SUBSURFACE INFORMATION

for the

P664 HELO PARKING AND LANDING APRON

NAVAL AIR STATION
JACKSONVILLE, FLORIDA

for

UNITED STATES NAVY

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BURNS & McDONNELL
PROJECT 70149

Burns & McDonnell
Engineers-Architects-Consultants
Kansas City, Missouri

FEBRUARY 2014

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Report of Geotechnical Exploration, P664 Helo Parking and Landing Apron, Naval Air Station, Jacksonville, Florida; prepared for Burns & McDonnell; prepared by AMEC Environmental and Infrastructure, Inc., dated February 18, 2014.

* * * * *

I. GENERAL

This subsurface information document consists of the data and results of a subsurface investigation described in a report titled *Report of Geotechnical Exploration, P664 Helo Parking and Landing Apron, Naval Air Station, Jacksonville, Florida*, dated February 18, 2014. The investigation was performed by AMEC Environmental and Infrastructure, Inc. (AMEC) of Jacksonville, Florida. The report, as prepared by AMEC, is included in Appendix A of this document.

Drilling and laboratory testing for this investigation was performed by AMEC. The drilling phase was performed on January 9, 2014. It included the completion of eight (8) borings drilled to a depth of 10 feet below grade. Laboratory tests were conducted on select available samples following the completion of drilling operations. Boring logs and laboratory test results, as prepared by AMEC, are included in the report in Appendix A of this document.

Samples recovered during the subsurface investigation were transported to the laboratory by AMEC. AMEC was not compensated to store the samples after testing and reporting beyond their customary retention period prior to disposal.

II. DESIGN NOTES

Geotechnical design notes have not been prepared by Burns & McDonnell for this project.

III. WATER LEVEL INFORMATION

Water levels were observed by AMEC, see Appendix A. It should be noted by the reader that fluctuations in water levels may occur over more prolonged periods of readings and can be influenced by various outside factors. It may take groundwater several days to reach its hydrostatic levels in holes in cohesive soils.

Seasonal variations in rainfall, changes to on-site conditions, and changes to off-site conditions can affect groundwater levels. Fluctuations in groundwater levels from those noted in logs should be anticipated during construction. Water levels observed and recorded by others reflect only those conditions that existed at the time of investigation and may vary from true phreatic groundwater levels.

Groundwater information as obtained by AMEC is presented in Appendix A of this document.

IV. ADDITIONAL SUBSURFACE INFORMATION

Burns & McDonnell has requested from the United States Navy (Owner) additional subsurface information in the vicinity of the Site. Burns & McDonnell was not provided with any additional information.

Burns & McDonnell is aware that a significant amount of construction activity has been undertaken in the near vicinity of the Site. Additional information in the form of geotechnical reports and/or construction records may exist. Requests for additional information should be directed to the Owner.

V. LIMITATIONS

A. DOCUMENT USE

The information provided in Appendix A has been prepared for the use of Burns & McDonnell for design purposes. No other warranty, express or implied, is made as to the information included in this document. In the event that conclusions and recommendations based on data contained in this document are made by others, such conclusions and recommendations are the responsibility of others.

The information gathered and presented in this document was not obtained for an environmental audit nor to evaluate the potential for hazardous materials at the Site. The equipment, techniques, and personnel used to perform geoenvironmental exploration differ substantially from those applied in soil and foundation engineering. The purpose of this document is not intended as preparation for a Geotechnical Baseline Report, nor to provide information for use in developing construction cost estimates.

B. VARIATIONS

The subsurface information submitted in this document is based upon data obtained from test borings completed at the approximate locations indicated on the Field Exploration Plan in Appendix A. This document does not reflect variations which may occur between test borings. The nature and extent of variations between the test borings may not become evident until excavation is performed. If during construction, soil, rock, and/or groundwater conditions appear to be different from those described herein, Burns & McDonnell should be advised at once so that recommendations made may be evaluated and modified, if necessary. Water levels, as described in this document, reflect only those conditions that existed at the time that this particular subsurface investigation was performed by AMEC. Fluctuations or changes in water levels and groundwater conditions can be influenced by sources outside the site investigated, by seasonal rainfall, and by changes in drainage conditions in and around the Site. Fluctuations can occur and should be anticipated between the time of investigation and the time of construction.

* * * * *

APPENDIX A

***Report of Geotechnical Exploration, P664 Helo Parking and Landing Apron, Naval Air Station, Jacksonville, Florida*; prepared for Burns & McDonnell; prepared by AMEC Environmental and Infrastructure, Inc., dated February 18 2014.**

REPORT OF GEOTECHNICAL EXPLORATION

P664 HELO PARKING AND LANDING APRON
NAVAL AIR STATION
JACKSONVILLE, FLORIDA

- PREPARED FOR -

BURNS & MCDONNELL

- Prepared By -

AMEC ENVIRONMENT & INFRASTRUCTURE, INC.
3901 CARMICHAEL AVENUE
JACKSONVILLE, FLORIDA 32207

AMEC PROJECT NO. 6734-12-9688

FEBRUARY 18, 2014

IMPORTANT NOTICE

This report was prepared exclusively for Burns & McDonnell by AMEC Environment & Infrastructure, Inc. (AMEC). The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

February 18, 2014

Mr. Jason Shepherd, P.E.
Burns & McDonnell
3650 Mansell Road, Suite 300
Alpharetta, Georgia 30022

Subject: **Report of Geotechnical Exploration**
P664 Helo Parking and Landing Apron
Naval Air Station
Jacksonville, Florida
AMEC Project No. 6734-12-9688

Dear Mr. Shepherd:

AMEC Environment & Infrastructure, Inc. (AMEC) is pleased to submit this report that documents the results of our geotechnical exploration for the subject project.

In summary, the subsurface conditions encountered by the borings consisted of loose to dense fine sand and slightly silty fine sand to a maximum depth drilled at 10 feet. Occasional layers of loose to firm clayey fine sand or silty fine sand (about 1 to 3 feet thick) were encountered in each of the borings. The depth to groundwater was about 3 to 5 feet below existing grade.

We consider the subsurface conditions in the explored area to be acceptable for construction of the proposed helicopter parking and landing apron. Site preparation will consist of stripping of existing pavements and concrete pads, vegetation and topsoils; implementation of surface water (and possibly groundwater) control; proofrolling to detect zones of weak or loose soils created by previous site demolition or excavation operations; removal of any abandoned foundations and replacement with compacted structural fill material; surficial soil densification by vibratory compaction; and structural fill placement and compaction in controlled lifts. Detailed recommendations for site preparation are presented in the Recommendations section 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 ENVIRONMENT AND INFRASTRUCTURE, INC.
State of Florida Board of Professional Engineers Certificate of Authorization No. 5392

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LICENSE
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2-18-14
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File (1)

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1.0 PROJECT INFORMATION AND STRUCTURAL CONDITIONS

The purpose of this exploration was to develop information concerning the site and subsurface conditions in order to evaluate site preparation requirements for the planned helicopter parking and landing apron in Jacksonville, Florida. This report briefly describes the field and laboratory testing activities and presents the findings. The enclosed guideline recommendations for site preparation and pavement construction represent approaches we feel would be appropriate for the planned construction.

1.1 Background Information

Project information was provided by you during the period of August 11, 2012 to present. We were furnished with the following items:

- Technical Guidelines for Subsurface Investigation and Geotechnical Report
  Helicopter Apron
  Naval Air Station Jacksonville
  Jacksonville, Florida
  Furnished By: Burns & McDonnell (B&M)
  Dated: August, 2012

- Scope Plan (Drawing No. C-001)
  Prepared by: B&M
  Dated: August 11, 2012

- Project Scope
  Unauthored and Undated
  Furnished by: B&M

As shown on the Site Location Map and Field Exploration Plan in the Appendix, the project site is located in the northwest quadrant of the intersection of Albemarle Avenue and Catapult Road, at the Naval Air Station in Jacksonville, Florida. The site is an IR (Installation Restoration) site, as it was once a jet fuel storage area. It is now clear of tanks and structures but some surficial pavement and concrete pads exist throughout the subject site.

As shown on the Field Exploration Plan in the Appendix, the proposed construction site will be irregularly shaped, with overall plan dimensions of approximately 530 feet in the east-west direction by 650 feet in the north-south direction. The total square footage of the apron will be approximately 325,000 square feet. The subject site will include ten helicopter parking spots and a hot pit refueling area.

1.2 Structural Loading Conditions and Grading Requirements

We have not been provided with helicopter or other vehicle loading or frequency information for pavement design purposes. We understand that no more than 2 feet of earthwork cut or fill will be required to bring the site to the desired grade.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

In order to explore the subsurface conditions in the area of the planned construction, we drilled eight Standard Penetration Test (SPT) borings to a depth of 10 feet each below existing ground surface. The borings were drilled by our subcontractor, TransAmerican Drilling and Testing, Inc. A senior engineering technician from our office was present during the field activities to observe the drilling operations and document the borings. Bulk soil samples were also obtained from the depth range of approximately 1½ to 2½ feet adjacent to three of the boring locations with a shovel. As the site was determined to be an IR site, all field personnel were required to have completed the 40-hour HAZWOPER course, or the 8-hour OSHA refresher course, prior to site access. In addition, this also required that the drilling operations be compliant with petroleum-specific decontamination and waste storage/disposal procedures.

The boring locations were selected by an engineer from our office. The actual boring locations were located in the field by an engineer from this office using taped measurements from existing features. The ground surface elevations at the boring locations were neither provided to us nor determined by us.

The Soil Test Boring Records, in the Appendix, graphically show the penetration resistances and groundwater levels, and present the soil descriptions for each SPT 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 field exploratory drilling and sampling techniques used are presented in the Field and Laboratory Procedures section of the Appendix.

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. The laboratory testing included the following:

- 6 water content tests
- 12 grain size distribution tests
- 2 Atterberg limits (plasticity) determinations
- 3 Modified Proctor compaction tests

The results of these tests are presented on the Summary of Laboratory Test Results, Grain Size Distribution Report, and Compaction Test 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, electro-chemical property tests (including pH, chloride content, sulphate content, and electrical resistivity), sulfide, and Redox potential tests were performed on each of the three bulk soil samples in order to help determine their corrosion potential. The results of these tests are presented on the Summary of Electro-Chemical Property Test Results and Summary of Oxidation-Reduction Potential and Sulfide Test Results sheets in the Appendix. Brief descriptions of the laboratory test procedures used are presented in the Field and Laboratory Procedures section in the Appendix.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The existing site conditions were observed by representatives from our office on December 12, 2013, and January 9, 2014. The site is located immediately east of Taxiway B in the northwest quadrant of the Albemarle Avenue and Catapult Road intersection, which is directly across the street from Building 118 and a control tower. The St. Johns River is directly east of the subject site. At the time of our visit, the ground cover primarily consisted of grass, asphalt pavement and concrete pads. The topography was relatively flat and level. We note there is a possibility that abandoned foundations associated with the prior fuel farm may exist below existing grade and should be anticipated during site preparation and construction of the helicopter apron.

3.2 Subsurface Conditions

3.2.1 General

A pictorial representation of the subsurface conditions encountered in the proposed helicopter apron construction area is shown on the Generalized Subsurface Profile presented in the Appendix. The profile and the soil conditions outlined below highlight the major subsurface stratification. The Soil Test Boring Records in the Appendix should be referred to for detailed descriptions of the subsurface conditions encountered at each boring location. When reviewing the boring records and the subsurface profile, it should be understood that soil conditions may vary between and away from the boring locations.

In general, the upper 6 feet of the borings generally encountered gray to brown fine sand (Unified Soil Classification System symbol, SP), slightly silty fine sand (SP-SM), and silty fine sand (SM). Asphalt pavement and limerock fragments were encountered within the sandy soils in the upper 1½ feet of the subsurface profile of Boring B-6. A large tree root was encountered in Boring B-5 in the depth range of 6 to 8 feet. The SPT N-values in this stratum ranged from 6 to 30 blows/foot. We note that a fuel odor was detected in Boring B-2 in the 4½- to 6½-foot depth range.

Gray, brown, and red fine sand (SP), slightly silty fine sand (SP-SM), silty fine sand (SM), and clayey fine sand (SC) were penetrated to the maximum boring termination depth of 10 feet. The SPT N-values in this stratum ranged from 4 to 19 blows/foot. We note that a fuel odor was detected in Boring B-7 in the 5- to 8-foot depth range.

3.2.2 Groundwater

The depth to groundwater was measured at the boring locations at the time of drilling. The groundwater table was generally encountered at depths of about 3 to 5 feet below grade in the proposed helicopter apron area. Fluctuation in groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, tidal fluctuations in the adjacent St. Johns River, 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 RECOMMENDATIONS

4.1 Basis for Recommendations

The following recommendations are based upon the previously presented project information along with the data obtained in this exploration. The field and laboratory data have been compared with previous performances of similar pavements bearing on soils similar to those encountered at this site. If the location or configuration of the helicopter apron is changed, please contact us so that our recommendations may be reviewed for continued applicability. The discovery of any site or subsurface condition during construction that deviates from the data obtained in the borings performed for this project should also be reported to us for our evaluation. The assessment of site environmental conditions or the presence of pollutants in the soil, rock or groundwater of the site is beyond the proposed scope of this geotechnical exploration.

We note that expansive soils, karst geology, collapsible soils, active faults, and exposed rock were not encountered by the borings performed for this exploration.

4.2 Soil Corrosion Potential/Environmental Corrosion Classification

Based on the results of the laboratory electro-chemical property tests, the soils exhibit moderate to high corrosion properties (moderately to extremely aggressive according to Florida Department of Transportation (FDOT) criteria) due to the results of the chloride content tests (900 to 2,600 ppm). We note, however, that the results of the sulfate content tests indicate the sulfate content is considered low or within acceptable range. With this in mind, it appears that Type I or II Portland cements may be used at this site.

4.3 Site Preparation Recommendations

4.3.1 Surface Stripping

All pavements, abandoned foundations, construction debris, topsoils, vegetation, and roots should be stripped and removed from all areas to receive new paving. The depth to which stripping will be required could vary to some degree. Some localized areas may require more than 18 inches of stripping to remove abandoned foundations, pavements, old tree stumps, or other unacceptable materials, whereas other areas may require 6 inches or less.

Any excavations created during the removal process should be backfilled with acceptable structural backfill material (defined in Section 4.3.7) that is placed and compacted in controlled lifts to a minimum dry density equal to 95 percent of the Modified Proctor maximum dry density (ASTM D 1557). Buried pipes should be either removed, or grouted if left in-place.

4.3.2 Temporary Excavation Stability

After the site has been prepared as previously outlined, any shallow excavations (i.e., for buried utilities or the hot pit refueling area) can be made. Generally, for excavations less than 4 feet deep in sandy soils, the sides of the excavation can temporarily stand with vertical cut slopes as a result of the apparent cohesion from the soil moisture. For excavations greater than 4 feet deep, however, temporary side slopes in the sandy soils of 1½:1 (H:V) or flatter should be maintained or the excavation properly braced or shored. The flatness of the slope will depend upon the type of groundwater control employed. Where groundwater is permitted to seep through the sides of the excavation, temporary side slopes of 2:1 (H:V) or flatter should be maintained for excavations deeper than 4 feet. In areas where groundwater will be more effectively controlled through the use of vacuum wellpoint dewatering systems, temporary excavation side slopes should be cut no steeper than 1½:1 (H:V). The soils encountered within the depths explored by the borings at this site are designated as OHSA soil Type C.

4.3.3 Surface Water Control

The need for surface water runoff control should be anticipated during the site preparation and construction process. Construction areas should be graded to drain stormwater runoff away from the immediate area of preparation. This is particularly important during wetter climatic seasons. Lack of proper controls could result in ponding of surface water in foundation and pavement areas and on compaction surfaces. The ponded water, combined with machine or foot traffic during construction operations or other activities, could disturb otherwise acceptable soils or previously compacted existing soils, causing instability, pumping, and generally unacceptable conditions. The ponded water will also impede or prevent necessary soil compaction operations and make construction trafficability difficult.

4.3.4 Shallow Groundwater Control

The need for significant groundwater control is not anticipated; however, perched groundwater may be encountered if wet climatic conditions exist during foundation construction. If required, groundwater can generally be lowered 1 to 3 feet for short periods by pumping from barrel sumps located in perimeter ditches or pits if gravity drainage cannot be established. All sump inlets should be located outside of the pavement areas to avoid loosening of the fine sandy bearing soils due to upward seepage pressures. Groundwater should be maintained at least 1 foot below the bottom of any excavations made during construction, and 2 feet below the surface of any vibratory compaction operations.

4.3.5 Proofrolling of Exposed Surface Soils

Following stripping operations and documentation of the acceptability of the exposed surface soils by the geotechnical engineer, the proposed construction area should be proofrolled using a loaded dump truck. The purpose of the proofrolling procedure is to delineate (by rutting or excessive permanent deflection) any weak or loose zones created by previous site demolition or excavation operations, which should then be removed and replaced with acceptable compacted structural fill soils. It is noted that relatively clean fine sands are anticipated within the upper 6 to 8 feet of the subsurface profile. Based on this consideration, a significant amount of over-excavation of soft soils is not anticipated.

Proofrolling should be performed, however, to detect any localized areas (between boring locations) where weak or loose soil zones may exist.

Any areas that rut or deflect excessively during the proofrolling process should be removed and replaced with acceptable, compacted structural fill soils. We recommend that a qualified geotechnical engineer or engineering technician working under the direction of a geotechnical engineer observe and document the proofrolling operations.

4.3.6 Surficial Soil Compaction

Following proofrolling, the exposed sandy soils in the construction areas should be compacted with overlapping passes of a moderate weight vibratory drum roller having a total operating static weight (including fuel and water) of at least 5 tons and a drum diameter of 4 feet. A density equivalent to at least 95 percent of the Modified Proctor maximum dry density (ASTM D 1557) should be uniformly obtained to a depth of at least 12 inches below the compacted surface. Regardless of the degree of compaction achieved, a minimum of eight complete coverages should be made in the pavement construction areas with the roller in order to increase the density and improve the uniformity of the underlying sandy soils. The roller coverages should be divided evenly into two perpendicular directions, where possible.

4.3.7 Structural Filling and Backfilling

Structural fill, as required, may be placed in lifts not exceeding 12 inches in loose thickness when using the vibratory roller described previously. If the overlapping tracks of a bulldozer or lightweight vibratory compaction equipment are utilized, then the fill loose lift thickness should be reduced to 6 inches. Each lift should be thoroughly compacted with the compaction equipment until densities equivalent to at least 95 percent of the Modified Proctor maximum dry density are uniformly obtained.

Ideally, structural fill should consist of an inorganic, non-plastic, granular soil containing less than 10 percent material passing the No. 200 mesh sieve (relatively clean sand with a

Unified Soil Classification of SP, SP-SC, or SP-SM). The soils encountered by the borings in the upper approximate 6 feet of the subsurface profile are considered acceptable for reuse as structural fill or backfill, provided they are inorganic. Any soils excavated from below the water table will require stockpile and drying prior to placement to facilitate compaction.

4.3.8 Pavement Subgrade Preparation

Pavement subgrades should be compacted to a density of at least 98 percent of the Modified Proctor maximum dry density to a depth at least 12 inches below the bottom of the pavement base course. The vibratory compaction equipment discussed previously should be used to densify the sandy subgrade soils.

It is generally desirable to maintain the highest normal annual groundwater level at least 18 to 24 inches below the bottom of the pavement base or subbase course depending upon the wheel loads anticipated. Pavement grading design should maintain this minimum separation whenever possible.

4.3.9 Pavement Subgrade Parameters

The acceptable existing near-surface fine sandy soils and recommended structural fill soils can generally achieve a modulus of subgrade reaction (k) value of 250 pci when compacted to 98 percent of the Modified Proctor maximum dry density (ASTM D-1557). These soils, as well as other locally available fine sands and slightly silty fine sands in the Jacksonville area, typically exhibit laboratory bearing ratio (LBR) values on the order of 20 to 30 when compacted to densities equivalent to 98 percent of the Modified Proctor maximum dry density. In general, the fine sandy soils should make fair to good subgrades. Based on our experience with testing of similar soils, we recommend that a LBR value of 25 (corresponding CBR value of 20 and resilient modulus, M_R, value of 8,750 psi) be assigned for design purposes for the 98-percent compaction criteria.

4.4 General Construction Monitoring and Testing Guidelines

Prior to initiating compaction operations, we recommend that representative samples of the structural fill/backfill material to be used and acceptable exposed in-place soils be collected and tested to determine their compaction and classification characteristics. The maximum dry density, optimum moisture content, LBR (or CBR), gradation and plasticity characteristics should be determined. These tests are needed for compaction quality control of the structural fill/backfill material and existing soils and to determine if the fill/backfill material is acceptable.

A representative number of in-place field density tests should be performed in the compacted existing soils and in each lift of structural fill or backfill to confirm that the required degree of compaction has been obtained. Our recommend minimum density testing frequencies are presented in Table 1.

Table 1: Recommended Field Density Test Frequencies

Area	Recommended Minimum Density Test Frequency
Pavement Subgrade Soils	1 test per 10,000 ft^2 in compacted existing soils and in each lift of structural fill or backfill

4.5 Construction Plans and Specifications Review

We recommend that this office be provided the opportunity to make a general review of the 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.

The evaluation of conditions that may be encountered in construction requires engineering judgment and interpretation. For this reason, we recommend that AMEC remain involved with this project during the construction process. If we are not retained during construction, we cannot assume responsibility for misinterpretation of our recommendations, or for unfavorable pavement performance as a result of judgments rendered by others.

APPENDIX

REFERENCE:
ORANGE PARK QUADRANGLE; FLORIDA
TOPOGRAPHIC MAP
DATED: 1994
U.S. GEOLOGICAL SURVEY

VERTICAL DATUM: NGVD 29

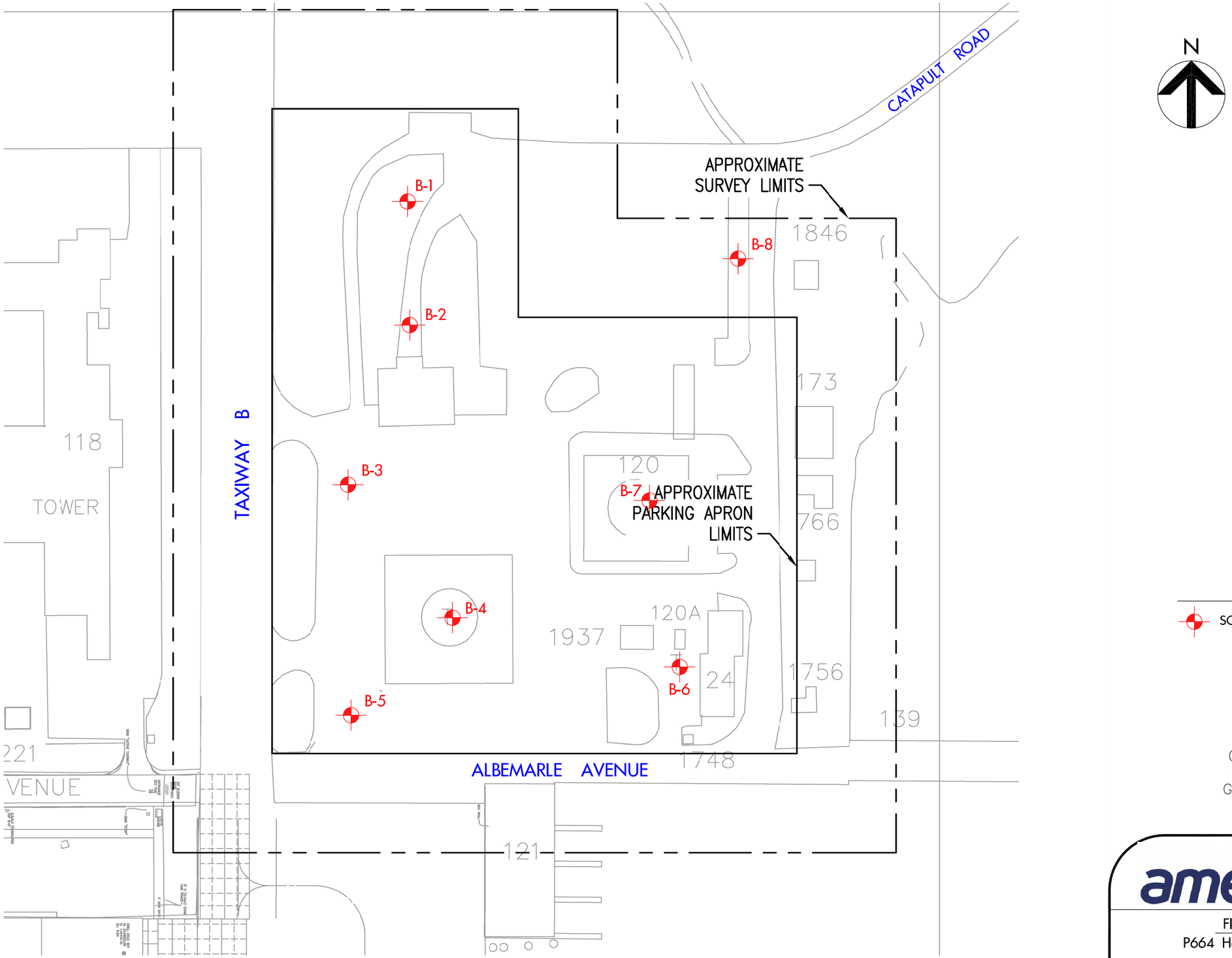
0 1000' 2000'
GRAPHIC SCALE

amec

3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

SITE LOCATION MAP
P664 Helo Parking and Landing Apron
Naval Air Station
Jacksonville, Florida

DRAWN: JP	DATE: 1/24/14	SCALE: 1"=2000'
CHECKED:	PROJ. NO. 6734-12-9688	APPROX.



N

LEGEND

SOIL TEST BORING LOCATION

0 50' 100'

GRAPHIC SCALE

REFERENCE: Scope Plan (Drawing No. C-001)
Prepared by: Burns & McDonnell
Plot Date: August 11, 2012

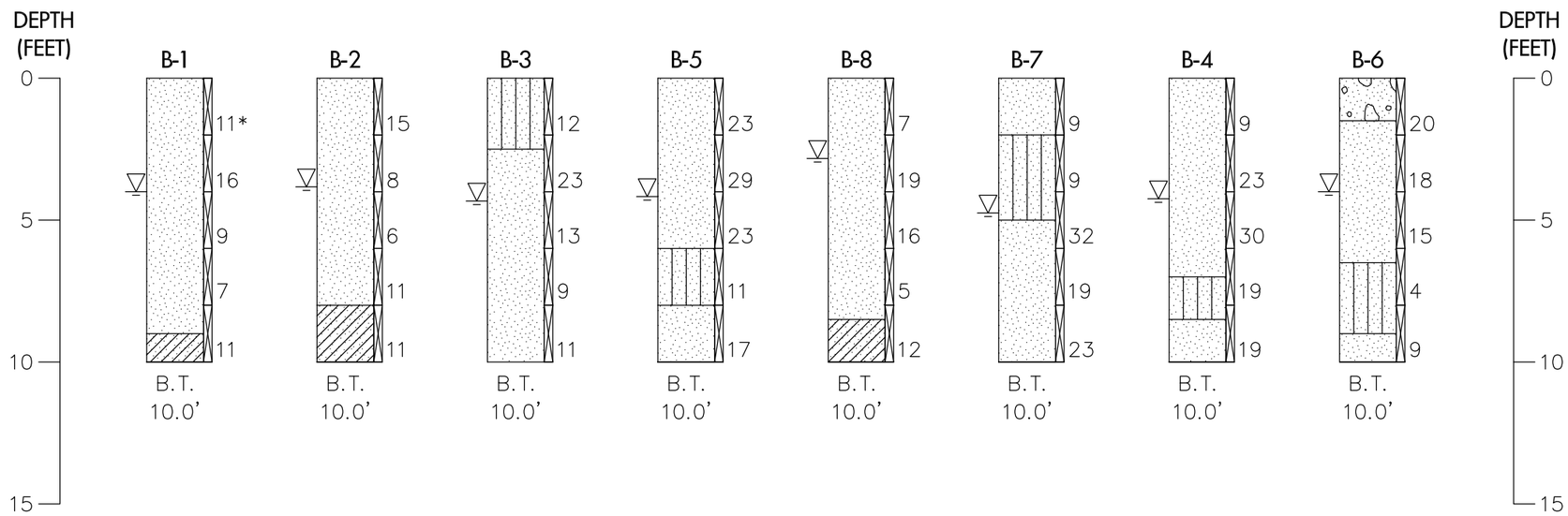
amec

3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

FIELD EXPLORATION PLAN

P664 Helo Parking and Landing Apron
Naval Air Station
Jacksonville, Florida

DRAWN: JP	DATE: 1/24/14	SCALE: 1"=100'
CHECKED:	PROJ. NO. 6734-12-9688	APPROX.



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

LEGEND

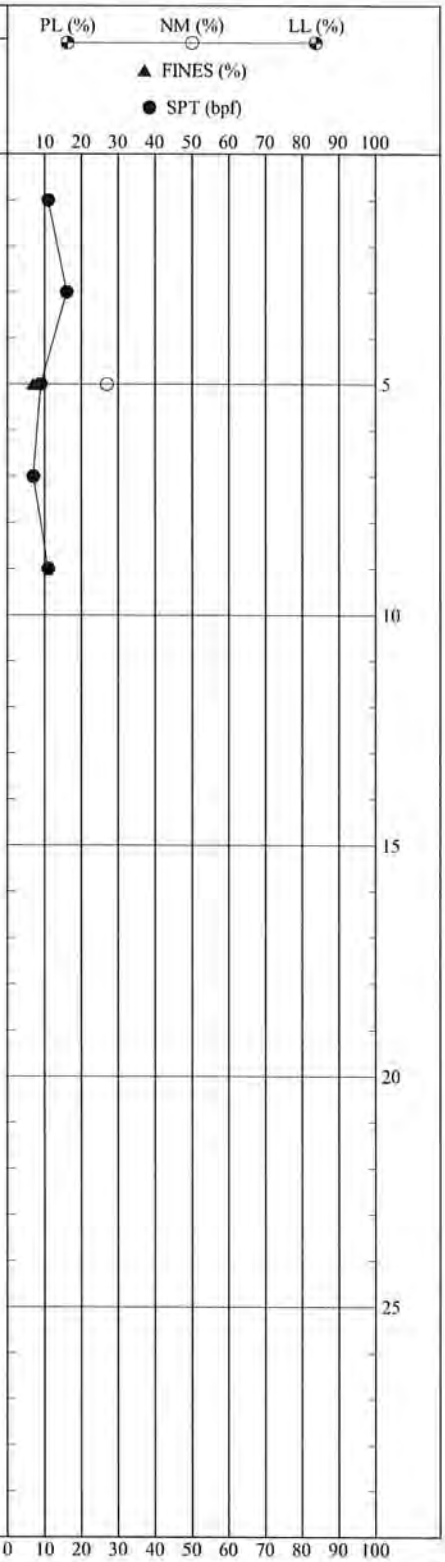
- Fine SAND (SP) With Limerock and Asphalt Fragments
- Fine SAND (SP); Slightly Silty Fine SAND (SP–SM)
- Clayey Fine SAND (SC)
- Silty Fine SAND (SM)
- Standard Penetration Test Sample
- * Standard Penetration Resistance (Blows/ft.) Measured Using a Manual Hammer System
- Groundwater Level @ Time of Drilling
- B.T. Boring Terminated
- 10.0' Depth Terminated

amec
3901 CARMICHAEL AVENUE
JACKSONVILLE, FL 32207
(904) 396-5173

GENERALIZED SUBSURFACE PROFILE
P664 Helo Parking and Landing Apron
Naval Air Station
Jacksonville, Florida

DRAWN: JP	DATE: 1/24/14	SCALE: AS SHOWN
CHECKED:	PROJ. NO. 6734-12-9688	

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	FIRM brown slightly silty fine SAND (SP-SM) with a trace of limerock fragments			SPT-1		3-4-7
	FIRM to LOOSE gray to brown slightly silty fine SAND (SP-SM)			SPT-2		6-8-8
5				SPT-3		5-5-4
				SPT-4		2-3-4
	FIRM gray-brown clayey fine SAND (SC)			SPT-5		5-5-6
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

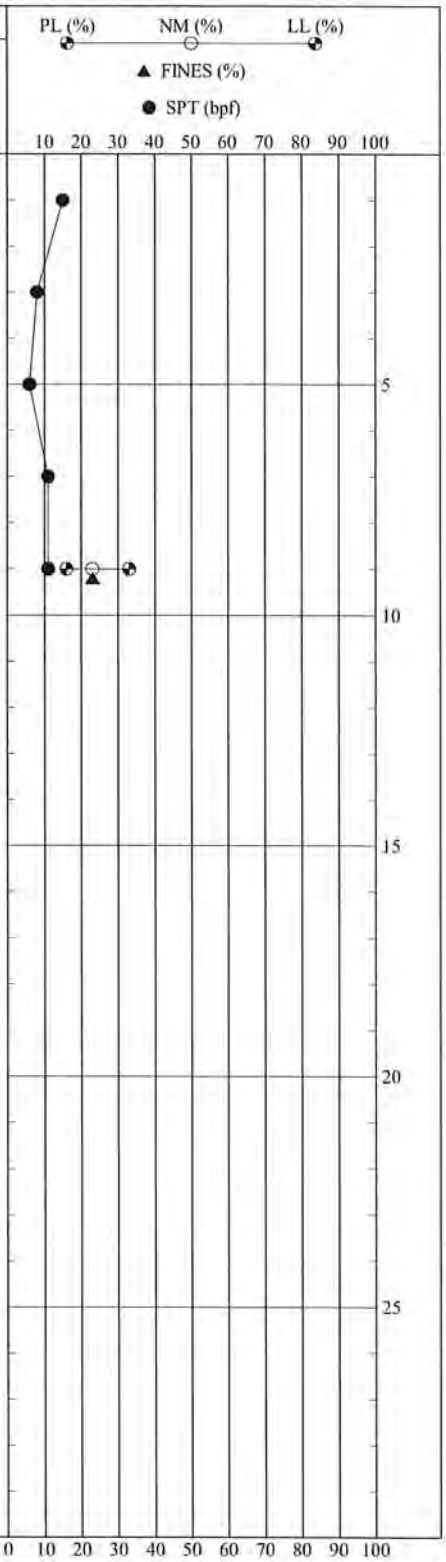
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N:
Coord E:
Drilled: January 9, 2014
Proj. No.: 6734-12-9688
Boring No.: B-1
Checked By: SAS

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	FIRM gray-brown slightly silty fine SAND (SP-SM) with a trace of limerock fragments			SPT-1		4-6-9
	LOOSE gray-brown fine SAND (SP) with a trace of silt			SPT-2		5-5-3
5	LOOSE gray slightly silty fine SAND (SP-SM) with fuel odor			SPT-3		4-3-3
	FIRM brown fine SAND (SP) with fuel odor			SPT-4		4-5-6
	FIRM gray-brown clayey fine SAND (SC)			SPT-5		4-5-6
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

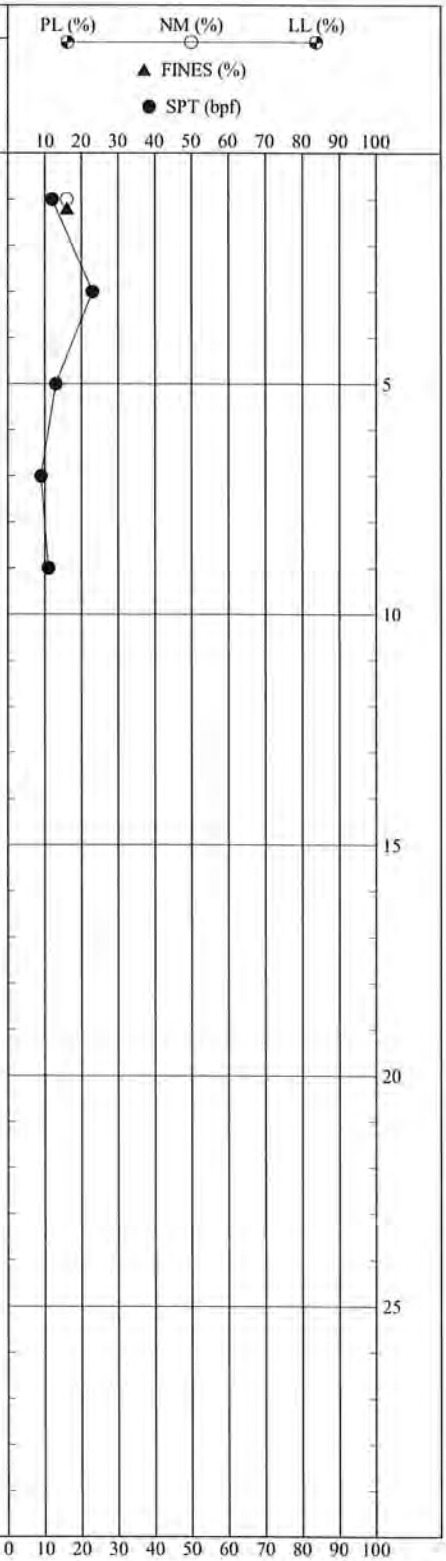
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N: **Boring No.:** B-2
Coord E: **Checked By:** SAS
Drilled: January 9, 2014
Proj. No.: 6734-12-9688

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	FIRM brown silty fine to medium SAND (SM) with a few limerock fragments			SPT-1		5-6-6
	VERY FIRM tan slightly silty fine SAND (SP-SM)			SPT-2		10-11-12
	FIRM to LOOSE gray and brown fine SAND (SP) ▽			SPT-3		5-6-7
5				SPT-4		4-4-5
				SPT-5		6-6-5
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW_GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

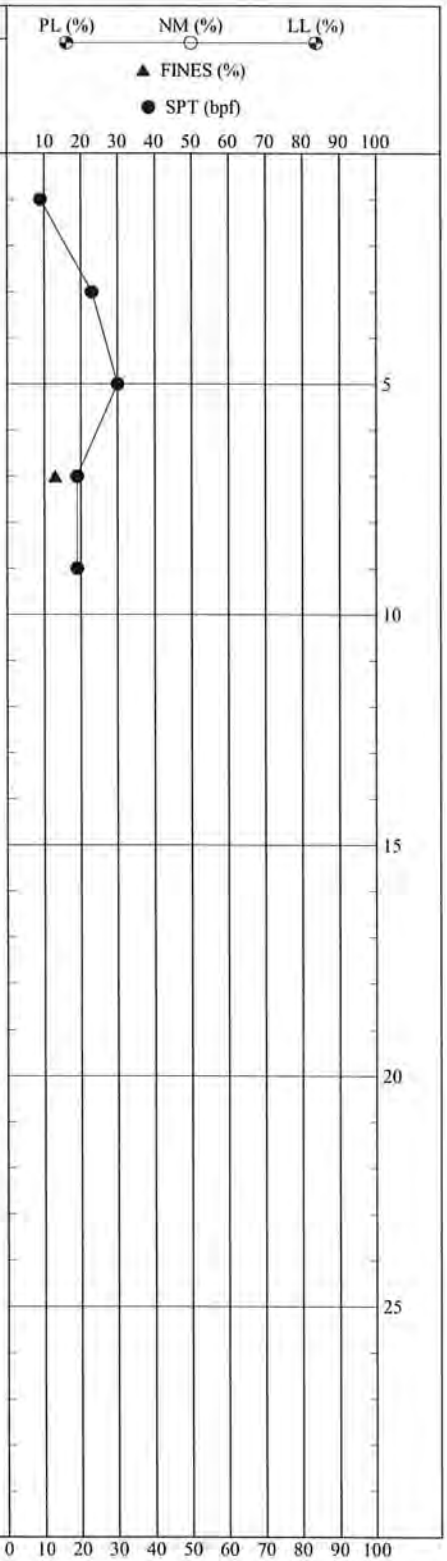
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N: **Boring No.:** B-3
Coord E: **Checked By:** SAS
Drilled: January 9, 2014
Proj. No.: 6734-12-9688

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	LOOSE pale brown fine SAND (SP)			SPT-1		3-4-5
	VERY FIRM to DENSE pale brown, brown, and gray fine SAND (SP)			SPT-2		7-11-12
5				SPT-3		15-15-15
	VERY FIRM gray-brown silty fine SAND (SM)			SPT-4		7-8-11
	VERY FIRM brown fine SAND (SP)			SPT-5		8-11-8
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW_GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

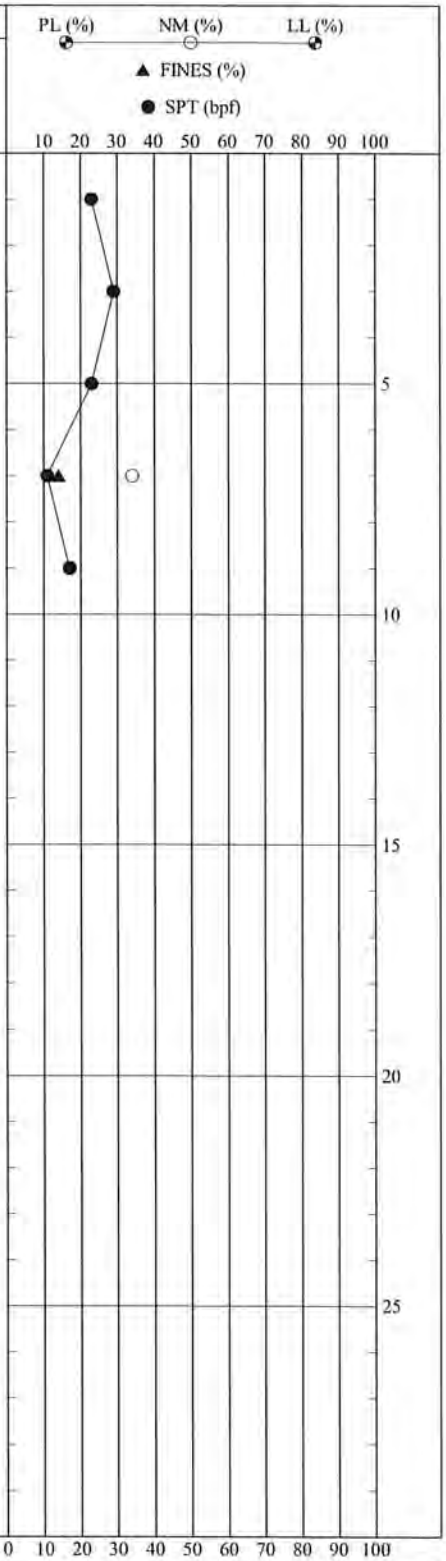
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N:
Coord E:
Drilled: January 9, 2014
Proj. No.: 6734-12-9688
Boring No.: B-4
Checked By: SPB

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	VERY FIRM pale brown, tan, and gray-brown fine SAND (SP)			SPT-1		2-8-15
				SPT-2		12-14-15
5				SPT-3		7-9-14
	FIRM dark gray silty fine SAND (SM) with a large tree root			SPT-4		6-4-7
	FIRM gray fine SAND (SP)			SPT-5		8-9-8
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

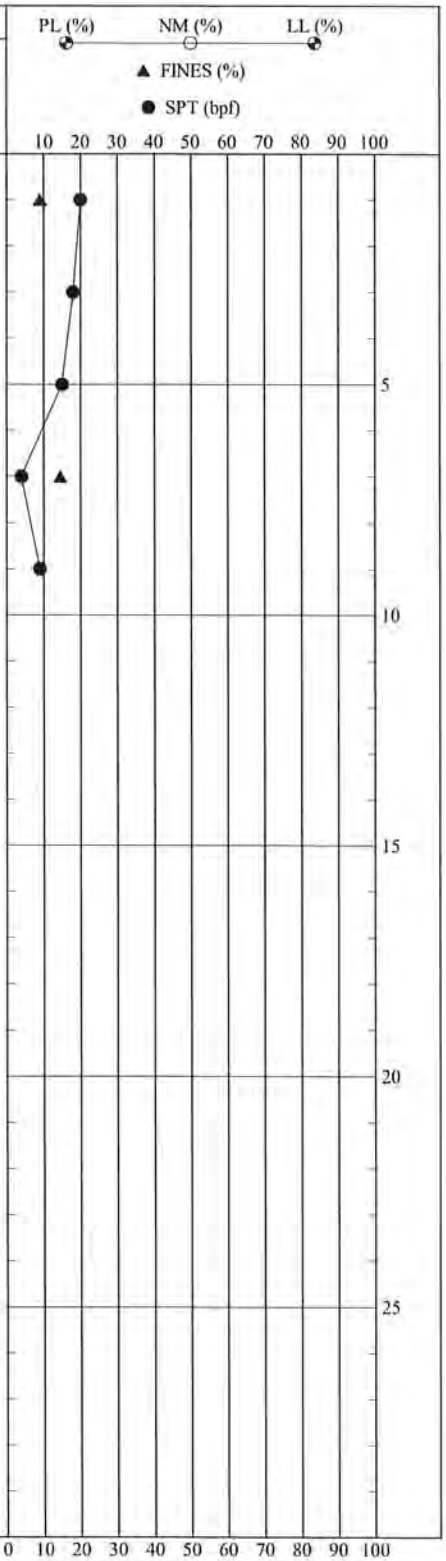
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N: **Boring No.:** B-5
Coord E: **Checked By:** SB
Drilled: January 9, 2014
Proj. No.: 6734-12-9688

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	FIRM brown slightly silty fine SAND (SP-SM) with many limerock fragments and asphaltic concrete			SPT-1		2-7-13
	FIRM light gray to gray fine SAND (SP)			SPT-2		8-8-10
5				SPT-3		8-8-7
	VERY LOOSE dark brown silty fine SAND (SM)			SPT-4		3-1-3
	LOOSE brown fine SAND (SP) with a trace of silt			SPT-5		4-4-5
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW_GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

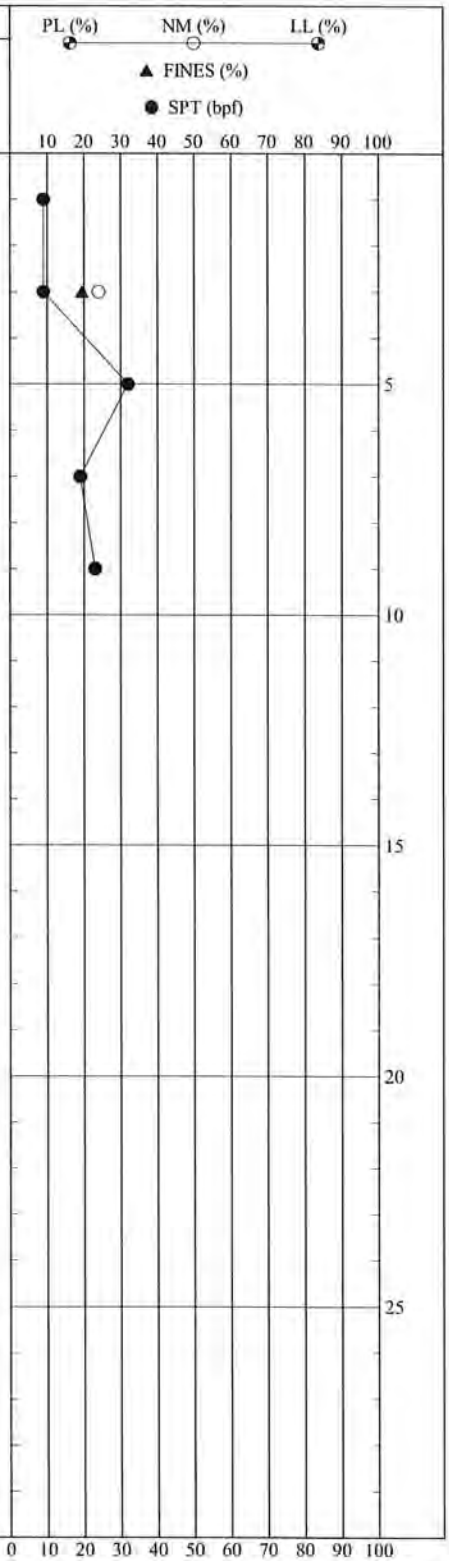
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N:
Coord E:
Drilled: January 9, 2014
Proj. No.: 6734-12-9688
Boring No.: B-6
Checked By: SAS

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	LOOSE light brown fine SAND (SP)			SPT-1		1-3-6
	LOOSE gray silty fine SAND (SM)			SPT-2		4-4-5
5	DENSE gray fine SAND (SP) with a trace of silt and a fuel odor			SPT-3		10-11-21
	FIRM gray slightly silty fine SAND (SP-SM) with fuel odor			SPT-4		9-9-10
	VERY FIRM gray-brown fine SAND (SP)			SPT-5		9-11-12
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Drilling & Testing
DRILLER: Stefan/Marshall
EQUIPMENT: Manual Hammer
METHOD: Auger/Mud Rotary
HOLE DIA.: 4"
REMARKS:

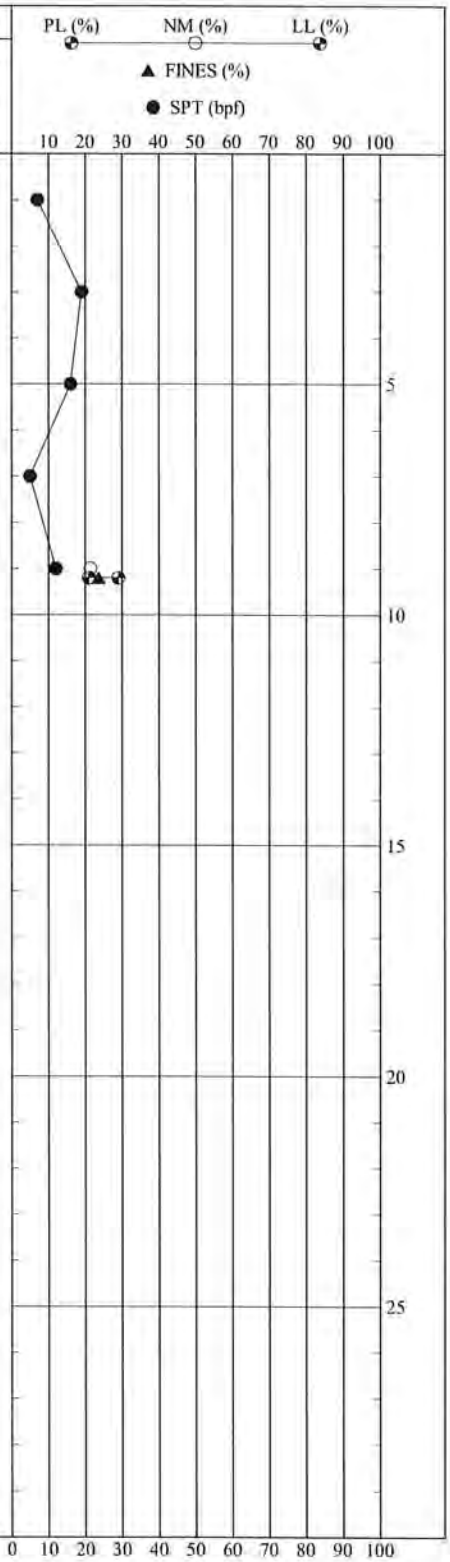
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: P664 Helo Parking and Landing Apron
Coord N:
Coord E:
Drilled: January 9, 2014
Proj. No.: 6734-12-9688
Boring No.: B-7
Checked By: GAS

amec

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6" 2nd 6" 3rd 6"
0	LOOSE gray-brown slightly silty fine SAND (SP-SM) with a few limerock fragments			SPT-1		1-2-5
	FIRM brown fine SAND (SP) with a trace of silt			SPT-2		4-8-11
	FIRM to LOOSE brown fine SAND (SP)			SPT-3		7-7-9
5				SPT-4		6-3-2
	FIRM gray-brown and red clayey fine SAND (SC)			SPT-5		4-5-7
10	BORING TERMINATED					
15						
20						
25						
30						



SOIL 9688-01LOGS.GPJ LAW_GIBB.GDT 2/14/14

CONTRACTOR: TransAmerican Testing & Drilling
DRILLER: Stefan/Marshall
EQUIPMENT: 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: P664 Helo Parking and Landing Apron
Coord N:
Coord E:
Drilled: January 9, 2014
Proj. No.: 6734-12-9688
Boring No.: B-8
Checked By: CAS

amec

SUMMARY OF LABORATORY TEST RESULTS

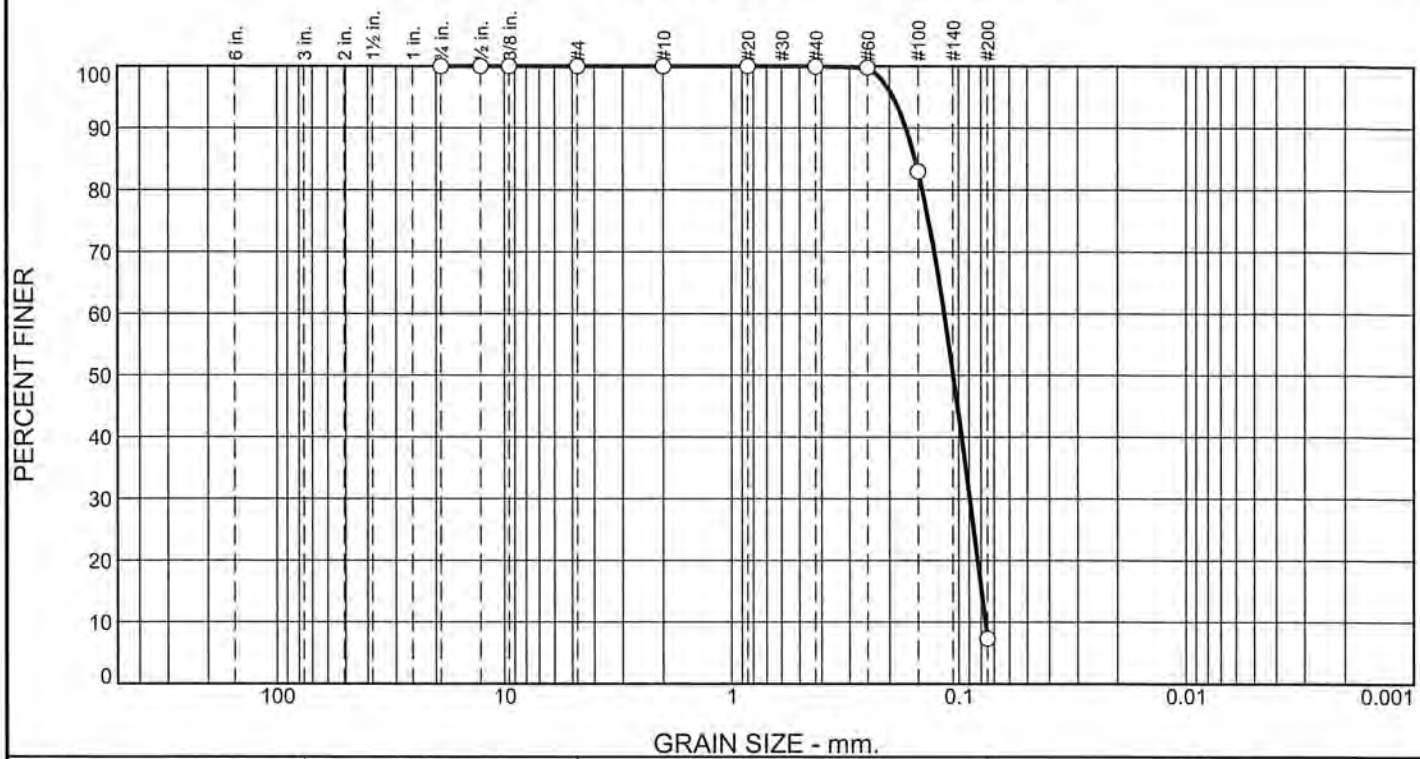
P664 Helo Parking and Landing Apron
Naval Air Station Jacksonville
Jacksonville, Florida

Boring No.	SPT Sample No.	Depth Range (feet)	Unified Soil Classification System Symbol	Water Content W_n (%)	Liquid Limit LL (%)	Plastic Limit PL (%)	Plasticity Index PI (%)	Liquidity Index LI	Specific Gravity G_s	Optimum Moisture (%)	Max. Dry Density (pcf)	Grain Size		
												Gravel (%)	Sand (%)	Fines (%)
B-1	3	4.0 / 6.0	SP-SM	27.3								0.0	92.7	7.3
B-2	Bulk	1.5 / 2.5	SM							11.7	114	2.3	78.7	19.0
B-2	5	8.0 / 10.0	SC	22.9	33	16	17	0.4				0.0	77.1	22.9
B-3	1	0.0 / 2.0	SM	15.5								5.2	78.8	16.0
B-4	Bulk	1.5 / 2.5	SP-SM							14.5	102.6	0.0	95.0	5.0
B-4	4	6.0 / 8.0	SM									0.0	86.7	13.3
B-5	4	6.0 / 8.0	SM	34.1								0.0	86.1	13.5
B-6	1	0.0 / 2.0	SP-SM									28.2	63.2	8.6
B-6	4	6.0 / 8.0	SM									0.0	85.5	14.5
B-7	Bulk	1.5 / 2.5	SP							16.4	100.4	0.0	96.3	3.7
B-7	2	2.0 / 4.0	SM	23.9								1.6	78.9	19.5
B-8	5	8.0 / 10.0	SC	21.4	29	21	8	0.1				0.0	76.4	23.6

AMEC Environment & Infrastructure, Inc. Jacksonville, Florida	AMEC Project No. 6734-12-9699	Table No. 1 of 1

Reviewed by: MBW
Date: 2/14/14

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	92.6	7.3	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.8		
#100	83.0		
#200	7.3		

* (no specification provided)

Material Description

Brow-Gray Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

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

Coefficients

D_{90}= 0.1694 D_{85}= 0.1547 D_{60}= 0.1156
D_{50}= 0.1056 D_{30}= 0.0895 D_{15}= 0.0796
D_{10}= 0.0766 C_u= 1.51 C_c= 0.90

Remarks

Moisture Content: 27.3%

Date Received: 1/17/14 **Date Tested:** 1/24/14
Tested By: CM
Checked By: SAS
Title: Senior Geotechnial Engineer

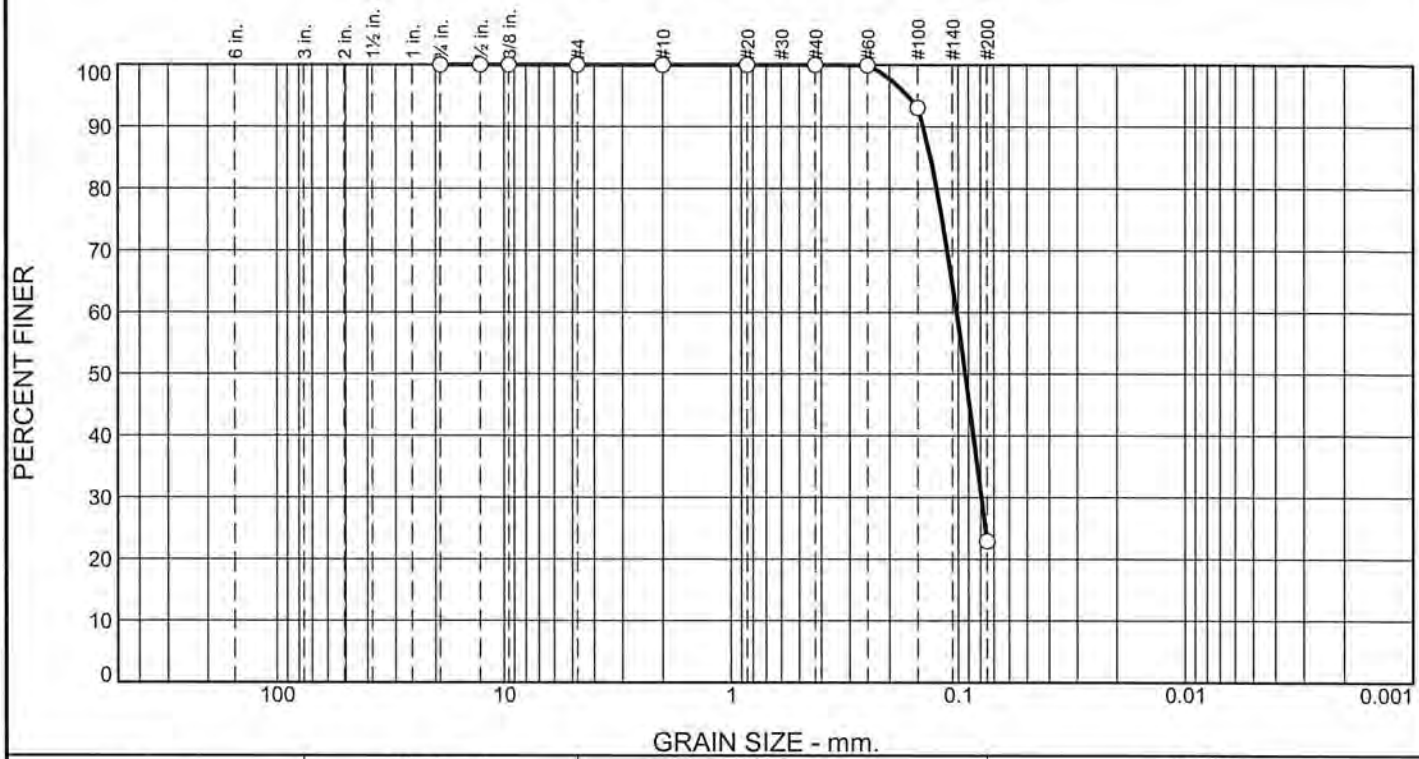
Source of Sample: B-1 **Depth:** 4.0'- 6.0' **Date Sampled:**
Sample Number: 3

AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad
Project No: 6734129688 **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	77.1	22.9	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.9		
#100	93.1		
#200	22.9		

* (no specification provided)

Material Description

Grey-Brown Clayey Fine SAND

Atterberg Limits (ASTM D 4318)

PL= 16 **LL=** 33 **PI=** 17

Classification

USCS (D 2487)= SC **AASHTO (M 145)=** A-2-6(1)

Coefficients

D_{90}= 0.1420 D_{85}= 0.1320 D_{60}= 0.1016
D_{50}= 0.0932 D_{30}= 0.0793 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content: 22.9%

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-2 **Depth:** 8.0'- 10.0' **Date Sampled:**
Sample Number: 5

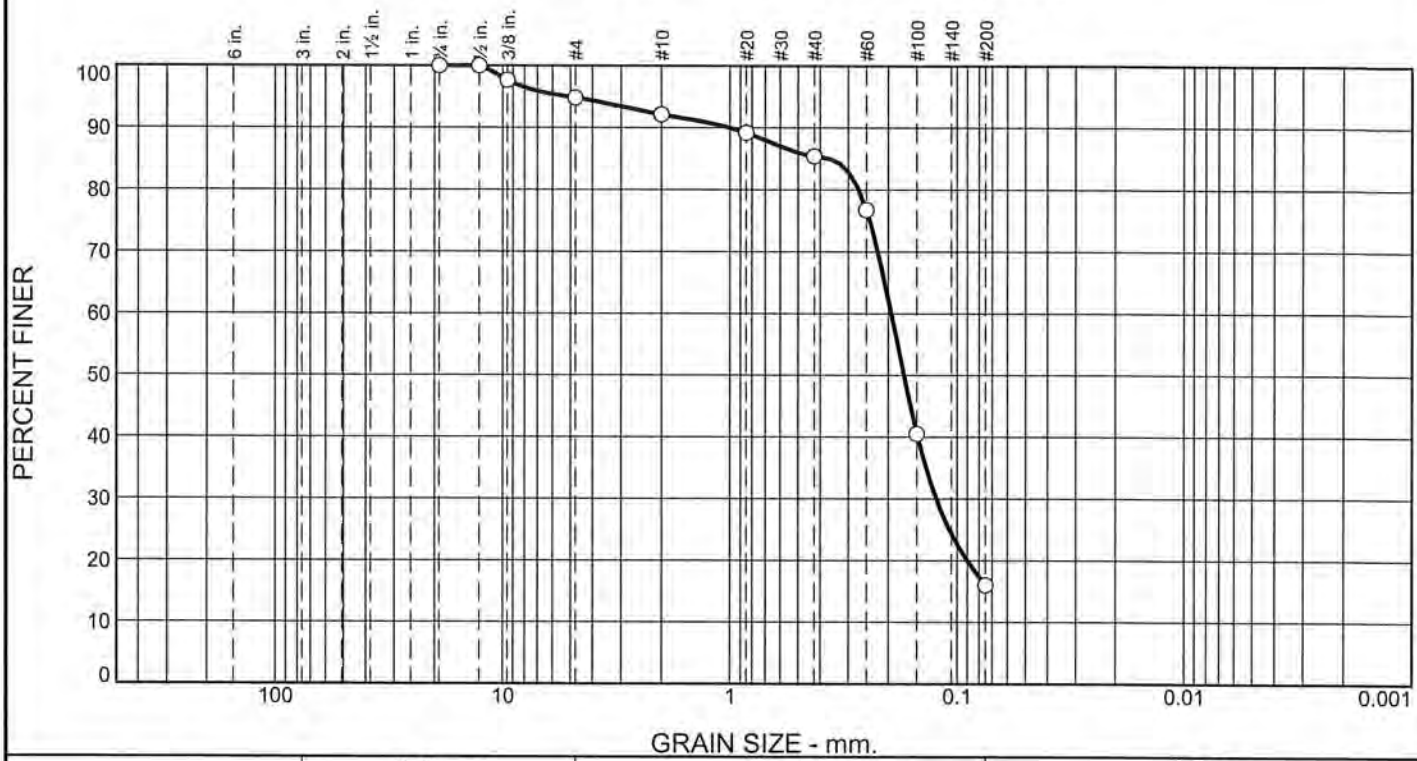
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.2	2.7	6.7	69.4	16.0	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	97.6		
#4	94.8		
#10	92.1		
#20	89.2		
#40	85.4		
#60	76.7		
#100	40.5		
#200	16.0		

* (no specification provided)

Material Description

Brown Silty Fine to Medium SAND with a Few Limerock Fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4

Coefficients

D_{90}= 1.0062 D_{85}= 0.3632 D_{60}= 0.1944
D_{50}= 0.1711 D_{30}= 0.1233 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content: 15.5%

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-3 **Depth:** 0.0'- 2.0' **Date Sampled:**
Sample Number: 1

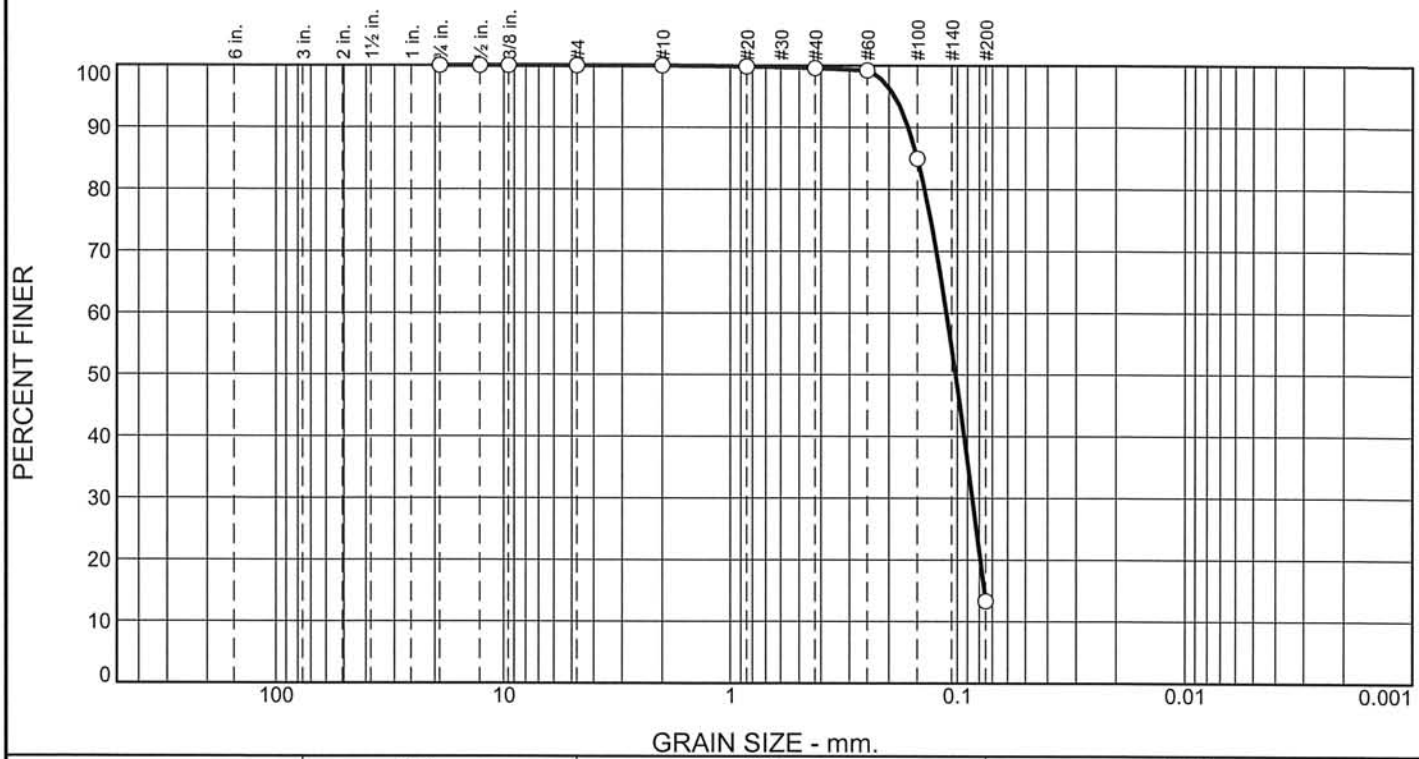
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	86.3	13.3	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.6		
#60	99.2		
#100	85.0		
#200	13.3		

* (no specification provided)

Material Description

Gray-Brown Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4

Coefficients

D_{90}= 0.1648 D_{85}= 0.1501 D_{60}= 0.1116
D_{50}= 0.1018 D_{30}= 0.0858 D_{15}= 0.0760
D_{10}= C_u= C_c=

Remarks

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-4 **Depth:** 6.0'- 8.0'
Sample Number: 4

Date Sampled:

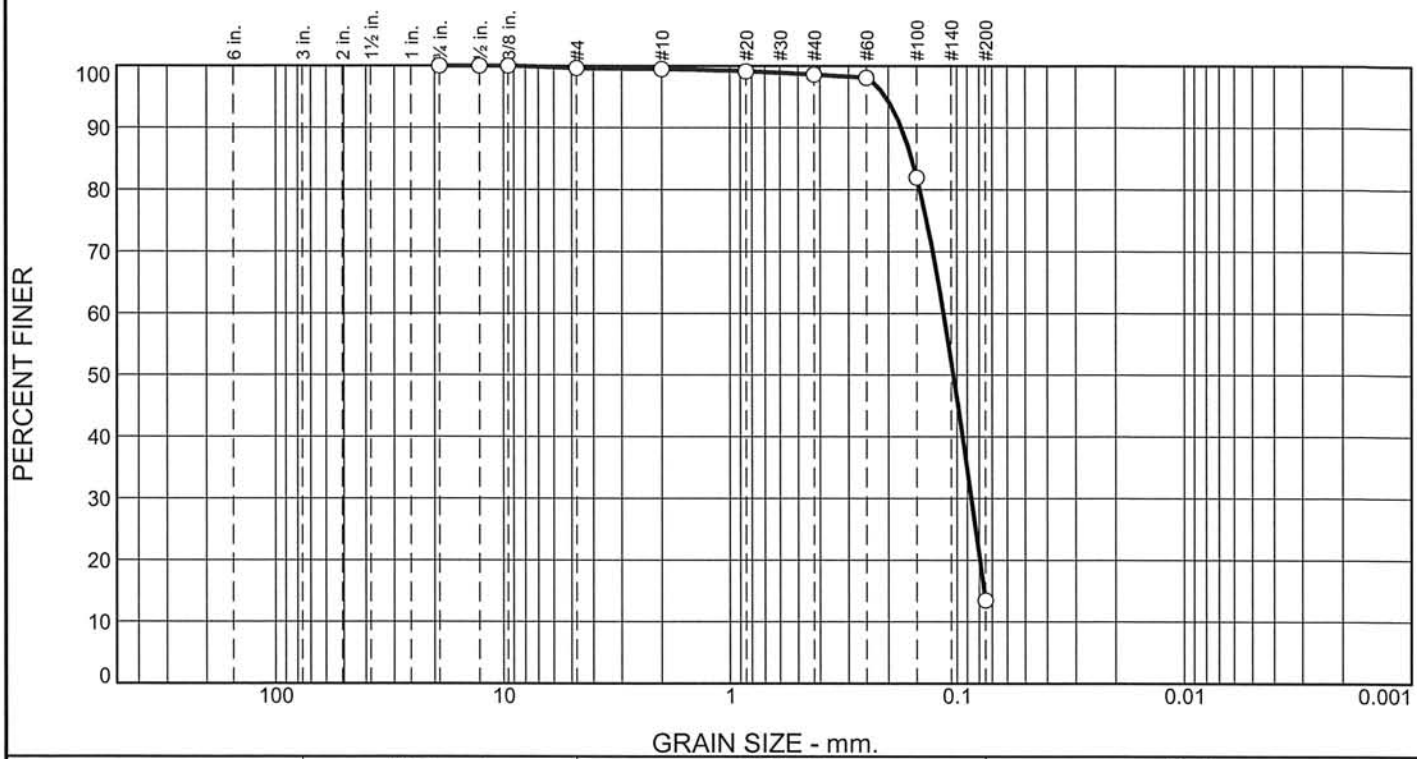
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.1	0.9	85.1	13.5	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	99.6		
#10	99.5		
#20	99.1		
#40	98.6		
#60	98.1		
#100	82.0		
#200	13.5		

* (no specification provided)

Material Description

Dark Gray Silty Fine SAND with a Trace of Roots

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4

Coefficients

D_{90}= 0.1755 D_{85}= 0.1580 D_{60}= 0.1144
D_{50}= 0.1036 D_{30}= 0.0865 D_{15}= 0.0760
D_{10}= C_u= C_c=

Remarks

Moisture Content: 34.1%

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-5 **Depth:** 6.0'- 8.0' **Date Sampled:**
Sample Number: 4

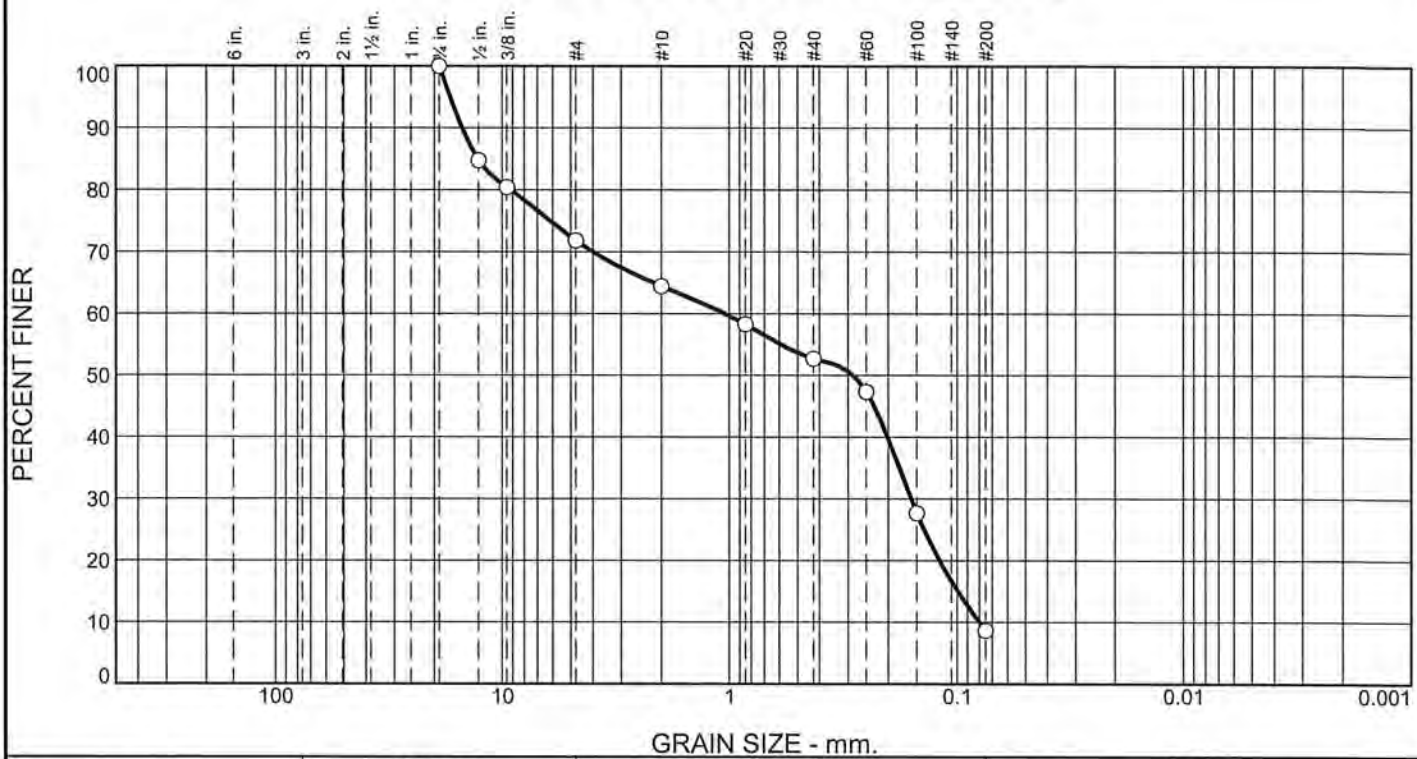
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	28.2	7.4	11.7	44.1	8.6	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	84.7		
3/8	80.4		
#4	71.8		
#10	64.4		
#20	58.3		
#40	52.7		
#60	47.3		
#100	27.7		
#200	8.6		

* (no specification provided)

Material Description

Brown Slightly Silty Fine SAND w/ many Limerock and Asphalt Fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

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

Coefficients

D_{90}= 15.0210 D_{85}= 12.8371 D_{60}= 1.0490
D_{50}= 0.2858 D_{30}= 0.1590 D_{15}= 0.0991
D_{10}= 0.0798 C_u= 13.14 C_c= 0.30

Remarks

Date Received: 1/17/14 **Date Tested:** 2/3/14
Tested By: CM
Checked By: SAS
Title: Senior Geotechnial Engineer

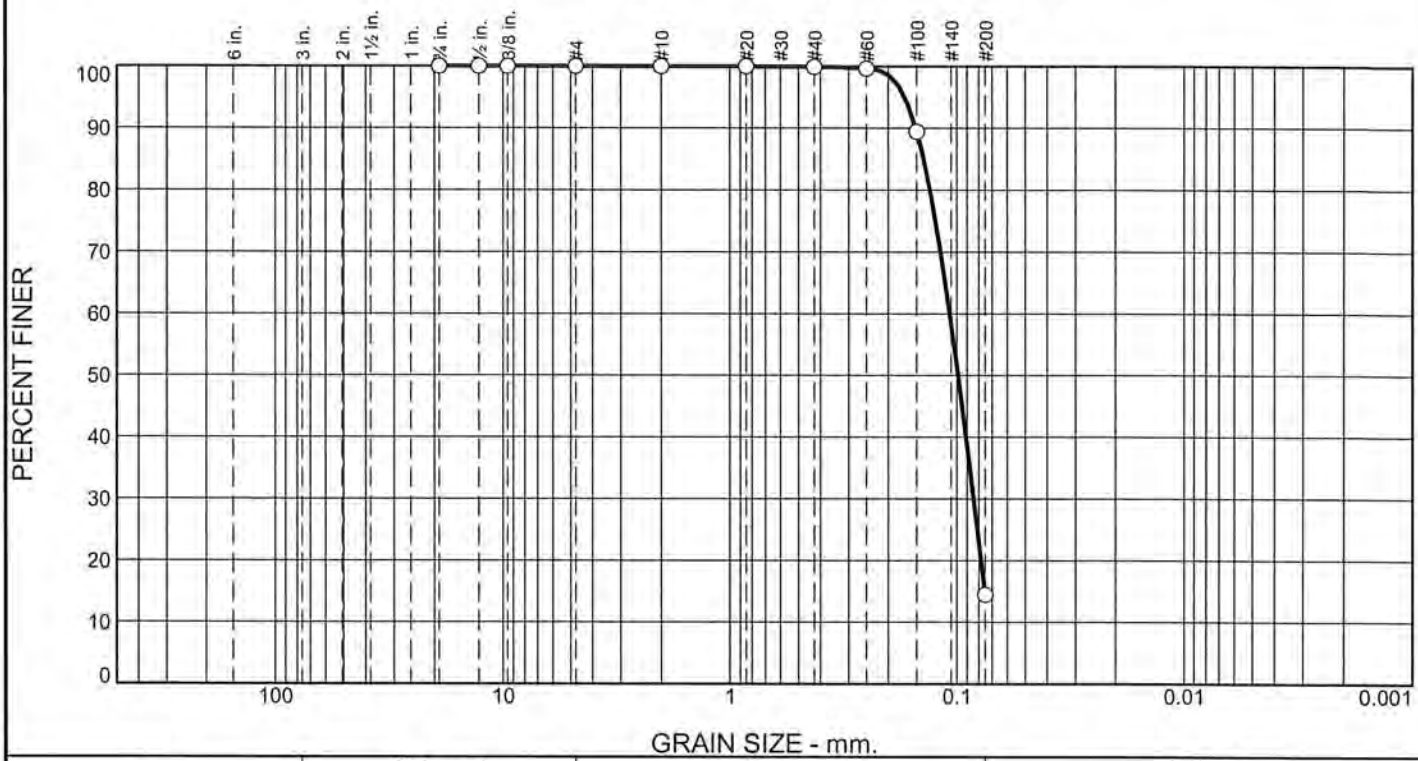
Source of Sample: B-6 **Depth:** 0.0'-2.0' **Date Sampled:**
Sample Number: 1

AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad
Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	85.4	14.5	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.6		
#100	89.4		
#200	14.5		

* (no specification provided)

Material Description

Dark Brown Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NP **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4

Coefficients

D_{90}= 0.1515 D_{85}= 0.1401 D_{60}= 0.1074
D_{50}= 0.0987 D_{30}= 0.0843 D_{15}= 0.0753
D_{10}= C_u= C_c=

Remarks

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-6 **Depth:** 6.0'- 8.0'
Sample Number: 4 **Date Sampled:**

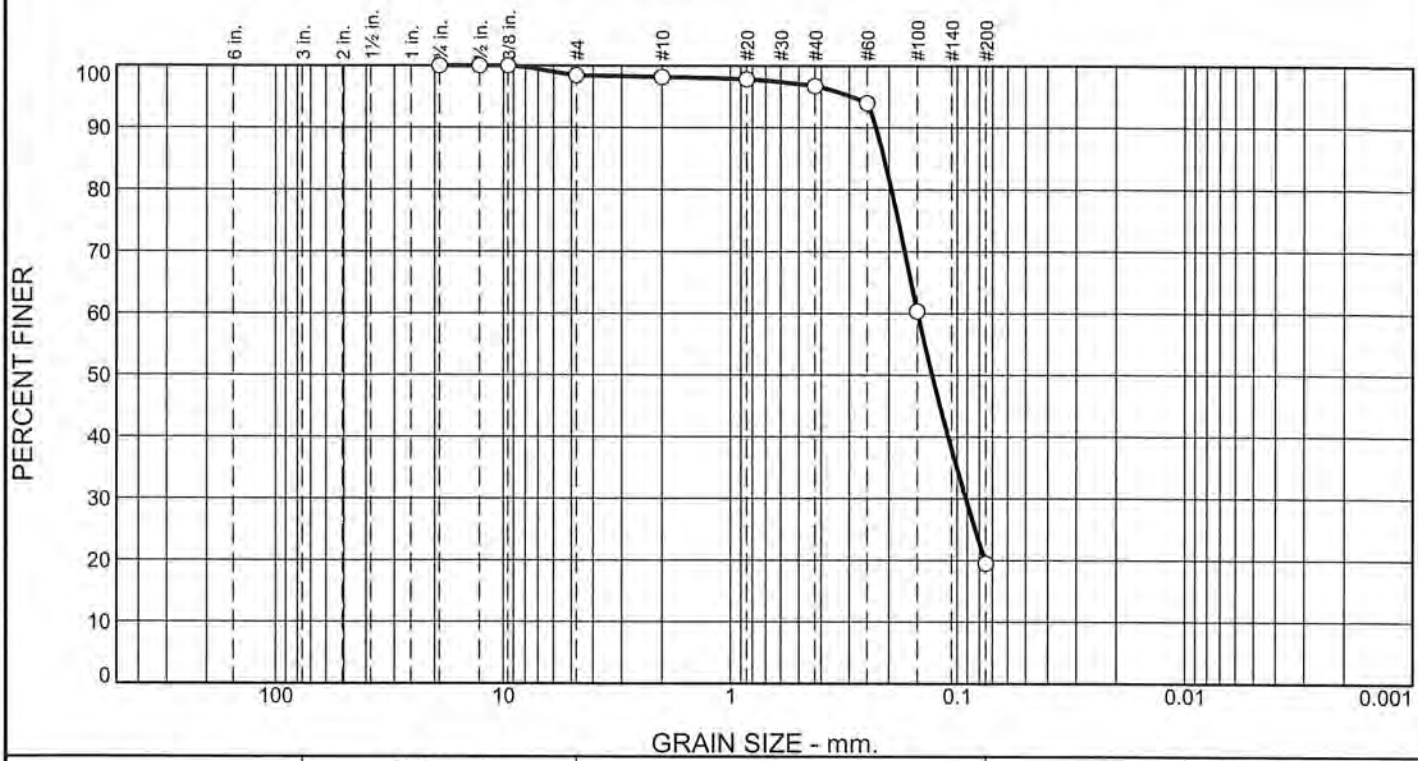
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.6	0.2	1.5	77.2	19.5	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	98.4		
#10	98.2		
#20	97.8		
#40	96.7		
#60	94.0		
#100	60.3		
#200	19.5		

* (no specification provided)

Material Description

Grey Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4

Coefficients

D_{90}= 0.2288 D_{85}= 0.2101 D_{60}= 0.1493
D_{50}= 0.1290 D_{30}= 0.0916 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content: 23.9%

Date Received: 1/17/14 **Date Tested:** 1/27/14
Tested By: CM
Checked By: SAS
Title: Senior Geotechnial Engineer

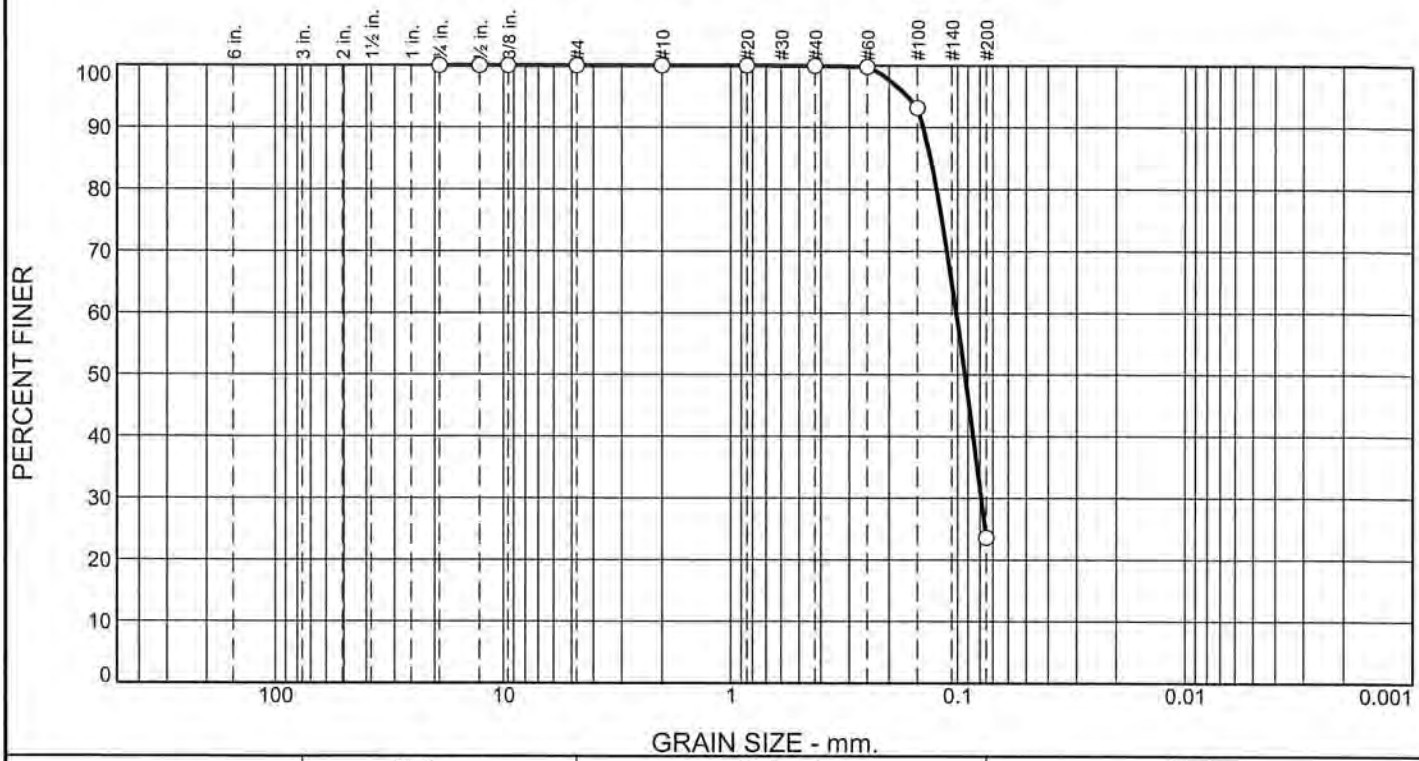
Source of Sample: B-7 **Depth:** 2.0'- 4.0' **Date Sampled:**
Sample Number: 2

AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad
Project No: 6734129688 **Figure**

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	76.3	23.6	

Test Results (D-6913 & D-1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
1/2	100.0		
3/8	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.8		
#100	93.2		
#200	23.6		

* (no specification provided)

Material Description

Gray-Brown and Red Clayey Fine SAND

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 29 **PI=** 8

Classification

USCS (D 2487)= SC **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.1416 D_{85}= 0.1316 D_{60}= 0.1013
D_{50}= 0.0929 D_{30}= 0.0789 D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content: 21.4%

Date Received: 1/17/14 **Date Tested:** 1/27/14

Tested By: CM

Checked By: SAS

Title: Senior Geotechnial Engineer

Source of Sample: B-8 **Depth:** 8.0'- 10.0' **Date Sampled:**
Sample Number: 5

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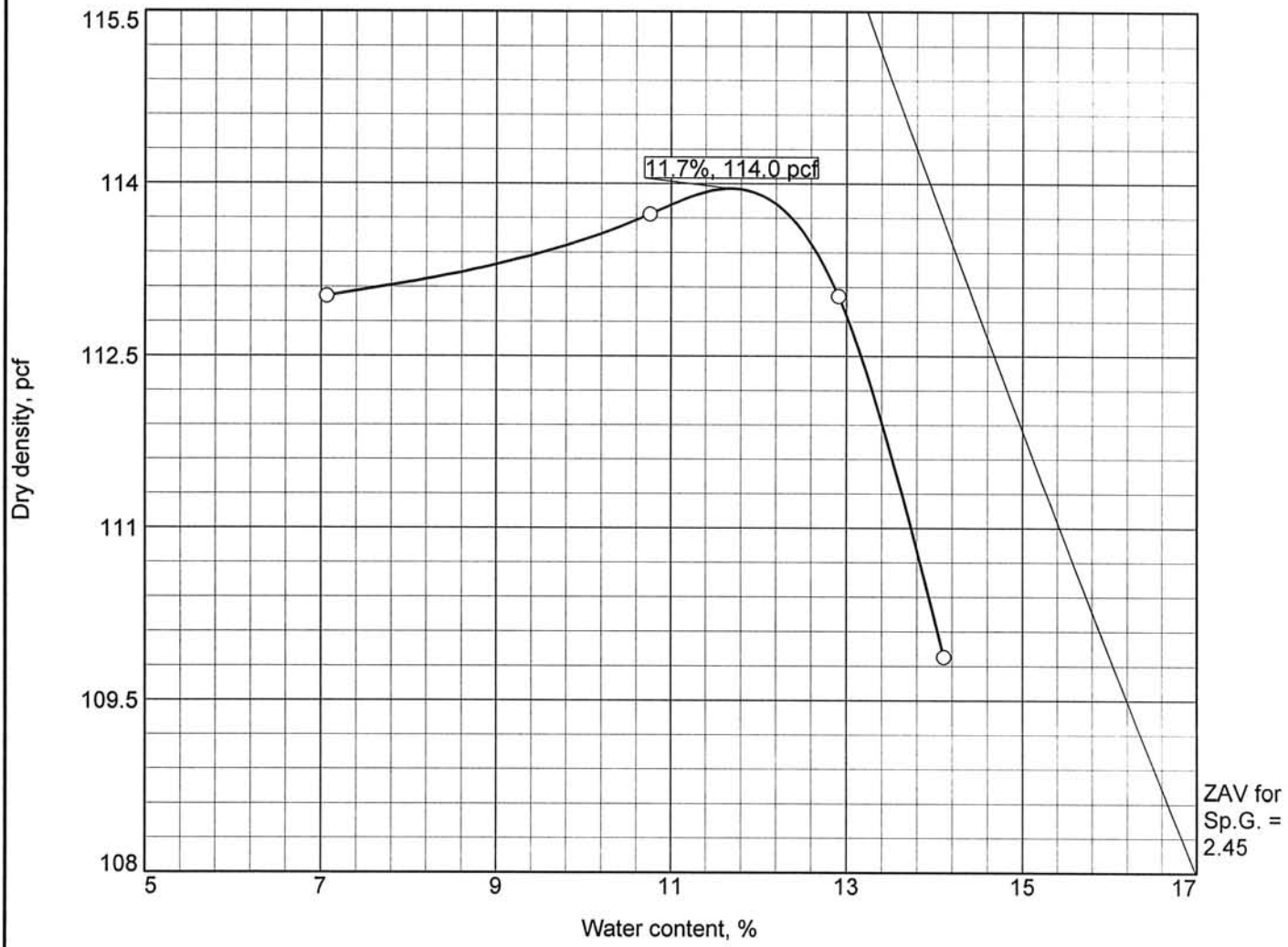
Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
1.5'- 2.5'	SM	A-2-4(0)			NP	NP	0.9	19.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 114.0 pcf Optimum moisture = 11.7 %	Brown Gray Silty Fine SAND

Project No. 6734129688 **Client:** Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

○ **Source of Sample:** B-2

Remarks:

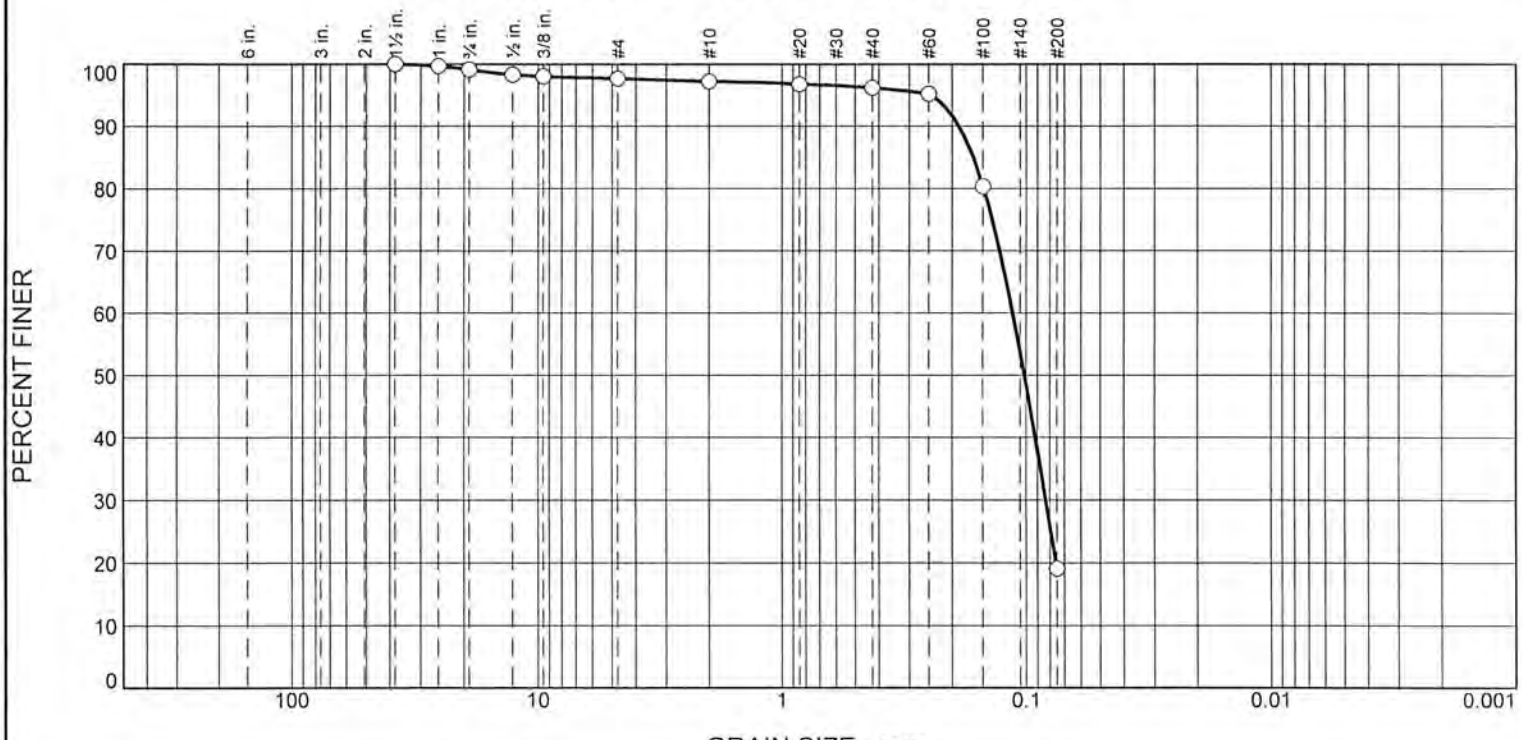
AMEC E&I

Jacksonville, Florida

Figure

Tested By: CM

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.9	1.4	0.4	1.1	77.2	19.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1.0	99.7		
3/4	99.1		
1/2	98.3		
3/8	98.0		
#4	97.7		
#10	97.3		
#20	96.8		
#40	96.2		
#60	95.2		
#100	80.4		
#200	19.0		

* (no specification provided)

Material Description

Brown-Gray Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.1881 D_{85}= 0.1643 D_{60}= 0.1135
D_{50}= 0.1018 D_{30}= 0.0833 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/14/14 **Date Tested:** 1/22/14

Tested By: CM

Checked By: SAS

Title:

Source of Sample: B-2 (Existing Material) **Depth:** 1.5'- 2.5' **Date Sampled:** 1/10/14

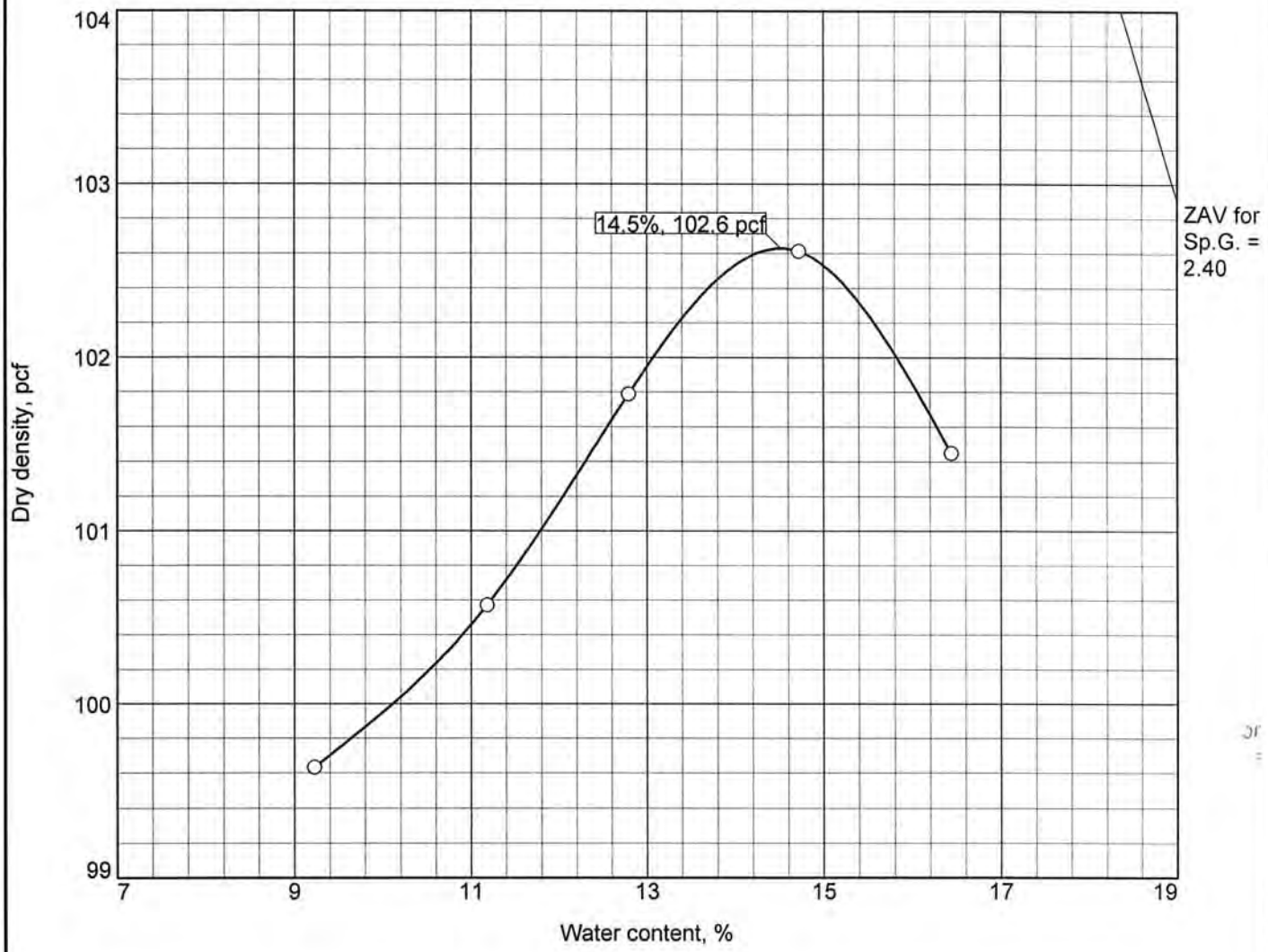
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

COMPACTION TEST REPORT



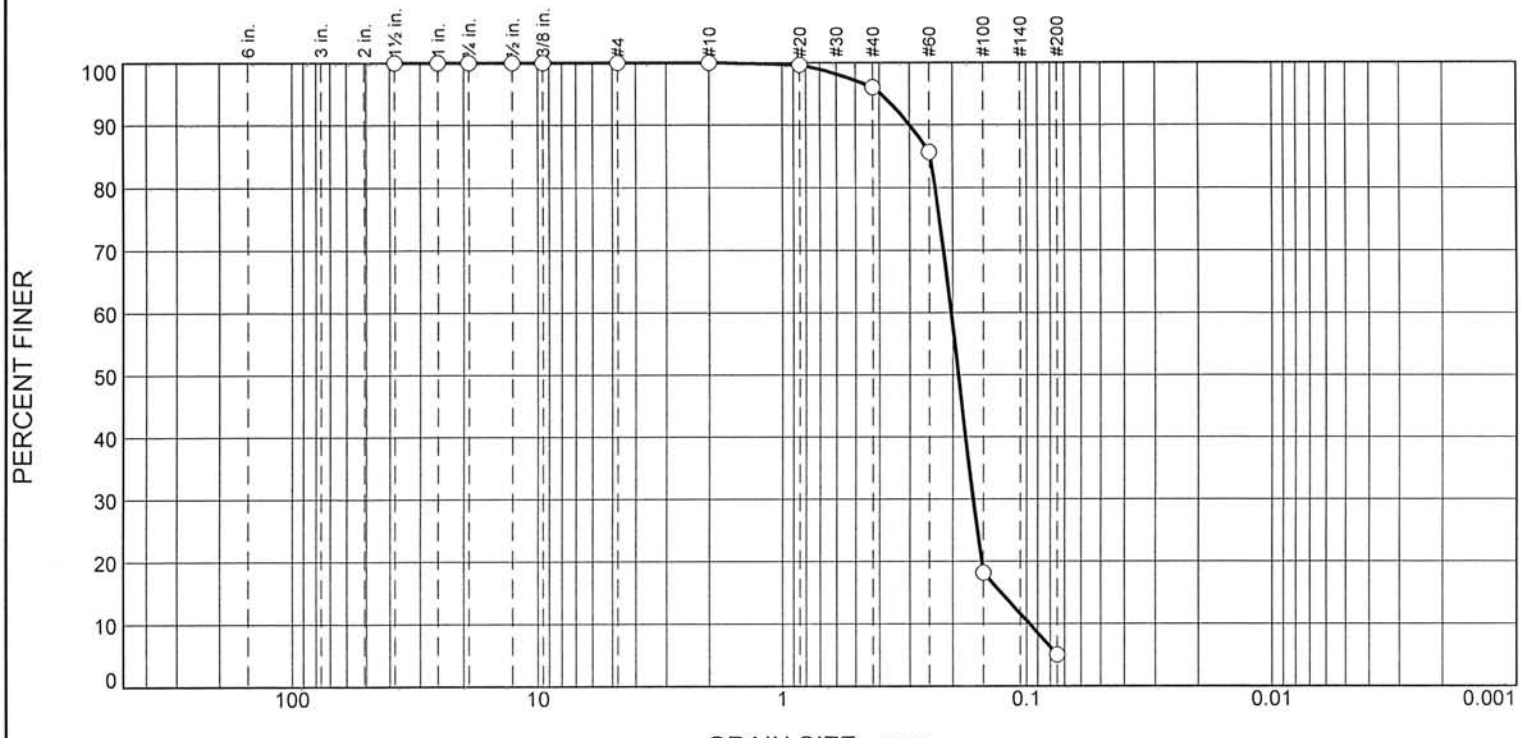
Test specification: ASTM D 1557-07 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
6.0'- 8.0'	SM	A-2-4					0.0	13.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 102.6 pcf Optimum moisture = 14.5 %	Gray-Brown Silty Fine SAND
Project No. 6734129688 **Client:** Burns & McDonnell **Project:** P664 Helo Parking & Landing Pad ○ **Source of Sample:** B-4 **Sample Number:**	**Remarks:**
AMEC E&I **Jacksonville, Florida**	**Figure**

Tested By: CM **Checked By:** SAS

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	4.0	91.0	5.0	

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	100.0		
#20	99.6		
#40	96.0		
#60	85.7		
#100	18.1		
#200	5.0		

* (no specification provided)

Material Description

Brown Slightly Silty Fine SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

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

Coefficients

D_{90}= 0.3002 D_{85}= 0.2482 D_{60}= 0.2032
D_{50}= 0.1900 D_{30}= 0.1654 D_{15}= 0.1272
D_{10}= 0.0976 C_u= 2.08 C_c= 1.38

Remarks

Date Received: 1/14/14 **Date Tested:** 1/22/14

Tested By: CM

Checked By: SAS

Title:

Source of Sample: B-4 (Existing Soil) **Depth:** 1.5'- 2.5' **Date Sampled:** 1/10/14

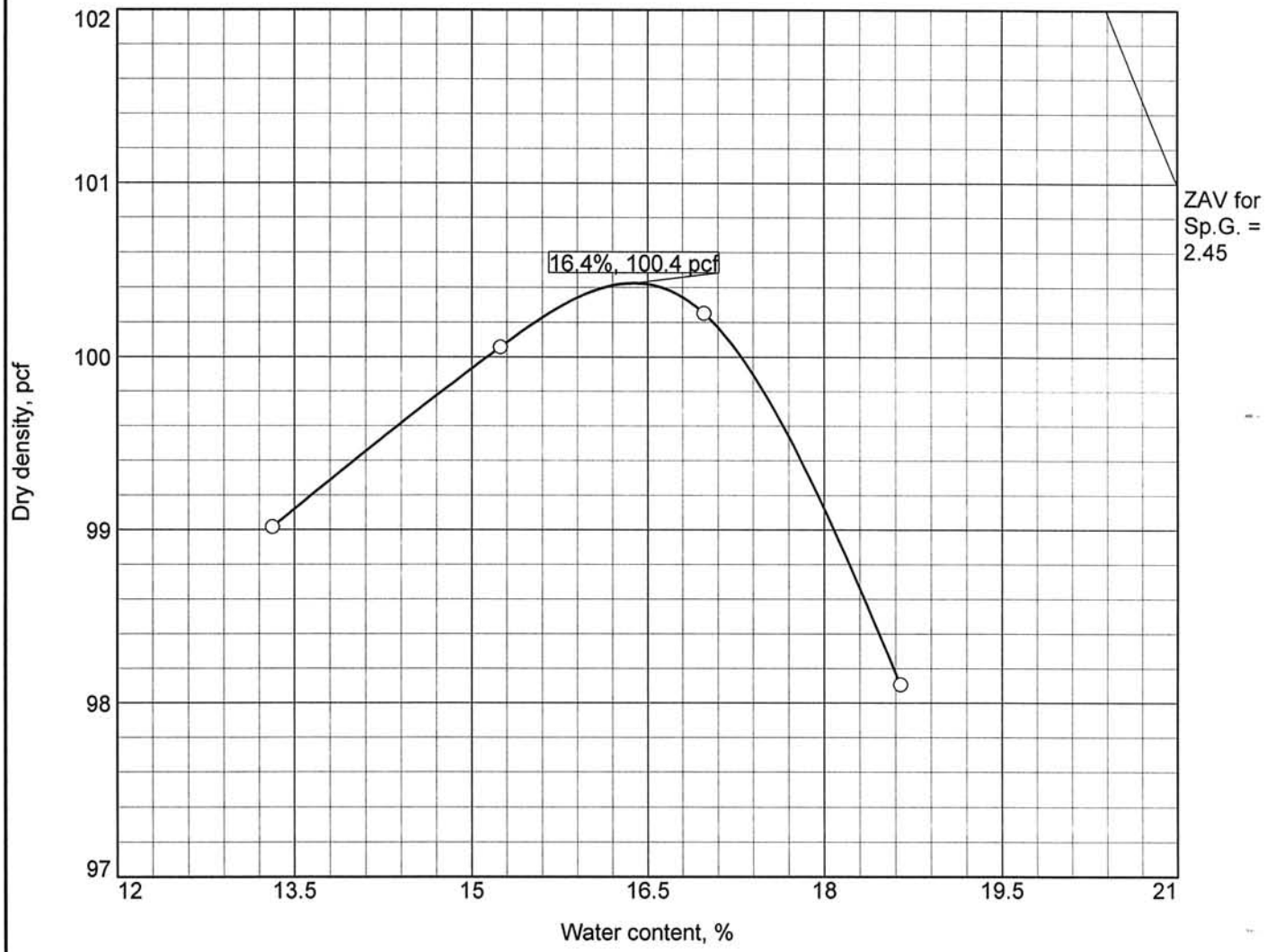
AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-07 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
2.0'- 4.0'	SM	A-2-4					0.0	19.5

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 100.4 pcf Optimum moisture = 16.4 %	Grey Silty Fine SAND

Project No. 6734129688 **Client:** Burns & McDonnell
Project: P664 Helo Parking & Landing Pad

○ **Source of Sample:** B-7 **Sample Number:** 2

Remarks:

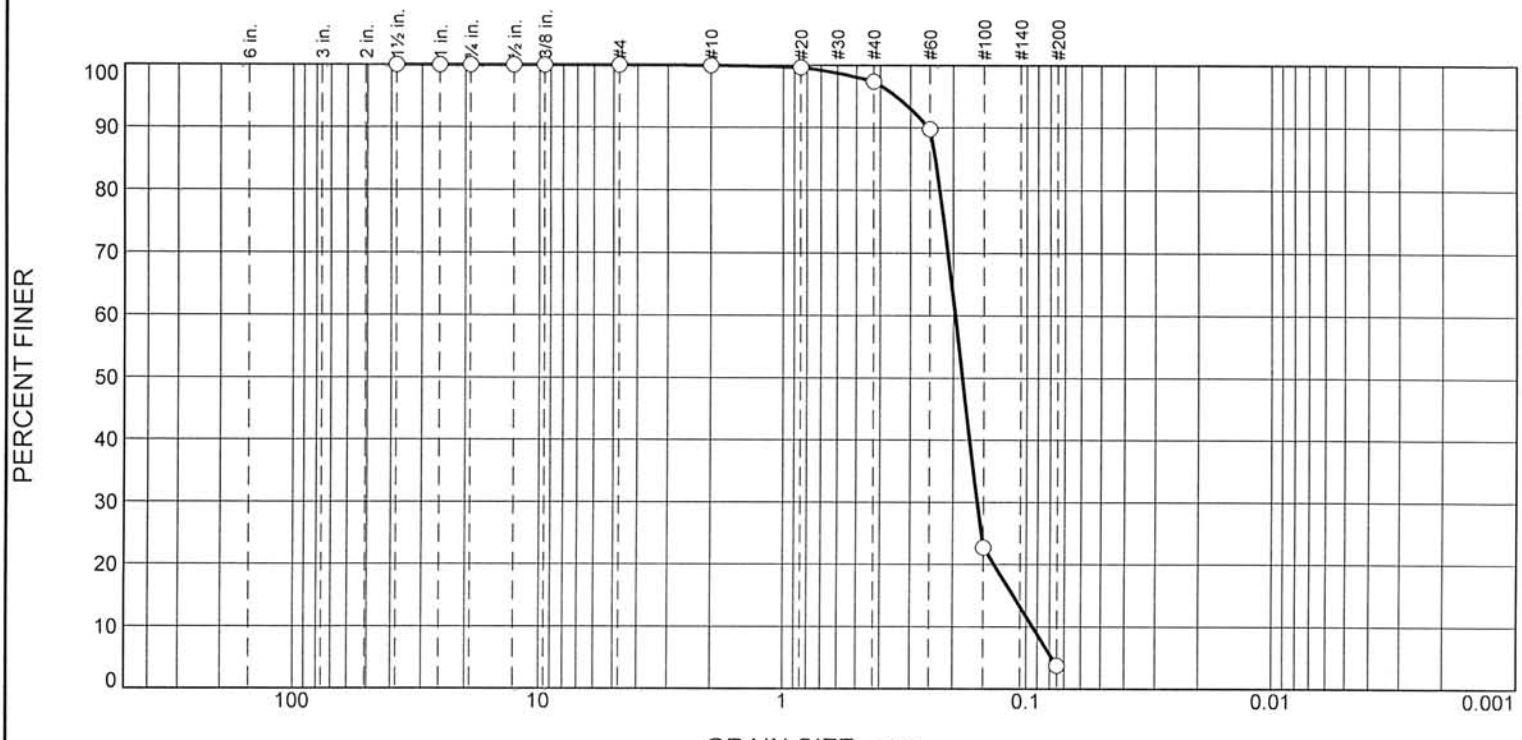
AMEC E&I

Jacksonville, Florida

Figure

Tested By: CM **Checked By:** SAS

Grain Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.5	93.7	3.7	

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	99.7		
#40	97.4		
#60	89.8		
#100	22.7		
#200	3.7		

* (no specification provided)

Material Description

Brown Fine SAND

Atterberg Limits (ASTM D 4318)

PL= NP LL= NP PI= NP

Classification

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

Coefficients

D_{90}= 0.2529 D_{85}= 0.2379 D_{60}= 0.1967
D_{50}= 0.1839 D_{30}= 0.1595 D_{15}= 0.1132
D_{10}= 0.0943 C_u= 2.09 C_c= 1.37

Remarks

Date Received: 1/14/14 **Date Tested:** 1/22/14

Tested By: CM

Checked By: SAS

Title:

Source of Sample: B-7 (Existing Material) **Depth:** 1.5'- 2.5' **Date Sampled:** 1/10/14

AMEC E&I

Jacksonville, Florida

Client: Burns & McDonnell

Project: P664 Helo Parking & Landing Pad

Project No: 6734129688 **Figure**

SUMMARY OF LABORATORY ELECTRO-CHEMICAL PROPERTY TEST RESULTS

P664 Helo Parking and Landing Apron
Naval Air Station Jacksonville
Jacksonville, Florida

Boring No.	Sample Type	Sample No.	Depth (feet)	pH	Electrical Resistivity (ohm-cm)	Sulfate Content (ppm)	Chloride Content (ppm)	FDOT Substructure Environmental Classification*	
								Steel	Concrete
2	Brown-gray Silty Fine Sand (SM)	Bulk	1.5 - 2.5	8.1	5,200	663	2,600	Extremely Aggressive	Extremely Aggressive
4	Brown Slightly Silty Fine Sand (SP-SM)	Bulk	1.5 - 2.5	8.3	4,200	372	1,000	Moderately Aggressive	Moderately Aggressive
7	Brown Fine Sand (SP)	Bulk	1.5 - 2.5	8.9	14,000	146	900	Moderately Aggressive	Moderately Aggressive
AMEC Environmental & Infrastructure, Inc. Jacksonville, Florida					**AMEC Project No. 6734-12-9688**			**Page 1 of 1**	

Prepared By:	SAS 2-14-14
Reviewed By:	MBW 2/18/14

* Reference: Structures Design Guidelines (FDOT), Chapter 1 (Effective January, 2013).

SUMMARY OF OXIDATION-REDUCTION POTENTIAL AND SULFIDE TEST RESULTS

P664 Helo Parking and Landing Apron
Naval Air Station Jacksonville
Jacksonville, Florida

Composite Sample No.	Sample Type	Sample No.	Depth (feet)	Oxidation-Reduction Potential (mV@degrees C)	Sulfide*	
					Moisture (%)	Sulfide (mg/kg)
2	Brown-gray Silty Fine Sand (SM)	Bulk	1.5 - 2.5	221 @ 19.3	13.1	< 173**
4	Brown Slightly Silty Fine Sand (SP-SM)	Bulk	1.5 - 2.5	237 @ 19.3	11.0	< 165**
7	Brown Fine Sand (SP)	Bulk	1.5 - 2.5	238 @ 19.4	10.9	< 163**
AMEC Environmental & Infrastructure, Inc. Jacksonville, Florida			**AMEC Project No. 6734-12-9688**		**Page 1 of 1**	
					Prepared By:	SAS 2-14-14
					Reviewed By:	MRW 2/14/14

* Tests were performed by Pace Analytical Services, Inc.
** Adjusted Method Detection Limit

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)	
∇ 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 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 - 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

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 or SLIGHTLY CLAYEY	SP-SM OR SP-SC
12% TO 30%	SILTY OR CLAYEY	SM OR SC
30% TO 50%	VERY SILTY OR 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

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KEY TO SYMBOLS AND DESCRIPTIONS

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 advanced by augering. 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 manual hammer (rope and cathead system) 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 classified by a geotechnical engineer in the field during drilling operations.

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.

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.

Compaction - Modified Proctor compaction tests (ASTM D 1557), Method C, were performed on the bulk soil samples to determine their compaction characteristics including their maximum dry density and optimum moisture content. The resulting moisture-density relationships are presented in the Appendix.

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 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.

pH - The pH is an expression of the concentration of dissociated hydrogen ions present in aqueous solution. pH values range from 1 to 14 with values below 7 indicating acidic conditions and values above 7 indicating alkaline conditions. This test was performed using a calibrated electronic pH meter with a sensing probe. The meter was calibrated by immersing the probe in a solution with a known pH. The soil pH was determined by mixing equal weights of soil and distilled water and testing the supernatent solution with the pH probe. This test was performed in general accordance with FM 5-550.

Electrical Resistivity - Resistivity is a measure of the resistance to flow of electrical current through the soil. Resistivity, the inverse of conductivity, was measured in units of ohm-centimeters. This test was performed in general accordance with FM 5-551.

Chloride Content - The chloride content of the soil sample was determined by titration with mercuric nitrate. The soil was rinsed with an amount of distilled water equal in weight to the dry soil. The soil was then removed from the water (which consisted of distilled water and natural soil moisture) and the mercuric nitrate titration was performed on the water. This test was performed in general accordance with FM 5-552.

Sulfate Content - The sulfate content of the soil sample was determined turbidimetrically. The soil was rinsed with an amount of distilled water equal in weight to the weight of dry soil. The soil was then removed from the water (which consisted of distilled water and natural soil moisture) and the turbidity of the water was determined using a photometer. The turbidity gives an indirect indication of the sulfate content. This test was performed in general accordance with FM 5-553.

Oxidation-Reduction Potential – A soil's oxidation-reduction potential (ORP) is an indication of soil corrosivity and its impact on buried metallic structures. When used in conjunction with electrical resistivity, it can aid in predicting corrosion tendencies and the subsequent service life of buried structures. This test was performed in general accordance with ASTM G 200-09.

Sulfide Content - A soil's sulfide content is an indication of soil corrosivity and its impact on buried piping. Testing was performed by Pace Analytical Services, Inc., in general accordance with EPA 9030A (preparation method) and EPA 9034 (analytical method).