

# Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee

October 3, 2018 Terracon Project No. E2175127F

## **Prepared for:**

Hazen and Sawyer Nashville, Tennessee

**Prepared by:** 

Terracon Consultants, Inc. Chattanooga, Tennessee



October 3, 2018

Hazen and Sawyer 545 Mainstream Drive, Suite 320 Nashville, Tennessee 37228

- Attn: Mr. Michael Orr, P.E.
  - P: (615) 202-6219
  - E: morr@hazenandsawyer.com
- Re: Final Geotechnical Engineering Report Hamm Road Wet Weather Storage Facility 155 Hamm Road Chattanooga, Tennessee Terracon Project No. E2175127F

Dear Mr. Orr:

We have completed the Final Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PE2175127 dated December 6, 2017. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.



Schuster

lerracon

GeoReport

Frank Whitman, P.E. Senior Engineer

Terracon Consultants, Inc. 51 Lost Mound Drive, Suite 135 Chattanooga, Tennessee 37406

P (423) 499 6111 terracon.com



## **REPORT TOPICS**

INTRODUCTION	1
SITE CONDITIONS	1
PROJECT DESCRIPTION	2
GEOTECHNICAL CHARACTERIZATION	3
GEOTECHNICAL OVERVIEW	9
EARTHWORK	11
SHALLOW FOUNDATIONS	16
GROUND IMPROVEMENT	18
SPECIALTY FOUNDATIONS	
SEISMIC CONSIDERATIONS	23
FLOOR SLABS	23
BELOW-GRADE STRUCTURES	25
LATERAL EARTH PRESSURES	26
PAVEMENTS	28
GENERAL COMMENTS	

**Note:** This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the **Terracon** logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

## **ATTACHMENTS**

## EXPLORATION AND TESTING PROCEDURES SITE LOCATION AND EXPLORATION PLANS

**EXPLORATION RESULTS** (Boring Logs, Laboratory Data, & Geophysical Graphics) **SUPPORTING INFORMATION** (General Notes & Unified Soil Classification System)

Hamm Road Wet Weather Storage Facility 155 Hamm Road Chattanooga, Tennessee Terracon Project No. E2175127F October 3, 2018

## INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed wet weather storage project to be located at 155 Hamm Road in Chattanooga, Tennessee. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Site preparation and earthwork
- Demolition considerations
- Excavation considerations
- Dewatering considerations

- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Lateral earth pressures
- Pavement design and construction

The geotechnical engineering scope of services for this project included the advancement of 38 test borings to depths ranging from approximately 10 to 71.6 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section of this report.

## SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description	
Parcel Information	The project is located at 155 Hamm Road in Chattanooga, Tennessee.	
	Approximate Latitude/Longitude 35.054765° / -85.329771° (See Exhibit D)	

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



Item	Description		
Existing Improvements According to Google Earth much of the property is covered with slabs which are the remnants of a heavy equipment manufacturi operated by Koehring. All buildings were demolished but concrewere left in place. Fire hydrants remain, but no other improvement apparent.			
Current Ground Cover	According to Google Earth current ground cover consists of concrete slabs, gravel, grass, shrubs, and some trees.		
Existing Topography	According to Google Earth the site elevation ranges from 665 to 691.		
Geology	Most of the site is underlain by the Mississippian age Fort Payne Formation, a formation characterized by bedded and disseminated chert, shale and siltstone beds, and zones of limestone and dolomite. The thickness of the Fort Payne is variable because of differential dissolution of the carbonate materials in the formation.		
	The eastern edge of the site is underlain by the Mississippian / Devonian age Chattanooga Shale, a layer of brownish-black bituminous shale followed by the Silurian age Rockwood Formation, a reddish brown and yellow shale with thin beds of siltstone and sandstone. Geologic maps of the area indicate the beds strike between north and northeast, with dip of beds between about 5 and 10 degrees ranging from west to southeast due to crumpling.		

## **PROJECT DESCRIPTION**

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description		
Information Provided	Site plans and associated information supplied by Hazen and Sawyer.		
Project Description	Wet weather storage project to include diversion structures, a pumping station, three 10 million gallon tanks, and associated buildings and structures.		
Proposed Structures	Anticipated structures include up to three 10 MG tanks as part of Phase 1 of the Wet Weather Combined Sewer Storage project. Other components will include the Diversion Structure, Pump Station, Electrical Building, Generator Building, and Odor Control Building		
Loading - Tanks	195 ft diameter, 45 ft high, prestressed concrete, bearing pressure 3,500 lbs/sq ft		
Loading – Buildings	Slab supported structures are anticipated at the Electrical Building, Generator Building, and Odor Control Building. Allowable bearing pressure = 1,000 lbs/sq ft or less Tolerable settlement: < 1 inch total, < ½ inch differential Detect and remove zones of fill as noted in Earthwork		





Item	Description	
Loading - Diversion Structure	24 ft by 20 ft top of structure at grade, bearing 31 feet below ground at 2,000 lbs/sq ft	
Loading - Pump Station	on 44 ft by 35 ft top of structure at grade, bearing 51 feet below ground at 3,500 lbs/sq ft	
Loading - Valve Vault 14 ft by 11 ft top of structure at grade, bearing 8 feet below ground lbs/sq ft		
	Finished floor elevation has not been established.	
Grading/Slopes	Existing concrete slabs will be demolished. The underlying fill will be undercut to a depth of at least 4 feet below final grade. Removal of structurally or environmentally unacceptable materials beyond that depth may be required.	
	We recommend slopes, whether cut or fill less than 15 feet in height should be no steeper than 3H:1V (Horizontal: Vertical). Slopes higher than 15 feet should be individually analyzed for stability, and may require additional sampling and laboratory testing of soils to determine the unconsolidated undrained shear strength of soil for analysis of long-term stability.	
Free-Standing Retaining Walls	Retaining walls will likely be required between the excavated slope/bank along the western boundary of the site and the adjacent tank(s).	
Paved driveway and parking will be constructed in selected site are to be determined. Traffic is understood to be limited to maintenan- vehicles.		
Estimated Start of Construction	2018	

## **GEOTECHNICAL CHARACTERIZATION**

### Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The following table provides ground surface elevation and auger refusal depth at each boring location.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



Boring Number	Ground Surface Elevation (feet) <sup>1</sup>	Auger refusal Depth (feet) <sup>1</sup>
T-1	676.43	29.2
T-2	676.77	40.4
T-3	675.85	70.0
T-4	676.18	41.4
T-5	675.58	40.6
T-6	675.72	10.0
T-7	676.39	36.5
T-8	674.97	55.6
T-9	675.95	67.6
T-10	676.50	71.6
T-11	676.12	51.0
T-12	676.54	44.3
T-13	674.82	46.0
T-14	676.58	59.0
T-15	676.53	41.8
T-16	676.41	70.0
T-17	674.51	70.0
T-18	669.44	50.1
T-19	673.69	56.0
T-20	674.76	60.4
T-21	669.44	49.3
T-22	673.74	53.0
T-23	674.03	59.9
T-24	669.50	49.0
DS-1	661.81	46.5
DS-2	661.39	44.2
DS-3	661.39	44.2
OC-1	675	51.2
OC-2	674	53.3
OC-3	676	53.0
OC-4	676	58.5
PS-1	670 54.7	
PS-2	669 49.5	
PS-3	669 48.5	
PS-4	669	49.1

Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



EB-1	669	51.2
EB-2	669	49.8
VB-1	676	48.6

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
Surface	6'-22'	Fill / Yellow and Red Silty Clay, Foundry Sand in some locations	N/A
1	28'-38'	Lean Clay / Light Brown	Medium Stiff to Stiff
2	48'-58'	Lean Clay / Clayey Gravel	Stiff to Very Stiff
2a	48'-58'	Gray Clay	Very Soft
3	48'-62'	Silty Clayey Sand	Dense
4	Undetermined	Limestone / Dolomite / Shale	Hard

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

The site is underlain by a geologic complex that includes rock which may be susceptible to dissolution along joints and bedding planes in the rock mass. This may result in voids and solution channels within the rock strata and a highly irregular bedrock surface. The weathering of the bedrock and subsequent collapse or erosion of the overburden into these openings results in what is referred to as karst topography, if there are an abundance of collapses within an area.

The owner should be aware of karst related risks associated with this site. Any construction in karst topography is accompanied by some degree of risk for future internal soil erosion and ground subsidence that could affect the stability of the proposed structures. However, our borings did not disclose any obvious signs of sinkhole activity within the depths explored and a review of topographic drawings did not disclose closed depressions within relative proximity of the project site.

Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



#### **Groundwater Conditions**

The boreholes were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some borings. The water levels observed in the boreholes can be found on the boring logs in **Exploration Results**, and are summarized below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet) <sup>1</sup>	Approximate Depth to Groundwater after Drilling (feet) <sup>1</sup>	
T-3	32	Borehole caved	
T-4	33	Borehole caved	
T-5	33	Borehole caved	
T-8	33	Borehole caved	
T-9	30	Borehole caved	
T-11	33	Borehole caved	
T-17	35	Borehole caved	
T-18	34.6	Borehole caved	
T-19	20	Borehole caved	
T-20	50 <sup>2</sup>	Borehole caved	
T-21	13 Borehole cave		
T-22	53	Borehole caved	
T-23	50 <sup>3</sup>	Borehole caved	
T-24	33	Borehole caved	
PS-1	48.5	Borehole caved	
PS-2	48.5	Borehole caved	
PS-3	18.5	44	
DS-2	38	Borehole caved	
DS-3	18.5	44.2	

1. Below ground surface

2. Wet soils observed at 38.5 feet

3. Wet soils observed at 48.5 feet

Groundwater was not observed in the remaining borings while drilling, or for the short duration the borings could remain open. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. 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.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. Installation of a dewatering system for construction of below ground structures, especially the diversion structure and the pump station, should be expected to influence ground water levels in adjacent areas, and may have effects not directly related to ground water.

### **Geophysical Data Interpretation**

In viewing the shear-wave velocity profiles, the depicted color scale represents estimated shear-wave velocities. According to the 2012 International Building Code Table 1613.5.2, shear-wave velocities are correlated to specific soil profile characteristics as described in the table below.

CONSISTENCY	SHEAR-WAVE VELOCITY (FT/SEC)
Rock	>2500
Weathered Bedrock	1250>2500
Stiff Soil	600>1250
Soft Soil	<600

Because soft soil is often found in and around incipient sinkholes, shear-wave velocities below 600 feet per second (ft/sec) are of interest. Also, shear-waves are not able to pass through voids. Consequently, voids in the soil horizon will also result in lower shear-wave velocity zones. Not all zones of soft soil indicate potential subsidence activity, but zones of soft soil found in areas with other anomalies are potential areas of concern. On the shear-wave velocity profiles, soft soils are represented by the color magenta while green, yellow, orange and red represent velocities in the range considered to be weathered rock and rock. Blue and green are within the range considered to be stiff to very dense soil. Sinkholes have been noted to occur at topographic lows and above topographic highs in the bedrock surface. However, sinkholes tend to favor zones where the bedrock surface has sharp changes over a relatively short distance.

It should be noted the terminology in the IBC table regarding the relative consistency of the soil profile does not directly match soil classification consistency ranges based on the Standard Penetration Test (SPT) N-values or undrained shear strength. Generally, a 'Soft Soil' by the IBC chart correlates to soils that in normal geotechnical terms are considered to have consistencies varying between very soft to stiff, whereas 'Stiff Soil' based on velocity correlates to a consistency of very stiff.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



### Geology

The project site is located within the Valley and Ridge Physiographic Province, which is comprised of geologic formations that were deposited during the Paleozoic Era. According to the *Geologic Map of Hamilton County, Tennessee,* compiled by Milici, Maher, and Moore III, dated 1978, the majority of the project site is underlain by the Mississippian-aged Fort Payne Formation. The Fort Payne Chert Formation is characterized by bedded and disseminated chert, shale, and siltstone beds, and zones of limestone and dolomite. The eastern portion of the project site is underlain by the Mississippian/Devonian-aged Chattanooga Shale, which consists of brownish-black bituminous shale. Geologic maps of the area indicate the beds strike between north and northeast, with a dip between about 5 and 10 degrees ranging from west to southeast.

It should be noted that the site is underlain by geologic complexes that are susceptible to dissolution along joints and bedding planes in the rock mass. This may result in voids and solution channels within the rock strata and a highly irregular bedrock surface. The weathering of the bedrock and subsequent collapse or erosion of the overburden into these openings results in what is referred to as karst topography, if there are an abundance of collapses within an area. Any construction within terrain susceptible to dissolution is typically accompanied by some degree of risk for future internal soil erosion and ground subsidence that could affect the stability of the proposed construction.

### **Geophysical Profile Summary**

As mentioned in the previous section, four (4) seismic arrays were conducted within the project site. A seismic array location plan along with the shear-wave velocity profiles are provided on Exhibits A-2 through A-6 in the attachments. A summary of the seismic array cross-sections is provided below.

Based on our observations of Array A, weathered rock (represented by the colors green and yellow) appears to be located approximately 25 to 50 feet below the current ground surface. Competent bedrock (represented by the color red) appears to be located below the weathered rock strata across the majority of the profile for Array A. The soil profile (represented by the color blue) appears to have variable thicknesses across the profile indicating an irregular bedrock topography underlying the site.

The cross-sectional profile of Array B also indicates weathered rock at a depth of approximately 25 feet below the current ground surface. There are two areas of relatively softer material underlying the denser stratum on either side of the profile. The first area of relatively softer material underlying denser strata is located underneath geophone location 6 to about 10 – this area depicts weathered rock (represented by the color green) underlying the more competent rock (represented by the color red). The second area is located on the other side of the profile underlying geophones locations 15 to 18. This area indicates very soft soil (represented by the color blue) or a void. This feature is also depicted in the profile for Array C, described below.



Array C indicates variable densities of material in the upper subsurface, possibly fill, as well as a two areas of relatively softer material underlying denser stratum. As depicted in Array B in the previous paragraph, there appears to be an area of very soft soil or a void underlying geophone locations 6 through 9 in Array C. The second feature is located in the center of the profile and is located underlying geophone locations 10 to 13. This area is represented by blue, and is underlying denser strata represented by green. The profile for Array C also depicts variable bedrock topography with varying degrees of density in the upper subsurface profile.

The cross-sectional profile of Array D represents a typical subsurface profile where soil (represented by blue) grades into weathered rock (represented by green and yellow) which grades into competent bedrock (represented by red. Weathered rock appears to be located at a depth of about 25 feet to 40 feet below the current surface. The shallow subsurface indicates varying degrees of density, represented by interbedded blue and green. This pattern of interbedded soil is typically representative of fill materials.

Please note that the depth of the cross-sectional profiles is dependent on the spacing of the geophones. In general, the depth of a cross-section is 1/3 the horizontal length of the seismic array. Arrays A, C, and D were extended to horizontal distances of 300 feet which yielded a depth profile of 100 feet below the current ground surface. Due to site restrictions (i.e. dense vegetation and roadways), Array B was limited to a horizontal distance of 264 feet which yielded a depth profile of 88 feet.

## Summary of Geophysical Findings

Observations in the shear-wave velocity profiles indicate variable strength of fill in the upper portions of the subsurface. As represented by interbedded layers of soil and weathered rock, fill in the upper portions of the site appears to be inconsistent. In addition, multiple areas of very soft soil, or voids, were observed underlying relatively denser strata in Array A, Array B, and Array C.

This limited geophysical investigation also revealed a variable bedrock topography underlying weathered-rock zones of varying thickness. The geologic stratification and topography of the site is typical of this formation and should be expected to provide challenges during future construction, especially given the indications of voids or vertically-aligned zones of extreme contrast in soil/rock competence.

## **GEOTECHNICAL OVERVIEW**

Concrete slabs cover much of the site in the vicinity of the proposed storage tanks. These slabs contain steel rails common to industrial facilities that pre-date forklifts. We understand the slabs will be demolished. Fill underlying the slabs extends to depths of about 6 to 22 feet, and consists

**Final Geotechnical Engineering Report** Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee October 3, 2018 
Terracon Project No. E2175127F



of lean to fat clays which range in consistency from very soft to stiff, with medium stiff to soft materials most common near the surface but some zones in which attempts to perform Standard Penetration Testing (SPT) resulted in an SPT N-value of zero, due to the sampler advancing through the 18-inch sample interval under the weight of the hammer and sampling tools. Similar zones were encountered in the native soils underlying the fill.

Auger refusal occurred at depths in the range of about 29 to 72 feet, except for T-6, where auger refusal occurred at 10 feet. In three locations, T-3, T-16 and T-17, drilling was terminated at a depth of 70 feet in hard material. Though augers could still be advanced, drilling was terminated because the risk of mechanical damage of equipment was high.

Rock coring indicated bedrock beneath most of the tank area to be residual chert, the in-place weathering product of the parent limestone formation subjected to dissolution by ground water. Portions of the site are underlain by dolomite bedrock which is a suitable bearing stratum for deep foundations.

The heavy loading of the water tanks and some ancillary structures will require deep foundations. Because of the variable bedrock conditions, we recommend utilizing micropiles, in which steel casing is set into bedrock, a rock socket is advanced, and reinforcement is grouted in place. Driven piles are also possible provided a means of proof-testing can be performed to verify that piles are not bearing on a thin rock stratum, and that the poor lateral support characteristics of the soils above bedrock are acceptable where lateral loading is anticipated, or can be compensated for by the use of battered (angled) piles or other structural means.

Where lightly loaded structures will bear near final grade, loading is light enough that remedial undercutting and fill placement could produce an allowable bearing capacity suitable for shallow foundation support. However, the presence of very soft soils in the 10 to 20 feet above auger refusal could result in excessive settlement if groundwater levels change due to construction dewatering, or the deep foundation installation process. If possible, the grading should be performed during the warmer and drier time of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations including subgrade improvement and fill placement are provided in the Earthwork section.

The **Pavements** section addresses general guidelines for the design of pavement systems, but will require specific loadings and traffic frequencies to provide final pavement design recommendations. However, if a light duty pavement will be adequate, given the likely use for maintenance vehicles only, a minimum recommended pavement section would consist of 6 inches of dense graded base stone topped with 2 inches of base course asphalt and 1 ½ inches of surface course asphalt. Where a rigid pavement is required, a minimum section of light duty pavement would consist of 4 inches of dense graded base topped with 5 inches of Portland

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 
Terracon Project No. E2175127F



cement concrete. Details are provided in the **Pavements** section of this report.

Support of floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk associated with building over the undocumented fills following the recommended reworking of the material. Should this be the case, certain ancillary buildings and structures may be supported on a shallow foundation system.

The General Comments section provides an understanding of the report limitations.

## EARTHWORK

Prior to earthwork, extensive demolition will be required, including removal of concrete slabs covering much of the proposed tank locations. Concrete floor slabs included rail systems. Other below grade structures may be encountered during demolition, requiring complete or partial removal and possible remedial fill placement.

Following demolition, earthwork will include clearing and grubbing, excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

### **Site Preparation**

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed tank pads, as well as ancillary structures, buildings and parking/driveway areas.

The subgrade should be proof-rolled with an adequately loaded vehicle such as a fully loaded tandem axle dump truck. The proof-rolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by stabilizing with some combination crushed concrete, limestone riprap, geogrid reinforcement, and soil amendments, such as cement stabilization. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



## **Existing Fill**

As noted in **Geotechnical Characterization**, existing fill was encountered throughout the site to depths ranging from about 6 to 22 feet. The fill contains industrial byproducts including what appears to be foundry sand and may have been placed in a controlled manner, but we have no records to indicate the degree of control. Support of footings, floor slabs, and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the footings and floor slabs on the existing fill, the following protocol should be followed. Once the planned grading has been completed, the area should be undercut 6 feet within the building areas as well as 10 feet beyond the lateral limits of the building areas. Once materials have been removed, the entire area should be proof-rolled with heavy, rubber tire construction equipment such as a fully loaded tandem axle dump truck, to aid in delineating areas of soft, or otherwise unsuitable soil. Once unsuitable materials have been remediated, and the subgrade has passed the proof-roll test, the existing, and undocumented fill that was removed can be evaluated for reuse as structural fill.

If the owner elects to construct pavements on the existing fill, the following protocol should be followed. Once the planned subgrade elevation has been reached the entire pavement area should be proof-rolled. Areas of soft, or otherwise unsuitable material should be undercut and replaced with either new structural fill or suitable, existing on site materials.

## Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Fill Type <sup>1</sup>	USCS Classification	Acceptable Parameters (for Structural Fill)
Low Plasticity Cohesive	CL, CL-ML ML, SM, SC	Liquid Limit less than 49 Plasticity index less than 36 12 % or more retained on #200 sieve
High Plasticity Cohesive <sup>2</sup>	СН, МН	Liquid Limit less than 60, Plasticity index less than 40
Granular	GW, GP, GM, GC, SW, SP, SM, SC	0 to 12% Passing #200 sieve

Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



Fill Type <sup>1</sup>	USCS Classification	Acceptable Parameters (for Structural Fill)
On-Site Soils	CL, CH, GC, SC	Liquid Limit less than 55 Plasticity Index less than 36
Controlled Low Strength Material (CLSM)		Also known as "flowable fill," CLSM is a cement-sand product commonly recommended as an alternative to structural fill, especially in deep excavations, or where natural water content or heavy precipitation make moisture-conditioning of fill untenable from a scheduling standpoint. Another alternative is to amend soils with lime kiln dust (LKD) or cement as a moisture-conditioning agent. Soils may be amended in place, or may be excavated, amended, and replaced in the excavation.

- 1. Structural and general 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 to the Geotechnical Engineer for evaluation prior to use on this site.
- 2. CH or MH soils should not be used within 3 feet of finished grade in building area and 1 foot below finished grade in other structural fill areas.

### **Fill Compaction Requirements**

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand- guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill
Minimum Compaction Requirements <sup>1, 2, 3</sup>	98% of max. below foundations and within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade	92% of max.
Water Content Range <sup>1</sup>	Low plasticity cohesive: -1% to +3% of optimum High plasticity cohesive: 0 to +4% of optimum Granular: -3% to +3% of optimum	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).

2. High plasticity cohesive fill should not be compacted to more than 100 percent of standard Proctor maximum dry density.

3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254).

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



### Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath structures and buildings should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the structure or building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

## Grading and Drainage

All grades must provide effective drainage away from the tank and building areas during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. Building roofs should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from building pads for at least 10 feet beyond the perimeter of any structures. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping, final grades should be verified 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. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

If possible, the bottom of deep excavations, such as the Pump Station, should be maintained with a grade that will direct water into a sump for ready dewatering of the excavation.

## **Earthwork Construction Considerations**

Shallow excavations, for ancillary structures, are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates,



saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

The groundwater table could affect over-excavation efforts for deep structures and will require a dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of over-excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

### **Construction Observation and Testing**

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and top soil, proofrolling and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Hamm Road Wet Weather Storage Facility - Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



## SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in Earthwork, the following design parameters are applicable for shallow foundations.

### **Design Parameters – Compressive Loads**

Item	Description
Maximum Net Allowable Bearing pressure <sup>1, 2</sup>	2,000 psf (foundations bearing within structural fill)
Required Bearing Stratum <sup>3</sup>	Structural fill
Minimum Foundation Dimensions	Columns:30 inchesContinuous:18 inches
Ultimate Passive Resistance <sup>4</sup> (equivalent fluid pressures)	390 pcf (cohesive backfill) 295 pcf (granular backfill)
Ultimate Coefficient of Sliding Friction <sup>5</sup>	0.3 (native clay) 0.35 (granular material)
Minimum Embedment below Finished Grade <sup>6</sup>	Exterior footings in unheated areas:24 inchesExterior footings in heated areas:24 inchesInterior footings in heated areas:24 inches
Estimated Total Settlement from Structural Loads <sup>2</sup>	Less than about 1 inch
Estimated Differential Settlement <sup>2, 7</sup>	About 2/3 of total settlement

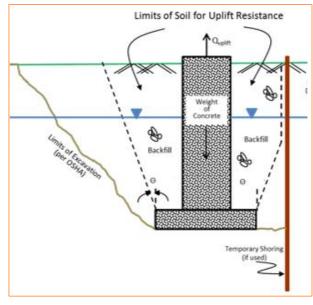
- The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding 1. overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
- Values provided are for maximum loads noted in Project Description. 2.
- 3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the Earthwork.
- 4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
- 5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
- Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping 6. ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
- 7. Differential settlements are as measured over a span of 50 feet.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



## **Design Parameters - Uplift Loads**

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, q, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 100 pcf should be used for the backfill. This unit weight should be reduced to 40 pcf for portions of the backfill or natural soils below the groundwater elevation.



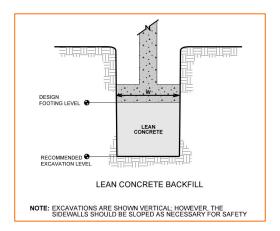
## **Foundation Construction Considerations**

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

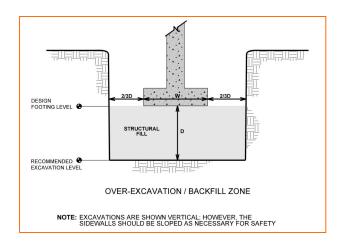
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils. The footings may bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F





Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with structural fill placed as recommended in the **Earthwork** section.



## **GROUND IMPROVEMENT**

As an alternative to supporting the ancillary structures on deep foundations, and replacing the fill, the structure and potentially floor slabs could be supported on lower strength/lower density native soils if ground improvement methods are utilized. Ground improvement methods are proprietary systems designed by licensed contractors who could provide further information regarding support options. Vibrated aggregate piers are commonly used in the local area to transfer foundations loads to a deeper, stratum.

#### **Final Geotechnical Engineering Report** Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



## **SPECIALTY FOUNDATIONS**

The proposed tanks and ancillary structures will be supported by a deep foundation system bearing on the underlying bedrock, primarily limestone and some shale. Depths to auger refusal were in the range of about 29 to 72 feet, but based on the results of coring, sound rock may be 100 feet or more in depth.

It is our understanding that driven piles may not be acceptable due to the absence of lateral support in very soft zones.

Micropiles are the preferred deep foundation option. The micropile design/build contractor will recommend the actual construction materials and procedures, installation depths and allowable loads. Allowable loads are often in the range of 100 to 300 kips per micropile (factor of safety, FS=2). Based on the hard, unweathered dolomite encountered during rock coring, we recommend a grout/rock bond of 200 psi be used for design.

### **Estimated Settlement**

Based on an 8-inch O.D. pipe with 0.75-inch wall thickness, a pipe pile (29 ksi steel) 66 feet long with a 10 foot rock socket would be expected to compress about <sup>3</sup>/<sub>4</sub> inch if loaded to 250 kips and about <sup>1</sup>/<sub>2</sub> inch if loaded to 175 kips. For the same rock socket, assuming sound rock, the estimated settlement is expected to be on the order of 0.1 inch, based on a rock compressive strength of 2,500 psi at a strain of 0.05 percent. To keep the total of estimated compression and settlement less than 1 inch, we recommend micropile loading of 250 kips to determine lateral spacing of micropiles. All estimated and recommended loading in this report is based on the assumption the foundation designer has applied appropriate factors of safety to achieve the design loading.

## **Driven Pile Design Parameters**

Though micropiles are the preferred option, value engineering using driven piles could be an option. The following table can be used to estimate capacities for individual driven steel H-piles. The values are considered to be adequate for estimation of allowable (safety factor applied) load carrying capacity for driven piles ranging in depth from about 30 to 90 feet. Driven piles should be spaced at least three pile widths apart (center-to-center) if side friction is used for compressive loads.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F

	Driven Pile Design Summary <sup>1, 2</sup>						
Approximate	Stratigraphy <sup>3</sup>		Allowable Skin Friction	Allowable End Bearing Pressure			
Elevation (feet)	No.	Material	(psf) <sup>4</sup>	(psf) <sup>5</sup>			
680 – 660	1	Lean Clay	500	NA			
680-660	1a	Lean Clay – Fill	250	NA			
660 - 630	2	Lean Clay	650	NA			
630-610	3	Weathered shale & siltstone	780	18,000			
630 - 610	3a	Very soft clay	0	0			
610 – 580	4	Weathered Limestone / Dolomite	2,000	50,000			

1. Design capacities are dependent upon the method of installation, and quality control parameters. The values provided are estimates and should be verified when installation protocol have been finalized.

2. Design capacities can be increased by 33% for highly transient loads

3. See Subsurface Profile in Geotechnical Characterization for more details on Stratigraphy

- 4. Applicable for compressive loading only. Reduce to 2/3 of values shown for uplift loading. Effective weight of pile can be added to uplift load capacity.
- 5. Piles should be driven to meet refusal criteria established during test pile installation and dynamic pile analysis. Piles terminated in shale should extend 2 feet into the bearing stratum for end bearing to be considered.

### **Driven Pile Lateral Loading**

The following table lists input values for use in LPILE analyses. LPILE will estimate values of  $k_h$  and  $E_{50}$  based on strength; however, non-default values of  $k_h$  should be used where provided, in particular for the sand strata. Since deflection or a service limit criterion will likely control lateral capacity design, no safety/resistance factor is included with the parameters.

Stra	atigraphy <sup>1</sup>	L-Pile					K (pci) <sup>2</sup>		q <sub>u</sub> (psi)
No.	Material	Soil Model	S <sub>u</sub> (psf) <sup>2</sup>	f <sup>2</sup>	g (pcf) <sup>2,3</sup>	٤ <sub>50</sub> 2	Stati c	Cyclic	2
1	Lean Clay	Soft clay	1,200	NA	110	0.007	500	200	250
2	Lean Clay	Stiff clay without g'water	2,000	NA	125	0.005	1,000	400	600
3	Weathered shale & siltstone	Weak rock	6,300	NA	135	0.001	2,000	800	1,200

llerracon

GeoReport

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



Stra	atigraphy <sup>1</sup>	L-Pile			2.2		K (pci) <sup>2</sup>		q <sub>u</sub> (psi)
No.	Material	Soil Model	S <sub>u</sub> (psf) <sup>2</sup>	f <sup>2</sup>	g (pcf) <sup>2,3</sup>	<b>٤</b> <sub>50</sub> <sup>2</sup>	Stati c	Cyclic	2
3a	Very soft clay	Soft clay	0	NA	100	0	0	0	0
4	Weathered Limestone / Dolomite	Strong rock	500,000	NA	200	0.0004	2,400	2,000	1,5 million

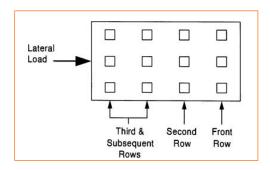
1. See Subsurface Profile in Geotechnical Characterization for more details on Stratigraphy.

2. Definition of Terms:

S<sub>u</sub>: Undrained shear strength

- f : Internal friction angle
- g: Moist unit weight
- ε<sub>50:</sub> Non-default E50 strain
- K: Horizontal modulus of subgrade reaction
- $q_{u}\!\!:$  Non-default soil modulus static. Refer to software guidelines for cyclic loading.
- 3. Buoyant unit weight values should be used below water table.

When piles are used in groups, the lateral capacities of the piles in the second, third, and subsequent rows of the group should be reduced as compared to the capacity of a single, independent pile. Guidance for applying p-multiplier factors to the p values in the p-y curves for each row of pile foundations within a pile group are as follows:



- Front row:  $P_m = 0.8$ ;
- Second row: P<sub>m</sub> = 0.4
- Third and subsequent row:  $P_m = 0.3$ .

The load capacities provided herein are based on the stresses induced in the supporting soil strata. The structural capacity of the piles should be checked to assure they can safely accommodate the combined stresses induced by axial and lateral forces. Lateral deflections of piles should be evaluated using an appropriate analysis method, and will depend upon the pile's diameter, length,



configuration, stiffness and "fixed head" or "free head" condition. We can provide additional analyses and estimates of lateral deflections for specific loading conditions upon request. The load-carrying capacity of piles may be increased by increasing the section (for H-piles), diameter (for pipe piles) and/or length.

### **Driven Pile Construction Considerations**

The contractor should select a driving hammer and cushion combination which can install the selected piling without overstressing the pile material. The hammer should have a rated energy in foot-pounds at least equal to 15 percent of the design compressive load capacity in pounds. The contractor should submit the pile driving plan and the pile hammer-cushion combination to the engineer for evaluation of the driving stresses in advance of pile installation. During driving a maximum of 10 blows per inch is recommended to reduce the potential of damage to the piles.

If practical refusal is experienced above the anticipated rock surface elevation, the pile may be on a boulder or other obstruction and a replacement pile should be driven. If this occurs, the situation should be evaluated by Terracon during the pile driving operations.

Difficult driving could also be encountered in the weathered rock, especially the areas underlain by the Fort Payne Chert. Consideration should be given to using protective points and/or flange stiffening if H-piles are used. The contractor should be prepared to cut or splice piles, as necessary. Splicing of piles should be in accordance with specifications provided by the project Structural Engineer.

Pile driving conditions, hammer efficiency, and stress on the pile during driving could be better evaluated during installation using a Pile Driving Analyzer (PDA). A Terracon representative should observe pile driving operations. Each pile should be observed and checked for buckling, crimping and alignment in addition to recording penetration resistance, depth of embedment, and general pile driving operations.

Nearby existing facilities (structures and subsurface utilities) should be observed prior to pile installation to document their condition. Structures should also be observed during pile installation for indications of movement. Pile driving should be stopped and Terracon contacted if movement or cracking of the existing structures is observed. Monitoring vibration levels during pile driving should be considered. Although vibrations from pile driving may be below levels that will cause structural damage, they may be felt by occupants of the adjacent buildings. The potential impact of driving piles at this site should be considered when evaluating this alternative.

The pile driving process should be performed under the direction of the Geotechnical Engineer. The Geotechnical Engineer should document the pile installation process including soil/rock and groundwater conditions encountered, consistency with expected conditions, and details of the installed pile.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



## SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of standard penetration resistance values (N-values) according to the 2012 International Building Code (which references the ASCE-7 Chapter 20; Table 20.3-1). In addition, field measurement of shear wave velocity using refraction techniques was performed to explore the possibility of a more favorable site classification than that determined using N-values.

As previously mentioned, Seismic Array A and Array C were evaluated for the average weighted shear wave velocity in the upper 100 feet. During this limited geophysical study, the average weighted shear-wave velocity profiles for Array A and Array C were determined to be 2,188 ft/sec and 2,019 ft/sec, respectively. Profiles for the average weighted shear-wave velocities of Array A and Array C are provided as Exhibits A-7 and A-8 in the attachments. The results follow:

Description	Value
2012 International Building Code Site Classification	C <sup>2</sup>
Site Latitude	35.054765°
Site Longitude	-85.329771°
$S_{DS}$ Spectral Acceleration for a Short Period <sup>3</sup>	0.522g
$S_{D1}$ Spectral Acceleration for a 1-Second Period <sup>3</sup>	0.284g

1. Seismic site classification in general accordance with the 2012 International Building Code, which refers to ASCE 7-10.

- 2. The 2012 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 104 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.
- 3. These values were obtained using online seismic design maps and tools provided by the USGS (<u>http://earthquake.usgs.gov/hazards/designmaps/</u>).

## **FLOOR SLABS**

Depending upon the finished floor elevation, unsuitable weak, soft to medium stiff soils may be encountered at the floor slab subgrade level. These soils should be replaced with structural fill so the floor slab is supported on at least 2 feet of compacted structural fill.

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and. positive drainage of the aggregate base beneath the floor slab.

Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



### Floor Slab Design Parameters

	ltem	Description			
		Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200			
		sieve) crushed aggregate compacted to at least 95% of ASTM D 698 $^{2, 3}$			
Floor Slab Support <sup>1</sup>		At least 18 inches of low plasticity cohesive or granular soils with at least 18% passing the U.S. No. 200 sieve material should be present below floor slabs where fat clay soils are present			
Estima	ated Modulus of				
Subgrade Reaction <sup>2</sup>		100 pounds per square inch per inch (psi/in) for point loads			
1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of slab cracking caused by differential movements between the slab and foundation.					
<ol> <li>Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in Earthwork, and the floor slab support as noted in this table. provided for point loads. For large area loads the modulus of subgrade reaction would be lower.</li> </ol>					
3.	3. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve Other design considerations such as cold temperatures and condensation development could warrant mo extensive design provisions.				

The use of a vapor retarder should be considered beneath concrete slabs on grade 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.

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

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted, but could be larger than normal and result in some cracking. Mitigation measures as noted in **Existing Fill** within **Earthwork** are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or posttensioned elements.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 
Terracon Project No. E2175127F



### **Floor Slab Construction Considerations**

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

## **BELOW-GRADE STRUCTURES**

Where below grade structures are anticipated, shoring and dewatering will be necessary. Design of shoring and dewatering systems is typically done by a specialty contractor.

## **RETAINING WALLS**

Retaining walls are anticipated between tanks and the existing slopes near the western property boundary, and may be up to 20 feet high. Retaining walls should be designed using lateral earth pressure parameters similar to those used for design of below grade structures, some of which function as retaining walls. Active earth pressure is appropriate where walls are free to deflect, at-rest earth pressure where walls are restrained, and passive earth pressure where the structure is moving toward the soil, such as the resisting face of a tie-back or deadman.

Retaining wall foundations bearing on structural fill should be designed for an allowable bearing capacity of 2,000 psf. Ordinarily, a higher allowable bearing capacity would be appropriate for structural fill, but because of the elevated potential for shallow foundations to be underlain by soils of highly variable consistency, we recommend basing preliminary foundation design for retaining walls on a lower value. Another factor to be considered is the type of wall. Cast walls are more susceptible to the effects of differential settlement than MSE walls. On the other hand, the distance between the wall and the existing slope must be wide enough to accommodate the design length of geo-grid reinforcement, possibly requiring excavation. Alternatively, a system of tie-backs may be required to stabilize the existing slope as part of retaining wall design and construction.

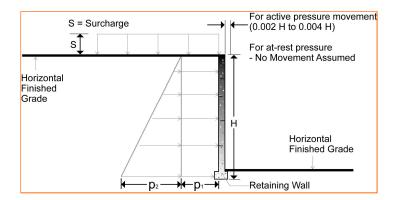
Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



## LATERAL EARTH PRESSURES

#### **Design Parameters**

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values 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 and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



Lateral Earth Pressure Design Parameters						
Earth Pressure	e Coefficient for Pressure <sup>3, 4, 5</sup>		Effective Fluid Pressures (psf) <sup>2, 4, 5</sup>			
Condition <sup>1</sup>	Backfill Type <sup>2</sup>	pressure p₁ (psf)	Unsaturated <sup>6</sup>	Submerged <sup>6</sup>		
$\Lambda ative (Ke)$	Granular - 0.31	(0.31)S	(40)H	(80)H		
Active (Ka)	Fine Grained - 0.41	(0.41)S	(50)H	(85)H		
At Deat (Ke)	Granular - 0.47	0.47)S	(55)H	(90)H		
At-Rest (Ko)	Fine Grained - 0.58	(0.58)S	(70)H	(95)H		
Dessive (Kp)	Granular - 3.25		(390)H	(250)H		
Passive (Kp)	Fine Grained - 2.46		(295)H	(205)H		

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.

2. Uniform, horizontal backfill, compacted to at least 95 percent of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.

- 3. Uniform surcharge, where S is surcharge pressure.
- 4. Loading from heavy compaction equipment is not included.
- 5. No safety factor is included in these values.

into the design.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F

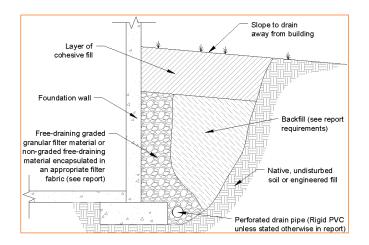


Lateral Earth Pressure Design Parameters					
Earth Pressure Coefficient for		Surcharge Pressure <sup>3, 4, 5</sup>	Effective Fluid Pressures (psf) <sup>2, 4,</sup>		
Condition <sup>1</sup>	Backfill Type <sup>2</sup>	pressure p1 (psf)	Unsaturated <sup>6</sup>	Submerged <sup>6</sup>	
6.       In order to achieve "Unsaturated" conditions, follow guidelines in Subsurface Drainage for Below Grade         Walls below.       "Submerged" conditions are recommended when drainage behind walls is not incorporated					

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up 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.

#### Subsurface Drainage for Below Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5 percent passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.



## **PAVEMENTS**

#### **General Pavement Comments**

Traffic loads and frequencies have not yet been determined. Therefore, our recommendations are general and will required re-evaluation once traffic information is known. A critical aspect of pavement performance is site preparation. Pavement designs, noted in this section, must be applied to the site, which has been prepared as recommended in the **Earthwork** section.

Support characteristics of subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade, such as soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

### **Pavement Section Thicknesses**

Asphaltic Concrete Design				
Layer	Thickness (inches)			
	Light Duty			
Surface course AC <sup>1</sup>	1.5			
Base Course AC <sup>1</sup>	2			
Aggregate Base <sup>2</sup>	6			

As a minimum, we suggest the following pavement sections be considered:

1. All materials should meet the current State of Tennessee Department of Transportation (TDOT) Standard Specifications for Highway and Bridge Construction.

Surface - TDOT Type A Asphaltic Cement Concrete: Section 411

- Asphaltic Base TDOT Type B Asphaltic Cement Concrete, Class I: Section 307
- 2. Mineral Aggregate Base stone per TDOT Section 303

Portland Cement Concrete Design				
	Thickness (inches)			
Layer	Light Duty			
PCC <sup>1</sup>	5			
Mineral Aggregate Base	4			
1. All materials should	1. All materials should meet the current Tennessee Department of Transportation (TDOT) Standard			

1. All materials should meet the current Tennessee Department of Transportation (TDOT) Standard Specifications for Highway and Bridge Construction.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 Terracon Project No. E2175127F



Portland Cement Concrete Design			
	Thickness (inches)		
Layer	Light Duty		
<ul> <li>Concrete Pavement - TDOT Portland Cement Concrete Type C: Section 501</li> </ul>			

The pavement sections provided in this report are estimates and should be re-evaluated when design specifics are available. Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, and be placed with a maximum slump of 4 inches. Although not required for structural support, a minimum 4-inch thick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements+-. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement design methods are intended to provide structural sections with adequate thickness over a subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of a potentially expansive clay subgrade such as the CH soils encountered in some exploration locations. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is, therefore, important to minimize moisture changes in the subgrade to reduce shrink/swell movements.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-

#### **Final Geotechnical Engineering Report** Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



surface soils. The civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with ACC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphaltic cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.

### **Pavement Drainage**

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to these grade-supported slabs, since this could saturate the subgrade and contribute to premature pavement or slab deterioration.

The pavement surfacing and adjacent sidewalks should be sloped to provide rapid drainage of surface water. Water should not be allowed to pond on or adjacent to t slabs, since it could saturate the subgrade and contribute to premature pavement or slab deterioration.

### **Pavement Maintenance**

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 
Terracon Project No. E2175127F



Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

## **GENERAL COMMENTS**

As the project progresses, we address assumptions by incorporating information provided by the design team, if any. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee
October 3, 2018 
Terracon Project No. E2175127F



Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# ATTACHMENTS



# EXPLORATION AND TESTING PROCEDURES

### **Field Exploration**

Number of Borings	Boring Depth (feet)	Planned Location
24 (T-1 through T-24)	29.2 to 71.6 (auger refusal) <sup>1</sup>	Water tanks
14 (DS-1 through DS-3;	29.2 to 71.6 (auger refusal)1       Water tanks         44.2 to 58.5 (auger refusal)       Diversion structure, odor control building, electrical building, pump station, valve bank	
PS-1 through PS-4;		'
OC-1 through OC-4;		
EB-1 and EB-2; VB-1)		

1. One boring encountered auger refusal at 10 feet, and two borings were terminated at a depth of 70 feet without encountering auger refusal.

**Boring Layout and Elevations:** Unless otherwise noted, Terracon personnel provide the boring layout. Coordinate data and elevations were provided by Earthworx, LLC.

**Subsurface Exploration Procedures:** We advance the borings with a combination of truckmounted, track-mounted, and ATV-mounted rotary drill rig using continuous flight augers (solid stem and/or hollow stem as necessary depending on soil conditions). Four samples are obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observe and record groundwater levels during drilling and sampling. Boreholes were initially open for observation of groundwater, but for safety purposes, were subsequently backfilled with auger cuttings.

The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The samples are placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Our exploration team prepares field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

At 14 selected locations, rock was sampled using diamond coring techniques.

#### **Final Geotechnical Engineering Report** Hamm Road Wet Weather Storage Facility Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F



### Laboratory Testing

The project engineer reviews the field data and assigns various laboratory tests to better understand the engineering properties of the various soil and rock strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System.

Where bedrock samples are obtained, rock classification is conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification is determined using the Description of Rock Properties.

## **Geophysical Testing**

The purpose of this study was to non-intrusively explore the subsurface conditions underlying the site to aid in the identification of potential karstic features and provide a shear-wave velocity profile of the upper 100 feet for the seismic site classification.

#### **Field Program**

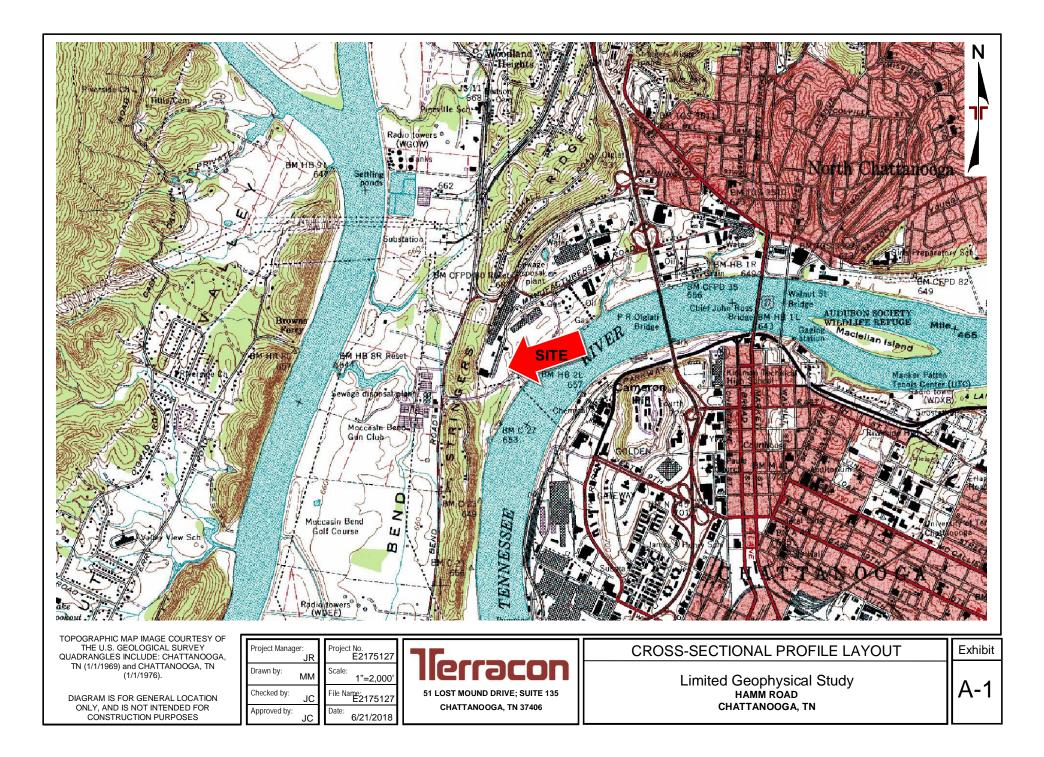
The field program for this investigation consisted of a limited geophysical survey which included four (4) seismic arrays designated Array A, Array B, Array C, and Array D. Profiles associated with the seismic arrays are attached as Exhibits A-3, A-4, A-5, and A-6 of this document, respectively.

Terracon used the SeisOpt® Refraction Microtremor<sup>™</sup> (ReMi) method to develop shear-wave velocity profiles at the site. These developed profiles show relatively higher and lower shear-wave velocity subsurface characteristics. Settlement-prone areas (i.e., voids and areas of soft soil) are generally depicted as zones of lower shear-wave velocity.

A total of four (4) seismic arrays, each using an arrangement of 24 geophones, were analyzed to depths ranging from 88 feet to 100 feet below current surface elevation. The collected shear-wave data was processed using computer software (SeisOpt® ReMi<sup>™</sup> by Optim, LLC), the shear-wave dispersion curve, and the picked point plot of the data. The shear-wave velocity profiles for each of the four (4) seismic arrays were generated from the SeisOpt® ReMi<sup>™</sup> method of data reduction and can be seen on the attached Exhibits A-3, A-4, A-5, and A-6.

In addition to the cross-sectional profiles generated for the four (4) seismic arrays, two of the arrays (Array A and Array C) were evaluated for their average, weighted shear-wave velocity profiles. These additional profiles help to characterize the upper 100 feet for use in the determination of the site's seismic site classification per the 2012 IBC. The average weighted shear-wave velocity profiles for seismic Array A and Array C are provided as Exhibits A-7 and A-8, respectively.

# SITE LOCATION AND EXPLORATION PLANS



#### **EXPLORATION PLAN**

Hamm Road Chattanooga, TN January 24, 2018 Terracon Project No. E2175127





DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS **EXPLORATION RESULTS** 

		BORING	LO	GI	10	. T-1				F	Page 1 of 2	2
PR	OJECT: Hamm Road		C	LIEN	NT:	Hazen & Sav Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LC	DEPTH	Elev.: 676.43 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	0.3 <u>, <b>TOPSOIL</b></u> FILL - GRAVELLY LEAN CLAY, angular, ligh brown and brown, black mineral staining	676	_	- ,	X	8-10-10 N=20			NA	9		
			_ 5 —	-	X	7-8-11 N=19			3.0 (HP)	17		
	6.0 GRAVELLY LEAN CLAY WITH SAND (CL), li brown and light gray, stiff, black mineral stair	670.5 ght ning	-		X	6-5-5 N=10			NA	16	34-20-14	55
			- 10- -	-	X	4-6-7 N=13			2.5 (HP)	20		
			- - 15	-	X	4-6-8 N=14			2.5 (HP)	26		
			- 20 -	-	X	3-4-5 N=9			1.5 (HP)	28		
			- - 25-	-	X	4-4-5 N=9			1.75 (HP)	26		
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.				Hamme	er Type: Auto	matic				·
3 1/4 Abando	used and addition         Ionment Method:         ing backfilled with auger cuttings upon completion.         WATER LEVEL OBSERVATIONS         No free water observed while drilling         51 Los	See Exploration and description of field ar used and additional of See Supporting Infor symbols and abbrevi	data (If mation	f any). i for exp								
		<b>Ti Lost M</b> Chatt		Dr Ste		Drill Rig:	arted: 01-05-2 o.: E2175127		_	g Com er: J. Fr	pleted: 01-05-: eeman	2018

	E	BORING	LO	G I	NC	). T-1				F	age 2 of 2	2
PR	OJECT: Hamm Road		0	CLIEI	NT:	Hazen 8 Nashvill	k Sawyer le, TN					
SIT	E: 155 Hamm Road Chattanooga, Tennessee						,					
GRAPHIC LOG		:lev.: 676.43 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH GRAVELLY LEAN CLAY WITH SAND (CL), ligi brown and light gray, stiff, black mineral stainin (continued)	ELEVATION (Ft.) ht ng	-	_								
7.0	29.2 Auger Refusal at 29.2 Feet	647	-	_	$\geq$	50/4"	'		NA ,	_9_		
	Stratification lines are approximate. In-situ, the transition may	be gradual.					-lammer Type: Auto	matic				
	L L L L L L L L L L L L L L L L L L L	See Exploration and description of field a used and additional	l data (I	f any).		edures	lotes:					
	onment Method: ng backfilled with auger cuttings upon completion.	See Supporting Info symbols and abbrev	viations	n for ex 3.	plana	tion of						
	WATER LEVEL OBSERVATIONS No free water observed while drilling					Bo	ring Started: 01-05-2	2018	Borin	ig Com	bleted: 01-05-2	2018
	No nee water observed writte dritting	ller				Dri	ll Rig:		Drille	er: J. Fre	eeman	
		51 Lost I Cha	Mound Ittanoog		135	Pro	oject No.: E2175127					

	I	BORING L	_C	)G	NC	). T-2				F	Page 1 of 2	2
PR	OJECT: Hamm Road		(	CLIE	NT:	Hazen & Sa Nashville,	awyer					
SI	TE: 155 Hamm Road Chattanooga, Tennessee					Nasrivine,	IN					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.05518° Longitude: -85.32985° Surface	Elev.: 676.77 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH 0.2_\ <u>TOPSOIL</u>	ELEVATION (Ft.)		≤ö	Ś					0		
	FILL - LEAN CLAY, with gravel, brown		-	_	X	5-6-7 N=13			NA			
F 3/30/18			- 5 -	_	X	2-2-2 N=4			NA			
EMPLATE.GD			-	_	X	3-2-2 N=4			NA			
ACON_DATATI			- 10-	_	X	4-4-5 N=9			1.5 (HP)			
GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	12.0 FILL - GRAVELLY LEAN CLAY , brown, black mineral staining	665	-	_								
E2175127 HAMN			- 15- -	_	X	2-6-8 N=14			2.0 (HP)			
OG-NO WELL			-	_								
GEO SMART I		:	-20	_	X	4-7-8 N=15			2.0 (HP)			
VAL REPORT. G	22.0 LEAN CLAY (CL), trace gravel, angular, light and light gray, very stiff, black mineral stainin	655 brown g	-	_								
FROM ORIGI		:	- 25-	_	X	6-8-9 N=17			2.0 (HP)			
ARATED	Stratification lines are approximate. In-situ, the transition ma	y be gradual.				Hami	mer Type: Auto	matic				<u> </u>
	ncement Method: /4 HSA	See Exploration and T description of field and used and additional da See Supporting Inform	d lab ata (l	oratory If any).	proce	edures	:					
Abano Si Bor	donment Method: ing backfilled with auger cuttings upon completion.	symbols and abbrevia			Pialid							
	WATER LEVEL OBSERVATIONS No free water observed while drilling	Terr					Started: 01-04-2	2017		-	pleted: 01-04-2	2017
THIS BC		51 Lost Mo	ound				g: No.: E2175127		Drille	er: J. Fr	eeman	

	BORIN	IG	LO	GI	NC	). T-2	2				F	Page 2 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazer	n & Saw /ille, TN	/yer				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					nuoni	,,	•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.05518° Longitude: -85.32985° Surface Elev.: 676.77 ( DEPTH ELEVATION (	·	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), trace gravel, angular, light brown and light gray, very stiff, black mineral staining (continued)	1,	-										
			- 30-	-	X	6-7 N=				2.5 (HP)			
	32.0 LEAN CLAY (CL), grayish brown to reddish brown, very soft to soft	645	-	-									
			- 35-	-	X	1-′ N:	1-1 =2			0.5 (HP)			
			-										
	40.4 6	36.5	- 40-	-	X	0-0 N:	0-0 =0			NA			
3 1/- Aband	Auger Refusal at 40.4 Feet         Auger Refusal at 40.4 Feet         Stratification lines are approximate. In-situ, the transition may be gradual.         cement Method: 4 HSA       See Explorating description of used and add         onment Method: ng backfilled with auger cuttings upon completion.       See Supporting	field a itional	and labo data (li prmatior	oratory f any). n for ex	proce	edures	Hammer Notes:	Type: Auto	matic				
	WATER LEVEL OBSERVATIONS						Boring Sta	rted: 01-04-2	2017	Borir	ng Com	pleted: 01-04-:	2017
	No free water observed while drilling	2	51				Drill Rig:			Drille	er: J. Fre	eeman	
	51		Mound I ttanoog		135		Project No	.: E2175127					

		BORING	LC	DG	NC	D. T-3				Page 1 of∶	3
PR	OJECT: Hamm Road			CLIE	NT:	Hazen 8 Nashvill	Sawyer				
SIT	E: 155 Hamm Road Chattanooga, Tenne	ssee					0, 111				
2	LOCATION See Exploration Plan Latitude: 35.055187° Longitude: -85.329613°	Surface Elev.: 675.85 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) LABORATORY	WATER WATER CONTENT (%)	LIMITS	PERCENT FINES
	DEPTH 0.3.√ <u>TOPSOIL</u> FILL - LEAN CLAY WITH GRAV reddish brown, light brown and b	ELEVATION (Ft.) 675.5 EL, angular, prown		_		3-4-3 N=7					
	-no recovery		5	-		N=3					
			10		X	1-2-3 N=5					
	17.0 LEAN CLAY (CL), light brown, n		15	-		2-2-2 N=4					
	22.0	654	20		X	2-2-3 N=5					
	LEAN CLAY (CL), light brown ar very stiff	nd light gray, stiff to	25	-	X	4-8-8 N=16		1.2 (HI			
3 1/4 Abando	Stratification lines are approximate. In-situ, cement Method: 4 HSA lonment Method: ing backfilled with auger cuttings upon comple	See Exploration ar description of field used and additiona See Supporting Inf symbols and abbre	al data iormati	(If any). on for e		es for a N redures	lammer Type: Aut	u l		1	
	WATER LEVEL OBSERVATIONS	51 Lost	Mound		135		ing Started: 01-03- Il Rig: iject No.: E217512	D	oring Com riller: J. Fr	pleted: 01-03- eeman	2018

			BORING								F	Page 2 of	3
PRO	OJECT:	Hamm Road		9	CLIE	NT:	Hazen & Sa Nashville,	awyer FN					
SIT	E:	155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LC	Latitude: 3		urface Elev.: 675.85 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	
	LEA very	<u>N CLAY (CL)</u> , light brown and light <u>c</u> stiff <i>(continued)</i>	gray, stiff to	30-	_	X	4-6-8 N=14			3.0 (HP)			
	37.0		639	35-		X	4-5-6 N=11			3.0 (HP)			
	<u>CLA</u> light	<u>YEY GRAVEL (GC)</u> , angular, light b gray, very dense	rown and	40-	_	X	50/4"			2.0 (HP)			-
				45-	_	X	50/5"						-
				50-	_	X	50/3"						-
± /"/	Stratificat	ion lines are approximate. In-situ, the transit	ion may be gradual.		1		Hamr	ner Type: Auto	omatic				
3 1/4	cement Met 4 HSA onment Met ng backfilled		See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data ( rmatic	(If any). on for ex								
		WATER LEVEL OBSERVATIONS           o free water observed while drilling					Boring	Started: 01-03-2	2018			pleted: 01-03-	-20
			51 Lost N	Nound				: No.: E2175127		Drille	er: J. Fre	eeman	

		BORING	LC	)G	NC	). T-3	3				F	Page 3 of 3	3
PR	OJECT: Hamm Road			CLIE	NT:	Hazer	n & Sav ville, TN	vyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nasin	vine, m	•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.055187° Longitude: -85.329613° Surface DEPTH	Elev.: 675.85 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	<u>CLAYEY GRAVEL (GC)</u> , angular, light brown light gray, very dense <i>(continued)</i>			_									
	57.0 POORLY GRADED GRAVEL WITH SAND (G light gray, very dense	<u>619</u> P <u>)</u> ,	55	-		50	)/1" )						
				_	$\ge$	14-5	50/2"						
			60	-									
				_	$\ge$	22-5	50/2"						
			65		×								
	-no recovery 70.0	606	70			50	)/3"						
	Boring Terminated at 70 Feet		70										
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.					Hamme	r Type: Auto	matic				
3 1/- Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration an description of field used and additiona See Supporting Info symbols and abbre	l data ormatio	(If any). on for e			Notes:						
	WATER LEVEL OBSERVATIONS						Boring Sta	rted: 01-03-2	2018	Borir	ng Com	oleted: 01-03-	2018
	No free water observed while drilling		Mound		135		Drill Rig: Project No	o.: E2175127		Drille	er: J. Fro	eeman	

		BORING	LO	G I	10	. <b>T-4</b>			F	Page 1 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & S Nashville,	awyer TN				
SIT	E: 155 Hamm Road Chattanooga, Tennessee					i taoli viito,					
GRAPHIC LOG	DEPTH	e Elev.: 676.18 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	<u>TOPSOIL</u> <u>FILL - GRAVELLY LEAN CLAY</u> , reddish bro and brown, black mineral staining	676	-		X	3-6-6 N=12 3-4-8		NA			
			5		$\wedge$	N=12 7-7-6 N=13		2.0 (HP)			
			- -10 -		X	5-7-8 N=15		NA			
			- - 15	-	X	3-2-2 N=4		NA			
	17.0 LEAN CLAY (CL), trace gravel, light brown a yellowish brown, stiff		- - 20- -	-	X	3-5-5 N=10		2.0 (HP)			
	22.0 LEAN CLAY WITH SAND (CH), light brown a light gray, medium stiff to soft		- - 25-		X	2-2-2 N=4		1.0 (HP)			
3 1/4 Aband	Stratification lines are approximate. In-situ, the transition m cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	ay be gradual. See Exploration and description of field au used and additional of See Supporting Infor symbols and abbrevi	data (l' matior	f any). n for ex		s for a Notes dures	mer Type: Autor	natic	I		
	WATER LEVEL OBSERVATIONS While drilling	JICON 51 Lost M Chatt		Dr Ste	_		Started: 01-05-2 g: No.: E2175127		ng Com ler: J. Fr	pleted: 01-05- eeman	2018

	BORIN	GL	0	GI	NC	). T-4	4				F	Page 2 of 2	2
PR	OJECT: Hamm Road		C	LIEI	NT:	Hazer	n & Sav ville, TI	vyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nasii	vine, ri	N					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.055012° Longitude: -85.330035° Surface Elev.: 676.18 (FI DEPTH ELEVATION (FI		טברוח (רנ.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIFI D TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH ELEVATION (F LEAN CLAY WITH SAND (CH), light brown and light gray, medium stiff to soft (continued)	<u>.)</u>	_										
			-	-	$\bigvee$	3-	2-3						
		3	0				=5						
			-										
		3	-		X		1-1 =2						
			-	-									
			_				2-1						
		4	0		Χ		=3						
/// <mark>///</mark> ///	41.4 6 Auger Refusal at 41.4 Feet	35											
	Stratification lines are approximate. In-situ, the transition may be gradual.						Hamme	r Type: Auto	matic				
	cement Method: See Exploration 4 HSA description of fi used and additi	and Te and and onal dat	estin labo ta (lf	<mark>g Proc</mark> pratory f any).	edure proc	es for a edures	Notes:						
	onment Method: symbols and ab	Informa	ation	for ex	plana	ation of							
	WATER LEVEL OBSERVATIONS						Borina Sta	arted: 01-05-2	2018	Borin	ng Com	oleted: 01-05-2	2018
$\square$	While drilling		7				Drill Rig:				er: J. Fr		
	51 L	ost Mou Chattan	ind [	Dr Ste				o.: E2175127			0. 1 10		

		BORING	LO	GI	NO	). T-5				F	Page 1 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & Nashvill	Sawyer				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nuonvin	, II <b>I</b>					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.055018° Longitude: -85.329689° Surface DEPTH	Elev.: 675.58 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	<u>TOPSOIL</u> <u>FILL - GRAVELLY LEAN CLAY WITH SAND</u> angular, reddish brown and brown, black min     staining	. 675.5	-	-	X	3-3-4 N=7				14		
			- 5 -	-	X	3-1-2 N=3				16		
			-	-	X	3-3-3 N=6				17		
			- 10- -	-	X	3-2-3 N=5				17	33-19-14	43
	brown		- - 15-	-	X	2-2-2 N=4				20		
	17.0 LEAN CLAY (CL), light brown, medium stiff	658.5	-	-								
			- 20-	-	X	1-1-3 N=4			1.0 (HP)	26		
	22.0 LEAN CLAY (CL), light brown and light gray, stiff	653.5 very	_	-								
			- 25	-	X	5-9-9 N=18			3.0 (HP)	24		
<u> </u>	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.		<u> </u>		H	lammer Type: Aut	omatic				
3 1/ NQ2 Aband	cement Method: 4 HSA 2 Wireline Core conment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field i used and additional See Supporting Info symbols and abbre	l data (li ormatior	f any). 1 for ex		dures	otes:					
	WATER LEVEL OBSERVATIONS While drilling	<b>Tier</b> 51 Lost Cha		Dr Ste	_	Dril	ing Started: 01-03- I Rig: ject No.: E217512		-		oleted: 01-03-2 eeman	2018

			BORING								F	Page 2 of	2
PR	OJECT	: Hamm Road			CLIE	NT:	Hazen & Sav Nashville, Tl	vyer N					
SIT	E:	155 Hamm Road Chattanooga, Tennessee											
2		ON See Exploration Plan 35.055018° Longitude: -85.329689°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	6
GR	DEPTH LE/ stiff	Si AN CLAY (CL), light brown and light <u>c</u> (continued)	urface Elev.: 675.58 (Ft.) ELEVATION (Ft.) gray, very	8	OBS	SAN		R		LAE	C C		
					_	$\square$	6-8-10 N=18			2.5 (HP)	22		
	32.0		643.5	30-	_		N=10			(111)			
	LE/	AN CLAY (CL), trace gravel, angular, wn, light gray and black, very stiff, bl ning	reddish				10-11-11			3.5			+
				35	_		N=22			(HP)	24		+
0.0	ligh	AVELLY LEAN CLAY (CL), trace san t brown and brown, very stiff, black n ning	638.5 d, angular, nineral		_								
		ger Refusal at 40.6' VANCED CASING	635	40-	_	X	7-9-10 N=19				17		
	AD	VANCED CASING			_								
· · · · · ·	<u>co</u>	gin NQ2 Wireline Rock Core ARSE SAND ploration team member described ma	630.5 aterial as a	45	_								
	coa	rse sand			-		<u>RUN 1:</u> Depth: 45.2' - 50.2' Run Length: 5'	0	0				
· · · · · · · · · · · · · · · · · · ·	50.2 <b>Cor</b>	ring Terminated at 50.2 Feet	625.5	50-									
	Stratifica	ation lines are approximate. In-situ, the transit	ion may be gradual.				Hamme	er Type: Auto	omatic				
3 1/4 NQ2	cement Me 4 HSA 2 Wireline (	Core	See Exploration an description of field used and additiona See Supporting Info	l data ( ormatic	(If any). on for ex								
	-	ed with auger cuttings upon completion.	symbols and abbre	viation	S.								
$\bigtriangledown$	WAT While a	TER LEVEL OBSERVATIONS	🗆 1 ler	۲2	יר		Boring Sta	arted: 01-03-	2018	_	-	pleted: 01-03-	-20
			51 Lost	Mound	_	· · · ·		o.: E2175127		Drille	er: J. Fr	eeman	

			BORING	LC	)G I	٩C	). T-6	6				F	Page 1 of	1
PR	OJECT:	Hamm Road		(	CLIEI	NT:	Hazer Nash	n & Saw /ille, TN	vyer I				-	
SIT	E:	155 Hamm Road Chattanooga, Tennessee						···· <b>·</b> , ···	-					
GRAPH		V See Exploration Plan .054879° Longitude: -85.329871° Surface	Elev.: 675.72 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	<u> </u>		675.5											
	<u>GRA\</u> black	/ELLY LEAN CLAY, reddish brown to br mineral staining	own,	-	-	X	3-4 N:	4-5 =9			NA			
				5 -	-	X	3-{ N=	5-5 :10			NA			
				-		$\times$	8-5	0/1"			1.5 (HP)/			
	10.0		005.5	-	-	-	50	/1"/			NA /			
10.0       66         Auger Refusal at 10 Feet       66         Image: Stratification lines are approximate. In-situ, the transition may be gradual.       66								Hammer	Type: Auto	matic				
	cement Meth 4 HSA	od:	See Exploration and description of field ar	Testi nd lab	ng Proce	edure proce	es for a edures	Notes:						
Aband Bori		with auger cuttings upon completion.	used and additional of See Supporting Infor symbols and abbrevi	matio	n for ex	olana	tion of				_			
		R LEVEL OBSERVATIONS vater observed while drilling						Boring Sta	rted: 01-05-2	2018	Borir	ng Com	oleted: 01-05-	2018
						<u> </u>		Drill Rig:			Drille	er: J. Fro	eeman	
			51 Lost M Chatt		Dr Ste ga, TN	135		Project No	.: E2175127					

	В	ORING I	LO	G I	NC	). T-7				F	Page 1 of 3	3
PF	ROJECT: Hamm Road		C	CLIE	NT:	Hazen & S Nashville	Sawyer					
Sľ	TE: 155 Hamm Road Chattanooga, Tennessee					Nasiiville	, IN					
GRAPHIC LOG		ev.: 676.39 (Ft.) LEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
<u></u>	10.5 <b>TOPSOIL</b>	676										
	FILL - GRAVELLY LEAN CLAY, reddish brown		-	-	X	5-7-7 N=14				12		
3/30/18		070 5	- 5 -	-	X	5-5-10 N=15				17		
EMPLATE.GDT	6.0 FILL - CLAYEY GRAVEL , brown 8.0	670.5	-	-	X	5-27-29 N=56				13		
ACON_DATAT	FILL - POORLY GRADED GRAVEL WITH SANI light brown		- 10-	_	X	18-24-30 N=54				3		
IO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT			-	-								
5127 HAMM	-no recovery		- 15-	-	X	6-8-9 N=17				31		
	17.0 SANDY LEAN CLAY WITH GRAVEL (CL), angu- light brown and reddish brown, stiff to very stiff, mineral staining	<u>659.5</u> lar, black	-	_								
GEO SMART LOG-N			- 20-	-	X	5-6-7 N=13			2.5 (HP)	27		
///Y			-	-								
ROM ORIGINA		:	- 25-	-	X	9-9-9 N=18			2.0 (HP)	22	32-17-15	54
PARATED FF	Stratification lines are approximate. In-situ, the transition may l	be gradual.		_		На	mmer Type: Auto	omatic				
I NG I I VALID IF	/4 HSA dr 12 Wireline Core us	ee Exploration and escription of field an sed and additional d ee Supporting Inform	nd labo lata (l' matior	oratory If any). n for ex	proce	edures	es:					
O Aban N Bo	donment Method: sy ring backfilled with auger cuttings upon completion.	mbols and abbrevia	ations	5.								
	WATER LEVEL OBSERVATIONS No free water observed while drilling					Borin	g Started: 12-22-2	2017	Borin	ng Com	pleted: 12-22-2	2017
HIS BOR		S1 Lost Mo	ound I	Dr Ste			-		Drille	er: J. Fr	eeman	
È		Chatta	anoog	ga, IN		Proje	ct No.: E2175127					

		BORIN	IG L	0	GΙ	NC	). T-7				F	Page 2 of	3
	PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Sav Nashville, Tl	vyer				0	
	SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nashvine, H						
	<b>GRAPHIC LOG</b>	LOCATION See Exploration Plan Latitude: 35.054812° Longitude: -85.330054° Surface Elev.: 676.39 DEPTH ELEVATION	· · /		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
NANA ANA ANA			649.5	_									
8			30	_ 0—		X	4-3-3 N=6			0.75 (HP)	29		
LATE.GDT 3/30/18		32.0 FAT CLAY (CH), light gray and reddish brown, medium stiff	<u>644.5</u>										
I_DATATEMP			3	_ 5—		X	4-3-5 N=8						
AD.GPJ TERRACON		36.5 Auger Refusal at 36.5' ADVANCED CASING	640	-									
NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT			4	0									
GEO SMART LOG-NO WE		44.0 Begin NQ2 Wireline Rock Core DOLOMITIC LIMESTONE, light brown, slightly weathered, minor shale bedding, medium strong	<u>632.5</u> 4	_ 5_									
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO S		47.0 CLAY AND CHERT FRAGMENTS	<u>629.5</u> 50	- - 0- -			<u>RUN 1:</u> Depth: 44' - 54' Run Length: 10'	33	18				
PARATED FF		Stratification lines are approximate. In-situ, the transition may be gradual.		_			Hamme	er Type: Auto	omatic				
B IS NOT VALID IF SE	3 1/4 NQ2 Aband	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion. See Supporti symbols and	f field and I ditional data ng Informa	laboi a (lf	ratory any). for ex	proce	edures						
NG LOG		WATER LEVEL OBSERVATIONS					Boring St	arted: 12-22-	2017	Borir	ng Com	pleted: 12-22-	2017
BORIN		No free water observed while drilling	26	_			Drill Rig:			Drille	er: J. Fr	eeman	
THIS		51	Lost Mour Chattan			135	Project N	o.: E2175127					

		BORING L	_0	G I	NC	). T-7				F	Page 3 of	3
PROJECT	: Hamm Road		0	CLIE	NT:	Hazen & Sav Nashville, TN	vyer N					
SITE:	155 Hamm Road Chattanooga, Tennessee											
	DN See Exploration Plan 35.054812° Longitude: -85.330054° Si	urface Elev.: 676.39 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
	AY AND CHERT FRAGMENTS (contin		-	_								
			- -55 - -	-		<u>RUN 2:</u>						
			- 06 -	-		Depth: 54' - 64' Run Length: 10'	0	0				
64.0 Cor	ing Terminated at 64 Feet	612.5	-									
Stratifica	Stratification lines are approximate. In-situ, the transition may be grad					Hamme	r Type: Auto	omatic				
Advancement Me 3 1/4 HSA		See Exploration and T description of field and	T <mark>estir</mark> d lab	ng Proc oratory	edure proc	es for a Notes: edures						
NQ2 Wireline ( Abandonment Me Boring backfille		used and additional da See Supporting Inform symbols and abbrevia	natio	n for ex	plana	ation of						
	ER LEVEL OBSERVATIONS					Boring Sta	irted: 12-22-	2017	Bori	ng Com	pleted: 12-22-	·2017
No free	water observed while drilling	– 1lerr				Drill Rig:			Drill	er: J. Fr	eeman	
		51 Lost Mo Chatta			135	Project No	o.: E2175127	7				

			BORING	LC	COG	NC	). T-8				F	Page 1 of 4	4
PR	OJECT:	Hamm Road			CLIE	NT:	Hazen	& Sawyer ille, TN					
SIT	ſE:	155 Hamm Road Chattanooga, Tennessee					Nasiiv	ille, i N					
GRAPHIC LOG		N See Exploration Plan .054818° Longitude: -85.329665° Su	rface Elev.: 674.97 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	DEPTH		ELEVATION (Ft.)		28	Ś					0	ļ	
		<u>- GRAVELLY LEAN CLAY</u> , reddish			-		5-5 N= 4-5	-6					
5DT 3/30/18	-no re	ecovery		5	_		N='						
ATEMPLATE.					_	X	1-1 N=						
ACON_DAI/				10	-	X	2-3 N=						
GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON DATATEMPLATE.GDT 33078				-									
L E2175127 HAM	17.0			15	- -	X	1-3 N=						
OG-NO WEL		I CLAY (CL), light brown and light g stiff	ray, stiff to		_								
GEO SMART L				20	- -	X	5-6 N= <sup>-</sup>			2.0 (HP)			
					_								
ROM ORIGINA				25	-	X	4-8- N=1			2.5 (HP)			
ARATED F	Stratificatio	on may be gradual.		1	<u> </u>		Hammer Type: Au	tomatic					
3 1/ NQ: 10 NQ: 10 Aband	cement Meth 4 HSA 2 Wireline Cc lonment Meth ing backfilled	ore	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	and la data ormati	boratory (If any). on for e:	/ proc	edures	Notes:					
	WATF	R LEVEL OBSERVATIONS							0040				0017
	While drii		1[er	٢,				3oring Started: 01-02 Drill Rig:	2018	_	ng Com	pleted: 01-02-	2018
			51 Lost I	Nound				Project No.: E217512	27		51. J. FI		

			BORING	LO	GI	10	). T-8				Page 2	2 of 4
PR	OJECT:	Hamm Road		C	CLIE	NT:	Hazen & Sav Nashville, T	wyer N				
SIT	ſE:	155 Hamm Road Chattanooga, Tennessee					,	-				
GRAPHIC LOG	Latitude: 35	I CLAY (CL). light brown and light grav.	e Elev.: 674.97 (Ft.) ELEVATION (Ft.) , stiff to	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) LABORATORY	HP (tsf) WATER	CONTENT (%)	NT FINES
	very s	stiff (continued)		- - 30-		X	6-8-10 N=18			.0 IP)		
	32.0 LEAN	<u>I CLAY (CL)</u> , gray, soft to medium stiff		- - 35- -		X	2-2-3 N=5			.0 IP)		
	42.0		633	- - 40- -	-	X	2-2-1 N=3					
	<u>CLA</u> )	′ <u>EY GRAVEL (GC)</u> , light brown, very de		- - 45-		$\times$	34-50/2"					
		RLY GRADED GRAVEL (GP), black, ve 9	ry	- - 50- -	-	$\times$	39-50/2"					
	Stratificatio	on lines are approximate. In-situ, the transition m	Hamme	er Type: Autor	natic							
3 1/- NQ2 Aband	cement Meth 4 HSA 2 Wireline Co conment Meth ing backfilled	ore	See Exploration and description of field an used and additional d See Supporting Inforr symbols and abbrevia	nd labo Jata (l' matior	oratory f any). n for ex	proce	dures					
	WATE While dri	R LEVEL OBSERVATIONS	JIen 51 Lost Mo Chatta	ound	Dr Ste			arted: 01-02-2			Completed: 0 J. Freeman	1-02-2018

		BORING	LO	GN	١C	). T-8				F	Page 3 of 4	4
PR	OJECT: Hamm Road		0		NT:	Hazen & Sav Nashville, Th	vyer J				•	
SIT	E: 155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054818° Longitude: -85.329665° Surface DEPTH	Elev.: 674.97 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	POORLY GRADED GRAVEL (GP), black, ver dense (continued)	ELEVATION (Ft.)	_									
• <b>^</b> •	55.6 Auger Refusal at 55.6' ADVANCED CASING	619.5	- 55- -	-		50/1"						
	57.3 Begin NQ2 Wireline Rock Core SAND AND CHERT FRAGMENTS 62.3	617.5	- - 60- -	-		RUN 1: Depth: 57.3' - 62.3' Run Length: 5'	0	0				
	ADVANCED CASING		- 65- - - - 70-	-								
			70- - - 75-	-								
	76.9	598	-	_								
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.		<u> </u>		Hamme	r Type: Auto	matic				
3 1/4 NQ2 Aband	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field ar used and additional of See Supporting Infor symbols and abbrevi	nd lab data (l matior	oratory f any). n for exp	proce	edures						
$\nabla$	WATER LEVEL OBSERVATIONS					Boring Sta	irted: 01-02-2	2018	Borin	ig Com	oleted: 01-02-2	2018
<u> </u>	While drilling					Drill Rig:			Drille	er: J. Fre	eeman	
		- 51 Lost M Chatt		Dr Ste 1 ja, TN	35	Project No	o.: E2175127					

	BORING	G L(	C	G N	IC	). T-8				F	Page 4 of ₄	4
PR	OJECT: Hamm Road		CL	.IEN	IT:	Hazen & Sav Nashville, TN	vyer I				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054818° Longitude: -85.329665° Surface Elev.: 674.97 (Ft.	·	WATER I EVEI	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	DEPTH       ELEVATION (Ft.         DOLOMITE, light brown and light gray, slightly       weathered, white mineral staining on faces, strong         79.7       rock (continued)       595         DOLOMITE, gray, minor shale bedding, strong rock       595         BOLOMITE, gray, minor shale bedding, strong rock       595         Coring Terminated at 86.9 Feet       565	. <u>.</u> 80	- - - -			RUN 2: Depth: 76.9' - 86.9' Run Length: 10'	86	71				
	Stratification lines are approximate. In-situ, the transition may be gradual.			·			r Type: Auto	matic				
3 1/4 NQ2 Aband	cement Method:     See Exploration       4 HSA     description of fie       2 Wireline Core     used and additio       onment Method:     See Supporting       ng backfilled with auger cuttings upon completion.     symbols and abt	ld and la nal data <mark>nformat</mark> i	aborat (If ar ion fo	atory p ny).	roce	edures						
$\nabla$	WATER LEVEL OBSERVATIONS While drilling					Boring Sta	rted: 01-02-2	2018	Borir	ng Com	pleted: 01-02-2	2018
<u> </u>					_	Drill Rig:			Drille	er: J. Fr	eeman	
		st Moun hattano			35	Project No	.: E2175127					

	В	ORING L	.0	G١	٩C	). T-9				P	age 1 of 4	1
PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Sa	wyer				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nashville, T	N					
GRAPHIC LOG		ت بر: 675.95 (Ft.)	UEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
03/	DEPTH ELL FILL - GRAVELLY LEAN CLAY, reddish brown	EVATION (Ft.)		0	.,							
			_	-	X	2-2-2 N=4						
		Ę	_ 5 —		X	2-3-3 N=6						
			_		X	2-2-2 N=4						
	8.0 FILL - LEAN CLAY WITH GRAVEL , brown	668	_		X	2-2-2 N=4						
	12.0	6641	0—									
	LEAN CLAY (CL), trace gravel, angular, light brown, stiff		_		$\bigvee$	4-4-6 N=10		2	2.0			
		1	5— _			N=10		(1	IP)			
			-			4-6-7			2.5			
		2	20—		Å	N=13			HP)			
			_									
	black mineral staining	2	_ 25—	-	X	6-6-7 N=13			.25 HP)			
	Stratification lines are approximate. In-situ, the transition may be	e gradual.		1		Hamm	er Type: Auton	natic				
3 1/	cement Method: Sec 4 HSA des 2 Wireline Core use	e Exploration and Te scription of field and ed and additional dat	estino labo ta (lf	g Proce pratory any).	edure proce	s for a Notes:						
	onment Method: syn ng backfilled with auger cuttings upon completion.	e Supporting Informa nbols and abbreviati			olana	tion of						
$\nabla$	WATER LEVEL OBSERVATIONS While drilling					Boring S	tarted: 12-22-20	017	Boring	Comp	oleted: 12-22-2	2017
<u> </u>		llerr				Drill Rig:		_	Driller:	: J. Fre	eeman	
		51 Lost Mou Chattan			135	Project N	lo.: E2175127					

		BORING L	.00	) N	10. T	-9				F	Page 2 of 4	4
PR	OJECT: Hamm Road		CL	IEN	T: Haz Nas	en & Sav hville, TN	vyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG		Elev.: 675.95 (Ft.)	DEPTH (Ft.) WATER LEVEL	OBSERVATIONS	SAMPLETYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	brown, stiff <i>(continued)</i>	3	- - 30 -			5-8-8 N=16			2.0 (HP)			
	<u>37.0</u> <u>CLAYEY GRAVEL (GC)</u> , angular, light gray, d	639	- - 35 -			3-4-10 N=14			1.25 (HP)			
	to very dense		- - 40 - -	Z		9-18-22 N=40						
		4	- - 15 -			1-23-25 N=48						
		5	- - 50 -	Z		-46-40 N=86						
ø_\\$/,	Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic											
3 1/ NQ: Aband	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and Te description of field and used and additional da See Supporting Informa symbols and abbreviat	ita (If an ation fo	ıy).		Notes:						
	WATER LEVEL OBSERVATIONS While drilling	Jierr 51 Lost Mou	und Dr S	Ste 13		Drill Rig:	rted: 12-22-2	017	_	g Comp er: J. Fre	oleted: 12-22-	2017
Bor	WATER LEVEL OBSERVATIONS		und Dr S	Ste 13		Drill Rig:	nrted: 12-22-2	017	_			20

				BORING	LC	C	Ν	0. T-(	9				F	Page 3 of	4
PF	RO.	JECT:	Hamm Road			CLI	ENT	: Haze	n & Sav ville, Th	vyer					
SI	ITE		155 Hamm Road Chattanooga, Tennessee					Nuon	vinc, 11	•					
GRAPHIC LOG	La		See Exploration Plan 054686° Longitude: -85.329887° S	urface Elev.: 675.95 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL	OBSERVATIONS SAMPLE TVPE		RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
		CLAY	<u>EY GRAVEL (GC)</u> , angular, light g y dense <i>(continued)</i>			_									
					55	_			23-36 =59						
GDT 3/30/18						-									
IPLATE.		light b	rown, black mineral staining			_	$\geq$	18-4	5-50/1"						
ATATEM					60										
GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18						_									
D.GPJ 1		reddis			-	$\geq$	26-50	0-50/1"							
7 HAMM ROA				65	-										
rell E217512	<u>(</u> 67.	67.6 Auger Refusal at 67.6' ADVANCE CASING				_									
NON-90					70	-									
AART LC						-									
						_									
NAL REPOR					75	-									
FROM ORIGI						_									
ARATED	Stratification lines are approximate. In-situ, the transition may be gradual								Hamme	r Type: Auto	matic				
<u></u> ≝ 3 ′	1/4 H	nent Metho ISA /ireline Co	See Exploration an description of field used and additiona	and la	borato	ry pro		Notes:							
Aban Si Bo			with auger cuttings upon completion.	See Supporting Info symbols and abbre			expla	nation of							
	V	WATE	R LEVEL OBSERVATIONS				- 7	חכ		arted: 12-22-2	2017			oleted: 12-22-	2017
				51 Lost	Mound		e 135		Drill Rig: Project No	o.: E2175127		Drille	er: J. Fr	eeman	

		BORING	LC	C	N	Э. Т-9	9				F	Page 4 of 4	4
PR	OJECT: Hamm Road			CLIE	INT	: Hazei	n & Sav	vyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nash	ville, TN	N					
GRAPHIC LOG	DEPTH	: Elev.: 675.95 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	FIFI D TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
3 1/ NQ:	ADVANCE CASING (continued) 86.5 Begin NQ2 Wireline Rock Core COARSE SAND 93.0 Coring Terminated at 93 Feet Stratification lines are approximate. In-situ, the transition material stratification lines are approximate. In-situ, the transition stratification lines are approximate. In-situ, the transition stratification lines are approximate. In		and la I data ormatio	ing Pro	cceduu y proc	Depth 9 Run L 6	N 1: : 86.5' - 33' ength: .5' Hamme Notes:	0 r Type: Auto	O				
	Ionment Method: ing backfilled with auger cuttings upon completion. WATER LEVEL OBSERVATIONS	symbols and abbre	viation	IS.			Porine Of-	atod: 40.00	2017	Dari		nlatadi 40.00	2047
$\bigtriangledown$	While drilling	ller	۲;	זר		חנ		arted: 12-22-2	2017	_	-	pleted: 12-22-	2017
		51 Lost I	Mound	d Dr St	e 135		Drill Rig:			Drill	er: J. Fr	eeman	
1				oga, TN			Project No	o.: E2175127		1			

			BORING	LO	G I	10	. T-10				F	Page 1 of 3	3
PR	ROJE	CT: Hamm Road			CLIE	NT:	Hazen & Saw Nashville, TN	/yer I					
SI	TE:	155 Hamm Road Chattanooga, Tenne	ssee										
GRAPHIC LOG		ATION See Exploration Plan de: 35.05453° Longitude: -85.33° H	Surface Elev.: 676.50 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
€ & <sub>1</sub> 0	0.6	<u>CONCRETE</u>	676										
		FILL - LEAN CLAY , trace grave	i, angular, brown		-		1-1-2 N=3			1.25 (HP)			
r 3/30/18	6.0		670.5	5	_		2-2-2 N=4			1.25 (HP)			
TEMPLATE.GD		FILL - LEAN CLAY WITH GRAV reddish brown, black mineral sta	EL, angular,		-		4-5-4 N=9			2.5 (HP)			
ACON_DATAT				10	-		5-7-9 N=16			3.25 (HP)			
GEO SMART LOG-NO WELL E2175/27 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18					_								
175127 HAMM				15	_		9-13-12 N=25			3.25 (HP)			
3-NO WELL E2	17.0	FILL - POORLY GRADED GRAV	659.5 /EL WITH CLAY_		_								
EO SMART LOO				20	-		30-40-21 N=61						
1007-A	22.0 I	<b>_EAN CLAY (CL)</b> , trace gravel, a prown, stiff, black mineral stainin	654.5 angular, light ng		_								
ROM ORIGINA				25	-		4-6-8 N=14			2.0 (HP)			
ZATED F	Strat	ification lines are approximate. In-situ, t	the transition may be gradual.		1		Hammer	Type: Auto	matic				
Advar		t Method:	See Exploration and	d Test	ting Pro	cedure	es for a Notes:						
OI VAFID Abanc		t Method: kfilled with auger cuttings upon complei	description of field a used and additional See Supporting Info symbols and abbre	and la I data ormati	boratory (If any). on for e	/ proc	edures						
		ATER LEVEL OBSERVATIONS					Boring Sta	rted: 12-21-2	017	Borin	ng Com	pleted: 12-22-2	2017
	Whi	le drilling					Drill Rig:				er: J. Fr	-	
SIHI			51 Lost I Cha		d Dr Ste oga, TN	135	Project No	.: E2175127					

	В	ORING	LO	GN	10	. T-10				F	Page 2 of 3	3
PR	OJECT: Hamm Road		(	CLIE	NT:	Hazen & Nashville	Sawyer				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nashvine	,					
GRAPHIC LOG			DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	27.0	649.5	_									
	SANDY LEAN CLAY (CL), light brown, medium	stiff	-	_								1
			- 30-		X	3-2-3 N=5			1.25 (HP)			
	32.0 LEAN CLAY (CL), trace gravel, angular, reddis brown, gray and light brown, medium stiff to ve black mineral staining	644.5 h :ry stiff,	-									
			- 35-	_	X	4-4-4 N=8			1.5 (HP)			
			-									
				_	X	10-19-4 N=23		(	2.0 (HP)			
	42.0 GRAVELLY LEAN CLAY (CL), angular, brown a light brown, very stiff to hard, black mineral sta	4 <u>634.5</u> r, brown and ineral staining	-	_								
			- 45-	-	X	7-13-17 N=30		2	2.75 (HP)			
		rface Elev.: 676.50 (Ft.) ELEVATION (Ft.) ELEVATION (Ft.) 649.5 edium stiff 644.5 eddish i to very stiff, 634.5 rown and al staining 634.5 - - - - - - - - - - - - -	-									
			-	_	X	30-38-50/	5"		3.0 (HP)			
	52.0	624.5	-	_								
	Stratification lines are approximate. In-situ, the transition may	be gradual.		1		Ha	ammer Type: Auto	matic	I		I	
3 1/4	u s	sed and additiona	l data (l ormatio	lf any). n for ex			es:					
Aband Bori	onment Method: ng backfilled with auger cuttings upon completion.	ymbols and abbre	viations	5.								
$\overline{}$	WATER LEVEL OBSERVATIONS					Borir	ng Started: 12-21-2	:017	Borin	g Com	oleted: 12-22-2	2017
<u> </u>	While drilling				_	Drill	Rig:		Drille	er: J. Fre	eman	
					135	Proje	ect No.: E2175127					

	E	BORING LO	DG	N	Э. Т-	·10				P	Page 3 of 3	3
PR	OJECT: Hamm Road		CLI	EN	T: Haz Nas	en & Sav shville, Th	vyer N					
SIT	FE: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	DEPTH	Elev.: 676.50 (Ft.)	WATER LEVEL	OBSERVATIONS	SAMPLE ITPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
6000 000 000 000 000 000 000 000 000 00	SANDY LEAN CLAY WITH GRAVEL (CL), an reddish brown to brown	gular,	_ 5_ _ _		23-	-40-50/5"			2.75 (HP)			
		6	- - 0 -		2	8-50/4"			2.5 (HP)			
	low recovery	6	_ 5— _ _	N	<	50/4"						
10000000000000000000000000000000000000	low recovery	<b>7</b> 605	_ _ 0 _		46-	-13-50/3"						
	Auger Refusal at 71.6 Feet											
	Stratification lines are approximate. In-situ, the transition ma	y be gradual.				Hamme	r Type: Auto	matic				
3 1/ Aband	icement Method: 4 HSA Ionment Method: ing backfilled with auger cuttings upon completion.	See Exploration and Te description of field and used and additional dat See Supporting Informa symbols and abbreviation	a (If any ation for	/).					_			
	WATER LEVEL OBSERVATIONS While drilling	<b>Tierr</b> 51 Lost Mou	nd Dr St	te 13		Drill Rig:	arted: 12-21-2	2017	_	ig Comp er: J. Fre	oleted: 12-22-	2017
		Chattan	ooga, T	N		Project No	o.: E2175127					

			BORING	LO	)G I	10	. T-11				F	Page 1 of 2	2
PR	OJECT:	Hamm Road			CLIE	NT:	Hazen & Sa Nashville, 1	awyer				-	
SIT	ſE:	155 Hamm Road Chattanooga, Tennessee					Nuonvine, 1						
GRAPHIC LOG		N See Exploration Plan 5.054532° Longitude: -85.329766°	Surface Elev.: 676.12 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
5357	0.3_\ <b>ASP</b>	HALT	676										
	3.0 <b>FILL</b>	- POORLY GRADED GRAVEL, lig	673		_		50			NA	0		
DT 3/30/18	Diaci	< mineral staining		5	_		1-1-2 N=3			NA	16		
ATEMPLATE.G					-		1-2-1 N=3			NA	16		
RACON_DAT				10	-	X	1-1-1 N=2			NA	19		
GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18					-								
E2175127 HAMIN				15	-  -  -	X	4-7-10 N=17			NA	11		
0G-NO WELL B	17.0 <u>LEA</u> and	<u>N CLAY (CL)</u> , trace gravel, angular light gray, medium stiff to stiff	; light brown		-								
GEO SMART L				20		X	3-4-5 N=9			2.5 (HP)	26		
AL REPORT.					-								
				25	- j-	X	3-3-4 N=7			2.25 (HP)	23		
PARATED	Stratificat	ion lines are approximate. In-situ, the trans	ition may be gradual.		_		Hamn	ner Type: Auto	matic				
3 1/ 101 \AFID Aband	icement Met 4 HSA ionment Met		See Exploration an description of field used and additiona See Supporting Info symbols and abbre	and la I data ormati	boratory (If any). on for e	/ proc	edures						
00 00													
	WATE While dr	ER LEVEL OBSERVATIONS illing					Boring S	Started: 01-09-2	2018	Borir	ng Com	pleted: 01-09-2	2018
S BO		-	51 Lost							Drille	er: J. Fr	eeman	
Ϊ					oga, TN		Project	No.: E2175127					

	В	ORING L	_00	G N	Ю.	T-11				F	age 2 of 2	2
PR	OJECT: Hamm Road		C	LIEI	NT:	Hazen & Sav Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054532° Longitude: -85.329766° Surface DEPTH LEAN CLAY (CL), trace gravel, angular, light and light gray, medium stiff to stiff (continued	Elev.: 676.12 (Ft.) ELEVATION (Ft.) prown	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			- 30- -		X	5-6-7 N=13			2.5 (HP)	23		
	37.0	639	- - 35 -		X	6-6-8 N=14			2.5 (HP)	22		
	LEAN CLAY WITH SAND (CL), light brown, so medium stiff	ft to	- - 40 -		X	1-2-1 N=3			NA	23	28-20-8	78
			- - 45		X	1-2-3 N=5			NA	27		
	51.0	625	- - 50-			50/3"	,		<u>NA</u>	_22_;		
	Auger Refusal at 51 Feet Stratification lines are approximate. In-situ, the transition may					Hamme	er Type: Auto	matic				
3 1/- Aband	nonment Method:	See Exploration and description of field at used and additional of See Supporting Infor symbols and abbrevi	data (If mation	any). for ex		on of						
	WATER LEVEL OBSERVATIONS While drilling	<b>Tien</b> 51 Lost M Chatt		Dr Ste	_	Drill Rig:	arted: 01-09-2 o.: E2175127	2018		g Comp er: J. Fre	oleted: 01-09-	2018

PR	OJECT: Hamm Road		CLIENT: Hazen & Sawyer Nashville, TN										
SIT	E: 155 Hamm Roa Chattanooga, T												
2	LOCATION See Exploration Plan Latitude: 35.054394° Longitude: -85.3			DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	
	DEPTH		Elev.: 676.54 (Ft.) ELEVATION (Ft.)	DEPT	WATEF OBSER	SAMPL	FIELD	RECO	Ϋ́ς,	LABOF HP	CONTI	LL-PL-PI	
	FILL - LEAN CLAY , trace brown and dark brown, black brown brown and brown black brown bla	gravel, angular, red ack mineral staining	ldish	_									
				-		A	4-4-6 N=10				14		_
				- 5 -	-		3-4-6 N=10				16		
				-			3-5-5 N=10				17		+
	8.0 LEAN CLAY (CL), trace g	ravel angular light	668.5 2000	_	-	$\vdash$							┢
	and grayish brown, mediu staining	m stiff to stiff, black	mineral	- 10-		X	3-5-7 N=12			2.5 (HP)	18		
				-	-								
				-	-		4-4-4 N=8			1.5 (HP)	22		-
	17.0		659.5	15- -									
	FAT CLAY (CH), trace gra brown, light brown and gra black mineral staining	ivel, angular, reddisł ayish brown, mediun	า	-									
				- 20-	-	X	2-3-3 N=6			1.5 (HP)	30	59-23-36	
	22.0 <u>SILTY CLAY (CL-ML)</u> , ligt	nt gray, stiff to very s	654.5 stiff	-									
				-			5-7-6 N=13				26		
				25– -									
	Stratification lines are approximate.	In-situ, the transition may	y be gradual.				Н	ammer Type: A	utomatic				
	cement Method: 4 HSA		See Exploration and description of field a used and additional	l data (li	f any).		dures	otes:					
	onment Method: ng backfilled with auger cuttings upon	completion.	See Supporting Info symbols and abbre	ormation viations	for ex	planati	on of						
	WATER LEVEL OBSERVA						Bori	ing Started: 12-1	5-2017	Borir	ng Com	pleted: 12-18-	-20
No free water observed while drilling									_			_	

		I	BORING	LO	G I	0	. T-12				F	Page 2 of :	2
PR	OJECT:	Hamm Road			CLIE	NT:	Hazen & Sa Nashville,	awyer				0	
SI	TE:	155 Hamm Road Chattanooga, Tennessee					Nastiville,	IN					
GRAPHIC LOG	Latitude: 35	N See Exploration Plan .054394° Longitude: -85.330194° Surface	e Elev.: 676.54 (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
	DEPTH SILT (cont	<u>Y CLAY (CL-ML)</u> , light gray, stiff to very <i>inued)</i>	ELEVATION (Ft.) stiff		_								
				30	_		6-8-9 N=17				21		
TE.GDT 3/30/18	trace	gravel, angular			_								
DATATEMPLA				35	_		4-5-4 N=9			1.0 (HP)	44		
NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	37.0 <u>LEAN</u> gray	<u>N CLAY WITH GRAVEL (CL)</u> , angular, li and light brown, hard	639.5 ght		_								
HAMM ROAD.C				40	_		9-42-9 N=51				27		
/ELL E2175127					_								
NON-0	44.3	er Refusal at 44.3 Feet	632			$\times$	10-50/3"				21		
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG- Duedqy (1 back) 1 back (2 back) 1 back) 1 back (2 back) 1 back (2 back) 1 back (2 back) 1 back	Auge												
ARATED FRO	Stratificati	on lines are approximate. In-situ, the transition m	nay be gradual.				Hami	mer Type: Auto	omatic				
Advar 3 1/ Abanc Bor	/4 HSA	ement Method: HSA See Explora description used and ac See Suppor symbols and backfilled with auger cuttings upon completion.			borator (If any) on for e	y proc	edures	:					
	_												
		vater observed while drilling	<b>Ter</b>	72			Boring	Started: 12-15-	2017		-	pleted: 12-18-	2017
IIS BO			51 Lost M	Mound	d Dr Ste	135		-		Drille	er: J. Fr	eeman	
É			Cha	ttanoo	oga, TN		Project	No.: E2175127	,	1			

## **BORING LOG NO. T-13** Page 1 of 3 **PROJECT: Hamm Road CLIENT: Hazen & Sawyer** Nashville, TN SITE: 155 Hamm Road Chattanooga, Tennessee ATTERBERG LIMITS PERCENT FINES LOCATION See Exploration Plan WATER LEVEL OBSERVATIONS SAMPLE TYPE **GRAPHIC LOG** WATER CONTENT (%) LABORATORY HP (tsf) FIELD TEST RESULTS RECOVERY (%) DEPTH (Ft.) Latitude: 35.054428° Longitude: -85.329564° RQD (%) LL-PL-PI Surface Elev.: 674.82 (Ft.) ELEVATION (Ft.) DEPTH FILL - LEAN CLAY WITH GRAVEL, angular, reddish brown, brown and light brown 1.25 3-3-5 (HP) N=8 3-4-5 N=9 5 2-2-3 N=5 -low recovery 2-3-2 -low recovery N=5 10 5-5-3 -low recovery N=8 15 3-4-4 N=8 20 653 1.2 LEAN CLAY (CL), trace sand, angular, light brown and light gray, stiff to very stiff 6-10-10 4.0 (HP) N=20 25 Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic Advancement Method: Notes: See Exploration and Testing Procedures for a 3 1/4 HSA description of field and laboratory procedures NQ2 Wireline Core used and additional data (If any) Supporting Information for explanation of See Abandonment Method: symbols and abbreviations. Boring backfilled with auger cuttings upon completion. WATER LEVEL OBSERVATIONS Boring Started: 12-19-2017 Boring Completed: 12-19-2017 No free water observed while drilling Drill Rig: Driller: J. Freeman 51 Lost Mound Dr Ste 135 Project No.: E2175127 Chattanooga, TN

GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON\_DATATEMPLATE.GDT 3/30/18 THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.

	E	BORING L	OGI	NC	). T-1	3				F	Page 2 of 3	3
PR	OJECT: Hamm Road		CLIE	ENT	: Hazer Nashv	n & Saw ville, TN	yer I					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG		ELEVATION (Ft.)	UEPTH (Ft.) WATER LEVEL OBSEPVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	and light gray, stiff to very stiff (continued)		- - 30- -			9-11 =20			3.25 (HP)			
		3	- - 35 -			6-6 =12			2.0 (HP)			
	42.0	633	- - 40 -			7-9 =16						
	LEAN CLAY (CL), trace sand, angular, gray, v soft 46.0 Auger Refusal at 46.0' ADVANCED CASING		- - 15 -			0-0 =0						
	49.1 <b>Begin NQ2 Wireline Rock Core</b> <u>BEDDED SILICIOUS ZONES OF CHERT AND</u> <u>DOLOMITE</u> , light brown and light gray, slightly weathered, medium strong	<u>625.5</u> 2	- 50 -									
	Stratification lines are approximate. In-situ, the transition may	y be gradual.			I	Hammer	Type: Auto	matic				I
3 1/ NQ: Aband	4 HSA 2 Wireline Core	See Exploration and Te description of field and used and additional da See Supporting Inform symbols and abbreviat	laborator ta (If any) ation for e	y pro	cedures	Notes:						
	WATER LEVEL OBSERVATIONS No free water observed while drilling	JICON 51 Lost Mou Chattar		e 135	חנ	Drill Rig:	rted: 12-19-2 .: E2175127	2017	_	ng Comp er: J. Fre	oleted: 12-19- eeman	2017

				BORING	LC	)G	i N	10	. T-1	3				F	Page 3 of 3	3
	PR	OJECT: Hamm	Road			CL	IE	NT:	Hazer	n & Saw ville, TN	vyer					
	SIT		mm Road nooga, Tennesse	9 <b>6</b>					Nasii	vine, Tr	•					
	GRAPHIC LOG	LOCATION See Exp Latitude: 35.054428° Lo		Surface Elev.: 674.82 (Ft.)	DEPTH (Ft.)		WA IEK LEVEL OBSERVATIONS	SAMPLE TYPE	FIFI D TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	Advan 31/1 NQ2 Aband	DOLOMITE, lig weathered, me	DUS ZONES OF CH         Iht brown and light gr         idium strong (continue         dium strong (continue         iht gray, slightly weat         ht gray, slightly weat         approximate. In-situ, the tr         cuttings upon completion.	ay, slightly ed) 605 hered, medium 605	75 75 and Isa		Proceatory).	edure	Depth 7 Run L 20 Depth: Run Le	Notes:	63					
RING L		No free water obse	OBSERVATIONS erved while drilling	— 1[er			Γ				rted: 12-19-2	2017	_	-	oleted: 12-19-	2017
HIS BO			-	51 Lost	Moun	nd Dr	Ste			Drill Rig:	·· E2175107		Drille	er: J. Fr	eeman	
⊨				Ch	attano	oga,	IN			Project No	.: E2175127					

PRC	DJECT: Hamm Road					Hazen	& Sawy ille, TN	ver			r	Page 1 of	<u> </u>
SITE	E: 155 Hamm Road Chattanooga, Tennessee					Nashv	ille, in						
υ Ο	LOCATION See Exploration Plan		Ft.)	EVEL TONS	-YPE	LST ST	Ś	RY		ORY )	۲ (%)	ATTERBERG LIMITS	;
GRAPH		Elev.: 676.58 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	KESULI	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	
	DEPTH ).6 CONCRETE	ELEVATION (Ft.) 676		-									┢
	FILL - LEAN CLAY WITH GRAVEL, angular, brown and reddish brown		-			4-4 N=							_
			-		$\square$	IN=	-0						-
			- 5 -		$\square$	3-4 N=				1.75 (HP)			
			-			3-6 N= <sup>-</sup>				1.75 (HP)			-
	B.0 FILL - GRAVELLY LEAN CLAY, angular, rec brown, black mineral staining	668.5 Idish	-	-		2.5	7			. ,			-
			10-		Д	3-5 N=							+
			-	_									
			-			7-7 N=1				2.5 (HP)			
		0505	15- -	-									
	7.0 FILL - SANDY LEAN CLAY, reddish brown	659.5	-	-									
			- 20-	_	X	4-5 N=							
24 11 12 22		654.5	-										
	FAT CLAY (CH), trace gravel, angular, light g light brown and reddish brown, stiff	iray,	-			6-6-	.10						_
			25-		Д	N=							+
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.	-	1			Hammer T	ype: Auto	matic				
dvance 3 1/4	ement Method: HSA	See Exploration and description of field a used and additional	and lab	oratory	proce	es for a edures	Notes:						
bandor Boring	nment Method: g backfilled with auger cuttings upon completion.	See Supporting Info symbols and abbrev			kplana	ition of							
	WATER LEVEL OBSERVATIONS						Boring Starte	ed: 12-15-2	2017	Borir	ng Comi	oleted: 12-15-	-20
Z	While drilling	ller	٢٢				Drill Rig:			_	er: J. Fr		
		51 Lost I		Dr Ste			Project No.:						

	I	BORING								P	Page 2 of :	3
PR	OJECT: Hamm Road		C	LIEI	NT:	Hazen & Sa Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					·						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.05433° Longitude: -85.329995°	e Elev.: 676.58 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
ں ا	DEPTH	ELEVATION (Ft.)		ЗB	SA	ш.			Γ	ŏ		Ш Ь
	27.0 FAT CLAY (CH), with black sand, reddish bro and black, stiff	<u>649.5</u> own	- - - 30-	-	X	6-7-7 N=14						
	33.0 LEAN CLAY WITH GRAVEL (CL), angular, re brown and light brown, very soft to hard -no recovery	643.5 eddish	- - 35-		X	0-0-0 N=0						
			- - 40 -	-	X	2-2-4 N=6						
			- 45- -	-		50/1"						
	-no recovery		- - 50- -	-	$\sim$	50/2"						
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.		1		Hamm	ner Type: Auto	matic				
3 1/- Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data (li rmatior	f any). i for ex								
$\nabla$	WATER LEVEL OBSERVATIONS		_			Boring S	tarted: 12-15-2	2017	Borin	ig Comp	bleted: 12-15-	2017
	While drilling	S1 Lost N	lound I	Dr Ste					Drille	er: J. Fre	eeman	
		Cha	ttanoog	a, IN		Project l	No.: E2175127		1			

	I	BORING	LO	GN	10	. T-1	4				F	Page 3 of 3	3
PR	OJECT: Hamm Road			CLIE	NT:	Hazer	n & Saw ville, TN	vyer N				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Huom	, , , , , ,	•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.05433° Longitude: -85.329995° Surface DEPTH	Elev.: 676.58 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	LEAN CLAY WITH GRAVEL (CL), angular, re brown and light brown, very soft to hard (con	eddish		_									
	-no recovery		55-	-			)/1")						
	59.0 -no recovery Auger Refusal at 59 Feet	617.5		_		50	)/1"						
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.					Hamme	r Type: Auto	matic				
3 1/- Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data ( ormatic	(If any). on for ex			Notes:						
	WATER LEVEL OBSERVATIONS						Boring Sta	irted: 12-15-2	2017	Borir	ng Comp	oleted: 12-15-	2017
$\square$	While drilling	Iler	٢٦	DC			Drill Rig:			Drille	er: J. Fre	eeman	
		51 Lost I Cha		Dr Ste ga, TN	135	_	-	o.: E2175127					

		E	BORING	LO	GI	NO	. T-1	5				F	Page 1 of ₄	4
PR	OJECT:	Hamm Road			CLIE	NT:	Hazer	n & Saw /ille, TN	yer					
SIT	E:	155 Hamm Road Chattanooga, Tennessee					Nasin	/iiie, iii						
LOG	LOCATION	See Exploration Plan		⁼t.)	VEL	ТҮРЕ	ST	S	RY		ORY )	د (%)	ATTERBERG LIMITS	INES.
GRAPHIC LOG	Latitude: 35	054334° Longitude: -85.329764°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE T	LD TE	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
GR,	DEPTH	Surface	Elev.: 676.53 (Ft.) ELEVATION (Ft.)	DE	NA1 OBSF	SAM		ц	RE		LAB	CO		PERC
Å	0.5 <b>CON</b>	CRETE	676											
	<u>FILL</u>	BLACK SANDY CLAY				$\square$	5-9	9-5						
					-	$\square$	N=	:14						
				_		X		2-2 =4						
				5										
	with c	oncrete, low recovery				$\mid$	4-5	0/0"						
							2-1	3-4						
				10	_	$\square$		=7						
un Li				10	_									
	12.0		664.5											
	FILL reddis	<ul> <li>LEAN CLAY WITH GRAVEL, angular, sh brown</li> </ul>			_									
					_		3-2	2-2						
	-IOW r	ecovery		15	_	$\square$	N	=4						
					_									
	17.0 I FAN	CLAY (CL), light brown, reddish brown	659.5 and		_									
	light g	gray, medium stiff to stiff, black mineral	staining		_									
					_	$\square$		3-4 =7			2.0			
				20	_	$\square$		-/			(HP)			
					-									
					_									
					-									
					-	$\mathbb{X}$		3-4 =7			1.5 (HP)			
				25	-						( )			
/////	Stratificatio	on lines are approximate. In-situ, the transition ma	av be gradual		-			Hammer	Type: Autor	matic				
	Stratificatio		ay be gradual.					nammer	Type. Autor	nauc				
3 1/4	cement Meth 4 HSA 2 Wireline Co		See Exploration and description of field a	d Test and la	ing Pro	<mark>cedur</mark> e y proc	es for a edures	Notes:						
NQ2			used and additional See Supporting Info				ation of							
		with auger cuttings upon completion.	symbols and abbrev	viatior	IS.									
$\bigtriangledown$	WATE While dril	R LEVEL OBSERVATIONS						Boring Star	ted: 12-21-2	017	Borir	ig Com	oleted: 12-21-2	2017
	wille ull	······································	51 Lost I					Drill Rig:			Drille	er: J. Fro	eeman	
					oga, TN			Project No.	E2175127					

	BORIN	GL	.0	GN	10	. T-15				P	age 2 of 4	ļ
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & Sav Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054334° Longitude: -85.329764° Surface Elev.: 676.53 DEPTH ELEVATION	` ´	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) LABORATORY	HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	LEAN CLAY (CL), light brown, reddish brown and light gray, medium stiff to stiff, black mineral staining (continued)	(Fl.)	-									
		:	- 30-		X	3-4-5 N=9		2. (ŀ	25 IP)			
	32.0 e LEAN CLAY (CL), gray, very soft	644.5	-	-								
		:	- 35-	-	X	0-0-0 N=0						
			-	-								
	stiff		- 40	-	Χ	18-7-4 N=11						
	41.8 Auger Refusal at 41.8'	<u>634.5</u>	-	-								
			45- - -	-								
			-	_								
			50- - -	-								
	Stratification lines are approximate. In-situ, the transition may be gradual.					Hamme	er Type: Autom	atic				
3 1/-	vancement Method: See Exploration 3 1/4 HSA description of used and addi See Support			f any).								
	onment Method: symbols and a symbol s	abbrevia	ations	s.	pidf18			<u> </u>				
$\nabla$	WATER LEVEL OBSERVATIONS While drilling					Boring St	arted: 12-21-20	17 F	Boring	Comp	oleted: 12-21-2	2017
<u> </u>					_	Drill Rig:		r	Driller:	J. Fre	eeman	
	51	Lost Mo Chatta			135	Project N	o.: E2175127					

## **BORING LOG NO. T-15**

		BORING L	0	GN	<b>O</b>	. 1-1:	5				F	Page 3 of	4
PR	OJECT: Hamm Road		C	CLIEN	NT:	Hazen Nashv	& Saw ille, TN	yer					
SI	TE: 155 Hamm Road Chattanooga, Tennessee												
g	LOCATION See Exploration Plan		~	SN	ЫП	⊢ ⊢		~		ž	(%	ATTERBERG LIMITS	ES I
GRAPHIC LOG	Latitude: 35.054334° Longitude: -85.329764°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	ESULIS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
GR		. ,	ä	WA.	SAN		r	R		LAE	CO		PER
	DEPTH ADVANCED CASING (continued)	ELEVATION (Ft.)											
			- 55- - - - 60- - - - - - - 65-										
			- - 70- - - 75- - -										
			-	-									
	Stratification lines are approximate. In-situ, the tran	sition may be gradual.					Hammer	Type: Auto	matic				
3 1/ NQ Abano	ncement Method: /4 HSA /2 Wireline Core donment Method: ing backfilled with auger cuttings upon completion.	See Exploration and T description of field and used and additional da See Supporting Inform symbols and abbrevia	ata (If natior	f any). I for exp			Notes:						
	WATER LEVEL OBSERVATIONS					E	Boring Star	ted: 12-21-2	2017	Borir	ng Com	oleted: 12-21-	2017
$\square$	While drilling	— llerr	0	C			Drill Rig:			_	er: J. Fre		
		51 Lost Mo Chatta			35	F	-	: E2175127		+			

## **BORING LOG NO. T-15** Page 4 of 4 **PROJECT: Hamm Road CLIENT: Hazen & Sawyer** Nashville, TN SITE: 155 Hamm Road Chattanooga, Tennessee ATTERBERG LIMITS PERCENT FINES LOCATION See Exploration Plan WATER LEVEL OBSERVATIONS SAMPLE TYPE **GRAPHIC LOG** WATER CONTENT (%) LABORATORY HP (tsf) RECOVERY (%) FIELD TEST RESULTS DEPTH (Ft.) Latitude: 35.054334° Longitude: -85.329764° RQD (%) LL-PL-PI Surface Elev.: 676.53 (Ft.) ELEVATION (Ft. DEPTH ADVANCED CASING (continued) 80 80.7 596 . . o ( SAND AND CHERT FRAGMENTS 000 85 0000 Ø 000 90-10 92.0 584.5 5 Begin NQ2 Wireline Rock Core DOLOMITE, light brown and light gray, slightly weathered, vugs, minor shale partings, strong rock 95 RUN 1: Depth: 92.3' -102.3' 91 74 Run Length: 10' 100 102.3 574 Coring Terminated at 102.3 Feet Stratification lines are approximate. In-situ, the transition may be gradual. Hammer Type: Automatic Advancement Method: Notes: See Exploration and Testing Procedures for a 3 1/4 HSA description of field and laboratory procedures NQ2 Wireline Core used and additional data (If any) Supporting Information for explanation of See Abandonment Method: Boring backfilled with auger cuttings upon completion. symbols and abbreviations. WATER LEVEL OBSERVATIONS Boring Started: 12-21-2017 Boring Completed: 12-21-2017

51 Lost Mound Dr Ste 135

Chattanooga, TN

Drill Rig:

Project No.: E2175127

Driller: J. Freeman

E2175127 HAMM ROAD.GPJ TERRACON\_DATATEMPLATE.GDT 3/30/18 GEO SMART LOG-NO WELL THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.

While drilling

PR	OJECT: Hamm Road			CLIE	NT:	Hazen & Nashvil	& Sawyer le, TN					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054178° Longitude: -85.329894°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
GR∕		Elev.: 676.41 (Ft.)	В	WAT	SAM	빌꾼	RE		LAB(	CON		ERO
۵ N		ELEVATION (Ft.) 676										<u> </u>
Å	BLACK SAND AND GRAVEL	070		_								<u> </u>
				_	Д	8-3-3 N=6				3		
				_		4-4-4 N=8				7		
			5-	_								
0					Д	3-3-2 N=5				8		<u> </u>
			10-			3-2-1 N=3				7		
				-								
日本			15-	_		8-7-3 N=10				9		
			10	_								
	-no recovery		20-	_	$\square$	4-3-3 N=6						
	22.0	654.5		_								
	LEAN CLAY (CL), trace sand, angular, light be and grayish brown, medium stiff to stiff	rown		_								
			25	_	Д	4-3-4 N=7			3.0 (HP)	23		
///// 	Stratification lines are approximate. In-situ, the transition ma	y be gradual.		_			Hammer Type: Auto	omatic				
	cement Method: 4 HSA	See Exploration and description of field ar used and additional d	id lat	poratory	edure proce		Notes:					
	onment Method: ng backfilled with auger cuttings upon completion.	See Supporting Information Symbols and abbrevia	natio	on for ex	plana	ation of						
	WATER LEVEL OBSERVATIONS						oring Started: 12-15-	2017	Borir	na Com	pleted: 12-15-	2017
$\triangleleft$	While drilling	llpr					-	_017		-	-	
		51 Lost M			· ·		ill Rig:		Drille	er: J. Fr	eeman	
				ga, TN		Pr	oject No.: E2175127	,				

	BC	RING I		G N	10.	T-16				F	Page 2 of 3	3
PR	OJECT: Hamm Road		C	LIE	NT:	Hazen & Sa Nashville, 1	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					,						
GRAPHIC LOG	DEPTH ELE LEAN CLAY (CL), trace sand, angular, light brow	/.: 676.41 (Ft.) EVATION (Ft.) 'n	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	and grayish brown, medium stiff to stiff <i>(continue</i>	d)	- - 30- -		X	4-4-6 N=10			2.75 (HP)	23		
	<ul> <li>32.0</li> <li>CLAYEY SAND WITH GRAVEL (SC), angular, reddish brown and light brown, medium dense, b mineral staining</li> <li>37.0</li> </ul>	644.5 lack 639.5	- - 35- -		X	6-5-5 N=10			2.0 (HP)	16	43-22-21	44
	CLAYEY GRAVEL WITH SAND (GC), angular, reddish brown, very dense, black mineral staining		- - 40- -		X	13-30-33 N=63				7		
			- 45- -		X	38-32-29 N=61				17		
			_  50— _		X	20-38-41 N=79				14		
<u>, Q.</u> 	Stratification lines are approximate. In-situ, the transition may be	gradual.				Hamm	ner Type: Auto	matic				
3 1/4 Aband	use See	e Exploration and cription of field a d and additional e Supporting Info abols and abbrev	data (If rmation	any). for ex								
	WATER LEVEL OBSERVATIONS While drilling	S1 Lost N Chat		Dr Ste			itarted: 12-15-2				pleted: 12-15-2	2017

	I	BORING	LO	GN	10	. T-16	6				F	Page 3 of 3	3
PR	OJECT: Hamm Road		(	CLIE	NT:	Hazen Nashv	& Saw	yer					
SIT	TE: 155 Hamm Road Chattanooga, Tennessee					Nasiiv	ine, 11						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054178° Longitude: -85.329894° Surface	e Elev.: 676.41 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE		RESULIS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
<u>.</u>	CLAYEY GRAVEL WITH SAND (GC), angula reddish brown, very dense, black mineral sta	ır,	_										
	(continued)		55-		X	15-31 N=6	1-30 61				22		
	57.0 <u>POORLY GRADED GRAVEL WITH SAND (G</u> angular, dark gray, very dense	619.5 i <b>P)</b> ,	-										
			60-	-		50/	1"				16		
			-	-									
			- 65-	-		50/	' <u>2"</u> j				9_)		
			-		X	50/	2"				13		
	70.0 Boring Terminated at 70 Feet	606.5	70-										
<u> </u>	Stratification lines are approximate. In-situ, the transition m	ay be gradual.					Hammer	Type: Auto	matic				
	cement Method: 4 HSA	See Exploration an description of field	d Testir and lab	ng Proc	edure proce	es for a edures	Notes:						
	lonment Method: ing backfilled with auger cuttings upon completion.	used and additiona See Supporting Info symbols and abbre	ormatio	n for ex	plana	ation of							
$\bigtriangledown$	WATER LEVEL OBSERVATIONS While drilling	ller					Boring Sta	rted: 12-15-2	2017	Borir	ng Com	oleted: 12-15-	2017
		- <b>IICI</b> 51 Lost					Drill Rig:			Drille	er: J. Fro	eeman	
			ittanoo		100	F	Project No.	: E2175127					

				BORING	LO	GN	10	. T-17				F	Page 1 of 3	3
Р	ROJ	JECT:	Hamm Road		(	CLIE	NT:	Hazen & Sa Nashville,	awyer					
S	ITE:		155 Hamm Road Chattanooga, Tennessee					Nasrivine,						
GRAPHIC LOG	Lat		See Exploration Plan 054953° Longitude: -85.329426° Surfac	e Elev.: 674.51 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		FILL - brown	<b>GRAVELLY LEAN CLAY</b> , angular, re , light brown and black			_								
2112		-110 16	covery			_	Д	2-2-4 N=6						
0/18					5 -	_	X	1-1-2 N=3						
GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18					5-	_		1-1-1 N=2						
DATATEMPL						_		1-1-1						
ERRACON_I				10-	_	$\square$	N=2							
KOAD.GPJ T					_									
127 HAMM F				15-	_	$\square$	3-4-4 N=8							
WELL E2175	17.		CLAY (CL), light brown and light gray	657.5		_								
LOG-NO		mediu	m stiff to stiff			_		3-3-5			1.75			
GEO SMAR					20-	_	$\square$	N=8			(HP)			
						_								
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.					25-	_	$\mid$	3-4-6 N=10			1.75 (HP)			
ARATED FRO	s	tratificatio	nay be gradual.		-		Hami	mer Type: Auto	omatic					
Advi Advi 1 0	ancem 1/4 HS	nent Metho SA	bd:	See Exploration and description of field a used and additional	and lab	poratory	proce	es for a Notes edures	:					
IV LON SI S		nent Metho backfilled	od: with auger cuttings upon completion.	See Supporting Info symbols and abbrev	rmatio	n for ex	kplana	ation of						
le Loc		WATE	R LEVEL OBSERVATIONS	76				Boring	Started: 01-05-2	2018	Borir	ng Com	pleted: 01-05-2	2018
	N	lo free w	ater observed while drilling	- 1ler	٢٦							er: J. Fr		
THISE				51 Lost M	Nound				No.: E2175127	,	+			

	E	BORING LO	OG I	10	. T-17			F	Page 2 of 3	3
PR	OJECT: Hamm Road		CLIE	NT:	Hazen & Sav Nashville, Th	vyer N				
SIT	E: 155 Hamm Road Chattanooga, Tennessee				·····, ··	-				
GRAPHIC LOG	DEPTH	Elev.: 674.51 (Ft.)	UEPTH (Ft.) WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%) ROD	(%) (%) LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	<b>LEAN CLAY (CL)</b> , light brown and light gray, medium stiff to stiff <i>(continued)</i>	3		X	4-6-7 N=13		2.0 (HP)			
		3	- - 5 -	X	2-2-3 N=5		1.0 (HP)			
		4	- - 0- -	X	2-2-4 N=6		1.25 (HP)			
	47.0	627.5	- - - 5 -	X	1-3-3 N=6		1.25 (HP)			
	<u>CLAYEY GRAVEL (GC)</u> , light brown, very der		- - 60 -	X	50/4"					
	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.			Hamme	r Type: Automat	lic			<u> </u>
3 1/ Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and Te description of field and used and additional dat See Supporting Informa symbols and abbreviati	laboratory ta (If any). ation for e	/ proc	edures					
	WATER LEVEL OBSERVATIONS No free water observed while drilling	<b>Tierr</b> 51 Lost Mou Chattar		135	Drill Rig:	nted: 01-05-2018		ng Comj er: J. Fro	pleted: 01-05-; eeman	2018

			BORING L	0	GN	10	. T-1	7				F	Page 3 of 3	3
PR	OJECT:	Hamm Road		0	CLIE	NT:	Hazer	n & Saw /ille, TN	vyer					
SIT		155 Hamm Road Chattanooga, Tennessee					Nasin	/iiie, Tr	•					
GRAPHIC LOG		See Exploration Plan 154953° Longitude: -85.329426°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	IELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5	DEPTH	Surrac EY GRAVEL (GC), light brown, very do	ELEVATION (Ft.)		AN OBS	SAI	ш		<u>к</u>		ΓA	ö		PER
	<i>(contir)</i> -no ree	ued)		-		X	50	/2"						
			Ę	- 55-										
	57.0 POOR very d	LY GRADED GRAVEL (GP), light brow ense	617.5 wn,	-	_									
• <b>•</b> •				-	-	$\times$	7-5	0/4"						
			6	-06 - -	-									
				-	-	$\times$		/2//						
			e	- 65-	-		50	<u>13</u>						
				-	_									
<u>,                                    </u>		Refusal at 69.1 Feet	605.5	-	_	$\times$	5-5	0/1"						
	Stratification	n lines are approximate. In-situ, the transition n	nay be gradual.		1			Hammer	r Type: Auto	matic	l			
	cement Metho 4 HSA	d:	See Exploration and T description of field and used and additional da	ata (I	f any).			Notes:						
	onment Metho	d: vith auger cuttings upon completion.	<ul> <li>See Supporting Inform symbols and abbreviat</li> </ul>			piana								
		R LEVEL OBSERVATIONS						Boring Sta	rted: 01-05-2	2018	Borir	ng Com	oleted: 01-05-2	2018
	No free wa	ater observed while drilling	]lerr					Drill Rig:			Drille	er: J. Fro	eeman	
			– 51 Lost Mo Chatta			135		Project No	.: E2175127					

			BORING	LC	)G I	NO	. T-18				F	Page 1 of 3	3
PF	ROJECT	: Hamm Road			CLIE	NT:	Hazen & Nashville	Sawyer					
Sľ	TE:	155 Hamm Road Chattanooga, Tennessed	9					,					
GRAPHIC LOG	Latitude:	ON See Exploration Plan 35.054934° Longitude: -85.328981°	Surface Elev.: 669.44 (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
135	0.3_\ <b>AS</b>		ELEVATION (Ft.)										
	red	L - LEAN CLAY WITH GRAVEL (C dish brown, light gray and brown	; <u>∟</u> , anguiar,		-		4-3-5 N=8				10		
3/30/18				5	_		3-2-2 N=4				14		
APLATE.GDT					_		3-2-2 N=4				14		
N_DATATEN					_		3-4-5 N=9			1.5 (HP)	17		
0 WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	12.0 <b>FA</b>	<u>r CLAY (CH)</u> , light brown, medium	657.5 stiff	10	 - -								
5127 HAMM ROA			15	- - ;		2-2-3 N=5			1.0 (HP)	27	50-22-28	86	
3-NO WELL E217		AN CLAY (CL), trace sand, angula dium stiff to stiff	652.5 r, light brown,		-								
GEO SMART LOG-N				20	_ }		3-3-4 N=7			2.0 (HP)	23		
					-								
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.				25	_ ;		7-5-8 N=13			3.0 (HP)	23		
ARATED FR	Stratifica	ation lines are approximate. In-situ, the tra	nsition may be gradual.		_		Ha	ammer Type: Auto	omatic				
Adva 3 1 NC	ncement Me /4 HSA 2 Wireline		See Exploration an description of field used and additiona	and la I data	borator (If any)	y proc	edures	tes:					
LON Aban SI DO	-	ed with auger cuttings upon completion.	See Supporting Info symbols and abbre			xplana	ation of						
	WA While d	TER LEVEL OBSERVATIONS						ng Started: 12-18-	2017	Borir	ng Com	pleted: 12-18-:	2017
THIS BOF			51 Lost Cha	Moun		135		Rig: ect No.: E2175127		Drille	er: J. Fr	eeman	

	BORIN	G١	_00	GN	0.	T-18				F	Page 2 of 3	3
PR	OJECT: Hamm Road		C	CLIEI	NT:	Hazen & Sav Nashville, Th	vyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054934° Longitude: -85.328981° Surface Elev.: 669.44 ( DEPTH ELEVATION ( LEAN CLAY (CL), trace sand, angular, light brown,		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	medium stiff to stiff (continued)		- - 30- -	-	X	3-5-5 N=10			2.0 (HP)	25		
		32.5	- - 35- -		X	2-3-2 N=5			0.75 (HP)	24		
	<b>LEAN CLAY (CL)</b> , trace sand, angular, gray, very soft		- - 40 -	-	X	0-0-0 N=0				28		
	47.06	622.5	- - 45 -	-	X	0-0-0 N=0				29		
	GRAVELLY LEAN CLAY WITH SAND (CL), angular, light gray and dark gray, hard 50.1 Auger Refusal at 41.8' ADVANCED CASING	<u>)19.5</u>	- - 50-	-	X	25-25-25 N=50				4		
	51.8 6 Stratification lines are approximate. In-situ, the transition may be gradual.	<u>617.5</u>	_			Hamme	r Type: Auto	matic				
3 1/ NQ2 Aband	cement Method: 4 HSA 2 Wireline Core moment Method: ng backfilled with auger cuttings upon completion. See Exploration Used and addi See Supportin symbols and a	field a itional ng Infor	Ind labo data (If rmatior	oratory f any). i for ex	proce	dures						
		Lost N		Dr Ste			arted: 12-18-2 0.: E2175127	2017	_	g Comj er: J. Fre	oleted: 12-18- eeman	2017

			BORING	LC	)(	G N	10	. T-1	8				F	Page 3 of 3	3
	PR	OJECT: Hamm Road			С	LIE	NT:	Hazer Nash	n & Sav ville, TN	vyer N					
	SIT	FE: 155 Hamm Road Chattanooga, Tennessee								-					
	GRAPHIC LOG		e Elev.: 669.44 (Ft.)	DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPU TERRACON_DATATEMPLATE.GDT 3/30/18		DEPTH Begin NQ2 Wireline Rock Core DOLOMITE, light brown, light gray and light slightly weathered, minor shale bedding, stru (continued)  66.8 Coring Terminated at 66.8 Feet  Stratification lines are approximate. In-situ, the transition m icement Method: 4 HSA 2 Wireline Core Ionment Method: Ing backfilled with auger cuttings upon completion. WATED LEVEL ODDEPINATIONS	ong rock	and la I data ormati		Proc ratory any).	edure	RU Depth: 61 Run L Depth: 66 Run Le	<u>N 1:</u> : 51.8' - I.8' ength: 0' <u>N 2:</u> : 61.8' - 5.8' ength: 5'	64 65	26 30				
RING LC	$\nabla$	WATER LEVEL OBSERVATIONS While drilling	ller	<b>C</b> ;					-	irted: 12-18-2	2017		-	pleted: 12-18-	2017
'HIS BO			51 Lost		d D	r Ste			Drill Rig: Proiect No	o.: E2175127		Drille	er: J. Fr	eeman	
-				attai 10	Jyd	4, IIN				0121		1			

			BORING	LO	GN	10	. T-1	9				F	Page 1 of 3	3
PR	OJECT:	Hamm Road			CLIE	NT:	Hazer	n & Saw /ille, TN	/yer					
SIT	E:	155 Hamm Road Chattanooga, Tennessee					Nasin	nie, in						
2		See Exploration Plan 054898° Longitude: -85.329197° Surfac	e Elev.: 673.69 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH 0.7 <b>CONC</b>	CRETE	ELEVATION (Ft.)		- 0	00								۵.
		BLACK SAND	670.5		_	X	3-2 N:	2-2 =4						
	FILL and re	• GRAVELLY LEAN CLAY , angular, br eddish brown	own	5-	_	X		2-2 =4						
					_		2-2 N:	2-3 =5						
				10-	-	X		2-3 =5			1.0 (HP)			
				-										
				15	_	X	2-2 N:	2-4 =6						
	<u>17.0</u> FILL ·	CLAYEY GRAVEL, angular, light gra	656.5 Y		_									
				20				5-2 :17						
	22.0 LEAN mediu	CLAY (CL), light gray and light brown, Im stiff to stiff	651.5 ,		_									
				25	_	X		2-2 =4			1.0 (HP)			
	Stratificatio	n lines are approximate. In-situ, the transition m			_			Hommor	Type: Auto	motio				
	Stratificatio		lay be gradual.					Tiammer	Type. Auto	mauc				
3 1/4 Abando	cement Meth 4 HSA onment Meth ng backfilled		See Exploration an description of field used and additiona See Supporting Info symbols and abbre	and lat I data ( ormatio	boratory (If any). on for ex	proc	edures	Notes:						
<u> </u>	WATE	R LEVEL OBSERVATIONS						Devi Ci		040	- ·			0042
$\square$	While dril		1 <b>Ter</b>	٢,				Boring Sta	rted: 01-05-2	:018		ng Comp	oleted: 01-05-2	2018
			51 Lost Cha		l Dr Ste oga, TN	135			.: E2175127			л. <b>О</b> . ГП		

	E	BORING LO	OG I	NC	). T-19	9			F	Page 2 of 3	3
PR	OJECT: Hamm Road		CLIE	ENT	: Hazen Nashv	& Sawyei ille, TN	r				
SIT	E: 155 Hamm Road Chattanooga, Tennessee										
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054898° Longitude: -85.329197° Surface DEPTH	: Elev.: 673.69 (Ft.) ELEVATION (Ft.)	WATER LEVEL	SAMPLE TYPE	FIELD TEST	RESULIS	RaD	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	LEAN CLAY (CL), light gray and light brown, medium stiff to stiff <i>(continued)</i>			X	4-5 N=			2.5 (HP)			
		3	- - 5- -		3-5 N=			2.25 (HP)			
		4	    		2-4 N=			1.5 (HP)			
	light gray	4	- - - - -		2-3 N=	-4 -7		1.25 (HP)			
		5	- - i0 -		2-4 N=			1.5 (HP)			
	52.0 Stratification lines are approximate. In-situ, the transition ma	621.5 ay be gradual.	_			Hammer Type	e: Automatic				
3 1/- Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and Te description of field and used and additional dat See Supporting Informa symbols and abbreviati	ta (If any) ation for ε	).		Notes:					
	WATER LEVEL OBSERVATIONS While drilling	<b>Tierr</b> 51 Lost Mou Chattar		e 135	ן <b>ח</b> נ	Boring Started: Drill Rig: Project No.: E2			ng Com er: J. Fr	pleted: 01-05- eeman	2018

			BORING	LO	GN	10	. T-19	)			F	Page 3 of	3
PF	ROJECT:	Hamm Road			CLIE	NT:	Hazen a Nashvil	& Sawyer lle. TN				-	
SI	TE:	155 Hamm Road Chattanooga, Tennessee						,					
GRAPHIC LOG		N See Exploration Plan 3.054898° Longitude: -85.329197° Sur	face Elev.: 673.69 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
	POO brow	<b>RLY GRADED GRAVEL (GP)</b> , angula n			_								
				55 <sup>.</sup>	_	X	50/2						
	56.0 Auge	er Refusal at 56 Feet	617.5										
	Stratification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: 3 1/4 HSA See Exploration description of the					Proc	es for a	Hammer Type: Aut Notes:	omatic				
Aban Bo	donment Metl bring backfilled	nod: I with auger cuttings upon completion.	See Supporting Info symbols and abbre	l data ( ormatio	(If any). on for ex								
	WATE While dri	ER LEVEL OBSERVATIONS					В	oring Started: 01-05	-2018	Borir	ng Com	pleted: 01-05-	2018
			51 Lost	Mound			_	rill Rig: roject No.: E217512	7	Drille	er: J. Fr	eeman	

				BORING	LC	C	) N	10	. T-20				F	Page 1 of 4	4
PR	OJE	CT:	Hamm Road			CI	LIE	NT:	Hazen & Sa Nashville,	awyer TN					
SI	ſE:		155 Hamm Road Chattanooga, Tennessee	)					Nuonvine,						
GRAPHIC LOG			See Exploration Plan		DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
GRAP				Surface Elev.: 674.76 (Ft.)	DEP.		WATE DBSER	SAMPI	FIELU	RECO	<u>π</u> Ο	LABOF	CONT	LL-PL-PI	PERCE
	DEPT	FILL -	CLAYEY GRAVEL WITH SAND and light brown	ELEVATION (Ft.) , angular,											
		DIOWI						$\mathbf{\nabla}$	3-3-5 N=8				16		
						_		$\square$	11 0						
						_		X	3-2-3 N=5				16		
					5	_									
						_		X	1-2-2 N=4				14		
						_		$\bigtriangledown$	1-1-2				20		
						)		$\square$	N=3						
						_									
	reddish brown					_		X	1-1-1 N=2			0.5 (HP)	13	37-22-15	40
					15										
	17.0	<b>LEAN</b> black	CLAY (CL), light brown and ligh mineral staining	ot gray, stiff,		_									
					20			X	3-4-5 N=9			2.75 (HP)	25		
						_									
					0.0	_		$\square$	3-4-6 N=10			2.5 (HP)	27		
					25	c									
	Stratification lines are approximate. In-situ, the transition may be gradual.							I]	Hamr	ner Type: Auto	matic	I		<u> </u>	I
Advar 3 1/ NQ	acement Method: 4 HSA 2 Wireline Core See Exploration of used and add					abora	atory	<mark>edure</mark> proce	edures Notes	:					
		decemption				tion f	• •	plana	tion of						
		VATE		- 16-					Boring	Started: 01-04-2	2018	Borir	ng Com	pleted: 01-04-	2018
	vvn	ie urili		51 Lost	-	_	_	_		j:		Drille	er: J. Fr	eeman	
					attanc				Project	No.: E2175127					

	Ε	BORING	LO	G N	0.	T-20				P	age 2 of 4	4
PR	OJECT: Hamm Road		C	LIEN	IT:	Hazen & Sa Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					, .						
GRAPHIC LOG	DEPTH LEAN CLAY (CL), light brown and light gray,	Elev.: 674.76 (Ft.) ELEVATION (Ft.) Stiff,	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	black mineral staining (continued)		- - 30- -	-	X	3-4-5 N=9		(	2.5 HP)	23		
	37.0	638	- - 35- -		X	4-3-5 N=8		(	2.5 HP)	25		
	<b>LEAN CLAY WITH SAND (CL)</b> , gray, soft to medium stiff		- - 40 -	-	X	2-2-3 N=5		(	).75 HP)	25		
	47.0	628	- - 45- -		X	0-1-2 N=3		(	0.5 HP)	24	31-22-9	79
	CLAYEY GRAVEL (GC), light brown and brow medium dense	vn,	- 50		X	6-10-15 N=25		(	4.5 HP)	19		
<u> </u>	52.0 Stratification lines are approximate. In-situ, the transition ma	623 ay be gradual.	_			Hamm	er Type: Auto	matic				
3 1/4 NQ2 Aband	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data (If ormatior	f any). i for exp								
	WATER LEVEL OBSERVATIONS While drilling	JICCT 51 Lost I Cha		Dr Ste 1		Drill Rig:	arted: 01-04-2			g Comp r: J. Fre	oleted: 01-04-:	2018

		BORING	LO	GI	NO	). T-2	20				F	، age 3 of	4
PR	OJECT: Hamm Road			CLIE	NT	Hazer	n & Sav	vyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nash	ville, TI	N					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054789° Longitude: -85.329379° Surfac DEPTH	ce Elev.: 674.76 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	EIFLD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	POORLY GRADED GRAVEL WITH SAND (Creddish brown, dense to very dense	<u>GP)</u> ,		_									
			55 <sup>-</sup>	_			21-20 =41						
	<sub>59.9</sub> Auger Refusal at 59.9'	615	00	-	$\mid$	6-5	50/3"						
	ADVANCED CASING		60 <sup>-</sup>										
	61.9 VOID	613		_									
			65 <sup>.</sup>	_									
				_									
			70	_									
				_									
			75 <sup>.</sup>	_									
	77.1	597.5											
	Begin NQ2 Wireline Rock Core			_									
	Stratification lines are approximate. In-situ, the transition n	nay be gradual.					Hamme	r Type: Auto	matic				
3 1/-	cement Method: 4 HSA 2 Wireline Core	See Exploration and description of field a used and additional See Supporting Info	and lal I data	borator (If any)	y proc	edures	Notes:						
	onment Method: ng backfilled with auger cuttings upon completion.	symbols and abbrev											
							Boring Sta	arted: 01-04-2	2018	Borir	ng Com	oleted: 01-04-	2018
	While drilling	ller					Drill Rig:			Drille	er: J. Fre	eeman	
		51 Lost I Cha		l Dr Ste oga, TN			Project No	o.: E2175127					

	BORING LOG NO. T-20 Page 4 of 4												
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazer Nash	n & Saw ville, TN	vyer I					
SIT	E: 155 Hamm Road Chattanooga, Tennessee							-					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054789° Longitude: -85.329379° Surface DEPTH	Elev.: 674.76 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	INTERBEDDED DOLOMITE AND SHALE, ligh gray and white, slightly weathered, medium s (continued)	nt strong	- 80-	-		82	<u>N 1:</u> : 77.1' - 2.1' ength: 5'	32	13				
			- - 85- -	-		Depth: 87	<u>N 2:</u> : 82.1' - 7.1' ength: 5'	40	35				
1	87.1 Coring Terminated at 87.1 Feet	587.5	-	-									
	Stratification lines are approximate. In-situ, the transition may be gradual.						Hamme	r Type: Auto	matic	L			
3 1/	NQ2 Wireline Core used and ad			See Exploration and Testing Proceed description of field and laboratory pused and additional data (If any).									
	onment Method: ng backfilled with auger cuttings upon completion.	<ul> <li>See Supporting Information for explanation of symbols and abbreviations.</li> </ul>											
	WATER LEVEL OBSERVATIONS			Boring Started: 01-04-				2018	Boring Completed: 01-04-2018				
							Drill Rig:		Driller: J. Freeman				
		51 Lost M Chatt	lound l tanoog		135			.: E2175127					

			BORING I	LO	)G N	10	. T-21				F	Page 1 of 2	2
PR	OJECT:	Hamm Road			CLIE	NT:	Hazen & Sa Nashville, T	wyer				_	
SIT	ſE:	155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG		N See Exploration Plan 0.054761° Longitude: -85.329042° Surt	face Elev.: 669.44 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
<b>***</b>		- LEAN CLAY, with gravel, reddish b	ELEVATION (Ft.)		-0	0							
	brow	n			_	X	3-4-4 N=8						
				5	_	X	4-4-3 N=7						
	-low i	recovery		-	_	$\square$	3-4-10 N=14						
	-low I	recovery		10	_	$\square$	3-4-6 N=10						
				10	_ _ 								
	-low ı	recovery		15	-	$\left  \right\rangle$	3-2-3 N=5						
	17.0 LEAN and I	<u>N CLAY (CL)</u> , trace sand, angular, lig ight gray, medium stiff to stiff	652.5 ht brown		_								
GEU SMAKI LUG-N				20	-	X	2-3-3 N=6			1.0 (HP)			
					-								
				25	-	X	3-3-3 N=6			1.0 (HP)			
	Stratificati	on lines are approximate. In-situ, the transition	n may be gradual.		_		Hamm	ner Type: Auto	matic				
Advan	cement Meth	See Exploration and	1 Test	ting Proc	edure	s for a Notes:							
3 1/- 3 1/- 10 Aband	4 HSA		See Exploration and description of field a used and additional See Supporting Info	and la data rmati	boratory (If any). <mark>on</mark> for ex	proce	edures						
	WATER LEVEL OBSERVATIONS						Boring S	tarted: 12-19-2	2017 Boring Completed: 12-19-2017				
	While dri					Drill Rig:				Driller: J. Freeman			
					51 Lost Mound Dr Ste 135 Chattanooga, TN Project No.: E2175127								

	BORING LOG NO. T-21     Page 2 of 2       COJECT: Hamm Road     CLIENT: Hazen & Sawyer											
PR	OJECT: Hamm Road		CL	IEN	Г: На Na	zen & Sav shville, T	wyer N					
SIT	FE: 155 Hamm Road Chattanooga, Tennessee					, -	-					
GRAPHIC LOG	DEPTH LEAN CLAY (CL), trace sand, angular, light	ELEVATION (Ft.)	DEPTH (Ft.) WATER LEVEL	OBSERVATIONS		FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	and light gray, medium stiff to stiff (continue		- - 30 -			3-4-6 N=10			1.5 (HP)			
		3	- - 35 -			3-4-6 N=10			1.5 (HP)			
	42.0	627.5	- - 40 -			2-2-2 N=4						
	LEAN CLAY (CL), trace sand, angular, gray, soft		- - 15 -			0-0-0 N=0						
	49.3 Auger Refusal at 49.3 Feet	620	_			0-0-0 N=0	,					
	Stratification lines are approximate. In-situ, the transition m	hay be gradual.					er Type: Auto	matic				
3 1/- Aband	icement Method: 4 HSA Ionment Method: ing backfilled with auger cuttings upon completion.	See Exploration and Tr description of field and used and additional da See Supporting Inform symbols and abbreviat	ita (If an <mark>ation</mark> foi	ıy).								
	WATER LEVEL OBSERVATIONS While drilling	51 Lost Mon Chattar		Ste 13		Drill Rig:	arted: 12-19-2 o.: E2175127	2017	_	ig Comp er: J. Fre	oleted: 12-19-: eeman	2017

	BORING LOG NO. T-22 Page 1 of 3																	
PR	OJECT:	Hamm Road			CLIE	NT	Hazer	n & Saw ville, TN	/yer				-					
SIT	E:	155 Hamm Road Chattanooga, Tennessed	9				Nasin	ville, TN										
GRAPHIC LOG	Latitude: 35	N See Exploration Plan	Surface Elev.: 673.74 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES				
\$ <sup>\$</sup> \$	DEPTH	CRETE	ELEVATION (Ft.) 673															
	EILL and I	- GRAVELLY LEAN CLAY , redo prown			_			1-2 =3										
				5	-			1-2 =3										
					_			2-2 =4										
					-			2-2 =4										
					_													
				15	- ;		2-2 N	2-2 =4										
	17.0 LEAI black	<u>N CLAY (CL)</u> , light brown, stiff to mineral staining	essessive very stiff,		_													
				20		X		4-6 =10			3.0 (HP)							
					-													
				25	- j-			5-6 =11			3.0 (HP)							
/	Stratification lines are approximate. In-situ, the transition may be gradual.							Hammer	Type: Auto	matic								
	Advancement Method: See Exploration an					cedur	es for a	Notes:										
Aband	dvancement Method:       See Exploration and description of field used and additional set additional set and additional set additiona				(If any). on for e													
	WATER LEVEL OBSERVATIONS							Boring Sta	rted: 01-05-2	2018	Borir	ng Com	oleted: 01-05-2	2018				
$\square$	No free v	water observed while drilling	— ller					Drill Rig:										
					d Dr Ste oga, TN			Project No	.: E2175127		Boring Completed: 01-05-2018 Driller: J. Freeman							

	BORING LOG NO. T-22 Page 2 of 3												
PR	OJECT: Hamm Road		С	LIEN	T: F N	lazen & Sav lashville, Ti	wyer N						
SIT	E: 155 Hamm Road Chattanooga, Tennessee				-		-						
GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABUKAI UKY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES	
	LEAN CLAY (CL), light brown, stiff to very stif black mineral staining <i>(continued)</i>		- - 30- -		X	4-7-10 N=17		(1	3.0 HP)				
	<u>37.0</u> LEAN CLAY (CL), gray, medium stiff	636.5	_ 35— _ _			4-5-7 N=12		(1	1.5 HP)				
			- 40 -			2-2-2 N=4		C (1	).75 HP)				
		2	- 45- -			2-2-3 N=5			).75 HP)				
		ę	- 50- -			1-3-4 N=7			1.0 HP)				
	Stratification lines are approximate. In-situ, the transition ma	[		Hamme	er Type: Auto	matic							
3 1/ Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and T description of field and used and additional da See Supporting Inform symbols and abbrevia	d laboi ata (lf a nation	ratory p any).	rocedu	res							
	WATER LEVEL OBSERVATIONS No free water observed while drilling	<b>Tilest</b> Mo Chatta	ound D	r Ste 1		Drill Rig:	arted: 01-05-2 o.: E2175127			g Comp r: J. Fre	oleted: 01-05-: eeman	2018	

	BORING LOG NO. T-22 Page 3 of 3												
PR	OJECT: Hamm Road			CLIEN	NT:	Hazer Nash	n & Saw ville, TN	/yer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nuon	viiic, T	•					
GRAPHIC LOG		Elev.: 673.74 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	LEAN CLAY (CL), gray, medium stiff (continue												
/////	53.5 Auger Refusal at 53.5 Feet	620				50	)/0"						
	Stratification lines are approximate. In-situ, the transition ma	y be gradual.					Hamme	Type: Auto	matic				
			Teeti	ing Proce	edure	s for a	Notes:						
3 1/ Aband	4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data ( rmatic	(If any). on for exp									
$\nabla$	WATER LEVEL OBSERVATIONS				-		Boring Sta	rted: 01-05-2	2018	Borir	ng Com	oleted: 01-05-	2018
<u>v</u>							Drill Rig:			Drille	er: J. Fro	eeman	
	51 Lost I Cha				00		Project No	.: E2175127					

	BORING LOG NO. T-23 Page 1 of 3														
PR	OJECT:	Hamm Road			CLIE	INT	Hazen	n & Saw /ille, TN	yer						
SIT		155 Hamm Road Chattanooga, Tennessee					Nasin	/iiie, TN	I						
GRAPHIC LC	Latitude: 35.	I See Exploration Plan 054586° Longitude: -85.329427° Surface	e Elev.: 674.03 (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES	
à. à	DEPTH 0.5 CONC		ELEVATION (Ft.) 673.5			·								-	
	FILL -	<b>GRAVELLY LEAN CLAY</b> , angular, bro	own		_			2-2 =4							
				5	_			2-2 =4							
	-low re	ecovery			_			1-2 =3							
								2-3 =5							
				15	_		9-3 N:	3-4 =7							
	17.0 LEAN very s	<b>CLAY (CL)</b> , light brown and light gray, tiff, black mineral staining	657 stiff to		-										
				20	_			5-9 •14			3.5 (HP)				
					_										
					_			-13 -22			4.0 (HP)				
	Stratification lines are approximate. In-situ, the transition may be gradual.				_			Hammer	Type: Auto	matic					
	dvancement Method: See Exploration and					cedur	es for a	Notes:							
Abando	3 1/4 HSA description of fie used and addition see Supporting symbols and abt being backfilled with auger cuttings upon completion.				borator (If any) <mark>on</mark> for e	y proo	edures								
_								Boring Star	ted: 01-04-2	018	Borir	ng Com	oleted: 01-04-	2018	
							חנ	Drill Rig:			Drille	er: J. Fr	: J. Freeman		
		51 Lost N Chat		d Dr Ste oga, TN			Project No.	: E2175127							

	BORING LOG NO. T-23     Page 2 of 3       OJECT: Hamm Road     CLIENT: Hazen & Sawyer Nashville, TN												
PR	OJECT: Hamm Road		C	LIEN	NT: H N	lazen Nashv	i & Saw /ille, TN	yer I					
SIT	E: 155 Hamm Road Chattanooga, Tennessee												
GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	<b>LEAN CLAY (CL)</b> , light brown and light gray, very stiff, black mineral staining <i>(continued)</i>		- - 30- -	r e	X	3-6 N=				3.5 (HP)			
			- - 35- -	e e	X	3-4 N:				2.0 (HP)			
	42.0	632	- 40- -	,	X	4-4 N:	1-5 =9			1.25 (HP)			
	LEAN CLAY (CL), gray, very soft 47.0	627	_ 45— _	k	X	0-0 N:							
	<u>SANDY LEAN CLAY (CL)</u> , trace gravel, angu gray, stiff		_ _ 50— _		X	4-7 N=							
	52.0 Stratification lines are approximate. In-situ, the transition ma	622 ay be gradual.	_				Hammer	Type: Auto	matic				
3 1/ Aband	cement Method: 4 HSA onment Method: ng backfilled with auger cuttings upon completion.	See Exploration and description of field an used and additional d See Supporting Inforr symbols and abbrevia	lata (If a mation	any).			Notes:						
	WATER LEVEL OBSERVATIONS While drilling	<b>Tierr</b> 51 Lost Mc Chatta		r Ste 1		n	Drill Rig:	rted: 01-04-2 .: E2175127	2018	_	g Comp er: J. Fre	bleted: 01-04-:	2018

	BORING LOG NO. T-23 Page 3 of 3													
PR	OJECT:	Hamm Road			CLIE	NT:	Haze	n & Sav ville, TN	vyer					
SIT		155 Hamm Road Chattanooga, Tennesse	9				Nash	vine, Ti	•					
GRAPHIC LC		See Exploration Plan 054586° Longitude: -85.329427°	Surface Elev.: 674.03 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	EIEL D TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	POOF	RLY GRADED GRAVEL (GP), and sh brown to light gray, very dens	ngular,		_									
				55	-	×	50	0/3" ,						
			613.5	60	-	$\times$	2-5	50/4"						
60.4 613.5          Auger Refusal at 60.4 Feet         Image: Stratification lines are approximate. In-situ, the transition may be gradual.								Hamme	r Type: Auto	matic				
3 1/4	use Sec		See Exploration and description of field a used and additional See Supporting Info	l data ormatio	(If any). on for ex			Notes:						
	ndonment Method: symbolic symbolic symb		symbols and abbrev	mbols and abbreviations.										
$\Box$	WATE While dril	R LEVEL OBSERVATIONS	- 1[er	۲;					irted: 01-04-2	2018			pleted: 01-04-2	2018
		51 Lost 1	Mound				Drill Rig: Project No	tig: Driller: J. Freeman						

	BORING LOG NO. T-24 Page 1 of 3													
PR	OJECT:	Hamm Road		C		NT:	Hazen	n & Saw /ille, TN	yer					
SIT		155 Hamm Road Chattanooga, Tennessee					Nasin	/ine, TN						
GRAPHIC LO	Latitude: 35.	See Exploration Plan 054581° Longitude: -85.328985° Surface	Elev.: 669.50 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH 0.3_\ <b>ASPH</b>	ALT_	ELEVATION (Ft.)		-									_
	FILL ·	LEAN CLAY WITH GRAVEL, angular, h brown and light brown		-		X	6-3 N:					15		
				- 5 -	_	X	3-2 N:					13		
				-		X	3-2 N:				1.0 (HP)	19		
			- 10-	_	X	3-2 N:					17			
	12.0 LEAN and li	<u>CLAY (CL)</u> , trace sand, angular, light b ght gray, stiff, black mineral staining	-	_										
				- 15-	-	Х	3-6 N=				2.5 (HP)	24		
				-	-									
				- 20-	-	X	3-5 N=				2.5 (HP)	22		
				-	-									
						X	6-7 N=				3.0 (HP)	23		
				-	$\left  \right $									
	Stratification lines are approximate. In-situ, the transition may be gradual.							Hammer	Type: Auto	matic				
3 1/4	dvancement Method: 3 1/4 HSA NQ2 Wireline Core See Exploration and description of field ar used and additional of See Supporting Infra				f any).			Notes:						
	See Supporting Inform pandonment Method: Boring backfilled with auger cuttings upon completion.					biana	tion of							
$\nabla$	WATE While dril	R LEVEL OBSERVATIONS	ler					Boring Star	ted: 12-19-2	017	Borin	g Com	oleted: 12-19-2	2017
		<u> </u>	51 Lost M			<u> </u>		Drill Rig:			Drille	er: J. Fre	eeman	
			tanoog		55		Project No.	: E2175127						

	BORING	g Lo	C	6 N	0.	T-24				F	Page 2 of 3	3
PR	OJECT: Hamm Road		CL	LIEN	IT: H N	lazen & Sa <sup>.</sup> lashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					,						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054581° Longitude: -85.328985° Surface Elev.: 669.50 (F DEPTH ELEVATION (F LEAN CLAY (CL), trace sand, angular, light brown	·		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	and light gray, stiff, black mineral staining <i>(continued)</i>	3	- - 0- -	ž	X	3-5-7 N=12			1.5 (HP)	22	34-23-11	87
	<u>LEAN CLAY (CL)</u> , trace sand, angular, gray, very soft		- - 5		X	0-0-0 N=0				26		
		4	- - 0 -		X	0-0-0 N=0				29		
		4	- 5- -		X	0-0-0 N=0				31		
	ADVANCED CASING	0.5 5	- - 0- -	s		0-0-0 N=0				18		
,	Stratification lines are approximate. In-situ, the transition may be gradual.		_			Hamm	er Type: Auto	matic				
3 1/4 NQ2 Aband	cement Method: 4 HSA     See Exploration description of furse used and addit       0 mment Method: ng backfilled with auger cuttings upon completion.     See Supporting symbols and all       WATER LEVEL OBSERVATIONS     Image: Completion in the symbols and all	onal dat Informa	a (If a ation f	any).		n of						
	While drilling	ost Mou Chattan	nd Dr	Ste 1		Drill Rig:	arted: 12-19-2	2017	-	-	pleted: 12-19-; eeman	2017

		I	BORING I	LO	GN	10	. T-2	4				F	Page 3 of 3	3
PR	OJECT:	Hamm Road			CLIE	NT:	Hazer Nash	n & Saw ville, TN	vyer I					
SIT	E:	155 Hamm Road Chattanooga, Tennessee					, aon	, , , , , ,	•					
GRAPHIC LOG	Latitude: 35	V See Exploration Plan .054581° Longitude: -85.328985° Surface	e Elev.: 669.50 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIFI D TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
    	SHA	RBEDDED DOLOMITE, CHERT, AND <u>E</u> , light gray, light brown and light gree slightly weathered, medium strong <i>(cor</i>	ELEVATION (Ft.) nish ntinued) 614	55-	_		Depth 58	<b>N 1:</b> : 50.7' - 5.7' ength: 5'	65	0				
	DOL	DMITE, light gray, slightly weathered, m bedding, strong rock		60-			Depth 60	<u>N 1:</u> : 55.7' - ).7' ength: 5'	87	74				
	60.7 Coriı	ng Terminated at 60.7 Feet	609											
Advan	Stratificati	on lines are approximate. In-situ, the transition m		1 Teet	na Dro		- for a	Hamme Notes:	r Type: Auto	matic				
3 1/4 NQ2 Aband	4 HSA 2 Wireline Co onment Mething backfilled	ore lod: with auger cuttings upon completion.	See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	data ( rmatic	(If any). on for ex			110103.						
$\nabla$	WATE While dri							Boring Sta	rted: 12-19-2	2017	Borir	ng Com	pleted: 12-19-	2017
	willie dri	iiny	ller					Drill Rig:			Drille	er: J. Fr	eeman	
			- 51 Lost M Cha		Dr Ste ga, TN	135		Project No	.: E2175127					

		E	BORING L	.0	G N	Ю.	OC-1				F	Page 1 of 2	2
PF	ROJEC	: Hamm Road		(	CLIE	NT:	Hazen & Saw Nashville, TM	/yer					
SI	TE:	155 Hamm Road Chattanooga, Tennessee					nasiiviile, Ir	•					
GRAPHIC LOG		ON See Exploration Plan 35.0544° Longitude: -85.3293° Approximate Surfac	e Elev: 676 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	DEPTH		ELEVATION (Ft.)		≥®	S₽	ш. 	ш. 		Ľ	Ö		Ë
	FIL	<u>NCRETE</u> <u>L - SANDY LEAN CLAY WITH GRAVEL</u> , wn, yellow and gray	675.5+/-		_		4-2-3 N=5			2.0 (HP)			
3/30/18				5 -	-	X	2-2-2 N=4			2.5 (HP)			
EMPLATE.GDT					_	X	2-3-3 N=6			1.75 (HP)			
ICON_DATAT				10-	_	X	2-2-3 N=5			1.5 (HP)			
IO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	12.0 LE stif	<b>AN CLAY (CL)</b> , brown, yellow and gray, m f	edium		_								
L E2175127 HAMM				15-		X	1-2-2 N=4			1.5 (HP)			
GEO SMART LOG-NO WEL				20-	_	X	2-3-4 N=7			2.0 (HP)			
	22.0 LE	AN CLAY (CL), brown and gray, very stiff	654+/-		_								
ROM ORIGIN				25-	-	X	4-7-11 N=18			3.25 (HP)			
PARATED FI	Stratific	ation lines are approximate. In-situ, the transition m	ay be gradual.		1		Hamme	Type: Auto	natic				
1 2 1 Aband	ncement M /4 HSA donment M ring backfil		See Exploration and description of field a used and additional See Supporting Info symbols and abbrev	ind lab data ( rmatic	poratory If any).	proce	edures						
		TER LEVEL OBSERVATIONS					Boring Sta	rted: 02-06-2	018	Borin	g Com	pleted: 02-06-2	2018
BORIN	No free	e water observed while drilling					Drill Rig: D	R0009		Drille	er: C. Pe	enton	·
THIS			- 51 Lost M Chat		Dr Ste ga, TN	135	Project No	.: E2175127					

	BORING	G LC	0	G N	0.	OC-	-1				F	Page 2 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen	a & Saw /ille, TN	yer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nasin	/iiie, TN	I					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3293° Approximate Surface Elev: 676 (Ft.) DEPTH ELEVATION (		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
	LEAN CLAY (CL), brown and gray, very stiff (continued)	<u>FL.)</u>	_										
		3	- 30-		X	4-8 N=							
	32.064 LEAN CLAY (CL), brown, stiff	4+/-	-										
		3	- 35	_	X	3-4 N:				1.25 (HP)			
	37.0 63 SANDY LEAN CLAY (CL), olive and brown, medium stiff	9+/-	_	-									
		4	- 10-	-	X	2-3 N:				1.0 (HP)			
			_	-									
		4	- 15	-	X	0-2 N:				0.75 (HP)			
	47.0 62 SANDY LEAN CLAY (CL), olive and gray, stiff	<u>!9+/-</u>	_	-									
		5	-050	-	X	4-4 N=				1.5 (HP)			
	51.2 62 Auger Refusal at 51.2 Feet	25+/-	-										
	Stratification lines are approximate. In-situ, the transition may be gradual.						Hammer	Type: Auto	matic				L
	cement Method: See Exploration 4 HSA description of used and addi See Supportin	tional da	ita (li	f any).			Notes:						
	Ionment Method: symbols and a symbols and a	bbreviat	tions		. ~								
	WATER LEVEL OBSERVATIONS						Boring Star	rted: 02-06-2	2018	Borir	ng Com	pleted: 02-06-2	2018
	No free water observed while drilling	<b>?`</b>	0				Drill Rig: D	R0009		Drille	er: C. Pe	enton	
	51	Lost Mou Chattar			135			: E2175127		1			

		B		00	G N	10.	OC-2				F	Page 1 of 3	3
PR	OJECT:	Hamm Road		•	CLIE	NT:	Hazen & Saw Nashville, TN	vyer					
SIT	ſE:	155 Hamm Road Chattanooga, Tennessee					nasiiville, Ir	•					
GRAPHIC LOG		V See Exploration Plan		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	TEST JLTS	VERY 6)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
GRAPH	DEPTH	Approximate Surface	Elev: 676 (Ft.) +/- ELEVATION (Ft.)	DEPT	WATER	SAMPL	FIELD TEST RESULTS	RECOVERY (%)	80 80	LABOR HP	CONTE	LL-PL-PI	PERCEN
	<mark>0.3</mark> <b>∖<u>ASP</u>ŀ</b>		675.5+/-										
EK S	FILL reddi	- SANDY LEAN CLAY WITH GRAVEL , sh brown		-	-	$\bigtriangledown$	3-4-5			0			
				-		$\land$	N=9			(HP)			
	e S			-	_	X	3-4-4 N=8			0 (HP)			
				5-			1-3-3						
				-	_	$\mid$	N=6						
	4			10-	_		2-3-4 N=7			1.25 (HP)			
	12.0		664+/-		_								
	LEAN	I CLAY (CL), brown, stiff	00+1/-		_								
				15-	_	$\left \right $	3-4-5 N=9			3.5 (HP)			
					_								
					_		2-5-6			3.25			
				20-	-	$\mid$	N=11			(HP)			
				-	_								
Advan 2 1/ Abanc Bor					_	X	3-6-9 N=15			4.0 (HP)			
				25-	_								
	Stratification	on lines are approximate. In-situ, the transition ma	y be gradual.				Hamme	r Type: Autor	natic				
Advan 2 1/	ncement Meth /4 HSA	od:	See Exploration and description of field an used and additional d	d lab	poratory	proce	es for a Notes:						
Aband Bor	lonment Meth ing backfilled	od: with auger cuttings upon completion.	See Supporting Inform symbols and abbrevia			kplana	ition of						
	WATE	R LEVEL OBSERVATIONS					Boring Sta	rted: 02-06-2	018	Borin		pleted: 02-06-2	.2019
		vater observed while drilling	ller	-		Π	Drill Rig: D		010	-	-		2010
			51 Lost Mo	ound	Dr Ste					Duile	er: C. Pe	511011	
			Chatta	anoo	ga, TN		Project No	.: E2175127					

	В	ORING L	00	G N	0.	OC-2				P	Page 2 of 3	3
PR	OJECT: Hamm Road		C	LIEN	IT: H N	lazen & Sa Nashville, T	wyer N					
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3293° Approximate Surface DEPTH LEAN CLAY (CL), brown, stiff <i>(continued)</i>	Elev: 676 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
			- - 30- -		X	3-7-9 N=16			3.5 (HP)			
	32.0 LEAN CLAY (CL), olive to brown, very soft	644+/-	_ _ 35—		X	0-0-1 N=1			0.75 (HP)			
			_ _ 40— _		X	1-1-1 N=2			0.75 (HP)			
			_ _ 45— _	. Z	X	0-0-0 N=0			1.0 (HP)			
			_ _ 50— _	. 2	X	0-0-1 N=1			0.75 (HP)			
	Stratification lines are approximate. In-situ, the transition ma	y be gradual.				Hamm	er Type: Auto	omatic				
2 1/ Aband	cement Method: 4 HSA ionment Method: ing backfilled with auger cuttings upon completion.	See Exploration and description of field an used and additional d See Supporting Informsymbols and abbrevia	lata (If mation	any). for exp								
	WATER LEVEL OBSERVATIONS No free water observed while drilling	<b>There</b> 51 Lost Mo Chatta		Dr Ste 1		Drill Rig:	tarted: 02-06-2 DR0009 Io.: E2175127		-	ig Comp er: C. Pe	oleted: 02-06- enton	2018

	B	BORING L	00	GΝ	0.	OC-2	2				F	Page 3 of 3	3
PR	OJECT: Hamm Road		(	CLIE	NT:	Hazen Nashvi	& Sawy	/er					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nuonvi							
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3293° Approximate Surface		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST BESUILTS	KESULIS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
	LEAN CLAY (CL), olive to brown, very soft (continued)	ELEVATION (Ft.)											_
	Auger Refusal at 53.3 Feet	622.5+/-	-										
	Stratification lines are approximate. In-situ, the transition ma cement Method: 4 HSA	ay be gradual.	nd lab	oratory	eduree		Hammer 1 Notes:	Fype: Auto	matic				
	onment Method: ing backfilled with auger cuttings upon completion.	See Supporting Inform symbols and abbrevia	matio	n for ex	olana	ition of							
BOU										<b>—</b>			
	WATER LEVEL OBSERVATIONS No free water observed while drilling	Terr					Boring Starte		018	_		oleted: 02-06-	2018
		51 Lost Mo	ound	Dr Ste 1			Drill Rig: DR			Drille	er: C. Pe	enton	
		Chatta	anoo	ga, TN		P	Project No.:	E2175127					

	B	ORING I	_00	G N	0.	OC-3				F	Page 1 of 3	3
PR	OJECT: Hamm Road		0	CLIE	NT:	Hazen & Sa Nashville, T	wyer				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					nasrivine, i	N					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3294° Approximate Surface E	Elev: 675 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
<u>a</u> a .	DEPTH E	ELEVATION (Ft.) 674.5+/-		- 0	0,							<u> </u>
	FILL - POORLY GRADED SAND AND GRAVED brown and red	672+/-	-	-	X	3-6-6 N=12		(	0 (HP)			
	FILL - GRAVELLY FAT CLAY WITH SAND, orange and brown		- - 5 -		X	2-1-1 N=2			1.75 (HP)			
			-	-	X	1-1-1 N=2			0.75 (HP)			
	8.0 FILL - GRAVELLY FAT CLAY WITH SAND, orange and brown	667+/-	-	-	X	2-2-3 N=5			1.75 (HP)			
			-10 - -	_								
			- 15-	-	X	2-2-6 N=8			1.0 (HP)			
	17.0 LEAN CLAY (CL), gray and brown, stiff	658+/-	-	_								
			- 20-	-	X	2-4-6 N=10			2.75 (HP)			
	22.0 LEAN CLAY (CL), gray and brown, very stiff	653+/-	-	-								
			- 25-	_	X	4-8-14 N=22			4.0 (HP)			
	Stratification lines are approximate. In-situ, the transition may	be gradual.	-			Hamm	er Type: Auto	matic				L
Advan	cement Method:		d Terf	De-	o di ca	s for a Notes:						
2 1/- Aband	4 HSA C	See Exploration an description of field used and additiona See Supporting Info symbols and abbre	and lab I data (I ormatio	oratory f any). n for ex	proce	edures						
BUI	WATER LEVEL OBSERVATIONS								1			
	No free water observed while drilling		٢٢				tarted: 02-06-2	018			oleted: 02-06-2	2018
		51 Lost Cha		Dr Ste			DR0009		Drille	er: C. Pe	enton	

	В	ORING LO	ЭG	) N	0.	OC-3				P	age 2 of 3	3
PR	OJECT: Hamm Road		С	LIEN	NT:	Hazen & Sa Nashville,	awyer TN				•	
SI	E: 155 Hamm Road Chattanooga, Tennessee					Nuonvine,						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3294° Approximate Surface E DEPTH E	lev: 675 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), gray and brown, very stiff (continued)	LEVATION (FL)	_									
		3	- - 30- -		X	5-7-13 N=20						
	32.0 LEAN CLAY (CL), trace silt, brown and gray, medium stiff	643+/-	- - 35-		X	3-4-4 N=8			1.5 HP)			
					X	3-4-6 N=10		(1	1.5 HP)			
	42.0 SILTY LEAN CLAY (CL-ML), gray, very soft	633+/-	40— — — —									
		4	- 15 -	k	X	0-0-0 N=0		(I	0.75 HP)			
		5	_ 50— _	ĸ	X	0-0-1 N=1			1.0 HP)			
	Stratification lines are approximate. In-situ, the transition may	be gradual.			1	Ham	mer Type: Auto	matic				
2 1/ Abanc	u s	ee Exploration and Te escription of field and sed and additional dat see Supporting Informa ymbols and abbreviati	ata (If a lation	any).			:					
	WATER LEVEL OBSERVATIONS No free water observed while drilling	lerr					Started: 02-06-2	2018	Boring	g Comp	leted: 02-06-2	2018
		51 Lost Mou Chattan	und D	r Ste 1	_		g: DR0009 No.: E2175127		Driller	: C. Pe	enton	

	В	ORING L	00	G N	0.	OC-	3				F	Page 3 of 3	3
PR	OJECT: Hamm Road		(	CLIEN	NT:	Hazen Nashvi	& Saw	yer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nasirvi	ine, m						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0544° Longitude: -85.3294° Approximate Surface	. ,	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	KESULIS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH SILTY LEAN CLAY (CL-ML), gray, very soft 53.0 (continued)	ELEVATION (Ft.) 622+/-											
	Stratification lines are approximate. In-situ, the transition ma	vy be gradual.					Hammer	Type: Auto	matic				
Advan	cement Method:					, T							
2 1/ Aband	4 HSA Ionment Method: ing backfilled with auger cuttings upon completion.	See Exploration and description of field ar used and additional of See Supporting Inforr symbols and abbrevia	data (l matio	If any). In for exp			Notes:						
	WATER LEVEL OBSERVATIONS No free water observed while drilling						Boring Star	rted: 02-06-2	2018	Borir	ng Com	oleted: 02-06-	2018
		51 Lost M			_		Drill Rig: D	R0009		Drille	er: C. Pe	enton	
				ga, TN		F	Project No.	: E2175127					

		E	BORING L	00	G N	10.	OC-4				F	Page 1 of 3	3
PF	ROJECT	Hamm Road		0	CLIE	NT:	Hazen & Sav Nashville, T	wyer N					
SI	TE:	155 Hamm Road Chattanooga, Tennessee											
LOG	LOCATIC	N See Exploration Plan		't.)	VEL	YPE	SST	۲۲		ЗКΥ	(%)	ATTERBERG LIMITS	INES
GRAPHIC LOG	Latitude: 3	5.0543° Longitude: -85.3294°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
GRA	DEDTU	Approximate Surface		DEI	WATI OBSE	SAMF	FIEI	REC		LABO	S N S		PERC
	DEPTH FILL brow	- LEAN CLAY WITH GRAVEL, orange t	ELEVATION (Ft.)										
NO.		A1		-		$\square$	2-2-3			1.5			
				_		$\square$	N=5			(HP)			
				_			2-2-3			1.5			
50/18				5 -		$\square$	N=5			(HP)			
				-	_								
				-	_	X	2-2-2 N=4			1.0 (HP)			
				-	_								
GEO SMART LOG-NO WELL EXT5127 HAMM POND GPJ TEHACON_DATATEGDI 3/30/18				-	_	$\square$	1-2-2 N=4			0.75 (HP)			
				10-		$\square$	11-4			(111)			
				-									
D.GP				-									
				-	_								<u> </u>
T HAW				15		М	1-1-1 N=2			1.0 (HP)			
217512				15-									
			658+/-	_									
S Q	LEA	<u>N CLAY (CL)</u> , brown, stiff		-	_								
				-		$\square$	3-5-7			2.25			
SMAH				20-		$\square$	N=12			(HP)			
				-	_								
Ť				-									
IAL KE				-	_								<u> </u>
AIGIN				-		X	4-5-9 N=14			3.0 (HP)			
MOX				25-									
	Stratificat	ion lines are approximate. In-situ, the transition ma	ay be gradual.				Hamme	er Type: Auto	matic				
	noomont M-4	hod											
⇒ Advar ≚ 21 ⊖ NG	ncement Met /4 HSA 2 Wireline C		See Exploration and description of field an used and additional d	nd lab	oratory	proce	edures Notes:						
Aban	donment Met	hod:	See Supporting Inform	matio	n for ex	kplana	tion of						
		d with auger cuttings upon completion.	,										
		ER LEVEL OBSERVATIONS					Boring St	arted: 02-06-2	2018	Borir	ng Com	pleted: 02-06-	-2018
		water observed while drilling	51 Lost Mo				Drill Rig:	DR0009		Drille	er: C. Pe	enton	
Ĩ					Dr Ste ga, TN	135	Project N	o.: E2175127					

	BORING	G L(	OG	G N	О.	OC-4	Ļ				F	age 2 of	3
PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Nashvill	& Sawy le, TN	ver					
SIT	E: 155 Hamm Road Chattanooga, Tennessee						·						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0543° Longitude: -85.3294° Approximate Surface Elev: 675 (Ft.) DEPTH ELEVATION (F LEAN CLAY (CL), brown, stiff (continued)		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS		RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
		3	_  30— _		X	3-5-7 N=12				2.25 (HP)			
		<u>8+/-</u>	_  35		X	5-5-9 N=14				2.5 (HP)			
	<u>SILTY LEAN CLAY (CL-ML)</u>	2	- 40— -		X	1-2-3 N=5	3			0.75 (HP)			
		2 8+/-	_ 45— _		X	1-2-2 N=4				1.0 (HP)			
	<u>SILTY CLAYEY SAND (SC-SM)</u> , gray, dense	Ę	- - 50- -		X	9-22-2 N=46				1.25 (HP)			
	Stratification lines are approximate. In-situ, the transition may be gradual.						Hammer T	ype: Auto	matic				
2 1/ NQ:	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion. See Supporting symbols and al	edures	lotes:										
Aband Bori		Lost Mo Chatta	und D	Dr Ste		Dri	oring Starte ill Rig: DR( oject No.: I	0009	2018		g Comp er: C. Pe	oleted: 02-06- enton	2018

				BORING	LO	G	Ν	0.	OC-	4				F	Page 3 of 3	3
PF	ROJE	ECT:	Hamm Road			CL	IEN	NT:	Hazen Nashv	& Saw	/yer					
Sľ	TE:		155 Hamm Road Chattanooga, Tennessee						Nasiiv	ine, in						
GRAPHIC LOG	Latit	tude: 35.	See Exploration Plan 0543° Longitude: -85.3294° Approximate Surfa	ace Elev: 675 (Ft.) +/-	DEPTH (Ft.)	WATER I EVEI	OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULIS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	DEP		<u>CLAYEY SAND (SC-SM)</u> , gray, dens nued)	ELEVATION (Ft.)		_	-									
5DT 3/30/18	E0 E	Δυσο	r Pofusal at 58 5'	646 5 1	55			~	50/	1")						
E2175127 HAMM ROAD GPU TERRACON_DATATEMPLATE.GDT	≤ 58.5 ≤ - - - - - - - - - - - - - -	Begin INTER SILTS mediu	r Refusal at 58.5' NQ2 Wireline Rock Core <u>RBEDDED DOLOMITE, SHALE, AND</u> <u>TONE</u> , light gray, light brown and ligh im strong	<u>616.5+/-</u> nt green, 606.5+/-	60				<b>RUN</b> Depth: 68. Run Le 10	58.5' - .5' ength:	35	8				
		<b>Corin</b> ratificatio	may be gradual.					for a	Hammer Notes:	Type: Auto	matic					
Adval 21 NC Aban Bo	1/4 HSA 22 Wire	A eline Cor	re	See Exploration an description of field used and additiona See Supporting Infr symbols and abbre	and la I data ormati	iborat (If ar <mark>on</mark> fo	tory ıy).	proce	edures	NULES:						
			R LEVEL OBSERVATIONS							Boring Sta	rted: 02-06-2	2018	Borir	ng Com	pleted: 02-06-	2018
BOR	No	o free w	ater observed while drilling	ller	_		_	_		Drill Rig: D	R0009		Drille	er: C. Pe	enton	
					Mound			135		Project No	.: E2175127					

	BORII		G	NC	). V	′B-1				F	Page 1 of 2	2
PR	OJECT: Hamm Road		CLI	EN	F: Ha	azen & Sav ashville, T	wyer N				-	
SI	E: 155 Hamm Road Chattanooga, Tennessee				i ve	Silvine, I						
90	LOCATION See Exploration Plan	t.	ν., ÆL	SNO		ST S	۲.		RY	(%)	ATTERBERG LIMITS	NES
GRAPHIC LOG	Latitude: 35.0552° Longitude: -85.3294°	(Ft.) +/-	R LE	VATIC		FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	RATO <sup>o</sup> (tsf)	ATER TENT (		NT FI
GRAF	Approximate Surface Elev: 678 (	(Ft.) +/-	WATER LEVEL	OBSERVATIONS		FIEL REG	REC	ш	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
2	DEPTH ELEVATIC FILL - CLAYEY GRAVEL, orange and brown	DN (Ft.)			-							
			_			3-5-5						
×			_	Ž		N=10						
	3.0 FILL - LEAN CLAY WITH GRAVEL, orange and	675+/-	_									
	brown		_			1-2-2 N=4						
		5	; —	Ľ	$\rightarrow$	N-4						
			_			0-0-1			1.0			
			_	Z	$\square$	N=1			(HP)			
			_									
			_			1-1-2 N=3			0.5 (HP)			
		10	0						. ,			
	12.0	666+/-	_									
	SANDY LEAN CLAY WITH GRAVEL (CL), brown,	000+/-	_									
	very soft		_									
			_			0-2-3 N=5			1.0 (HP)			
		15	5									
			_									
			_									
									0.5			
e l						0-0-0 N=0			0.5 (HP)			
		20										
			_			0-0-0			3.25			
		25	5	Ž		N=0			(HP)			
	Stratification lines are approximate. In-situ, the transition may be gradua	al.				Hamme	er Type: Auto	matic				
dvar	cement Method:	ration and Tax	oting D	roood	uroo for	a Notes:						
	4 HSA description	ration and Tes n of field and la additional data	aborato	ory pr		u						
hand	See Suppo	orting Informat	tion for		ination	of						
	ng backfilled with auger cuttings upon completion.											
	WATER LEVEL OBSERVATIONS					Boring St	tarted: 02-12-2	2018	Borir	ng Com	pleted: 02-12-2	2018
	No free water observed while drilling	erra				Drill Rig:				er: R. P	-	
		51 Lost Mour Chattanc			5	Project N	lo.: E2175127					

	E	BORING I	100	G N	0.	VB-1				F	age 2 of 2	2
PF	OJECT: Hamm Road		0	CLIEI	NT:	Hazen & Sav Nashville, Tl	vyer N					
SI	TE: 155 Hamm Road Chattanooga, Tennessee					· · · · · · · · · · · · · · · · · · ·						
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0552° Longitude: -85.3294° Approximate Surface DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
6.870 G	SANDY LEAN CLAY WITH GRAVEL (CL), brown very soft <i>(continued)</i> 28.0 LEAN CLAY WITH SAND (CL), brown and gra stiff	650+/	- - - 30-	-	X	3-5-6 N=11			4.25 (HP)			
le ance a	34.5 SANDY LEAN CLAY WITH GRAVEL (CL), gra soft	643.5+/- ay,	- - 35- -		X	4-6-6 N=12			4.0 (HP)			
000000000000000000000000000000000000000	42.0	636+/-	- - 40- -	-	X	0-0-0 N=0			0.5 (HP)			
0.0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0	SANDY LEAN CLAY WITH GRAVEL (CL), ye to orange, medium dense	llow	- - 45- -	-	$\times$	15-50/3"			0.5 (HP)			
	48.6 Auger Refusal at 48.6 Feet	629.5+/-	-									
	Stratification lines are approximate. In-situ, the transition may be gradual.       Hammer Type: Automatic											
3 1 Aban	donment Method: /4 HSA donment Method: ring backfilled with auger cuttings upon completion.	See Exploration an description of field used and additional See Supporting Info symbols and abbre	and lab I data (I prmation	oratory f any). n for ex	proce	dures						
	WATER LEVEL OBSERVATIONS No free water observed while drilling	<b>Tier</b> 51 Lost	Mound	Dr Ste		Drill Rig: I		2018	_	g Comp r: R. Pr	oleted: 02-12-	2018
		Cha	ittanoog	ga, TN		Project No	o.: E2175127					

		B	ORING L	.0	GN	10	. EB-1				F	Page 1 of 3	3
PR	ROJEC	: Hamm Road		(	CLIE	NT:	Hazen & Sav Nashville, Ti	wyer N					
SI	TE:	155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG		ON See Exploration Plan 35.0551° Longitude: -85.3288° Approximate Surface E	Elev: 669 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH 0.5 <b>AS</b>	PHALT	ELEVATION (Ft.) 668.5+/-		28	Ś				_	0		
		L - LEAN CLAY WITH GRAVEL, orange an			_	X	1-4-6 N=10			1.0 (HP)			
3/30/18	5.5		663.5+/-	5 -	_	X	3-3-2 N=5			1.0 (HP)			
EMPLATE.GDT	<u>FIL</u>	<u>L - CLAYEY GRAVEL</u> , brown			_	X	3-6-7 N=13						
ACON_DATAT				10-	_	X	1-3-2 N=5						
ROAD.GPJ TERF	12.0 LE	AN CLAY WITH SAND (CL), brown, stiff	657+/-		_								
HAMM					_	$\left \right $	4-5-5 N=10		1	.5/3.0			
E-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 30018				15-	_								
GEO SMART LOG-N				20-	-	X	4-3-5 N=8			2.0 (HP)			
					_								
				25-	_	X	3-4-6 N=10			2.25 (HP)			
	Stratific	ation lines are approximate. In-situ, the transition may	be gradual.		-		Hamme	er Type: Auto	matic				
Advar			See Exploration and	Testi	ng Proc	cedure	es for a Notes:						
01 NQ Abanc	/4 HSA 2 Wireline donment M ring backfil	Core c	lescrip <sup>t</sup> ion of field ar used and additional of See Supporting Infor symbols and abbrevi	nd lab data ( <mark>matic</mark>	poratory (If any).	/ proc	edures						
		TER LEVEL OBSERVATIONS	75				Boring Sta	arted: 02-12-2	2018	Borin	ng Com	pleted: 02-12-2	2018
	No free	e water observed while drilling					Drill Rig:	DR754		Drille	er: R. Pi	reston	
			51 Lost M Chatt		Dr Ste ga, TN	135	Project N	o.: E2175127					

	BORING	LO	G	N	0.	EB-1				F	Page 2 of 3	3
PR	OJECT: Hamm Road		CLI	EN	IT:	Hazen & Sa Nashville, T	awyer				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					nasiville,	I N					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0551° Longitude: -85.3288° Approximate Surface Elev: 669 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL	OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH ELEVATION (Ft.) LEAN CLAY WITH SAND (CL), brown, stiff 27.0 (continued) SILTY LEAN CLAY (CL-ML), dark gray, medium stiff	-	-									
		30	_ )	2	X	2-3-5 N=8			0.5 (HP)			
	32.0637+/- LEAN CLAY (CL), dark gray, very stiff	-	-									
		35	- ;		X	0-0-0 N=0			0.5 (HP)			
			_									
		40	- (	2	X	0-0-0 N=0			0.75 (HP)			
			_			0-0-0			1.0			
		45	; -	2		N=0			(HP)			
• ()• • ()• • ()•	47.0	_	_									
		50	)	K	X	10-35-50/5"						
	51.2     Auger Refusal at 51.2'     618+/-       Begin NQ2 Wireline Rock Core     618+/-	_										
	Stratification lines are approximate. In-situ, the transition may be gradual.					Hamr	ner Type: Auto	matic				<u> </u>
3 1/ NQ2 Aband	cement Method: 4 HSA 2 Wireline Core onment Method: ng backfilled with auger cuttings upon completion. See Supporting In symbols and abbre	al data formati	(If any ion for	y).								
	WATER LEVEL OBSERVATIONS					Boring	Started: 02-12-2	2018	Borir	ng Com	oleted: 02-12-2	2018
					_	Drill Rig	: DR754		Drille	er: R. Pi	reston	
	51 Losi Ch	t Moun nattano			35	Project	No.: E2175127					

				BORING I	LC	)Ģ	3 N	0	. EB-	1				F	Page 3 of 3	3
	PR	OJECT:	Hamm Road			С	LIEI	NT:	Hazen	ı & Saw /ille, TN	/yer					
	SIT		155 Hamm Road Chattanooga, Tennessee						Nuon	, inc, inc	•					
	GRAPHIC LOG		See Exploration Plan 0551° Longitude: -85.3288° Approximate Surfa	ce Elev: 669 (Ft.) +/-	DEPTH (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
RT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18		61.2	MITE, light gray, minor shale bedding continued)	ELEVATION (Ft.)	55	- - - - -	WATE	SAME	EU Depth: 61 Run L: 11	<u>V 1:</u> 51.2' - .2' ength:	10	3		CON		PERCI
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.	3 1/ NQ2 Aband	Stratificatio cement Meth 4 HSA 2 Wireline Co lonment Meth ing backfilled	nay be gradual. See Exploration and description of field used and additional See Supporting Info symbols and abbre	and la I data ormat	aboi a (If tion	ratory any).	proc	edures	Hammer Notes:	r Type: Auto	matic					
G LOG		WATE	R LEVEL OBSERVATIONS							Boring Sta	rted: 02-12-2	2018	Borir	ng Com	oleted: 02-12-	2018
<b>30RIN</b>		No free w	ater observed while drilling	- ller		7				Drill Rig: D				er: R. Pi		
THIS F				51 Lost I Cha	Moun			135		Project No	.: E2175127					

	BORIN	IG LC	0	3 N	0.	EB-2				F	Page 1 of 2	2
PR	OJECT: Hamm Road		C	LIE	NT:	Hazen & Sav Nashville, TM	vyer				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0551° Longitude: -85.3287° Approximate Surface Elev: 669 (F	, .	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	HP (tsf)	WATER CONTENT (%)	Atterberg Limits	PERCENT FINES
×77)		1 (Ft.) 68.5+/-										
	FILL - CLAYEY SAND, dark brown and black		_	-	X	3-5-7 N=12			.5 IP)			 
	5.5 66	63.5+/-	- 5 -	-	X	0-0-0 N=0						
	FILL - GRAVELLY CLAY , dark brown	661+/-	_	-	X	2-2-1 N=3			25 IP)			
	GRAVELLY LEAN CLAY WITH SAND, brown		- - 0-	-	X	9-5-5 N=10		1.2	5/0.5			
	12.0 SANDY LEAN CLAY (CL), brown, stiff	<u>657+/-</u>	_	-								
		1	-	-	X	3-5-5 N=10			.0 IP)			
			-	-								
		2	-02	-	X	3-4-5 N=9			.0 IP)			
			_	-								
		2	_ 25—	-	X	3-4-5 N=9			5 IP)			
	Stratification lines are approximate. In-situ, the transition may be gradual		_	1		Hamme	r Type: Autom	atic				
	sement Method: See Explora	ition and Te	estin	a Proc	edure	s for a Notes:						
Aband	ement Method: HSA See Explora description or used and ad See Suppor symbols and symbols and	lditional dat ting Informa	ta (If ation	f any). for ex								
BOLI	ng backfilled with auger cuttings upon completion.											
	WATER LEVEL OBSERVATIONS No free water observed while drilling	26					rted: 02-12-20	18	Boring	g Comp	oleted: 02-12-2	2018
		1 Lost Mou	und [	Dr Ste					Driller	:: R. Pr	eston	
		Chattan				Project No	.: E2175127					

	BORING	i LC	)(	G N	0.	EB-2				F	Page 2 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & Nashville	Sawyer				0	
SIT	TE: 155 Hamm Road Chattanooga, Tennessee					Nastivine	e, in					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0551° Longitude: -85.3287° Approximate Surface Elev: 669 (Ft.) + DEPTH ELEVATION (F			WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), brown, stiff (continued) 27.0 642											
	SILTY LEAN CLAY (CL), gray and dark gray, very soft		_									
		3	-0	-	X	0-0-0 N=0			0.75 (HP)			
			-	-								
		3	- 5-	-	X	0-0-0 N=0			0.5 (HP)			
			_	-								
		4	- - 0-	-	X	0-0-0 N=0			0.75 (HP)			
			_	-								
		4	- 5-	-	X	0-0-0 N=0			0.75 (HP)			
	47.0 622 SILTY LEAN CLAY (CL-ML), gray, hard	+/-	_	-								
			_	-	$\bigvee$	25-31-42	///"		1.25			
XX	49.8 619 Auger Refusal at 49.8 Feet	+/-			$\square$	20 01 42			(HP)			
	Stratification lines are approximate. In-situ, the transition may be gradual.					Н	ammer Type: Auto	matic				
3 1/ Aband	Incernent Method: If HSA See Exploration description of fi used and additive See Supporting symbols and ab	onal dat	ta (It	f any).		edures	otes:					
Bor	ing backfilled with auger cuttings upon completion.								_			
	WATER LEVEL OBSERVATIONS No free water observed while drilling					Bori	ing Started: 02-12-2	2018	Borin	ng Com	oleted: 02-12-2	2018
					_	Drill	Rig: DR754		Drille	er: R. Pr	reston	
		ost Mou Chattan			135	Proj	ject No.: E2175127					

	BOR	ING LO	00	S N	0.	PS-1				F	Page 1 of 3	3
PR	OJECT: Hamm Road		С	LIEN	T:	Hazen & Sav Nashville, TM	vyer					-
SIT	E: 155 Hamm Road Chattanooga, Tennessee						•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0553° Longitude: -85.3288° Approximate Surface Elev: 669 DEPTH ELEVAT	9 (Ft.) +/- 'ION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	ASPHALT AGGREGATE FILL - POORLY GRADED SAND AND GRAVEL, black	668.5+/- 668.5+/-	_		X	8-15-18 N=33 10-5-5						
			5 — _ _		X	10-5-5 N=10 13-50/6"						
	hard at 10'	1	- - 10- -		X	15-35-31 N=66						
	12.0 SILTY LEAN CLAY WITH SAND (CL), brown, stiff, chemical and fuel aroma	657+/-	_ _ 15— _ _		X	2-4-7 N=11			3.75 HP)			
		2	_ 20— _ _		X	3-6-8 N=14			3.0 (HP)			
		2	_ 25— _		X	3-4-6 N=10			2.5 HP)			
	Stratification lines are approximate. In-situ, the transition may be grad	lual.				Hamme	r Type: Auto	matic				
3 1/4 Aband	used and See Sup	loration and T ion of field and d additional da porting Inform and abbreviat	ata (If nation	any). for exp								
$\bigtriangledown$	WATER LEVEL OBSERVATIONS					Boring Sta	irted: 02-08-2	018	Boring	g Comp	oleted: 02-08-2	2018
<u> </u>	While drilling	err				Drill Rig: D	DR754		Drille	r: R. Pr	eston	
		51 Lost Mo Chatta			35	Project No	.: E2175127					

	BORIN	IG LO	00	G N	0	PS-1				F	Page 2 of 3	3
PR	OJECT: Hamm Road		C	CLIEI	NT:	Hazen & Nashville	Sawyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nasiiviin	e, IN					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0553° Longitude: -85.3288° Approximate Surface Elev: 669 (F DEPTH ELEVATIO	<i>'</i>	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	SILTY LEAN CLAY WITH SAND (CL), brown, stiff, chemical and fuel aroma (continued)		_	-								
		3	- 30	-	X	3-3-4 N=7			1.25 (HP)			
	32.0 LEAN CLAY WITH SILT (CL), dark gray, very soft	637+/-	_									
		3	- 35 -	-	Х	0-0-0 N=0			0.75 (HP)			
			_	-	$\bigtriangledown$	0-0-0 N=0			0.75			
		4	+0 - -	-	$ \bigtriangleup $	N=0		(	(HP)			
		4	- - 15-	-	X	0-0-0 N=0		(	1.25 (HP)			
000	47.0 CLAYEY SAND WITH GRAVEL (SC), brown, very dense	622+/-	-									
Participant and		5	- 50 	-	$\times$	17-50/2			0.75 <u>(HP)</u> /			
	Stratification lines are approximate. In-situ, the transition may be gradua	<u> </u>		1		Н	lammer Type: Auto	matic		<u> </u>		L
3 1/- Aband	cement Method: 4 HSA See Explor description used and a See Suppo symbols an ing backfilled with auger cuttings upon completion.	of field and dditional da	l labo ata (li	oratory f any).	proce	edures	otes:					
	WATER LEVEL OBSERVATIONS	1				Bori	ing Started: 02-08-2	018	Borin		pleted: 02-08-2	2018
$\Box$	While drilling	211	b				I Rig: DR754			er: R. Pi	-	
		51 Lost Mou Chattar	und [	Dr Ste	_		ject No.: E2175127			a. (X. PI		

				В	ORING	LC	)G I	10	. PS-	1				F	Page 3 of 3	3
	PR	OJECT:	Hamm Road				CLIE	NT:	Hazen	n & Saw /ille, TN	vyer					
	SIT	ſE:	155 Hamm Road Chattanooga, Ten	nessee					Nasin	/III <del>C</del> , II	•					
	<b>GRAPHIC LOG</b>	Latitude: 35	V See Exploration Plan 0553° Longitude: -85.3288°	Approximate Surface	Elev: 669 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	2	DEPTH CLAY dense	<b>EY SAND WITH GRAVI</b> (continued)				_									
	0	54.7	r Refusal at 54.7 Feet		614.5+/-		_	X	5-	50						
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT 3/30/18	3 1/ Aband	Stratification lines are approximate. In-situ, the transition may be gradual.  Stratification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: 3 1/4 HSA  Advancement Method: Boring backfilled with auger cuttings upon completion.  WATER LEVEL OBSERVATIONS  WATER LEVEL OBSERVATIONS				and la Il data ormat	aborator (If any) ion for e	y proc	edures	Hammer	r Type: Auto	matic				
G LOG I		WATE	R LEVEL OBSERVATIO	DNS	76					Boring Sta	irted: 02-08-2	2018	Borir	ng Comi	oleted: 02-08-	2018
BORIN(	$\square$	While dril	ling		ller	_				Drill Rig: D				er: R. Pr		
THIS				51 Lost Cha		d Dr Ste oga, TN			Project No	o.: E2175127						

	BOR	ING LO	00	3 N	0.	PS-2				F	Page 1 of 3	3
PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Sa	wyer				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nashville, T	N					
GRAPH		9 (Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.5 <u>ASPHALT</u> 0.8 <u>CONCRETE</u> <u>FILL - POORLY GRADED SAND</u> , dark brown and black	<u>668.5+/-</u> <u>668+/-</u>			X	14-16-11 N=27						
			_ 5 —		X	6-7-4 N=11						
					X	15-28-14 N=42						
		1	_ 10—		X	8-9-6 N=15						
	12.0 SANDY LEAN CLAY (CL), brown and gray, stiff	657+/-										
		1	-		X	1-4-5 N=9			4.0 (HP)			
		2	_ 20—		X	3-6-9 N=15			4.0 HP)			
		2			X	3-6-4 N=10			3.0 (HP)			
	Stratification lines are approximate. In-situ, the transition may be grad	dual.				Hamm	ner Type: Auto	matic				
3 1/4 NQ2 Aband	wireline Core used an See Sup	bloration and Tr ion of field and d additional da poorting Inform a and abbreviat	ata (If ation	any). for exp								
	WATER LEVEL OBSERVATIONS	-				Boring S	tarted: 02-08-2	2018	Borin	a Comr	oleted: 02-08-2	2018
$\square$	While drilling	lerr	5			Drill Rig:				r: R. Pr		_010
		51 Lost Mou Chattar	und D	or Ste 1			No.: E2175127		Dille			

		BORII	NG LC	)G	Ν	0.	PS-2				F	Page 2 of 3	3
	PR	OJECT: Hamm Road		CL	IEN	NT:	Hazen & Saw Nashville, TN	yer				0	
	SIT	E: 155 Hamm Road Chattanooga, Tennessee		-			Nasilvine, IN						
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0553° Longitude: -85.3287° Approximate Surface Elev: 669 ( DEPTH ELEVATIO		WATER LEVEL	OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
-		SANDY LEAN CLAY (CL), brown and gray, stiff 27.0 ( <i>continued</i> ) SILTY LEAN CLAY WITH SAND (CL-ML), dark gray, very soft	642+/-	_		X	0-0-0 N=0			0.75 (HP)			
PLATE.GDT 3/30/18			3	0 - -									
PJ TERRACON_DATATEM			3	5		X	0-0-0 N=0			0.75 (HP)			
NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18			4	- 0 -	ĸ	X	0-0-0 N=0			0.75 (HP)			
GEO SMART LOG-NO WE			4	_ 5_ _	×	X	0-0-0 N=0			0.75 (HP)			
	'°(	47.0 <u>SAND WITH GRAVEL (SP)</u> , gray and black, very dense	622+/-		Z.		11-50						
ED FROM ORIGINAL F	·····	49.5 <b>Auger Refusal at 49.5'</b> Begin NQ2 Wireline Rock Core <u>SHALE</u> , dark gray, unweathered, medium stiff	<u>619.5+/-</u> 51	0			11-30						
PARATE		Stratification lines are approximate. In-situ, the transition may be gradua	al.	1	1	1	Hammer	Type: Autor	natic				
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.	3 1/ NQ2 Aband	4 HSA descriptior 2 Wireline Core used and a See Suppo	ration and Te n of field and I additional dat orting Informa nd abbreviatio	laborat a (If an tion fo	ory y).	proce	edures						
SING LO	$\nabla$	WATER LEVEL OBSERVATIONS While drilling	BLL				Boring Star	ted: 02-08-2	018	Borir	ng Com	oleted: 02-08-2	2018
THIS BOR			51 Lost Mour Chattan	nd Dr S	Ste 1	_		R754 : E2175127		Drille	er: R. Pr	reston	

		BO	RING LC	)(	3 N	0	. PS-2				F	Page 3 of 3	3
	PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Sav Nashville, T	wyer N					
	SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nuonvine, 1						
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0553° Longitude: -85.3287° Approximate Surface Elev:	669 (Ft.) +/-		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
ATE.GDT 3/30/18		<u>SHALE</u> , dark gray, unweathered, medium stiff (continued)	<u>ATION (Ft.)</u> 54	 5			<b>RUN 1:</b> Depth: 49.5' - 59.5' Run Length: 10'	40	21				
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT		3 1/4 HSA description of field					Hamm	er Type: Auto	matic				
G IS NOT VALID IF SEPAR	3 1/4 NQ2 Aband	4 HSA desci 2 Wireline Core used see	Exploration and Te iption of field and I and additional data Supporting Informa ols and abbreviatio	labo a (If tion	ratory any).	proce	edures						
NG LO	$\nabla$	WATER LEVEL OBSERVATIONS While drilling					Boring St	arted: 02-08-2	2018	Borir	ng Com	oleted: 02-08-2	2018
S BORI		write criting	51 Lost Mour	_			Drill Rig:	DR754		Drille	er: R. Pr	eston	
Ĭ			Chattan			100	Project N	o.: E2175127					

	E	BORING L	.0	GN	10	PS-3			F	Page 1 of 3	3
PR	OJECT: Hamm Road			CLIE	NT:	Hazen & Sav	wyer				
SI	TE: 155 Hamm Road Chattanooga, Tennessee					Nashville, Ti	N				
LOG	LOCATION See Exploration Plan		Ft.)	IONS	-YPE	ISI	RY	) ORY	۲ (%)	ATTERBERG LIMITS	INES
GRAPHIC LOG	Latitude: 35.0552° Longitude: -85.3288°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
GР	Approximate Surface	Elev: 669 (Ft.) +/- ELEVATION (Ft.)	Δ	<b>VA</b> OBS	SA	Ē	Ē	LAI	0 0		PER
1947 Terr	0.5 ASPHALT	668.5+/-							+		
	FILL - POORLY GRADED SAND, black, with organics (wood)		-	-		40.04.04					
			-	_	Х	12-24-21 N=45					
			-								
			-	_	$\square$	27-22-16					
IO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18			5-	_	$\square$	N=38			+		
GDT			-			19-10-21			+		
LATE			-	_	$\square$	N=31					
VTEMP			-	_							
DAT			-	_	$\mathbb{N}$	3-2-1 N=3					
ACON			10-	_	$\square$	N=3					
TERR				_							
GPU	12.0 LEAN CLAY WITH SAND (CL), brown and gra	657+/-		_							
OAD.	stiff										
MMR	Sun				$\bigtriangledown$	3-3-6		3.0	1		
27 HA					$\square$	N=9		(HP	)		
21751											
IO WE											
GEO SMART LOG-N	3										
IART I					Х	8-6-6 N=12		4.0/2	.0		
EO SN			20-								
EPOR			-								
IAL RI											
RIGIN			-		X	3-4-6 N=10		2.25 (HP	)		
OMOS			25-		$\square$				1		
ARAT	Stratification lines are approximate. In-situ, the transition ma	ay be gradual.				Hamme	er Type: Auton	natic			
H S Advar L 3 1	ncement Method: /4 HSA	See Exploration and	Testi	ng Proo	cedure	s for a Notes:					
ALID		description of field ar used and additional of			proce	edures					
>	donment Method:	See Supporting Information symbols and abbrevi			kplana	ition of					
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT.	ing backfilled with auger cuttings upon completion.										
I I I I I I I I I I I I I I I I I I I	WATER LEVEL OBSERVATIONS					Boring St	arted:	Boi	ing Com	pleted:	
BORI	No free water observed while drilling	ller	ſ			Drill Rig:	DR754	Dri	ller: R. P	reston	
SHT		51 Lost M Chatt		Dr Ste ga, TN	135	Project N	o.: E2175127				

	BC	DRING L	.00	G N	0.	PS-3				P	age 2 of 3	3
PR	OJECT: Hamm Road		C		NT:	Hazen & Sav Nashville, T	wyer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					nashville, h	N					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0552° Longitude: -85.3288° Approximate Surface Ele		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%) I ABORATORY	HP (tsf) WATER	CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	DEPTH EL 27.0 LEAN CLAY WITH SILT (CL), gray and dark gra soft to very soft	<u>EVATION (Ft.)</u> 642+/- y,	-	-								
			- 30-	-	X	3-2-1 N=3			).5 IP)			
			-	-								
			- 35- -	-	Х	0-0-0 N=0			9.5 IP)			
			-	-		0-0-0		0	.75			
			40- -	_	Å	N=0		(H	IP)			
			-	-	$\bigvee$	0-0-0		0.	.75			
	47.0	622+/-	45- -	_		N=0			IP)			
	CLAYEY GRAVEL (GC), brown, very dense         48.5       Auger Refusal at 48.5'         Begin NQ2 Wireline Rock Core         DOLOMITE, light gray to light brown and light	620.5+/-	-	_		50/0"						
	green, slightly weathered, minor shale bedding, strong rock		50- -	_								
	Stratification lines are approximate. In-situ, the transition may b	e gradual.		1		Hamme	er Type: Auton	natic				
3 1/- Aband	4 ITSA de US Sé	ee Exploration and escription of field an ed and additional of ee Supporting Inform mbols and abbrevia	nd labo Jata (li matior	oratory f any). n for exp	proce	edures						
	WATER LEVEL OBSERVATIONS							<u> </u>				
	No free water observed while drilling	Jler				Boring St Drill Rig:			Boring ( Driller: I	-		
		51 Lost M		Dr Ste 1	<u> </u>		o.: E2175127					

		BOF	RING LC	)(	) N	10	. PS-3				F	Page 3 of 3	3
	PR	OJECT: Hamm Road		С	LIE	NT:	Hazen & Sa Nashville, T	awyer					
	SIT	FE: 155 Hamm Road Chattanooga, Tennessee					Nasriville,	I N					
	<b>GRAPHIC LOG</b>	LOCATION See Exploration Plan Latitude: 35.0552° Longitude: -85.3288° Approximate Surface Elev: 6			WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
3DT 3/30/18		DEPTH ELEVA DOLOMITE, light gray to light brown and light green, slightly weathered, minor shale bedding, strong rock (continued) 58.5	610.5+/-	_			RUN 1: Depth: 48.5' - 58.5' Run Length: 10'	56	16				
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPU TERRACON_DATATEMPLATE.GDT		/4 HSA descri	adual.	laboi	ratory		es for a Notes:	ner Type: Auto	matic				
G IS NOT VAL		See S	upporting Informa Is and abbreviation	ition		plana	ation of						
NG LOC		WATER LEVEL OBSERVATIONS					Boring S	Started:		Borir	ng Com	pleted:	
BORI		No free water observed while drilling	lerr	2				: DR754		Drille	er: R. Pi	reston	
THIS.			51 Lost Mour Chattan			135	Project	No.: E2175127					

		E	BORING L	0	GN	10	PS-4				F	Page 1 of 2	2
PR	OJECT:	Hamm Road			CLIE	NT:	Hazen &	& Sawyer					
SIT	E:	155 Hamm Road Chattanooga, Tennessee					Nashvil	ie, in					
2		See Exploration Plan 0552° Longitude: -85.3287°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	Е ТҮРЕ	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	DEPTH	Approximate Surface	ELEVATION (Ft.)	DEPT	WATEF OBSER\	SAMPLE	FIELD	RECC (%	97.02 07.02	LABOR HP	CONTE	LL-PL-PI	PERCEN
	0.5 <u>ASPH</u>		668.5+/-										
	dark	POORLY GRADED SAND AND GRAVE prown and black	<u>=L_,</u>		_	$\square$	10-1- N=4						
				-	_	X	1-2-1 N=20						
				5-	_	$\bigtriangledown$	1-1-2						
					_		N=3						
				10-	_	X	1-3-2 N=5						
	12.0 SANI medi	DY LEAN CLAY (SC), brown and gray, Im stiff to stiff	657+/-		_								
				15	_	X	3-3-2 N=5			2.0 (HP)			
					_								
				20-	_	X	3-3-6 N=9			3.0 (HP)			
					-								
				05	-	X	3-4-5 N=9			1.75 (HP)			
	Stratificatio	on lines are approximate. In-situ, the transition ma		25	_			Hammer Type: Auto	omatic				
			,										
	cement Meth 4 HSA	od:	See Exploration and description of field ar used and additional of See Supporting Inform	data (	(If any).		edures	lotes:					
		with auger cuttings upon completion.	symbols and abbrevi	ation	s.					<b>—</b>			
		R LEVEL OBSERVATIONS vater observed while drilling	Terr				Bo	ring Started: 02-08-	2018	Borin	ng Com	oleted: 02-08-2	2018
	110 1100 1					_	Dr	ill Rig: DR754		Drille	er: R. Pr	eston	
			51 Lost M Chatt		Dr Ste ga, TN	135	Pr	oject No.: E2175127	,				

		BORI	NG L	.00	G N	10	PS-4				P	age 2 of 2	2
	PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & Sav Nashville, Th	vyer				0	
	SIT	<ul> <li>155 Hamm Road</li> <li>Chattanooga, Tennessee</li> </ul>					nasiiville, II	N Contraction					
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.0552° Longitude: -85.3287° Approximate Surface Elev: 669 (	Ft.) +/-	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABURALURI HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH ELEVATIO			28	Ś					0		Ц
		27.0 LEAN CLAY WITH SILT (CL), gray and dark gray, very soft	642+/-	-	-		0-0-0			0.5			
TE.GDT 3/30/18				30- - -	-	$\land$	N=0			HP)			
DATATEMPLA				- 35-	-	X	0-0-0 N=0			0.75 HP)			
NO WELL E2175127 HAMM ROAD.GPJ TERRACON_DATATEMPLATE.GDT 3/30/18				-	-								
7 HAMM ROAD				- 40-	-	X	0-0-0 N=0			0.5 HP)			
WELL E217512				-	-								
GEO SMART LOG-NO				- 45-	-	X	0-0-0 N=0		(1	1.0 HP)			
	0	47.0 <u>CLAYEY SAND WITH GRAVEL (SC)</u> , dark gray, very dense	622+/-	-									
ORIGINAL REP	6	49.1 Auger Refusal at 49.1 Feet	620+/-	-		X	15-50/1"						
RATED FROM		Stratification lines are approximate. In-situ, the transition may be gradua	al.				Hamme	r Type: Autor	natic				
IF SEPA		vancement Method: See Exploration and description of field a				edure	es for a Notes:						
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT	Aband	Ionment Method: ing backfilled with auger cuttings upon completion.	additional conting Inform	data (I matioi	lf any). n for ex								
NG LO		WATER LEVEL OBSERVATIONS					Boring Sta	arted: 02-08-2	018	Boring	g Comp	oleted: 02-08-2	2018
BORI			26				Drill Rig: [	DR754		Driller	: R. Pr	eston	
THIS			51 Lost M Chatt		Dr Ste ga, TN	135	Project No	o.: E2175127					

	E	BORING L	_00	GΝ	О.	DS-1				F	Page 1 of 2	2
PR	OJECT: Hamm Road		C	CLIEN	IT:	Hazen & Sa Nashville, 1	wyer				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG		Elev.: 661.81 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	DEPTH 0.5 <u>ASPHALT</u>	ELEVATION (Ft.) 661.5										
	FILL - LEAN CLAY WITH GRAVEL, greenish and brown	gray	-	-	X	3-6-8 N=14		,	2.5 (HP)			
	brown and black		- 5 -	_	X	2-3-3 N=6			3.0 (HP)			
	• •	654	-		X	3-2-2 N=4			1.75 (HP)			
	8.0 FILL - LEAN CLAY WITH GRAVEL, brown, y and gray	ellow	- - 10-		X	3-5-5 N=10			1.75 (HP)			
	12.5 -low recovery FILL - LEAN CLAY, brown	649.5	-	_								
			- 15- -	- 4	X	2-1-1 N=2			2.5 (HP)			
	17.0 LEAN CLAY (CL), brown and gray, medium s stiff	tiff to	-	_								
			- 20- -	- 4	X	2-3-4 N=7			2.0 (HP)			
			-	-	$\checkmark$	2-6-7			4.0			
			25- -	_	$\wedge$	N=13			(HP)			
	Stratification lines are approximate. In-situ, the transition ma	y be gradual.				Hamn	ner Type: Auto	matic				
3 1/-	cement Method: 4 HSA	See Exploration and description of field a used and additional See Supporting Info	data (If rmatior	f any). 1 for exp								
	onment Method: ng backfilled with auger cuttings upon completion.	symbols and abbrev	iations									
	WATER LEVEL OBSERVATIONS				_	Boring S	Started:		Borin	ig Comp	oleted:	
	No free water observed while drilling				_		: DR754		Drille	er: R. Pr	eston	
		51 Lost M Cha	Nound I ttanoog		35	Project	No.: E2175127					

	E	BORING I	LO	G N	0.	DS	-1				F	Page 2 of 2	2
PR	OJECT: Hamm Road			CLIE	NT:	Hazer	n & Saw ville, TN	/yer					
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nash	vine, Tr	•					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.055013° Longitude: -85.327216° Surface DEPTH	Elev.: 661.81 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-PI	PERCENT FINES
	27.0	635											
	SANDY LEAN CLAY (CL), brown and gray, medium stiff			_									
			30-	_	Х	2-: N	3-4 =7			1.5 (HP)			
				_									
			35-	-	X		0-6 =6			.5 (HP)			
	37.0	625	00	_									
0	CLAYEY GRAVELLY SAND (SP-SC), blue-gra and greenish brown, medium stiff	ау		_									
			40-	_	X	3-3 N	3-4 =7						
	-no recovery below 42'			_									
			45-	_	X		6-29 =45						
0	46.5	615.5		_									
	Auger Refusal at 46.5 Feet												
	Stratification lines are approximate. In-situ, the transition ma	y be gradual.		-	I		Hamme	r Type: Auto	matic				<u> </u>
	cement Method: 4 HSA	See Exploration and description of field a used and additional	data (	(If any).			Notes:						
	onment Method: ng backfilled with auger cuttings upon completion.	See Supporting Info symbols and abbrev			plana	ition of							
	WATER LEVEL OBSERVATIONS No free water observed while drilling						Boring Sta	rted:		Borir	ng Comp	pleted:	
	No nee water observed write dritting				_		Drill Rig: D	DR754		Drille	er: R. Pr	eston	
		51 Lost I Cha		Dr Ste ga, TN	135		Project No	.: E2175127					

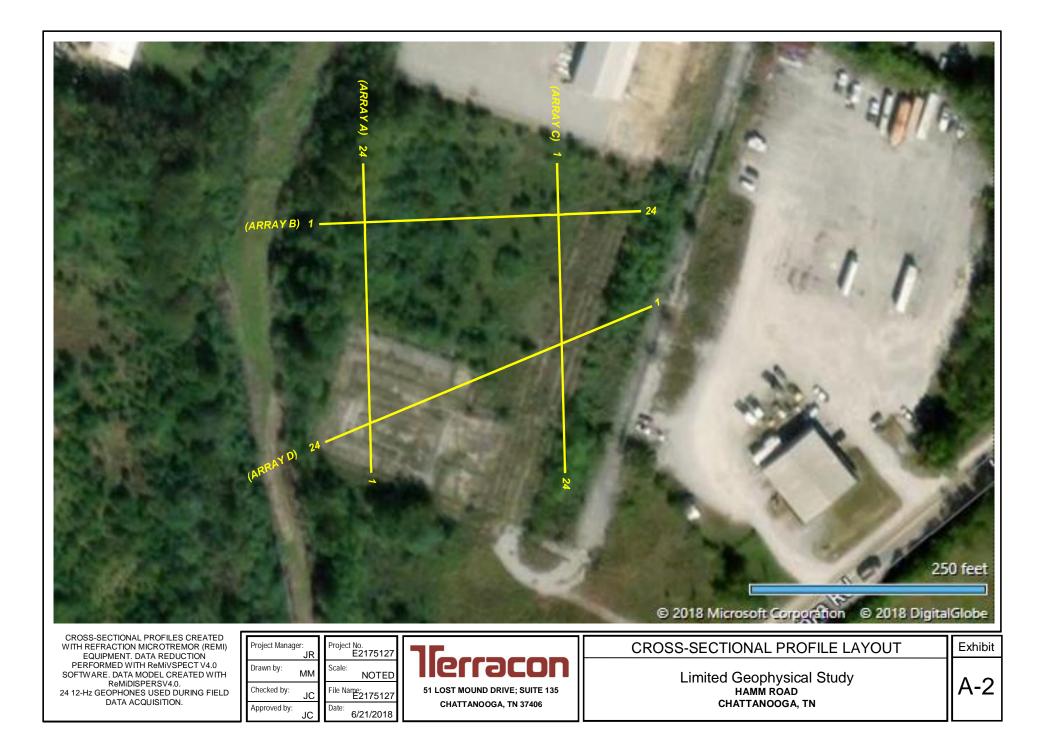
			BORING	LC	)G	N	<b>IO</b> .	DS-2				F	Page 1 of 3	3
PR	OJECT	: Hamm Road			CL	.IEI	NT:	Hazen & Sav Nashville, Th	vyer					
SIT	re:	155 Hamm Road Chattanooga, Tennessee						Nashvine, Ti	•					
GRAPHIC LOG		DN See Exploration Plan 35.054966° Longitude: -85.32715°		H (Ft.)		LEVEL ATIONS	Е ТҮРЕ	JLTS JLTS	VERY	D ()	ATORY (tsf)	'ER NT (%)	ATTERBERG LIMITS	T FINES
GRAPH		Su	rface Elev.: 661.39 (Ft.)	DEPTH (Ft.)		WA IEK LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	LL-PL-PI	PERCENT FINES
	DEPTH FIL trac	L - LEAN CLAY, trace gravel, brown a wood fragments	ELEVATION (Ft.) and gray,											
5000					_		X	3-4-4 N=8			4.0 (HP)			
				5	_		X	7-6-4 N=10			2.0 (HP)			
10 WELL EXTRICT HAMM KOADGPU TERRACON DATATEMPLATE (501 3/3078	-no	recovery			_		$\square$	2-2-2 N=4	0					
	-no	recovery			_			0-2-2	0					
				10	)		$\square$	N=4						
-COAU-GPJ					_									
				15	-		X	1-1-1 N=2			1.0 (HP)			
WELL EZT	17.0 LEA	N CLAY (CL), dark brown and black,	644.5 medium		_									
GEO SMARI LOG-NO	stiff				_		$\mathbf{X}$	0-3-3 N=6			2.25 (HP)			
				20	) -									
AL REPORT	22.0 <b>SAI</b> stiff	NDY LEAN CLAY (CL), gray and rust	<u>639.5</u> orange,		_									
				25	5-		Х	3-6-9 N=15			2.5 (HP)			
	Stratifica	tion lines are approximate. In-situ, the transition	on may be gradual.		_			Hamme	r Type: Auto	matic				
Advan → Advan → 3 1/	ancement Method: See Exploration 1/4 HSA description of fie Q2 Wireline Core used and additi				sting l	Proc atorv	edure	s for a Notes:						
	22 Wireline Core       used and addition         donment Method:       See Supporting I         ring backfilled with auger cuttings upon completion.       symbols and abb					iny).								
		ER LEVEL OBSERVATIONS	- 76					Boring Sta	arted: 02-05-2	2018	Borir	ng Com	pleted: 02-05-	2018
	While a	Irilling	– lier			<u> </u>						er: C. Pe		
			51 Lost Cha	Moun			135	Project No	o.: E2175127					

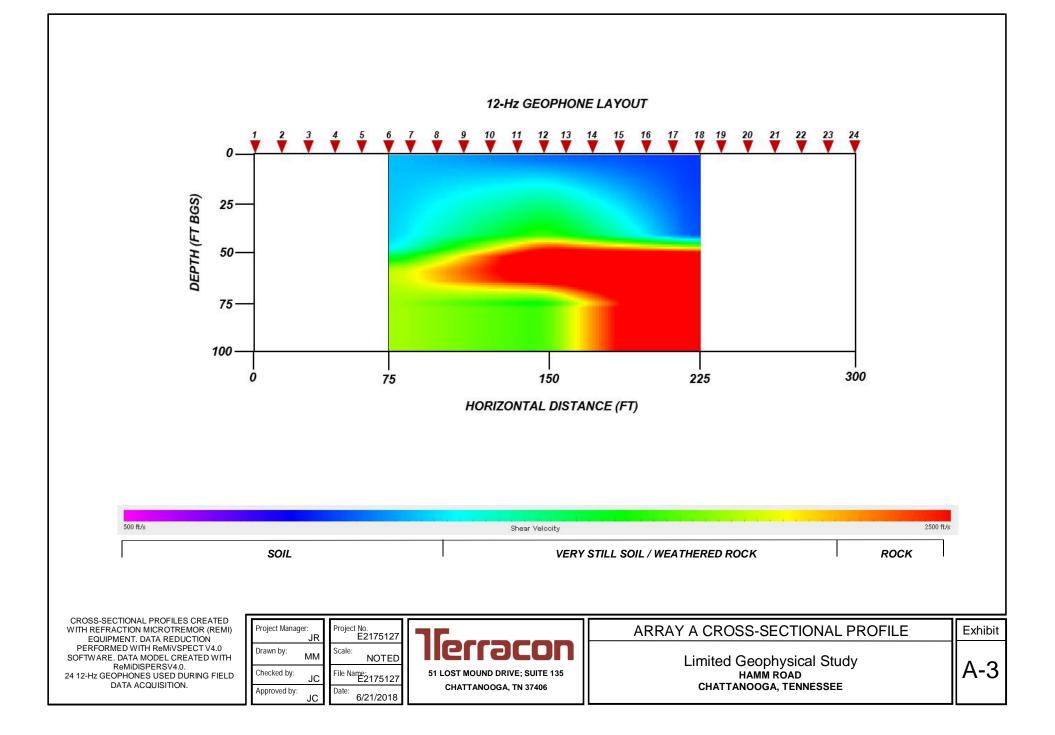
	В	ORING L	_00	G N	О.	DS-2				F	Page 2 of 3	3
PR	OJECT: Hamm Road		C	LIE	NT:	Hazen & Nashville	Sawyer e, TN				-	
SIT	E: 155 Hamm Road Chattanooga, Tennessee											
GRAPHIC LOG	DEPTH E SANDY LEAN CLAY (CL), gray and rust orange	ev.: 661.39 (Ft.) LEVATION (Ft.) 3.	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
	stiff (continued)	629.5	- - 30- -	-	X	3-4-6 N=10			1.5 (HP)			
	<u>SANDY LEAN CLAY (CL)</u> , gray and orange, medium stiff 37.0	624.5	- - 35- -	-	X	4-3-4 N=7			1.0/2.0			
	<u>SILTY SANDY CLAY (CL-ML)</u> , dark gray, mediu stiff 42.0	ım 619.5	- - 40 -		X	0-0-5 N=5			.75 (HP)			
	CLAYEY SAND WITH GRAVEL (SC), red, densi 44.2 Auger Refusal at 44.2' Begin NQ2 Wireline Rock Core SLIGHTLY WEATHERED SHALE, calcareous, I gray and gray, medium strong	617	- - 45	-	$\times$	45-50/2'	"		1.0 (HP)/			
			- - 50	-		RUN 1: Depth: 44. 54.2' Run Leng 10'	2' - 44	14				
	Stratification lines are approximate. In-situ, the transition may b	be gradual.				Ha	ammer Type: Aut	omatic				L
3 1/ NQ: Aband	4 HSA da 2 Wireline Core us	ee Exploration and escription of field a sed and additional ee Supporting Info ymbols and abbrev	and labo data (If rmation	for ex	proce	dures	tes:					
	WATER LEVEL OBSERVATIONS While drilling	JICER 51 Lost M Char	_	Dr Ste		Drill	ng Started: 02-05 Rig: DR754 ect No.: E217512		_	ig Comp er: C. Pe	oleted: 02-05-	2018

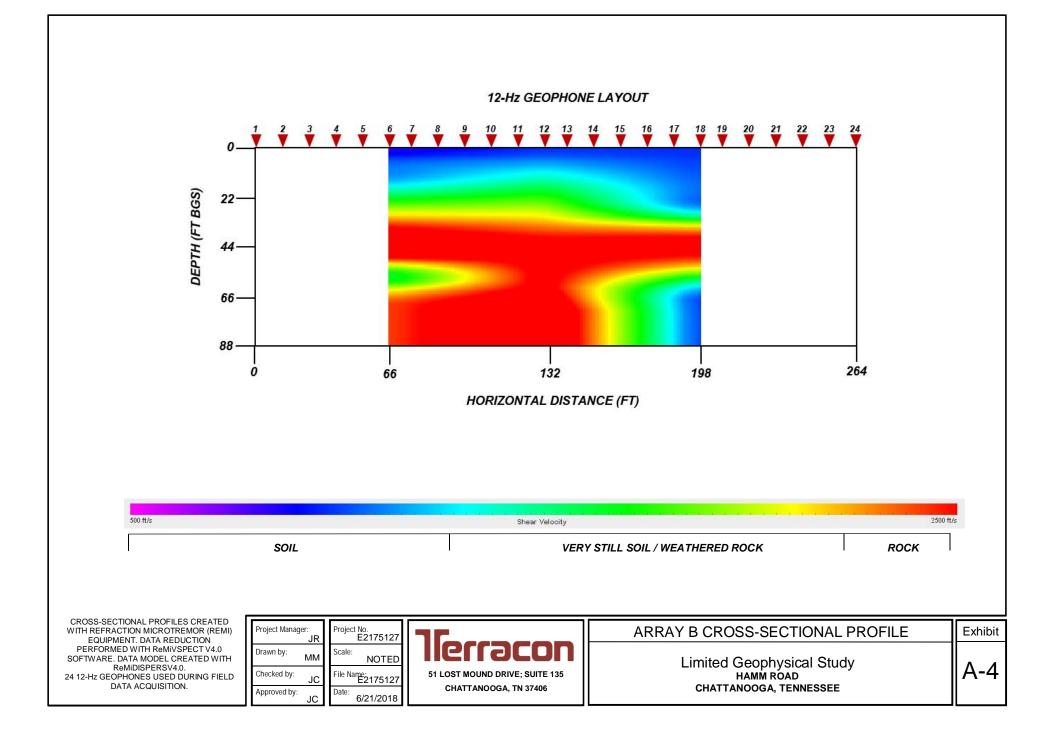
				BORING	GLC	)(	G N	10	. DS-	2				F	Page 3 of 3	3
	PR	OJECT:	Hamm Road			C	LIE	NT:	Hazen	i & Saw ville, TN	/yer					
	SIT	E:	155 Hamm Road Chattanooga, Tennessed	)					Huom		•					
	GRAPHIC LOG	Latitude: 35	N See Exploration Plan	Surface Elev.: 661.39 (I			WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	Atterberg Limits LL-PL-Pi	PERCENT FINES
		gray	HTLY WEATHERED SHALE, ca and gray, medium strong (contin	ued)		_	-									
ATE.GDT 3/30/18		54.2 SHA unwe	LE, calcareous, light gray, gray, eathered, medium strong	and maroon,	607 5 602	- 5- - -	-		RUI Depth: 59 Run Le	54.2' - .2'	100	74				
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL E2175127 HAMM ROAD GPJ TERRACON_DATATEMPLATE.GDT	Stratification lines are approximate. In-situ, the transition may be gradual.         Advancement Method: 3 1/4 HSA NQ2 Wireline Core       See Exploration and description of field used and additional See Supporting Info Symbols and abbre								Hammer	· Type: Auto	matic					
IS NOT VALID IF SI	3 1/4 NQ2 Aband	1/4 HSA     description of fie       Q2 Wireline Core     used and additio					oratory f any). n for ex	proc	edures	Notes:						
IG LOG I			ER LEVEL OBSERVATIONS							Boring Sta	rted: 02-05-2	2018	Borir	ng Com	pleted: 02-05-	2018
<b>BORIN</b>	$\nabla$	While dri	illing			_				Drill Rig: D				er: C. P		
THIS				_ost Mou Chattan			135		Project No	.: E2175127						

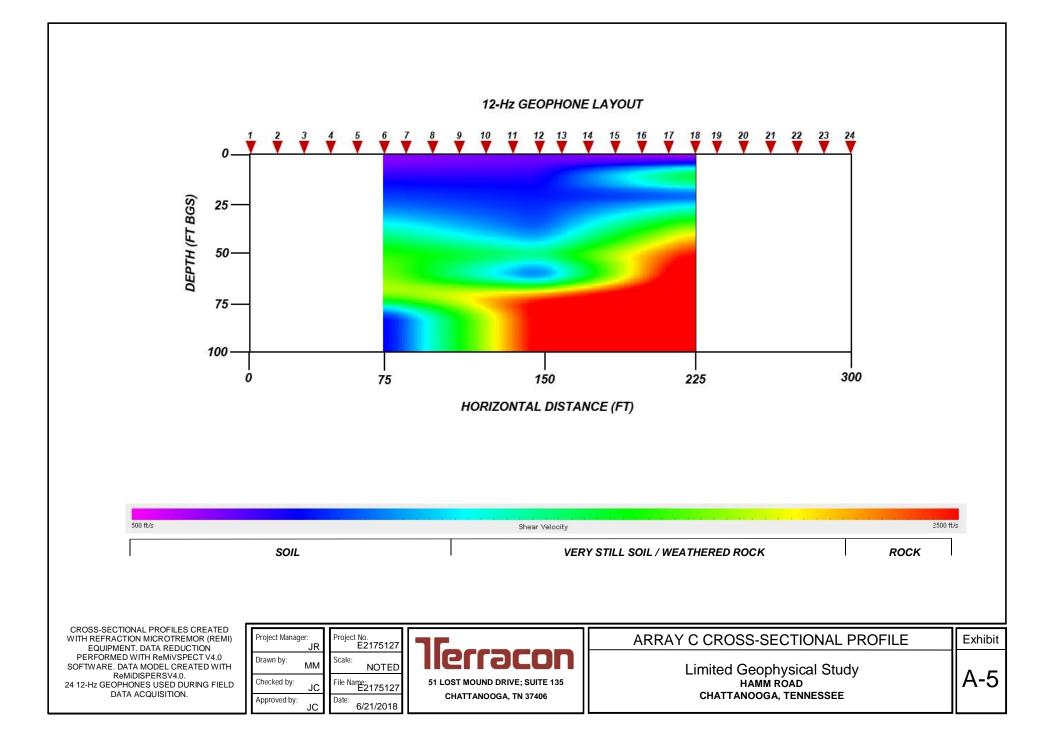
		E	BORING I	LO	GN	10	DS-	3				F	Page 1 of 2	2
PR	OJECT	Hamm Road			CLIE	NT:	Hazen	k Saw	yer					
SIT	E:	155 Hamm Road Chattanooga, Tennessee					Nasin	, inc, in						
GRAPHIC LOG		N See Exploration Plan 5.054948° Longitude: -85.327227° Surface	: Elev.: 661.39 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST	RESULTS	RECOVERY (%)	RQD (%)	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
<u> </u>	0.5 <b>TOP</b>		661											
	<u>FILL</u>	- LEAN CLAY, brown and orange			_	X	3-4 N=			1.	75/2.7	5		
	5.5		656	5-	_	X	2-2 N=				1.5 (HP)			
	<b>FILL</b> 7.5	- LEAN CLAY, with rock, brown	654		_	$\times$	3-50	0/3"			1.25 (HP)/			
	<u>LEA</u> med	<u>N CLAY (CL)</u> , with chert, yellow to brown um stiff	Ι,	10	_	X	1-3 N=				1.25 (HP)			
	12.0		649.5	10	_									
	<u>CLA</u>	YEY SAND (SC), black, very loose			_	$\bigtriangledown$	0-0				1.0			
				15	_	$\square$	N=	=2			(HP)			
	17.0 LEA	N CLAY (CL), olive to brown, very soft	644.5		- - 									
				20	_	X	0-0 N=				1.25 (HP)			
	22.0 <b>SAN</b>	DY LEAN CLAY (CL), tan and gray, stiff	639.5		_									
				25	_	X	4-6 N=			3	.5/1.7	5		
	Stratificat	on lines are approximate. In-situ, the transition ma	ay be gradual.		_			Hammer	Type: Auto	matic				
	cement Met 4 HSA	nod:	See Exploration and	d Test	ing Proc	edure	s for a	Notes:						
used and ad See Support		used and additional See Supporting Info	<ul> <li>Exploration and Testing Procedures for a scription of field and laboratory procedures ad and additional data (If any).</li> <li>Supporting Information for explanation of nbols and abbreviations.</li> </ul>											
	WAT	ER LEVEL OBSERVATIONS						Boring Star	ted: 02-08-2	018	Borir	ıg Comi	oleted: 02-08-2	2018
$\nabla$	While dr	illing letion of drilling	ller	٢				Drill Rig: DF			_	er: R. Pr		
	, comp		51 Lost I Cha		l Dr Ste oga, TN	135		Project No.:	E2175127					

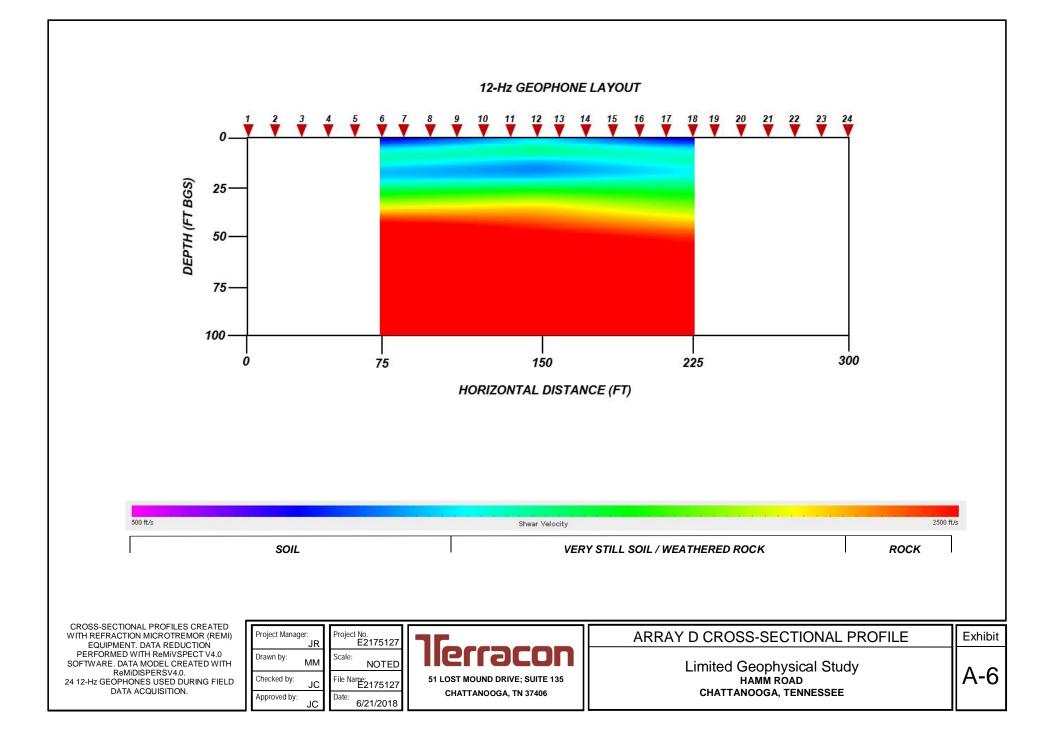
	В	ORING L	_00	G N	0.	DS-3				F	age 2 of 2	2
PR	OJECT: Hamm Road		C	CLIE	NT:	Hazen & S Nashville	Sawyer				0	
SIT	E: 155 Hamm Road Chattanooga, Tennessee					Nuonvino	,					
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.054948° Longitude: -85.327227° Surface El	ev.: 661.39 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	RECOVERY (%)	RQD (%)	LABURAI URY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), tan and gray, stiff	LEVATION (Ft.)		>ō	S					0		đ
	(continued)		-	-	$\bigvee$	0-3-4			1.5			
	medium stiff		30- - -	-	$\bigtriangleup$	N=7		(	HP)			
			- 35-	-	X	2-2-2 N=4			2.0 HP)			
	37.0 624.5 CLAYEY SAND (SC), dark gray, medium dense		-									
			- 40 -	-	Х	0-2-10 N=12			.75 HP)			
	42.0 EXTREMELY WEATHERED SHALE	619.5	-	-								
	44.2 Auger Refusal at 44.2 Feet	617	-	$\nabla$	$\ge$	35-50/2"			2.5 HP)			
Stratification lines are approximate. In-situ, the transition may be gradual.						На	mmer Type: Auto	matic				
Advancement Method: 3 1/4 HSA See Exploration and description of field a used and additional See Supporting Info Symbols and abbreviations		data (If rmatior	f any). 1 for ex			es:						
Bori	ng backfilled with auger cuttings upon completion.								I			
$\Box$	WATER LEVEL OBSERVATIONS While drilling	Ter	61				Boring Started: 02-08-2018 Boring Completed: 02-08-2018				2018	
	At completion of drilling	51 Lost N		Dr Ste			Rig: DR754 ect No.: E2175127		Drillei	r: R. Pr	eston	

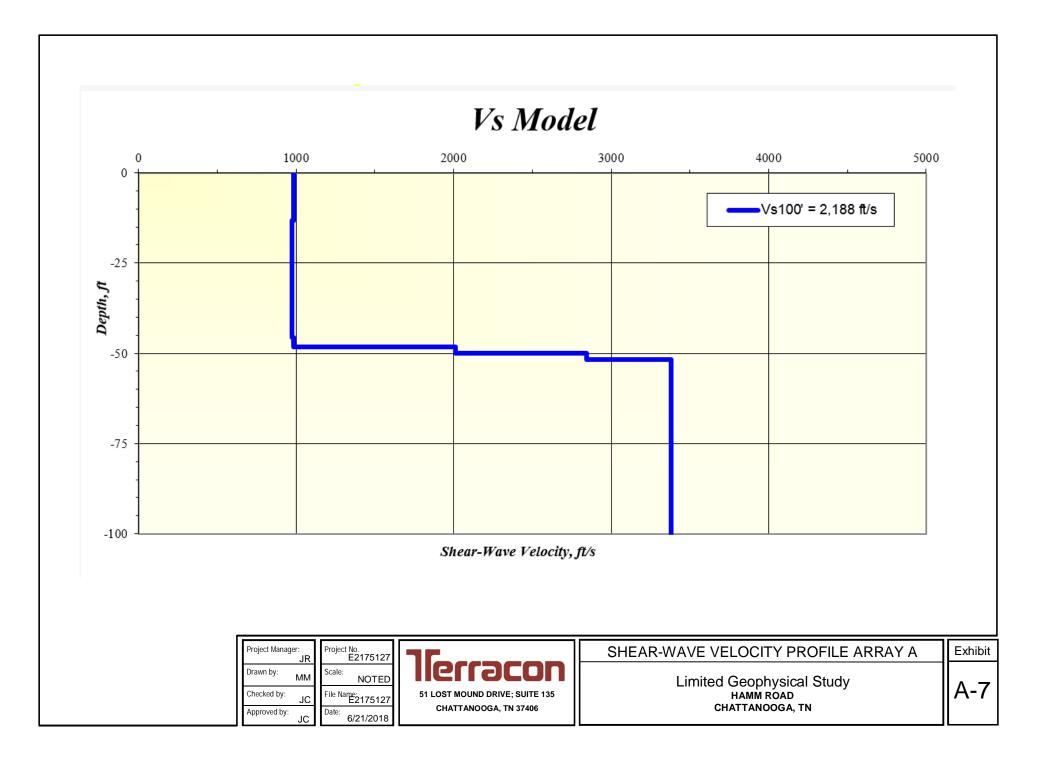


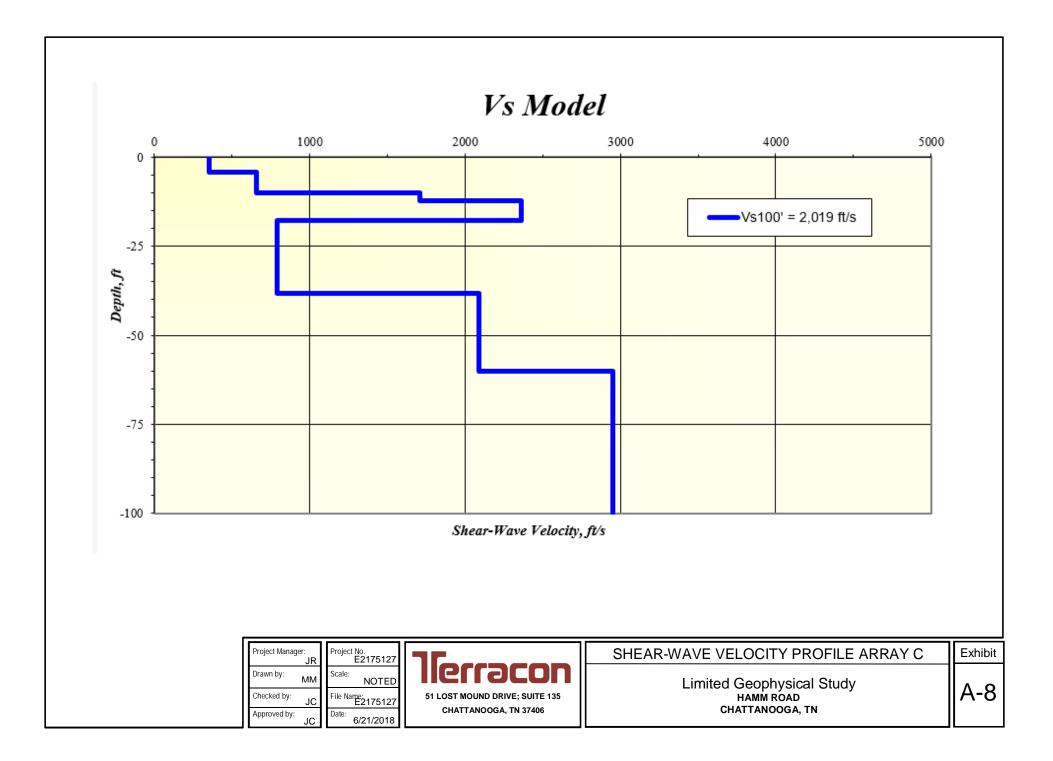












**SUPPORTING INFORMATION** 

## UNIFIED SOIL CLASSIFICATION SYSTEM

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee October 3, 2018 Terracon Project No. E2175127F

## 1lerracon GeoReport Soil Classification Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests A Group

			16313 /	Symbol	Group Name <sup>B</sup>	
Gravels:	Clean Gravels:	Cu <sup>3</sup> 4 and 1 £ Cc £ 3 <sup>E</sup>		GW	Well-graded gravel F	
More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines <sup>C</sup>	Cu < 4 and/or 1 > Cc > 3	GP	Poorly graded gravel F		
	Gravels with Fines: Fines classify as ML or MH		1H GM		Silty gravel <sup>F, G, H</sup>	
	More than 12% fines <sup>C</sup>	Fines classify as CL or C	Ή	GC	Clayey gravel F, G, H	
Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands:	Cu <sup>3</sup> 6 and 1 £ Cc £ 3 <sup>E</sup>		SW	Well-graded sand	
	Less than 5% fines <sup>D</sup> $Cu < 6$ and/or $1 > Cc > 3^{E}$				Poorly graded sand	
	Sands with Fines:	Fines classify as ML or N	ИH	SM	Silty sand <sup>G, H, I</sup>	
	More than 12% fines <sup>D</sup>	Fines classify as CL or C	Ή	SC	Clayey sand <sup>G, H, I</sup>	
	Inorgania	PI > 7 and plots on or ab	ove "A"	CL	Lean clay <sup>K</sup> , <sup>L, M</sup>	
Silts and Clays:	-	PI < 4 or plots below "A" line J		ML	Silt <sup>K</sup> , L, M	
Liquid limit less than 50		Liquid limit - oven dried	< 0.75	OL	Organic clay <sup>K</sup> , L, M, N	
		Liquid limit - not dried	< 0.75		Organic silt <sup>K</sup> , L, M, O	
	Inorganic:	PI plots on or above "A"	line	СН	Fat clay <sup>K, L, M</sup>	
Silts and Clays:	norganic.	PI plots below "A" line		MH	Elastic Silt <sup>K, L, M</sup>	
Liquid limit 50 or more	Ormonia	Liquid limit - oven dried	< 0.75	ОН	Organic clay <sup>K, L, M, P</sup>	
	Organic.	Liquid limit - not dried	< 0.75		Organic silt K, L, M, Q	
Highly organic soils:         Primarily organic matter, dark in color, and organic odor					Peat	
	Gravels: More than 50% of coarse fraction retained on No. 4 sieve Sands: 50% or more of coarse fraction passes No. 4 sieve Silts and Clays: Liquid limit less than 50 Silts and Clays: Liquid limit 50 or more	Gravels: More than 50% of coarse fraction retained on No. 4 sieveClean Gravels: Less than 5% fines C Gravels with Fines: More than 12% fines CSands: 50% or more of coarse fraction passes No. 4 sieveClean Sands: Less than 5% fines DSands: sieveClean Sands: Less than 5% fines DSilts and Clays: Liquid limit less than 50Inorganic: Organic:Silts and Clays: Liquid limit 50 or moreInorganic: Organic:	Gravels: More than 50% of coarse fraction retained on No. 4 sieveClean Gravels: Less than 5% fines CCu $^3$ 4 and 1 £ Cc £ 3 FSands: 50% or more of coarse fraction passes No. 4 sieveGravels with Fines: More than 12% fines DFines classify as ML or MSands: 50% or more of coarse fraction passes No. 4 sieveClean Sands: Less than 5% fines DCu $^3$ 6 and 1 £ Cc £ 3 FSilts and Clays: Liquid limit less than 50Inorganic:PI > 7 and plots on or ab PI < 4 or plots below "A"	Gravels:       Less than 5% fines C       Cu < 4 and 7 L C C 2 3 C	Gravels:       Clean Gravels:       Cu 3 4 and 1 £ Cc £ 3 E       GW         More than 50% of coarse fraction retained on No. 4 sieve       Less than 5% fines C       Cu < 4 and/or 1 > Cc > 3 E       GP         Gravels:       More than 12% fines C       Fines classify as ML or MH       GM         More than 12% fines C       Fines classify as CL or CH       GC         Sands:       Clean Sands:       Less than 5% fines D       Cu < 6 and 1 £ Cc £ 3 E	

A Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

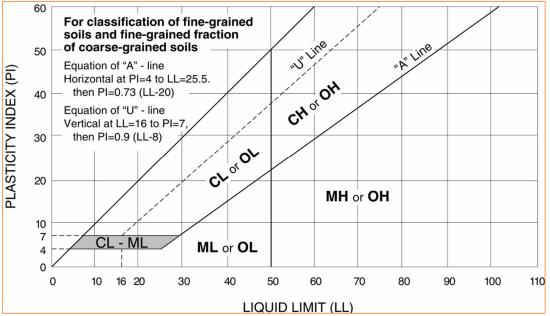
- <sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
- <sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

<sup>E</sup> Cu = D<sub>60</sub>/D<sub>10</sub> Cc = 
$$\frac{(D_{30})^2}{D_{40} \times D}$$

F If soil contains <sup>3</sup> 15% sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

- <sup>H</sup> If fines are organic, add "with organic fines" to group name.
- I f soil contains <sup>3</sup> 15% gravel, add "with gravel" to group name.
- <sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
- K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
- L If soil contains <sup>3</sup> 30% plus No. 200 predominantly sand, add "sandy" to group name.
- <sup>M</sup>If soil contains <sup>3</sup> 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
- NPI 3 4 and plots on or above "A" line.
- <sup>O</sup>PI < 4 or plots below "A" line.
- P PI plots on or above "A" line.
- <sup>Q</sup>PI plots below "A" line.



## **DESCRIPTION OF ROCK PROPERTIES**

Hamm Road Wet Weather Storage Facility 
Chattanooga, Tennessee

October 3, 2018 
Terracon Project No. E2175127F



WEATHERING								
Fresh	Rock fresh, crystals bri	ght, few joints may s	how	slight staining. Roc	k rings under	hammer if crystalline.		
/ery slight Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.								
Slight						in. Joints may contain clay. In Iline rocks ring under hammer.		
Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.								
Moderately severe	All rock except quartz show kaolinization. Ro					Il and discolored and majority ith geologist's pick.		
Severe						t reduced in strength to strong of strong rock usually left.		
Very severe	All rock except quartz of only fragments of stron		. Ro	ck "fabric" discernibl	e, but mass e	ffectively reduced to "soil" with		
Complete	be present as dikes or	stringers.				cattered locations. Quartz may		
HARDNESS (for en	gineering description o	f rock – not to be co	onfu	sed with Moh's sca	le for miner	als)		
Very hard	Very hard Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows or geologist's pick.							
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.							
Moderately hard	Can be scratched with a geologist's pick. Han					avated by hard blow of point of		
Medium	Can be grooved or gou to pieces about 1-in. m					an be excavated in small chips k.		
Soft	Can be gouged or groo in size by moderate blo					chips to pieces several inches ger pressure.		
Very soft	Can be carved with kn broken with finger pres				k. Pieces 1-	in. or more in thickness can be		
	Joi	nt, Bedding, and Fo	liatio	on Spacing in Rock	1			
Sp	acing	Jo	oints	;	E	Bedding/Foliation		
Less t	than 2 in.	Very	y clo	se	Very thin			
2 in	Close			Thin				
1 ft.	. – 3 ft.	Modera	ately	close	Medium			
3 ft.	W	Vide		Thick				
More t	han 10 ft.	Very	y wio	de		Very thick		
1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.								
Rock	Quality Designator (RQ	D) <sup>1</sup>		Joi	nt Openness	s Descriptors		
ROD as a perce	entage Diagnost	ic description		Opennes		Descriptor		

Itor (RQD)		Joint Opennes	ba Deacriptora				
Diagnostic description		Openness	Descriptor				
Exceeding 90         Excellent           90 - 75         Good           75 - 50         Fair           50 - 25         Poor		No Visible Separation Tig					
		Less than 1/32 in.	Slightly Open				
		1/32 to 1/8 in.	Moderately Open				
		1/8 to 3/8 in.	Open				
Very poor		3/8 in. to 0.1 ft.	Moderately Wide				
1. RQD (given as a percentage) = length of core in pieces 4			Wide				
	Diagnostic description Excellent Good Fair Poor Very poor	Diagnostic description Excellent Good Fair Poor Very poor	Diagnostic descriptionOpennessExcellentNo Visible SeparationGoodLess than 1/32 in.Fair1/32 to 1/8 in.Poor1/8 to 3/8 in.Very poor3/8 in. to 0.1 ft.				

inches and longer / length of run

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. <u>Subsurface Investigation for</u> <u>Design and Construction of Foundations of Buildings.</u> New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, <u>Engineering Geology Field Manual</u>.