August 8, 2017

Knox Community Development Corporation Housing Authority
901 North Broadway Street
Knoxville, Tennessee 37917

c/o Partners Development

Attention: Alex Decker
adecker@partnersinfo.com

Subject: **REPORT OF GEOTECHNICAL EXPLORATION**
KCDC Five Points Phase 3
Infrastructure Improvements
Knoxville, Knox County, Tennessee
GEOServices Project No. 21-17541

Dear Mr. Decker:

We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed in accordance with our Proposal No. 11-17281, dated July 21, 2017. The following report presents our findings and recommendations for the proposed construction. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,
GEOServices, LLC

W. Ros Kingery III, P.E.
Vice President
TN 111,645

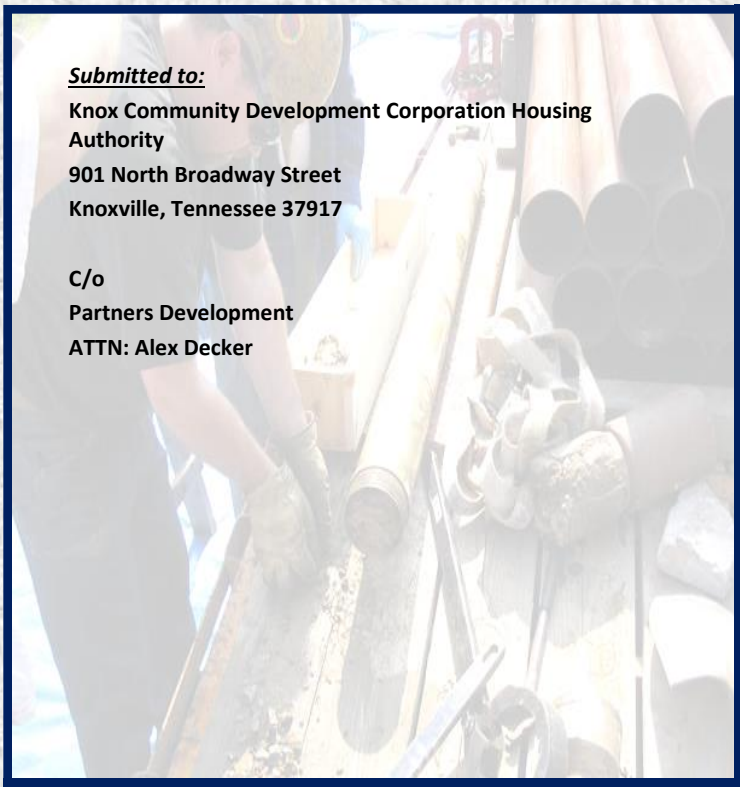
T. Brian Williamson, P.E.
Project Manager
TN 118,861

TBW/WRK: tbw

REPORT OF GEOTECHNICAL EXPLORATION

KCDC Five Points Phase 3 Infrastructure Improvements

KNOXVILLE, TN



Submitted to:

Knox Community Development Corporation Housing Authority
901 North Broadway Street
Knoxville, Tennessee 37917

C/o
Partners Development
ATTN: Alex Decker

Submitted by:
GEOServices, LLC
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Phone (865) 539-8242
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GEOSERVICES, LLC

PROJECT NO. 21-17541

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this geotechnical report was to explore the subsurface conditions for the design and construction of the proposed Phase 3 of Knox Community Development Corporation (KCDC) Five Points Development in Knoxville, Tennessee. This report provides general recommendations for site grading and design and construction of the foundation system, including slab-on-grade construction. Additionally, recommendations for light and heavy-duty pavements are provided.

1.2 PROJECT INFORMATION AND SITE DESCRIPTION

The project site is the existing Walter P. Taylor Housing Community located at 2240 Martin Luther King Jr. Avenue in Knoxville, Tennessee. Specifically, the site is encompassed by Martin Luther King Jr. Avenue to the north, McConnel Street to the east, Kenner Avenue to the south and S. Kyle Street to the west. Based on our review of the *Preliminary Site Plan* prepared by Civil & Environmental Consultants, Inc., we understand the project will consist of the demolition of existing infrastructure (i.e. buildings, pavement and utilities), site grading, roadway construction and construction of numerous multi-story structures. We assume the structures will be up to three-three stories in height and will be wood-framed construction supported on a system of shallow foundations and concrete slabs on grade. Additionally, we have assumed that earthwork cuts and fill of less than 10 feet will be required to achieve the proposed site grades.

1.3 SCOPE OF STUDY

This geotechnical exploration involved a site reconnaissance, field drilling, laboratory testing, and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, and conclusions and recommendations. Following the text of this report, Appendix A presents figures and test boring records. Appendix B presents a summary of laboratory test results.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on, or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

2.1 FIELD EXPLORATION

The existing subsurface conditions were explored with the requested sixteen (16) soil test borings. Due to a gravel layer encountered in boring B-5, an offset boring (B-5A) was performed. The requested boring locations located by using the provided site plan and a handheld GPS unit. Drilling was performed on July 27 and 28, 2017. The borings were advanced using 2.25-inch inside diameter hollow stem augers (HSA) with a GEOProbe track mounted drill rig. The approximate locations of the test borings performed on site are referenced in Figure 2. Detailed logs for soil test borings can be found in Appendix A of this report.

Within each boring, SPT and split-spoon sampling were performed at 2.5 feet intervals in the upper 10 feet, and 5 feet intervals thereafter. The drill crew worked in accordance with ASTM D 6151 (hollow stem auger drilling). Standard Penetration Tests and split-spoon sampling were performed in accordance with ASTM D 1586.

In split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth, and provide an indication of strength of cohesive materials.

2.2 LABORATORY TEST PROGRAM

The obtained soil samples were returned to our laboratory where they were visually classified by a geotechnical professional. Selected soil samples were then tested for natural moisture determinations (ASTM D 2216), Atterberg limits determinations (ASTM D 4318) and organic content (ASTM D 2974). The results of the laboratory testing are discussed in the following sections. A summary of these results is presented in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site lies in the Appalachian Valley and Ridge Physiographic Province of East Tennessee. This Province is characterized by elongated, northeasterly-trending ridges formed on highly resistant sandstone and shale. Between ridges, broad valleys and rolling hills are formed primarily on less resistant limestone, dolomite and shale.

Published geologic information indicates that the site is underlain by the Ottosee Shale and the Bays formations. The Ottosee Shale is a mixture of fossiliferous shale and limestone with minor quantities of siltstone, sandstone and marble. Within a limited area, any one of these rock types may dominate. The various rock types grade into and interfinger with one another throughout the section. The shale portion of the formation typically weathers to produce a tan or yellowish brown silty clay residuum with weathered shale fragments. The limestone portions of the formation weather to a reddish or orangish-brown clay residuum. The Bays Formation consists mainly of dark-red, calcareous, silty mudstone. The amount of calcium carbonate in this mudstone is low at the base of the Bays, but increases upward in the section.

Since the bedrock underlying this site contains carbonate rock (i.e. limestone/dolomite), it is susceptible to the 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 these 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 mass and flushing of overburden soil into the cavities within the bedrock. This loss of solids creates a cavity, or dome, within the overburden. Growth of the cavity over time, or excavation over the dome, can create a condition in which rapid subsidence, or collapse, of the roof of the dome occurs.

A certain degree of risk with respect to sinkhole formation and subsidence should be considered at any site located within geologic areas underlain by potentially soluble rock units. While a rigorous effort to assess the sinkhole potential at this site was beyond the scope of services, we did not observe obvious surficial signs of sinkhole activity at this site. Additionally, no closed depressions, which are indicative of past sinkhole activity, were observed on the United States Geological Survey (USGS – Knoxville Quadrangles TN) topographic map within the near vicinity (1,500 feet) of this site.

Based on this information, it is our opinion that the risk of sinkhole development at this site is no greater than at other sites located within similar geologic settings which have been developed successfully. However, the owner must be willing to accept a moderate risk of sinkhole development at this site. The risk of sinkhole development can be reduced by following the recommendations provided in the *Sinkhole Risk Reduction and Corrective Actions* (Section 5.6) section of this report.

3.2 SOIL STRATIGRAPHY

The following subsurface description is of a generalized nature to highlight the subsurface stratification features and material characteristics at the boring locations. The boring logs included in Appendix A of this report should be reviewed for specific information at each boring location.

Information on actual subsurface conditions exists only at the specific boring locations and is relevant only to the time that this exploration was performed. Variations may occur and should be expected at the site.

Surface

Borings B-1, B-2, B-3, B-4, B-6, B-10, B-11, B-12, B-12, and B-16 encountered a surficial topsoil layer than was generally 5 to 6 inches in thickness. The remaining borings encountered a pavement layer consisting of approximately 4 inches of asphalt underlain by approximately 6 inches of basestone.

Fill Soils

Underlying the surficial layers encountered in borings B-5, B-5A, B-10 and B-11, existing fill soils were encountered to depths ranging from approximately 2 and 3 feet, beneath the existing ground surface. The fill generally consisted of reddish brown and brown fat clays (CH) with varying amounts of organics and rock fragments. The SPT N-values of the existing fill, used to evaluate the consistency of subsurface soils, ranged from 3 to 12 blows per foot (bpf), indicating a relative soil consistency of soft to stiff. The moisture content of selected samples of the existing fill soil ranged from 17.6 to 19.5 percent. Additionally, selected fill soil samples tested for organic contents ranging from approximately 4 to 6 percent.

Residual Soil

Beneath existing fill soils and beneath the surficial topsoil layer in the remaining borings, residual soils were encountered at depths ranging from 4.1 to 20 feet beneath the existing ground surface. Residual soils are formed from the in-place weathering of the underlying parent bedrock. The residual soils generally consisted of brown, tan and reddish-brown fat clays (CH) and lean clay (CL) with varying amounts of rock fragments. The SPT N-values, used to evaluate the consistency of the residual soils encountered, ranged from 2 bpf to 50 blows with four inches of penetration, indicating a relative soil consistency ranging from very soft to very hard. It should be noted that the N-values indicating very hard soils were encountered at depths near auger refusal and were

likely elevated. Additionally, the very soft soils were isolated to one boring (B-8). Therefore, the residual soils were generally firm, or better, in consistency.

The natural moisture content of selected samples of the residual soil ranged from 18.7 to 50.0 percent. The results of Atterberg Limits testing on selected samples of the residual soil revealed liquid limits (LL) ranging from 33 to 55 percent and plasticity indices (PI) from 15 and 31 percent. The residual soil is classified as fat clay (CH) and lean clay (CL) in accordance with the Unified Soil Classification System (USCS).

Auger Refusal

Auger refusal conditions were encountered in borings B-1, B-2, B-3, B-4, B-5A, B-7 and B-11 at depths of 4.1 feet (in boring B-4) and 12.8 feet (in boring B-1) beneath the existing ground surface. Auger refusal is a designation applied to any material that cannot be penetrated by the power auger. Auger refusal may indicate dense gravel or cobble layers, boulders, rock ledges or pinnacles, or the top of continuous bedrock. Rock coring, to explore the refusal material, was not included in our current scope of services. Therefore, the continuity and character of the refusal material was not determined. However, based on our experience in this geologic setting and the soils samples retrieved during our field exploration, it is our professional opinion that refusal depths correspond with top of pinnacled or continuous limestone/dolomite bedrock.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 SITE ASSESSMENT

The site is overlain by existing fill soils and residual soils that were generally firm or better in consistency with isolated soft zones. Some remediation of the soft soils during site development and foundation construction should be expected. Given the results of our field exploration and provided the site is developed in accordance with the recommendations presented in this report, it our professional opinion that the site can be developed successfully. Additionally, the proposed structures can be supported by conventional shallow foundations bearing in newly placed structural fill or stiff, or better, residual soils.

4.2 SITE PREPARATION RECOMMENDATIONS

4.2.1 Subgrade

All vegetation, unsuitable soil (if encountered), loose rock fragments greater than 6 inches, and other debris should be removed from the proposed construction areas. Demolition should consist of the complete removal of all above and below grade structures. Additionally, abandoned utilities should be completely removed. Utilities that are not abandoned should be rerouted outside of the building areas. 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.

4.2.2 Structural Soil 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 upon limited laboratory testing, the on-site materials appear suitable for use as structural soil fill. However, portions of the existing fill soils contained abundant organic materials. Therefore, portions of the existing fill will likely not be suitable for 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 contractors' 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.

4.2.3 Dense Graded Aggregate

Dense-graded aggregate fill may be required as backfill, to reach finished floor elevation. The crushed stone used for this section should be Type A, Class A, and Grading E in accordance with Section 903.05 of the Tennessee Department of Transportation specifications. The crushed stone fill should be placed in loose, horizontal lifts not exceeding 10 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698). Each lift should be compacted, tested by geotechnical personnel and approved before placing any subsequent lifts.

4.3 FOUNDATION RECOMMENDATIONS

4.3.1 Shallow Foundations

Foundations for the proposed construction are anticipated to bear in the firm or better residual soils or newly placed structural fill. 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. All exterior footings should be designed to bear at least 18 inches below finished exterior grade to protect against frost heave.

Detailed 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.

4.3.2 Slabs-on-Grade

For slab-on-grade construction, the site should be prepared as previously described. We recommend that the subgrade be topped with a minimum 4-inch layer of crushed stone to act as a capillary moisture block. The subgrade should be proofrolled and approved prior to the placement of the crushed stone. Based on the conditions encountered on this site, we recommend that the floor slabs be designed using a subgrade modulus of 100 pounds per cubic inch (pci). This modulus is appropriate for small diameter loads (i.e. a 1ft x 1ft plate) and should be adjusted for wider loads.

4.3.3 Settlement

Based on the subsurface conditions encountered and our field testing, we anticipate total settlements of less than 1 inch and differential settlements of less than ¾ inch. The settlement

information provided was with maximum column and continuous foundation loads on the order of 80 kips and 3 kips per linear foot (kpf), respectively, and an allowable bearing pressure of 2,500 psf.

4.4 SEISMIC DESIGN CRITERIA

International Building Code, 2012

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

Table 1: Seismic Design Parameters

Structure	S_s g	S_1 g	S_{DS} g	S_{D1} g
KCDC Five Points Phase 3	0.415	0.125	0.406	0.191

The provided values are based on the results of our field exploration and the assumptions that the buildings will be designed utilizing a risk category I, II or III. If the assumptions are found to be incorrect, we should be contacted to reevaluate these values. Moreover, if it were determined that an improvement to the seismic site class or spectral response accelerations would provide a significant economic benefit to the project, we recommend the owner retain GEOServices to perform a site-specific shear wave analysis in efforts to improve these values.

4.5 PAVEMENT DESIGN RECOMMENDATIONS

4.5.1 Flexible Pavement Design

AASHTO flexible pavement design methods have been utilized for pavement recommendations. Our recommendations are based on the assumptions that the subgrade has been properly prepared as described previously. Based on our experience with similar developments, we recommend the following light and heavy-duty flexible pavement sections:

Table 2: Flexible Pavement Recommendations

Pavement Materials	Light-Duty	Heavy-Duty
Bituminous Asphalt Surface Mix	1.5	1.5
Bituminous Asphalt Base Mix	2.0	2.5
Compacted Crushed Aggregate Base	6.0	8.0

We recommend a base stone equivalent to a Type A, Class A and Grading D in accordance with Section 903.05 of the Tennessee Department of Transportation specifications. The bituminous asphalt pavement should be Grading "E" as per Section 411 for the surface mix and Grading “BM” as per section 307 for the binder mix. Compaction requirements for the crushed aggregate base and the bituminous asphalt pavement should generally follow Tennessee Department of Transportation specifications.

4.5.2 Rigid Pavement Design

AASHTO rigid pavement design methods have been utilized for pavement recommendations. In areas of trash dumpster pads or areas where large trucks will be parked on the pavement, we recommend the use of a concrete paving section. Our recommendations are based on the assumptions that the subgrade has been properly prepared. Based on our experience with similar developments, we recommend the following rigid pavement section:

Table 3: Rigid Pavement Recommendations

Pavement Materials	Light-Duty	Heavy-Duty
4,000 psi Type I Concrete	6.0	8.0
Compacted Crushed Aggregate Base	4.0	4.0

Concrete should be reinforced with welded wire fabric or reinforcing bars to assist in controlling cracking from drying shrinkage and thermal changes. Sawed or formed control joints should be included for each 225 square feet of area or less (15 feet by 15 feet). Saw cuts should not cut through the welded wire fabric or reinforcing steel and dowels should be utilized at formed and/or cold joints.

4.5.3 General

Our recommendations are based upon the assumption that the subgrade has been properly prepared as described in previous sections and that if used, any off-site soil borrow to be used to backfill to the final subgrade meets the requirements of the structural fill section.

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. For rigid pavements, water-tight seals should also be provided at formed construction and expansion joints.

We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, owner, and project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life. If thinner pavement sections are warranted, alternate reinforced pavement sections can be considered, including the use of geo-grid reinforcement.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 FOUNDATION CONSTRUCTION

Foundation excavations should be opened, the subgrade evaluated, remedial work performed (if required), 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.

5.2 EXCAVATIONS

As previously mentioned, auger refusal materials were encountered in various soil test borings at depths ranging from 4.1 to 12.8 feet beneath the existing ground surface. Auger refusal conditions generally correspond to materials which require difficult excavation techniques for removal. Typically, soils penetrated by augers can be removed with conventional earthmoving equipment. However, excavation equipment varies, and field refusal conditions may vary. Generally, the weathering process is erratic and variations in the rock profile can occur in small lateral distances. Therefore, it is possible that some partially weathered rock and/or rock pinnacles or ledges requiring difficult excavation techniques may be encountered in site areas between our boring locations.

5.2.1 Excavation Safety

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service and under no circumstances should GEOS be assumed to be responsible for construction site safety.

5.3 MOISTURE SENSITIVE SOILS

The moderately plastic fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Construction traffic patterns should be varied to prevent the degradation of previously stable subgrade. In addition, the soils at this site which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. We caution if site grading is performed during the wet weather season increases in the undercut volume required due to the marginal fills should be expected. Further for site fills, methods such as discing and allowing the material to dry will be required to meet the required compaction recommendations. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather. However, November through March is typically the difficult grading period due to the limited drying conditions that exist.

5.4 HIGH PLASTICITY SOIL CONSIDERATIONS

Based on our experience in the East Tennessee area, soils with plasticity indices (PI) less than 30 percent have a slight potential for volume changes with changes in moisture content, and soils with a PI greater than 50 percent are highly susceptible to volume changes. Between these values, we consider the soils to be moderately susceptible to volume changes.

Highly plastic soils have the potential to shrink or swell with significant changes in moisture content. Unlike other areas of the country where high plasticity soils cause considerable foundation problems, East Tennessee does not typically endure long periods of severe drought or wet weather. However, in recent years drought conditions have been sufficient to cause soil shrinkage and related structural distress of buildings, floor slabs and pavements at sites underlain by high plasticity soils.

At sites that have high plasticity soils, certain precautions should be considered to minimize or eliminate the potential for volume changes. The most effective way to eliminate the potential for

volume changes is to remove highly plastic soils and replace them with compacted fill of non-expansive material. Testing and recommendations for the required depth of removal can be provided, if needed. If removal of the highly plastic soils is not desirable, then measures should be taken to protect the soils from excessive amounts of wetting or drying. In addition, modification of the soils by lime or cement treatment can be utilized to reduce the soil plasticity.

Several construction considerations may reduce the potential for volume changes in the subgrade soils. Foundations should be excavated, checked, and concreted in the same day to prevent excessive wetting or drying of the foundation soils. The floor subgrade should be protected from excessive drying and wetting by covering the subgrade prior to slab construction. The site should be graded in order to drain surface water away from the building both during and after construction. Installing moisture barriers around the perimeter of the slab will help limit the moisture variation of the soil and reduce the potential for shrinking or swelling. In addition, roof drains should discharge water away from the building area and foundations. Heat sources should be isolated from foundation soils to minimize drying of the foundation soils. Trees and large shrubs can draw large amounts of moisture from the soil during dry weather and should be kept well away from the building to prevent excessive drying of the foundation soils. Watering of lawns or landscaped areas should be performed to maintain moisture levels during dry weather.

Structural details to make the building flexible should be considered to accommodate potential volume changes in the subgrade. Floor slabs should be liberally jointed to control cracking, and the floor slab should not be structurally connected to the walls. Walls should incorporate sufficient expansion/contraction joints to allow for differential movement.

5.5 DRAINAGE AND SURFACE WATER CONCERNS

To reduce the potential for undercut and construction induced sinkholes, water should not be allowed to collect in the foundation excavations, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped

toward one corner to facilitate removal of any collected rainwater, subsurface water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

5.6 SINKHOLE RISK REDUCTION AND CORRECTIVE ACTIONS

Based on our experience, corrective actions can also be performed to reduce the potential for sinkhole development at this site. These corrective actions would decrease but not eliminate the potential for sinkhole development. Much can be accomplished to decrease the potential of future sinkhole activity by proper grade selection and positive site drainage.

In general, the portions of a site that are excavated to achieve the desired grades will have a higher risk of sinkhole development than the areas that are filled, because of the exposure of relic fractures in the soil to rainfall and runoff. On the other hand, those portions of a site that receive a modest amount of fill (or that have been filled in the past) will have a decreased risk of sinkhole development caused by rainfall or runoff because the placement of a cohesive soil fill over these areas effectively caps the area with a relatively impervious "blanket" of remolded soil. Therefore, the recommendations that follow incorporate a modest remedial treatment program designed to make the surface of the soil in excavated areas less permeable.

Although it is our opinion that the risk of ground subsidence associated with sinkhole formation cannot be eliminated, we have found that several measures are useful in site design and development to reduce this potential risk. These measures include:

- Maintaining positive site drainage to route surface waters well away from structural areas both during construction and for the life of the structure.
- The scarification and re-compaction of the upper 6 to 10 inches of soil in earthwork cut areas.
- Verifying that subsurface piping beneath structures is carefully constructed and pressure tested prior to its placement in service.

- The use of pavement or lined ditches, particularly in cut areas, to collect and transport surface water to areas away from structures.

Considerations when building within a sinkhole prone area are to provide positive surface drainage away from any proposed building or parking area both during and after construction. Backfill in utility trenches of other excavations should consist of compacted, well-graded material such as dense graded aggregate or compacted on site soils. The use of an open graded stone such as No. 57 stone is not recommended unless the stone backfill is provided an exit path and not allowed to pond. If sinkhole conditions are observed, the type of corrective action is most appropriately determined by GEOServices on a case-by-case basis.

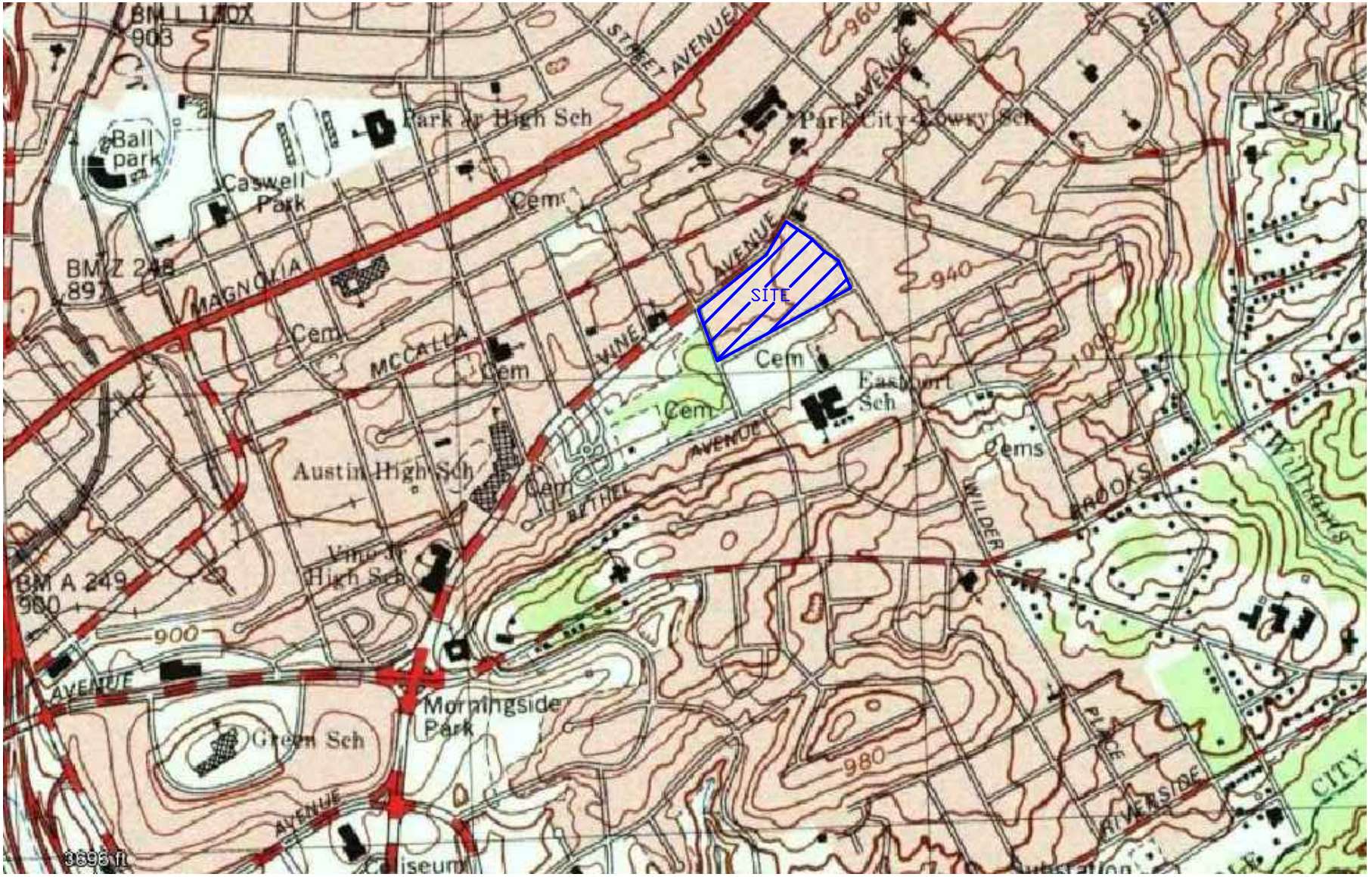
6.0 LIMITATIONS

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 borings 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

APPENDIX A

Figures and Test Boring Records



NOTES:

1.) BASE MAP: USGS Qaud Map (KNOXVILLE MAPS)

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

SITE LOCATION PLAN
KCDC FIVE POINTS
PHASE 3

KNOXVILLE, TN

DRAWN BY:	TBW
APPROVED BY:	WRK
SCALE:	N.T.S.
JOB NO.:	21-17541
DATE:	08/07/17

FIGURE 1

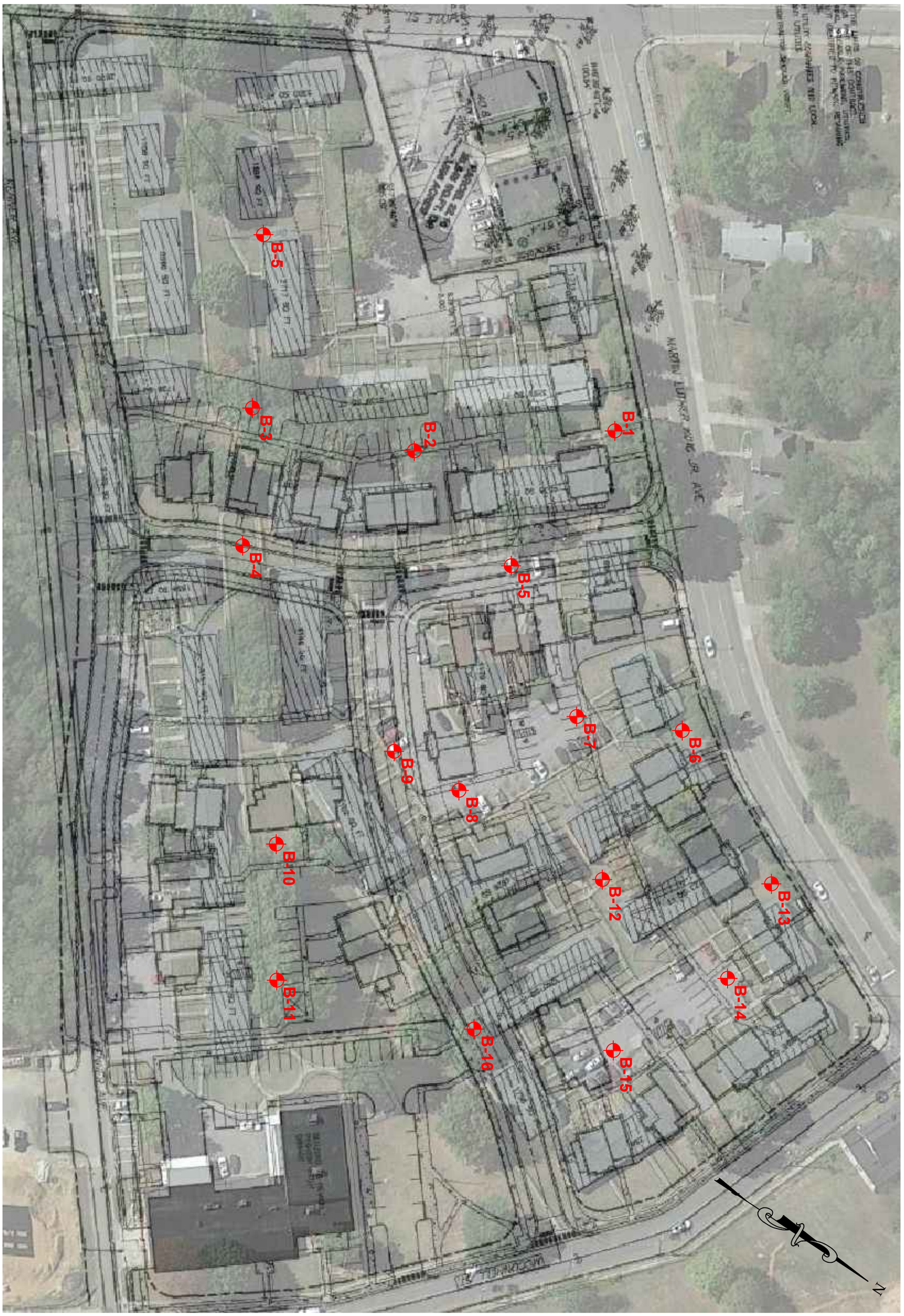


FIGURE 2

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

DRAWN BY:	TBW
APPROVED BY:	WRK
SCALE:	N.T.S.
JOB NO.:	21-17541
DATE:	08/07/17

BORING LOCATION PLAN

KCDC FIVE POINTS PHASE 3

KNOXVILLE, TN

NOTES:

1.) BORING LOCATIONS ARE SHOWN IN GENERAL ARRANGMENT ONLY.
2.) DO NOT USE BORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: JMB Investment Comp, Inc.

⊕ LOCATION OF SOIL TEST BORING

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

BOULDERS:	GREATER THAN 300 mm
COBBLES:	75 mm to 300 mm
GRAVEL:	4.74 mm to 75 mm
COARSE SAND:	2 mm to 4.74 mm
MEDIUM SAND:	0.425 mm to 2 mm
FINE SAND:	0.075 mm to 0.425 mm
SILTS & CLAYS:	LESS THAN 0.075 mm

COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0 - 500
3 - 4	SOFT	500 - 1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATON. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140 LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

ST:	UNDISTURBED SAMPLE
SS:	SPLIT SPOON SAMPLE
CORE:	ROCK CORE SAMPLE
AU:	AUGER OR BAG SAMPLE

SOIL PROPERTY SYMBOLS

N:	STANDARD PENETRATION, BPF
M:	MOISTURE CONTENT %
LL:	LIQUID LIMIT %
PI:	PLASTICITY INDEX %
Qp:	POCKET PENETROMETER VALUE, TSF
Qu:	UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW:	DRY UNIT WEIGHT, PCF

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
0 TO 25	VERY POOR

ROCK HARDNESS

VERY SOFT:	ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.
SOFT:	ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND CRUMBLES WITH FIRM HAND PRESSURE.
MODERATELY HARD:	SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.
HARD:	ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.
VERY HARD:	ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.

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LOG OF BORING B-1
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-1 DRY ON COMPLETION ? Yes

DATE July 27, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 12.8 FT. ELEV. -12.8 FT.
SAMPLED 12.8 FT. 3.9 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 12.8 FT. ELEV. -12.8 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	14					FAT CLAY (CH) - dark brown - dry - firm to stiff (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	6					
5.0	-5.0										Lean CLAY (CL) - reddish brown and tan - dry - firm (RESIDUUM)
		6.0	7.5	3	SS	6					
7.5	-7.5										
		8.5	10.0	4	SS	8					FAT CLAY (CH) - brown - dry - stiff (RESIDUUM)
10.0	-10.0										
12.5	-12.5										Auger Refusal at 12.8 Feet
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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GEOServices Project # 21-17541

LOG OF BORING B-2
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-2
DRY ON COMPLETION ? Yes

DATE July 27, 2017
REFUSAL: Yes DEPTH 8.2 FT. ELEV. -8.2 FT.
SAMPLED 8.2 FT. 2.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 8.2 FT. ELEV. -8.2 FT.
BORING ADVANCED BY: POWER AUGERING X

SURFACE ELEV. FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	12					
2.5	-2.5										
		3.5	5.0	2	SS	13					FAT CLAY (CH) - brown - dry - stiff (RESIDUUM)
5.0	-5.0										
		6.0	7.5	3	SS	10					
7.5	-7.5										
											Auger Refusal at 8.2 Feet
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-3
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-3
DRY ON COMPLETION ? Yes

DATE July 27, 2017
SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 9.9 FT. ELEV. -9.9 FT.
SAMPLED 9.9 FT. 3.0 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 9.9 FT. ELEV. -9.9 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	8				21.7	
2.5	-2.5										
		3.5	5.0	2	SS	8		52	31	20	Fat CLAY (CH) - brown - dry - firm to stiff (RESIDUUM)
5.0	-5.0										
		6.0	7.5	3	SS	7				18.7	
7.5	-7.5										
		8.5	9.4	4	SS	50/4"				35	Lean CLAY (CL) - with weathered shale - brown - dry - hard (RESIDUUM)
10.0	-10.0										Auger Refusal at 9.9 Feet
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-4
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-4 DRY ON COMPLETION ? Yes

DATE July 28, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 4.1 FT. ELEV. -4.1 FT.
SAMPLED 4.1 FT. 1.2 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 4.1 FT. ELEV. -4.1 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	6					Lean CLAY (CL) - with root structure - dark brown and brown - moist - firm (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	50/1"					Auger Refusal at 4.1 Feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-5
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-5
DRY ON COMPLETION ? Yes

DATE July 27, 2017
SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 3.0 FT. ELEV. -3.0 FT.
SAMPLED 3.0 FT. 0.9 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 3.0 FT. ELEV. -3.0 FT.
BORING ADVANCED BY: . POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	3					Lean CLAY (CL) - with rock fragments - brown - moist - soft (FILL)
2.5	-2.5										Gravel Encountered at 3.0 Feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-5A
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-5A
DRY ON COMPLETION ? Yes

DATE July 27, 2017
SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 8.3 FT. ELEV. -8.3 FT.
SAMPLED 8.3 FT. 2.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 8.3 FT. ELEV. -8.3 FT.
BORING ADVANCED BY:
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS						No sample collected
2.5	-2.5										
		3.5	5.0	2	SS	15					Lean CLAY (CL) - with abundant rock fragments - tan - dry - stiff to hard (RESIDUUM)
5.0	-5.0										
		6.0	7.5	3	SS	50/4"					
7.5	-7.5										Auger Refusal at 8.3 Feet
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-6
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-6
DRY ON COMPLETION ? Yes

DATE July 27, 2017
SURFACE ELEV. FT.
REFUSAL: No
DEPTH 20.0 FT.
ELEV. -20.0 FT.
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 20.0 FT. ELEV. -20.0 FT.
BORING ADVANCED BY:
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	7					Lean CLAY (CL) - with rock fragments and root structure - reddish brown and brown - dry - firm (FILL)
2.5	-2.5										
		3.5	5.0	2	SS	5					Fat CLAY (CH) - reddish brown, tan, and oxcide staining at depth - moist - firm to stiff (RESIDUUM)
5.0	-5.0										
		6.0	7.5	3	SS	11					
7.5	-7.5										
		8.5	10.0	4	SS	12					
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	6					Lean CLAY (CL) - with rock fragments - brown - moist to wet at depth - firm to stiff (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	10					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

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LOG OF BORING B-7
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-7
DRY ON COMPLETION ? Yes

DATE July 27, 2017
SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 13.3 FT. ELEV. -13.3 FT.
SAMPLED 13.3 FT. 4.1 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 13.3 FT. ELEV. -13.3 FT.
BORING ADVANCED BY: . POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	5				39.2	
2.5	-2.5										Fat CLAY (CH) - reddish brown and tan - moist - firm (RESIDUUM)
		3.5	5.0	2	SS	6				37.3	
5.0	-5.0										
		6.0	7.5	3	SS	6				31.5	
7.5	-7.5										
		8.5	10.0	4	SS	7				40.7	Fat CLAY (CH) - with rock fragments - reddish brown, tan and brown - moist - firm (RESIDUUM)
10.0	-10.0										
12.5	-12.5										
											Auger Refusal at 13.3 Feet
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

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LOG OF BORING B-8
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-8 DRY ON COMPLETION ? Yes

DATE July 27, 2017 SURFACE ELEV. FT.
REFUSAL: No DEPTH 20.0 FT. ELEV. -20.0 FT.
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 20.0 FT. ELEV. -20.0 FT.
BORING ADVANCED BY: . POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	5					
2.5	-2.5										
		3.5	5.0	2	SS	3					
5.0	-5.0										Lean CLAY (CL) -light brown - moist - soft to firm (RESIDUUM)
		6.0	7.5	3	SS	5					
7.5	-7.5										
		8.5	10.0	4	SS	7					
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	2					Lean CLAY (CL) -light brown - wet - soft to stiff (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	8					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

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LOG OF BORING B-9
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-9
DRY ON COMPLETION ? Yes

DATE July 27, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

SURFACE ELEV. FT.
DEPTH 20.0 FT. ELEV. -20.0 FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	8					Lean CLAY (CL) - reddish brown and tan - dry - stiff (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	6					
5.0	-5.0										
		6.0	7.5	3	SS	9					
7.5	-7.5										
		8.5	10.0	4	SS	5					
10.0	-10.0										Lean CLAY (CL) - with weathered shale - brown - moist - firm to stiff (RESIDUUM)
12.5	-12.5										
		13.5	15.0	5	SS	7					
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	12					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

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LOG OF BORING B-10
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-10
DRY ON COMPLETION ? Yes

DATE July 28, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

SURFACE ELEV. FT.
DEPTH 20.0 FT. ELEV. -20.0 FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	7				19.5	Lean CLAY (CL) - with root structure - dark brown - dry - firm (FILL)
2.5	-2.5										
		3.5	5.0	2	SS	8				20.2	
5.0	-5.0										Lean CLAY (CL) - light brown and oxcide staining - dry - stiff (RESIDUUM)
		6.0	7.5	3	SS	13				21.4	
7.5	-7.5										
		8.5	10.0	4	SS	14		33	15	22.3	
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	17				39.7	Fat CLAY (CH) - brown - moist - very stiff (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	20					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-11
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-11 DRY ON COMPLETION ? Yes

DATE July 28, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 12.5 FT. ELEV. -12.5 FT.
SAMPLED 12.5 FT. 3.8 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 12.5 FT. ELEV. -12.5 FT.
BORING ADVANCED BY: . POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	12				17.6	Lean CLAY (CL) - with root structure - dark brown and tan - dry - stiff (FILL)
2.5	-2.5										
		3.5	5.0	2	SS	7				26.7	
5.0	-5.0										
		6.0	7.5	3	SS	13				28.5	Lean CLAY (CL) - with chert fragments at depth - dark brown and brown - dry - firm to stiff (RESIDUUM)
7.5	-7.5										
		8.5	10.0	4	SS	14				30.7	
10.0	-10.0										
											Auger Refusal at 12.5 Feet
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-12
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-12
DRY ON COMPLETION ? Yes

DATE July 28, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

SURFACE ELEV. FT.
DEPTH 20.0 FT. ELEV. -20.0 FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	4				27.3	Lean CLAY (CL) - with shale like structure - reddish brown and tan - dry - soft (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	8				36.1	
5.0	-5.0										Fat CLAY (CH) - brown - moist - firm to stiff (RESIDUUM)
		6.0	7.5	3	SS	6				40.9	
7.5	-7.5										
		8.5	10.0	4	SS	11				50	
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	8				36.5	Fat CLAY (CH) - brown - wet - stiff (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	10				41.4	
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-13
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-13
DRY ON COMPLETION ? Yes

DATE August 3, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

SURFACE ELEV. FT.
DEPTH 20.0 FT. ELEV. -20.0 FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	Dry	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	10					Lean CLAY (CL) - with rock fragments - dark brown and brown - moist - stiff (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	8					
5.0	-5.0										
		6.0	7.5	3	SS	10					Lean CLAY (CL) - with shale like structure - light brown and tan - moist - stiff (RESIDUUM)
7.5	-7.5										
		8.5	10.0	4	SS	8					
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	7					Fat CLAY (CH) - light brown and tan - moist to wet with depth - firm (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	7					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-14
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-14
DRY ON COMPLETION ? Yes

DATE July 28, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

SURFACE ELEV. FT.
DEPTH 20.0 FT. ELEV. -20.0 FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	Dry	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	5					
2.5	-2.5										
		3.5	5.0	2	SS	5					
5.0	-5.0										
		6.0	7.5	3	SS	5					
7.5	-7.5										
		8.5	10.0	4	SS	5					
10.0	-10.0										Lean CLAY (CL) - light brown and reddish brown - moist - firm to stiff (RESIDUUM)
12.5	-12.5										
		13.5	15.0	5	SS	6					
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	9					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-15
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-15
DRY ON COMPLETION ? Yes

DATE July 28, 2017
REFUSAL: No
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK
BEGAN CORING
FOOTAGE CORED (LF)
BOTTOM OF HOLE DEPTH 20.0 FT.
BORING ADVANCED BY:

DEPTH 20.0 FT. ELEV. -20.0 FT.
SURFACE ELEV. FT.
DEPTH FT. ELEV. FT.
DEPTH FT. ELEV. FT.
FT.
ELEV. -20.0 FT.
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT. / ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT. / ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT. / ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Asphalt (4 inches) / Basestone (6 inches)
		1.0	2.5	1	SS	10					Lean CLAY (CL) - reddish brown and tan - dry - stiff (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	11					
5.0	-5.0										
		6.0	7.5	3	SS	8					Fat CLAY (CH) - with trace chert fragments - brown and tan - dry - firm to stiff (RESIDUUM)
7.5	-7.5										
		8.5	10.0	4	SS	7					
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	10					Lean CLAY (CL) - with shale like structure - brown - dry - stiff (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	13					
20.0	-20.0										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Five Points Phase 3
Knoxville, Tennessee
GEOServices Project # 21-17541

LOG OF BORING B-16
SHEET 1 OF 1

DRILLER Tri-State Drilling
ON-SITE REP.

BORING NO. / LOCATION B-16
DRY ON COMPLETION ? Yes

DATE July 28, 2017
SURFACE ELEV. FT.
REFUSAL: No
DEPTH 20.0 FT.
ELEV. -20.0 FT.
SAMPLED 20.0 FT. 6.1 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 20.0 FT. ELEV. -20.0 FT.
BORING ADVANCED BY:
POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.
PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	2.5	1	SS	7				34.6	Lean CLAY (CL) - with shale like strucutre and root structure - reddish brown and tan - dry - firm (RESIDUUM)
2.5	-2.5										
		3.5	5.0	2	SS	9		55	29	35.8	
5.0	-5.0										Fat CLAY (CH) - brown - dry - firm to stiff (RESIDUUM)
		6.0	7.5	3	SS	9				36	
7.5	-7.5										
		8.5	10.0	4	SS	5				42.2	
10.0	-10.0										
12.5	-12.5										
		13.5	15.0	5	SS	4				45.7	Fat CLAY (CH) - brown - moist - firm (RESIDUUM)
15.0	-15.0										
17.5	-17.5										
		18.5	20.0	6	SS	6				47.3	
20.0	-20.0										

Boring Terminated at 20.0 Feet

REMARKS:

APPENDIX B

Soil Laboratory Data

GEOServices, LLC-Geotechnical and Materials Engineers

KCDC Phase III

GEOServices Project No. 21-17541

August 7, 2017

SOIL DATA SUMMARY

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	Percent Organic Content
				LL	PL	PI		
B-3	1	1.0-2.5'	21.7%					
	2	3.5-5.0'	20.0%	52	21	31	CH	
	3	6.0-7.5'	18.7%					
	4	8.5-10.0'	35.0%					
B-7	1	1.0-2.5'	39.2%					
	2	3.5-5.0'	37.3%					
	3	6.0-7.5'	31.5%					
	4	8.5-10.0'	40.7%					
B-10	1	1.0-2.5'	19.5%					6.1
	2	3.5-5.0'	20.2%					
	3	6.0-7.5'	21.4%					
	4	8.5-10.0'	22.3%	33	18	15	CL	
	5	13.5-15.0'	39.7%					
	6	18.5-20.0'	38.6%					
B-11	1	1.0-2.5'	17.6%					4.6
	2	3.5-5.0'	26.7%					
	3	6.0-7.5'	28.5%					
	4	8.5-10.0'	30.7%					
B-12	1	1.0-2.5'	27.3%					
	2	3.5-5.0'	36.1%					
	3	6.0-7.5'	40.9%					
	4	8.5-10.0'	50.0%					
	5	13.5-15.0'	36.5%					
	6	18.5-20.0'	41.4%					
B-16	1	1.0-2.5'	34.6%					
	2	3.5-5.0'	35.8%	55	26	29	CH	
	3	6.0-7.5'	36.0%					
	4	8.5-10.0'	42.2%					
	5	13.5-15.0'	45.7%					
	6	18.5-20.0'	47.3%					