FOR INFORMATION PURPOSES ONLY

SUBSURFACE INVESTIGATION
AND
GEOTECHNICAL ENGINEERING REPORT

HOLIDAY INN SPS
Manassas, Virginia

Prepared for:

GHD, INC
16701 Melford Boulevard, Suite 330
Bowie, Maryland 20715

GC&T No. 215M-8166

September 7, 2016

GC&T

Geotechnical Environmental Construction Services

4899 Prince William Parkway
Woodbridge, VA 22192
(703) 730-4160
www.gctonline.net

September 7, 2016

Mr. Steven Carter, PE
GHD, Inc.
16701 Melford Boulevard, Suite 330
Bowie, Maryland 20715

Re: **Holiday Inn, SPS Pump Station**
Subsurface Investigation and Geotechnical Engineering Report
Triangle, Prince William County, Virginia
GC&T Project No. 215M-8166

Dear Mr. Carter,

Geotechnical Consulting & Testing, Inc. (GC&T) has completed the authorized subsurface investigation and a geotechnical engineering report for the above referenced project site.

This report describes the details of the exploratory methods used; summarizes the findings of the field investigation and laboratory testing; and presents our geotechnical evaluation and recommendations to assist in the planning and design of the proposed Pumping Station.

We thank you for your confidence in our services. We will remain available for future consultation during the design and construction phases of the project. Should you have any questions regarding the content of this report, please do not hesitate to call our office at (703) 730-4160.

Respectfully submitted,
GEOTECHNICAL CONSULTING & TESTING, INC.

COMMONWEALTH OF VIRGINIA
EMAD E. SAADEH
Lic. No. 017719
SEP 07 2016
PROFESSIONAL ENGINEER

Jamal N. Tahat, MSc
Project Engineer

Emad E. Saadeh, PE
President/Chief Engineer

P:\Report and Letters\GEOTECH\GHD\Holiday Inn Pump Station\Holiday Inn SPS Geotechnical Report.docx

TABLE OF CONTENTS

APPENDIX

Site Vicinity Map

Soil Type Map

Boring Location Plan

Filed Classification of Soil

Test Boring Logs (B-1 and B-2)

Soil Laboratory Test Results

Soil Survey of Prince William County (Pages 235, and 238)

1.0 INTRODUCTION

Geotechnical Consulting & Testing, Inc. (GC&T) has completed the subsurface investigation and a geotechnical engineering study for the proposed *Pump Station* located in Manassas, Virginia, identified herein as *Holiday Inn SPS* in our proposal/agreement. The scope of our services was performed in accordance with GC&T Proposal/Agreement No. 215M-8166 dated November 11, 2015. The subsurface investigation and geotechnical evaluation were authorized by Mr. Steven Carter, PE, Project Engineer for *GHD, Inc.*

Based on the information provided in your email dated November 10, 2015 including the *Geotechnical RFP – Soil Boring and Geotechnical Analysis – Holiday Inn SPS Replacement/ GHD No. 11109266* (*the specifications*), and the *Holiday Inn Pump Station* plan prepared by *CDM Smith* (*the plans*) we understand that the project will consist of the replacement of the existing *Holiday Inn* Sewage Pumping Station – SPS (*the pump station*) located at 6901 Sudley Road in Manassas, Virginia.

1.1 Purpose and Scope of Work

The objectives of this study were to determine the physical and geotechnical engineering characteristics of the subsurface at specific locations across the site, and to evaluate those conditions with respect to the proposed pump station and ancillary equipment. More specifically, this geotechnical study was performed to:

- Identify and evaluate the types of overburden soils, groundwater conditions, and existing site conditions at the designated structure locations.

- Provide geotechnical engineering recommendations for the design and construction of *the pump station* and ancillary equipment (above and below ground) to include net allowable soil bearing pressure, structure bearing-grade comments, frost depth, and estimated settlements.

- Provide general construction guidelines for site grading and earthwork activities, including an assessment of the suitability and engineering applications existing soils, temporary control of groundwater, and placement of compacted fill for the proposed structures.

The scope of this work includes a site reconnaissance by our geotechnical staff, a subsurface exploration consisting of test borings; laboratory tests on selected soil samples; a geotechnical analysis of the field and laboratory test results; and the preparation of this geotechnical report.

1.2 Site Location and Description

The project site is located at a parcel of land identified as 6901 Sudley Road in Manassas, Virginia. The project site is located approximately 3,400 feet east of Sudley Road and about 2,700 feet north of Interstate 66, behind the community college site. The parcel identified by Prince William County with GPIN 7697-39-2308. A Site Vicinity Map is presented at the end of this report.

The site is generally flat to gently sloping to an eastern direction. The site is mostly clear, covered with grass with mature trees present on the north and east; and surrounded by an existing fence. An existing gravel access road provides entry to the site. Ground relief at the site is characterized as lightly to moderate sloping to the northeast with elevations ranging from EL. 183 to EL.178 feet above mean sea level (MSL).

1.3 Project Description

An electronic copy of the *Preliminary Site Demolition Plan and Proposed Site Plan* entitled *Holiday Inn Sewage Pumping Station Replacement* dated June 24, 2016 prepared by *GHD, Inc.* (*the plans*); and *the specifications* were utilized for the preparation of this geotechnical engineering report.

According to *the plans*, we understand that the project consists of: (i) the demolition of an existing fuel tank, an emergency generator and concrete pads as well as utility poles; and, (ii) the construction of a pump station, including a control building, an emergency generator, a valve and flow meter vault and all underground utilities (*the pump station).* Access to the site will be provided by the existing gravel road entering from Sudley Road, and includes a locked gate with entry provided by the Virginia Service Authority.

During preparation of this report, we were also provided with a copy of the *Holiday Inn Sewage Facilities for the Greater Manassas Sanitary District, Prince William County, Virginia* prepared by *Wiley & Wilson* last dated March 15, 1972. These plans were utilized as reference for elevations of existing structures as they relate to the *pump station*.

2.0 METHODOLOGY

2.1 Subsurface Investigation

The subsurface exploration included a total of two (2) soil test borings (B-1 and B-2) advanced to a depth of 30 feet or auger refusal which ever encounter. The boring layout was performed by a GC&T geotechnical engineer based on layout provided by *GHD, Inc.,* who also provided the corresponding elevations. The approximate locations of the borings are indicated in the Boring Location Plan (BLP) included in the Appendix of this report with GPS coordinate information of the final drilled locations as noted on the individual boring logs. It should be noted that the proposed boring locations did not cover the area of the new vault due to the presence of existing structures as shown in *the plans*.

The soil test borings were performed on August 10, 2016 using an all-terrain CME 550-ATV drill rig, with automatic hammer. Hollow-stem, continuous flight augers having a 2-1/4 inch inside diameter were used to advance the borings. Standard Penetration Testing (SPT) was performed inside each boring in general accordance with ASTM D-1586-84. The SPT employs a 2-inch outside diameter, split-barrel sampler, driven 18 inches into the ground by a 140-pound safety hammer with a free fall of 30 inches. The number of blows required to drive the sampler the second and third 6-inch intervals is recognized as the standard penetration resistance or the N-value of the soil at the specified depth of sampling. The N-value is used to provide a quantitative indication of the in-place density of non-cohesive soils or the consistency of cohesive soils. Soil samples were recovered from the test borings at predetermined intervals using a split spoon sampler in conjunction with performing the Standard Penetration Test (SPT). The soil samples were placed in sealed jars and transported to our office in Dulles, Virginia for laboratory testing purposes.

Materials encountered during the field investigation were visually classified by a GC&T geotechnical engineer in accordance with ASTM Standard D-2488, *Description and Identification of Soils - Visual-Manual Method* and the *Unified Soil Classification System - USCS*. The field observations include the description of each soil stratum encountered, the estimated depth and thickness of each layer, and groundwater observations. These field observations are recorded on the individual boring log sheets, which are presented in the Appendix of this report.

Groundwater observations were made during the drilling of the test borings by a visual examination of recovered samples from the standard penetration tests, auger cuttings, and watermarks on the split-barrel sampler and drill rods. Further, groundwater readings were made upon the completion of each boring prior to backfilling.

The soil samples obtained from our exploration will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

A summary of the borings drilled is listed in the following table, Table 1: Boring Summary.

Table 1: Boring Summary

Boring	Top elevation (ft)	Bottom elevation (ft)	Boring depth (ft)	Cave in depth *after 24 hrs.* (ft)	Cave in elevation *after 24 hrs.* (ft)	Ground Water depth after *24 hrs.* (ft)	Groundwater elevation *after 24 hrs.* (ft)	N-Value range (bpf)
B-1	182.80	159.20	23.6	9.0	173.80	8.0	174.80	11-50/1
B-2	182.60	169.00	13.6	6.0	176.60	Dry	NA	14–50/1

2.2 Laboratory Testing

Representative soil samples were collected from the test borings and transported to our office in Dulles, Virginia for laboratory testing. Selected samples were classified in accordance with ASTM Standard D-2487 *Classification of Soils for Engineering Purposes* by performing specific laboratory tests. The laboratory tests included the following test methods:

Table 2. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Natural Moisture Content	ASTM D2216	4
Particle Size Analysis of Soils	ASTM D 422	2
Atterberg Limits	ASTM D 4318	2
pH Testing	ASTM G-51	4
Sulfides Organic Soils	ASTM G-516	2
Chloride Content	ASTM D512B	2
Redox Potential	ASTM G200	2

These tests were performed to determine the physical characteristics and soil classification of the various soils encountered during the subsurface investigation. The laboratory test results are presented on the individual data sheets, which can be found in the Appendix of this report.

3.0 FINDINGS

3.1 Geology and Soil Mapping

A review of the local geologic information indicates that the site is geologically located in the *Triassic Mesozoic Basin*. The subject property is generally underlain by undifferentiated sandstone portion of the *Newark Supergroup*. The *Triassic Basin* is a structural trough filled with sedimentary and igneous rocks of the Mesozoic Age which borders the eastern margin of the Blue Ridge in Northern Virginia. This basin is a massive formation extending locally from the *Rapidan River* near Madison, Virginia, northward across the Potomac River and terminates just west of Frederick, Maryland. In the particular area of question, the basin formed a "playa" type lake which was filled with predominantly micaceous silty and sandy materials. These materials have been compressed and thermally altered by local and regional metamorphism to produce reddish to purplish brown, calcareous siltstone, sandstone and conglomeritic rock.

After the Triassic Basin was formed and largely filled, volcanic action resulted in magma penetrating portions of the now partially lithified sediments within the Triassic basin. This solidified magma is locally identified as diabase. At the contact zones between the diabase and the siltstone, the siltstone nearest the intrusion will be thermally altered (metamorphosed) into a rock material known as hornfels or "baked" siltstone.

Based on the *Soil Survey of Prince William County*, published by the *United States Department of Agriculture and Virginia Polytechnic Institute and State University,* the site is predominantly mapped as being underlain by soil described as *Manassas silty loam* (35B), and *Arcola-Nestoria complex* (5C). Groundwater was being found as expected considering the geology of the area.

The *Manassas silty loam*, 2 to 7 percent slopes (35B) soils, are very deep, gently sloping, and well drained and moderately well drained. *Arcola-Nestoria complex* (5C), 7 to 15 percent slopes, these soils are strongly sloping. These soils are considered as *Category III* and *Category II* as *Problem Soils* and *Potential Problem Soils*, respectively, due to seasonal high groundwater table conditions, and high shrink/swell potential. The soils may not be suitable as foundation materials without special engineering solutions.

Groundwater typically occurs in a perched condition above the dense rock layers. The flow of groundwater is severely restricted to within fractures in the rock resulting in permanent mud seams that act as seepage conduits just below the overburden soils. The flow of groundwater is generally consistent with the overall topography and landscape of the site and its immediate vicinity. The depth to perched groundwater varies as result of recent precipitation, evaporation, runoff and the drainage characteristics of the site.

Hydrologic soil group classes are used in determining soil-land use conditions for estimating runoff in the *Virginia Erosion and Sediment Control Handbook*. The Hydrologic Class (A, B, C or D, listed below) is an indicator of the minimum rate of infiltration obtained for a bare soil after prolonged wetting.

By using the hydrologic classification and the associated land use, runoff curve numbers can be selected. Runoff curve numbers are used for determining peak discharge and total volume of surface water runoff for given conditions. Based on the above indicated classification, the in-situ soils classify within Hydrologic Classes **"B"** for *Manassas silty loam*, (35B); and **"C"** for the *Arcola-Nestoria complex,* (5C) soils.

3.2 Subsurface Observations

Based on the results of our field investigation, the geologic profile was observed to be generally consistent with the published geologic data. Approximately 1 to 6 inches of topsoil was encountered in both borings. The generalized stratification presented herein is based on the number of borings performed, laboratory testing of selected recovery samples and the geological setting in the site.

The overburden residual soils and sedimentary rock layers encountered during this subsurface investigation are grouped into two (2) main strata below a naturally-occurring layer of topsoil of 1 to 6 inches thick.

Natural soils were encountered immediately after a layer of FILL soils, consisting of silty SAND (SC), and sandy SILT (ML) soils near the surface to a maximum depth of 2.5 feet below existing grade, where it transitioned to natural residual soils, and weathered rock. A description of each stratum encountered below the topsoil layer is summarized as follows:

FILL MATERIAL:

This stratum consists of FILL materials classified as reddish brown clayey SAND (SC) with some gravels, and sandy SILT (ML) soils. These soils were encountered immediately below the topsoil layer in both borings, extending to a maximum depth of 2.5 feet below existing grades.

SPT N-values recorded in this stratum ranged between 26 and 47 blows per foot (bpf) which can be described as medium to dense relative densities. The high blow count could possibly be attributable to a rock fragment driven by the SPT spoon tip, and therefore should be discounted.

STRATUM I: COARSE-GRAINED SOILS

Stratum I is generally characterized as reddish brown clayey SAND (SC) soils. This stratum was encountered below the existing fill layer in boring B-1, and extending to the weathered rock stratum to a depth of 13.5 feet below existing ground surface.

SPT N-values recorded in this stratum ranged between 11 to 31 blows per foot (bpf) which can be described as medium to dense relative densities. The plasticity of these soils was characterized as low based on values ranging between 6 and 7. The moisture of the samples analyzed ranged between 6 and 6.5 percent.

STRATUM II: WEATHERED ROCK

This stratum is generally characterized as reddish brown WEATHERED SILTSTONE/SANDSTONE ROCK with clayey SAND (SC) and fines. This Stratum was encountered in all borings, below Stratum I soils extending to a maximum depth ranging between 13.6 and 23.6 where auger refusal was recorded.

SPT N-values recorded in this stratum ranged from 68 blows per foot to 50 blows per two inches as the borings advanced to their termination depths. The recovered soils were moist to dry and can be described as having very dense relative densities.

3.3 Groundwater Observations

Ground or perched water level measurements were also performed in the open boreholes during drilling, upon drilling completion and 24 hours after drilling completion.

Groundwater was only encountered in boring B-1 during drilling at a depth of 8.5 feet; and upon completion at 8.3 feet below grade. Groundwater readings obtained 24 hours after drilling completion confirmed the presence of groundwater only in boring B-1 at an approximate depth of 8 feet below ground surface elevation. Cave-in readings obtained 24 hours after drilling completion were recorded at depths ranging between 6 to 9 feet below ground surface.

Fluctuations in ground or perched water levels should be expected with variations in factors such as precipitation, surface run-off, and construction activity. The borings were backfilled with soil spoils after completion of long-term water readings.

3.4 Laboratory Test Results

Our laboratory testing program included the tests indicated in *the specifications*. Soil classification, moisture content tests, and various soil characterization tests (Chloride, Redox Potential, Sulfide content and pH) were performed on the in-situ soils and representative samples recovered from the borings, in potential cut areas. It should be noted that organic soils were not encountered during this exploration; as a result, testing for sulfides and sulfates was not completed.

The results of the laboratory tests confirmed the description of natural soils as indicated above. A complete copy of the laboratory test results and the individual laboratory test reports are included in the Appendix of this report. A summary of the results are detailed in the following table:

Table 3: Summary of Laboratory Test Results

Sample Location(ID)	*USCS Classification*	*Percent Fines (-#200) %*	*Liquid Limit (LL) %*	*Plasticity Index (PI)%*	*Natural Moisture (%)*
B-1, S-2	SC	21.9	25	7.0	6.5
B-2, S-2	SC	17.0	24	6.0	6.0
B-1, S-2	SC	21.9	25	7.0	6.5
B-2, S-2	SC	17.0	24	6.0	6.0

The individual laboratory testing results for soil corrosivity as required in *the specifications* has been included in **Section 4.5** of this report.

4.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following information is based upon the findings of this geotechnical study and a review an advanced copy of the site plan, entitled *Prince William County Service Authority, VA Holiday Inn Sewage Pumping Station Replacement/ GHD No. 11109266-C002 'Site Plan,* provided by *GHD*, dated June 24th, 2016 (*the plans*). The following sections provide general geotechnical guidelines for the design and construction of the proposed structures.

4.1 Suitability of On-site Materials

The coarse-grained material encountered in Stratum I and generally consisting of silty clayey SAND (SC-SM) is generally considered suitable for soil backfill.

Materials having a liquid limit and a plasticity index greater than or equal to 40 and 15, respectively, are generally not considered suitable for use as compacted structural fill to support foundations or access roads. This unsuitable material includes the high plasticity clays (CH) or elastic SILT (MH).

4.2 Earthwork Operations

4.2.1 STRIPPING OF TOPSOIL

All areas proposed for cut or fill shall be cleared, grubbed and stripped of all topsoil and root mat layer to the proposed limits of construction as shown on the approved plans for this project. The depth of the topsoil encountered at the boring locations varied between 1 and 6 inches; however, due to the nature of the site, these depth may vary. Therefore, the depth of stripping shall be determined in the field. Topsoil may be stockpiled for later use in landscape areas.

4.2.2 PROOF-ROLLING

All areas delineated and surveyed in the field to receive structural fill should be proof-rolled with a fully-loaded rubber-tired dump truck, having an axle weight of at least 10 tons, in order to identify all soft or unstable areas to be undercut. The geotechnical engineer or his assigned representative should decide on the depth of undercut in order to avoid the removal of suitable or otherwise firm soils.

4.2.3 BORROW MATERIAL

All borrow material, whether on-site or imported from an off-site source, should be tested for suitability and quality before its use as fill or backfill. The material should be tested to determine particle gradation, plasticity, and maximum dry density. The following standard tests should be performed to determine the above properties of all imported fill material:

Laboratory Test	Test Designation
Determination of Moisture Content of Soils	ASTM D2216
Particle Size Analysis of Soils	ASTM D 422
Atterberg Limits	ASTM D 4318
pH Tests	ASTM D4972
Organic Content	ASTM D2974
Standard Proctor Test	VTM-1, ASTM D-698

Structural fill material shall consist of quality, low plasticity, free of organic soil that classify as GW, GP, GM, GC, SW, SP, SC, or SM in accordance with ASTM D2487 and shall have a maximum of 30% retained on a standard ¾-inch sieve.

Proposed structural fill that are classified as SC and SM shall be tested to ensure that the material has a liquid limit and plasticity index less than 40 and 15, respectively; and a maximum dry density determined by ASTM D698 or VTM-1 greater than 105 pounds per cubic foot. Fine-grain material from on or off site borrow sources that classifies as CL and ML shall be tested to ensure that the material has a liquid limit and plasticity index less than or equal to 45 and 20, respectively; and a maximum of 70% passing a U.S. Standard No. 200 sieve. All fill material shall be free of ice, snow, organic material, construction debris, rock sizes greater than 4 inches, marine clay soils, or other deleterious material.

4.2.4 FILL PLACEMENT AND TESTING

New engineered fill materials to be placed underneath proposed structures; and, or as trench backfill at least four feet away from the vaults, should consist of approved material, free of organic matter and debris, or rock fragments greater than 4 inches.

Potentially expansive soils should not be used as structural fill and should be defined as materials with a Liquid Limit (LL) greater than or equal to 40 and Plasticity Index (PI) greater than or equal to 15.

Materials not meeting the above criteria may be used as engineered fill if the material is shown to have a "very low" expansion potential per IBC 2012. Unacceptable fill materials also include topsoil and organic materials (OH, OL), and high plasticity silts (MH) or clays (CH) that do not have very low expansion potential. Under no circumstances should high plasticity soils be used as fill material in proposed structural areas unless they can be shown to have a very low expansion index.

Fill and backfill materials should be placed in lifts not exceeding 8-inches in loose thickness and moisture conditioned to within ±2% of the optimum moisture content. Soil bridging lifts within the expanded structure limits should not be used, since excessive settlement of the structures will likely occur. Controlled fill soils in the structural areas should be compacted to a minimum of 95% of the maximum dry density obtained in accordance with the Virginia Test Method (VTM-1).

4.2.5 GROUNDWATER CONTROL

As mentioned earlier, groundwater levels at the site had risen to 8.0 ft below the current site grades 24 hours after completion of our borings as result of that, the presence of groundwater shall be expected during the construction stage of the project.

In order to minimize the presence of water during excavation, temporary dewatering measures, i.e. sump pits and continuous pumping, will be required during the excavation for site utilities or below-grade structures.

4.3 Excavation

We anticipate that conventional earth-moving equipment will be suitable for the excavation of the on-site soils to the depths indicated to SPT blow count of 50 blows per 1 inch of penetration. Below these depths the rock becomes more dense and durable. Hoe chippings could then be utilized to advance the excavation into the dense and mildly weathered Siltstone/Sandstone rock.

Groundwater should be expected above the rock layer just below the overburden soil. This water is perched water above the rock and should dissipate with short time periods. We, however, recommend that all trench excavations be prepared for dewatering action utilizing sump pumps located in side pits next to the excavation. The pumps will have to run continuously during the winter period when ground saturation is at highest levels.

Temporary excavations greater than 4 feet shall be properly shored or sloped away from the excavation with a minimum grade of 1.5H:1V. If sloping of temporary trenches and pits is not desired, then trench boxes should be utilized. All excavations shall be performed in accordance with the current OSHA and VOSHA.

4.4 Foundation Support

4.4.1 FOUNDATION SUBGRADE PREPARATION

Pump Station Control Building, Emergency Generator and slab-on-grade structures

Based on the information provided to us, the project will include the demolition of the emergency generator, fuel tank, utility pole, pump manhole, and all concrete pads prior to the construction of the newly proposed structures.

We believe that the proposed structures can be constructed on shallow foundations consisting of spread mat and/or continuous footings founded on natural soils or on properly compacted engineered fill are considered feasible for support of the structures. Normal settlements on the order of one-inch (total) and one-half inch (differential) can be expected for foundations bearing on firm natural soils or select fill.

We recommend that a net soil bearing pressure of **2,000** pounds per square foot (psf) be utilized. For the most part, the local requirements for frost protection (i.e., 24 inches) will govern the depths at which the footings are designed to bear. Normal settlements on the order of one inch (total) and one-half inch (differential) shall be expected for foundations bearing on firm natural soils or properly densified existing fill.

The soils encountered near proposed subgrade consist mostly of clayey SAND (SC) and sandy SILT (ML) with varying amounts of gravel and fines. These natural soils can be utilized for the support of the proposed structures provided that it meets the requirements stated in section **4.1Suitability of On-site Materials** of the report.

However, if existing FILL material are encountered within the footprint of the proposed structures, we recommend that these soils be removed in their entirety from the footprint of the proposed structures and establish the proposed grades with engineered fill according to Section **4.2.4 Fill Placement and Testing.**

Wet Well, and Valve, Flow Meter Vault

For foundation support for the wet well and valve, we recommend that, as a minimum, an area of at least at 1.25 times the outer diameter of the manhole be evaluated for proper support of these structures. Considering the estimated depth of these structures, we estimate that the material to be present at foundation depth shall consist of weathered rock. Therefore, we believe that the allowable soil bearing capacity at this depth can be expected at **3,000** (psf).

Based on the information obtained during subsurface investigation, groundwater shall be expected at foundation depth. Therefore, excavation for the construction of the foundation and manhole installation will have to be enlarged to allow for the installation of a sump well to direct the flow of ground water and the installation of submersible pump for dewatering.

Considering the groundwater and cave-in depths encountered in the borings, we anticipate that groundwater may be encountered within the walls of the vaults. The fully enclosed system will have a tendency to experience buoyancy and will likely heave the structures. According to plan provided by GHD, the pool elevation within the structure is at 169.25 ft which is below groundwater elevation, heaving may be an issue if the overburden pressure is not great enough to resist buoyancy.

If heaving of the structure is a concern, we recommend the excavation for the structure be deepened to permit the installation of a structurally connected, enlarged bottom slab to serve as "ballast concrete" inside the structure. The additional thickness of the slab will serve to increase the weight of the structure, and therefore resist buoyancy. The buoyancy calculations should be based on a hydrostatic pressure equal to 62.4 pounds per cubic foot (pcf) times the height of the groundwater table above the bottom of the structures. Groundwater table levels of EL. 174 feet MSL shall be used for design.

4.5 Below Grade Walls

Below grade walls and vault walls shall be designed for a laterally increasing at-rest earth pressure of **60 psf** per foot of wall height. The vault walls below groundwater elevation should be designed to withstand hydrostatic pressures. This recommended value does not include the influence of any surcharge loads. Any surcharge loads, such as those transmitted by traffic, slopes, or surface features imposed within a 45 degree slope of the base of the walls, should be considered in the design. For calculation of lateral pressure from surcharge loads a phi angle of 30 degrees can be used. This will provide an active and at-rest earth pressure coefficients of 0.33 and 0.5, respectively, for the wall design.

The parameters recommended above also assume that relatively freely draining materials are used as backfill immediately adjacent to the walls and that the material is placed with proper compaction.

Soils having liquid limit and plasticity index values greater than 45 and 20, respectively, shall not be allowed as backfill against the foundation walls. Backfill material shall have a maximum of 70% fines passing the No. 200 sieve, and shall not contain rock sizes greater than 4 inches in diameter. The backfill material shall be compacted to 95% of the maximum dry density in accordance with ASTM D698 Standard Proctor.

4.6 Ground-Supported Slabs

Slab-on-grade subgrades shall be supported on low plasticity natural soils or on approved compacted structural fill support layer as described above. A subgrade reaction modulus of **125 pci** may be used for the design of floor slabs-on-grade supported on low plasticity natural soils or approved compacted structural fill.

If the visual inspection of the subgrade material and/or hand auger recovered material reveals the presence of fine-grain soils, i.e. clays or silts, we recommend that a sample of the soil subgrade be tested to ensure that high plasticity soils, having liquid limit and plasticity index values greater than 40 and 15, respectively, are not present at the slab subgrade. Highly elastic or plastic soils, when encountered, should be undercut to at least 2 feet below the slab subgrade and replaced with properly compacted structural fill.

All slabs shall be inspected for quality of the subgrade material, concrete formwork and placement of reinforcing steel. The inspection shall be performed by a qualified soil inspector under the direction of a Virginia-registered geotechnical engineer

4.7 Seismic Soil Profile

The seismic site class definition was evaluated based on the requirements of International Building Code (IBC 2012) and ASCE 7. Based on the subsurface conditions encountered during exploration, indicating an average Standard Penetration Resistance, N-values of less than 15 for the top 30 feet, the site is classified as "**Class D**".

4.8 Underground Utility Pipes

Our analysis for potential corrosion conditions in relation to the proposed underground piping system included laboratory testing of soil samples obtained from drilling operation according to the testing program detailed in *the specifications*.

Considering the depth of proposed underground utilities and the extent of soil layer, soil samples were tested at 13.5 feet below existing site grades in Boring B-1 and 5 feet below the existing site grades in boring B-2. The results obtained from the selected samples are presented in **Table 4: Summary of Laboratory Tests II – (Corrosion Analysis)**

Table 4: Summary of Laboratory Tests II – (Corrosion Analysis)

Sample Location(ID)	*pH*	*Resistivity (ohm-cm)*	*Oxidation Reduction Potential (mV)*	*Sulfides*	*Natural Moisture (%)*
B-1, S-5	6.62	2000	194	ND	6.5
B-2, S-2	6.92	2400	166	ND	8.3
ND – Not Detected by Laboratory Equipment Limits					

The pH values shown in the table above are typical of the soil conditions in the area of the project site according to the Soil Survey of Prince William County[1]. It should be noted that the Sulfides testing showed no detectable limits, which generally indicates a low potential for acid 'build-up' or potential for soil conditions to increase in acidity.

With regards to the *Oxidation Reduction Potential* results, typically, Redox values above 100 mV indicate free oxygen in the soil and the potential for corrosion. The selection of the pipe materials should consider both the pH and Redox levels recorded.

[1] Information regarding pH levels can be found in page 235 and 238 of the Survey. See attached.

5.0 CLOSING REMARKS

5.1 Additional Services

We recommend that quality control testing and geotechnical engineering consulting services be provided during the construction phase of this project. These services shall include:

- Observe undercutting of unsuitable soils and inspect the subgrade for building and all other structures;
- Perform laboratory testing of any material proposed for use as structural fill (access road);
- Verify soil bearing capacity and perform foundation inspections for the proposed structures;

These inspections and field testing services shall be performed by a qualified soil and concrete inspector under the supervision of a Virginia-registered professional engineer. GC&T will be pleased to furnish these and other services during the design and construction phases of the project.

5.2 Qualifications

This report has been prepared for the exclusive use of *GHD, Inc.* to assist them and their engineers during the planning and design phases of the proposed development. The opinions, conclusions, and recommendations contained herein are based upon the soil test borings, our interpretation of the data, and generally accepted principles of geotechnical engineering.

Please be advised that although the test borings were logged by experienced engineers, it is sometimes difficult to record changes in subsoil stratigraphy within narrow limits; therefore, some deviation in the materials reported on the field logs and the materials encountered in the field should be anticipated. Any change in soil type observed during construction, or change in proposed location of the structures or grades should be provided to us so that we may modify portions of this text if necessary. Any conclusions or recommendations that are based on data contained in this report that are made by others are the responsibility of others.

APPENDIX

Site Vicinity Map

Soil Type Map

Boring Location Plan

Filed Classification of Soil

Test Boring Logs (B-1 and B-2)

Soil Laboratory Test Results

Soil Survey of Prince William County (Pages 235, and 238)

GEOTECHNICAL CONSULTING & TESTING, INC.

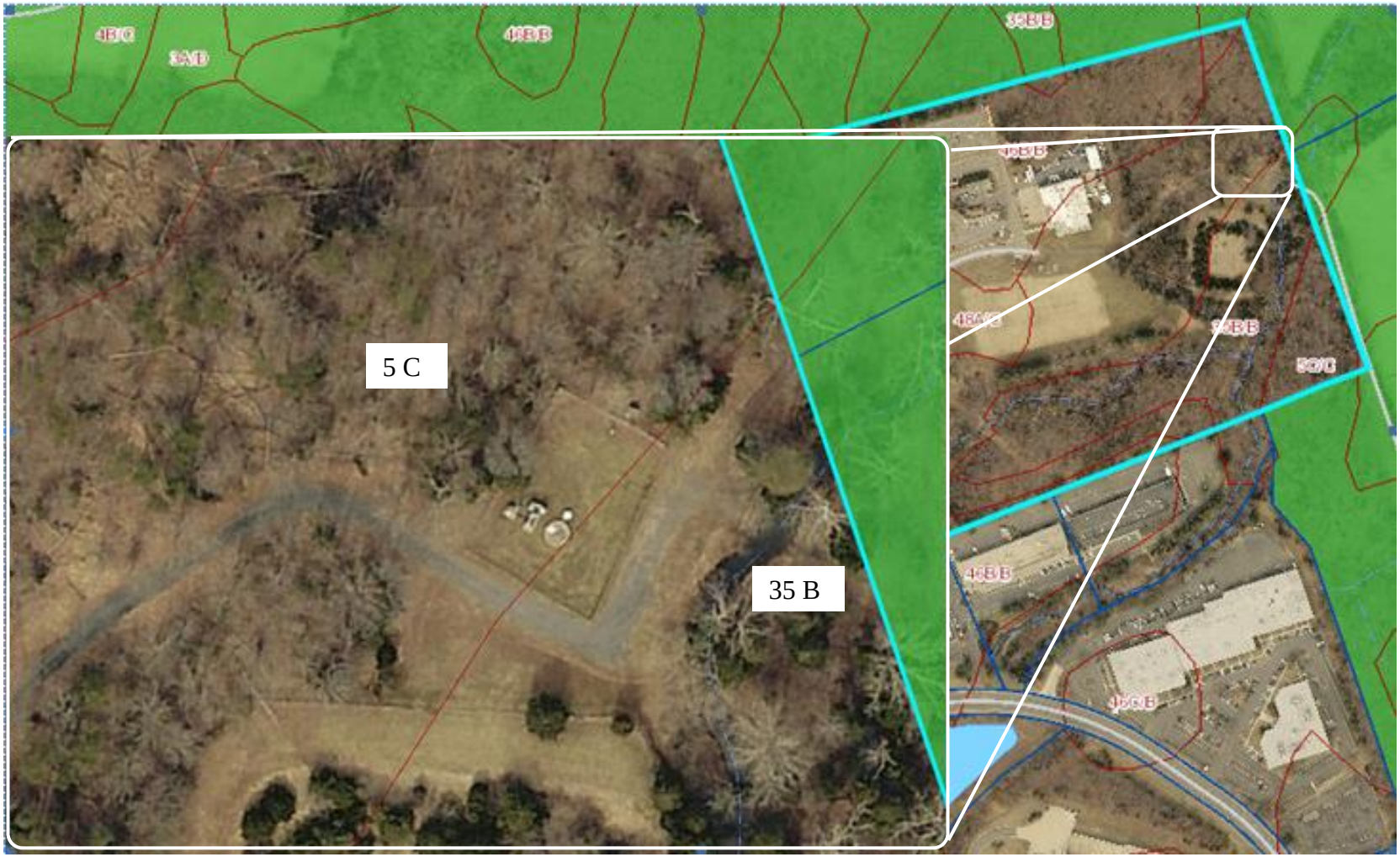
4899 Prince William Parkway
Woodbridge, Virginia 22192
703-730-4160 FAX: 703-730-4170

HOLIDAY INN PUMP STATION

PROJECT # 215M-8166

Site Vicinity Map

Created by:
JAMAL TAHAT



GEOTECHNICAL CONSULTING & TESTING, INC.

4899 Prince William Parkway
Woodbridge, Virginia 22192
703-730-4160 FAX: 703-730-4170

HOLIDAY INN PUMP STATION

PROJECT # 215M-8166

Soil Map

Created by:
JAMAL TAHAT

LEGEND

⊕ BORING LOCATIONS

Geotechnical Consulting & Testing Inc.

4899 Prince William Pkwy.-Woodbridge,Virginia 22192
Phone:(703)730-4160 Fax:(703)337-5359
www.gctonline.net

DRAWN BY:	DATE
XL	09/07/16
CHECKED BY: J.T.	
SCALE: 1" = 20'	

BORING LOCATION PLAN
HOLIDAY INN PUMP STATION
MANASSAS, VIRGINIA

JOB NUMBER: 215M-8166

SHEET 1 OF 1 SHEET

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

Soil identification is made based on the estimated particle size for predominately course-grained soils and on the cohesiveness of predominately fine-grained soils. When a soil sample consists of two or more types, the soil percentages are estimated by weight and indicated as follows:

Soil Type	Particle Size
Boulder	12"+
Cobble	3 – 12"
Gravel	
(Course)	¾" - 3"
(Fine)	#4 – ¾"
Sand	
(Coarse)	#10 - #4
(Medium)	#40 – #10
(Fine)	#200 - #40
Silt / Clay	<#200

Soil Component	Soil Type	Percentage
Major (Uppercase Letters)	SILT	50+
	CLAY	50+
	SAND	50+
	GRAVEL	50+
Secondary (Adjective)	Clayey / Silty	over 12%
	Sandy / Gravelly	over 30%
(with)	Clay / Silt	5 to 12%
	Sand / Gravel	15 to 30%
(trace)	Presence only	

The Standard Penetration Resistance values (N-values) are used to describe the relative density of coarse-grained soils or the consistency of fine-grained soils

RELATIVE DENSITY

N-value	Term
0 – 4	Very Loose
5 – 10	Loose
11 – 29	Medium Dense
30 – 50	Dense
51+	Very dense

CONSISTENCY

N- value	Term
0 – 1	Very Soft
2 – 4	Soft
5 – 8	Medium Stiff
9 – 15	Stiff
16 – 30	Very Stiff
31 – 60	Hard
60+	Very Hard

Geotechnical Consulting & Testing Inc.
4899 Prince William Parkway
Woodbridge VA 22192
Tel.: (703) 730-4160 Fax: (703) 730-4170

BORING LOG SOIL CLASSIFICATION AND N-VALUE CHART

VISUAL-MANUAL CLASSIFICATION PROCEDURE

TEST BORING LOG

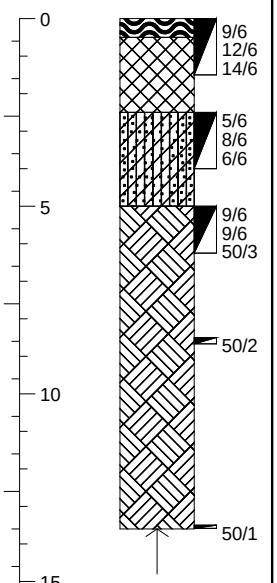
SOIL BORING NO. B-2 ELEVATION: 182.60 ft.

PROJECT:	Holiday Inn Pump Station	GC&T JOB NO.:	215M-8166
CLIENT:	GHD	DATE DRILLED:	08-10-2016
DRILL RIG:	CME 550 ATV	LOGGED BY:	Xiwen Li

AT COMPLETION -- AFTER 24 HOURS

WATER DEPTH: Dry Dry

CAVE-IN DEPTH: 6.1 ft. 6.0 ft.



ELEVATION and DEPTH	SOIL SYMBOLS SAMPLERS AND TEST DATA	SPT "N" VALUE	USCS	DESCRIPTION	MOIST. %	LIQUID LIMIT	PLASTIC INDEX	% PASS # 200	LOGGERS REMARKS
		26	OH	Topsoil (1"-6")					
			Fill	Reddish brown silty SANDY with gravel, moist, medium					
		14	SC-SM	dense. (SC)	6.0	24	6	17.0	pH: 6.78
				Reddish brown clayey SANDY with gravel, moist, medium stiff.					
		50/3	ROCK	(SC)	8.3				Resistivity (2400 ohm-cm)
				Reddish brown WEATHERED ROCK, moist, to dry, very dense.					
		50/2							Oxidation Reduction potential (166 mV)
									Sulfied: ND
		50/1		End of boring at 13.6 ft./Auger Refusal at 13.6 ft.					pH: 6.92

Test boring terminated at 13.6 ft.

ENGINEER'S COMMENTS:

Lines between material descriptions indicate approximate boundaries; actual transitions may vary between test boring locations.

TEST BORING LOG

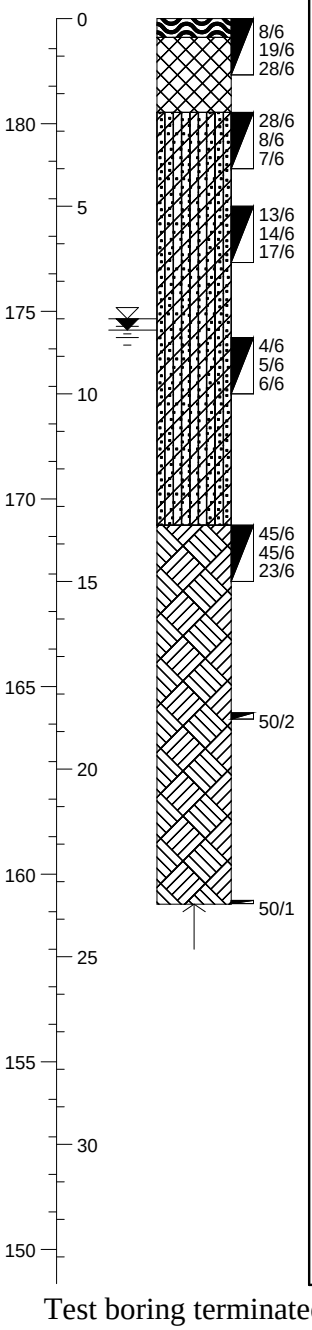
SOIL BORING NO. B-1 ELEVATION: 182.8 ft.

PROJECT:	Holiday Inn Pump Station	GC&T JOB NO.:	215M-8166
CLIENT:	GHD	DATE DRILLED:	08-10-2016
DRILL RIG:	CME 550 ATV	LOGGED BY:	Xiwen Li

AT COMPLETION -- AFTER 24 HOURS

WATER DEPTH: 8.3 ft. 8.0 ft.

CAVE-IN DEPTH: 15.0 ft. 9.0 ft.



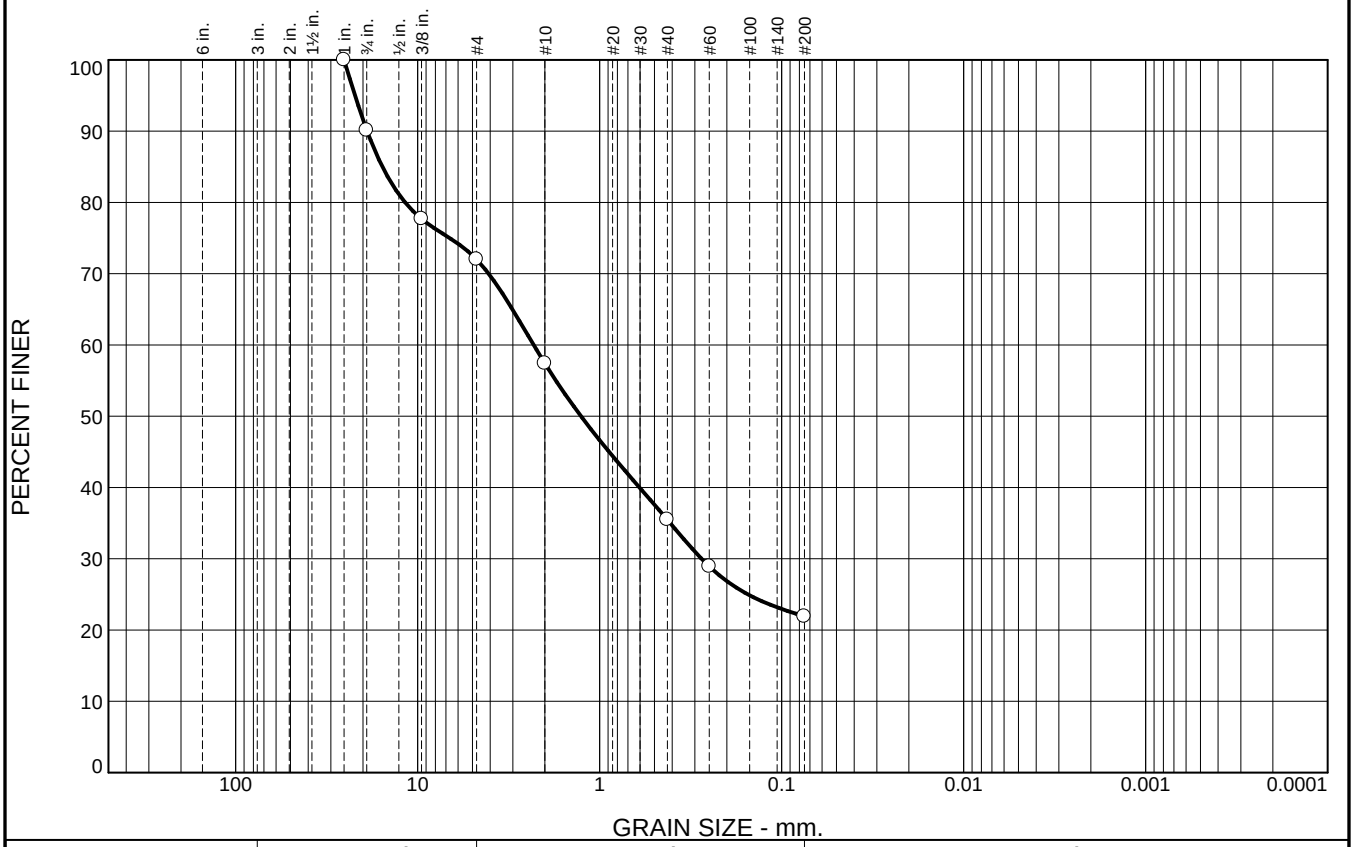
ELEVATION and DEPTH	SOIL SYMBOLS SAMPLERS AND TEST DATA	SPT "N" VALUE	USCS	DESCRIPTION	MOIST. %	LIQUID LIMIT	PLASTIC INDEX	% PASS # 200	LOGGERS REMARKS
		47	OH FILL	Topsoil (1"-6") Reddish brown sandy SILT, with gravel, moist, hard. (ML)					
180		15	SC-SM	Reddish brown silty SAND with gravel, moist, medium dense.	6.5	25	7	21.9	pH: 6.82
175		31		Turning dense at 5.0 ft.					
		11		Turning medium dense at 8.5 ft.					Resistivity (2000 ohm-cm)
170		68	ROCK	Reddish brown WEATHERED ROCK, moist to dry, very dense.	6.5				Oxidation Reduction potential (194 mV)
165		50/2							Sulfides: ND
160		50/1		End of boring at 23.6 ft./Auger refusal at 23.6 ft.					pH: 6.62

Test boring terminated at 23.6 ft.

ENGINEER'S COMMENTS:

Lines between material descriptions indicate approximate boundaries; actual transitions may vary between test boring locations.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.9	18.1	14.6	21.9	13.6	21.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
3/4	90.1		
3/8	77.7		
#4	72.0		
#10	57.4		
#40	35.5		
#60	28.9		
#200	21.9		

* (no specification provided)

Soil Description

Red Brown, Silty, clayey sand with gravel (Shale)

Atterberg Limits

PL= 18 LL= 25 PI= 7

Coefficients

D_{90}= 18.9704 D_{85}= 15.6308 D_{60}= 2.3059
D_{50}= 1.2665 D_{30}= 0.2758 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

pH: 6.82

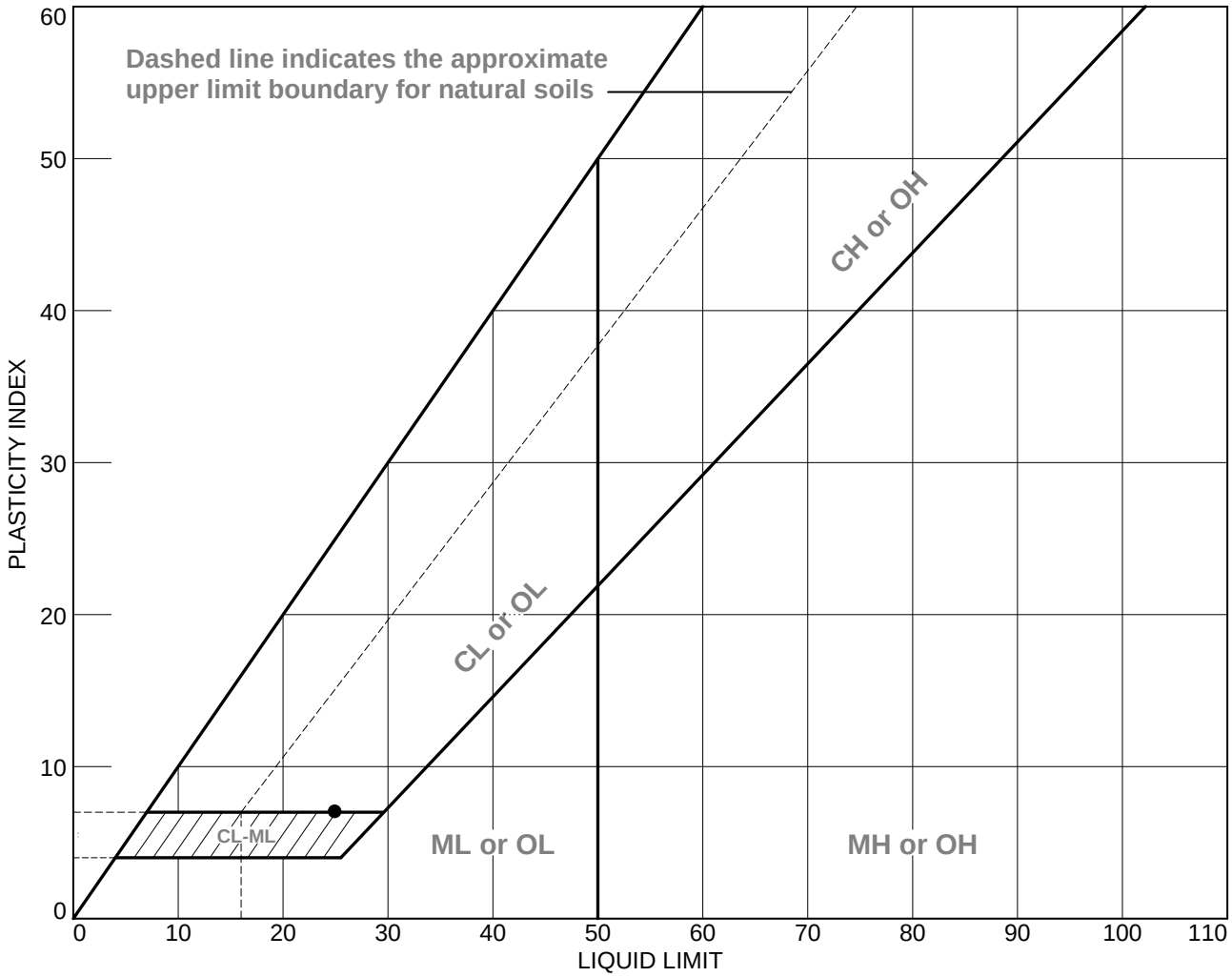
Location: B-1
Sample Number: S-2 **Depth:** 2.5 - 4.0' **Date:** 08-18-16

Geotechnical Consulting & Testing, Inc.
Dulles, VA

Client: GHD, Inc.
Project: Holiday Inn SPS Replacement

Project No: 215M-8166 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



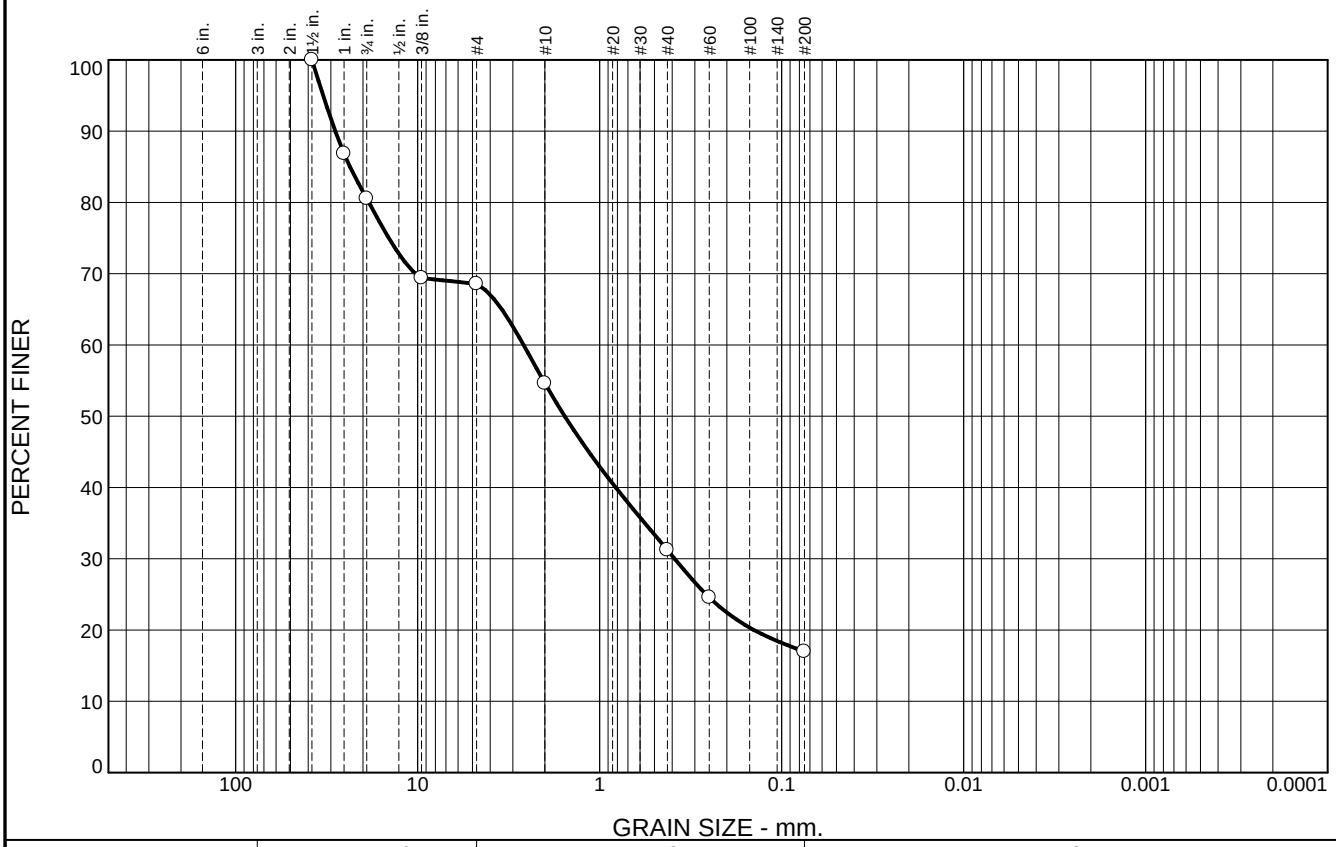
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	S-2	2.5 - 4.0'	6.5	18	25	7	SC-SM

Geotechnical Consulting & Testing, Inc.
Dulles, VA

Client: GHD, Inc.
Project: Holiday Inn SPS Replacement

Project No.: 215M-8166 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.5	11.9	14.0	23.4	14.2	17.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	86.8		
3/4	80.5		
3/8	69.4		
#4	68.6		
#10	54.6		
#40	31.2		
#60	24.6		
#200	17.0		

* (no specification provided)

Soil Description

Red Brown, Silty, clayey sand with gravel (Shale)

Atterberg Limits

PL= 18 LL= 24 PI= 6

Coefficients

D_{90}= 28.3726 D_{85}= 23.5672 D_{60}= 2.6196
D_{50}= 1.5566 D_{30}= 0.3877 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-1-b

Remarks

pH: 6.78

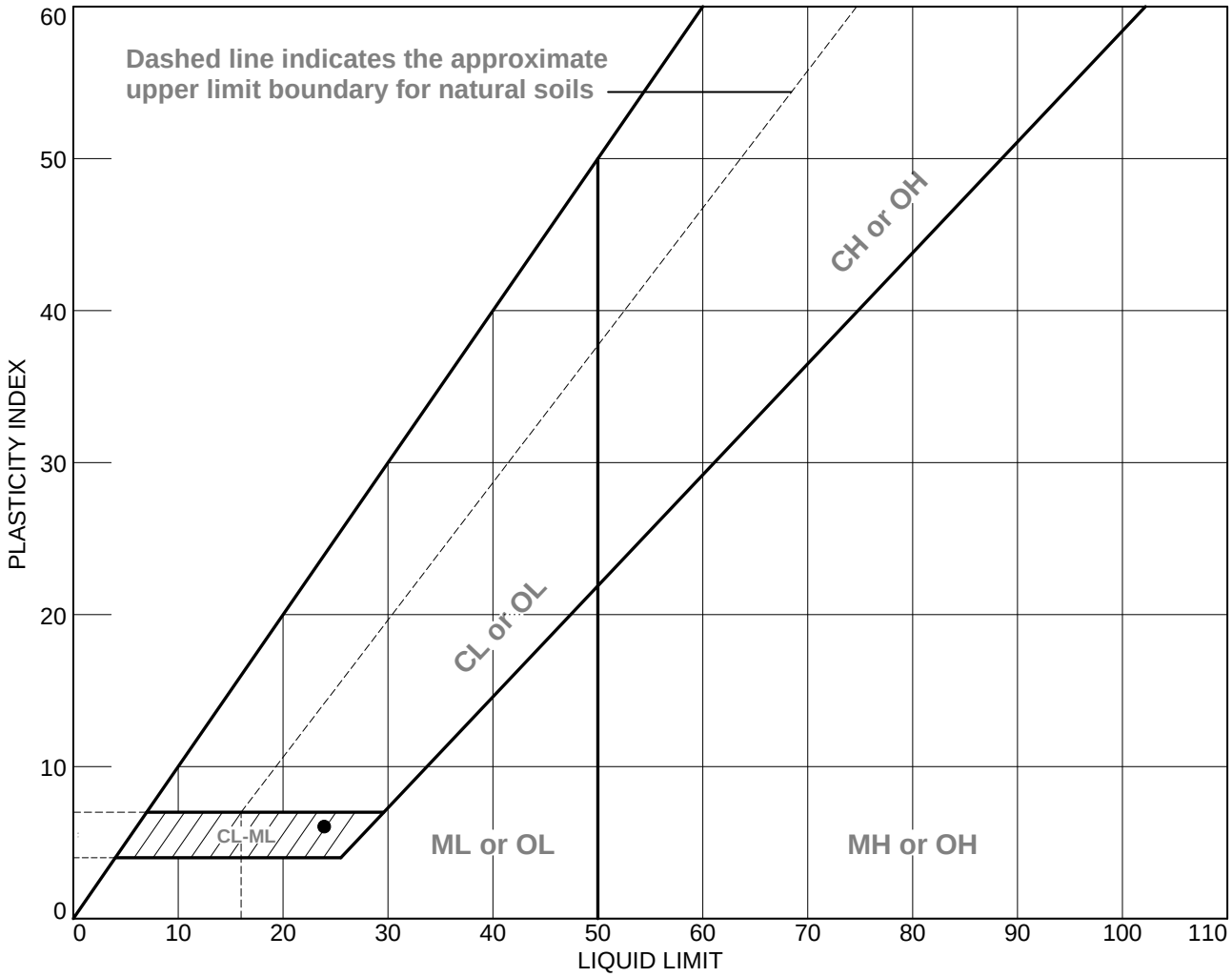
Location: B-2
Sample Number: S-2 **Depth:** 2.5 - 4.0' **Date:** 08-18-16

Geotechnical Consulting & Testing, Inc.
Dulles, VA

Client: GHD, Inc.
Project: Holiday Inn SPS Replacement

Project No: 215M-8166 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-2	S-2	2.5 - 4.0'	6.0	18	24	6	SC-SM

Geotechnical Consulting & Testing, Inc.
Dulles, VA

Client: GHD, Inc.
Project: Holiday Inn SPS Replacement

Project No.: 215M-8166 **Figure**

Summary of Laboratory Tests

Appendix
Sheet 1 of 1
Project Number:

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Natural Moisture (%)	Resistivity (ohm-cm)	Oxidation Reduction Potential (mV)	Sulfides (mg/kg)	pH
B-1	0.0 - 1.5	Jar	SANDY SILT WITH ROCK FRAGMENTS, red/brown (VISUAL)	6.5	2000	194	ND	6.62
B-2	0.0 - 1.5	Jar	SANDY SILT WITH ROCK FRAGMENTS, dark red (VISUAL)	8.3	2400	166	ND	6.92

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; ND=Not Detected; ; P=Present; T=Trace; -- indicates no test performed

Schnabel ENGINEERING

Project: Holiday Inn Pump Station

Analytical Report for

Schnabel Engineering, LLC

Certificate of Analysis No.: 16081719

Project Manager: Steve Fung
Project Name : Holiday Inn SPS
Project Location: Manassas, VA
Project ID : 215M-8166

August 29, 2016

Phase Separation Science, Inc.
6630 Baltimore National Pike
Baltimore, MD 21228
Phone: (410) 747-8770
Fax: (410) 788-8723

OFFICES:
6630 BALTIMORE NATIONAL PIKE
ROUTE 40 WEST
BALTIMORE, MD 21228
410-747-8770
800-932-9047
FAX 410-788-8723

PHASE SEPARATION SCIENCE, INC.

August 29, 2016

Steve Fung
Schnabel Engineering, LLC
1504 Woodlawn Drive
Baltimore, MD 21207

Reference: PSS Work Order(s) No: **16081719**
Project Name: Holiday Inn SPS
Project Location: Manassas, VA
Project ID.: 215M-8166

Dear Steve Fung :

This report includes the analytical results from the analyses performed on the samples received under the project name referenced above and identified with the Phase Separation Science (PSS) Work Order(s) numbered **16081719**.

All work reported herein has been performed in accordance with current NELAP standards, referenced methodologies, PSS Standard Operating Procedures and the PSS Quality Assurance Manual unless otherwise noted in the Case Narrative Summary. PSS is limited in liability to the actual cost of the sample analysis done.

PSS reserves the right to return any unused samples, extracts or related solutions. Otherwise, the samples are scheduled for disposal, without any further notice, on September 21, 2016, with the exception of air canisters which are cleaned immediately following analysis. This includes any samples that were received with a request to be held but lacked a specific hold period. It is your responsibility to provide a written request defining a specific disposal date if additional storage is required. Upon receipt , the request will be acknowledged by PSS, thus extending the storage period.

This report shall not be reproduced except in full, without the written approval of an authorized PSS representative. A copy of this report will be retained by PSS for at least 5 years, after which time it will be disposed of without further notice, unless prior arrangements have been made.

We thank you for selecting Phase Separation Science, Inc. to serve your analytical needs. If you have any questions concerning this report, do not hesitate to contact us at 410-747-8770 or info@phaseonline.com.

Sincerely,

Dan Prucnal
Laboratory Manager

Sample Summary

Client Name: Schnabel Engineering, LLC

Project Name: Holiday Inn SPS

Work Order Number(s): 16081719

Project ID: 215M-8166

The following samples were received under chain of custody by Phase Separation Science (PSS) on 08/17/2016 at 01:40 pm

Lab Sample Id	Sample Id	Matrix	Date/Time Collected
16081719-001	B-1 S-5	SOIL	08/10/16 00:00
16081719-002	B-2 S-3	SOIL	08/10/16 00:00

Please reference the Chain of Custody and Sample Receipt Checklist for specific container counts and preservatives. Any sample conditions not in compliance with sample acceptance criteria are described in Case Narrative Summary.

Notes:

1. The presence of a common laboratory contaminant such as methylene chloride may be considered a possible laboratory artifact. Where observed, appropriate consideration of data should be taken.
2. Unless otherwise noted in the case narrative, results are reported on a dry weight basis with the exception of pH, flashpoint, moisture, and paint filter test.
3. Drinking water samples collected for the purpose of compliance with SDWA may not be suitable for their intended use unless collected by a certified sampler [COMAR 26.08.05.07.C.2].
4. The analyses of 1,2-dibromo-3-chloropropane (DBCP) and 1,2-dibromoethane (EDB) by EPA 524.2 and calcium, magnesium, sodium and iron by EPA 200.8 are not currently promulgated for use in testing to meet the Safe Drinking Water Act and as such cannot be used for compliance purposes. The listings of the current promulgated methods for testing in compliance with the Safe Drinking Water Act can be found in the 40 CFR part 141.1, for the primary drinking water contaminates, and part 141.3, for the secondary drinking water contaminates.
5. Sample prepared under EPA 3550C with concentrations greater than 20 mg/Kg should employ the microtip extraction procedure if required to meet data quality objectives.
6. The analysis of acrolein by EPA 624 must be analyzed within three days of sampling unless pH is adjusted to 4-5 units [40 CFR part 136.3(e)].
7. Method 180.1, The Determination of Turbidity by Nephelometry, recommends samples over 40 NTU be diluted until the turbidity falls below 40 units. Routine samples over 40 NTU may not be diluted as long as the data quality objectives are not affected.
8. Alkalinity results analyzed by EPA 310.2 that are reported by dilution are estimated and are not in compliance with method requirements.

Standard Flags/Abbreviations:

B	A target analyte or common laboratory contaminant was identified in the method blank. Its presence indicates possible field or laboratory contamination.
C	Results Pending Final Confirmation.
E	The data exceeds the upper calibration limit; therefore, the concentration is reported as estimated.
Fail	The result exceeds the regulatory level for Toxicity Characteristic (TCLP) as cited in 40 CFR 261.24 Table 1.
J	The target analyte was positively identified below the reporting limit but greater than the MDL.
MDL	This is the Laboratory Method Detection Limit which is equivalent to the Limit of Detection (LOD). The LOD is an estimate of the minimum amount of a substance that an analytical process can reliably detect. This value will remain constant across multiple similar instrumentation and among different analysts. An LOD is analyte and matrix specific.
ND	Not Detected at or above the reporting limit.
RL	PSS Reporting Limit.
U	Not detected.

Certifications:

NELAP Certifications: PA 68-03330, VA 460156
State Certifications: MD 179, WV 303
Regulated Soil Permit: P330-12-00268
NSWC USCG Accepted Laboratory
LDBE MWAA LD1997-0041-2015

OFFICES:
6630 BALTIMORE NATIONAL PIKE
ROUTE 40 WEST
BALTIMORE, MD 21228
410-747-8770
800-932-9047
FAX 410-788-8723

PHASE SEPARATION SCIENCE, INC.

CERTIFICATE OF ANALYSIS

No: 16081719

Schnabel Engineering, LLC, Baltimore, MD

August 29, 2016

Project Name: Holiday Inn SPS
Project Location: Manassas, VA
Project ID: 215M-8166

Sample ID: B-1 S-5 **Date/Time Sampled: 08/10/2016 00:00** **PSS Sample ID: 16081719-001**
Matrix: SOIL **Date/Time Received: 08/17/2016 13:40**

Inorganic Anions — Analytical Method: EPA 300.0

	Result	Units	RL	Flag	Prepared	Analyzed	Analyst
Chloride	ND	mg/kg	10.8		08/18/16	08/18/16 16:35	4005

Sample ID: B-2 S-3 **Date/Time Sampled: 08/10/2016 00:00** **PSS Sample ID: 16081719-002**
Matrix: SOIL **Date/Time Received: 08/17/2016 13:40**

Inorganic Anions — Analytical Method: EPA 300.0

	Result	Units	RL	Flag	Prepared	Analyzed	Analyst
Chloride	ND	mg/kg	10.7		08/18/16	08/18/16 15:23	4005

Case Narrative Summary

Client Name: Schnabel Engineering, LLC

Project Name: Holiday Inn SPS

Work Order Number(s): 16081719
Project ID: 215M-8166

Any holding time exceedances, deviations from the method specifications, regulatory requirements or variations to the procedures outlined in the PSS Quality Assurance Manual are outlined below.

The analyses of chlorine, pH, dissolved oxygen, temperature and sulfite for drinking water and non-potable samples tested for compliance have a maximum holding time of 15 minutes. As such, all laboratory analyses for these analytes exceed holding times.

Matrix spike and matrix spike duplicate analyses may not be performed due to insufficient sample quantity. In these instances, a laboratory control sample and laboratory control sample duplicate are analyzed unless otherwise noted or specified in the method.

Sample Receipt:

Sample(s) received at a temperature greater than 6 degrees C and ice was not present.

16081719: Analyses associated with analyst code 4005 were performed by Enviro-Chem Laboratories, Inc.

General Comments:
Per client, samples were taken on 8/10/16.
Results reported on a dry weight basis.
NELAP accreditation was held for all analyses performed unless noted below. See www.phaseonline.com for complete PSS scope of accreditation.
EPA 300.0

Analytical Data Package Information Summary

Work Order(s): 16081719
Report Prepared For: Schnabel Engineering, LLC, Baltimore, MD
Project Name: Holiday Inn SPS
Project Manager: Steve Fung

Method	Client Sample Id	Analysis Type	Lab Sample Id	Analyst	Mtx	Prep Batch	Analytical Batch	Sampled	Prepared	Analyzed
EPA 300.0	B-1 S-5	Initial	16081719-001	4005	S	135325	135325	08/10/2016	08/18/2016 16:35	08/18/2016 16:35
	B-2 S-3	Initial	16081719-002	4005	S	135325	135325	08/10/2016	08/18/2016 15:23	08/18/2016 15:23

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
1A----------	0-8	10-27	1.30-1.40	0.6-2.0	0.20-0.24	4.5-5.5	Low----------	0.43	5	.5-2
Aden	8-31	35-60	1.45-1.60	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.28		
	31-58	27-50	1.50-1.65	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.28		
	58-78	10-27	1.55-1.70	0.6-2.0	0.12-0.20	4.5-5.5	Low----------	0.32		
	78	---	---	---	---	---	----------	----		
2B*, 2C*, 2D*, 2E*:										
Airmont--------	0-11	5-15	1.00-1.20	2.0-6.0	0.08-0.10	4.5-5.5	Low----------	0.10	4	2-4
	11-27	20-35	1.20-1.50	2.0-6.0	0.08-0.10	4.5-5.5	Low----------	0.10		
	27-45	10-27	1.70-1.90	0.06-0.2	0.04-0.08	4.5-5.5	Low----------	0.10		
	45-65	10-35	1.20-1.50	0.6-6.0	0.04-0.08	4.5-5.5	Low----------	0.05		
Weverton-------	0-7	5-15	1.00-1.20	2.0-6.0	0.10-0.17	4.5-5.5	Low----------	0.15	4	.5-2
	7-38	20-35	1.20-1.50	0.6-2.0	0.04-0.08	4.5-5.5	Low----------	0.10		
	38-52	10-27	1.20-1.50	0.6-2.0	0.02-0.06	4.5-5.5	Low----------	0.05		
	52	---	---	---	---	---	----------	----		
3A----------	0-7	7-27	1.25-1.55	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37	3	1-2
Albano	7-28	35-60	1.35-1.65	0.06-0.2	0.11-0.18	4.5-7.3	Moderate-----	0.32		
	28-40	20-40	1.35-1.65	0.06-0.6	0.05-0.10	5.6-7.3	Low----------	0.17		
	40	---	---	---	---	---	----------	----		
4B----------	0-9	15-27	1.20-1.50	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.37	2	.5-2
Arcola	9-22	18-35	1.30-1.50	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.24		
	22-28	15-27	1.20-1.50	0.6-2.0	0.04-0.08	4.5-5.5	Low----------	0.15		
	28	---	---	---	---	---	----------	----		
5C*, 5D*:										
Arcola----------	0-9	15-27	1.20-1.50	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.37	2	.5-2
	9-22	18-35	1.30-1.50	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.24		
	22-28	15-27	1.20-1.50	0.6-2.0	0.04-0.08	4.5-5.5	Low----------	0.15		
	28	---	---	---	---	---	----------	----		
Nestoria--------	0-8	10-27	1.40-1.60	0.6-2.0	0.10-0.16	4.5-6.0	Low----------	0.28	1	.5-2
	8-14	15-27	1.35-1.55	0.6-2.0	0.04-0.10	4.5-6.0	Low----------	0.10		
	14-18	10-27	1.35-1.55	0.6-2.0	0.04-0.10	4.5-6.0	Low----------	0.05		
	18-30	---	---	---	---	---	----------	----		
	30	---	---	---	---	---	----------	----		
6A----------	0-8	15-32	1.20-1.40	0.2-0.6	0.16-0.27	4.1-5.5	Low----------	0.43	3	1-4
Baile	8-45	10-35	1.30-1.60	0.06-0.2	0.12-0.24	4.1-5.5	Moderate-----	0.43		
	45-62	10-25	1.30-1.60	0.06-0.6	0.10-0.24	4.1-5.5	Low----------	0.43		
7A----------	0-12	10-25	1.25-1.40	0.6-6.0	0.12-0.16	4.5-6.0	Low----------	0.37	4	2-3
Bermudian	12-38	17-35	1.30-1.50	0.6-6.0	0.12-0.16	4.5-6.0	Low----------	0.28		
	38-64	5-20	1.35-1.55	6.0-20.0	0.04-0.08	4.5-6.0	Low----------	0.17		
8C----------	0-8	10-25	1.20-1.50	0.6-6.0	0.14-0.19	3.6-5.5	Low----------	0.32	4	1-2
Braddock	8-55	35-55	1.20-1.50	0.6-2.0	0.12-0.17	3.6-5.5	Moderate-----	0.24		
	55-69	25-45	1.20-1.50	0.6-6.0	0.06-0.12	3.6-5.5	Low----------	0.24		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
28B, 28C---------	0-9	10-27	1.00-1.30	0.6-2.0	0.18-0.22	4.5-6.0	Low----------	0.32	4	1-3
Haymarket	9-13	25-45	1.20-1.50	0.2-0.6	0.10-0.16	4.5-6.0	Moderate-----	0.28		
	13-38	40-60	1.20-1.50	0.2-0.6	0.08-0.12	4.5-6.0	High---------	0.10		
	38-46	25-45	1.20-1.50	0.2-0.6	0.10-0.16	4.5-6.0	Moderate-----	0.28		
	46-72	15-35	1.30-1.60	0.6-2.0	0.10-0.20	5.6-7.8	Low----------	0.28		
29B---------------	0-11	10-27	1.00-1.30	0.6-6.0	0.12-0.20	4.5-6.5	Low----------	0.28	4	1-3
Hoadly	11-29	18-35	1.20-1.50	0.6-2.0	0.10-0.18	4.5-6.5	Low----------	0.28		
	29-41	18-35	1.70-1.90	<0.06	0.08-0.10	4.5-6.5	Low----------	0.28		
	41-53	20-40	1.30-1.60	0.6-2.0	0.10-0.18	4.5-6.5	Moderate-----	0.24		
	53-72	10-35	1.30-1.60	0.6-2.0	0.10-0.18	4.5-6.5	Low----------	0.24		
30B---------------	0-10	15-27	1.00-1.30	0.6-2.0	0.16-0.22	4.5-6.0	Low----------	0.32	4	.5-2
Jackland	10-15	20-40	1.20-1.50	0.06-0.2	0.10-0.16	4.5-6.0	High---------	0.28		
	15-38	40-60	1.20-1.50	<0.06	0.08-0.12	4.5-7.,	Very high----	0.10		
	38-60	10-40	1.30-1.60	0.6-2.0	0.10-0.14	4.5-7.8	Low----------	0.15		
31B*, 31C*:										
Jackland--------	0-10	15-27	1.00-1.30	0.6-2.0	0.16-0.22	4.5-6.0	Low----------	0.32	4	.5-2
	10-15	20-40	1.20-1.50	0.06-0.2	0.10-0.16	4.5-6.0	High---------	0.28		
	15-38	40-60	1.20-1.50	<0.06	0.08-0.12	4.5-7.,	Very high----	0.10		
	38-60	10-40	1.30-1.60	0.6-2.0	0.10-0.14	4.5-7.8	Low----------	0.15		
Haymarket-------	0-9	10-27	1.00-1.30	0.6-2.0	0.18-0.22	4.5-6.0	Low----------	0.32	4	1-3
	9-13	25-45	1.20-1.50	0.2-0.6	0.10-0.16	4.5-6.0	Moderate-----	0.28		
	13-38	40-60	1.20-1.50	0.2-0.6	0.08-0.12	4.5-6.0	High---------	0.10		
	38-46	25-45	1.20-1.50	0.2-0.6	0.10-0.16	4.5-6.0	Moderate-----	0.28		
	46-72	15-35	1.30-1.60	0.6-2.0	0.10-0.20	5.6-7.8	Low----------	0.28		
32A---------------	0-9	10-27	1.20-1.40	0.6-2.0	0.13-0.21	4.5-6.0	Low----------	0.37	3	.5-2
Kelly	9-38	35-60	1.20-1.40	<0.2	0.11-0.21	6.1-7.3	High---------	0.28		
	38-41	20-50	1.30-1.60	0.06-2.0	0.11-0.21	6.1-7.3	High---------	0.24		
	41-45	---	---	---	---	---	-------------	----		
	45	---	---	---	---	---	-------------	----		
33B*, 33C*, 33D*:										
Legore----------	0-15	---	---	0.6-6.0	0.12-0.24	5.1-6.0	Low----------	0.24	3	.5-2
	15-28	---	---	0.6-2.0	0.12-0.24	5.6-6.5	Moderate-----	0.17		
	28-72	---	---	0.6-6.0	0.08-0.12	5.6-6.5	Low----------	0.28		
Oakhill---------	0-8	10-27	1.30-1.60	2.0-6.0	0.10-0.16	4.5-5.5	Low----------	0.20	3	.5-2
	8-25	10-35	1.35-1.65	0.6-2.0	0.04-0.10	5.6-7.3	Low----------	0.10		
	25-34	5-27	1.30-1.60	0.6-2.0	0.02-0.10	5.6-7.3	Low----------	0.10		
	34	---	---	---	---	---	-------------	----		
34B, 34C, 34D----	0-7	10-27	1.20-1.55	0.6-6.0	0.08-0.17	4.5-5.5	Low----------	0.32	4	.5-2
Lunt	7-39	35-60	1.30-1.60	0.6-2.0	0.13-0.19	4.5-5.5	High---------	0.32		
	39-72	5-30	1.45-1.65	>2.0	0.04-0.12	4.5-5.5	Low----------	0.17		
35B---------------	0-10	10-27	1.25-1.55	0.6-6.0	0.14-0.20	4.5-5.5	Low----------	0.37	4	2-4
Manassas	10-43	20-35	1.30-1.60	0.6-6.0	0.16-0.20	4.5-5.5	Low----------	0.24		
	43-60	15-30	1.30-1.60	0.6-6.0	0.06-0.10	4.5-5.5	Low----------	0.20		
36D, 36E----------	0-13	16-23	1.40-1.60	2.0-6.0	0.14-0.20	5.1-5.5	Low----------	0.32	3	.5-3
Marr	13-53	18-35	1.40-1.70	0.6-2.0	0.16-0.24	4.5-5.5	Low----------	0.28		
	53-72	12-20	1.40-1.60	2.0-6.0	0.10-0.18	4.5-5.5	Low----------	0.37		
37A---------------	0-7	15-27	1.20-1.50	0.6-2.0	0.16-0.22	3.6-5.0	Moderate-----	0.32	5	1-2
Marumsco	7-29	35-60	1.10-1.30	0.06-0.2	0.10-0.14	3.6-5.0	High---------	0.20		
	29-47	25-55	1.10-1.40	0.2-0.6	0.10-0.16	3.6-5.0	High---------	0.20		
	47-75	5-50	1.20-1.50	0.06-20	0.06-0.16	3.6-5.0	High---------	0.24		

See footnote at end of table.