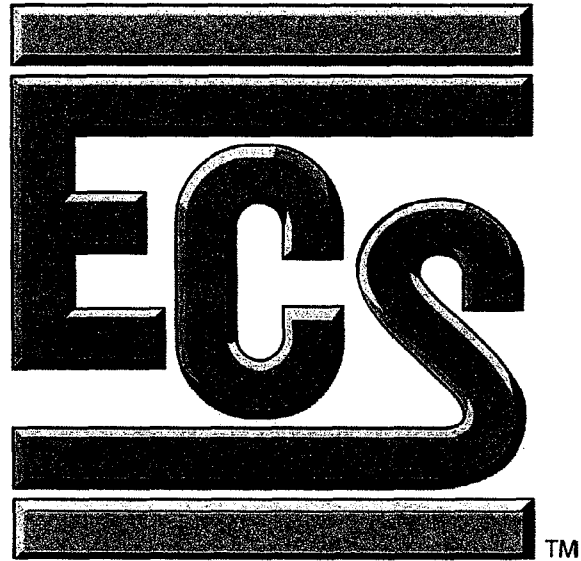




**PRELIMINARY REPORT OF
SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING ANALYSIS**

**N STREET NOMA
WASHINGTON, DC**

ECS PROJECT NO. 01:24758

**FOR
THE JBG COMPANIES**

AUGUST 10, 2015



ECS MID-ATLANTIC, LLC

"Setting the Standard for Service"

Geotechnical • Construction Materials • Environmental • Facilities

August 10, 2015

Mr. Clay Friend
The JBG Companies
4445 Willard Avenue
Suite 400
Chevy Chase, Maryland 20815

ECS Project No. 01:24758

Reference: Preliminary Report of Subsurface Exploration and Geotechnical Engineering Analysis, N Street NoMA, 51 N Street NE, Washington, DC.

Dear Mr. Friend:

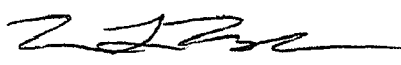
As authorized by your acceptance of ECS Proposal No. 51261-GPR, dated May 20, 2015 and Revised June 9, 2015, ECS Mid-Atlantic, LLC (ECS) has completed the subsurface exploration and geotechnical engineering analysis for the proposed construction of the residential development at 51 N Street, in northeast Washington, DC.

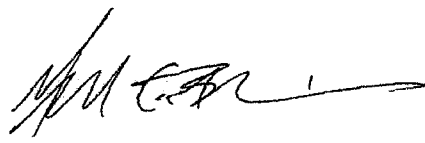
A report, including the results of our subsurface exploration, boring data, laboratory testing, engineering recommendations, and a Boring Location Diagram are enclosed herein. The recommendations presented are intended for use by your office and for use by other professionals involved in the design and construction stages of the project described herein.

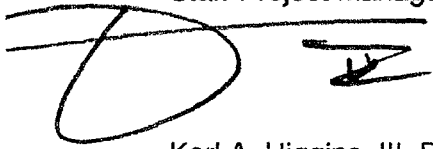
We appreciate the opportunity to be of service to The JBG Companies on this project. If you have any questions with regard to the information and recommendations contained in this report, or if we may be of further service to you during the planning and/or construction phase of this project, please do not hesitate to contact the undersigned.

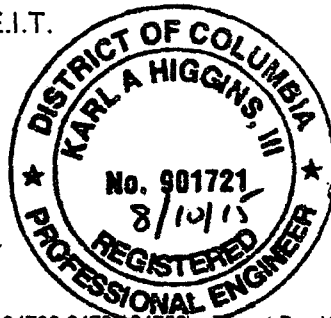
Respectfully,

ECS MID-ATLANTIC, LLC


Rebecca L. Ruschman, E.I.T.
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PRELIMINARY REPORT

PROJECT

Subsurface Exploration and
Geotechnical Engineering Analysis
N Street Noma
Washington, DC

CLIENT

The JBG Companies
4445 Willard Avenue
Suite 400
Chevy Chase, Maryland 20815

PROJECT NO. 01:24758

DATE August 10, 2015

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PROJECT OVERVIEW

Introduction

This report presents the results of our subsurface exploration and geotechnical engineering analysis performed for the proposed construction at 51 N Street NE in Washington, DC. This report was conducted in general accordance with ECS Proposal No. 51261-GPR, dated May 20, 2015 and Revised June 9, 2015, 2015, and authorized by your office. In preparing this report, we have utilized information from our current subsurface exploration as well as a report for a nearby site prepared by ATC Associates Inc. We have also had the opportunity to discuss the project with you via email and telephone conversations.

Site Location and Existing Site Conditions

The project site is located at the physical addresses of 51 N Street, 1250 1st Street, and 50 Patterson Street in Northeast Washington DC. Specifically, we understand you intend to redevelop the existing parcels denoted as Lots 860, 861, and 862 at the above-referenced street addresses. The site is bound to the north by N Street, NE, to the east by 1st Street, NE, to the south by Patterson Street, NE, and to the west by at-grade asphalt parking areas. The site is currently occupied by a seven-story commercial building located at the physical address of 51 N Street, SE and on-site parking located to the east and south of the existing building. The southeast corner of the block (not included in the redevelopment) is denoted as Lot 844 and is currently occupied by an existing one-story brick building. The site is relatively flat with elevations ranging between elevation EL. +50 and EL. +54.

Proposed Construction

At the time that this report was prepared, the project was in the planning stages. As such, proposed conceptual construction drawings were not available at this time; however, based on our conversation, we understand that the general design concept for the proposed construction will include razing the existing structure and developing three new structures, one each at 1250 1st Street NE, 50 Patterson St NE, and 51 N Street NE. The buildings will have 11 levels above-grade, 10 levels above-grade and 12 levels above-grade, respectively. Each structure will have a below-grade space that extends approximately 40 feet below the assumed at-grade finished floor elevation. The combined building footprint is expected to be up to 60,000 square feet. Based on this information and our experience with similar construction, we anticipate a design lowest level finished floor elevation of approximately EL. +13.5 feet and maximum column loads on the order of 1,500 to 2,000 kips.

Purpose and Scope of Work

The purpose of this program was to explore the subsurface conditions at the site and to develop engineering recommendations to guide the design and construction of the project. We accomplished these purposes by performing the following scope of services:

1. Reviewing the geotechnical reports prepared for nearby project sites by ECS;
2. Drilling soil borings using a conventional drill rig;

3. Performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties;
4. Analyzing the field and laboratory data from this and previous explorations to develop appropriate engineering recommendations; and,
5. Preparing this geotechnical report of our findings and recommendations.

The conclusions and recommendations contained in this report are based on six (6) soil borings (referenced as B-1, B-2, and ECS-3 through ECS-6) conducted by ECS at the project site and within the anticipated limits of the proposed construction to a depth of about 80 feet below the existing site grades, which corresponds to a termination elevation of approximately EL. -26 feet to EL. -30 feet. The subsurface exploration included split spoon soil sampling, Standard Penetration Tests (SPT), and groundwater level observations in the boreholes. The results of the completed soil borings along with a Boring Location Diagram are included in the Appendix of this report. We also reviewed the ATC geotechnical report dated December 18, 2008 (project 09.20597.0056) which contains data for the NE quadrant of the site.

The Boring Location Diagram and boring elevations were developed from publically available information and are considered accurate to within ± 2 feet.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The subsurface exploration consisted of performing a total of six (6) borings to a depth of up to about 80 feet below existing site grades. The soil borings were performed with a truck-mounted auger drill rig, which utilizes continuous flight, hollow stem augers to advance the boreholes. In hollow stem auger drilling operations, drilling fluid is not used to maintain or advance the borings. After completion of the borings, the boreholes were grouted to the surface. Excess spoils were containerized as required by the DDOE and a soil sample was tested to determine to means and methods for disposal. At the time this report was prepared, the soils had not been removed from the site.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. Sampling was typically performed at 2.5 foot intervals in the upper 10 feet and every 5 feet thereafter. The number of blows required to drive the sampler through the last 12-inch interval is termed the Standard Penetration Test (SPT) N-value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of granular soils. In a less reliable way, it also indicates the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the soils encountered in the boring was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and brought to our laboratory in Chantilly, Virginia for further visual examination and laboratory testing.

ReMi

A Refraction Microtremor (ReMi) survey was performed at the subject site on July 7, 2015. The ReMi survey consisted of two (2) transect locations designated as Line 1 and Line 2. The locations of these lines are shown on the attached ReMi Survey Location Diagram. The location of the ReMi traverse lines were estimated in the field by measuring from existing features, and therefore, the location of the ReMi traverse lines should be considered approximate.

The data gathering process in the field used standard seismic refraction equipment to measure subsurface soil and/or rock characteristics using ambient vibrations (microtremors) as a seismic source. The equipment used for the survey was a SeisDAQ III ReMi recording unit capable of storing record lengths up to about 100 seconds using 24, 10-Hz, and 4.5-Hz geophones. A single geophone sensor was used at each one of the channel geophone locations to record surface wave velocity dispersion. The analysis presented herein was developed using 12 channels with 10-Hz and 4.5-Hz geophones (seismometers) set along a relatively straight-line at evenly spaced intervals of 20 feet between channels. A minimum of 20 unfiltered 30-second records were recorded along each line.

Data Processing

The ReMi data were processed using SeisOpt® ReMi™ software to reveal a one-dimensional average shear-wave (S-wave) velocity image for each line. The method provides an effective and efficient way to generate information for large volumes of the subsurface profile in one dimension along each line. In addition, the survey also provides the average shear wave velocity to a depth of 100 feet that is used to evaluate the seismic Site Class per the IBC 2012 and Chapter 20 of ASCE requirements.

ReMi processing requires three steps: 1) velocity spectral analysis, 2) Rayleigh phase velocity dispersion picking and 3) shear wave velocity modeling. The seismic data records collected were processed using proprietary software and the refraction microtremor method described by Louie (2001) and Pullammanappallil et. al.(2003). A brief discussion of each of the three steps is presented in the attachment titled "Reference Notes for Refraction Microtremor (ReMi) Testing.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications, moisture content tests, Atterberg Limits tests, and grain size distribution analysis tests. All data obtained from the laboratory tests is included in the Appendix of this report.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included with this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual, rather than distinct.

The soil samples 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.

EXPLORATION RESULTS

Regional Geology

The proposed site is located in the Coastal Plain Physiographic Province. The natural soils at the site consist of Alluvium deposits of Quaternary age (Pleistocene). These water deposited alluvial/colluvial soils typically consist of interbedded layers of silt, sand, clay, and gravel. Underlying the Alluvial/Colluvial Deposits is expected to be the marine deposits of the Potomac Formation, which are typically Cretaceous Age sands, silts, and clays. The Potomac Formation is the oldest sedimentary deposit in the Washington metro area and is the bearing stratum for many shallow and deep foundations. At significant depths the site is underlain by crystalline bedrock.

As we understand, the natural soil profile at the site has been altered by documented past development that has resulted in the placement of man-made fills. Existing man-made fill can be quite variable in depth, composition, and consistency and the engineering properties of such material can be difficult to assess. Although there is no specific correlation between the standard penetration resistances (N-values) recorded in test borings and the percent compaction of existing fill, a qualitative assessment of the fill can often be made based on the magnitude of the N-values and observations of the sampled fill materials. Because the man-made fill soils were often generated from nearby excavations, these soils can, at times appear similar to natural alluvial soil deposits. Further, as the fill soils age, they may obtain the visual characteristics of natural soils. Hence, it is difficult at times to distinguish between natural alluvial soils and man-made fill materials.

Soil Conditions

The surficial materials at the project site consisted of approximately 4 to 8 inches of asphalt and gravel in all borings with the exception of B-2 which also had approximately 3 feet of concrete underlying the asphalt. Underlying the surficial materials, the subsurface profile can be divided into three strata: (I) Fill, (II) Natural Alluvial Soils, and (III) upper Potomac Soils. The following sections describe each soil strata in more detail.

Stratum I - Fill and Possible Fill

Fill and Possible Fill soils were observed in all borings from ground surface (EL +54 ft) to elevations ranging from EL. +20 to EL. +37 feet (17 feet to 32 feet below existing site grades). The Fill soils generally consisted of SAND (SP), Clayey and Silty SAND (SC and SM), and Lean CLAY (CL) with varying amounts of gravel and contained rock, brick, and asphalt fragments, as well as organics. SPT N-Values in this material ranged from 2 blows per foot (bpf) to 34 bpf with the higher blow counts attributed to concrete, gravel, and brick fragments. The N-values correspond to relative densities of very loose to very dense for cohesionless soils and consistencies of very soft to hard for cohesive soils. Please note that in the previous subsurface exploration by ATC Associates on the eastern portion of the site there was a concrete slab observed approximate 4 feet to 5 feet below the existing grades.

Stratum II – Natural Alluvial Soils

Natural alluvial deposits were observed below the Stratum I – Fill soils and extended to about elevation EL. +20 to +15 feet. The natural alluvial soils typically consisted of SAND (SP), Silty and Clayey SAND (SM and SC), and Lean CLAY (CL). SPT N-Values ranged between 2 bpf and over 50 blows per 3 inches of penetration, which correspond to relative densities of medium dense to very dense for cohesionless soils and stiff to very hard consistencies for cohesive soils.

Stratum III – Upper Potomac Soils

Potomac Soils were encountered beneath Stratum II (below EL. +20 ft) and extend throughout the remaining depths of the borings. The Potomac soils typically consisted of Silty SAND (SM) and sandy Lean CLAY (CL) with varying amounts of organics. Please note that a pocket of highly organic soil (OL/OH, Lignite) was encountered in Boring B-2 between EL. -8 to EL. -13 feet. These organics were often Lignite, a coal-like organic material that is fossilized and not compressible. Lignite should not be confused with other organic soils that have low strength and are compressible. SPT N-values of these soils ranged between 42 bpf and 50 blows over 2 inches of penetration, which corresponds to relative densities of dense to very dense in cohesionless soils and hard to very hard consistencies in the cohesive soils.

Groundwater Observations

During the subsurface exploration, water was observed at depths ranging between 13.5 feet and 23 feet below existing site grades which corresponds to EL. +29 feet and EL. +41 feet.

The highest groundwater observations are normally encountered in late winter and early spring. Variations in the location of the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of our explorations.

ANALYSIS AND RECOMMENDATIONS

The conclusions and recommendations presented in this report are based on the proposed design of three separate structures each with 4 below-grade levels, up to 13 above-grade levels, a lowest finished floor elevation (FFE) of approximately EL. +13.5 feet, assumed maximum column loads of 2,000 kips, and the results from our subsurface exploration. The following paragraphs should be incorporated in the design and construction of the project to reduce possible soil and/or foundation related problems. These include recommendations with regard to building foundations, below-grade walls and drainage, earthwork, ground slabs, construction dewatering, temporary excavation support, and seismic design parameters. Discussion of the factors affecting the building foundations for the proposed construction, as well as additional recommendations regarding design and construction at the project site are included below as well. We recommend that ECS review the final design and specifications to check that the earthwork and foundation recommendations presented in this report have been properly interpreted and implemented in the design and specifications.

The lowest garage level finished floor elevation is anticipated to be at EL. +13.5 feet; we anticipate that if a shallow foundation system is selected, the footing will bear between about EL. +8.5 feet. At EL. +8.5 ft (+/-), the soils recently transitioned between Stratum II and III, with Stratum III being much more capable than the upper strata. Conventional spread footings to support the entire proposed development appears to be feasible, provided the footings bear in Stratum III soils. If lignite is encountered at the footing elevation, it may require undercutting depending on the amount. The following section provides additional details for the shallow foundation system.

Shallow Foundations

If the footing sizes can be accommodated by the design team and contractor, a shallow foundation system (consisting of individual column footings) bearing in the competent natural soils of Stratum III soils can be designed for an allowable bearing pressure of 10,000 psf. The perimeter exterior, continuous footings supporting the walls should be designed for an allowable bearing pressure of 6,000 psf. Column footings must be at least 5 feet below the top-of-slab elevation due to bearing concerns (EL. +8.5 feet or deeper); wall footings may bear at shallow as EL. 10.5 ft. At EL. +10.5/+8.5 feet, the soils are transitioning between two geologic strata and it is important that the bearing conditions be confirmed by the geotechnical engineer before concrete placement.

Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. Due to the high bearing pressures relative to the geologic setting, it will be important to have the geotechnical engineer of record inspect the foundation subgrade prior to placing foundation concrete. If soft or unsuitable soils (including softer lignite) are observed at the footing bearing elevations, the unsuitable soils should be undercut and removed. Any undercut should be backfilled with lean concrete (1,000 psi at 28 days) up to the original design bottom of footing elevation, and the footing constructed on top of the hardened lean concrete. During construction, the bearing capacity at the final footing excavation should be tested in the field by the geotechnical engineer's authorized representative to document that the in situ bearing capacity at the bottom of each footing excavation is adequate for the design loads.

In order to prevent disproportionately small footing sizes, we recommend that continuous footings have a minimum width of 2.0 feet and that isolated column footings have a minimum lateral dimension of 4.0 feet. The minimum dimensions recommended above help reduce the possibility of foundation bearing failure and excessive settlement due to local shear or "punching" action. All column footings should be placed at a minimum depth of 5 feet below finished grade or top of slab.

Based on our past experience with similar projects in DC, uncontrolled groundwater can result in disturbing an otherwise acceptable foundation subgrade. If groundwater is not effectively controlled and lowered at least 2 feet below foundation subgrade levels, frequent foundation subgrade undercutting may be needed. Due to the anticipated complications of the below-grade excavation, size of the footings, and the infiltrating groundwater, we suggest that the project budget include the costs of "mud matting" all shallow foundation subgrades immediately after they are excavated and approved by the geotechnical engineer in order to preserve the integrity of the subgrade material.

In areas where individual footings are stepped down and founded at different elevations, it is important to provide a minimum slope of 1H:1V between the bottom edge of each foundation at their closest point. Both the drainage layer for the below grade wall and underslab gravel layers should be hydraulically connected in areas where footings are lowered.

Settlement of a structure is a function of the compressibility of the natural soils, the design bearing pressure, column loads, and the elevation of the footing with respect to the original ground surface. The expected settlement of the columns for the tower will be on the order of 1.5 inches. Differential settlement between column footings and walls is estimated to be less than 1 inch.

These settlement estimates have been based on ESTIMATED structural loading and expected planned finish floor elevation. Once the loads and floor elevations are better known, ECS should revise our report accordingly.

Floor Slab Design

The on-site natural soils are considered suitable for support of the lowest floor slabs, although moisture control during earthwork operations, including the use of discing or appropriate drying equipment, should be expected. Based on a lowest finished floor elevation of EL. +13.5 feet, it appears that the slabs for the structure will bear on cohesive clays (CL) of Stratum III. In an undisturbed state, this material should be suitable for support of the floor slabs; however, if these soils are disturbed and trafficked, they will deteriorate and require undercutting. Additional backfill if required placed for support of the floor slabs should be placed in accordance with the recommended earthwork requirements included in this report. Materials placed as fill or backfill below the floor slab should be placed in lifts not exceeding 8 inches in loose thickness, moisture conditioned to within 2 percentage points of the optimum moisture content, and compacted to a minimum of 95% of the maximum density obtained in accordance with ASTM Specification D698, Standard Proctor Method.

For the design and construction of any interior slabs-on-grade for the proposed structure, we recommend that any soft or unsuitable materials be removed from these areas and backfilled. The stripped area should be observed by an experienced soil technician during the time of construction in order to aid in locating all such unsuitable materials, which should be removed.

We recommend that the floor slab be isolated from the foundation elements so that differential settlement of the structure will not induce shear stresses in the floor slab. Furthermore, in order to minimize the crack width of any shrinkage cracks that may develop near the surface of the slab, we recommend mesh reinforcement be included in the design of the floor slab. The mesh should be in the top half of the slab to be effective. Special attention should be given to the surface curing of the slab in order to minimize uneven drying of the slab and associated cracking.

We also recommend that the lower floor slab be underlain by a minimum of 6 inches of granular material having a maximum aggregate size of 1.5 inches and no more than 2% soil fines passing the No. 200 sieve. This granular layer will facilitate the fine grading of the subgrade and help prevent the rise of water through the floor slab. Prior to placing the granular material, the floor subgrade soil should be properly compacted, proofrolled, and free of standing water, mud, and frozen soil. Before the placement of concrete, a vapor barrier may be placed on top of the granular material to provide additional moisture protection.

Below Grade Wall Design

Please refer to the separate diagram in the Appendix that provides the lateral earth pressure diagram. We recommend that all below grade walls be designed to withstand lateral earth pressures and surcharge loads from soil, adjacent building foundations, or streets. The drained earth pressure diagram requires the wall drainage system to effectively eliminate hydrostatic pressures behind the walls. We recommend that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure.

The project may also include loading dock walls. These walls are likely to be of cantilever walls (free to rotate at the top). Cantilever loading dock walls should be designed for a linearly increasing lateral earth pressure of 45 psf per vertical foot of wall and designed assuming a drained condition. In addition, we recommend that the drained design noted in the underslab drainage system noted below be used for design of cantilever walls.

Any surcharge loads imposed within a 45 degree slope of the base of the wall should be considered in the below grade wall design. The influence of these surcharge loads on the below grade walls should be based on an at-rest pressure coefficient, k_0 , of 0.5 in the case of restrained walls, and an active pressure coefficient, k_a of 0.33 in the case of cantilever walls.

To minimize excessive pressures against the below grade walls, and to reduce the settlement of the wall backfill, it is recommended that the wall backfill (if required) be compacted to 95% of the maximum dry density determined in accordance with ASTM Specification D698, Standard Proctor Method. Where the fill will be supporting pavement or other structures, the fill should also be compacted to 95% of this specification. Backfill materials which are placed behind below-grade walls should be free of organic materials and debris, free-draining (or with proper drainage provisions), non-frost susceptible, and should not include any highly plastic clays or silts (CH or MH). It is imperative that no CH or MH soils be used as backfill, due to the shrink-swell potential of these materials. The backfill should also have a Liquid Limit less than 40 and Plasticity Index of less than 15. The fill placed adjacent to the below grade walls should not be over compacted. Heavy earthwork equipment should maintain a minimum horizontal distance away from the below grade walls of 1 foot per foot of vertical wall height. Lighter compaction equipment should be used close to the below grade walls.

Suitable man-made drainage materials may be used in lieu of the granular backfill, adjacent to the below grade walls. Examples of suitable materials include Enca Mat, Mira-drain, or Geotec drains. These materials should be covered with a filter fabric having an apparent open size (AOS) consistent with the size of the soil to be retained. The material should be placed in accordance with the manufacturer's recommendations and connected to either the perimeter drain system or the underslab drainage system, which in turn should be properly drained from sumps. The lateral earth pressures indicated above are applicable for either granular backfill or the manufactured drainage medium. We recommend that the lowest level of the parking structure be waterproofed with suitable water stops between the walls and floor slab at the foundation level. Lateral Earth Pressure Diagrams are included in the Appendix of this report.

Underslab Subdrainage

We recommend that the below grade areas be provided with a perimeter and underslab subdrainage system. Please refer to the sketch titled "Below Grade Wall Waterproofing and Underslab Drainage Details" contained in the Appendix as this plan depicts our recommendations. The system may consist of perforated wall, closed joint drain tiles located around the interior perimeter of the below grade areas, as close as feasible to the exterior wall, slightly below the finished floor level. Weep holes (which convey drainage from behind the walls to the underslab subdrainage system) should be placed at a spacing of no greater than 8 feet on center, generally designed to align between the soldier piles of the earth retention system. The weep holes should be a minimum of four inches in diameter, and should freely drain from the exterior drainage medium to be collected by the interior perimeter drain line just inside the base of the wall. The drain lines should be surrounded by coarse-grained material having a gradation compatible with the size of the opening utilized in the drain lines and the surrounding soils to be retained.

Due to the large size of the project, we recommend that the perimeter and underslab drain system for the proposed structure be designed to flow to at least two (2) permanent sumps. We recommend that each permanent sump be designed with a full duplex capability (i.e., two pumps per pit), with each individual pump rated at a capacity of at least 50 gpm with a duplex capacity of 100 gpm. With two sumps, a total pumping capacity of 200 gpm should be achieved.

The contractor should monitor the pumping rate of the construction dewatering system in order to verify that the permanent sump pump has been adequately sized. Smaller or conversely larger pumps may ultimately be needed. Once the plans are further developed, please contact ECS so that we can refine our pumping estimates.

A network of interior drain lines is needed in addition to the interior perimeter lines. Lateral drain lines under the floor slab should be placed at no more than 30 feet on center. Underslab drain lines should have a minimum diameter of 4 inches, and they should be slotted or appropriately perforated. For the filter fabric we recommend a non-woven product such as Mirafi 140N with an AOS of 70 (U.S. Sieve). An equivalent geotextile fabric can also be used if approved by the Geotechnical Engineer of Record. Clean out access should be installed at all sharp bends and at approximately every 100 feet for straight runs. A grit collection chamber should be installed upstream of the sump to reduce the amount of granular materials reaching the pumps.

Seismic Design Considerations

The subsurface exploration completed for the proposed development included the drilling of borings up to a depth of up to about 80 feet below the existing surface elevation. The International Building Code (IBC) 2012 requires site classification for seismic design based on the upper 100 feet of a soil profile. Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions.

The seismic site class definitions for the weighted average of either the SPT N-values or the shear wave velocities in the upper 100 feet of the soil profile are presented in Table 20.3-1 of ASCE 7 and in the table below.

Table 1: Site Classification (ASCE 7)

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (feet/s)	Standard Penetration Test (SPT) N-value
A	Hard Rock	$V_s > 5,000$ fps	N/A
B	Rock	$2,500 < V_s \leq 5,000$ fps	N/A
C	Very dense soil and soft rock	$1,200 < V_s \leq 2,500$ fps	$N_{AVG} > 50$ bpf
D	Stiff Soil Profile	$600 \leq V_s \leq 1,200$ fps	$15 \leq N_{AVG} \leq 50$ bpf
E	Soft Soil Profile	$V_s < 600$ fps	$N_{AVG} < 15$ bpf

The estimated shear wave velocity profiles for the two (2) ReMi Line locations and supporting data are included as Figures 1 through 4 in this report. Based on the data collected from the Refraction Microtremor (ReMi) survey, the two (2) surveyed ReMi lines produced an average shear wave velocity (V_s) of 1207 ft/s and 1076 ft/s, to a depth of 100 feet below the existing ground surface. Using these average shear wave velocities (V_s), the site is classified as seismic Site Class "D" in accordance with the IBC 2012.

The above measurement result represent the average shear wave velocity of a large volume of the subsurface and thus is representative of conditions responsible for site response to earthquake shaking. The local velocities and depths of individual layers may vary along the length of lines. Some variation in shear wave velocities should be expected across the site.

In addition to the seismic site class noted above, ECS has determined the design spectral response acceleration parameters following the IBC 2012 methodology. The Mapped Responses were estimated from the free Java Ground Motion Parameter Calculator available from the USGS website. The design responses for the short and 1-second period (S_{DS} and S_{D1}) are noted in bold at the far right end of the following table.

Table 2: Ground Motion Parameters (IBC 2012 Method)

Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class D		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_s	0.118	F_a	1.2	S_{MS}	0.189	S_{DS}	0.126
1.0	S_1	0.051	F_v	1.7	S_{M1}	0.122	S_{D1}	0.081

The Site Class definition should not be confused with the Seismic Design Category designation, which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, ECS would be pleased to discuss additional testing capabilities in this regard.

Qualification of Report

The modeled results presented in this letter report represent average shear wave velocities of a large cross-sectional area of the subsurface and thus are representative of conditions responsible for site response to earthquake shaking. The local velocities and depths of individual layers may vary along the length of lines. Some variation in shear wave velocities should be expected across the site.

PROJECT CONSTRUCTION

Subgrade Preparation and Earthwork Operations

Regardless of the foundation design chosen, initial preparation of the site should consist of complete removal of all landscaping, sidewalks, existing structural elements, topsoil, roots, and other deleterious materials within the footprint of the proposed structure. Further excavation to the design subgrade level should be limited to about 1 foot above the design subgrade. This will allow any equipment required to excavate footing foundations the ability to negotiate the site on material that will ultimately be removed. We recommend this plan in order to limit undercutting that may be necessary due to the surface disturbance caused by construction traffic and exposure to weather. This is especially important for proper construction of the slab and foundation system.

Upon removal of the protective layer and excavation to the floor subgrade, the building slab areas should be observed by the Geotechnical Engineer of Record or his authorized representative. Any soft or unsuitable materials encountered during the observation process should be removed and replaced with an approved backfill material in accordance with the earthwork specifications presented in this report.

All excavations should be adequately sloped or braced in order to protect construction personnel and equipment working at the site. OSHA safety regulations should be followed in all cases. If any problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, the Geotechnical Engineer should be notified immediately.

Fill Placement

All fills should consist of an approved material, free of organic matter and debris, cobbles greater than 4-inches and have a Liquid Limit and Plasticity Index less than 40 and 20, respectively. Unacceptable fill materials include topsoil and organic materials (OH, OL), and high plasticity silts and clays (CH, MH). Under no circumstances should high plasticity soils be used as fill material in proposed structural areas or close to site slopes. The site's Stratum II soils appear to be suitable for reuse as backfill material provided the amount of non-soil constituents are low and removed and meet the criterion outlined in this report. Below grade wall backfill will require a maximum Liquid Limit and Plasticity Index of 40 and 15, respectively.

The on-site soils may require moisture content adjustments, such as the application of discing or other drying techniques or spraying of water to the soils prior to their use as compacted fill (termed manipulation). The planning of earthwork operations should recognize and account for increased costs associated with manipulation of the on-site materials considered for reuse as compacted fill.

Fill materials should be placed in lifts not exceeding 8-inches in loose thickness and moisture conditioned to within ± 2 percentage points of the optimum moisture content. Soil bridging lifts should not be used, since excessive settlement of overlying structures will likely occur. Controlled fill soils should be compacted to a minimum of 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor Method. However, the upper one foot of soil supporting slabs-on-grade, pavements, sidewalks, or gutters should be compacted to a minimum of 100% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor Method.

The expanded footprint of the proposed pavement and fill areas should be well defined, including the limits of the fill zones at the time of fill placement. Grade control should be maintained throughout the fill placement operations. All fill operations should be observed on a full-time basis by a qualified soil technician to determine that the specified compaction requirements are being met. A minimum of one compaction test per 2,500 square foot area should be tested in each lift placed. The elevation and location of the tests should be clearly identified at the time of fill placement.

Compaction equipment suitable to the soil type used as fill should be used to compact the fill material. Theoretically, any equipment type can be used as long as the required density is achieved. Ideally, a steel drum roller would be most efficient for compacting and sealing the surface soils. All areas receiving fill should be graded to facilitate positive drainage from building pad and pavement areas of any free water associated with precipitation and surface runoff.

It should be noted that prior to the commencement of fill operations and/or utilization of any off-site borrow materials, the Geotechnical Engineer of Record should be provided with representative samples to determine the material's suitability for use in a controlled compacted fill and to develop moisture-density relationships. In order to expedite the earthwork operations, if off-site borrow materials are required, it is recommended they be comprised of a select granular material which will provide suitable support and be easily compacted and well drained.

Fill materials should not be placed on frozen soils or frost-heaved soils and/or soils which have been recently subjected to precipitation. All frozen soils should be removed prior to continuation of fill operations. Borrow fill materials, if required, should not contain frozen materials at the time of placement. All frost-heaved soils should be removed prior to placement of controlled, compacted fill, granular subbase materials, foundation or slab concrete, and asphalt pavement materials.

Earth Retention System

A temporary excavation system will likely be required for the proposed construction. A free draining system consisting of soldier piles and wood lagging is recommended. The system should be braced externally using tiebacks, if possible, or internally with rakers.

Spacing of the soldier piles and braces should be determined by a structural analysis. However, we recommend that the maximum center line to center line spacing of the soldier piles not exceed 8 feet. In addition, wooden lagging should have a minimum thickness of 3 inches (although larger thicknesses may be required). The final design of the system should be performed by a specialist in this area and is not part of the scope of this report. The earth retention system should be designed for both global stability as well as stability at the face of the excavation.

The lateral earth pressures (LEP) for the temporary earth retention system should be chosen by the design-build contractor based on site specific soils/site features. In particular, the LEP adjacent to the northern and western portions of the building should be designed assuming at-rest assumptions (i.e. no vertical or lateral movement). ECS recommends a peer review of the SOE design be performed.

If tiebacks are used, we recommend a "performance test" be performed on 10% of randomly selected tiebacks (or a minimum of three tiebacks, whichever is greater). The performance test

evaluates the tieback load carrying capacity, deflections during loading, and movements with respect to time. The tieback capacity should be considered adequate when a stable condition is obtained under a particular test load for a duration of 15 minutes. In addition, we recommend that each tieback be "proof tested" to 120% of its design load.

In areas where tiebacks are not feasible, an internal bracing system of rakers would be required. Rakers should be braced against toe blocks or other reaction points that have been designed to carry the load.

The contractor should avoid stockpiling excavated materials immediately adjacent to the excavation walls. We recommend that stockpile materials be kept back from the excavation a minimum distance equal to one-half the excavation depth to avoid surcharging the excavation walls. If this is impractical due to space constraints, the excavation walls should be retained with bracing designed for the anticipated surcharge loading.

Earth Retention System/Support of Excavation (SOE) Performance Requirements

We recommend the following specification for use in the construction documents associated with the earth retention system.

Part 1 – General

1. Contractor/Designer shall design and construct a temporary Support of Excavation (SOE) system sufficient to support the project's below grade construction.

Part 2 – Submittals

1. SOE design plans sealed by a licensed Professional Engineer for the jurisdiction the work is performed in.
2. All supporting calculations for the SOE design, including global stability calculations.
3. Subsurface data utilized for the SOE design.
4. The braced excavation contractor shall submit the anticipated movement amounts (vertically and laterally) of each portion of the excavation support system to the owner's engineering consultant. These anticipated movements will also serve as the basis for evaluating the performance of the excavation support system. If creep movements are anticipated, the contractor shall state the total expected magnitude and rate during the time frame the SOE system is required to support the excavation. The contractor's estimated excavation support movements shall be subject to review and acceptance by the owner's engineering consultant before they are used as the performance standard.
5. Jack calibration data for any equipment utilized to tension tieback anchors. Calibration records must be current within a 12 month period of the time of anchor stressing.
6. Proposed Performance Test Locations and elevations (for tieback anchors).
7. If not stated on the plans, the method of soldier pile installation.

Part 3 – Performance Requirements

1. The performance of the braced excavation system will be monitored (measured) by the owner's engineering consultants. These measurements will serve as the basis for determining the performance and adequacy of the excavation support system. The initial baseline measurements and periodic movement data will be provided to all parties involved in construction. The initial baseline measurements shall be obtained before significant portions of the below grade excavation work occur, and preferably before any excavation work begins. The contractor may make his own independent measurements; however, the owner's engineering consultant's measurements will serve as the basis for performance evaluation.

2. If the movements of the excavation support system exceed the contractor's estimate, additional support for the excavation support system shall be provided by the contractor on an urgent basis, at no additional cost to the owner. If the excavation support system is creeping (inward or downward), and the owner's engineers projected estimate of total movement (within the performance time period of the excavation support system) exceeds the total movement estimates provided by the contractor, then additional support shall be added to the braced excavation system to halt the creeping, also on an urgent basis, at no additional cost to the owner.

Part 4 – Monitoring by Owner's Engineering Consultant

1. Prior to or very near the commencement of below grade excavation work, baseline data of the position of the SOE system will be obtained. Baseline measurements and subsequent movement evaluation will be performed with either total station, laser technology or optical surveying equipment. Total station technology is capable of making precise measurements of movement (± 3.175 mm [± 0.125 inches]). Reflector "targets" will be attached to the SOE system by the Owner's Engineering Consultant, with the full cooperation and assistance of the SOE contractor. The Owner's Engineering Consultant, with the assistance of the SOE contractor, shall replace any previously established targets if they are damaged during construction.

2. Monitoring Frequency. The SOE monitoring frequency is as follows:

- Once to three times weekly during excavation of lowest below grade levels
- Once to three times weekly during construction of all below grade levels
- Monitoring frequency will remain at three times per week until the structural engineer (SE) indicates that all below grade level walls and floors are constructed and capable of resisting the below grade soil and water pressures.
- Monitoring ceases after below grade construction ends and SER indicates that all below grade level walls and floors are constructed and capable of resisting the below grade soil and water pressures.

3. Reporting.

- The results of the monitoring readings will be transmitted verbally to either the general contractor's representative or the SOE contractor's representative during the field work. Any significant movements since the prior readings will be identified.
- Written reports containing the monitoring data and corresponding graphical presentation of said data will be provided by the Engineer to all interested parties, electronically and in hardcopy form, on a weekly or twice monthly basis.

Adjacent Structure Monitoring

Based upon the current design and excavation depths proposed for this project, we recommend a movement monitoring plan be implemented during construction to monitor the performance of the support of excavation (SOE) system and the existing structures located in proximity to the proposed excavation. As such, we recommend that movement monitoring be performed on any structures located in close proximity to the proposed excavation (i.e., on the order of a 3H:1V zone from the bottom of the excavation). A preconstruction condition survey is also recommended to document existing conditions prior to construction.

Our experience in this area has indicated that settlements induced from lateral deformation of the temporary earth retention system can cause significant settlement of adjacent and existing structures. While it is unlikely that significant settlement of adjacent structures and streets will occur if proper design/workmanship (and performance monitoring) is employed during construction, it is prudent to perform such monitoring to defend against unfounded claims of structural damage by adjacent property owners. By having data available, such claims can potentially be resolved more quickly. ECS is capable of providing monitoring of the support of excavation system and adjacent structures for lateral and vertical movements during construction.

WMATA

As we understand, the closest railroad/WMATA facility exists to the east of the project. We expect these facilities are out of the zone of influence for the project, however, this should be confirmed once project designs are further along. Therefore, any required coordination with WMATA can be identified or ruled out early in the planning phase.

Underpinning

Although not in the scope of this report, several structures at the project are within the zone of influence of this project. As such, we expect these structures will require underpinning or special protection during excavation. We recommend that structures founded within the zone of influence be reviewed by the structural engineer to determine if underpinning is required.

Construction Dewatering

Aggressive dewatering will be a critical aspect of this project. Our past experience in similar geologic conditions indicates that the alluvial sands (SC and SP) at the site can transmit high volumes of groundwater into below-grade excavations. Therefore, high groundwater in-flow concentrations are expected around the perimeter of the excavation for the proposed development, as a result of the more granular and free draining sand materials.

We recommend that the site dewatering be capable of lowering the water table to about two(ft) feet below the lowest footing subgrade level not pour footings "in the wet". To accomplish this level of dewatering, we expect that the contractor will use a deep well dewatering system that includes a network of perimeter wells that are slotted the full excavation height, positioned exterior to the support of excavation (SOE) system (supplementing with interior wells is also recommended). The wells may be spaced between 40 and 80 feet on-center along the excavation perimeter, as determined by the contractor's dewatering plan design. Several interior wells may also be needed. A network of dewatering trenches at the base of the

excavation interior will be needed to supplement the deep well system. Since construction dewatering is such a critical aspect of the planned development, we suggest that ECS review the dewatering plans before they are implemented.

We recommend the dewatering contractor assume a design water table elevation of EL. +35 feet. They should make note of the highly permeable sands below this elevation and consider them in the design. The flow for the temporary system should be calculated by the dewatering contractor and should not be confused with the flows in the permanent, underslab drainage system.

If traditional underpinning is utilized, it will be critical for the construction dewatering system to be in place prior to initiating the underpinning installation.

Closing

This report has been prepared in order to aid in the evaluation of this project. The analysis and recommendations submitted in this report are based upon the data obtained from the subsurface exploration detailed herein. This report does not reflect any variations that may occur between the test locations. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between test locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will become necessary for a reevaluation of the recommendations for this report after performing onsite observations during the construction period and noting the characteristics and variations.

This report was prepared for the sole use of The JBG Companies and its consultants; the only intended beneficiaries of our work. The scope is limited to this specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to it. In the event of any change in the nature or location of the proposed construction outlined in this report or the accompanying plans and specifications, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the design engineer. No other party should rely on the information contained herein without prior written consent of ECS Mid-Atlantic, LLC.

In addition to geotechnical engineering services, ECS Mid-Atlantic, LLC has the in-house capability to perform multiple additional services as this project moves forward. These services include the following:

- Construction Material Testing/Special Inspections
- 3D/Vibration Monitoring of Existing Structures
- Third Party Plan Review
- Building Envelope/Waterproofing Inspections
- Underslab Drainage Design

We would be pleased to provide these services for you. If you have any questions with regard to this information or need any further assistance during the design and construction of the project please feel free to contact us.

APPENDIX

Unified Soil Classification System

Reference Notes for Borings Logs

Boring Logs

Laboratory Test Data

ReMi Reference Sheet

ReMi Survey Location Diagram

ReMi Data

Below-Grade Wall Lateral Earth Pressure Diagram (Drained)

Zone of Influence Diagram

Below-Grade Wall Waterproofing and Underslab Drainage Diagram

Boring Location Diagram

Boring Cross Sections A-A' to B-B'

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions		Group Symbols		Typical Names		Laboratory Classification Criteria													
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size) Gravels (More than half of coarse fraction is larger than No. 4 sieve size) Clean gravels (Little or no fines) Gravels with fines (Appreciable amount of fines) GM^a d u Silty gravels, gravel-sand mixtures GC Clayey gravels, gravel-sand-clay mixtures Sands (More than half of coarse fraction is smaller than No. 4 sieve size) Clean sands (Little or no fines) SP Poorly graded sands, gravelly sands, little or no fines Sands with fines (Appreciable amount of fines) SM^a d u Silty sands, sand-silt mixtures SC Clayey sands, sand-clay mixtures						Determine percentages of sand and gravel from grain-size curve. 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 5 percent GM, GC, SM, SC Borderline cases requiring dual symbols ^b 5 to 12 percent				$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10} \times D_{60})$ between 1 and 3									
										Not meeting all gradation requirements for GW									
										Atterberg limits below "A" line or P.I. less than 4		Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols							
										Atterberg limits below "A" line or P.I. less than 7									
										$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10} \times D_{60})$ between 1 and 3									
										Not meeting all gradation requirements for SW									
										Atterberg limits above "A" line or P.I. less than 4		Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols							
										Atterberg limits above "A" line with P.I. greater than 7									
										Fine-grained soils (More than half material is smaller than No. 200 Sieve) Silts and clays (Liquid limit less than 50) ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays OL Organic silts and organic silty clays of low plasticity Silts and clays (Liquid limit greater than 50) MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts CH Inorganic clays of high plasticity, fat clays OH Organic clays of medium to high plasticity, organic silts Highly Organic soils Pt Peat and other highly organic soils						Plasticity Chart			

Determine percentages of sand and gravel from grain-size curve.
 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
 Borderline cases requiring dual symbols ^b

^a Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

^b Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash sample
REC	Rock Sample Recovery %	RQD	Rock Quality Designation %

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140-lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

<i>Density</i>		<i>Relative Properties (Sands & Gravels)</i>	
Under 4 blows/ft	Very Loose	With Clay or Silt	5% to 12%
5 to 10 blows/ft	Loose	Clayey or Silty	>12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense	<i>Relative Properties (Silts & Clays)</i>	
Over 51 blows/ft	Very Dense	With Sand or Gravel	<30%
Over 80 blows/ft	Extremely Dense	Sandy or Gravelly	≥30%

<i>Particle Size Identification</i>		
Boulders		12 inches or larger
Cobbles		3 to 12 inches
Gravel	Coarse	¾ to 3 inches
	Fine	¼ to ¾ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

<i>Blows/ft</i>	<i>Consistency</i>	<i>Unconfined Comp. Strength Q_p (tsf)</i>	<i>Degree of Plasticity</i>	<i>Plasticity Index</i>
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00-8.00		
Over 51	Very Hard	Over 8.00		

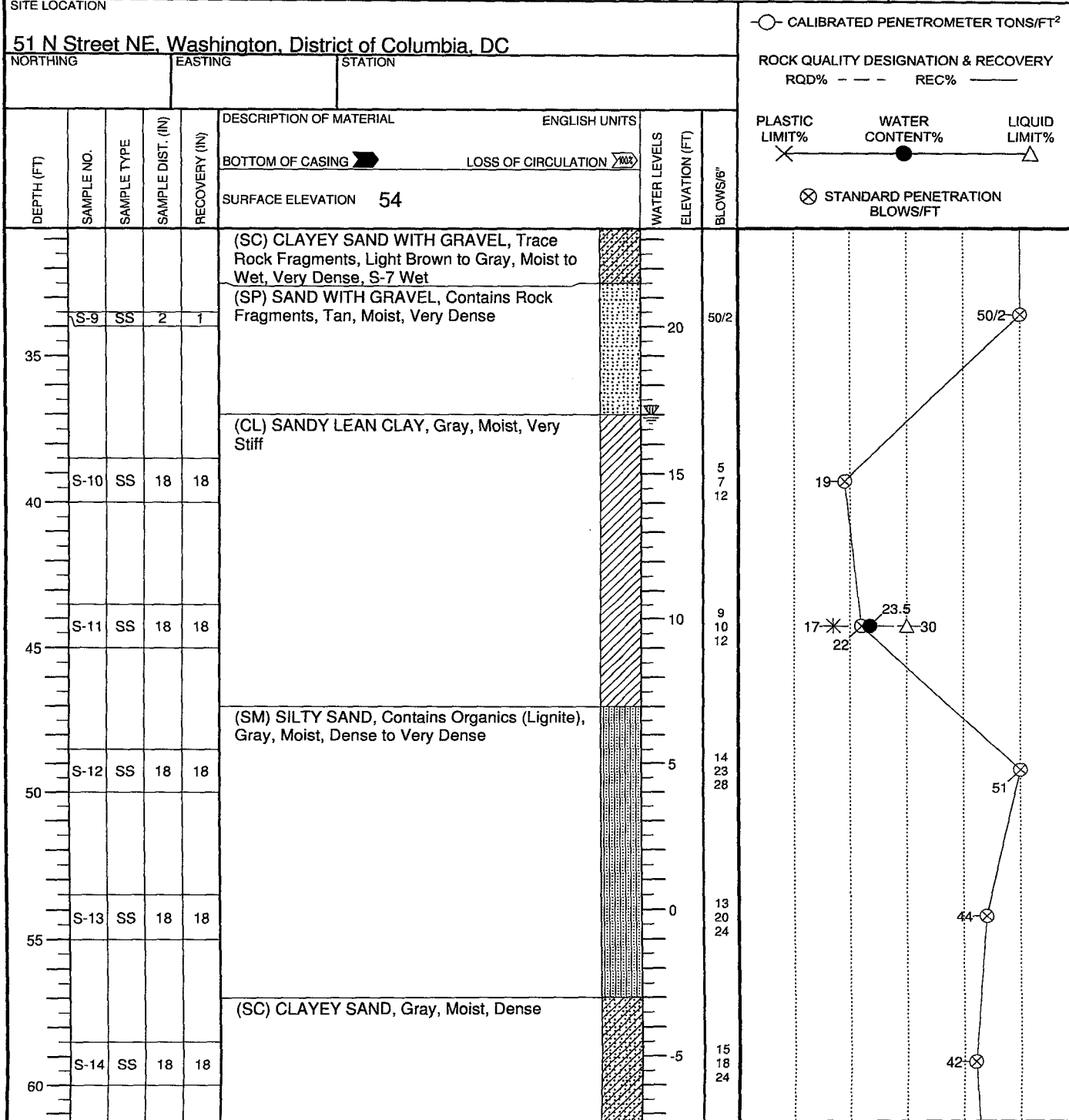
III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	▽	Est. Seasonal High GWT

The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

CLIENT		JOB #	BORING #	SHEET	
The JBG Companies		24758	B-1	1 OF 3	
PROJECT NAME		ARCHITECT-ENGINEER			
N Street NoMa - Geotech		Scott S. Stannard			
SITE LOCATION					
51 N Street NE, Washington, District of Columbia, DC					
NORTHING		EASTING		STATION	
		DESCRIPTION OF MATERIAL		ENGLISH UNITS	
		BOTTOM OF CASING		LOSS OF CIRCULATION	
		SURFACE ELEVATION 54			
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS ELEVATION (FT)
0					
	S-1	SS	18	18	
	S-2	SS	18	18	
5					
	S-3	SS	18	12	
	S-4	SS	18	15	
10					
	S-5	SS	18	14	
15					
	S-6	SS	18	0	
20					
	S-7	SS	10	10	
25					
	S-8	SS	3	2	
30					
Asphalt Depth [4"] (SC FILL) CLAYEY SAND WITH GRAVEL, Trace Brick Fragments, Black, Moist, Very Loose to Loose (CL FILL) SANDY LEAN CLAY, Brown, Moist, Soft (SC FILL) CLAYEY SAND WITH GRAVEL, Trace Brick Fragments, Contains Organics, Brown to Gray, Moist, Very Loose to Loose (SC POSSIBLE FILL) CLAYEY SAND WITH GRAVEL, Brown to Gray, Moist, Very Loose (SC) CLAYEY SAND WITH GRAVEL, Trace Rock Fragments, Light Brown to Gray, Moist to Wet, Very Dense, S-7 Wet					
WATER LEVELS ELEVATION (FT) BLOWS/6"					
○ CALIBRATED PENETROMETER TONS/FT² ROCK QUALITY DESIGNATION & RECOVERY RQD% - - - REC% - - - PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% ⊗ STANDARD PENETRATION BLOWS/FT					
CONTINUED ON NEXT PAGE.					
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 23.5		WS	WD	BORING STARTED 07/07/15	CAVE IN DEPTH
WL(BCR) 37.0		WL(ACR)		BORING COMPLETED 07/07/15	HAMMER TYPE Auto
WL				RIG CME 55 FOREMAN N. Alswellem	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies	JOB # 24758	BORING # B-1	SHEET 2 OF 3	
PROJECT NAME N Street NoMa - Geotech		ARCHITECT-ENGINEER Scott S. Stannard		
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				



CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 23.5	WS ☐	WD ☒	BORING STARTED	07/07/15	CAVE IN DEPTH
WL(BCR) 37.0	WL(ACR)		BORING COMPLETED	07/07/15	HAMMER TYPE Auto
WL			RIG CME 55	FOREMAN N. Alswellem	DRILLING METHOD 3.25 HSA

CLIENT		JOB #	BORING #	SHEET
The JBG Companies		24758	B-1	3 OF 3
PROJECT NAME		ARCHITECT-ENGINEER		
N Street NoMa - Geotech		Scott S. Stannard		
SITE LOCATION				
51 N Street NE, Washington, District of Columbia, DC				
NORTHING		EASTING		STATION
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)
	S-15	SS	18	18
65				
	S-16	SS	18	18
70				
	S-17	SS	18	18
75				
	S-18	SS	18	18
80				
85				
90				
DESCRIPTION OF MATERIAL				
BOTTOM OF CASING				
LOSS OF CIRCULATION				
SURFACE ELEVATION 54				
(SC) CLAYEY SAND, Gray, Moist, Dense				
(CL) SANDY LEAN CLAY, Gray, Moist, Hard to Very Hard				
END OF BORING @ 80'				
ENGLISH UNITS				
WATER LEVELS				
ELEVATION (FT)				
BLOWS/6"				
-○- CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% --- REC% --- PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% X ● ▲ ⊗ STANDARD PENETRATION BLOWS/FT				
15 19 25 20 22 25 14 22 30 15 26 35 -10 -15 -20 -25 -30 -35				
44-⊗ 47-⊗ 52-⊗ 61-⊗				
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.				
WL 23.5		WS	WD	BORING STARTED 07/07/15
WL(BCR) 37.0		WL(ACR)		BORING COMPLETED 07/07/15
WL				RIG CME 55 FOREMAN N. Alswellem
				CAVE IN DEPTH
				HAMMER TYPE Auto
				DRILLING METHOD 3.25 HSA

CLIENT	JOB #	BORING #	SHEET	
The JBG Companies	24758	B-2	1 OF 3	
PROJECT NAME	ARCHITECT-ENGINEER			
N Street NoMa - Geotech		Scott S. Stannard		

SITE LOCATION

51 N Street NE, Washington, District of Columbia, DC

NORTHING

EASTING

STATION

○ CALIBRATED PENETROMETER TONS/FT²

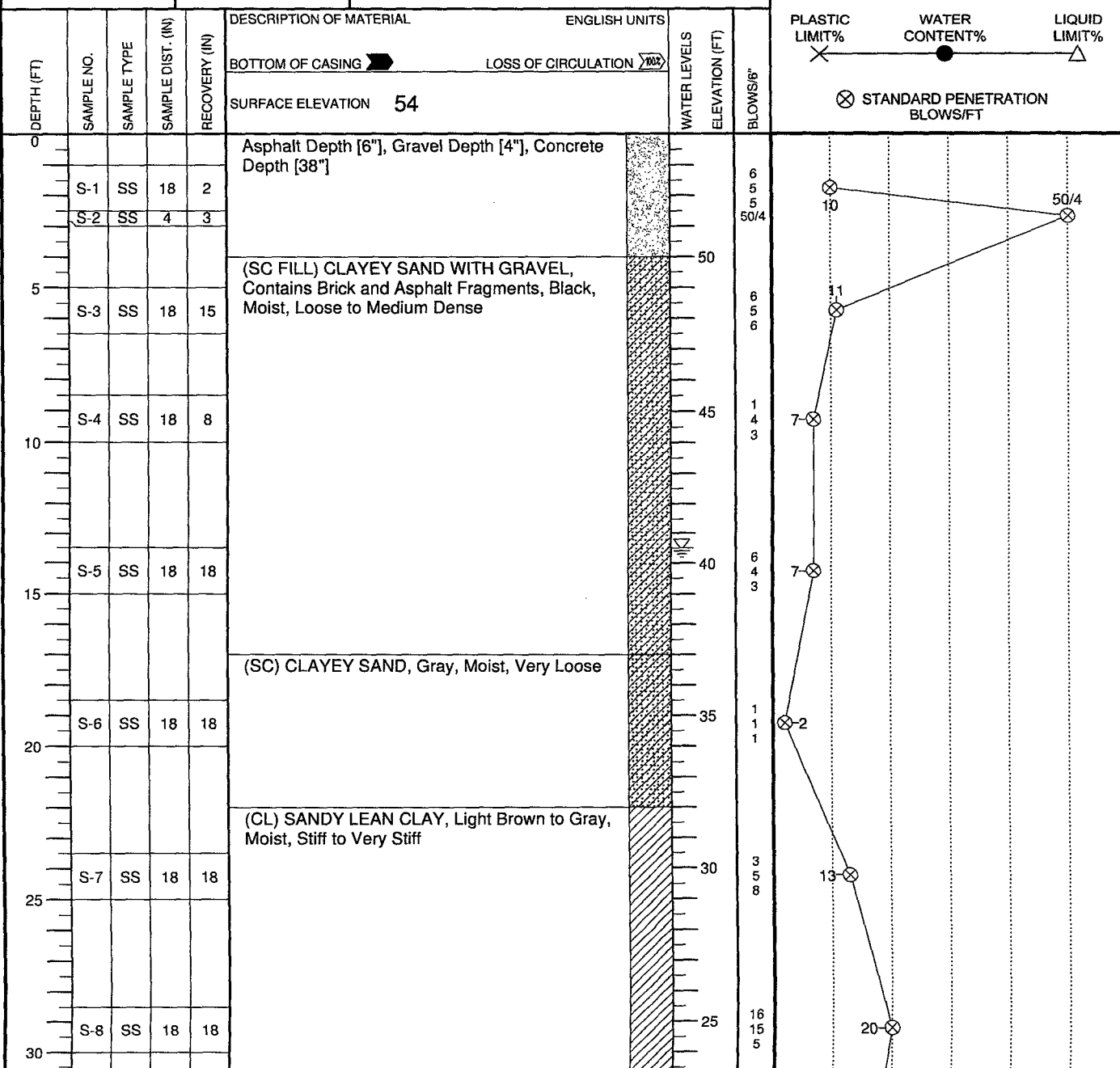
ROCK QUALITY DESIGNATION & RECOVERY
RQD% - - - REC% - - -

PLASTIC
LIMIT%

WATER
CONTENT%

LIQUID
LIMIT%

⊗ STANDARD PENETRATION
BLOWS/FT

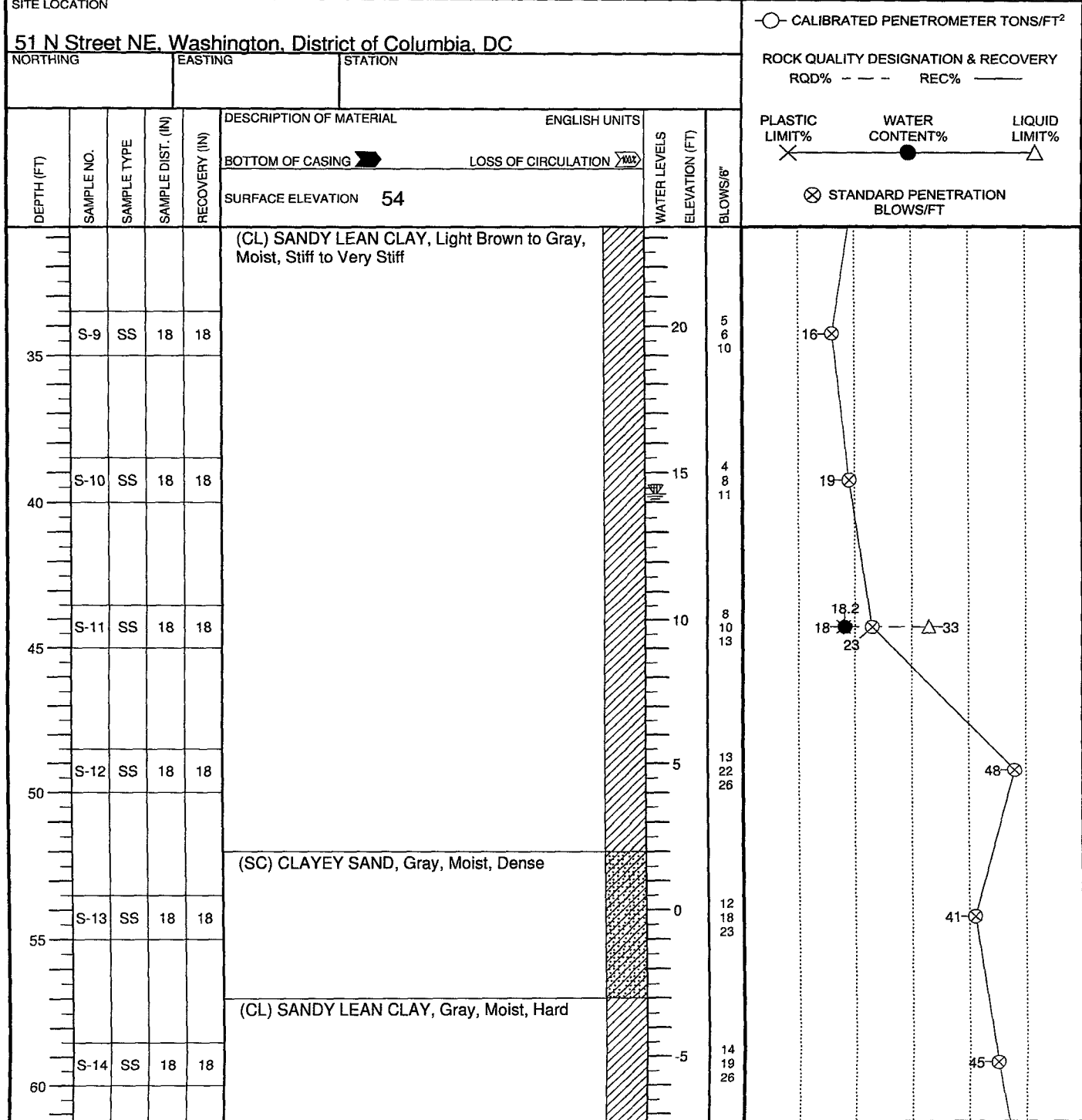


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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 13.5	WS ☐	WD ☒	BORING STARTED	07/07/15	CAVE IN DEPTH
WL(BCR) 39.7	WL(ACR)		BORING COMPLETED	07/07/15	HAMMER TYPE Auto
WL			RIG CME 55	FOREMAN N. Alswellem	DRILLING METHOD 3.25 HSA

CLIENT	JOB #	BORING #	SHEET
The JBG Companies	24758	B-2	2 OF 3
PROJECT NAME		ARCHITECT-ENGINEER	
N Street NoMa - Geotech		Scott S. Stannard	



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 13.5	WS ☐	WD ☒	BORING STARTED 07/07/15	CAVE IN DEPTH
WL(BCR) 39.7	WL(ACR)		BORING COMPLETED 07/07/15	HAMMER TYPE Auto
WL			RIG CME 55 FOREMAN N. Alsweillem	DRILLING METHOD 3.25 HSA

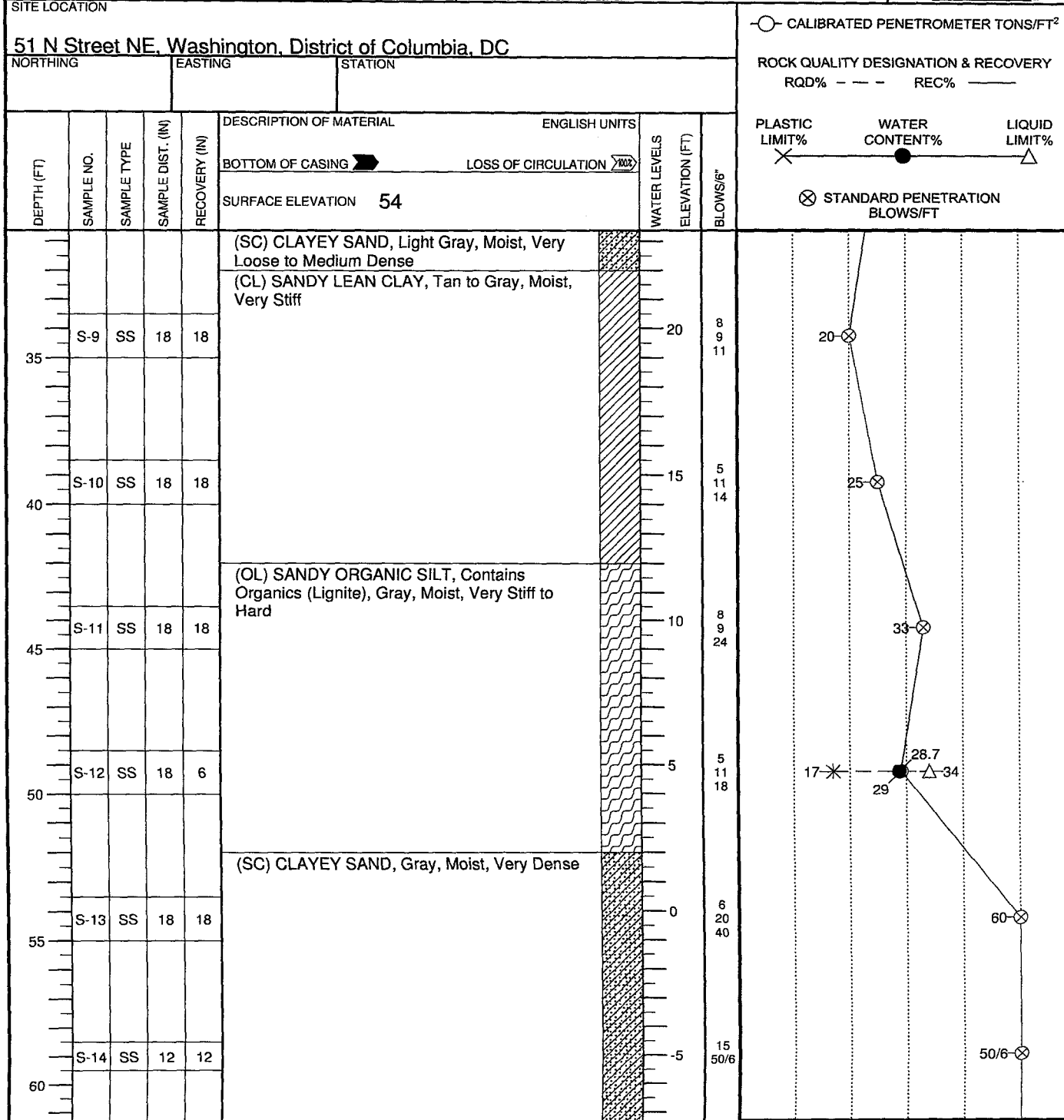
CLIENT The JBG Companies				JOB # 24758		BORING # B-2		SHEET 3 OF 3		
PROJECT NAME N Street NoMa - Geotech				ARCHITECT-ENGINEER Scott S. Stannard						
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC										
NORTHING				EASTING		STATION		-○- CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% - - - REC% - - - PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% ✕ ● △ ⊗ STANDARD PENETRATION BLOWS/FT		
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ENGLISH UNITS	WATER LEVELS ELEVATION (FT)	BLOWS/6"		
					BOTTOM OF CASING LOSS OF CIRCULATION					
					SURFACE ELEVATION 54					
65	S-15	SS	18	18	(CL) SANDY LEAN CLAY, Gray, Moist, Hard		-10	16 21 29	50	
					(OL/OH) ORGANIC SOIL WITH SAND, Black, Moist, Very Hard, Lignite					
70	S-16	SS	18	18	(CL) SANDY LEAN CLAY, Gray, Moist, Hard to Very Hard		-15	17 20 24	44	
75	S-17	SS	18	18			-20	16 20 22	42	
80	S-18	SS	18	18			-25	13 28 34	62	
					END OF BORING @ 80'					
85							-30			
90							-35			
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.										
WL 13.5		WS ☐		WD ☒		BORING STARTED 07/07/15		CAVE IN DEPTH		
WL(BCR) 39.7		WL(ACR)				BORING COMPLETED 07/07/15		HAMMER TYPE Auto		
WL						RIG CME 55 FOREMAN N. Alsweilem		DRILLING METHOD 3.25 HSA		

CLIENT The JBG Companies			JOB # 24758		BORING # ECS-3		SHEET 1 OF 3				
PROJECT NAME N Street NoMa - Geotech			ARCHITECT-ENGINEER Scott S. Stannard								
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC											
NORTHING			EASTING		STATION				○ CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% --- REC% ---		
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL		ENGLISH UNITS		WATER LEVELS ELEVATION (FT)	BLOWS/6"	PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% ✕ ● △ ⊗ STANDARD PENETRATION BLOWS/FT
					BOTTOM OF CASING LOSS OF CIRCULATION						
					SURFACE ELEVATION 54						
0	S-1	SS	18	3	Asphalt Depth [8"] (SP FILL) SAND WITH GRAVEL, Contains Brick Fragments and Organics, Gray and Black, Moist, Loose				3	10	
1									5	8	
2	S-2	SS	18	12	(SC FILL) CLAYEY SAND WITH GRAVEL, Black, Moist, Loose				4	16	
3									5	10	
4					(SP FILL) SAND WITH GRAVEL, Contains Rock Fragments, Tan, Moist, Medium Dense				5	2	
5	S-3	SS	18	12					6	1	
6					(OL/OH FILL) ORGANIC SOIL WITH SAND, Black, Moist, Soft				7	2	
7									8	1	
8	S-4	SS	18	12					9	2	
9									10	1	
10									11	2	
11	S-5	SS	18	12					12	1	
12					(SC) CLAYEY SAND WITH GRAVEL, Gray, Moist, Very Loose				13	2	
13									14	1	
14									15	2	
15	S-6	SS	18	3					16	1	
16					(SC) CLAYEY SAND, Gray, Wet, Very Loose to Very Dense				17	2	
17									18	1	
18									19	2	
19	S-7	SS	18	8					20	1	
20					(SC) CLAYEY SAND, Light Gray, Moist, Very Loose to Medium Dense				21	2	
21									22	1	
22									23	2	
23	S-8	SS	18	5					24	1	
24									25	2	
25									26	1	
26									27	2	
27									28	1	
28									29	2	
29									30	1	
30									31	2	
31									32	1	
32									33	2	
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93									94	1	
94									95	2	
95									96	1	
96									97	2	
97									98	1	
98									99	2	
99									100	1	

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 22.5	WS ☐	WD ☒	BORING STARTED	07/02/15	CAVE IN DEPTH @ 56.3'
WL(BCR) 26.0	WL(ACR) 29.0		BORING COMPLETED	07/02/15	HAMMER TYPE Auto
WL			RIG CME 55	FOREMAN Nadal	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies	JOB # 24758	BORING # ECS-3	SHEET 2 OF 3	
PROJECT NAME N Street NoMa - Geotech	ARCHITECT-ENGINEER Scott S. Stannard			
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				

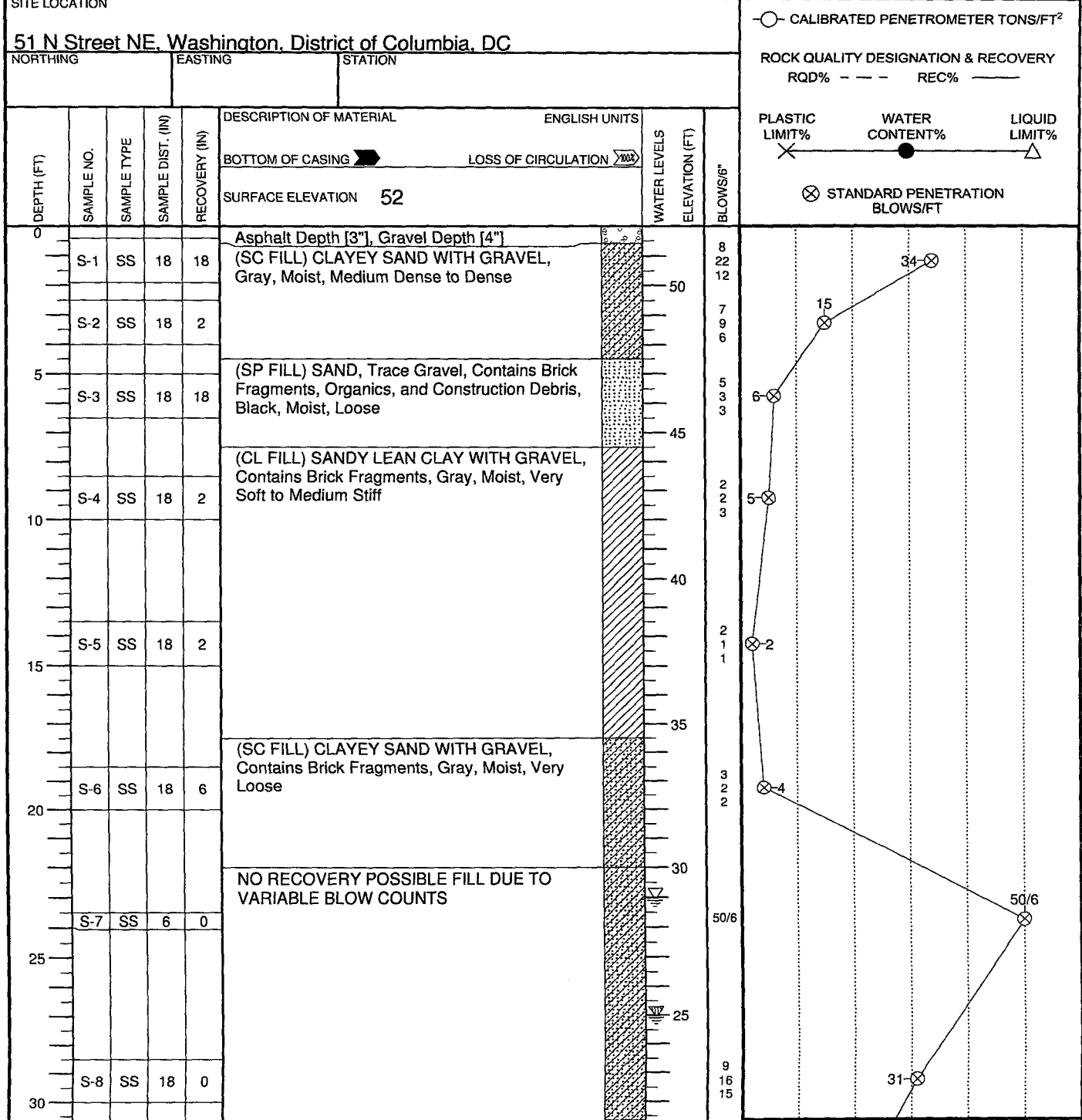


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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 22.5	WS ☐	WD ☒	BORING STARTED	07/02/15	CAVE IN DEPTH @ 56.3'
WL(BCR) 26.0	WL(ACR) 29.0		BORING COMPLETED	07/02/15	HAMMER TYPE Auto
WL			RIG CME 55	FOREMAN Nadal	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies		JOB # 24758	BORING # ECS-3	SHEET 3 OF 3					
PROJECT NAME N Street NoMa - Geotech		ARCHITECT-ENGINEER Scott S. Stannard							
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC									
NORTHING		EASTING		STATION					
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ENGLISH UNITS	WATER LEVELS ELEVATION (FT)	BLOWS/6"	○ CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% --- REC% --- PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% ⊗ STANDARD PENETRATION BLOWS/FT
					BOTTOM OF CASING SURFACE ELEVATION 54 (SC) CLAYEY SAND, Gray, Moist, Very Dense (CL) SANDY LEAN CLAY, Gray, Moist, Very Hard END OF BORING @ 80'	LOSS OF CIRCULATION LOSS OF CIRCULATION			
65	S-15	SS	17	17			-10	8 20 50/5	70/11
70	S-16	SS	17	17			-15	14 21 50/5	71/11
75	S-17	SS	18	18			-20	22 31 25	56
80	S-18	SS	18	18			-25	18 31 44	75
85							-30		
90							-35		
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.									
WL 22.5		WS		WD		BORING STARTED 07/02/15		CAVE IN DEPTH @ 56.3'	
WL(BCR) 26.0		WL(ACR) 29.0				BORING COMPLETED 07/02/15		HAMMER TYPE Auto	
WL						RIG CME 55 FOREMAN Nadal		DRILLING METHOD 3.25 HSA	

CLIENT The JBG Companies	JOB # 24758	BORING # ECS-4	SHEET 1 OF 3	
PROJECT NAME N Street NoMa - Geotech		ARCHITECT-ENGINEER Scott S. Stannard		
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 23	WS ☐	WD ☒	BORING STARTED	07/03/15	CAVE IN DEPTH @ 52'
WL(BCR) 27	WL(ACR) 31		BORING COMPLETED	07/03/15	HAMMER TYPE Auto
WL			RIG CME 55	FOREMAN Nadal	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies			JOB # 24758		BORING # ECS-4		SHEET 2 OF 3		
PROJECT NAME N Street NoMa - Geotech			ARCHITECT-ENGINEER Scott S. Stannard						
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC									
NORTHING			EASTING			STATION			-○- CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% - - - REC% - - - PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% X ● ▲ ⊗ STANDARD PENETRATION BLOWS/FT
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ENGLISH UNITS	WATER LEVELS ELEVATION (FT)	BLOWS/6"	
					BOTTOM OF CASING	LOSS OF CIRCULATION			
					SURFACE ELEVATION 52				
35	S-9	SS	18	18	NO RECOVERY POSSIBLE FILL DUE TO VARIABLE BLOW COUNTS (CL) SANDY LEAN CLAY, Gray, Moist, Very Stiff to Very Hard		20	3 7 10	
40	S-10	SS	18	18			15	5 9 14	
45	S-11	SS	18	18			10	6 10 10	
50	S-12	SS	3	3			5	50/3	
55	S-13	SS	6	0			0	50/6	
60	S-14	SS	11	11			-5	40 50/5	
CONTINUED ON NEXT PAGE.									
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.									
WL 23 WS ☐ WD ☒			BORING STARTED 07/03/15			CAVE IN DEPTH @ 52'			
WL(BCR) 27 WL(ACR) 31			BORING COMPLETED 07/03/15			HAMMER TYPE Auto			
WL			RIG CME 55 FOREMAN Nadal			DRILLING METHOD 3.25 HSA			

CLIENT		JOB #	BORING #	SHEET				
The JBG Companies		24758	ECS-4	3 OF 3				
PROJECT NAME		ARCHITECT-ENGINEER						
N Street NoMa - Geotech		Scott S. Stannard						
SITE LOCATION								
51 N Street NE, Washington, District of Columbia, DC								
NORTHING	EASTING	STATION						
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ENGLISH UNITS	WATER LEVELS ELEVATION (FT)	BLOWS/6"
					BOTTOM OF CASING	LOSS OF CIRCULATION		
					SURFACE ELEVATION	52		
65	S-15	SS	18	18	(CL) SANDY LEAN CLAY, Gray, Moist, Very Stiff to Very Hard		-10	14 26 27
70	S-16	SS	18	18			-15	18 25 30
75	S-17	SS	18	18			-20	12 21 32
80	S-18	SS	18	18			-25	12 24 33
85					END OF BORING @ 80'		-30	
90							-35	

○ CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY

RQD% --- REC% ---

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%

X ● △

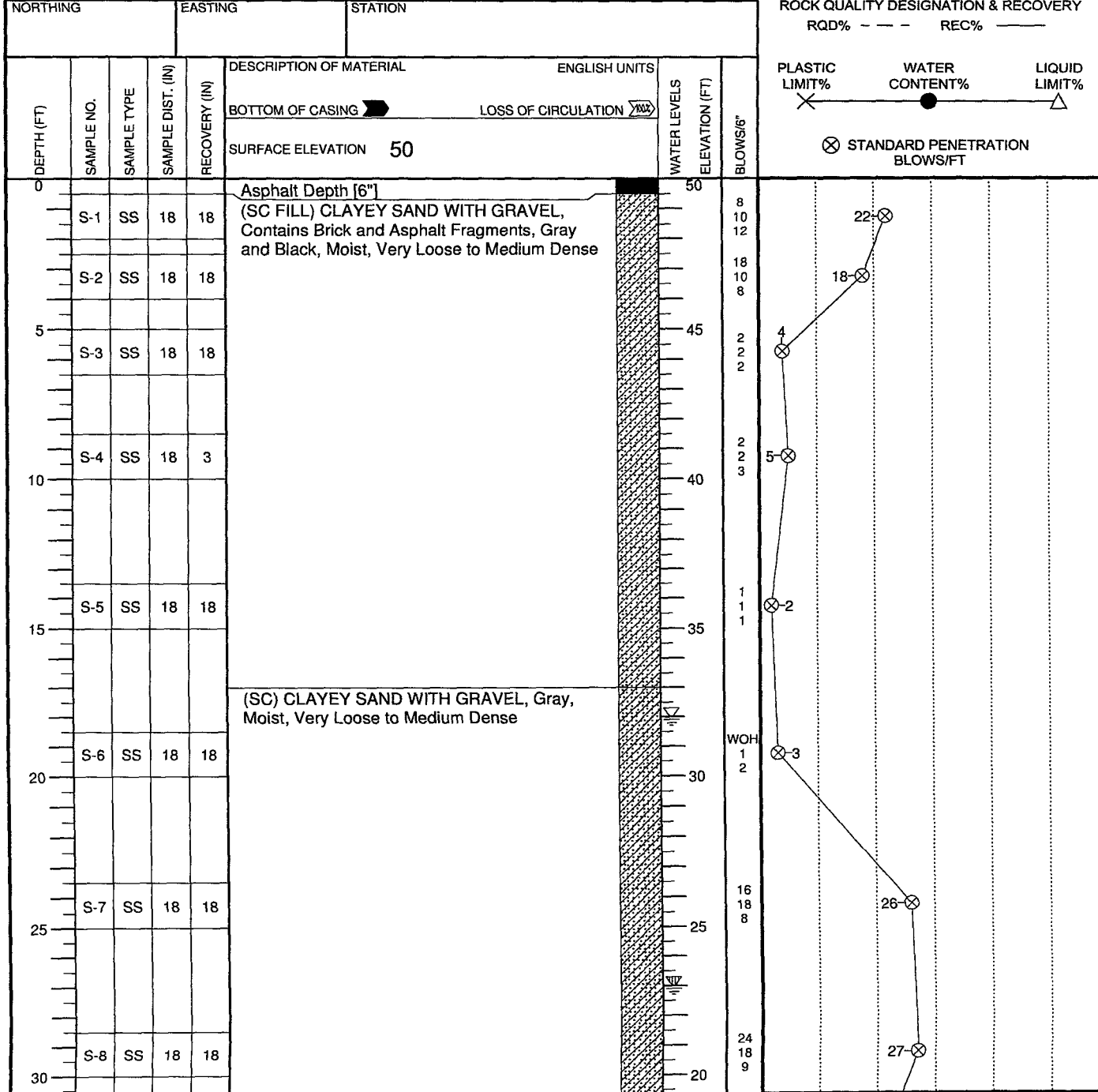
⊗ STANDARD PENETRATION BLOWS/FT

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 23 WS □ WD ⊠	BORING STARTED 07/03/15	CAVE IN DEPTH @ 52'
WL(BCR) 27 WL(ACR) 31	BORING COMPLETED 07/03/15	HAMMER TYPE Auto
WL	RIG CME 55 FOREMAN Nadal	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies	JOB # 24758	BORING # ECS-5	SHEET 1 OF 3	
PROJECT NAME N Street NoMa - Geotech	ARCHITECT-ENGINEER Scott S. Stannard			

SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC		
NORTHING	EASTING	STATION



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 18	WS ☐	WD ☒	BORING STARTED	07/07/15	CAVE IN DEPTH
WL(BCR) 27	WL(ACR)		BORING COMPLETED	07/07/15	HAMMER TYPE Auto
WL			RIG 550 ATV	FOREMAN Kevin K.	DRILLING METHOD 3.25 HSA

CLIENT	JOB #	BORING #	SHEET
The JBG Companies	24758	ECS-5	2 OF 3
PROJECT NAME		ARCHITECT-ENGINEER	
N Street NoMa - Geotech		Scott S. Stannard	



51 N Street NE, Washington, District of Columbia, DC

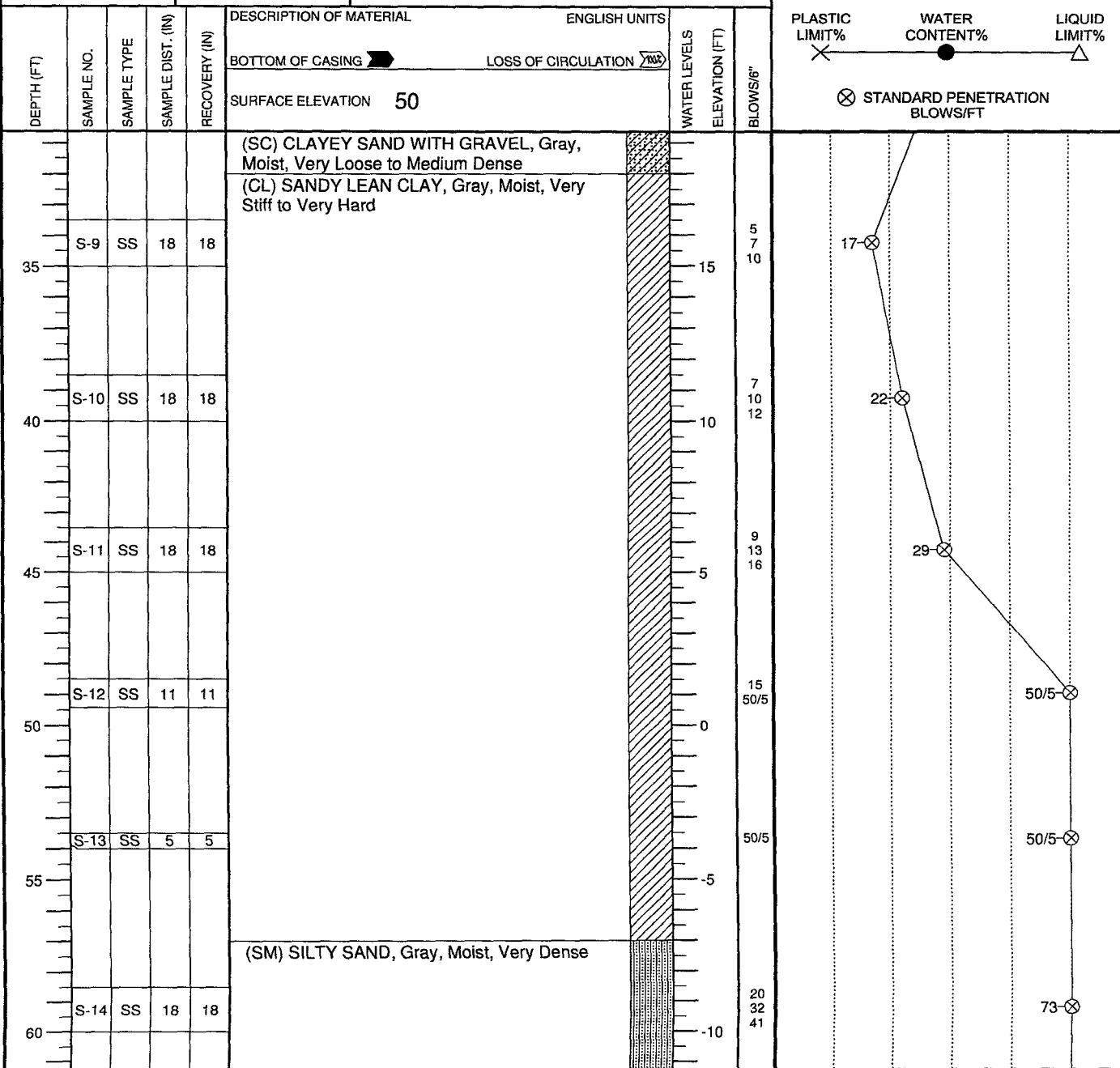
NORTHING EASTING STATION

—○— CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY
RQD% — — — REC% — — —

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
X ● △

⊗ STANDARD PENETRATION BLOWS/FT

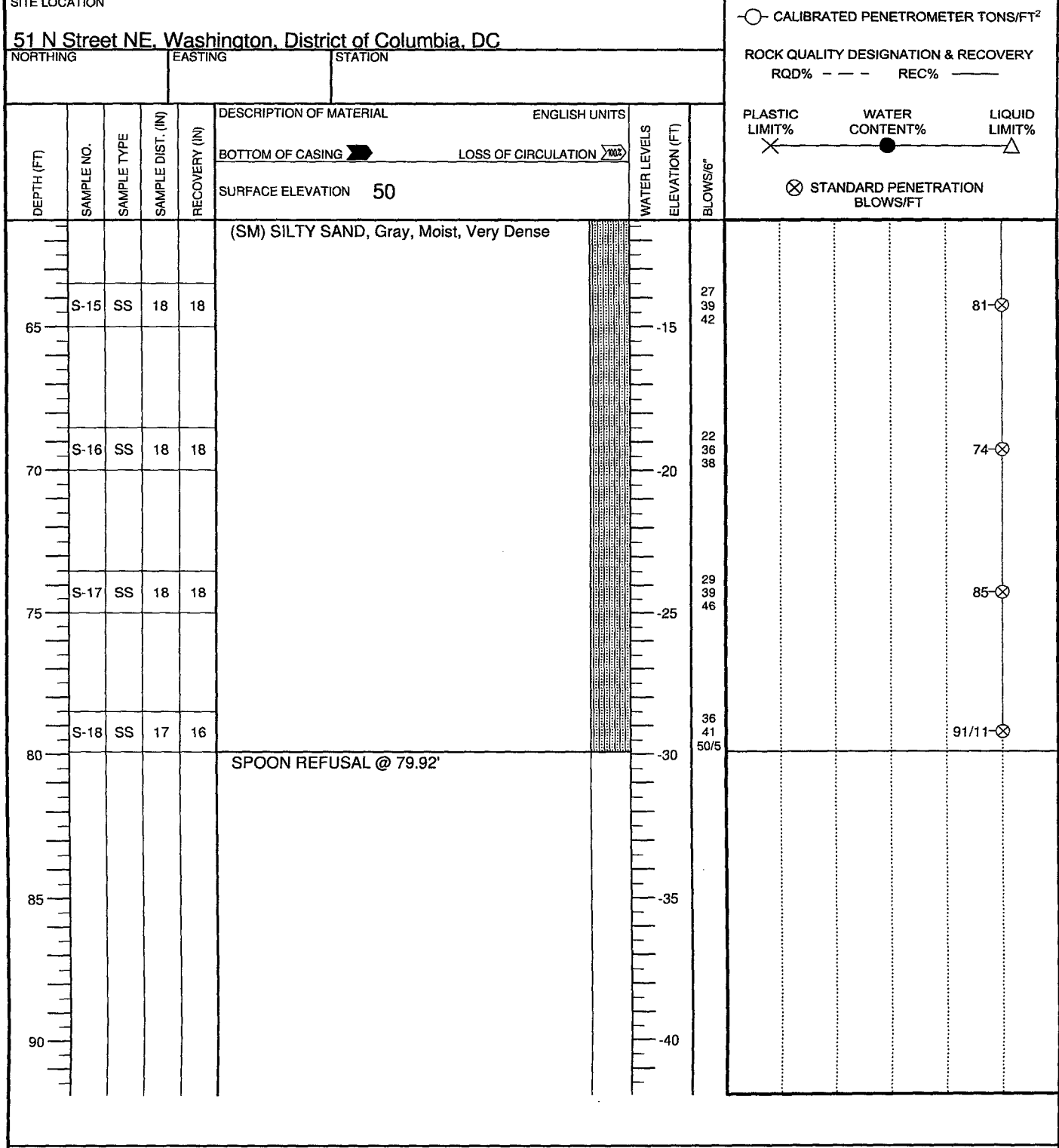


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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 18	WS ☐ WD ☒	BORING STARTED	07/07/15	CAVE IN DEPTH
WL(BCR) 27	WL(ACR)	BORING COMPLETED	07/07/15	HAMMER TYPE Auto
WL		RIG 550 ATV	FOREMAN Kevin K.	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies	JOB # 24758	BORING # ECS-5	SHEET 3 OF 3	
PROJECT NAME N Street NoMa - Geotech		ARCHITECT-ENGINEER Scott S. Stannard		
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				



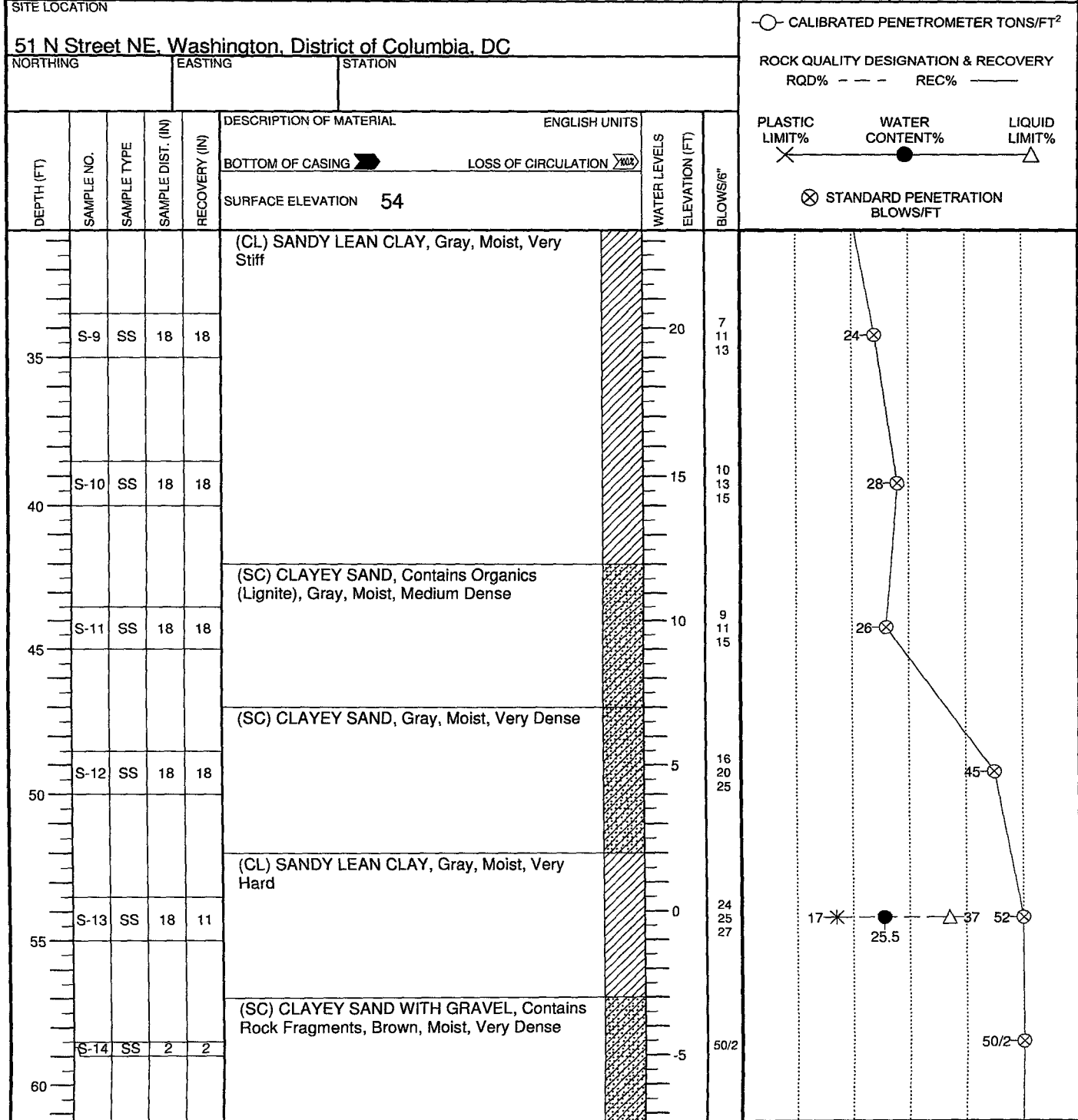
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 18	WS ☐	WD ☒	BORING STARTED	07/07/15	CAVE IN DEPTH
WL(BCR) 27	WL(ACR)		BORING COMPLETED	07/07/15	HAMMER TYPE Auto
WL			RIG 550 ATV	FOREMAN Kevin K.	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies			JOB # 24758		BORING # ECS-6		SHEET 1 OF 3		
PROJECT NAME N Street NoMa - Geotech			ARCHITECT-ENGINEER Scott S. Stannard						
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC									
NORTHING			EASTING			STATION			-○- CALIBRATED PENETROMETER TONS/FT ² ROCK QUALITY DESIGNATION & RECOVERY RQD% - - - REC% - - - PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT% ✕ ● △ ⊗ STANDARD PENETRATION BLOWS/FT
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ENGLISH UNITS	WATER LEVELS ELEVATION (FT)	BLOWS/6"	
					BOTTOM OF CASING ➡	LOSS OF CIRCULATION ➡			
					SURFACE ELEVATION 54				
0	S-1	SS	18	13	Asphalt Depth [4"] (SM FILL) SILTY SAND, Light Brown, Moist, Very Loose		50	4	
	S-2	SS	18	14				2	
5	S-3	SS	18	12	(SC FILL) CLAYEY SAND WITH GRAVEL, Trace Brick Fragments, Black, Moist, Very Loose			3	
								2	
10	S-4	SS	18	17			45	3	
								2	
15	S-5	SS	18	6			40	2	
								1	
20	S-6	SS	18	10	(CL POSSIBLE FILL) SANDY LEAN CLAY WITH GRAVEL, Trace Rock Fragments, Gray, Moist, Medium Stiff to Very Hard		35	7	
								3	
25	S-7	SS	5	5			30	50/5	
								5	
30	S-8	SS	18	16	(CL) SANDY LEAN CLAY, Gray, Moist, Very Stiff		25	19	
								10	
								9	
								10	

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 13.0 WS ☐ WD ☒		BORING STARTED 07/02/15		CAVE IN DEPTH	
WL(BCR) 22.0 WL(ACR)		BORING COMPLETED 07/02/15		HAMMER TYPE Auto	
WL		RIG 550 ATV FOREMAN Kevin K.		DRILLING METHOD 3.25 HSA	

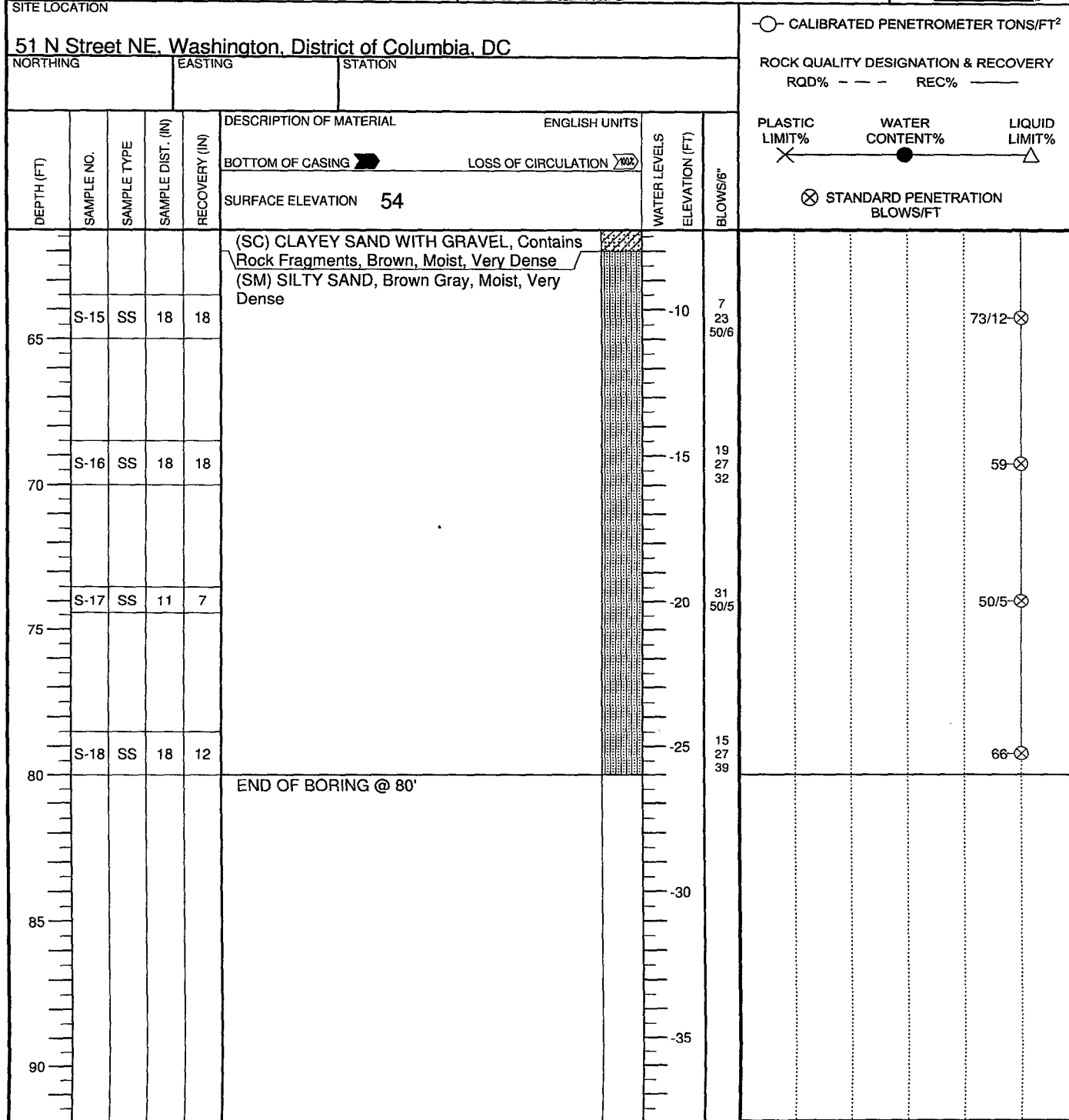
CLIENT The JBG Companies	JOB # 24758	BORING # ECS-6	SHEET 2 OF 3	
PROJECT NAME N Street NoMa - Geotech		ARCHITECT-ENGINEER Scott S. Stannard		
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 13.0	WS ☐	WD ☒	BORING STARTED	07/02/15	CAVE IN DEPTH
WL(BCR) 22.0	WL(ACR)		BORING COMPLETED	07/02/15	HAMMER TYPE Auto
WL			RIG 550 ATV	FOREMAN Kevin K.	DRILLING METHOD 3.25 HSA

CLIENT The JBG Companies	JOB # 24758	BORING # ECS-6	SHEET 3 OF 3	
PROJECT NAME N Street NoMa - Geotech	ARCHITECT-ENGINEER Scott S. Stannard			
SITE LOCATION 51 N Street NE, Washington, District of Columbia, DC				



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.					
WL 13.0	WS ☐	WD ☒	BORING STARTED	07/02/15	CAVE IN DEPTH
WL(BCR) 22.0	WL(ACR)		BORING COMPLETED	07/02/15	HAMMER TYPE Auto
WL			RIG 550 ATV	FOREMAN Kevin K.	DRILLING METHOD 3.25 HSA

Laboratory Testing Summary

Page 1 of 1

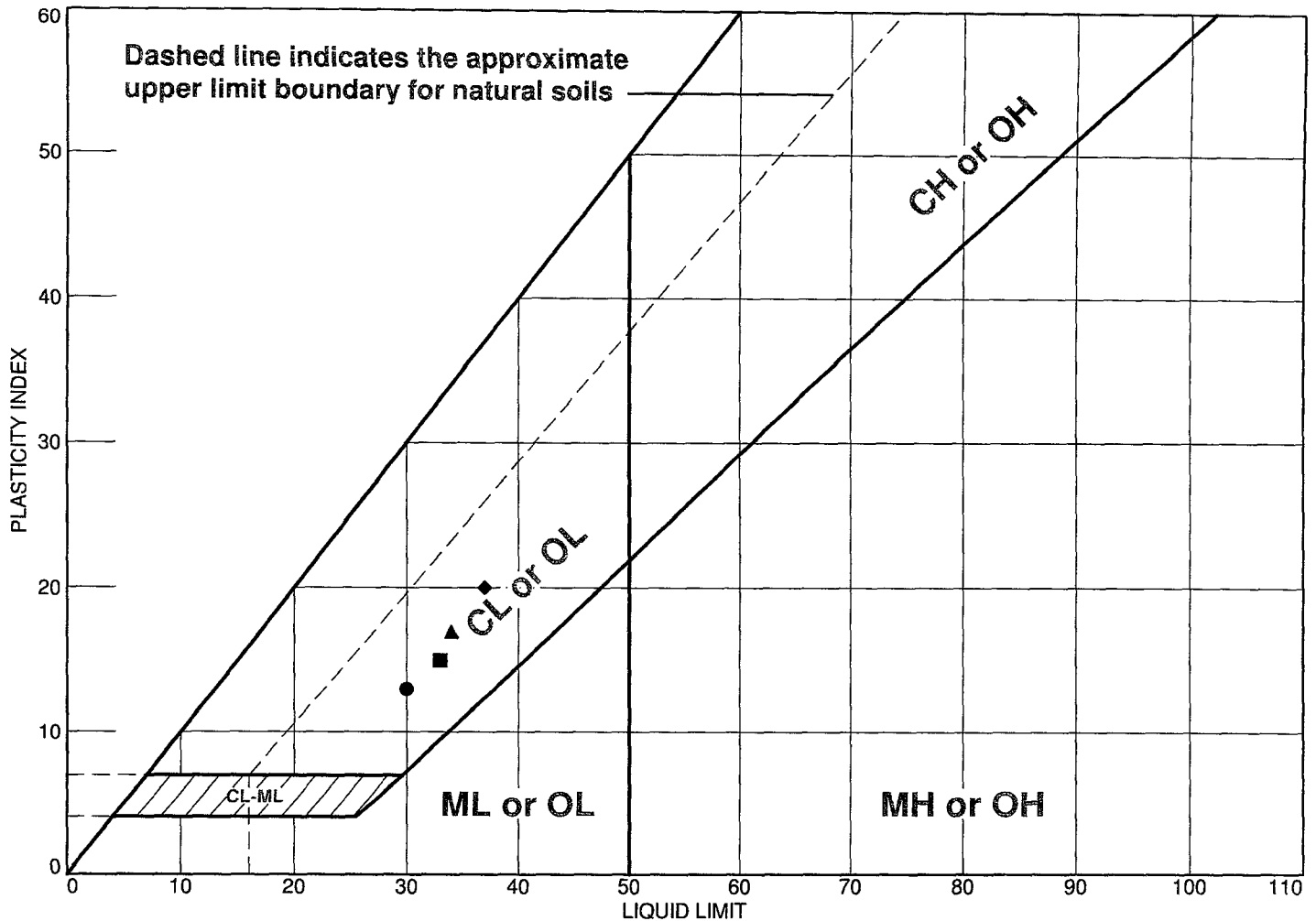
Sample Source	Sample Number	Depth (feet)	MC1 (%)	Soil Type ²	Atterberg Limits ³			Percent Passing No. 200 Sieve ⁴	Moisture - Density (Corr.) ⁵		CBR Value ⁶	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1	S-11	43.50 - 45.00	23.5	CL	30	17	13	81.6				
	S-12	48.50 - 50.00									OC=4.93	
	S-13	53.50 - 55.00									OC=5.80	
B-2	S-11	43.50 - 45.00	18.2	CL	33	18	15	87.1				
ECS-3	S-11	43.50 - 45.00									OC=9.88	
	S-12	48.50 - 50.00	28.7	OL	34	17	17	95.2				
ECS-4												
ECS-5												
ECS-6	S-11	43.50 - 45.00									OC=13.35	
	S-13	53.50 - 55.00	25.5	CL	37	17	20	86.4				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No.	24758	 ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, VA 20151-3232 Phone: (703) 471-8400 Fax: (703) 834-5527
Project Name:	N Street NoMa - Geotech	
PM:	Nicolas H. Vaughn	
PE:	Scott S. Stannard	
Printed On:	Monday, August 10, 2015	

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay with Sand Grayish Brown (CL)	30	17	13	98.5	81.6	CL
■	Lean Clay Grayish Brown (CL)	33	18	15	99.7	87.1	CL
▲	Organic Silt Grayish Brown (OL)	34	17	17	98.2	95.2	OL
◆	Lean Clay Grayish Brown (CL)	37	17	20	94.0	86.4	CL

Project No. 24758 **Client:** The JBG Companies

Project: N Street NoMa - Geotech

● Source of Sample: B-1 **Depth:** 43.50-45.00 **Sample Number:** S-11
■ Source of Sample: B-2 **Depth:** 43.50-45.00 **Sample Number:** S-11
▲ Source of Sample: ECS-3 **Depth:** 48.50-50.00 **Sample Number:** S-12
◆ Source of Sample: ECS-6 **Depth:** 53.50-55.00 **Sample Number:** S-13

Remarks:

● Data Entered: 7/16/15
 ■ Data Entered: 7/16/15
 ▲ Data Entered: 7/16/15
 ◆ Data Entered: 7/16/15



ECS MID-ATLANTIC, LLC

14026 Thunderbolt Place, Suite 100
Chantilly, VA 20151-3232

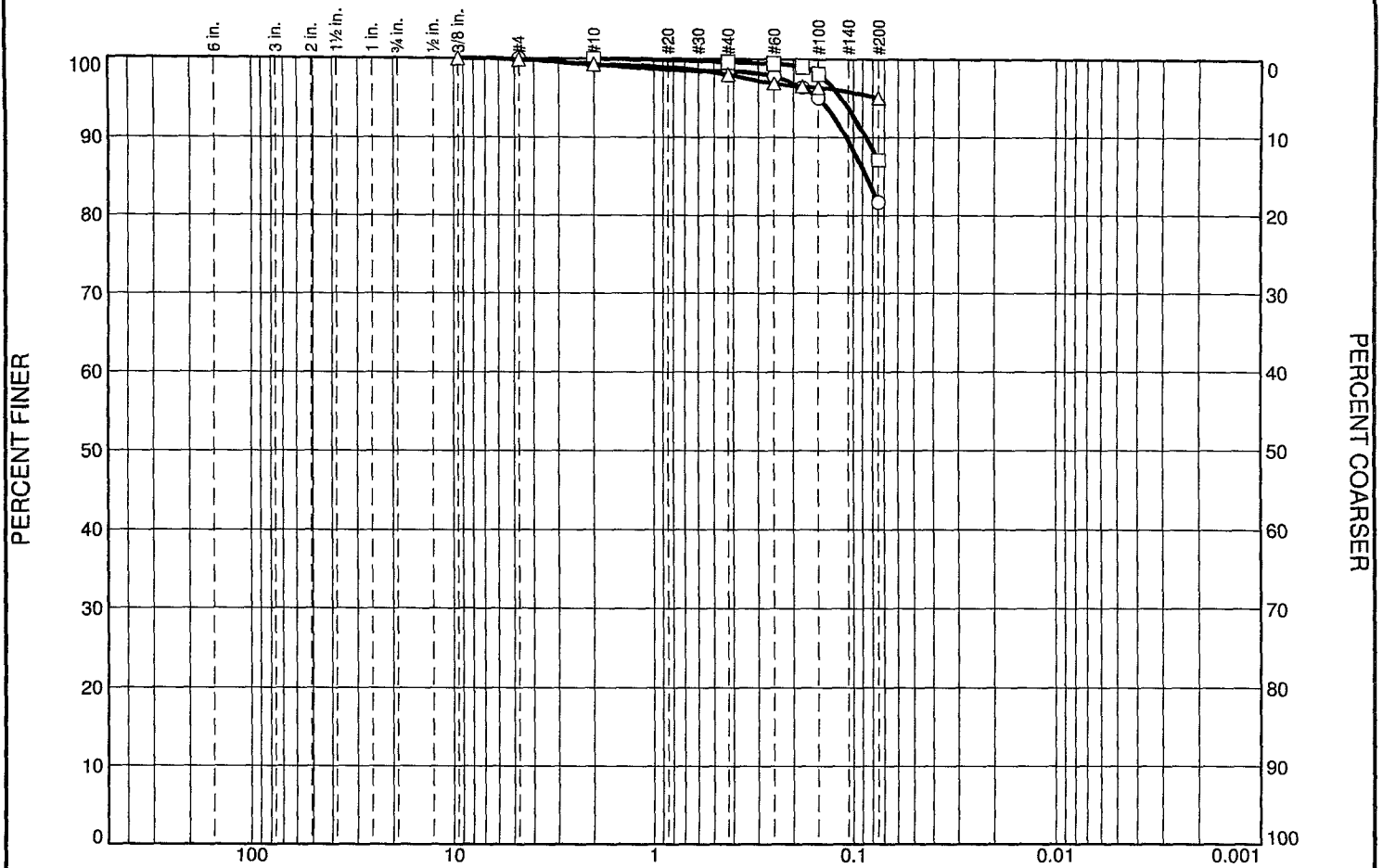
Phone: (703) 471-8400
Fax: (703) 834-5527

Figure

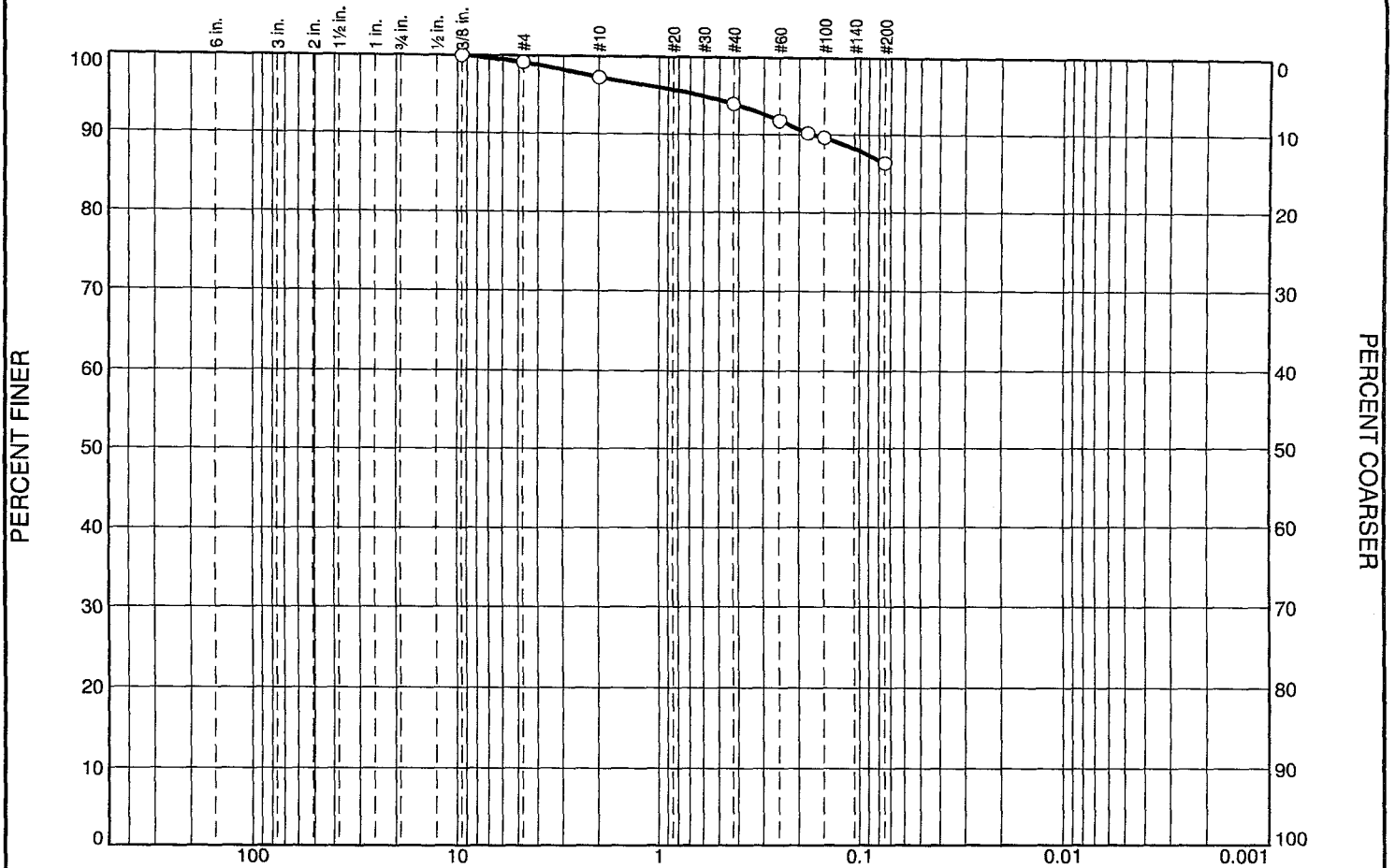
Tested By: HNT1

Checked By: DVT

Particle Size Distribution Report



Particle Size Distribution Report



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
☐	0.0	0.0	0.8	1.8	3.4	7.6	86.4	
☒	LL	PL	D85	D60	D50	D30	D15	D10
☐	37	17						

MATERIAL DESCRIPTION							TEST DATE	USCS	NM
☐ Lean Clay Grayish Brown (CL)								CL	25.5

Project No. 24758 Client: The JBG Companies Project: N Street NoMa - Geotech ☐ Source of Sample: ECS-6 Depth: 53.50-55.00 Sample Number: S-13	Remarks: ☐ Data Entered: 7/16/15
 ECS MID-ATLANTIC, LLC 14026 Thunderbolt Place, Suite 100 Chantilly, VA 20151-3232 Phone: (703) 471-8400 Fax: (703) 834-5527	

Figure

Tested By: KV

Checked By: DVT

REFERENCE NOTES FOR REFRACTION MICROTREMOR (ReMi) TESTING

Data Acquisition

The data gathering process uses standard refraction seismic equipment to measure subsurface soil and/or rock characteristics using ambient vibrations (microtremors) as a seismic source. The equipment used for the survey is a SeisDAQ ReMi recording unit capable of storing record lengths up to about 100 seconds using 12 channels with 10-Hz, and 4.5 Hz geophones set along a relatively straight-line at evenly spaced intervals. A minimum of 20, unfiltered 30-second records are recorded along each line.

Data Processing

The data are processed using SeisOpt® ReMi™ software to reveal a one-dimensional average shear-wave (S-wave) velocity image for each line. The method provides an effective and efficient way to generate information on large volumes of the subsurface profile in one dimension along each line. In addition, the survey also provides the average shear wave velocity to a depth of 100 feet that is used to evaluate the seismic Site Class per the IBC 2012 and ASCE 7 requirements.

ReMi processing requires three steps: 1) velocity spectral analysis, 2) Rayleigh phase velocity dispersion picking and 3) shear wave velocity modeling. The seismic data records collected are processed using proprietary software and the refraction microtremor method described by Louie (2001) and Pullammanappallil et. al.(2003). A brief discussion of each of the three steps is presented below:

Step 1: The velocity spectral analysis is the p-tau transformation which consists of multiple seismogram amplitudes relative to distance and time. The seismogram amplitudes are converted to the ray parameter (p) which is the inverse of apparent velocity and an intercept time (τ). The transform is a simple line integral across a seismic record in distance (x) and time (t) where the inverse in the apparent velocity in the x -direction is the slope of the line ($p = dx/dt$). The distances used in the refraction microtremor are distances of geophones from one end of the array. A complex Fourier transform is computed from the p -tau traces where the power spectrum is the magnitude squared of the complex Fourier transform. The slope of dispersive waves is an integral part of the p - f analysis. By recording many channels and using the p - f method the program successfully analyzes Rayleigh wave dispersion.

Step 2: Rayleigh-Wave Dispersion Picking: A spectral power ratio calculation is added to the p - f technique for spectral normalization of the record. Picks are made at frequencies where there is a definite peak in spectral ratio often below 4 Hz and above 14 Hz where an identifiable dispersive surface wave does not appear. The p - f image frequently shows the average velocity to 100 feet of depth from the phase velocity of a strong peak ratio appearing between 4 Hz and 8 Hz depending on the relative stiffness of the site subsurface. An attempt is made to pick the lower edge of the lowest velocity but at a reasonable peak ratio.

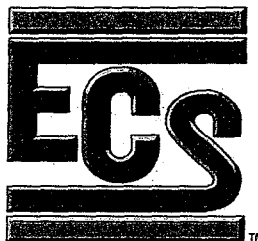
Step 3: Shear Wave Velocity Modeling: This step consists of interactive forward-modeling of dispersion curves by the practitioner which yields information on velocity constraints. The modeling iterates on phase velocity at each period and reports when a solution has not been found within the given parameters. The program uses a graphical modeling adjustment that allows rapid fitting of the dispersion curves.



ReMi Survey Location Diagram

N Street NoMa

51 N Street NE
Washington, DC



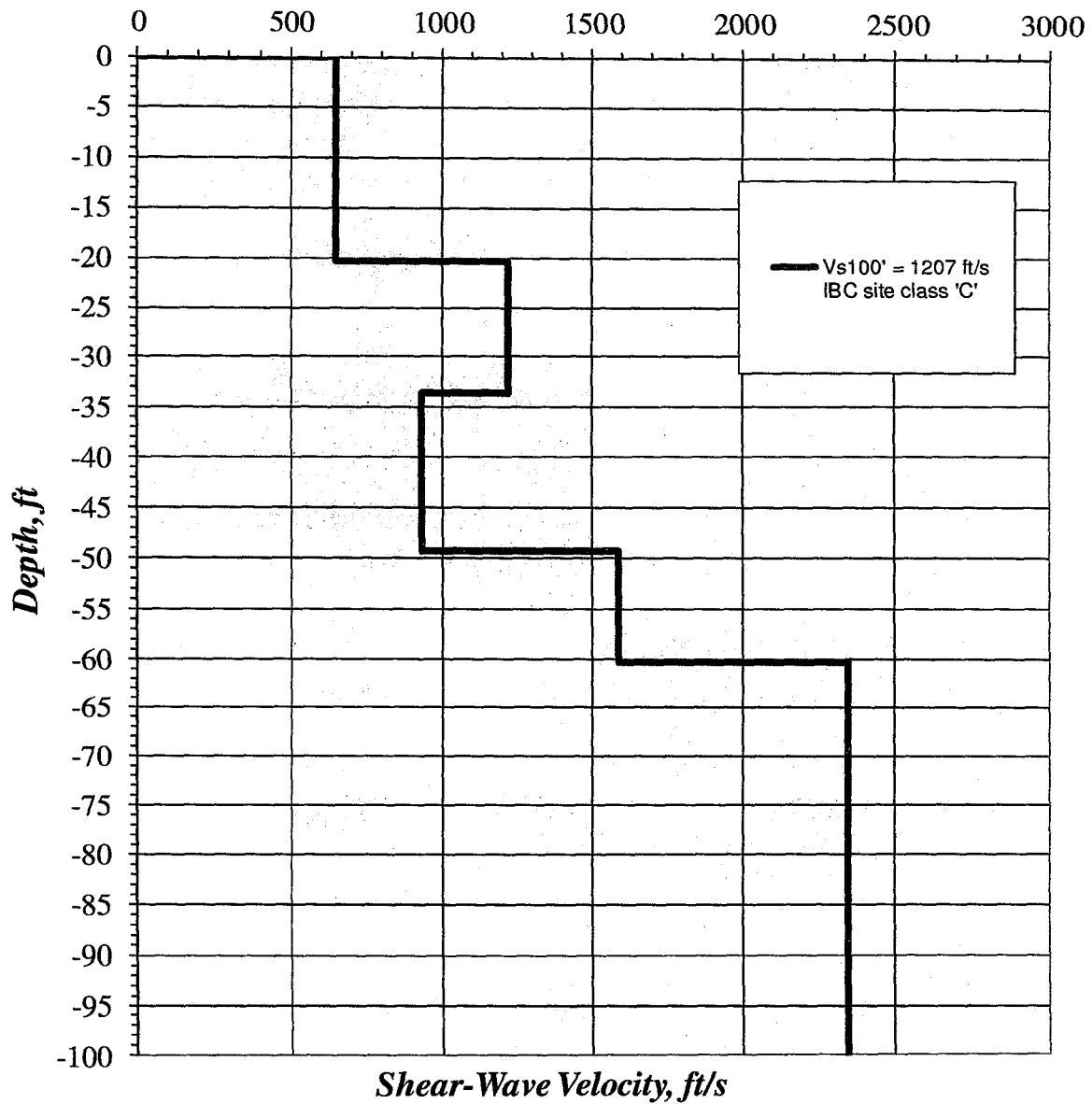
ECS Project No: 01:24758

Date: July 20, 2015

Figure Number: 1

Scale: NTS

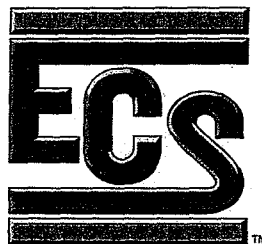
Vs Model



Line 1 – Shear Wave Velocity Model

N Street NoMa

51 N Street NE
Washington, DC



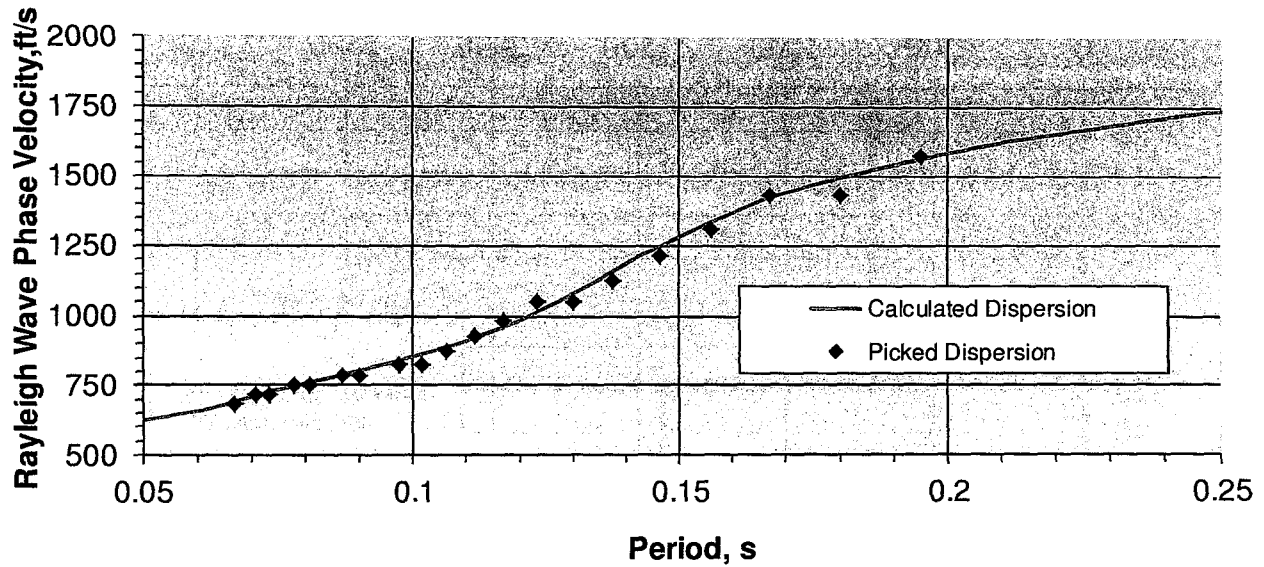
ECS Project No: 01:24758

Date: July 20, 2015

Figure Number: 2

Scale: NTS

Dispersion Curve Showing Picks and Fit



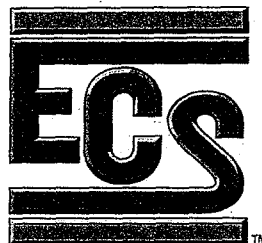
p-f Image with Dispersion Modeling Picks



Line 1 – Dispersion Curve

N Street NoMa

**51 N Street NE
Washington, DC**

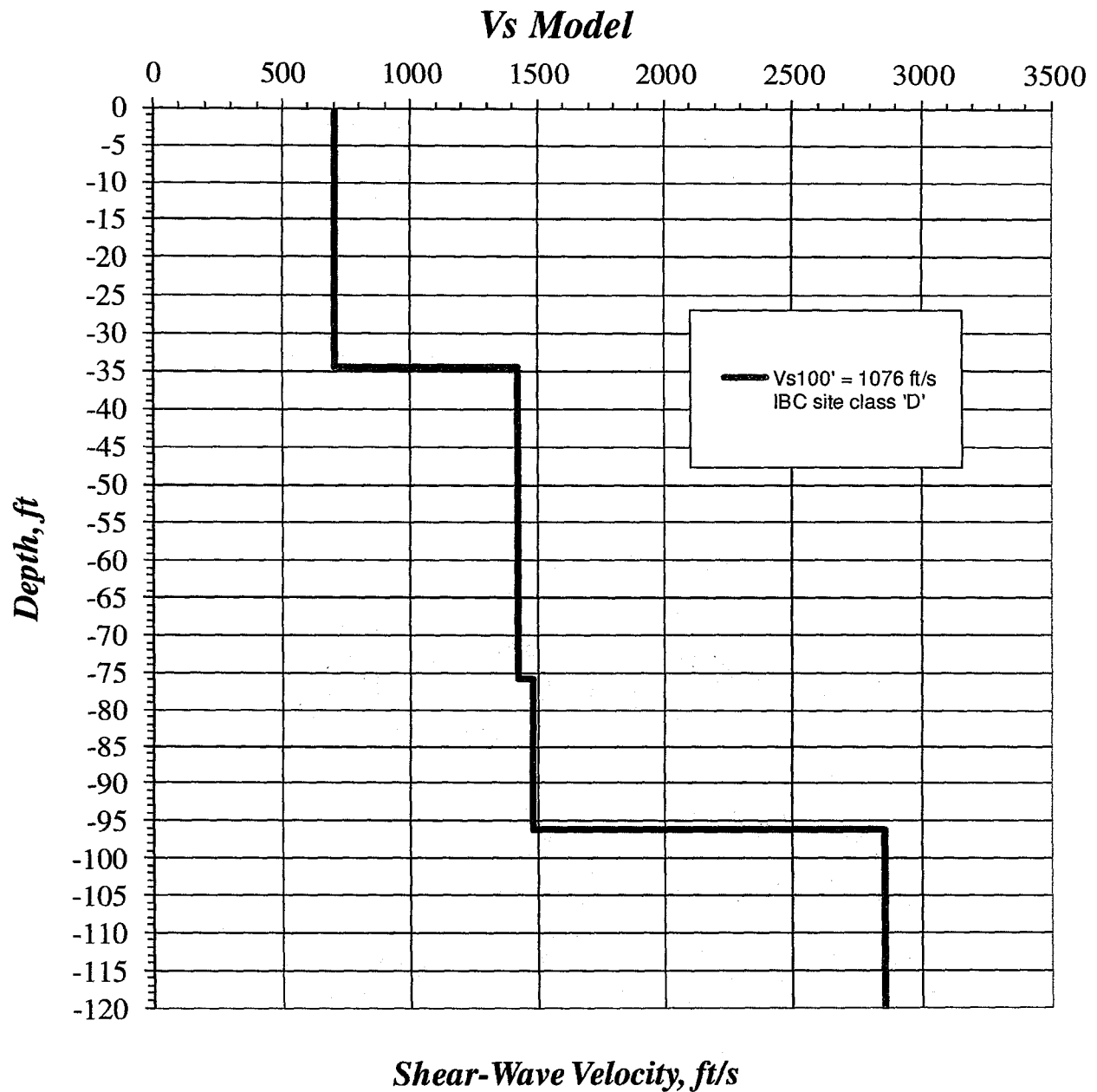


ECS Project No: 01:24758

Date: July 20, 2015

Figure Number: 3

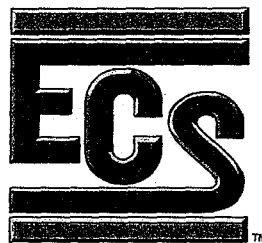
Scale: NTS



Line 2 – Shear Wave Velocity Model

N Street NoMa

51 N Street NE
Washington, DC



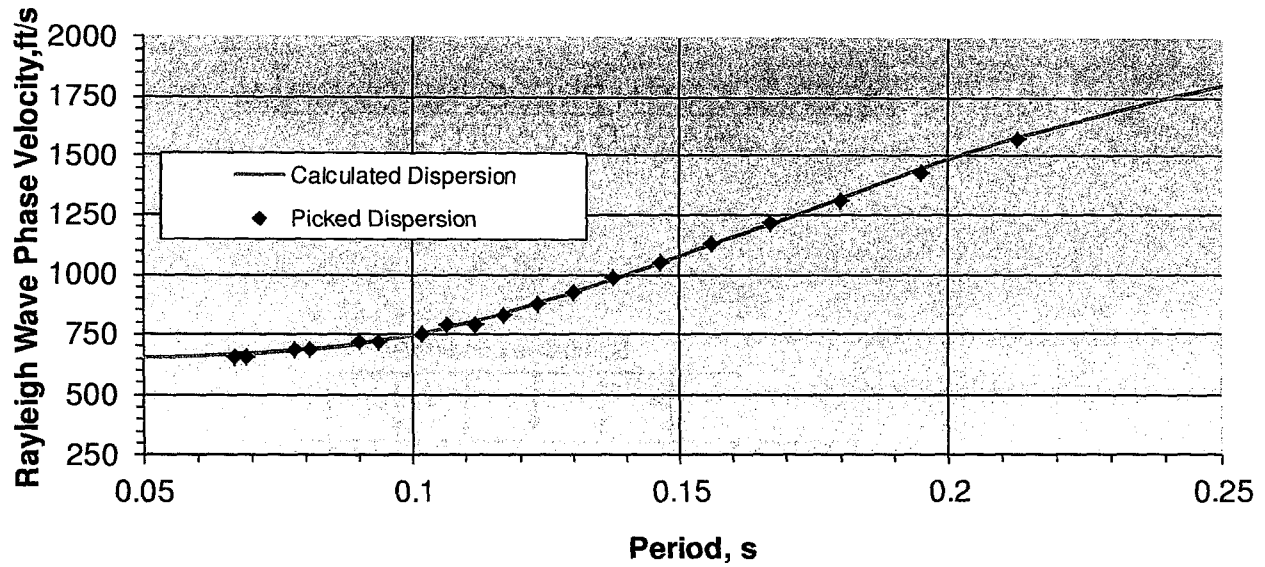
ECS Project No: 01:24758

Date: July 20, 2015

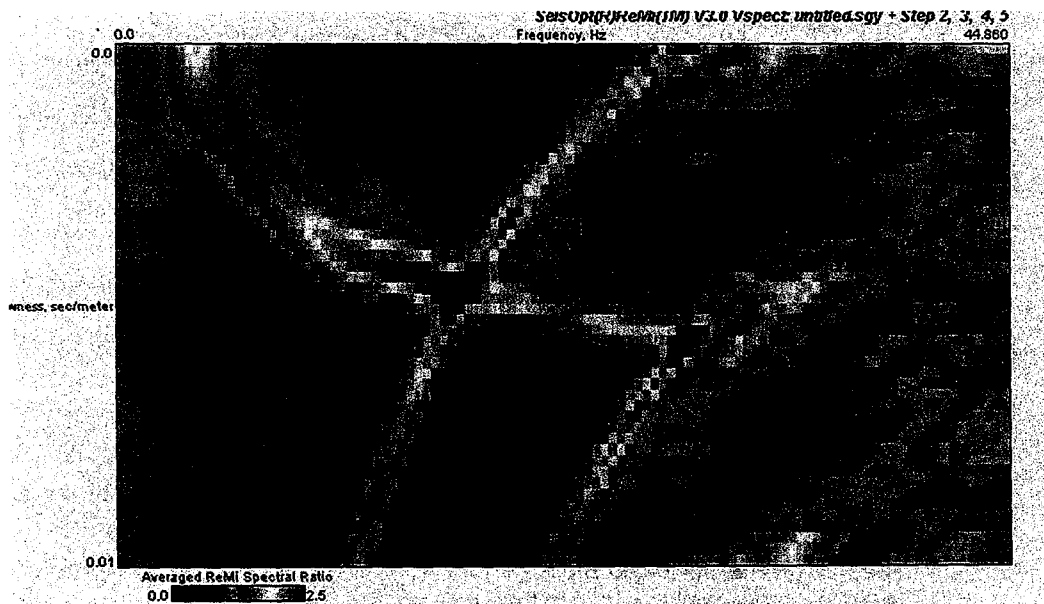
Figure Number: 4

Scale: NTS

Dispersion Curve Showing Picks and Fit



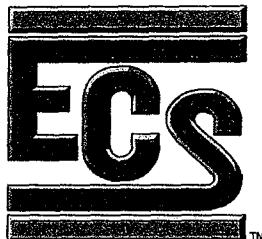
p-f Image with Dispersion Modeling Picks



Line 2 – Dispersion Curve

N Street NoMa

51 N Street NE
Washington, DC



ECS Project No: 01:24758

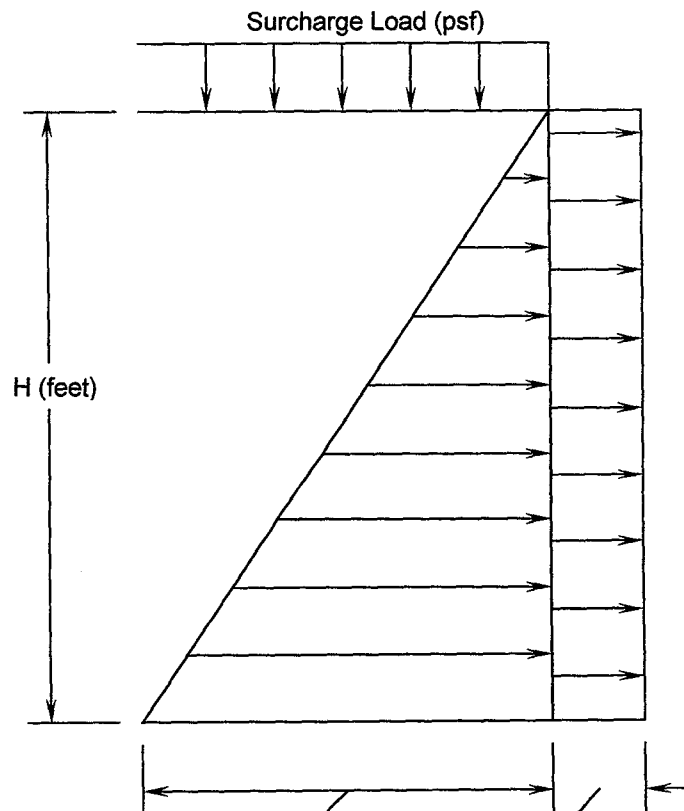
Date: July 20, 2015

Figure Number: 5

Scale: NTS



LATERAL EARTH PRESSURE DIAGRAM DRAINED CONDITION



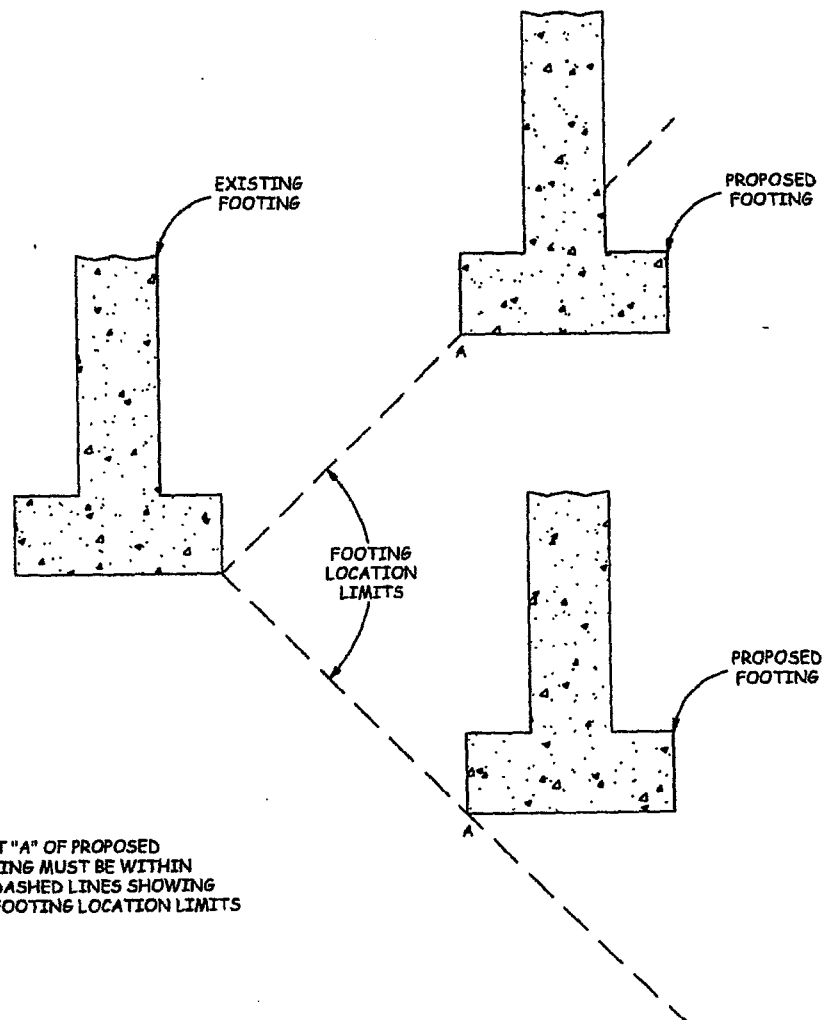
Lateral Earth Pressure = $60 H$ psf
(For below grade walls restrained from movement
at top and bottom, drained conditions presumed)

Horizontal Pressure from Surcharge
= $0.5 \times$ Vertical Surcharge

Not Applicable for Temporary SOE Walls

DESIGN OF FUTURE FOOTING ADJACENT TO EXISTING FOOTING

NOT TO SCALE

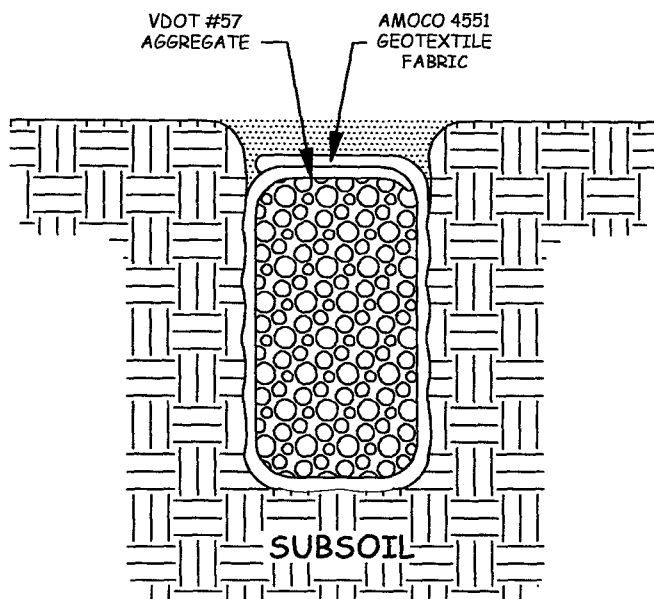


NOTE: POINT "A" OF PROPOSED
FOOTING MUST BE WITHIN
THE DASHED LINES SHOWING
THE FOOTING LOCATION LIMITS

FRENCH DRAIN INSTALLATION PROCEDURE

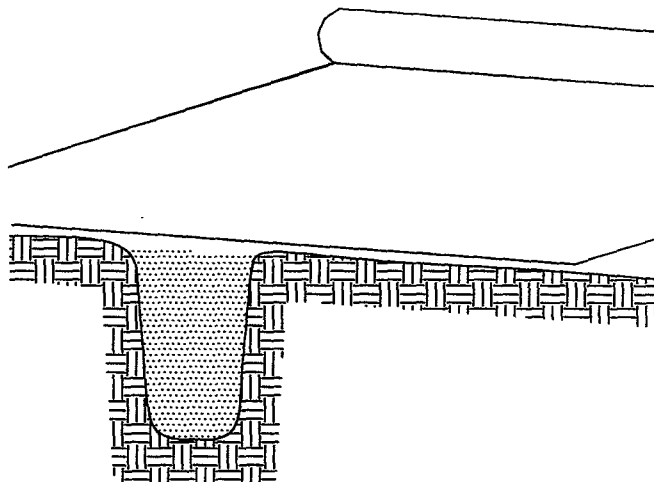
NOT TO SCALE

FINAL CONFIGURATION



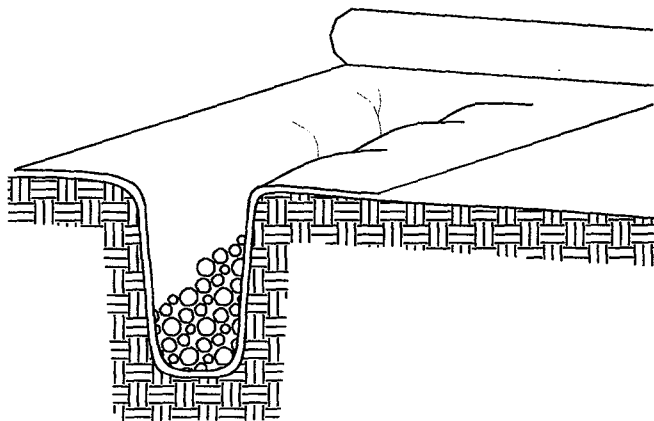
SUBDRAIN USING FILTER FABRIC

STEP 1



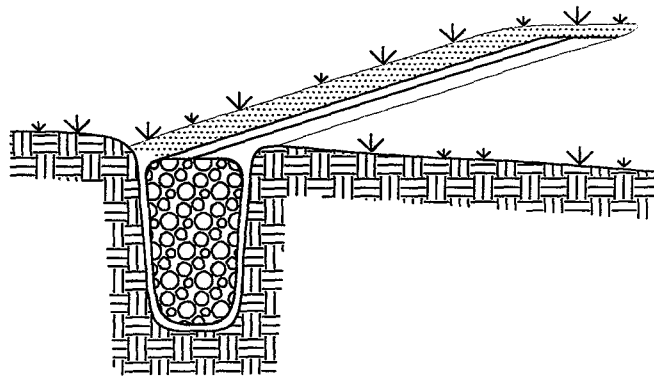
FABRIC IS UNROLLED DIRECTLY OVER TRENCH

STEP 2

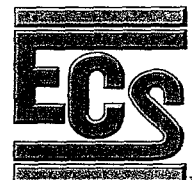


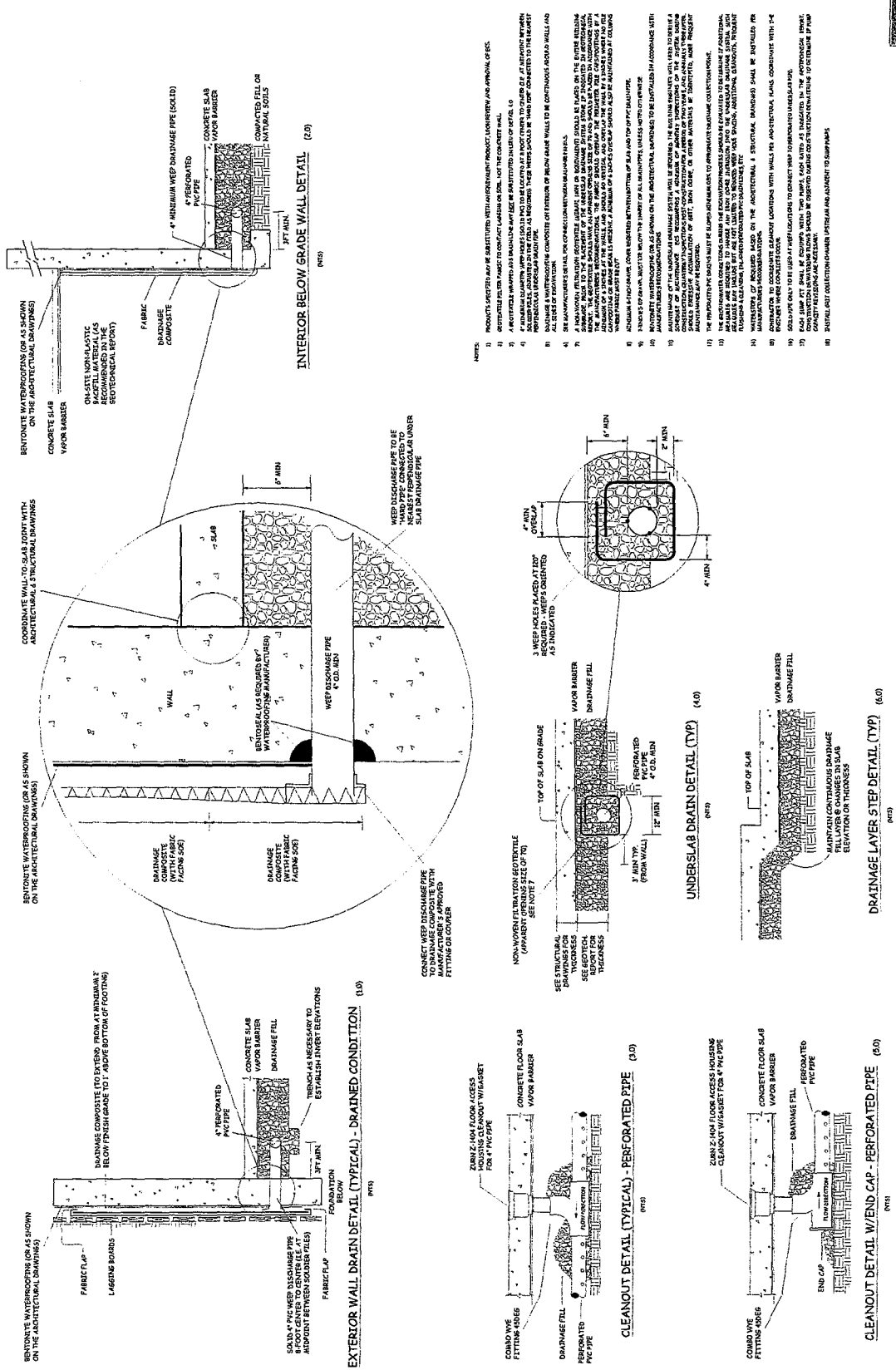
THE TRENCH IS FILLED WITH AGGREGATE

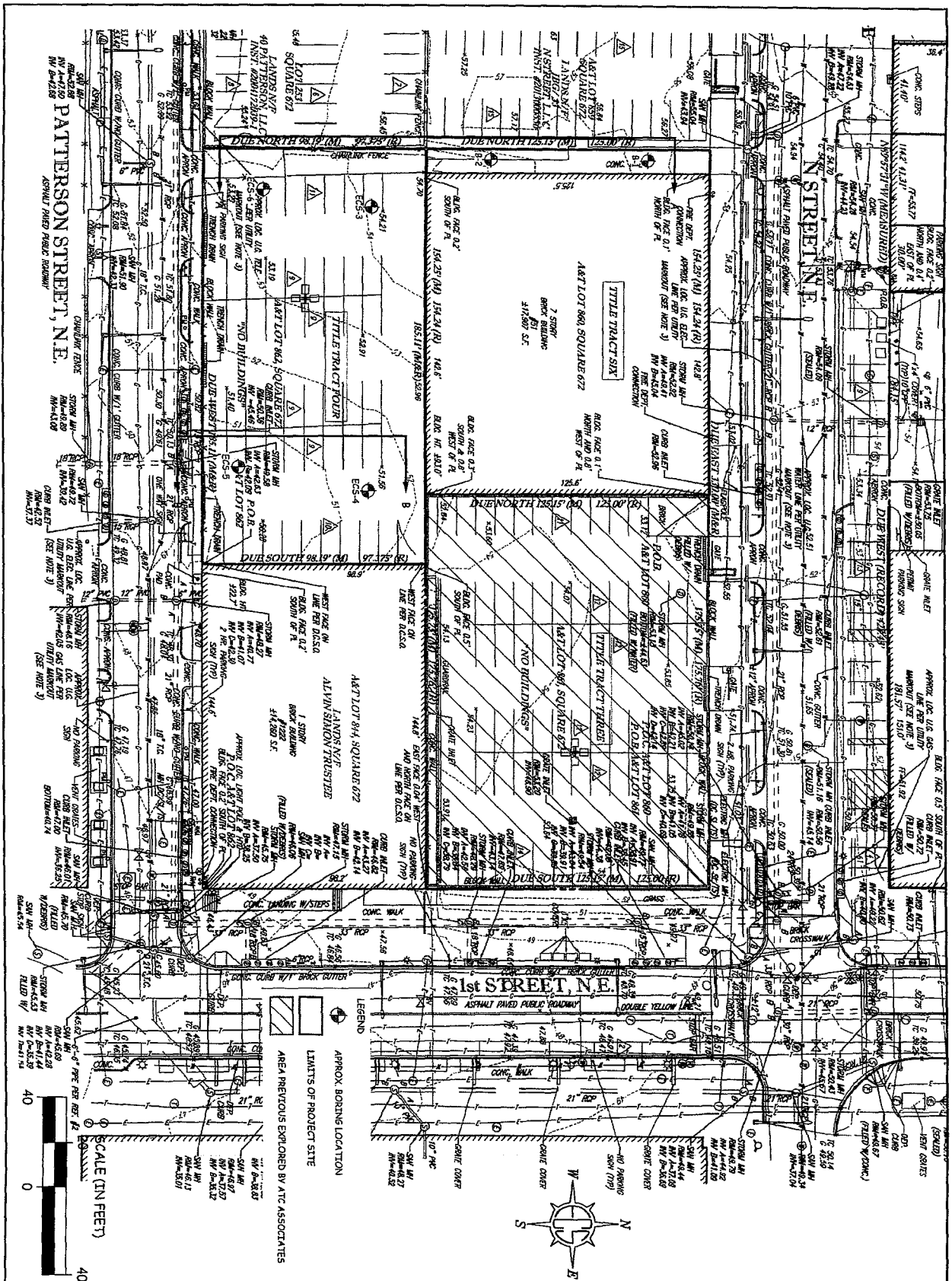
STEP 3



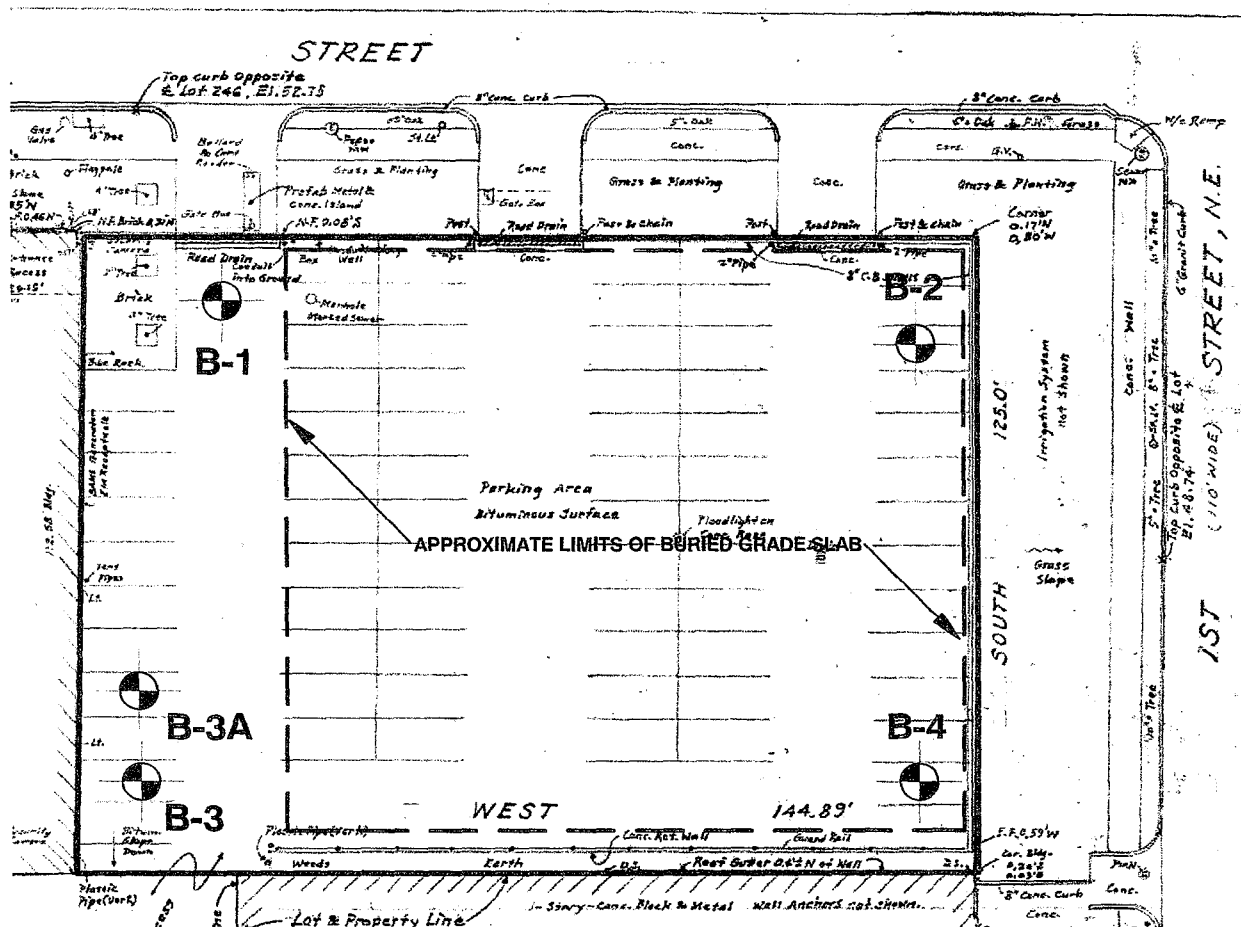
THE FABRIC IS LAPPED CLOSED AND
COVERED WITH BASE STONE







DATE	SHEET	PROJECTION	SCALE	ENGINEER	PLR	RAC	ECS REVISIONS	BORING LOCATION DIAGRAM THE JBG		N STREET NOMA NE WASHINGTON, DC
07-23-15	1 OF 3	24758	1"=40'	RAC	RAC					



NOTE: BORING LOCATION PLAN ADAPTED FROM DRAWING ENTITLED "PLAT OF SURVEY LOTS 247, 254, 847 & 848 SQUARE 672" PREPARED BY LOCRAFT CIVIL ENGINEERS DATED MARCH 8, 2005

LEGEND

- B-1
 ATC SOIL TEST BORINGS ATC B-1 TO B-4
- B-3A
 ATC PRESSUREMETER TEST LOCATION
- EXISTING PRIVATE PROPERTY LINE
- - - APPROXIMATE LIMITS OF BURIED GRADE SLAB

 VATC ASSOCIATES INC. 9231 RUMSEY ROAD COLUMBIA, MD 21045		PROJECT: 1250 1ST STREET NE WASHINGTON, DC	
CLIENT: JBG COMPANIES		DRAWN BY: WRT PROJECT NO.: 09.20597.0056 TASK: 00001	FIGURE NO. 2
DRAWING TITLE: BORING LOCATION PLAN		DATE: 12/11/2008 SCALE: As shown FILE NAME: Figure 2.dwg	

FIELD OPERATIONS

The general field procedures employed by ATC Associates are summarized in ASTM D 420 "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground-water conditions. These methods include geophysical and in-situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

- (a) Continuous 3¼ or 4¼-inch I.D. hollow stem augers;
- (b) Wash borings using roller cone or drag bits (mud or water);
- (c) Continuous flight augers (ASTM D 1452).
- (d) Continuous sampling using a tripod-mounted drill rig.

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling is utilized, when deemed necessary, to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by the Driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observation of ground water. It also contains the driller's interpretation of the soil conditions between samples. Therefore, these boring records contain both factual and interpretive information.

The soil samples plus the field boring records are then reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records that are the basis for engineering evaluations and recommendations.

The final test boring records represent our interpretation of the contents of the field records based on both visual classification and laboratory test results. The test boring records depict subsurface conditions at specific locations and at the time of drilling. Subsurface conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground-water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on subsurface profiles represent approximate boundaries. The actual transition between materials may be gradual.

SOIL SAMPLING PROCEDURES

Penetration Test and Split-barrel Sampling

The borings were advanced using a track or truck mounted drill rig with a split-spoon sampler. Penetration testing and split-barrel sampling were conducted in the borings at regular intervals.

The standard penetration test (SPT) provides an indication of the soil strength and compressibility. The SPT resistances and split-barrel sampling are conducted simultaneously according to ASTM Specification D 1586. At regular intervals, soil samples are obtained with a standard split-tube sampler. The sampler is first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the 12-inch increment is recorded and is designated the "penetration resistance," or "N-Value."

Representative portions of the soil samples obtained from each split-barrel sample are placed in glass jars, sealed, and transported to our laboratory. Descriptions of the split-tube samples and the penetration resistances are shown on the attached Test Boring Records.

Water Level Measurements

Water level readings and caved depths are measured in completed borings as noted on the Test Boring Records. These water level readings indicate the approximate location of the ambient ground-water table at the time of our field investigation. In some instances, the caved depths may possibly indicate ground-water activity. The time of boring water level reported on the Test Boring Records is determined by field crews as the drilling tools are advanced.

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core; NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash Sample

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb hammer falling 30 inches on a 2-inch O.D. split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

<i>Density</i>		<i>Relative Properties</i>	
Under 6 blows/ft	Very Loose	Trace	1% - 10%
6 to 10 blows/ft	Loose	Little	11% - 20%
11 to 30 blows/ft	Medium Dense	Some	21% - 35%
31 to 50 blows/ft	Dense	With	36% - 50%
51 to 80 blows/ft	Very Dense		
Over 80 blows/ft	Extremely Dense		

Particle Size Identification

Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	1/2 to 1 inch
	Fine	1/4 to 1/2 inch
Sand	Coarse	2.00mm to 1/4 inch (dia. of pencil lead)
	Medium	0.42mm to 2.00mm (dia. of broom straw)
	Fine	0.074mm to 0.42mm (dia. of human hair)
Silt		0.002 to 0.074mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

<i>Blows/Ft</i>	<i>Consistency</i>	<i>Unconfined Comp. Strength</i>	<i>Degree of Plasticity</i>	<i>Plasticity Index</i>
		<i>Qp (tsf)</i>		
Under 4	Very Soft	Under 0.25	None to Slight	0 - 4
4 to 5	Soft	0.25 - 0.49	Slight	5 - 7
6 to 10	Med. Stiff	0.50 - 0.99	Medium	8 - 22
11 to 15	Stiff	1.00 - 1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00 - 3.00		
31 to 50	Hard	4.00 - 8.00		
Over 51	Very Hard	Over 8.00		

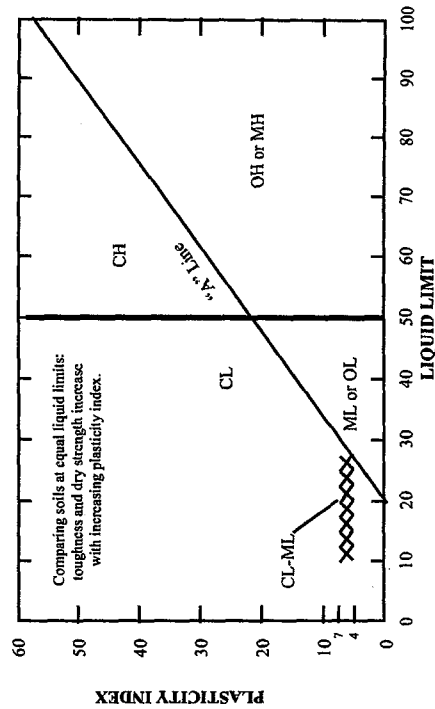
The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. the measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.



Unified Soil Classification System ASTM D-2487

MAJOR DIVISIONS		GROUP SYMBOLS (1)	TYPICAL NAMES	LABORATORY CLASSIFICATION CRITERIA																																																			
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Plasticity Chart (for Laboratory classification of fine grained soils)





9231 Rumsey Road
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Fax (410) 381-0247

TEST BORING LOG

CLIENT JBG Companies
PROJECT NAME Proposed Development
PROJECT LOCATION 1250 1st Street NE
Washington, DC

BORING # B-1
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 10/19/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
SURFACE ELEVATION 55.0 feet msl											
5" ASPHALT, 3" STONE BASE	1.0										
FILL sampled as brown silty sand with varying amounts of aggregate, asphalt, brick and organics	54.0		1	SPT			8-14-5				
		5	2	SPT			2-3-8				
brick fragments noted 8-10' bgs			3	SPT			8-6-3				
		10	4	SPT			2-1-2				
decomposed organic materials 14.5-15' bgs			5	SPT			2-2-2				
brick fragments noted 18.5-20' bgs		20	6	SPT			3-3-2				
MEDIUM DENSE brown silty fine SAND (SM), trace to little gravel, wet	22.0 33.0		7	SPT			8-11-8				
STIFF brown and gray sandy CLAY (CH), moist	27.0 28.0		8	SPT			3-5-5				
VERY STIFF brown and gray fine sandy SILT (ML), moist	32.0 23.0		9	SPT			3-4-16				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
⊕ At Completion (in augers) _____ ft.
⊗ At Completion (open hole) _____ ft.
⚡ After _____ hours _____ ft.
⚡ After _____ hours _____ ft.
⚡ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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Phone: (410) 381-0232
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TEST BORING LOG

CLIENT JBG Companies
PROJECT NAME Proposed Development
PROJECT LOCATION 1250 1st Street NE
Washington, DC

BORING # B-1
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 10/19/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION		Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
(continued)												
				10	SPT			4-7-9				
		40										
		42.0										
	VERY STIFF brown and gray sandy CLAY (CH), moist	13.0		11	SPT			3-7-10				
		45										
		47.0										
	DENSE TO EXTREMELY DENSE gray and black silty fine SAND (SM), trace to little lignite fragments, moist	8.0		12	SPT			11-24-29				
		50										
		55		13	SPT			20-23-30				
		60		14	SPT			11-29-47				
		65		15	SPT			5-17-22				
		67.0										
	DENSE gray clayey fine to medium SAND (SC), trace lignite fragments, moist	-12.0		16	SPT			8-17-18				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
⊕ At Completion (in augers) _____ ft.
⊗ At Completion (open hole) _____ ft.
▽ After _____ hours _____ ft.
▽ After _____ hours _____ ft.
⊕ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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TEST BORING LOG

CLIENT JBG Companies
PROJECT NAME Proposed Development
PROJECT LOCATION 1250 1st Street NE
Washington, DC

BORING # B-1
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 10/19/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 inch increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
(continued)											
EXTREMELY DENSE gray silty fine to medium SAND (SM), moist	72.0 -17.0		17	SPT	X		15-35-50				
VERY STIFF TO HARD dark gray clayey SILT (MH), trace to little sand, moist	77.0 -22.0		18	SPT	X		2-8-13				
			19	SPT	X		14-20-30				
			20	SPT	X		7-17-20				
EXTREMELY DENSE gray silty fine SAND (SM), moist	92.0 -37.0		21	SPT	X		6-33-50/4"				
VERY STIFF dark green and gray silty CLAY (CH), moist	97.0 -42.0		22	SPT	X		7-7-10				
BORING TERMINATED AT 100 FEET BELOW GROUND SURFACE (BGS)	100.0 -45.0										

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
± At Completion (in augers) _____ ft.
⊗ At Completion (open hole) _____ ft.
▼ After _____ hours _____ ft.
▼ After _____ hours _____ ft.
⚡ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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TEST BORING LOG

CLIENT JBG Companies
PROJECT NAME Proposed Development
PROJECT LOCATION 1250 1st Street NE
Washington, DC

BORING # B-2
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 11/22/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. in.
Boring Method HSA Shelby Tube OD in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
SURFACE ELEVATION 58.0 feet msl											
5" ASPHALT, 4" STONE BASE	1.0										
FILL sampled as brown sand and silt with aggregate, asphalt and concrete fragments	57.0		1	SPT			6-24-32				
	4.0		2	SPT			38-50/4"				
CONCRETE SLAB ENCOUNTERED	54.8										
APPROXIMATELY 4 TO 5 FEET BGS	53.0		3	SPT			5-4-3				
LOOSE dark brown silty fine to medium SAND (SM), trace to little clay, moist to wet at 10 feet bgs			4	SPT			2-3-2				
	12.0										
SOFT brown and gray silty CLAY (CL), wet, trace to little fine sand	46.0		5	SPT			1-2-2				
			6	SPT			1-1-2				
	22.0										
VERY DENSE brown sandy quartz GRAVEL (GM), little silt, moist	36.0		7	SPT			16-29-23				
LOOSE TO MEDIUM DENSE gray fine to medium silty SAND (SM), moist to wet at 35 feet bgs	27.0		8	SPT			4-8-5				
	31.0										
			9	SPT			3-5-4				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools ft.
± At Completion (in augers) 33.5 ft.
⊗ At Completion (open hole) 52.0 ft.
▼ After hours ft.
▼ After hours ft.
⊗ Cave Depth ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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TEST BORING LOG

CLIENT JBG Companies BORING # B-2
PROJECT NAME Proposed Development JOB # 09.20597.0056
PROJECT LOCATION 1250 1st Street NE DRAWN BY L. Hogg
Washington, DC APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 11/22/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. in.
Boring Method HSA Shelby Tube OD in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
(continued)											
			10	SPT			8-5-15				
	42.0	40									
EXTREMELY DENSE gray fine to medium sandy subrounded GRAVEL (GM), trace to little silt, wet	16.0		11	SPT			50				
	47.0	45									
MEDIUM DENSE TO DENSE gray very fine to medium silty SAND (SM), moist	11.0		12	SPT			6-10-17				
		50									
			13	SPT			6-15-22				
		55									
VERY DENSE gray fine to medium clayey SAND (SC), moist	1.0		14	SPT			9-14-27				
	60.0	60									
	-2.0										
BORING INITIALLY TERMINATED ON 10/18/08 ON APPARENT CONCRETE SLAB AT DEPTH OF 4 FEET BELOW GROUND SURFACE (BGS). BORING RESUMED WITH 2 1/4" HSA ON 11/22/08. BORING TERMINATED AT DEPTH OF 60 FEET BGS ON 11/22/08											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools - ft.
± At Completion (in augers) 33.5 ft.
⊗ At Completion (open hole) 52.0 ft.
⌵ After _____ hours _____ ft.
⌵ After _____ hours _____ ft.
⌵ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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TEST BORING LOG

CLIENT JBG Companies BORING # B-3
PROJECT NAME Proposed Development JOB # 09.20597.0056
PROJECT LOCATION 1250 1st Street NE DRAWN BY L. Hogg
Washington, DC APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/18/08 Hammer Wt. 140 lbs.
Date Completed 10/18/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
(continued)											
HARD gray and brown clayey SILT (MH), moist	38.0 14.0	40	8	SPT			8-11-18				
		45	9	SPT			8-12-19				
EXTREMELY DENSE gray fine to medium silty SAND (SM), trace to little lignite fragments, little clay at 55' bgs, moist	47.0 5.0	50	10	SPT			50/6"				
		55	11	SPT			13-14-38				
	60.0 -8.0	60	12	SPT			11-50/5"				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
⊕ At Completion (in augers) _____ ft.
⊗ At Completion (open hole) _____ ft.
▼ After _____ hours _____ ft.
▼ After _____ hours _____ ft.
⚡ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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TEST BORING LOG

CLIENT JBG Companies BORING # B-3
PROJECT NAME Proposed Development JOB # 09.20597.0056
PROJECT LOCATION 1250 1st Street NE DRAWN BY L. Hogg
Washington, DC APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/18/08 Hammer Wt. 140 lbs.
Date Completed 10/18/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows - 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
SURFACE ELEVATION 52.0 feet msl											
4" ASPHALT	1.0										
FILL sampled as orange brown and brown clay and sand with asphalt and brick fragments 3.5-5' bgs, trace to little organics 13.5-15' bgs	51.0										
		5	1	SPT			3-5-6				
		10	2	SPT			3-4-4				
		15	3	SPT			2-2-2				
	19.0	20	4	SPT			1-1-2				
SOFT brown silty CLAY (CL), moist to wet	33.0										
	22.0	25	5	SPT			4-29-23				
DENSE brown gravelly fine to coarse SAND (SM), little silt and clay, wet	30.0										
	27.0	30	6	SPT			5-6-9				
VERY STIFF brown and gray sandy CLAY (CH), wet	25.0										
	32.0		7	SPT			6-13-21				
HARD brown and gray very fine sandy SILT (ML), moist	20.0										

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
⚡ At Completion (in augers) _____ ft.
⊗ At Completion (open hole) _____ ft.
⚡ After _____ hours _____ ft.
⚡ After _____ hours _____ ft.
⚡ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling



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Phone: (410) 381-0232
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TEST BORING LOG

CLIENT JBG Companies
PROJECT NAME Proposed Development
PROJECT LOCATION 1250 1st Street NE
Washington, DC

BORING # B-4
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started 10/19/08 Hammer Wt. 140 lbs.
Date Completed 11/22/08 Hammer Drop 30 in.
Driller L. Cisler Spoon Sampler OD 2 in.
Field Professional L. Hogg Rock Core Dia. _____ in.
Boring Method HSA Shelby Tube OD _____ in.

TEST DATA

SOIL CLASSIFICATION	Stratum Depth/Elev.	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test (SPT) Sample Blows- 6 Inch Increments	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Remarks
SURFACE ELEVATION 58.0 feet msl											
4" ASPHALT, 4" CONCRETE	1.0										
FILL sampled as brown and black gray silty sand	57.0		1	SPT			50				
			2	SPT			3-8				
CONCRETE SLAB ENCOUNTERED APPROXIMATELY 4 TO 5 FEET BGS	5.0	5	3	SPT			8-8-9				
gravel, concrete and brick fragments noted 5-6.5' bgs	53.0										
	8.0		4	SPT			3-2-3				
LOOSE red-brown fine to medium silty SAND (SM), little clay at 15 feet bgs, wet	50.0	10									
			5	SPT			1-1-2				
	18.0	15									
SOFT dark brown and gray clayey SILT (ML), trace to little fine sand, wet	40.0	20	6	SPT			1-2-2				
	23.0		7	SPT			12-12-13				
MEDIUM DENSE brown sandy quartz GRAVEL (GM), little silt, moist	35.0	25									
			8	SPT			11-6-5				
	28.0										
MEDIUM DENSE gray and dark gray silty fine to medium SAND (SM), little to some gravel at 38-40', moist to wet at 40' bgs	30.0	30									
			9	SPT			8-6-6				

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
⊕ At Completion (in augers) 38.0 ft.
⊗ At Completion (open hole) 55.8 ft.
⏴ After _____ hours _____ ft.
⏵ After _____ hours _____ ft.
⚡ Cave Depth _____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

CLIENT **JBG Companies**
PROJECT NAME **Proposed Development**
PROJECT LOCATION **1250 1st Street NE**
Washington, DC

BORING # B-4
JOB # 09.20597.0056
DRAWN BY L. Hogg
APPROVED BY W. Tucker

DRILLING and SAMPLING INFORMATION

Date Started	<u>10/19/08</u>	Hammer Wt.	<u>140</u> lbs.
Date Completed	<u>11/22/08</u>	Hammer Drop	<u>30</u> in.
Driller	<u>L. Cisler</u>	Spoon Sampler OD	<u>2</u> in.
Field Professional	<u>L. Hogg</u>	Rock Core Dia.	_____ in.
Boring Method	<u>HSA</u>	Shelby Tube OD	_____ in.

TEST DATA

[illegible]

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
 ± At Completion (in augers) 38.0 ft.
 ⊕ At Completion (open hole) 55.8 ft.
 ▽ After _____ hours _____ ft.
 ▽ After _____ hours _____ ft.
 ⊞ Cave Depth _____ ft.

Boring Method

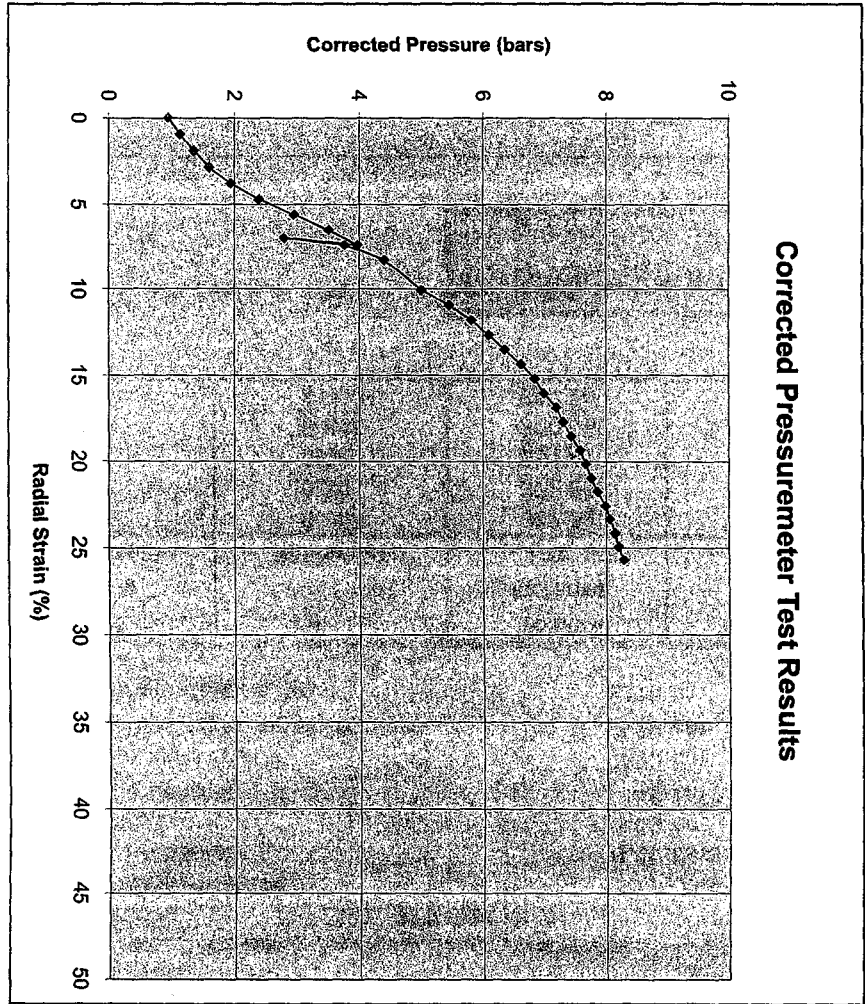
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

PRESSUREMETER TEST REPORT

PROJECT: 1250 First Street	BORING: B-3A
LOCATION: Northeast, Washington, D.C.	TEST #: 1
IN-SITU SOIL TESTING, L.C.	DEPTH: 31.7 ft
ENGINEER: Roger Faltnetzger, P.E., F. ASCE	TEST DATE: 10/18/2008

Interpreted Pressuremeter Parameters		
P_o	1.6	bar
P_L	10.0	bar
P_L'	8.4	bar
E_o	82	bar
E_r	317	bar
E_r/P_L'	9.7	

Pressure Bar	Volume cm ³	$\Delta R/R_o$ %	Selected points
0.94	0	0.00	Eo1 Eo2 Er1 Er2
1.14	40	0.96	
1.35	79	1.91	
1.60	119	2.86	
1.94	159	3.79	
2.39	198	4.71	
2.95	237	5.62	
3.51	277	6.53	
3.96	316	7.43	
2.79	297	6.99	
3.76	316	7.43	Eo1 Eo2 Er1 Er2
4.40	356	8.32	
5.01	435	10.08	
5.45	474	10.95	
5.82	514	11.82	
6.10	554	12.68	
6.35	593	13.53	
6.62	633	14.38	
6.84	673	15.23	
6.99	713	16.06	
7.19	752	16.90	Eo1 Eo2 Er1 Er2
7.30	792	17.72	
7.43	832	18.54	
7.59	872	19.36	
7.67	912	20.17	
7.76	952	20.98	
7.86	992	21.78	
7.99	1031	22.57	
8.07	1071	23.36	
8.14	1111	24.15	
8.20	1151	24.93	Eo1 Eo2 Er1 Er2
8.28	1191	25.70	



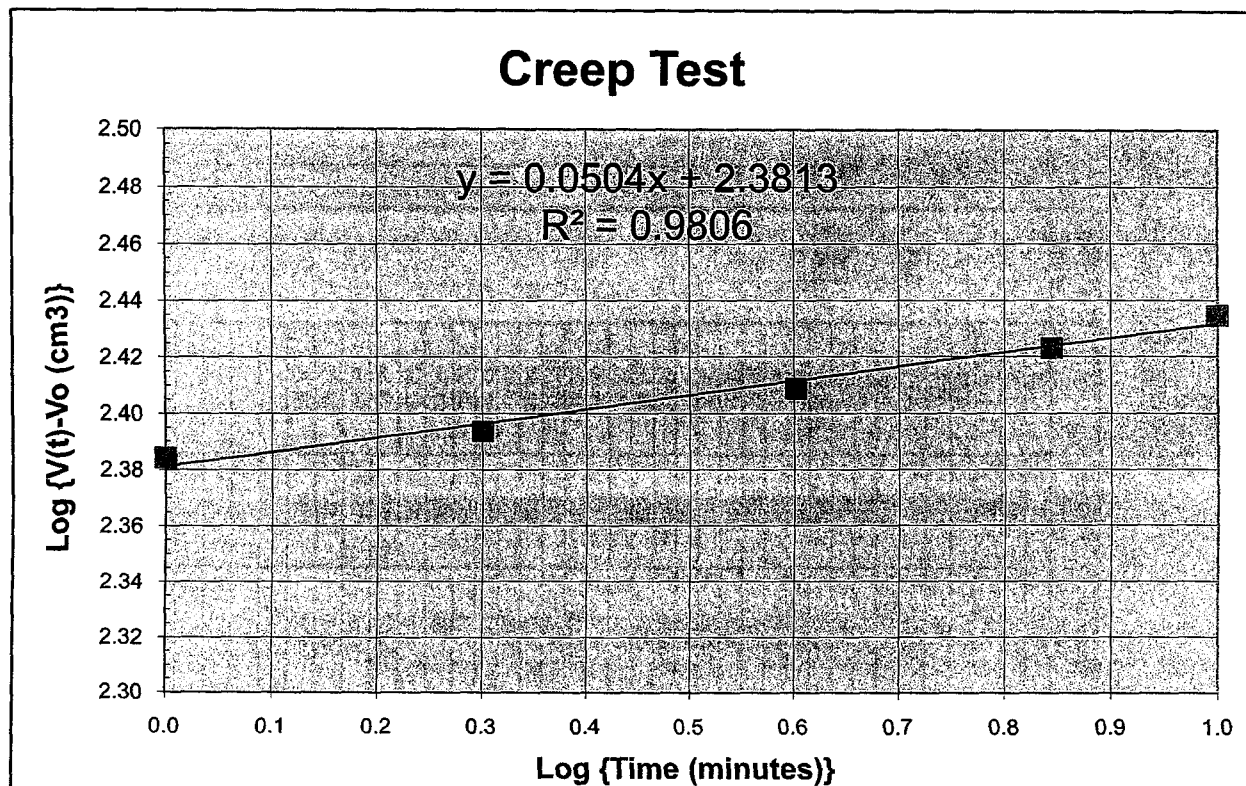
Pressuremeter Creep Test

Project: 1250 First Street
 Sounding No.: B-3A
 Test Depth: 31.7 feet
 Holding Gauge Pressure = 3.77 bars
 Corrected Pressure = 4.40 bars
 Initial Probe Radius = 3.69 cm
 Initial Probe Length = 48 cm
 Initial Volume of Probe = 2053 cm³
 Probe Radius Contacting Borehole = 3.80 cm
 Initial Borehole Volume, V₀ = 2178 cm³

Time (minutes)	Log (Time) (minutes)	Volume Increase (cm ³)	Total Probe Volume (cm ³)	V(t)-V ₀ (cm ³)	Log [V(t)-V ₀] (cm ³)
1	0.000	367.33	2420.59	242.29	2.384
2	0.301	372.65	2425.91	247.61	2.394
4	0.602	381.45	2434.71	256.41	2.409
7	0.845	390.05	2443.31	265.01	2.423
10	1.000	397.10	2450.36	272.06	2.435

$$E_0(t)/E_0(t=1 \text{ min}) = \{t/1\}^{-n}$$

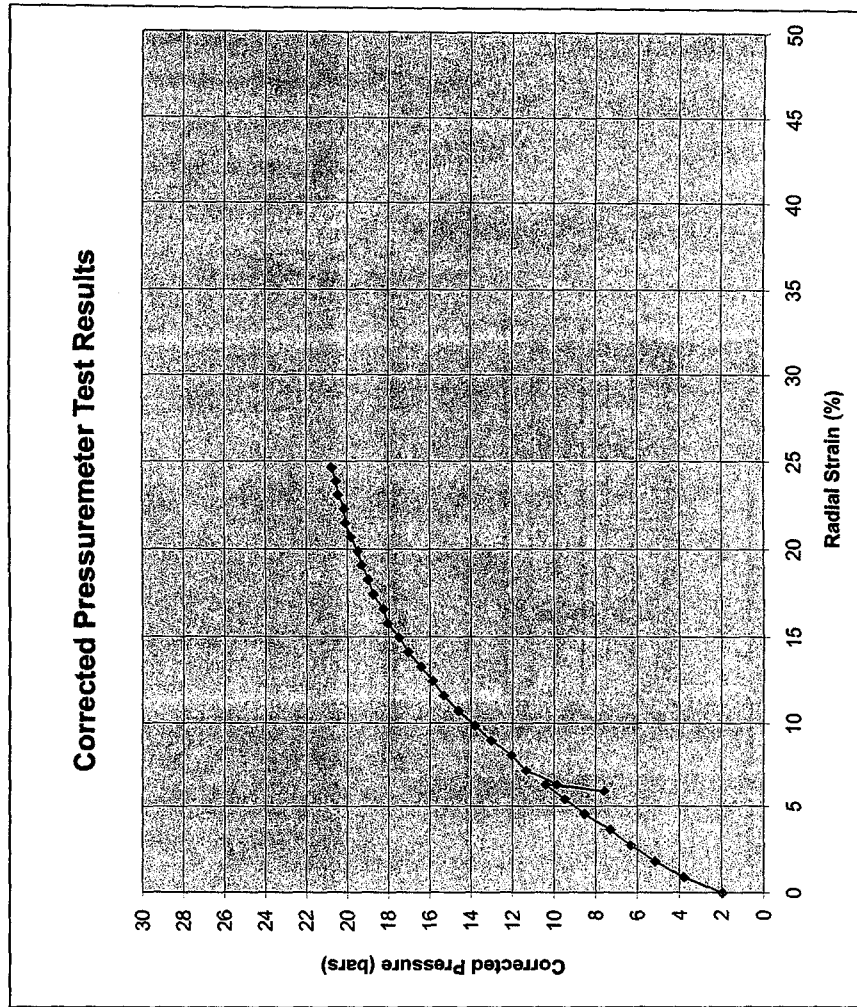
n = 0.0504



PROJECT:	1250 First Street	BORING:	B-3A
LOCATION:	Northeast, Washington, D.C.	TEST #:	2
IN-SITU SOIL TESTING, L.C.		DEPTH:	40.8 ft
ENGINEER:	Roger Failmezger, P.E., F. ASCE	TEST DATE:	10/18/2008

[illegible]

Interpreted Pressuremeter Parameters	
P_o	2.0 bar
P_L	24.0 bar
P_s^*	22.0 bar
E_o	182
E_s	775
E/P_s^*	8.3



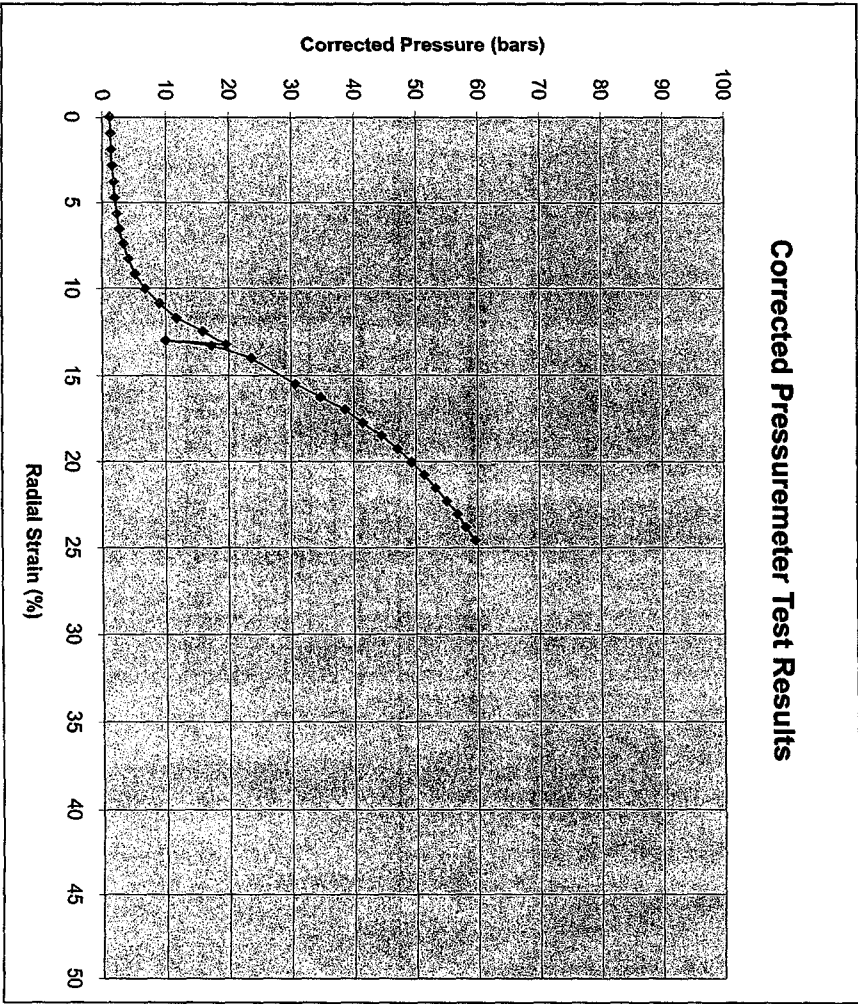
PRESSUREMETER TEST REPORT

PROJECT: 1250 First Street	BORING: B-3A
LOCATION: Northeast, Washington, D.C.	TEST #: 3
IN-SITU SOIL TESTING, L.C.	DEPTH: 51.5 ft
ENGINEER: Roger Failmeizger, P.E., F. ASCE	TEST DATE: 10/18/2008

Interpreted Pressuremeter Parameters	
P_o	2.5 bar
P_L	90.0 bar
P_u	87.5 bar
E_o	602 bar
E_r	3582 bar
E_u/P_u	6.9

Pressure Bar	Volume cm ³	$\Delta R/R_o$ %	Selected points
1.27	0	0.00	Eo1
1.34	40	0.97	
1.48	80	1.93	
1.59	120	2.87	
1.85	159	3.81	
2.06	199	4.74	
2.37	239	5.65	
2.81	278	6.56	
3.40	318	7.46	
4.22	357	8.34	
5.29	395	9.20	Eo2
6.81	434	10.05	
9.11	471	10.88	
11.72	508	11.69	
15.92	543	12.45	
19.67	579	13.22	
23.61	614	13.99	
30.64	686	16.51	
34.67	722	16.26	
38.60	757	17.00	E1
41.47	794	17.76	
44.45	831	18.52	
47.06	868	19.27	
49.35	905	20.03	
51.33	943	20.80	
53.18	981	21.56	
55.05	1019	22.32	
56.67	1057	23.07	
58.06	1095	23.83	E2
59.63	1133	24.58	

Corrected Pressuremeter Test Results



Pressuremeter Creep Test

Project: 1250 First Street
 Sounding No.: B-3A
 Test Depth: 51.5 feet
 Holding Gauge Pressure = 22.47 bars
 Corrected Pressure = 23.61 bars
 Initial Probe Radius = 3.69 cm
 Initial Probe Length = 48 cm
 Initial Volume of Probe = 2053 cm³
 Probe Radius Contacting Borehole = 3.99 cm
 Initial Borehole Volume, V₀ = 2395 cm³

Time (minutes)	Log (Time) (minutes)	Volume Increase (cm ³)	Total Probe Volume (cm ³)	V(t)-V ₀ (cm ³)	Log [V(t)-V ₀] (cm ³)
1	0.000	652.88	2706.14	311.22	2.493
2	0.301	660.53	2713.79	318.87	2.504
4	0.602	668.75	2722.01	327.09	2.515
7	0.845	674.33	2727.59	332.67	2.522
10	1.000	677.47	2730.73	335.81	2.526

$$E_0(t)/E_0(t=1 \text{ min}) = \{t/1\}^{-n}$$

n = 0.0334

