Geotechnical Report

Proposed Portsmouth Police Station

Portsmouth, Rhode Island

April 12, 2016

Prepared For:

The Town of Portsmouth
2200 East Main Road
Portsmouth, RI 02871

Prepared By:

Northeast Engineers & Consultants, Inc.
"A Knowledge Corporation"®
55 John Clarke Road
Middletown, RI 02842

NE&C Project No.: 15201.1

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1.0 INTRODUCTION

The proposed Portsmouth police station project is located at 2200 East Main Road in Portsmouth Rhode Island on the corner of East Main Road and Town Access Road. The existing police station lies to the South of Town Access Road and to the West of East Main Road. To the west of the police station lies a parking lot, the septic system serving the police station, and the police shooting range. The Town of Portsmouth fire station lies on the north side of Town Access Road. The existing police station was originally built in 1975 and consists of a single story masonry structure on a slab-on-grade foundation. To meet the current demands of the Portsmouth Police operations, a larger more modern facility is required.

The Town of Portsmouth in conjunction with Drummey Rosane Anderson (DRA) Architects proposes to build the new police station between the existing building and the backstop of the shooting range. The proposed police station will be a two story wood framed structure with a full depth basement. The proposed site lies over the existing, active, septic system. The existing building will need to remain in use during construction of the new facility.

The purpose of this study is to identify the existing subsurface soil conditions and to evaluate and identify soil parameters for the design of the building foundations and other site improvements for the project.

2.0 SUBSURFACE EXPLORATIONS

A subsurface exploration program was undertaken to determine subsurface soil conditions within the area of the proposed building. Sixteen (16) soil borings were performed at locations shown on Figure 1- Soil Boring and Utility Location Plan found in Appendix A. The soil boring logs are included in Appendix B.

2.1 BORINGS

Sixteen (16) borings, designated B-1 through B-16 were performed by New England Boring of Brockton, MA between January 26th and February 2nd, 2016. Borings were conducted with a tracked ATV rig with a continuous flight hollow stem auger and a standard split spoon for sampling. Bore holes were advanced to refusal, no borehole was able to be advanced past 25 feet. NE&C was present during drilling to monitor progress and visually observe samples as they were removed from the sampler spoon.

Split spoon soil samples were obtained in accordance with ASTM D1586, the Standard Penetration Test (SPT) at 5 foot intervals. The SPT consists of driving a 1-3/8 inch inside diameter split spoon 24 inches using a 140 pound hammer with a drop height of 30 inches. The standard penetration number is the total number of blows required to drive the hammer between 6 and 18 inches.

2.2 SUBSUFACE CONDITIONS

According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the soils located at the project site are, Broadbrook Silt Loam and Newport Silt Loam. Both soils are very similar in makeup and appearance. These silty loams are created from the relatively shallow granite/gneiss and/or schist and/or shale/siltstone bedrocks that exist below these soils. From the soil and rock samples obtained we know that the bedrock is a predominantly shale bedrock. Additionally small deposits of granite and quartz gravel were encountered throughout the site. Water was not encountered below topsoil in any of the borings.

During the initial investigation NE&C discovered several utilities in the location of the proposed police station. NE&C discovered an active septic system to the west of the police station just beyond the rear parking lot. The septic system begins with a chamber towards the south west corner of the lot. The system has several infiltration trenches that run north – south. This system lies squarely within the proposed footprint of the new police station. NE&C discovered a fiber optic communication line that runs from the south west corner of the police station to the public works building which lies to the west of the police station. The fiber line runs along the south facing fence line of the police shooting range. This fiber optic line runs through the proposed footprint of the new police station.

While speaking to the director of public works regarding the fiber optic line NE&C discovered that the area to the south west of the police station which contains a generator, transformer, and communication tower contains many unmarked power and communications cables in the upper 2'-0" of soil. This area lies just outside of the proposed footprint of the new police station building; however, this area should be approached with care as this equipment is crucial to the operation of the police station.

Boring logs can be found in Appendix B.

2.2.1 Fill

No fill was discovered in any of the boring locations. Shallow fill should be expected in the area of the septic system's tank and leaching trenches.

2.2.2 Topsoil

In the undeveloped areas of the site, topsoil was encountered. The topsoil consists of a dark brown silty fine and medium sand. The SPT N-values were approximately 3-10 blows per 6-inches in this shallow stratum. Testing revealed the typical gradation to be 10.9% - 22.6% gravel, 38.3% - 44.1% sand and 39.1% - 45.0% fines. Based on the Unified Soil Classification System (USCS), the topsoil is classified as (SM), Brown Silty Sand.

2.2.3 Broadbrook Silt Loam

The stratum below this very silty sand consists of a Broadbrook Silt Loam; based on the USCS, this is characterized as Gray Silty Sand with Gravel (SM). This lower stratum consists of 43.5% - 57.6% Gravel, 38.7% - 24.3% Sand, and 17.8% -18.1% Fines.

2.2.4 Groundwater

Groundwater was not encountered at any point during the boring program. Considering the depth of bedrock and the percentage of fines in the soils groundwater is unlikely to be an issue for the proposed full basement. The foundation design should include a French drain either draining to daylight or a sump pump.

3.0 LABORATORY TESTING

Laboratory testing included grain size analysis in accordance with ASTM D422/T88 on samples obtained from borings B-10 and B-3. Results of the grain size analysis including grain distribution graphs are included in Appendix C.

4.0 SEISMIC DESIGN CONSIDERATIONS

4.1 SITE CLASSIFICATION

In accordance with ASCE 7-10, Table 20.3-1, the soil profile of the project site is characterized as Site Class C, very dense soil and soft rock.

4.2 IBC SEISMIC LOAD FACTORS

IBC Seismic load factors should be taken as $S_s = 0.17$ and $S_1 = 0.06$

4.3 LIQUEFACTION EVALUATION

Liquefaction potential has been found to be the greatest where the groundwater level is shallow and loose fine sand occurs within 50 feet of the ground surface. Liquefaction potential decreases with increasing grain size, clay and gravel content, and soil density, but increases as the seismic ground acceleration and duration of shaking increases. Soils which have a relative density over 75% pose no risk of liquefaction. The soils at the project site have a relative density well above this minimum and therefore pose minimal concern of liquefaction. Furthermore the quantity of gravel found in the lower stratum of soil further lessens the chances of liquefaction. Additionally no groundwater was encountered during the borings even further lessening the chances of liquefaction.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

It is our opinion, based on our field exploration, laboratory testing and engineering analyses, the site is suitable for the proposed construction when treated in accordance with the recommendations in this report. The soil in the stratum below the topsoil consists of silty sand with gravel. The only concern regarding soils of this composition is permeability. Typical drainage and foundation waterproofing best practices will be sufficient to ensure no issues with water ingress to the foundation.

5.2 SITE PREPARATION AND GRADING

5.2.1 General

This section pertains to demolition, site preparation, incidental buried utility relocation or installation, and grading and excavations required for the project.

5.2.2 Clearing and Grubbing

The Site should be cleared of all debris and unsuitable or deleterious materials, or structures that conflict with the proposed construction. Utilities in conflict with the proposed construction should be relocated or removed from the Site. Excavation should be performed as necessary to remove any loose or disturbed soils, if encountered. The resulting excavations or voids should be treated in a manner acceptable to the geotechnical consultant.

5.2.3 Removals

In order to allow the building to be constructed with a full basement material should be removed to allow the footing to rest on virgin material or bare rock.

5.2.4 Temporary excavation slopes

The temporary excavations for removal of loose materials and for foundations should be sloped at a gradient of 1.5 horizontal to 1.0 vertical or flatter. If existing structures such as buried utilities or pavement are within the proposed excavation, they should either be relocated or underpinned; or the excavation should be shored.

5.2.5 Fill material requirements

Excluding the topsoil, the existing soils are considered to be suitable as engineered fill, from a geotechnical viewpoint. The onsite and any import materials used as engineered fill should consist of inorganic, well-graded granular soils, and have a maximum size of six inches.

5.2.6 Fill placement and compaction requirements

Soil used as engineered fill should be moisture conditioned to near optimum moisture content, placed in 12 inch thick loose lifts and compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557-91. Crushed stone should be placed in layers not more than 2 feet thick and spread evenly to achieve compaction.

5.2.7 Types and frequency of field tests for engineered compacted fill

The geotechnical consultant should be retained to observe and test all engineered compacted fill and backfill placement. The types and frequency of in-place field density tests during placement of engineered compacted fill and frequency of laboratory determinations of maximum density of fill materials should generally be left to the discretion of the geotechnical consultant. As a general guideline, at least one in-place field density test should be performed for every two feet vertical of fill placed in a single operation, or for every 500 cubic yards of fill placed in a single operation, or for each soil type used, or each single compaction operation. A laboratory Compaction Characteristics Test (ASTM D 1557) will be required when there is a change in the compaction characteristic of the on-site material or import material being used.

5.2.8 Utility installations

Sides of trenches should be sloped or shored in accordance with OSHA standards. Properly designed trench shields may be used in lieu of shoring. We recommend that excavations less than five feet deep be sloped or protected with portable trench shields. The on-site sandy soils are susceptible to possible caving, which represents a potential hazard to workmen hunched over for installations of conduits, even in shallow excavations.

Backfill under, around and over buried conduits should be compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557. Buried utility lines should be provided with bedding as recommended by the project civil engineer, or the utility company or agency that has jurisdiction. Excavation should be performed as necessary to remove all loose and disturbed soils and unsuitable fill materials.

5.3 SPREAD FOOTINGS

NE&C has found that the layer of very dense undisturbed silty sand with gravel found below the top layer of topsoil to be very competent material. The ideal foundation for the soil type is spread concrete footings and concrete foundation walls. NE&C determined the corrected SPT N values from the borings; these values were then used to determine the angle of internal friction and subsequently an allowable bearing capacity. For a square spread footing in this soil strata the maximum net allowable soil bearing pressure is 5,000 pounds per square foot according to Meyerhof's calculations on allowable bearing capacity of sands based on settlement. The above noted maximum allowable bearing capacities , a minimum embedment of 48 inches for exterior footings, a minimum embedment of 24 inches for interior footings, a minimum width of 2 feet per side, and a maximum total and differential settlement of 0.25 inches.

Interior and exterior column footings should be limited to between 2 and 8 feet wide. For footings greater or less than the above mentioned widths the net allowable bearing pressure should be reassessed.

5.4 SHALLOW (STRIP) FOUNDATIONS

NE&C found the top layer of the silty sand that comprises the soil of the site to contain a high percentage (35%-45%) of fines. This layer of soil should be bypassed for any shallow strip footings to ensure the footings are constructed on material mainly comprised of sand and gravel (<20% fines). NE&C has determined the maximum net allowable soil bearing pressure for strip footings on the undisturbed glacial till to be 5,000 pounds per square foot. The above noted maximum net allowable bearing capacity was developed using an allowable settlement of 0.25 inches, a minimum embedment of 48 inches for exterior footings, a minimum embedment of 24 inches for interior footings, and a minimum width of 2 feet.

Interior and exterior strip footings should be limited to between 2 and 6 feet wide. For footings greater or less than the above mentioned widths the net allowable bearing pressure should be reassessed.

5.4.1 Frost Protection Depth

The frost protection depth for footings in Portsmouth Rhode Island is 3'-4"

5.5 RETAINING WALLS

5.5.1 Bearing Capacity

NE&C has determined that the appropriate allowable bearing capacities for undisturbed soils supporting retaining walls to be 5,000 pounds per square foot. NE&C has determined the angle of internal friction for this soil is between 30° and 35°for the soils at the project site. This value is for undisturbed soils; should the fill behind retaining wall be obtained from the project site it should be compacted to 95% compaction. NE&C suggests retaining walls conservatively be designed using 30° for the angle of internal friction. Backfill slopes and surcharges from vehicles or pedestrians will need to be taken into account where pertinent.

5.5.2 Coefficient of Friction

The coefficient of friction is 0.3 for concrete poured directly onto silty sand with gravel that has been found to be the primary soil on the project site. For this reason NE&C believes that all cast concrete should have a 12" minimum layer of crushed rock laid down before pouring the concrete. This will aid in increasing the friction force between the retaining wall and the soil.

5.6 PLAN REVIEW

The geotechnical consultant should be retained to review grading and foundation plans and specifications to ascertain conformance with Site conditions and recommendations presented herein.

5.7 TESTING AND OBSERVATION

The geotechnical consultant should be retained to perform on-site construction observations and testing to ascertain that conditions correspond to the findings and conclusions presented herein and that construction conforms generally to the recommendations presented herein. The geotechnical consultant should be called out for testing and observations as indicated in this report and at least for the following:

Inspection of all subgrade and fill bottoms following excavation, before scarifying, compaction and any fill is placed.

Continuous inspection of all temporary construction excavations located closer to existing structures than one and one-half times the depth of excavation, and inspection of all other temporary construction excavations following excavation, before beginning work near the sides of excavation.

Testing and inspection of all fill placement as discussed under the subsection **Types and Frequency of Field Tests for Engineered Compacted Fill**.

Inspection of all foundation excavations before rebar or concrete is placed.

It is the responsibility of the contractor to coordinate all inspections and testing required by this firm or by other regulatory agencies. We should be should be given at least 48 hours notice that construction is commencing and no less than 24 hours notice of required geotechnical tests and/or inspections.

6.0 LIMITATIONS AND SPECIAL TERMS AND CONDITIONS

The analyses, conclusions, and recommendations contained in this report are based on Site conditions as they existed at the time of our investigation and further assume the explorations to be representative of the subsurface conditions throughout the Site. No warranty is made nor should any be construed that unforeseen geotechnical or geological weakness may not exist between exploratory points and exposures nor below the depths explored. If different subsurface conditions are observed during construction, we should be promptly notified for review and reconsideration of our recommendations.

This report was prepared for the exclusive use and benefit of the owner, architect, and engineer for evaluating the design of the facility as it relates to certain geotechnical aspects. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions included in this report.

If the proposed project is substantially modified from which is discussed herein under **Proposed Development**, we should be retained to review the new proposed development to ascertain that our findings, conclusions and recommendations are applicable.

Site conditions can change with time. If more than 18 months has passed since the preparation of this report, we should review the Site and ascertain that our findings, conclusions and recommendations are still applicable.

We recommend that Northeast Engineers & Consultants be retained and given the opportunity to review those portions of the plans and specifications which pertain to foundations and earthwork to ascertain that they are consistent with the recommendations of this report and to inspect construction, particularly foundations, shoring, site grading, and earthwork to ascertain that actual Site conditions are consistent with the findings of this report and that construction conform to the recommendations of this report. The review of plans and specifications, and construction inspection and testing by Northeast Engineers & Consultants is an integral part of the conclusions and recommendations made in this report, and if others are retained for these services, the client will be assuming our responsibility for any potential claims that may arise during or after construction.

The services as described in this report include professional opinions and judgments based on the data collected. Our investigation was performed using the standard of care and level of skill ordinarily exercised under similar circumstances by reputable soil engineers and geologists currently practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional advice included in this report.

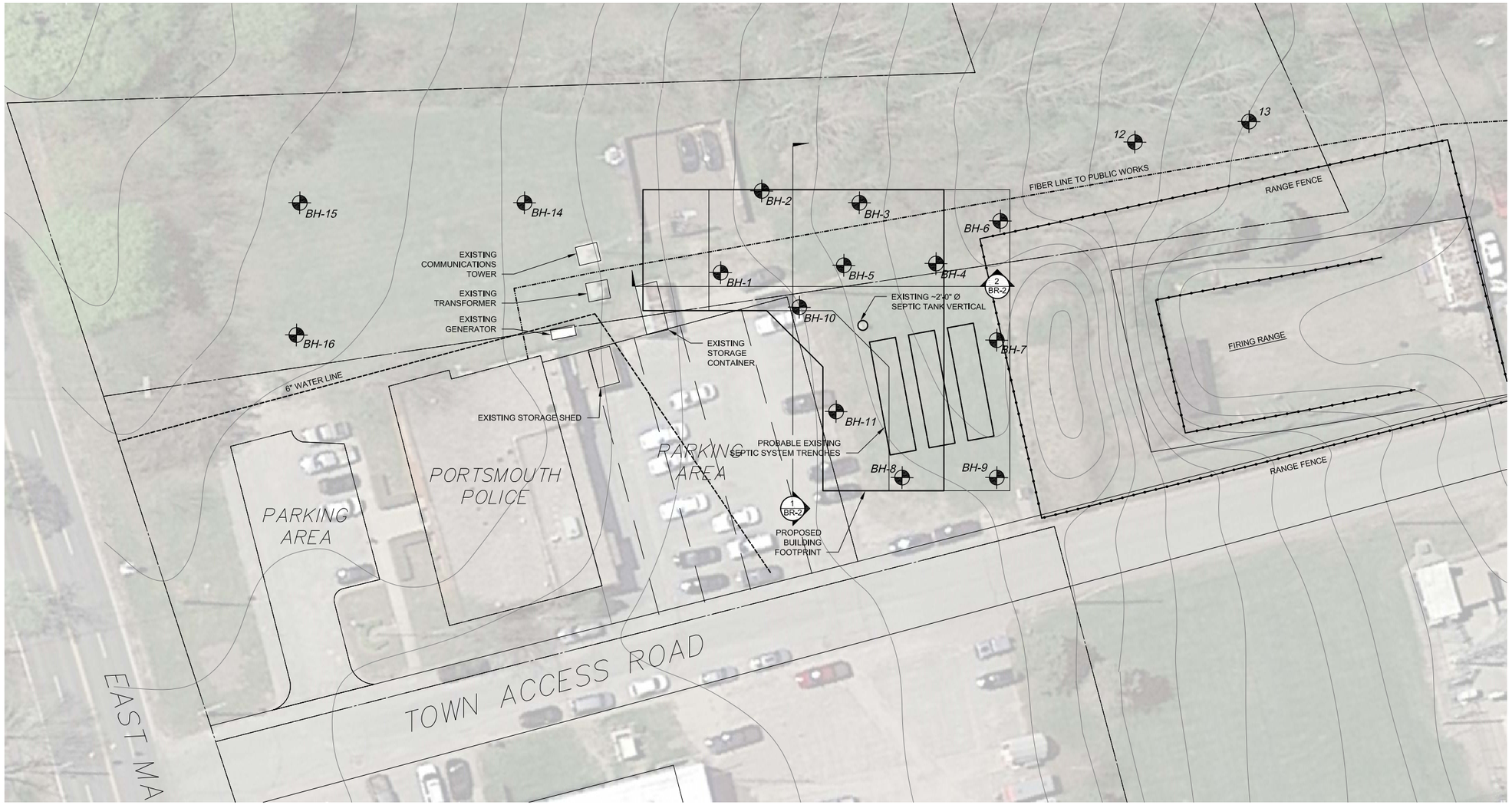
We would be pleased to provide you with additional consultation services through the design and construction phases of this challenging project. If you have any questions concerning this project or desire any additional information, please contact us.

APPENDIX A FIGURES

NORTHEAST ENGINEERS
& CONSULTANTS, INC.

SITE/CIVIL
LAND PLANNING
WATERFRONT
SURVEYING
GEOTECHNICAL
ENVIRONMENTAL
TRANSPORTATION
STRUCTURAL
MATERIALS TESTING

55 JOHN CLARKE ROAD MIDDLETOWN RHODE ISLAND 02842
PHONE (401) 846-0015 FAX (401) 846-4189
www.northeastengineers.com



LEGEND

MARK	
BH-XX	BORE HOLE PERFORMED BY NEW ENGLAND BORING BETWEEN 1/26/16 AND 2/01/16
----------	6" WATER LINE, LOCATION DETERMINED FROM CBYD AND EXISTING BUILDING PLANS
—·—·—	FIBER OPTIC COMMUNICATION LINE, LOCATION DETERMINED FROM PUBLIC WORKS DRAWING

No.	Revision	Date	App.

Designed By: | Drawn by: NCM | Checked by:

Scale: AS NOTED | Date: JAN 12, 2016

Project Title:

PORTSMOUTH POLICE STATION
BORING PROGRAM

Client/Owner:

Town of Portsmouth
2200 East Main Road
Portsmouth, RI 02871

Issued for:

Drawing Title:

BORING LOCATIONS
AND
UTILITY LOCATIONS

Drawing Number: BR-1

Sheet of

Project Number: 15201.1

Survey Index: – –

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C:\Users\steveno\Desktop\NE&C Projects\15201.1 Portsmouth Police Station Boring\Drawings\Current\Police Station Utilities.dwg

NORTHEAST ENGINEERS
& CONSULTANTS, INC.

SITE/CIVIL
LAND PLANNING
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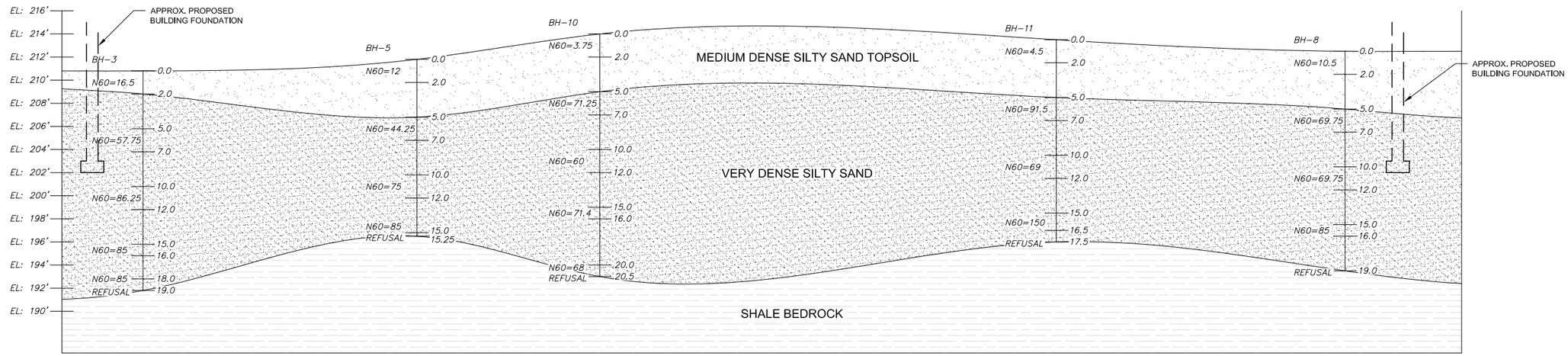
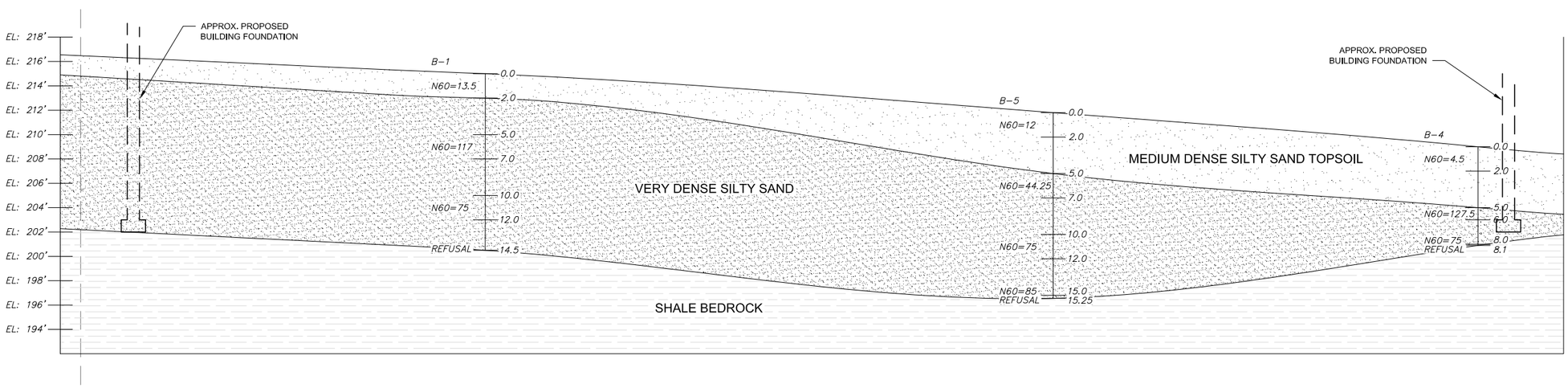


SOIL CROSS SECTION (1 / BR-2)
SCALE: 1" = 5'-0"



SOIL CROSS SECTION (2 / BR-2)
SCALE: 1" = 5'-0"

No.	Revision	Date	App.

Designed By:	Drawn by: NCM	Checked by:	
Scale: AS NOTED	Date: JAN 12, 2016		

Project Title:

PORTSMOUTH POLICE STATION
BORING PROGRAM

Client/Owner:

Town of Portsmouth
2200 East Main Road
Portsmouth, RI 02871

Issued for:

Drawing Title:

SOIL PROFILES

Drawing Number:
BR-2

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Project Number:
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APPENDIX B BORING LOGS

(603) 437-1610 **New England Boring Contractors** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038

Boring # BH-1 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/27/16 **Date End:** 1/27/16 **Location:** See Plan

Auger: HSA
Size: 3.25”
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30”

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/27/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	6”	6-8-16-15		Dry, medium dense, brown, FINE TO COARSE SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
5’0”	S-2	5’ – 6’6”	18”	6”	40-56-100/6”		Dry, very dense, brown, FINE TO COARSE SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
-							
10’0”	S-3	10’ – 10’11”	11”	6”	70-100/5”		Dry, very dense, brown, FINE TO COARSE SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
-						14’6”	Auger Refusal at 14’6”, Possible bedrock or boulder.
15’0”							Bottom of Exploration = 14’6”
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

(603) 437-1610 **New England Boring Contractors** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038

Boring # BH-2 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/27/16 **Date End:** 1/27/16 **Location:** See Plan

Auger: HSA
Size: 3.25”
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30”

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/27/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	18”	2-6-10-18		Dry, medium dense, brown, FINE TO MEDIUM SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
5’0”	S-2	5’ – 7’	24”	12”	39-45-55-76		Dry, very dense, brown, FINE TO COARSE SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
-							
10’0”	S-3	10’ – 10’11”	11”	6”	70-100/5”		Dry, very dense, brown, FINE TO COARSE SAND, some inorganic silt, some fine to coarse gravel.
-							
-							
-							
-							
15’0”	S-4	15’ – 15’4”	4”	2”	100/4”	15’4”	Auger Refusal at 15’4”, Possible bedrock or boulder.
-							Bottom of Exploration = 15’4”
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

(603) 437-1610 **New England Boring Contractors** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038

Boring # BH-3 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/27/16 **Date End:** 1/27/16 **Location:** See Plan

Auger: HSA
Size: 3.25"
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30"

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/27/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-	S-1	0' – 2'	24"	12"	6-10-12-16		Dry, medium dense, brown, FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
5'0"	S-2	5' – 7'	24"	6"	22-36-41-44		Dry, very dense, brown, FINE TO MEDIUM SAND and fine to coarse gravel, some inorganic silt.
-							
-							
-							
-							
10'0"	S-3	10' – 12'	24"	18"	45-55-60-76		Dry, very dense, brown, FINE TO MEDIUM SAND and fine to coarse gravel, some inorganic silt.
-							
-							
-							
-							
15'0"	S-4	15' – 16'	24"	6"	50-100/6"		Dry, very dense, brown, FINE TO MEDIUM SAND and fine to coarse gravel, some inorganic silt.
-							
-							
-	S-5	18' – 19'	12"	5"	70-100/6"	19'	Auger Refusal at 19', Possible bedrock or boulder.
-							Bottom of Exploration = 19'
20'0"							
-							
-							
-							
-							
25'0"							
-							
-							
-							
-							
30'0"							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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P.O. Box 165
Derry, NH 03038

Boring # BH-4 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/28/16 **Date End:** 1/28/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/28/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	2”	15-3-3-4		Dry, loose, brown, FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 6’6”	24”	12”	34-70-95		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-						8’1”	
-	S-3	8’ - 8’1”	1”	1”	100/1”		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
10’0”							Auger Refusal at 8’1”, Possible bedrock or boulder.
-							Bottom of Exploration = 8’1”
-							
-							
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Derry, NH 03038

Boring # BH-5 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/27/16 **Date End:** 1/27/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/27/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
- - - -	S-1	0’ – 2’	24”	3”	6-8-8-12	5’	Dry, medium dense, brown, FINE TO MEDIUM SAND, some inorganic silt.
5’0” - - - -	S-2	5’ – 7’	24”	10”	19-23-36-48		Dry, very dense, brown FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
10’0” - - - -	S-3	10’ – 11’	12”	10”	50-100/6”		Dry, very dense, brown FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
15’0” - - - -	S-3	15’ -15’3”	3”	3”	100/3”	15’3”	Dry, very dense, brown FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt. Auger Refusal at 15’3”, Possible bedrock or boulder.
20’0” - - - -							Bottom of Exploration = 15’3”
25’0” - - - -							
30’0” -							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-6 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 02/01/16 **Date End:** 02/01/16 **Location:** See Plan

Auger: HSA
Size: 3.25”
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30”

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	12”	2-4-6-12		Dry, medium dense, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
5’0”	S-2	5’ – 7’	24”	18”	41-52-53-60		Dry, very dense, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
-							
10’0”							Attempted sample at 10’ = 100/0” No recovery
-							Advance to 13’.
-						13’	Auger Refusal at 13’, Possible bedrock or boulder.
-							Bottom of Exploration = 13’
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Derry, NH 03038

Boring # BH-7 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/28/16 **Date End:** 01/28/16 **Location:** See Plan

Auger: HSA
Size: 3.25"
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30"

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	Depth:	Casing:	Stabilization Period

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-	S-1	0' – 2'	24"	18"	3-3-7-4		Dry, loose, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5'	
5'0"	S-2	5' – 7'	24"	12"	9-9-14-15		Dry, medium dense, brown FINE TO MEDIUM SAND and little fine to medium gravel, trace inorganics silt.
-							
-							
-							
-							
10'0"	S-3	10' – 12'	24"	12"	33-40-45-52		Dry, medium dense, brown FINE TO MEDIUM SAND and little fine to medium gravel, trace inorganics silt.
-							
-							
-							
-							
15'0"	S-4	15' – 15'10"	10"	6"	35-100/4"		Dry, medium dense, brown FINE TO MEDIUM SAND and little fine to medium gravel, trace inorganics silt.
-							
-						18'	Auger Refusal at 18', Possible bedrock or boulder.
-	S-5	18'	0	0	100/0"		No Recovery
-							Bottom of Exploration = 18'
20'0"							
-							
-							
-							
-							
25'0"							
-							
-							
-							
-							
30'0"							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-8 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/28/16 **Date End:** 01/28/16 **Location:** See Plan

Auger: HSA
Size: 3.25"
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30"

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6"	S/C	SAMPLE DESCRIPTION
-	S-1	0' – 2'	24"	16"	2-4-10-14		2" TOPSOIL, Dry, loose, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5'	
5'0"	S-2	5' – 7'	24"	16"	30-41-52-58		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
10'0"	S-3	10' – 12'	24"	12"	38-34-44-51		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
15'0"	S-4	15' – 16'	12"	8"	40-100/6"		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-							
-						19'	Auger Refusal at 19', Possible bedrock or boulder.
-							Bottom of Exploration = 19'
20'0"							
-							
-							
-							
-							
25'0"							
-							
-							
-							
-							
30'0"							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-9 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/28/16 **Date End:** 01/28/16 **Location:** See Plan

Auger: HSA
Size: 3.25”
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30”

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	Depth:	Casing:	Stabilization Period

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	3”	3-6-12-22		2” TOPSOIL, Dry, loose, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 7’	24”	14”	35-48-55-70		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 12’	24”	20”	40-51-62-73		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
15’0”	S-4	15’ – 17’	24”	20”	50-55-60-50		Dry, very dense, gray FINE TO MEDIUM SAND and fine to coarse gravel, trace inorganic silt.
-							
-						18’	Auger Refusal at 18’, Possible bedrock or boulder.
-							No Recovery
-							Bottom of Exploration = 18’
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-10 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 02/02/16 **Date End:** 02/02/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	14”	2-2-3-2		Dry, loose, brown FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 7’	24”	18”	36-44-51-66		Dry, very dense, gray FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 12’	24”	18”	24-36-44-58		Dry, very dense, gray FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
-							
15’0”	S-4	15’ – 17’	24”	16”	39-46-44-17		Dry, very dense, gray FINE TO MEDIUM SAND, some inorganic silt.
-							
-							
-							
-							
20’0”	S-5	20’ – 20’6”	4”	4”	100/4”	20’6”	Dry, very dense, gray FINE TO MEDIUM SAND, some inorganic silt.
-							
-							Advanced to 24’ and began coring.
-							
-	C-1	24’ – 29’	60”	50”			BEDROCK
25’0”							
-							
-							
-						29’	
-							Bottom of Exploration = 29’
30’0”							
-							

Drillers. Orrin Cone	**Helper:**	**Inspector:**

Remarks:

S/#: Sample	**PEN:** Penetration	**REC:** Recovery	**S/C:** Strata Change

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Boring # BH-11 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 1/29/16 **Date End:** 1/29/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date: 1/29/16	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	14”	2-3-3-6		2” TOPSOIL, Dry, loose, brown, FINE TO MEDIUM SAND some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 7’	24”	12”	10-22-36-41		Dry, very dense, brown FINE TO MEIDUM SAND and fine gravel, trace inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 12’	24”	5”	45-56-66-74		Dry, very dense, brown FINE TO MEIDUM SAND and fine gravel, trace inorganic silt.
-							
-						13’6”	Auger Refusal at 13’6”, Possible bedrock or boulder.
-							Bottom of Exploration = 13’6”
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-12 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 02/01/16 **Date End:** 02/01/16 **Location:** See Plan

Auger: HSA
Size: 3.25"
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30"

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	**S./#**	**DEPTH**	**PEN**	**REC**	**BLOWS/6"**	**S/C**	**SAMPLE DESCRIPTION**
-	S-1	0' – 2'	24"	14"	2-4-7-7		2" TOPSOIL, Dry, loose, brown, FINE TO MEDIUM SAND some inorganic silt.
-							
-							
-						5'	
5'0"	S-2	5' – 6'11"	23"	16"	46-55-66		Dry, very dense, gray FINE TO MEIDUM SAND and fine gravel, trace inorganic silt.
-					100/5"		
-							
-							
-							
10'0"	S-3	10' – 12'	24"	18"	76-56-36-41		Dry, very dense, gray FINE TO MEIDUM SAND and fine gravel, trace inorganic silt.
-							
-							
-							
-							
15'0"	S-4	15' – 16'6"	18"	12"	65-77-100/6"		Dry, very dense, gray FINE TO MEIDUM SAND and fine gravel, trace inorganic silt.
-							
-		17'6"	0	0	100/0"		Auger Refusal at 17'6", Possible bedrock or boulder.
-							Bottom of Exploration = 17'6"
-							
20'0"							
-							
-							
-							
-							
25'0"							
-							
-							
-							
-							
30'0"							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-13 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 02/01/16 **Date End:** 02/01/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	12”	4-8-8-9		2” TOPSOIL, Dry, loose, brown, FINE TO MEDIUM SAND some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 7’	24”	20”	35-50-55-70		Dry, very dense, gray FINE TO MEDIUM SAND and fine gravel, trace inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 12’	24”	12”	38-41-58-71		Dry, very dense, gray FINE TO MEDIUM SAND and fine gravel, trace inorganic silt.
-							
-							
-							
-							
15’0”	S-4	15’ – 16’6”	18”	12”	68-74-100/6”		Dry, very dense, gray FINE TO MEDIUM SAND and fine gravel, trace inorganic silt.
-							
-							
-						18’6”	Auger Refusal at 18’6”, Possible bedrock or boulder.
-							Bottom of Exploration = 18’6”
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone	**Helper:**	**Inspector:**

Remarks:

S/#: Sample	**PEN:** Penetration	**REC:** Recovery	**S/C:** Strata Change

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Boring # BH-14 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/26/16 **Date End:** 01-16-16 **Location:** See Plan

Auger: HSA
Size: 3.25”
Hammer:

Sampler:
S/S

Hammer: 146 lbs
Fall: 30”

Sampler:
1-3/8 in. I.D.
30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	10”	3-6-7-7		2” TOPSOIL, Dry, loose, brown, FINE TO MEDIUM SAND little fine to coarse gravel, trace inorganic silt.
-							
-							
-							
5’0”	S-2	5’ – 7’	24”	12”	40-76-90 100		Dry, loose, brown, FINE TO MEDIUM SAND, little fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 12’	24”	20”	33-38-48-50		Dry, loose, brown, FINE TO MEDIUM SAND, little fine to coarse gravel, trace inorganic silt.
-							
-						12’6”	
-							Bottom of Exploration = 12’6”
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample **PEN:** Penetration **REC:** Recovery **S/C:** Strata Change

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Boring # BH-15 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/26/16 **Date End:** 01/26/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs.	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	12”	2-6-7-7		Dry, loose, brown FINE TO MEDIUM SAND some inorganic silt.
-							
-							
-							
5’0”	S-2	5’ – 5’11”	11”	2”	46-100/5”	5’11”	Dry, very dense, brown FINE TO MEDIUM SAND some inorganic silt.
-							
-							Bottom of Exploration = 5’11”
-							
-							
10’0”							
-							
-							
-							
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

S/#: Sample	**PEN:** Penetration	**REC:** Recovery	**S/C:** Strata Change

(603) 437-1610 **New England Boring Contractors** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038

Boring # BH-15A **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/26/16 **Date End:** 01-16-16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs.	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-							Brown, FINE TO MEDIUM SAND, some inorganic silt and fine to coarse gravel.
-							
-							
-							
5’0”	S-2	5’ – 5’9”	9”		60-100/3”		Very dense, brown, FINE TO MEDIUM SAND, some inorganic silt and fine to coarse gravel.
-						7’	
-							Auger Refusal at 7’, possible bedrock or boulder.
-							Bottom of Exploration = 7’
-							
10’0”							
-							
-							
-							
-							
15’0”							
-							
-							
-							
-							
20’0”							
-							
-							
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone	**Helper:**	**Inspector:**

Remarks:

S/#: Sample	**PEN:** Penetration	**REC:** Recovery	**S/C:** Strata Change

(603) 437-1610 **New England Boring Contractors** **Fax: (603) 437-0034**
P.O. Box 165
Derry, NH 03038

Boring # BH-16 **Project**: Northeast Engineers & Consultants, Inc. Test Drilling **Project #** C04793

Project Address: 2270 East Main Road **City:** Portsmouth **State:** RI **Zip:**

Date Start: 01/26/16 **Date End:** 01/26/16 **Location:** See Plan

Auger: HSA	**Sampler:**	**Hammer:** 146 lbs.	**Sampler:**
Size: 3.25”	S/S	Fall: 30”	1-3/8 in. I.D.
Hammer:			30 in.

G R O U N D W A T E R O B S E R V A T I O N

Date:	**Depth:**	**Casing:**	**Stabilization Period**

DP	S./#	DEPTH	PEN	REC	BLOWS/6”	S/C	SAMPLE DESCRIPTION
-	S-1	0’ – 2’	24”	16”	2-6-7-7		Dry, medium dense, brown FIME TO MEDIUM SAND, some inorganic silt.
-							
-							
-						5’	
5’0”	S-2	5’ – 6’11”	11”	18”	46-100/5”		Dry, very dense, gray FINE TO MEDIUM SAND, fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
10’0”	S-3	10’ – 10’6”	11”	3”	46-100/5”		Dry, very dense, gray FINE TO MEDIUM SAND, fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
15’0”	S-4	15’ – 17’	11”	16”	46-100/5”		Dry, very dense, gray FINE TO MEDIUM SAND, fine to coarse gravel, trace inorganic silt.
-							
-							
-							
-							
20’0”	S-5	20’ – 20’9”	9”	6”	80-100/3”	20’9”	Dry, very dense, gray FINE TO MEDIUM SAND, fine to coarse gravel, trace inorganic silt.
-							
-							Bottom of Exploration = 20’9”
-							
-							
25’0”							
-							
-							
-							
-							
30’0”							
-							

Drillers. Orrin Cone **Helper:** **Inspector:**

Remarks:

APPENDIX C SOIL TESTIING DATA

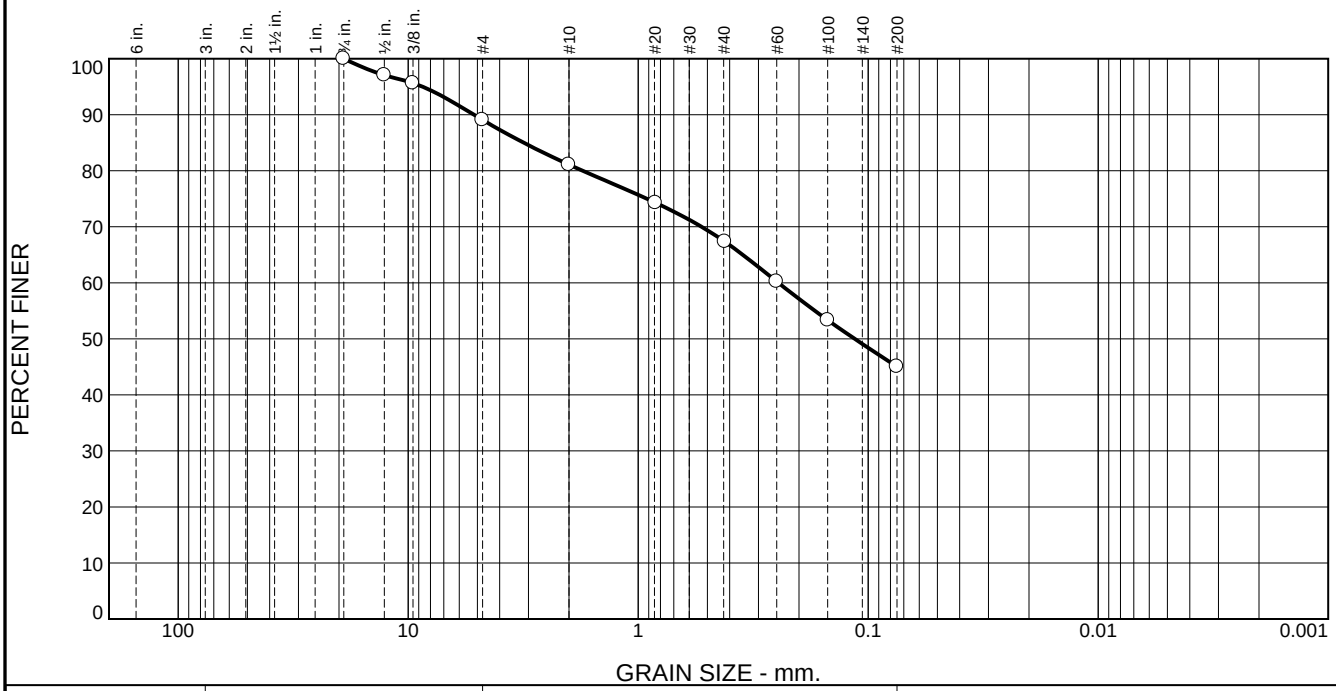
THIELSCH ENGINEERING	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 http://www.thielsch.com	Client Information: **Northeast Engineers & Consult.** 55 John Clarke Road Middletown, RI 02842 **PM: Steve Otten** Assigned By: N. Merriman	Laboratory Information **Portsmouth Police Station** **Portsmouth, RI** **Project Number: 15201.1** TEI Project Number: 74-16-0002.39 Report Date: 2/19/2016

LABORATORY TESTING DATA SHEET

Boring No.	Sample No.	Depth (ft)	Lab No.	Identification Tests												
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines % (<#200)	ORG %	Dry unit wt. pcf	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) Corrected	CBR Dry unit wt. pcf	CBR @ 0.1" @ 0.2"	Laboratory Log and Soil Description
B-10	S-1	2	16-S-114				10.9	44.1	45.0							Brown silty sand (SM)
B-10	S-2	6	16-S-115	11.8			13.6	46.4	40.0							Gray silty sand (SM)
B-10	S-3	11	16-S-116		--	NP	19.7	43.4	36.9							Gray silty sand with gravel (SM)
B-10	S-4	16	16-S-117				47.2	37.5	15.3							Gray-brown silty gravel with sand (GM)
B-10	S-5	21	16-S-118	2.0			43.5	38.7	17.8							Light brown silty gravel with sand (GM)
B-3	S-1	2	16-S-119				22.6	38.3	39.1							Brown silty sand with gravel (SM)
B-3	S-2	6	16-S-120	12.6			21.7	36.6	41.7							Gray silty sand with gravel (SM)
B-3	S-3	11	16-S-121		--	NP	34.1	43.4	22.5							Gray silty sand with gravel (SM)
B-3	S-4	16	16-S-122				24.7	46.4	28.9							Gray silty sand with gravel (SM)
B-3	S-5	21	16-S-123	3.5			57.6	24.3	18.1							Gray silty gravel with sand (GM)

Reviewed By _____ Date Reviewed 2/22/2016

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.9	8.0	13.6	22.5	45.0	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	97.0		
.375"	95.7		
#4	89.1		
#10	81.1		
#20	74.3		
#40	67.3		
#60	60.2		
#100	53.4		
#200	45.0		

* (no specification provided)

Material Description

Brown silty sand

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 5.1754 D_{85}= 3.1432 D_{60}= 0.2457
D_{50}= 0.1144 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: MS/JE
Checked By: Matthew Polsky
Title: Laboratory Manager

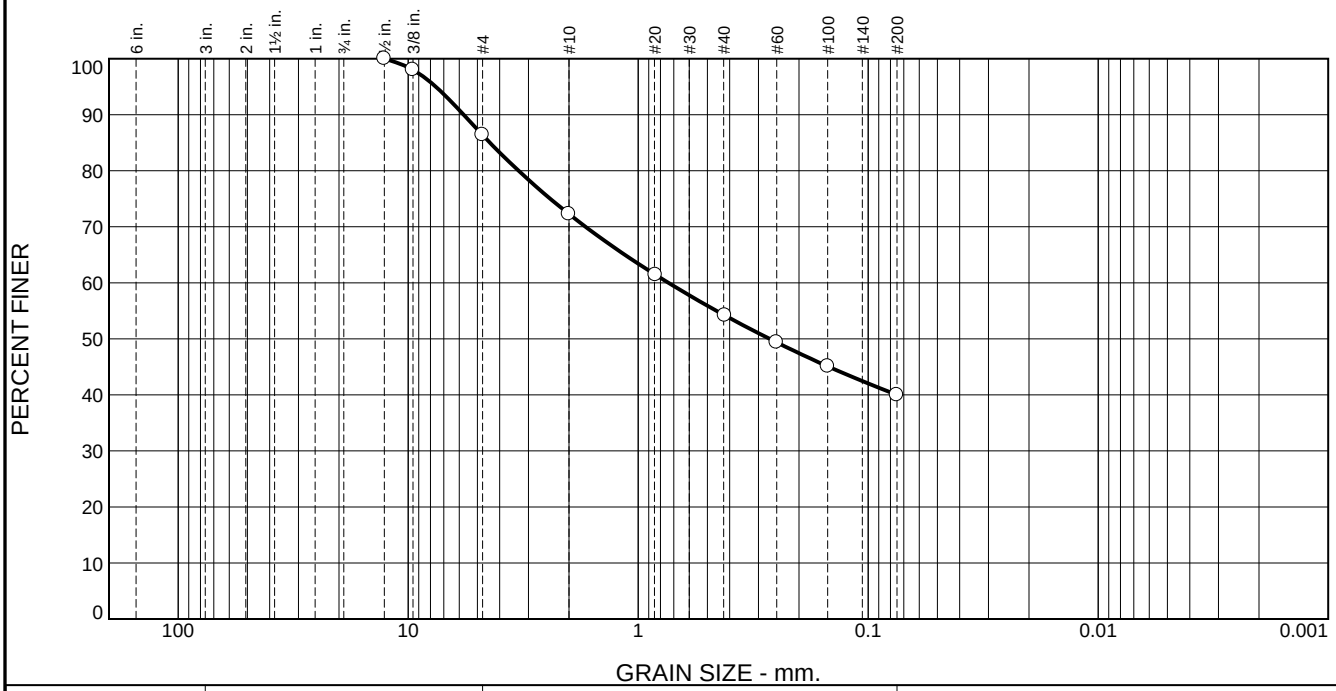
Source of Sample: B-10 **Depth:** 2' **Date Sampled:**
Sample Number: S-1

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-114

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.6	14.1	18.0	14.3	40.0	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.5"	100.0		
.375"	98.0		
#4	86.4		
#10	72.3		
#20	61.4		
#40	54.2		
#60	49.4		
#100	45.1		
#200	40.0		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 5.7363 D_{85}= 4.4088 D_{60}= 0.7384
D_{50}= 0.2682 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: MS/JE
Checked By: Matthew Polsky
Title: Laboratory Manager

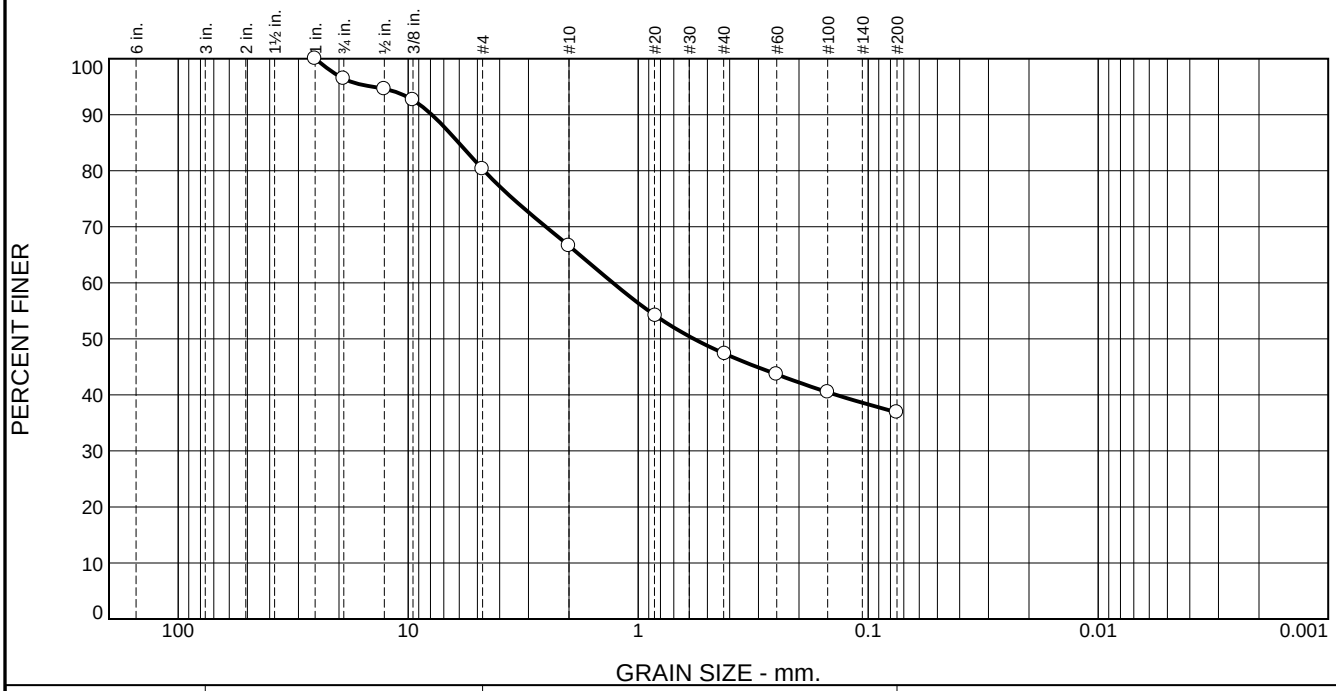
Source of Sample: B-10 **Depth:** 6' **Date Sampled:**
Sample Number: S-2

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-115

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.6	16.1	13.7	19.2	10.5	36.9	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	96.4		
.5"	94.6		
.375"	92.6		
#4	80.3		
#10	66.6		
#20	54.1		
#40	47.3		
#60	43.7		
#100	40.5		
#200	36.9		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 7.8900 D_{85}= 6.0267 D_{60}= 1.2881
D_{50}= 0.5726 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/18/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

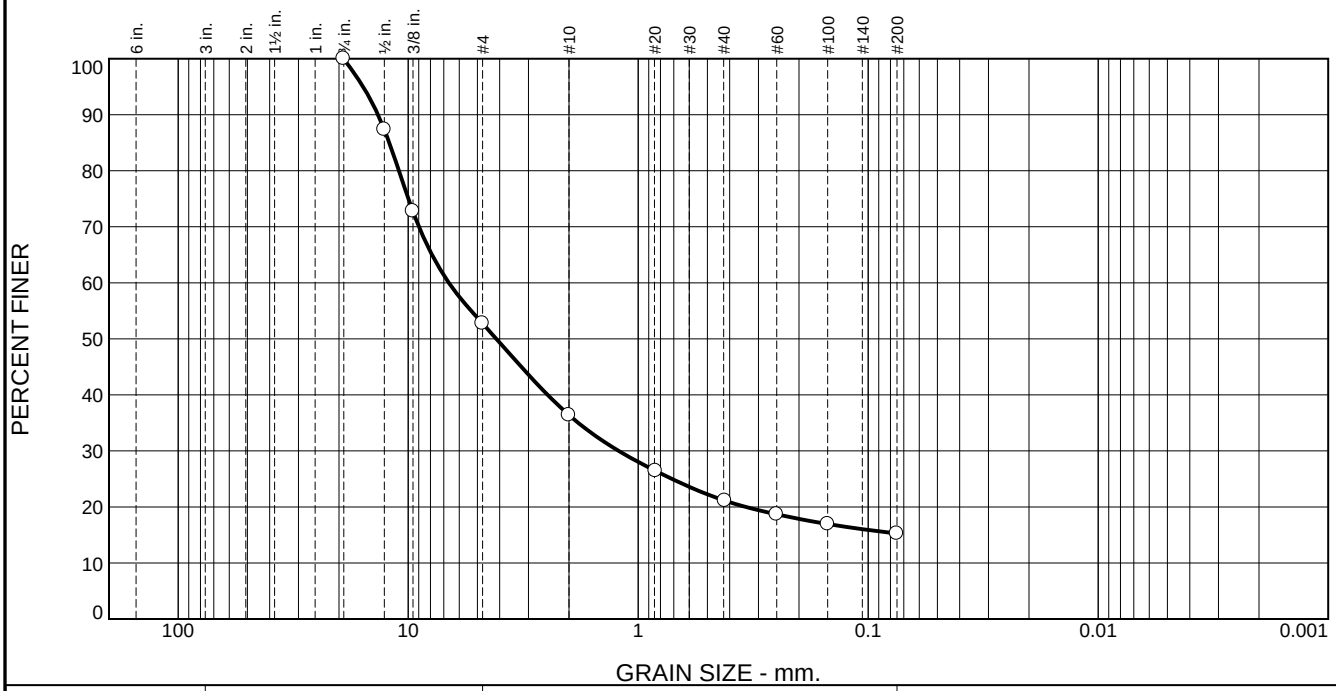
Source of Sample: B-10 **Depth:** 11'
Sample Number: S-3 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-116

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	47.1	16.4	15.2	5.9	15.3	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	87.4		
.375"	72.8		
#4	52.8		
#10	36.4		
#20	26.4		
#40	21.1		
#60	18.7		
#100	16.9		
#200	15.3		

* (no specification provided)

Material Description

Gray-brown silty gravel with sand

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 13.5212 D_{85}= 12.0835 D_{60}= 6.6552
D_{50}= 4.1368 D_{30}= 1.2157 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: MS/JE
Checked By: Matthew Polsky
Title: Laboratory Manager

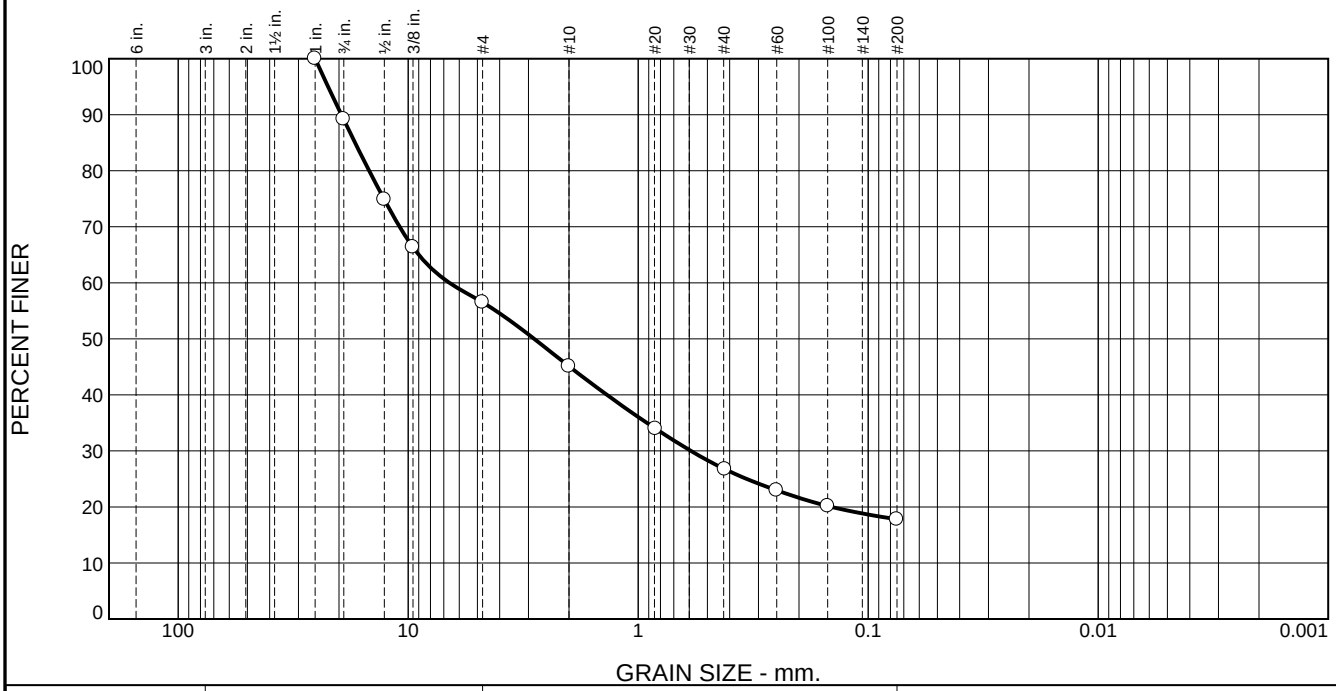
Source of Sample: B-10 **Depth:** 16'
Sample Number: S-4 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-117

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	32.6	11.4	18.3	9.0	17.8	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	89.2		
.5"	74.9		
.375"	66.4		
#4	56.5		
#10	45.1		
#20	34.0		
#40	26.7		
#60	23.0		
#100	20.2		
#200	17.8		

* (no specification provided)

Material Description

Light brown silty gravel with sand

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 19.5103 D_{85}= 17.0200 D_{60}= 6.6111
D_{50}= 2.8319 D_{30}= 0.5893 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: MS/JE
Checked By: Matthew Polsky
Title: Laboratory Manager

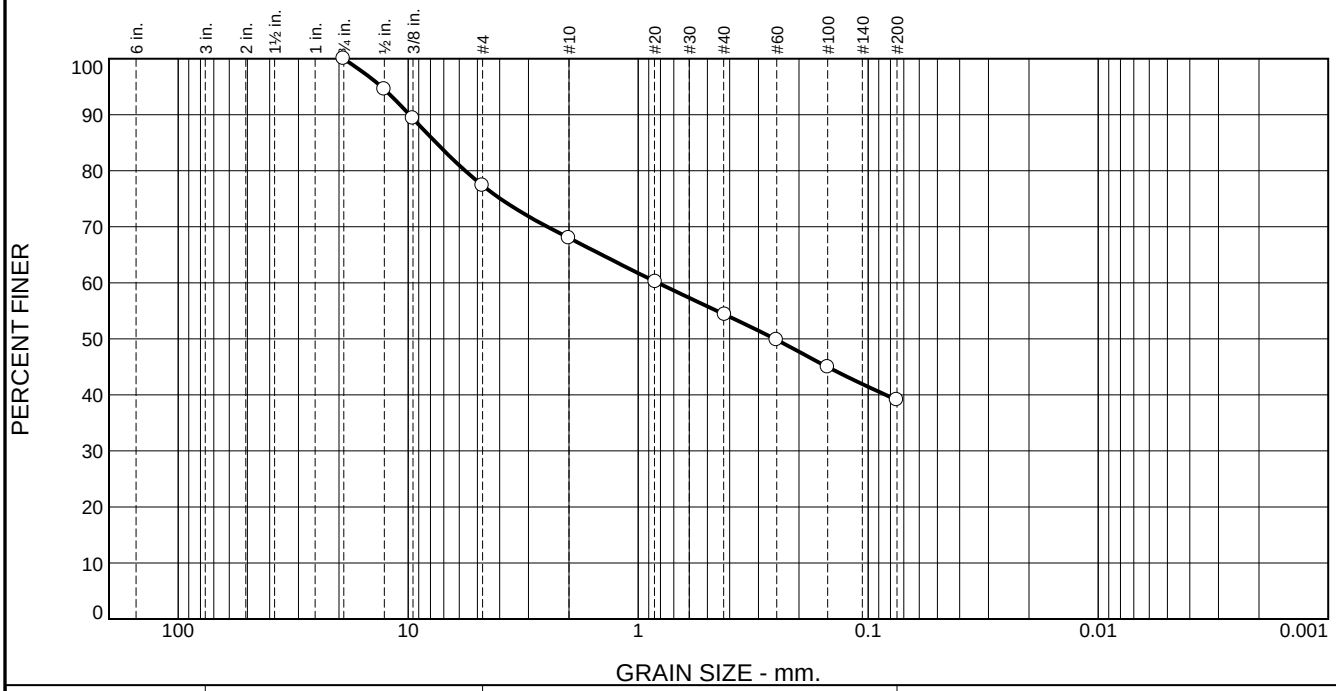
Source of Sample: B-10 **Depth:** 21'
Sample Number: S-5 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-118

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.6	9.4	13.6	15.3	39.1	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	94.5		
.375"	89.4		
#4	77.4		
#10	68.0		
#20	60.2		
#40	54.3		
#60	49.8		
#100	45.0		
#200	39.1		

* (no specification provided)

Material Description

Brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 9.8797 D_{85}= 7.5581 D_{60}= 0.8212
D_{50}= 0.2548 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

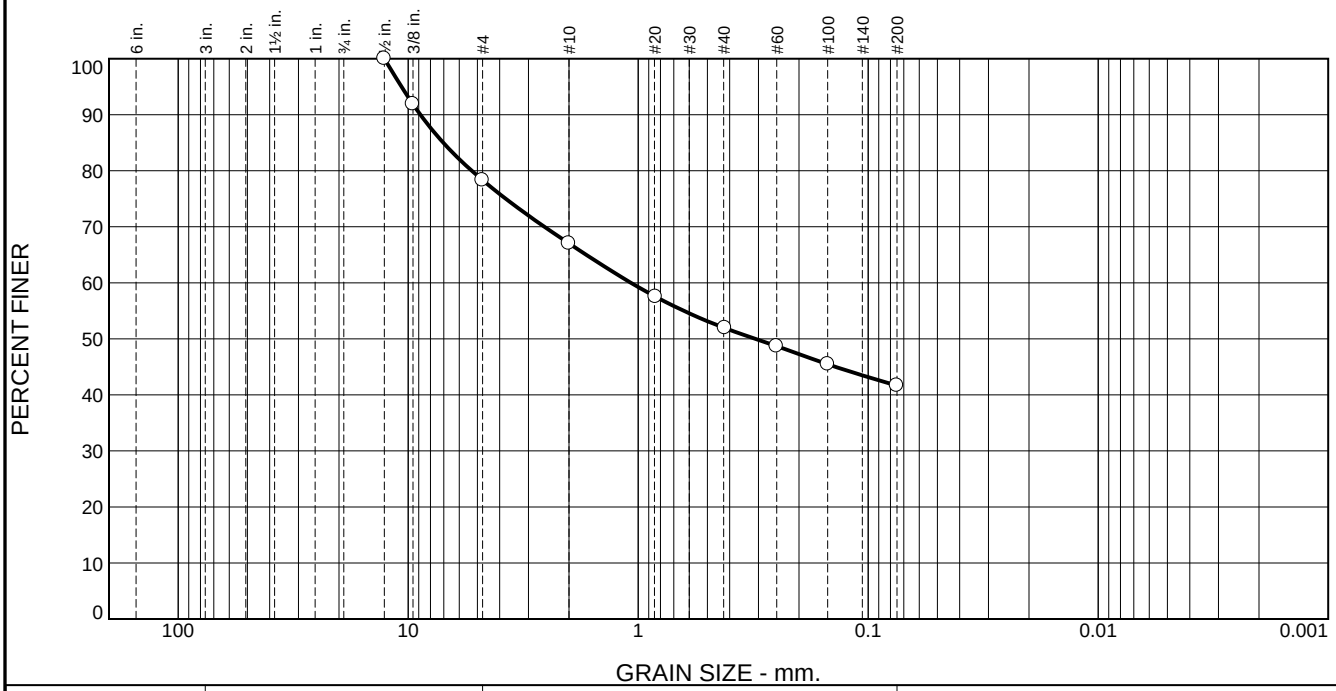
Source of Sample: B-3 **Depth:** 2'
Sample Number: S-1 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-119

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	21.7	11.3	15.0	10.3	41.7	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.5"	100.0		
.375"	91.9		
#4	78.3		
#10	67.0		
#20	57.5		
#40	51.9		
#60	48.7		
#100	45.5		
#200	41.7		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 8.8524 D_{85}= 7.0363 D_{60}= 1.0750
D_{50}= 0.3096 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

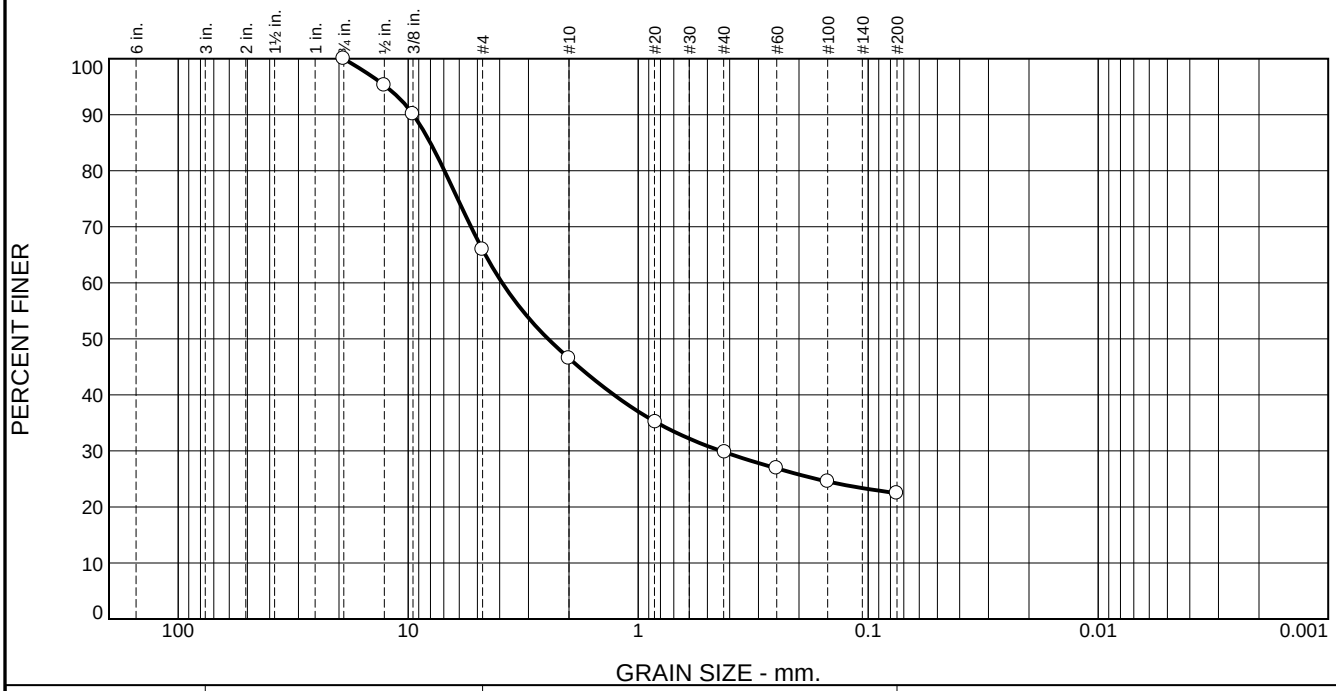
Source of Sample: B-3 **Depth:** 6'
Sample Number: S-2 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-120

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	34.1	19.4	16.7	7.3	22.5	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	95.3		
.375"	90.1		
#4	65.9		
#10	46.5		
#20	35.2		
#40	29.8		
#60	26.9		
#100	24.5		
#200	22.5		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 9.5035 D_{85}= 8.0151 D_{60}= 3.9031
D_{50}= 2.4637 D_{30}= 0.4369 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/18/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

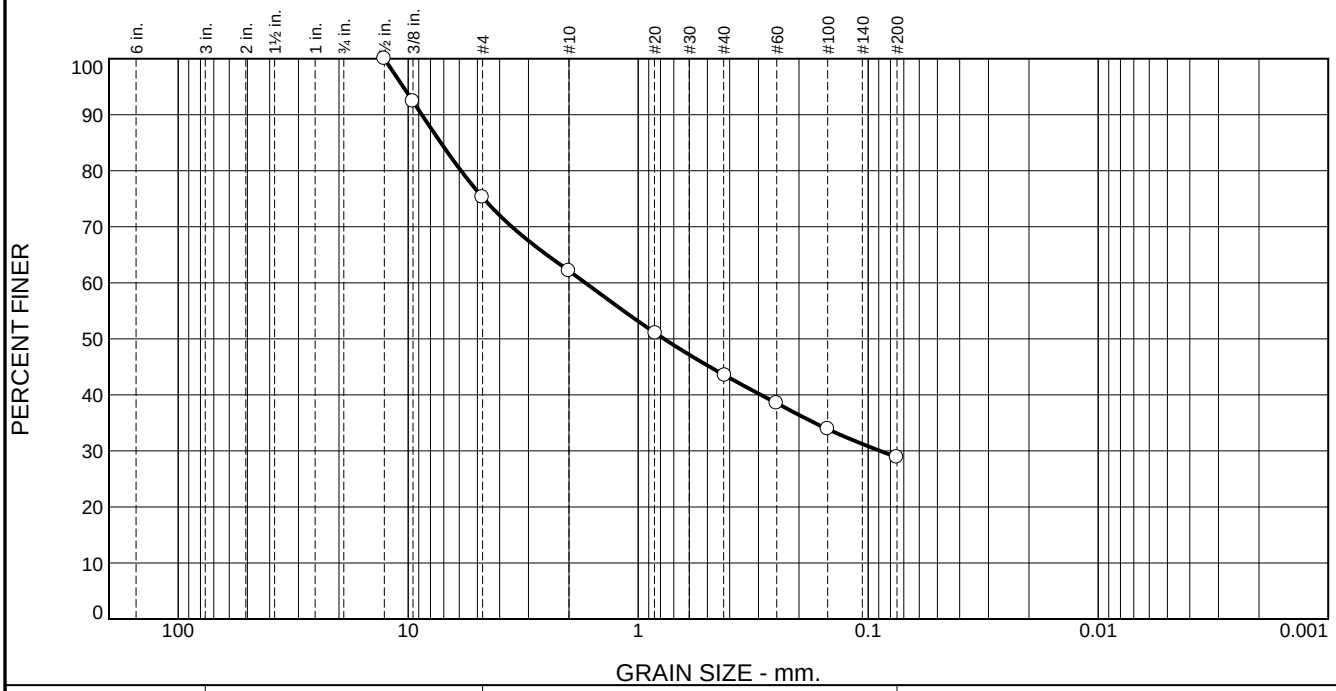
Source of Sample: B-3 **Depth:** 11'
Sample Number: S-3 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-121

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	24.7	13.2	18.5	14.7	28.9	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.5"	100.0		
.375"	92.4		
#4	75.3		
#10	62.1		
#20	51.0		
#40	43.5		
#60	38.5		
#100	33.9		
#200	28.9		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits (ASTM D 4318)

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

Classification

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

Coefficients

D_{90}= 8.7255 D_{85}= 7.2096 D_{60}= 1.6980
D_{50}= 0.7710 D_{30}= 0.0887 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

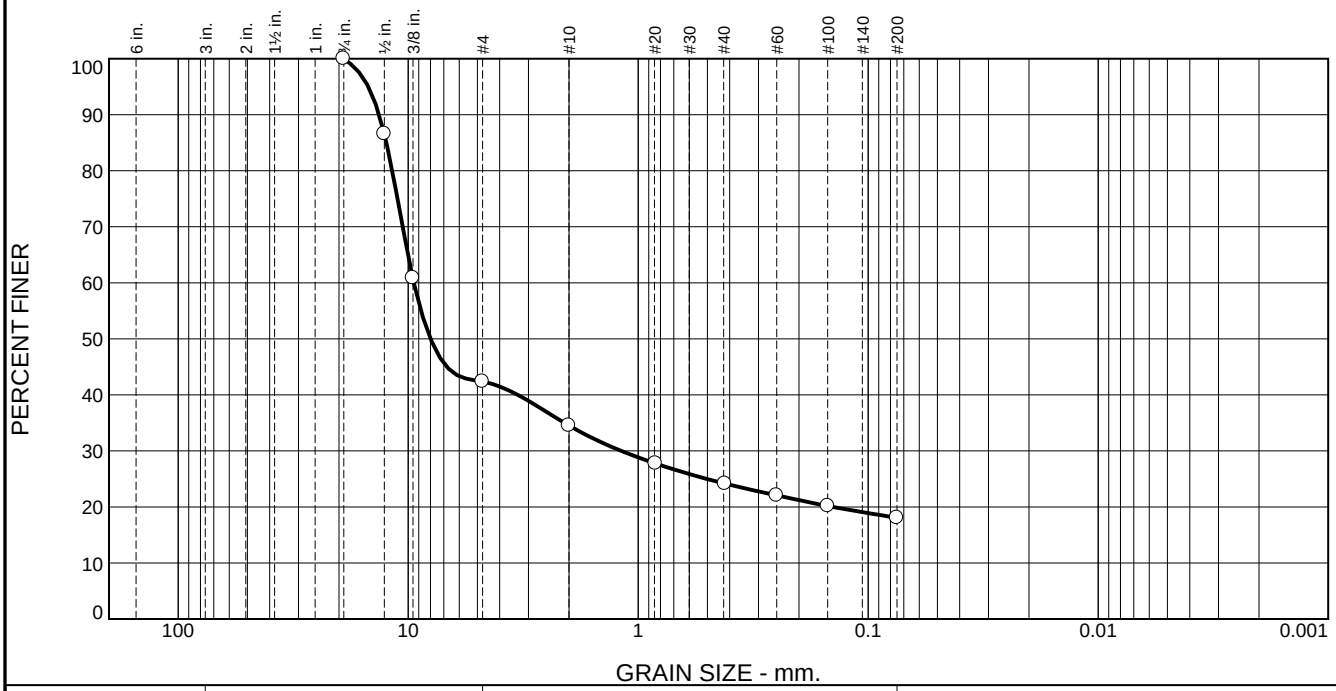
Source of Sample: B-3 **Depth:** 16'
Sample Number: S-4 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-122

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	57.6	7.9	10.3	6.1	18.1	

TEST RESULTS (D422)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
.5"	86.6		
.375"	60.9		
#4	42.4		
#10	34.5		
#20	27.8		
#40	24.2		
#60	22.1		
#100	20.2		
#200	18.1		

* (no specification provided)

Material Description

Gray silty gravel with sand

Atterberg Limits (ASTM D 4318)

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

Classification

USCS (D 2487)= GM **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 13.3743 D_{85}= 12.4402 D_{60}= 9.4460
D_{50}= 7.9948 D_{30}= 1.1829 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/10/16 **Date Tested:** 2/17/16
Tested By: GG/MS
Checked By: Matthew Polsky
Title: Laboratory Manager

Source of Sample: B-3 **Depth:** 21'
Sample Number: S-5 **Date Sampled:**

Thielsch Engineering Inc.

Cranston, RI

Client: Northeast Engineers & Consult.
Project: Portsmouth Police Station, Portsmouth, RI
Project No: 15201.1 **Figure** 16-S-123