GEOServices, LLC-Geotechnical and Materials Engineers

December 17, 2018

Cannon & Cannon, Incorporated
8550 Kingston Pike
Knoxville, Tennessee 37919

Attention: Mr. Jason Hunt, P.E.
jhunt@cannnon-cannon.com

Subject: **REPORT OF LIMITED GEOTECHNICAL EXPLORATION**
Clifton Road Development
Knoxville's Community Development Corporation (KCDC)
Knoxville, Tennessee
GEOServices Project No. 21-18941

Dear Mr. Hunt:

We are submitting the results of the limited geotechnical exploration performed for the subject project. The geotechnical exploration was performed in accordance with our email and phone correspondence dating from March 2, 2018. The following report presents our findings and recommendations for the proposed construction.

PROJECT INFORMATION AND SITE DESCRIPTION

The project site is located on the east side of Clifton Road and on the north side of Sanderson Road, generally near the intersection of the two above mentioned roads in Knoxville, Tennessee. Project information was provided by you in the form of a set of site plans titled "*Clifton Road Development"* prepared by Cannon & Cannon, Incorporated, and dated September 10, 2018. We understand that the proposed construction will consist of 28 new stand-alone duplexes and the associated parking areas and driveways.

We note that the majority of units will have access from Clifton Road, however a limited number of units (7) will have access for Whedbee Drive, Chillicothe Street, and Sanderson. We note there will be at least two proposed retaining walls, from about 75 to 120 feet in length, and with maximum heights of about 8 and 15 feet, respectively. Wall designs or recommendations are not included in our scope of services. Finally, information on the type of construction of foundation loads was not provid3ed. However, we anticipate the structures will be one to two, two-story, wood frame construction, utilize a conventional system of shallow foundations and concrete slab-on-grade. We have assumed that maximum individual column and continuous wall foundation loads will be on the order of 15 kips and 2 kips per linear foot, respectively.

Based on the provided topographic information, the majority of the project site generally slopes gently downhill from south to the north. However, a small portion of the site near Sanderson Road general exhibits topography that slopes gently to moderately downhill from the east to the west Existing site elevations range from an approximate maximum elevation of about 1076 feet mean sea-level (MSL) in the southern portion of the site near the intersection of Sanderson and Clifton to approximately 936 feet MSL in the northern extent of the site near the intersection of Clifton and Whedbee. Based on the anticipated finish grades, we understand maximum earthwork cuts of up to about 15 feet and fills of less than 10 feet will be required to reach proposed grades across the site.

Existing ground cover generally consists of areas of short grass and vegetation with isolated mature growth trees located in southern portions of the site. Based on a review of available historical aerial imagery, the site was once occupied by a limited number of residential structures. The structures have been demolished; however, remnants of the structures (construction debris) may still be onsite.

FIELD EXPLORATION

The existing subsurface conditions were explored with fifteen (15) observation pits excavated at the approximate locations as shown on the Observation Pit Location Plans attached to this report. The observation pit locations were selected and located by GEOServices personnel. Excavations were performed with a mini-excavator by our subcontractor on December 4, 2018. Observations were performed during excavation by our Mr. Michael Bridges, E.I. All depths in this report reference the ground surface that existed at the time of this exploration. Each observation pit location was backfilled and tamped before departing the site. Detailed information pertaining to each observation pit can be found in the Observation Pit Logs included as an attachment to this letter.

GEOLOGIC CONDITIONS

The project site, and most of East Tennessee, lies in the Appalachian Valley and Ridge Physiographic Province. The Province is characterized by elongated, northeasterly-trending ridges formed on highly resistant sandstones and shales. Between ridges, broad valleys and rolling hills are formed primarily on less resistant limestones, dolomites and shales.

Published geologic information indicates that the site is underlain by the bedrock of the Conasauga Group. In the area of this site, the Conasauga Group is composed of the following formations; Nolichucky Shale, Maryville Limestone, Rutledge Limestone, Rogersville Shale, and Pumpkin Valley Shale. The Nolichucky Shale formation is primarily composed of thin-bedded shale and calcareous siltstone with minor amounts of limestone and weathers to produce a reddish-brown or faintly green shaley soil containing red clay from limestone units. The Maryville and Rutledge Limestones are massive, crystalline to aphanitic limestones containing thin dolomitic layers which typically weather to produce a reddish orange clay residuum containing chert fragments. The Rogersville Shale consists of light green, olive green, and purple shale which typically weathers to a thin acidic clay soil containing shale chips. The Pumpkin Valley Shale consists of red, yellow, or brown shale which typically weathers to produce silty clay residuum with some sand and shale-like structure.

The boundary between soil and rock is not sharply defined in this geologic setting and there often is a transitional zone, termed "weathered rock" overlying competent bedrock. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and/or zones of weathered rock within the soil mantle well above the general bedrock level.

Since the bedrock underlying this site contains carbonate rock (i.e. limestone/dolomite), the site is susceptible to the typical carbonate hazards of irregular weathering, cave and cavern conditions, and overburden sinkholes. Carbonate rock, while appearing very hard and resistant, is soluble in slightly acidic water. This characteristic, plus differential weathering of the bedrock mass is responsible for the hazards. Of these hazards, the occurrence of sinkholes is potentially the most damaging to overlying soil-supported structures. Sinkholes occur primarily due to differential weathering of the bedrock and flushing or raveling of overburden soils into the cavities in the bedrock. The loss of solids creates a cavity or dome in the overburden. Growth of the dome over time or excavation over the dome can create a condition in which rapid, local subsidence or collapse of the roof of the dome occurs.

SUBSURFACE CONDITIONS

The following subsurface description is of a generalized nature to highlight the subsurface stratification features and material characteristics at the testing locations. The observation trench logs included as an attachment to this report should be reviewed for specific information at each observation trench location. Information on actual subsurface conditions exists only at the specific observation locations and is relevant only to the time that this exploration was performed. Variations may occur and should be expected at the site.

Surficial

A surficial layer of topsoil with interbedded root structure was encountered each observation pit that was approximately 2 to 12 inches in thickness.

Fill

Beneath the surficial topsoil layer in observation pits OP-6 through OP-12, OP-14 and OP-15, a layer of fill was encountered to depths ranging from 1 to 6 feet beneath the existing surface. Note that the deeper zones of fill were encountered in observation pit OP-9. Additionally, the shallower fill zones were generally encountered in OP-11, OP-12, OP-14 and OP-15, where buried topsoil was encountered. Fill is defined as material that has been transported and placed by man. The fill encountered generally consisted of brown lean clay (CL) with varying amounts of deleterious materials (e.g. trash, wood, cinders, organics, etc.). The fill was generally observed to be soft and often noted to be moist.

Residual Soil

Beneath the existing fill material/buried topsoil, and beneath the surficial topsoil encountered in the remaining observation pits, residual soils were encountered to depths ranging from 3to 8 feet below existing ground surface. Residual soils are formed from the in-place weathering of the underlying parent bedrock. The residual soils generally consisted of orangish brown and light brown lean clay (CL) or orangish brown and reddish-brown fat clay (CH) with varying amounts of shale or chert fragments. The residual soils were visually estimated to be firm to very stiff in consistency.

SITE ASSESSMENT

Based on the results of the field exploration, it is our opinion that the site is adaptable for the proposed construction. Additionally, if the site is prepared within accordance with the recommendations presented herein, it is our opinion that the proposed structures can be supported on conventional shallow foundations and slabs-on-grade. However, the site does have certain challenges that should be fully understood prior to construction. These challenges included: existing fill, buried debris, previous developments and lower consistency residual soils.

Existing fill material was encountered nine of the observation pits that contained various amounts of deleterious materials (e.g. wood, construction debris, etc.). Additionally, buried topsoil was encountered in four of the observation pits below the existing fill. We recommend the existing fill (including buried topsoil) be completely removed and be disposed of according to state and local regulations. Additionally, as previously mentioned, portions of the site were once occupied by residential type structures that have been demolished. Therefore, the presence of underground utilities, foundations, or additional buried debris is possible. If encountered, these materials should be completely removed and the resulting excavations should be backfilled with properly placed fill material. Structural fill recommendations are presented herein.

Lower consistency (i.e. firm) residual soils were often encountered at or near the fill and residual interface. These firm soils will likely not provide adequate support for foundation or subgrade support. As such, we recommend thoroughly proofrolling subgrades once any required excavations are performed. Recommendations for proofrolling is provided herein. Any areas that do not performed adequately should be remediated as directed by the geotechnical engineer. Appropriate recommendations should be made in the field and will be dependent on the observations made. However, typical remediation recommendations consist of undercut/replacement, geotextile fabrics or a combination thereof.

SITE PREPARATION RECOMMENDATIONS

Subgrade

All vegetation, topsoil, loose rock fragments greater than 6 inches, existing fill, abandoned utilities (if any exist), and other debris should be removed from the proposed construction areas. Stripping operations should extend a minimum of 5 feet beyond the limits of proposed pavement areas and 10 feet beyond building limits.

After completion of stripping operations and any required excavations to reach planned subgrade elevation, we recommend that the subgrade be proofrolled with a fully-loaded, tandem-axle dump truck or other pneumatic-tired construction equipment of similar weight. The geotechnical engineer or his representative should observe proofrolling. Areas judged to perform unsatisfactorily by the engineer should be undercut and replaced with structural soil fill or remediated at the geotechnical engineer's recommendation. Areas to receive structural soil fill should also be proofrolled prior to the placement of any fill.

Structural Fill

Material considered suitable for use as structural fill should be clean soil free of organics, trash, and other deleterious material, containing no rock fragments greater than 6 inches in any one dimension. Preferably, structural soil fill material should have a standard Proctor maximum dry density of 90 pcf, or greater, and a plasticity index (PI) of 35 percent or less. All material to be used as structural fill should be tested by the geotechnical engineer to confirm that it meets the project requirements before being placed. Based on visual observation, the on-site residual soil appears generally suitable for use as structural soil fill. The existing fill should NOT be considered suitable for structural fill.

Structural fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Each lift should be compacted to at least 98 percent of the soil's maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus (-) 2 percent to plus (+) 3 percent of the optimum moisture content. Each lift should be tested by geotechnical personnel to confirm that the contractor's method is capable of achieving the project requirements before placing any subsequent lifts. Any areas which have become soft or frozen should be removed before additional structural fill is placed.

FOUNDATION RECOMMENDATIONS

Shallow Foundations

Foundations for the proposed residences are anticipated to bear in properly compacted structural fill or residual soils. The recommended allowable soil bearing capacity for design of the foundations is 2,500 psf. Even if design loads would allow smaller sizes, we recommend that continuous footings be a minimum of 18 inches wide and isolated spread footings be a minimum of 24 inches wide to reduce the possibility of a localized punching shear failure. Exterior footings should be designed to bear at least 18 inches below finished exterior grade to protect against frost heave. Interior footings can be located on acceptable bearing materials at nominal depths compatible with architectural and structural considerations.

Foundation subgrade observations should be performed by a GEOServices geotechnical engineer, or his qualified representative, so that the recommendations provided in this report are consistent with the site conditions encountered. A dynamic cone penetrometer (DCP) is commonly utilized to provide information that is compared to the data obtained in the geotechnical report. Where unacceptable materials are encountered, the material should be excavated to stiff, suitable soils or remediated at the geotechnical engineer's direction. Typical remedial measures consist of undercutting, overexcavation, or combinations thereof.

Foundation excavations should be opened, the subgrade evaluated, remedial work performed, and concrete placed in an expeditious manner. Exposure to weather often reduces foundation support capabilities, thus necessitating remedial measures prior to concrete placement. It is also important that proper surface drainage be maintained both during construction (especially in terms of maintaining dry footing trenches) and after construction. Soil backfill for footings should be placed in accordance with the recommendations for structural fill presented herein.

SEISMIC DESIGN CRITERIA

International Building Code

In accordance with the International Building Code 2012/2015, we have provided the following table of seismic design information. After evaluating the subsurface conditions and the planned site changes at the site, it was determined that the site would be located within seismic site class D and Seismic Design Category C. A table follows, showing the calculated spectral response accelerations for both a short and 1-second period.

Table 1: Seismic Design Parameters

Structure	IBC Year	S_s (g)	S_1 (g)	S_{DS} (g)	S_{D1} (g)
Clifton Road Housing Development	2012/2015	0.411	0.124	0.403	0.191

The provided values are based on the results of our field exploration and the assumption that the structure will be designed utilizing a Risk Category I, II or III. If these assumptions are incorrect, we should be contacted to reevaluate the seismic design information.

In accordance with IBC 2015 section 1803.5.12, we have provided a discussion on the following geologic and seismic hazards: slope instability, liquefaction, total/differential settlement, and surface displacement due to faulting or seismically induced lateral spread or lateral flow.

Liquefaction occurs when soil, primarily saturated cohesionless soils, undergo a loss in strength due to monotonic, transient, or repeated disturbance that commonly occurs during a seismic event (Kramer 1996). This loss of strength occurs due to increased pore water pressures caused by an undrained condition. The increase in pore water pressure decreases the effective stress in the soil, thus reducing the soils ability to support any applied loads. For liquefaction to occur, there must be an increase in pore pressure meaning the soil must be saturated and be able to behave in an undrained condition. According to the NHI 2011 Reference Manual on LRFD Seismic Analysis and Design of Transportation Geotechnical Features and Structural Foundations, if any of the following criteria are satisfied then a significant liquefaction hazard does not exist:

- The geologic materials underlying the site are either bedrock or have very low liquefaction susceptibility according to the relative susceptibility ratings shown in the Estimated Susceptibility of Sedimentary Deposits to Liquefaction During Strong Ground Motion table presented by Youd and Perkins in 1978.

- The soils below the groundwater table at the site are one of the following:
    - Clayey soils which have a clay content greater than 15%, liquid limit greater than 35%, or natural water content less than 90% of the liquid limit.
    - Sand with a minimum corrected SPT $(N_1)_{60}$ value of 30 blows/foot.
    - The water table is deeper than 50 feet below the ground surface or proposed finished grade at the site.

We note that the excavations most commonly encountered moderately to highly plastic soils clay contents likely well above 15%. Additionally, based on experience in this geologic region and immediate vicinity of the site, it is our opinion that a liquefaction hazard does not exist for the subject development. As such, we do not expect significant additional total and differential settlement, lateral soil movement, reduction in bearing capacity or lateral soil reaction, permanent increase in soil lateral pressure, or flotation of buried structures in accordance with Section 1803.5.12 of the International Building Code (IBC 2012).

We also noted mapped faults on the geologic maps we reviewed for this project vicinity of the site. However, the known faults within the East Tennessee valley are generally ancient, with no known active faults reaching the surface. Therefore, it is our opinion that surface displacement due to faulting or seismically induced lateral spreading or lateral flow, is not a seismic hazard that will affect the subject development. In addition, seismically induced slope instability is also not expected to be a seismic hazard that will affect the subject development.

FLEXIBLE PAVEMENT RECOMMENDATIONS

Flexible (asphalt) pavements should be designed and constructed to meet the requirements of the City of Knoxville. The pavement subgrade should be prepared in accordance with the recommendations presented within this report.

All paved areas should be constructed with positive drainage to direct water off-site and to minimize surface water seeping into the pavement subgrade. The subgrade should have a minimum slope of 1 percent. In down grade areas, the basestone should extend through the slope to allow any water entering the basestone to exit. If the surface coarse of the roadway will be left off during construction of the houses, consideration should be given to increasing the basestone thickness or binder thickness to reduce the potential for roadway repairs during residential construction.

LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the observations trenchs will not become evident until construction. We recommend that GEOServices be retained to observe the project construction in the field. GEOServices cannot accept responsibility for conditions which deviate from those described in this report if not retained to perform construction observation and testing. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may need to be re-evaluated.

We appreciate the opportunity to provide these services. If you have any questions, please feel free to contact us at your convenience.

Sincerely,

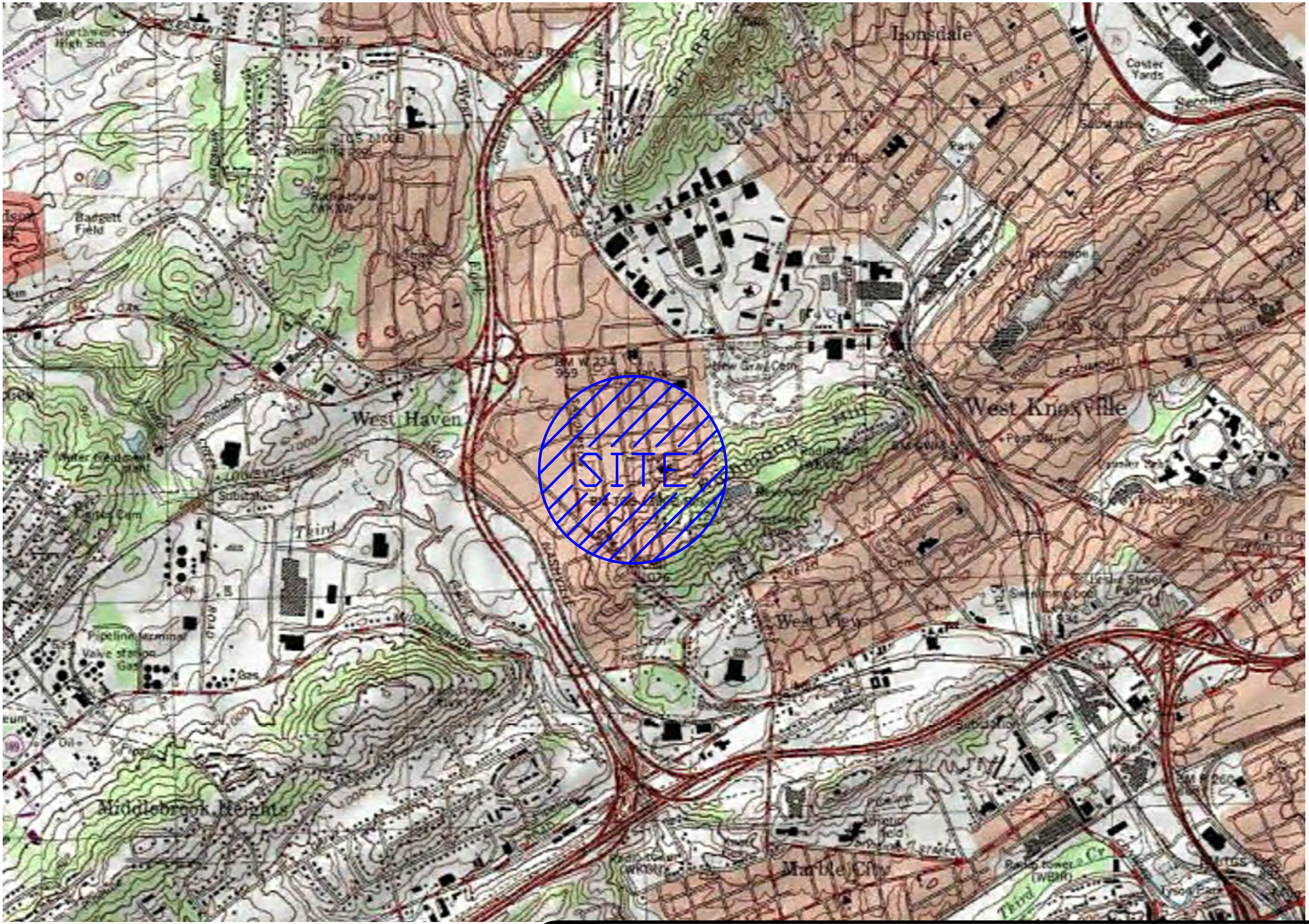
GEOServices, LLC

THOMAS BRIAN WILLIAMSON
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 118961
STATE OF TENNESSEE
12-17-18

Matthew B. Haston, P.E.
Senior Geotechnical Engineer

T. Brian Williamson, P.E.
Geotechnical Department Manager

Attachments: Observation Trench Location Plan; Observation Trench Logs



NOTES:

1.) BASE MAP: USGS QUADRANGLE (KNOXVILLE, TENNESSEE)

GEOS

GEOServices, LLC-Geotechnical and Materials Engineers

2561 Willow Point Way
Knoxville, Tennessee 37931

Office: 865-539-8242
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SITE VICINITY MAP

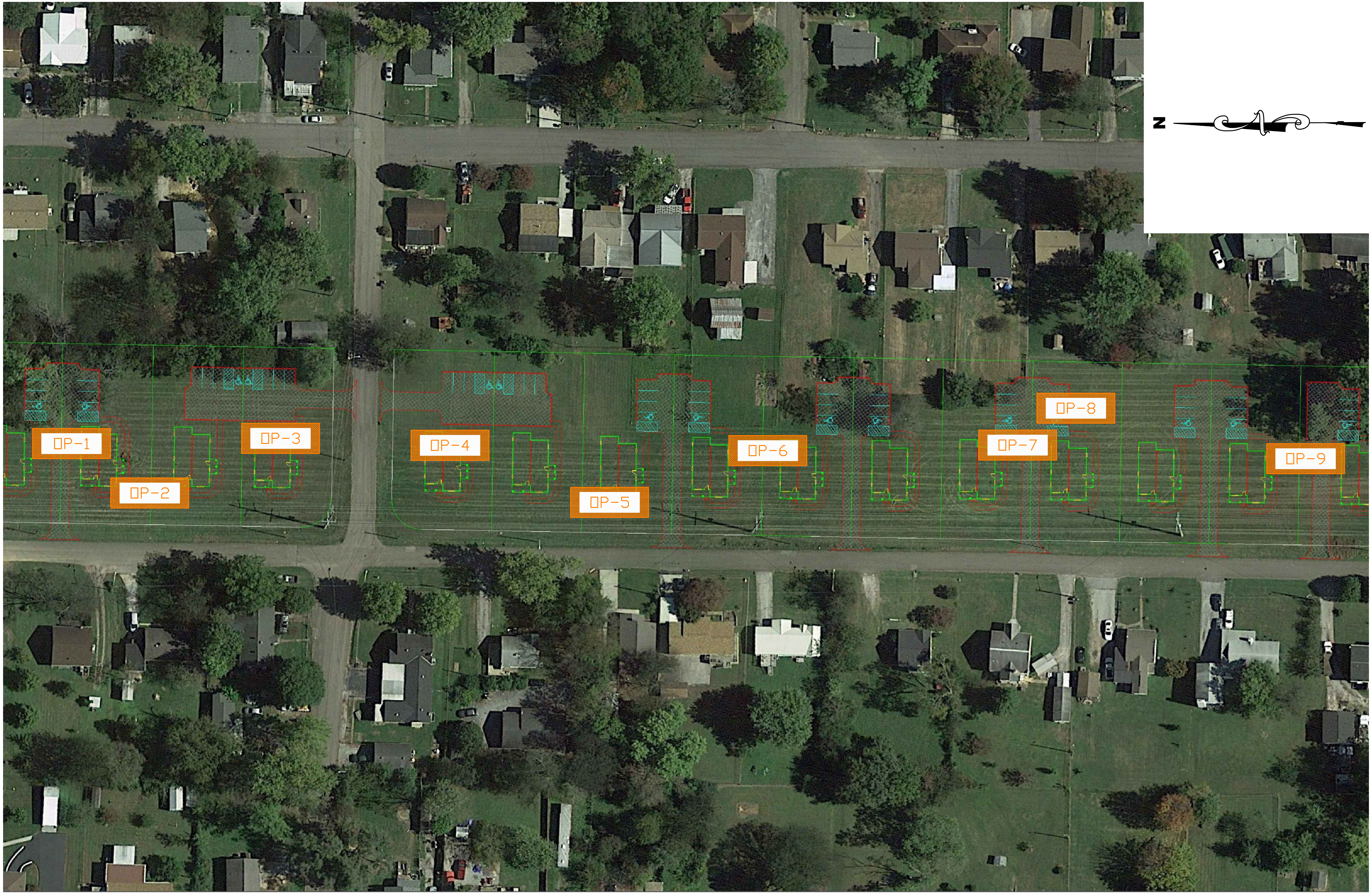
CLIFTON ROAD DEVELOPMENT

KCDC

KNOXVILLE, TENNESSEE

DRAWN BY:	MRB
APPROVED BY:	TBW
SCALE:	N.T.S.
JOB NO.:	21-18941
DATE:	12/11/18

FIGURE 1



NOTES:

1.) OBSERVATION PIT LOCATIONS ARE SHOWN IN GENERAL ARRANGEMENT ONLY.
2.) DO NOT USE OBSERVATION PIT LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: Cannon and Cannon.

OP-1 LOCATION OF OBSERVATION PITS

OBSERVATION PIT LOCATION PLAN

CLIFTON ROAD DEVELOPMENT

KCDC

KNOXVILLE, TENNESSEE

DRAWN BY:	MRB
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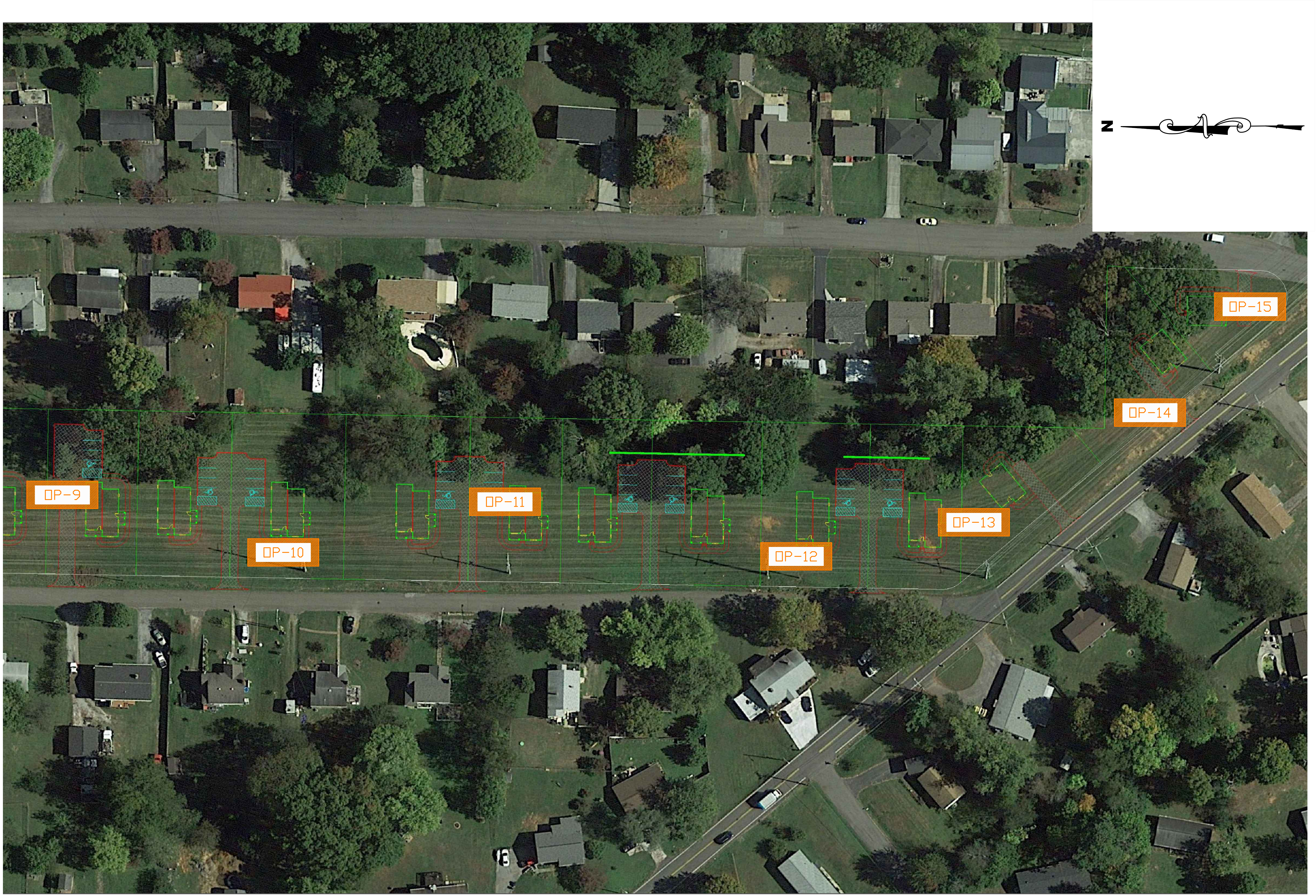
Figure 2



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OBSERVATION PIT LOCATION PLAN

CLIFTON ROAD DEVELOPMENT

KCDC

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Figure 3

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-1	0.0	0.8	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist to wet	Soft
	0.8	2.0	Residuum	Lean CLAY (CL) - with trace root structures - orangish brown and brown - moist	Firm
	2.0	3.0	Residuum	Lean CLAY (CL) - with shale fragments and shale like structure - orangish brown and gray - moist	Stiff to Very Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-2	0.0	1.0	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist to wet	Soft
	1.0	2.0	Residuum	Lean CLAY (CL) - with trace root structures - orangish brown and brown - moist to wet	Soft to Firm
	2.0	3.0	Residuum	Lean CLAY (CL) - with shale fragments and shale like structure - orangish brown and dark brown - moist	Stiff to Very Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018

GEOS Project No. 21-18941

Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-3	0.0	1.0	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	1.0	2.0	Residuum	Lean CLAY (CL) - with trace root structures - orangish brown and brown - moist	Firm
	2.0	3.0	Residuum	Lean CLAY (CL) - with shale fragments and shale like structure - orangish brown and dark brown - moist	Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN　　Date: December 4, 2018

GEOS Project No. 21-18941

Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-4	0.0	0.8	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.8	2.0	Residuum	Lean CLAY (CL) - with trace root structures - brown - moist	Firm
	2.0	3.0	Residuum	Lean CLAY (CL) - with trace shale fragments - orangish brown and dark brown - moist	Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-5	0.0	0.5	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.5	1.5	Residuum	Lean CLAY (CL) - with trace root structures - orangish brown - moist	Firm
	1.5	3.0	Residuum	Lean CLAY (CL) - with trace shale fragments - orangish brown and gray - moist	Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-6	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	2.0	Fill	Lean CLAY (CL) - with concrete fragments, trash and cinders - reddish brown and black - moist	Unsuitable Materials
	2.0	3.0	Residuum	Fat CLAY (CH) - reddish brown - moist	Firm
	3.0	3.5	Residuum	Lean CLAY (CL) - with shale fragments - orangish brown and gray - moist	Stiff
		3.5		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-7	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	2.0	Fill	Lean CLAY (CL) - with trace root structures - orangish brown and dark brown - moist	Soft
	2.0	6.0	Residuum	Fat CLAY (CH) - with trace chert fragments - reddish brown - moist	Firm
		6.0		Observation Pit Terminated at 6.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
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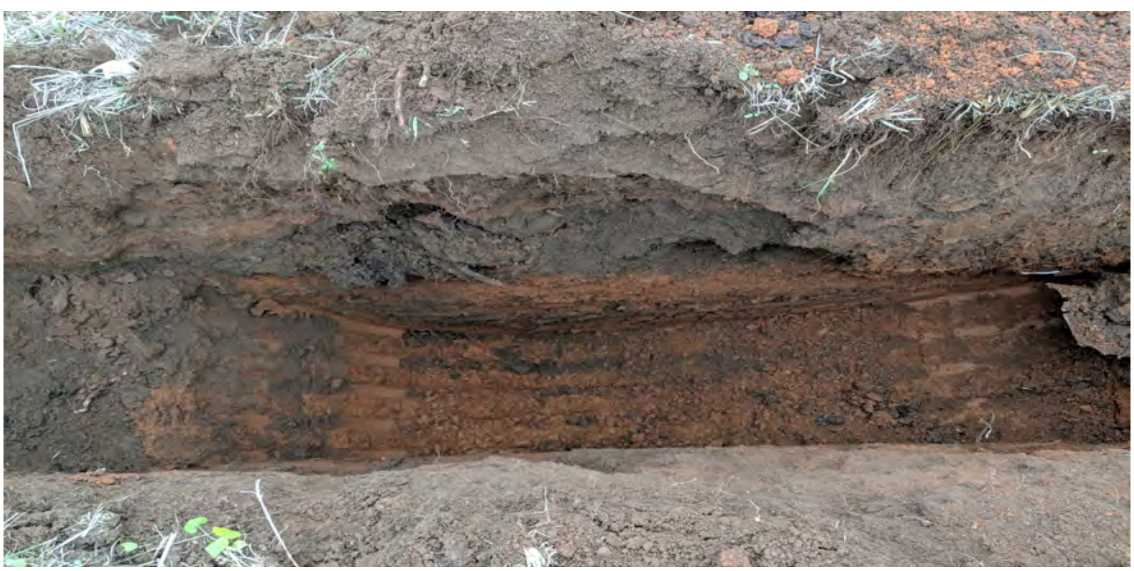
Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-8	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	3.5	Fill	Lean CLAY (CL) - with trash, wheels, window frame - brown - moist	Unsuitable Materials
	3.5	6.5	Residuum	Fat CLAY (CH) - reddish brown - moist	Firm to Stiff
		6.5		Observation Pit Terminated at 6.5 Feet	



Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
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Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-9	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	6.0	Fill	Lean CLAY (CL) - with trash, wood logs and a big stump - dark brown - moist	Unsuitable Materials
	6.0	8.0	Residuum	Lean CLAY (CL) - orangish brown and light brown - moist	Firm to Stiff
		8.0		Observation Pit Terminated at 8.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018

GEOS Project No. 21-18941

Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-10	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	2.0	Fill	Lean CLAY (CL) - with trace organics - dark brown - moist	Unsuitable Materials
	2.0	4.0	Residuum	Fat CLAY (CH) - reddish brown - moist to wet	Soft to Firm
	4.0	7.0	Residuum	Lean CLAY (CL) - orangish brown - moist	Firm to Stiff
		7.0		Observation Pit Terminated at 7.0 Feet	

Observation Pit Logs

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Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-11	0.0	0.2	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.2	1.0	Fill	Lean CLAY (CL) - with gravel - reddish brown - moist	Firm
	1.0	2.0	Topsoil	Lean CLAY (CL) - with trace root structures - dark brown - moist	Soft
	2.0	3.5	Residuum	Lean CLAY (CL) - with chert fragments - light brown - moist	Stiff to Very Stiff
		3.5		Observation Pit Terminated at 3.5 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
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GEOServices, LLC-Geotechnical and Materials Engineers

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-12	0.0	0.2	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.2	0.7	Fill	Fat CLAY (CH) - with gravel - reddish brown - moist	Firm
	0.7	1.5	Topsoil	Lean CLAY (CL) - with trace root structures - dark brown - moist	Soft
	1.5	3.5	Residuum	Lean CLAY (CL) - with trace chert fragments - light brown - moist to wet	Firm
	3.5	6.5	Residuum	Lean CLAY (CL) - with chert fragments - orangish brown and reddish brown - moist	Stiff
		6.5		Observation Pit Terminated at 6.5 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-13	0.0	1.0	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	1.0	2.5	Residuum	Lean CLAY (CL) - light brown - moist	Soft to Firm
	2.5	3.5	Residuum	Lean CLAY (CL) - with shale fragments - reddish brown and orangish brown - moist	Stiff to Very Stiff
		3.5		Observation Pit Terminated at 3.5 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN   Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-14	0.0	0.2	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.2	1.0	Fill	Lean CLAY (CL) - with trace gravel - orangish brown - moist	Soft to Firm
	1.0	2.0	Topsoil	Lean CLAY (CL) - with trace root structures - dark brown and brown - moist to wet	Soft
	2.0	3.0	Residuum	Fat CLAY (CL) - with chert fragments - orangish brown and reddish brown - moist	Stiff
		3.0		Observation Pit Terminated at 3.0 Feet	

Observation Pit Logs

Clifton Road Development - KCDC - Knoxville, TN Date: December 4, 2018
GEOS Project No. 21-18941
Personnel: Michael R. Bridges, E.I.

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-15	0.0	0.3	Topsoil	Lean CLAY (CL) - with grass and root mat - brown - moist	Soft
	0.3	1.0	Fill	Lean CLAY (CL) - with trash, organics and cinders - dark brown - moist	Soft
	1.0	1.5	Topsoil	Lean CLAY (CL) - with trace root structures - dark brown and brown - moist	Soft
	1.5	3.5	Residuum	Lean CLAY (CL) - with chert fragments - light brown and orangish brown - moist	Firm
	3.5	5.0	Residuum	Fat CLAY (CL) - with chert fragments - reddish brown - moist	Stiff
		5.0		Observation Pit Terminated at 5.0 Feet