# REPORT OF SUBSURFACE INVESTIGATION AND GEOTECHNICAL ENGINEERING SERVICES

**114 Briarwood Drive**

**Hampton, Virginia**

**G E T** Project No: WM15-131G

July 1, 2015

**PREPARED FOR:**

**Engineering Concepts, Inc.**

1592-E Penniman Road • Williamsburg, VA 23185
Phone: (757)-564-6452
www.getsolutionsinc.com

July 1, 2015

TO: **Engineering Concepts, Inc.**
20 South Roanoke Street, P.O. Box 619
Fincastle, Virginia 24090

Attn: Mr. J. Scott Caldwell, P.E.

RE: Report of Subsurface Investigation and Geotechnical Engineering Services
**114 Briarwood Drive**
Hampton, Virginia
**G E T** Project No: WM15-131G

Dear Mr. Caldwell:

In compliance with your instructions, we have completed our Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the project implementation.

Thank you for the opportunity to work with you on this project. We trust that the information contained herein meets your immediate need, and should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Respectfully Submitted,
**G E T Solutions, Inc.**

Joseph R. Robinson, P.E.
Project Engineer
Virginia Lic. No. 050157

James R. Wheeler
Senior Project Geologist

COMMONWEALTH OF VIRGINIA
JOSEPH R. ROBINSON
Lic. No. 050157
PROFESSIONAL ENGINEER

Copies: (1) Client

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# 1.0 PROJECT INFORMATION

## 1.1 Project Authorization

**G E T Solutions, Inc.** has completed our subsurface investigation and geotechnical engineering services for the proposed elevation of the residential structure at 114 Briarwood Drive located in Hampton, Virginia. The geotechnical engineering services were conducted in general accordance with **G E T** Proposal No. PWM15-144G. Authorization to proceed with our services was obtained in the form of a signed Work Authorization form from Mr. Scott Caldwell with Engineering Concepts, Inc. on April 23, 2015.

## 1.2 Project and Site Description

The project site is a residential home located at 114 Briarwood Drive in Hampton, Virginia. The development at this site is to consist of raising the existing wood-frame structure 5 to 7 feet above its current elevation while replacing the existing foundation if deemed necessary. The first floor will then be supported over a crawl space. The maximum wall loads are expected to remain similar at up to 1.5 klf.

If any of the noted information is incorrect or has changed, please inform **G E T Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

## 1.3 Purpose and Scope of Services

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface conditions encountered were then evaluated with respect to the available project characteristics.

In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the boring performed at the proposed development.
2. General location and description of potentially deleterious material encountered in the boring that may interfere with construction progress or structure performance, including existing fills or surficial/subsurface organics.
3. Construction considerations for foundation excavations.
4. Feasibility of utilizing a shallow foundation system for support of the proposed structure. Design parameters required for the foundation system, including foundation sizes, allowable bearing pressures, foundation levels and expected total and differential settlements.
5. Determine pertinent information regarding the groundwater impact and management.
6. Seismic site class determination in accordance with the 2012 International Building Code and our experience with similar soil conditions in the local area.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site.

## 2.0 FIELD AND LABORATORY PROCEDURES

### 2.1 Field Exploration

In order to explore the general subsurface soil types and to aid in developing associated construction design parameters, the following field exploration program was performed at the site:

- One (1) 20-foot deep Standard Penetration Test (SPT) boring (designated as B-1) was drilled near the footprint of the proposed structure.

The SPT boring was performed with the use of rotary wash "mud" drilling procedures in general accordance with ASTM D 1586. The test was performed continuously from the existing ground surface to depth of 12-feet, and at 5-foot intervals thereafter. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using an automatic hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring log. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer). A representative portion of each disturbed split-spoon sample was collected with each SPT, placed in a glass jar, sealed, labeled, and returned to our laboratory for review.

The boring location was established and staked in the field by a representative of **G E T Solutions, Inc.** The approximate boring location is shown on the attached "Boring Location Plan" (Appendix I), which was reproduced based on a satellite image of the site.

### 2.2 Laboratory Testing

Representative portions of all soil samples collected during drilling were sealed in glass jars, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D2488. A summary of the soil classification system is provided in Appendix II.

# 3.0 SITE AND SUBSURFACE CONDITIONS

## 3.1 Site Geology

The project site lies within a major physiographic province called the Atlantic Coastal Plain. Numerous transgressions and regressions of the Atlantic Ocean have deposited marine, lagoonal, and fluvial (stream lain) sediments. The regional geology is very complex, and generally consists of interbedded layers of varying mixtures of sands, silts and clays. Based on our review of existing geologic and soil boring data, the geologic stratigraphy encountered in our subsurface explorations generally consisted of marine deposited sands and clays.

## 3.2 Subsurface Soil Conditions

The results of our soil test boring are summarized below in Table I:

**Table I - Summary of Soil Test Boring**

| AVERAGE DEPTH (Feet) | STRATUM | DESCRIPTION | RANGES OF UNCORRECTED SPT(1) N-VALUES |
|---|---|---|---|
| 0 to 0.17 | Topsoil | 2 inches of Topsoil | - |
| 0.17 to 20 | I | SAND (SC, SM) with varying amounts of Silt, Clay and fibrous organics | 2 - 18 |

*Notes (1) SPT = Standard Penetration Test, Uncorrected N-Values in Blows-per-foot*
*(2) WOH = Weight-of-Hammer*

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration are included on the "Boring Log" sheet (Appendix III) which should be reviewed for specific information as to the individual boring. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring location. Variations may occur and should be expected throughout the building footprint. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual or occur between sample intervals. It is noted that the topsoil designation references the presence of surficial organic laden soil, and does not represent any particular quality specification. It is recommended that this material be tested for approval prior to use.

### 3.3 Groundwater Information

The groundwater level was recorded at the boring location and as observed through the relative wetness of the recovered soil samples during the drilling operations. The initial groundwater table was generally determined to occur at a depth of 10 feet below current grades at the boring location at the time of our site reconnaissance. The borehole was backfilled upon completion for safety considerations. As such, the reported groundwater level may not be indicative of the static groundwater level.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). In the project's area, seasonal groundwater fluctuations of ± 2 feet are common; however, greater fluctuations have been documented. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedures, if necessary.

## 4.0 EVALUATION AND RECOMMENDATIONS

Our recommendations are based on the previously discussed project information, our interpretation of the soil test boring, and our observations during our site reconnaissance. If the proposed construction should vary from what was described, we request the opportunity to review our recommendations and make any necessary changes.

### 4.1 Temporary Support of Existing Structure

The proposed construction consists of raising the wood-frame residence 5 to 7 feet above its existing elevation and removing and replacing the existing foundations if deemed necessary. It is essential that the structure be properly supported and braced during the foundation assessment, possible demolition of existing foundations, and installation of new foundations. The design of the temporary foundation support is the responsibility of the contractor.

### 4.2 Suitability of Existing Foundations

Once the structure is elevated and temporarily supported, an assessment of the existing foundations can take place. If the existing foundations are deemed suitable, new foundations may not be required. The elevated structure can then be supported on the existing foundations. If the existing foundations are not deemed suitable, it is recommended to demolish and remove them and install new foundations. **Due to the high degree of uncertainty with regard to the condition of the existing foundations and their original bearing conditions, it is recommended that a budget for replacement of all existing foundations be anticipated as part of this project.**

## 4.3 Structural Fill and Placement

Following the approval of the natural subgrade soils by the Geotechnical Engineer, the placement of the fill required to establish the design grades may begin. Any material to be used for structural fill should be evaluated and tested by **G E T Solutions, Inc.** prior to placement to determine if they are suitable for the intended use. Suitable structural fill material should consist of sand or gravel containing less than 25% by weight of fines (SP, SM, SW, GP, GW), having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris and other unsuitable material.

All structural fill should be compacted to a dry density of at least 95 percent of the Standard Proctor maximum dry density (ASTM D698). In general, the compaction should be accomplished by placing the fill in maximum 6-inch loose lifts and mechanically compacting each lift to at least the specified minimum dry density. A representative of **G E T Solutions, Inc.** should perform field density tests on each lift as necessary to assure that adequate compaction is achieved.

Because of the close proximity of the structure to other residences, it is recommended that any areas needing compaction should be compacted with small, hand-operated compaction equipment in lieu of a vibratory roller to avoid transmission of vibrations that could cause settlement damage or disturb occupants.

## 4.4 Foundation Design Recommendations

If existing foundations are deemed unsuitable to support the elevated structure, the following are our recommendations for the design of new foundations. Provided that the construction procedures are properly performed, the proposed structure can be supported by shallow foundations bearing upon firm natural soil or well-compacted structural fill material. Foundation undercut will be required to penetrate unsuitable fill soils (see Section 4.6 for further information concerning the foundation undercut) if encountered. The footings can be designed using a net allowable soil pressure of 2,000 pounds per square foot (psf). In using net pressures, the weight of the footings and backfill over the footings, need not be considered. Hence, only loads applied at or above the finished grade need to be used for dimensioning the footings.

In order to develop the recommended bearing capacity of 2,000 pounds per square foot (psf), the base of the footings should have an embedment of at least 18 inches beneath finished grades and wall footings should have a minimum width of 18 inches. The recommended 18-inch footing embedment is considered sufficient to provide adequate cover against frost penetration to the bearing soils.

## 4.5 Settlements

It is estimated that, with proper site preparation, the maximum resulting post-construction total settlement of the foundations should be up to 1 inch. The maximum differential settlement magnitude is expected to be less than ½-inch between adjacent footings (wall footings of widely varying loading conditions).The settlements were estimated on the basis of the results of the field penetration tests. Careful field control will contribute substantially towards minimizing the settlements.

## 4.6 Foundation Excavations

In preparation for shallow foundation support, the footing excavations should extend into firm natural soil or well compacted structural fill. It will be necessary to undercut the structure's foundations to extend through all fill materials, where encountered. All foundation excavations should be observed by a representative of **G E T Solutions, Inc.** At that time, the Geotechnical Engineer should also explore the extent of excessively loose, soft, or otherwise unsuitable material within the exposed excavations. Also, at the time of the footing observations, the Geotechnical Engineer will advance hand auger borings in the bases of the foundation excavations to verify that the bearing soils are consistent with those documented in this report and to verify that all fill soils were removed. The necessary depth of penetration will be established during the subgrade observations.

When pockets of unsuitable soils requiring undercut are encountered in the footing excavations, the proposed footing elevation should be re-established by means of backfilling with "flowable fill" or a suitable structural fill material compacted to a dry density of at least 95 percent of the Standard Proctor maximum dry density (ASTM D 698), as described in Section 4.3 of this report, prior to concrete placement. This construction procedure will provide for a net allowable bearing capacity of 2,000 psf.

Immediately prior to foundation concrete placement, it is suggested that the bearing surfaces of all foundations be compacted using hand operated mechanical tampers. In this manner, any localized areas, which have been loosened by excavation operations, should be adequately recompacted. The compaction testing in the base of the foundation may be waived by the Geotechnical Engineer, where firm bearing soils are observed during the foundation inspections.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from physical disturbance, rain or frost. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not possible, the footing excavations should be adequately protected.

### 4.7 Seismic Evaluation

On the basis of the results of our soil test borings (the upper 15 feet of the recovered soils, maximum explored depth) and our experience with similar soil conditions in the project area, it is our opinion that this site should be classified as a Site Class "D" in accordance with Table 20.3-1 Site Classification of the ASCE 7-10 Minimum Design Loads for Buildings and Other Structures, Chapter 20 (referenced in the 2012 IBC). Typically, the seismic evaluation requires soils information associated with the upper 100 feet. If the site classification is critical to the structural design it will be necessary to perform a 100-foot deep CPT boring (or to refusal) with shear wave velocity testing to substantiate the site classification.

## 5.0 CONSTRUCTION CONSIDERATIONS

### 5.1 Drainage and Groundwater Concerns

It is expected that dewatering may be required for excavations that extend below the groundwater table level. Dewatering from excavations above the groundwater level is expected to be accomplished by pumping from sumps. Dewatering at depths below the groundwater level may require well pointing and/or shoring.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction. Again, we recommend that the contractor determine the actual groundwater levels at the time of construction to determine groundwater impact on this project.

### 5.2 Excavations

In Federal Register, Volume 54, No. 209 (October, 1959), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **G E T Solutions, Inc**. is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

## 6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the client, and their consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the client and their consultants for the specific application to the 114 Briarwood Drive project located in Hampton, Virginia.

## APPENDICES

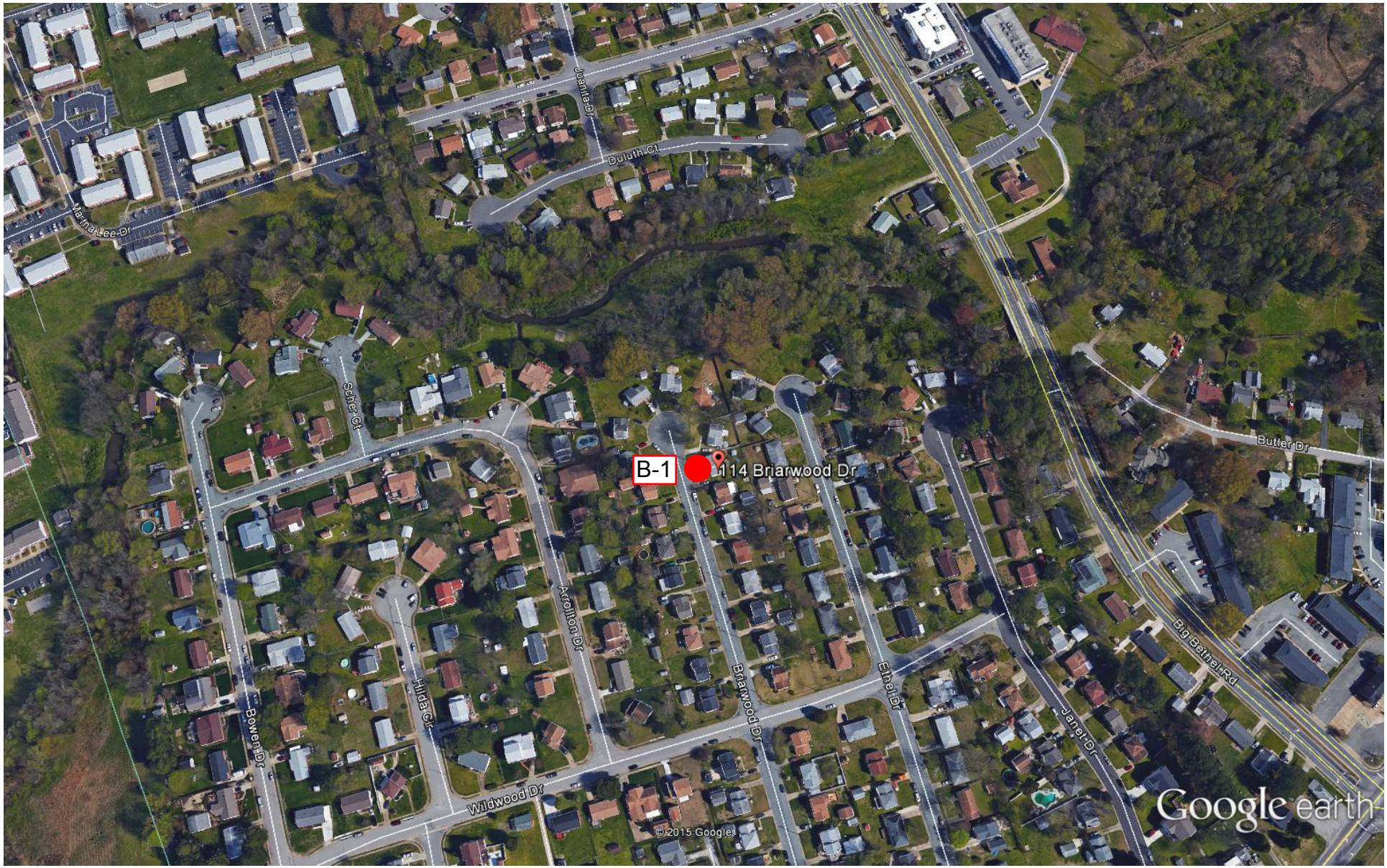
I. BORING LOCATION PLAN

II. SOIL CLASSIFICATION SYSTEM

III. BORING LOG

# APPENDIX I

BORING LOCATION PLAN




Google earth

feet 1000

meters 400

# APPENDIX II

SOIL CLASSIFICATION SYSTEM

GET Solutions, Inc.
Geotechnical • Environmental • Testing

**Virginia Beach**
204 Grayson Road
Virginia Beach, VA 23462
(757) 518-1703

**Williamsburg**
1592 Penniman Rd. Suite E
Williamsburg, Virginia 23185
(757) 564-6452

**Elizabeth City**
504 East Elizabeth St. Suite 2
Elizabeth City, NC 27909
(252) 335-9765

# CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

## Standard Penetration Test (SPT), N-value

Standard Penetration Tests (SPT) were performed in the field in general accordance with ASTM D 1586. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler each 6-inch increment (4 increments for each soil sample) of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value.

## NON COHESIVE SOILS

(SILT, SAND, GRAVEL and Combinations)

### Relative Density

| | |
|---|---|
| Very Loose | 4 blows/ft. or less |
| Loose | 5 to 10 blows/ft. |
| Medium Dense | 11 to 30 blows/ft. |
| Dense | 31 to 50 blows/ft. |
| Very Dense | 51 blows/ft. or more |

## COHESIVE SOILS

(CLAY, SILT and Combinations)

### Consistency

| | |
|---|---|
| Very Soft | 2 blows/ft. or less |
| Soft | 3 to 4 blows/ft. |
| Medium Stiff | 5 to 8 blows/ft. |
| Stiff | 9 to 15 blows/ft. |
| Very Stiff | 16 to 30 blows/ft. |
| Hard | 31 blows/ft. or more |

### Particle Size Identification

| | | |
|---|---|---|
| **Boulders** | 8 inch diameter or more | |
| **Cobbles** | 3 to 8 inch diameter | |
| **Gravel** | Coarse | 1 to 3 inch diameter |
| | Medium | $^1/_2$ to 1 inch diameter |
| | Fine | $^1/_4$ to $^1/_2$ inch diameter |
| **Sand** | Coarse | 2.00 mm to $^1/_4$ inch (diameter of pencil lead) |
| | Medium | 0.42 to 2.00 mm (diameter of broom straw) |
| | Fine | 0.074 to 0.42 mm (diameter of human hair) |
| **Silt** | | 0.002 to 0.074 mm (cannot see particles) |

### Relative Proportions

| Descriptive Term | Percent |
|---|---|
| Trace | 0-5 |
| Few | 5-10 |
| Little | 15-25 |
| Some | 30-45 |
| Mostly | 50-100 |

### Strata Changes

In the column "Description" on the boring log, the horizontal lines represent approximate strata changes.

### Groundwater Readings

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as tidal influences and man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.).

## CLASSIFICATION SYMBOLS (ASTM D 2487 and D 2488)

### Coarse Grained Soils

More than 50% retained on No. 200 sieve

**GW** - Well-graded Gravel
**GP** - Poorly graded Gravel
**GW-GM** - Well-graded Gravel w/Silt
**GW-GC** - Well-graded Gravel w/Clay
**GP-GM** - Poorly graded Gravel w/Silt
**GP-GC** - Poorly graded Gravel w/Clay
**GM** - Silty Gravel
**GC** - Clayey Gravel
**GC-GM** - Silty, Clayey Gravel
**SW** - Well-graded Sand
**SP** - Poorly graded Sand
**SW-SM** - Well-graded Sand w/Silt
**SW-SC** - Well-graded Sand w/Clay
**SP-SM** - Poorly graded Sand w/Silt
**SP-SC** - Poorly graded Sand w/Clay
**SM** - Silty Sand
**SC** - Clayey Sand
**SC-SM** - Silty, Clayey Sand

### Fine-Grained Soils

50% or more passes the No. 200 sieve

**CL** - Lean Clay
**CL-ML** - Silty Clay
**ML** - Silt
**OL** - Organic Clay/Silt
Liquid Limit 50% or greater
**CH** - Fat Clay
**MH** - Elastic Silt
**OH** - Organic Clay/Silt

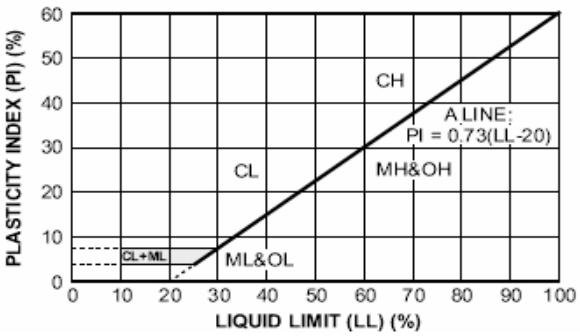
### Highly Organic Soils

**PT** - Peat

Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

| | |
|---|---|
| Less than 5 percent | GW, GP, SW,SP |
| More than 12 percent | GM, GC, SM, SC |
| 5 to 12 percent | Borderline cases requiring dual symbols |

### Plasticity Chart



# APPENDIX III

BORING LOG

# RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
Geotechnical • Environmental • Testing

Virginia Beach
204 Grayson Road
Virginia Beach, VA 23642
757-518-1703

Williamsburg
1592-E Penniman Road
Williamsburg, VA 23185
757-564-6452

Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

## BORING ID B-1

PROJECT NAME: **114 Briarwood Drive**
CLIENT: **Engineering Concepts, Inc.**
PROJECT LOCATION: **Hampton, VA**
BORING LOCATION: **See Attached Boring Location Plan**
DRILLING METHOD(S): **Rotary wash "mud"**
GROUNDWATER*: INITIAL (ft) ▽: **10** AFTER ___ HOURS (ft) ▼: ___ CAVE-IN (ft) ◌: ___
*The initial groundwater readings are not intended to indicate the static groundwater level.*

PROJECT NUMBER: **WM15-131G**
SURFACE ELEVATION (MSL) (ft): ___
LOGGED BY: **J. Robinson, P.E.**
DATE STARTED: **6/24/2015**
DATE COMPLETED: **6/24/2015**
DRILLER: **Earthcon**

| Elevation (ft) | Depth (ft) | STRATA DESCRIPTION | Strata Legend | Sample ID | Sample Type | Sample Recovery (in.) | Blow Counts (N-Values) | %<#200 | TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70) |
|---|---|---|---|---|---|---|---|---|---|
| | 0.2 | 2-in Topsoil | | | | | | | |
| | | Orange/Gray, moist, Silty fine SAND (SM) with trace fibrous organics, medium dense | | 1 | SPT | 14 | 7-10-8-8 (18) | | |
| | | | | 2 | SPT | 17 | 7-8-6-7 (14) | | |
| | 4.0 | Orange/Gray, moist, Clayey fine to medium SAND (SC), medium dense | | 3 | SPT | 20 | 5-6-7-6 (13) | | |
| | 5 | | | | | | | | |
| | 6.0 | Gray, moist to wet, Silty fine to medium SAND (SM), very loose to loose | | 4 | SPT | 16 | 4-5-5-5 (10) | | |
| | | | | 5 | SPT | 24 | 4-3-4-5 (7) | | |
| ▽ | 10 | Wet below 10 ft | | | | | | | |
| | | | | 6 | SPT | 24 | 3-2-1-1 (3) | | |
| | 15 | | | | | | | | |
| | | | | 7 | SPT | 24 | 2-1-1-1 (2) | | |
| | 20.0 | | | | | | | | |
| | 20 | Boring terminated at 20 feet below existing grade. | | | | | | | |

Sample Type(s):
SPT - Standard Penetration Test

Notes:

*This information pertains only to this boring and should not be interpreted as being indicitive of the site.*