ECS LLC

MID-ATLANTIC

REPORT OF
SUBSURFACE EXPLORATION, LABORATORY TESTING, AND GEOTECHNICAL ENGINEERING ANALYSES

Tractor Supply Store
Sussex Highway
Seaford, Sussex County, Delaware

ECS Project No. 02-4105

Prepared For:

THE KEITH CORPORATION
5935 CARNEGIE BOULEVARD, SUITE 200
CHARLOTTE, NORTH CAROLINA 28209

September 20, 2006

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental

September 20, 2006

Ms. Wendy Fulton
The Keith Corporation
5935 Carnegie Boulevard, Suite 200
Charlotte, North Carolina 28209

ECS Project No. 02-4105

Reference: Report of Subsurface Exploration, Laboratory Testing, and Geotechnical Engineering Analyses for **Tractor Supply Store**, Sussex Highway, Seaford, Sussex County, Delaware

Dear Ms. Fulton:

ECS Mid-Atlantic, LLC, (ECS) has completed the preliminary geotechnical investigation for the above-referenced project. This work was performed in accordance with our Proposal No. 02-7833-P, dated March 17, 2006. The attached engineering report contains a discussion of the available project information, the subsurface conditions encountered in the borings, and evaluations and recommendations regarding geotechnical considerations for design and construction of the proposed site developments.

It has been our pleasure to be of service to The Keith Corporation. We would appreciate the opportunity to continue our role as Geotechnical Engineer of Record during final design and subsequent construction. If you have any questions with regard to the information contained in the enclosed report, or if we can be of further assistance to you during the planning or construction phases of the project, please contact us.

Most sincerely,
ECS MID-ATLANTIC, LLC

Kristofer R. Miller, I.E.
Project Manager

John D. Woodburn, P.E.
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cc:: Environmental Consultants International; Attn: Mr. Ken Kullman

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Submitted by:

ECS Mid-Atlantic, LLC
1340 Charwood Road, Suite P
Hanover, Maryland 21076

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TRACTOR SUPPLY STORE
SEAFORD, DELAWARE

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TRACTOR SUPPLY STORE
SEAFORD, DELAWARE

INTRODUCTION

Site Location and Description

The project site is located on the west side of Sussex Highway, just north of its intersection with Camp Road, in the Seaford area of Sussex County, Delaware. A Site Location Map is provided in the Appendix. For purposes of discussions in this report, Sussex Highway is assumed to extend in a general north to south direction.

At the time of a recent site visit, the site was found to be generally open, flat, and grassy. Existing site grades appeared to be relatively level throughout the site. The site is bordered by commercial or residential properties on the north, west, and south sides and by Sussex Highway on the east side.

Project Information

Based upon the information provided to us, which included an untitled, undated site plan, we understand that the developments proposed for this site are to include the construction of an approximately 19,097 square foot Tractor Supply store with associated parking areas and drive lanes on all sides of the building. A Stormwater Management Pond will be located generally south of the proposed building and is shown to have embankment slopes constructed at a 3H:1V configuration. Additionally, a 6,048 square foot septic area is planned for the southwestern corner of the Tractor Supply store property. Additional developments at the site include the construction of 59,670 square feet of storage rental units as well as a second 6,000 square foot septic area; however, the storage units and second septic area are being developed separately, and were not a part of our study.

Structural configuration and loading information was not provided; however, we anticipate that the Tractor Supply store will be constructed with typical steel framing, masonry block exterior walls and ground-supported slabs. Furthermore, we anticipate that the building will have maximum wall, column, and slab loads estimated to be on the order of 4 kips per foot, 100 kips, and 125 pounds per square foot, respectively.

Scope of Services

In accordance with the scope of services included in our proposal, the subsurface exploration consisted of drilling a total of fourteen (14) soil test borings to depths of about 10 to 25 feet each, in general accordance with ASTM D 1586 standards. The scope of work for this report also included visually classifying soil boring samples, performing limited laboratory soil testing, performing various engineering analyses, and providing this written report of findings, evaluations, and recommendations. This report contains the following information:

a) A general review of the project information.

b) A review of site and geologic conditions.

c) A review of the subsurface conditions encountered, including soil and groundwater conditions.

d) Recommendations for foundation types and design parameters, including allowable bearing pressures and estimates of foundation settlement based on empirical relationships.

e) Recommendations for ground-supported slab construction.

f) Recommendations for asphalt pavement based upon estimates of field CBR values.

g) Recommendations for SWM pond construction in accordance with State and County requirements.

h) Recommendations for wastewater treatment and disposal facility construction in accordance with State and County requirements.

i) General earthwork construction recommendations, including an evaluation of the suitability of the on-site materials for reuse as engineered fill.

j) Recommendations relative to groundwater control, if necessary.

k) An Appendix, which includes a Site Location Map, a Boring Location Plan, the records of the field exploration (Boring Logs), and the results of laboratory testing.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil test borings were drilled with a truck-mounted drill rig, using continuous-flight, hollow-stem augers (HSA) to advance the boreholes. Drilling fluid was not used during advancement of the boreholes.

Representative soil samples were obtained by means of the split-barrel sampling procedure in general accordance with ASTM D 1586. In the split-barrel sampling procedure, a 2-inch O.D. split-barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value (blow count, or N-value) and is indicated for each sample on the Boring Logs.

N-values can be used to provide a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, N-values also provide an indication of consistency for cohesive soils. The indications of relative density and consistency are qualitative, since many factors can significantly affect N-values and prevent direct correlations, including differences among drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the subsurface conditions encountered in the borings was maintained by the Drill Crew during the drilling operations. After recovery, each boring sample was removed from the sampler and visually classified. Representative portions of the soil samples were then sealed in glass jars and returned to the ECS laboratory for further visual examination and possible laboratory testing.

The boring locations were selected by ECS and staked in the field by a representative of ECS, utilizing GPS triangulation methods and existing site features as references. The ground surface elevations at the boring locations were not provided. It should be noted that after completion of our initial boring layout, the boring stakes were destroyed when the grass throughout the site was mowed. Therefore, ECS was required to make a second trip to the site for boring stake-out.

Laboratory Testing Program

The laboratory testing program included visual classifications of all soil samples by an experienced Geotechnical Engineer. The classifications were based on texture and plasticity in accordance with the Unified Soil Classification System (USCS). A brief explanation of the USCS is included in the Appendix of this report. The USCS group symbol for each soil type is indicated in parentheses following the soil descriptions on the Boring Logs.

During the visual classification procedures, the Geotechnical Engineer grouped the various soil types into the major strata noted on the Boring Logs. The stratification lines designating the interfaces between various soil strata on the Boring Logs are approximate. In situ, these transitions will likely be gradual and could occur at slightly different levels from those shown on the Boring Logs.

The limited laboratory testing program included index property tests, such as moisture contents, Atterberg limits, and percent passing the No. 200 sieve, on selected samples to determine pertinent engineering properties of the soils and to verify the visual classifications. The results of the laboratory testing are included in the Appendix of this report.

The soil samples will be retained in the ECS laboratory for a period of 60 days. After that holding period, the samples will be disposed, unless ECS receives other instructions regarding their disposition.

EXPLORATION RESULTS

Geologic Conditions

Based upon the results of the borings and our review of the "*Generalized Geologic Map of Delaware*", dated 1976, the project site is located within the Coastal Plain Physiographic Province, which is characterized by river and marine sediments deposited during successive periods of fluctuating sea levels and moving shorelines. Generally, the sediments thicken from west to east, towards the Atlantic Ocean. The uppermost sediments are often comprised of interbedded sands, gravels, clays, and silts. It appears that the uppermost Coastal Plain soils in the area of the site are associated with the Columbia Formation, which generally consists of brown quartz sands and gravels.

Subsurface Conditions

The soil test borings each generally encountered approximately 8 inches of topsoil at existing surface grades overlying the natural Columbia Formation soils, which were found to extend through the depths explored by the borings. Details of subsurface conditions encountered in the various borings can be found on the individual Boring Logs in the Appendix.

Natural Coastal Plain soils associated with the Columbia Formation were encountered below the topsoil in each of the borings and extended to depths in the range of 10 to 25 feet below existing site grades, which were the termination depths of the borings. The Columbia Formation soils were generally brown or gray in color and consisted of Sandy Silty CLAY (CL), Clayey SAND (SC), SAND some Clay (SC), SAND with Silt (SM), and Silty SAND (SM) soil types. N-values recorded in the natural soils were in the range of 2 bpf to 46 bpf, indicating very loose to dense relative densities for the granular soils and stiff consistencies for the cohesive soils.

Water Level Observations

Groundwater level observations were made in each of the boreholes during the drilling operations, at the completion of drilling operations, both before and after removal of the drilling augers, and up to 24 hours after completion of the borings. Free groundwater was encountered during the drilling operations in 8 of the 14 borings, at depths in the range of about 4.3 to 13.5 feet below existing site grades. Cave-in depths measured within the borings upon completion of drilling or up to 24 hours after completion of drilling were found to range from 4.5 to 12.5 feet below the ground surface. The groundwater levels and the cave-in levels observed for each boring are shown on the Boring Logs presented in the Appendix.

The recorded groundwater levels reflect the conditions at the time of this exploration only. Fluctuations in the location of groundwater tables or perched water tables can occur as a result of seasonal variations in evaporation, precipitation, surface water run-off, and other factors.

Laboratory Test Results

Samples from the borings were visually classified by an experienced Geotechnical Engineer in accordance with the Unified Soil Classification System (USCS). In addition, selected soil samples from the borings were tested for moisture content, Atterberg limits, and gradation analyses to confirm visual classifications and to provide data for estimates of engineering properties. Results of the various laboratory tests were not available at the time of this report and will be issued in an Addendum to this report when completed.

EVALUATIONS AND RECOMMENDATIONS

Building Recommendations

The finished floor slab elevation of the proposed Tractor Supply store was not indicated on the provided site plan; however, ECS anticipates that the finished floor slab elevation of the store will be generally located at or near existing site grades, to minimize the amount of cuts and fills required during construction. Therefore, considering typical footing embedment depths required for protection against freeze/thaw, ECS assumes that footing bearing depths for the proposed building should be no greater than about 5 feet below existing site grades.

Foundation Considerations

Based upon the results of the borings and our understanding of the proposed construction, it is ECS's opinion that conventional footings can be used for support of the proposed Tractor Supply building. The foundations can be supported on suitable natural soils or on new engineered fill constructed over suitable natural soils.

For footing design, it appears that the natural soils at the site should be suitable for a net allowable soil bearing pressure of 2,500 pounds per square foot (psf). New engineered fill, placed and compacted over suitable natural soils in accordance with the recommendations of this report, should also be suitable for a net allowable soil bearing pressure of 2,500 psf. The net allowable soil bearing pressure refers to the pressure which can be transmitted to the foundation bearing soils in excess of the final overburden pressure at the base of a footing.

Prior to the placement of reinforcement and concrete for footings, the bases of the footing excavations should be observed, tested, and approved by a qualified representative of the Geotechnical Engineer to verify that soil conditions at each footing location are suitable for the design bearing pressure. If unsuitable soils are encountered at planned subgrade levels for any footing, the unsuitable soils should be undercut to suitable bearing materials. The footing can be directly supported on competent soils at greater depths or, alternatively, the design footing bearing level can be restored through placement of lean concrete or engineered fill materials. If the design bearing level is restored using engineered fill, then the excavation to remove the unsuitable soils should extend at least 0.5 ft laterally beyond the bottom edge of the footing for each 1 ft of vertical undercut below the footing bearing level. The engineered fill materials should be placed and compacted as discussed in greater detail later.

In order to reduce the possibility of excessive settlement due to local shear or "punching" action, we recommend that column footings have a minimum lateral dimension of 2.5 feet and continuous wall footings should have a minimum width of 1.5 feet. In addition, footings should be placed at sufficient depths to provide adequate protection against frost heave. It is recommended that exterior footings or footings in unheated areas should be placed at minimum depths of 30 inches below finished exterior grades for frost protection. Interior footings in heated areas can be located at minimum depths of 18 inches below finished floor grades, provided that architectural and structural considerations are also satisfied. However, if interior footings in future heated areas are constructed at levels above 30 inches and subsequently are subjected to freezing temperatures, there is a possibility for frost heave of those footings. Therefore, the Contractor should take adequate precautions to maintain temperatures above freezing around any shallow interior footings prior to enclosure and heating of the building.

All load-bearing wall foundations should be suitably reinforced with continuous longitudinal steel. To provide continuity and to minimize the effects of differential movements, the foundations should be constructed as continuous units to the greatest extent possible. Where top and bottom steel is provided in continuous wall foundations, a minimum footing thickness of 12 inches is recommended.

Ground-Supported Floor Slabs

Building floor slabs may be ground-supported on suitable natural soils or new engineered fill soils, provided that the subgrades are prepared in accordance with the recommendations in the sections entitled Subgrade Preparation and Fill Placement. Slab subgrades prepared in accordance with this report and provided with a minimum 4-inch thick granular subbase layer can be designed for a modulus of subgrade reaction (R) of 120 pci.

It is recommend that ground-supported slabs be underlain by a minimum of 4 inches of MSHA No. 57 graded coarse aggregate, CR-6 or GA S/B dense-graded aggregate, or approved equivalents. Acceptable granular subbase materials should have no aggregate size greater than 1.5 inches, 95 to 100 percent passing the 1 inch sieve, and less than 12 percent by total weight passing the Number 200 sieve. The granular subbase materials will provide a capillary break between the subgrade and the concrete slab, a higher modulus of subgrade reaction, and more uniform support conditions. All granular materials should be compacted; however, if the granular subbase materials have more than 5 percent fines, those materials should be compacted to a minimum of 100 percent of the maximum dry density as determined by the Standard Proctor compaction test method (ASTM D 698).

Where moisture vapor seepage through concrete slabs is a concern, a moisture vapor barrier, consisting of at least 8-mil polyethylene sheets, should be placed on top of the granular materials before the placement of the concrete. However, with the use of a moisture vapor barrier, special attention should be given to the surface curing of the slab in order to minimize uneven drying of the slab and any associated cracking and curling.

It is recommended that ground-supported slabs be isolated from the foundation footings so that differential movement between the footings and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free floating slab, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab. Slabs must also be provided with proper control joints to minimize the effects of concrete shrinkage and differential settlements. To minimize the widths of any shrinkage cracks that may develop near the surface of the slab, it is recommended that welded-wire mesh reinforcement be provided. The welded-wire mesh should be in located the top half of the slab to be effective.

It is important that the slab subgrade be firm and stable before the placement of the granular subbase materials, the moisture barrier, and the concrete. The subgrade should be thoroughly proofrolled with suitable equipment and/or probed by a qualified representative of the Geotechnical Engineer in an effort to detect unstable or otherwise unacceptable soil conditions. Proofrolling should be concentrated in those areas where any wall and utility backfill have been placed. Soils in any excessively unstable areas should be undercut and replaced with new engineered fill. Recommendations for construction of engineered fill are presented in subsequent paragraphs.

In the event there is a significant time lag between the site grading work and the fine grading of concrete slab areas prior to the placement of the subbase stone or concrete, the Geotechnical Engineer should verify the condition of the prepared subgrade. Prior to final slab construction, the subgrade may require scarification and re-compaction to provide firm and stable conditions.

Pavement Construction

It is ECS's opinion that two pavement sections generally should be considered for use at the project site – a standard-duty pavement section for parking areas that will receive primarily automobile and light truck traffic, and a heavy-duty pavement section for the site entrances, drive lanes, and other areas that will receive frequent heavier truck traffic. We have based our pavement designs upon estimates of traffic loadings that are considered suitable for a project site of this size and usage.

It is our judgment that traffic conditions associated with standard-duty pavements can be represented by approximately 15,000 18-kip equivalent single-axle loads (ESALs) during an approximately 20-year service life, while traffic conditions associated with heavy-duty pavements can be represented by approximately 150,000 ESALs during an approximately 20-year service life. If such traffic loading are not considered to be representative of likely traffic conditions, ECS should be further consulted.

Subgrade support conditions are the other major parameter of importance to pavement design and performance. It is anticipated that the subgrade soil conditions which will be exposed at final subgrade levels when the project site is graded prior to pavement construction will consist of natural soils or new engineered fill soils with USCS classifications of SC, SM, or more granular. Based upon our previous experience, our knowledge of the geology in the area of the project site, and the preliminary nature of this study, it is our judgment that the pavement subgrade soils be assumed to have California Bearing Ratio (CBR) values of 4, or greater when compacted to at least 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D 698).

The pavement sections provided below have been designed based on methodology from the American Association of State Highway and Transportation Officials' (AASHTO) *Guide for Design of Pavement Structures*, 1993. Summarized below are the subgrade strength parameters, the traffic conditions, and other design parameters and criteria considered in these analyses.

CBR value:	4
Traffic for Standard-Duty Pavement:	15,000 ESALs
Traffic for Medium-Duty Pavement:	150,000 ESALs
Reliability:	85 percent
Overall Variance:	0.45
Initial Serviceability:	4.2
Terminal Serviceability:	2.0

Using the above-indicated design parameters, we have estimated the following preliminary pavement sections:

Pavement Material	**Compacted Material Thicknesses (Inches)***	
	Standard-Duty (15,000 ESALs)	**Heavy-Duty (150,000 ESALs)**
Surface Course Asphalt HMA Superpave - 9.5 mm **	1.5	1.5
Base Course Asphalt HMA Superpave – 12.5 mm **	2.0	3.0
Graded Aggregate Base GAB	4.0	6.0
Total Pavement Thickness	7.5	10.5
* Compaction: Level 1 (50 Gyrations) ** Binder Type: PG64-22		

It is ECS's opinion that the suggested flexible pavement sections may not be suitable for the support of heavy, concentrated wheel loads. Therefore, we recommend that rigid Portland cement concrete pavement sections should be provided for dumpster storage areas, the trailer loading/unloading areas, and the fenced concrete storage area located to the north of the building. The Portland cement concrete pavement section should be at least 6 inches thick and should consist of air-entrained Portland cement concrete having a minimum 28-day compressive strength of 4,000 pounds per square inch (psi). A minimum of 4 inches of compacted dense-graded aggregate subbase (CR-6 or GA S/B) should be placed beneath all rigid concrete pavements. For dumpster storage areas, the Portland cement concrete slab area should be large enough to support the dumpster and at least the front wheels of the truck used to unload the dumpster.

All pavement materials and construction should be in accordance with the most current versions of the Delaware DOT and Sussex County requirements.

The pavement sections provided in the tables above were developed for the indicated in-service traffic conditions only and do not provide an allowance for construction traffic conditions. Therefore, if pavements will be constructed early during site development to accommodate construction traffic, consideration must be given to the construction of heavier pavement sections, capable of accommodating the much heavier loads normally associated with construction traffic, as well as the future in-service traffic. ECS can provide additional design assistance with regard to pavements upon request.

SWM Pond Construction

Details regarding the construction of the proposed SWM pond at the site were not provided, although we anticipate that the pond will be designed and constructed in accordance with the USDA Soil Conservation Service Small Pond Code 378, as required by Delaware Sediment & Stormwater Regulations.

Cut-Off Trench and Impervious Core

Considering the existing grades at the site, ECS anticipates that the facility will be constructed primarily in cut, with some fill placement for embankments towards the west end of the facility. Therefore, in accordance with Code 378 requirements for SWM pond construction, a cut-off trench and impervious core should be provided in all areas where new fill embankments will be constructed and where the principal spillway is located (if a spillway is provided).

The cutoff trench should extend at least 4 feet below the downstream toe of the new fill embankments, and in the area of the principal spillway, the cut-off trench should extend at least 4 feet below the bottom of the principal spillway pipe. The cut-off trench should also have a minimum width of 4 feet, and should have side slopes of 1H:1V, or flatter. An impervious core should be provided in the area of the cutoff trench and embankment fill areas, and should extend vertically upward to the 10-year stormwater surface elevation. Fill materials for the cutoff trench and impervious core construction should consist of GC, SC, CL, or CH soil types and have at least 30 percent by weight passing the No. 200 sieve.

Based upon the results of the soil borings, it appears likely that there may not be sufficient quantities of natural clayey soils at the project site for use as fill materials in cutoff trench and impervious core construction. Therefore, the Contractor should anticipate the need to haul suitable clayey soils to the site. The off-site soils that are identified for use in cut-off trench and impervious core construction will need to be sampled, tested, and approved by the Geotechnical Engineer, prior to their use in SWM facility construction at the site.

Fill materials for the cut-off trench and impervious core should be placed in 8-inch loose lifts and compacted to at least 95 percent of the maximum dry density in accordance with the Standard Proctor test method, ASTM D 698. To provide lower coefficients of permeability, we recommend that moisture contents at the time of construction should generally be within the range of the optimum moisture content to 3 percentage points wet of the optimum moisture content. Placement and compaction of the cut-off trench and impervious core fill materials should be monitored by the Geotechnical Engineer on a full-time basis to ensure that fill materials are being placed and compacted in accordance with plans and specifications.

General Embankment Construction

According to the plans provided, it appears that the SWM pond should be constructed primarily in cut, with slope configurations of 3H:1V. Based upon the results of the borings, we anticipate that the pond cut slopes should primarily contain natural granular soil types classified as SM per ASTM D-2487. It is our judgment that these soil types should be suitable for a slope configuration as steep as 3H:1V.

It appears that embankment construction through placement of new fill soils may also be required towards the western end of the pond. Embankment soils placed for fill slopes outside the limits of the cut-off trench and impervious core should consist of soils classified as CL, ML, SC, SM, or more granular in accordance with ASTM D-2487. Soils of these types should be readily available from excavated materials associated with the proposed site development. Embankment fill materials should be placed in 8-inch loose lifts and compacted to at least 95 percent of the maximum dry density in accordance with the Standard Proctor test method, ASTM D 698. Fill slopes constructed as outlined herein should also be suitable for the slope configuration as steep as 3H:1V.

Infiltration Considerations

Based upon our understanding of the proposed site developments and the existing site conditions, there do not appear to be any ditches, swales, or other bodies of water to which stormwater can be discharged from the pond. Therefore, ECS anticipates that infiltration of stormwater within the pond will be utilized.

In accordance with Delaware Sediment & Stormwater Regulations, infiltration practices may only be utilized where the bottom of the facility is constructed at least three feet above the seasonal high water table (whether perched or regional). The high water table may be determined by direct measurement or by the depth at which mottling of the soil occurs. The bottom of the facility must also be located at least three feet above impervious layers of soil, and must not be constructed in existing fill soils. Furthermore, infiltration practices are limited to soils having an infiltration rate of at least 1.02 inches per hour (i.e., the soils should have a USDA Soil Classification of Sandy Loam or more granular).

Based upon the depths at which groundwater was encountered in Boring SWM-3, the depths at which mottling was observed in Borings SWM-1 and SWM-2, and the depths at which impervious Sandy Silty CLAY (CL) soils were encountered in Boring SWM-2, it appears that the bottom of the pond/infiltration facility should be constructed at a depth of about 4.5 feet below the ground surface at Borings SWM-1 and SWM-2, or at a depth of about 3.5 feet below the ground surface at Boring SWM -3, whichever is higher.

Based upon the results of Borings SWM-1, SWM-2, and SWM-3, as well as the anticipated facility depth as described above, it appears that the soils that should be encountered at the base of the pond/infiltration facility should generally consist of granular Sandy LOAM soils. It is our opinion that the Sandy LOAM soils in the area of the pond should be capable of infiltrating water at a rate of at least 1.02 inches per hour. ECS recommends that upon finalization of pond design details, including the bottom elevation of the facility, in-situ infiltration testing be performed to establish actual infiltration rates for the soils at the base of the facility.

Septic Facility Design

According to the Delaware Department of Natural Resources and Environmental Control – Division of Water Resources, wastewater treatment and disposal facilities must have a bottom elevation located at least 36 inches above the limiting zone. The limiting zone is defined as "any horizon or condition in the soil profile or underlying strata which includes: a) The presence of seasonal or perennial saturation as evidenced by redoximorphic features (soil mottling) or direct measurement of observation wells; or b) Rock with open joints, fractures or solution channels, masses of loose rock fragments, or loose weathered rock, including gravel, with insufficient fine soil to fill the voids between the fragments; or c) Geologic stratum or soil zone in which the permeability of the stratum or zone effectively limits the movement of water." Furthermore, the soils encountered at the base of the facility must have a percolation rate less than 120 minutes per inch (mpi) and greater than 20 mpi (i.e. the soils must have USDA Soil Classifications ranging from LOAM to Loamy SAND).

Based upon the results of Boring S-1, which was performed in the general area of the proposed septic area for the Tractor Supply development, soils having a USDA classification of Sandy LOAM were encountered down to a depth of about 10 feet below the existing ground surface. Minimum percolation rates for Sandy LOAM soils typically are on the order of 60 mpi, which would make the soils acceptable. However, a groundwater depth measurement obtained 24 hours after completion of the boring indicated water was at a depth of about 4.3 feet below the ground surface. It was also observed that soil mottling began at a depth of about 3.5 feet below the ground surface.

Therefore, unless the base of the septic system is placed within 6-inches of the existing ground surfaces, it is our opinion that the use of percolation within a conventional below-grade treatment and disposal system may not be feasible because of the relatively shallow groundwater in the proposed septic area. Perhaps alternative treatment and disposal methods also should be considered.

Earthwork Operations

Subgrade Preparation

Subgrade preparation should generally include the stripping of any topsoil and other unsuitable surface materials from the planned structure and pavement areas. Caution should be taken when stripping topsoil materials so as to not mix these materials with otherwise suitable subgrade soils. It is recommended that the stripping of unsuitable surficial materials should extend to a minimum of 5 feet beyond the structure and pavement area limits.

Subsequent to stripping operations, the exposed subgrade soils in the planned building and pavement areas should be examined by a qualified representative of the Geotechnical Engineer. The exposed soils should be thoroughly proofrolled by a vehicle having an axle weight of at least 10 tons, such as a fully-loaded tandem-axle dump truck. This procedure is intended to assist in identifying any localized yielding materials. In the event that any yielding materials are encountered during the proofrolling operations, those subgrade soils should either be thoroughly densified in-place, or undercut to firm ground and replaced with controlled, compacted fill to final subgrade elevations.

Fill Placement

Prior to placement of compacted fill, representative bulk samples (about 50 pounds) should be taken of the proposed fill soils and laboratory tests should be conducted to determine Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. These test results will be necessary for proper control of construction for new engineered fill.

Upon achieving competent subgrade conditions, the Contractor can place and compact engineered fill to reach final subgrade levels. In general, any materials to be used as structural fill should consist of soil types classified as CL, ML, SC, SM or more granular, in accordance with ASTM D 2487, and should have a Liquid Limit less than 40 and a Plasticity Index less than 20. The results of the borings indicate that the majority of the on-site natural soils should be suitable for re-use at the site, with moisture adjustment during fill placement.

Finer-grained, more plastic, and organic soil types, if encountered at the site, may be used as fill materials in landscape areas. Any such materials encountered during grading operations should be either stockpiled for later use in landscape fills, or should be placed in approved disposal areas either on-site or off-site. Prior to the utilization of any on-site or off-site borrow materials, the Geotechnical Engineer should be provided with representative samples in order to determine the suitability of the materials for use as a controlled compacted fill and to develop moisture-density relationships. In order to expedite the earthwork operations, it is recommended that any off-site borrow materials generally should comprise of SC or more granular soil types.

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). Structural fill placed within the upper 2 feet of floor slab and pavement subgrades should be compacted to at least 98 percent of the Standard Proctor maximum dry density to provide improved support characteristics. Generally, the moisture content of the fill material should be maintained within ±2 percentage points of the optimum moisture content for the fill material, as determined by ASTM D 698. Fill placed in non-structural areas should be compacted to at least 90 percent of the Standard Proctor maximum dry density in order to avoid significant subsidence.

Due to the textural variations of the on-site soils, variations in moisture-density relationships should be anticipated. Such variations must be determined in the field by a qualified representative of the Geotechnical Engineer at the time of construction, so that any necessary changes to fill placement and compaction procedures can be implemented.

The footprint of the proposed building areas 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 representative of the Geotechnical Engineer to determine that minimum compaction requirements are being achieved. A minimum of one compaction test per lift should be made per 2,500 square feet of fill lift area, but not fewer than two tests per lift should be made for any lift. The elevations and locations of the field density tests should be clearly identified at the time of fill placement and compaction.

Compaction equipment suitable for the soil types being used as fill should be selected to compact the fill. Theoretically, any equipment type can be used, so long as the required density is achieved. Ideally, a vibratory steel drum roller generally will be the most efficient for compaction of granular soil types and for sealing the surface soils, while a sheepsfoot roller or pneumatic-tire roller generally will be most efficient for compaction of cohesive soil types.

At the end of each work day, all fill areas should be graded to facilitate surface drainage of any surface runoff associated with precipitation, and should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor should scarify existing subgrade soils so that a weak plane will not be formed between the new fill and the existing subgrade soils. We recommend that subgrade soils should be scarified to depths of about 4 inches prior to placement of new fill.

Fill materials should not be placed on frozen soils, frost-heaved soils, and/or excessively wet soils. All frozen, frost-heaved, or excessively wet soils should be removed prior to continuation of fill operations. Borrow fill materials should not contain frozen materials at the time of placement. All frozen, frost-heaved, or excavated wet soils should be removed prior to placement of controlled, compacted fill. Moisture contents for excessively wet soils will need to be lowered to the range limits previously discussed.

If any problems are encountered during the earthwork operations, or if site conditions are found to deviate from those indicated by the borings, the Geotechnical Engineer should be notified immediately.

Construction Considerations

The on-site soils contain silt and clay fines that will be sensitive to moisture increases and to construction disturbance. Construction activities in the presence of excessive moisture can lead to softening of the subgrade soils and loss of bearing capacity. Therefore, it will be prudent to schedule earthwork operations during the warmer and drier seasons that generally occur from late spring to early fall. Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to provide for drainage of surface water from areas being developed.

A firm working surface for the placement of engineered fill should be established prior to construction of new fills. The moisture content of the fill soils at the time of placement should be carefully controlled to ensure that the required compaction effort can be achieved without excessive pumping or movement of the fill mass. In the event that the earthwork operations are accomplished during the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction.

As noted in the **Water Level Observations** section of this report, groundwater was encountered in eight of the fourteen borings at the time of the subsurface exploration. However, based upon the depths at which water was encountered, ECS anticipates that groundwater should not be encountered during construction of the building and pavement areas, although groundwater may be encountered during installation of utilities and construction of the SWM pond and/or septic area, depending on the final design elevations of those facilities. It is our judgment that any elevated groundwater or perched water should be able to be controlled using conventional control methods such as the use of ditches, sump pits, and pumps, so long as excavations extend minimally below the groundwater levels. If groundwater infiltration into excavations cannot be controlled by such methods, then dewatering using wellpoints may be needed.

All foundation excavations must be protected to prevent the disturbance of the subgrade materials and to minimize any potential loss of support capacity. Foundation concrete generally should be placed for foundations during the same day that the foundation excavations are made and approved. Should excavating and placing the foundation concrete the same day not be practical, we recommend that a concrete mud mat, 2 to 3 inches thick, be placed to protect the subgrade soils from moisture changes and disturbance. If protection of the soils is not provided, then undercutting of softened or loosened soils may be necessary prior to the placement of reinforcing steel and foundation concrete.

Prior to the placement of any foundation concrete or mud mat, the subgrade soils must be carefully examined and tested by a qualified representative of the Geotechnical Engineer to confirm the availability of the design soil bearing capacity. To minimize disturbance to the subgrade soils during excavation, we recommend that a bucket without scarifying teeth, in addition to hand excavation methods, be used during the final phases of the excavation for the foundations.

Any cuts or excavations associated with building and utility excavations may require forming or bracing, slope flattening or other physical measures to control sloughing and/or to prevent slope failures. Contractor should be familiar with and follow OSHA requirements to ensure that adequate protection of the excavations and trench walls is provided.

The surface soils contain appreciable fines and are considered erodible. The Contractor should provide and maintain good site drainage during earthwork operations to help to maintain the integrity of the surface soils. All erosion and sedimentation controls should be in accordance with sound engineering practice and current local requirements. Surface water should be directed away from the construction area, and the work area should be sloped at gradients of 1 to 2 percent to reduce the potential for ponding water and the subsequent saturation of the surface soils.

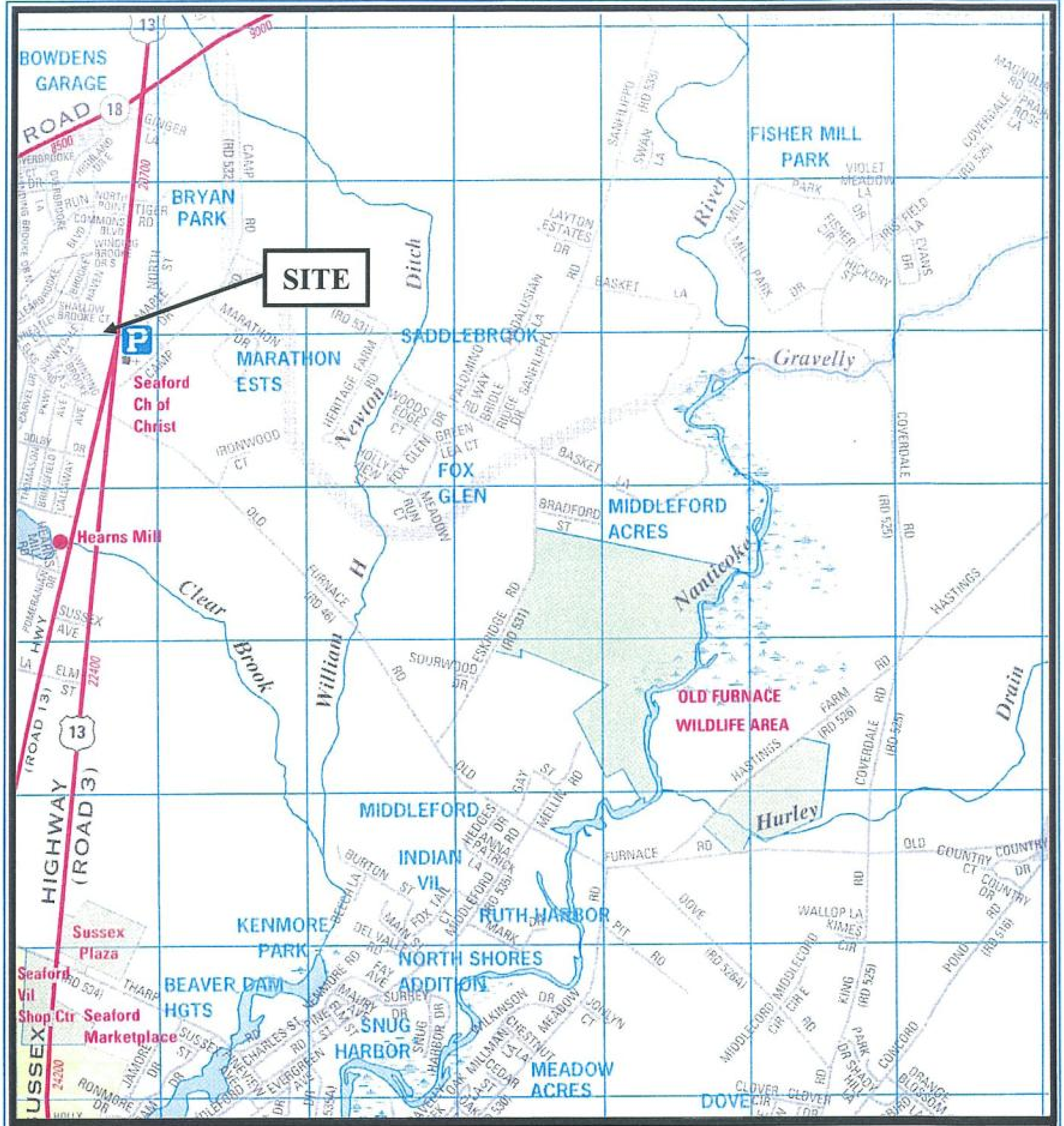
CLOSING

This report has been prepared to provide the Owner and the Design Team with subsurface information and evaluations and recommendations to guide geotechnical-related design and construction for development of the project site. The evaluations and recommendations presented in this report are, of necessity, based on the information made available to us at the time of the actual writing of the report and the site conditions, surface and subsurface, that existed at the time the exploratory borings were drilled. Additional geotechnical consulting may be required as planning and design for the project progress.

If there are significant changes to the proposed construction from those previously discussed, ECS may need to review the changes to determine whether the evaluations and recommendations of this report will remain valid. ECS should be provided with appropriate plans and other information as project design progresses, so that we can review the information and provide additional geotechnical guidance, as needed. The Geotechnical Engineer should be retained to review any earthwork specifications to assure that the recommendations of this report have been properly interpreted and included in the construction documents.

APPENDIX

- Site Location Map
- Unified Soil Classification System
- Laboratory Testing Results
- Reference Notes for Boring Logs
- Boring Logs
- Boring Location Plan



Source: ADC Street Map Book of Sussex County, Delaware, dated 2005.
Scale: 1" = 2,000'

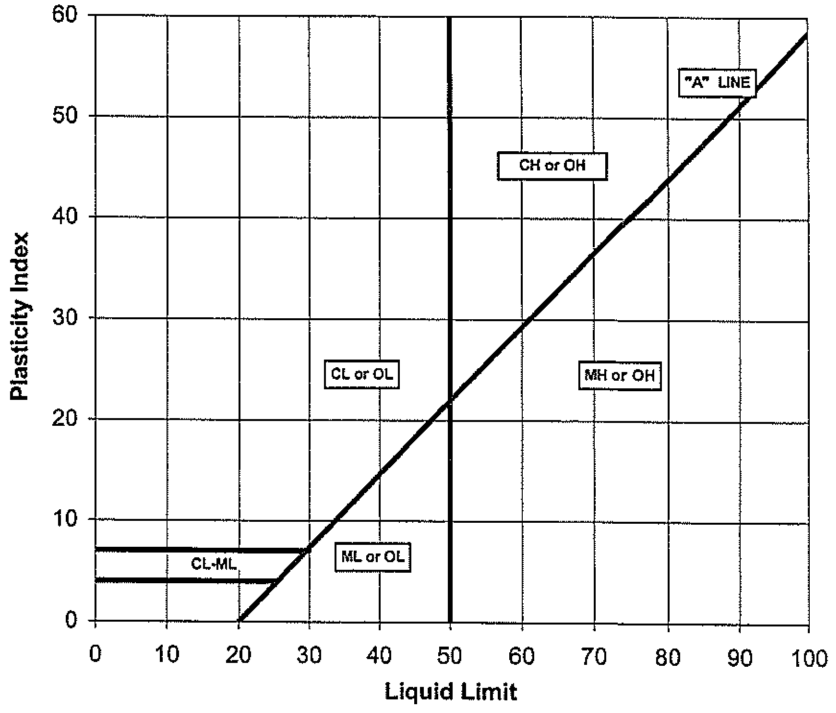
▲
NORTH

Tractor Supply Store Sussex Highway Seaford, Sussex County, Delaware, 19973	ECS LLC MID-ATLANTIC	**Site Location Map** ECS Project 02-4105 September 2006

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classifications 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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})}{D_{10} X D_{60}}$ 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	Silty Gravels, grave-sand-silt 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
			GC	Clayey Gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line with P.I. greater 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		$Cu = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$ 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	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			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			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and Clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			

Plasticity Chart



REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols:

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

II. Correlation of Penetration Resistances to Soil Properties:

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. Hammer falling 30 inches on a 2-inch 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 3 blows/ft.	Very Loose	Adjective Form	36% to 49%
4 to 6 blows/ft.	Loose	With	21% to 35%
7 to 10 blows/ft.	Firm	Some	11% to 20%
11 to 30 blows/ft.	Medium Dense	Trace	1% to 10%
31 to 50 blows/ft.	Dense		
51 to 80 blows/ft.	Very Dense		
Over 80 blows/ft.	Extremely Dense		

Particle Size Identification

Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00mm (dia. of broom straw)
	Fine	0.074 to 0.42mm (dia. of human hair)
Silt and Clay		0 .0 to 0.074mm (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 4	Very Soft	Under 0.25	None to Slight	0 - 4
4 to 5	Soft	0.25-0.49	Slight	5 – 7
6 to 10	Med. Stiff	0.50-0.99	Medium	8- 22
11 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00-8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	AB	Before Auger Removal
WS	While Sampling	AC	After Auger Removal
WD	While Drilling	EOD	End Of The Day

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

CLIENT	JOB #	BORING #	SHEET
The Keith Corporation	4105	B-1	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME
Tractor Supply Store

ARCHITECT-ENGINEER
Environmental Consultants International

SITE LOCATION
Sussex Highway, Seaford, Delaware

-○- 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+

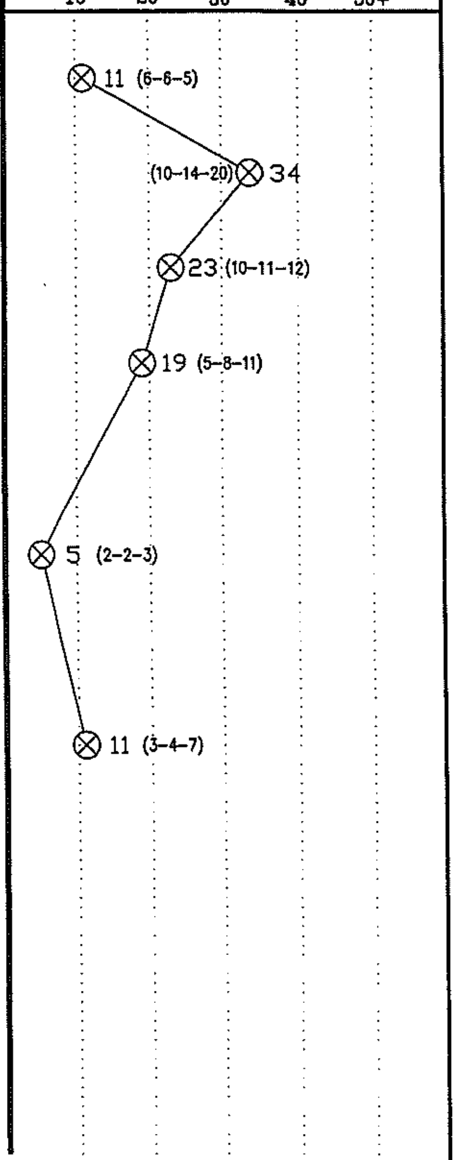
DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0					Topsoil Depth 8"
	1	SS	18	17	Fine Silty SAND, Brown, Moist, Medium Dense, (SM)
	2	SS	18	13	Fine to Coarse SAND, Some Clay, Gray and Brown, Moist, Medium Dense to Dense, (SC)
5					
	3	SS	18	18	
	4	SS	18	18	
10					
	5	SS	18	18	Fine to Coarse SAND, With Silt, Gray, Saturated, Loose to Medium Dense, (SM)
15					
	6	SS	18	16	
20					END OF BORING @ 20.0'
25					
30					

WATER LEVELS ELEVATION (FT)



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

▽WL 13.5' WS OR WD	BORING STARTED 08/18/06	
▽WL(BCR) ▽WL(ACR) 9.0'	BORING COMPLETED 08/18/06	CAVE IN DEPTH @ 11.8' @ 1 HR
▽WL 8.3' @ 1 HR	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06)

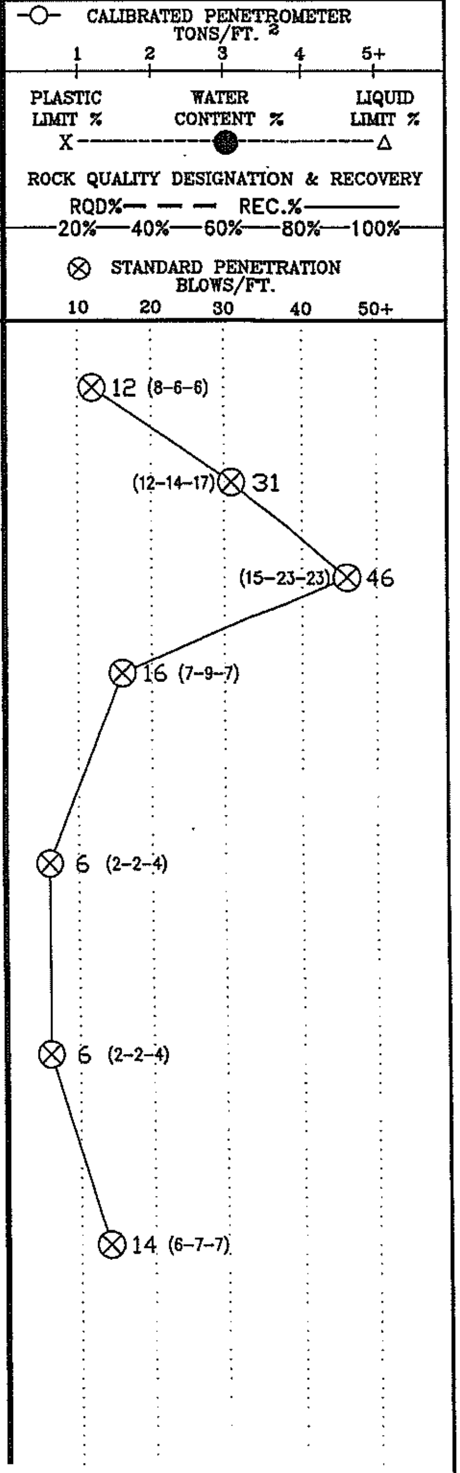
lmaurer(08/22/2006)

CLIENT The Keith Corporation	JOB # 4105	BORING # B-2	SHEET 1 OF 1	ECS LLC MID-ATLANTIC
PROJECT NAME Tractor Supply Store	ARCHITECT-ENGINEER Environmental Consultants International			

SITE LOCATION
Sussex Highway, Seaford, Delaware

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL
0					Topsoil Depth 8"
	1	SS	18	7	Fine Silty SAND, Brown, Moist, Medium Dense, (SM)
5	2	SS	18	18	Fine to Medium SAND, With Silt, Brown, Moist, Dense, (SM)
	3	SS	18	18	Fine to Coarse SAND, Some Clay, Gray, Moist, Medium Dense to Dense, (SC)
10	4	SS	18	18	
15	5	SS	18	18	Fine to Coarse SAND, With Silt, Gray, Saturated, Loose to Medium Dense, (SM)
20	6	SS	18	18	
25	7	SS	18	15	
30					END OF BORING @ 25.0'



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

▽WL 13.5' WS OR (WD)	BORING STARTED 08/18/06	
▼WL(BCR) ▼WL(ACR) 9.3'	BORING COMPLETED 08/18/06	CAVE IN DEPTH @ 12.3' @ 2 HRS
▽WL 8.2' @ 2 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRW (08-25-06) KRW (08-25-06)

kmoore(08/22/2006)

CLIENT	JOB #	BORING #	SHEET
The Keith Corporation	4105	B-3	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME
Tractor Supply Store

ARCHITECT-ENGINEER
Environmental Consultants International

SITE LOCATION
Sussex Highway, Seaford, Delaware

-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%

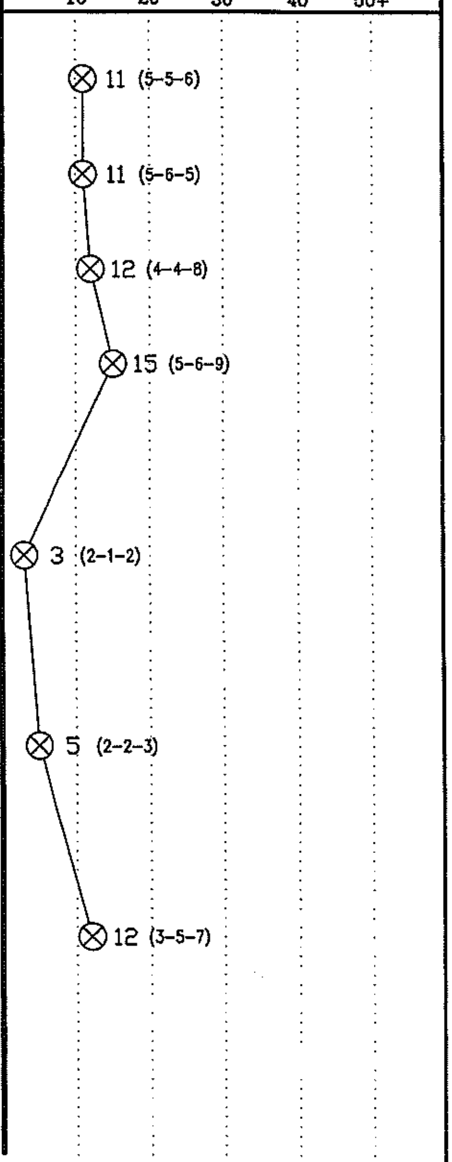
⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50+

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	14	Fine Silty SAND, Brown, Moist, Medium Dense, (SM)		
5	2	SS	18	11			
	3	SS	18	18	Fine Clayey SAND, Trace Fine Gravel, Gray, Moist, Medium Dense, (SC)	▽	
10	4	SS	18	16	Fine to Coarse SAND, With Silt, Gray, Moist to Saturated, Very Loose to Medium Dense, (SM)	▼ ▽	
15	5	SS	18	18			
20	6	SS	18	8			
25	7	SS	18	18	END OF BORING @ 25.0'		
30							



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

▽WL 13.5' WS OR (WD)	BORING STARTED 08/18/06	
▼WL(BCR) ▼WL(ACR) 10.7'	BORING COMPLETED 08/18/06	CAVE IN DEPTH @ 12.5' @ 3 HRS
▽WL 7.5' @ 3 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRW (08-25-06) KRW (08-25-06)

lmoore(08/22/2006)

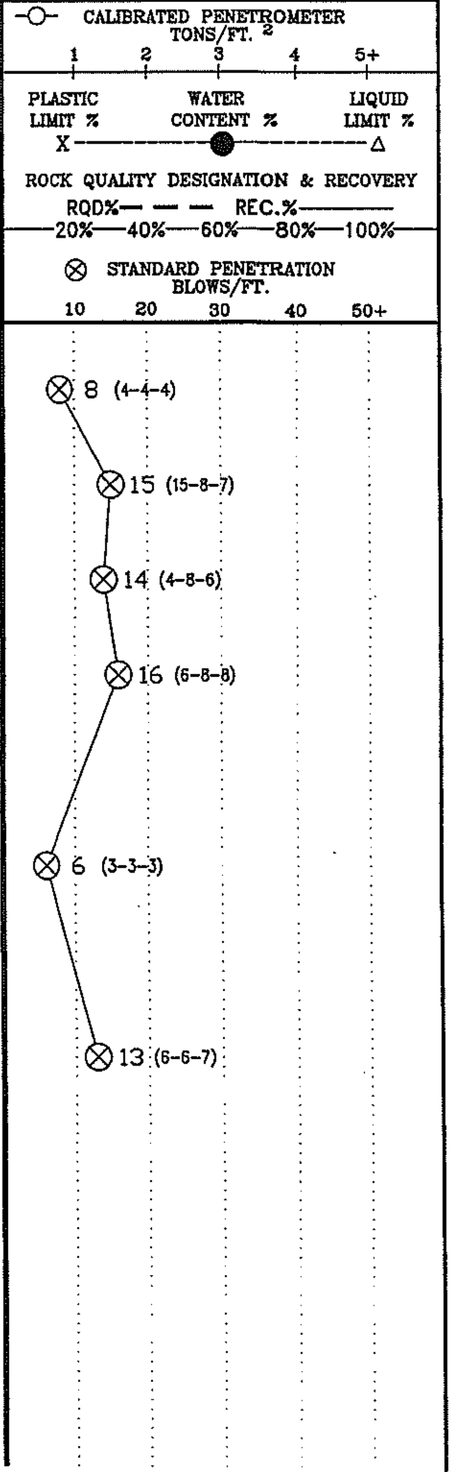
CLIENT The Keith Corporation	JOB # 4105	BORING # B-4	SHEET 1 OF 1	ECS LLC MID-ATLANTIC
PROJECT NAME Tractor Supply Store	ARCHITECT-ENGINEER Environmental Consultants International			
SITE LOCATION Sussex Highway, Seaford, Delaware				

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 8"			
	1	SS	18	17	Fine Silty SAND, Brown, Moist, Firm to Medium Dense, (SM)			8 (4-4-4)
5	2	SS	18	0				15 (15-8-7)
	3	SS	18	18	Fine to Coarse SAND, With Silt, Brown and Gray, Moist, Medium Dense, (SM)	▽ ▼		14 (4-8-6)
10	4	SS	18	18				16 (6-8-8)
15	5	SS	18	18	Fine Silty SAND, Gray, Saturated, Loose to Medium Dense, (SM)	▽		6 (3-3-3)
20	6	SS	18	14				13 (6-6-7)
					END OF BORING @ 20.0'			
25								
30								



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

▽WL 13.5' WS OR WD	BORING STARTED 08/18/06	
▽WL(BCR) ▼WL(ACR) 8.0'	BORING COMPLETED 08/18/06	CAVE IN DEPTH @ 11.3' @ 4 HRS
▽WL 6.8' @ 4 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRW (08-25-06) KRW (08-25-06)

Imported(08/22/2006)

CLIENT	JOB #	BORING #	SHEET
The Keith Corporation	4105	B-5	1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Tractor Supply Store

ARCHITECT-ENGINEER: Environmental Consultants International

SITE LOCATION: Sussex Highway, Seaford, Delaware

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

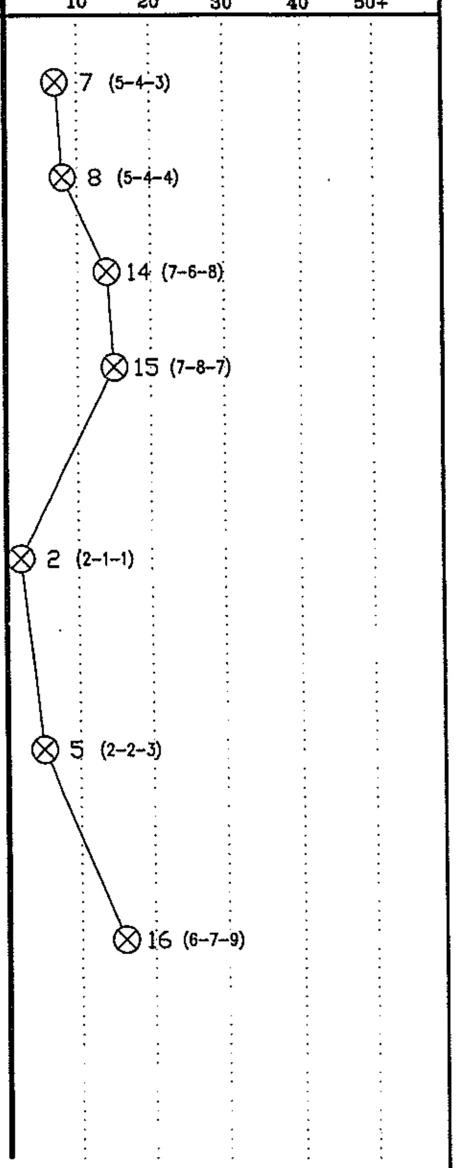
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
X ——— ● ——— △

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 8"	
	1	SS	18	16	Fine Silty SAND, Brown, Moist, Firm, (SM)	7 (5-4-3)
	2	SS	18	6		8 (5-4-4)
5						
	3	SS	18	18	Fine to Coarse SAND, With Silt, Brown and Gray, Moist, Medium Dense, (SM)	14 (7-6-8)
	4	SS	18	12		15 (7-8-7)
10						
	5	SS	18	18	Fine Silty SAND, Gray, Saturated, Very Loose to Medium Dense, (SM)	2 (2-1-1)
15						
	6	SS	18	12		5 (2-2-3)
20						
	7	SS	18	18		16 (6-7-9)
25					END OF BORING @ 25.0'	
30						



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

▽WL 12.5' WS OR [✓ WD]	BORING STARTED 08/17/06	
▽WL(BCR) ▽WL(ACR) 8.5'	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 9.3' @ 24 HRS
▽WL 6.8' @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06)

lmoore(08/22/2006)

CLIENT
The Keith Corporation

JOB #
4105

BORING #
P-1

SHEET
1 OF 1

ECS LLC
MID-ATLANTIC

PROJECT NAME
Tractor Supply Store

ARCHITECT-ENGINEER
Environmental Consultants International

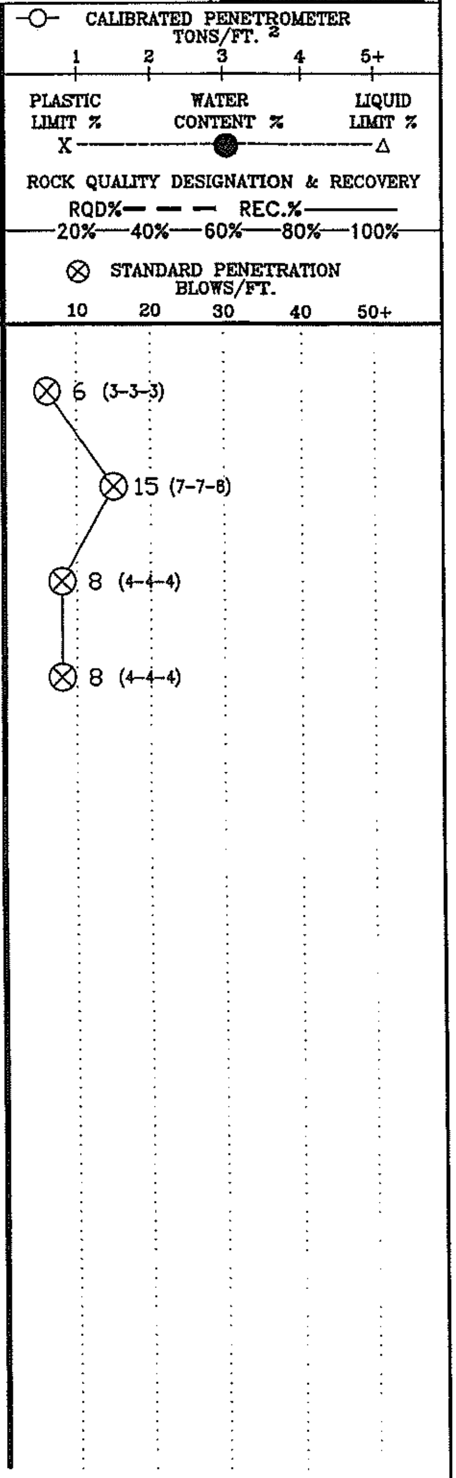
SITE LOCATION
Sussex Highway, Seaford, Delaware

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ⯈ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 8"			
	1	SS	18	16	Fine Silty SAND, Brown, Moist, Loose to Medium Dense, (SM)			6 (3-3-3)
5	2	SS	18	13				15 (7-7-8)
	3	SS	18	18	Fine to Coarse SAND, With Silt, Brown and Gray, Very Moist, Firm, (SM)	▽		8 (4-4-4)
10	4	SS	18	18				8 (4-4-4)
					END OF BORING @ 10.0'			
15								
20								
25								
30								



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

▽WL 7.0'	WS OR [✓ WD]	BORING STARTED	08/17/06	
▽WL(BCR)	▽WL(ACR) DRY	BORING COMPLETED	08/17/06	CAVE IN DEPTH @ 6.7' @ 24 HRS
▽WL 6.1' @ 24 HRS		RIG B50	FOREMAN DIAMOND	DRILLING METHOD HSA

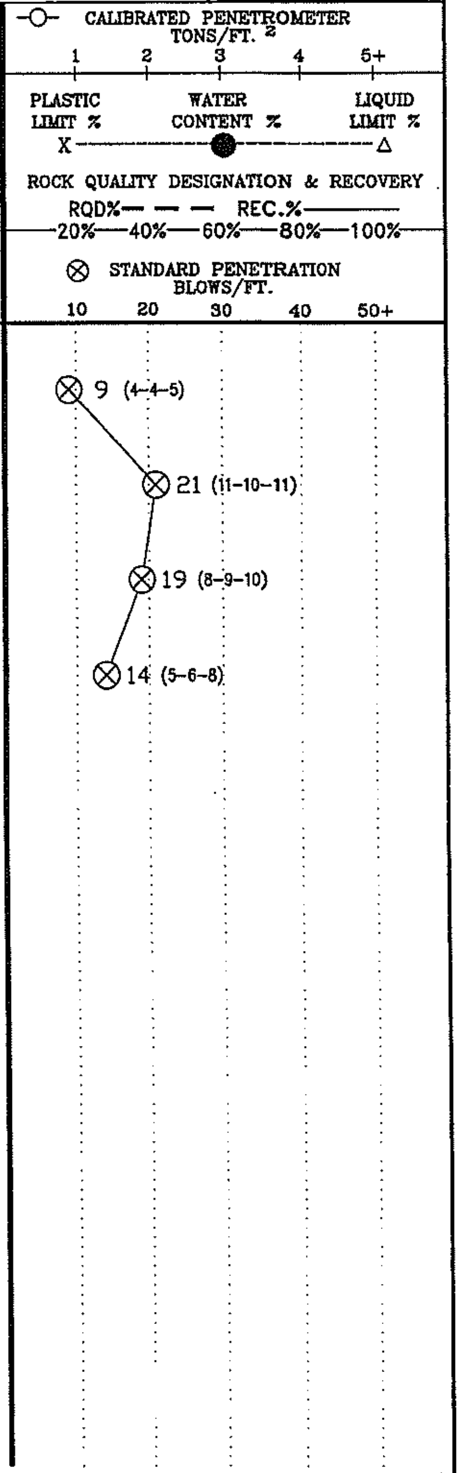
KRM (08-25-06) KRM (08-25-06)

lmaurer(08/22/2006)

CLIENT The Keith Corporation	JOB # 4105	BORING # P-2	SHEET 1 OF 1
PROJECT NAME Tractor Supply Store	ARCHITECT–ENGINEER Environmental Consultants International		
SITE LOCATION Sussex Highway, Seaford, Delaware			

ECS LLC MID-ATLANTIC

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL ENGLISH UNITS BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100% SURFACE ELEVATION	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	15	Fine Silty SAND, Trace Fine Gravel, Brown and Gray, Moist, Firm to Medium Dense, (SM)		
5	2	SS	18	1			
	3	SS	18	18			
10	4	SS	18	18			
					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽WL DRY WS OR [✓ WD]	BORING STARTED 08/17/06	
▽WL(BCR) ▽WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 4.5' @ 24 HRS
▽WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06)

lmoures(08/22/2006)

CLIENT
The Keith Corporation

JOB # 4105

BORING # P-3

SHEET 1 OF 1

ECS LLC
MID-ATLANTIC

PROJECT NAME
Tractor Supply Store

ARCHITECT-ENGINEER
Environmental Consultants International

SITE LOCATION
Sussex Highway, Seaford, Delaware

-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%

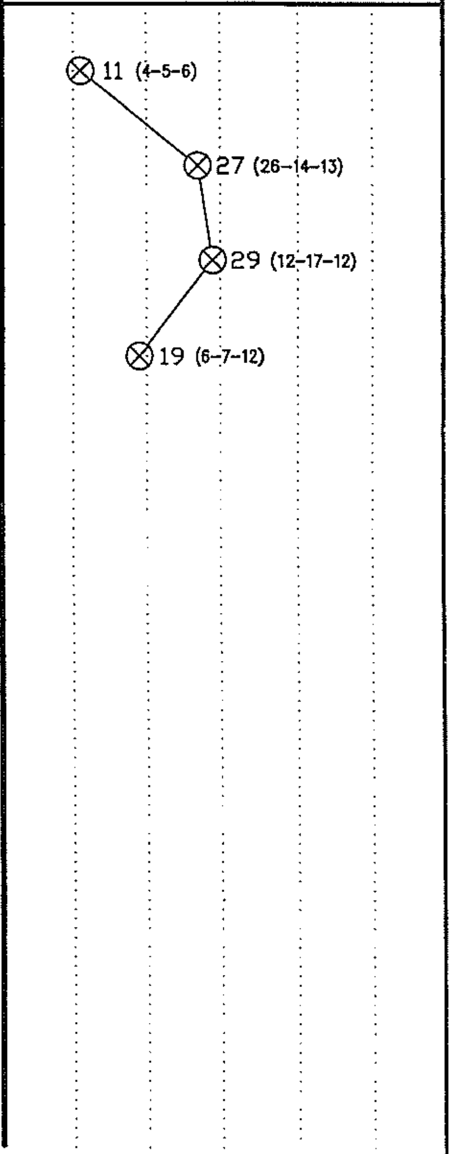
⊗ STANDARD PENETRATION BLOWS/FT.
10 20 30 40 50+

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	16	Fine Silty SAND, Brown and Gray, Moist, Medium Dense, (SM)		
5	2	SS	18	14			
	3	SS	18	18			
	4	SS	18	18			
10					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

∇WL DRY WS OR [✓ WD]	BORING STARTED 08/17/06	
∇WL(BCR) ∇WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 6.0' @ 24 HRS
∇WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06)

kmoore(08/22/2006)

CLIENT
The Keith Corporation

JOB # 4105

BORING # P-4

SHEET 1 OF 1

ECS LLC
MID-ATLANTIC

PROJECT NAME
Tractor Supply Store

ARCHITECT-ENGINEER
Environmental Consultants International

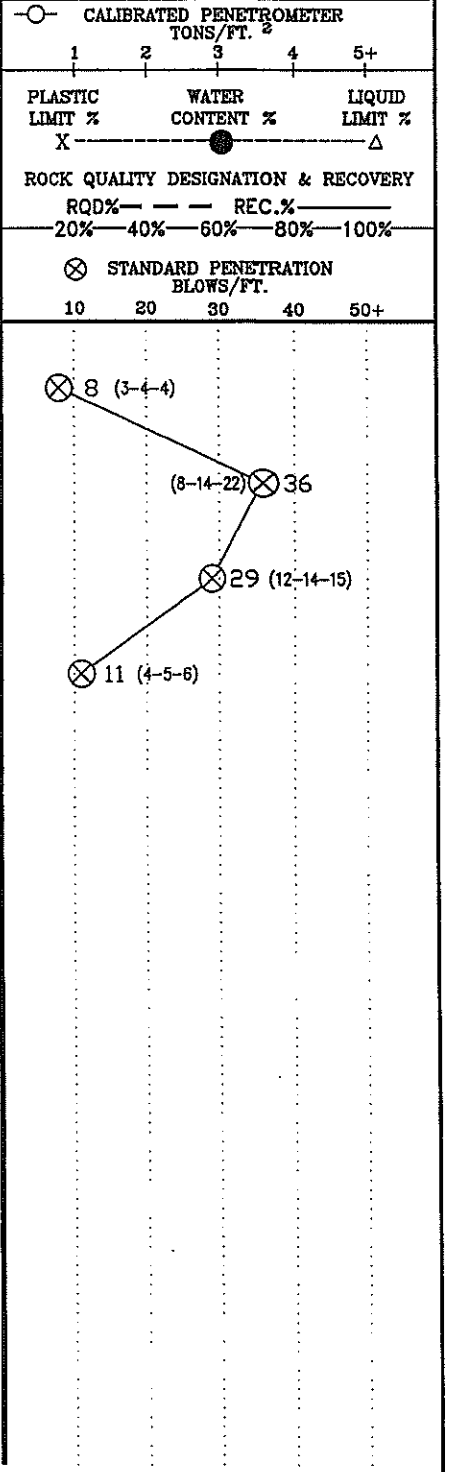
SITE LOCATION
Sussex Highway, Seaford, Delaware

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ⯈ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	14	Fine Silty SAND, Brown, Moist, Firm, (SM)		
5	2	SS	18	16	Fine to Coarse SAND, With Silt, Brown and Gray, Moist, Medium Dense to Dense, (SM)		
	3	SS	18	18			
10	4	SS	18	18	Sandy Silty CLAY, Gray, Moist, Stiff, (CL)		
					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽WL DRY WS OR (WD)	BORING STARTED 08/17/06	
▽WL(BCR) ▽WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 5.8' @ 24 HRS
▽WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06)

lmoure(08/22/2006)

CLIENT The Keith Corporation	JOB # 4105	BORING # P-5	SHEET 1 OF 1
PROJECT NAME Tractor Supply Store	ARCHITECT-ENGINEER Environmental Consultants International		
SITE LOCATION Sussex Highway, Seaford, Delaware			

ECS LLC MID-ATLANTIC

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

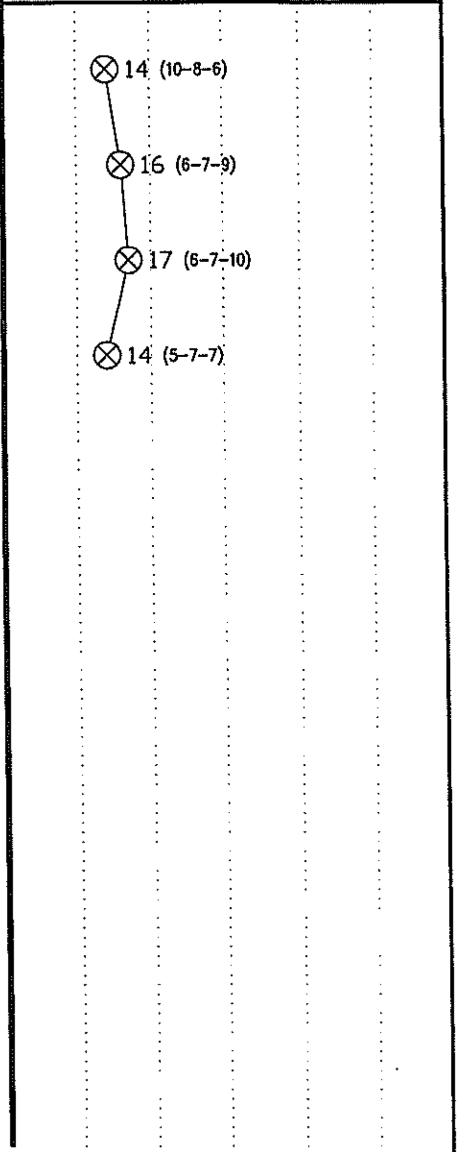
-○- CALIBRATED PENETROMETER TONS/FT.^{2} 1 2 3 4 5+

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	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	17	Fine Silty SAND, Brown, Moist, Medium Dense, (SM)		
5	2	SS	18	9			
	3	SS	18	18	Fine to Coarse SAND, With Silt, Brown, Moist, Medium Dense, (SM)		
10	4	SS	18	18			
					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽WL DRY WS OR WD	BORING STARTED 08/17/06	
▽WL(BCR) ▽WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 5.0' @ 24 HRS
▽WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KBW (08-25-06) KBW (08-25-06)

kmaurer(08/22/2006)

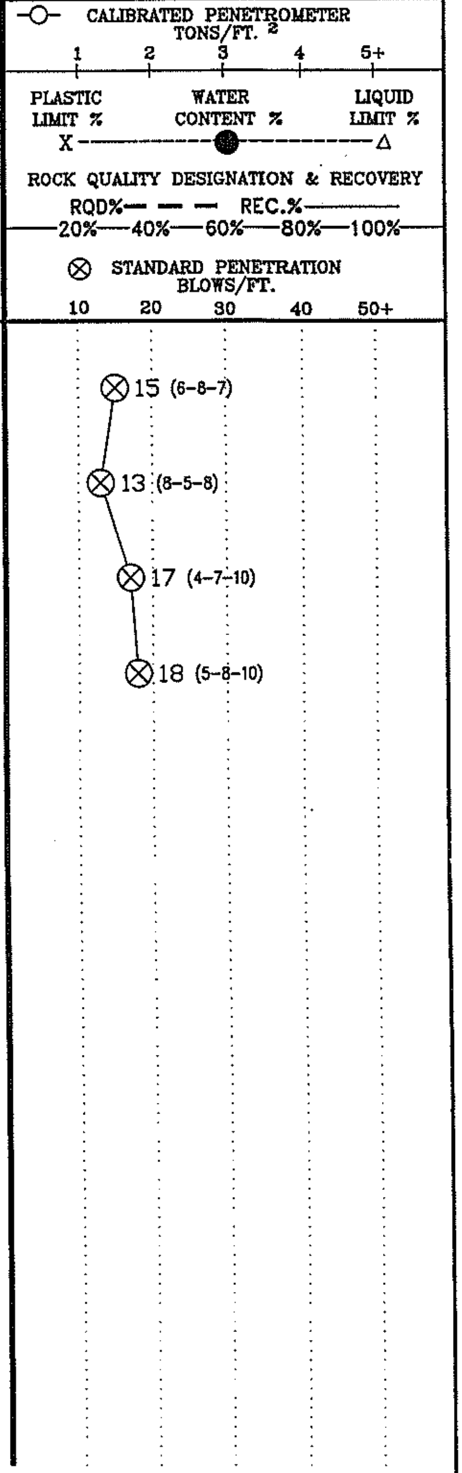
CLIENT: The Keith Corporation
JOB #: 4105
BORING #: SWM-1
SHEET: 1 OF 1

ECS LLC MID-ATLANTIC

PROJECT NAME: Tractor Supply Store
ARCHITECT-ENGINEER: Environmental Consultants International
SITE LOCATION: Sussex Highway, Seaford, Delaware

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

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	15	Fine Silty SAND, Brown, Moist, Medium Dense, (SM) [Sandy LOAM]		
	2	SS	18	0			
5							
	3	SS	18	16			
	4	SS	18	18	Fine to Coarse SAND, With Silt, Orangish Brown and Gray, Moist, Medium Dense, (SM) [Sandy LOAM]		
10					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽WL DRY WS OR (WD)	BORING STARTED 08/17/06	
▽WL(BCR) ▽WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 4.3' @ 24 HRS
▽WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06) KRM (09-13-06)

lmoore(08/22/2006)

CLIENT The Keith Corporation	JOB # 4105	BORING # SWM-2	SHEET 1 OF 1
PROJECT NAME Tractor Supply Store	ARCHITECT-ENGINEER Environmental Consultants International		
SITE LOCATION Sussex Highway, Seaford, Delaware			

ECS LLC MID-ATLANTIC

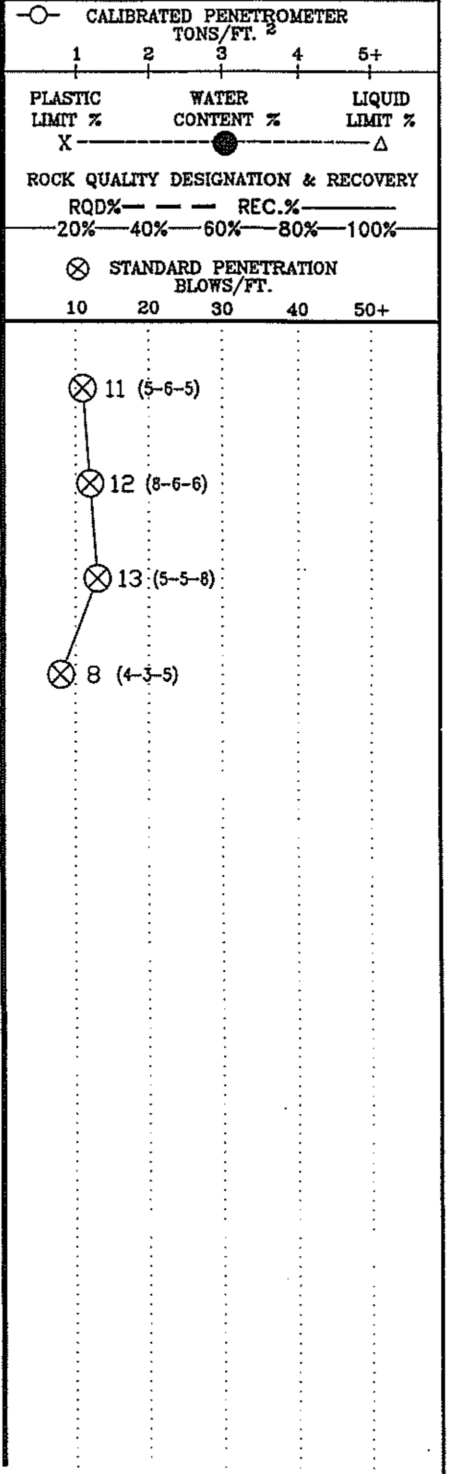
DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	STANDARD PENETRATION BLOWS/FT.
0					Topsoil Depth 8"	
	1	SS	18	14	Fine Silty SAND, Brown, Moist, Medium Dense, (SM) [Sandy LOAM]	11 (5-6-5)
5	2	SS	18	0		12 (6-6-6)
	3	SS	18	18	Fine to Coarse SAND, With Silt, Brown, Moist, Medium Dense, (SM) [Sandy LOAM]	13 (5-5-8)
10	4	SS	18	18	Sandy Silty CLAY, Gray, Moist, Medium Stiff, (CL) [Sandy CLAY]	8 (4-3-5)

END OF BORING @ 10.0'



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

WL DRY WS OR [✓ WD]	BORING STARTED 08/17/06	
WL(BCR) WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 5.3' @ 24 HRS
WL DRY @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRW (08-25-06) KRW (08-25-06) KRW (09-13-06)

lmoore(08/22/2006)

CLIENT	JOB #	BORING #	SHEET
The Keith Corporation	4105	SWM-3	1 OF 1

PROJECT NAME: Tractor Supply Store

ARCHITECT-ENGINEER: Environmental Consultants International

SITE LOCATION: Sussex Highway, Seaford, Delaware

-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%

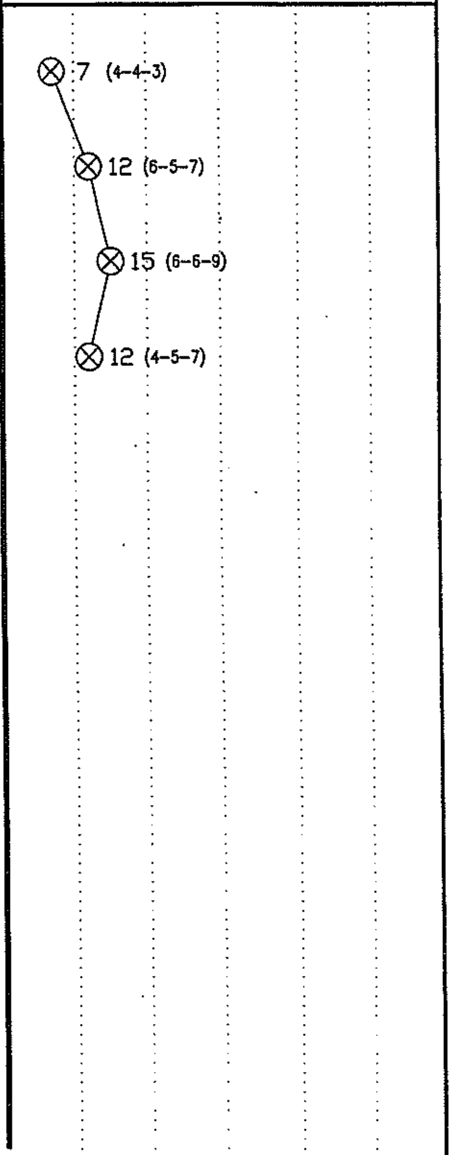
⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50+

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	12	Fine Silty SAND, Brown, Moist, Firm to Medium Dense, (SM) [Sandy LOAM]		
	2	SS	18	10			
5							
	3	SS	18	18	Fine to Medium SAND, With Silt, Brown and Gray, Moist, Medium Dense, (SM) [Sandy LOAM]		
	4	SS	18	18			
10					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽WL 7.3'	WS OR (WD)	BORING STARTED 08/17/06	
▽WL(BCR)	▽WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 7.0' @ 24 HRS
▽WL 6.6' @ 24 HRS		RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06) KRM (09-13-06)

kmoore(08/22/2006)

CLIENT The Keith Corporation	JOB # 4105	BORING # S-1	SHEET 1 OF 1
PROJECT NAME Tractor Supply Store	ARCHITECT-ENGINEER Environmental Consultants International		
SITE LOCATION Sussex Highway, Seaford, Delaware			

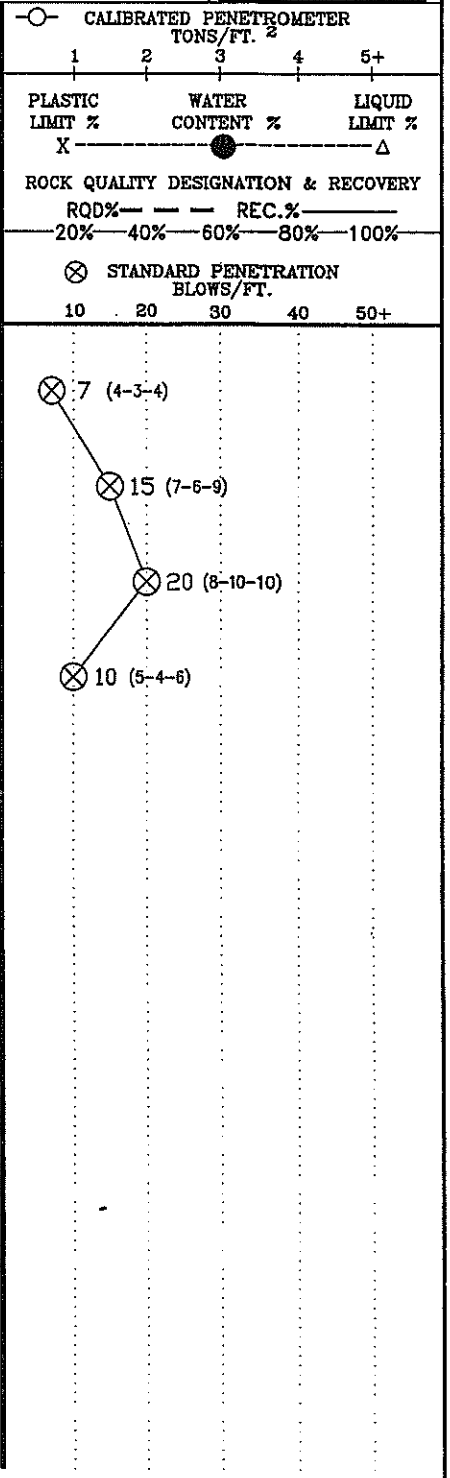
ECS LLC MID-ATLANTIC

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING ➧ LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)
0					Topsoil Depth 8"		
	1	SS	18	13	Fine Silty SAND, Brown, Moist, Firm, (SM) [Sandy LOAM]		
	2	SS	18	12	Fine to Coarse SAND, With Silt, Brownish Gray and Gray, Moist, Firm to Medium Dense, (SM) [Sandy LOAM]	▽	
5							
	3	SS	18	18			
	4	SS	18	18		▽	
10					END OF BORING @ 10.0'		
15							
20							
25							
30							



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

▽ WL 8.8' (WS) OR WD	BORING STARTED 08/17/06	
▽ WL(BCR) ▽ WL(ACR) DRY	BORING COMPLETED 08/17/06	CAVE IN DEPTH @ 5.2' @ 24 HRS
▽ WL 4.3' @ 24 HRS	RIG B50 FOREMAN DIAMOND	DRILLING METHOD HSA

KRM (08-25-06) KRM (08-25-06) KRM (09-13-06)

lmoore(08/22/2006)