REPORT OF GEOTECHNICAL EXPLORATION

PROPOSED RESIDENTIAL DEVELOPMENT
104 HUFF DRIVE
GREENVILLE, SOUTH CAROLINA

Prepared For:
CMP Investments, LLC.
11 Park Street, Suite 2
Montclair, New Jersey 07042

BLE Project Number J22-18082-02

July 15, 2022

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July 15, 2022

CMP Investments, LLC.
11 Park Street, Suite 2
Montclair, New Jersey 07042

Attention: Mr. Zach Shulruff

Subject: **Report of Geotechnical Exploration**
Proposed Residential Development
104 Huff Drive
Greenville, South Carolina
BLE Project No. J22-18082-02

Dear Mr. Shulruff:

Bunnell-Lammons Engineering, Incorporated (BLE) is pleased to present this report of geotechnical exploration for the proposed residential development at 104 Huff Drive in Greenville, South Carolina. This exploration was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P22-0376 dated March 7, 2022. The exploration was authorized on June 13, 2022 by the signature of Mr. Shulruff on our Proposal Acceptance Sheet.

Sincerely,

BUNNELL-LAMMONS ENGINEERING, INC.

Jason C. Jansante, P.E.
Project Engineer
Registered, South Carolina #34614

SOUTH CAROLINA PROFESSIONAL ENGINEER 7/15/22 NO. 34614 LICENSED JASON C. JANSANTE

Gary L. Weekley, P.E.
Senior Engineer
Registered, South Carolina #10398

SOUTH CAROLINA BUNNELL-LAMMONS ENGINEERING, INC. No. C01452 CERTIFICATE OF AUTHORIZATION

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1.0 AUTHORIZATION

A geotechnical exploration for the proposed residential development at 104 Huff Drive in Greenville, South Carolina was performed generally as described in Bunnell-Lammons Engineering (BLE) Proposal No. P22-0376 dated March 7, 2022. The exploration was authorized on June 13, 2022 by the signature of Mr. Shulruff on our Proposal Acceptance Sheet.

2.0 SCOPE OF EXPLORATION

This report presents the findings of the geotechnical exploration performed for the proposed residential development in Greenville, South Carolina (reference Figure 1 in Appendix A). The intent of this exploration was to evaluate the subsurface soil and groundwater conditions at the site and provide recommendations for the proposed development.

3.0 PROJECT INFORMATION

The following project information was provided in a request for proposal (RFP) from Mr. Shulruff to our Mr. Ty Hawkins. Included in the RFP was a preliminary site map of the proposed development.

It is proposed to construct a residential development at 104 Huff Road in Greenville, South Carolina. The residential development will consist of 67 single-family homes throughout the ±22-acre property. We assume that each single-family home will be one to two stories tall and supported by conventional shallow foundations with a concrete slab on grab. Associated access drives will connect to Huff Drive and Stevenson Lane (emergency access only). In addition, a stormwater detention pond will be in the northwest corner of the site. The site is heavily wooded with small to large trees with a single-family home within the northern corner of the site that will remain in place. A creek borders the site to the north.

Structural information was not available as of the date of this report. However, based on our experience with similar projects, we anticipate maximum continuous wall loads of approximately 2 kips per linear foot. Grading information was also not available; however, we assumed that site grading operations will result in a maximum of approximately 10 feet of earthwork cut or fill.

4.0 FIELD EXPLORATION

The site was explored by excavating fourteen test pits at the approximate locations shown on the attached Test Pit Location Plan (in Appendix A). Test Pit Logs are presented as Appendix C. The test pits were excavated using a Takeuchi TB240 track-mounted mini-excavator. The test pit excavations were located and observed by our Mr. David Yarbray. The test pit locations shown in Appendix A should be considered approximate. A description of our field procedures is also included as Appendix B.

5.0 SITE GEOLOGY

The project site is located in the Piedmont Physiographic Province, an area underlain by ancient igneous and metamorphic rocks. The virgin soils encountered in this area are the residual product of in-place chemical weathering of the rock. In areas not altered by erosion, previous construction or other human activities, the typical residual soil profile consists of clayey soils near the surface where soil weathering is more advanced. The near surface clayey soils are typically underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined. This transitional zone is termed partially weathered rock (PWR) and is normally found overlying the parent bedrock. For engineering purposes, partially weathered rock is defined as residual material with a standard penetration resistance of at least 100 blows per foot. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. As a result, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

6.0 SUBSURFACE CONDITIONS

The test pits typically encountered between 3 and 5 inches of topsoil, with an average thickness of approximately 4 inches. Beneath the topsoil layer, the test pits encountered cultivated soils, residual soils and material sufficient to cause equipment refusal typical of the Piedmont Physiographic Province. Cultivated soils were encountered at test pits TP-6, TP-12 and TP-13 extending to depths ranging from 1 to 2 feet below the ground surface. The cultivated soils were noted to consist of clayey sand (SC) and silty sand (SM).

Residual soils were encountered beneath the cultivated soils and beneath topsoil in the remaining test pits. The residual soils consist of sandy lean clay (CL), sandy silt (ML), clayey sand (SC) and silty sand (SM). The residual soils were noted to be micaceous. Rock fragments were encountered at some of the test pits that could be penetrated with the mini-excavator used in the exploration. The letters in parentheses represent a visual classification of the soils in accordance with the Unified Soil Classification System. A key to symbols and classification is included as Appendix D.

Equipment refusal was encountered as shown in the following table.

Boring No.	Refusal Depth (feet)	Boring No.	Refusal Depth (feet)
TP-1	10	TP-8	2
TP-2	4	TP-9	4
TP-3	NE	TP-10	1.75
TP-4	5.5	TP-11	NE
TP-5	4.5	TP-12	NE
TP-6	7	TP-13	NE
TP-7	1.25	TP-14	7

NE – not encountered during exploration

Groundwater was not encountered by the test pits at the time of excavation. However, it should be noted that groundwater levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Groundwater may be perched overlying rock layers and refusal material. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall.

The above descriptions provide a general summary of the subsurface conditions encountered. The Test Pit Logs included as Appendix C contain information recorded at each test pit location. The Test Pit Logs represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. It should be noted that the soil conditions will vary between test pit locations.

7.0 PROJECT RECOMMENDATIONS

7.1 Clearing and Grubbing

All topsoil, vegetation, trees, roots, disturbed soils, asphalt, gravel, existing construction, and surface soils containing organic matter or other deleterious materials should be stripped from within the proposed building and pavement areas. Root balls for mature trees typically extend deeper than the nominal topsoil thickness. Topsoil and organic soils may be stockpiled for later use in areas to be landscaped. Other deleterious material should be disposed of offsite or in areas of the site that will not be developed.

7.2 Difficult Excavation Conditions

As indicated in Section 6.0 of this report, refusal to the track-mounted mini-excavator was encountered at ten test pits at depths ranging from 1.25 feet to 10 feet below the ground surface. Also weathered rock layers that could be excavated by the mini-excavator were encountered at other test pits.

The degree of weathering of partially weathered rock typically decreases with increasing depth until sound rock is eventually encountered. The partially weathered rock, as well as the soil above, may also contain boulders, lenses or ledges of hard rock. Some of the partially weathered rock of the transitional zone could be penetrated by the track-mounted excavators used in the exploration and can sometimes be excavated without blasting. However, it is often extremely difficult to excavate partially weathered rock without blasting, especially in confined excavations such as utility trenches and footings. The ease of excavation depends on the quality of grading equipment, skill of the equipment operators and geologic structure of the material itself such as the direction of bedding, planes of weakness, and spacing between discontinuities. Weathered rock or rock that cannot be penetrated by the excavator will normally require blasting or pneumatic hammers to loosen the material to facilitate removal.

Depending on the final grading plans, site grading activities may be completed with conventional earthmoving equipment and procedures; however, confined excavations (footings, utility trenches, etc.) and the stormwater detention pond will likely require ripping tools and pneumatic hammers. In addition, blasting may be necessary to efficiently remove more resistant rock and large boulders that could be present within excavations.

7.3 Drainage

Groundwater was not encountered within the assumed shallow excavation depths. However, groundwater levels may fluctuate several feet with seasonal rainfall variations. Normally, the highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall. Perched groundwater may be encountered overlying shallow rock layers. The contractor should be prepared to promptly remove any surface water or groundwater from the construction area. This has been done effectively on past jobs by means of gravity ditches and pumping from filtered sumps.

7.4 Proofrolling

After stripping and rough excavation grading, we recommend that areas to provide support for the foundations, floor slabs, engineered fill and pavement be carefully inspected for soft surficial soils and proofrolled with a 25 to 35-ton, four-wheeled, rubber-tired roller or similar approved equipment. The proofroller should make at least four passes over each location, with the last two passes perpendicular to the first two where practical.

Any areas which wave, rut or deflect excessively and continue to do so after several passes of the proofroller should be excavated to firmer soils. The excavated areas should be backfilled in thin lifts with engineered fill. The proofrolling and excavating operations should be carefully monitored by an experienced engineering technician working under the direction of the geotechnical engineer. Proofrolling should not be performed when the ground is frozen or wet from recent precipitation.

7.5 Engineered Fill

All fill used for raising site grade or for replacement of material that is undercut should be uniformly compacted in thin lifts to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). In addition, a minimum of the upper 18 inches of subgrade fill beneath pavements and floor slabs should be compacted to at least 98 percent of the maximum dry density. We recommend that the fill be placed and compacted at a moisture content within three percent of the standard Proctor optimum moisture content.

Based on our visual examination and experience with similar soil types, the residual soil appears to be generally suitable for use as engineered fill with proper moisture adjustment. The cultivated soils are marginally suitable for use as engineered fill because of organic content and will be impacted by prevailing weather. In general, soils having a Plasticity Index (PI) greater than 30 (less than 15 is preferable) should not be used for fill. Soils used for engineered fill should be reasonably free from organics (less than 3% organics by weight) and should exhibit a standard Proctor maximum dry density greater than 90 pcf. Rock pieces in fill soils should be less than 6-inch diameter and 3-inch diameter within 4 feet of finished grade.

Before filling operations begin, representative samples of each proposed fill material should be collected and tested to determine the compaction and classification characteristics. The maximum dry density and optimum moisture content should be determined. Once compaction begins, a sufficient number of density tests should be performed by an experienced engineering technician working under the direction of the geotechnical engineer to measure the degree of compaction being obtained. Existing slopes steeper than 6:1 (horizontal:vertical) should be benched prior to placement of engineered fill such that the fill is placed in horizontal layers and keyed into the existing slopes.

The edge of engineered fill extending above surrounding grade should extend horizontally beyond the outside edge of the building foundations at least 10 feet or a distance equivalent to the height of fill to be placed, whichever is greater, before sloping. Fill slope surfaces should be protected from erosion by grassing or some other means.

The surface of compacted subgrade soils can deteriorate and lose its support capabilities when exposed to environmental changes and construction activity. Deterioration can occur in the form of freezing, formation of erosion gullies, extreme drying, exposure for a long period of time or rutting by construction traffic. We recommend that the surfaces of floor slab and pavement subgrades that have deteriorated or softened be recompacted prior to construction of the floor slab or pavement. Additionally, any excavations through the subgrade soils (such as utility trenches) should be properly backfilled in compacted lifts. Recompaction of subgrade surfaces and compaction of backfill should be checked with a sufficient number of density tests to determine if adequate compaction is being achieved.

7.6 Slopes

Confined temporary excavations such as for utility installation or below-grade wall construction should conform to OSHA regulations. For permanent slopes which are not confined, our experience suggests that excavation side slopes through the existing soil overburden at the site should be laid back at a 2H:1V (horizontal to vertical) slope or flatter. Permanent fill slopes placed on a suitable foundation should be constructed at 2.5:1, or flatter. Fill slopes should be adequately compacted. Cut and fill slope surfaces should be protected from erosion by grassing or other means. Permanent slopes of 3:1 or flatter may be desirable for mowing.

8.0 BASIS OF RECOMMENDATIONS

Our geotechnical evaluation of the subsurface conditions has been based on our understanding of the project information and data obtained in our exploration as well as our experience on similar projects. The generalized subsurface conditions used in our foundation evaluation have been based on interpolation of the subsurface data between the widely spaced test pit excavations. Subsurface conditions between the test pits will likely differ. If the project information is incorrect or the development location (horizontal or vertical) and/or dimensions are changed, please contact us so that our recommendations can be reviewed. The discovery of any site or subsurface conditions during construction which deviate from the data obtained in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions for presence of pollutants in the soil, rock and groundwater of the site was beyond the scope of this exploration. Soil cuttings used as backfill in test pits will settle over time resulting in a depression at the surface. It is beyond the scope of our services to return to the site to repair excavations that have exhibited settlement of the backfill soils.

APPENDIX A
Figures

BUNNELL LAMMONS ENGINEERING

Proposed Residential Development CMP Investments, LLC. 18082-02	06/14/22	TEST LOCATION PLAN	

APPENDIX B
Field Exploration Procedures

Field Exploration Procedures

Test Pits

Test pits were excavated with a backhoe under the observation of a BLE representative. The test pit locations were selected by our representative and the soils were identified in the field based on the conditions observed by our representative. Test Pit records are attached, showing the soil descriptions.

APPENDIX C
Test Pit Logs

TEST PIT LOGS

PROPOSED DEVELOPMENT

Greenville, South Carolina

Project Name:	Proposed Development - 104 Huff Drive	**Date:**	6/30/2022
Project No.:	J22-18082-02	**Equipment:**	Takeuchi TB240

Test Pit	Topsoil *(inches)*	Soil Conditions	Depth *(feet)*	Refusal *(feet)*	Groundwater *(feet)*	Date	By:
TP-1	3	Red and brown, slightly micaceous, clayey, fine to medium SAND (SC) - Residuum	3" to 1.5'	10	-	6/30/2022	WDY
		Red and brown, micaceous, fine to medium sandy SILT (ML)	1.5' to 10'				
		at 5.5'- brown and gray					
TP-2	4	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	4" to 1'	4	-	6/30/2022	WDY
		Red and brown, micaceous, clayey, fine to medium SAND with rock fragments (SC)	1' to 4'				
TP-3	4	Red and brown, micaceous, clayey, fine to medium SAND (SC) - Residuum	4" to 2'	-	-	6/30/2022	WDY
		Red and brown, micaceous, silty, fine to medium SAND (SM)	2' to 7'				
		at 4' - red and tan, with rock fragments					
		Brown and gray, slightly micaceous, fine to medium sandy SILT with rock fragments (ML)	7' to 10'				
TP-4	3	Tan and brown, micaceous, silty, fine to medium SAND (SM) - Residuum	3" to 1'	5.5	-	6/30/2022	WDY
		Light brown and white, slightly micaceous, silty, fine to medium SAND (SM)	1' to 5.5'				
		at 5.25' - with Rock					
TP-5	5	Red and brown, micaceous, clayey, fine to medium SAND (SC) - Residuum	5" to 4.5'	4.5	-	6/30/2022	WDY
TP-6	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Cultivated	3" to 2'	7	-	6/30/2022	WDY
		Red and brown, micaceous, clayey, fine to medium SAND (SC) - Residuum	2' to 4.5'				
		Red and tan, micaceous, silty, fine to medium SAND (SM)	4.5' to 7				
TP-7	3	Red, micaceous, fine to medium, sandy SILT (ML) - Residuum	3" to 1.25'	1.25	-	6/30/2022	WDY

TEST PIT LOGS

PROPOSED DEVELOPMENT

Greenville, South Carolina

Project Name:	Proposed Development - 104 Huff Drive	**Date:**	6/30/2022
Project No.:	J22-18082-02	**Equipment:**	Takeuchi TB240

Test Pit	Topsoil *(inches)*	Soil Conditions	Depth *(feet)*	Refusal *(feet)*	Groundwater *(feet)*	Date	By:
TP-8	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	3" to 1'	2	-	6/30/2022	WDY
		Red and brown, micaceous, clayey, fine to medium SAND (SC)	1' to 2'				
TP-9	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	3" to 1.5'	4	-	6/30/2022	WYD
		Red and light brown, micaceous, clayey, fine to medium SAND (SC)	1.5' to 4'				
TP-10	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	3" to 1.75'	1.75	-	6/30/2022	WYD
TP-11	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	3" to 1'	-	-	6/30/2022	WDY
		Red and tan, slightly micaceous, clayey, fine to medium SAND (SC)	1' to 3.5'				
		Red and brown, slightly micaceous, silty, fine to medium SAND (SM)	3.5' to 5'				
		Red and tan, micaceous, fine to medium sandy SILT (ML)	5' to 10'				
TP-12	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Cultivated	3" to 1'	-	-	6/30/2022	WDY
		Red and brown, micaceous, clayey, fine to medium SAND (SC) - Residuum	1' to 3.6'				
		Dark red and tan, micaceous, silty, fine to medium SAND (SM)	3.6' to 10'				
TP-13	3	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Cultivated	3" to 1'	-	-	6/30/2022	WDY
		Red and light brown, slightly micaceous, clayey, fine to medium SAND (SC) - Residuum	1' to 3.5'				
		Red, micaceous, fine to medium, sandy Clay (CL)	3.5' to 7'				
TP-14	4	Tan and brown, slightly micaceous, silty, fine to medium SAND (SM) - Residuum	4" to 1.5'	7	-	6/30/2022	WDY
		Red and brown, micaceous, clayey, fine to medium SAND (SC)	1.5' to 4'				
		Light brown and white, slightly micaceous, silty, fine to medium SAND (SM)	4' to 7'				
		at 3.5' - with Rock fragments					

APPENDIX D
A Key to Soil Classification

KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

BUNNELL-LAMMONS ENGINEERING, INC.
GREENVILLE, SOUTH CAROLINA

Penetration Resistance* Blows per Foot	Relative Density
SANDS	
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

Penetration Resistance* Blows per Foot	Consistency
SILTS and CLAYS	
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

*ASTM D 1586

Particle Size Identification

Boulder: Greater than 300 mm
Cobble: 75 to 300 mm
Gravel:
Coarse - 19 to 75 mm
Fine - 4.75 to 19 mm
Sand:
Coarse - 2 to 4.75 mm
Medium - 0.425 to 2 mm
Fine - 0.075 to 0.425 mm
Silt & Clay: Less than 0.075 mm

KEY TO DRILLING SYMBOLS

- Grab Sample
- Split Spoon Sample
- Undisturbed Sample

NR = No reaction to HCL
NA = Not applicable
NS = No sample

- Groundwater Table at Time of Drilling
- Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

- Well-graded Gravel GW
- Poorly-graded Gravel GP
- Partially Weathered Rock BLDRCBBL
- High Plasticity Clay CH
- Poorly Graded Sand SP
- Low Plasticity Clay CL
- Sandy Clay CLS
- Silty Clay CL-ML
- Silt ML
- Bedrock BEDROCK
- Clayey Silt MH
- Sandy Silt MLS
- Sand SW
- Clayey Sand SC
- Waste WOOD
- Silty Sand SM
- Topsoil TOPSOIL
- Liquid Sludge SLUDGE
- Fill FILL

APPENDIX E
Important Information About This Geotechnical Report

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.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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 <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

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