AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

BPA NO.	1. CONTRACT ID CODE	PAGE 1 OF PAGES 2

2. AMENDMENT/MODIFICATION NUMBER	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NUMBER	5. PROJECT NUMBER (if applicable)
0002	04-27-2021		589A4-20-158

6. ISSUED BY CODE 36C255	7. ADMINISTERED BY (If other than Item 6) CODE 36C255
Department of Veterans Affairs Network Contracting Office (NCO) 15 3450 S 4th Street Trafficway Leavenworth KS 66048	Department of Veterans Affairs Network Contracting Office (NCO) 15 3450 S 4th Street Trafficway Leavenworth KS 66048

8. NAME AND ADDRESS OF CONTRACTOR (Number, street, county, State and ZIP Code)

To all Offerors/Bidders

CODE | FACILITY CODE

(X)	
	9A. AMENDMENT OF SOLICITATION NUMBER 36C25521R0075
X	9B. DATED (SEE ITEM 11)
	10A. MODIFICATION OF CONTRACT/ORDER NUMBER
	10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[x] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers [ ] is extended, [X] is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or electronic communication which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by letter or electronic communication, provided each letter or electronic communication makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified. May 17, 2021 by 2:00 PM CDT

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
[ ]	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
[ ]	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
[ ]	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
[ ]	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return ___________ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Renovate Warehouse for Pandemic Preparedness, 589A4-20-158

This amendment provides the following:
a. The sign in sheet for those that were in attendence to the Pre-bid meeting and project walk-thru is attached.
b. The GeoTechnical Report is attached.
c. Reminder all questions are due by April 29, 2021 by 4:00 PM CDT.
d. All other terms and conditions remain unchanged.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA (Signature of Contracting Officer)	16C. DATE SIGNED

A.1 List of Attachments

See attached document: ATTENDANCE ROSTER.

See attached document: 589A4-20-158 GeoTech Report.

GEOTECHNICAL ENGINEERING REPORT
FOR
CLH ARCHITECTS, P.C.

VA HOSPITAL WAREHOUSE
COLUMBIA, MISSOURI

DECEMBER 31, 2020

Crockett GTL Project Number: G20602

1000 W Nifong Blvd, Bldg 1 • Columbia, MO 65203
Phone: 573-447-0292
www.CrockettEngineering.com

CROCKETT
GEOTECHNICAL - TESTING LAB
1000 W Nifong Blvd. - Building 1
Columbia, Missouri 65203
(573) 447-0292

December 31, 2020

CLH Architects, P.C.
3705 North 200th Street
Elkhorn, Nebraska 68022

Attn: Mr. Richard J. Onken, AIA

Re: Geotechnical Engineering Report
VA Hospital Warehouse
Columbia, Missouri
Crockett GTL Project Number: G20602

Dear Mr. Onken:

Crockett Geotechnical - Testing Lab (Crockett GTL) has completed the geotechnical engineering services for the referenced project. This report should be read in its entirety. This report presents the results of our field explorations, laboratory testing, and recommendations for design and construction of the referenced project.

We appreciate the opportunity to be of service and look forward to working with you during the construction phase of this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Aaron Grimm, E.I.T.
Project Manager

Eric H. Lidholm, P.E.
Principal Engineer
Missouri: E-23265

Enclosures

cc: 1 – Client (.PDF)
1 – File

TABLE OF CONTENTS

Geotechnical Engineering Report
VA Hospital Warehouse
Columbia, Missouri
Crockett Project Number: G20602
December 31, 2020

1 INTRODUCTION

Crockett Geotechnical - Testing Lab (CGTL) has conducted a geotechnical exploration for the proposed development. The purpose of our exploration was to:

- Characterize and evaluate the subsurface conditions,
- Provide design and construction recommendations for:
  - uncontrolled and undocumented fill
  - shrink/swell prone soils
  - earthwork
  - foundations
  - new floor slabs on-grade
  - seismic considerations
  - lateral earth pressures
  - special inspection requirements

2 SITE AND PROJECT INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

Item	Description
Location	This project is located at the existing VA Hospital Warehouse facility located at 800 Hospital Drive in Columbia, Missouri. Specifically the project site is located approximately 200 feet east of the intersection of Tiger Avenue and East Stadium Boulevard in Columbia, Missouri A Site Location Map showing the approximate location of this project is included in the Appendix of this report
Approximate GPS Coordinates	38.936306, -92.329975
Existing improvements	Existing warehouse and driving/loading areas

Item	Description
Current ground cover	Existing warehouse, pavement, grass
Existing topography	The site has been altered significantly by prior site grading and construction activities

2.2 Project Description

Item	Description
Proposed structure	The western half of the existing structure will be replaced by a two story structure The eastern half of the existing structure will remain but may require retrofitting and additional support
Building Construction	Steel framed with masonry block walls
Maximum Loads (provided)	Column Loads: 185 kips Strip Loads: 3.0 klf
Fished Floor Elevation (FFE)	723.3 feet (MSL) – obtained from a Boundary and Topography plan prepared by Engineering Surveys & Services and dated 6-30-16
Grading (approximate)	We anticipate general site grading to consist of less than approximately 3 feet of cut or fill
Slopes	Final slopes are assumed to be no steeper than 3H:1V (Horizontal to Vertical)
Free-standing retaining walls	None anticipated
Below grade areas	Stem walls

3 SUBSURFACE CONDITIONS

3.1 Field Exploration and Laboratory Testing

Four (4) borings were drilled for this project at the approximate locations indicated on the Boring Location Plan included in the Appendix of this report. Additional information follows:

Field Exploration	
Boring Locations [1]	Designated and staked by a Crockett GTL geotechnical engineer
Boring Elevations [1]	The boring locations and elevations were obtained from a Boundary and Topographic Survey prepared by Engineering Surveys & Services and dated 6-30-16
Drill Rig	CME45 track-mounted drill rig equipped with 4-inch solid stem augers
Sampling Methods [2]	Representative samples were obtained using thin-walled tube sampling and split-barrel tube sampling procedures
1. The location and elevation of the borings should be considered accurate only to the degree implied by the means and methods used to define them 2. A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site	

The samples were tagged for identification, sealed to reduce moisture loss and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes material descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

The field logs were prepared by the drill crew. Final logs included with this report represent the engineer's interpretation of the field logs and include modifications based upon laboratory tests and observation made of the samples. Detailed information regarding the material encountered and the results of field sampling and laboratory testing are shown on the Boring Logs included in the Appendix of this report. The descriptions of the soil on the final boring logs are in general accordance with the Unified Soil Classification System which is included in the Appendix of this report.

3.2 Encountered Subsurface Conditions

From the ground surface in borings B-1, B-3 and B-4 was topsoil that ranged in thickness from approximately 2 to 8-inches. From the ground surface in boring B-2 was approximately 8-inches of concrete. Surficial material thickness should be expected to vary between borings.

Underlying the topsoil in boring B-1 was uncontrolled fill. Uncontrolled fill is fill material that is variable in strength, density, moisture content, and composition. This particular uncontrolled fill appeared to drill as if it was comprised of construction debris. The boring was abandoned at a depth of 12.5 feet while still within the uncontrolled fill after encountering difficult drilling and impenetrable obstructions while drilling with 4-inch solid stem augers. The thickness and aerial extent of this uncontrolled fill could not be determined and should be expected to vary elsewhere on the site.

Underlying the concrete in boring B-2 was base rock that extended to approximate depth of 7.0 feet. Base rock thickness should be expected to vary elsewhere on this site.

Underlying the topsoil in borings B-3 and B-4 was undocumented fill. Undocumented fill is fill material that appears to be compacted to a relatively high degree but for which no compaction test records are available to verify satisfactory compaction and moisture control was achieved during construction of the fill. The undocumented fill extended to depths ranging from approximately 7.0 to 8.0 feet in these borings and should be expected to vary elsewhere on the site.

Underlying the base rock in boring B-2 and the undocumented fill in boring B-3 was native gravelly lean to fat clay or lean to fat clay that was visually identified as glacial drift. The glacial drift extended to depths ranging from approximately 13.5 to 19.0 feet in these borings.

Underlying the undocumented fill in boring B-4 was native shaley fat clay. The shaley fat clay extended to an approximate depth of 20.0 feet.

Underlying the glacial drift in borings B-2 and B-3 and the shaley fat clay in boring B-4 was weathered limestone. Auger refusal was achieved in these borings within the weathered limestone at depths ranging from approximately 12.5 to 19.3 feet.

Detailed descriptions of the encountered materials are listed on the individual boring logs included in the Appendix of this report. Strata lines indicate the approximate location of changes in material types. The transition between material types may be gradual.

3.3 Groundwater

The boreholes were observed while drilling and after completion of drilling for the presence and level of groundwater. In addition, delayed groundwater levels were also obtained in some borings. The groundwater levels observed are noted on the attached boring logs, and are summarized below:

Groundwater Levels			
Boring Number	Depth to Groundwater (feet)		
	At Time of Drilling	At End of Drilling	After Completion of Drilling
B-1	6.0	Not encountered	Not encountered @ ¼ hrs

Groundwater Levels			
Boring Number	Depth to Groundwater (feet)		
	At Time of Drilling	At End of Drilling	After Completion of Drilling
B-2	Not encountered	Not encountered	Not encountered @ ¼ hrs
B-3	Not encountered	Not encountered	Not encountered @ ¼ hrs
B-4	Not encountered	Not encountered	Not encountered @ ¼ hrs

Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Pockets, lenses, and stringers of sand are sometimes encountered in the soil types encountered in the vicinity of the referenced project. These sand pockets are normally discontinuous and often contain water of variable quality and quantity. These sand pockets may be encountered during foundation excavation.

Perched groundwater can develop over low permeability soil or rock strata. This possibility should be considered when developing design and construction plans and specifications for the project. Groundwater levels depend on seasonal and climatic variations and may be present at different levels in the future. In addition, without extended periods of observation, accurate groundwater level measurements may not be possible, particularly in low permeability soils.

The boreholes were backfilled prior to departing the project site. Groundwater records are indicated on the boring logs included in the Appendix of this report.

4 GEOTECHNICAL RECOMMEDATIONS

4.1 UNCONTROLLED FILL

Uncontrolled fill was encountered in boring B-1 which was located about 27 feet west-northwest of the northwestern corner of the existing warehouse structure. Uncontrolled fill is fill material that is variable in strength, density, moisture content, and composition. This particular uncontrolled fill appeared to drill as if it was comprised of clay and construction debris. The boring was abandoned at 12.5 feet while still within the uncontrolled fill due to difficult drilling conditions and impenetrable obstructions while drilling with 4-inch solid stem augers. The thickness and aerial extent of the uncontrolled fill could not be determined and should be expected to vary elsewhere on the site. The uncontrolled fill as encountered in boring B-1 is not suitable for the support of foundations and/or floor slabs.

4.2 Undocumented Fill

Undocumented fill was encountered in boring B-3 and B-4 to depths ranging from about 7.0 to 8.0 feet and base rock was encountered in boring B-2 to a depth of about 7.0 feet. These borings were located immediately south of the existing warehouse structure. It is not known if undocumented fill is present within the building footprint. Undocumented fill is fill material that appears to be compacted to a relatively high degree but for which no compaction test reports are available to verify satisfactory compaction and moisture control was achieved throughout the fill area. The undocumented fill, as encountered in borings B-2 through B-4, is not recommended for support of foundations under the anticipated structural loads.

4.3 Shrink/Swell Prone Soils

The following recommendations are for new floor slab on grade areas. Soil that has the capability to shrink or swell with variations in moisture content is present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and at least minor cracking in the structure should be anticipated. The severity of cracking and other cosmetic damage such as uneven floor slabs will probably increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction.

The procedures for constructing a low volume change zone, as recommended in this report, may not eliminate all future subgrade volume change and resultant floor slab movements. However, the procedures outlined should significantly reduce the potential for subgrade volume change. Additional reductions in floor slab movements could be achieved by using a thicker low volume change zone. Details regarding this low volume change zone are provided in the Floor Slab section of this report. Any compacted structural fill placed in the upper 30-inches beneath new floor slab areas should meet the requirements for Low Volume Change (LVC) Material which is defined in the Earthwork section of this report.

In addition, all grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in greater soil movement and can result in unacceptable structural performance. After building construction has been completed, we recommend verifying final grades to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary, as part of the structure´s maintenance program.

4.3.1 Swell Test Results

Two (2) swell tests were performed on a thin-walled tube sample to help evaluate the potential for soil swell. The results of this test follow:

Swell Test Results [1]				
Boring Number	Sample Number	Sample Depth, ft	Confining Pressure, psf	Measured Swell, %
B-3	S-1	2.0	60	3.2
B-4	S-1	2.0	60	3.3
1. Additional results and details are provided on the One-Dimensional Swell Potential of Cohesive Soils report(s) included in the Appendix of this document				

4.3.2 Estimated Swell

A swell estimation technique that uses soil index properties (liquid limit, dry density, and moisture content) was utilized to evaluate the potential for swell of the existing soils at the floor slab on-grade level. Based upon the results of this method, the potential swell of the existing near surface soils is estimated to in the range of 1.0 to 5.25 and averaged about 3.0%.

4.3.3 Swell Discussion

Literature indicates swell greater than 1.5% is considered high, or critical. Swell less than 0.5% is considered low or non-critical. Swell on the order of 0.5% to 1.5% is considered marginal. Because of the estimated swell potential of the near surface soils, differential movement of lightly loaded, grade supported structures (i.e. floor slabs) is possible.

4.4 Earthwork

We recommend the exposed subgrade be thoroughly evaluated before the start of any fill operations. We recommend the geotechnical engineer be retained to evaluate the bearing material for the foundations and subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs have been reviewed and evaluated with respect to the proposed project plans known to us at this time.

4.4.1 Site Preparation

All unsuitable material should be removed from the construction areas prior to placing structural fill. After stripping and grubbing, the site should be proofrolled to aid in locating loose or soft areas. Proofrolling can be performed with a loaded tandem axle dump truck. Soft, wet, dry and low-density soil should be removed or be moisture conditioned and recompacted in place as structural fill prior to placing new structural fill.

4.4.2 Structural Fill Material Requirements

Compacted structural fill should consist of approved materials free of organic matter and debris. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted for evaluation prior to use.

Structural Fill Material Requirements		
Material Type	USCS Classification	Acceptable Uses
Lean Clay and Clayey Sand	CL & SC (LL<40)	All locations
Lean to Fat Clay	CL-CH (40<LL<50)	> 30-inches below floor slab
Fat Clay	CH (LL≥50+)	> 30-inches below floor slab
Low Volume Change Material	• Similar to MoDOT Type 1 or 5 crushed limestone aggregate, limestone screenings, or granular material such as sand, gravel or crushed stone containing at least 18% low plasticity fines • Low plasticity cohesive soil or granular soil having at least 18% low plasticity fines • Can also consist of soil treated with chemicals (hydrated lime, Code-L, etc.)	

4.4.3 Structural Fill Compaction Requirements

Structural Fill Compaction Requirements	
Soil Fill Lift Thickness	• 9 inches or less when using heavy self-propelled compaction equipment • 6-inches or less when using hand guided or light self-propelled equipment

Structural Fill Compaction Requirements	
Compaction Requirements [1, 2]	95% of standard Proctor dry density (ASTM D-698) 1. We recommend engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved 2. As stated within ASTM D698, this procedure is intended for soils with 30% or less material larger than ¾˝. Accordingly, we recommend full time proof-roll observation be performed instead of moisture density testing for materials containing more than 30% aggregate retained on the ¾˝ sieve
Compaction Moisture Content Requirements	
• Lean to Fat Clay and Fat Clay	Optimum moisture content (OMC) to 4% above the standard Proctor optimum moisture content
• Lean Clay and Silt	2% below to 3% above standard Proctor OMC
• Granular	Workable moisture content. Shall not pump when proofrolled

4.4.4 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structure is recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.4.5 Underground Utilities

Underground utilities can provide a pathway for water to migrate below at-grade slabs. Drain and utility pipes beneath at-grade slabs should have tight joints to prevent leakage. If utility trenches are backfilled with relatively free-draining granular material, they should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure and at-grade slabs. In addition, we recommend constructing an impermeable cut-off consisting of an effective clay plug at least 3 feet in length where underground utilities enter or exit the perimeter of the structure.

With the exception of individual service lines to the building that intersect foundations perpendicularly, below grade utilities should not be located within the stress influence zone of the building foundations. Accordingly, below grade utilities should be located outside a zone extending 45-degrees downward and outward from the edge of the footings.

4.4.6 Earthwork Construction

In periods of dry weather, the surficial soils may be of sufficient strength to allow fill construction on the stripped and grubbed ground surface. However, unstable subgrade conditions could develop if the soils are wet or subjected to repetitive construction traffic. Should unstable subgrade conditions be encountered, stabilization measures will need to be employed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to construction.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork/fill placement and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of structural fills; backfilling of excavations into the completed subgrade, and just prior to construction.

4.4.7 Temporary Excavations

The Occupational Safety and Health Administration (OSHA) has developed regulations to provide for the safety of workers entering excavations. Temporary excavations will probably be required during grading operations. All operations should be performed under the supervision of qualified site personnel in accordance with OSHA Excavation and Trench Safety Standards.

4.5 Foundations

Due to the anticipated structural loads and corresponding unsatisfactory settlement expected if a shallow foundation system is utilized to carry the loads, we recommend a deep foundation system be utilized. This would likely involve the use of a pin pile system such as micro-piles or push-piles to provide the additional support needed by the existing foundation system.

Lightly loaded incidental foundations unrelated to the structural support of the warehouse structure can be supported by a shallow spread-footing foundation system bearing on suitable native soil, thoroughly investigated and approved undocumented fill or on new structural fill. Design recommendations and construction considerations for shallow foundations follow:

4.5.1 Shallow Foundation Design Recommendations

Design recommendations for lightly loaded incidental shallow foundations are as follows:

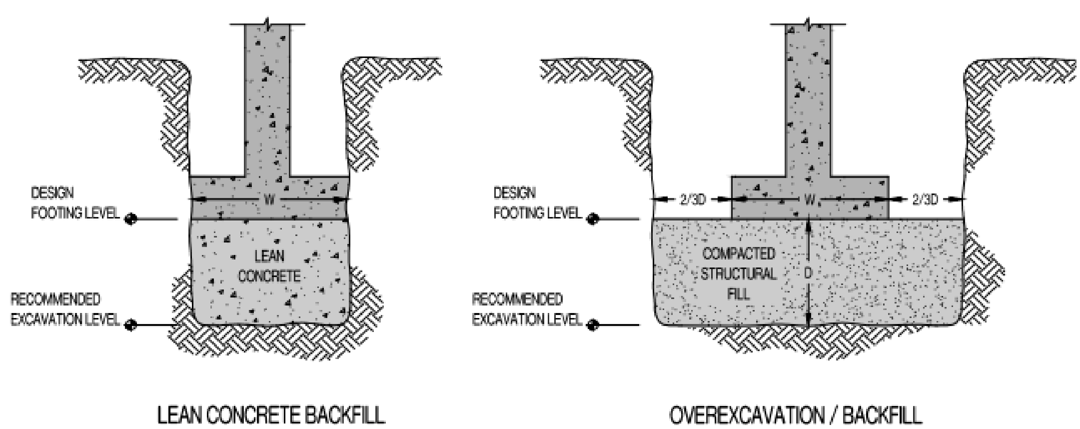
Shallow Foundation Design Recommendations	
Allowable bearing pressure • Isolated foundations • Continuous foundations • Allowable overstress for transient loads (i.e. snow, wind, seismic) 1. Assumes all foundations will bear directly upon suitable native soil, thoroughly investigated and approved undocumented fill or on new structural fill	2,000 psf 1,700 psf 33%
Minimum foundation dimensions • Isolated foundations • Continuous foundations	30 inches 12 inches
Ultimate passive pressure (equivalent fluid pressure) 1. The sides of the spread footing foundation excavations must be nearly vertical and the concrete should be placed neat against the vertical faces for the passive earth pressure values to be valid 2. Passive resistance in the frost zone should be neglected 3. Some movement of the footing will be required to mobilize resistance from passive pressure and sliding friction	270 pcf
Ultimate coefficient of sliding friction	0.32
Minimum embedment below finished grade for frost protection	30 inches
Uplift Resistance • Soil Total Unit Weight • Concrete Total Unit Weight 1. Only the soil directly overlying the foundation should be used for uplift resistance 2. Unit weight values do not include factors of safety 3. Assumes foundations are drained and are constructed above the highest groundwater level	120 pcf 150 pcf
Approximate Foundation Settlement • Total • Differential 1. Assumes maximum footing size of 5.0 feet for isolated foundations and 1.5 foot for continuous foundations	< 1 inch < ¾ inch

4.5.2 Shallow Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil and rock prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soil at the foundation bearing level become excessively dry, disturbed, saturated, or frozen the affected soil should be removed prior to placing concrete. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended the geotechnical engineer be retained to observe and test the soil foundation bearing materials.

Groundwater was encountered in some of the borings and conditions may develop such that it may be encountered during foundation excavation. In addition, some surface and/or perched groundwater may enter foundation excavations during construction. It is anticipated any water entering foundation excavations from these sources can be removed using sump pumps or gravity drainage.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings should bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with well graded granular material placed in lifts of 9 inches or less in loose thickness and compacted to at least 98 percent of the material's maximum standard effort maximum dry density (ASTM D 698). The lean concrete backfill and overexcavation-and-backfill procedures are described in the diagram below.



NOTE:
EXCAVATIONS IN SKETCHES SHOWN VERTICAL FOR CONVENIENCE. EXCAVATIONS SHOULD BE SLOPED AS NECESSARY FOR SAFETY.

4.5.3 Pin Pile Foundation Recommendations

A pin-pile foundation system could be considered to supplement the load carrying capability of new and existing foundations. Many of these pin-pile systems are proprietary in nature and require specialized contractors for installation. Further, pin-pile foundation elements are usually part of the foundation contractor's design-build system. Therefore, the subsurface exploration information contained in this report should be provided to the foundation contractors for detailed analysis and design and cost information.

Feasible types of pin pile elements could be broadly categorized as being installed by statically pushing the structural element into place or by drilling the structural element into place. Considering the type of soils encountered in the borings, it is our professional opinion that a drilled system is preferable at this site.

Support of the pin-piles should be derived from the underlying limestone bedrock. The bedrock contact elevation, as encountered in the borings drilled for this investigation, was within the range of elevation 704.5 feet to 708.0 feet; however, the bedrock elevation could change abruptly over small horizontal distances. To account for this possibility, the project specifications should allow adjustment of the pile lengths in the field to ensure appropriate refusal criteria are achieved for end bearing in suitable bedrock.

We recommend a CGTL engineer or their representative be present on a full-time basis during installation of pin-piles to evaluate the materials removed from the excavations (if applicable) and to evaluate that proper construction procedures are used determine when adequate capacity has been developed, to observe the base of the drilled pier to determine the cuttings have been adequately removed, and also to observe the concreting techniques.

4.5.4 Pile Group Effect – Axially Loaded Piles

Piles should be spaced a minimum of 3 diameters center-to-center. Closer spacing may require a reduction in axial load capacity. Axial capacity reduction can be determined by comparing the allowable axial capacity determined from the sum of individual piles in a group versus the capacity calculated using the perimeter and base of the group acting as a unit. The lesser of the two capacities should be used in design.

4.5.5 Pile Group Effect – Laterally Loaded Piles

Laterally loaded piles behave as a group when center to center spacing is less than 8 diameters in the direction of loading. Allowable passive resistance provided by a row of piles in line with the direction of the load should be reduced as determined by multiplying the individual lateral resistances of the piles by the number of piles in line and the appropriate reduction factor provided in the following table:

Pile Group Effect [1]	
Centerline to Centerline Pile Spacing in Direction of Loading (B = Pile Width)	Group Reduction Factor
8B	1.0
7B	1.4
6B	1.8
5B	2.2
4B	2.6
3B	3.0

1. Obtained from: Design of Pile Foundations, EM 1110-2-2906, 15 January 1991

Lateral loads acting perpendicular to a row of piles with center-to-center spacing of 3 diameters or less will cause the foundations to react essentially as a vertical wall. For this case, the lateral earth pressures provided in the Lateral Earth Pressures section of this report should be used for the projected pile diameter. With spacing of greater than 3 diameters, the values provided in the previous table for individual piles may be used.

4.6 New Floor Slab Areas

Active soils that are prone to volume change with variations in moisture content are present near the anticipated at-grade floor slab subgrade level. Risk associated with construction on potentially expansive subgrade soils must be assumed by the owner. These risks can be reduced, but not eliminated, by constructing a zone of low volume change material below the floor slab.

New Floor Slab Area Design Recommendations [1, 2]	
New floor slab support	30-inch low volume change zone
Modulus of subgrade reaction • For point loading conditions	100 (psi/in)

New Floor Slab Area Design Recommendations [1, 2]	
Aggregate base course/capillary break • Free draining granular material • Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve)	4 to 6 inches Aggregate base course can be considered as part of the low volume change zone

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movement between the slab and foundation. However, if floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates that any differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or slab cracks that occur beyond the length of the structural dowels. The structural engineer should account for this potential differential movement through use of sufficient control joints, appropriate reinforcing or other means
2. If the subgrade should become desiccated or saturated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Care should be taken to maintain the recommended subgrade moisture content and density until construction of the building floor slabs

Control joints should be utilized in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a water-proof, non-extruding, compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.7 Seismic Considerations

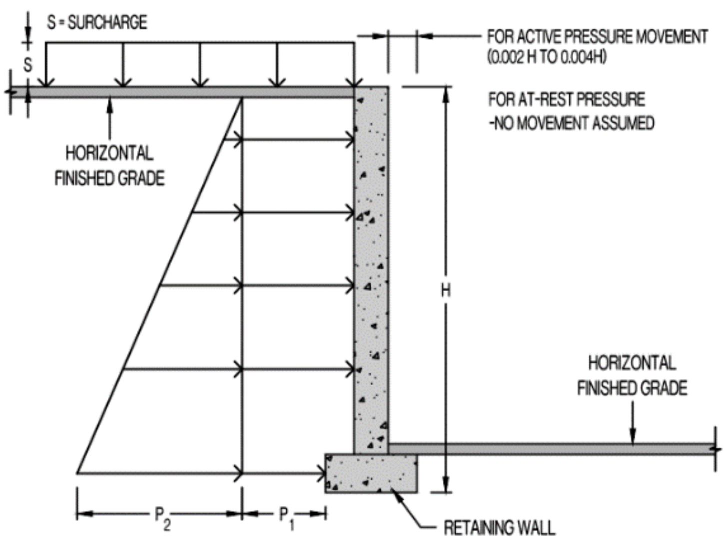
The International Building Code and ASCE 7 requires the average properties in the upper 100 feet of the subsurface profile be determined for seismic site classification. The drilling scope performed for this project had borings that extended to a maximum depth of 19.3 feet. As such, we provide the following seismic site classification:

Seismic Site Classification	
Code Used	International Building Code & ASCE 7
Site Classification	C

Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a more favorable seismic site class.

4.8 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels may be utilized on this site. Walls should be designed using the earth pressures indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients			
Backfill Type	Active (K_a)	At Rest (K_o)	Passive (K_p)
Cohesive Equivalent Fluid Unit Weights	50 pcf	70 pcf	280 pcf
Granular Equivalent Fluid Unit Weights	40 pcf	60 pcf	360 pcf

Earth Pressure Coefficients			
Backfill Type	Active (K_a)	At Rest (K_o)	Passive (K_p)
Surcharge Pressure, P_1 (psf) Cohesive Granular	 (0.42)S (0.33)S	 (0.58)S (0.46)S	 --- ---
Earth Pressure, P_2 (psf) Cohesive Granular	 (50)H (40)H	 (70)H (55)H	 --- ---
Sliding Resistance	0.32 (coefficient of friction)		

- The values are applicable when the surface of the backfill behind the wall is horizontal. Increased values will result with steeper than horizontal slopes
- No safety factor included in soil parameters
- Does not include loading from heavy compaction equipment
- No hydrostatic pressures acting on wall
- Backfill compacted to at least 95% standard Proctor dry density, or at least 80% relative density, as appropriate for material type
- Soil backfill unit weight a maximum of 120 pcf
- No dynamic loading
- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height
- For passive earth pressures to develop, the wall must move horizontally
- Ignore passive pressure in the frost zone
- For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively
- Exterior granular backfill should be capped with approximately 2 feet of cohesive soil to reduce the potential for surface water infiltration into the granular backfill
- Uniform surcharge, where S is surcharge pressure

We recommend all below-grade walls be provided with a drainage system. A minimum 4-inch diameter, perforated drain pipe should be placed at the foundation level. Granular drainage material, consisting of 1-inch clean crushed rock, classified as GP by ASTM D 2487, with less than 5 percent passing the No. 200 sieve, should be placed a minimum of 6 inches in all directions around the drainage pipe. Synthetic filter fabric, such as Mirafi 140N or equivalent, should encapsulate the drainpipe and granular drainage material.

The pipe should be sloped to drain by gravity or through weep holes located on approximately 10-foot centers for above-grade retaining walls, or to a sump with a pump for below-grade walls where positive drainage by gravity cannot be achieved. Any interior sumps must be isolated "watertight" from the interior subgrade to prevent the movement of moisture from the sump into the underlying soils.

4.9 Special Inspection Requirements

The following items require special inspections in accordance with Chapter 17 of the International Building Code:

Schedule of Special Inspection Services [1, 2]			
Material/Activity	Service	Applicable to this Project	
		Y/N	Extent
1705.6 Soil		Y	
• Verify materials below shallow foundations are adequate to achieve the design bearing capacity	Field Inspection	Y	Periodic
• Verify excavations are extended to proper depth and have reached proper material	Field Inspection	Y	Periodic
• Perform classification and testing of controlled fill materials.	Field Inspection	Y	Periodic
• Verify use of proper material, densities, and lift thicknesses during placement and compaction of controlled fill	Field Inspection	Y	Continuous
• Prior to placement of controlled fill, observe subgrade and verify site has been prepared properly	Field Inspection	Y	Periodic
1705.7 Driven Deep Foundations		Y	
1705.8 Cast-In-Place Deep Foundations		Y	
• Observe drilling operations and maintain complete and accurate records for each element	Field Inspection	Y	Continuous
• Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable), and adequate end bearing strata capacity. Record concrete or grout volumes	Field Inspection	Y	Continuous
• For concrete elements, perform additional inspections in accordance with section 1705.3	See section 1705.3	Y	See section 1705.3
• Perform additional inspections and tests in accordance with the construction documents	Field Inspection and Testing	Y	In accordance with the construction documents
1705.9 Helical Pile Foundations		N	
1. Testing and inspections services shall be performed by an approved agency in general accordance with section 1703 of the International Building Code 2. This section references 2015 IBC. Other code years may have a differing section number for concrete elements			

The contractor shall request special inspection of the items listed above prior to those items becoming inaccessible and unobservable due to the progression of work.

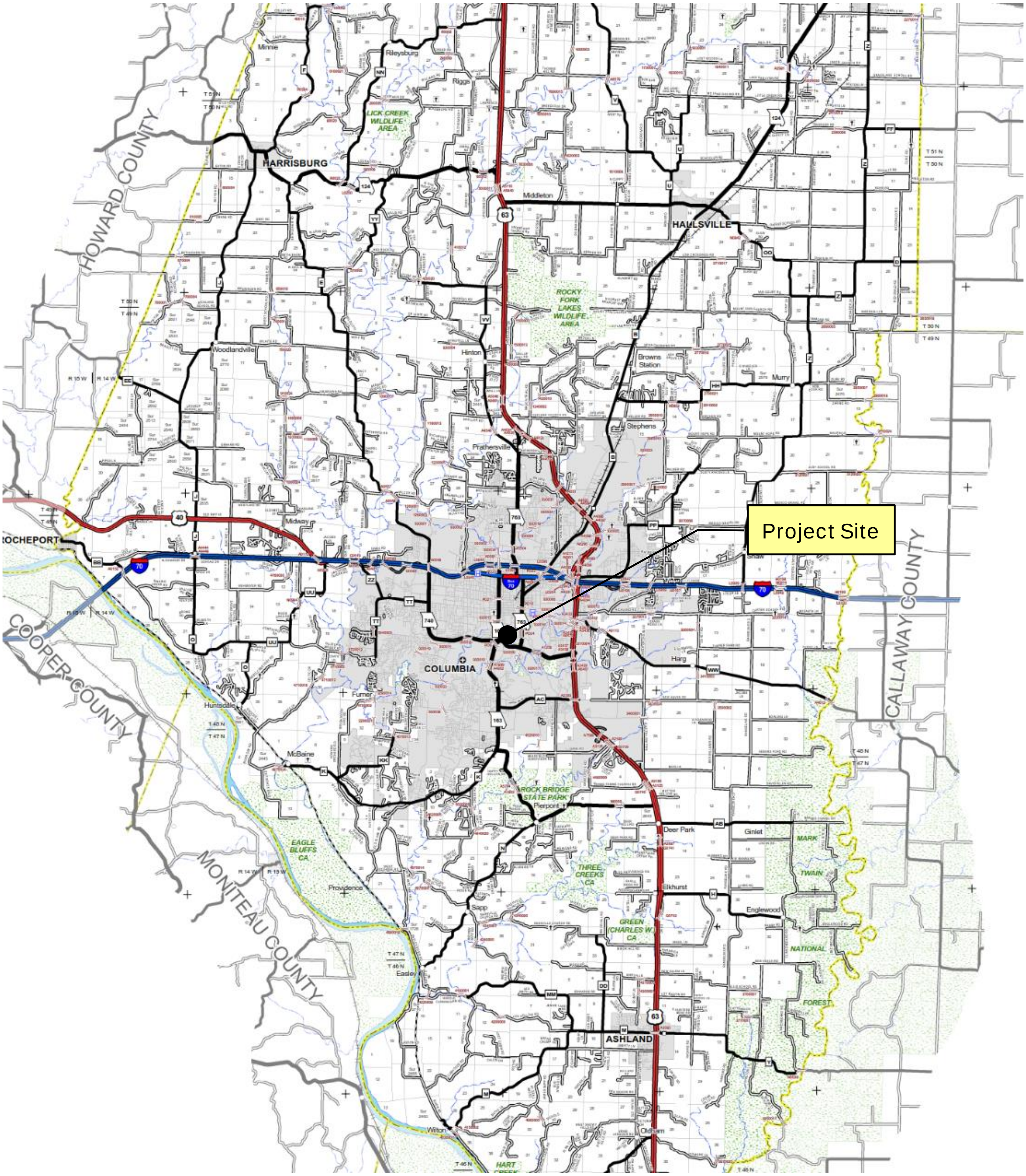
5 GENERAL COMMENTS

The recommendations provided herein are for the exclusive use of our client. Our recommendations are specific only to the project described herein and are not meant to supersede more stringent requirements of local ordinances or codes. The recommendations are based on subsurface information obtained at our boring locations, sample locations, our understanding of the project as described in this report, and geotechnical engineering practice consistent with the current standard of care. No warranty is expressed or implied. CGTL should be contacted if conditions encountered are not consistent with those described.

CGTL should be provided with a set of final plans and specifications, once they are available, to review whether our recommendations have been understood and applied correctly and to assess the need for additional exploration or analysis. Failure to provide these documents to CGTL may nullify some or all of the recommendations provide herein. In addition, any changes in the planned project or changes in site conditions may require revised or additional recommendations on our part.

The final part of our geotechnical service should consist of direct observation during construction to observe that conditions actually encountered are consistent with those described in this report and to assess the appropriateness of the analyses and recommendations contained herein. CGTL cannot assume liability or responsibility for the adequacy of recommendations without being retained to observe construction.

APPENDIX



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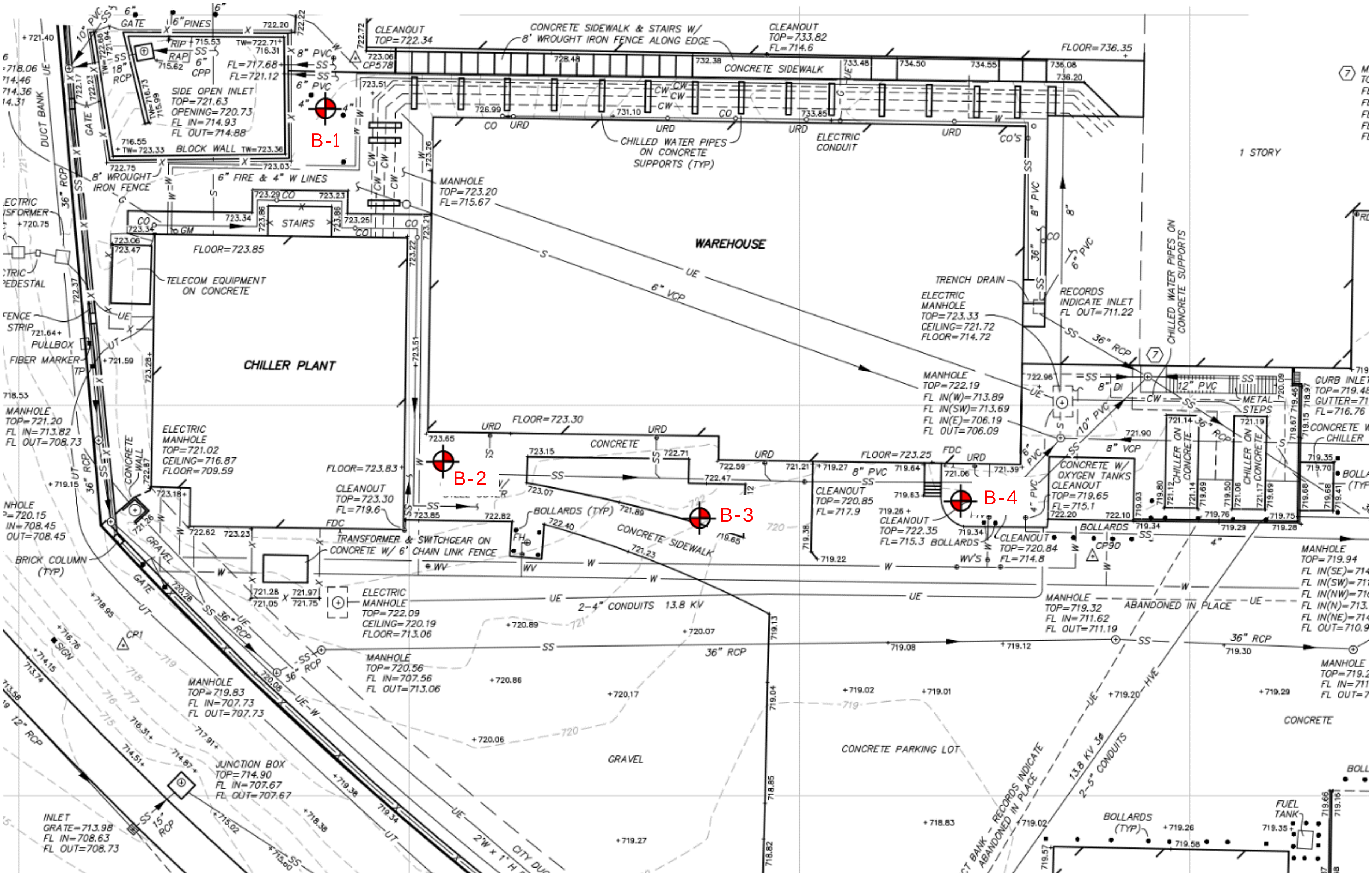
SITE LOCATION MAP

VA HOSPITAL WAREHOUSE
COLUMBIA, MISSOURI

PROJECT NO.: G20602

Prepared By:
CROCKETT
GEOTECHNICAL - TESTING LAB
1000 W. Nifong Blvd, Building 1
Columbia, MO 65203
573-447-3981
www.CrockettGTL.com



PROJECT NO: G20602

BORING LOCATION PLAN

VA HOSPITAL WAREHOUSE
COLUMBIA, MISSOURI

Prepared By:
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Crockett GTL
1000 W Nifong Blvd
Columbia, MO 65203
Telephone: 573-447-0292

BORING NUMBER B-1

CLIENT CLH Architects, P.C.
PROJECT NAME VA Hospital Warehouse
PROJECT NUMBER G20602
PROJECT LOCATION Columbia, Missouri
DATE STARTED 12/16/20 **COMPLETED** 12/16/20
GROUND ELEVATION 723 ft MSL **HOLE SIZE** 4"
DRILLING CONTRACTOR IPES
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
∇ **AT TIME OF DRILLING** 6.00 ft / Elev 717.00 ft
LOGGED BY Grimm **CHECKED BY** Lidholm
AT END OF DRILLING --- Not encountered
NOTES Borehole backfilled upon completion
0.25hrs AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY LENGTH	BLOW COUNTS (N VALUE)	PENETROMTER (psf)	UNC. COMP. (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0 – 0.5		TOPSOIL (6-inches) — 722.5										
0.5		UNCONTROLLED FILL: Clay soil, dark brown and brown, trace to with gravel, mixed with apparent construction debris	ST 1	13		2000	1679	105	22			
		--: with gravel to gravelly	ST 2	8		1400			10			
5		∇ --: becomes gravelly, with possible cobbles and boulders										
			SPT 3	0	5-3-5 (8)							
10		--: obstructions present from 10.0' - 12.5'										
12.5		710.5										

Hole abandoned at 12.5 feet.
Bottom of borehole at 12.5 feet.

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CROCKETT GEOTECHNICAL - TESTING LAB

BORING NUMBER B-2

CLIENT CLH Architects, P.C.
PROJECT NAME VA Hospital Warehouse
PROJECT NUMBER G20602
PROJECT LOCATION Columbia, Missouri
DATE STARTED 12/16/20 **COMPLETED** 12/16/20
GROUND ELEVATION 723.5 ft MSL **HOLE SIZE** 4"
DRILLING CONTRACTOR IPES
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
AT TIME OF DRILLING --- Not encountered
LOGGED BY Grimm **CHECKED BY** Lidholm
AT END OF DRILLING --- Not encountered
NOTES Borehole backfilled upon completion
0.25hrs AFTER DRILLING --- Not encountered

DEPTH (ft)	MATERIAL DESCRIPTION	Elev.	SAMPLE TYPE NUMBER	RECOVERY LENGTH	BLOW COUNTS (N VALUE)	PENETROMTER (psf)	UNC. COMP. (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0 – 0.7	CONCRETE (8-inches)	722.8										
0.7 – 7.0	BASE ROCK: Gray, with fines	716.5	ST 1	20					5			
			ST 2	19					5			
7.0 – 19.0	GRAVELLY LEAN TO FAT CLAY: Brown and gray, trace rust stains, trace sand and gravel (glacial drift)	704.5	SPT 3	12	13-15-13 (28)	6000			12			
	--: zones of fat clay		SPT 4	16	4-5-8 (13)	5800			25			
19.0 – 19.3	WEATHERED LIMESTONE: Hard	704.3	SPT 5	4	4-50/3"	4400			23			

Refusal at 19.3 feet.
Bottom of borehole at 19.3 feet.

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CROCKETT GEOTECHNICAL - TESTING LAB

BORING NUMBER B-3

CLIENT CLH Architects, P.C.
PROJECT NAME VA Hospital Warehouse
PROJECT NUMBER G20602
PROJECT LOCATION Columbia, Missouri
DATE STARTED 12/16/20 **COMPLETED** 12/16/20
GROUND ELEVATION 721 ft MSL **HOLE SIZE** 4"
DRILLING CONTRACTOR IPES
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
AT TIME OF DRILLING --- Not encountered
LOGGED BY Grimm **CHECKED BY** Lidholm
AT END OF DRILLING --- Not encountered
NOTES Borehole backfilled upon completion
0.25hrs AFTER DRILLING --- Not encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY LENGTH	BLOW COUNTS (N VALUE)	PENETROMTER (psf)	UNC. COMP. (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0		0.2 TOPSOIL (2-inches) 720.8										
		UINDOCUMENTED FILL: Lean to fat clay, brown and dark brown, with gravel to gravelly	ST 1	13		12000			13	40	17	23
		--: zones of fat clay	ST 2	15		9000			10			
5												
		7.0 714.0										
		LEAN TO FAT CLAY: Gray and brown, trace sand and gravel (glacial drift)	ST 3	15		3400	3065	106	21			
10												
		13.5 707.5										
		WEATHERED LIMESTONE: Hard	SPT 4	0	50/0"							
15												
		16.0 705.0										
		Refusal at 16.0 feet. Bottom of borehole at 16.0 feet.	SPT 5	0	50/0"							

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CROCKETT GEOTECHNICAL - TESTING LAB

BORING NUMBER B-4

CLIENT CLH Architects, P.C.
PROJECT NAME VA Hospital Warehouse
PROJECT NUMBER G20602
PROJECT LOCATION Columbia, Missouri
DATE STARTED 12/16/20 **COMPLETED** 12/16/20
GROUND ELEVATION 720 ft MSL **HOLE SIZE** 4"
DRILLING CONTRACTOR IPES
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
AT TIME OF DRILLING --- Not encountered
LOGGED BY Grimm **CHECKED BY** Lidholm
AT END OF DRILLING --- Not encountered
NOTES Borehole backfilled upon completion
0.25hrs AFTER DRILLING --- Not encountered

DEPTH (ft)	MATERIAL DESCRIPTION	ELEV.	SAMPLE TYPE NUMBER	RECOVERY LENGTH	BLOW COUNTS (N VALUE)	PENETROMTER (psf)	UNC. COMP. (psf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
0 – 0.7	TOPSOIL (8-inches)	719.3										
0.7 – 8.0	UNDOCUMENTED FILL: Lean to fat clay, brown and dark brown, trace sand and gravel		ST 1	12		5200		105	26	49	16	33
	--: gravelly zones		ST 2	10		8500		115	14			
8.0		712.0										
8.0 – 12.0	SHALEY FAT CLAY: Light brown and tan, gray, trace to with rust stains		ST 3	13		3600	2225	100	24			
12.0		708.0										
12.0 – 12.5	WEATHERED LIMESTONE: Hard	707.5										

Refusal at 12.5 feet.
Bottom of borehole at 12.5 feet.

BORING LOG LEGEND AND NOMENCLATURE

Sample Type	Description
AU	Auger sample, disturbed, obtained from auger cuttings
NR	No recovery or lost sample
RC	Rock core, diamond core bit, nominal 2-inch diameter rock sample (ASTM D 2113)
ST	Thin walled (Shelby) tube sample, relatively undisturbed (ASTM D 1587)
SPT	Split spoon sample, disturbed (ASTM D 1586)
VA	Shear vane (ASTM D 2753)

Grain Size Terminology	
Boulders	Larger than 12-inches
Cobbles	3-inches to 12-inches
Gravel	Retained on #4 sieve to 3-inches
Sand	Retained on #200 sieve but passes #4 sieve
Silt or Clay	Passes #200 sieve

Descriptor	Relative Proportion of Sand and Gravel	Relative Proportion of Fines
Trace	Less than 15% by dry weight	Less than 5% by dry weight
With	15% to 30% by dry weight	5% to 12% by dry weight
Modifier	More than 30% by dry weight	More than 12% by dry weight

Relative Density of Coarse grained Soils	
Descriptive Term	SPT N-Value, Blows/Foot
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50+

Consistency of Fine Grained Soils		
Descriptive Term	SPT N-Value, Blows/Foot	Unconfined Compressive Strength, psf
Very Soft	0 - 1	0 - 500
Soft	2 - 3	501 - 1,000
Medium	4 - 9	1,001 - 2,000
Stiff	10 - 29	2,001 - 4,000
Very Stiff	30 - 49	4,001 - 8,000
Hard	50+	> 8,000

USCS Soil Classification System				
Major Divisions			Group Symbol	Group Name
coarse grained soils more than 50% retained on #200 sieve	gravel >50% of coarse fraction retained on #4 (4.75 mm) sieve	clean gravel <5% small than #200 sieve	GW	well-graded gravel, fine to coarse gravel
			GP	poorly graded gravel
		gravel with >12% fines	GM	silty gravel
			GC	clayey gravel
	sand >50% of coarse fraction passes #4 (4.75 mm) sieve	clean sand	SW	well-graded sand, fine to coarse sand
			SP	poorly graded sand
		sand with >12% fines	SM	silty sand
			SC	clayey sand
fine grained soils more than 50% passes #200 sieve	silt and clay liquid limit < 50	inorganic	ML	silt
			CL	clay
		organic	OL	organic silt, organic clay
	silt and clay liquid limit ≥ 50	inorganic	MH	silt of high plasticity, elastic silt
			CH	clay of high plasticity, fat clay
		organic	OH	organic clay, organic silt
highly organic soils			PT	peat

Weathering	Description of Rock Properties
Fresh	No discoloration. Not oxidized.
Slightly weathered	Discoloration or oxidation of most surfaces but or short distance from fractures
Moderately weathered	Discoloration or oxidation extends from fractures, usually throughout. All fractured surfaces are oxidized or discolored.
Severely weathered	Discoloration or oxidation throughout. All fractured surfaces are oxidized or discolored. Surfaces are friable.
Decomposed	Resembles a soil. Partial or complete remnant rock structure may be present.

Rock Quality Designator (RQD)	
RQD, %	Rock Quality
90 - 100	Excellent
75 - 90	Good
50 - 75	Fair
25 - 50	Poor
0 - 25	Very poor

Joint, Bedding, and Foliation Spacing in Rock		
Spacing	Joints	Bedding/Foliation
< 2-inches	Very close	Very thin
2-inches - 1-foot	Close	Thin
1-foot - 3-feet	Moderately Close	Medium
3-feet - 10-feet	Wide	Thick
>10-feet	Very Wide	Very thick

CROCKETT
GEOTECHNICAL - TESTING LAB

One-Dimensional Swell Potential of Cohesive Soils
ASTM D 4546

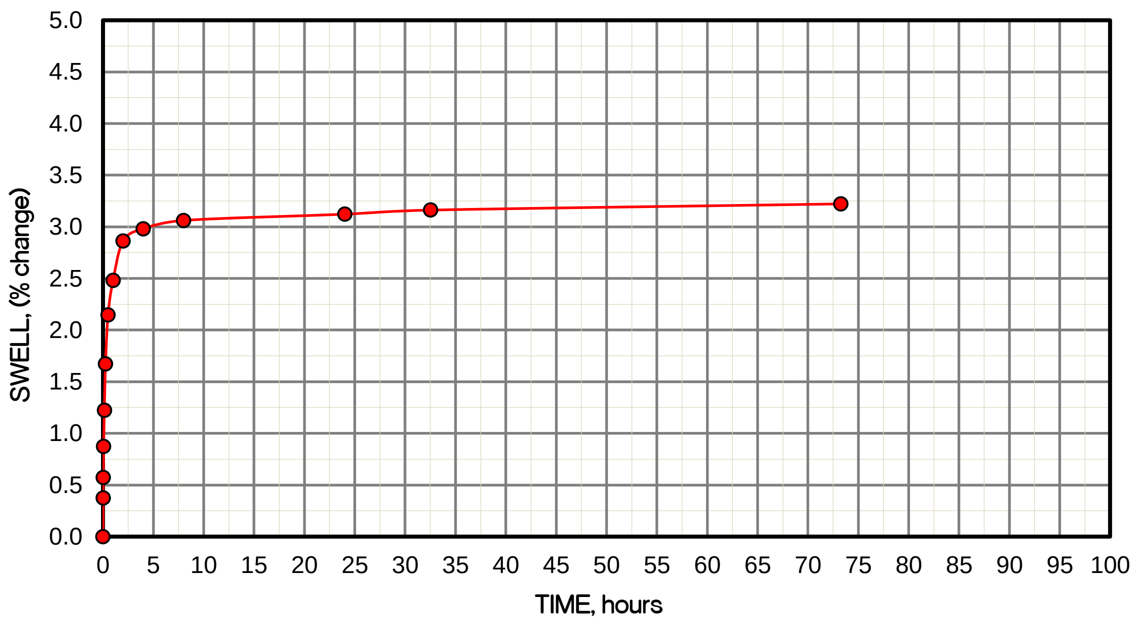
Client Name: CLH Architects, P.C.
Project Name: VA Hospital Warehouse
Project Location: Columbia, Missouri

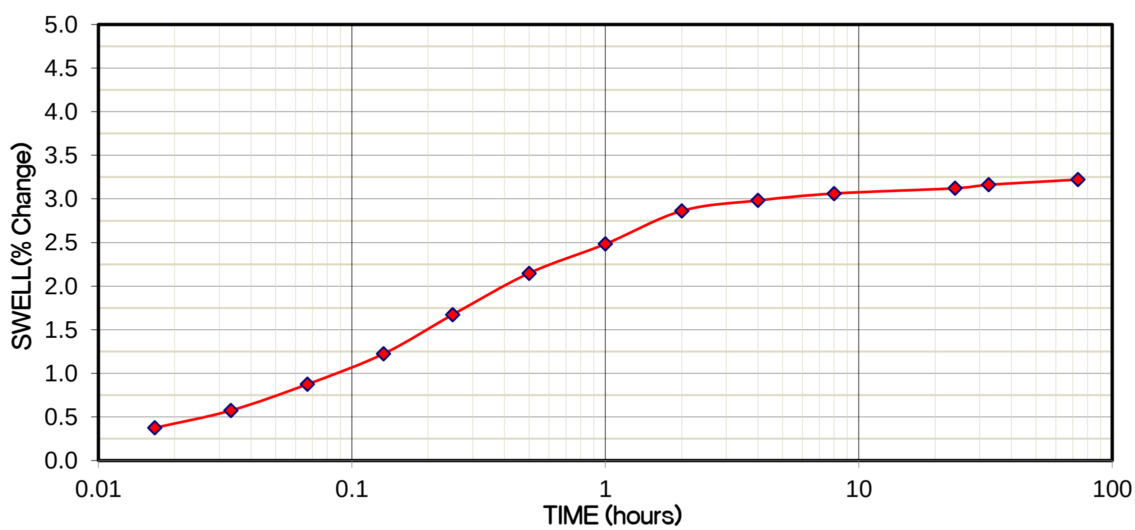
Project No.: G20602
Date: 12/31/20

TEST RESULTS
SWELL: 3.2 %

Boring Number: 3
Sample No.: 1
Sample Date: 12/21/20
Depth (ft): 2.0
Sample Description: UNDOCUMENTED FILL: Lean to fat clay, brown and dark brown, with gravel to gravelly
Test Procedure: ASTM D 4546, Method B
Reviewed by: Eric H. Lidholm, P.E.

Liquid Limit: 40
Plastic Limit: 17
Plasticity Index: 23 *(NP = Non Plastic)*
Initial Moisture Content: 13.1 %
Initial Dry Density: 108.5 pcf
Surcharge Pressure: 60 psf
Final Moisture Content: 20.2 %
Final Dry Density: 104.5 pcf





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GEOTECHNICAL - TESTING LAB

One-Dimensional Swell Potential of Cohesive Soils
ASTM D 4546

Client Name: CLH Architects, P.C.
Project Name: VA Hospital Warehouse
Project Location: Columbia, Missouri

Project No.: G20602
Date: 12/31/20

TEST RESULTS
SWELL: 3.3 %

Boring Number:	4	Sample No.:	1
Sample Date:	12/21/20	Depth (ft):	2.0

Sample Description: UNDOCUMENTED FILL: Lean to fat clay, brown and dark brown, trace sand and gravel

Test Procedure: ASTM D 4546, Method B
Reviewed by: Eric H. Lidholm, P.E.

Liquid Limit:	49	
Plastic Limit:	16	
Plasticity Index:	33	*(NP = Non Plastic)*
Initial Moisture Content:	25.6	%
Initial Dry Density:	99.1	pcf
Surcharge Pressure:	60	psf
Final Moisture Content:	25.4	%
Final Dry Density:	99.6	pcf