SINCE 1881

FROEHLING & ROBERTSON, INC.

Engineering • Environmental • Geotechnical

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November 26, 3013

Mr. Marvin Moss
Laurens County Development Corporation
P.O. Box 427
Laurens, South Carolina 29360

Reference: **Preliminary Report of Subsurface Exploration**
40 Acre Industrial Tract – Highway 72
Clinton, South Carolina
F&R Project Number: 65R-3070

Dear Mr. Moss:

As requested, Froehling and Robertson, Inc. (F&R) has performed a preliminary Geotechnical Exploration for the proposed 40 Acre Tract located off of Highway 72 in Clinton, South Carolina. Our services were performed in general accordance with F&R's Proposal No. 1465-0259G dated October 29, 2013. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and subsurface conditions, and presents our recommendations.

The site is located on a 40 acre tract off of Highway 72 in Clinton. The site is identified as Tax Map No. 901-35-01-033. The site is mainly clear with some scattered trees around the perimeter of the property. There are some access roads on the property, and some clearing has previously been performed. The site slopes from the northwest to the southeast, with an estimated relief of over 50 feet across the property.

Project Information

We have not been provided any information on the usage of the property. At the time of our borings, grading information had not been provided to us.

This report includes the boring logs, a description of the soil conditions that have been encountered, recommendations for site preparation activities and other general recommendations. Enclosed with this report is the Boring Location Plan as well as our soil test boring records.

Subsurface Exploration

Our subsurface exploration consisted of completing five soil test borings (B-1 thru B-5) performed to depths of 25 feet. The borings were performed at random locations throughout the property, which were laid out by a member of F&R prior to our mobilization to the site. The borings were performed on November 20, 2013. Elevations on the boring logs have been estimated with the use of Google Earth. The boring locations are shown on the attached Boring Location Plan.

The soil test borings were performed in accordance with generally accepted practice using an all-terrain mounted CME-55 rotary drill rig. The soil test borings were performed using hollow-stem, continuous-flight auger drilling techniques in general compliance with ASTM standards. Representative soil samples were obtained using a standard two-inch outside diameter (O.D.) split-barrel sampler in general accordance with ASTM D-1586, Penetration Test and Split-Barrel Sampling of Soils (Standard Penetration Test). The number of blows required to drive the split-barrel sampler three consecutive 6-inch increments was recorded, and the blows of the last two 6-inch increments were added together to obtain the Standard Penetration Test (SPT) N-value representing the penetration resistance of the soil. Standard Penetration Tests were performed on four samples in the top ten feet and at five foot intervals throughout the boring depth. Groundwater measurements and/or hole cave depths were recorded at the time of auger retrieval. Upon completion of drilling, the boreholes were backfilled with auger cuttings.

Site Description and Geology

The property is mainly clear with some scattered trees around the perimeter of the property. Some previously cleared "paths" traverse throughout the site.

The subject property is located within the Piedmont Physiographic Province of South Carolina, which is characterized by rolling topography, deeply weathered bedrock, and a relative paucity of solid outcrop. Rocks are strongly weathered in the Piedmont's humid climate and bedrock is generally buried under a thick (2-20 m) blanket of saprolite. Outcrops are commonly restricted to stream valleys where saprolite has been removed by erosion. The soils encountered in this area are the residual product of in-place chemical weathering of rock presently underlying the site. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients.

The boundary between soil and rock is not clearly defined. The transitional zone, termed as "partially weathered rock", is normally found overlying the parent bedrock. Weathering is facilitated by fractures, joints, and by the presence of less resistant rock types. Saprolite consists of rock that has been subject to intense chemical weathering. Although saprolite thickness varies considerably in the province, local thickness can be predicted to some extent. Also, the rock structure governs groundwater movement and may affect rock weathering more than mineral dissolution kinetics. In some areas, weathering has resulted in a structureless soil termed residuum or "residual soil". In general, a gradual downward lithological and textural change from residuum to saprolite and from saprolite to bedrock exists.

Findings

At the boring locations, residual soils were encountered at the ground surface. Minimal to no surficial soils were encountered at each boring location. The borings were extended to 25 feet each, and groundwater was not encountered in any of the borings at the time of drilling.

The subsurface conditions discussed in the following paragraphs and those shown on the attached Boring Logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs. Sometimes the relatively small sample obtained in the field is insufficient to definitively describe the origin of the subsurface material. In these cases, we qualify our origin descriptions with "possible" before the word describing the material's origin (i.e. possible colluvium, etc.). Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Data from the specific soil test borings are shown on the attached Boring Logs.

Strata breaks designated on the Boring Logs represent approximate boundaries between soil types. The transition from one soil type to another may be gradual or occur between soil samples. This section of the report provides a general discussion of subsurface conditions encountered within areas of proposed construction at the project site. More detailed descriptions of the subsurface conditions at the individual boring locations are presented on the Boring Logs.

Residual: Residual soils were encountered in all borings at the ground surface. The residual soils generally consisted of loose to very dense silty SAND (SM), and firm to very hard sandy SILT (ML). Soft weathered rock classified as silty SAND was encountered in boring B-3 at a depth of 7.5 to 12 feet. Standard Penetration Resistances (N-values) in the residuum ranged from 5 to in excess of 100 blows per foot. The boring performed at the rear of the property, B-5, encountered the very dense and very hard soils with N-values in excess of 30 blows per foot. The majority of the N-values in the remaining borings ranged between 8 and 16.

Groundwater: Groundwater was not encountered in any of the borings at the time of drilling. Groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. The groundwater levels were only measured at the time of drilling. Generally, the highest groundwater levels occur in late winter and early spring, and the lowest levels in late summer and early fall. Based on our soil borings, we do not anticipate that groundwater will be encountered during general grading at the site.

Engineering Recommendations

The following evaluations and recommendations are based on our observations at the site, interpretations of the field data obtained during this exploration, and our experience with similar subsurface conditions and projects.

Based on our observations and Standard Penetration Resistances (N-values), foundations for the proposed building can likely be designed using a net allowable bearing capacity from 2,000 to 3,000 pounds per square foot (psf). When a building location is finalized on the property, we would recommend that additional borings be performed at specific locations in the building footprint to better define the soil conditions.

Following initial site preparations, we recommend that all areas to receive engineered fill or foundations be proof-rolled with a loaded tandem axle dump truck or other similar heavy construction equipment to confirm the stability of the subgrade soils and detect the presence of soft or unstable areas. Our geotechnical engineer or his representative should observe the proof-rolling operations. If proof-rolling reveals unstable conditions, the method of repair should be as directed by the project geotechnical engineer, but will likely consist of several options, such as undercutting the unsuitable soils and replacement with adequately compacted structural fill, scarifying and reconditioning, or the use of geotextiles for ground stabilization. The soil borings appeared to consist of fairly dense and stiff soils, therefore, if any soft soils are encountered, they should be fairly minimal and isolated around the site. Please note that due to the overall spacing of our borings around the site, subsurface conditions may vary between our boring locations and in unexplored areas of the site.

During grading operations hidden features in the substratum may be encountered within the proposed construction area. Details regarding removal of deleterious material must be determined on a case-by-case basis, and, therefore, contract documents should include a contingency cost for the removal of subsurface features. Excavated areas should be backfilled in general accordance with the compacted fill recommendations presented herein. Site preparation monitoring by F&R personnel is recommended.

We also recommend that site grading be performed in the summer months when groundwater levels are typically at their lowest levels. In addition, drying of any wet near-surface soils will be much easier to perform.

Difficult Excavation Considerations

Based on the results of the soil test borings, we anticipate that the near-surface soils can be excavated using conventional equipment. A layer of soft weathered rock and possible soil suspended boulder was encountered in boring B-3 from 7.5 feet to 12 feet. Although auger refusal was not encountered in the borings, it is possible that soft/hard weathered rock, intermittent rock lenses, or boulders may be encountered during site grading. We would like to point out that our experience indicates rock in a weathered, boulder, and/or massive form may vary erratically in location and depth. Therefore, there is always a potential that these materials could be encountered at shallower depths between the boring locations. The depth to, and thickness of weathered rock, rock lenses or seams, and bedrock, can vary dramatically in short distances and between boring locations; therefore, weathered rock may be encountered during construction at locations or depths, between boring locations, not encountered during this exploration.

LIMITATIONS

This summary report has been prepared for the exclusive use of Laurens County Development Corporation for specific application to the referenced project in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. These recommendations do not reflect variations in subsurface conditions that could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, we reserve the right to re-evaluate our recommendations based upon the available data. In the event changes are made in the proposed construction plans, the recommendations presented in this report shall not be considered valid unless reviewed by our firm and the recommendations of this report modified or verified in writing.

Once Building locations and site grading plans are finalized, and structural loading information has been determined, F&R recommends that additional subsurface exploration and geotechnical evaluation be performed to provide specific geotechnical engineering recommendations. When building locations are finalized, additional borings should be performed in the building to confirm the soil conditions for the buildings and our preliminary bearing pressure recommendations.

F&R appreciates the opportunity to work with Ryan Homes on this project. If there are any questions concerning this report or if any additional information is required, please do not hesitate to contact us.

Sincerely,
FROEHLING & ROBERTSON, INC.

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 14327 ROSS R. DEAVER

Ross R. Deaver, PE
Regional Vice President

SOUTH CAROLINA FROEHLING & ROBERTSON, INC. No. C00056 CERTIFICATE OF AUTHORIZATION

Steve Ackerman (by RRD)
Steve Ackerman, P.E.
Manager – Engineering Services

APPENDIX "I"

Boring Location Plan, Figure No. 1

BORING LOCATION PLAN		
FROEHLING & ROBERTSON, INC. ENGINEERING • ENVIRONMENTAL • GEOTECHNICAL 18 Woods Lake Road, Greenville, SC 29607 | USA T 864.271.2840 | F 864.271.8124	Client:	Laurens County Development Corporation
	Project:	40 Acre Industrial Tract
	Location:	Clinton, South Carolina
	F&R Project No:	65R-3070
	Plan Source:	Client
	Date: 2013	Approximate Scale: No Scale — Figure 1

APPENDIX "II"

Key to Soil Classification
Unified Soil Classification Chart
Boring Logs

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

Sands and Gravels

No. of Blows, N	Relative Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
Over 50	Very dense

Silts and Clays

No. of Blows, N	Relative Density
0 - 2	Very soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very stiff
31 - 50	Hard
Over 50	Very hard

Particle Size Identification (Unified Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	**Coarse** - 3/4 to 3 inches diameter **Fine** - 4.76 mm to 3/4 inch diameter
Sand:	**Coarse** - 2.0 mm to 4.76 mm diameter **Medium** - 0.42 mm to 2.0 mm diameter **Fine** - 0.074 mm to 0.42 mm diameter
Silt and Clay:	Less than 0.07 mm (particles cannot be seen with naked eye)

Modifiers

The modifiers provide our estimate of the amount of silt, clay or sand size particles in the soil sample.

Approximate Content	Modifiers
$\leq$ 5%:	Trace
5% to 12%:	Slightly silty, slightly clayey, slightly sandy
12% to 30%:	Silty, clayey, sandy
30% to 50%:	Very silty, very clayey, very sandy

Field Moisture	Description
Saturated:	Usually liquid; very wet, usually from below the groundwater table
Wet:	Semisolid; requires drying to attain optimum moisture
Moist:	Solid; at or near optimum moisture
Dry:	Requires additional water to attain optimum moisture

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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 SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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BORING LOG

Boring: B-1 (1 of 1)

Project No: 65R-3070
Client: LCDC
Project: 40 Acre Industrial Tract
City/State: HIghway 72 - Clinton, SC

Elevation: 582 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 11/20/13
Driller: F&R

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUAL Stiff to very stiff dry red fine slightly clayey sandy **SILT (ML)** with trace mica	3-6-8	0.0	14	No groundwater encountered in the boring
			5-8-11	1.5	19	
579.0	3.0	Stiff dry red to light brown fine micaceous sandy **SILT (ML)**	5-5-7	3.0	12	
			3-4-6	4.5	10	
				6.0		
573.5	8.5	Loose moist white medium to fine silty **SAND (SM)**	2-3-4	8.5	7	
				10.0		
568.5	13.5	Stiff to firm moist orange to brown fine micaceous sandy **SILT (ML)**	2-4-5	13.5	9	
				15.0		
			4-3-3	18.5	6	
				20.0		
			3-3-4	23.5	7	
557.0	25.0	Boring terminated at 25 feet		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

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BORING LOG

Boring: B-2 (1 of 1)

Project No: 65R-3070
Client: LCDC
Project: 40 Acre Industrial Tract
City/State: HIghway 72 - Clinton, SC

Elevation: 572 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 11/20/13
Driller: F&R

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUAL Stiff to very stiff dry red fine sandy **SILT (ML)** with trace mica	3-6-9	0.0	15	No Groundwater encountered in the boring
			8-9-9	1.5	18	
569.0	3.0	Loose dry orange medium to fine silty **SAND (SM)**	3-4-4	3.0	8	
567.5	4.5	Firm moist red to brown fine micaceous sandy **SILT (ML)**	2-3-3	4.5	6	
				6.0		
563.5	8.5	Loose dry grey to brown fine silty **SAND (SM)**	1-2-3	8.5	5	
				10.0		
558.5	13.5	Medium dense dry white coarse to fine silty **SAND (SM)**	6-6-17	13.5	23	
				15.0		
			30-17-8	18.5	25	
552.0	20.0	Stiff moist brown to black fine micaceous sandy **SILT (ML)**		20.0		
			4-7-6	23.5	13	
547.0	25.0	Boring terminated at 25 feet		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

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BORING LOG

Boring: B-3 (1 of 1)

Project No: 65R-3070
Client: LCDC
Project: 40 Acre Industrial Tract
City/State: HIghway 72 - Clinton, SC

Elevation: 586 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 11/20/13
Driller: F&R

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUAL Stiff red dry fine slightly clayey sandy **SILT (ML)**	5-4-5	0.0	9	No groundwater encountered in the boring
584.5	1.5	Stiff to firm brown to orange dry fine micaceous slightly sandy **SILT (ML)**	5-6-6	1.5	12	
			3-3-4	3.0	7	
			2-3-4	4.5	7	
				6.0		
578.5	7.5	**SOFT WEATHERED ROCK** - Sampled as very dense white to tan slightly silty **SAND (SM)** with rock fragments Hard drilling from 9.5' to 11.5' (possible soil suspended boulder)	35-50/2"	8.5	100+	
				9.2		
574.0	12.0	Loose orange to tan to white dry medium to fine silty **SAND (SM)**	4-4-6	13.5	10	
				15.0		
567.5	18.5	Very Stiff to stiff brown to grey moist fine micaceous sandy **SILT (ML)**	5-6-10	18.5	16	
				20.0		
			5-6-8	23.5	14	
561.0	25.0	Boring terminated at 25 feet		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

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BORING LOG

Boring: B-4 (1 of 1)

Project No: 65R-3070
Client: LCDC
Project: 40 Acre Industrial Tract
City/State: HIghway 72 - Clinton, SC

Elevation: 564 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 11/20/13
Driller: F&R

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUAL Firm to very stiff red to brown dry fine slightly clayey sandy **SILT (ML)**	3-4-5	0.0	9	No groundwater encountered in the boring
			5-7-8	1.5	15	
			4-3-5	3.0	8	
559.5	4.5	Stiff red to orange moist fine micaceous sandy **SILT (ML)**	3-4-8	4.5	12	
				6.0		
555.5	8.5	Loose white to tan dry medium to fine silty **SAND (SM)**	6-5-5	8.5	10	
				10.0		
			2-4-3	13.5	7	
				15.0		
			2-2-3	18.5	5	
544.0	20.0	Stiff grey to black moist fine micaceous sandy **SILT (ML)**		20.0		
			5-6-8	23.5	14	
539.0	25.0	Boring terminated at 25 feet		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

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BORING LOG

Boring: B-5 (1 of 1)

Project No: 65R-3070
Client: LCDC
Project: 40 Acre Industrial Tract
City/State: HIghway 72 - Clinton, SC

Elevation: 582 ±
Total Depth: 25.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 11/20/13
Driller: F&R

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		RESIDUAL Medium dense brown to tan dry medium to fine silty **SAND (SM)**	4-5-6	0.0	11	No groundwater encountered in the boring
			7-9-9	1.5	18	
579.0	3.0	Hard brown to yellow moist medium to fine sandy **SILT (ML)** with slight mica	10-19-20	3.0	39	
			7-14-18	4.5	32	
				6.0		
573.5	8.5	Dense to very dense dry medium to fine silty **SAND (SM)**	10-14-20	8.5	34	
				10.0		
			16-27-34	13.5	61	
567.0	15.0	Hard grey to tan moist fine micaceous sandy **SILT (ML)**		15.0		
			13-15-19	18.5	34	
				20.0		
			13-19-25	23.5	44	
557.0	25.0	Boring terminated at 25 feet		25.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

APPENDIX "III"

ASFE Document
"Important Information about Your Geotechnical Engineering Report"

Important Information About Your

Geotechnical Engineering Report

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

The following information is provided to help you manage your risks.

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 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 your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the 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.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of 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,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- 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 study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the 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 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 construction recommendations included in your report. *Those 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 recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower 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. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing 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 Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors 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 contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors 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 contractors do not 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.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental 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 geoenvironmental 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, a number of 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 ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

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