100	73.7		
#200	5.9		

* (no specification provided)

Material Description

Dark Brown Organically Stained Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 0.1930 D_{85}= 0.1766 D_{60}= 0.1273
D_{50}= 0.1144 D_{30}= 0.0939 D_{15}= 0.0815
D_{10}= 0.0779 C_u= 1.63 C_c= 0.89

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-22 **Depth:** 13.5'- 15.0' **Date Sampled:** 6-24-15

Sample Number: SPT-6

AMEC E&I

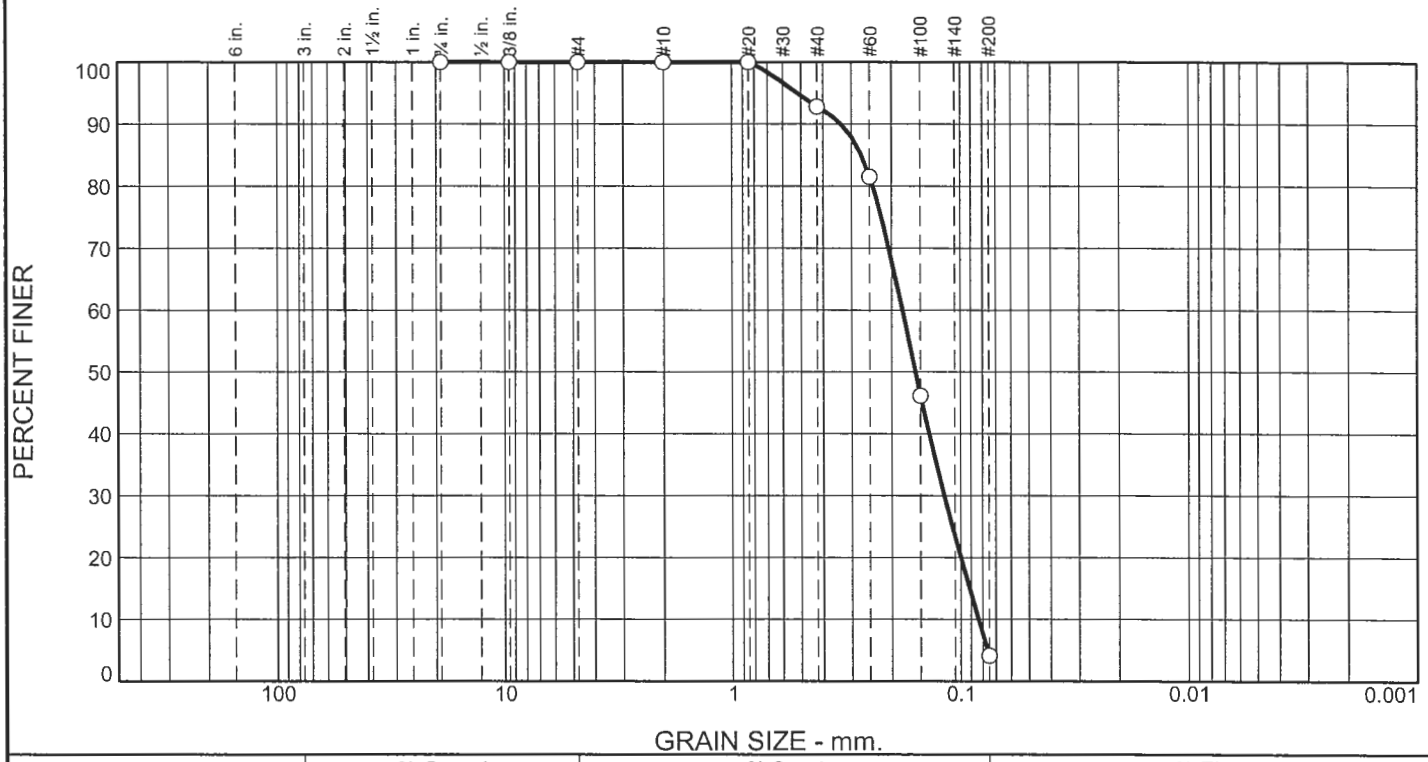
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	7.2	88.7	4.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	92.8		
#60	81.5		
#100	46.2		
#200	4.1		

* (no specification provided)

Material Description

Orange-Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.3335 D_{85}= 0.2723 D_{60}= 0.1801
D_{50}= 0.1580 D_{30}= 0.1180 D_{15}= 0.0914
D_{10}= 0.0835 C_u= 2.16 C_c= 0.93

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical MBW

Source of Sample: B-23 **Depth:** 18.5'- 20.0' **Date Sampled:** 6-26-15

Sample Number: SPT-7

AMEC E&I

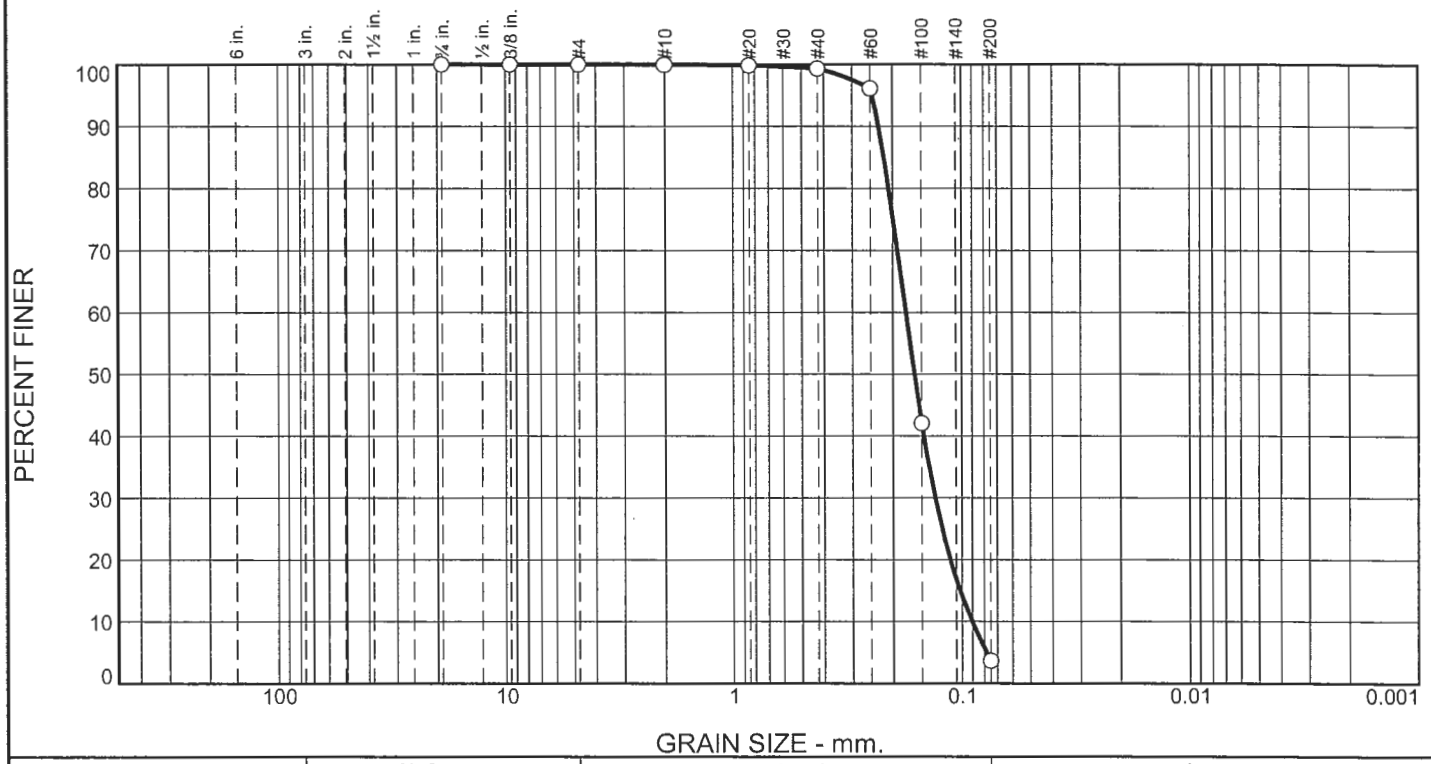
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.6	95.6	3.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.9		
#20	99.8		
#40	99.3		
#60	96.1		
#100	42.1		
#200	3.7		

* (no specification provided)

Material Description

Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 0.2307 D_{85}= 0.2187 D_{60}= 0.1758
D_{50}= 0.1614 D_{30}= 0.1310 D_{15}= 0.1020
D_{10}= 0.0903 C_u= 1.95 C_c= 1.08

Remarks

Date Received: 7-10-15 **Date Tested:** 7-15-15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-27 **Depth:** 13.5'- 15.0' **Date Sampled:** 6-26-15

Sample Number: SPT-5

AMEC E&I

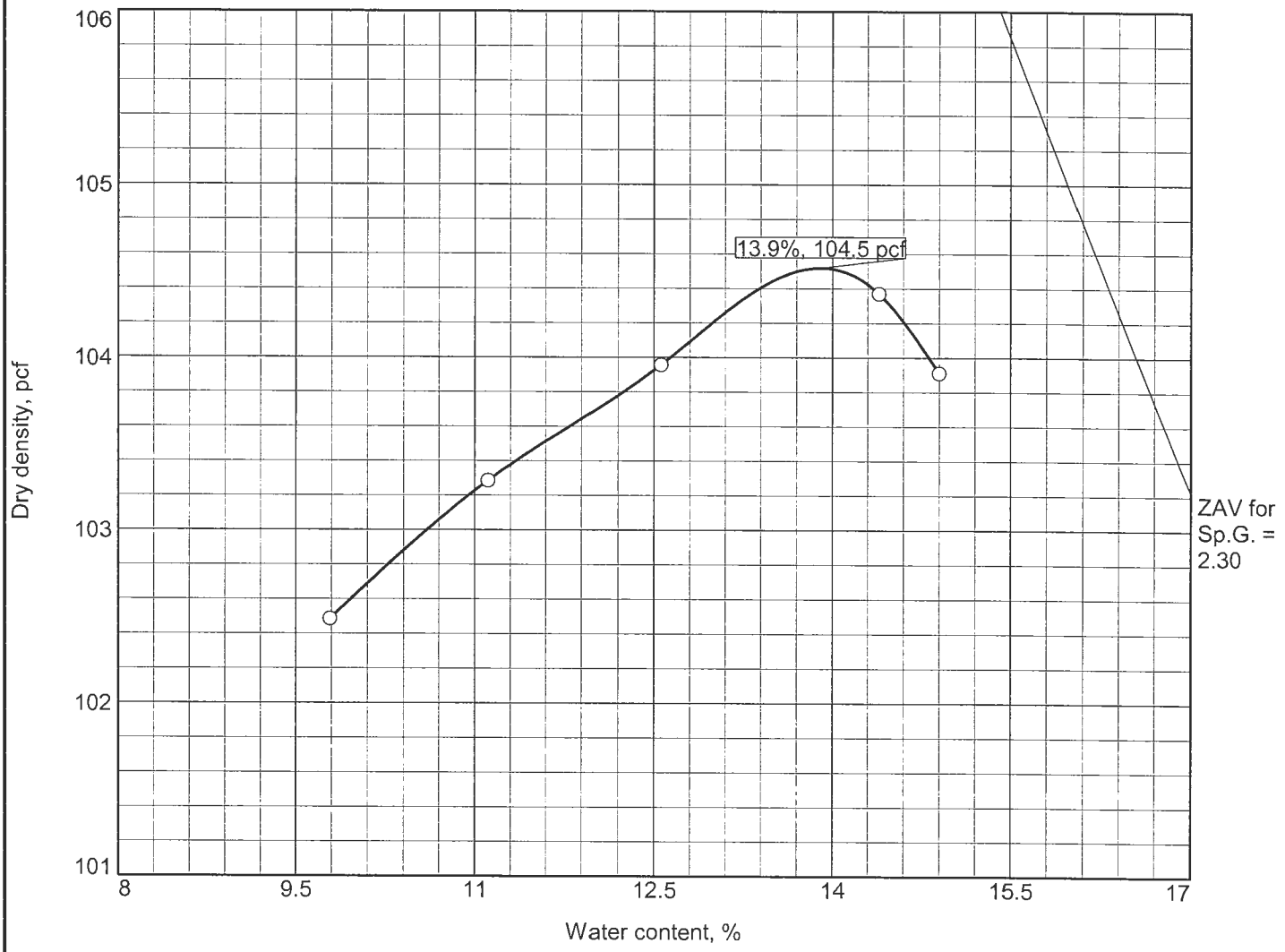
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0'-14.5'	SP	A-3					0.0	4.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 104.5 pcf Optimum moisture = 13.9 %	Dark Brown Fine SAND with a Trace of Silt

Project No. 6734159829 **Client:** Taylor Engineering, Inc.
Project: FIND DU-9 DMMA

○ **Source of Sample:** B-1 **Sample Number:** BULK

AMEC E&I

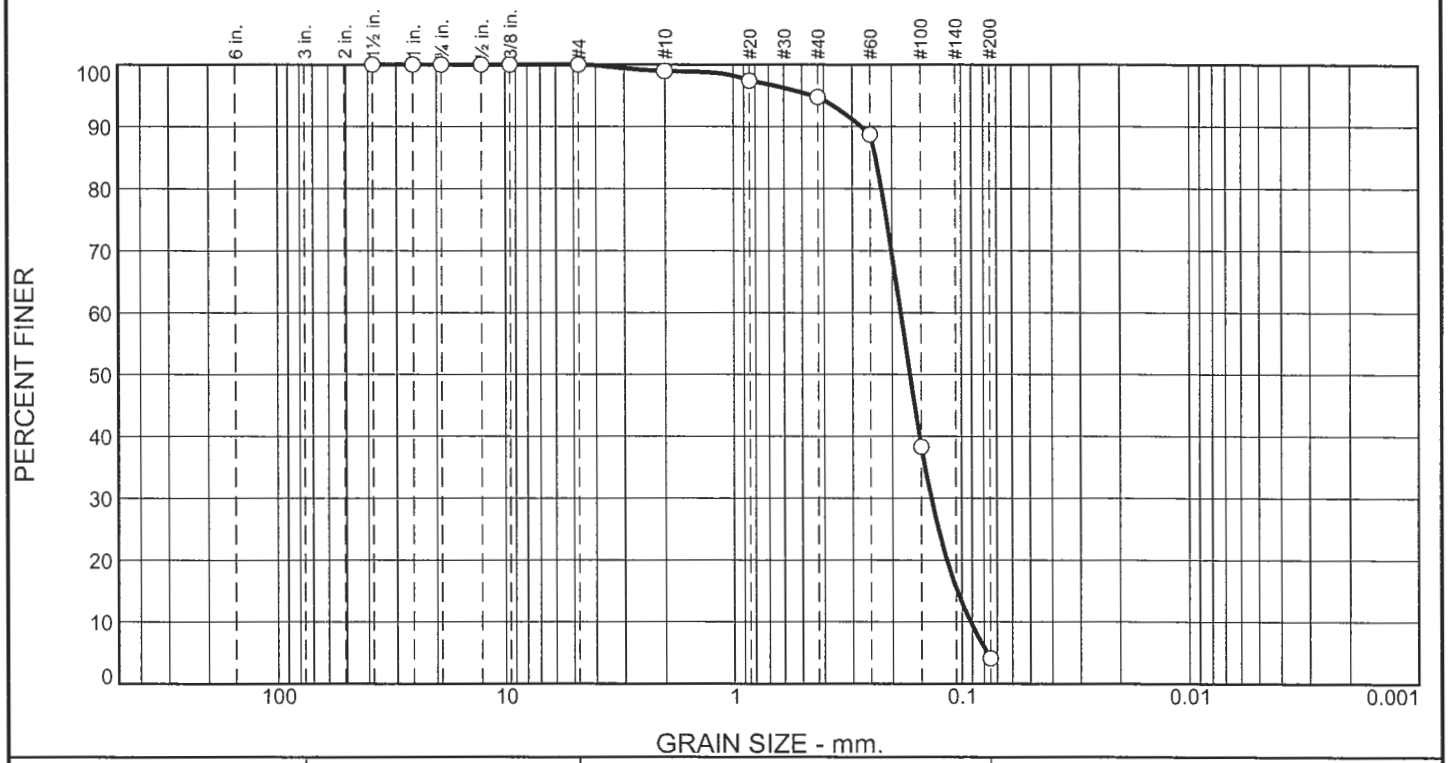
Jacksonville, Florida

Remarks:

Figure

Tested By: A. Coleman **Checked By:** Michael B. Woodward, P.E. MBW

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.1	4.1	90.7	4.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1.0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	98.9		
#20	97.4		
#40	94.8		
#60	88.7		
#100	38.3		
#200	4.1		

* (no specification provided)

Material Description

Dark Brown Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.2734 D_{85}= 0.2369 D_{60}= 0.1842
D_{50}= 0.1683 D_{30}= 0.1359 D_{15}= 0.1048
D_{10}= 0.0916 C_u= 2.01 C_c= 1.09

Remarks

Date Received: 6-24-15 **Date Tested:** 7/20/15

Tested By: A. Coleman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-1 **Depth:** 0.0'-14.5' **Date Sampled:** 6-24-15

Sample Number: BULK

AMEC E&I

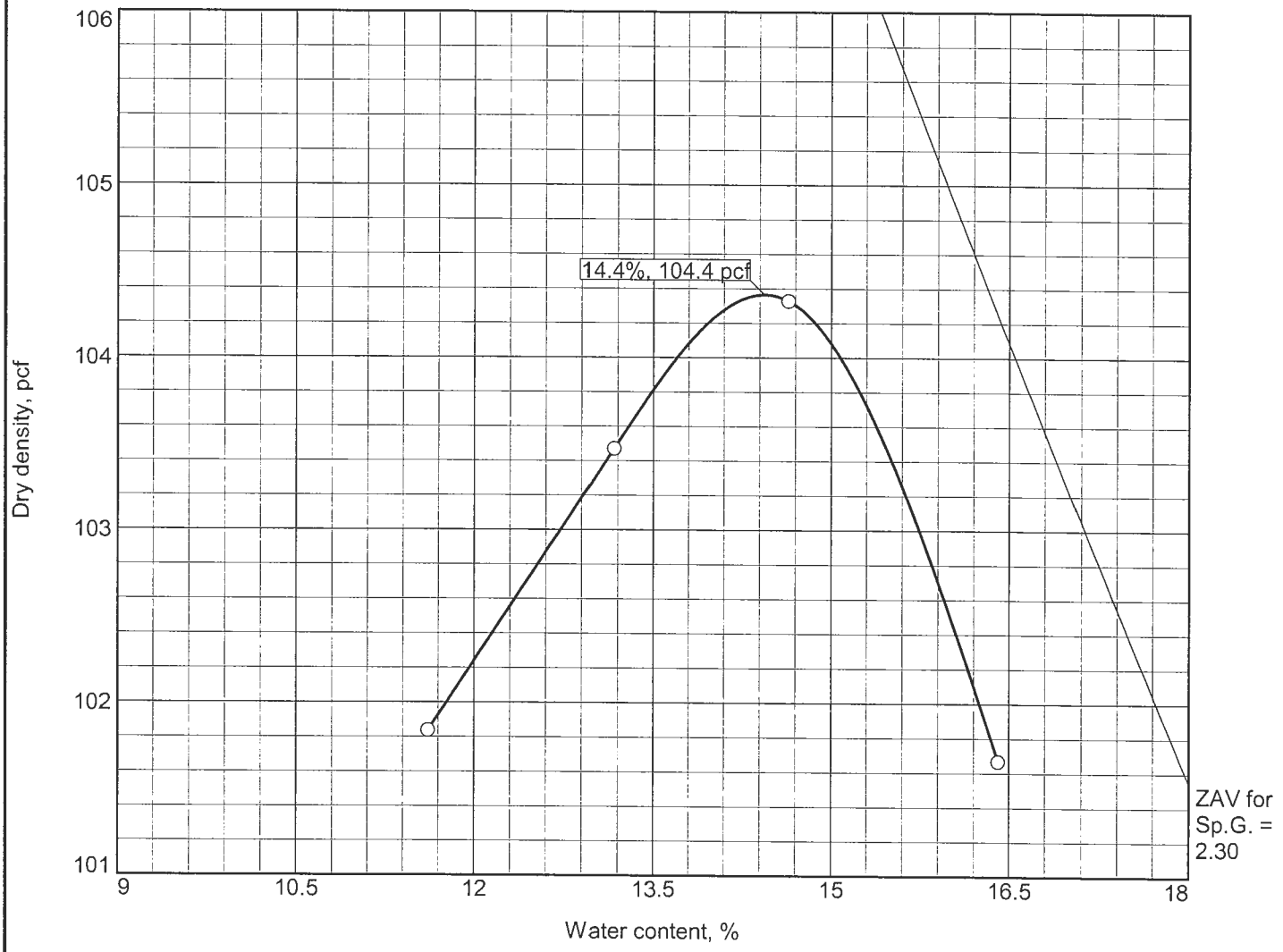
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0'-14.0'	SP-SM	A-3					0.0	5.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 104.4 pcf Optimum moisture = 14.4 %	Light Grey Slightly Silty Fine SAND

Project No. 6734159829 **Client:** Taylor Engineering, Inc.
Project: FIND DU-9 DMMA

○ **Location:** B-3 **Sample Number:** BULK

AMEC E&I

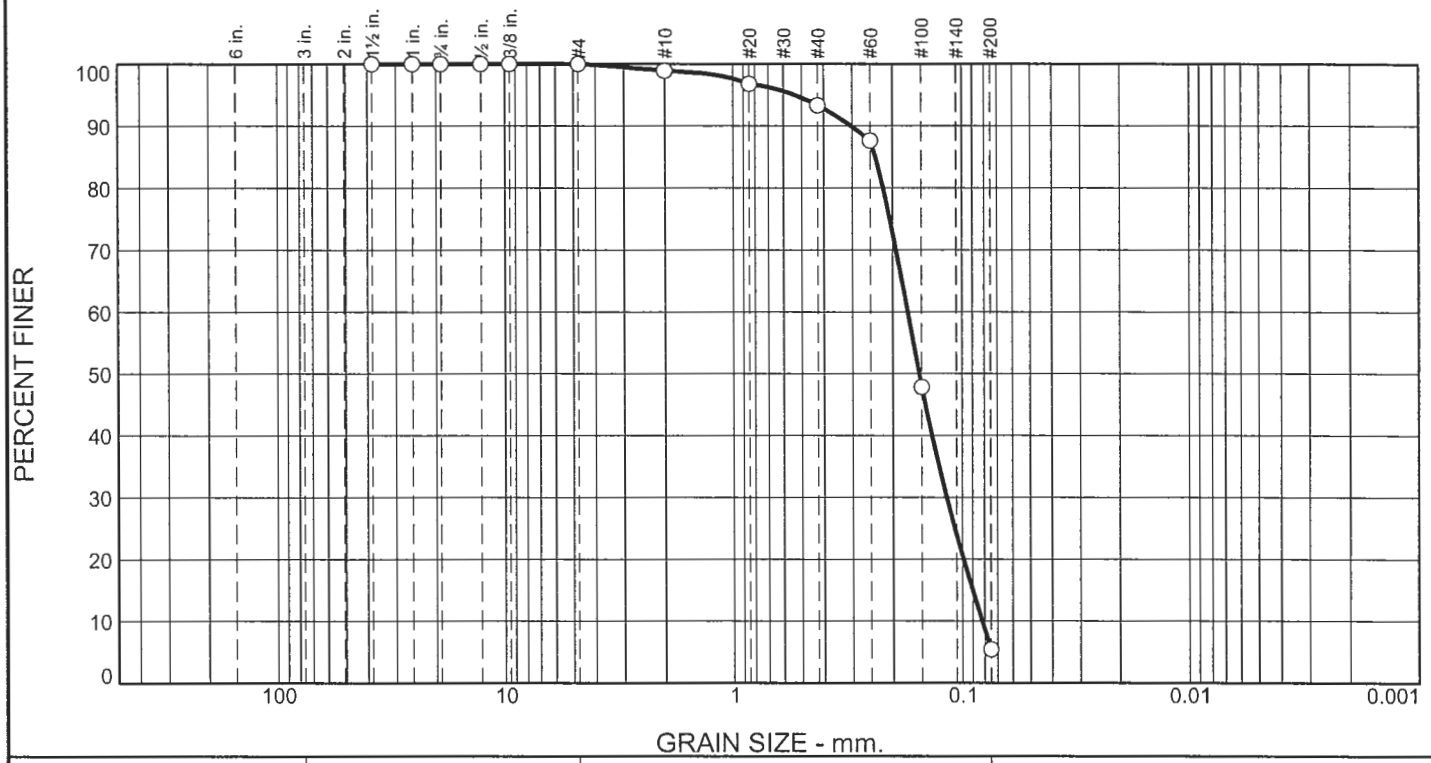
Jacksonville, Florida

Remarks:

Figure

Tested By: D.Newman **Checked By:** Michael B. Woodward, P.E. MBW

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.1	5.6	87.9	5.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1.0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	98.9		
#20	96.8		
#40	93.3		
#60	87.6		
#100	47.8		
#200	5.4		

* (no specification provided)

Material Description

Light Grey Slightly Silty Fine SAND (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.3031 D_{85}= 0.2378 D_{60}= 0.1727
D_{50}= 0.1539 D_{30}= 0.1171 D_{15}= 0.0903
D_{10}= 0.0820 C_u= 2.11 C_c= 0.97

Remarks

Date Received: 6/24/15 **Date Tested:** 7/20/15

Tested By: D.Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical Eng

Location: B-3 **Date Sampled:** 6-24-15

Sample Number: BULK **Depth:** 0.0'-14.0'

AMEC E&I

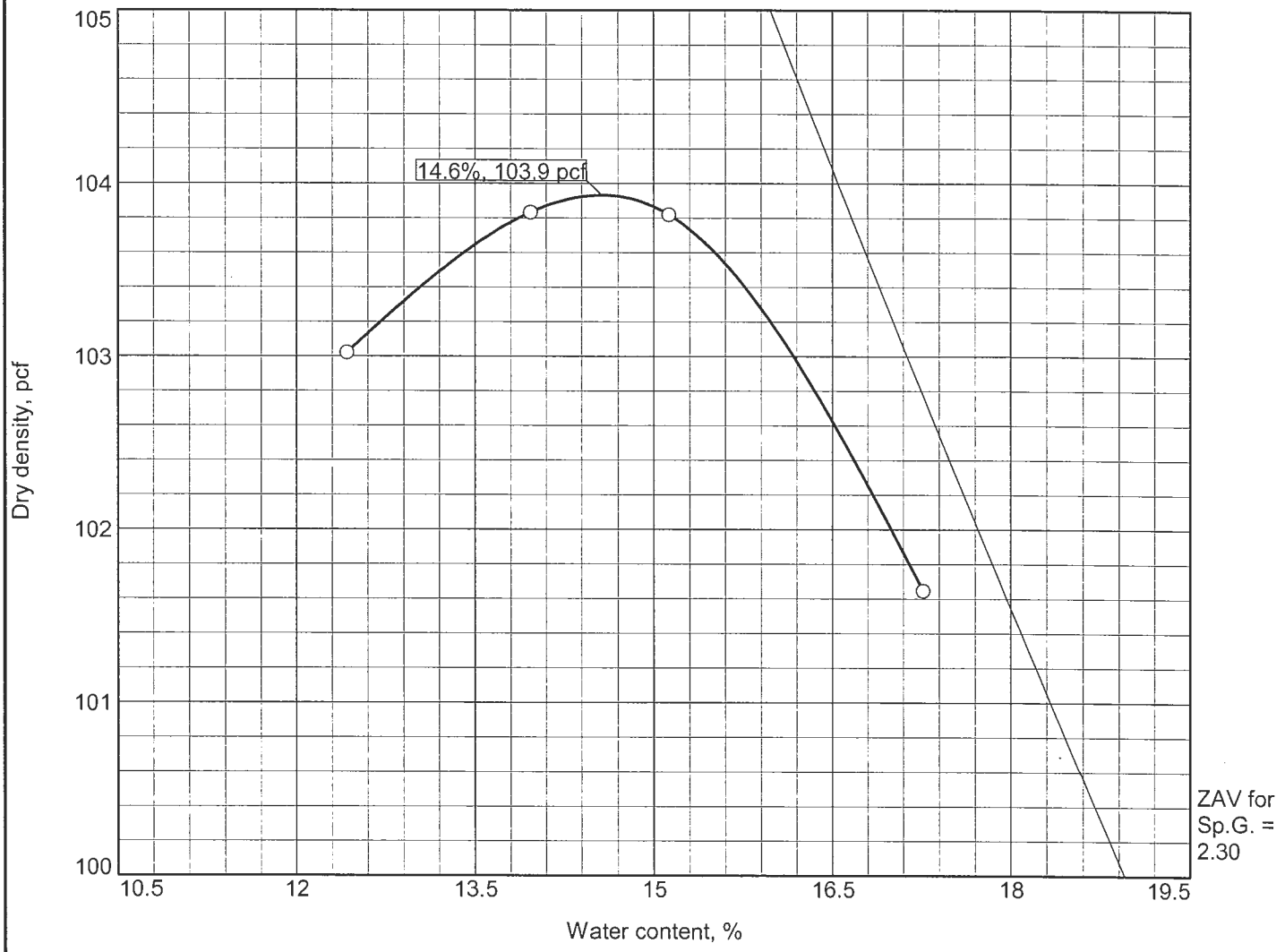
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

COMPACTION TEST REPORT



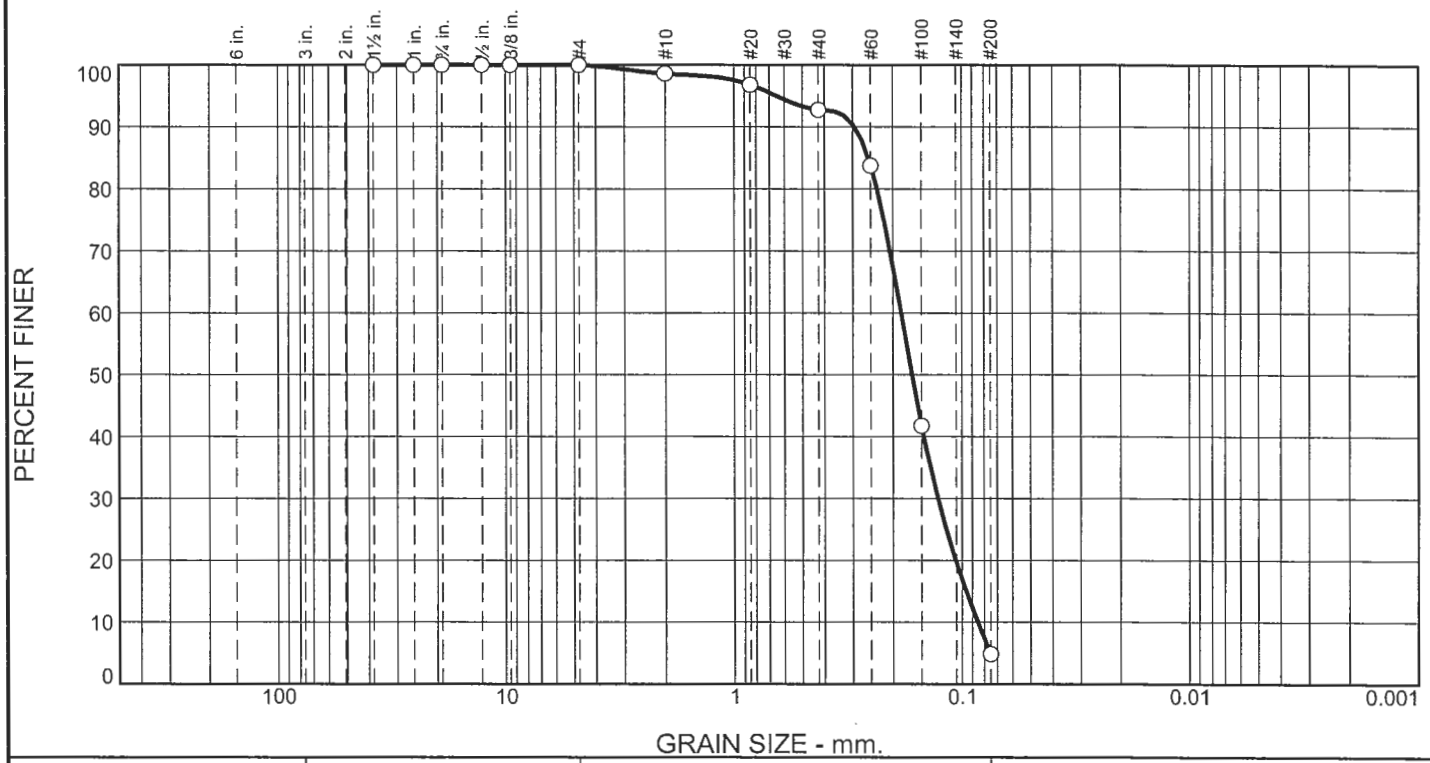
Test specification: ASTM D 1557-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0'-15.5'	SP	A-3			NP		0.0	4.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 103.9 pcf Optimum moisture = 14.6 %	Light Gray Fine SAND with a Trace of Silt
Project No. 6734159829 **Client:** Taylor Engineering, Inc. **Project:** FIND DU-9 DMMA ○ **Source of Sample:** B-5 **Sample Number:** BULK **AMEC E&I** **Jacksonville, Florida**	**Remarks:** **Figure**

Tested By: D. Newman **Checked By:** Michael B. Woodward, P.E. MBW

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.4	5.8	87.9	4.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1.0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	98.6		
#20	96.8		
#40	92.8		
#60	83.8		
#100	41.8		
#200	4.9		

* (no specification provided)

Material Description

Light Gray Fine SAND with a Trace of Silt

Atterberg Limits (ASTM D 4318)

PL= LL= NP PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.2944 D_{85}= 0.2560 D_{60}= 0.1843
D_{50}= 0.1651 D_{30}= 0.1273 D_{15}= 0.0959
D_{10}= 0.0853 C_u= 2.16 C_c= 1.03

Remarks

Date Received: 6-24-15 **Date Tested:** 7/21/15

Tested By: D. Newman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical MBW

Source of Sample: B-5 **Depth:** 0.0'-15.5' **Date Sampled:** 6-24-15

Sample Number: BULK

AMEC E&I

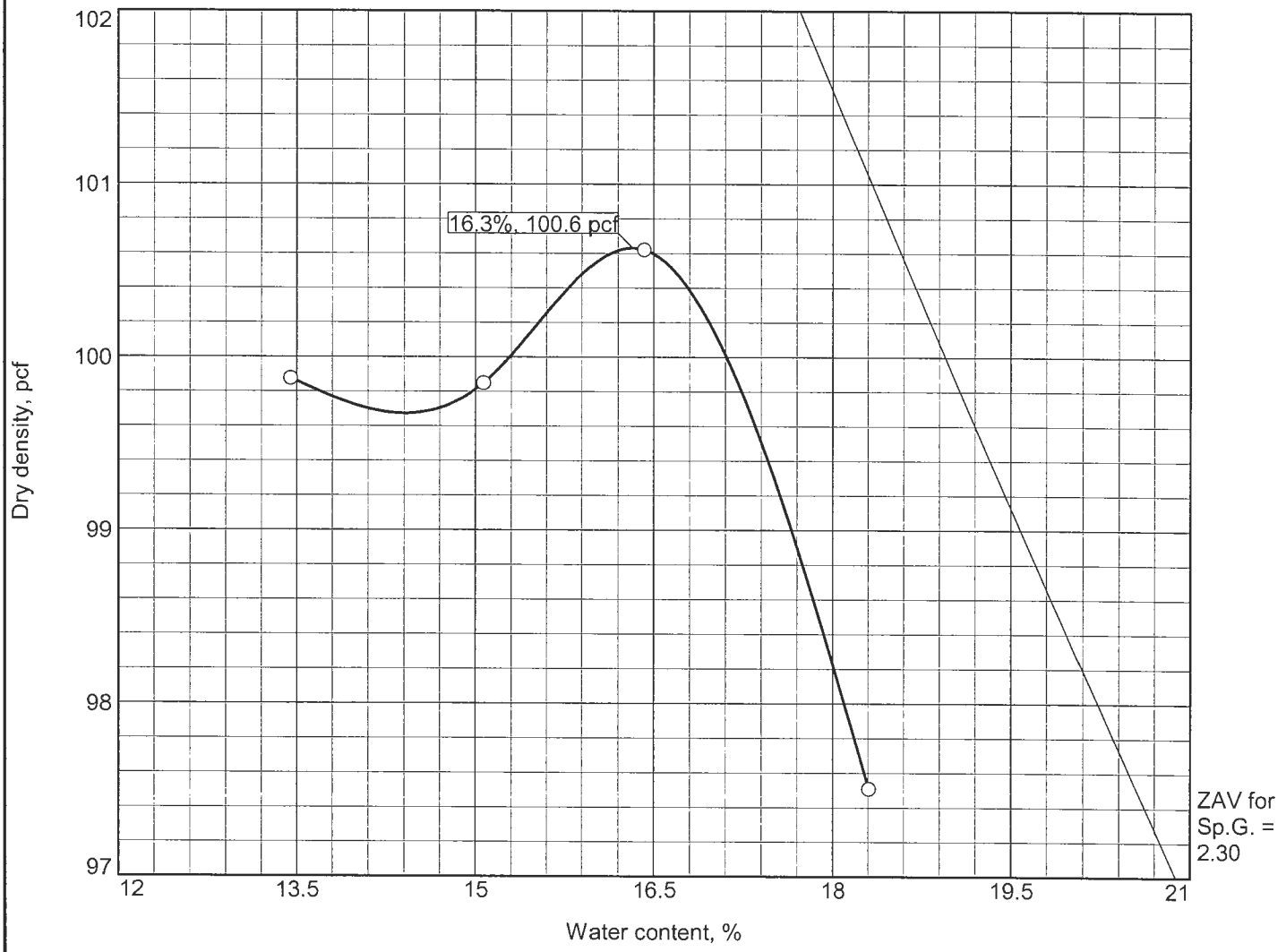
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0'-13.5'	SP-SM	A-3			NP		0.0	6.5

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 100.6 pcf Optimum moisture = 16.3 %	Brownish Gray Slightly Silty Fine SAND (SP-SM)

Project No. 6734159829 **Client:** Taylor Engineering, Inc.
Project: FIND DU-9 DMMA

○ **Source of Sample:** B-7 **Sample Number:** BULK

AMEC E&I

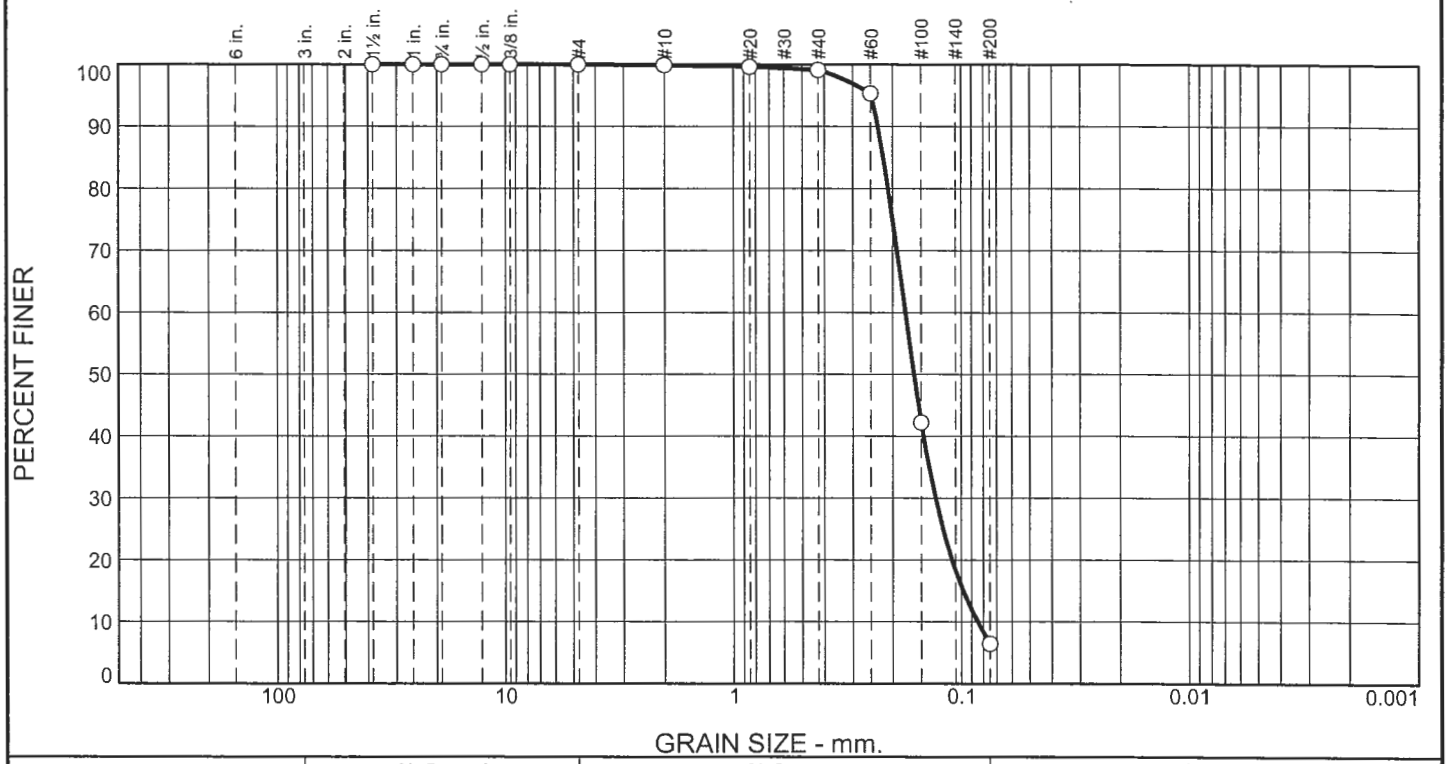
Jacksonville, Florida

Remarks:

Figure

Tested By: A. Coleman **Checked By:** Michael B. Woodward, P.E. MBW

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.8	92.6	6.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1.0"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.9		
#20	99.6		
#40	99.1		
#60	95.3		
#100	42.2		
#200	6.5		

* (no specification provided)

Material Description

Brownish Gray Slightly Silty Fine SAND (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= NP PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.2327 D_{85}= 0.2203 D_{60}= 0.1762
D_{50}= 0.1615 D_{30}= 0.1299 D_{15}= 0.0982
D_{10}= 0.0848 C_u= 2.08 C_c= 1.13

Remarks

Date Received: 6-24-15 **Date Tested:** 7/20/15

Tested By: A. Coleman

Checked By: Michael B. Woodward, P.E.

Title: Principal Geotechnical

Source of Sample: B-7 **Depth:** 0.0'-13.5' **Date Sampled:** 6-24-15

Sample Number: BULK

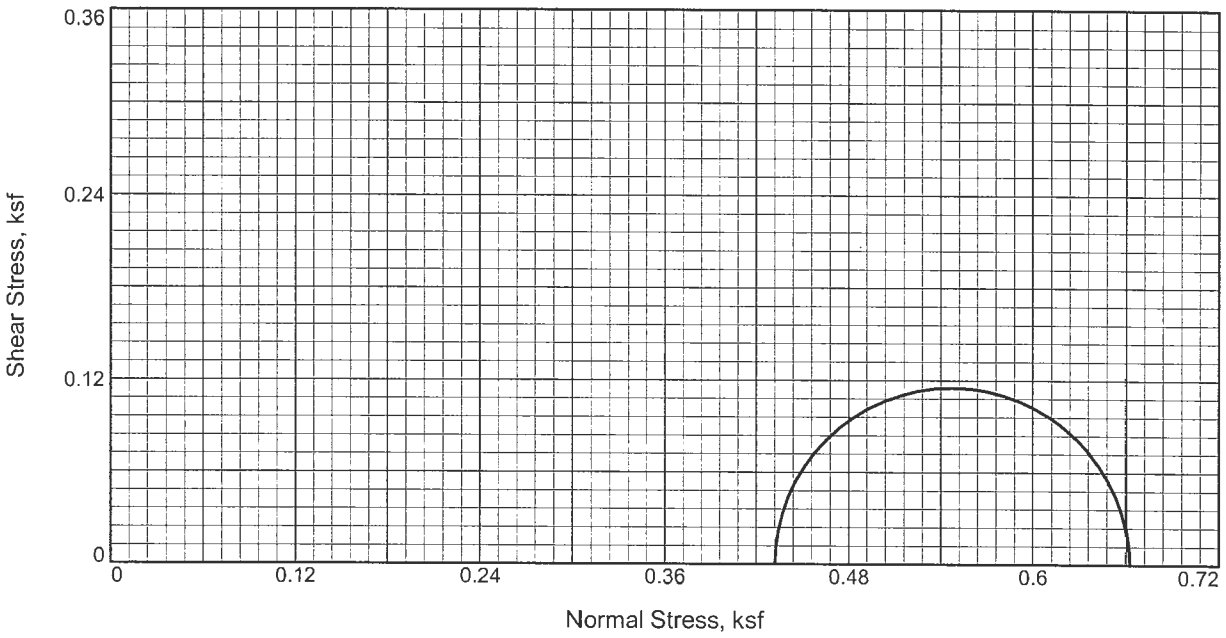
AMEC E&I

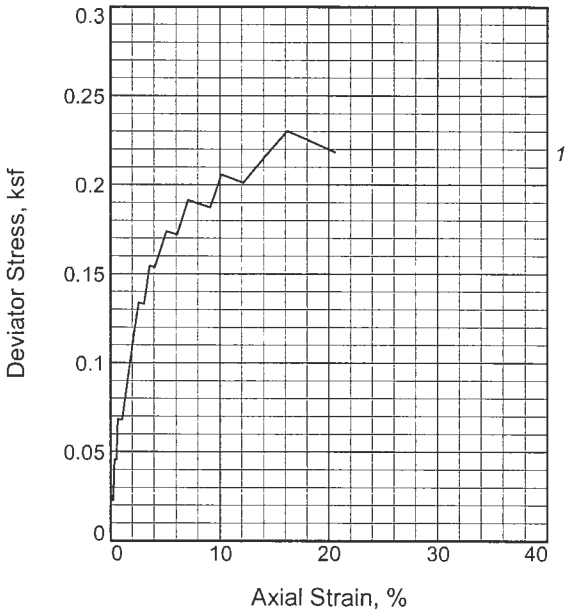
Jacksonville, Florida

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Project No: 6734159829 **Figure**





Sample No.		1
Initial	Water Content, %	179.5
	Dry Density, pcf	29.8
	Saturation, %	104.5
	Void Ratio	4.5489
	Diameter, in.	2.83
	Height, in.	4.97
At Test	Water Content, %	171.7
	Dry Density, pcf	29.8
	Saturation, %	100.0
	Void Ratio	4.5489
	Diameter, in.	2.83
	Height, in.	4.97
Strain rate, in./min.		0.03
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, ksf		0.23
Ult. Stress, ksf		
σ_1 Failure, ksf		0.66
σ_3 Failure, ksf		0.43

Type of Test:
Unconsolidated Undrained

Sample Type: UD

Description: Dark Gray Slightly Sandy Clayey SILT (MH)

Assumed Specific Gravity= 2.65

Remarks: Su=115 psf

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-11 **Depth:** 1.5'-3.5'

Sample Number: UD-1

Proj. No.: 6734159829 **Date Sampled:** 6-26-15

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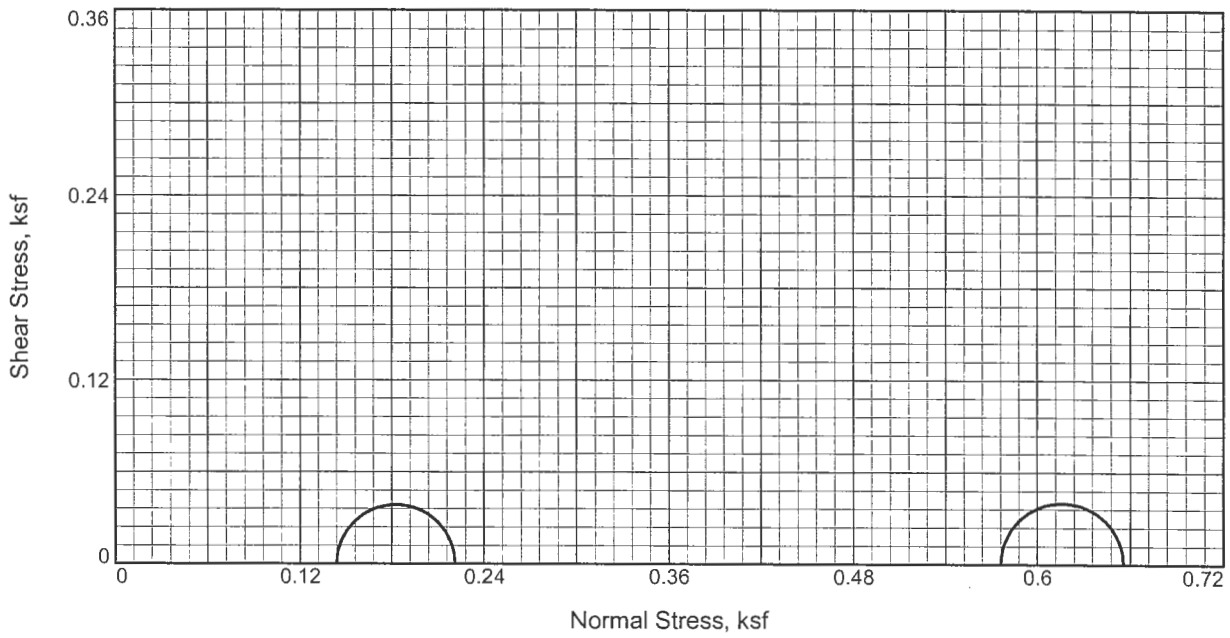
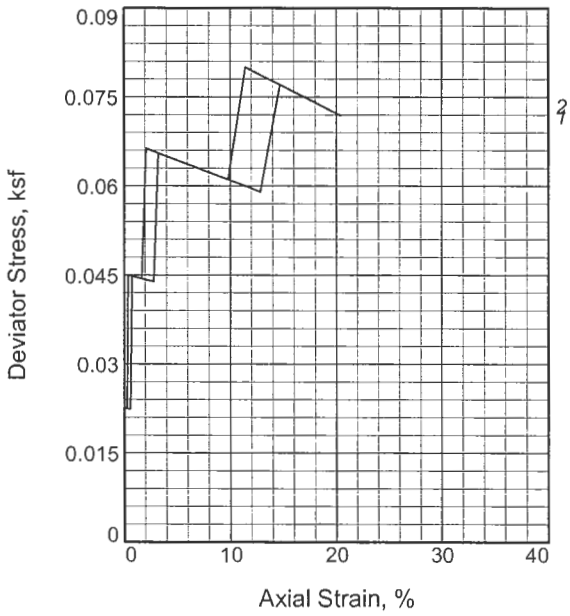
Figure TX-1

Tested By: MC **Checked By:** MW





Sample No.		1	2
Initial	Water Content, %	223.2	208.5
	Dry Density, pcf	24.0	24.5
	Saturation, %	100.1	96.1
	Void Ratio	5.9057	5.7504
	Diameter, in.	2.85	2.85
	Height, in.	5.48	6.17
At Test	Water Content, %	222.9	217.0
	Dry Density, pcf	24.0	24.5
	Saturation, %	100.0	100.0
	Void Ratio	5.9057	5.7504
	Diameter, in.	2.85	2.85
	Height, in.	5.48	6.17
Strain rate, in./min.		0.03	0.03
Back Pressure, psi		0.00	0.00
Cell Pressure, psi		1.00	4.00
Fail. Stress, ksf		0.08	0.08
Ult. Stress, ksf			
σ_1 Failure, ksf		0.22	0.66
σ_3 Failure, ksf		0.14	0.58

Type of Test:
Unconsolidated Undrained
Sample Type: UD
Description: Dark Gray Slightly Sandy CLAY (CH)

LL= 220 **PL=** 60 **PI=** 160
Assumed Specific Gravity= 2.65
Remarks: Su=40 psf

Client: Taylor Engineering, Inc.

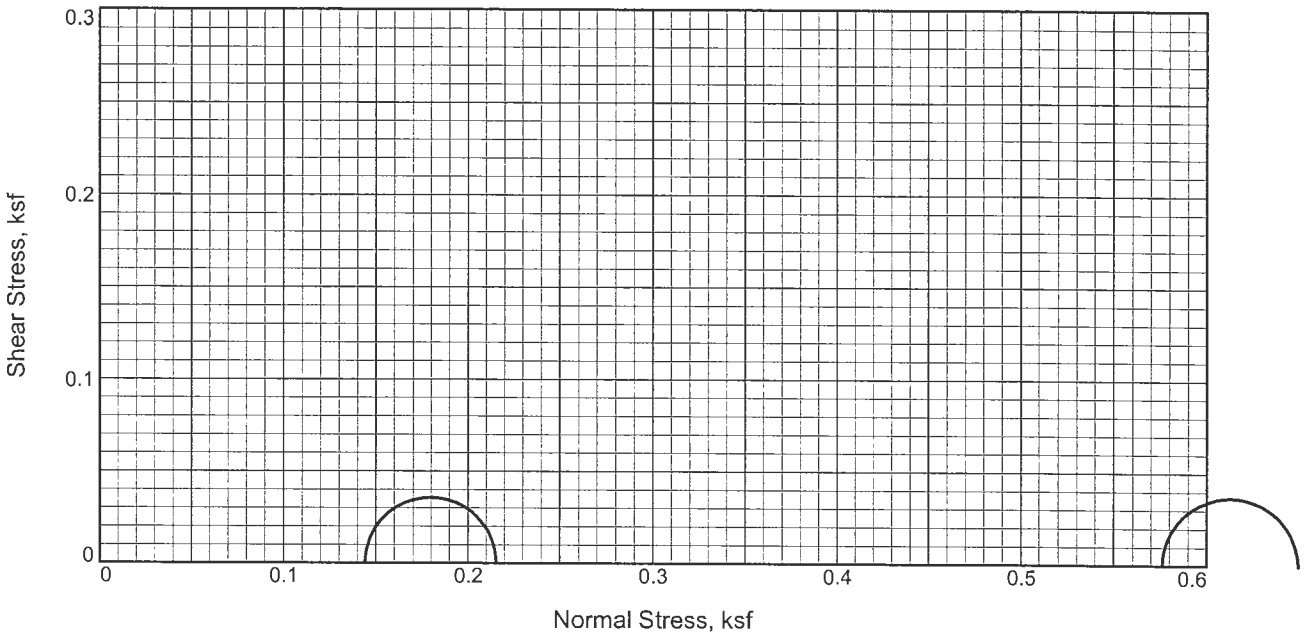
Project: FIND DU-9 DMMA

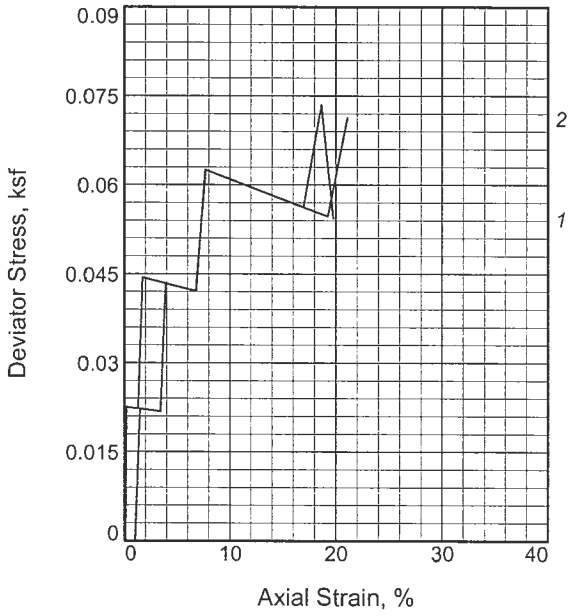
Source of Sample: B-13 **Depth:** 0-2'
Sample Number: UD-1
Proj. No.: 6734159829 **Date Sampled:** 6-29-15

TRIAXIAL SHEAR TEST REPORT
AMEC E&I
Jacksonville, Florida

Figure TX-2

Tested By: MC **Checked By:** Mike B. Woodward, P.E. MBW





Sample No.		1	2
Initial	Water Content, %	216.8	204.3
	Dry Density, pcf	23.7	24.8
	Saturation, %	96.2	95.4
	Void Ratio	5.9724	5.6722
	Diameter, in.	2.85	2.85
	Height, in.	5.92	5.22
At Test	Water Content, %	225.4	214.0
	Dry Density, pcf	23.7	24.8
	Saturation, %	100.0	100.0
	Void Ratio	5.9724	5.6722
	Diameter, in.	2.85	2.85
	Height, in.	5.92	5.22
Strain rate, in./min.		0.03	0.03
Back Pressure, psi		0.00	0.00
Cell Pressure, psi		4.00	1.00
Fail. Stress, ksf		0.07	0.07
Ult. Stress, ksf			
σ_1 Failure, ksf		0.65	0.22
σ_3 Failure, ksf		0.58	0.14

Type of Test:
Unconsolidated Undrained
Sample Type: UD
Description: Dark Gray Slightly Sandy CLAY (CH)

LL= 223 **PL=** 66 **PI=** 157
Assumed Specific Gravity= 2.65
Remarks: Su=35 psf

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-24 **Depth:** 0-2'
Sample Number: UD-1
Proj. No.: 6734159829 **Date Sampled:** 6-29-15

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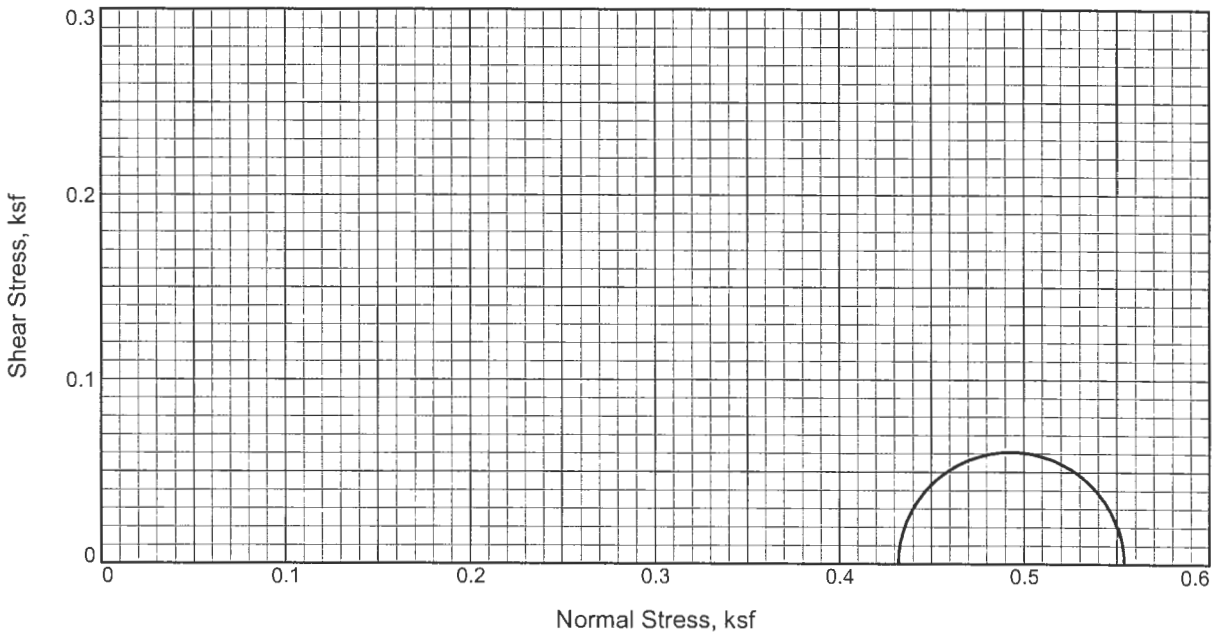
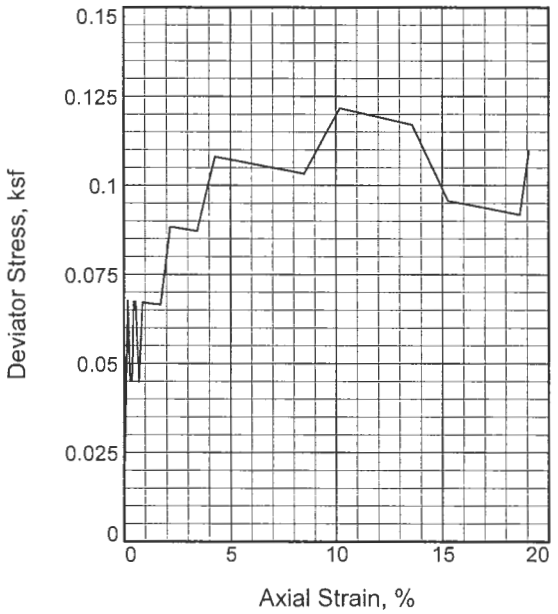
AMEC E&I
Jacksonville, Florida

Figure TX-3

Tested By: MC **Checked By:** Mike.B.Woodward, P.E.





Sample No.		1
Initial	Water Content, %	220.3
	Dry Density, pcf	23.0
	Saturation, %	94.4
	Void Ratio	6.1836
	Diameter, in.	2.85
	Height, in.	5.92
At Test	Water Content, %	233.3
	Dry Density, pcf	23.0
	Saturation, %	100.0
	Void Ratio	6.1836
	Diameter, in.	2.85
	Height, in.	5.92
Strain rate, in./min.		0.03
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, ksf		0.12
Ult. Stress, ksf		
σ_1 Failure, ksf		0.55
σ_3 Failure, ksf		0.43

Type of Test:
Unconsolidated Undrained
Sample Type: UD
Description: Dark Gray Slightly Sandy CLAY (CH)

LL= 249 **PL=** 68 **PI=** 181
Assumed Specific Gravity= 2.65
Remarks: SU=60 psf

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-31 **Depth:** 0-2'
Sample Number: UD-1
Proj. No.: 6734159829 **Date Sampled:** 6-29-15

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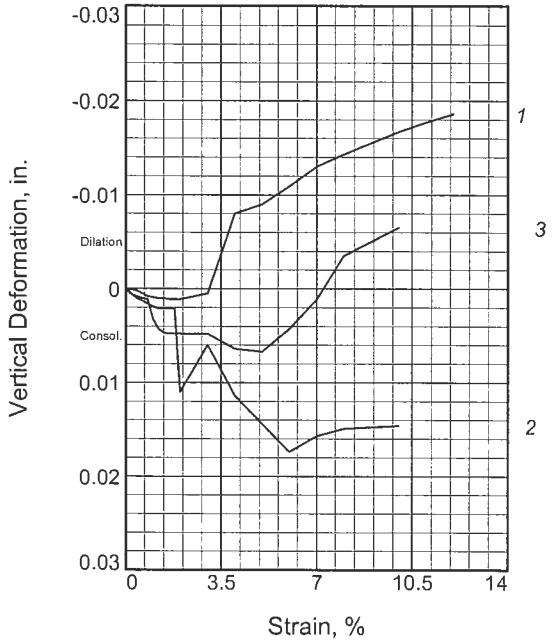
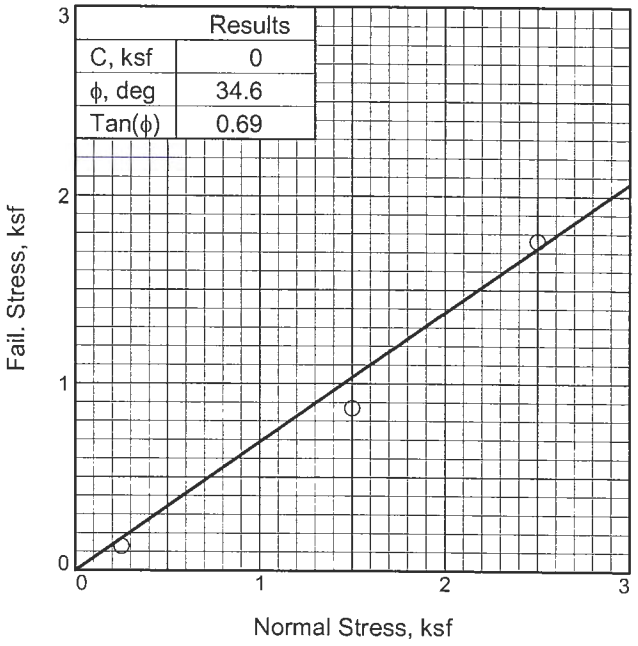
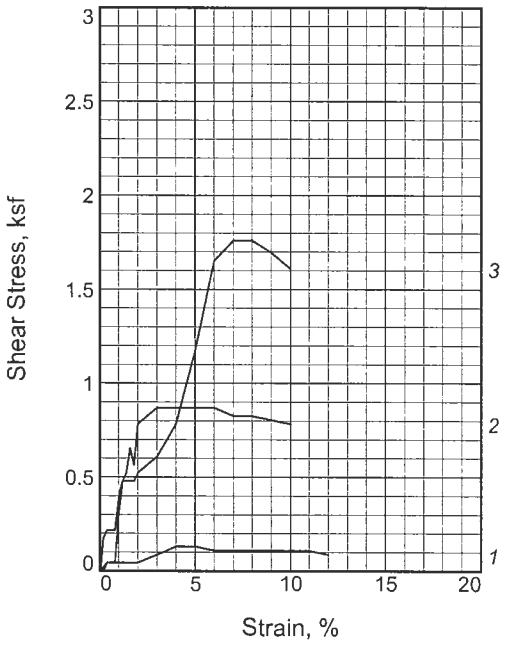
Figure TX-4

Tested By: MC **Checked By:** Mike B. Woodward, P.E.







Sample No.		1	2	3
Initial	Water Content, %	14.2	13.5	14.2
	Dry Density, pcf	98.9	99.7	100.4
	Saturation, %	56.1	54.3	58.2
	Void Ratio	0.6724	0.6586	0.6475
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
At Test	Water Content, %	25.1	22.8	23.9
	Dry Density, pcf	98.9	99.8	100.5
	Saturation, %	99.0	91.9	98.1
	Void Ratio	0.6721	0.6583	0.6453
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
Normal Stress, ksf		0.25	1.50	2.50
Fail. Stress, ksf		0.13	0.87	1.76
Strain, %		4.0	3.0	7.0
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.03	0.03	0.03

Sample Type: Bulk
Description: Dark Brown Fine SAND with a Trace of Silt

Assumed Specific Gravity= 2.65
Remarks: Sample remolded to 95.4% of Modified Proctor Maximum Dry Density

Figure DS-1

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-1 **Depth:** 0.0'-14.5'
Sample Number: BULK
Proj. No.: 6734159829 **Date Sampled:** 6-24-15

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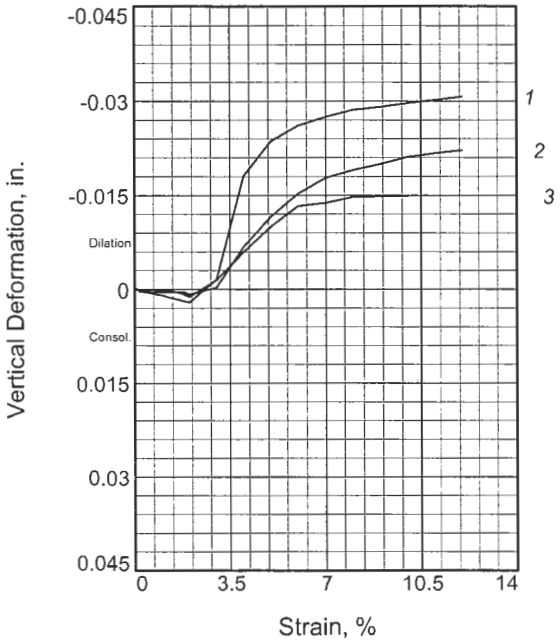
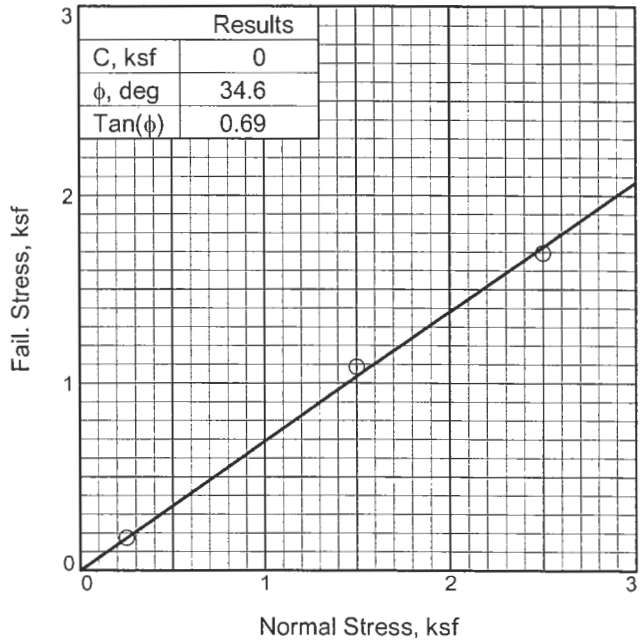
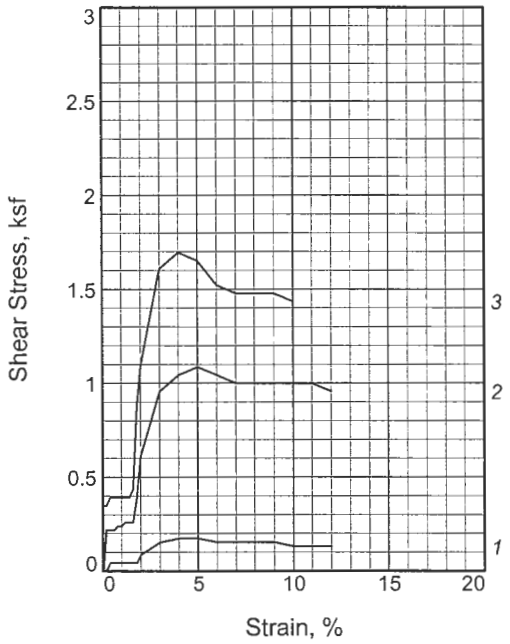
Jacksonville, Florida

Tested By: MC **Checked By:** MBW







Sample No.		1	2	3
Initial	Water Content, %	15.4	15.7	14.1
	Dry Density, pcf	97.3	98.9	98.5
	Saturation, %	58.1	61.7	55.0
	Void Ratio	0.6997	0.6728	0.6787
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
At Test	Water Content, %	21.9	23.0	22.1
	Dry Density, pcf	97.4	98.9	98.6
	Saturation, %	83.2	90.6	86.5
	Void Ratio	0.6992	0.6722	0.6781
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
Normal Stress, ksf		0.25	1.50	2.50
Fail. Stress, ksf		0.17	1.09	1.69
Strain, %		4.0	5.0	4.0
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.03	0.03	0.03

Sample Type: Bulk
Description: Light Grey Slightly Silty Fine SAND (SP-SM)

Assumed Specific Gravity= 2.65
Remarks: Sample remolded to 94.2% of Modified Proctor Maximum Dry Density

Figure DS-2

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Location: B-3
Sample Number: BULK **Depth:** 0.0'-14.0'
Proj. No.: 6734159829 **Date Sampled:** 6-24-15

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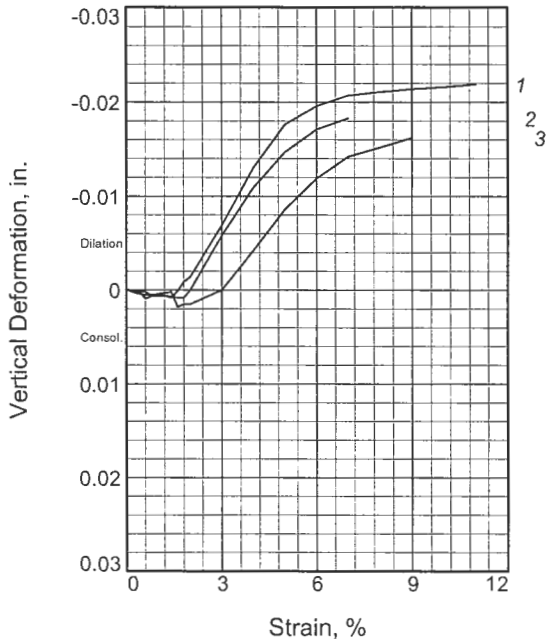
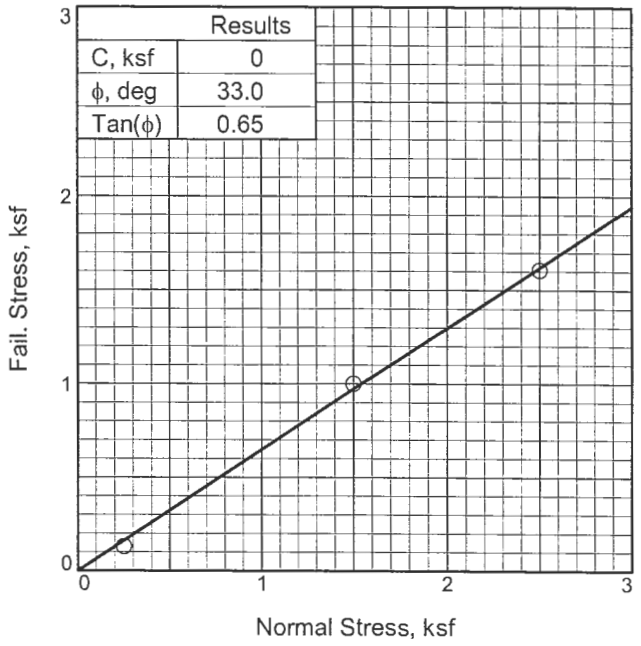
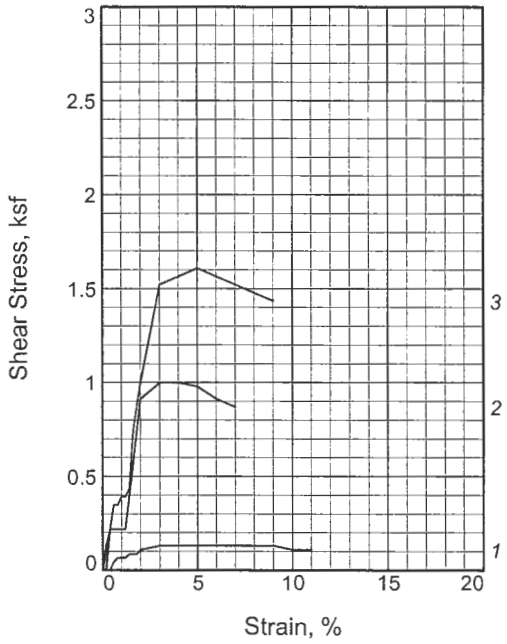
Tested By: MC **Checked By:** MBW





Results	
C, ksf	0
ϕ, deg	33.0
Tan(ϕ)	0.65



Sample No.		1	2	3
Initial	Water Content, %	14.8	14.8	14.6
	Dry Density, pcf	99.0	99.3	97.7
	Saturation, %	58.4	58.9	56.0
	Void Ratio	0.6716	0.6663	0.6931
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
At Test	Water Content, %	20.6	22.1	22.6
	Dry Density, pcf	99.0	99.3	97.7
	Saturation, %	81.3	87.9	86.4
	Void Ratio	0.6715	0.6661	0.6928
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
Normal Stress, ksf		0.25	1.50	2.50
Fail. Stress, ksf		0.13	1.00	1.61
Strain, %		3.0	3.0	5.0
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.03	0.03	0.03

Sample Type: Bulk
Description: Light Gray Fine SAND with a Trace of Silt (SP)

Assumed Specific Gravity= 2.65
Remarks: Sample remolded to 95.0% of Modified Proctor Maximum Dry Density

Figure DS-3

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-5 **Depth:** 0.0'-15.5'
Sample Number: BULK
Proj. No.: 6734159829 **Date Sampled:** 6-24-15

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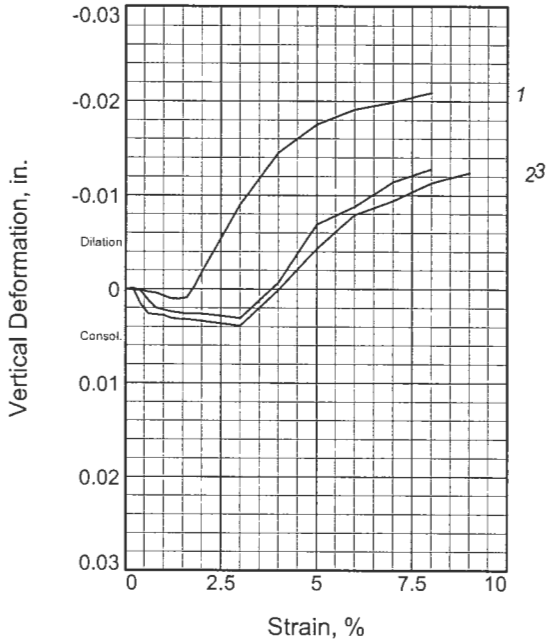
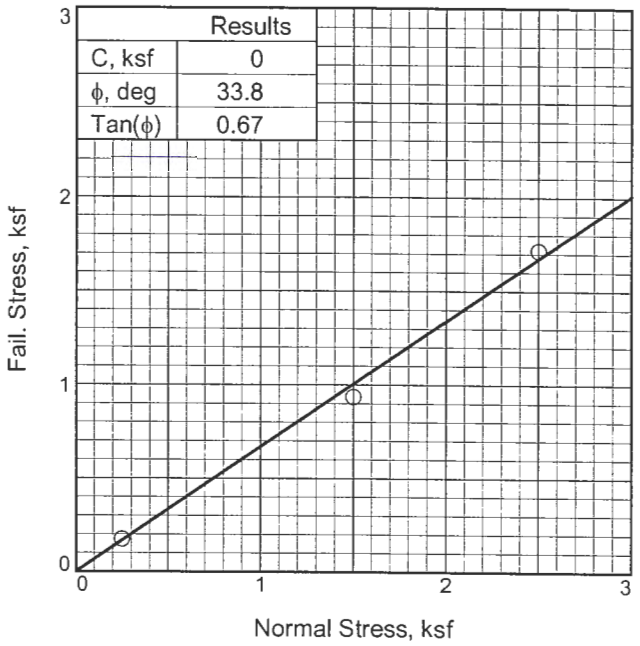
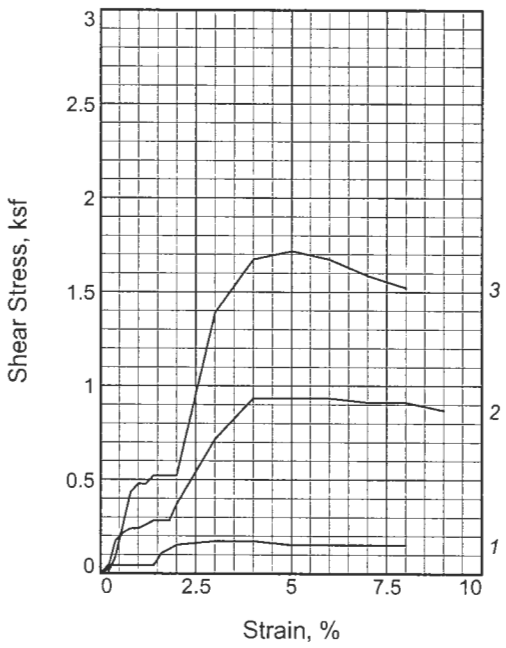
Jacksonville, Florida

Tested By: MC **Checked By:** MBW







Sample No.		1	2	3
Initial	Water Content, %	16.4	16.4	16.2
	Dry Density, pcf	96.9	95.4	96.4
	Saturation, %	61.3	59.0	60.0
	Void Ratio	0.7075	0.7346	0.7165
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
At Test	Water Content, %	22.2	25.8	23.7
	Dry Density, pcf	96.9	95.4	96.4
	Saturation, %	83.3	93.0	87.8
	Void Ratio	0.7074	0.7342	0.7161
	Diameter, in.	2.50	2.50	2.50
	Height, in.	1.50	1.50	1.50
Normal Stress, ksf		0.25	1.50	2.50
Fail. Stress, ksf		0.17	0.93	1.72
Strain, %		3.0	4.0	5.0
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.03	0.03	0.03

Sample Type: Bulk
Description: Brownish Gray Slightly Silty Fine SAND (SP-SM)

Assumed Specific Gravity= 2.65
Remarks: Sample remolded to 95.7% of Modified Proctor Maximum Dry Density

Figure DS-4

Client: Taylor Engineering, Inc.

Project: FIND DU-9 DMMA

Source of Sample: B-7 **Depth:** 0.0'-13.5'
Sample Number: BULK
Proj. No.: 6734159829 **Date Sampled:** 6-24-15

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Jacksonville, Florida

Tested By: MC **Checked By:** MBW

LABORATORY PROCEDURES

Water 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 general accordance with ASTM D2216.

Fines Content - In this test, the sample is dried and then washed over a No. 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in general accordance with ASTM D1140.

Organic Content (Organic Loss on Ignition) - The amount of organic material in a sample is determined in this test. The sample is first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage of the total dry weight of the sample prior to ignition. This test was conducted in general accordance with ASTM D2974.

Atterberg Limits (Plasticity) - A soil's Plasticity Index (PI) is the numerical difference between the Liquid Limit (LL) and the Plastic Limit (PL). The LL is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in general accordance with ASTM D 4318. The PL is the moisture content at which the soil begins to crumble when rolled into a small thread and is also determined in general accordance with ASTM D4318.

The Liquidity Index (LI) was computed from the above test data. This ratio is an expression which compares the relative natural moisture state of the soil with its liquid and plastic limits and is an indicator of various other physical properties such as strength, sensitivity, compressibility, and preconsolidation characteristics.

Grain Size Distribution - The grain size tests were performed to determine the particle size and distribution of each sample tested. The sample was dried, weighed, and washed over a No. 200 mesh sieve. The dried sample was then passed through a standard set of nested sieves to determine the grain size distribution of the soil particles coarser than the No. 200 sieve. This test is similar to that described by ASTM D422.

Compaction - Modified Proctor compaction testing (ASTM D1557), Method A was performed on representative bulk soil samples to determine their compaction characteristics including their maximum dry density and optimum moisture content.

Minimum Density - The minimum density of a cohesionless bulk soil sample was determined by pouring of the dry soil to obtain the loosest state. This test was conducted in accordance with ASTM D4254.

Consolidated-Drained Direct Shear - The strength parameters of selected soil samples were obtained using the direct shear testing method in general accordance with AASHTO T 236. This testing was conducted on representative bulk soil samples. The bulk soil samples were compacted to a dry density approximately equal to approximately 95% of the Modified Proctor maximum dry density. The specimens were then placed within a metal shear box with porous inserts. After preparation, the test samples were loaded with a specified normal force and then sheared at a specified slow rate to ensured drained conditions. During the shearing process, the time, vertical and horizontal displacements, and shear force were recorded at regular intervals until the specimen failed in shear. This process was repeated twice more for each test using greater normal forces. The test results were then plotted (normal stress vs. shear stress) and the cohesion and angle of internal friction were determined from this plot.

Constant-Head Hydraulic Conductivity - Remolded bulk samples of the soil encountered in selected areas were chosen for hydraulic conductivity testing. The cohesionless soils were remolded to specified densities (approximately 95% of the Modified Proctor maximum dry density). A rigid wall permeameter was utilized. The testing procedure used was in general accordance with ASTM D2434.

Unconsolidated - Undrained Triaxial Shear - The strength parameters of selected soil samples were obtained by triaxial shear testing. Samples of cohesive soils were trimmed from relatively undisturbed samples. The test samples were about 3 inches in diameter, with the height of each sample approximately twice the diameter. The test samples, after preparation, were encased in rubber membranes, placed in a compression chamber, and saturated with water. An all-round confining pressure was then applied. An axial load was then applied until the sample failed in shear. During the axial load application, the sample's internal drainage was closed. The resulting pore water pressure developed inside the sample were measured by a pressure transducer. The test

results are presented in the form of Mohr diagrams and stress-strain curves on the Triaxial Shear Test Report sheets in Appendix B. These tests were conducted in general accordance with ASTM D2850.

Pocket Penetrometer – The undrained shear strength (s_u) of representative thin-walled tube samples of the cohesive soils was estimated using a manual pocket penetrometer (Facchini Geotester).