REPORT OF

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING SERVICES

KENSINGTON VOLUNTEER FIRE STATION NO. 25 ADDITION
14401 CONNECTICUT AVENUE
SILVER SPRING, MARYLAND

FOR

HUGHES GROUP ARCHITECTS

NOVEMBER 24, 2010

ECS MID-ATLANTIC, LLC "Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

November 24, 2010

Mr. Mark Crosnicker, AIA, LEED AP
Hughes Group Architects
22630 Davis Drive
Suite 175
Sterling, Virginia 20164

ECS Job No.: 13-4269

Reference: Report of Subsurface Exploration and Geotechnical Services, Kensington Volunteer Fire Station No. 25 Addition, 14401 Connecticut Avenue, Silver Spring, Maryland

Dear Mr. Crosnicker:

As authorized by acceptance of our proposal 13-5170-GP dated October 5, 2010, ECS Mid-Atlantic, LLC (ECS) has completed subsurface exploration and geotechnical engineering services for the proposed additions to the existing fire station. Our report, including the results of our subsurface exploration program, and geotechnical engineering analysis is enclosed with this letter.

We understand the project will consist of three additions to the original building on the north, east, and west sides. The additions will be about 4,600 to 4,900 square feet and will house a new apparatus bay, dormitory space, and a training and living area.

The enclosed report provides recommendations on soil bearing pressures, foundation settlement estimates, placement and compaction of new fills, drainage, construction, and other factors which may influence construction at the site.

We appreciate this opportunity to be of service to Hughes Group Architects on this project. If you have any questions regarding the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please do not hesitate to contact us.

Respectfully,
ECS MID-ATLANTIC, LLC

STATE OF MARYLAND
JEFFREY A. McGREGOR
No. 30901
PROFESSIONAL ENGINEER

Jeffrey A. McGregor, P.E.	Salvatore V. Fiorentino, P.E.
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Enclosures: (1) Report
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REPORT

PROJECT

Subsurface Exploration
And Geotechnical Services
Kensington Volunteer Fire Station No. 25 Addition
14401 Connecticut Avenue
Silver Spring, Maryland

CLIENT

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KENSINGTON VOLUNTEER FIRE STATION NO. 25 ADDITION

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PROJECT OVERVIEW

Project Location and Proposed Construction

The project site is located northeast of the intersection of Connecticut Avenue and Bel Pre Road in Silver Spring, Maryland. A Site Location Diagram is included at the end of this report.

We understand the project will consist of about 14,500 square feet of new building additions, in three separate areas. No structural loading for the additions was provided to us; however, we have considered column loads on the order of 150 kips and wall loads on the order of 5 to 6 kips per foot in our analysis. The addition footprints are currently occupied by grass and pavement areas. The existing station has a floor level between EL 416.35 (existing garage) and EL 417 (living area). The new additions will match the existing floor levels. Existing site grades within the addition areas range from about EL 412 to EL 418. Cuts and fills on the order of a few feet will be necessary.

Scope of Work

The conclusions and recommendations contained in this report are based on our field subsurface explorations, laboratory testing, and review of available geologic data. The subsurface exploration program included a total of 9 soil borings extended to depths of 4 to 25 feet below the existing ground surface. Four (4) test pits were excavated along the north and east exterior walls of the existing station to verify existing foundation depth and geometry. Laboratory tests were then performed on selected soil samples to identify the soils and to assist in determination of the properties of the on-site soils. We have also visited the site recently to conduct a site reconnaissance of current conditions.

The boring and test pit locations were selected by Hughes Group Architects and located in the field by ECS. The ground surface elevations at the boring locations were estimated from topographic plans provided to us by Hughes Group Architects and should be considered approximate. The Boring Location Diagram in the Appendix indicates the approximate physical location of the borings and test pits performed at the site.

Purposes of Exploration

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

1. drilling borings to explore the subsurface soil and groundwater conditions,

2. excavating test pits along the existing exterior walls to observe existing foundation depth and geometry,

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

4. analyzing the field and laboratory test results to develop appropriate engineering recommendations.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

Borings

The soil borings were performed using an ATV-mounted auger drilling rig, (CME 750), which utilized continuous flight, hollow stem augers to advance the boreholes. Drilling fluid was not used in this process.

Representative soil samples were obtained by means of the split-spoon sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch O.D., split-spoon sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through the last 12-inch interval is termed the Standard Penetration Test (SPT) value, or 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 noncohesive 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 were then sealed and brought to our laboratory for further visual examination and laboratory testing.

Test Pits

Shallow test pits were excavated along the exterior walls to expose the tops and sides of the existing footings. Three of the test pits were excavated with a Komatsa hydraulic mini-excavator with a maximum reach of about 8 feet. Test pit TP-3 was excavated by hand due to site access issues; however, the side of the footing could not be exposed to verify footing thickness.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check the field classification and to determine pertinent engineering properties. The laboratory testing program included visual sample classifications, moisture content tests, Atterberg Limits, washed sieve gradation tests, and standard proctor tests. All data obtained from the laboratory tests are included on the respective boring logs on separate sheets in the Appendix.

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.

EXPLORATION RESULTS

Current Site Conditions

The proposed addition areas are currently occupied by a parking lot and entrance drive (north end), HVAC and utility meters (east end), and grass, sidewalks, and paved parking (west end). The existing grades with the north addition footprint vary from about EL 416 to EL 418. Existing grades within the east and west additions vary from about EL 412 to about EL 416.

Regional Geology

The project site is located in the Piedmont Physiographic Province, an area underlain by ancient igneous and metamorphic rock. The virgin soils encountered in this area are the residual product of in-place chemical weathering of the parent rock presently underlying the site. The typical residual soil profile consists of silty to clayey soils near the surface where soil weathering is more advanced, underlain by more sandy silts and silty sands that generally become harder and more dense with depth to the top of parent bedrock. The boundary between soil and rock, termed weathered or “Decomposed Rock”, is not sharply defined.

The natural soils at the site consist of primarily of residual materials formed from the in-place physical and chemical weathering of the underlying parent bedrock. This rock is believed to be part of the Lower Pelitic Schist Formation and normally consists of tonalite, dark quartz, diorite, gabbro, amphibolite, and undifferentiated basic rocks. The relative density of the residual soils is primarily dependent upon the degree of weathering, surface disturbance, groundwater action, and residual mineral bonding. Typically, the weathering profile produces materials which are denser and more granular with increasing depth.

Soil Conditions

Subsurface conditions within the proposed building additions were evaluated with 9 soil test borings (B-1 through B-9) drilled to depths of 4 to 25 feet below the existing ground surface. Four (4) test pits were also excavated along the existing exterior walls. The borings were drilled either to refusal, or to the planned depth of 25 feet. The approximate boring locations are presented on the enclosed Boring Location Diagram.

Approximately 5 to 7 inches of topsoil was encountered at the surface grades of most of the borings. Organic root mat and soft surficial soils most likely extend below the topsoil zone. Asphalt was encountered at the surface grades of borings B-2 and B-3 and test pit TP-2 to depths of 3 to 5 inches. Approximately 5 to 9 inches of gravel underlies the asphalt.

Fill soils were encountered in the test pits and in borings B-3, B-4, B-8, and B-9 to depths of 2 to 8 feet. The soils were identified as CLAY (CL), Sandy SILT (ML), and Silty SAND (SM). Construction debris and gravel was observed in the fill in the test pits. Based on SPT results, the silty and sandy fill soils are generally firm medium dense, while the clay fill soils are generally stiff.

Natural soils were encountered below the surface cover, or existing fill (if present), in the borings. The natural soils were identified as Sandy SILT (ML) and Silty SAND (SM). Based on SPT results, the natural soils are generally medium dense to dense.

Below the natural soils in the borings, extremely dense materials with a blow count greater than 60 have been noted on the boring logs as decomposed rock. The decomposed rock was found in the borings at depths of 3.5 to 25 feet. These materials can exhibit rock like qualities and depending on various parameters may be extremely difficult to excavate, and may require rock excavation methods for removal. The residual materials are expected to increase in density with depths across the project site.

The bedrock surface is assumed to be at refusal levels in the borings.

Groundwater Observations

Observations for groundwater were made during sampling and upon completion of the drilling operations at each boring location. Groundwater was not encountered in the borings to the depths they were drilled. Some of the open borings were checked for water 24-hours after the drilling was completed. Seeping water was observed near the top of the existing exterior wall footings in test pits TP-3 and TP-4. This is most likely a perched water condition near the interface of the existing fill soils and the natural soils. Cave-in depths in the boring ranged from 2.9 feet to 19.1 feet below existing grades. In auger drilling 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. Furthermore, visual observation of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions.

Based on the absence of groundwater observed in the borings, we believe the groundwater table should not be a significant factor during design and construction of the at-grade additions. The perched conditions observed in the test pits may require localized pumping during construction to maintain dry and stable footing excavations. Surface water runoff and flow across the site may be a factor, and steps should be taken during construction to control surface water runoff and to remove any water that may accumulate in the excavations.

The highest groundwater observations are normally encountered in winter and early spring. Our current groundwater observations were taken in early fall after a period of dry weather. 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. Free water may also be encountered at the interface of fill soils, if present, and natural soils, or at the interface of natural soils and decomposed rock or bedrock.

Existing Footing Observations

Four (4) test pits were dug with a hydraulic mini excavator and observed by an ECS representative at the site to evaluate the geometry of the existing exterior wall footings. Due to site access issues, test pit TP-3 was excavated by hand. The test pits were excavated at locations where the proposed additions will tie into the existing building. The test pit locations appear on the Boring Location Diagram as TP-1 to TP-4. The following table gives the approximate depth to the bottom of the footing and the footing geometry at the test pit locations:

Test Pit	Depth to Top of Footing (feet)	Depth to Bottom of Footing (feet)	Footing Projection (inches)
TP-1	3.5	4.5	10 to 15
TP-2	3.5	4.5	18
TP-3	5.0	Unknown	7
TP-4	4.0	5.33	7

Please see the Test Pit Photographs and the Test Pit Logs in Appendix of this report for more details. Fill soil consisting of Sandy SILT (ML) material was encountered below the topsoil and asphalt layer in the locations of test pits, and generally extended to the top of the footings. The footings are founded on medium dense natural Sandy SILT (ML) soils, and very dense decomposed rock materials.

GEOTECHICAL ANALYSIS AND RECOMMENDATIONS

The recommendations presented in this report are based on the project information provided to us, the results of the soil test borings and test pits, laboratory testing, and our engineering analysis. Considering the results of our field exploration, and based on our experience with similar projects, it is our opinion that the new additions may be supported on foundation systems consisting of spread footings when founded on suitable natural soils, decomposed rock, or new compacted structural fill. These soils are considered suitable for the support of the slab on grade, provided that the subgrade soils have been properly prepared, as described in this report, and approved by the Geotechnical Engineer or their authorized representative.

Foundation Recommendations

The proposed building additions can be supported on a system of shallow foundations consisting of spread and/or continuous footings. Based on the anticipated structural loading, SPT values, and our experience with the soils at the site, we recommend footings bearing on suitable natural silt and sand soils be designed using a net allowable bearing pressure of 4,000 pounds per square foot. If footings bear on the decomposed rock materials, the allowable bearing pressure may be increased to 8,000 psf. For footings bearing on new compacted structural fill, we recommend using a net allowable bearing pressure of 3,000 pounds per square foot.

Existing fill was encountered to shallow depths in some of the borings. Fill is also present around the existing building and utilities. If existing fill soils are encountered at new foundation levels, prior to construction of building foundation, the existing fill soils should be evaluated by the geotechnical engineer with hand auger borings and dynamic cone penetrometer testing. When the existing fill is considered suitable, foundations may be founded directly on the fill. If unsuitable existing fill soils are encountered, the unsuitable soils should be undercut and replaced with new engineered structural fill or crushed stone. The existing fill soils observed in the test pits are considered unsuitable due to the presence of construction debris within the fill. Alternately, foundations may be lowered through the existing fill soils and founded on natural soils, or CR-6 stone after undercutting of any unsuitable existing fill soils.

For footings being placed on new engineered fill placed in accordance with the earthwork operations section, a net allowable bearing pressure of 3,000 pounds per square foot should also be used. The net allowable soil bearing pressure refers to that pressure which may be transmitted from the foundation to the bearing soils in excess of the final minimum surrounding over burden pressure.

In order to reduce the possibility of foundation bearing failure or excess settlement due to local shear or “punching” action, we recommend that all continuous footings have a minimum width of 1.5 feet and that all isolated column footings have a minimum lateral dimension of 2.5 feet. In addition, footings should be placed at a depth to provide adequate frost cover protection. For this region, we recommend footings in unheated areas be placed at a minimum depth of 2.5 feet below finished grade.

Settlement of the structure is a function of the compressibility of the natural soils, bearing pressure, column loads, and elevation of footings with respect to the final ground surface. Based on the anticipated structural loading, the settlement of the individual footing, designed in accordance with our recommendations presented in this report, is expected to be small and within tolerable limits for the proposed building additions. For footings placed on suitable natural soils or on properly compacted fill, maximum total settlement is expected to be on the order of less than 1 inch. Maximum differential settlement between adjacent columns is expected to be approximately 0.5 inch.

Seismic Soil Coefficient and Site Class

Based on the boring information, the seismic soil coefficient is 1.5 per IBC 2000 table 1610.3.1 and the seismic site class is “C” per IBC 2000 table 1615.1.1.

Floor Slab Design

According to the test borings and based on existing grades, the soils anticipated below the floor slabs should consist of natural Sandy SILT (ML), Silty SAND (SM), decomposed rock, new compacted structural fill, or existing fill. The natural soils should generally be suitable for support of the floor slabs. If existing fill is encountered at slab subgrades and not removed prior to new fill placement, these areas should be evaluated by the Geotechnical Engineer to determine its suitability for slab support. Some undercutting and replacement of unsuitable existing fill should be budgeted for. The lowest floor slabs can then be designed as a slab-on-grade, and a modulus of subgrade reaction of 200 pci can be used. The floor slab subgrade should be prepared in accordance with our recommendations outlined in the section entitled "**Earthwork Operations**", which includes stripping, and compacted fill placement.

We recommend that the floor slabs be isolated from the foundation footings so that differential settlement of the structure will not induce stresses on the floor slab. Also, in order to minimize the crack width of any shrinkage cracks that may develop near the surface of the slabs, 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.

We recommend that a capillary cutoff layer be provided under the floor slab to prevent the rise of moisture through the floor slab. The capillary layer should consist of a minimum of 6 inches of clean crushed stone or washed gravel, with a maximum 2% passing the No. 200 sieve. AASHTO No. 57 stone should be suitable for this purpose. A 6 mil polyethylene barrier should be placed on top of the stone to provide additional moisture protection and prevent concrete intrusion into the stone. Placement of this barrier should occur immediately before the placement of floor slab concrete in order to minimize damage to the layer. However, special attention should be given to the surface curing of the slab in order to minimize uneven drying of the slab and associated cracking.

Underpinning

Based on the provided plans, the new additions will match the existing floor grades of the building. Therefore, underpinning of existing foundations is not expected to be necessary. If an uneven adjacent footing situation does occur, regular pit-type underpinning is considered feasible and may be designed for an allowable soil bearing pressure of 4,000 pounds per square foot when founded on the natural soils or decomposed rock.

Below Grade Walls

If the new additions have below grade walls, they should be designed to withstand lateral earth pressures at at-rest conditions and any surcharge loads within a 45 degree slope from the base of the wall. We recommend that the below grade walls be designed for a linearly increasing lateral earth pressure of 60 psf per vertical foot of wall. This lateral earth pressure diagrams does not include hydrostatic pressure and assumes full drainage and a subdrainage system should be installed behind the walls. In addition exterior grades should be properly sloped to allow drainage of surface runoff away from the building. We recommend a minimum slope of 5% away from the structures. Surcharge loading within a 45 degree slope from the bottom of the wall should be applied with a combined active and at rest pressure coefficient of 0.4. In order to maintain a 60 psf lateral earth pressure, drainage of the backfill of the proposed building must be provided. A lateral earth pressure earth pressure diagram is included in the Appendix at the end of this report.

A lateral passive earth pressure of 350 psf per foot of soil may be used for design. The passive resistance should be neglected to a depth of 2.5 feet in areas exposed to freezing conditions and in areas where there is a possibility that the soil in front of the wall will become disturbed or be excavated at any time in the future. Considering the relatively fine-grained soils, which may constitute the wall foundation bearing subgrade, a friction factor of 0.3 is recommended for sliding resistance analysis.

To achieve a desirable balance between minimizing excessive pressures against the below grade walls and reducing the settlement of the wall backfill, we recommend that the wall granular backfill be compacted to 95% of the maximum dry density obtained in accordance with ASTM Specification D-698, Standard Proctor Method.

Backfill materials behind below grade walls should consist of inorganic materials classified SM, SC or more granular per ASTM D-2487 that are free of debris. 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.

Retaining Walls

All retaining walls that are free to rotate at the top must be designed to resist active lateral earth pressures. Retaining walls may be designed for an active lateral pressure of 40 psf per foot of wall height. This value assumes level backfill behind the walls and does not include the influence of any surcharge loads. Any surcharge loads imposed within a 45 degree slope of the base of the walls should be considered in the below grade wall design. Additionally, a lateral passive earth pressure of 350 psf per vertical foot of soil may be used in the design. The passive resistance on the walls should be neglected if there is a possibility that the soil in front of the wall will be excavated at any time in the future. Considering the relatively fine-grained soils anticipated at the wall foundation bearing level, a friction factor of 0.4 is recommend for sliding resistance analysis. A soil friction angle (Φ) of 30 degrees may be used for retaining wall design. Foundations for retaining walls may be designed for a bearing pressure of 2,500 psf when founded on suitable natural soils, or new compacted structural fill.

The parameters recommended above also assume that freely draining materials are used to backfill the walls and that adequate drainage will be provided at the base of the walls. Drainage of retaining walls may be accomplished through the use of 2-inch diameter weep holes spaced about 8 to 10 feet, penetrating the wall, immediately above the proposed grade in front of the wall. Alternatively, a longitudinal drain line may be placed behind the retaining wall, sloped to discharge by gravity to daylight or to a storm sewer.

Earthwork Operations

Proper monitoring of newly placed fill with respect to lift thickness and compaction of each lift is expected to be necessary at this site. The following paragraphs detail our recommendations regarding earthwork operations.

Fill and Floor Subgrades

The existing ground surface in the proposed structural areas should be stripped of all topsoil, concrete, vegetation, rootmat, topsoil, asphalt, and any other soft or unsuitable material. Complete removal of the unsuitable materials should also be performed within the proposed building prior to placement of any new fill. The stripping within the proposed building areas should be extended at least 10 feet, where possible, beyond the planned limits.

Prior to fill and/or gravel placement, the subgrade soils should be carefully examined by an experienced Geotechnical Engineer or authorized representative to identify any localized loose, yielding, or otherwise unsuitable materials. After examining the exposed soils, loose and yielding areas should be identified by proofrolling with an approved piece of equipment, such as a loaded dump truck, having an axle weight of at least 10 tons. Any soft or unsuitable materials encountered during this proofrolling should be removed and replaced with an approved engineered fill compacted to the criteria given below in the section entitled “Fill Placement”. If existing fill is encountered, it should be thoroughly investigated with test pits and proofrolled to determine whether it is suitable to remain in place. Provided the material is firm and free of organic and deleterious materials, the existing fill may remain in place. If the existing fill is found to be unsuitable, it should be removed and replaced with new compacted structural fill compacted to the criteria given below in the section entitled “Fill Placement.”

The preparation of fill subgrades, as well as the proposed building floor slab, should be observed by an experienced geotechnical engineer, or their representative, to verify that all unsuitable materials have been removed, and that the subgrade is suitable for support of the proposed construction and/or fills. In some areas, excessively soft and/or wet soils may be encountered at fill subgrades, especially in the winter or early spring months. We strongly recommend against utilizing soil bridging lifts to span over soft fill subgrade soils within the expanded building limits. All soft areas shall be excavated and removed.

Fill Placement

Upon achieving competent subgrade materials, the exposed soils should be filled, where appropriate, to planned building subgrade levels with an approved controlled, compacted engineered fill. Engineered fill for support of slabs should consist of soils classified ML, SM, SC or more granular per ASTM D-2487 and have a liquid limit less than 40 and plasticity index less than 15. Unacceptable fill materials include topsoil, organic materials (OH, OL) and high plasticity silts and clays (ML, CH). All such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved disposal areas either on-site or off-site. All other soil materials not excluded above are acceptable for reuse as fill, provided that the moisture content is within acceptable levels to obtain compaction.

An examination of the soils recovered during our current exploration and our previous experience in the area indicates that a majority of the on site soils should generally be suitable for reuse as controlled, compacted fill, with moisture adjustment during fill placement. The existing fill soils may not be suitable for reuse if they contain excessive amounts of debris. During construction if some of the natural soil is found to have a high moisture content, it may be necessary to dry it out before being reused as fill. Our moisture content and proctor testing indicates that portions of the on-site soil are wet of optimum, especially in the area of boring B-7. It should be noted that prior to the utilization of any off-site borrow materials, the Geotechnical Engineer should be provided with representative samples in order to determine the material's suitability for use as 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 to be comprised of a select granular material which will provide suitable support, and be easily compacted and well drained.

All structural fill should be placed in loose lifts, which do not exceed 8 inches in thickness, and should be compacted to at least 95 percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D-698). Generally, the moisture content of the fill materials should be maintained within ±2 percent of the optimum moisture content for the fill material, as determined by ASTM D-698. Fill placed in non-structural areas (e.g. grassed areas) should be compacted to at least 90 percent of the maximum dry density according to ASTM D-698, in order to avoid significant subsidence.

Existing utilities may be relocated or abandoned prior to the proposed construction. Utility trenches should be filled with new compacted fill, or filled with crushed stone. Utilities can also be grouted full and abandoned in place.

The footprint of the proposed building additions should be well defined, including the limits of the fill zones at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified soils technician to determine that minimum compaction requirements are being achieved. A minimum of one compaction test per 2,500 square foot area should be made for each lift. 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 selected to compact the fill. 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, away from the building pad, of any free water associated with precipitation and surface run-off.

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 and foundation or slab concrete.

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.

Rock Excavation/Blasting Operations

Material requiring rock excavation methods was encountered in some of the borings. Although not expected to be necessary to reach proposed slab grades, rock excavation methods or blasting might be necessary in the areas of deeper cuts, or during installation of deep underground utility lines.

For construction purposes, excavation difficulty may be correlated to SPT results. It should be possible to excavate materials displaying SPT results of 50/3 inches of penetration or less with conventional earthwork equipment which may include ripping with a caterpillar dozer or equivalent with a single tooth ripper. Materials exhibiting SPT results greater than 50/3 inches or at auger refusal levels most likely will require hoe ramming, and possibly blasting, particularly in narrow trench excavations. Moreover, it is important that the appropriate contractors be provided a copy of the complete geotechnical report, including the associated subsurface data, and any other geotechnical reports, in order to ensure that the contractors are familiar with the site subsurface conditions and the appropriate equipment is utilized for the project. The following table indicates boring locations and elevations where material requiring rock excavation may be required:

BORING	APPROXIMATE ELEVATION OF MATERIALS REQUIRING ROCK EXCAVATION METHODS FOR REMOVAL
B-1	EL 408
B-2	EL 401
B-3	EL 395
B-4	EL 411
B-5	EL 399
B-6	EL 395
B-8	EL 390
B-9	EL 398

Construction Considerations

Precautionary measures should be taken to ensure that preparation of the subgrade and footing bearing surfaces are accomplished by the recommended procedures. These precautions are necessary, as the materials observed in our borings are disturbance sensitive, and will become weakened if water intrudes into the footing excavations. Therefore, we recommend that all excavations be properly dewatered, if necessary, using conventional sump pit and pumping operations. The site should be graded such that surface water runoff is directed away from the excavations.

Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for extended periods of time. Therefore, foundation concrete should be placed the same day that excavations are completed. 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.

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 surface soils. The surface of the site should be kept properly graded in order to enhance drainage of the surface water away from the proposed construction areas during the earthwork phase. Other practices would involve sealing the exposed soils daily with a smooth drum roller to reduce the potential for infiltration of surface water in the exposed soils. All erosion and sedimentation shall be controlled in accordance with sound engineering practice and current County requirements.

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

Closing

This report has been prepared to aid in the evaluation of this site and to assist the design team with the design of the proposed building additions. The report scope is limited to this specific project and the location described. The project description represents our current understanding of the significant aspects of the proposed improvements relevant to the geotechnical considerations.

We have appreciated the opportunity to be of service to Hughes Group Architects and hope to continue our involvement on the project during the final design and construction phases. ECS is capable of providing all construction materials testing services for the project, and we would appreciate the opportunity to offer our services.

APPENDIX

Site Location Diagram

Lateral Earth Pressure Diagram

Unified Soil Classification System

Laboratory Data

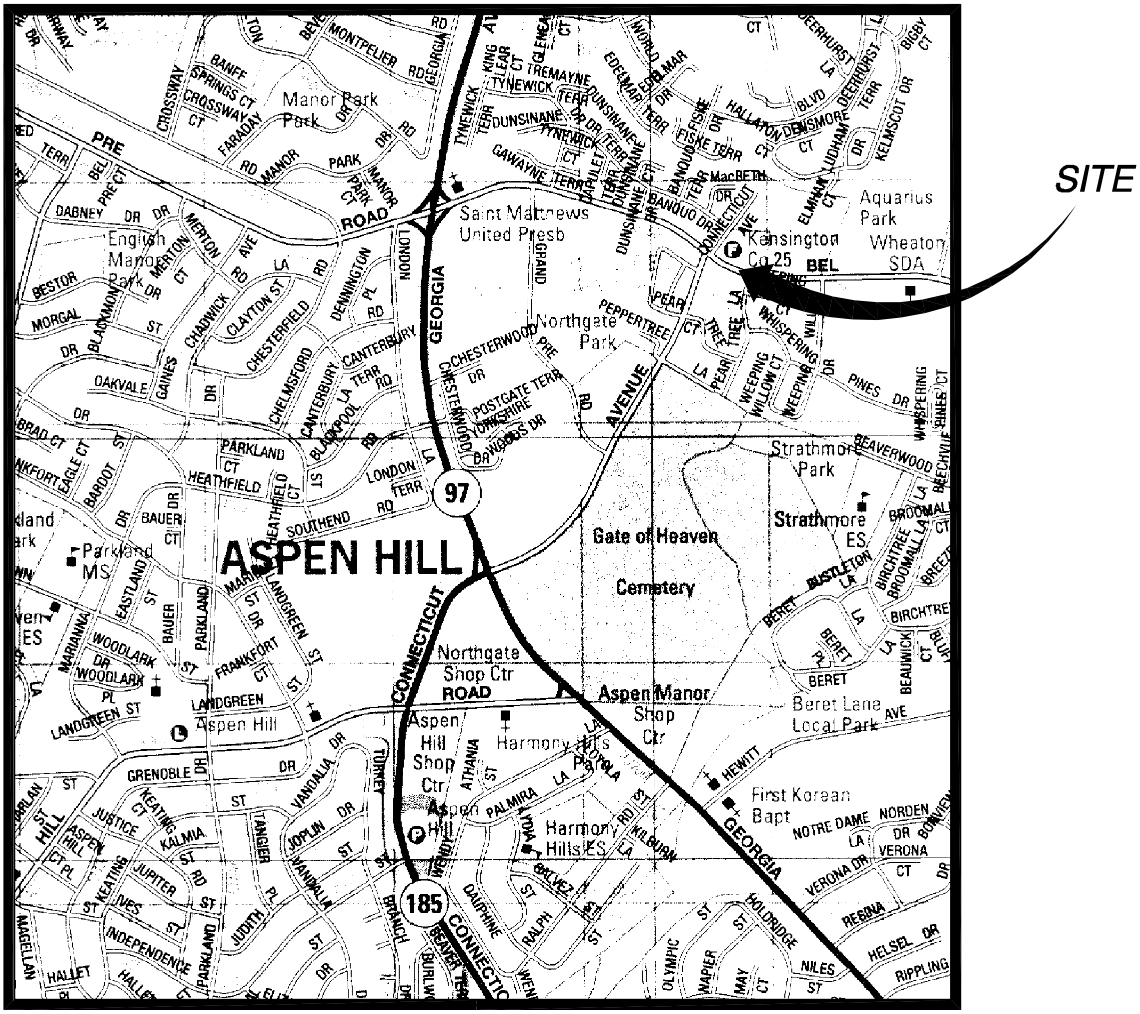
Reference Notes For Boring Logs

Boring Logs B-1 to B-9

Test Pit Logs TP-1 to TP-4

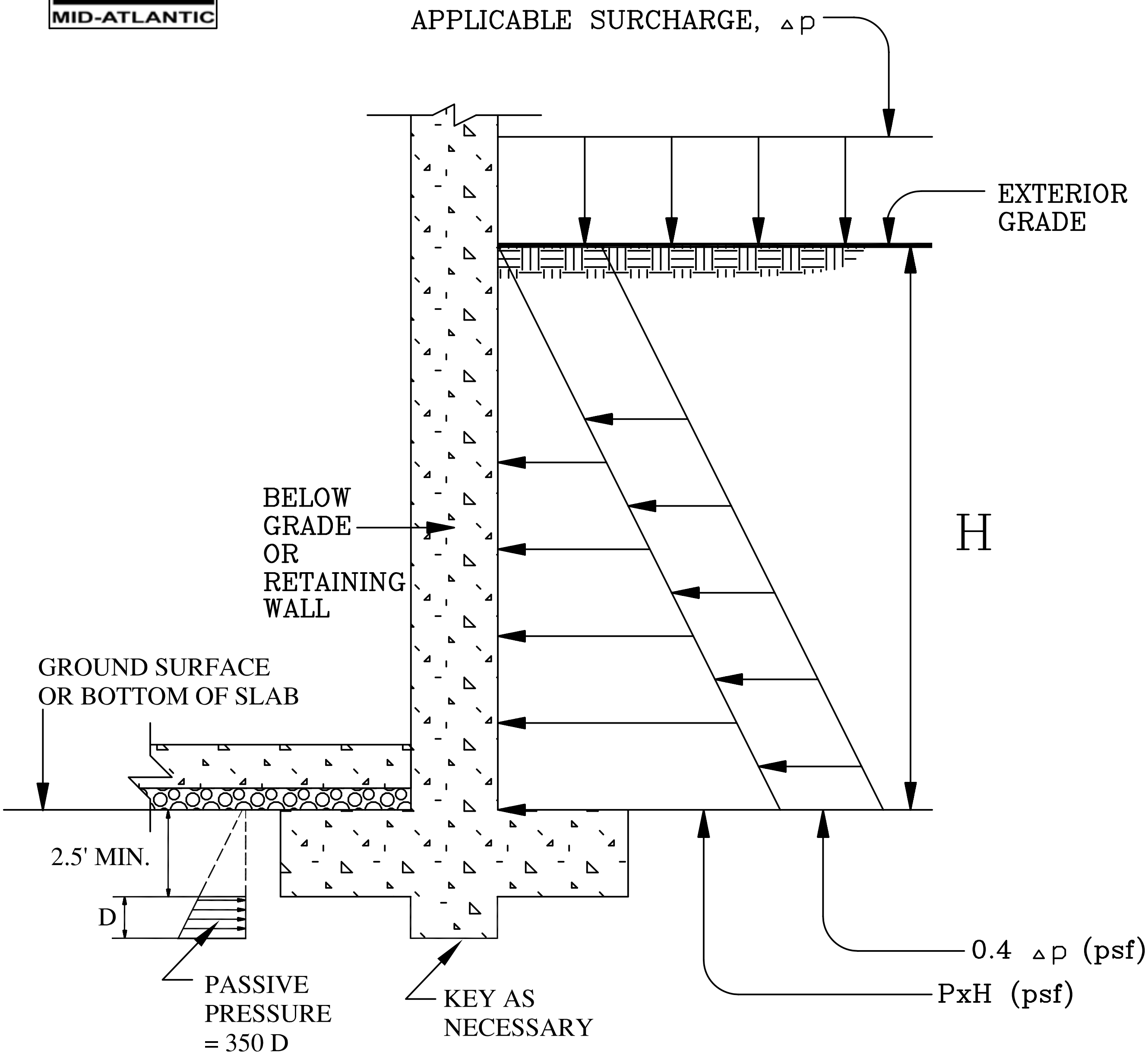
Test Pit Photographs

Boring Location Diagram



ECS LLC MID-ATLANTIC	SITE LOCATION DIAGRAM KENSINGTON VOLUNTEER FIRE STATION #25					
	HUGHES GROUP ARCHITECTS					
	AMH	JAM	11-1-10	NTS	13-4269	1 OF 1

ECS LLC
MID-ATLANTIC



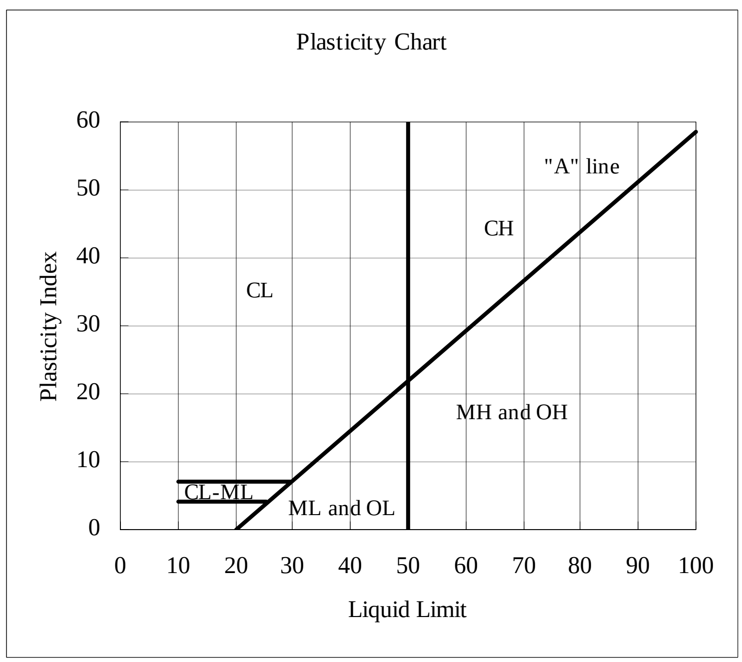
LEGEND:

P = LATERAL EARTH PRESSURE (60 plf) FOR RIGID WALLS
(40 plf) FOR RETAINING WALLS

LATERAL EARTH PRESSURE DIAGRAM
FOR BELOW GRADE & RETAINING WALLS

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

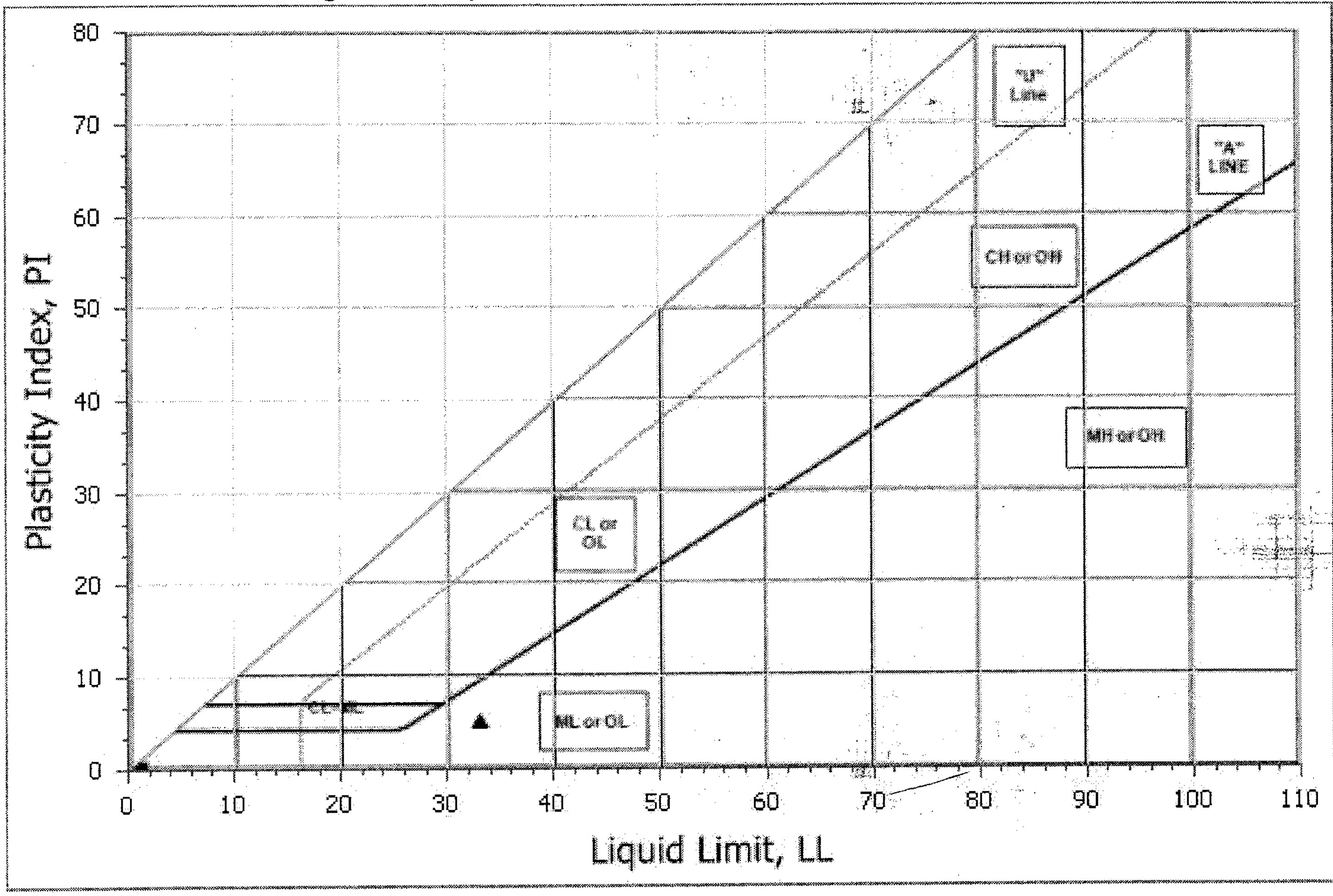
Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine 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; 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 of 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 (see below)		
			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			



[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)

Atterberg Limits (ASTM D 4318) Test Summary (Method A)



All samples are prepared using 'DRY' method unless otherwise noted

Boring Number Sample Number	Depth (feet)	Test Symbol	Description	MC (%)	LL	PL	PI	% Passing #200 Sieve	% Sample Retained on #40 Sieve	Notes
B-3 / S-2	3.50 - 5.00	▲	GREENISH BROWN SILTY SAND	39.6	33	28	5	46.5	23.1	

Project No.	4269
Project Name:	Kensington Volunteer Fire Station #25
PM:	Jeffrey A. McGregor
PE:	Salvatore V. Fiorentino
Printed on (date)	November 15, 2010

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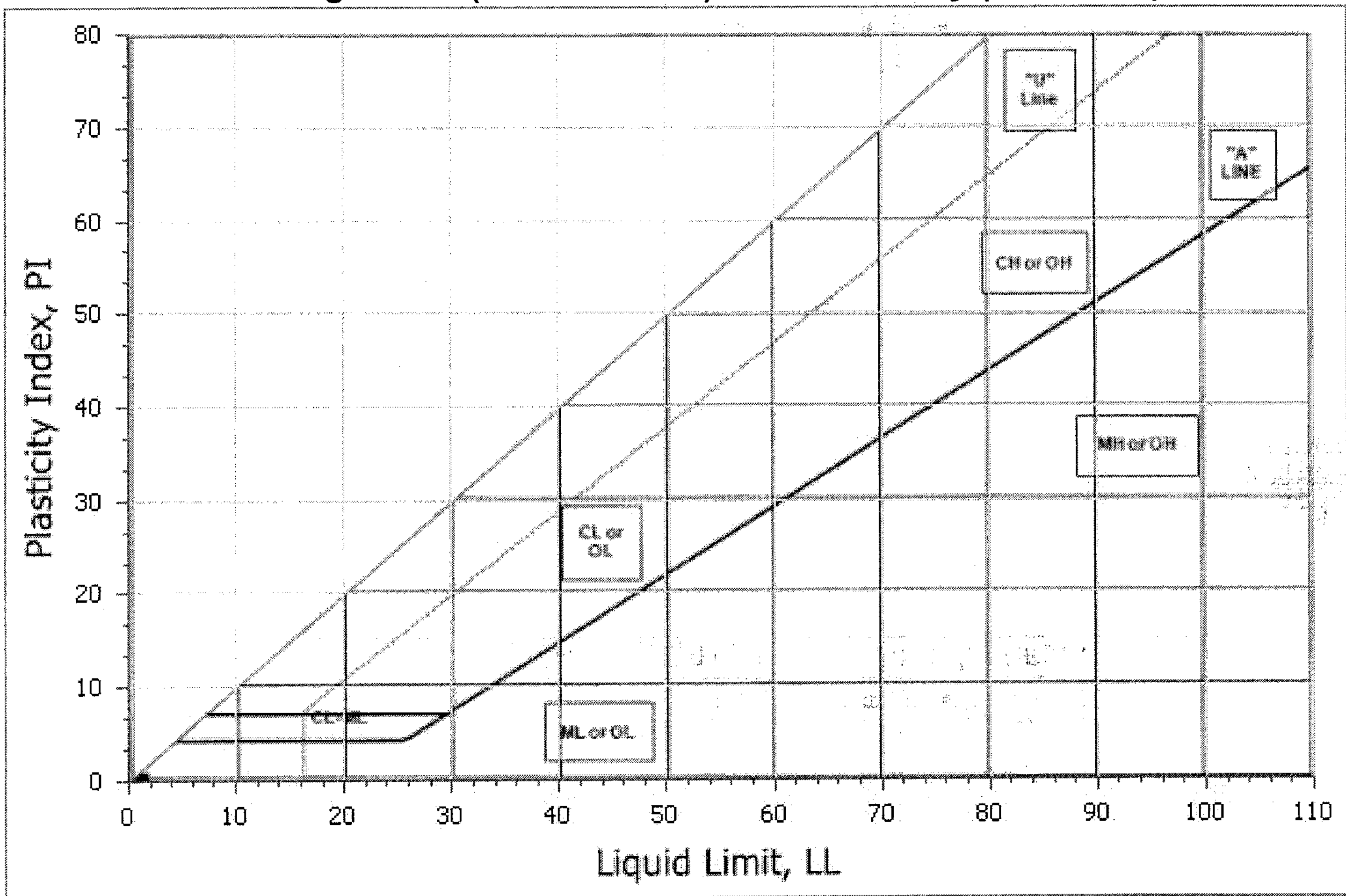
Frederick, MD

Atterberg Limits (ASTM D 4318) Test Summary (Method A)



All samples are prepared using 'DRY' method unless otherwise noted

Boring Number Sample Number	Depth (feet)	Test Symbol	Description	MC (%)	LL	PL	PI	% Passing #200 Sieve	% Sample Retained on #40 Sieve	Notes
B-6 / S-2	3.50 - 5.00	▲	BROWN SANDY SILT	9.5	NP	NP	NP	51.5	9.6	

Project No.	4269	**ECS Mid-Atlantic, LLC**
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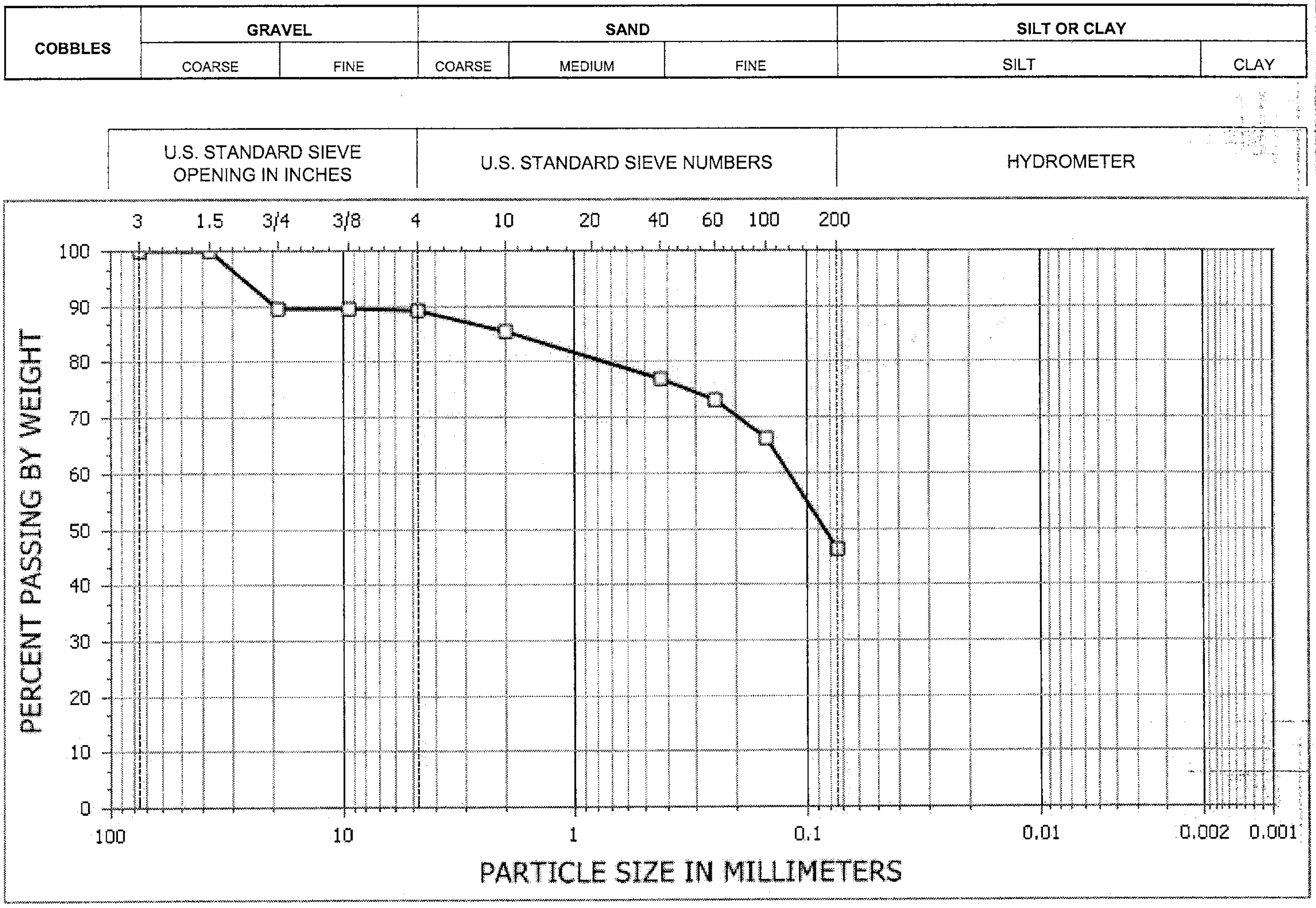
Printed on (date)	November 15, 2010	

Grain Size (ASTM D 422) Test Summary



Boring Number Sample Number	Depth (feet)	Test Symbol	LL	PI	Description
B-3 / S-2	3.50 - 5.00	☐	33	5	GREENISH BROWN SILTY SAND

Project No. 4269
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Printed on (date) November 15, 2010

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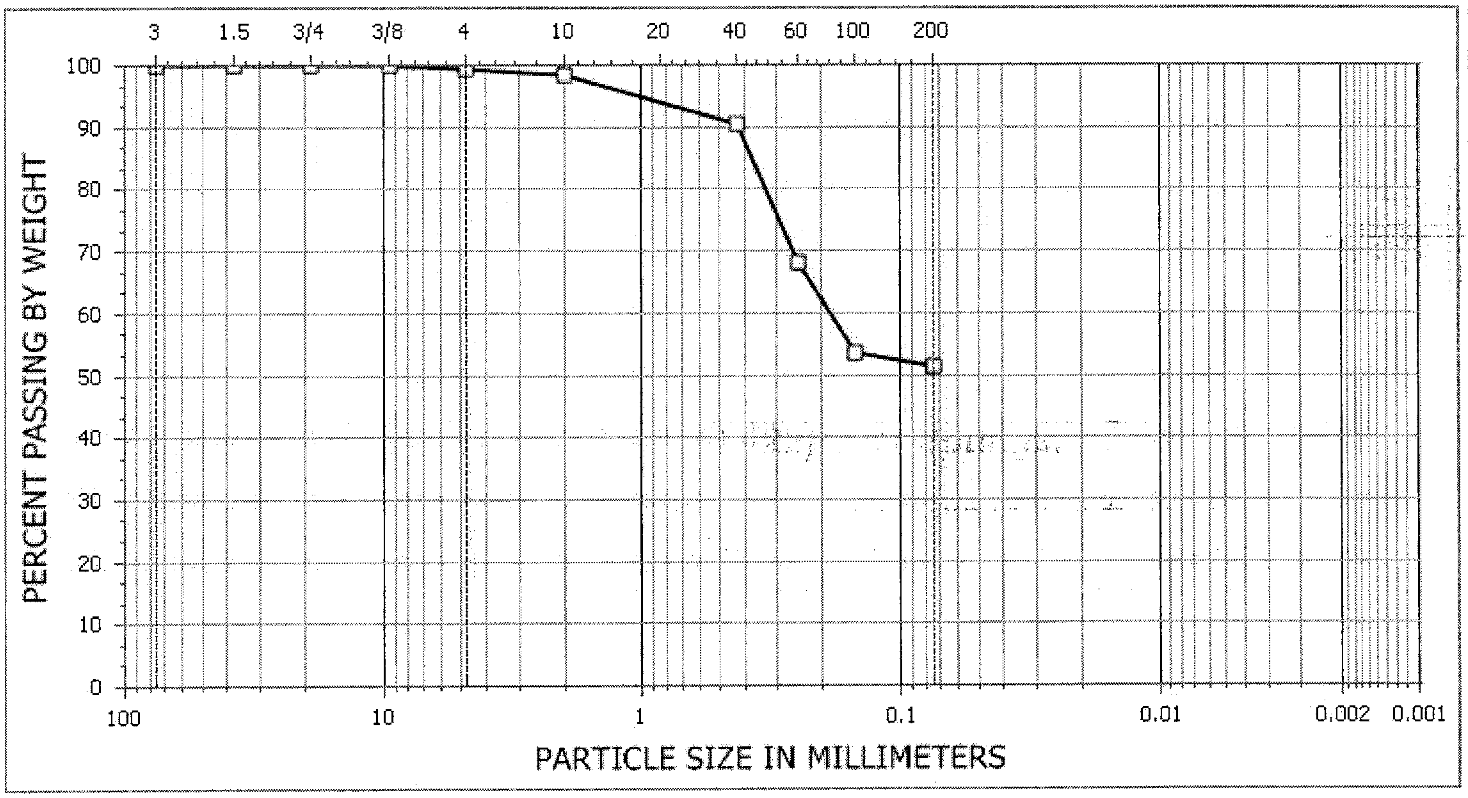
Frederick, MD

Grain Size (ASTM D 422) Test Summary

COBBLES	GRAVEL		SAND			SILT OR CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING IN INCHES	U.S. STANDARD SIEVE NUMBERS	HYDROMETER



Boring Number Sample Number	Depth (feet)	Test Symbol	LL	PI	Description
B-6 / S-2	3.50 - 5.00	□			BROWN SANDY SILT

Project No.	4269	**ECS Mid-Atlantic, LLC**
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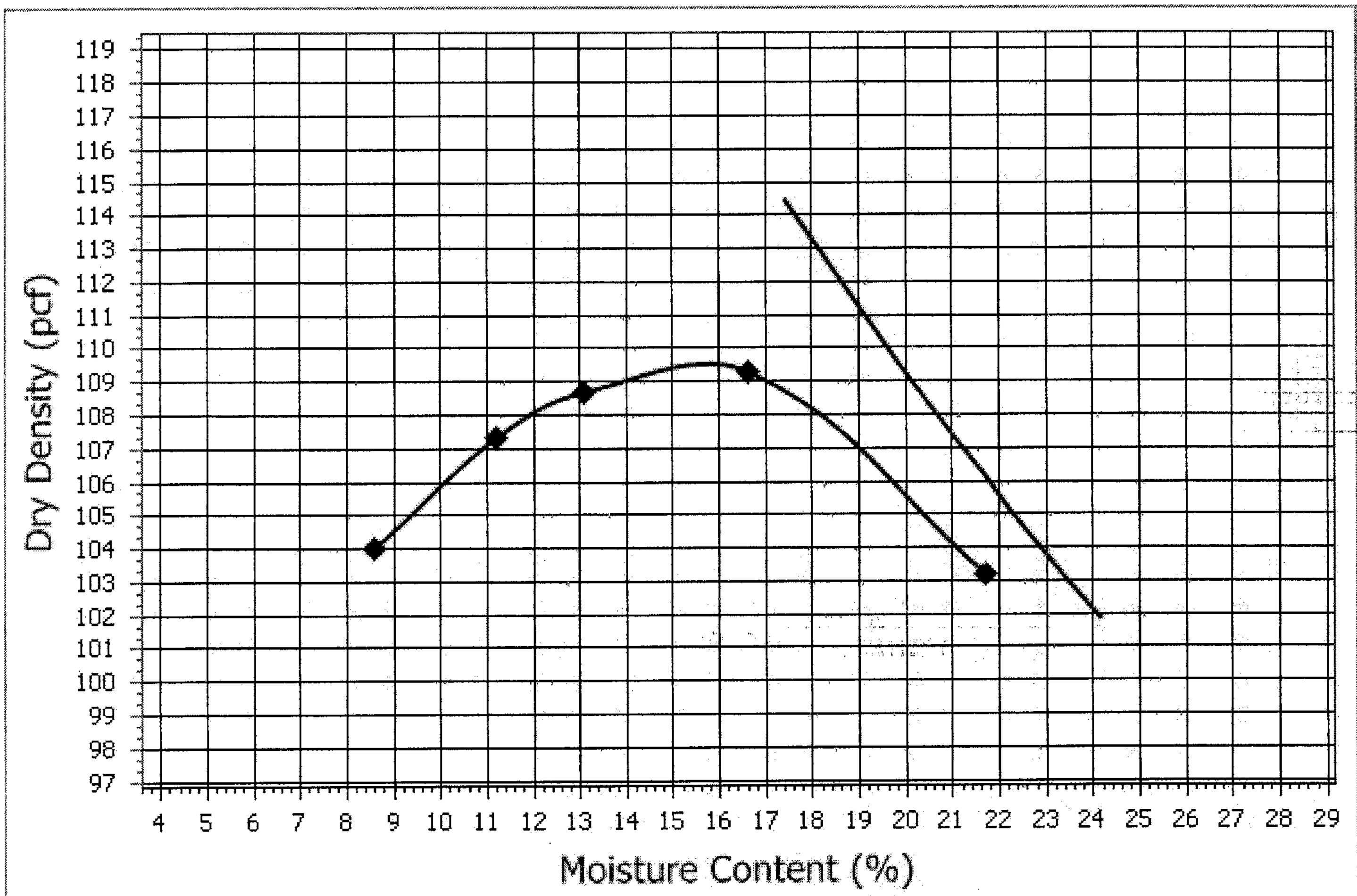
PM:	Jeffrey A. McGregor	
PE:	Salvatore V. Fiorentino	**Frederick, MD**
Printed on (date)	November 15, 2010	

Proctor (ASTM D 698)Test Summary



Liquid Limit (LL)	----	Natural Moisture Content	10
Plastic Limit (PL)	----	Percent Passing No. 200 Sieve	51.5
Plasticity Index (PI)	----	Percent Retained on the No. 4 Sieve	1
Liquidity Index (LI)	----	Maximum Dry Density (pcf)	109.5
Description	BROWN SANDY SILT	Optimum Moisture Content (%)	15.8
		Corr. Maximum Dry Density (pcf)	109.5
Classification	ML	Corr. Optimum Moisture Content (%)	15.8
Test Method	A	Test Standard	ASTM D 698
Specific Gravity of Soil	2.70	Specific Gravity of Soil Determination Test Method	Estimated
Specific Gravity of Oversize Fraction	2.70	Specific Gravity of Oversize Fraction Test Method	Estimated
Boring Number	B-6	Sample Number	S-2
Preparation Method	Wet	Rammer Type	Manual

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Printed on (date)	November 15, 2010	

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)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ 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)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
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
Hughes Group Architects	4269	B-1	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

-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: 417

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 5"		
	1	SS	18	8	Silty SAND, With Rock Fragments, Brown and Gray, Moist, Firm, (SM)	415	9 (6-6-3)
5	2	SS	18	6	Decomposed Rock, Grayish Brown, Moist, Very Dense		(14-35-45) 80
	3	SS	5	5		410	(50/5) 50/5
	4	SS	2	2			(50/2) 50/2
10						405	
	5	SS	0	0	AUGER REFUSAL @ 13.5'		(50/0) 50/0
15							
20						400	
25						395	
30						390	

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

WL 0.0 — WS OR WD	BORING STARTED 10/15/10	DRILLER: D&S
WL(BCR) — WL(ACR) DRY	BORING COMPLETED 10/15/10	CAVE IN DEPTH @ 10.2' AT 24 HRS
WL DRY	RIG 750 ATV — FOREMAN T. Covington	DRILLING METHOD HSA

ahewitt (11-16-10)

JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-2	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME	ARCHITECT-ENGINEER
Kensington Volunteer Fire Station #25	

SITE LOCATION
14401 Connecticut Avenue, silver spring, MD 20906

-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 417

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Asphalt Depth 5"	417	
	1	SS	18	12	Gravel Depth 5"	415	27 (10-11-16)
	2	SS	11	8	Silty SAND, Brown, Moist, Medium Dense, (SM)		(22-50/5) 50/5
5					Decomposed Rock, Gray and Brown, Moist, Very Dense		
	3	SS	11	5		410	(46-50/5) 50/5
	4	SS	10	4			(42-50/4) 50/4
10						405	
	5	SS	15	10			(14-27-50/3) 77/9
15						400	
	6	SS	0	0			(50/0) 50/0
20					AUGER REFUSAL @ 20.0'		
						395	
25						390	
30							

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

WL 0.0 — WS OR WD	BORING STARTED 10/18/10	DRILLER: D&S
WL(BCR) — WL(ACR) DRY	BORING COMPLETED 10/18/10	CAVE IN DEPTH @ 10.2'
WL	RIG 750 ATV — FOREMAN T. Covington	DRILLING METHOD HSA

(10/27/2010)

JMcGregor

dhewitt (11-16-10)

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-3	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

-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%

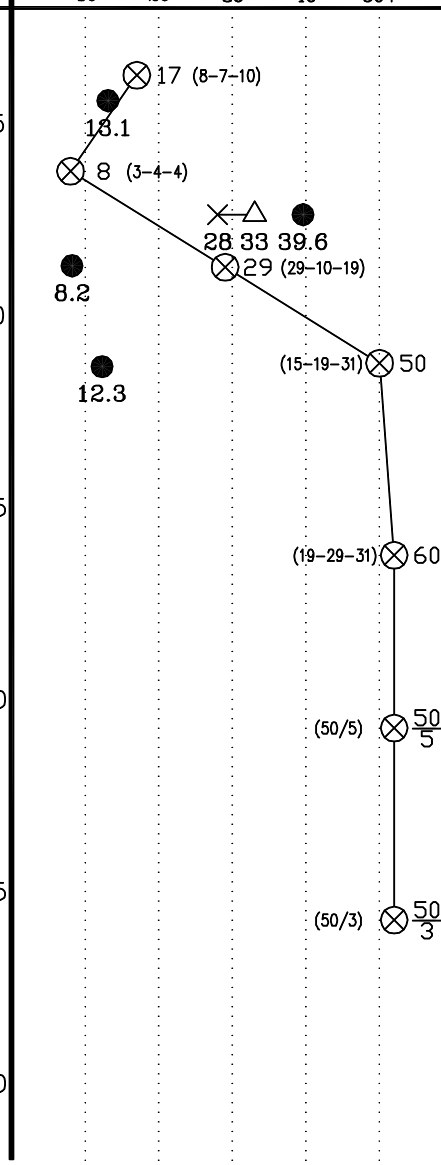
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION: 418

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0					Asphalt Depth 3"	418
	1	SS	18	8	Gravel Depth 9"	
					Silty SAND, Trace Concrete and Steel Reinfocring at 6-7.5', Brown and Gray, Moist, Firm to Medium Dense, (SM-FILL)	415
5	2	SS	18	10		
	3	SS	18	6		
					Sandy SILT, Brown and Gray, Moist, Dense, (ML)	410
10	4	SS	18	12		
					Decomposed Rock, Brown and Gray, Moist, Very Dense	405
15	5	SS	18	8		
	6	SS	5	5		400
20						
	7	SS	3	3		395
25					END OF BORING @ 25.0'	
30						390



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

WL 0.0 — WS OR WD	BORING STARTED 10/15/10	DRILLER: D&S
WL(BCR) — WL(ACR) DRY	BORING COMPLETED 10/15/10	CAVE IN DEPTH @ 18.6'
WL	RIG 750 ATV — FOREMAN T. Covington	DRILLING METHOD HSA

(10/27/2010)

JMcGregor

dhewitt (11-16-10)

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-4	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

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 414

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 5"	414	
	1	SS	18	15	Silty SAND, Brown and Gray, Moist, Firm, (SM-FILL)		9 (3-3-6)
	2	SS	3	2	Decomposed Rock, Gray and Brown, Moist, Very Dense	410	50/3 (50/3)
5					AUGER REFUSAL @ 4.0'		
10						405	
15						400	
20						395	
25						390	
30						385	

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

WL 0.0	WS OR WD	BORING STARTED 10/15/10	DRILLER: D&S
WL(BCR)	WL(ACR) DRY	BORING COMPLETED 10/15/10	CAVE IN DEPTH @ 2.9'
WL		RIG 750 ATV FOREMAN T. Covington	DRILLING METHOD HSA

ahewitt (11-16-10) (10/27/2010) JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-5	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

-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+

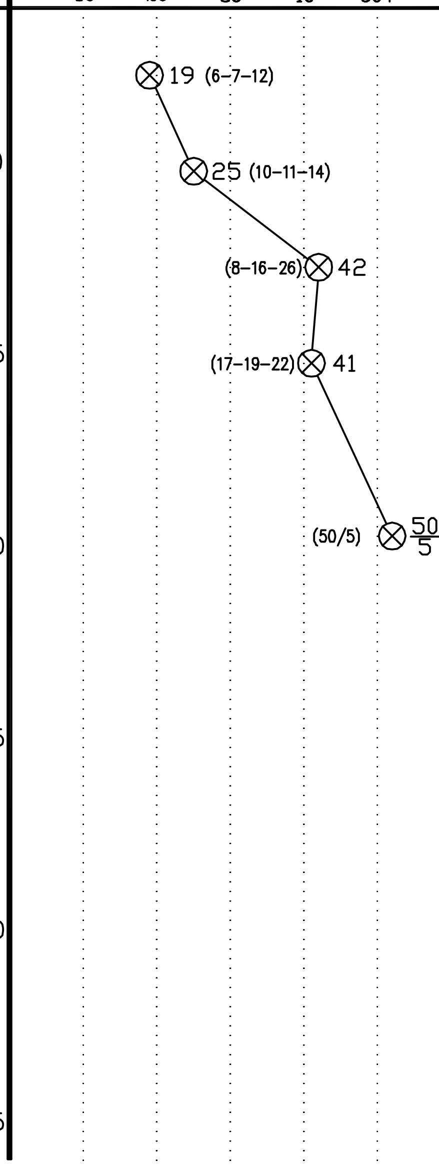
DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 414

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 5"	414	
	1	SS	18	12	Sandy SILT, Dark Brown, Moist, Medium Dense, (ML)		19 (6-7-12)
5	2	SS	18	16		410	25 (10-11-14)
	3	SS	18	12	Sandy SILT, Dark Brown and Gray, Moist, Dense, (ML)		(8-16-26) 42
10	4	SS	18	14		405	(17-19-22) 41
15	5	SS	5	5	Decomposed Rock, Dark Gray and Brown, Moist, Very Dense	400	(50/5) 50/5

AUGER REFUSAL @ 15.0'



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

WL 0.0 — WS OR WD	BORING STARTED 10/15/10	DRILLER: D&S
WL(BCR) — WL(ACR) DRY	BORING COMPLETED 10/15/10	CAVE IN DEPTH @ 11.9' AT 24 HRS
WL DRY	RIG 750 ATV FOREMAN T. Covington	DRILLING METHOD HSA

ahewitt (11-16-10) (10/27/2010) JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-6	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

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

PLASTIC LIMIT % — 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 414

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	WATER CONTENT %	STANDARD PENETRATION BLOWS/FT.
0–0.5					Topsoil Depth 6"			
	1	SS	18	12	SILT, Trace Sand and Clay, Orangish Brown, Moist, Firm, (ML)		25.3	10 (3-4-6)
	2	SS	18	14	SILT, With Mica, Dark Brown, Moist, Medium Dense, (ML)	410	9.5	26 (6-12-14)
	3	SS	10	8	Decomposed Rock, Dark Gray and Brown, Moist, Very Dense		8.3	50/4 (36-50/4)
	4	SS	18	12		405	5.2	65 (36-39-26)
	5	SS	17	12		400		84/11 (26-34-50/5)
	6	SS	3	3		395		50/3 (50/3)
	7	SS	1	1		390		50/1 (50/1)

END OF BORING @ 25.0'

Depth scale: 0, 5, 10, 15, 20, 25, 30. Elevation scale: 410, 405, 400, 395, 390, 385.

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

WL 0.0 — WS OR WD	BORING STARTED 10/18/10	DRILLER: D&S
WL(BCR) — WL(ACR) 0.0	BORING COMPLETED 10/18/10	CAVE IN DEPTH @ 18.6' AT 4 HRS
WL	RIG 750 ATV — FOREMAN T. Covington	DRILLING METHOD HSA

ahewitt (11-16-10)

(10/27/2010)

JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-7	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

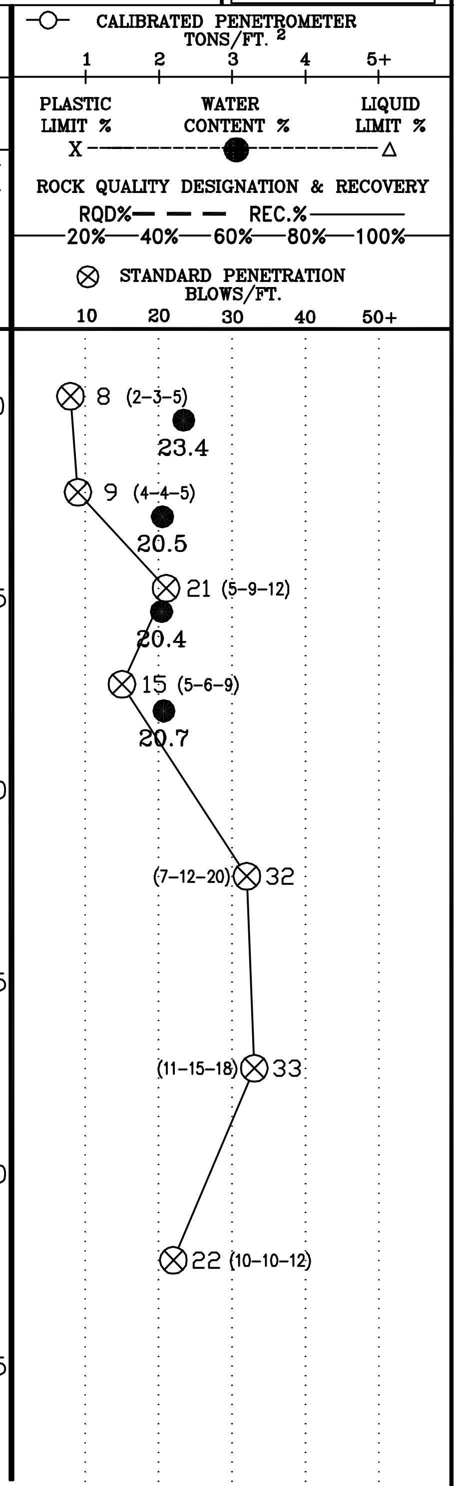
SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

SURFACE ELEVATION: 412

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0					Topsoil Depth 6"	
1	1	SS	18	12	Silty SAND, Orange and Brown, Moist, Firm, (SM)	410
4	2	SS	18	16		
6	3	SS	18	18	Sandy SILT, With Mica, Dark Brown and White, Moist, Medium Dense to Dense, (ML)	405
8.5	4	SS	18	18		
13.5	5	SS	18	16		400
18.5	6	SS	18	18		395
23.5	7	SS	18	14		390
25					END OF BORING @ 25.0'	385



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

WL	WS OR WD	BORING STARTED 10/18/10	DRILLER: D&S
WL(BCR)	WL(ACR) DRY	BORING COMPLETED 10/18/10	CAVE IN DEPTH @ 18.6'
WL		RIG 750 ATV FOREMAN T. Covington	DRILLING METHOD HSA

dhewitt (11-16-10)

(10/27/2010)

JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-8	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION: 412

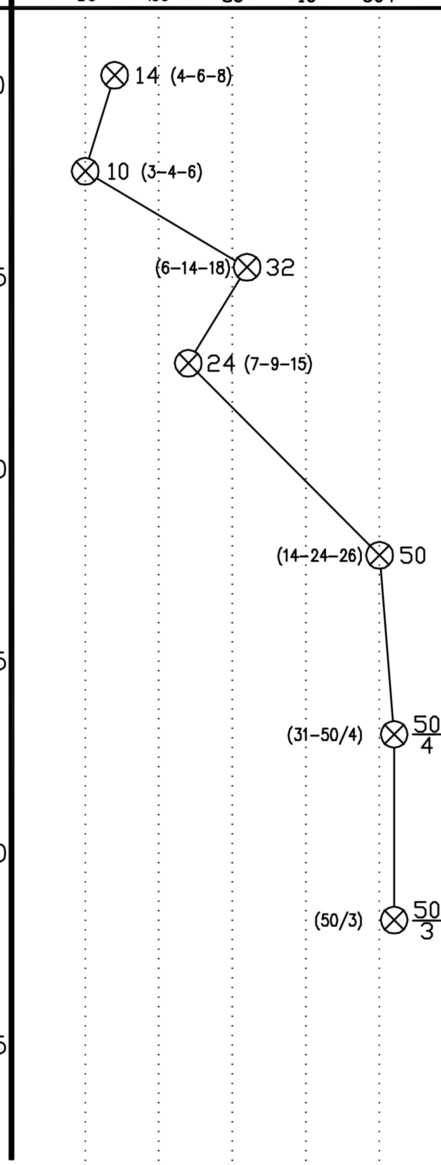
–O– CALIBRATED PENETROMETER TONS/FT.² 1 2 3 4 5+

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+

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 7"		
	1	SS	18	8	CLAY, Orangish Brown, Moist, Stiff, (CL-FILL)	410	14 (4-6-8)
	2	SS	18	16	SILT, Trace Clay, Orangish Brown, Moist, Firm, (ML)		10 (3-4-6)
5	3	SS	18	12	Sandy SILT, Brown and White, Moist, Medium Dense to Dense, (ML)	405	32 (6-14-18)
	4	SS	18	14			24 (7-9-15)
10						400	
	5	SS	18	18			50 (14-24-26)
15						395	
	6	SS	10	8	Decomposed Rock, Brown, Moist, Very Dense		50/4 (31-50/4)
20						390	
	7	SS	3	3			50/3 (50/3)
25					END OF BORING @ 25.0'	385	
30							



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

WL 0.0 — WS OR WD	BORING STARTED 10/18/10		DRILLER: D&S
WL(BCR) — WL(ACR) 0.0	BORING COMPLETED 10/18/10		CAVE IN DEPTH @ 19.1' AT 2 HRS
WL	RIG 750 ATV	FOREMAN T. Covington	DRILLING METHOD HSA

(10/27/2010)

ahewitt (11-16-10)

JMcGregor

CLIENT	JOB #	BORING #	SHEET
Hughes Group Architects	4269	B-9	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Kensington Volunteer Fire Station #25

ARCHITECT-ENGINEER:

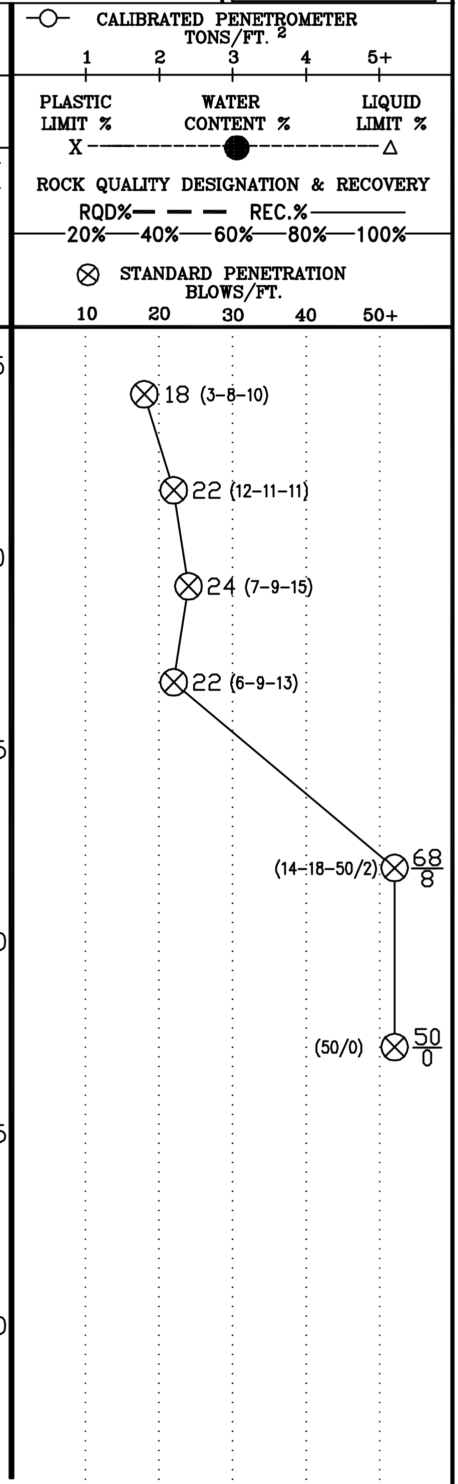
SITE LOCATION: 14401 Connecticut Avenue, silver spring, MD 20906

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION 416

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 6"	416	
	1	SS	18	14	Sandy SILT, Trace Organics and Gravel, Dark Gray and Brown, Moist, Medium Dense, (ML-FILL)	415	18 (3-8-10)
	2	SS	18	10	Sandy SILT, Clay, Orange and Brown, Moist, Medium Dense, (ML)		22 (12-11-11)
5						410	
	3	SS	18	14			24 (7-9-15)
	4	SS	18	16			22 (6-9-13)
10						405	
	5	SS	14	10	Decomposed Rock, Brown and Gray, Moist, Very Dense		68/8 (14-18-50/2)
15						400	
	6	SS	0	0			50/0 (50/0)
20					AUGER REFUSAL @ 19.5'	395	
25						390	
30							



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

WL — WS OR WD	BORING STARTED 10/18/10		DRILLER: D&S
WL(BCR) — WL(ACR) 0.0	BORING COMPLETED 10/18/10		CAVE IN DEPTH @ 15.2' AT 3 HRS
WL	RIG 750 ATV	FOREMAN T.Covington	DRILLING METHOD HSA

ahewitt (11-16-10) (10/27/2010) JMcGregor

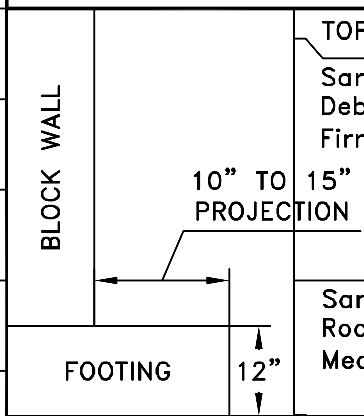
ECS LLC MID-ATLANTIC

PROJECT NAME:	TEST PIT #:
KENSINGTON VOLUNTEER FIRE STATION #25	TP-1

CLIENT:	JOB #:	SURFACE ELEVATION:
HUGHES GROUP ARCHITECTS	13-4269	417

LOCATION:	ARCH./ENG:
SILVER SPRING, MARYLAND	

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP	SAMPLE NO.	MOIST. CONT.
0	417	TOPSOIL DEPTH 4"					
		Sandy SILT, With Construction Debris, Brown, Moist, Loose to Firm, (ML-FILL)	E				
2	415						
		Sandy SILT, With Decomposed Rock, Brown and White, Moist, Medium Dense, (ML)	D				
4	413						
		Decomposed Rock, Brown and White, Moist, Very Dense	VD				
		END OF TEST PIT @ 4.5'					
6	411						
8	409						
10	407						
14	403						
18	399						
22	395						



REMARKS:
FOOTING APPEARS TO STEP OUT FROM 10" TO 15" OFF THE WALL FACE.

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

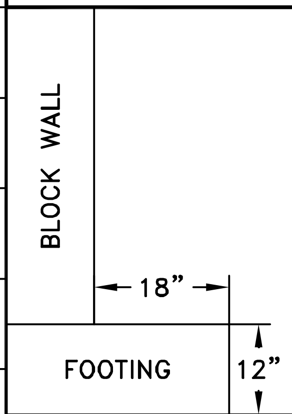
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

CONTRACTOR:	OPERATOR:	ECS ENG'R:
JOHNS LABOR GROUP	KYLE KAUFFMAN	JAM
MAKE:	MODEL:	DATE:
KOMATSU	MINI-EXCAVATOR	10-20-10
REACH:	CAPACITY:	UNITS:
		English

AMH (11-11-10) AMH (11-11-10) AMH (11-15-10) AMH (11-16-10)

ECS LLC MID-ATLANTIC	PROJECT NAME: KENSINGTON VOLUNTEER FIRE STATION #25		TEST PIT #: TP–2
	CLIENT: HUGHES GROUP ARCHITECTS	JOB #: 13–4269	SURFACE ELEVATION: 416
	LOCATION: SILVER SPRING, MARYLAND	ARCH./ENG:	

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP	SAMPLE NO.	MOIST. CONT.
0	416	ASPHALT DEPTH 4"	E				
		CR–6 DEPTH 8"	E				
		Sandy SILT, With Construction Debris, Orangish Brown, Wet, Firm, (ML–FILL)	E				
2	414	Decomposed Rock, and Sandy SILT, Grayish Brown, Moist, Medium Dense to Dense, (ML)	M				
4	412	Decomposed Rock, Grayish Brown, Moist, Very Dense	VD				
6	410						
8	408						
10	406						
14	402						
18	398						
22	394						



END OF TEST PIT @ 4.5'

REMARKS:
NE SIDE OF APPARATUS BAY

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

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

CONTRACTOR: JOHNS LABOR GROUP	OPERATOR: KYLE KAUFFMAN	ECS ENG'R: JAM
MAKE: KOMATSU	MODEL: MINI–EXCAVATOR	DATE: 10–20–10
REACH:	CAPACITY:	UNITS: English

AMH (11–11–10) AMH (11–11–10) AMH (11–15–10) AMH (11–16–10)

ECS LLC MID-ATLANTIC

PROJECT NAME:	TEST PIT #:
KENSINGTON VOLUNTEER FIRE STATION #25	TP-3

CLIENT:	JOB #:	SURFACE ELEVATION:
HUGHES GROUP ARCHITECTS	13-4269	415

LOCATION:	ARCH./ENG:
SILVER SPRING, MARYLAND	

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP	SAMPLE NO.	MOIST. CONT.
0	415	TOPSOIL DEPTH 4"					
		Sandy SILT, With Gravel, Brown, Orange, and Gray, Moist, Medium Dense, (ML-FILL)	M				
2	413						
4	411						
		SILT, Gray and Black, Moist, Medium Dense, (ML)	D				
6	409	END OF TEST PIT @ 6.0'					
8	407						
10	405						
14	401						
18	397						
22	393						

BLOCK WALL

7"

FOOTING

Note: Footing thickness could not be verified due to depth of hole and hand digging.

REMARKS:
WATER SEEPING INTO PIT @ TOP OF FOOTING

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

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

CONTRACTOR:	OPERATOR:	ECS ENG'R:
HAND EXCAVATED		JAM
MAKE:	MODEL:	DATE: 10-20-10
REACH:	CAPACITY:	UNITS: English

AMH (11-11-10) AMH (11-11-10) AMH (11-15-10) AMH (11-16-10)

ECS LLC MID-ATLANTIC	PROJECT NAME: KENSINGTON VOLUNTEER FIRE STATION #25	TEST PIT #: TP-4
	CLIENT: HUGHES GROUP ARCHITECTS / JOB #: 13-4269	SURFACE ELEVATION: 412
DEPTH (FT.) / ELEV. (FT.)	LOCATION: SILVER SPRING, MARYLAND / ARCH./ENG.:	EXCAV. EFFORT / DCP / QP / SAMPLE NO. / MOIST. CONT.

DESCRIPTION OF MATERIAL

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP	SAMPLE NO.	MOIST. CONT.
0	412	GRAVEL DEPTH 2"					
0–3.5	412–408.5	Sandy SILT, With Gravel, Roots, and Construction Debris, Brown and Gray, Moist, Medium Dense to Firm, (ML-FILL)	E				
3.5–4	408.5–408	Topsoil, Black, Wet					
4–5.3	408–406.7	Clayey SILT, Greenish Gray, Moist, Medium Dense, (ML)	M				

BLOCK WALL

7"

FOOTING

16"

END OF TEST PIT @ 5.3'

Depth scale (FT.): 0, 2, 4, 6, 8, 10, 14, 18, 22

Elevation scale (FT.): 412, 410, 408, 406, 404, 402, 398, 394, 390

REMARKS:
AROUND CORNER FROM GAS METER. WATER SEEPING INTO PIT @ 5'

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

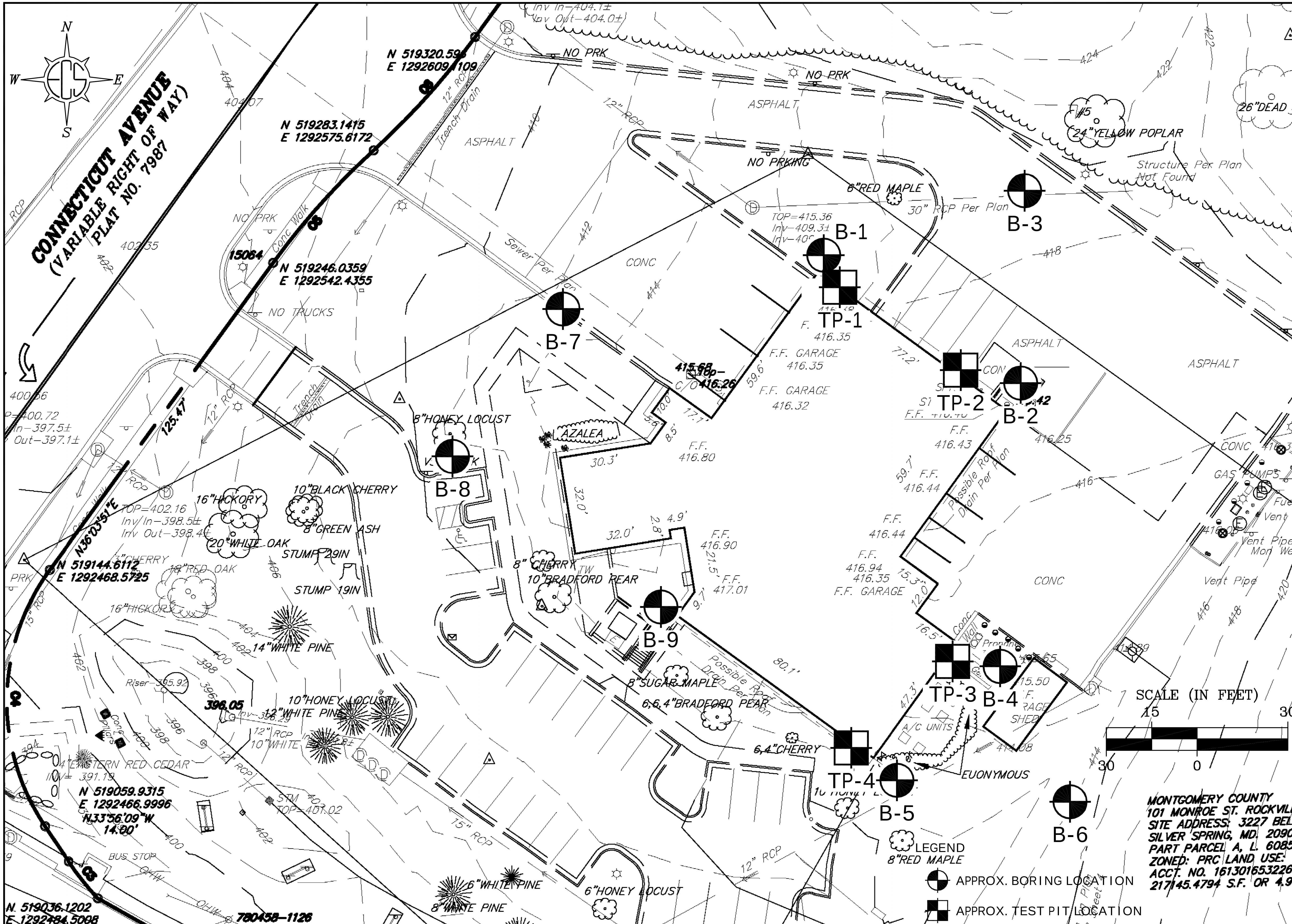
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

CONTRACTOR: JOHNS LABOR GROUP	OPERATOR: KYLE KAUFFMAN	ECS ENG'R: JAM
MAKE: KOMATSU	MODEL: MINI-EXCAVATOR	DATE: 10-20-10
REACH:	CAPACITY:	UNITS: English

AMH (11-11-10) AMH (11-11-10) AMH (11-15-10) AMH (11-16-10)

TEST PIT PHOTOGRAPHS TAKEN OCTOBER 20, 2010	ECS LLC MID-ATLANTIC	KENSINGTON VOLUNTEER FIRE STATION #25 ECS PROJECT NO. 13-4269

TEST PIT PHOTOGRAPHS TAKEN OCTOBER 20, 2010	ECS LLC MID-ATLANTIC	KENSINGTON VOLUNTEER FIRE STATION #25 ECS PROJECT NO. 13-4269



KENSINGTON VOLUNTEER
FIRE STATION #25
SILVER SPRING, MARYLAND

ECS LLC MID-ATLANTIC

BORING LOCATION
DIAGRAM
HUGHES GROUP ARCHITECTS

ECS REVISIONS	
ENGINEER JAM	DRAFTING AMH
SCALE 1" = 30'	
PROJECT NO. 13-4269	
SHEET 1 OF 1	
DATE 11-08-10	