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REPORT

For Engineering Strategies, Inc.

Geotechnical Exploration
New Maintenance Building
Rockdale County Water Treatment Plant
3090 Gees Mill Road Northeast
Rockdale County, Conyers, Georgia
Project No.: ENGSI-18-GA-02751-01

625 Holcomb Bridge Road, Norcross, GA 30071 • 770-209-0029 • unitedconsulting.com

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ENGSI-18-GA-02751-01

November 5, 2018

Mr. Pedro M. Rossello, PE
President
Engineering Strategies, Inc.
3855 Shallowford Road
Suite 525
Marietta, Georgia 30062

Via Email: prossello@esi-ga.com

RE: Report of Geotechnical Exploration
New Maintenance Building
Rockdale County Water Treatment Plant
3090 Gees Mill Road Northeast
Conyers, Rockdale County, Georgia
Project No.: ENGSI-18-GA-02751-01

Dear Mr. Rossello:

United Consulting is pleased to submit this report of our Geotechnical Exploration for the above-referenced project. We appreciate the opportunity to assist you with this project and look forward to our continued participation. Please contact us if you have any questions or if we can be of further assistance.

Sincerely,

UNITED CONSULTING

GEORGIA REGISTERED No. 20383 PROFESSIONAL ENGINEER MICHAEL A. KEMP

Michael A. Kemp, P.E.
Geotechnical Engineer

Chris L. Roberds, P.G.
Senior Executive Vice President

SRT/MAK/CLR/rg

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1.0 EXECUTIVE SUMMARY

United Consulting has completed a Geotechnical Exploration on the New Maintenance Building site at the Rockdale County Water Treatment Plant located at 3090 Gees Mill Road Northeast in Conyers, Rockdale County, Georgia. Please refer to the text of the report for a more detailed discussion of the items summarized below.

1. Borings B-1 and B-1A encountered approximately 8 feet of fill soils, and borings B-2, B-2A, B-3, and B-5 encountered approximately 3 to 4.5 feet of fill soils. The fill generally appeared to be clean and moderately to well compacted. However, we recommend that the quality of the fill be thoroughly evaluated at the time of construction and funds be allocated for the removal of any low consistency fill soils, debris or other unsuitable materials that may be encountered.

2. Partially Weathered Rock (PWR) was encountered in all the borings starting at depths ranging from 3 to 13 feet. Auger refusal was encountered in all the borings at depths ranging from 4.5 to 15 feet. <u>Significant difficult excavation conditions (ripping and blasting in mass excavation and blasting for trench/utility excavations) associated with PWR or rock should be expected for excavations at this site. United Consulting recommends the construction budget include funds for difficult excavation.</u>

3. Groundwater was not encountered in the borings at the time of drilling. Shallow groundwater is not expected to impact construction; however, the contractor should be prepared to control groundwater or perched water, as needed.

4. Provided that the site is prepared as recommendations, it is our opinion that the proposed maintenance building can be supported on conventional shallow foundations such as spread footings and/or continuous strip footings. An allowable soil bearing pressure of up to 3,000 pounds per square foot (psf) can be used for the design of conventional shallow foundations.

5. United Consulting utilized available geotechnical information (N-Values) and our experience with similar soil conditions to provide a seismic site classification of “Site Class C” for the site.

2.0 PROJECT INFORMATION

The project site is located at the Rockdale County Water Treatment Plant located at 3090 Gees Mill Road Northeast in Conyers, Rockdale County, Georgia. At the time of our exploration, the Project Site was a vacant gravel and grass covered area located in the southern portion of the Rockdale County Water Treatment Plant. The project site contained a gravel road running north-south across the central portion of the Site. The project site area is surrounded structures associated with the water treatment plan, and is bounded to the north by a concrete driveway, to the east by generator with a concrete pad and gravel parking lot, to the south by wooded areas with some cleared paths, and to the west by vacant, grass covered areas and a detention pond. The larger treatment plant area was surrounded by wooded areas. The general location of the project site is shown on the attached Boring Location Plan (Figure 1).

A topographic site plans indicated that the site was gently sloping down from the southeast areas toward the northwest. The highest elevation near 770 was in the southeastern portion of the site and the lowest elevation of about 762 was in the northwestern portion of the site. The Finished Floor Elevation (FFE) of the proposed maintenance building is at elevation 766. Based on this information, we anticipate maximum cuts and fills on the order of 5 feet or so will be required.

We understand that a 160’ x 70’ x 17’ high (minimum) Pre-Engineered Steel Building will be constructed. Structural loads were not provided, but based on previous experience we estimate maximum loads on columns will not exceed about 120 kips.

If the actual loads and site grading information vary significantly from the above anticipated values, United Consulting must be contacted to determine if our recommendations should be re-evaluated and/or revised.

3.0 PURPOSE

The purpose of this Geotechnical Exploration was to assess the general type and condition of the subsurface materials at the Project Site and to provide recommendations regarding the design and construction of the building foundations, grading, earthwork, quality control and other geotechnical related issues, deemed pertinent to this project.

4.0 SCOPE

The scope of our geotechnical exploration included the following items:

1. A visual reconnaissance of the site from a geotechnical standpoint;
2. Drilling five (5) SPT borings and three (3) offset borings;
3. Visual evaluation of the soil samples obtained during our field testing program for further identification and classification;
4. Analyzing the existing soil conditions with respect to the proposed construction; and
5. Preparing this report to document the results of our field-testing program, engineering analysis, and to provide our findings and general recommendations.

5.0 SUBSURFACE CONDITIONS

Initially, the borings encountered a surficial layer of gravel, grass, or topsoil. Borings B-1 and B-1A encountered approximately 8 feet of fill soils, and borings B-2, B-2A, B-3, and B-5 encountered approximately 3 to 4.5 feet of fill soils. The fill soil consisted of firm to stiff silt with varying amounts of sand, mica, and clay and traces of rock fragments, root hair, and wood pieces. Boring B-3 also encountered a surficial layer of medium dense fill sand with some rock fragments and traces of silt and clay. Standard Penetration Test resistances (N-values) within the fill silts ranged from 6 bpf to 10 bpf, and the fill sand had an N-value of 21 bpf.

Below the fill soils in the aforementioned borings and surficial materials in the remaining borings, typical residual soils of the Piedmont Physiographic Province of Georgia were encountered. The residual soils generally consisted of medium dense to dense sand with varying amounts of silt, rock fragments, and mica. N-values within the residual sand soils ranged from 14 to 43 bpf.

Partially Weathered Rock (PWR) was encountered in all the borings starting at depths ranging from 3 to 13 feet. PWR is a term for residuum that can be penetrated with a soil drilling auger but has N-values in excess of 100 bpf. The PWR encountered was classified as very dense sand with varying amounts of silt and rock fragments and traces of mica.

Auger refusal was encountered in all the borings at depths ranging from 4.5 to 15 feet. Auger refusal is the depth that the boring cannot be advanced with a soil drilling auger. Auger refusal below residual soils generally represents a seam of dense PWR, boulders, or top of massive bedrock.

Groundwater was not encountered in the borings at the time of drilling. Groundwater levels should also be anticipated to fluctuate with the change of seasons, during periods of very low or high precipitation, or due change in floodplain or watershed upstream of the site.

For a more detailed description of the subsurface conditions encountered, please refer to the boring logs in The Appendix.

6.0 DISCUSSION AND RECOMMENDATIONS

The following recommendations are based on our understanding of the proposed construction, the data obtained in the soil test borings, a site reconnaissance, and our experience with subsurface conditions similar to those encountered at the project site.

We recommend that United Consulting be provided with updated documents early in the preparation of final construction drawings to determine if our recommendations are still valid or should be re-evaluated and revised.

6.1 Existing Fill Evaluation

Borings B-1 and B-1A encountered approximately 8 feet of fill soils, and borings B-2, B-2A, B-3, and B-5 encountered approximately 3 to 4.5 feet of fill soils. In general, the fill encountered appeared to be clean and moderately to well compacted.

As with any undocumented fill, it is possible that poor quality fill, trash pits, debris or other deleterious materials could be present intermediate of the boring locations. We recommend that areas of existing fill be thoroughly evaluated during construction by proofrolling. Further, we suggest that funds be allocated for the remediation of isolated areas of poor quality fill or debris that may be encountered during construction.

6.2 Site Preparation

Historically, the project site contained an apparent gravel parking lot, which was subsequently abandoned. As such, the existing gravel should be removed from the areas of the proposed construction. Any remaining underground utilities should be relocated to at least 10 feet outside the perimeter of the proposed building footprints. The abandoned lines should then be excavated and removed from the area of the proposed construction. All excavations should be subsequently backfilled with properly compacted engineered fill. We do not recommend active or non-active utility lines located below the area of the proposed structures be left in place. Any abandoned utility pipes, if left in place and outside of the proposed building footprint, should be filled-in under pressure with cement grout having a minimum 28-day compressive strength of 500 pounds per square inch (psi). This would prevent localized cave-in upon eventual deterioration and loss of structural integrity of the pipe.

The existing topsoil, vegetation and trees including their root mat should also be removed from the area of the proposed construction. Removal of trees should include removal of their root ball, which may extend to several feet below grade.

After lowering the site grade where planned and prior to placement of engineered fill or commencement of construction, areas to receive fill, foundations, slabs, and pavements, including the area of the proposed structure, should be proofrolled with a fully loaded tandem-axle dump truck. Proofrolling should be performed under the observation of the Geotechnical Engineer or his representatives so that areas which exhibit "pumping" (wave type displacement) during proofrolling may be treated by a method recommended by the Geotechnical Engineer. This method may consist of undercutting, and backfilling with suitable engineered fill, replacing with surge stone, and a layer of crusher run, or some other method that is deemed suitable.

6.3 Caving Considerations

All excavations should be conducted in accordance with the Occupational Safety and Health Administration (OSHA) guidelines. Flattening of the excavation sidewalls and/or the use of bracing may be needed to maintain stability during construction.

6.4 Difficult Excavation

Partially Weathered Rock (PWR) was encountered in all the borings starting at depths ranging from 3 to 13 feet. Auger refusal was encountered in all the borings at depths ranging from 4.5 to 15 feet. Because of the relatively shallow depths at which PWR and auger refusal were encountered, significant difficult excavation conditions (ripping and blasting in mass excavation and blasting for trench/utility excavations) associated with PWR or rock should be expected for excavations at this site.

Site grades and building configurations should be kept as high as possible to limit the impact of difficult excavation. However, because of the relatively shallow levels at which these materials were encountered, we expect that that excavation of PWR and rock will also be required during mass site grading and to facilitate foundation construction. We recommend that PWR and rock, where present, be over excavated to at least 12 inches below building and retaining wall foundation bearing depths, or to a depth below utility trench invert elevations, and replaced with engineered fill. This will allow for foundations and utilities to be installed with conventional light construction equipment, and help reduce the potential for differential foundation settlement.

It is also important to note that depths to PWR and rock can vary over short horizontal distances in the Piedmont geologic area, and PWR and rock could be encountered during construction at shallower depths between and outside the boring locations for this study.

PWR typically requires loosening by ripping with large dozers pulling single tooth rippers in mass excavation. The use of specialized excavation equipment (such as ram-hoes, jackhammers, or possibly blasting) is typically required for PWR excavation in confined (trench) excavations. Relatively sound, massive, rock typically requires blasting for removal in mass or trench excavation.

Excavation techniques will vary based on the weathering of the materials, fracturing and jointing in the rock, and the overall stratigraphy of the feature. Actual field conditions usually display a gradual weathering progression with poorly defined and uneven boundaries between layers of different materials. We recommend that the following definitions for rock in earthwork excavation be included in bid documents:

1. General Excavation: Any material occupying an original volume of more than 1 cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rating of not less than 80,000 lbs. usable pull (Caterpillar D-8 or larger).

2. Trench Excavation: Any material occupying an original volume of more than 1/2 cubic yard which cannot be excavated with a backhoe having a bucket curling force rated at not less than 40,000 lbs., using a rock bucket and rock teeth (John Deere 790 or larger).

Removal of rock by blasting can be very expensive. The costs of excavation vary with the type of material encountered and the quantities to be excavated. Hence, control of quantities is important. You may consider independent recording of the blasting contractors air track drilling in order to have independent verification of quantities. We will be happy to assist as requested by you with this undertaking.

6.5 Earthwork

The onsite soils, if free of organic and other deleterious materials, should generally be suitable for reuse as engineered fill with proper moisture control. Partially weathered rock (PWR) can be used as engineered fill if it breaks up sufficiently to meet gradation requirements. PWR can also be mixed with soil to meet gradation requirements. Because less than about 5 feet of fill placement is anticipated, blast rock should not be used as fill for this project.

Due to the presence of high silt contents, some of the onsite soil may be sensitive to moisture variation. During rainy seasons, these soils will be difficult to dry. As a practical consideration during extended periods of wet weather, wet onsite soils may need to be discarded and replaced with drier soils. These soils should be placed within a narrow range of their optimum moisture content (typically within about 3 percent of optimum moisture) to achieve proper compaction. Typical restrictions on suitable fill are no organics, plasticity index less than 25, and maximum particle size of four inches, with not more than 30 percent greater than 3/4-inch. These restrictions should also be applied to imported borrow soils if needed.

Positive drainage should be maintained at all times to prevent saturation of exposed soils in case of sudden rains. Rolling the surface of disturbed soils will also improve runoff and reduce the soil moisture and construction delays. The degree of soil stability problems will also be dependent upon the precautions taken by the contractor to help protect the soils from saturation during construction.

6.6 Groundwater Considerations

Groundwater was not encountered in the borings at the time of drilling. Shallow groundwater is not expected to significantly impact mass grading. However, due to the presence of fill and soils containing high silt content, the site is susceptible to formation of perched water after rainfall. The contractor should be prepared to remove perched water and/or groundwater as needed.

6.7 Slopes

The topography at the site is gently sloping down from the southeast areas toward the northwest. We recommend that where fill is to be placed on existing slopes or gullies greater than 4(H):1(V), the slopes be benched to prevent sliding of the fill mass along the existing surface. This can be achieved by notching the slope face by at least about two feet horizontally with the compactor blade as each lift is compacted. A typical benching detail is provided in The Appendix.

Permanent slopes should be constructed no steeper than 2(H):1(V). Fill slopes of up to 20 feet in total height constructed to 2(H):1(V) should be acceptable for this project, assuming proper benching, and placement and compaction of engineered fill. Fill slopes greater than 20 feet must be designed by a licensed professional engineer, and global stability evaluated. If less than desirable soils, such as topsoil or wet soils are to be wasted on slopes, or if an appropriate level of quality control and compaction testing under the supervision of the geotechnical engineer is not planned during slope construction, 2(H):1(V) slopes will not be adequate and flatter slopes should be considered.

All slopes should be protected from erosion during construction and provided with appropriate permanent vegetation or other cover after construction. Slopes should be protected from concentrated run-off flow by means of berms and drainage ditches to direct runoff around slopes or through concrete channels. Appropriate vegetative cover should consist of fast growing grasses that will rapidly create a dense root mat over the entire slope. Landscaping consisting of isolated shrubs and pine straw will not provide adequate slope protection.

A minimum building or retaining wall setback (from the nearest edge of foundations) of at least 10 feet from the crest of slopes is recommended. A minimum setback of 5 feet is recommended for pavement and curbs.

6.8 Foundation Design and Construction

Following site preparation as recommended, the proposed maintenance building can be supported on a shallow foundation system. The shallow foundations may consist of shallow strip and/or isolated column footings supported within and underlain by suitable bearing soils. Based on the subsurface exploration data obtained, a maximum net allowable soil bearing pressure of 3,000 pounds per square foot (psf) is recommended for foundation design. We expect that maximum total and differential foundation settlement will be on the order of 1.0 and 0.5 inches respectively. Due to the presence of existing, undocumented fill, some localized excavation and replacement of soft or otherwise unsuitable fill from below the foundation bearing locations may be required in order for shallow foundations to be feasible.

As mentioned previously, <u>we recommend that PWR and rock, where present in the building areas, be over excavated to at least 12 inches below foundation bearing depths, or to a depth below utility trench invert elevations, and replaced with engineered fill.</u> This will allow for foundations and utilities to be installed with conventional light construction equipment, and help reduce the potential for differential foundation settlement.

We recommend minimum footing dimensions of 20 inches for strip footings and 24 inches for square footings. Footings should bear at least 12 inches below outside finished grades for frost protection. The Geotechnical Engineer must evaluate each footing excavation prior to steel reinforcement or concrete placement. Conditions that are observed should be compared to the test boring data and design requirements. If unsuitable bearing material is encountered, it should be excavated and replaced or otherwise treated as recommended by the Geotechnical Engineer.

Surface water control should be maintained to prevent accumulation of water in footing excavations. Standing water in footing excavations should be removed promptly. Soil softened by the water should be removed, and the Geotechnical Engineer or his representative should reexamine the area.

6.9 Ground Floor Slabs

A slab-on-grade may be utilized for the structure. We recommend a subgrade modulus of 120 pounds per cubic inch (pci) be used for slab design. It has been our experience that the floor slab subgrade is often disturbed by weather, foundation and utility line installation, and other construction activities between completion of grading and slab construction. For this reason, our geotechnical engineer should evaluate the subgrade immediately prior to placing the concrete. Areas judged by the geotechnical engineer to be unstable should be redensified or undercut and replaced with engineered fill compacted to at least 98 percent of its Standard Proctor maximum dry density.

6.10 Retaining Walls

The following retaining wall recommendations pertain to cast-in-place building and site retaining walls and are not intended for modular block or MSE walls. If modular block or MSE walls are planned on the site, United Consulting should be notified because additional evaluation will be required to provide recommendations specific to the planned wall types and locations.

The design of retaining walls must include the determination of the lateral pressure that will act on the wall. The lateral earth pressure is a function of the soil properties, surcharge loads behind the wall, and amount of deformation that the wall can undergo. This deformation is basically dependent upon the relative rigidity of the wall system.

The active earth pressure condition develops when the wall moves away from the soil over a sufficient distance, such as for a freestanding cantilever wall. The at-rest condition exists when there is no lateral strain on the soil, such as walls, which are rigidly restrained like a basement or sub-foundation wall. The passive condition occurs when the wall moves into the soil.

The following equivalent fluid pressures are recommended for three earth pressure conditions.

Table 1 - Lateral Earth Pressures

Earth Pressure Condition	Earth Pressure Coefficient	Recommended Equivalent Fluid Pressure
Active	$K_A = 0.33$	40 psf/foot
At-Rest	$K_O = 0.50$	60 psf/foot
Passive	$K_P = 3.00$	360 psf/foot

We note that considerable horizontal deflections are required to mobilize the passive pressure; therefore, the designer should consider a safety factor of 2 to the stated ultimate passive earth pressure in design.

The recommended equivalent fluid pressures are based on an assumed soil density of 120 pcf, an internal friction angle of 30 degrees and cohesion of zero. A coefficient of friction of 0.36 for sliding may be used for the retaining wall design.

The parameters listed above are based on a level properly compacted backfill, no friction at the wall-soil interface, and no surcharge effects. For design of retaining walls, which could be inundated, the buoyant unit weight of the inundated soil should be used to determine the lateral earth pressure. The hydrostatic pressure based on the maximum ponding elevation should be utilized in the analysis.

Heavy compaction equipment should not be used to compact backfill within 5 feet laterally behind any retaining wall unless the wall is designed for the increased pressure or temporarily braced. Therefore, light compaction equipment may be required in this zone. Retaining wall backfill should be compacted to 95 percent of the Standard Proctor maximum dry density. A permanent drainage system such as a footing drain, or a fabric drain such as Enka drain, Mira drain, etc., is recommended for any retaining walls which are more than 5 feet in height.

The retaining walls should be designed by a professional engineer familiar with retaining wall design and registered in Georgia. Global stability should be determined, and the designer should consider sloping backfill, surcharges and other factors affecting wall loadings.

6.11 Fill Placement

Moisture-density determinations should be performed for each soil type used to provide data necessary for quality assurance testing. The natural moisture content at the time of compaction should be within moisture content limits, which will allow the required compaction to be obtained. This is generally within three percentage points of the optimum moisture. The contractor should be prepared to increase or decrease soil water content as needed to achieve the required degrees of compaction.

The fill should be placed in thin lifts (not to exceed 8-inch loose thickness) and compacted. We recommend the fill be compacted to at least 98 percent of Standard Proctor (ASTM D 698) maximum dry density within top two feet and at least 95 percent of Standard Proctor maximum dry density elsewhere on the site.

A Geotechnical Engineer on a full-time basis should observe grading operations. In-place density tests taken by that individual will assess the degree of compaction being obtained. The frequency of the testing should be determined by the Geotechnical Engineer.

6.12 Seismic Site Class

United Consulting utilized available geotechnical information (N-values) and our experience with the similar soil conditions to provide a seismic site class for the Site. United Consulting recommends that a seismic site classification of “Site Class C” be utilized for the site.

A site class determination based on the average N values is necessarily conservative. A site-specific geophysical study acquiring soil shear wave velocity data may or may not demonstrate sufficient stiffness to allow a higher site class. Shear wave velocity measurements were beyond our authorized scope of work. United Consulting will be pleased to provide the additional seismic services, if requested.

7.0 LIMITATIONS

This report is for the exclusive use of **Engineering Strategies, Inc.,** and the designers of the project described herein, and may only be applied to this specific project. Our conclusions and recommendations have been prepared using generally accepted standards of Geotechnical Engineering practice in the State of Georgia. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others.

The right to rely upon this report and the data within may not be assigned without UNITED CONSULTING'S written permission.

The scope of this evaluation was limited to an evaluation of the load-carrying capabilities and stability of the subsoils. Oil, hazardous waste, radioactivity, irritants, pollutants, molds, or other dangerous substance and conditions were not the subject of this study. Their presence and/or absence are not implied or suggested by this report, and should not be inferred.

Our conclusions and recommendations are based upon design information furnished to us, data obtained from the previously described exploration and testing program and our past experience. They do not reflect variations in subsurface conditions that may exist intermediate of our borings, and in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon "on-site" observations of the conditions.

If the design or location of the project is changed, the recommendations contained herein must be considered invalid, unless our firm reviews the changes and our recommendations are either verified or modified in writing. When design is complete, we should be given the opportunity to review the foundation plan, grading plan, and applicable portions of the specifications to confirm that they are consistent with the intent of our recommendations.

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APPENDIX

General Notes/Narrative of Drilling Operations
Figure 1 – Boring Location Plan
Exploration Procedures
SPT Boring Logs (8)
Typical Benching Detail
Typical Retaining Wall Drainage Detail

GENERAL NOTES

The soil classifications noted on the Boring Logs are visual classifications unless otherwise noted. Minor constituents of a soil sample are termed as follows:

Trace	0 - 10%
Some	11 - 35%
Suffix "y" or "ey"	36 - 49%

LEGEND

 Split Spoon Sample obtained during Standard Penetration Testing

 Relatively Undisturbed Shelby Tube Sample

 Groundwater Level at Time of Boring Completion

 Groundwater Level at 24 hours (or as noted) after Termination of Boring

w	Natural Moisture Content	
LL	Liquid Limit	
PL	Plastic Limit	Atterberg Limits
PI	Plasticity Index	
PF	Percent Fines (Percent Passing #200 Sieve)	
γ_d	Dry Unit Weight (Pounds per Cubic Foot or PCF	
γ_m	Moist or In-Situ Unit Weight (PCF)	
γ_{sat}	Saturated Unit Weight (PCF)	

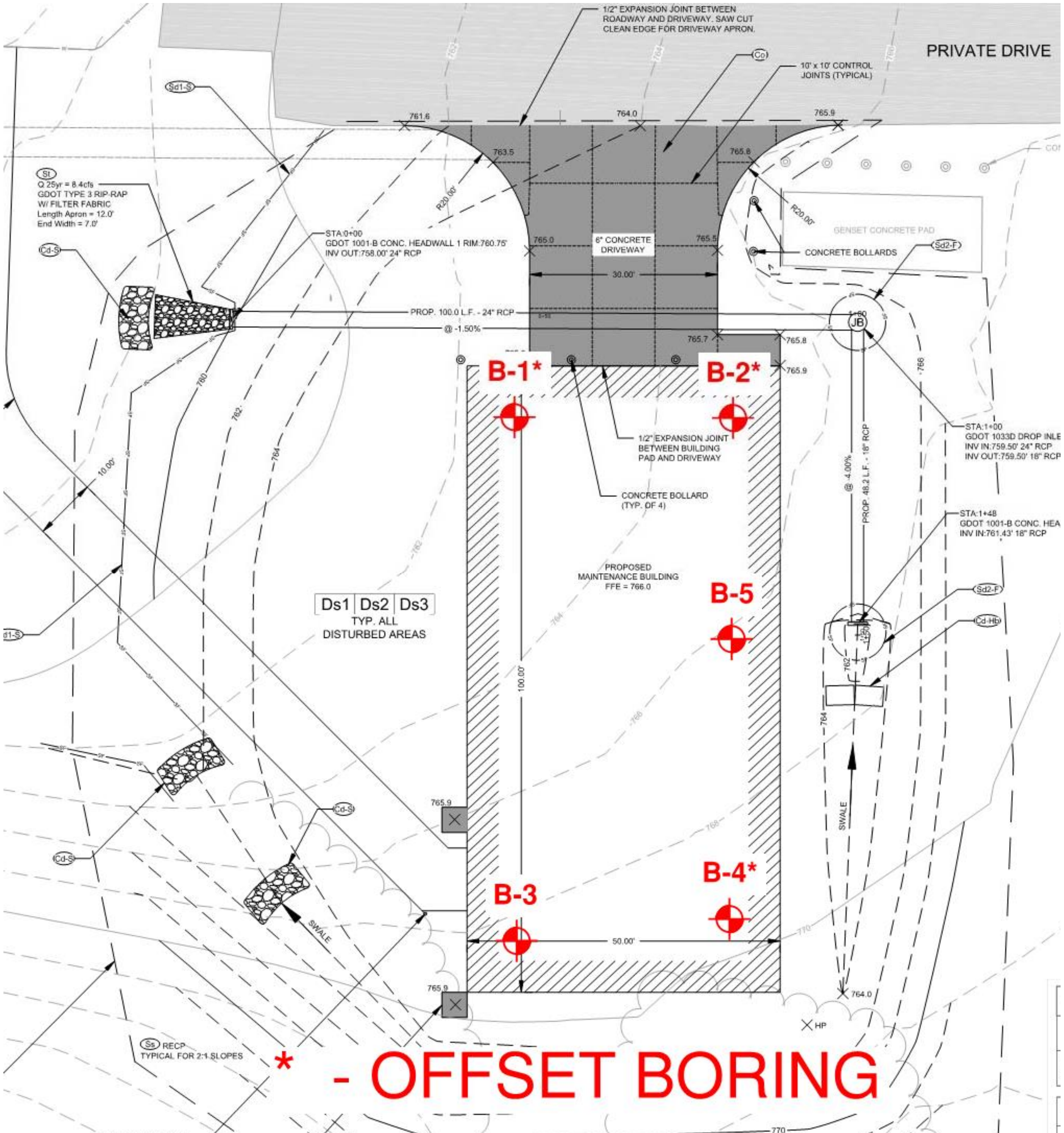
BORING LOG DATA AND NARRATIVE OF DRILLING OPERATIONS

The test borings were made by mechanically advancing helical hollow stem augers into the ground. Samples were covered at regular intervals in each of the borings following established procedures for performing the Standard Penetration Test in accordance with ASTM Specification D-1586. Soil samples were obtained with a standard 1.4" I.D. x 2.0" O.D. split barrel sampler. The sampler is first seated 6" to penetrate any loose cuttings and then driven an additional foot with the blows of a 140 pound hammer freely falling a distance of 30". The number of blows required to drive the sampler each six inches is recorded on the Boring Logs. The total number of blows required to drive the sampler the final foot is designated the "standard penetration resistance." This driving resistance, known as the "N" value, is a measure of the relative density of granular soils and is an indication of the consistency of cohesive deposits.

The Following table describes soil consistencies and relative densities based on standard-penetration resistance values (N) determined by the Standard Penetration Test.

	"N"	Consistency
	0-2	Very Soft
	3-4	Soft
	5-8	Firm
Clay and Silt	9-15	Stiff
	16-30	Very Stiff
	Over 31	Hard

	"N"	Relative Density
	0-4	Very Loose
	5-10	Loose
	11-19	Firm
Sand	20-29	Medium Dense
	30-49	Dense
	50+	Very Dense



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N

Scale:	NTS	Notes	Client:	Engineering Strategies, Inc.	FIG. 1
Prepared:	SRT		Site:	New Maintenance Building Rockdale County Water Treatment Plant 3090 Gees Mill Rd, Conyers, Rockdale County, GA	
Checked:	MAK				
Project No.:	ENGSI-18-GA-02751-01		Title:	Boring Location Plan	

EXPLORATION PROCEDURES

Five (5) SPT borings (designated B-1 through B-5) and three (3) offset borings were performed at the approximate locations indicated on the attached Boring Location Plan (Figure 1). The SPT borings were performed in general accordance with ASTM D 1586. Soil samples obtained during testing were visually evaluated by the Project Engineer and classified according to the visual-manual procedure described in ASTM D 2488. A narrative of field operations is included in The Appendix.

The test locations in the field were determined by the Project Engineer by measuring distances and estimating angles from existing site features. The test locations should, therefore, be considered approximate.

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NORCROSS, GEORGIA 30071
(770)209-0029, FAX (770)582-2800

BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-1
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

FFE= 766

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
766	Topsoil	0							
	Silt - some mica, trace sand, clay, roots, and rock fragments; firm; red brown (Fill)		1		3-4-3	7	14		Automatic Hammer Hammer Efficiency=86% to 98&
760	- sandy, trace wood pieces, no mica; dark gray	5	2		1-3-3	6	6		
755	Partially Weathered Rock sampled as: Sand - mostly rock fragments, some silt, trace mica; very dense; orange-brown-white (Residual)	10	3		8-29-50/4"	50/4"	14		Hard Drilling
	AUGER REFUSAL AT 11 FEET								Groundwater was not encountered at the time of drilling.
750		15							
745		20							
740		25							
735		30							
730		35							
725		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-1A
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
FFE= 766	Gravel+Topsoil	0							
	Silt - trace roots, mica, and wood pieces; firm; red brown (Fill)		1		3-3-4	7	14		Offset 10' South of B-1 Automatic Hammer Hammer Efficiency=86% to 98&
760	- some clay, no mica; dark gray	5	2		2-2-5	7	16		
755	Partially Weathered Rock sampled as: Sand - mostly rock fragments; very dense; white (Residual)	10	3		50/6"	50/6"	2		Hard Drilling Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 10 FEET								
750		15							
745		20							
740		25							
735		30							
730		35							
725		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-2
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

FFE= 766

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
765	Gravel+Topsoil	0							
	Silt - some sand and mica; firm; red brown (Fill)		1		3-3-3	6	10		Automatic Hammer Hammer Efficiency=86% to 98&
	- some clay, trace root hair; dark brown								
760	Sand - trace silt and rock fragments; firm; gray-brown (Residual)	5	2		3-7-7	14	8		
	Partially Weathered Rock sampled as: Sand - mostly rock fragments; very dense; gray-white		3		50/5"	50/5"	1		Hard Drilling Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 6.5 FEET								
755		10							
750		15							
745		20							
740		25							
735		30							
730		35							
725		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-2A
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
FFE= 766	Topsoil	0							
765	Silt - some sand and mica, trace clay; firm; red brown (Fill)		1		2-3-3	6	8		Offset 10' South of B-2 Automatic Hammer Hammer Efficiency=86% to 98&
	- some clay, trace root hair; dark brown		2		2-3-50/3"	50/3"	12		
760	Partially Weathered Rock sampled as: Sand - trace rock fragments; very dense; gray-brown (Residual)	5							Hard Drilling Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 6.5 FEET								
755		10							
750		15							
745		20							
740		25							
735		30							
730		35							
725		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-3
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
770	Topsoil	0							
	Sand - some rock fragments, trace silt and clay; medium dense; red brown (Fill)		1		7-10-11	21	10		Automatic Hammer Hammer Efficiency=86% to 98&
FFE= 766									
765	Partially Weathered Rock sampled as: Sand - some rock fragments, trace silt and mica; very dense; gray-white (Residual)	5	2		5-22-50/1"	50/1"	8		
760	- gray-brown with orange intrusions	10	3		6-50/5"	50/5"	4		
									Hard Drilling
755		15	4		50/0"	50/0"	0		No Recovery
	AUGER REFUSAL AT 15 FEET								Groundwater was not encountered at the time of drilling.
750		20							
745		25							
740		30							
735		35							
730		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-4
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
770	Topsoil	0							
	Sand - some rock fragments, trace silt and mica; dense; gray-orange-brown (Residual)		1		16-27-16	43	16		Automatic Hammer Hammer Efficiency=86% to 98&
FFE= 766	Partially Weathered Rock sampled as: Sand - mostly rock fragments; very dense; white								
765		5	2		50/3"	50/3"	3		Hard Drilling Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 4.5 FEET								
760		10							
755		15							
750		20							
745		25							
740		30							
735		35							
730		40							

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BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-4A
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
770	Grass+Topsoil	0							
	Sand - some silt, trace rock fragments and mica; firm; orange-brown (Residual)		1		7-6-13	19	14		Offset 10' North of B-4 Automatic Hammer Hammer Efficiency=86% to 98&
FFE= 766									
765	- some mica; orange-yellow-brown	5	2		5-7-9	16	12		
760	- gray-orange-brown	10	3		3-8-11	19	14		
755	Partially Weathered Rock sampled as: Sand - mostly rock fragments; very dense; white	15	4		50/2"	50/2"	2		Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 14 FEET								
750		20							
745		25							
740		30							
735		35							
730		40							

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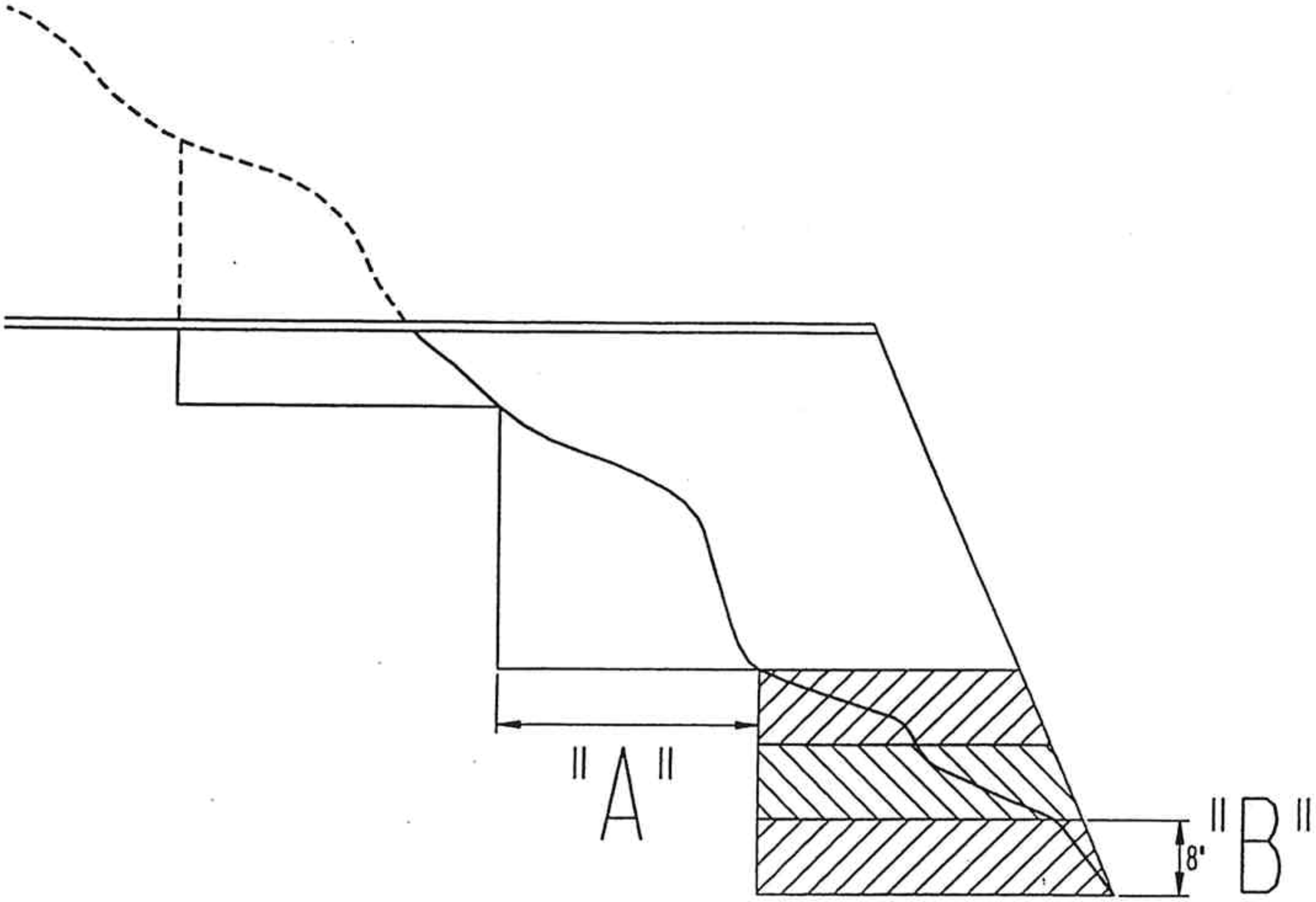
BORING LOG

CONTRACTED WITH: Engineering Strategies, Inc. BORING NO.: B-5
PROJECT NAME: New Maintenance Building DATE: 10/16/18
JOB NO.: ENGSI-18-GA-02751-01 DRILLER: Big Dog RIG: Diedrich D-50 LOGGED BY: SRT

ELEV.	DESCRIPTION	DEPTH in FEET	SAMPLES NO.	TYPE	BLOWS/6"	N VALUE	RECOV.	W	NOTES
FFE= 766	Topsoil	0							
765	Silt - some sand and mica; stiff; red brown (Fill)		1		3-5-5	10	14		Automatic Hammer Hammer Efficiency=86% to 98&
	- some clay, trace roots and wood piece; dark gray		2		6-34-50/1"	50/1"	10		
760	Partially Weathered Rock sampled as: Sand - mostly rock fragments; very dense; gray-white (Residual)	5							Hard Drilling
	- white		3		50/2"	50/2"	2		Groundwater was not encountered at the time of drilling.
	AUGER REFUSAL AT 9 FEET	10							
755		15							
750		20							
745		25							
740		30							
735		35							
730		40							
725									



1. THE ABOVE DIAGRAM ILLUSTRATES A TYPICAL BENCHING FOR PLACEMENT OF FILL ON A SLOPING SURFACE.

2. THE DIAGRAM SHOWS THAT BEFORE FILL IS PLACED, THE FIRST STEP IS CUT INTO THE SLOPE A MAXIMUM DISTANCE OF ABOUT 8 FEET 'A' (ABOUT 3/4 THE WIDTH OF USUAL D-8 BULLDOZER BLADE). SUCCESSIVE LAYERS OF FILL ARE THEN PLACED. BEFORE FINAL LAYER IS PLACED, THE SECOND STEP IS CUT 8 FEET INTO THE SLOPE AND SUCCESSIVE LAYERS ARE AGAIN PLACED.

3. SELECT FILL MATERIAL SHOULD BE PLACED IN 8 INCH LIFTS AND COMPACTED TO THE SPECIFIED DENSITY ('B').

TYPICAL BENCHING DETAIL

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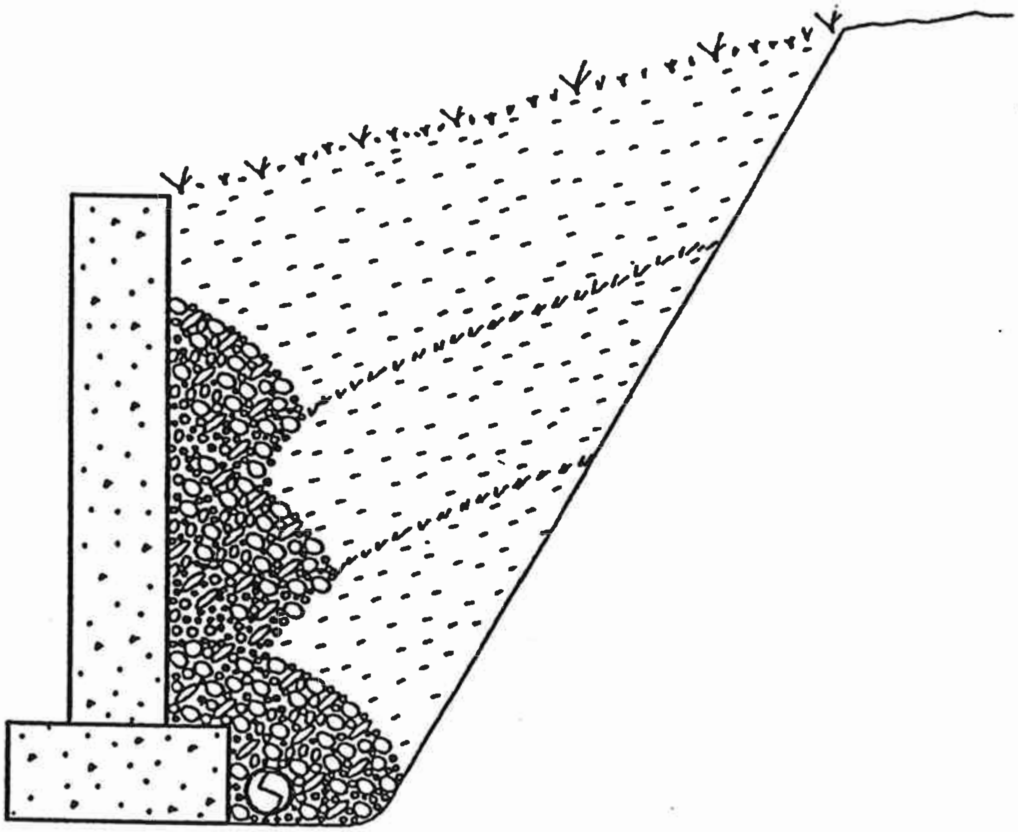
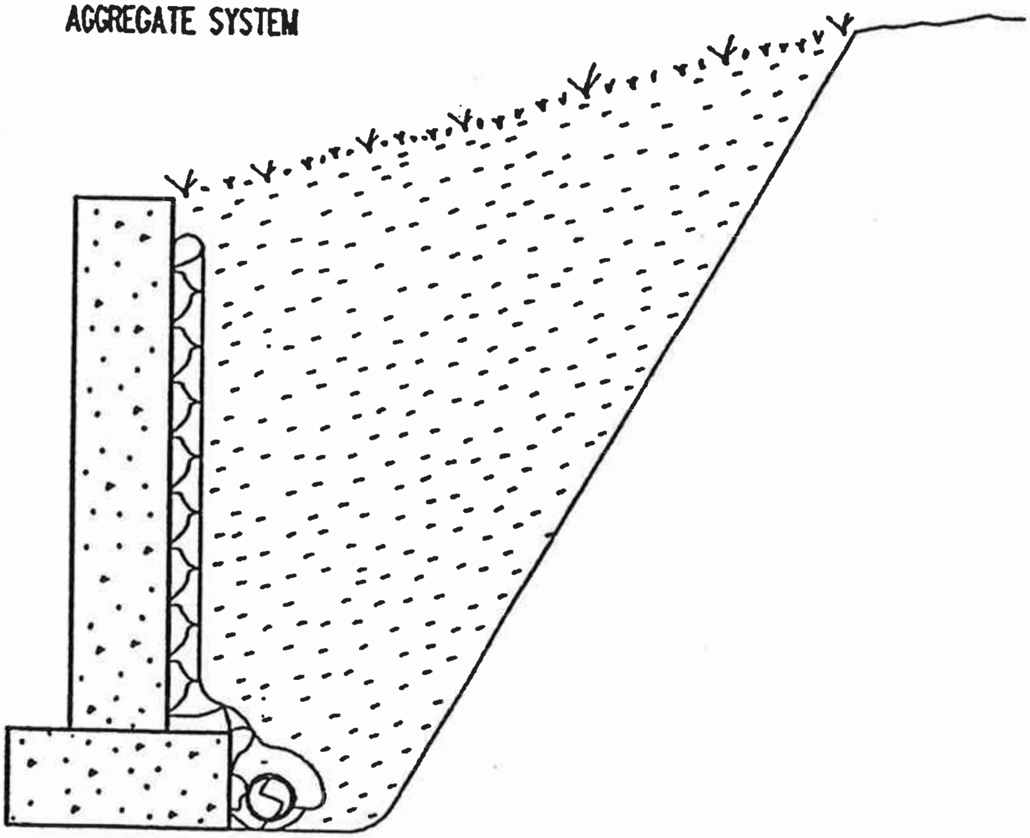
UC01109FD



AGGREGATE SYSTEM



MIRADRAIN SYSTEM

RETAINING WALL
DRAIN DETAIL

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UCOIBENCH

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL of the Geoprofessional Business Association

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