REPORT OF

PRELIMINARY SUBSURFACE EXPLORATION
AND GEOTECHNNICAL ENGINEERING ANALYSIS

ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT
CITY OF ALEXANDRIA, VIRGINIA

FOR

THE GRAHAM COMPANIES, LTD.

FEBRUARY 14, 2008

February 14, 2008

Mr. Benjamin Graham
The Graham Companies, Ltd.
P.O. Box 1788
Middleburg, Virginia 20188

ECS Job No. 13983

Reference: Report of Preliminary Subsurface Exploration and Geotechnical Engineering Analysis, Robinson Terminal at Alexandria Waterfront, Alexandria, Virginia

Dear Mr. Graham:

As authorized by your acceptance of ECS Mid-Atlantic, LLC (ECS) Proposal No. 28347-GP, dated October 31, 2007, we have completed the preliminary subsurface exploration for the above-referenced project in the City of Alexandria. The enclosed report discusses the subsurface exploration procedures, the results of our subsurface exploration and laboratory testing programs, and presents our preliminary recommendations for the proposed redevelopment. It also evaluates the implementation of below grade parking for the proposed development. A Boring Location Diagram/Vicinity Map is included in the Appendix of this report, along with boring logs and laboratory test results.

This report has been prepared to aid in the preliminary evaluation of this site and to assist the design team with the design of the proposed development. We appreciate the opportunity to be of service to The Graham Companies, Ltd., on this project. If you have any questions regarding the information and recommendations contained in the accompanying report, please do not hesitate to contact us.

Respectfully,

ECS MID-ATLANTIC, LLC

(kms)

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REPORT

PROJECT

Preliminary Subsurface Exploration and
Geotechnical Engineering Analysis
Robinson Terminal at Alexandria Waterfront
Alexandria, Virginia

CLIENT

The Graham Companies, Ltd.
P.O. Box 1788
Middleburg, Virginia 20188

PROJECT #13983

DATE February 14, 2008

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PROJECT OVERVIEW

Introduction and Site Description

This report presents the results of our preliminary subsurface exploration and geotechnical engineering analysis and recommendations for the proposed redevelopment of the Robinson Terminal Property in the City of Alexandria, Virginia. This study was conducted in general accordance with ECS Proposal No. 28347-GP, dated October 31, 2007, and authorized by your office.

The subject site is currently occupied by two warehouses, one to the east and west side of 500 North Union Street. The Potomac River runs north to south of the eastern dock of the parcel. The site is bordered by Pendleton Street to the north and Oronoco Street to the south. The general location and limits of the site is shown on the Boring Location Diagram/Vicinity Map included in the Appendix of this report.

Proposed Construction

Based on preliminary schematics provided to us by your office prepared by Land Design, we understand that the proposed project will consist of the construction of a four-story building on the easternmost portion of the site, a five-story building west of North Union Street and four townhouses just south of the five-story parcel. Finished floor elevations have yet to be determined. Based on recent discussions with the developer, there is a desire to utilize below-grade basement parking for both structures (and possibly the townhouses) to a depth of one to two basement levels below grade. There is also the possibility that no basement levels will be utilized, if the geotechnical conditions are such that the construction of below-grade basement levels is problematic. Please note that this project is in the preliminary design phase; therefore, we have anticipated bearing elevations, column loading conditions, and building layout locations for this report. Once further development plans have been completed, this information should be incorporated into a final report of geotechnical exploration and analysis for the site. Additional borings and testing is recommended to complete the geotechnical study for this site.

Scope of Work

The conclusions and recommendations contained in this report are based on a total of 6 soil borings performed by ECS. Borings B-1, B-3, and B-5 were extended to a depth of 60 feet while borings B-2, B-4 and B-6 extended to a depth of 80 feet below the existing ground surface. The boring locations were selected by ECS and staked in the field utilizing Global Positioning System (GPS) equipment. The results of the borings, along with a Boring Location Diagram, are included in the Appendix of this report. The Boring Location Diagram was developed from the site plans provided to us by your office. The elevations noted on the boring logs were interpolated from contours and elevations obtained from the site plan which provides topographic contours to the nearest 1-foot intervals and finished floor elevations for the existing warehouses to the nearest hundredth of a foot.

Purposes of Exploration

The purposes of this preliminary exploration were to explore the soil and groundwater conditions at the site and to develop preliminary engineering recommendations to guide design and construction of the project. We accomplished these purposes by:

1. drilling six (6) soil borings and set of two (2) temporary monitoring wells to explore the subsurface soils and groundwater conditions,

2. performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties, and

3. analyzing the field and laboratory data from this and the project sites to develop appropriate engineering recommendations, and

4. preparing this preliminary engineering report.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with a truck-mounted auger drill rig, which utilized continuous flight, hollow stem augers to advance the boreholes. Drilling fluid was used in the boring exploration. The borings were subsequently backfilled with the auger spoils generated during drilling procedures after their completion.

In the soil borings, representative soil samples are obtained by means of the split-barrel sampling procedure in general 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 or 24 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 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 cohesionless 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 borings was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample was in sealed in glass jars and brought to our laboratory for further visual examination and laboratory testing.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to verify field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications of all soil samples recovered during drilling operations, and natural moisture content, Atterberg Limits and grain size analysis of selected soil samples. All data from the laboratory testing program are included in the respective boring logs and in the Appendix of this report.

An ECS geotechnical engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the USCS is included with this report. The soil engineer grouped the various soil types 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 from the soil borings 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 Atlantic Coastal Plain Physiographic Province of Virginia. This Coastal Plain Province is characterized by a series of south-easterly dipping layers of relatively consolidated sandy clay deposits, with lesser amounts of gravel. These coastal Plain deposits are estimated to be approximately 250 feet thick and are underlain by the eastward continuation of the crystalline rock of the Piedmont Physiographic Province.

In general, the higher elevations of the site area have remnants of the Quaternary Age River Terrace deposits. The Quaternary Age Deposits are typically underlain by the Potomac Group sediments of the Cretaceous Age. The Cretaceous Age Potomac Group deposits generally consist of interbedded, layers of sand, silt, clay and gravel layers.

The clay layers of the Potomac Group are commonly referred to as "marine clay". These very stiff to hard clays are often moderately to highly over consolidated and have a blocky structure. The clays vary in their composition and shear strength parameters. Fissures and slickensided surfaces are often present within these clays. In their natural state, these clays exhibit considerable strength, but after removal of overburden by erosion or grading, a significant reduction in shear strength occurs. This strength loss is attributed to opening of fissures, allowing water movement along the openings which leads to a lower effective strength along the slickensided surfaces. The residual shear strength of the clays is generally used in stability analysis to model conditions of reduced shear strength due to large, long-term movements of slopes, which sometimes occurs. These marine clays are highly plastic and have a high shrink/swell potential, due to the presence of montmorillonite as their predominate clay mineral. Marine clays are typically continuous layers in a lateral direction of considerable distance, although, in some cases, they may form isolated clay pockets, grade into sand, or pinch-out.

In the developed Washington, DC metropolitan area, especially in urban areas adjacent to the Potomac and Anacostia Rivers, the presence of often deep fill is common, as land was created in former low-lying areas adjacent to the rivers. The borings drilled for the subject development indicated the presence of urban fill extending down to approximately EL. -6 feet.

Soil Conditions

The subsurface conditions encountered within the six preliminary soil borings were consistent with the regional geology and geotechnical data from nearby project sites. Each boring was overlain by an approximately 1 foot floor slab of the existing warehouses.

Stratum I – Fill

Beneath the concrete slab, fill soils were encountered in each boring, ranging from depths of 4 to 15 feet below existing ground surface. Fill depths correspond with elevations ranging from approximately EL. 8 to -6 feet. The fill soils varied greatly in type, moisture, and relative density/consistency. These materials included sand, silt, clay, bricks, asphalt, organics, and gravel in addition to other debris. These materials are anticipated to have been placed in an uncontrolled manner.

Stratum II – Alluvial Soils

Beneath the fill soils, natural alluvial soils were encountered in the borings. This stratum was generally encountered between EL. 8 to -6 feet and EL. -40 to -50 feet. Generally, these soils consisted of interbedded and alternating layers of Silty SAND (SM), GRAVEL (GP, GW), and CLAY (CL/CH). In general, the soils ranged from loose to very dense and soft to very stiff in relative density and consistency, respectively. The Stratum II soils varied widely in relative density and/or consistency in addition to soil type over short horizontal distances, a characteristic common for sites bordering large rivers such as the Potomac. It is likely that the ancient Potomac River eroded and replaced soils of differing type and density over long periods of time, the result of which is a highly variable soil layer extending from approximately EL. -5 feet to EL. -50 feet.

Stratum III – Potomac Soils

Marine CLAY (CH) was generally encountered below approximately EL. -40 feet to EL. -50 feet. These soils were generally recorded to be stiff to hard in consistency.

Groundwater Conditions

Observations for groundwater were made by the drilling crew during sampling and upon completion of the drilling operations at each ECS boring location. In hollow-stem augering operations, water is not introduced into the boreholes, and the groundwater position can often be determined by observing water flowing into or out of the boreholes. However, please note that drilling "mud" was utilized in most of the borings during drilling operations to advance the boreholes through fine-grained soils. In this type of drilling, slurry is introduced into the boreholes to assist drilling as a function of the soil type and high ground water table. Visual observation of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions. During our exploration, water was encountered in all borings prior to the addition of drilling mud at depths ranging from 5 feet to 14 feet below existing site grades. These depths correspond roughly to levels between EL.-5 feet and EL. 5.7 feet and are generally consistent with what we expected based on the level of the adjacent Potomac River.

ECS also set two temporary monitoring wells in Borings B-2 and B-4 in order to evaluate the groundwater in a stabilized condition (however, reliable data was only retrieved from the well set at Boring B-4). Readings were taken one week following installation. Water levels were found to be at a depth of 3.5 feet below existing ground surface, respectively, or approximately EL. 5.7 feet for B-4.

The highest groundwater observations are normally encountered in late winter and early spring, and our current groundwater observations are expected to be near the seasonal water table. 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 this exploration. The groundwater levels at this site are also expected to fluctuate with levels in the Potomac River considering the proximity.

ANALYSIS AND RECOMMENDATIONS

Based on the results of the preliminary subsurface exploration and geotechnical engineering analysis, along with the proposed construction information provided to us, the site is considered suitable for the proposed development as described herein. This report is preliminary in nature and should be supported with a final geotechnical analysis (including additional borings) and report once the construction designs are further completed. As we understand, the current developments are considering at-grade construction, or possibly one to two basement levels.

From a geotechnical perspective, the significant challenges for building development include the presence of relatively deep fill extending as deep as EL. -6 feet, underlain by variably sorted and variably dense alluvial deposits associated with the adjacent Potomac River. The presence of relatively shallow groundwater also complicates below-grade building construction. Based upon these challenges, ECS suggests the following schemes for building development, with the understanding that additional exploration will be conducted to support these preliminary conclusions.

At-Grade Construction

If the planned development does not include below-grade basement construction, and foundations will be constructed within several feet of current site grades, ECS suggests that the buildings be supported by deep foundations due to the presence of existing urban fill extending down to approximately EL. -6 feet. The presence of the uncontrolled fill would be problematic for conventional shallow foundations, and total and differential settlements would exceed the typical values permissible considering the type of planned building construction. The type of deep foundations considered for the subject development include driven displacement piles (precast, prestressed concrete piles) and drilled shafts. Both foundation types would extend through the Stratum I fill and deeply sorted Stratum II alluvium to bear within the underlying Potomac Formation soils found below EL. -40 to -50 feet. Preliminary support recommendations are provided in subsequent report sections.

One Below-Grade Level Construction

If one below-grade level is considered for the planned development, we anticipate that the lowest basement level will appear at approximately EL. -1 feet, with corresponding foundation bearing elevations at approximately EL. -5 feet. At about EL. -5 feet, the soils transition from the overlying fill materials into the variably dense underlying alluvial Stratum II soils. The natural soils below EL. -5 feet appear suitable for support of conventional shallow foundations or a mat foundation, with the possible exception of the soils encountered near Boring B-5. In the vicinity of Boring B-5, ECS encountered relatively low Standard Penetration Test (SPT) N-values between 3 and 2 bpf extending below EL. -20 feet, and the recovery of soil samples was poor for unknown reasons. The predominant soil characteristic identified below EL. -5 feet was medium dense granular soils, which are suitable for shallow foundation or mat foundation support, as indicated above. Because only one of six borings encountered what we would consider to be poor soil conditions, ECS suggests additional testing in the vicinity of Boring B-5 to further characterize the depth, strength, and compressibility characteristics of those soils. The outcome of the additional study will provide final recommendations with respect to allowable bearing pressures or the possibility of limited deep foundation support in the vicinity of Boring B-5.

Considering a bearing elevation of approximately EL. -5 feet, ECS anticipates that the bearing soils would be capable of supporting overlying pressures of approximately 3,000 to 4,000 psf for either a spread footing or a mat foundation. Since stabilized groundwater levels as high as approximately EL. +5 feet were encountered, effective temporary construction dewatering will be required to construct either a mat foundation or spread footings below EL. -5 feet. The borings reveal the presence of highly permeable granular soils from Stratum II below EL. -5 feet, and the contractor would be required to develop a coherent dewatering scheme to address these permeable granular soils that will transmit significant volumes of groundwater into the excavation.

Two Below-Grade Level Construction

If two levels of below-grade construction are considered, we anticipate that the foundation bearing elevation would be approximately EL. -13 feet. Similar to the one below-grade level scheme, the foundation bearing soils at this deeper elevation will also consist of the Stratum II alluvial soils, which were measured to be predominantly medium dense to dense at this approximate elevation, again with the possible exception of Boring B-5, where looser soils were encountered. The soils below EL. -13 feet appear capable of supporting shallow spread footings and/or a mat foundation, with bearing pressures in the 3,000 to 5,000 psf range, pending further characterization of the compressibility and strength characteristics of the soils in the vicinity of Boring B-5. The most significant challenge of constructing two below-grade levels would be the control of groundwater during construction and post-construction. With a bearing elevation of approximately EL. -13 feet, the lowest foundation level will be approximately 18 feet below the permanent groundwater elevation, and the base of the excavation will be in highly permeable granular soils. For these reasons, it may be more practical to consider a mat foundation for the two below-grade level scheme, whereby permanent long-term groundwater pumping is not necessary. The basement walls will require full waterproofing up to the finished exterior grade at about EL. +10 feet, and the base of the mat will also require waterproofing. The use of a mat foundation and a waterproofed basement space is relatively common construction practice in the Washington metro area, particularly considering the proximity of the Potomac River to the project site. For these reasons, and to consider preliminary pricing schemes, we suggest that a mat foundation be considered the most feasible foundation type for two below-grade levels at this time. As stated above, additional exploration will be needed in the vicinity of Boring B-5 to confirm the permissible allowable bearing pressures.

Drilled Shaft (Caisson) Foundations – No Basement Levels

Belled or straight drilled shafts may be used to support the proposed buildings. Belled shafts would require slightly deeper embedment to ensure a stable bell geometry. An allowable end bearing pressure of 15 tons per square foot (tsf) is anticipated for caissons bearing in suitable Potomac Group soils at depths below approximately EL. -40 feet to EL. -50 feet.

Considering the N-value data, we have estimated the approximate highest bearing elevations at each boring location for this design. These anticipated bearing elevations are listed in the following table. At some locations, based on our interpretation of the subsurface profile, we have considered what we believe to be key constructability issues and have determined that it may be necessary to extend the caissons through suitable bearing soils to allow for safe belling of the caissons. The suitability of the belling and bearing strata should be verified by ECS, during the final exploration; however, from a preliminary standpoint it appears feasible. Belling feasibility verification in the field should include discussions with the driller, review of the nearby boring data, observations of the auger cuttings and physical testing of the soils encountered.

Table 1

Boring	Estimated Highest Bearing Elevation (ft) for 15 tsf Caissons – Straight Shafts	Estimated Highest Bearing Elevation (ft) for 15 tsf Caissons – Belled Shafts
B-1	EL. -40	EL. -45
B-2	EL. -40	EL. -45
B-3	EL. -40	EL. -45
B-4	EL. -40	EL. -45
B-5	EL. -50	EL. -55
B-6	EL. -50	EL. -55

For caissons supporting column and wall loads, we recommend a minimum caisson shaft diameter of 30 inches in order to allow access for inspection and cleaning. More details on shaft installation will be provided in the final report.

Driven Pile Foundations – No Basement Levels

Driven precast concrete pile foundations are also feasible for building support at this site. We recommend that 12 or 14-inch square pre-cast concrete piles (6 ksi compressive strength) be utilized. Please see Table 2 below for a summary of preliminary pile capacity ranges. Estimated tip elevations have not been provided as part of this preliminary report.

Table 2- Summary of Pile Capacity

Pile Size (Inch)	Allowable Compression (FS= 2.0) Capacity (Tons)	Estimated Design Tip Elevation (ft)
12	90	EL. -55
14	140	EL. -55

Please note the pile capacity ranges provided above are preliminary, and should be revised once the lowest level elevation and column loading information is available. Slightly deeper piles may be required in the vicinity of Borings B-5 and B-6. The lowest level elevation will help to determine what length of piles are feasible and most economical for the project.

The piles should be driven and tested to two times design capacity. Pile driving operations should be monitored continuously by the geotechnical engineer to ensure that the required length and capacity is obtained at each pile location. We recommend that a series of control piles be driven in each building area at permanent pile locations prior to ordering the production piles. The control piles will need to be driven to both confirm the usable capacity, lengths, and to outline the criteria for installing the production piles. We recommend that the hammer used to drive both production and control (test) piles be capable of achieving to a design tip elevation of at least EL. -55 feet. The minimum ram weight should be on the order of 8 to 12 kips, depending on the size and length of the piles. Predrilling may be required to advance the piles through the Stratum II soils, particularly where gravel soils exist. This topic will be further discussed in the final report.

Piles should be driven to the design tip elevations provided in the test pile program. Piles may be acceptable if terminated above the design tip elevation provided that the geotechnical engineer reviews the driving record and compares it with the test pile results. <u>An acceptable terminating blow count criteria will be established during the test pile program; however, the contractor should fully anticipate that the piles will need to be driven to the design tip elevations regardless of blow count or opinions of "hard driving"</u>.

The hammer type and size used for the test pile program should be identical to the hammer type and size used for production piles. The appropriate hammer size and type to be used for pile driving operations should be selected on the basis of wave equation analyses, prior to mobilization to the site. Any hammer approved by the GER's review of the wave equation analysis may be used, provided the test pile results and subsequent PDA test data correspond well with the preliminary wave equation analyses. The hammer must be capable of installing the piles to the design tip elevations, without overstressing the piles in tension or compression during driving. If the contractor selects a single acting diesel hammer, a stroke stick must be supplied so that the hammer stroke can be observed. If a double acting diesel hammer is selected, a bounce chamber pressure gauge should be on site at all times so that the bounce chamber pressure can be observed at random by the pile driving inspector. Based on the loads of the piles and the objectives of the test pile program, we do <u>not</u> recommend utilizing a double-acting diesel hammer.

We do not recommend the use of multiple hammers during the test pile or production program, unless they are validated by proper dynamic tests with the PDA. Based on our review of subsurface conditions, we believe that a single-acting air, steam, or hydraulic hammer would be the most appropriate hammer for the pre-cast, pre-stressed concrete piles. However, other hammer types are certainly feasible, depending upon the results of the wave equation analysis.

The wave equation analysis should evaluate the proposed equipment's capability of installing the piles without damaging stresses. For pre-cast, concrete piles, we recommend a minimum concrete compressive strength of 6,000 psi and a minimum effective pre-stress of 700 psi after losses. A concrete mix resistant to corrosion should be used in the pile design. Additional criteria should be established by the structural engineer. For concrete piles, the maximum compressive pile driving stresses should not exceed 0.85 x Concrete compressive strength – prestressing (after losses); and the maximum tensile pile driving stresses should not exceed the prestressing + 3 x (square root of the compressive strength).

The 6 ksi compressive strength must be obtained prior to driving the piles. Since most production piles are driven relatively soon after they are cast (5-14 days), an early strength mix is needed. We suggest a 100% Portland cement mix with appropriate admixtures that achieves 6 ksi strength in 7 days. We do not suggest using non-Portland cementitious materials such as fly ash or slag that generally do not have good early strength characteristics.

The contractor's installation prices should include the cost of using a new pile cushion with every concrete pile installed. More than one pile cushion per pile may be required if the pile cushion compresses more than 25% of its original height or if driving stresses exceed previously determined values.

The piles should be installed at a minimum center to center pile spacing of three times the nominal width of the pile but not less than three feet. Pile heave should be monitored and piles that heave 3/8 inch or more should be re-driven the heave amount plus one additional half-inch (0.5 inch). Initially, pile heave measurements should be taken immediately after each individual pile is driven and after each pile group is completed. If heave measurements indicate heave is not a significant factor, the frequency of the measurements can be reduced or eliminated. Piles should be driven from the interior pile group outwards in a radial fashion, to help limit group densification effects and improve pile installation.

Special care should be taken during the pile driving operations in order to prevent any damage to the surrounding structures. It is our opinion that it will be prudent to perform vibration monitoring at the existing structures adjacent to the site and depending on the observed response during driving, it may be necessary to modify the pile driving procedures. It is also recommended to perform a preconstruction survey on the existing adjacent structures prior to the initiation of pile driving operations.

With other projects in the vicinity, we have observed that the clay, silt and fine sand soils in this vicinity demonstrate a property that is commonly referred to as "soil setup," during and after pile driving operations. All the piles at this site will penetrate into, and in many instances, will be supported by these soils. Because of the fine grain nature of clay soils, water between the individual particles cannot rapidly escape when compressed. During pile driving operations, the dynamic impact of the pile causes a hydraulic effect which essentially reduces the apparent strength of the clay during the driving operations. Once this water pressure has dissipated, these soils will re-adhere to the pile, which is the process of "soil setup."

It is almost impossible to verify that soil setup is occurring during driving operations. In fact, the phenomenon usually takes place after a few hours, to in some instances, many days, following the completion of the driving operations. Hence, we have derived a test pile program that will account to the anticipated amount of soil setup.

Driven Pile Test Program

A test pile program consisting of installing a series of test piles should be installed while being monitored with a Pile Driving Analyzer (PDA) is recommended before production piles are cast. The total of recommended test piles is determined by the geotechnical engineer after preparation of the final report, just prior to the test pile program. The test piles should be driven throughout the building area near our previous boring locations as selected by the GER. At least 48-hours after the piles are initially installed, each test pile should be restruck while being monitored with a Pile Driving Analyzer. The restrike data will be used to evaluate the ultimate pile capacity and subsequent production pile lengths. The PDA data will also be used to evaluate the effectiveness of the contractor's installation equipment and whether or not the driving stresses exceed the maximum values established herein. The test pile program should consist of the following chronological aspects:

1. The pile driving contractor should submit his proposed hammer assembly and at least two Wave Equation Analyses for Piles (WEAP) to the geotechnical engineer for approval prior to mobilizing to the site. The project's longest and shortest piles shall be evaluated. We recommend conducting a drivability study and not a bearing graph analysis to evaluate the hammer's ability to achieve the design tip elevations without overstressing the piles. Maximum compressive and tensile stresses should be indicated, as well as the total number of hammer blows to achieve the design tip elevation and the pile cushion type/thickness.

2. Drive a series test piles with PDA monitoring.

3. After 48 hours, restrike all test piles with PDA monitoring (to evaluate soil setup).

4. Perform CAPWAP analysis on at least one selected blow during restrike activities, preferably one early high energy blow prior to significant pile head movement.

The geotechnical engineer, based on his familiarity with the design of the project, should be retained to conduct the test pile program with respect to the PDA testing and reporting. Once the data is analyzed, production pile lengths and driving criteria can be established.

Floor Slab Design – No Basement Levels

Throughout the proposed building footprint, the slab subgrade will be underlain by existing loose/soft fill soils. These existing loose/soft materials may be problematic with respect to slab support. Based upon our interpretation of the subgrade conditions, two options exist related to slab support.

Option 1

Option 1 consists of constructing a structural slab for the project. The deep foundation elements utilized for building support can be added or designed in a manner to provide adequate support for the slab and reduce the potential for damaging total and differential slab settlements. The Structural Engineer of Record should design the spacing of the deep foundation elements to design the slab as a structural system.

Option 2

As an alternative to using deep foundation elements to support a structural slab, the slab can be supported on an engineered fill layer consisting of a minimum of 24 inches of a select granular fill, such as AASHTO 21-A or an approved recycled concrete, underlain by a geogrid such as a Tensar BX1200, or equivalent. The final elevation of the grid and aggregate should take into consideration the utilities underlying the slab, and ideally, the grid should be placed below any planned utility excavations.

Prior to placing the geogrid and the 24 inches of select material, the exposed subgrade should be undercut 2 feet, moisture-conditioned to near optimum moisture content, and compacted to 95 percent relative compaction in accordance with ASTM D-698. The compacted subgrade should then be proofrolled using a 10 ton single axle dump truck. Any soft or unstable areas should be undercut as directed by the geotechnical engineer and backfilled with suitable compacted fill.

The developer should note that utilizing the geogrid reinforced, engineered fill alternative carries a higher risk for future slab damage due to potentially damaging settlements from the underlying loose/soft soils. Option 2 presents a higher risk of post-construction slab settlement when compared to Option 1. However, both options are anticipated to result in tolerable settlement amounts long term, with the potential for some additional movement in Option 2.

Floor Slab Design – One or Two Basement Levels

If one or two basement levels are considered, it is our anticipation that the overlying Stratum I fill soils will be removed in the process of establishing the design subgrade elevations. As such, the anticipated soils at the slab foundation bearing elevation would consist of slight remnant fill materials, or predominantly granular Stratum II soils. With some potential selective undercutting, more likely for the one below-grade level scheme, slabs can be supported on grade without deep foundation support for either one or two below-grade levels. The minimum slab thickness shall be 4 inches, and the anticipated modulus of subgrade reaction to design the subgrade thickness is 70 kips per cubic foot (kcf). The slab shall be underlain by typical capillary drainage layers 4 to 6 inches thick, or potentially deeper if an underslab subdrainage design is required, and a suitable polyvapor barrier shall be used to reduce the transmission of moisture from the subgrade to the basement level.

Additional Explorations

Additional borings are suggested to complete the study for this project. Specifically, the borings should be targeting the looser/softer soils encountered in the vicinity of Borings B-5 and B-6.

PROJECT CONSTRUCTION

Construction Considerations

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are dug. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1- to 3-inch thick "mud mat" of "lean" concrete be placed on the bearing soils before the placement of reinforcing steel.

In a dry and undisturbed state, the upper 1 foot of the majority of the soil at the site will provide good subgrade support for fill placement and construction operations. However, when wet, this soil will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations which would help maintain the integrity of the soil.

The surface of the site should be kept properly graded in order to enhance drainage of the surface water away from the proposed building areas during the construction phase. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

The surficial soils contain fines which are considered moderately erodible. The Contractor should provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surficial soils. All erosion and sedimentation shall be controlled in accordance with sound engineering practice and current County requirements.

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 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.

Construction Dewatering

Considering an at-grade development, dewatering measures will be needed to be used in order to keep the subgrade and working level material suitable. The dewatering system should be designed to lower the water table a minimum of 3 feet below the lowest foundation excavation level. While a well system may not be required considering an at grade development, dewatering may likely be completed with an aggressive trenching, sump pit and pumping system. A totally dry subgrade should not be anticipated; however, the surface of the subgrade should be sufficiently dewatered to provide an adequate surface on which to construct the foundations. During construction operations, we recommend that the contractor continuously monitor the effect of the dewatering operations to ensure that no fine-grained soil materials are being pumped from the surrounding overburden soils.

If either one or two below-grade basement levels are contemplated, excavations will extend below the permanent groundwater elevation, and significant recharge of groundwater is anticipated based on the proximity to the Potomac River. As such, the construction dewatering scheme is critical for considering one or two below-grade basement levels. The dewatering mechanisms chosen by the contractor shall be capable of lowering the groundwater at least 3 feet below planned foundation bearing elevation subgrades during construction. The volumes of water will be significant and dependent upon the excavation size and depth. Once more details are available with regard to the lowest anticipated bearing elevation and the size of the excavation, ECS can provide anticipated temporary groundwater volumes. Deeper excavations will require more aggressive forms of dewatering. It is our anticipation that a perimeter system of downhole submersible wells extending well below planned excavation limits would be the most suitable form of dewatering for the subject development, supplemented with interior deep wells as the excavation progresses.

Underslab Drainage – One or Two Below-Grade Levels

For any portion of the building with one or two basement levels and conventional shallow foundations are utilized, we do recommend underslab drainage be considered. The use of spread footings is considered a "drained" design. If a mat foundation is considered, underslab subdrainage will not be required for either one or two below-grade basement levels. The project site is in close proximity to the Potomac River and therefore, elevated permanent groundwater is expected. We recommend that any portions of the buildings below grade, or near the seasonal high groundwater table be provided with a perimeter and interior drainage system to prevent the buildup of hydrostatic pressure and seepage of groundwater into the underslab area. The drain system should consist of a perforated, closed joint drain tile located around the perimeter of the building, outside or just inside the building walls and below the lowest floor slab elevation. Both the perimeter and underslab drain lines should be surrounded by a minimum of 6 inches of approved, free draining granular filter material, having a gradation compatible with the size of the openings of the drain lines and the soils to be retained. The perimeter drain and filter material may be substituted by a geosynthetic composite drain material.

We recommend that the underslab drainage system consist of 4-inch diameter slotted or perforated drain lines spaced at approximately 30 feet on center. The drain lines should slope slightly to regional sump pit locations that form the permanent dewatering system for the building. The capillary cutoff layer and underslab dewatering system should consist of a minimum of 10 inches of gravel having a maximum size of 1.5 inches and a maximum of 2% of fines passing the No. 200 sieve. Cleanouts should also be provided at every other right angle bend and at about every 100 feet of pipe length in order to permit periodic flushing of the drainage system lines.

Once a final subgrade elevation is determined, ECS will recommend a design pumping volume. The recommended sump pit capacity is primarily required to handle initial dewatering upon shut down of the construction dewatering system, perched groundwater conditions, as well as seasonal fluctuations in the deeper groundwater table elevations. Typically, once the water levels have stabilized under the new drainage conditions, discharge quantities are less than those initially required during dewatering system shut down. The actual flow for the site will vary based primarily on the type of subsurface materials, the depth to the restrictive drainage layer, and long-term groundwater levels.

Where the garage floor slab elevation changes within the structure, perimeter drain lines should also be installed on the uphill side of the retaining wall. The granular materials should also be hydraulically connected to the underslab drainage stone of the upper and lower floor slab, as depicted on the Zone of Influence Diagram included in the Appendix. This hydraulic connection is necessary to remove any water which may infiltrate into the uphill underslab.

Seismic Design Considerations

The subsurface exploration completed at this site included the drilling of borings to maximum depths on the order of 83.3 feet below existing site grades. The International Building Code (IBC) 2003 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 shear wave velocity in the upper 100 feet of the soil profile are presented in Table 1615.1.1 of the 2003 IBC Code and in the table below.

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (feet/s)
A	Hard Rock	Vs > 5,000 fps
B	Rock	2,500 < Vs ≤5,000 fps
C	Very dense soil and soft rock	1,200 < Vs ≤2,500 fps
D	Stiff Soil Profile	600 ≤Vs ≤1,200 fps
E	Soft Soil Profile	Vs < 600 fps

Considering the soil profile encountered at this site, we recommend a seismic site classification of Site Class D.

Closing

This report has been prepared in order to aid in the preliminary evaluation of this project. The report scope is preliminary in nature limited to the specific project and location described herein. The recommendations and discussion provided in this enclosed report are for planning purposes and should be used in conjunction with the final geotechnical study, which should be performed once the final layout and development details are determined.

Appendix

APPENDIX

Unified Soil Classification System

Reference Notes for Boring Logs

Boring Logs B-1 through B-6

Laboratory Testing Summary

Plasticity Chart

Grain Size Analysis

Lateral Earth Pressure Diagrams (2)

Zone of Influence Diagram

French Drain Installation Procedure

Below-Grade Wall Waterproofing and Underslab Subdrainage Details (for Shallow Foundations)

Boring Location Diagram/Vicinity Map

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

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

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

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density-Sands, Silts

SPT-N (bpf)	Relative Density
0 – 5	Very Loose
6 – 10	Loose
11 – 30	Medium Dense
31 – 50	Dense
51+	Very Dense

Consistency of Cohesive Soils

SPT-N (bpf)	Consistency	Unconfined Compressive Strength, Qp, tsf
0 – 3	Very Soft	Under 0.25
4 – 5	Soft	0.25 - 0.49
6 – 10	Medium Stiff	0.50 - 0.99
11 – 15	Stiff	1.00 - 1.99
16 – 30	Very Stiff	2.00 - 3.99
31 – 50	Hard	4.00 - 8.00
51+	Very Hard	Over 8.00

Weathered Rock (WR) may be defined as SPT-N values exceeding 100 bpf depending on site specific conditions. Refer carefully to boring logs.

Rock Fragments, gravel, cobbles, boulders, or debris may produce N-values that are not representative of actual soil properties.

III. Unified Soil Classification Symbols:

GP – Poorly Graded Gravel
GW – Well Graded Gravel
GM – Silty Gravel
GC – Clayey Gravels
SP – Poorly Graded Sands
SW – Well Graded Sands
SM – Silty Sands
SC – Clayey Sands

ML – Low Plasticity Silts
MH – High Plasticity Silts
CL – Low Plasticity Clays
CH – High Plasticity Clays
OL – Low Plasticity Organics
OH – High Plasticity Organics
CL-ML – Dual Classification (Typical)

IV. Water Level Measurement Symbols:

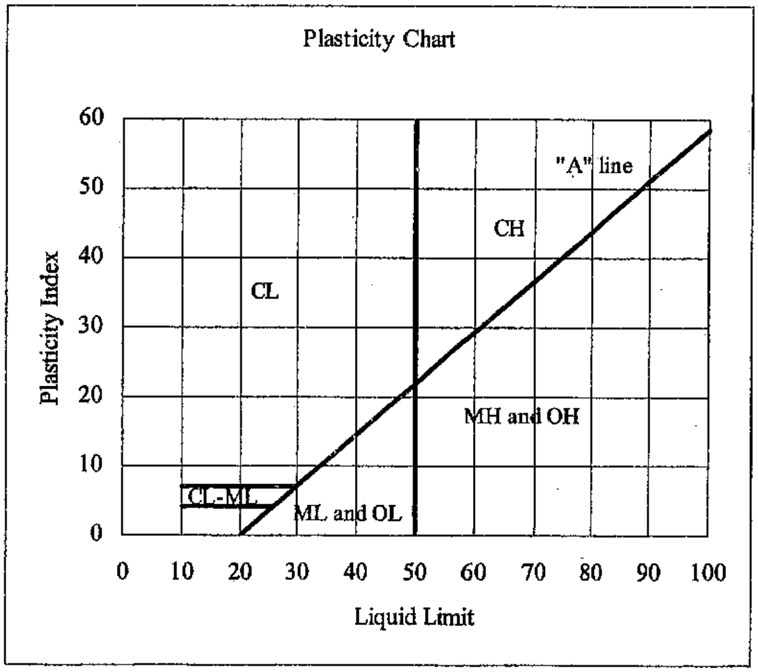
WL - Water Level
WS - While Sampling
WD - While Drilling

BCR – Before Casing Removal
ACR – After Casing Removal
WCI – Wet Cave In
DCI – Dry Cave In

The water levels are those water levels actually measured in the bore hole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clays 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 required.

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)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentage 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; 5 to 12 percent Borderline cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4 $C_c = (D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a]	d	Silty gravels, gravel-sand mixtures		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
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6 $C_c = (D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount o fines)	SM[a]	d	Silty sands, sand-silt mixtures		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
				u				
			SC		Clayey sands, sand-clay mixtures		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	Plasticity Chart		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy 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			



[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 Winterkorn and Fang, 1975.

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-1	1 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

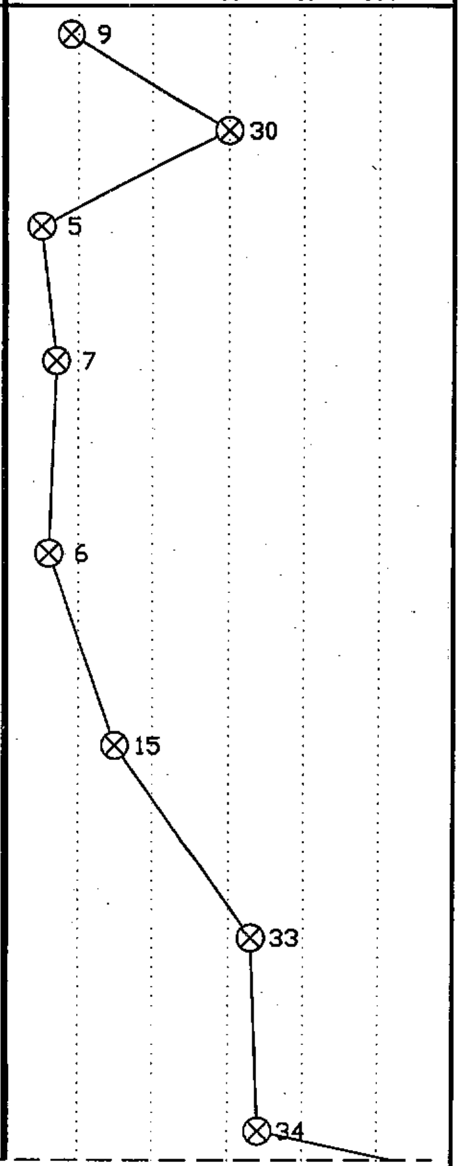
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION: 11.80

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0	1	SS	18	18	Concrete Depth 12"		
					Gravel Depth 4"		10
	2	SS	18	18	Sandy SILT, Some Clay, Trace Brick and Asphalt, Dark Gray, Moist, Very Loose to Medium Dense, (FILL)		
5	3	SS	18	14			5
	4	SS	18	10		∇	
10							0
	5	SS	18	16	SILT, With Fine Sand, Trace Clay and Mica, Brown to Purplish Brown, Moist, Loose to Medium Dense, (ML)		
15							−5
	6	SS	18	18			
20					No Recovery		−10
	7	SS	18	0			
25					Silty SAND, With Gravel, Trace Quartz, Brown, Moist to Wet, Dense, (SM)		−15
	8	SS	18	12			
30							



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

∇WL 8.5' WS OR WD	BORING STARTED 12/19/2007	
∇WL(BCR) N/A ∇WL(ACR) N/A	BORING COMPLETED 12/19/2007	CAVE IN DEPTH ● 17.0'
∇WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

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dmdan(01/03/2008)

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-1	2 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY — RQD% — REC.% — 20% 40% 60% 80% 100%

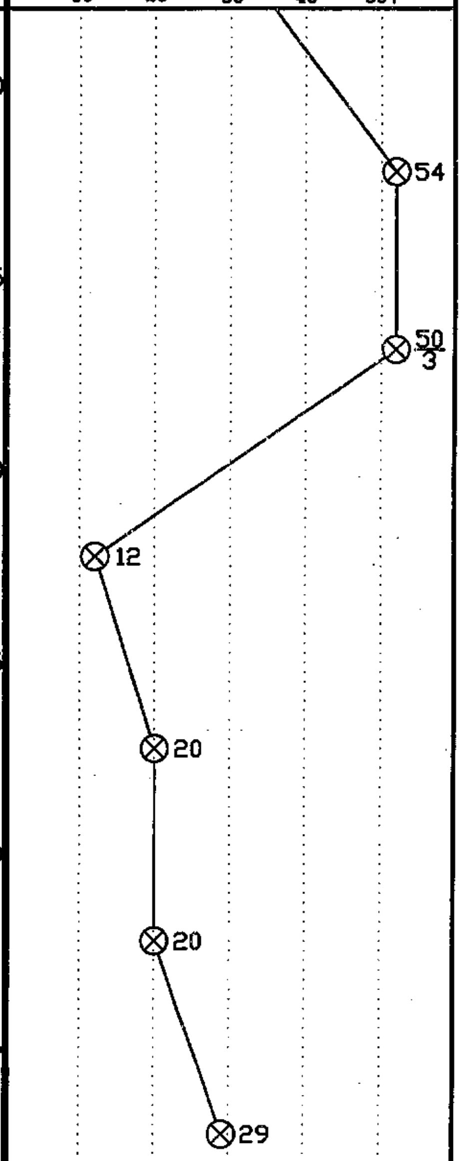
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 11.80

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
30					Silty SAND, With Gravel, Trace Quartz, Brown, Moist to Wet, Dense, (SM)	
					GRAVEL, Trace Silty Sand, Gray, Wet, Very Dense, (GP)	-20
35	9	SS	18	1		
					Silty SAND, With Gravel, Dark Gray, Wet, Very Dense, (SM)	-25
40	10	SS	9	2		
					Marine CLAY, Trace Fine Sand and Gravel, Dark Purplish Brown, Moist to Wet, Medium Dense, (CH)	-30
45	11	SS	18	3		
						-35
50	12	SS	18	3		
						-40
55	13	SS	18	3		
						-45
60	14	SS	18	18		



END OF BORING @ 60.00'

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

▽WL 8.5' WS OR WD	BORING STARTED 12/19/2007	
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 12/19/2007	CAVE IN DEPTH ● 17.0'
▽WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

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CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-2	1 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

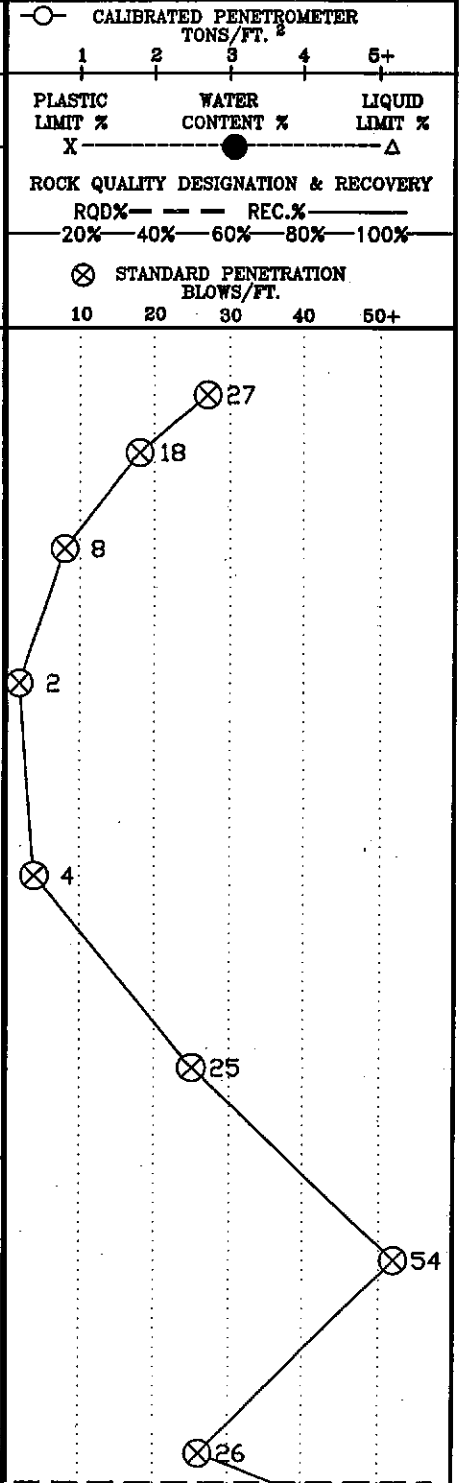
SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 11.80

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0					Concrete Depth 12"	
	1	SS	18	18	Gravel Depth 6"	10
	2	SS	18	14	Silty SAND, Trace CLAY, Gravel, Quartz and Organics, Dark Gray to Brown, Moist, Medium Dense, (FILL)	
5	3	SS	18	16		
					CLAY, Trace Fine Sand and Silt, Brown, Moist, Medium Stiff, (CL)	5
	4	SS	18	18	Clayey SILT, Trace Fine Sand, Dull Brown, Moist to Wet, Very Loose, (ML)	
10						0
15	5	SS	18	18		
					Silty SAND, With Gravel, Dark Gray, Moist to Wet, Medium Dense to Dense, (SM)	-5
20	6	SS	18	18		-10
25	7	SS	18	14		-15
					GRAVEL, Some Silty Sand, Brown, Wet, Medium Dense to Dense, (GW)	
30	8	SS	18	14		



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

WL 8.5' WS OR WD	BORING STARTED 12/20/2007		
WL(BCR) N/A WL(ACR) N/A	BORING COMPLETED 12/20/2007	CAVE IN DEPTH N/A	
WL 27.9' @ 7DAYS	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

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CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-2	2 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% —— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 11.80

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
30					GRAVEL, Some Silty Sand, Brown, Wet, Medium Dense to Dense, (GW)	-20	
35	9	SS	18	8		-25	36
40	10	SS	18	10		-30	42
					Silty CLAY, Trace Fine Sand, Brown, Moist, Very Stiff, (CL)		
45	11	SS	18	14		-35	21
50	12	SS	18	16		-40	25
55	13	SS	18	10		-45	28
					Marine CLAY, Grayish Brown, Moist, Very Stiff, (CH)		
60	14	SS	18	18			22

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

WL 8.5' WS OR WD	BORING STARTED 12/20/2007	
WL(BCR) N/A WL(ACR) N/A	BORING COMPLETED 12/20/2007	CAVE IN DEPTH N/A
WL 27.9' @ 7DAYS	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-2	3 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

—O— CALIBRATED PENETROMETER TONS/FT.^{2}: 1 2 3 4 5+

PLASTIC LIMIT % X —— WATER CONTENT % ● —— LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 11.80

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
60					Marine CLAY, Grayish Brown, Moist, Very Stiff, (CH)	-50	
65	15	SS	18	18		-55	23
70	16	SS	18	18		-60	21
75	17	SS	18	18		-65	21
80	18	SS	18	18			26
					END OF BORING @ 80.00'	-70	
85						-75	
90							

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

WL 8.5' WS OR WD	BORING STARTED 12/20/2007		
WL(BCR) N/A WL(ACR) N/A	BORING COMPLETED 12/20/2007	CAVE IN DEPTH ● N/A	
WL 27.9' @ 7DAYS	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

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CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-3	1 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% —— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.00

SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	STANDARD PENETRATION BLOWS/FT.
1	SS	18	16	7
2	SS	18	16	15
3	SS	18	10	9
4	SS	18	18	5
5	SS	18	16	20
6	SS	18	18	22
7	SS	18	14	39
8	SS	18	12	37

Depth (FT) 0 to 30; Elevation (FT) 5 to -20.

Concrete Depth 12"

Sandy SILT, With Clay, Brown and Dark Gray, Moist, Loose to Medium Dense, (FILL)

Silty SAND, Trace Gravel, Brown, Moist to Wet, Medium Dense, (SM)

GRAVEL, With Silty Sand, Brown, Moist to Wet, Dense to Very Dense, (GW)

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

▽WL 14.0' WS OR WD	BORING STARTED 12/26/2007		
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 12/26/2007	CAVE IN DEPTH ● N/A	
▽WL	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-3	2 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

PLASTIC LIMIT % X —— WATER CONTENT % ● —— LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% —— 20% 40% 60% 80% 100%

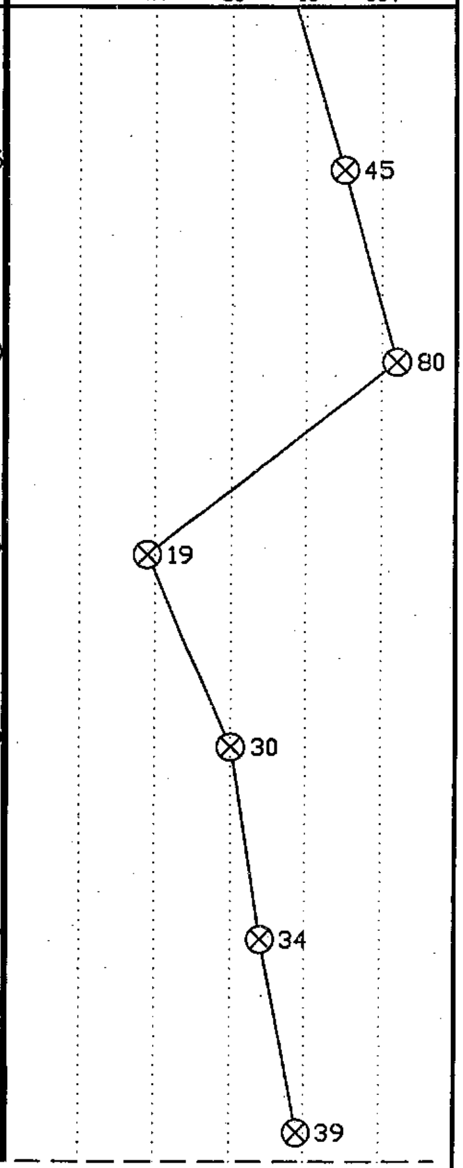
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.00

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
30					GRAVEL, With Silty Sand, Brown, Moist to Wet, Dense to Very Dense, (GW)	
	9	SS	18	12		-25
35						
	10	SS	18	14		-30
40						
					Marine CLAY, Reddish Brown and Gray, Moist, Very Stiff, (CH)	
	11	SS	18	16		-35
45						
	12	SS	18	14		-40
50						
	13	SS	18	16		-45
55						
	14	SS	18	16		-50
60						



END OF BORING @ 60.00'

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

▽WL 14.0' WS OR WD	BORING STARTED 12/26/2007	
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 12/26/2007	CAVE IN DEPTH @ N/A
▽WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

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PA (01-09-08) RC (01-10-08) RC (01-29-08)

aflanders(01/04/2008)

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-4	1 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME	ARCHITECT-ENGINEER
ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT	

SITE LOCATION
ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.^{2} 1 2 3 4 5+

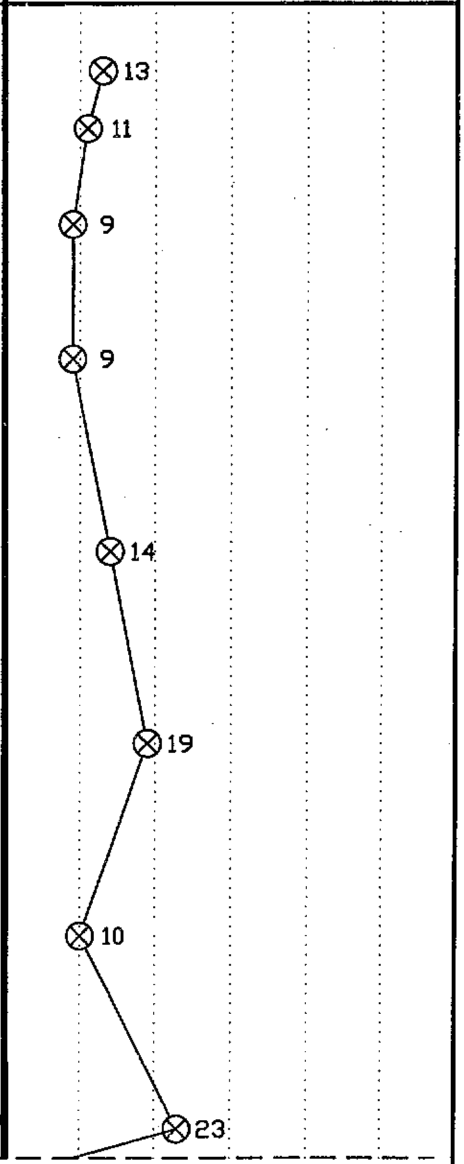
PLASTIC LIMIT % X —— WATER CONTENT % ● —— LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% —— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS
BOTTOM OF CASING — LOSS OF CIRCULATION 100%
SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Concrete Depth 12"		
	1	SS	18	14	Silty SAND, With Gravel, Concrete, Brick and Roots, Trace Clay, Brown to Tannish Brown, Moist to Wet, Loose to Medium Dense, (FILL)		13
	2	SS	18	10		5	11
5	3	SS	18	12			9
	4	SS	18	10		0	9
10							
	5	SS	18	12	Silty SAND, With Gravel, Brown, Moist to Wet, Medium Dense, (SM)	-5	14
15							
	6	SS	18	18		-10	19
20							
	7	SS	18	16		-15	10
25							
	8	SS	18	18		-20	23
30							



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

WL 8.5' WS OR WD	BORING STARTED 12/27/2007		
WL(BCR) N/A WL(ACR) N/A	BORING COMPLETED 12/27/2007	CAVE IN DEPTH @ N/A	
WL 3.5' @ 7DAYS	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-4	2 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% —— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
30					Silty SAND, With Gravel, Brown, Moist to Wet, Medium Dense, (SM)		
					Marine CLAY, Trace Sand, Reddish Brown and Gray, Moist, Very Stiff to Hard, (CH)		
	9	SS	18	9		-25	9
35							
	10	SS	18	18		-30	18
40							
	11	SS	18	18		-35	16
45							
	12	SS	18	18		-40	24
50							
	13	SS	18	18		-45	29
55							
	14	SS	18	13		-50	27
60							

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

▽WL 8.5' WS OR (WD)	BORING STARTED 12/27/2007		
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 12/27/2007	CAVE IN DEPTH @ N/A	
▽WL 3.5' @ 7DAYS	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-4	3 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
60					Marine CLAY, Trace Sand, Reddish Brown and Gray, Moist, Very Stiff to Hard, (CH)		
	15	SS	18	16		-55	28
65							
	16	SS	18	17		-60	32
70							
	17	SS	18	16		-65	37
75							
	18	SS	18	18		-70	42
80					END OF BORING @ 80.00'		
						-75	
85							
						-80	
90							

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

WL 8.5' WS OR WD	BORING STARTED 12/27/2007	
WL(BCR) N/A WL(ACR) N/A	BORING COMPLETED 12/27/2007	CAVE IN DEPTH @ N/A
WL 3.5' @ 7DAYS	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-5	1 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

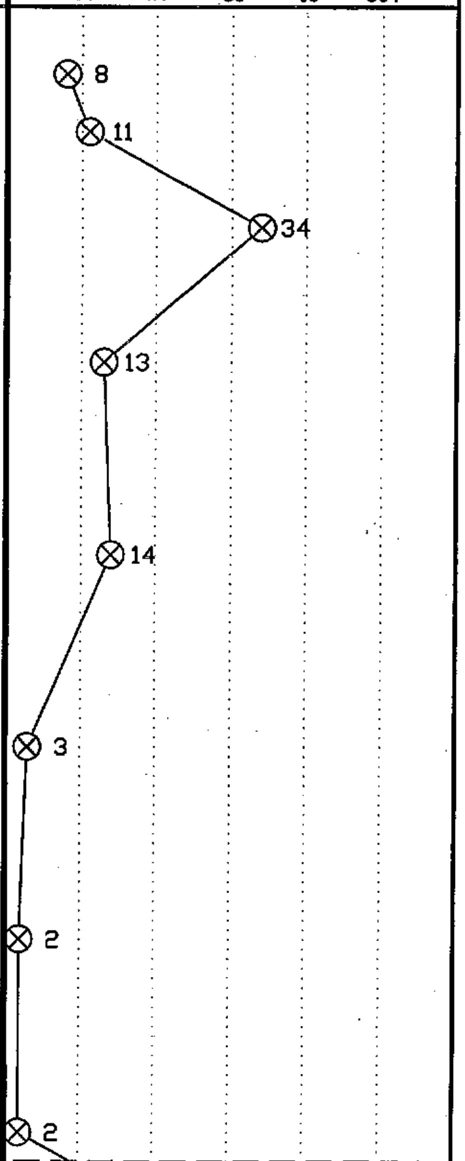
DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0					Concrete Depth 12"
	1	SS	18	5	Silty SAND, With Gravel, Concrete, Brick and Wood, Trace Clay, Brown, Moist, Loose to Medium Dense, (FILL)
	2	SS	18	12	
5	3	SS	18	18	
10	4	SS	18	12	
15	5	SS	18	14	
					No Recovery
20	6	SS	18	0	
25	7	SS	18	0	
					Silty SAND, Trace Gravel, Dark Brown to Purplish Brown, Moist to Wet, Very Loose to Loose, (SM)
30	8	SS	18	6	

WATER LEVELS / ELEVATION (FT): 5, 0, -5, -10, -15, -20



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

∇WL 8.5' WS OR WD	BORING STARTED 1/2/2008		
▼WL(BCR) N/A ▼WL(ACR) N/A	BORING COMPLETED 1/2/2008	CAVE IN DEPTH ● N/A	
∇WL	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

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CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-5	2 OF 2

ECS LLC MID-ATLANTIC

PROJECT NAME	ARCHITECT-ENGINEER
ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT	

SITE LOCATION
ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.[2] 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% —— 20% 40% 60% 80% 100%

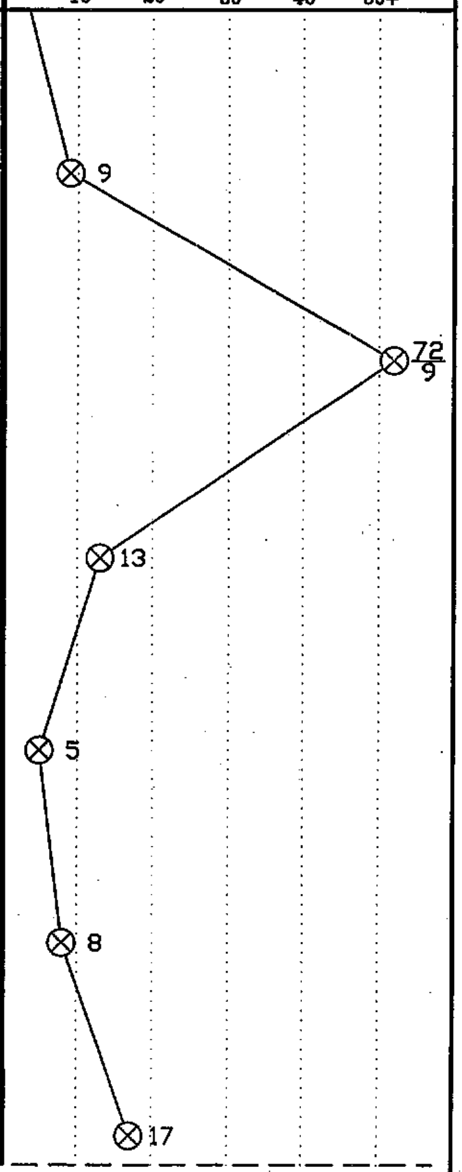
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
30					Silty SAND, Trace Gravel, Dark Brown to Purplish Brown, Moist to Wet, Very Loose to Loose, (SM)			
35	9	SS	18	16			-25	9
40	10	SS	15	1	GRAVEL, With Silty Sand, Dark Brown, Wet, Very Dense, (GP)		-30	72/9
45	11	SS	18	16	Sandy CLAY, Brown and Gray, Moist to Wet, Stiff, (CL)		-35	13
50	12	SS	18	16			-40	5
55	13	SS	18	16			-45	8
60	14	SS	18	18	Marine CLAY, Trace Rock Fragment, Reddish Brown and Gray, Moist, Very Stiff, (CH)		-50	17



END OF BORING @ 60.00'

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

▽WL 8.5' WS OR WD	BORING STARTED 1/2/2008	
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 1/2/2008	CAVE IN DEPTH ● N/A
▽WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

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afanders(01/04/2006)

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-6	1 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

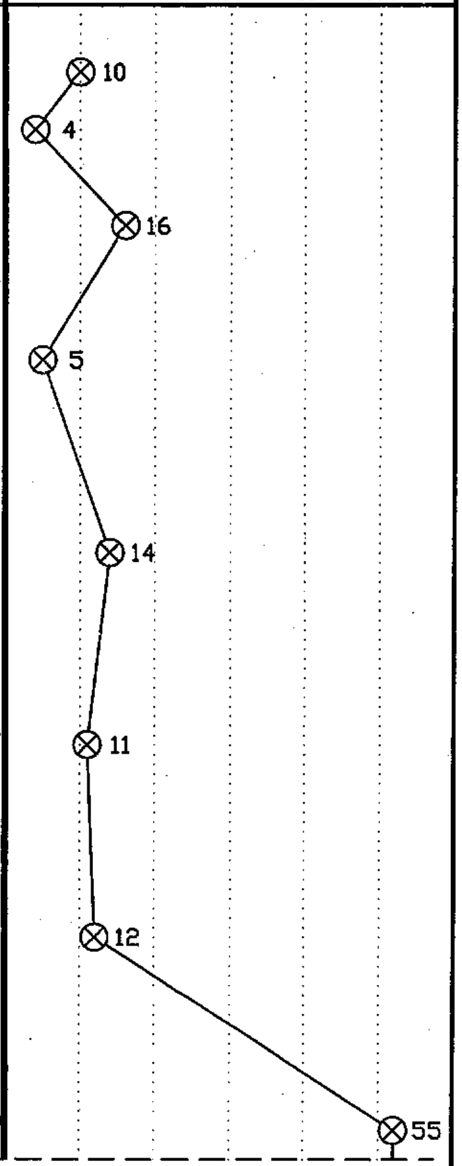
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Concrete Depth 12"			
	1	SS	18	8	Silty SAND, With Gravel and Brick, Brown to Purplish Brown, Moist, Loose to Medium Dense, (FILL)			10
	2	SS	18	8				4
5						▽	5	
	3	SS	18	18				16
	4	SS	18	18			0	5
10								
					Silty SAND, Trace Gravel, Dark Brown, Moist to Wet, Medium Dense, (SM)			
15	5	SS	18	12			-5	14
20	6	SS	18	14			-10	11
25	7	SS	18	12			-15	12
					Silty SAND, With Gravel, Dark Brown, Moist, Medium Dense to Very Dense, (SM)			
30	8	SS	18	14			-20	55



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

▽ WL 5.0' WS OR WD	BORING STARTED 12/28/2007	
▼ WL(BCR) N/A ▼ WL(ACR) N/A	BORING COMPLETED 12/28/2007	CAVE IN DEPTH @ 14.0'
▽ WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

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PA (01-09-08) RC (01-10-08) RC (01-29-08)

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CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-6	2 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

-O- CALIBRATED PENETROMETER TONS/FT.²: 1 2 3 4 5+

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ

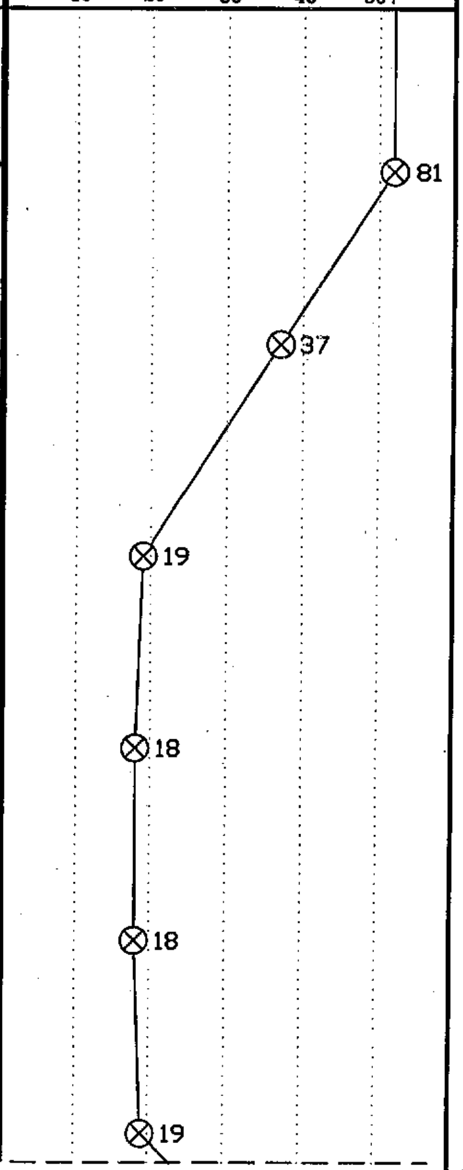
ROCK QUALITY DESIGNATION & RECOVERY: RQD% — — — REC.% ——— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50+

SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
				Silty SAND, With Gravel, Dark Brown, Moist, Medium Dense to Very Dense, (SM)	
9	SS	18	14		81
10	SS	18	16		37
11	SS	18	16		19
				Marine CLAY, Trace Sand, Reddish Brown and Gray, Moist, Very Stiff, (CH)	
12	SS	18	16		18
13	SS	18	18		18
14	SS	18	18		19

DEPTH (FT): 30, 35, 40, 45, 50, 55, 60

ELEVATION (FT): -25, -30, -35, -40, -45, -50



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

▽WL 5.0' WS OR WD	BORING STARTED 12/28/2007		
▽WL(BCR) N/A ▽WL(ACR) N/A	BORING COMPLETED 12/28/2007	CAVE IN DEPTH @ 14.0'	
▽WL	RIG T-1	FOREMAN CONNELLY	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
GRAHAM COMPANIES, LTD	13983	B-6	3 OF 3

ECS LLC MID-ATLANTIC

PROJECT NAME: ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT

ARCHITECT-ENGINEER:

SITE LOCATION: ALEXANDRIA, VIRGINIA (500 N. UNION STREET)

-O- CALIBRATED PENETROMETER TONS/FT.^{2} 1 2 3 4 5+

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

ROCK QUALITY DESIGNATION & RECOVERY RQD% — — — REC.% —— 20% 40% 60% 80% 100%

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 9.20

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
60					Marine CLAY, Trace Sand, Reddish Brown and Gray, Moist, Very Stiff, (CH)		
65	15	SS	18	16		-55	23
70	16	SS	18	16		-60	23
75	17	SS	18	16		-65	24
80	18	SS	18	16		-70	26
85					END OF BORING @ 80.00'	-75	
90						-80	

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

▽WL 5.0' WS OR WD	BORING STARTED 12/28/2007	
▼WL(BCR) N/A ▼WL(ACR) N/A	BORING COMPLETED 12/28/2007	CAVE IN DEPTH ● 14.0'
▽WL	RIG T-1 FOREMAN CONNELLY	DRILLING METHOD HSA

Engineering Consulting Services Mid-Atlantic, LLC

Chantilly, Virginia

Laboratory Testing Summary

Completed Date: 1/10/08

Project Number: 13983 **Project Name: Robinson Terminal @ Alexandria Waterfront**

Project Engineer: DSM **Principal Engineer: SSS** **Summary By: HNT1**

Boring Number	Sample Number	Depth (feet)	Moisture Content (%)	USCS	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction Maximum Density (pcf)	Compaction Optimum Moisture (%)	CBR Value	Other
B-1	S-1	0 - 1.5	13.4									
B-1	S-2	2.5 -4.0	17.6									
B-1	S-3	5.0 - 6.5	18.9									
B-1	S-4	8.5 - 10.0	18.7									
B-1	S-5	13.5 - 15.0	20.8									
B-1	S-6	18.5 - 20.0	23.0									
B-1	S-7	23.5 - 25.0										
B-1	S-8	28.5 - 30.0	15.8									
B-1	S-9	33.5 - 35.0	10.4									
B-1	S-10	38.5 - 40.0	10.4									
B-1	S-11	43.5 - 45.0	34.7									
B-1	S-12	48.5 - 50.0	40.5									
B-1	S-13	53.5 - 55.0	38.2									
B-1	S-14	58.5 - 60.0	43.3	CH	81	28	53	86.3				
B-2	S-5	13.5 - 15.0	16.6									
B-4	S-1	0 - 1.5	8.7									
B-4	S-2	2.5 -4.0	9.0									
B-4	S-3	5.0 - 6.5	8.6									
B-4	S-4	8.5 - 10.0	28.1									
B-4	S-5	13.5 - 15.0	27.8									
B-4	S-6	18.5 - 20.0	26.8									

Summary Key:

SA = See Attached
S = Standard Proctor
M= Modified Proctor
V = Virginia Test Method
OC = Organic Content

Hyd = Hydrometer
Con = Consolidation
DS = Direct Shear
GS = Specific Gravity

UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
LS = Lime Stabilization
CS = Cement Stabilization

NP = Non Plastic

Engineering Consulting Services Mid-Atlantic, LLC
Chantilly, Virginia
Laboratory Testing Summary

Completed Date: 1/10/08

Project Number: 13983 **Project Name:** Robinson Terminal @ Alexandria Waterfront

Project Engineer: DSM **Principal Engineer:** SSS **Summary By:** HNT1

Boring Number	Sample Number	Depth (feet)	Moisture Content (%)	USCS	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Compaction Maximum Density (pcf)	Compaction Optimum Moisture (%)	CBR Value	Other
B-4	S-7	23.5 - 25.0	19.9									
B-4	S-8	28.5 - 30.0	8.1									
B-4	S-9	33.5 - 35.0	26.2									
B-4	S-10	38.5 - 40.0	32.4									
B-4	S-11	43.5 - 45.0	31.9									
B-4	S-12	48.5 - 50.0	34.5									
B-4	S-13	53.5 - 55.0	27.0									
B-4	S-14	58.5 - 60.0	29.2									
B-4	S-15	63.5 - 65.0	29.9									
B-4	S-16	68.5 - 70.0	29.1									
B-4	S-17	73.5 - 75.0	29.9									
B-4	S-18	78.5 - 80.0	26.5									
B-6	S-13	53.5 - 55.0	31.7	CH	102	27	75	99.4				

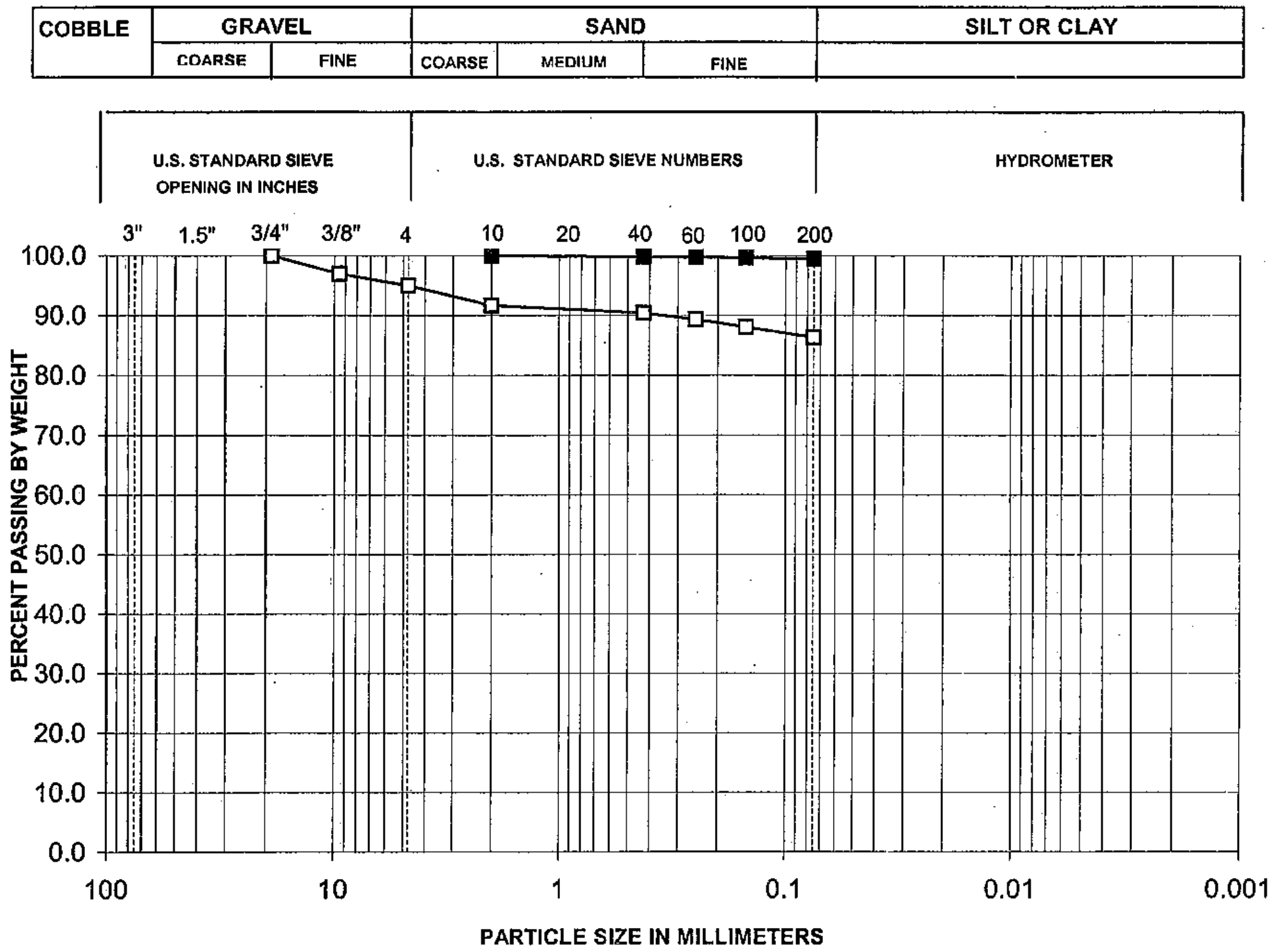
Summary Key:

SA = See Attached
S = Standard Proctor
M= Modified Proctor
V = Virginia Test Method
OC = Organic Content

Hyd = Hydrometer
Con = Consolidation
DS = Direct Shear
GS = Specific Gravity

UCS = Unconfined Compression Soil
UCR = Unconfined Compression Rock
LS = Lime Stabilization
CS = Cement Stabilization

NP = Non Plastic



Boring/ Sample No.	Depth (feet)	Symbol	LL	PI	Description
B-1 S-14	58.5-60.0	□	81	53	Fat Clay Yellowish Brown (CH)
B-6 S-13	53.5-55.00	■	102	75	Fat Clay Yellowish Brown (CH)
		△			
		▲			

Applicable ASTM: D-422

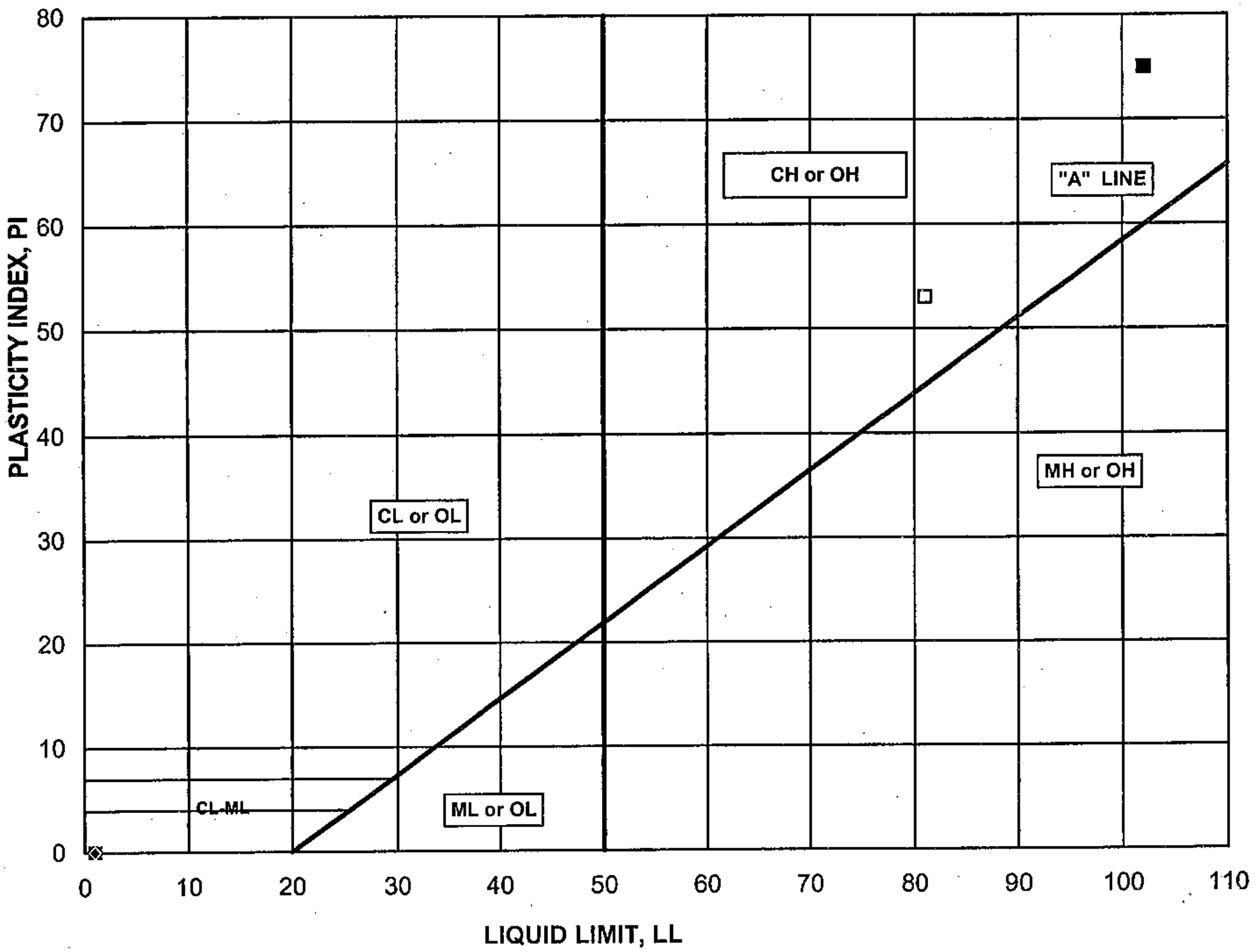
Project: Robinson Terminal @ Alexandria Waterfron

Project No: 13983

Performed Date: 1/9/08

ECS MID-ATLANTIC, LLC
Chantilly, Virginia

Grain Size Analysis



BORING/ SAMPLE No.	DEPTH (feet)	TEST SYMBOL	DESCRIPTION	WATER CONTENT (%)	LL	PL	PI
B-1 / S-14	58.5-60.0	□	Fat Clay Yellowish Bown (CH)	43.3	81	28	53
B-6 / S-13	53.5-55.0	■	Fat Clay Yellowish Bown (CH)	31.7	102	27	75
/		△			-	-	-
/		▲			-	-	-
/		X			-	-	-
/		○			-	-	-
/		●			-	-	-
/		◇			-	-	-
/		◆			-	-	-
/		+			-	-	-
		X					

Applicable ASTM: D-4318

Project: Robinson Terminal @ Alexandria Waterfront

Project No.: 13983

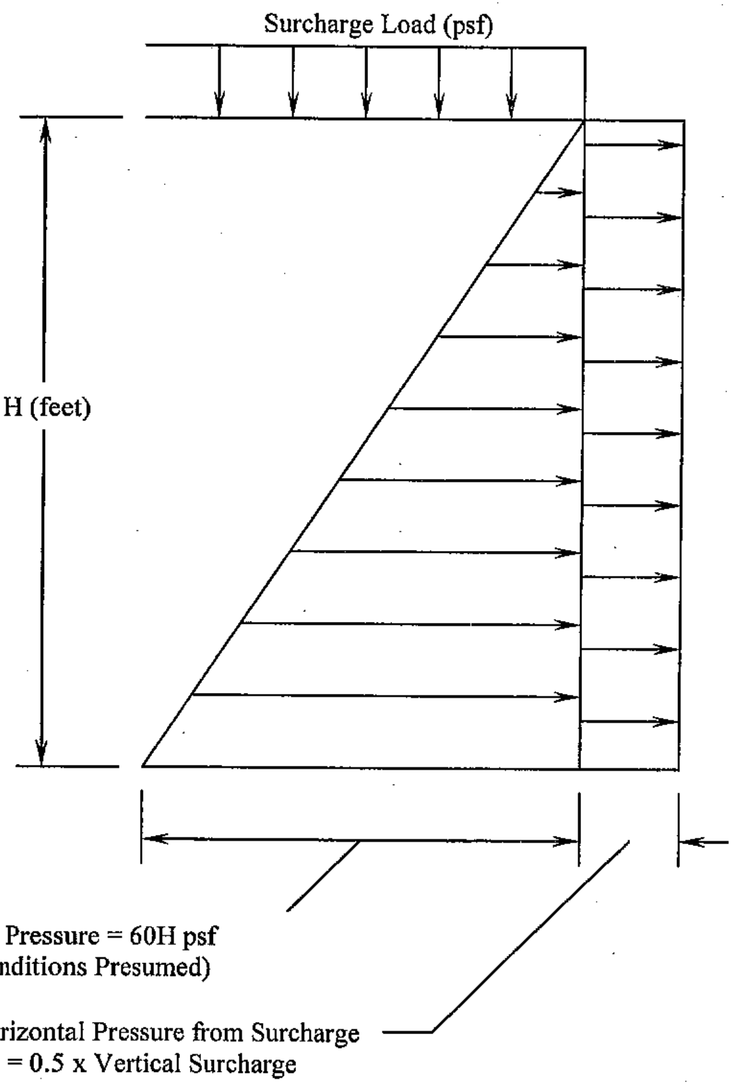
Performed Date: 01/07/2008

ECS-Mid-Atlantic, LLC

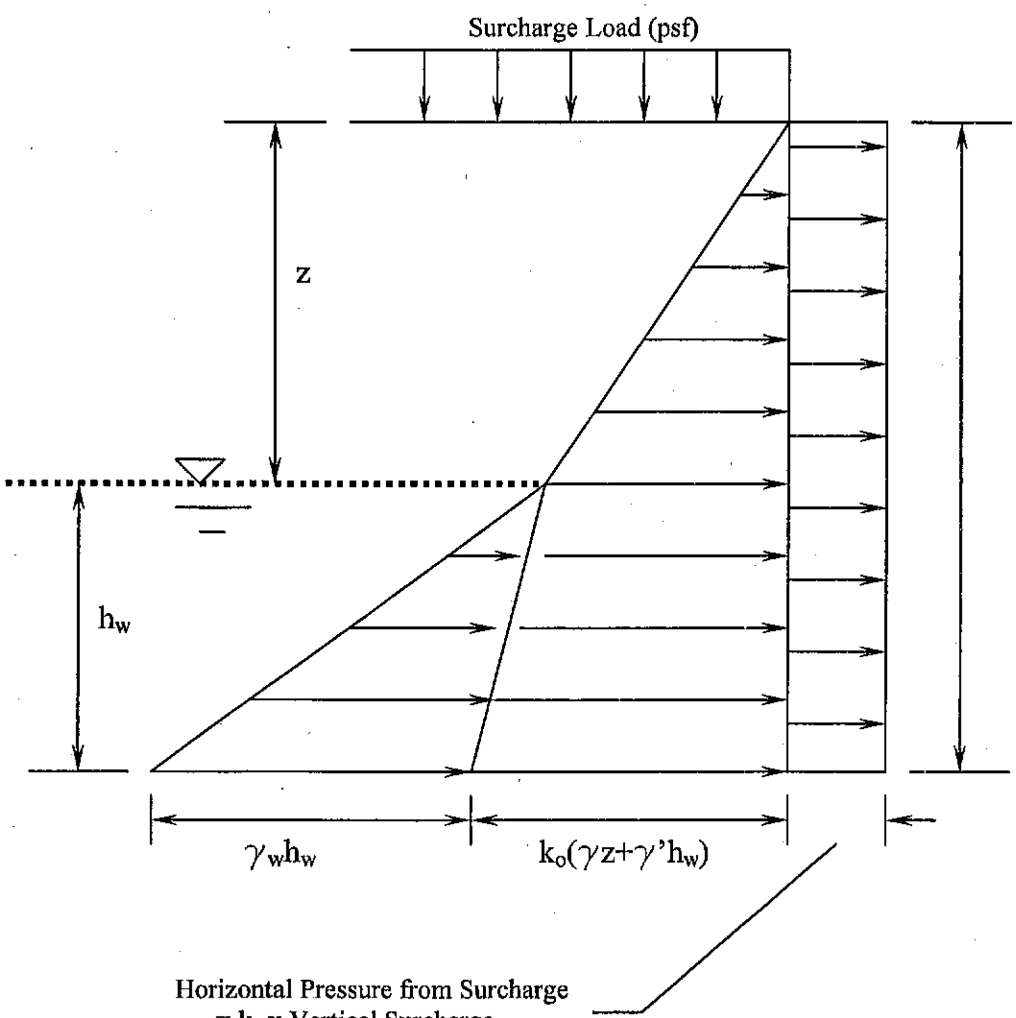
Chantilly, Virginia

Plasticity Chart

111167M.xls



LATERAL EARTH PRESSURE DIAGRAM – FOR USE WITH A SHALLOW, SPREAD FOOTING FOUNDATION (A DRAINED DESIGN)

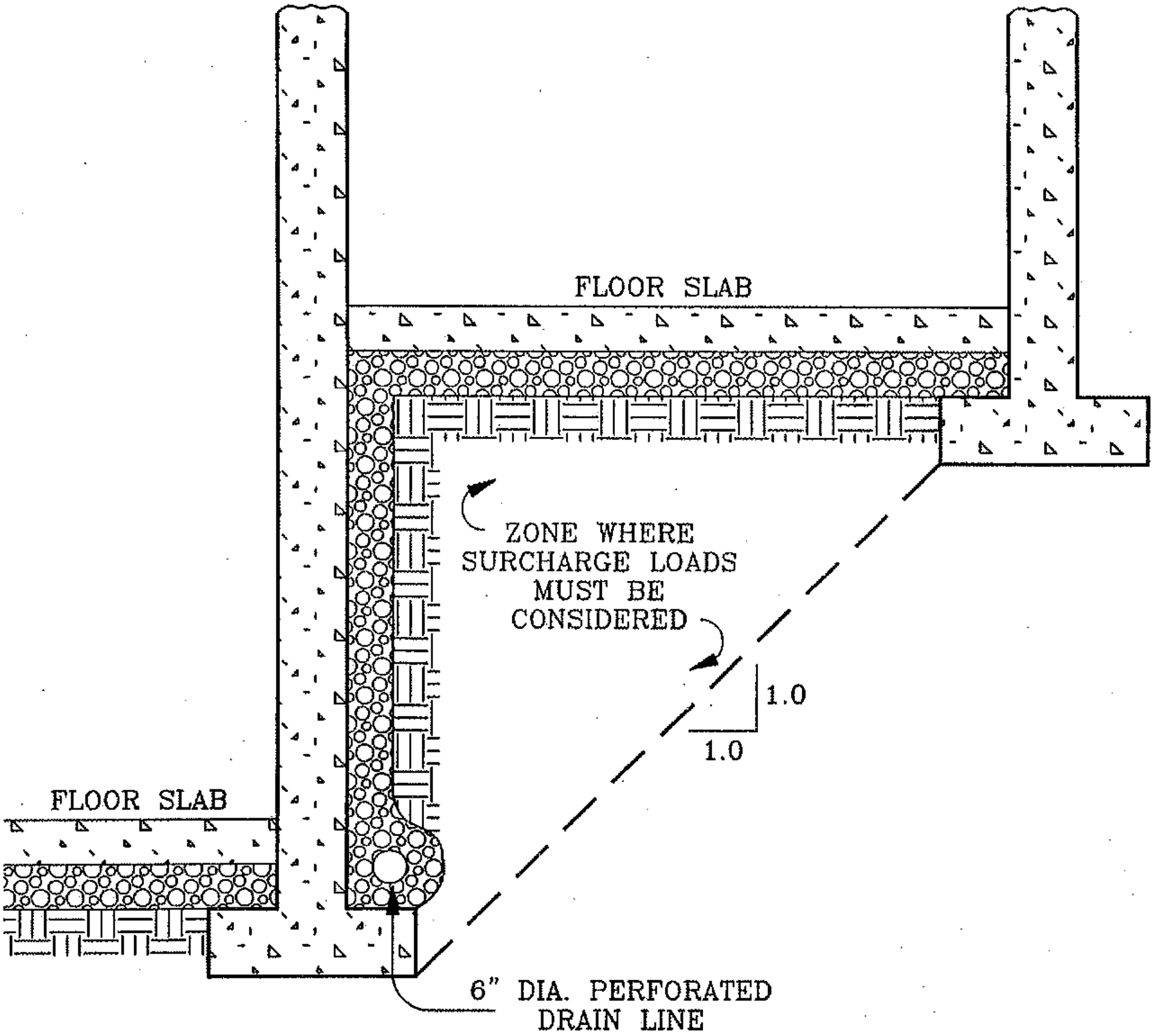


Term	Description	Value
γ_w	Unit Weight of Water	62.4 pcf
γ'	Effective or Buoyant Soil Weight	62.6 pcf
k_o	At-rest earth pressure coefficient	0.50
γ	Unit Weight of Soil	125 pcf

▽ Ground Water Level

LATERAL EARTH PRESSURE DIAGRAM –UNDRAINED FOR USE WITH A MAT FOUNDATION

ZONE OF INFLUENCE DIAGRAM ©
(GARAGE RAMP OR ELEVATOR PIT WALLS)



NOTE: HYDRAULICALLY CONNECT UPPER WALL DRAIN AND UNDERSLAB GRAVEL TO RETAINING WALL GRAVEL BACKFILL AND DRAIN AS SHOWN.

ECS LLC MID-ATLANTIC
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PHONE : (703) 471-8400
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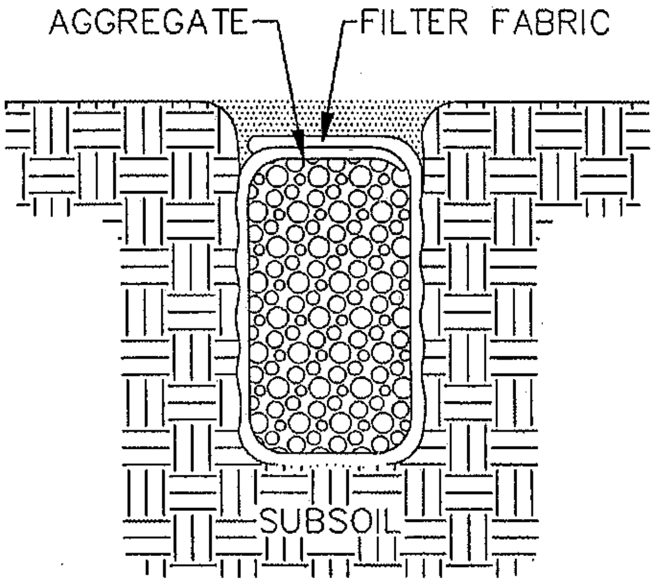
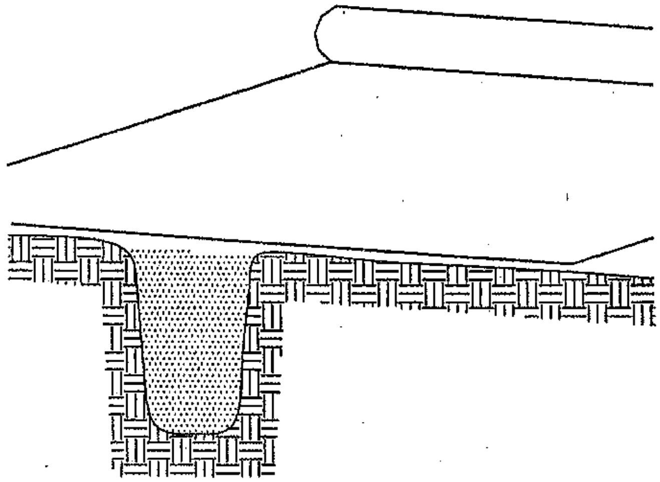
FINAL CONFIGURATION



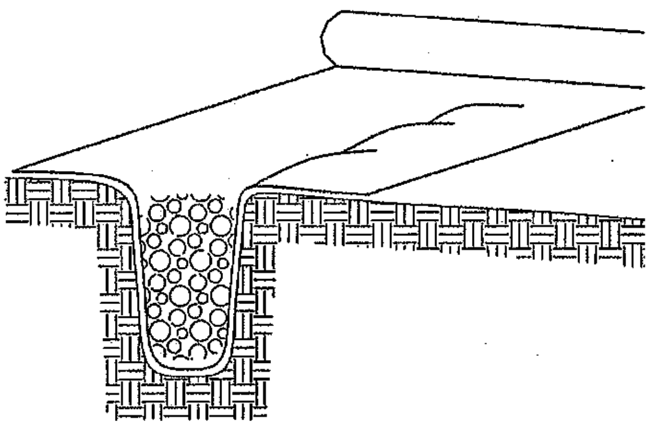
SUBDRAIN USING FILTER FABRIC

STEP 1



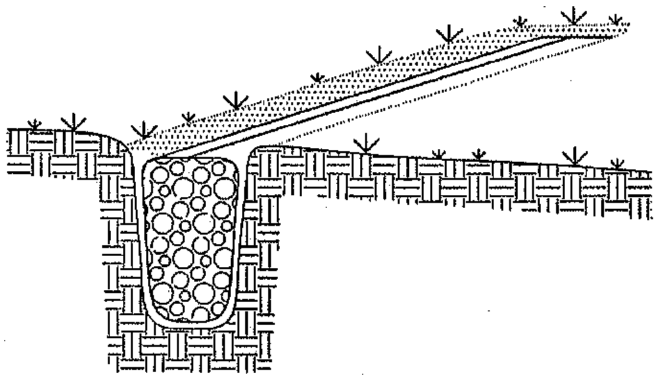
FABRIC IS UNROLLED
DIRECTLY OVER TRENCH

STEP 2



THE TRENCH IS FILLED
WITH AGGREGATE

STEP 3



THE FABRIC IS LAPPED CLOSED
AND COVERED WITH SOIL

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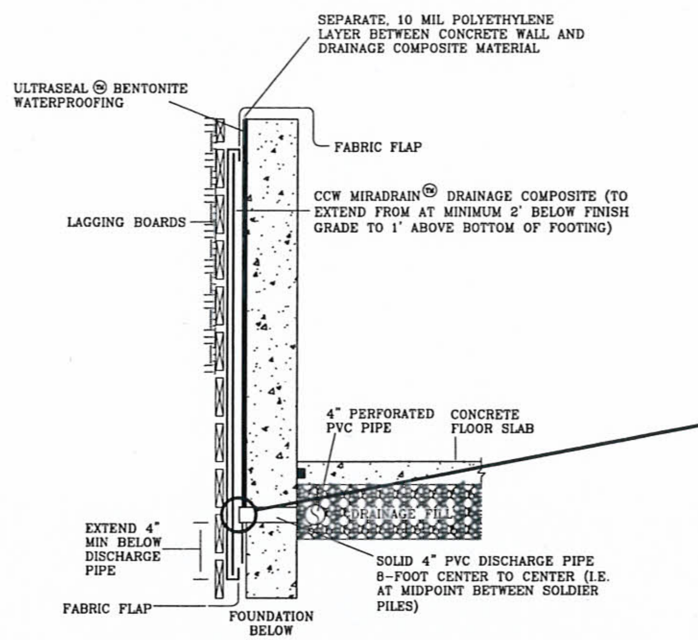
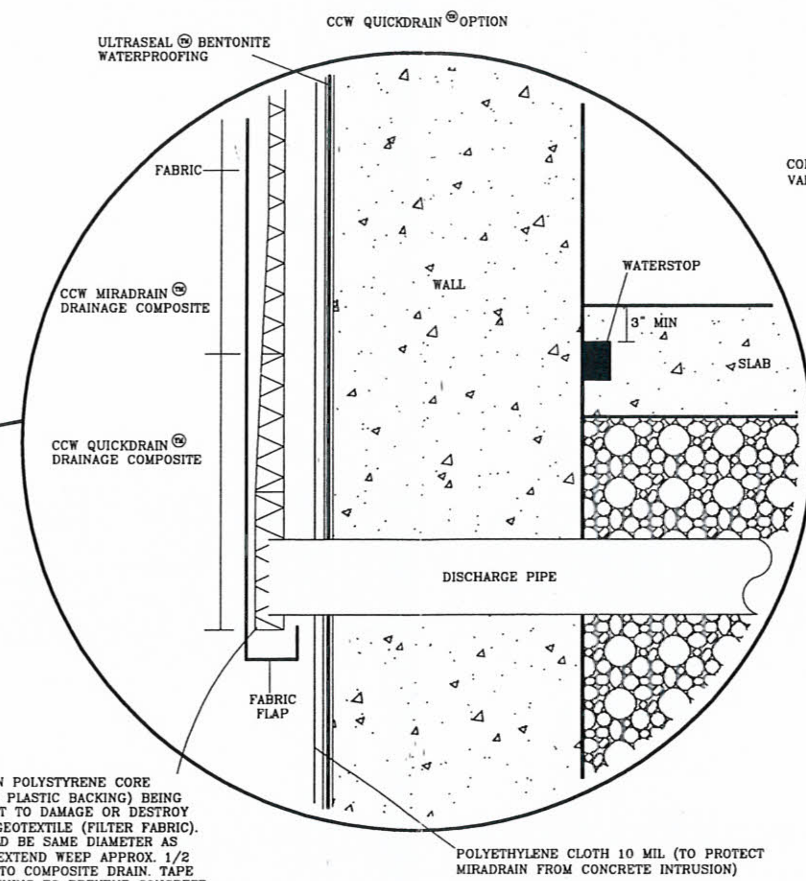
FRENCH DRAIN INSTALLATION PROCEDURE©

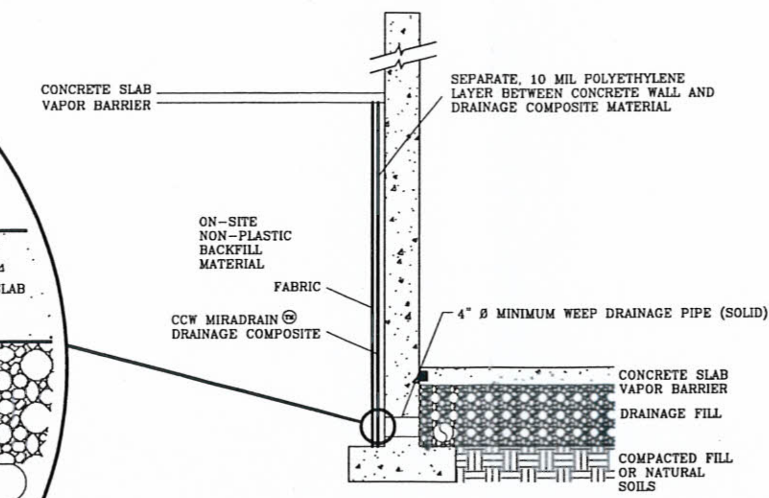


EXTERIOR WALL DRAIN DETAIL (TYPICAL) – DRAINED CONDITION (1.0)

(NTS)

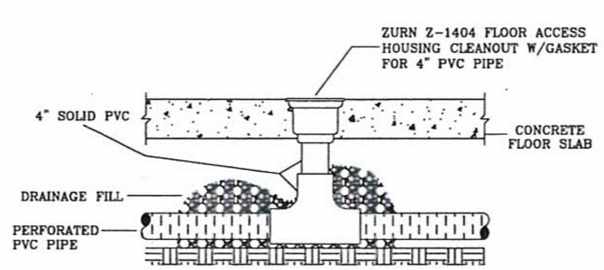


CUT HOLE IN POLYSTYRENE CORE (IMPERVIOUS PLASTIC BACKING) BEING CAREFUL NOT TO DAMAGE OR DESTROY NONWOVEN GEOTEXTILE (FILTER FABRIC). HOLE SHOULD BE SAME DIAMETER AS WEEPHOLE. EXTEND WEEP APPROX. 1/2 DISTANCE INTO COMPOSITE DRAIN. TAPE AROUND OPENING TO PREVENT CONCRETE INTRUSION INTO DRAINAGE MEDIUM OR WEEP PIPE.



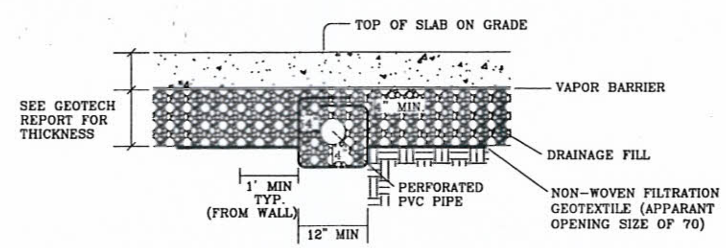
INTERIOR BELOW GRADE WALL DETAIL (2.0)

(NTS)



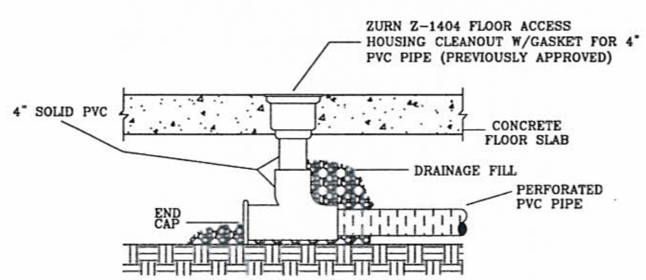
CLEANOUT DETAIL (TYPICAL) – PERFORATED PIPE (3.0)

(NTS)



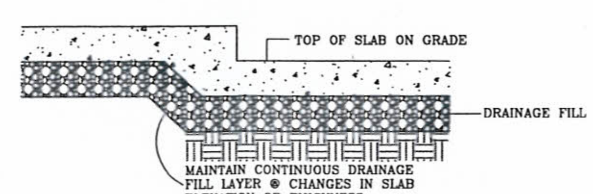
UNDERSLAB DRAIN DETAIL (TYP) (4.0)

(NTS)



CLEANOUT DETAIL W/END CAP – PERFORATED PIPE (5.0)

(NTS)



DRAINAGE LAYER STEP DETAIL (TYP) (6.0)

(NTS)

NOTES:

1) PRODUCTS SPECIFIED MAY BE SUBSTITUTED WITH AN EQUIVALENT PRODUCT, UPON REVIEW AND APPROVAL OF ECS.
2) GEOTEXTILE FILTER FABRIC TO CONTACT LAGGING OR SOIL, NOT THE CONCRETE WALL.
3) A GEOTEXTILE WRAPPED PVC DRAIN LINE MAY BE SUBSTITUTED IN LIEU OF THE DETAIL SHOWN.
4) 4" MINIMUM DIAMETER WEEP HOLES (SOLID PVC) TO BE LOCATED AT 8 FOOT CENTER TO CENTER (I.E. AT MIDPOINT BETWEEN SOLDIER PILES, ADJUSTED IN THE FIELD AS REQUIRED).
5) DRAINAGE COMPOSITE ON EXTERIOR OF BELOW GRADE WALLS TO BE CONTINUOUS AROUND WALLS AND ALL SIDES OF EXCAVATION.
6) SEE MANUFACTURER'S DETAIL FOR CONNECTION BETWEEN DRAINAGE PANELS.
7) A NON-WOVEN FILTRATION GEOTEXTILE (MIRAFI 140N OR EQUIVALENT) SHOULD BE PLACED ON THE ENTIRE SUBGRADE PRIOR TO THE PLACEMENT OF THE UNDERSLAB DRAINAGE SYSTEM STONE. THE GEOTEXTILE SHOULD HAVE AN APPARENT OPENING SIZE OF 70 AND SHOULD BE PLACED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. THE SAME FABRIC SHALL BE USED TO SURROUND THE PERFORATED DRAINAGE PIPE.
8) MINIMUM 4-INCH COVER REQUIRED BETWEEN BOTTOM OF SLAB AND TOP OF PVC DRAIN PIPE.
9) TO INSTALL DRAINAGE PIPE TO QUICKDRAIN: CUT HOLE IN POLYSTYRENE CORE OF QUICKDRAIN (IMPERVIOUS PLASTIC BACKING) BEING CAREFUL NOT TO DAMAGE OR DESTROY NONWOVEN GEOTEXTILE (FILTER FABRIC). HOLE SHOULD BE SAME DIAMETER AS WEEPHOLE. EXTEND WEEP APPROX. ½ DISTANCE INTO COMPOSITE DRAIN. TAPE AROUND OPENING TO PREVENT CONCRETE INSTRUCTION INTO DRAINAGE MEDIUM OR WEEP PIPE.
10) ULTRASEAL BENTONITE WATERPROOFING TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MEMBRANE TO BE HORIZONTALLY ORIENTED. ALTERNATIVE PRODUCT MAY BE SUBSTITUTED UPON REVIEW AND APPROVAL OF ECS.

BELOW-GRADE WALL WATERPROOFING AND UNDERSLAB DRAINAGE DETAILS

ECS LLC MID-ATLANTIC

I:\Geotechnical\(e)Projects\13900-13999\01-13983\b-Drafting\13983BLD2.dwg, 1/29/2008 11:02:07 AM, ECS Mid-Atlantic, LLC. Chantilly, VA.

ENGINEER	DRAFTING
DSM	PA
SCALE	1"=50'
PROJECT NO.	13983
SHEET	1 OF 1
DATE	1/8/2008

ECS REVISIONS

BORING LOCATION DIAGRAM

GRAHAM COMPANIES, LTD

ECS LLC
MID-ATLANTIC

ROBINSON TERMINAL AT ALEXANDRIA WATERFRONT ALEXANDRIA

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