

Geotechnical Engineering Report

Providence VA Medical Center Building Addition
Providence, Rhode Island

October 9, 2013

Project No. J1135105

Prepared for:

Harriman Architects & Engineers
Auburn, Maine

Prepared by:

Terracon Consultants, Inc.
Manchester, New Hampshire

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October 9, 2013

Harriman Architects & Engineers
46 Harriman Drive
Auburn, ME 04210

Attn: Mr. John D. Kuchinski, PE
P: (207) 784 5100
F: (207) 782 3017
E: jkuchinski@harriman.com

Re: Geotechnical Engineering Report
Providence VA Medical Center Building Addition
830 Chalkstone Avenue
Providence, Rhode Island
Terracon Project No. J1135105

Dear Mr. Kuchinski:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above-referenced project. Services were performed in general accordance with our proposal PJ4130004 dated January 9, 2013 and your subsequent authorization. This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.

Carl W. Thunberg
Sr. Project Geotechnical Engineer

Lawrence J. Dwyer, PE
Principal

/cwt



Terracon Consultants, Inc. 77 Sundial Avenue, Suite 401W Manchester, NH 03103
P (603) 647 9700 F (603) 647 4432 terracon.com

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EXECUTIVE SUMMARY

Terracon has performed a geotechnical exploration for the proposed building addition at the Providence Veterans Administration Medical Center at 830 Chalkstone Avenue in Providence, Rhode Island. Terracon's geotechnical scope of services included advancing eight test borings to depths ranging from approximately 9 to 42 feet below the existing ground surface within the proposed building area. Boring B-4 was eliminated due to underground utilities in the proposed drilling location.

Based on the information obtained from our subsurface explorations, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Soil conditions generally consisted of 2.0 to 15.0 feet of fill underlain by a natural glaciofluvial deposit which is, in turn, underlain by glacial till. Groundwater was not encountered in the borings.
- The proposed building may be supported by conventional shallow spread footings bearing directly on proof-rolled natural glaciofluvial sand or on compacted structural fill placed above such materials. Existing fill, where encountered at footing subgrade elevation, should be removed to natural glaciofluvial subgrade and compacted structural fill placed to achieve design elevation. Footings should be stepped downward as necessary to match the existing footing elevations where the new addition ties into the existing building.
- Although groundwater was not encountered in the borings while drilling, the basement excavation will be depressed and open for a sustained time. Temporary construction dewatering from rainfall, snowmelt, or surface runoff should be anticipated for construction of the basement area. Due to the proposed occupancy, perimeter foundation drains, and basement dampproofing, should be included in the basement design.
- Assuming proper site and subgrade preparation, total and differential settlement should be within tolerable limits.
- Based on the *2009 International Building Code* the seismic site classification is D. The site does not appear to be susceptible to liquefaction in the event of an earthquake.
- Terracon should observe and evaluate earthwork on the project. The earthwork evaluation should include observation and testing of compacted fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction.

The geotechnical executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details are not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

**GEOTECHNICAL ENGINEERING REPORT
PROVIDENCE VA MEDICAL CENTER
PROVIDENCE, RHODE ISLAND
Terracon Project No. J1135105
October 9, 2013**

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed building addition at the Providence Veterans Administration Medical Center at 830 Chalkstone Avenue in Providence, Rhode Island. The purpose of our services is to provide information and geotechnical engineering recommendations relative to the following:

- subsurface soil conditions
- earthwork
- groundwater conditions
- foundation design and construction

Our geotechnical engineering scope of services included advancing eight test borings to depths ranging from approximately 9 to 42 feet below the existing ground surface within the proposed building area. The borings are designated as B-1 through B-3 and B-5 through B-9. B-4 was not drilled due to underground utilities at the proposed drilling location. A Site Location Map and a Boring Location Plan are included in Appendix A as Exhibits A-1 and A-2, respectively. Logs of the test borings are also included in Appendix A.

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	See Exhibit A-2, Boring Location Plan.
Structure	Three-story, steel framed hospital storage and sterile processing building as an addition to the existing structure.
Maximum Loads (assumed)	Columns: 50 kips Slabs: 100 psf max
Grading	Minor cuts and fills limited to 2 feet of cut or fill for site grading. Full basement excavation.
Freestanding Retaining Walls	Existing site retaining walls to remain. No new retaining walls anticipated
Below Grade Areas	Basement

2.2 Site Location and Description

Item	Description
Location	East side of the hospital, adjacent to the existing A-Wing, at 830 Chalkstone Avenue in Providence, Rhode Island.
Existing Improvements	The site is currently developed with existing structures, pavement and landscaped areas as part of the hospital campus. There is an existing approximately 40-foot-tall, several-tier retaining wall to the east of the proposed addition.
Current Ground Cover	Predominantly bituminous parking and drive areas, with grass landscaped areas.
Existing Topography ¹	Generally sloping downward from west to east from approximately El 85 feet to El 81 feet in the project area.

1. Elevations are based on contours illustrated on the untitled drawing provided by Harriman.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Based on the results of the borings, subsurface conditions can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/ Relative Density
Fill	3.0 to 15.0	Silty Sand with Gravel, brown to dark brown. Roots and Organic Soil at bottom of fill in B-7 and B-8	Loose to Dense
Glaciofluvial Deposit	22.5 to 35	Poorly graded Sand (SP) , trace Silt, trace Gravel, to Poorly graded Sand with Silt and Gravel (SP-SM)	Very Loose to Very Dense
Glacial Till	>42	Poorly graded Gravel with Silt (GP-SM) to Poorly graded Sand with Silt and Gravel (SP-SM)	Very dense

Visual soil classifications and conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate locations of changes in soil types; in-situ, the transition between materials may be gradual. Details of each boring can be found on the boring logs in Appendix A. A discussion of field sampling procedures is included in Appendix A.

3.2 Groundwater

The boreholes were observed during and after drilling for the presence and level of groundwater. Free groundwater was not encountered in the borings during drilling. Note that the borings were

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backfilled immediately upon completion for safety. Groundwater levels observed while drilling may not be representative of long-term equilibrated groundwater levels.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

3.3 Laboratory Testing

Laboratory testing was performed on soil samples obtained from the test borings to assist in classification and to evaluate relative engineering parameters. Grain-size analyses and moisture content were performed on select samples from the site investigation. Results of the tests are included in Appendix B and are summarized below:

Sample Identification	Depth (feet)	USCS	Gravel (%)	Sand (%)	Fines (%)	Moisture Content (%)
B-1, S-3	5 - 7	SM	22	62	16	6.5
B-5, S-3	5 - 7	SM	21	54	25	7.0
B-7, S-3	5 - 7	GM	46	41	13	2.8
B-9, S-7	20 - 22	SP	10	87	3	1.6

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The project includes demolishing a portion of the existing emergency care unit and constructing a 25,000-SF single-story addition with a 5,000-SF basement area. At this time, survey data are not available regarding the existing basement grade elevation. The proposed basement floor grade is presumed to match the existing basement elevation.

We recommend supporting the proposed building on shallow spread footings bearing directly on the glaciofluvial deposits or on structural fill placed on proofrolled glaciofluvial deposits. Borings encountered fill at approximately 15 feet below existing grade in B-2. Due to the proposed basement, the majority of the existing fill is expected to be removed as part of bulk excavation to basement floor slab subgrades.

The existing fill is considered unsuitable for support of foundations and floor slabs due to the uncontrolled nature of its placement and the presence of organic soils observed in some of the borings. Existing fill is not suitable for foundation support and should be replaced with compacted structural fill within the entire building footprint, extending to include the foundation bearing zone. Floor slabs may be supported on the natural glaciofluvial deposit, or on compacted structural fill placed above these materials.

Construction of foundations for the proposed basement area may require underpinning of existing foundations, depending on final building layout. Where excavations will disturb the foundation bearing zone (defined as the area beneath a line extending horizontally 12 inches, and downward and outward at 1 horizontal to 1 vertical [1H:1V] from the footing edges), underpinning will be required to prevent undermining existing foundations.

Though groundwater was not encountered in the borings while drilling, the basement excavation will be depressed and open for a sustained time. Temporary construction dewatering from rainfall, snowmelt, or surface runoff should be anticipated for construction of the basement area. Due to the proposed occupancy, perimeter foundation drains, and basement dampproofing, should be included in the basement design.

Geotechnical engineering recommendations for foundation systems and other earth-connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field testing, engineering analyses, and our current understanding of the proposed improvements at the site.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation, and placement of fill for the project. The recommendations presented for design and construction of earth supported elements including foundations and pavements are contingent upon following the recommendations outlined in this section.

Terracon representatives should observe and evaluate the earthwork on the project. The earthwork evaluation should include observing and testing engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction.

4.2.1 Site Preparation

The project area is currently developed, with paved parking and drive areas, a retaining wall, and landscaped traffic islands. Existing site improvements, pavements, and underground utilities should be re-located or removed from within the proposed building area.

Existing fill, where encountered at footing subgrade elevation, should be removed to natural glaciofluvial subgrade and compacted structural fill placed to achieve design elevation. Due to the proposed basement construction, it is anticipated that the majority of existing fill materials will be removed during the course of normal bulk excavation for basement construction.

Existing utility piping more than 4 inches in diameter below proposed pavement areas, not intended to remain in-service, should be removed or abandoned in-place by filling with grout. Where utilities and pavements are removed, disturbed soil should be undercut and the excavations should be backfilled in compacted lifts. Fill materials and compaction efforts should be consistent with the intended future use.

4.2.2 Subgrade Preparation

Following the required stripping, excavation to rough grade, and before placing new fill or constructing foundations, soil subgrades should be proofrolled with at least six passes in perpendicular directions of a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor in trenches. The geotechnical engineer, or his/her representative, should review the subgrade during the proofrolling process. Soft/unstable zones, as well as unsuitable materials identified by the geotechnical engineer, should be overexcavated from the slab and footing bearing zones to competent material and replaced with compacted structural fill, as necessary. Overexcavation efforts should be accomplished in accordance with the recommendations presented in Section **4.3.2 Construction Considerations**.

Following proofrolling, structural fill may be placed and compacted to achieve design footing subgrade. Where subgrades become wet, unstable, and/or difficult to proofroll, the use of crushed stone should be considered in lieu of structural fill. Crushed stone, when used, should be underlain with a geotextile separation fabric, such as Mirafi 140N or equivalent.

4.2.3 Fill Materials and Placement

Excavated on-site soils are anticipated to consist primarily of existing granular fill or glaciofluvial deposits. Based on visual classifications and results of gradation analyses, excavated on-site soils are anticipated to be suitable for reuse as structural fill and common fill, provided they are free of deleterious material, are stable and can be adequately compacted. Fill should meet the following material property requirements:

Fill Type ¹	USCS Classification	Acceptable Location For Placement
Structural Fill ²	GW, GP, SW, SP, GW-GM, GP-GM, SW-SM, SP-SM	All locations and elevations.
Common Fill ³	Varies	Common fill may be used for site grading. Common fill should not be used under settlement sensitive structures.

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Crushed Stone ⁴	GP	¾-inch crushed stone meeting the criteria in Rhode Island DOT Standard Specifications for Road and Bridge Construction M.02.03.
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1. Compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used. Fill should not be placed on a frozen subgrade.
2. Imported structural fill should meet the following gradation:

Sieve Size	Percent Passing by Weight
6"	100
3"	70 – 100*
¾"	45 – 95
No. 4	30 – 90
No. 10	25 – 80
No. 40	10 – 50
No. 200	0 – 10

* Maximum 2-inch particle size within 12 inches of the underside of footings or slabs

3. Common fill should have a maximum particle size of 6 inches and no more than 25 percent by weight passing the US No. 200 sieve.
4. Crushed stone should be underlain with a geotextile filter fabric such as Mirafi 140N, or equivalent.

4.2.4 Compaction Requirements

Item	Description
Fill Lift Thickness	8 inches or less in loose thickness.
Compaction Requirements ¹	95% Modified Proctor maximum dry density (ASTM D1557, Method C)
Moisture Content – Granular Material	+/-3% of optimum

1. We recommend testing engineered fill for moisture content and compaction during placement. If in-place density test results indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

4.2.5 Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction.

Though groundwater was not encountered in the borings while drilling, the proposed basement occupancy will require wall finishes and floor coatings that are highly sensitive to moisture damage. In order to maintain the below grade space in a dry state, perimeter foundation drains are recommended around building foundations. Drains should consist of a minimum 4-inch diameter, Schedule 40 perforated PVC pipe or Advanced Drainage Systems™ drain pipe. The pipe should be surrounded by a minimum of 4 inches of ¾-inch crushed stone containing not

more than 10 percent material that passes the No. 4 sieve. The crushed stone should be encapsulated with a geotextile such as Mirafi 140N or equivalent. Drains should be sloped to allow for gravity flow and may discharge to daylight or an approved storm drain system.

Below grade foundation walls should be protected from water intrusion by the application of a damp-proofing barrier such as bituthene® or approved equivalent.

4.2.6 Underpinning

The proposed basement floor is presumed to match the existing basement floor grade. Underpinning is not anticipated to be required. Localized underpinning may potentially be required for utilities, elevator pits or other structures. Based on the subsurface conditions and anticipated excavation depths, we recommend jet grouting, or conventional cast-in-place concrete underpinning pits, if underpinning is required. An underpinning method that induces vibration, such as sheet pile installation and extraction, may cause localized settlement in the relatively clean sand deposit. We can provide the names of local underpinning contractors upon request.

4.2.7 General Construction Considerations

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations, as required, to maintain stability of the excavation sides and the excavation bottom. Instability in the form of slope raveling, caving, and sloughing should be expected in all excavations and trenches that extend into the granular materials with little to no cohesion. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards.

Based upon the encountered subsurface conditions, subgrade soils exposed during construction are anticipated to be relatively stable. However, the subgrade stability may be affected by precipitation, repetitive construction traffic, or other factors. If unstable conditions develop, replacement with granular materials may be necessary.

If construction dewatering should become necessary, the contractor should select a dewatering method to lower groundwater at least 2 feet below the excavation subgrade in order to minimize bearing surface disturbance during construction of footings and utilities.

Efforts should be made to prevent surface water runoff from collecting in excavations. Subgrade soils that become unstable should be replaced with compacted structural fill or crushed stone, as necessary. Crushed stone, if used, should be underlain with a geotextile filter fabric such as Mirafi 140N, or equivalent.

4.3 Building Foundations and Floor Slabs

The proposed building can be supported by conventional shallow spread footings bearing directly on proofrolled natural glaciofluvial deposits or on compacted structural fill placed above the proofrolled natural subgrade. Design recommendations for the proposed structure are presented in the following paragraphs. Footings from the new addition should be stepped downward as necessary to match the existing footing grade where it joins the existing basement, in order to prevent surcharging or imparting lateral loads from one structure to the other.

4.3.1 Design Recommendations

Description	Value
Foundation type	Conventional shallow spread footings
Bearing material	Proof-rolled glaciofluvial deposits or compacted structural fill placed above proof-rolled sand.
Net allowable bearing pressure ¹	5,000 psf
Minimum strip footing width	16 inches
Minimum isolated spread footing width	24 inches
Minimum footing embedment below finished grade for frost protection ²	48 inches
Total estimated settlement ³	<1 inch
Estimated differential settlement ³	Half the total settlement

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes unsuitable fill or unstable soils, where present, will be replaced with compacted structural fill or crushed stone.
2. Perimeter footing and footings beneath unheated areas. Minimum recommended embedment for interior footings beneath heated areas is 18 inches below finished grade.
3. Foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footing, the thickness of compacted fill, and the quality of the earthwork operations

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead-load computations.

4.3.2 Construction Considerations

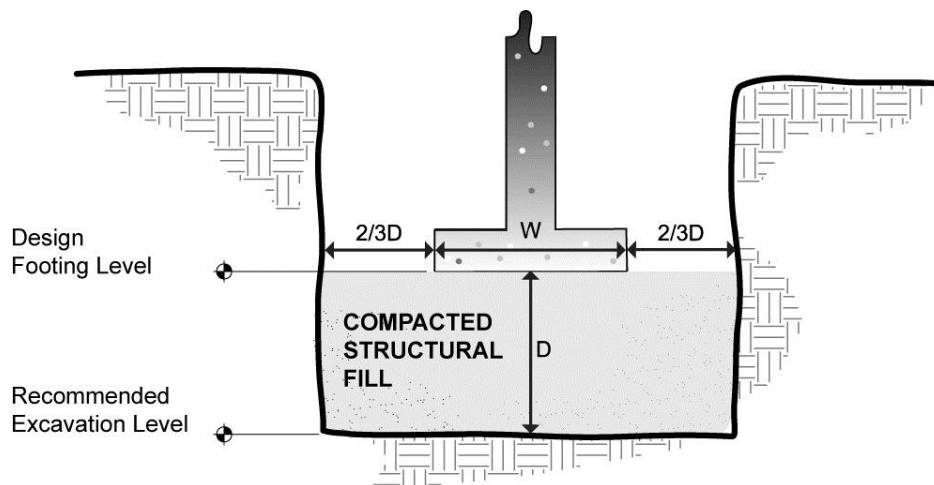
Foundations for the proposed building and related structural elements should bear on natural glaciofluvial deposits, lean concrete, or compacted structural fill placed above such materials. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of depth below the footings. Soil subgrades should be reviewed and prepared as described in Section **4.2.2 Subgrade Preparation** of this report. The overexcavation should then be backfilled up to the footing base elevation with lean concrete or structural fill as described in Section **4.2.3 Fill Materials and Placement**. Lean

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concrete may be the preferred backfill method in tightly constrained areas adjacent to existing structures, or in areas sensitive to vibration such as operating rooms.



Overexcavation / Backfill

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

The geotechnical engineer should observe foundation excavation. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

4.4 Seismic Considerations

Description	Value
Code Used	2009 <i>International Building Code</i> (IBC)
Site Class	D ¹
Maximum considered earthquake ground motions (5 percent damping)	0.370g (S_{MS} - 0.2 second spectral response acceleration)
	0.150g (S_{M1} - 1.0 second spectral response acceleration)
Liquefaction Potential	Not considered susceptible to liquefaction within limits of drilling

1. Currently the State of Rhode Island uses the 2009 *International Building Code* (IBC), Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile. The current scope requested does not include the required 100-foot soil profile determination. Borings extended to a maximum depth of 42 feet and this seismic site class definition considers that similar conditions continue below the maximum depth of the subsurface explorations.

4.5 Floor Slabs

4.5.1 Design Recommendations

Description	Value
Floor Slab support ¹	Proofrolled natural glaciofluvial deposits or a minimum 8-inch-thick layer of compacted structural fill or crushed stone placed above existing granular fill for the first-floor level, proofrolled as discussed in Section 4.2 Earthwork . Provide a minimum 12-inch-thick layer of compacted structural fill or crushed stone beneath the basement-level slab.
Modulus of subgrade reaction (k)	150 pounds per square inch per inch (psi/in)

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.

The use of a vapor retarder/barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet, or other moisture-sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder/barrier, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier. Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

4.5.2 Construction Considerations

The natural glaciofluvial deposit subgrade should be reviewed and proofrolled with a minimum 10-ton vibratory roller as described in Section **4.2 Earthwork**. Following proofrolling, compacted structural fill may be placed as necessary to achieve slab subgrade.

4.6 Lateral Earth Pressures

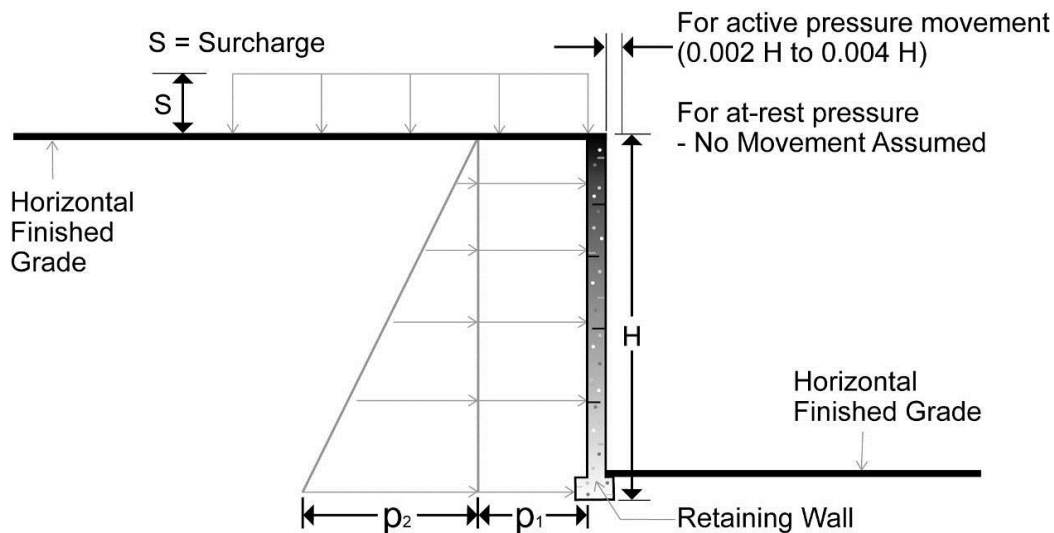
The lateral earth pressure recommendations given in the following paragraphs are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls.

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Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (K_a)	Granular - 0.33	40	$(0.33)S$	$(40)H$
At-Rest (K_o)	Granular - 0.50	60	$(0.50)S$	$(60)H$
Passive (K_p)	Granular - 3.00	360	---	---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about $0.002 H$ to $0.004 H$, where H is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- In-situ soil backfill weight a maximum of 125 pcf
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall

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- No dynamic loading
- Ignore passive pressure in frost zone
- Equivalent fluid densities do not include a factor of safety
- S is the surcharge in pounds per square foot

Backfill placed against structures should consist of granular soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at angles of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.50 should be used as the ultimate coefficient of friction between the footing and compacted structural fill or crushed stone.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications, so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction, and other earth-related construction phases of the project.

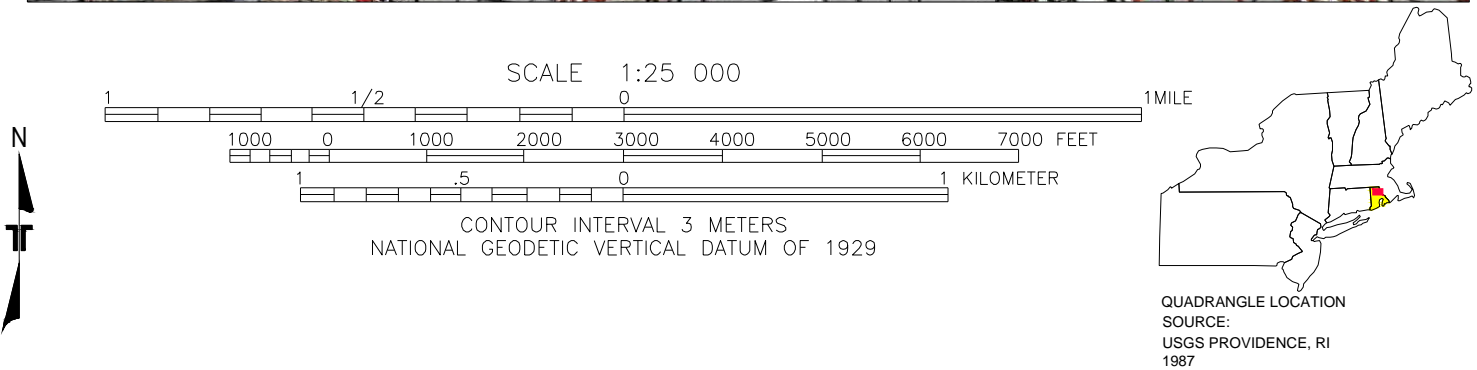
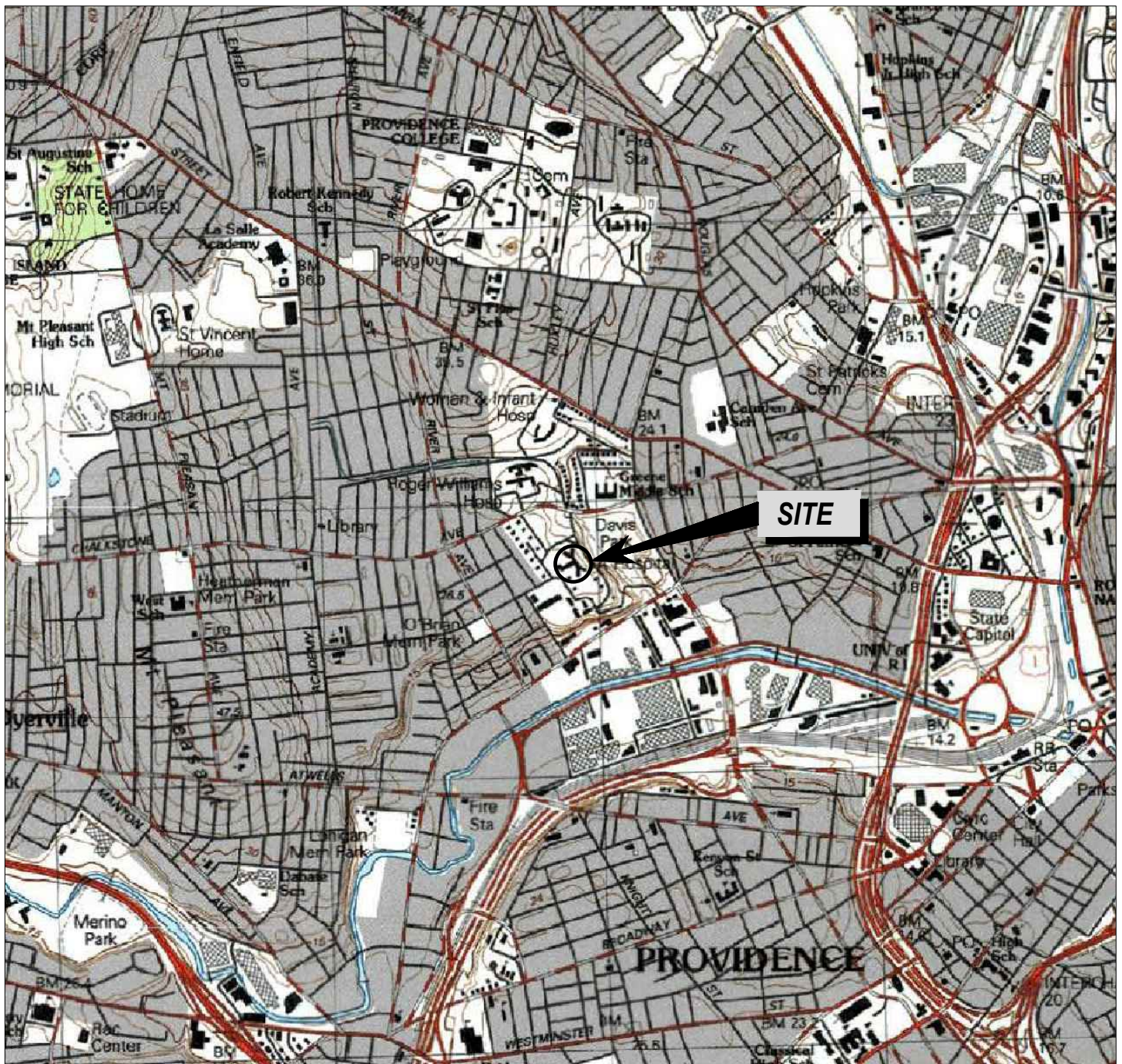
The analysis and recommendations presented in this report are based upon the data obtained from the explorations performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between explorations, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

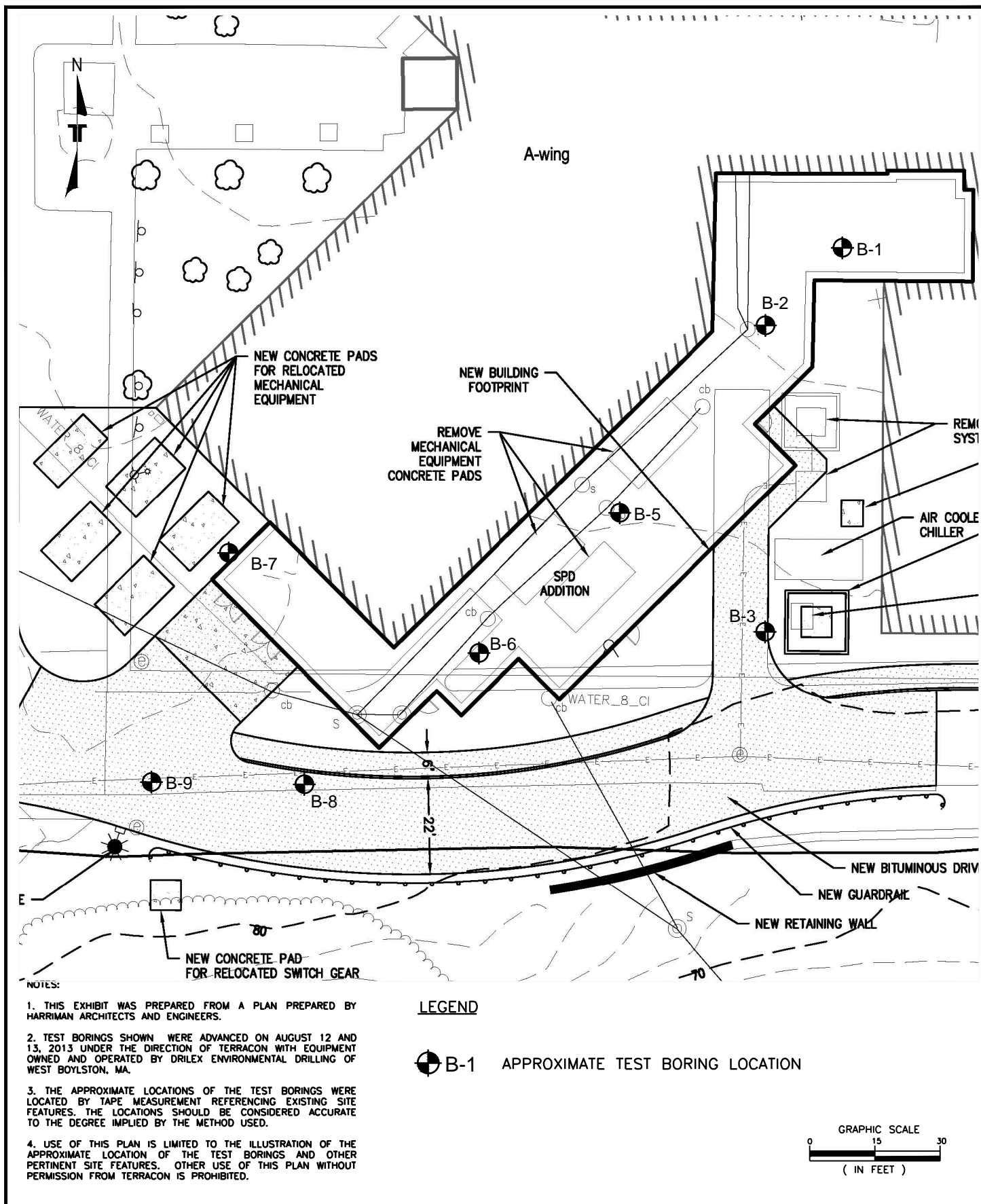
This report has been prepared for the exclusive use of our client for specific application to the project discussed and prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION



Project Mngr:	CWT	Project No.	J1135105		SITE LOCATION MAP VETERANS ADMINISTRATION HOSPITAL BUILDING ADDITION 830 CHALKSTONE AVENUE PROVIDENCE, RHODE ISLAND	EXHIBIT A-1
Drawn By:	MCR	Scale:	AS SHOWN			
Checked By:	CWT	File No.	J1135105.dwg			
Approved By:	LJD	Date:	October 2013			
				77 Sundial Ave. PH. (603) 647 9700	Manchester, NH 03103 FAX (603) 647 4432	



Project Mngr:	CWT	Project No.	J1135105
Drawn By:	MCR	Scale:	1" = 30'
Checked By:	CWT	File No.	J1135105.dwg
Approved By:	LJD	Date:	October 2013

Terracon

77 Sundial Ave. Manchester, NH 03103
PH. (603) 647 9700 FAX (603) 647 4432

BORING LOCATION PLAN

VETERANS ADMINISTRATION
HOSPITAL BUILDING ADDITION
830 CHALKSTONE AVENUE
PROVIDENCE, RHODE ISLAND

EXHIBIT

A-2

Field Exploration Description

Eight test borings (B-1 through B-3 and B-5 through B-9) were drilled to depths ranging from approximately 9 to 42 feet below the ground surface at the site on August 12 and 13, 2013. B-4 was eliminated due to underground utilities at the proposed drilling location. Explorations were advanced at the approximate locations shown on the attached Boring Location Plan (Exhibit A-2).

Geosearch, Inc. of Fitchburg, Massachusetts advanced the test borings using an ATV-mounted drill rig and 4.25-inch-inside-diameter hollow-stem augers. Borings were located in the field by tape measurement from existing site features. The accuracy of boring locations should only be assumed to the level implied by the method used to define them.

Generally, samples were obtained nearly continuously in the upper 10 feet, and at 5-foot intervals thereafter using a standard 2-inch-outside-diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed in general accordance with industry standards. Density of soil samples are based on N-values, which is determined by the number of hammer blows required to drive the sampler from 6 to 18 inches.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Groundwater conditions were measured in each boring at the time of drilling. Visual classification of soils and observed groundwater levels are shown on test boring logs included in Appendix A.


BORING LOG NO. B-1

Page 1 of 1

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION	DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	See Exhibit A-2						
		Surface Elev.: 84 (Ft.)					
	DEPTH	ELEVATION (Ft.)					
	0.3 4-inches topsoil	83.5					
	FILL - SILTY SAND WITH GRAVEL , brown, medium dense to loose					17	4-10-18-14 N=28
						8	8-4-4-9 N=8
			5				
						11	1-7-6-8 N=13
						14	11-11-13-14 N=24
	9.0 Blue warning tape in auger cuttings, abandoned boring	75					
	Boring Terminated at 9 Feet						
<p>Stratification lines are approximate. In-situ, the transition may be gradual.</p> <p>Hammer Type: Automatic</p>							
<p>Advancement Method: 4.25" Hollow stem augers</p>		<p>See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.</p>		<p>Notes:</p>			
<p>Abandonment Method: Borings backfilled with soil cuttings upon completion.</p>							
<p>WATER LEVEL OBSERVATIONS</p> <p>No free water observed</p>				<p>Boring Started: 8/12/2013</p>		<p>Boring Completed: 8/12/2013</p>	
				<p>Drill Rig: CME550 ATV</p>		<p>Driller: Jay</p>	
				<p>Project No.: J1135105</p>		<p>Exhibit: A-4</p>	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ







BORING LOG NO. B-2

Page 1 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)					
	0.5	83.5					
	6-inches topsoil/grass Hand dug to 1 foot						
	FILL - SILTY SAND WITH GRAVEL , dark brown, medium dense to dense						
						10	9-13-11-11 N=24
						13	18-22-21-24 N=43
						9	7-12-11-8 N=23
						14	6-9-9-5 N=18
							
						8	11-8-4-5 N=12
	15.0	69					
	POORLY GRADED SAND (SP) , trace gravel and silt, brown, medium dense, (GLACIOFLUVIAL)						
						3	14-13-9-9 N=22
							
						14	3-7-7-9 N=14
							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/12/2013

Boring Completed: 8/12/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ




BORING LOG NO. B-2

Page 2 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION	DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	See Exhibit A-2	Surface Elev.: 84 (Ft.)	ELEVATION (Ft.)				
	POORLY GRADED SAND (SP) , trace gravel and silt, brown, medium dense, (GLACIOFLUVIAL) <i>(continued)</i>	35.0	49			18	24-13-10-14 N=23
	POORLY GRADED GRAVEL (GP) , with silt, brown, medium dense to dense, (GLACIAL TILL)	35.0	42			22	16-14-12-14 N=26
	Boring Terminated at 42 Feet						
Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic							
Advancement Method: 4.25" Hollow stem augers		See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any).		Notes:			
Abandonment Method: Borings backfilled with soil cuttings upon completion.		See Appendix C for explanation of symbols and abbreviations.					
WATER LEVEL OBSERVATIONS No free water observed				Boring Started: 8/12/2013		Boring Completed: 8/12/2013	
				Drill Rig: CME550 ATV		Driller: Jay	
				Project No.: J1135105		Exhibit: A-5	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ

Page 1 of 2

CLIENT: Harriman
Auburn, ME

GRAPHIC LOG	LOCATION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	See Exhibit A-2					
	DEPTH	ELEVATION (Ft.)				
	3-inches bituminous concrete pavement pavement base: poorly graded sand with silt, brown, medium dense	80				
	FILL - POORLY GRADED SAND WITH SILT , trace gravel, brown, medium dense				19	5-13-21-27 N=34
	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, (GLACIOFLUVIAL)	78.5			18	9-12-17-14 N=29
	Poorly graded gravel, brown , medium dense		5		8	12-14-15-19 N=29
	Rock stuck in sampler tip				1	23-16-14-41 N=30
	POORLY GRADED SAND (SP) , with silt and gravel, brown, medium dense to dense, (GLACIOFLUVIAL)	71.5	10		13	12-17-19-14 N=36
			15		7	8-10-12-14 N=22
			20			4-7-8-10 N=15
		25				

Hammer Type: Automatic

Notes:

No free water observed

Terracon

Boring Completed: 8/12/2013

Driller: Jay

Exhibit: A-6

Page 2 of 2

CLIENT: Harriman
Auburn, ME

g LOCATION See Exhibit A-2

Surface Elev.: 81.5 (Ft.)

ELEVATION (Ft.)

DEPTH (Ft.)

WATER LEVEL
OBSERVATIONS

SAMPLE TYPE

RECOVERY (In.)

FIELD TEST RESULTS

30.0

51.5

30

1

9-45-16-12
N=61

32.0

49.5

Boring Terminated at 32 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/12/2013

Boring Completed: 8/12/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-6

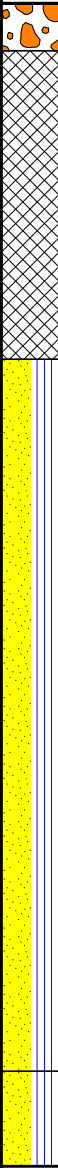
BORING LOG NO. B-5

Page 1 of 1

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)					
	1.0	81					
	12-inches crushed stone						
	7.5	74.5	5			12	6-9-8-6 N=17
						11	15-14-15-12 N=29
						19	33-15-19-21 N=34
						15	10-11-11-13 N=22
			10			13	5-14-11-10 N=25
			15			14	8-13-10-15 N=23
			20			16	18-12-14-15 N=26
	22.5	59.5				18	43-21-14-18 N=35
	24.5	57.5					
	Boring Terminated at 24.5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/12/2013

Boring Completed: 8/12/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-7

BORING LOG NO. B-6

Page 1 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)					
	0.3	81.5					
	3/4" crushed stone						
	2.0	80					
	FILL - SILTY SAND , with gravel, brown, medium dense					6	6-8-14-20 N=22
	SILTY SAND (SM) , with cobbles, brown, medium dense, (GLACIOFLUVIAL)					9	12-12-15-21 N=27
			5			7	4-8-12-50/4" N=20
			10			10	3-9-10-11 N=19
			15			0	4-14-22-22 N=36
			20			12	1-7-11-15 N=18
	20.0	62					
	POORLY GRADED SAND WITH GRAVEL (SP) , with gravel, trace silt, light brown, medium dense, (GLACIOFLUVIAL)						
	25.0	57					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ

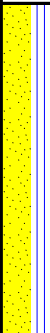

BORING LOG NO. B-6

Page 2 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION	DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	See Exhibit A-2	DEPTH	ELEVATION (Ft.)				
	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, gray, medium dense, (GLACIOFLUVIAL)	32.0	50			6	2-8-19-28 N=27
						11	10-18-16-22 N=34
Boring Terminated at 32 Feet							
Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic							
Advancement Method: 4.25" Hollow stem augers		See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any).		Notes:			
Abandonment Method: Borings backfilled with soil cuttings upon completion.		See Appendix C for explanation of symbols and abbreviations.					
WATER LEVEL OBSERVATIONS				Boring Started: 8/13/2013		Boring Completed: 8/13/2013	
<i>No free water observed</i>				Drill Rig: CME550 ATV		Driller: Jay	
				Project No.: J1135105		Exhibit: A-8	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ

BORING LOG NO. B-7

Page 1 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	Surface Elev.: 82 (Ft.)				
	ELEVATION (Ft.)					
	0.3 4-inches topsoil and roots	81.5				
	FILL - SILTY GRAVEL , brown, medium dense				22	14-15-18-17 N=33
					10	20-100 N=
		5				
					22	18-15-18-28 N=33
					9	44-49-50/1" N=50/1"
	Note: Boulder at 9 feet, offset 5 feet to the south					
	Trace roots in 10-12 foot sample					
		10				
					12	4-4-9-13 N=13
	12.0	70				
	POORLY GRADED SAND (SP) , with silt and gravel, brown, medium dense, (GLACIOFLUVIAL)					
		15				
					10	4-11-17-14 N=28
		20				
	20.0	62				
	POORLY GRADED SAND WITH SILT (SP-SM) , and gravel, brown, medium dense to loose, (GLACIOFLUVIAL)					
					12	3-8-11-10 N=19
		25				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ

BORING LOG NO. B-7

Page 2 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)				
	27.0	55			16	4-5-6-9 N=11
	POORLY GRADED SAND WITH SILT (SP-SM) , and gravel, brown, medium dense to loose, (GLACIOFLUVIAL) <i>(continued)</i>					
	Boring Terminated at 27 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-9








BORING LOG NO. B-8

Page 1 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)					
	0.3	80.5					
	4-inches topsoil FILL - POORLY GRADED SAND WITH SILT , trace gravel, brown, medium dense						4-6-8-9 N=14
			5				
	Organic soil from 5-7 feet						6-6-7-5 N=13
	7.0	74					
	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, brown, medium dense, (GLACIOFLUVIAL) Cobbles at 7-9 feet						7-8-9-10 N=17
			10				
							9-17-10-24 N=27
			15				
	Cobbles at 15-17 feet						4-6-6-9 N=12
			20				
							6-3-2-2 N=5
			25				
							3-5-7-12 N=12

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-10

BORING LOG NO. B-8

Page 2 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)				
	27.0	54			13	7-10-15-20 N=25
	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, brown, medium dense, (GLACIOFLUVIAL) <i>(continued)</i>					
	Boring Terminated at 27 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-10


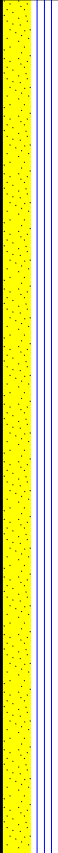
BORING LOG NO. B-9

Page 1 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)					
	0.3	3-inches forest mat	81				
		FILL - POORLY GRADED SAND WITH SILT , trace gravel, brown, medium dense				9	6-8-7-7 N=15
						16	6-8-5-9 N=13
			5				
		Cobbles at 6-7 feet				18	5-11-11-12 N=22
	7.0	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, brown, dense to medium dense, (GLACIOFLUVIAL)	74			19	12-15-12-17 N=27
		Cobbles at 10-12 feet				3	5-19-21-18 N=40
			15			0	5-14-14-20 N=28
			20			16	2-4-7-8 N=11
			25				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J1135105.GPJ

BORING LOG NO. B-9

Page 2 of 2

PROJECT: Veterans Administration Hospital
Building Addition

CLIENT: Harriman
Auburn, ME

SITE: 830 Chalkstone Avenue
Providence, Rhode Island

GRAPHIC LOG	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS
	DEPTH	ELEVATION (Ft.)				
	27.0	54			17	4-6-6-10 N=12
	POORLY GRADED SAND WITH SILT (SP-SM) , trace gravel, brown, dense to medium dense, (GLACIOFLUVIAL) <i>(continued)</i>					
	Boring Terminated at 27 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.25" Hollow stem augers

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:
Borings backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Boring Started: 8/13/2013

Boring Completed: 8/13/2013

Drill Rig: CME550 ATV

Driller: Jay

Project No.: J1135105

Exhibit: A-11

APPENDIX B

LABORATORY TEST REPORTS

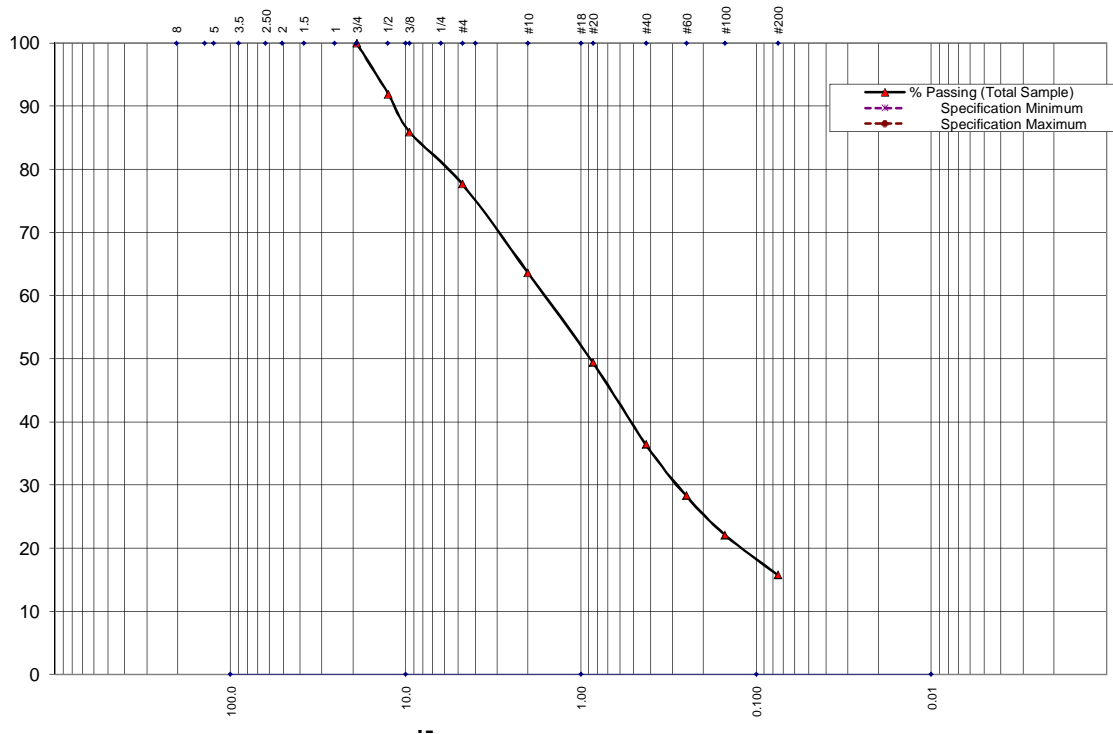
GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHODS:

Soil: D422, D1140

Concrete Aggregate: C136, C117

PERCENT FINER



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
0	22	23	44	33	Silt (>0.002mm)	Clay (<0.002mm)
		% Sand			16	

USCS Classification: SILTY SAND with gravel, Brown (SM)

Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Retained (g)	% Passing (Total Sample)	Specification Minimum Maximum	
200.0	8"				
152.4	6"				
90.0	3.5"				
76.2	3"				
63.0	2.5"				
50.0	2"				
37.5	1.5"				
25.0	1"				
19.0	3/4"	0	100		
12.5	1/2"	22.41	92		
9.5	3/8"	38.58	86		
4.75	#4	61.18	78		
2.00	#10	99.71	64		
0.85	#20	138.72	49		
0.425	#40	174.32	36		
0.250	#60	196.58	28		
0.150	#100	213.60	22		
0.075	#200	230.96	16		

Total Dry Wt. 274.07 g

Project: VA Hospital Addition	Project No.: J1135105	Report #: J1135105.0001
Location: Providence, RI	Specification: None provided	Date: 08/22/13
Source: B-1, S-3	Sampled from: 5' to 7' BGS	
Terracon 77 Sundial Avenue Manchester, NH 03103 (603) 647-9700 fax: (603) 647-4432 www.terracon.com	Remarks: Wn= 6.5%	
	Tested By: Dan Savage	Date: 08/23/13
	Reviewed By:	Date:

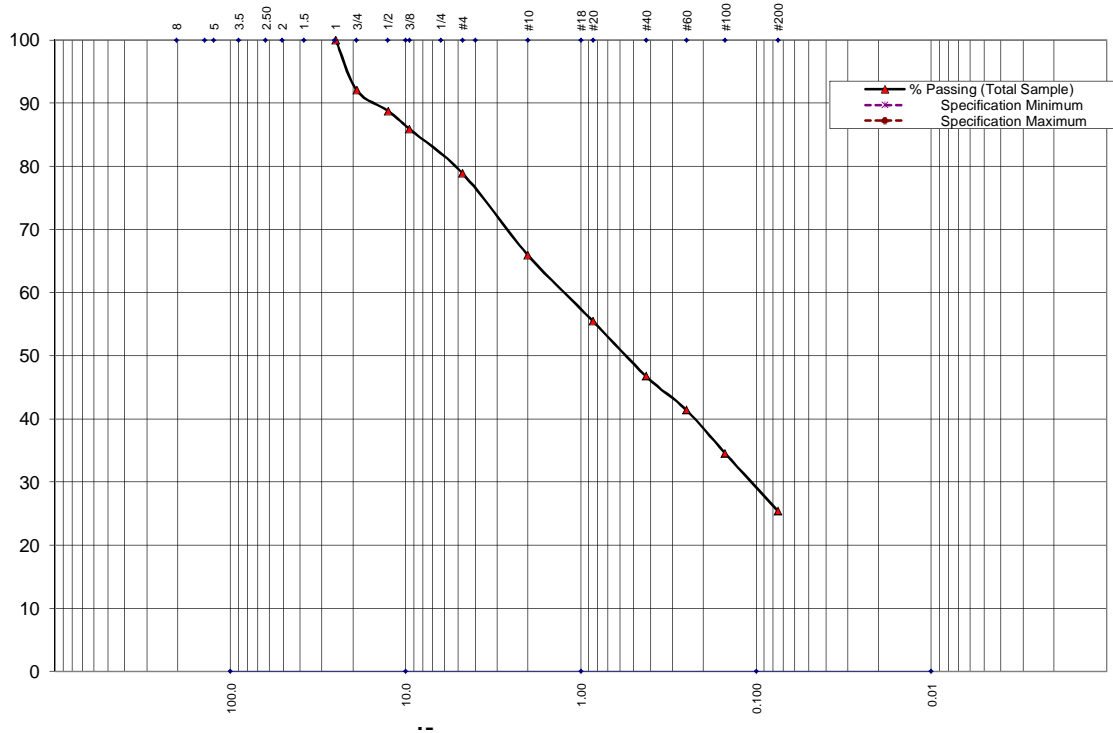
GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHODS:

Soil: D422, D1140

Concrete Aggregate: C136, C117

PERCENT FINER



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
0	21	24	36	40	Silt (>0.002mm)	Clay (<0.002mm)
		% Sand			25	

USCS Classification: SILTY SAND with gravel, Brown (SM)

Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Retained (g)	% Passing (Total Sample)	Specification Minimum Maximum	
200.0	8"				
152.4	6"				
90.0	3.5"				
76.2	3"				
63.0	2.5"				
50.0	2"				
37.5	1.5"				
25.0	1"	0	100		
19.0	3/4"	22.29	92		
12.5	1/2"	31.61	89		
9.5	3/8"	39.55	86		
4.75	#4	59.09	79		
2.00	#10	95.57	66		
0.85	#20	125.04	55		
0.425	#40	149.38	47		
0.250	#60	164.42	41		
0.150	#100	183.65	35		
0.075	#200	209.40	25		

Total Dry Wt. 280.62 g

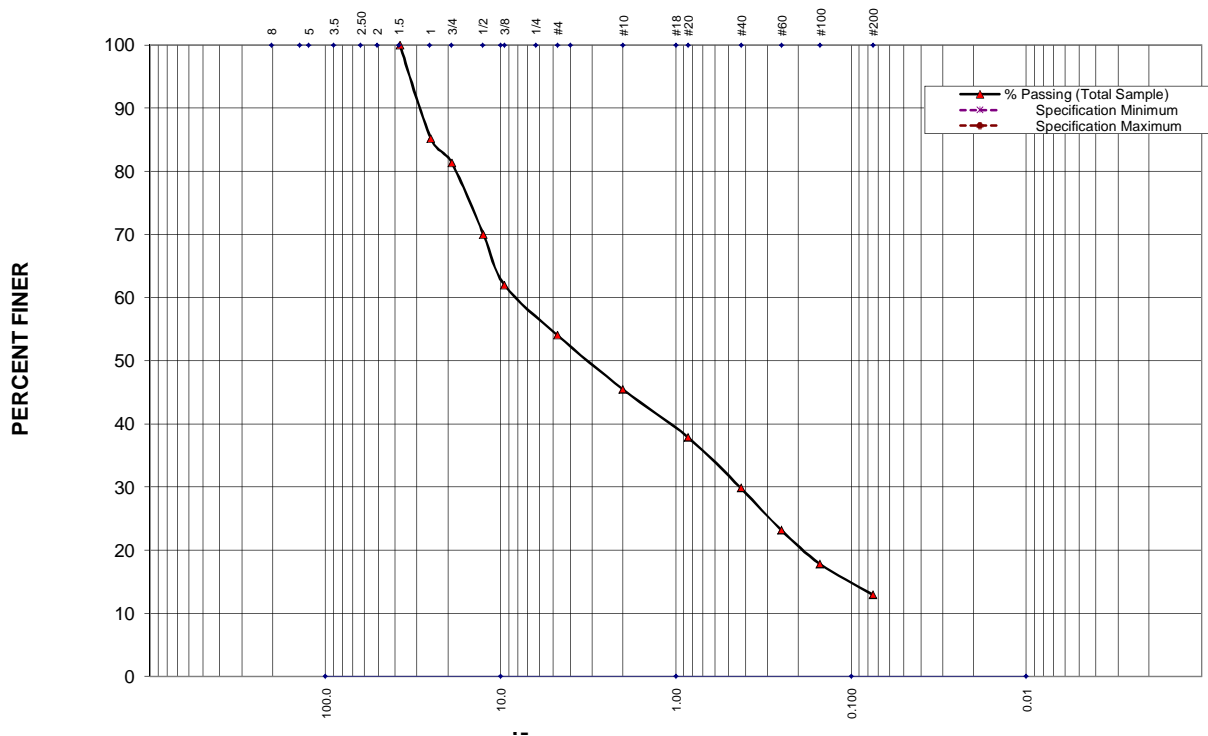
Project: VA Hospital Addition	Project No.: J1135105	Report #: J1135105.0002
Location: Providence, RI	Specification: None provided	Date: 08/22/13
Source: B-5, S-3	Sampled from: 5' to 7' BGS	
Terracon 77 Sundial Avenue Manchester, NH 03103 (603) 647-9700 fax: (603) 647-4432 www.terracon.com	Remarks: Wn= 7.0%	
	Tested By: Dan Savage	Date: 08/23/13
	Reviewed By:	Date:

GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHODS:

Soil: D422, D1140

Concrete Aggregate: C136, C117



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
0	46	21	38	41	Silt (>0.002mm)	Clay (<0.002mm)
		% Sand			13	

USCS Classification: SILTY GRAVEL with sand, Brown (GM)

Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Retained (g)	% Passing (Total Sample)	Specification Minimum Maximum	
200.0	8"				
152.4	6"				
90.0	3.5"				
76.2	3"				
63.0	2.5"				
50.0	2"				
37.5	1.5"	0	100		
25.0	1"	41.87	85		
19.0	3/4"	52.67	81		
12.5	1/2"	84.89	70		
9.5	3/8"	107.51	62		
4.75	#4	129.91	54		
2.00	#10	154.29	45		
0.85	#20	175.73	38		
0.425	#40	198.51	30		
0.250	#60	217.21	23		
0.150	#100	232.48	18		
0.075	#200	246.18	13		
Total Dry Wt.		282.80	g		

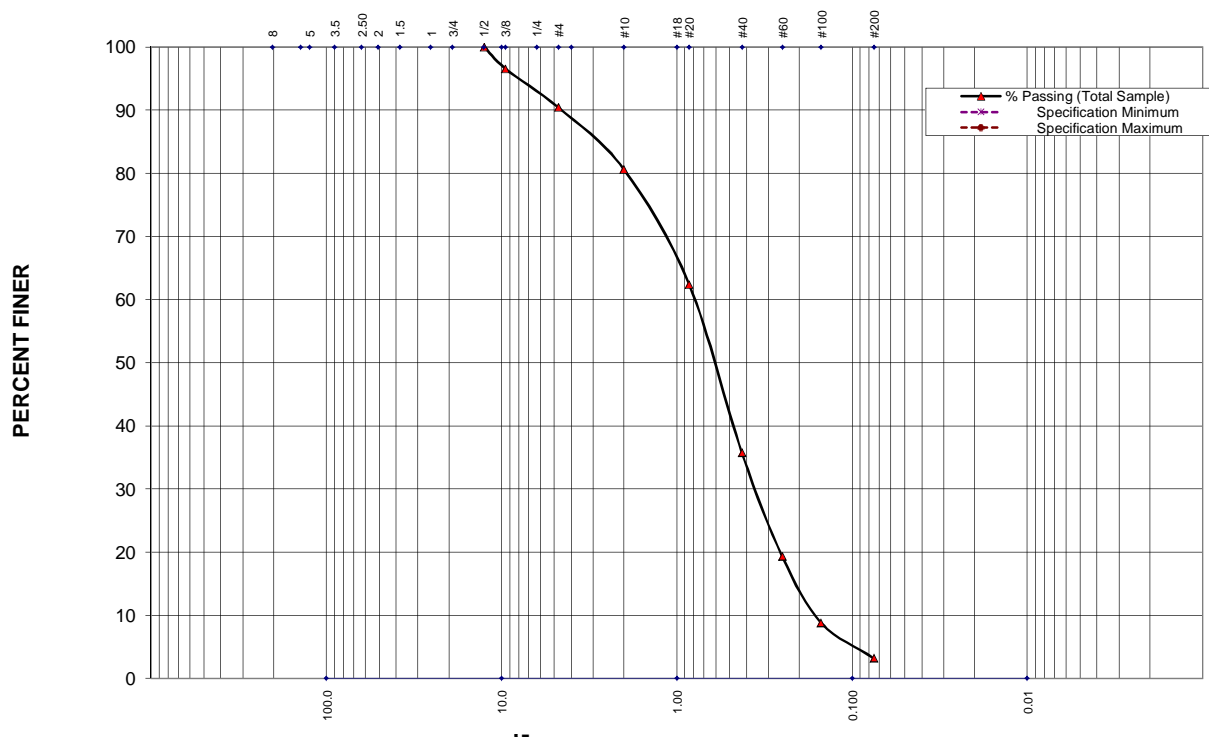
Project: VA Hospital Addition	Project No.: J1135105	Report #: J1135105.0003
Location: Providence, RI	Specification: None provided	Date: 08/22/13
Source: B-7, S-3	Sampled from: 5' to 7' BGS	
Terracon 77 Sundial Avenue Manchester, NH 03103 (603) 647-9700 fax: (603) 647-4432 www.terracon.com	Remarks: Wn= 2.8%	
	Tested By: Dan Savage	Date: 08/23/13
	Reviewed By:	Date:

GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHODS:

Soil; D422, D1140


Concrete Aggregate; C136, C117



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
0	10	11	51	37	Silt (>0.002mm)	Clay (<0.002mm)
		% Sand			3.2	

USCS Classification: POORLY GRADED SAND, Gray Brown (SP)

Particle Diameters (mm)	Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Retained (g)	% Passing (Total Sample)	Specification	
					Minimum	Maximum
	200.0	8"				
	152.4	6"				
	90.0	3.5"				
	76.2	3"				
	63.0	2.5"				
	50.0	2"				
	37.5	1.5"				
	25.0	1"				
	19.0	3/4"				
	12.5	1/2"	0	100		
	9.5	3/8"	9.91	97		
	4.75	#4	27.67	90		
	2.00	#10	56.03	81		
	0.85	#20	108.64	62		
	0.425	#40	185.80	36		
	0.250	#60	233.29	19		
	0.150	#100	263.68	9		
	0.075	#200	279.89	3.2		
Total Dry Wt.			289.14	g		

Project: VA Hospital Addition	Project No.: J1135105	Report #: J1135105.0004
Location: Providence, RI	Specification: None provided	Date: 08/22/13
Source: B-9, S-7	Sampled from: 20' to 22' BGS	
<div><div><div><div>77 Sundial Avenue</div><div>Manchester, NH 03103</div><div>(603) 647-9700 fax: (603) 647-4432</div><div>www.terracon.com</div></div></div><div><div>Remarks:</div><div>Wn= 1.6%</div><div>Cc= 1.0 Cu = 5.0</div><div>Tested By: Dan Savage</div><div>Reviewed By:</div><div>Date: 08/23/13</div><div>Date:</div></div></div>		

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon – 1- ³ / ₈ " I.D., 2" O.D., unless otherwise noted	HS: Hollow Stem Auger
ST: Thin-Walled Tube - 2" O.D., unless otherwise noted	PA: Power Auger
RS: Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA: Hand Auger
DB: Diamond Bit Coring - 4", N, B	RB: Rock Bit
BS: Bulk Sample or Auger Sample	WB: Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value."

WATER LEVEL MEASUREMENT SYMBOLS:

WL: Water Level	WS: While Sampling	N/E: Not Encountered
WCI: Wet Cave in	WD: While Drilling	
DCI: Dry Cave in	BCR: Before Casing Removal	
AB: After Boring	ACR: After Casing Removal	

DESCRIPTIVE SOIL CLASSIFICATION: Soils are generally categorized by Group Name with modifiers (Grain-size Distribution), Color, and Consistency. The order of the visual-manual classification is as follows:

1. Group Name
2. Modifiers (with, trace, or modified Group Name)
3. Color
4. Consistency (or Relative Density)

CONSISTENCY OF FINE-GRAINED SOILS

<u>Unconfined Compressive Strength, Qu, psf</u>	<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Consistency</u>
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Ring Sampler (RS) Blows/Ft.</u>	<u>Relative Density</u>
0 – 3	0-6	Very Loose
4 – 9	7-18	Loose
10 – 29	19-58	Medium Dense
30 – 49	59-98	Dense
50+	99+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other Constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other Constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E		GW	Well-graded gravel ^F
			Cu < 4 and/or 1 > Cc > 3 ^E		GP	Poorly graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E		SW	Well-graded sand ^I
			Cu < 6 and/or 1 > Cc > 3 ^E		SP	Poorly graded sand ^I
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}
			Fines Classify as CL or CH		SC	Clayey sand ^{G,H,I}
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots on or above “A” line ^J		CL	Lean clay ^{K,L,M}
			PI < 4 or plots below “A” line ^J		ML	Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried			Organic silt ^{K,L,M,O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line		CH	Fat clay ^{K,L,M}
			PI plots below “A” line		MH	Elastic Silt ^{K,L,M}
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried			Organic silt ^{K,L,M,Q}
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

