

GEOTECHNICAL ENGINEERING REPORT

**Proposed Kansas Energy and Service Center
SW 7th Street and SW Van Buren Street
Topeka, Kansas**

Project No. D14G1399

December 31, 2014

Prepared for:

**Kansas Department of Administration
HTK Architects, PA**

Prepared by:

GEOSOURCE
Your Source for Geotechnical and Materials Engineering

December 31, 2014

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**Subject: Geotechnical Engineering Report
Proposed Kansas Energy and Service Center
SW 7th Street and SW Van Buren Street
Topeka, Kansas
Project No. D14G1399**

Dear Ms. Flower:

We have completed the subsurface exploration and geotechnical engineering evaluation for the above referenced project. The purpose of the exploration was to obtain information on the subsurface conditions within the building site and, based on this information to provide geotechnical engineering recommendations for design and construction of foundations for the proposed structures.

In summary, the borings encountered existing fill and naturally deposited soils underlain by shale and limestone bedrock that continued to the depths explored. The existing fill was quite variable and contained some rubble. Because of this, we have recommended that the proposed building be supported on drilled pier foundations that extend through the fill to the underlying limestone bedrock.

This report completes our current scope of services for this project. The enclosed report describes our exploration procedures and presents the results of the testing and evaluation along with design and construction recommendations for this project. We appreciate the opportunity to work with you on this project and are prepared to provide the recommended construction services.

Respectfully submitted,

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED ENERGY AND SERVICE CENTER
SW 7TH STREET AND SW VAN BUREN STREET
TOPEKA, KANSAS

Project No. D14G1399
December 31, 2014

INTRODUCTION

GeoSource has completed the subsurface exploration and geotechnical engineering evaluation of the site for the proposed Kansas Energy and Service Center building, which is located southeast of the intersection of SW 7th Street and SW Van Buren Street in Topeka, Kansas. Our services for this project were provided in general accordance with our November 26, 2014 proposal. The exploration work was authorized on December 4, 2014 with the issuance of Purchase Order No. 17300-0000017324 by the Kansas Department of Administration.

PROJECT DESCRIPTION

We understand that the proposed building will be a two story, steel frame structure, with metal stud infill walls and brick veneer or stone panel exterior facing. The new building will have overall plan dimensions of approximately 120 by 160 feet. Maximum column loads for the new building were estimated by the Structural Engineer to be less than 260 kips. The finished floor elevation of the new building has tentatively been set at elevation 928.76 feet, USGS datum. The floor for the service base on the east side of the building will be stepped to follow the grade of the existing alley. The floor slab elevation at the northeast corner of the building will be at elevation 925.54 feet, the floor slab elevation at the southeast corner will be at 928.76 feet, and the intermediate floor slab elevation will be at 927.04 feet. The bottom of the elevator pit has tentatively been set at elevation 924.76 feet. At this proposed floor elevation up to 6 feet of new fill will be required to establish grades for the proposed building area.

Light duty parking lots are planned for the areas on the north and south sides of the new building. The parking lots will provide space for about 40 automobiles and other light personnel vehicles.

Drives will connect the parking lots to SW 7th Street and/or to the existing alley. No other specific information was provided regarding the design life of the pavement section.

A new utility tunnel will extend from the proposed Energy and Service Center building to the Kansas Statehouse along SW Van Buren Street. The plan and profile drawing of the tunnel that was provided to GeoSource indicated that the bottom of the tunnel will extend to about elevation 912 ± feet at the proposed building site and will be at about elevation 915 ± feet at the Statehouse parking garage. The tunnel will have a height of about 8 ± feet and will be constructed of reinforced concrete.

The scope of the exploration and engineering evaluation for this study, as well as the conclusions and recommendations in this report, were based on our understanding of the project as described above. If pertinent details of the project have changed or otherwise differ from our descriptions, we must be notified and engaged to review the changes and modify our recommendations, if needed.

DRILLING AND SAMPLING PROCEDURES

The field work for this project was performed between December 17 and 19 of 2014. A total of sixteen exploratory test borings were drilled for this project. Figure 1 in the Appendix shows the approximate locations of the borings with reference to the proposed building lines and other site features. The boring locations were established by GeoSource personnel. Distances from the existing city streets and other reference features to the boring locations were measured using a calibrated wheel. Right angles for locating the borings were estimated. The ground surface elevations shown on the boring logs are approximate and were determined using an engineer's level and rod. The elevations were referenced to the rim of the existing storm water manhole (SWMH), located on the west side of SW Van Buren Street about 165 feet south of SW 7th Street. The elevation of the manhole was given as 924.49 feet, USGS datum, on the site plan that was provided to GeoSource. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used to make these measurements.

The borings were performed with a truck-mounted, rotary drill rig using 4-inch diameter flight augers to advance the boreholes. Representative samples of the overburden soils and bedrock units were obtained at selected intervals using the Shelby tube and split-barrel sampling procedures as outlined in ASTM Specifications D-1587 and D-1586, respectively. The Shelby tube sampling procedure utilizes a thin-walled, steel tube with a sharp cutting edge that is pushed hydraulically into the bottom of the boring to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. The samples were sealed and returned to our laboratory for further examination, classification and testing.

The split-barrel sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with an automatic hammer. The number of blows required to advance the sampler the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Resistance Value (N). These "N" values are indicated on the boring logs at their depth of occurrence and provide an indication of the consistency of clays and the relative hardness of weathered bedrock units. A higher efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the Standard Penetration Resistance Values (N). The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Borings B-2 and B-4 were continued below the point of auger refusal through use of NQ3-diamond bit coring procedures. This diameter core barrel provides a sample having a diameter that is slightly smaller than 2 inches. Descriptions of the rock core are presented on the respective boring logs in addition to recovery and Rock Quality Designation (RQD) for the core recovered. Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. Rock Quality Designation is defined as the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. Rock Quality Designation provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

Boring logs are included in the Appendix of this report and present such data as soil and bedrock descriptions, consistency and relative hardness evaluations, depths, sampling intervals and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the drill crew. Field logs were prepared by the drill crew that included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final boring logs represent the geotechnical engineer's interpretation of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the boring logs were based on observations during our field work, an extrapolation of information obtained by examining samples from the borings and comparisons of soils and/or bedrock types with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between soil and bedrock types may be more gradational in nature rather than clearly defined.

LABORATORY TESTING PROGRAM

The laboratory testing program consisted of performing water content, dry unit weight and unconfined compression tests on representative portions of undisturbed samples obtained with the Shelby tube sampler. A calibrated hand penetrometer was used to determine the approximate unconfined compressive strength of samples that were deformed or otherwise unsuitable for unconfined compression testing. The hand penetrometer has been correlated with unconfined compression tests, and provides a better estimate of the consistency and strength than visual observation alone. Moisture content determinations were also performed on samples obtained using the split-barrel sampler. The results of the laboratory tests are presented on the respective boring logs.

Atterberg Limits tests were conducted on representative samples of the onsite soils. These tests provide information on the plasticity of the soil, which is a basis for soil classification and for estimating the potential of subgrade soils to change volume with variations in moisture content. Results of these tests are also indicated on the respective boring logs.

In addition, unconfined compression tests were performed on selected rock cores to evaluate the compressive strength of the bedrock units encountered in the borings. The results of the unconfined

compression tests are shown on the respective boring logs in the Appendix of this report. The unconfined compressive strengths are in psi (pounds per square inch).

As part of the testing program, the soil samples were classified by a geotechnical engineer using visual and manual procedures outlined in ASTM D-2487 and D-2488. The descriptions of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are shown on the boring logs. A brief description of this classification system is included in the Appendix of this report.

The bedrock units encountered in the borings were described in accordance with the enclosed General Notes for Bedrock on the basis of visual classification of disturbed auger cuttings and drilling characteristics. Core samples may reveal other rock types.

SITE CONDITIONS

The proposed building site is located southeast of the intersection of SW 7th Street and SW Van Buren Street in Topeka, Kansas. The site was bounded on the north by SW 7th Street, on the west by SW Van Buren Street and on the east by an existing alley. At the time the borings were performed, the site was a paved parking lot. Historical photographs indicated that the site was previously occupied by a power plant and several other buildings in the past. The borings encountered undocumented clay fill, most of which contained variable amounts of bricks, cinders, gravel and other miscellaneous construction debris from the former buildings. Auger refusal was encountered on rubble at boring locations B-8 and B-15, suggesting that buried foundations or basement walls and slabs or large concrete or limestone fragments are buried beneath portions of the proposed building site. At Boring B-2, a strong fuel odor was detected in the undocumented fill encountered between depths of about 5 to 10.3 feet.

SUBSURFACE CONDITIONS

The following presents a general summary of the major strata encountered during our subsurface exploration and includes a discussion of the results of field and laboratory tests conducted. Specific subsurface conditions encountered at the boring locations are presented on the individual boring logs in the Appendix of this report. Figure 2 in the Appendix shows a Generalized Subsurface Profile, based on the information obtained from the borings. The stratification lines shown on the boring logs and profile represent the approximate boundaries between soil and bedrock types; in-situ, the transition between materials may be more gradational in nature rather than clearly defined.

All of the borings were drilled in paved areas and encountered about 3 to 5 inches of asphaltic concrete pavement at the surface. Borings B-10 through B-13 were drilled on SW Van Buren Street along the alignment of the proposed utility tunnel and encountered brick pavers below the asphalt pavement.

The pavement section was underlain by undocumented fill that continued to depths of about 5.5 to 14.3 feet below the existing ground surface at the boring locations. The upper 2-½ to 3 feet of the fill was generally comprised of medium stiff to very stiff, light brown lean clay (CL), with a trace of fine sand. Laboratory tests performed on samples of this lean clay fill indicated moisture contents in the range of 13.4 to 25.6 percent, with dry densities of 102 to 115 pcf and unconfined compressive strengths of 1,450 to 5,990 psf. Atterberg Limits performed on this material indicated Liquid Limits in the range of 34 to 39, with Plasticity Indices of 15 to 20.

Beneath the upper fill layer, the borings encountered moderate to high plasticity fill that contained variable amounts of brick, cinders, gravel and other miscellaneous construction debris. No significant amounts of wood, trash or other unsuitable materials were encountered at the boring locations. As previously discussed, fuel contaminated soils were encountered in Boring B-2 below a depth of about 5 feet. In addition, significant amounts of rubble, including large size debris were encountered in Borings B-7, B-8 and B-15. Buried obstructions within the rubble fill were encountered in Borings B-8 and B-15. These obstructions could be buried foundation or large size

fragments of concrete or limestone. Laboratory tests performed on samples of the undocumented fill indicated moisture contents in the range of 11.4 to 55.7 percent, with dry densities of 97 to 106 pcf and unconfined compressive strengths of 1,420 to 5,300 psf. Standard Penetration Tests performed in the existing fill yielded “N” values ranging from 4 to 76 blows for one foot of penetration or less.

The undocumented fill was underlain by naturally deposited clay soils at 9 of the 16 boring locations. The natural clay soils were deposited by glacial ice that covered northeast Kansas in the Pleistocene Period. The glacial soils were visually classified as stiff to very stiff, lean clays (CL) and fat clays (CH). Laboratory tests performed on samples of the natural clay soils indicated moisture contents in the range of 17.1 to 28.0 percent, with dry densities of 102 to 107 pcf and unconfined compressive strengths of 2,050 to 4,440 psf. Soil colors varied from brown to light brown to reddish brown, with light gray and rust mottling. Standard Penetration Tests performed in the natural clay soils yielded “N” values in the range of 7 to 12 blows for one foot of penetration or less.

The undocumented fill and naturally deposited glacial clay soils were underlain by interbedded layers of shale and limestone bedrock that are part of the Topeka Limestone Formation of the Pennsylvanian Age Shawnee Group. The bedrock was encountered in the borings at depths ranging from about 10.3 to 14.3 feet across the proposed building site. The uppermost bedrock unit encountered was the weathered remnants of the Turner Creek Shale Member. The Turner Creek Shale is typically 2 to 5 feet thick and consists of weathered, olive tan to gray brown, clayey to silty shale. The Turner Creek Shale was underlain by the Sheldon Limestone Member. The Sheldon Limestone was described as a buff to light gray, fossiliferous limestone. The thickness of this limestone unit varied from about 1.5 feet to 2.8 feet across the site. The Jones Point Shale Member was encountered below the Sheldon Limestone and this bedrock unit typically consists of gray, silty to clayey shale that was about 1.8 to 2.2 feet thick at the boring locations where it was encountered.

The Jones Point Shale was underlain by the Curzon Limestone, which is the thickest limestone unit of the Topeka Formation. The Curzon Member is typically comprised of two or more beds of medium to thick-bedded, buff to light gray, fossiliferous limestone. The thickness of the Curzon

Limestone ranged from about 5.9 to 6.3 feet at the boring locations where it was encountered. The Curzon Member was underlain by the Iowa Point Shale Member. The Iowa Point Member is typically a hard, gray, clayey to silty shale that locally contains sandstone layers. At the proposed building site, the Iowa Point Shale had a thickness of only about 1 to 2 feet. The Iowa Point Shale was underlain by the Hartford Limestone Member, which is the basal member of the Topeka Limestone Formation. The Hartford Member typically has a total thickness of about 5 to 6 feet and consisted of massive, gray to bluish gray, fossiliferous limestone. Core samples of the bedrock from Borings B-2 and B-4 had recovery rates of 78 to 100 percent, with Rock Quality Designation (RQD) values in the range of 56 to 100 percent, indicating fair to good quality rock. The unconfined strength of the limestone units ranged from about 1,970 to 9,520 psi.

GROUNDWATER OBSERVATIONS

Groundwater observations were made in the boreholes both during and following completion of the drilling operations. Groundwater was encountered in Borings B-1, B-5, B-9 and B-15 at depths ranging from about 0.5 to 12.0 feet below the existing ground surface. At Boring B-15, groundwater was encountered very near the existing ground surface. The other borings remained, dry prior to coring, and no visible groundwater seepage was observed at the time the borings were performed.. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current groundwater conditions.

Coring of the bedrock at boring locations B-2 and B-4 required the introduction of water into the borehole as a drilling fluid to cool the bit and to flush the cuttings from the hole. No noticeable loss of drilling fluid was noted. The water levels indicated on the boring logs where coring procedures were used represent the water level in the borings after removal of casing and drill tools and is generally not an indicated of a true water table.

Groundwater in the underlying bedrock typically flows through joints and fissures in the limestone bedrock units. The shale bedrock units are generally less permeable and do not transmit significant amounts of groundwater seepage.

The composition of the glacial soils is often erratic due to the random nature of its deposition. Glacial deposits frequently contain isolated pockets of water bearing sands and gravel, as well as cobbles and large boulder size materials. Water bearing lenses within natural glacial deposits are generally limited in extent. Excavations encountering such lenses typically experience a sudden influx of groundwater due to the high permeability of the materials within the lens. Foundation and other excavations that encounter trapped water within the glacial soils can normally be dewatered using conventional sump pumps.

Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our evaluation, it is our professional opinion that the proposed project site can be developed for the proposed building and utility tunnel using conventional grading and foundation construction techniques. The existing undocumented fill was quite variable across the site and contained significant amounts of rubble and construction debris at some of the boring locations. Because of this, the undocumented fill is not suitable for support of shallow spread footings.

We have recommended that the proposed building be supported on drilled pier foundations that extend through the undocumented fill and naturally deposited glacial clay soils and are founded in the Curzon Limestone Member that underlies the proposed building site. Recommendations for

design and construction of drilled pier foundations are presented in the follow sections of this report.

As an alternative to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade would appear to be a viable foundation option for this project that may potentially provide an economic benefit to this project. Geopiers are rammed aggregate piers that are installed by a specialty contractor using a proprietary method. Recommendations for design and construction of geopiers is normally provided by Geopier US, the company that developed this method of ground improvement and foundation support.

The major concern, from a geotechnical engineering standpoint, is the presence of undocumented fill and the potential for encountering old foundations, walls and other buried structures, as well as large concentrations of rubble from the former buildings that previously occupied the site. If buried structures and/or large concentration rubble are encountered, they could hamper the installation of the drilled pier foundations and/or the drilling of the boreholes for the Geopiers. Removal and replacement of the existing undocumented fill does not appear to be an economical option for this project. One way to deal with the uncertainty, would be to establish a contingency fund for removal of old buried structures and/or rubble in areas affected by the new construction.

The construction of the proposed utility tunnel between the proposed building and Statehouse Parking Garage should be relatively straight forward. The borings indicated that some rock excavation will likely be required to install the tunnel at the currently proposed bottom elevations. Removal of the rock will likely require the use of pneumatic breakers, rock teeth or some other method of hard rock removal. Groundwater was not encountered in the borings that were drilled along the proposed tunnel alignment. However, it would be prudent to include underdrains below the floor slab of the tunnel and adjacent to the tunnel walls to prevent hydrostatic loading of the walls and seepage into the tunnel, should groundwater levels change in the future.

To reduce the potential for subgrade volume change and floor slab movement, we have recommended that a minimum of 24 inches of select, low volume change material be placed below building floor slabs. Thorough site preparation will be required to correct areas that were disturbed by previous construction activity at the proposed building site. The recommendations given in the following sections of this report describe subgrade preparation for building foundations, floor slabs and pavements, as well as undercutting procedures to remove existing fill, soft soils, expansive clays and other unsuitable materials. Proper fill placement techniques are also discussed and include: recommended types of fill materials, maximum lift thickness, as well as soil moisture content and compaction criteria for structural fill sections.

The recommendations submitted herein are based, in part, upon data obtained from our subsurface exploration. It should be recognized that subsurface conditions may vary between the exploration points and that the nature and extent of any subsurface variations that may exist at the proposed site will not become evident until exposed during construction. If variations appear evident, then the recommendations presented in this report should be reevaluated. In the event that any changes in the nature, design, location or floor slab elevations of the proposed building are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed by the geotechnical engineer and our recommendations modified in writing, if necessary.

SITE PREPARATION

Initial site preparation for the proposed project should commence with the removal of the existing pavement section and the demolition of any existing structures that are located within proposed construction areas. Demolition should include complete removal of all grade supported slabs, pavements, sidewalks and shallow spread footings. All broken concrete, asphalt and other debris from demolition of these structures should be removed from the site. Areas disturbed during demolition of the existing structures should be thoroughly evaluated by the geotechnical engineer prior to placement of structural fill. All disturbed soils should be undercut prior to placement of structural fill.

Relocation of any existing utility lines within the zone of influence of proposed construction areas should also be completed as part of the site preparation. The lines should be relocated to areas outside of the proposed construction. Excavations created during the removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to recompact the fill. In addition, the base of the excavations should be thoroughly evaluated by a geotechnical engineer or engineering technician prior to placement of fill. All fill should be placed in accordance with the recommendations presented in the Structural Fill section of this report.

Following completion of the demolition work, it is recommended that the exposed grade be scarified to a minimum depth of 8 inches and be moisture conditioned to bring the moisture content of the soils into the range recommended for structural fill. Moisture conditioning is the process of adjusting the moisture content of the scarified materials to a moisture content that is within a range of 0 to 4 percent above the optimum moisture content as determined by the Standard Proctor (ASTM D-698) compaction procedure. Following moisture conditioning, the scarified materials should be recompact to a minimum of 95 percent of Standard Proctor (ASTM D-698) maximum dry density. Soft or unstable areas that hamper compaction of the subgrade should be undercut and replaced with structural fill.

Following moisture conditioning and prior to placement of any new fill, it is recommended that the exposed grade be proofrolled. Proofrolling of the subgrade provides a more stable base for placement of structural fill and aids in identifying soft or disturbed areas. Unsuitable areas identified by the proofrolling operation should be undercut and replaced with structural fill. Proofrolling can be accomplished through use of a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading. Suitable structural fill should then be placed to design grades as soon as practical after reworking the subgrade to avoid moisture changes in the underlying soils.

If soft or unstable conditions are encountered during the proofrolling operation, stabilization of the soils may be required. Clean crushed rock having a particle diameter of 3 to 6 inches could be used to stabilize the subgrade prior to placement of structural fill. After initial undercutting, the large rock would be spread over the unstable subgrade and worked into the soft soils by close tracking with a

bulldozer or other suitable construction equipment. Additional rock would be added until the subgrade becomes firm enough to support construction equipment. The use of a geotextile fabric, in conjunction with crushed rock, could also be considered as a means of stabilizing the exposed grade.

CLIMATIC CONDITIONS

Weather conditions will influence the site preparation required. In spring and late fall, following periods of rainfall, the moisture content of the near surface soils may be significantly above the optimum moisture content. Additionally, it is common to encounter wet, unstable soils upon removal of the site pavements or flatwork as a result of moisture becoming trapped beneath relatively impervious concrete or asphalt pavements. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include aerating the wet subgrade, removal of the wet materials and replacing them with dry materials or treating the wet material with fly ash.

If site grading commences during summer months, the moisture contents of the onsite soils may be abnormally low, which can significantly increase the swell potential of the clay soils. Typically, discing and moisture conditioning of the exposed subgrade materials to the moisture content criteria outlined in the Structural Fill section will reduce this swell potential of the dry materials. As an alternative, the dry materials could be undercut and replaced with structural fill.

EXCAVATIONS

Excavations will be required for foundations, underground utilities and a utility tunnel for this project. It is anticipated that the foundation excavations will be in undocumented fill and naturally deposited clay soils above the water table. These materials can generally be excavated with conventional earthmoving equipment such as backhoes and large track hoes. Rubble fill and buried structures within the undocumented fill could hamper excavations in some areas of the site. Utility excavations that extend into the underlying weathered shale bedrock with a Standard Penetration Resistance (N) value of less than 25 blows per foot can generally be excavated with conventional earthmoving

equipment such as backhoes, large track hoes, loaders, etc. The borings indicated that the proposed utility tunnel excavation along SW Van Buren Street will extend into harder, less weathered shale and/or limestone bedrock units. Removal of the hard shale and limestone will be more difficult and will probably require the use of rock teeth, pneumatic breakers, or some other method of hard rock removal to complete the excavation for the utility tunnel.

Temporary construction slopes should be designed in strict compliance with the most recent governing regulations. The naturally deposited clay soils encountered in the borings would generally be classified as Type B soils, under Part 1926 of the OSHA regulations pertaining to open excavations. For these soils, it is recommended that temporary construction slopes be no steeper than 1(H) to 1(V). Construction slopes should be closely observed for signs of mass movement: tension cracks near the crest, bulging at the toe, etc. If potential stability problems are observed, the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor.

STRUCTURAL FILL

All structural fill should consist of approved materials, free of organic matter and debris. Fill placed within 24 inches below the building floor slab and leveling course materials should consist of a lower plasticity cohesive soil having a liquid limit less than 45. Higher plasticity soils could be used as structural fill in the lower portion of deep fill sections in the building area and/or as structural fill in pavement areas where more movement can generally be tolerated. Fill should be placed in lifts having a maximum loose lift thickness of 9 inches. All fill should be compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D-698 (standard Proctor compaction). The moisture content of the fill at time of compaction should be within a range of 0 to 4 percent above optimum moisture content as defined by the standard Proctor compaction procedure. Moisture contents should be maintained within this range until completion of the building floor slab.

Granular materials that do not have a well-defined moisture-density relationship that are placed below foundations and other structures should be compacted to a minimum of 70 percent of the materials

maximum relative density as determined by ASTM Specifications D-4253 and 4254. Granular backfill materials placed next to structures should be compacted to a minimum of 65 percent of the materials maximum relative density. There is no specific moisture content requirement for compaction of sands and sandy soils and the moisture content of these soils should be maintained in a suitable range that facilitates the compaction of the sand.

Based on the proposed floor slab elevations, it appears that it will be necessary to import fill material to the site. It is recommended the low volume change material be imported to complete the required fill sections.

FOUNDATIONS

The borings encountered undocumented fill with variable amounts of rubble and construction debris. The undocumented fill is not considered suitable for support of shallow spread footings. Because of this, we have recommended that the proposed building be supported on drilled pier foundations that extend through the undocumented fill and naturally deposited glacial clay soils and are founded in the Curzon Limestone that underlies the proposed building site. As an alternate to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade would appear to be a viable foundation option for this project. As previously discussed, Geopiers are rammed aggregate piers that are installed by a specialty contractor using a proprietary method. Recommendations for design and construction of geopiers is normally provided by Geopier US, the company that developed this method of ground improvement and foundation support.

DRILLED PIER FOUNDATIONS

Based on the subsurface conditions encountered at the site, it recommended that the proposed building be supported by a drilled pier and grade beam foundation system. It is recommended that all drilled piers be founded in the Curzon Limestone. Based on the borings, it is anticipated that the bearing elevations of the drilled piers will range from about 908 to 913 feet, across the proposed

building site. Greater penetration into the bedrock may be required at some locations depending on the extent and severity of bedrock weathering. Drilled piers that are founded in suitable limestone may be designed and proportioned using an allowable end bearing pressure of 60,000 psf.

Any uplift loads acting on the foundations can be resisted by the effective dead weight of the piers plus an allowable side friction value of 250 psf for the portion of the shaft in soils and 2,000 psf for the portion of the shaft in weathered shale and/or limestone bedrock.

Properly reinforced drilled piers are also capable of resisting transient lateral loads from wind and/or earthquakes. It has been our experience that drilled piers with a minimum shaft diameter of 30 inches and an embedment length of at least 10 feet are capable of resisting lateral loads of 25 kips or more, with maximum top of pier deflections of ½ inch or less. If desired, GeoSource can perform a more comprehensive lateral load analysis and provide additional recommendations, when final loads become available. All piers subject to lateral loads should be properly reinforced.

All piers should have a minimum shaft diameter of 36-inches in order to accommodate dewatering equipment and/or to permit access for proper hand cleaning and observation of the base. Some groundwater seepage should be anticipated during the installation of drilled piers and use of temporary casing and dewatering techniques may be required. Temporary casing may also be required in areas where significant amounts of debris and/or rubble are present in the undocumented fill. To minimize disturbance to the bearing surfaces caused by ponding of water, it is recommended that concrete be placed the same day that the piers are drilled. It is also recommended that temporary casing be installed when personnel are required to enter a drilled pier excavation to clean or observe the bearing surface.

To minimize disturbance to the bearing surfaces caused by ponding of water, it is recommended that concrete be placed the same day that the drilled shafts are completed. The bottom of the pier excavation should be clean and free of water and loose materials prior to placement of the reinforcing steel and concrete. Concrete placement should be continuous from the bottom to the top elevation of the shaft. For dry excavations, concrete may be placed by the free fall method,

provided that it can be directed down the center of the shaft without hitting the reinforcing steel or sides of the excavation. Wet excavated shafts will require that the concrete either be pumped from the bottom up or placed using a tremie. The tremie pipe should be clean and have a sufficient inside diameter for use with the specific concrete mix, but not less than 10 inches. The discharge end of the tremie should allow free radial flow of the concrete and be immersed at least 5 feet in concrete and maintain a positive pressure differential during placement to prevent water or spoil intrusion.

It is anticipated that the drilled piers can be installed with conventional drilling equipment. It is possible that obstructions, such as rubble fill or old buried foundations, walls and other structures from the former buildings may be encountered during the installation of the drilled piers. Core barrels, rock augers or special construction methods may be required to remove obstructions and/or to remove loose rock and other materials to properly prepare the foundation bearing surface for the drilled piers.

Temporary steel casing and dewatering procedures may be required for proper installation of the drilled piers. If concrete will be placed in conjunction with the use of temporary casing, there must be a sufficient head of concrete inside the casing to prevent soil and water from entering the pier excavation as the temporary casing is pulled. It is recommend that concrete be designed to have a minimum slump in the range of 6 to 8 inches to reduce the potential for arching as the casing is removed.

It is recommended that all drilled pier and/or footing excavations be observed and evaluated by the geotechnical engineer or his representative immediately prior to placement of foundation concrete. Unsuitable areas identified at this time should be corrected. Corrective procedures would be dependent upon conditions encountered and will most probably include deepening of the drilled piers.

Long-term structural settlement of drilled piers designed and constructed as outlined above should be minor; i.e., ½ inch or less.

GEOPIER FOUNDATION SYSTEM

As an alternate to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade appears to be a viable option for this project and may potentially provide an economic benefit to this project. Based on our experience with the *Geopier* soil reinforcement system, we anticipate that a *Geopier* reinforced subgrade could be designed to increase the net allowable soil bearing pressure at this site while limiting foundation settlement.

The *Geopier* soil reinforcement system has been used for a number of years to support structures as an alternative to deep foundations and/or to the removal and replacement of soft or unsuitable soils. The system allows the use of conventional spread footings and floor slabs cast on-grade, and reliably controls settlement to within design tolerances.

The *Geopier* soil reinforcement system consists of highly densified aggregate piers. The *Geopier* elements are installed by drilling 30-inch diameter holes, and ramming thin lifts of well-graded aggregate within the holes to form very stiff, high-density aggregate piers. The drilled holes for this project should extend through the undocumented fill to the underlying bedrock, a depth of about 13 to 19 feet below the finished floor elevation of the existing building. Following drilling of the *geopier* hole, well graded aggregate is compacted in 12-inch loose lifts in the drill hole. Ramming takes place with a high-energy beveled tamper that both densifies the aggregate and forces the aggregate laterally into the sidewalls of the hole. This action increases the lateral stress in surrounding soils, thereby further stiffening the reinforced composite soil mass. The result of *Geopier* installation is a significant strengthening and stiffening of subsurface soils that then support floor slabs and high-capacity footings.

Geopier designs are based on a two-layer settlement analysis as described by Lawton et al. (1994) and in the *Geopier* Reference Manual. Settlements within the “upper zone” (zone of soil that is reinforced with *Geopier* elements) are computed using a weighted modulus method that accounts for the stiffness of the *Geopier* elements, the stiffness of the matrix soil, and the area coverage of *Geopier* elements below supported footings. Settlements within the “lower zone” (zone of soils beneath the upper zone

which receives lower intensity footing stresses) are computed using conventional geotechnical settlement methods.

The *Geopier* soil reinforcement system is a design-build system and *Geopier* US should be contacted to provide engineering analyses and project specific design information for this project. Please contact Mr. Aaron J. Gaul, of *Geopier* Foundation Company – Midwest at (816) 531-6026 regarding the final system design, including the allowable foundation bearing pressure, *Geopier* shaft lengths and spacing, anticipated floor slab thickness, and a cost to support the proposed building.

If the *Geopier* system is selected, Quality Assurance testing should be performed during installation, including documentation of the soil conditions encountered, the shaft lengths, amount of aggregate used, verification of the modulus test readings, and tests on the compacted aggregate lifts. GeoSource would be pleased to provide this service.

SEISMIC HAZARDS DETERMINATION

Earthquake hazard evaluation is a complex task. Seismic sources must be identified and characterized, path effects must be evaluated (i.e., selection of appropriate attenuation relationships), and ground motions must be completed. Finally, an analysis of the motion with respect to the proposed construction must be made. In addition to the multi-discipline nature of this process, there is substantial parameter and modeling uncertainty associated with each of the steps. Typically, code based approaches are used for seismic hazard analyses. Our seismic hazard evaluation follows the IBC 2009 procedures.

United States Geological Society (USGS) has developed and mapped maximum earthquake response spectra for two design levels: an earthquake having a 10% probability of exceedance in 50 years and an earthquake having a 2% probability of exceedance in 50 years. The motions developed by USGS represent soft rock conditions, which are assumed to be representative of the

soil/rock that would be encountered below a depth of approximately 100 feet below existing grades at the site.

The USGS “soft rock” peak ground accelerations for the 10%/50 year and 2%/50 year events are 5.10% g and 18.60% g, respectively. Maximum spectral accelerations at the 0.2 second/1.0 second periods for the 10%/50 year and 2%/50 year events are 5.10% g / 2.10% g and 15.40% g / 5.40% g, respectively. Based on the subsurface information, the project site would be characterized as a Site Class C per the 2009 International Building Code (IBC). In addition, there is no significant risk of liquefaction or mass movement of the on-site soils due to a seismic event.

BUILDING FLOOR SLABS

The recommendations outlined in the Site Preparation and Structural Fill sections of this report are intended to produce subgrades that are suitable for support of building floor slabs. These recommendations include capping the building pad with a minimum of 24 inches of select, low volume change material below the floor slab and leveling course. The select fill layer below the floor slabs has been recommended to reduce the potential for subgrade volume change and floor slab movement. The recommended low plasticity structural fill thickness is in addition to any granular section that will be required below the floor slabs. The moisture content of the subgrade soils should be maintained within the recommended range until floor slabs are completed. Depending upon weather conditions, periodic wetting may be required.

Where possible, floor slabs should be designed and constructed as free slabs to allow for some differential movement between the walls, column points and floor slabs. It is recommended that a granular leveling course, having a minimum thickness of 4 inches, be used below normally loaded building floor slabs supported on soil subgrades. The granular section provides a capillary moisture break and acts as a leveling course. Clean crushed limestone gravel, with a nominal size of ½ to ¾ inch, would be recommended for the leveling course. A modulus of subgrade reaction of 100 pci may be used to design floor slabs constructed on an untreated clay subgrade.

In areas where floor loads are greater than 200 psf, it is recommended that a minimum of 12 inches of crushed limestone aggregate be placed below the building floor slab. The crushed rock may be substituted for a portion of 18 inches of select, low volume change fill layer recommended for normally loaded floor slabs. The purpose of the crushed rock is to provide an improved subgrade for the more heavily loaded floor slab areas. In addition, the crushed rock will also provide a good working surface during construction. It is recommended that the crushed rock have a gradation similar to KDOT AB-3. The crushed rock should be placed in 6 inch lifts and compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D 698. A modulus of subgrade reaction of 250 pci may be used to design floor slabs constructed on 12 inches of compacted crushed limestone aggregate.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building or pavement, this moisture will collect. To reduce the impact of this subsurface moisture and the potential impact of future induced moisture (such as landscape irrigation or precipitation), the current industry standard is to place a vapor retarder below the compacted crushed limestone layer. This membrane typically consists of visquene or polyvinyl plastic sheeting, having a thickness of at least 10 mils. It should be noted that although vapor barrier systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems typically will not necessarily assure that floor slab moisture transmission rates will meet floor covering manufacturer standards and that indoor humidity levels be appropriate to inhibit mold growth. The design and construction of such systems are totally dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the slab-on-grade floor design. Building design and construction may have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling of the

slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

The above procedures should reduce the potential for subgrade moisture variations and consequently reduce floor slab movement and cracking. However, these procedures will not completely eliminate the volume change characteristics of the natural clay soils and, because of the presence of unaltered clay soils that extend to much greater depths, some long-term volume change may occur along with some floor slab movement and cracking. Isolation of floor slabs from walls and columns should be considered to accommodate minor differential movement of floor slabs. If it is desired to further minimize the potential for subgrade volume change, the use of a greater thickness of low volume change material beneath the floor slab should be considered.

LATERAL EARTH PRESSURES

Based on our experience with soils similar to those encountered at the site, it is recommended that the walls of the utility tunnel be designed using an equivalent fluid pressure of 55 pounds per cubic foot. This lateral earth pressure assumes an "at rest" stress distribution condition; i.e., no wall rotation is allowed. The recommended load distribution does not include a factor of safety or take into account the influence of any hydrostatic loading of the walls. Also, the stress distributions do not include the influence of any foundations, pavement or other surcharge loads located in or adjacent to wall backfill.

To prevent hydrostatic loading on the walls and/or seepage into the utility tunnel, it is recommended that perforated drain lines be installed at the base of the walls and also under the bottom floor slab of the tunnel. The drain lines should be sloped to provide positive gravity and should extend to a sump or storm drain where the water is removed. The drain line should be wrapped with filter fabric to prevent intrusion of fines. The drain line should be backfilled with free draining granular material extending vertically above the drain line to within 2 feet of final grade. The remaining portion of the excavation should be backfilled with cohesive soils to minimize the infiltration of surface water. The

granular section behind the wall should have a minimum width of 2 feet and should be encapsulated in the suitable filter fabric to minimize intrusion of fines. The use of a prefabricated drainage blanket on the foundation wall could also be considered to prevent hydrostatic loading. Drainage blankets should be installed in accordance with the manufacturer's recommendations.

PAVEMENTS

Parking and drive area subgrades should be prepared in accordance with the recommendations given in the Site Preparation and Structural Fill sections of this report. The site soils are considered poor subgrade materials for support of pavements. Based on the soil types encountered at this site and previous experience with materials of this type, a design CBR value of 3 is recommended for design of pavement sections. For this design value, a full-depth asphaltic concrete section having a minimum thickness of 6 inches is recommended for automobile parking areas and 7.5 inches is recommended for the access drives. For asphaltic concrete pavements, a minimum surface course thickness of 2 inches is normally recommended.

Service drives used by semi-trailer and other heavy delivery trucks require thicker pavement sections. GeoSource would be pleased to provide specific thickness recommendations for heavy duty pavements, after we receive additional information regarding the type and number of trucks that are projected to use this facility over the design life of the pavement. Portland cement concrete pavements are recommended for approach slabs, dock aprons, truck drives and parking areas, trash dumpster pads and other areas where heavy wheel loads will be concentrated. It is recommended that the concrete pavements in these areas have a minimum thickness of 8 inches. We normally recommend a 4-inch leveling and drainage course of clean, crushed rock be placed below all concrete pavements.

Portland cement concrete pavements are recommended for the trash dumpster pad and other paved areas subjected to concentrated wheel loads and high stresses. The minimum recommended thickness in these areas is 7 inches. Normally, a 4-inch layer of granular fill is placed below concrete pavement sections.

We recommend that the pavement subgrades be evaluated by proofrolling immediately prior to paving. The moisture content and density of the top 8 inches of the subgrade should be checked within two days prior to commencement of actual paving operations. If the material is not in compliance with the required ranges of moisture or density, the subgrade should then be moisture conditioned and recompacted. If any significant event, such as precipitation, occurs after the evaluation, the subgrade should be reviewed by qualified personnel immediately prior to placing the pavement. The subgrade should be in its finished form at the time of the final review.

Proper drainage is a key to the long term performance of any pavement section. It is recommended that all pavements be properly sloped to provide rapid runoff of surface water. Water should not be allowed to pond on or adjacent to pavements, since this could result in saturation of the subgrade and cause premature deterioration of pavements. Pavements in Kansas are normally subjected to 30 or more freeze-thaw cycles in any given year. Because of this, periodic maintenance of all of the pavements is essential to long term performance and should be anticipated. This should include sealing of all cracks and joints and by maintaining proper surface drainage next to paved areas.

PLANS AND SPECIFICATIONS REVIEW

It is recommended that the geotechnical engineer be provided the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical engineering recommendations in the design and specifications. In the event that GeoSource is not given the opportunity to perform this recommended review, we will assume no responsibility for misinterpretation of our geotechnical engineering recommendations.

CONSTRUCTION OBSERVATION AND TESTING

To effectively achieve the intent of the geotechnical recommendations presented in this report and to maintain continuity from design through construction, GeoSource should be retained to provide observation and testing services during earthwork and foundation construction phases of the project. This will provide the geotechnical engineer with the opportunity to observe the subsurface conditions encountered during construction, evaluate the applicability of the geotechnical recommendations presented in our report as they relate to the soil and bedrock conditions encountered, and to provide follow up recommendations if conditions differ from those described in our report.

LIMITATIONS

The analysis and recommendations submitted in this report are based in part upon the subsurface information obtained from the exploration points performed at the indicated locations and our present knowledge of the proposed construction as outlined in the Project Description. Subsurface conditions may vary between the exploration points and across the site and our report does not reflect any variations which may occur. The nature and extent of such variations may not become evident until construction. If subsurface conditions are encountered during construction that differ from those described in this report, GeoSource should be notified immediately so that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads, floor slab elevations or locations, changes from that described in this report, our recommendations should also be reviewed and the recommendations modified accordingly.

This report has been prepared in accordance with the generally accepted geotechnical engineering practice as it exists in the area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of observation and testing will be conducted during the construction phase in order to evaluate

compliance with our recommendations. Our scope of services did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

This report has been prepared for the exclusive use of our client for specific application to the project discussed. Any party other than the client who wishes to use this report shall notify GeoSource in writing of such intended use. Additional work may be required before an updated report can be issued. Non-compliance with any of these requirements will release GeoSource from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify and hold harmless GeoSource from any claim or liability associated with such unauthorized or non-compliance.

APPENDIX

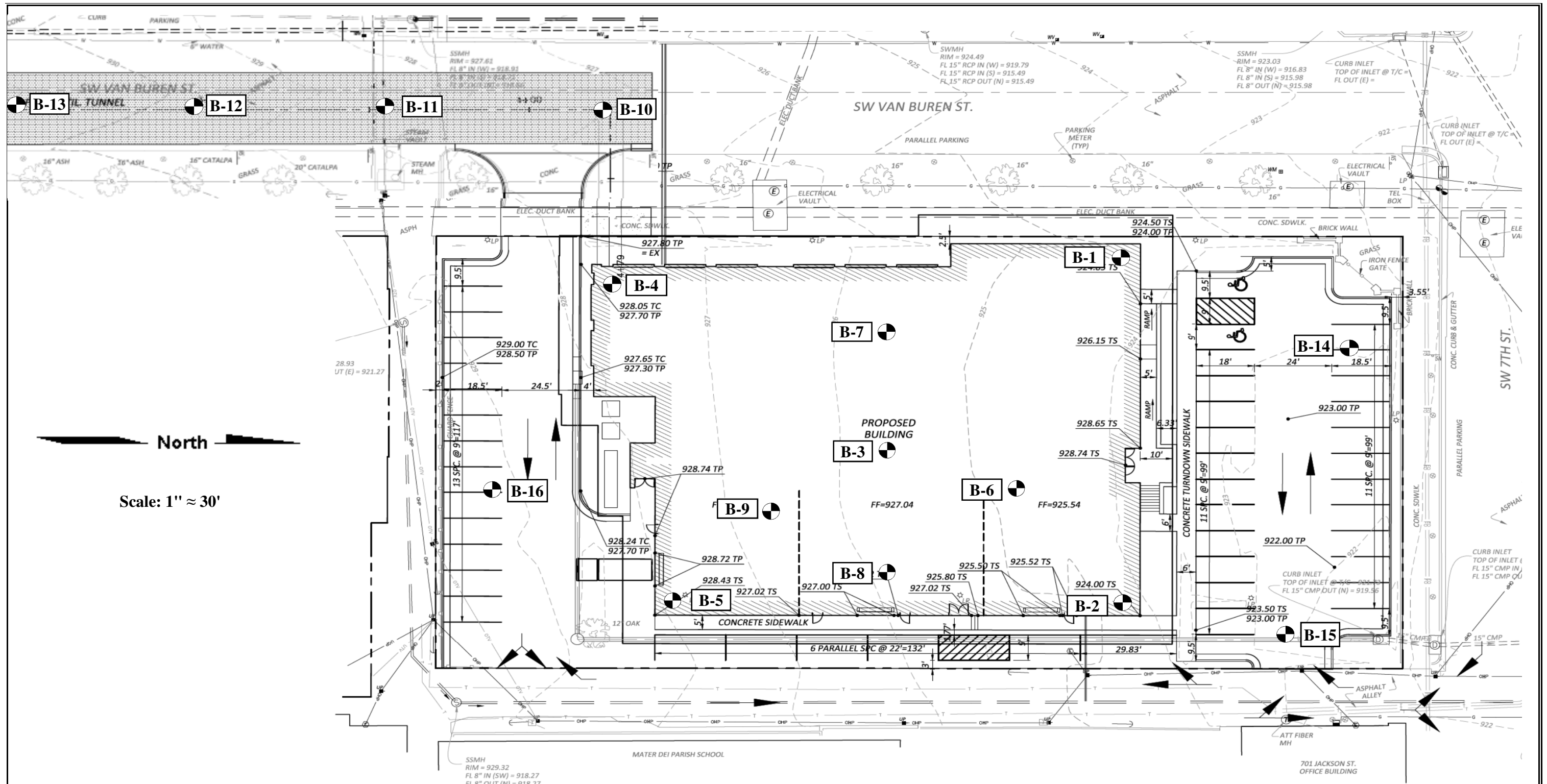
FIGURE 1: BORING LOCATION SKETCH

FIGURE 2: GENERALIZED SUBSURFACE PROFILE

BORING LOGS

GENERAL NOTES AND TERMS

BORING LOG SYMBOLS

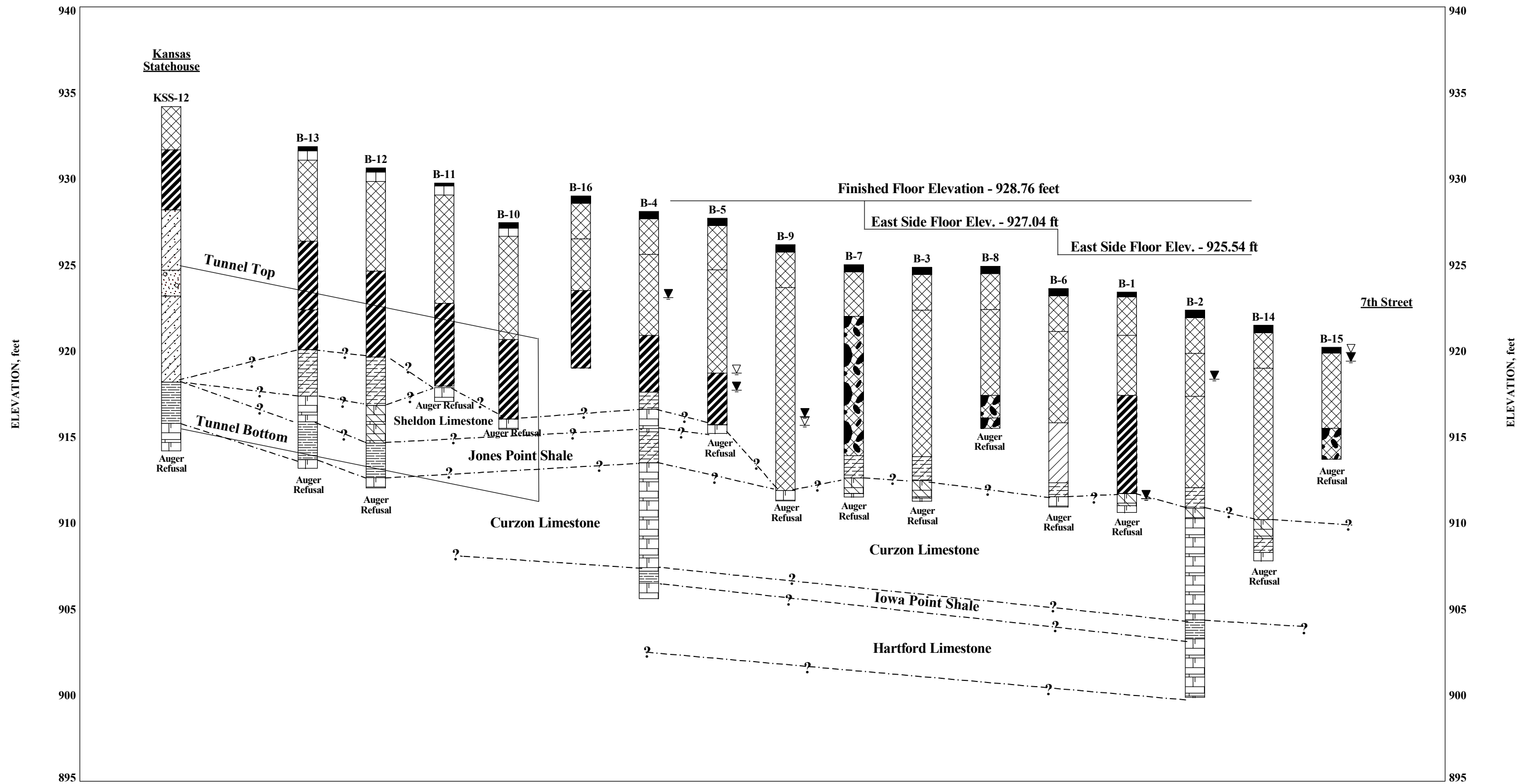


Boring Location Sketch

Figure 1

Proposed Kansas Energy and Service Facility
 SW 7th Street and Van Buren Street
 Topeka, Kansas
 Approved By: JJZ
 Project No. D14G1399

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GENERALIZED SUBSURFACE PROFILE

FIGURE 2

Proposed Kansas Energy & Service Center
 SW 7th Street and Van Buren Street
 Topeka, Kansas

Approved By: JJZ

Project No.: D14G1399

LEGEND											
	Asphalt		Rubble		Silty Sand		Lean to Fat Clay		Sand (SP)		Fat Clay
	Brick Pavers		Fill		Sandy Silt		Sandy Lean Clay		Sand (SW)		Lean Clay
	Baserock		Silt		Clayey Silt		Sandy Clay		Gravel		Fat Clay
									Weathered Shale		Weathered Limestone
									Weathered Sandstone		Shale
									Limestone		Sandstone
										Water Levels	
											While Drilling
											24 hrs. A.B.

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BOREHOLE INFORMATION Page 1 of 1										LOG OF BORING NO. B-1	
STATION OFFSET					PROJECT NAME Proposed Kansas Energy & Service Center						
NORTHING EASTING					SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas						
DRILLING COMPANY GeoSource, LLC					OWNER / ARCHITECT State of Kansas / HTK Architects						
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 4 feet east due to utilities MATERIAL DESCRIPTION Approx. Surface Elevation: 923.4	
	PA									Asphaltic Concrete (3")	
1	ST	15		*1500	102	25.6	CL		2.5	FILL , lean clay, medium stiff, light brown, trace fine sand	
	PA									FILL , lean to fat clay, stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
2	SS	18	7	*1500		21.6	CL CH		5		
	PA								6.0	FAT CLAY , stiff, brown mottled light gray and rust	
3	ST	20		4410	101	28.0	CH			FAT CLAY , stiff, brown mottled light gray and rust	
	PA								10		
									11.7	**LIMESTONE , weathered, broken and seamy	
									12.8	to very hard, light gray	
AUGER REFUSAL @ 12.8 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 37 <u>PL</u> 18 <u>PI</u> 19 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.											
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ 12.0 feet W.D.				BORING COMPLETED 12-17-14	
▼ 12.0 feet A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION Page 1 of 2										LOG OF BORING NO. B-2	
STATION		OFFSET								PROJECT NAME Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY GeoSource, LLC										OWNER / ARCHITECT State of Kansas / HTK Architects	
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 8 feet west due to utilities MATERIAL DESCRIPTION Approx. Surface Elevation: 922.4	
	PA									Asphaltic Concrete (5")	
1	ST	13		2420	107	22.7	CL		2.5	FILL , lean clay, stiff, light brown brown, trace fine sand 919.9	
	PA									FILL , fat clay, stiff, gray brown	
2	SS	18	8	*4000		29.4	CL CH		5.0	917.4	
	PA									FILL , lean to fat clay, soft, dark gray brown and greenish gray mixed, trace gravel (Stong Fuel Odor)	
3	ST	18	9	*1000		55.7	CL CH		10.3	912.1	
	PA								11.5	**SHALE , weathered, soft, olive tan	
									12.1	**LIMESTONE , weathered, seamy, gray	
R1	NQ3	100%	RQD=75%	**4990	138	8.7			15	LIMESTONE , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray	
				**8040	150	5.4			18.0	904.4	
R2	NQ3	78%	RQD=57%						19.1	SHALE , mod. hard, very thin bedded, tan 903.3	
				**3180	145	6.5			20	LIMESTONE , hard, solid, medium bedded, fossiliferous, buff to light gray	
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS			 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ Dry Prior to Coring					BORING COMPLETED 12-17-14	
▼ 4.0 feet A.C.R.					RIG CME-55	DRILLER MC
Backfilled @ Completion					APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-3	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
	PA									Approx. Surface Elevation: 924.9
1	ST	14		4500	115	15.3	CL		2.5	Asphaltic Concrete (5") FILL , lean clay, very stiff, light brown, trace fine sand
2	SS	18	20	*1500		19.0	CL CH		5	FILL , lean to fat clay, medium stiff to stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris
	PA									
3	SS	18	9	*3000		31.3	CL CH		10	
	PA								11.0	
									12.4	**SHALE , weathered, soft, olive tan
									13.6	**LIMESTONE , weathered, broken and seamy to very hard, light gray
									AUGER REFUSAL @ 13.6 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 39 <u>PL</u> 19 <u>PI</u> 20	
									**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.	

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS	BORING DATA	
▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion		
	BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 APPROVED JJZ DRILLER MC JOB # D14G1399	

BOREHOLE INFORMATION Page 1 of 2										LOG OF BORING NO. B-4	
STATION		OFFSET								PROJECT NAME Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY GeoSource, LLC										OWNER / ARCHITECT State of Kansas / HTK Architects	
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Approx. Surface Elevation: 928.1	
	PA									Asphaltic Concrete (5")	
1	ST	10		1500	107	19.3	CL		2.5	FILL , lean clay, medium stiff, light brown, trace fine sand 925.6	
	PA									FILL , fat clay, stiff, dark gray brown mixed, trace gravel and miscellaneous construction rubble	
2	SS	18	8	*3000		27.0	CH		5	▼ 920.9	
	PA								7.2	FAT CLAY , very stiff, light gray mottled light brown	
3	ST	18	10	*4500		17.5	CH		10	**SHALE , weathered, soft, olive tan 917.6	
	PA								10.5	LIMESTONE , hard, solid, thin-bedded, fossiliferous, buff 916.6	
									11.5	LIMESTONE , hard, solid, thin-bedded, fossiliferous, buff 915.3	
R1	NQ3	94%	RQD=56%	**7800	153	5.2			12.8	SHALE , weathered, soft, tan to light brown 913.5	
									14.6	LIMESTONE , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray	
									15		
									20		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14	
▼ Dry Prior to Coring				BORING COMPLETED 12-18-14	
▼ 5.0 feet A.C.R.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION									Page 2 of 2		LOG OF BORING NO. B-4		
STATION		OFFSET							PROJECT NAME			Proposed Kansas Energy & Service Center	
NORTHING		EASTING							SITE LOCATION			SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC							OWNER / ARCHITECT			State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION			
R3	NQ3	25%	RQD=0%						20.9	SHALE, hard, very thin bedded, gray		907.2	
									21.6			906.5	
									22.5	LIMESTONE, hard, light gray		905.6	
									BOTTOM OF BORING				
* Calibrated Penetrometer ** Rock Strength in psi													
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.													
WATER LEVEL OBSERVATIONS													
▼ Dry Prior to Coring													
▼ 5.0 feet A.C.R.													
Backfilled @ Completion													
									BORING STARTED 12-18-14				
									BORING COMPLETED 12-18-14				
									RIG CME-55		DRILLER MC		
									APPROVED JJZ		JOB # D14G1399		

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-5	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION							
										Approx. Surface Elevation: 927.7							
	PA									Asphaltic Concrete (5")							
1	ST	16		2940	109	20.3	CL		3.0	<u>FILL</u> , lean clay, stiff, light brown, trace fine sand 924.7							
2	ST	13		5300	106	22.1	CL CH		5	<u>FILL</u> , lean to fat clay, very stiff to medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris							
	PA																
3	ST	10		2050	106	22.1	CL CH		9.0	918.7 <u>FAT CLAY</u> , stiff, reddish brown							
	PA								12.0	915.7							
									12.5	915.2 **LIMESTONE , hard, gray							
										AUGER REFUSAL @ 12.5 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <table style="margin-left: auto; margin-right: auto;"> <tr> <td><u>LL</u></td> <td><u>PL</u></td> <td><u>PI</u></td> </tr> <tr> <td>36</td> <td>19</td> <td>17</td> </tr> </table> **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		<u>LL</u>	<u>PL</u>	<u>PI</u>	36	19	17
<u>LL</u>	<u>PL</u>	<u>PI</u>															
36	19	17															

* Calibrated Penetrometer ** Rock Strength in psi	
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.	

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ 9.0 feet W.D.				BORING COMPLETED 12-17-14	
▼ 10.0 feet A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-6	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Approx. Surface Elevation: 923.6	
	PA									Asphaltic Concrete (5")	
1	ST	14		*2500	104	21.1	CL		2.5	<u>FILL</u> , lean clay, stiff, light brown, trace fine sand 921.1	
2	SS	18	16	*2000		22.3	CL CH		5	<u>FILL</u> , lean to fat clay, medium stiff to stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris 915.8	
	PA								7.8		
3	SS	18	7	*2500		20.1	CL		10	<u>LEAN CLAY</u> , stiff, dark gray brown (Possible Fill) 912.3	
	PA								11.3		
									12.1	** <u>SHALE</u> , weathered, soft, olive tan 911.5	
									12.7	** <u>LIMESTONE</u> , hard, gray 910.9	
									AUGER REFUSAL @ 12.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering	
▽	Dry W.D.		
▼	Dry A.B.		
Backfilled @ Completion			

BORING STARTED		12-19-14	
BORING COMPLETED		12-19-14	
RIG	CME-55	DRILLER	MC
APPROVED	JJZ	JOB #	D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-7	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Approx. Surface Elevation: 925.0
	PA									Asphaltic Concrete (5")
1	ST	20		2950	107	20.0	CL		3.0	FILL , lean clay, stiff, light brown, trace fine sand 922.0
2	SS	12	76			11.4			5	RUBBLE FILL , brick, cinders, limestone and/or concrete rubble in a clay matrix
	PA									
3	SS	3	50/3"			15.1			10	
	PA								11.1	913.9
									12.4	912.6
									13.5	911.5
										AUGER REFUSAL @ 13.5 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 34 <u>PL</u> 19 <u>PI</u> 15 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS		
▽ Dry W.D.		
▼ Dry A.B.		
Backfilled @ Completion		

 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14	
		BORING COMPLETED 12-18-14	
RIG	CME-55	DRILLER	MC
APPROVED	JJZ	JOB #	D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-8	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Approx. Surface Elevation: 924.9	
	PA									Asphaltic Concrete (5")	
1	ST	10		3630	110	19.0			2.5	<u>FILL</u> , lean clay, stiff, light brown, trace fine sand 922.4	
	PA										
2	SS	18	5	*2500		23.3			5	<u>FILL</u> , lean to fat clay, medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris 917.4	
	PA								7.5		
3	SS	4	50/4"						9.4	<u>RUBBLE FILL</u> , brick, cinders, limestone or concrete debris in a clay matrix 915.5	
	PA										
										AUGER REFUSAL @ 9.4 FEET Driller' Note: Auger refusal on apparent limestone and/or concrete rubble.	
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion  GeoSource Your Source for Geotechnical and Materials Engineering								BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 APPROVED JJZ DRILLER MC JOB # D14G1399			

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-9	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
										Approx. Surface Elevation: 926.2	
	PA									Asphaltic Concrete (5")	
1	ST	8		2590	109	17.8	CL		2.5	<u>FILL</u> , lean clay, stiff, light brown, trace fine sand 923.7	
2	SS	18	4	*1500		25.7	CL CH		5	<u>FILL</u> , lean to fat clay, soft to medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
	PA										
3	SS	18	10	*2000		30.7	CL CH		10	▼ ▽	
	PA										
									14.3	911.9	
									14.9	** <u>LIMESTONE</u> , hard, gray 911.3	
										AUGER REFUSAL @ 14.9 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 34 <u>PL</u> 18 <u>PI</u> 16 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.	

* Calibrated Penetrometer
** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ 10.5 feet W.D.				BORING COMPLETED 12-17-14	
▼ 10.0 feet A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-10	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 4 feet east due to parked cars	
										MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 927.6		
	PA									Asphaltic Concrete (4") Brick Pavers FILL , lean to fat clay, medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
1	ST	6		*1500	98	26.5	CL CH				
	PA								5	FAT CLAY , very stiff, light grayish tan mottled rust	
2	SS	18	10	*4500		17.1	CH		6.8		
	PA								10	**LIMESTONE , hard, gray	
									11.4		
									12.0	915.6	
									AUGER REFUSAL @ 12.0 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion								 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

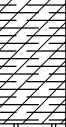
BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-11	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 6 feet east due to parked cars	
										MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 929.8		
	PA									Asphaltic Concrete (4") Brick Pavers FILL , lean clay, medium stiff, dark gray brown, trace fine sand and gravel	
1	ST	10		1420	97	25.8	CL				
	PA								5	FAT CLAY , very stiff, light grayish tan mottled rust	
									7.0		
2	SS	18	10	*5500		24.1	CH		10	**LIMESTONE , hard, gray	
	PA								11.8		
									12.7	917.1	
									AUGER REFUSAL @ 12.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion								 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

BOREHOLE INFORMATION								Page 1 of 2		LOG OF BORING NO. B-12	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 6 feet east due to parked cars	
										MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 930.7		
	PA									Asphaltic Concrete (3") Brick Pavers <u>FILL</u> , lean to fat clay, medium stiff, dark gray brown mixed, trace gravel	
1	ST	10		1480	98	25.9	CL CH				
	PA								5	6.0 924.7 <u>FAT CLAY</u> , very stiff, light grayish tan mottled rust	
3	ST	12		4440	107	20.0	CH				
	PA								10	11.0 919.7 ** <u>SHALE</u> , weathered, soft, olive tan to light gray	
4	SS	1	50/1"			6.4					
	PA								15	13.8 916.9 ** <u>LIMESTONE</u> , weathered, seamy to thin-bedded, buff to light gray	
										16.0 914.7 ** <u>SHALE</u> , hard, gray	
										18.0 912.7 18.6 ** <u>LIMESTONE</u> , hard, gray 912.1 AUGER REFUSAL @ 18.6 FEET	
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS								 Your Source for Geotechnical and Materials Engineering			
▽ Dry W.D.											
▼ Dry A.B.											
Backfilled @ Completion											
								BORING STARTED 12-18-14			
								BORING COMPLETED 12-18-14			
								RIG CME-55		DRILLER MC	
								APPROVED JJZ		JOB # D14G1399	

BOREHOLE INFORMATION										Page 2 of 2		LOG OF BORING NO. B-12	
STATION		OFFSET								PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC								OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers								HAMMER		Auto	
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION			
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.			
* Calibrated Penetrometer ** Rock Strength in psi													
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.													
WATER LEVEL OBSERVATIONS									BORING STARTED 12-18-14				
▼ Dry W.D.									BORING COMPLETED 12-18-14				
▼ Dry A.B.									RIG CME-55		DRILLER MC		
Backfilled @ Completion									APPROVED JJZ		JOB # D14G1399		



BOREHOLE INFORMATION								Page 1 of 2		LOG OF BORING NO. B-13	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
	PA									Asphaltic Concrete (3") Brick Pavers <u>FILL</u> , lean to fat clay, stiff, dark gray brown, trace gravel
1	ST	9		2830	104	28.3	CH			
	PA								5	5.5 926.4 <u>FAT CLAY</u> , very stiff, gray brown
3	SS	18	12	*3500		23.6	CH		10	9.5 922.4 <u>FAT CLAY</u> , very stiff, reddish brown
	PA									11.8 920.1 <u>**SHALE</u> , weathered, soft, olive tan to gray brown
4	SS	15	56/9"			20.7			15	14.5 917.4 <u>**LIMESTONE</u> , weathered, seamy to thin-bedded, light gray
	PA									16.0 915.9 <u>**SHALE</u> , hard, gray
										18.2 913.7 18.7 <u>**LIMESTONE</u> , hard, gray 913.2
										AUGER REFUSAL @ 18.7 FEET
* Calibrated Penetrometer ** Rock Strength in psi										
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.										

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14	
▽ Dry W.D.				BORING COMPLETED 12-18-14	
▼ Dry A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION										Page 2 of 2		LOG OF BORING NO. B-13		
STATION		OFFSET								PROJECT NAME		Proposed Kansas Energy & Service Center		
NORTHING		EASTING								SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas		
DRILLING COMPANY		GeoSource, LLC								OWNER / ARCHITECT		State of Kansas / HTK Architects		
METHOD		4-inch Flight Augers								HAMMER		Auto		
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION				
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.				
* Calibrated Penetrometer ** Rock Strength in psi														
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.														
WATER LEVEL OBSERVATIONS ▼ Dry W.D. ▼ Dry A.B. Backfilled @ Completion													BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-14	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Approx. Surface Elevation: 921.5
	PA									Asphaltic Concrete (5")
1	ST	10		1450	109	21.8	CL		2.5	FILL , lean to fat clay, medium stiff, light brown, trace fine sand 919.0
	PA									
2	SS	18	5	*2000		18.5	CH		5	FILL , fat clay, medium stiff to stiff, reddish brown, dark brown and brown layers, trace gravel
	PA									
3	SS	18	6	*2500		36.5	CH		10	
	PA								11.3	910.2
									12.4	** LIMESTONE , weathered, seamy 909.1
									13.2	** SHALE , weathered, soft, tan 908.3
									13.7	** LIMESTONE , hard, gray 907.8
										AUGER REFUSAL @ 13.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

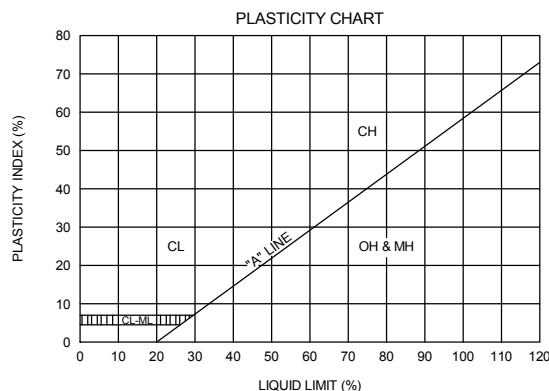
WATER LEVEL OBSERVATIONS	▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion Your Source for Geotechnical and Materials Engineering	
	BORING STARTED 12-19-14 BORING COMPLETED 12-19-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL	
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL	
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL	
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND	
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND	
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY	
			PI>4 AND PLOTS<"A" LINE	ML	SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT	
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY	
			PI PLOTS <"A" LINE	MH	ELASTIC SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	

BEDROCK AND OTHER MATERIAL SYMBOLS			
	Weathered Shale		Topsoil
	Shale		Asphaltic Concrete
	Seamy Limestone		Concrete
	Joint or Void		Fill
	Limestone		Rubble or Debris Fill
	Weathered Sandstone		Boulders and Cobble
	Sandstone		Granular Baserock
	Coal		Lean to Fat Clay

BEDROCK PROPERTIES & DESCRIPTIONS			
ROCK QUALITY DESIGNATION		BEDDING CHARACTERISTICS	
DESCRIPTION	RQD (%)	TERM	THICKNESS (inches)
Very Poor	0 - 25	Massive	> 60
Poor	25 - 50	Very Thick Bedded	36 - 60
Fair	50 - 75	Thick Bedded	12 - 36
Good	75 - 90	Medium Bedded	4 - 12
Excellent	90 - 100	Thin Bedded	1 - 4
		Very Thin Bedded	0.4 - 1
		Laminated	< 0.4
DEGREE OF WEATHERING			
Slightly Weathered - Slight decomposition of Parent material in joints and seams.			
Weathered - Well-developed and decomposed joints and seams.			
Highly Weathered - Rock highly decomposed, may be extremely broken.			
BEDROCK DISCONTINUITIES			
Bedding Planes Planes dividing the individual layers, beds or strata of rocks.			
Joints Fractures in rock, generally more or less vertical to the bedding.			
Seams Applies to bedding planes with an unspecified degree of weathering.			



PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT)				
SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	MEDIUM STIFF	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

BORING LOG SYMBOLS

SURFACE MATERIALS



TOPSOIL



FILL MATERIAL



ASPHALTIC CONCRETE



CONCRETE



GRANULAR BASE

COHESIVE SOILS



SILT



CLAYEY SILT



LEAN CLAY



LEAN TO FAT CLAY



FAT CLAY

LARGE GRANULAR SOILS



CLAYEY GRAVEL



SILTY GRAVEL



POORLY GRADED GRAVEL



WELL GRADED GRAVEL



COBBLES & BOULDERS

GRANULAR SOILS



SANDY SILT



SILTY SAND



FINE SAND



POORLY GRADED SAND



WELL GRADED SAND



GRAVELLY SAND

BEDROCK UNITS



SHALE



FISSILE SHALE



SANDSTONE



LIMESTONE



COAL

WEATHERED BEDROCK



JOINT OR VOID



WEATHERED SHALE



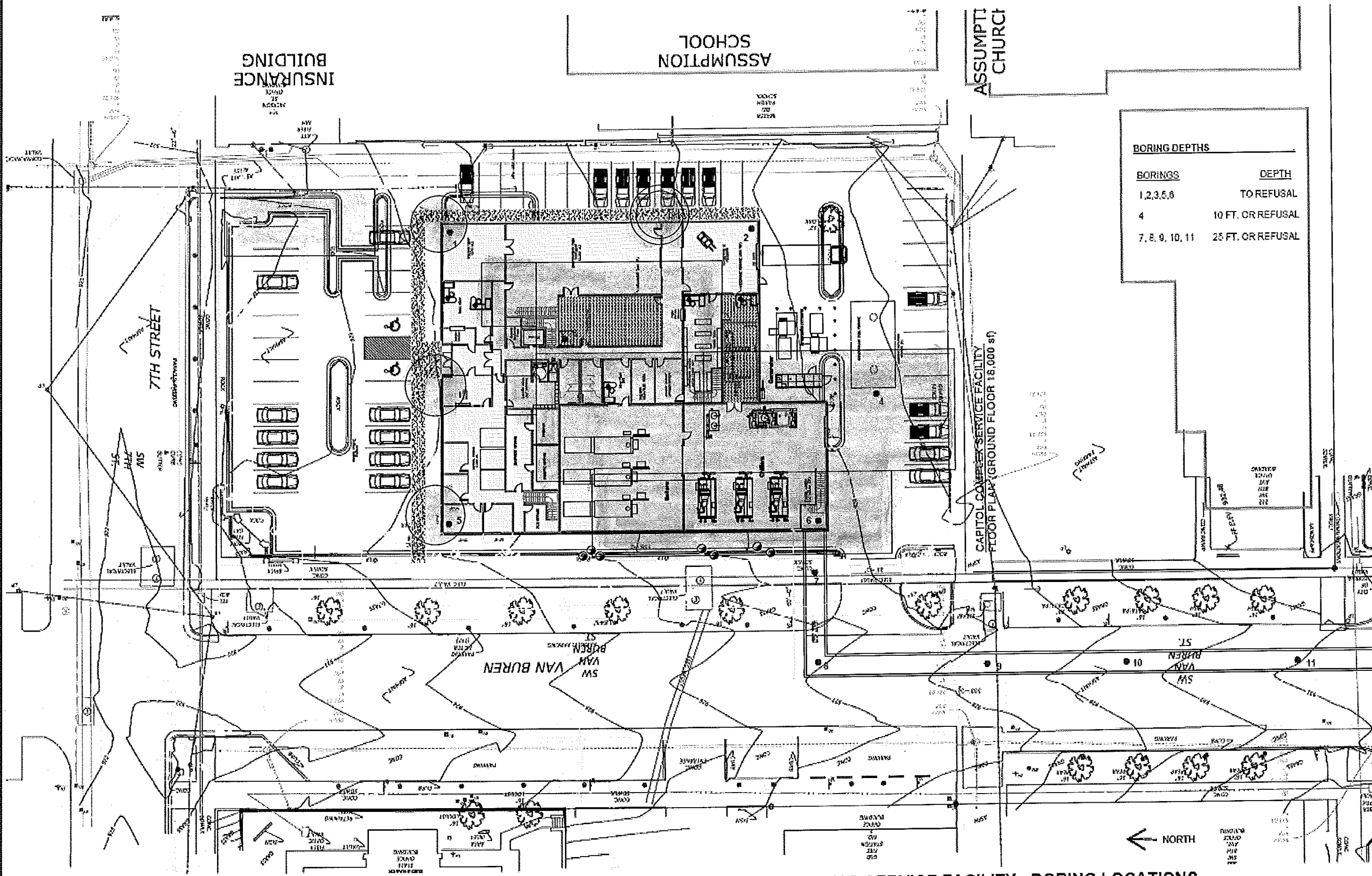
WEATHERED SANDSTONE



WEATHERED LIMESTONE

Annual Qualifications 2014

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96	Simpson Gumpertz & Heger, Inc.	Neal S. Anderson	NSAnderson@sgh.com	847-648-6025	Waltham, MA	X

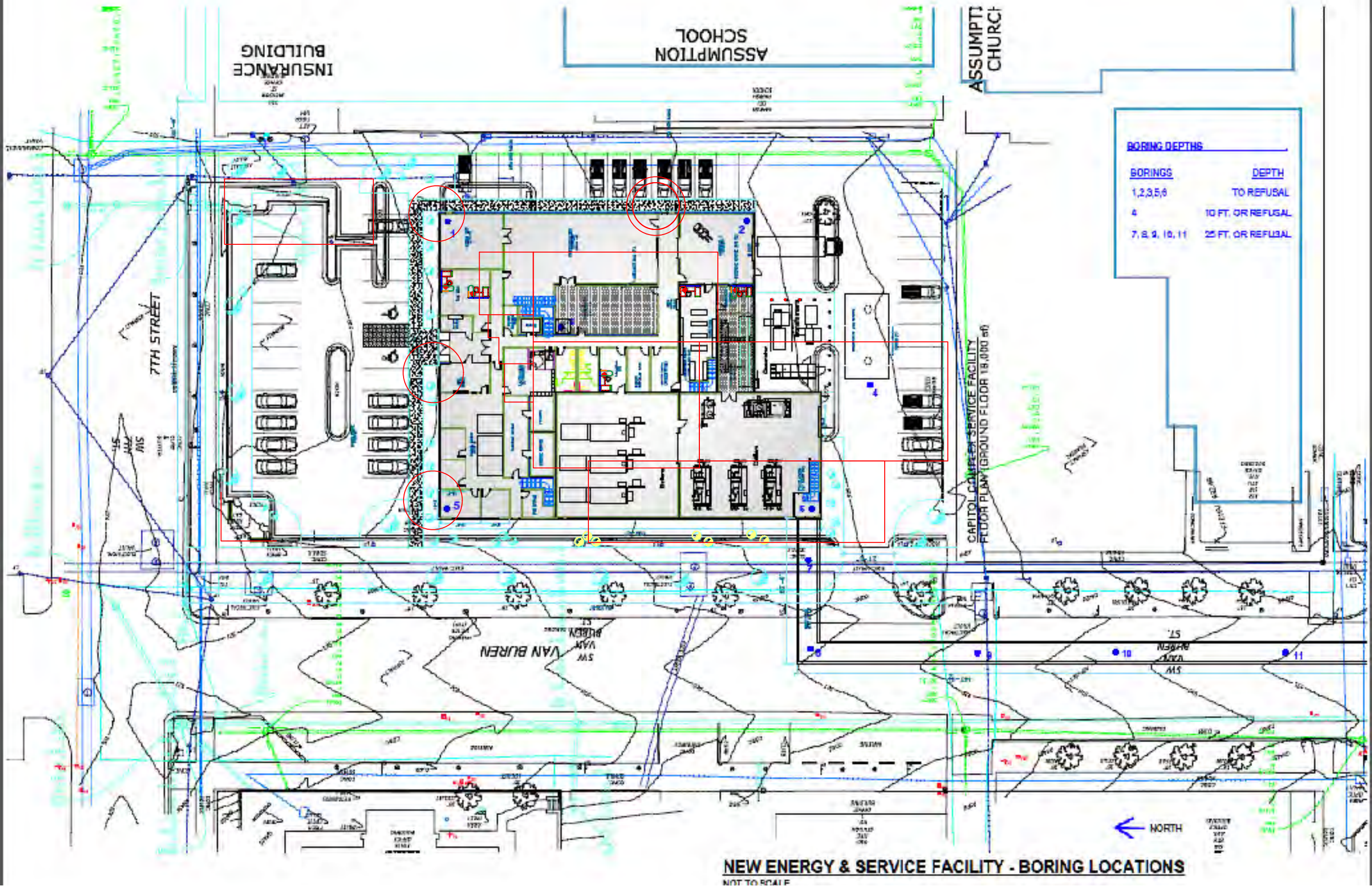


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PROJECT #:
PROJECT TITLE
 AGENCY NAME
 BUILDING NUMBER(S)
 DATE (INSERT DATE). DRAWN BY (INSERT NAME)

SHEET CONTENT
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 SHEET NO.
 ORIGINAL CONTRACT DOCUMENTS

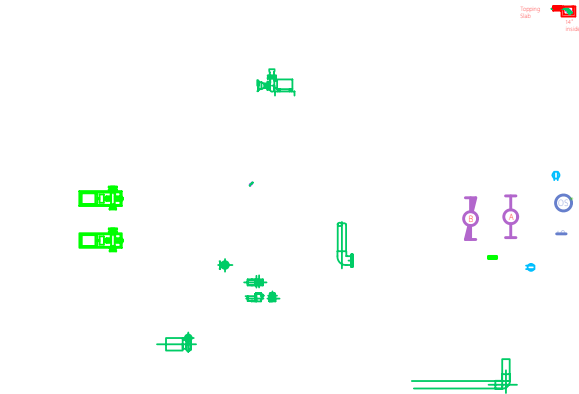
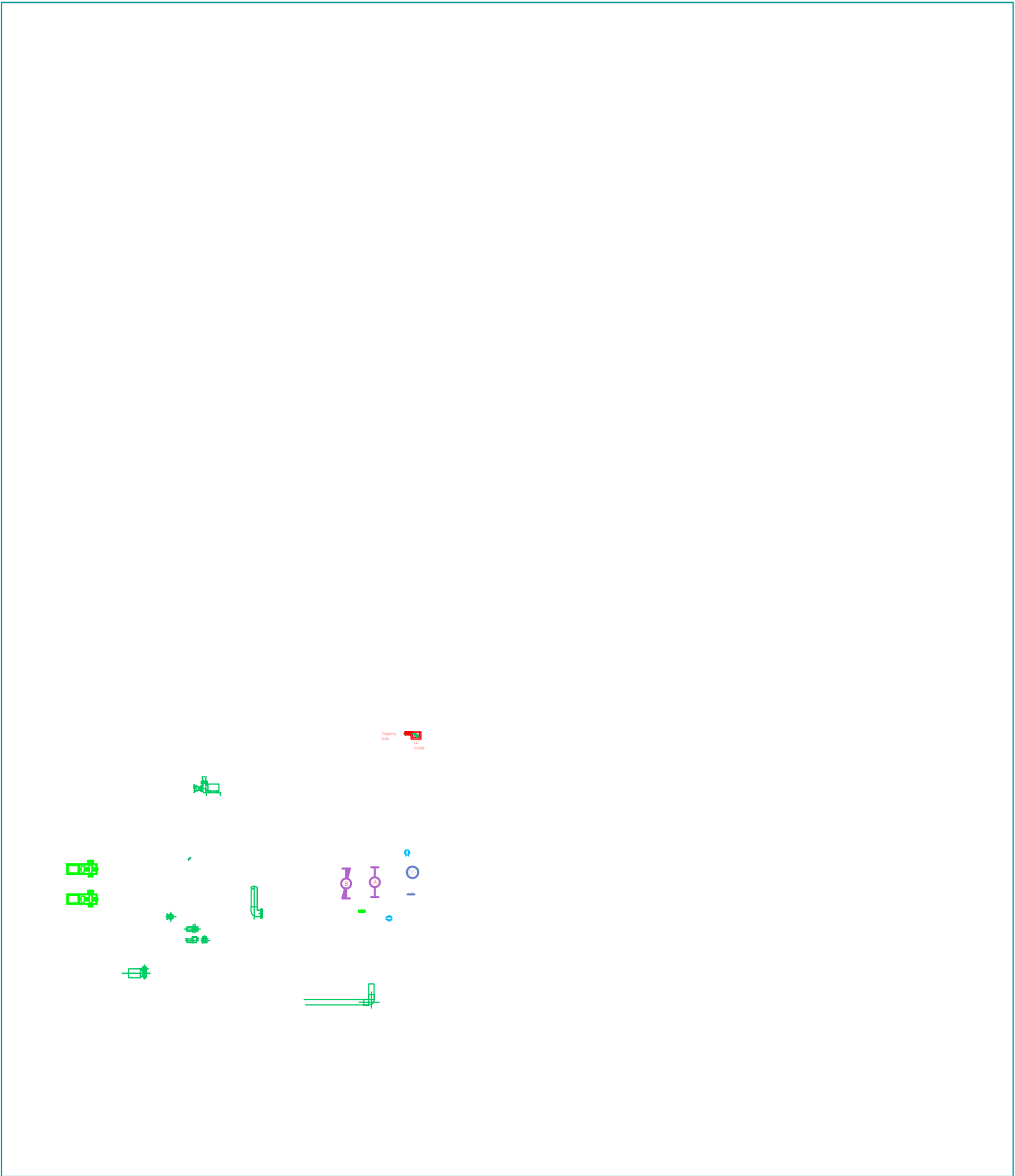
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					SHEET NO.			
					ORIGINAL CONTRACT DOCUMENTS			



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AGENCY NAME
BUILDING NUMBER(S)
DATE [INSERT DATE], DRAWN BY [INSERT NAME]

SHEET CONTENT
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ORIGINAL CONTRACT DOCUMENTS



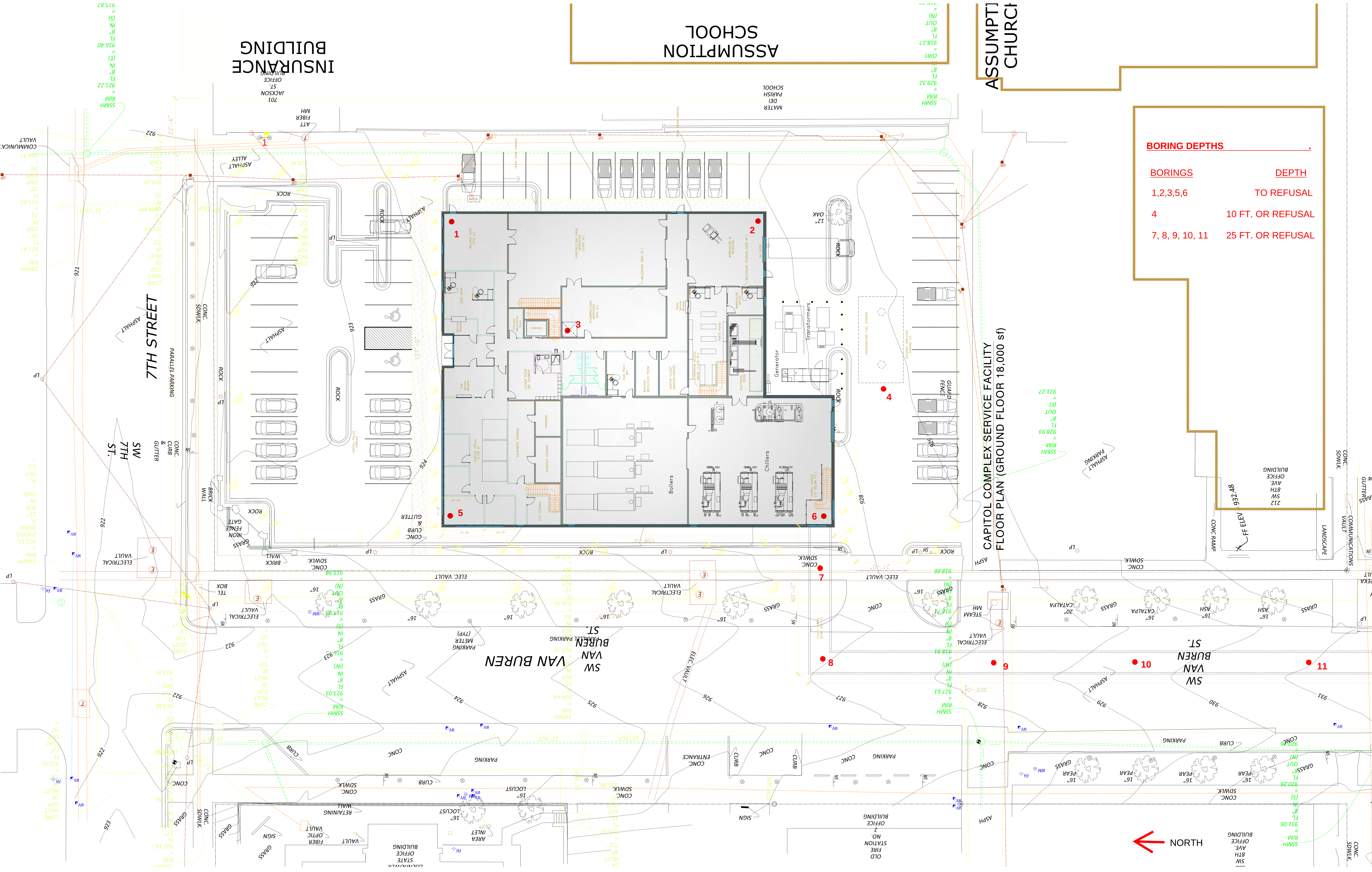
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PROJECT TITLE:

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OFFICE OF FACILITIES & PROCUREMENT
MANAGEMENT
DESIGN & CONSTRUCTION

DRAWN BY:
ENTER NAME
DATE:

A1
OF



BORING DEPTHS	
BORINGS	DEPTH
1,2,3,5,6	TO REFUSAL
4	10 FT. OR REFUSAL
7, 8, 9, 10, 11	25 FT. OR REFUSAL

NEW ENERGY & SERVICE FACILITY - BORING LOCATIONS
NOT TO SCALE



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16	Cook Flatt & Strobel Engineers, P.	Robert S. Chambers	chambers@cfse.com	785-272-4706	Topeka	X
25	GeoSource, LLC	Axel Novion	anovion@geosourceeng.com	816-326-8751	Topeka	X
31	HNTB Corporation	Michael R. Hess	mhess@hntb.com	816-472-1201	Kansas City, MO	X
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96	Simpson Gumpertz & Heger, Inc.	Neal S. Anderson	NSAnderson@sgh.com	847-648-6025	Waltham, MA	X

GEOTECHNICAL ENGINEERING REPORT

**Proposed Kansas Energy and Service Center
SW 7th Street and SW Van Buren Street
Topeka, Kansas**

Project No. D14G1399

December 31, 2014

Prepared for:

**Kansas Department of Administration
HTK Architects, PA**

Prepared by:

GEOSOURCE
Your Source for Geotechnical and Materials Engineering

December 31, 2014

Ms. Ramona A. Flower
State of Kansas
Office of Facilities & Procurement Management
800 SW Jackson Street, Suite 600
Topeka, Kansas 66612-1216

**Subject: Geotechnical Engineering Report
Proposed Kansas Energy and Service Center
SW 7th Street and SW Van Buren Street
Topeka, Kansas
Project No. D14G1399**

Dear Ms. Flower:

We have completed the subsurface exploration and geotechnical engineering evaluation for the above referenced project. The purpose of the exploration was to obtain information on the subsurface conditions within the building site and, based on this information to provide geotechnical engineering recommendations for design and construction of foundations for the proposed structures.

In summary, the borings encountered existing fill and naturally deposited soils underlain by shale and limestone bedrock that continued to the depths explored. The existing fill was quite variable and contained some rubble. Because of this, we have recommended that the proposed building be supported on drilled pier foundations that extend through the fill to the underlying limestone bedrock.

This report completes our current scope of services for this project. The enclosed report describes our exploration procedures and presents the results of the testing and evaluation along with design and construction recommendations for this project. We appreciate the opportunity to work with you on this project and are prepared to provide the recommended construction services.

Respectfully submitted,

GeoSource, LLC



John J. Zey, P.E.
Kansas: 8574



Axel S. Novion, P.E.
Kansas: 15390



Cc: Mr. Dennis A. Haugh, AIA – HTK Architects, PA
Mr. Clark Basinjer, PE – Bob D. Campbell & Company

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APPENDIX

Figure 1: Boring Location Sketch
 Figure 2: Generalized Subsurface Profile
 Boring Logs
 General Notes and Terms
 Boring Log Symbol

GEOTECHNICAL ENGINEERING REPORT
PROPOSED ENERGY AND SERVICE CENTER
SW 7TH STREET AND SW VAN BUREN STREET
TOPEKA, KANSAS

Project No. D14G1399
December 31, 2014

INTRODUCTION

GeoSource has completed the subsurface exploration and geotechnical engineering evaluation of the site for the proposed Kansas Energy and Service Center building, which is located southeast of the intersection of SW 7th Street and SW Van Buren Street in Topeka, Kansas. Our services for this project were provided in general accordance with our November 26, 2014 proposal. The exploration work was authorized on December 4, 2014 with the issuance of Purchase Order No. 17300-0000017324 by the Kansas Department of Administration.

PROJECT DESCRIPTION

We understand that the proposed building will be a two story, steel frame structure, with metal stud infill walls and brick veneer or stone panel exterior facing. The new building will have overall plan dimensions of approximately 120 by 160 feet. Maximum column loads for the new building were estimated by the Structural Engineer to be less than 260 kips. The finished floor elevation of the new building has tentatively been set at elevation 928.76 feet, USGS datum. The floor for the service base on the east side of the building will be stepped to follow the grade of the existing alley. The floor slab elevation at the northeast corner of the building will be at elevation 925.54 feet, the floor slab elevation at the southeast corner will be at 928.76 feet, and the intermediate floor slab elevation will be at 927.04 feet. The bottom of the elevator pit has tentatively been set at elevation 924.76 feet. At this proposed floor elevation up to 6 feet of new fill will be required to establish grades for the proposed building area.

Light duty parking lots are planned for the areas on the north and south sides of the new building. The parking lots will provide space for about 40 automobiles and other light personnel vehicles.

Drives will connect the parking lots to SW 7th Street and/or to the existing alley. No other specific information was provided regarding the design life of the pavement section.

A new utility tunnel will extend from the proposed Energy and Service Center building to the Kansas Statehouse along SW Van Buren Street. The plan and profile drawing of the tunnel that was provided to GeoSource indicated that the bottom of the tunnel will extend to about elevation 912 ± feet at the proposed building site and will be at about elevation 915 ± feet at the Statehouse parking garage. The tunnel will have a height of about 8 ± feet and will be constructed of reinforced concrete.

The scope of the exploration and engineering evaluation for this study, as well as the conclusions and recommendations in this report, were based on our understanding of the project as described above. If pertinent details of the project have changed or otherwise differ from our descriptions, we must be notified and engaged to review the changes and modify our recommendations, if needed.

DRILLING AND SAMPLING PROCEDURES

The field work for this project was performed between December 17 and 19 of 2014. A total of sixteen exploratory test borings were drilled for this project. Figure 1 in the Appendix shows the approximate locations of the borings with reference to the proposed building lines and other site features. The boring locations were established by GeoSource personnel. Distances from the existing city streets and other reference features to the boring locations were measured using a calibrated wheel. Right angles for locating the borings were estimated. The ground surface elevations shown on the boring logs are approximate and were determined using an engineer's level and rod. The elevations were referenced to the rim of the existing storm water manhole (SWMH), located on the west side of SW Van Buren Street about 165 feet south of SW 7th Street. The elevation of the manhole was given as 924.49 feet, USGS datum, on the site plan that was provided to GeoSource. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used to make these measurements.

The borings were performed with a truck-mounted, rotary drill rig using 4-inch diameter flight augers to advance the boreholes. Representative samples of the overburden soils and bedrock units were obtained at selected intervals using the Shelby tube and split-barrel sampling procedures as outlined in ASTM Specifications D-1587 and D-1586, respectively. The Shelby tube sampling procedure utilizes a thin-walled, steel tube with a sharp cutting edge that is pushed hydraulically into the bottom of the boring to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. The samples were sealed and returned to our laboratory for further examination, classification and testing.

The split-barrel sampling procedure utilizes a standard 2-inch O.D. split-barrel sampler that is driven into the bottom of the boring with an automatic hammer. The number of blows required to advance the sampler the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Resistance Value (N). These "N" values are indicated on the boring logs at their depth of occurrence and provide an indication of the consistency of clays and the relative hardness of weathered bedrock units. A higher efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the Standard Penetration Resistance Values (N). The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Borings B-2 and B-4 were continued below the point of auger refusal through use of NQ3-diamond bit coring procedures. This diameter core barrel provides a sample having a diameter that is slightly smaller than 2 inches. Descriptions of the rock core are presented on the respective boring logs in addition to recovery and Rock Quality Designation (RQD) for the core recovered. Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. Rock Quality Designation is defined as the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. Rock Quality Designation provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

Boring logs are included in the Appendix of this report and present such data as soil and bedrock descriptions, consistency and relative hardness evaluations, depths, sampling intervals and observed groundwater conditions. Conditions encountered in each of the borings were monitored and recorded by the drill crew. Field logs were prepared by the drill crew that included visual classification of the materials encountered during drilling, as well as drilling characteristics. Our final boring logs represent the geotechnical engineer's interpretation of the field logs combined with laboratory observation and testing of the samples. Stratification boundaries indicated on the boring logs were based on observations during our field work, an extrapolation of information obtained by examining samples from the borings and comparisons of soils and/or bedrock types with similar engineering characteristics. Locations of these boundaries are approximate, and the transitions between soil and bedrock types may be more gradational in nature rather than clearly defined.

LABORATORY TESTING PROGRAM

The laboratory testing program consisted of performing water content, dry unit weight and unconfined compression tests on representative portions of undisturbed samples obtained with the Shelby tube sampler. A calibrated hand penetrometer was used to determine the approximate unconfined compressive strength of samples that were deformed or otherwise unsuitable for unconfined compression testing. The hand penetrometer has been correlated with unconfined compression tests, and provides a better estimate of the consistency and strength than visual observation alone. Moisture content determinations were also performed on samples obtained using the split-barrel sampler. The results of the laboratory tests are presented on the respective boring logs.

Atterberg Limits tests were conducted on representative samples of the onsite soils. These tests provide information on the plasticity of the soil, which is a basis for soil classification and for estimating the potential of subgrade soils to change volume with variations in moisture content. Results of these tests are also indicated on the respective boring logs.

In addition, unconfined compression tests were performed on selected rock cores to evaluate the compressive strength of the bedrock units encountered in the borings. The results of the unconfined

compression tests are shown on the respective boring logs in the Appendix of this report. The unconfined compressive strengths are in psi (pounds per square inch).

As part of the testing program, the soil samples were classified by a geotechnical engineer using visual and manual procedures outlined in ASTM D-2487 and D-2488. The descriptions of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are shown on the boring logs. A brief description of this classification system is included in the Appendix of this report.

The bedrock units encountered in the borings were described in accordance with the enclosed General Notes for Bedrock on the basis of visual classification of disturbed auger cuttings and drilling characteristics. Core samples may reveal other rock types.

SITE CONDITIONS

The proposed building site is located southeast of the intersection of SW 7th Street and SW Van Buren Street in Topeka, Kansas. The site was bounded on the north by SW 7th Street, on the west by SW Van Buren Street and on the east by an existing alley. At the time the borings were performed, the site was a paved parking lot. Historical photographs indicated that the site was previously occupied by a power plant and several other buildings in the past. The borings encountered undocumented clay fill, most of which contained variable amounts of bricks, cinders, gravel and other miscellaneous construction debris from the former buildings. Auger refusal was encountered on rubble at boring locations B-8 and B-15, suggesting that buried foundations or basement walls and slabs or large concrete or limestone fragments are buried beneath portions of the proposed building site. At Boring B-2, a strong fuel odor was detected in the undocumented fill encountered between depths of about 5 to 10.3 feet.

SUBSURFACE CONDITIONS

The following presents a general summary of the major strata encountered during our subsurface exploration and includes a discussion of the results of field and laboratory tests conducted. Specific subsurface conditions encountered at the boring locations are presented on the individual boring logs in the Appendix of this report. Figure 2 in the Appendix shows a Generalized Subsurface Profile, based on the information obtained from the borings. The stratification lines shown on the boring logs and profile represent the approximate boundaries between soil and bedrock types; in-situ, the transition between materials may be more gradational in nature rather than clearly defined.

All of the borings were drilled in paved areas and encountered about 3 to 5 inches of asphaltic concrete pavement at the surface. Borings B-10 through B-13 were drilled on SW Van Buren Street along the alignment of the proposed utility tunnel and encountered brick pavers below the asphalt pavement.

The pavement section was underlain by undocumented fill that continued to depths of about 5.5 to 14.3 feet below the existing ground surface at the boring locations. The upper 2-½ to 3 feet of the fill was generally comprised of medium stiff to very stiff, light brown lean clay (CL), with a trace of fine sand. Laboratory tests performed on samples of this lean clay fill indicated moisture contents in the range of 13.4 to 25.6 percent, with dry densities of 102 to 115 pcf and unconfined compressive strengths of 1,450 to 5,990 psf. Atterberg Limits performed on this material indicated Liquid Limits in the range of 34 to 39, with Plasticity Indices of 15 to 20.

Beneath the upper fill layer, the borings encountered moderate to high plasticity fill that contained variable amounts of brick, cinders, gravel and other miscellaneous construction debris. No significant amounts of wood, trash or other unsuitable materials were encountered at the boring locations. As previously discussed, fuel contaminated soils were encountered in Boring B-2 below a depth of about 5 feet. In addition, significant amounts of rubble, including large size debris were encountered in Borings B-7, B-8 and B-15. Buried obstructions within the rubble fill were encountered in Borings B-8 and B-15. These obstructions could be buried foundation or large size

fragments of concrete or limestone. Laboratory tests performed on samples of the undocumented fill indicated moisture contents in the range of 11.4 to 55.7 percent, with dry densities of 97 to 106 pcf and unconfined compressive strengths of 1,420 to 5,300 psf. Standard Penetration Tests performed in the existing fill yielded “N” values ranging from 4 to 76 blows for one foot of penetration or less.

The undocumented fill was underlain by naturally deposited clay soils at 9 of the 16 boring locations. The natural clay soils were deposited by glacial ice that covered northeast Kansas in the Pleistocene Period. The glacial soils were visually classified as stiff to very stiff, lean clays (CL) and fat clays (CH). Laboratory tests performed on samples of the natural clay soils indicated moisture contents in the range of 17.1 to 28.0 percent, with dry densities of 102 to 107 pcf and unconfined compressive strengths of 2,050 to 4,440 psf. Soil colors varied from brown to light brown to reddish brown, with light gray and rust mottling. Standard Penetration Tests performed in the natural clay soils yielded “N” values in the range of 7 to 12 blows for one foot of penetration or less.

The undocumented fill and naturally deposited glacial clay soils were underlain by interbedded layers of shale and limestone bedrock that are part of the Topeka Limestone Formation of the Pennsylvanian Age Shawnee Group. The bedrock was encountered in the borings at depths ranging from about 10.3 to 14.3 feet across the proposed building site. The uppermost bedrock unit encountered was the weathered remnants of the Turner Creek Shale Member. The Turner Creek Shale is typically 2 to 5 feet thick and consists of weathered, olive tan to gray brown, clayey to silty shale. The Turner Creek Shale was underlain by the Sheldon Limestone Member. The Sheldon Limestone was described as a buff to light gray, fossiliferous limestone. The thickness of this limestone unit varied from about 1.5 feet to 2.8 feet across the site. The Jones Point Shale Member was encountered below the Sheldon Limestone and this bedrock unit typically consists of gray, silty to clayey shale that was about 1.8 to 2.2 feet thick at the boring locations where it was encountered.

The Jones Point Shale was underlain by the Curzon Limestone, which is the thickest limestone unit of the Topeka Formation. The Curzon Member is typically comprised of two or more beds of medium to thick-bedded, buff to light gray, fossiliferous limestone. The thickness of the Curzon

Limestone ranged from about 5.9 to 6.3 feet at the boring locations where it was encountered. The Curzon Member was underlain by the Iowa Point Shale Member. The Iowa Point Member is typically a hard, gray, clayey to silty shale that locally contains sandstone layers. At the proposed building site, the Iowa Point Shale had a thickness of only about 1 to 2 feet. The Iowa Point Shale was underlain by the Hartford Limestone Member, which is the basal member of the Topeka Limestone Formation. The Hartford Member typically has a total thickness of about 5 to 6 feet and consisted of massive, gray to bluish gray, fossiliferous limestone. Core samples of the bedrock from Borings B-2 and B-4 had recovery rates of 78 to 100 percent, with Rock Quality Designation (RQD) values in the range of 56 to 100 percent, indicating fair to good quality rock. The unconfined strength of the limestone units ranged from about 1,970 to 9,520 psi.

GROUNDWATER OBSERVATIONS

Groundwater observations were made in the boreholes both during and following completion of the drilling operations. Groundwater was encountered in Borings B-1, B-5, B-9 and B-15 at depths ranging from about 0.5 to 12.0 feet below the existing ground surface. At Boring B-15, groundwater was encountered very near the existing ground surface. The other borings remained, dry prior to coring, and no visible groundwater seepage was observed at the time the borings were performed.. The materials encountered in the test borings have relatively low permeabilities and observations over an extended period of time through use of piezometers or cased borings would be required to better define current groundwater conditions.

Coring of the bedrock at boring locations B-2 and B-4 required the introduction of water into the borehole as a drilling fluid to cool the bit and to flush the cuttings from the hole. No noticeable loss of drilling fluid was noted. The water levels indicated on the boring logs where coring procedures were used represent the water level in the borings after removal of casing and drill tools and is generally not an indicated of a true water table.

Groundwater in the underlying bedrock typically flows through joints and fissures in the limestone bedrock units. The shale bedrock units are generally less permeable and do not transmit significant amounts of groundwater seepage.

The composition of the glacial soils is often erratic due to the random nature of its deposition. Glacial deposits frequently contain isolated pockets of water bearing sands and gravel, as well as cobbles and large boulder size materials. Water bearing lenses within natural glacial deposits are generally limited in extent. Excavations encountering such lenses typically experience a sudden influx of groundwater due to the high permeability of the materials within the lens. Foundation and other excavations that encounter trapped water within the glacial soils can normally be dewatered using conventional sump pumps.

Fluctuations of groundwater levels can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our evaluation, it is our professional opinion that the proposed project site can be developed for the proposed building and utility tunnel using conventional grading and foundation construction techniques. The existing undocumented fill was quite variable across the site and contained significant amounts of rubble and construction debris at some of the boring locations. Because of this, the undocumented fill is not suitable for support of shallow spread footings.

We have recommended that the proposed building be supported on drilled pier foundations that extend through the undocumented fill and naturally deposited glacial clay soils and are founded in the Curzon Limestone Member that underlies the proposed building site. Recommendations for

design and construction of drilled pier foundations are presented in the follow sections of this report.

As an alternative to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade would appear to be a viable foundation option for this project that may potentially provide an economic benefit to this project. Geopiers are rammed aggregate piers that are installed by a specialty contractor using a proprietary method. Recommendations for design and construction of geopiers is normally provided by Geopier US, the company that developed this method of ground improvement and foundation support.

The major concern, from a geotechnical engineering standpoint, is the presence of undocumented fill and the potential for encountering old foundations, walls and other buried structures, as well as large concentrations of rubble from the former buildings that previously occupied the site. If buried structures and/or large concentration rubble are encountered, they could hamper the installation of the drilled pier foundations and/or the drilling of the boreholes for the Geopiers. Removal and replacement of the existing undocumented fill does not appear to be an economical option for this project. One way to deal with the uncertainty, would be to establish a contingency fund for removal of old buried structures and/or rubble in areas affected by the new construction.

The construction of the proposed utility tunnel between the proposed building and Statehouse Parking Garage should be relatively straight forward. The borings indicated that some rock excavation will likely be required to install the tunnel at the currently proposed bottom elevations. Removal of the rock will likely require the use of pneumatic breakers, rock teeth or some other method of hard rock removal. Groundwater was not encountered in the borings that were drilled along the proposed tunnel alignment. However, it would be prudent to include underdrains below the floor slab of the tunnel and adjacent to the tunnel walls to prevent hydrostatic loading of the walls and seepage into the tunnel, should groundwater levels change in the future.

To reduce the potential for subgrade volume change and floor slab movement, we have recommended that a minimum of 24 inches of select, low volume change material be placed below building floor slabs. Thorough site preparation will be required to correct areas that were disturbed by previous construction activity at the proposed building site. The recommendations given in the following sections of this report describe subgrade preparation for building foundations, floor slabs and pavements, as well as undercutting procedures to remove existing fill, soft soils, expansive clays and other unsuitable materials. Proper fill placement techniques are also discussed and include: recommended types of fill materials, maximum lift thickness, as well as soil moisture content and compaction criteria for structural fill sections.

The recommendations submitted herein are based, in part, upon data obtained from our subsurface exploration. It should be recognized that subsurface conditions may vary between the exploration points and that the nature and extent of any subsurface variations that may exist at the proposed site will not become evident until exposed during construction. If variations appear evident, then the recommendations presented in this report should be reevaluated. In the event that any changes in the nature, design, location or floor slab elevations of the proposed building are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed by the geotechnical engineer and our recommendations modified in writing, if necessary.

SITE PREPARATION

Initial site preparation for the proposed project should commence with the removal of the existing pavement section and the demolition of any existing structures that are located within proposed construction areas. Demolition should include complete removal of all grade supported slabs, pavements, sidewalks and shallow spread footings. All broken concrete, asphalt and other debris from demolition of these structures should be removed from the site. Areas disturbed during demolition of the existing structures should be thoroughly evaluated by the geotechnical engineer prior to placement of structural fill. All disturbed soils should be undercut prior to placement of structural fill.

Relocation of any existing utility lines within the zone of influence of proposed construction areas should also be completed as part of the site preparation. The lines should be relocated to areas outside of the proposed construction. Excavations created during the removal of the existing lines should be cut wide enough to allow for use of heavy construction equipment to recompact the fill. In addition, the base of the excavations should be thoroughly evaluated by a geotechnical engineer or engineering technician prior to placement of fill. All fill should be placed in accordance with the recommendations presented in the Structural Fill section of this report.

Following completion of the demolition work, it is recommended that the exposed grade be scarified to a minimum depth of 8 inches and be moisture conditioned to bring the moisture content of the soils into the range recommended for structural fill. Moisture conditioning is the process of adjusting the moisture content of the scarified materials to a moisture content that is within a range of 0 to 4 percent above the optimum moisture content as determined by the Standard Proctor (ASTM D-698) compaction procedure. Following moisture conditioning, the scarified materials should be recompact to a minimum of 95 percent of Standard Proctor (ASTM D-698) maximum dry density. Soft or unstable areas that hamper compaction of the subgrade should be undercut and replaced with structural fill.

Following moisture conditioning and prior to placement of any new fill, it is recommended that the exposed grade be proofrolled. Proofrolling of the subgrade provides a more stable base for placement of structural fill and aids in identifying soft or disturbed areas. Unsuitable areas identified by the proofrolling operation should be undercut and replaced with structural fill. Proofrolling can be accomplished through use of a fully-loaded, tandem-axle dump truck or similar equipment providing an equivalent subgrade loading. Suitable structural fill should then be placed to design grades as soon as practical after reworking the subgrade to avoid moisture changes in the underlying soils.

If soft or unstable conditions are encountered during the proofrolling operation, stabilization of the soils may be required. Clean crushed rock having a particle diameter of 3 to 6 inches could be used to stabilize the subgrade prior to placement of structural fill. After initial undercutting, the large rock would be spread over the unstable subgrade and worked into the soft soils by close tracking with a

bulldozer or other suitable construction equipment. Additional rock would be added until the subgrade becomes firm enough to support construction equipment. The use of a geotextile fabric, in conjunction with crushed rock, could also be considered as a means of stabilizing the exposed grade.

CLIMATIC CONDITIONS

Weather conditions will influence the site preparation required. In spring and late fall, following periods of rainfall, the moisture content of the near surface soils may be significantly above the optimum moisture content. Additionally, it is common to encounter wet, unstable soils upon removal of the site pavements or flatwork as a result of moisture becoming trapped beneath relatively impervious concrete or asphalt pavements. These conditions could seriously impede grading by causing an unstable subgrade condition. Typical remedial measures include aerating the wet subgrade, removal of the wet materials and replacing them with dry materials or treating the wet material with fly ash.

If site grading commences during summer months, the moisture contents of the onsite soils may be abnormally low, which can significantly increase the swell potential of the clay soils. Typically, discing and moisture conditioning of the exposed subgrade materials to the moisture content criteria outlined in the Structural Fill section will reduce this swell potential of the dry materials. As an alternative, the dry materials could be undercut and replaced with structural fill.

EXCAVATIONS

Excavations will be required for foundations, underground utilities and a utility tunnel for this project. It is anticipated that the foundation excavations will be in undocumented fill and naturally deposited clay soils above the water table. These materials can generally be excavated with conventional earthmoving equipment such as backhoes and large track hoes. Rubble fill and buried structures within the undocumented fill could hamper excavations in some areas of the site. Utility excavations that extend into the underlying weathered shale bedrock with a Standard Penetration Resistance (N) value of less than 25 blows per foot can generally be excavated with conventional earthmoving

equipment such as backhoes, large track hoes, loaders, etc. The borings indicated that the proposed utility tunnel excavation along SW Van Buren Street will extend into harder, less weathered shale and/or limestone bedrock units. Removal of the hard shale and limestone will be more difficult and will probably require the use of rock teeth, pneumatic breakers, or some other method of hard rock removal to complete the excavation for the utility tunnel.

Temporary construction slopes should be designed in strict compliance with the most recent governing regulations. The naturally deposited clay soils encountered in the borings would generally be classified as Type B soils, under Part 1926 of the OSHA regulations pertaining to open excavations. For these soils, it is recommended that temporary construction slopes be no steeper than 1(H) to 1(V). Construction slopes should be closely observed for signs of mass movement: tension cracks near the crest, bulging at the toe, etc. If potential stability problems are observed, the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor.

STRUCTURAL FILL

All structural fill should consist of approved materials, free of organic matter and debris. Fill placed within 24 inches below the building floor slab and leveling course materials should consist of a lower plasticity cohesive soil having a liquid limit less than 45. Higher plasticity soils could be used as structural fill in the lower portion of deep fill sections in the building area and/or as structural fill in pavement areas where more movement can generally be tolerated. Fill should be placed in lifts having a maximum loose lift thickness of 9 inches. All fill should be compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D-698 (standard Proctor compaction). The moisture content of the fill at time of compaction should be within a range of 0 to 4 percent above optimum moisture content as defined by the standard Proctor compaction procedure. Moisture contents should be maintained within this range until completion of the building floor slab.

Granular materials that do not have a well-defined moisture-density relationship that are placed below foundations and other structures should be compacted to a minimum of 70 percent of the materials

maximum relative density as determined by ASTM Specifications D-4253 and 4254. Granular backfill materials placed next to structures should be compacted to a minimum of 65 percent of the materials maximum relative density. There is no specific moisture content requirement for compaction of sands and sandy soils and the moisture content of these soils should be maintained in a suitable range that facilitates the compaction of the sand.

Based on the proposed floor slab elevations, it appears that it will be necessary to import fill material to the site. It is recommended the low volume change material be imported to complete the required fill sections.

FOUNDATIONS

The borings encountered undocumented fill with variable amounts of rubble and construction debris. The undocumented fill is not considered suitable for support of shallow spread footings. Because of this, we have recommended that the proposed building be supported on drilled pier foundations that extend through the undocumented fill and naturally deposited glacial clay soils and are founded in the Curzon Limestone that underlies the proposed building site. As an alternate to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade would appear to be a viable foundation option for this project. As previously discussed, Geopiers are rammed aggregate piers that are installed by a specialty contractor using a proprietary method. Recommendations for design and construction of geopiers is normally provided by Geopier US, the company that developed this method of ground improvement and foundation support.

DRILLED PIER FOUNDATIONS

Based on the subsurface conditions encountered at the site, it recommended that the proposed building be supported by a drilled pier and grade beam foundation system. It is recommended that all drilled piers be founded in the Curzon Limestone. Based on the borings, it is anticipated that the bearing elevations of the drilled piers will range from about 908 to 913 feet, across the proposed

building site. Greater penetration into the bedrock may be required at some locations depending on the extent and severity of bedrock weathering. Drilled piers that are founded in suitable limestone may be designed and proportioned using an allowable end bearing pressure of 60,000 psf.

Any uplift loads acting on the foundations can be resisted by the effective dead weight of the piers plus an allowable side friction value of 250 psf for the portion of the shaft in soils and 2,000 psf for the portion of the shaft in weathered shale and/or limestone bedrock.

Properly reinforced drilled piers are also capable of resisting transient lateral loads from wind and/or earthquakes. It has been our experience that drilled piers with a minimum shaft diameter of 30 inches and an embedment length of at least 10 feet are capable of resisting lateral loads of 25 kips or more, with maximum top of pier deflections of ½ inch or less. If desired, GeoSource can perform a more comprehensive lateral load analysis and provide additional recommendations, when final loads become available. All piers subject to lateral loads should be properly reinforced.

All piers should have a minimum shaft diameter of 36-inches in order to accommodate dewatering equipment and/or to permit access for proper hand cleaning and observation of the base. Some groundwater seepage should be anticipated during the installation of drilled piers and use of temporary casing and dewatering techniques may be required. Temporary casing may also be required in areas where significant amounts of debris and/or rubble are present in the undocumented fill. To minimize disturbance to the bearing surfaces caused by ponding of water, it is recommended that concrete be placed the same day that the piers are drilled. It is also recommended that temporary casing be installed when personnel are required to enter a drilled pier excavation to clean or observe the bearing surface.

To minimize disturbance to the bearing surfaces caused by ponding of water, it is recommended that concrete be placed the same day that the drilled shafts are completed. The bottom of the pier excavation should be clean and free of water and loose materials prior to placement of the reinforcing steel and concrete. Concrete placement should be continuous from the bottom to the top elevation of the shaft. For dry excavations, concrete may be placed by the free fall method,

provided that it can be directed down the center of the shaft without hitting the reinforcing steel or sides of the excavation. Wet excavated shafts will require that the concrete either be pumped from the bottom up or placed using a tremie. The tremie pipe should be clean and have a sufficient inside diameter for use with the specific concrete mix, but not less than 10 inches. The discharge end of the tremie should allow free radial flow of the concrete and be immersed at least 5 feet in concrete and maintain a positive pressure differential during placement to prevent water or spoil intrusion.

It is anticipated that the drilled piers can be installed with conventional drilling equipment. It is possible that obstructions, such as rubble fill or old buried foundations, walls and other structures from the former buildings may be encountered during the installation of the drilled piers. Core barrels, rock augers or special construction methods may be required to remove obstructions and/or to remove loose rock and other materials to properly prepare the foundation bearing surface for the drilled piers.

Temporary steel casing and dewatering procedures may be required for proper installation of the drilled piers. If concrete will be placed in conjunction with the use of temporary casing, there must be a sufficient head of concrete inside the casing to prevent soil and water from entering the pier excavation as the temporary casing is pulled. It is recommend that concrete be designed to have a minimum slump in the range of 6 to 8 inches to reduce the potential for arching as the casing is removed.

It is recommended that all drilled pier and/or footing excavations be observed and evaluated by the geotechnical engineer or his representative immediately prior to placement of foundation concrete. Unsuitable areas identified at this time should be corrected. Corrective procedures would be dependent upon conditions encountered and will most probably include deepening of the drilled piers.

Long-term structural settlement of drilled piers designed and constructed as outlined above should be minor; i.e., ½ inch or less.

GEOPIER FOUNDATION SYSTEM

As an alternate to supporting the proposed building on drilled pier foundations, shallow foundation support bearing on a *Geopier*® reinforced subgrade appears to be a viable option for this project and may potentially provide an economic benefit to this project. Based on our experience with the *Geopier* soil reinforcement system, we anticipate that a *Geopier* reinforced subgrade could be designed to increase the net allowable soil bearing pressure at this site while limiting foundation settlement.

The *Geopier* soil reinforcement system has been used for a number of years to support structures as an alternative to deep foundations and/or to the removal and replacement of soft or unsuitable soils. The system allows the use of conventional spread footings and floor slabs cast on-grade, and reliably controls settlement to within design tolerances.

The *Geopier* soil reinforcement system consists of highly densified aggregate piers. The *Geopier* elements are installed by drilling 30-inch diameter holes, and ramming thin lifts of well-graded aggregate within the holes to form very stiff, high-density aggregate piers. The drilled holes for this project should extend through the undocumented fill to the underlying bedrock, a depth of about 13 to 19 feet below the finished floor elevation of the existing building. Following drilling of the *geopier* hole, well graded aggregate is compacted in 12-inch loose lifts in the drill hole. Ramming takes place with a high-energy beveled tamper that both densifies the aggregate and forces the aggregate laterally into the sidewalls of the hole. This action increases the lateral stress in surrounding soils, thereby further stiffening the reinforced composite soil mass. The result of *Geopier* installation is a significant strengthening and stiffening of subsurface soils that then support floor slabs and high-capacity footings.

Geopier designs are based on a two-layer settlement analysis as described by Lawton et al. (1994) and in the *Geopier* Reference Manual. Settlements within the “upper zone” (zone of soil that is reinforced with *Geopier* elements) are computed using a weighted modulus method that accounts for the stiffness of the *Geopier* elements, the stiffness of the matrix soil, and the area coverage of *Geopier* elements below supported footings. Settlements within the “lower zone” (zone of soils beneath the upper zone

which receives lower intensity footing stresses) are computed using conventional geotechnical settlement methods.

The *Geopier* soil reinforcement system is a design-build system and *Geopier* US should be contacted to provide engineering analyses and project specific design information for this project. Please contact Mr. Aaron J. Gaul, of *Geopier* Foundation Company – Midwest at (816) 531-6026 regarding the final system design, including the allowable foundation bearing pressure, *Geopier* shaft lengths and spacing, anticipated floor slab thickness, and a cost to support the proposed building.

If the *Geopier* system is selected, Quality Assurance testing should be performed during installation, including documentation of the soil conditions encountered, the shaft lengths, amount of aggregate used, verification of the modulus test readings, and tests on the compacted aggregate lifts. GeoSource would be pleased to provide this service.

SEISMIC HAZARDS DETERMINATION

Earthquake hazard evaluation is a complex task. Seismic sources must be identified and characterized, path effects must be evaluated (i.e., selection of appropriate attenuation relationships), and ground motions must be completed. Finally, an analysis of the motion with respect to the proposed construction must be made. In addition to the multi-discipline nature of this process, there is substantial parameter and modeling uncertainty associated with each of the steps. Typically, code based approaches are used for seismic hazard analyses. Our seismic hazard evaluation follows the IBC 2009 procedures.

United States Geological Society (USGS) has developed and mapped maximum earthquake response spectra for two design levels: an earthquake having a 10% probability of exceedance in 50 years and an earthquake having a 2% probability of exceedance in 50 years. The motions developed by USGS represent soft rock conditions, which are assumed to be representative of the

soil/rock that would be encountered below a depth of approximately 100 feet below existing grades at the site.

The USGS “soft rock” peak ground accelerations for the 10%/50 year and 2%/50 year events are 5.10% g and 18.60% g, respectively. Maximum spectral accelerations at the 0.2 second/1.0 second periods for the 10%/50 year and 2%/50 year events are 5.10% g / 2.10% g and 15.40% g / 5.40% g, respectively. Based on the subsurface information, the project site would be characterized as a Site Class C per the 2009 International Building Code (IBC). In addition, there is no significant risk of liquefaction or mass movement of the on-site soils due to a seismic event.

BUILDING FLOOR SLABS

The recommendations outlined in the Site Preparation and Structural Fill sections of this report are intended to produce subgrades that are suitable for support of building floor slabs. These recommendations include capping the building pad with a minimum of 24 inches of select, low volume change material below the floor slab and leveling course. The select fill layer below the floor slabs has been recommended to reduce the potential for subgrade volume change and floor slab movement. The recommended low plasticity structural fill thickness is in addition to any granular section that will be required below the floor slabs. The moisture content of the subgrade soils should be maintained within the recommended range until floor slabs are completed. Depending upon weather conditions, periodic wetting may be required.

Where possible, floor slabs should be designed and constructed as free slabs to allow for some differential movement between the walls, column points and floor slabs. It is recommended that a granular leveling course, having a minimum thickness of 4 inches, be used below normally loaded building floor slabs supported on soil subgrades. The granular section provides a capillary moisture break and acts as a leveling course. Clean crushed limestone gravel, with a nominal size of ½ to ¾ inch, would be recommended for the leveling course. A modulus of subgrade reaction of 100 pci may be used to design floor slabs constructed on an untreated clay subgrade.

In areas where floor loads are greater than 200 psf, it is recommended that a minimum of 12 inches of crushed limestone aggregate be placed below the building floor slab. The crushed rock may be substituted for a portion of 18 inches of select, low volume change fill layer recommended for normally loaded floor slabs. The purpose of the crushed rock is to provide an improved subgrade for the more heavily loaded floor slab areas. In addition, the crushed rock will also provide a good working surface during construction. It is recommended that the crushed rock have a gradation similar to KDOT AB-3. The crushed rock should be placed in 6 inch lifts and compacted to a minimum of 95 percent of the material's maximum dry density as determined by ASTM D 698. A modulus of subgrade reaction of 250 pci may be used to design floor slabs constructed on 12 inches of compacted crushed limestone aggregate.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and, where the soil is covered by a building or pavement, this moisture will collect. To reduce the impact of this subsurface moisture and the potential impact of future induced moisture (such as landscape irrigation or precipitation), the current industry standard is to place a vapor retarder below the compacted crushed limestone layer. This membrane typically consists of visquene or polyvinyl plastic sheeting, having a thickness of at least 10 mils. It should be noted that although vapor barrier systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems typically will not necessarily assure that floor slab moisture transmission rates will meet floor covering manufacturer standards and that indoor humidity levels be appropriate to inhibit mold growth. The design and construction of such systems are totally dependent on the proposed use and design of the proposed building and all elements of building design and function should be considered in the slab-on-grade floor design. Building design and construction may have a greater role in perceived moisture problems since sealed buildings/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling of the

slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

The above procedures should reduce the potential for subgrade moisture variations and consequently reduce floor slab movement and cracking. However, these procedures will not completely eliminate the volume change characteristics of the natural clay soils and, because of the presence of unaltered clay soils that extend to much greater depths, some long-term volume change may occur along with some floor slab movement and cracking. Isolation of floor slabs from walls and columns should be considered to accommodate minor differential movement of floor slabs. If it is desired to further minimize the potential for subgrade volume change, the use of a greater thickness of low volume change material beneath the floor slab should be considered.

LATERAL EARTH PRESSURES

Based on our experience with soils similar to those encountered at the site, it is recommended that the walls of the utility tunnel be designed using an equivalent fluid pressure of 55 pounds per cubic foot. This lateral earth pressure assumes an "at rest" stress distribution condition; i.e., no wall rotation is allowed. The recommended load distribution does not include a factor of safety or take into account the influence of any hydrostatic loading of the walls. Also, the stress distributions do not include the influence of any foundations, pavement or other surcharge loads located in or adjacent to wall backfill.

To prevent hydrostatic loading on the walls and/or seepage into the utility tunnel, it is recommended that perforated drain lines be installed at the base of the walls and also under the bottom floor slab of the tunnel. The drain lines should be sloped to provide positive gravity and should extend to a sump or storm drain where the water is removed. The drain line should be wrapped with filter fabric to prevent intrusion of fines. The drain line should be backfilled with free draining granular material extending vertically above the drain line to within 2 feet of final grade. The remaining portion of the excavation should be backfilled with cohesive soils to minimize the infiltration of surface water. The

granular section behind the wall should have a minimum width of 2 feet and should be encapsulated in the suitable filter fabric to minimize intrusion of fines. The use of a prefabricated drainage blanket on the foundation wall could also be considered to prevent hydrostatic loading. Drainage blankets should be installed in accordance with the manufacturer's recommendations.

PAVEMENTS

Parking and drive area subgrades should be prepared in accordance with the recommendations given in the Site Preparation and Structural Fill sections of this report. The site soils are considered poor subgrade materials for support of pavements. Based on the soil types encountered at this site and previous experience with materials of this type, a design CBR value of 3 is recommended for design of pavement sections. For this design value, a full-depth asphaltic concrete section having a minimum thickness of 6 inches is recommended for automobile parking areas and 7.5 inches is recommended for the access drives. For asphaltic concrete pavements, a minimum surface course thickness of 2 inches is normally recommended.

Service drives used by semi-trailer and other heavy delivery trucks require thicker pavement sections. GeoSource would be pleased to provide specific thickness recommendations for heavy duty pavements, after we receive additional information regarding the type and number of trucks that are projected to use this facility over the design life of the pavement. Portland cement concrete pavements are recommended for approach slabs, dock aprons, truck drives and parking areas, trash dumpster pads and other areas where heavy wheel loads will be concentrated. It is recommended that the concrete pavements in these areas have a minimum thickness of 8 inches. We normally recommend a 4-inch leveling and drainage course of clean, crushed rock be placed below all concrete pavements.

Portland cement concrete pavements are recommended for the trash dumpster pad and other paved areas subjected to concentrated wheel loads and high stresses. The minimum recommended thickness in these areas is 7 inches. Normally, a 4-inch layer of granular fill is placed below concrete pavement sections.

We recommend that the pavement subgrades be evaluated by proofrolling immediately prior to paving. The moisture content and density of the top 8 inches of the subgrade should be checked within two days prior to commencement of actual paving operations. If the material is not in compliance with the required ranges of moisture or density, the subgrade should then be moisture conditioned and recompacted. If any significant event, such as precipitation, occurs after the evaluation, the subgrade should be reviewed by qualified personnel immediately prior to placing the pavement. The subgrade should be in its finished form at the time of the final review.

Proper drainage is a key to the long term performance of any pavement section. It is recommended that all pavements be properly sloped to provide rapid runoff of surface water. Water should not be allowed to pond on or adjacent to pavements, since this could result in saturation of the subgrade and cause premature deterioration of pavements. Pavements in Kansas are normally subjected to 30 or more freeze-thaw cycles in any given year. Because of this, periodic maintenance of all of the pavements is essential to long term performance and should be anticipated. This should include sealing of all cracks and joints and by maintaining proper surface drainage next to paved areas.

PLANS AND SPECIFICATIONS REVIEW

It is recommended that the geotechnical engineer be provided the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical engineering recommendations in the design and specifications. In the event that GeoSource is not given the opportunity to perform this recommended review, we will assume no responsibility for misinterpretation of our geotechnical engineering recommendations.

CONSTRUCTION OBSERVATION AND TESTING

To effectively achieve the intent of the geotechnical recommendations presented in this report and to maintain continuity from design through construction, GeoSource should be retained to provide observation and testing services during earthwork and foundation construction phases of the project. This will provide the geotechnical engineer with the opportunity to observe the subsurface conditions encountered during construction, evaluate the applicability of the geotechnical recommendations presented in our report as they relate to the soil and bedrock conditions encountered, and to provide follow up recommendations if conditions differ from those described in our report.

LIMITATIONS

The analysis and recommendations submitted in this report are based in part upon the subsurface information obtained from the exploration points performed at the indicated locations and our present knowledge of the proposed construction as outlined in the Project Description. Subsurface conditions may vary between the exploration points and across the site and our report does not reflect any variations which may occur. The nature and extent of such variations may not become evident until construction. If subsurface conditions are encountered during construction that differ from those described in this report, GeoSource should be notified immediately so that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads, floor slab elevations or locations, changes from that described in this report, our recommendations should also be reviewed and the recommendations modified accordingly.

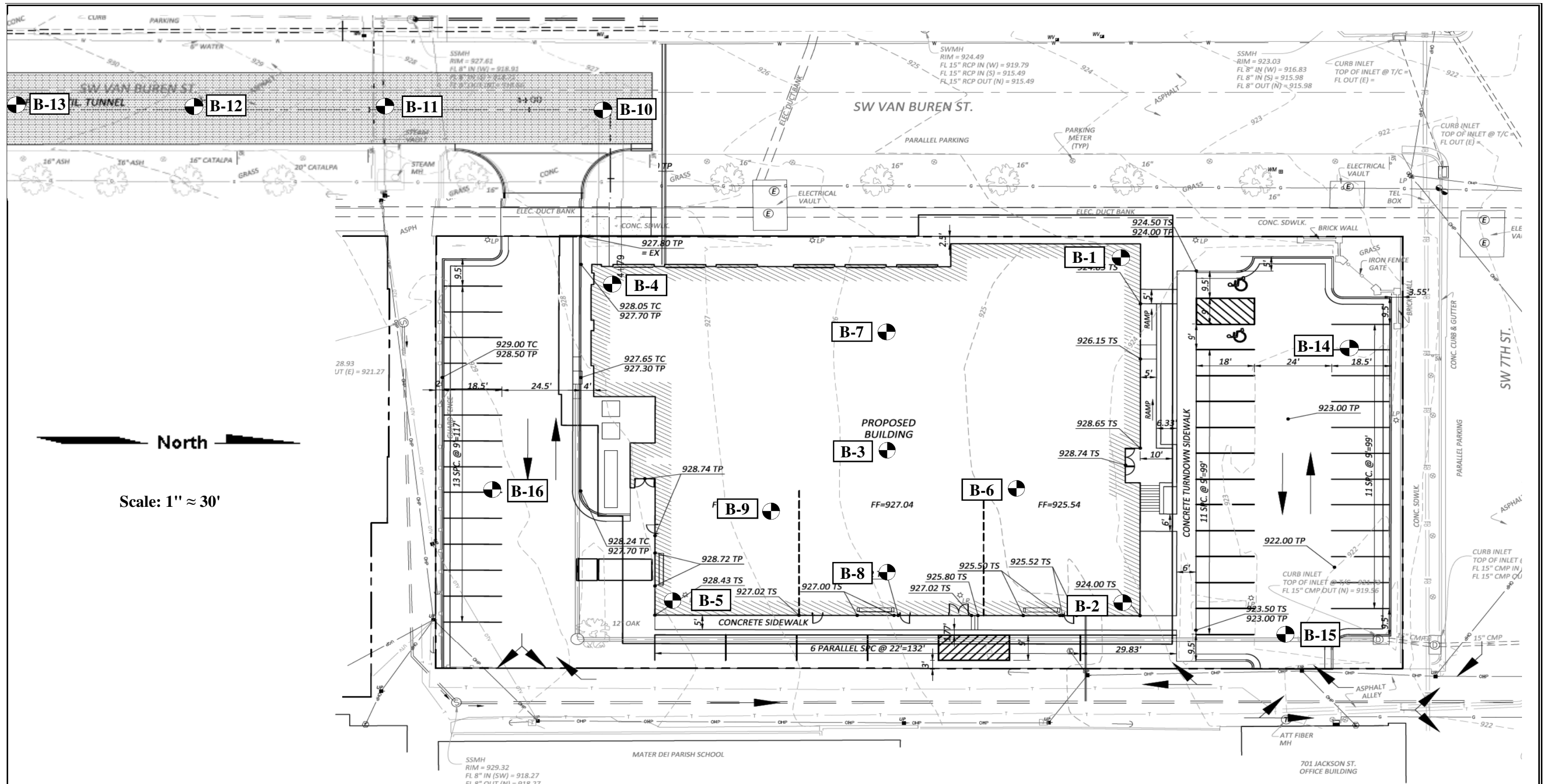
This report has been prepared in accordance with the generally accepted geotechnical engineering practice as it exists in the area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of observation and testing will be conducted during the construction phase in order to evaluate

compliance with our recommendations. Our scope of services did not include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site.

This report has been prepared for the exclusive use of our client for specific application to the project discussed. Any party other than the client who wishes to use this report shall notify GeoSource in writing of such intended use. Additional work may be required before an updated report can be issued. Non-compliance with any of these requirements will release GeoSource from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify and hold harmless GeoSource from any claim or liability associated with such unauthorized or non-compliance.

APPENDIX

FIGURE 1: BORING LOCATION SKETCH
FIGURE 2: GENERALIZED SUBSURFACE PROFILE
BORING LOGS
GENERAL NOTES AND TERMS
BORING LOG SYMBOLS

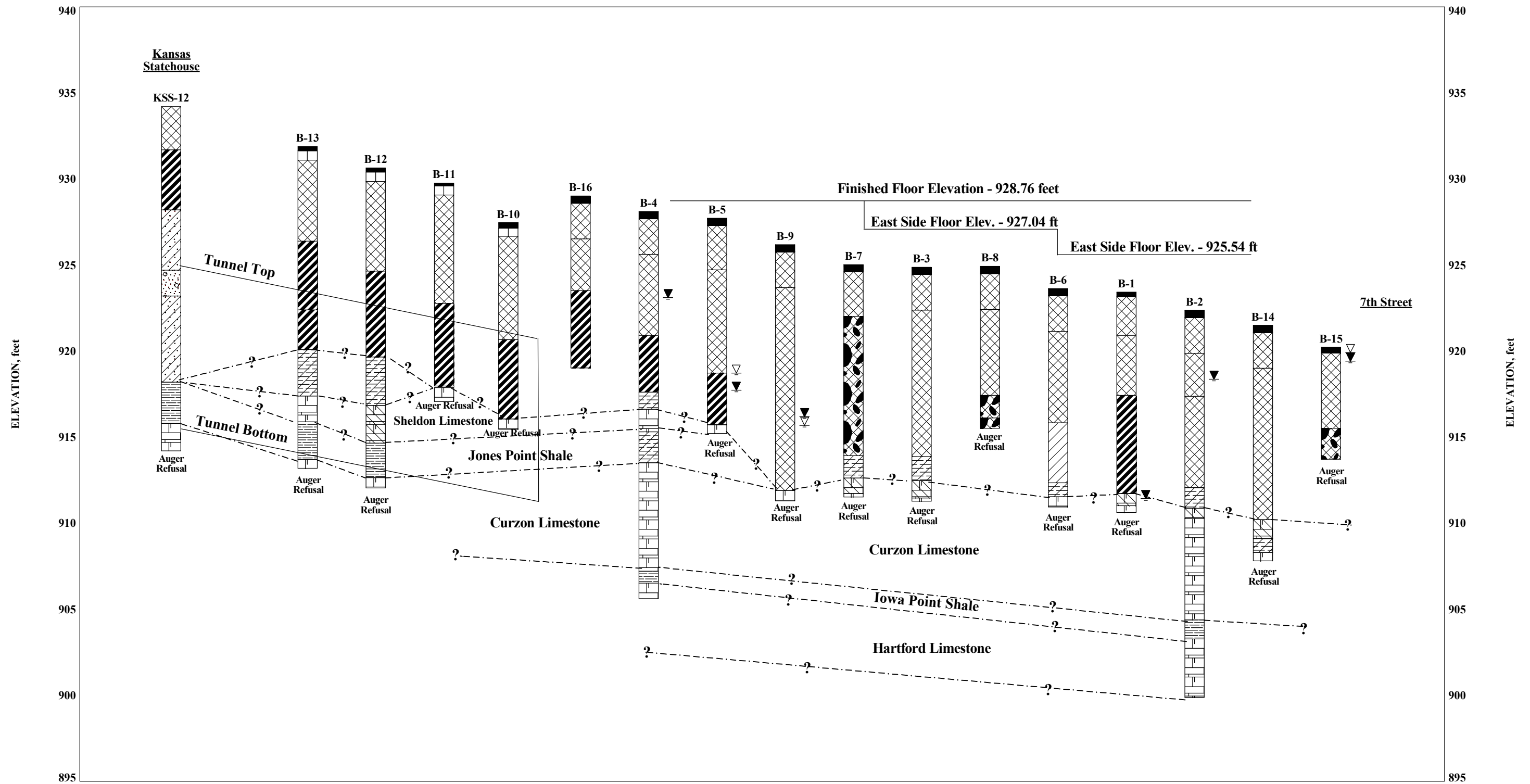


Boring Location Sketch

Figure 1

Proposed Kansas Energy and Service Facility
 SW 7th Street and Van Buren Street
 Topeka, Kansas
 Approved By: JJZ
 Project No. D14G1399





GENERALIZED SUBSURFACE PROFILE

FIGURE 2

Proposed Kansas Energy & Service Center
 SW 7th Street and Van Buren Street
 Topeka, Kansas

Approved By: JJZ

Project No.: D14G1399

LEGEND																
	Asphalt		Rubble		Silty Sand		Lean to Fat Clay		Sand (SP)		Fat Clay		Weathered Shale		Shale	<u>Water Levels</u>
	Brick Pavers		Fill		Sandy Silt		Sandy Lean Clay		Sand (SW)		Lean Clay		Weathered Limestone		Limestone	 While Drilling
	Baserock		Silt		Clayey Silt		Sandy Clay		Gravel		Fat Clay		Weathered Sandstone		Sandstone	 24 hrs. A.B.

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BOREHOLE INFORMATION Page 1 of 1										LOG OF BORING NO. B-1	
STATION OFFSET					PROJECT NAME Proposed Kansas Energy & Service Center						
NORTHING EASTING					SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas						
DRILLING COMPANY GeoSource, LLC					OWNER / ARCHITECT State of Kansas / HTK Architects						
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 4 feet east due to utilities MATERIAL DESCRIPTION Approx. Surface Elevation: 923.4	
	PA									Asphaltic Concrete (3")	
1	ST	15		*1500	102	25.6	CL		2.5	FILL , lean clay, medium stiff, light brown, trace fine sand 920.9	
	PA									FILL , lean to fat clay, stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
2	SS	18	7	*1500		21.6	CL CH		5		
	PA								6.0	FAT CLAY , stiff, brown mottled light gray and rust 917.4	
3	ST	20		4410	101	28.0	CH		10		
	PA								11.7	**LIMESTONE , weathered, broken and seamy 911.7	
									12.8	to very hard, light gray 910.6	
AUGER REFUSAL @ 12.8 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 37 <u>PL</u> 18 <u>PI</u> 19 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.											
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ 12.0 feet W.D.				BORING COMPLETED 12-17-14	
▼ 12.0 feet A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION Page 1 of 2										LOG OF BORING NO. B-2	
STATION		OFFSET								PROJECT NAME Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY GeoSource, LLC										OWNER / ARCHITECT State of Kansas / HTK Architects	
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 8 feet west due to utilities MATERIAL DESCRIPTION Approx. Surface Elevation: 922.4	
	PA									Asphaltic Concrete (5")	
1	ST	13		2420	107	22.7	CL		2.5	FILL , lean clay, stiff, light brown brown, trace fine sand 919.9	
	PA									FILL , fat clay, stiff, gray brown	
2	SS	18	8	*4000		29.4	CL CH		5.0	917.4	
	PA									FILL , lean to fat clay, soft, dark gray brown and greenish gray mixed, trace gravel (Stong Fuel Odor)	
3	ST	18	9	*1000		55.7	CL CH		10.3	912.1	
	PA								11.5	**SHALE , weathered, soft, olive tan 910.9	
									12.1	**LIMESTONE , weathered, seamy, gray 910.3	
R1	NQ3	100%	RQD=75%	**4990	138	8.7			15	LIMESTONE , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray	
				**8040	150	5.4			18.0	904.4	
R2	NQ3	78%	RQD=57%						19.1	SHALE , mod. hard, very thin bedded, tan 903.3	
				**3180	145	6.5			20	LIMESTONE , hard, solid, medium bedded, fossiliferous, buff to light gray	
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS			 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-17-14	
▽ Dry Prior to Coring					BORING COMPLETED 12-17-14	
▼ 4.0 feet A.C.R.					RIG CME-55	DRILLER MC
Backfilled @ Completion					APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-3	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
	PA									Approx. Surface Elevation: 924.9
1	ST	14		4500	115	15.3	CL		2.5	Asphaltic Concrete (5") FILL , lean clay, very stiff, light brown, trace fine sand
2	SS	18	20	*1500		19.0	CL CH		5	FILL , lean to fat clay, medium stiff to stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris
3	SS	18	9	*3000		31.3	CL CH		10	
	PA								11.0	
									12.4	**SHALE , weathered, soft, olive tan
									13.6	**LIMESTONE , weathered, broken and seamy to very hard, light gray
AUGER REFUSAL @ 13.6 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 39 <u>PL</u> 19 <u>PI</u> 20										913.9
**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.										912.5
										911.3

* Calibrated Penetrometer
** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS				BORING STARTED 12-18-14		
▽ Dry W.D.				BORING COMPLETED 12-18-14		
▼ Dry A.B.				RIG CME-55	DRILLER MC	
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399	

BOREHOLE INFORMATION										Page 1 of 2		LOG OF BORING NO. B-4	
STATION		OFFSET								PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC								OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION			
									Approx. Surface Elevation: 928.1				
	PA									Asphaltic Concrete (5")			
1	ST	10		1500	107	19.3	CL		2.5	<u>FILL</u> , lean clay, medium stiff, light brown, trace fine sand 925.6			
	PA									<u>FILL</u> , fat clay, stiff, dark gray brown mixed, trace gravel and miscellaneous construction rubble ▼			
2	SS	18	8	*3000		27.0	CH		5				
	PA									7.2 920.9			
										<u>FAT CLAY</u> , very stiff, light gray mottled light brown			
3	ST	18	10	*4500		17.5	CH		10	10.5 917.6			
	PA									11.5 916.6			
										<u>LIMESTONE</u> , hard, solid, thin-bedded, fossiliferous, buff 12.8 915.3			
R1	NQ3	94%	RQD=56%	**7800	153	5.2				<u>SHALE</u> , weathered, soft, tan to light brown 14.6 913.5			
										<u>SHALE</u> , weathered, soft, tan to light brown			
									15	<u>LIMESTONE</u> , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray			
										15			
										<u>LIMESTONE</u> , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray			
									20	20			
										<u>LIMESTONE</u> , hard, solid, medium to thick-bedded, fossiliferous, buff to light gray			
* Calibrated Penetrometer ** Rock Strength in psi													
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.													

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14	
▼ Dry Prior to Coring				BORING COMPLETED 12-18-14	
▼ 5.0 feet A.C.R.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION									Page 2 of 2		LOG OF BORING NO. B-4		
STATION		OFFSET							PROJECT NAME			Proposed Kansas Energy & Service Center	
NORTHING		EASTING							SITE LOCATION			SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC							OWNER / ARCHITECT			State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION			
R3	NQ3	25%	RQD=0%						20.9	SHALE, hard, very thin bedded, gray		907.2	
									21.6			906.5	
									22.5	LIMESTONE, hard, light gray		905.6	
									BOTTOM OF BORING				
* Calibrated Penetrometer ** Rock Strength in psi													
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.													
WATER LEVEL OBSERVATIONS													
▼ Dry Prior to Coring													
▼ 5.0 feet A.C.R.													
Backfilled @ Completion													
									BORING STARTED 12-18-14				
									BORING COMPLETED 12-18-14				
									RIG CME-55		DRILLER MC		
									APPROVED JJZ		JOB # D14G1399		

BOREHOLE INFORMATION Page 1 of 1										LOG OF BORING NO. B-5	
STATION OFFSET					PROJECT NAME Proposed Kansas Energy & Service Center						
NORTHING EASTING					SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas						
DRILLING COMPANY GeoSource, LLC					OWNER / ARCHITECT State of Kansas / HTK Architects						
METHOD 4-inch Flight Augers HAMMER Auto											
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 927.7		
	PA									Asphaltic Concrete (5")	
1	ST	16		2940	109	20.3	CL		3.0	FILL , lean clay, stiff, light brown, trace fine sand 924.7	
2	ST	13		5300	106	22.1	CL CH		5	FILL , lean to fat clay, very stiff to medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
	PA										
3	ST	10		2050	106	22.1	CL CH		9.0	▽ 918.7	
	PA								10	FAT CLAY , stiff, reddish brown ▼	
									12.0	915.7	
									12.5	915.2	
									**LIMESTONE , hard, gray		
									AUGER REFUSAL @ 12.5 FEET		
									ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 36 <u>PL</u> 19 <u>PI</u> 17		
									**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											

WATER LEVEL OBSERVATIONS	BORING STARTED 12-17-14	BORING COMPLETED 12-17-14
▽ 9.0 feet W.D.	RIG CME-55 DRILLER MC	
▼ 10.0 feet A.B.	APPROVED JJZ JOB # D14G1399	
Backfilled @ Completion		

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BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-6		
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center		
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas		
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects		
METHOD		4-inch Flight Augers HAMMER Auto										
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION		
										Approx. Surface Elevation: 923.6		
	PA									Asphaltic Concrete (5")		
1	ST	14		*2500	104	21.1	CL		2.5	<u>FILL</u> , lean clay, stiff, light brown, trace fine sand 921.1		
	PA											
2	SS	18	16	*2000		22.3	CL CH		5	<u>FILL</u> , lean to fat clay, medium stiff to stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris 915.8		
	PA								7.8			
3	SS	18	7	*2500		20.1	CL		10	<u>LEAN CLAY</u> , stiff, dark gray brown (Possible Fill) 912.3		
	PA								11.3			
									12.1	** <u>SHALE</u> , weathered, soft, olive tan 911.5		
									12.7	** <u>LIMESTONE</u> , hard, gray 910.9		
										AUGER REFUSAL @ 12.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		
* Calibrated Penetrometer ** Rock Strength in psi												
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.												
WATER LEVEL OBSERVATIONS								 Your Source for Geotechnical and Materials Engineering				
▽ Dry W.D.												
▼ Dry A.B.												
Backfilled @ Completion												
								BORING STARTED		12-19-14		
								BORING COMPLETED		12-19-14		
								RIG		CME-55	DRILLER MC	
								APPROVED		JJZ	JOB # D14G1399	

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-7	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Approx. Surface Elevation: 925.0
	PA									Asphaltic Concrete (5")
1	ST	20		2950	107	20.0	CL		3.0	FILL , lean clay, stiff, light brown, trace fine sand 922.0
2	SS	12	76			11.4			5	RUBBLE FILL , brick, cinders, limestone and/or concrete rubble in a clay matrix
	PA									
3	SS	3	50/3"			15.1			10	
	PA								11.1	913.9
									12.4	912.6
									13.5	911.5
										AUGER REFUSAL @ 13.5 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 34 <u>PL</u> 19 <u>PI</u> 15 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14	
▽ Dry W.D.				BORING COMPLETED 12-18-14	
▼ Dry A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-9	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
	PA									Approx. Surface Elevation: 926.2
1	ST	8		2590	109	17.8	CL		2.5	Asphaltic Concrete (5") <u>FILL</u> , lean clay, stiff, light brown, trace fine sand
2	SS	18	4	*1500		25.7	CL CH		5	<u>FILL</u> , lean to fat clay, soft to medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris
	PA									
3	SS	18	10	*2000		30.7	CL CH		10	▼ ▽
	PA									
									14.3	911.9
									14.9	911.3
										AUGER REFUSAL @ 14.9 FEET ATTERBERG LIMITS Sample 1, Depth 1-3 feet <u>LL</u> 34 <u>PL</u> 18 <u>PI</u> 16 **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

* Calibrated Penetrometer
** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

WATER LEVEL OBSERVATIONS		BORING STARTED 12-17-14	
▽ 10.5 feet W.D.		BORING COMPLETED 12-17-14	
▼ 10.0 feet A.B.		RIG CME-55	DRILLER MC
Backfilled @ Completion		APPROVED JJZ	JOB # D14G1399



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BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-10	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 4 feet east due to parked cars	
										MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 927.6		
	PA									Asphaltic Concrete (4") Brick Pavers <u>FILL</u> , lean to fat clay, medium stiff, dark gray brown, trace gravel, brick, cinders and miscellaneous construction debris	
1	ST	6		*1500	98	26.5	CL CH				
	PA								5	6.8 920.8 <u>FAT CLAY</u> , very stiff, light grayish tan mottled rust	
2	SS	18	10	*4500		17.1	CH				
	PA								10	11.4 916.2 12.0 **LIMESTONE , hard, gray 915.6 AUGER REFUSAL @ 12.0 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.	
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion								 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-11	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	Offset 6 feet east due to parked cars	
										MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 929.8		
	PA									Asphaltic Concrete (4") Brick Pavers FILL , lean clay, medium stiff, dark gray brown, trace fine sand and gravel	
1	ST	10		1420	97	25.8	CL				
	PA								5	FAT CLAY , very stiff, light grayish tan mottled rust	
									7.0		
2	SS	18	10	*5500		24.1	CH		10	**LIMESTONE , hard, gray	
	PA								11.8		
									12.7	917.1	
									AUGER REFUSAL @ 12.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion								 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399	

BOREHOLE INFORMATION										Page 2 of 2		LOG OF BORING NO. B-12	
STATION		OFFSET								PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING								SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC								OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers								HAMMER		Auto	
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION			
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.			
* Calibrated Penetrometer ** Rock Strength in psi													
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.													
WATER LEVEL OBSERVATIONS									BORING STARTED 12-18-14				
▼ Dry W.D.									BORING COMPLETED 12-18-14				
▼ Dry A.B.									RIG CME-55		DRILLER MC		
Backfilled @ Completion									APPROVED JJZ		JOB # D14G1399		



BOREHOLE INFORMATION								Page 1 of 2		LOG OF BORING NO. B-13	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION	
									Approx. Surface Elevation: 931.9		
	PA									Asphaltic Concrete (3") Brick Pavers FILL , lean to fat clay, stiff, dark gray brown, trace gravel	
1	ST	9		2830	104	28.3	CH		5		
	PA								5.5	926.4	
										FAT CLAY , very stiff, gray brown	
3	SS	18	12	*3500		23.6	CH		9.5		
	PA								10	FAT CLAY , very stiff, reddish brown	
									11.8		
										**SHALE , weathered, soft, olive tan to gray brown	
4	SS	15	56/9"			20.7			14.5		
									15	**LIMESTONE , weathered, seamy to thin-bedded, light gray	
	PA								16.0		
										**SHALE , hard, gray	
									18.2		
									18.7	913.2	
									AUGER REFUSAL @ 18.7 FEET		
* Calibrated Penetrometer ** Rock Strength in psi											
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.											
WATER LEVEL OBSERVATIONS ▽ Dry W.D. ▼ Dry A.B. Backfilled @ Completion  GeoSource Your Source for Geotechnical and Materials Engineering BORING STARTED 12-18-14 BORING COMPLETED 12-18-14 RIG CME-55 DRILLER MC APPROVED JJZ JOB # D14G1399											

BOREHOLE INFORMATION STATION OFFSET NORTHING EASTING DRILLING COMPANY GeoSource, LLC METHOD 4-inch Flight Augers HAMMER Auto Page 2 of 2										LOG OF BORING NO. B-13											
PROJECT NAME Proposed Kansas Energy & Service Center SITE LOCATION SW 7th Street and Van Buren Street Topeka, Kansas OWNER / ARCHITECT State of Kansas / HTK Architects																					
SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION											
										**Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.											
* Calibrated Penetrometer ** Rock Strength in psi																					
The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.																					
WATER LEVEL OBSERVATIONS																					
▽ Dry W.D.																					
▼ Dry A.B.																					
Backfilled @ Completion																					
										BORING STARTED 12-18-14											
										BORING COMPLETED 12-18-14											
										RIG CME-55					DRILLER MC						
										APPROVED JJZ					JOB # D14G1399						

BOREHOLE INFORMATION								Page 1 of 1		LOG OF BORING NO. B-14	
STATION		OFFSET						PROJECT NAME		Proposed Kansas Energy & Service Center	
NORTHING		EASTING						SITE LOCATION		SW 7th Street and Van Buren Street Topeka, Kansas	
DRILLING COMPANY		GeoSource, LLC						OWNER / ARCHITECT		State of Kansas / HTK Architects	
METHOD		4-inch Flight Augers HAMMER Auto									

SAMPLE NO.	SAMPLE TYPE	RECOVERY	STANDARD PENETRATION BLOWS/FT.	UNCONFINED STRENGTH PSF	DRY DENSITY PCF	MOISTURE CONTENT, %	UNIFIED SOIL SYMBOL	GRAPHIC LOG	DEPTH, Feet.	MATERIAL DESCRIPTION
										Approx. Surface Elevation: 921.5
	PA									Asphaltic Concrete (5")
1	ST	10		1450	109	21.8	CL		2.5	FILL , lean to fat clay, medium stiff, light brown, trace fine sand 919.0
	PA									
2	SS	18	5	*2000		18.5	CH		5	FILL , fat clay, medium stiff to stiff, reddish brown, dark brown and brown layers, trace gravel
	PA									
3	SS	18	6	*2500		36.5	CH		10	
	PA								11.3	910.2
									12.4	** LIMESTONE , weathered, seamy 909.1
									13.2	** SHALE , weathered, soft, tan 908.3
									13.7	** LIMESTONE , hard, gray 907.8
										AUGER REFUSAL @ 13.7 FEET **Rock classification is based on drilling characteristics and visual observation of disturbed samples. Core samples may reveal other rock types.

* Calibrated Penetrometer ** Rock Strength in psi

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ the transition may be gradual.

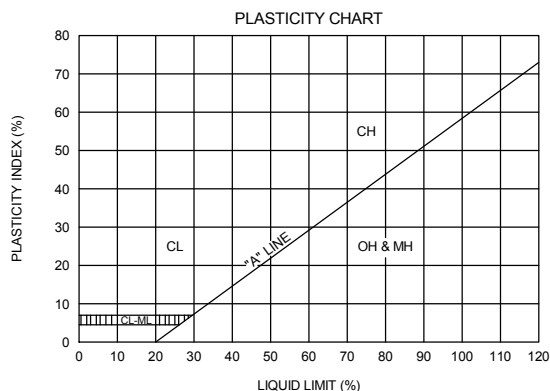
WATER LEVEL OBSERVATIONS		 Your Source for Geotechnical and Materials Engineering		BORING STARTED 12-19-14	
▽ Dry W.D.				BORING COMPLETED 12-19-14	
▼ Dry A.B.				RIG CME-55	DRILLER MC
Backfilled @ Completion				APPROVED JJZ	JOB # D14G1399

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL	
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL	
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL	
	SANDS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND	
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND	
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY	
			PI>4 AND PLOTS<"A" LINE	ML	SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT	
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY	
			PI PLOTS <"A" LINE	MH	ELASTIC SILT	
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	

BEDROCK AND OTHER MATERIAL SYMBOLS			
	Weathered Shale		Topsoil
	Shale		Asphaltic Concrete
	Seamy Limestone		Concrete
	Joint or Void		Fill
	Limestone		Rubble or Debris Fill
	Weathered Sandstone		Boulders and Cobble
	Sandstone		Granular Baserock
	Coal		Lean to Fat Clay

BEDROCK PROPERTIES & DESCRIPTIONS			
ROCK QUALITY DESIGNATION		BEDDING CHARACTERISTICS	
DESCRIPTION	RQD (%)	TERM	THICKNESS (inches)
Very Poor	0 - 25	Massive	> 60
Poor	25 - 50	Very Thick Bedded	36 - 60
Fair	50 - 75	Thick Bedded	12 - 36
Good	75 - 90	Medium Bedded	4 - 12
Excellent	90 - 100	Thin Bedded	1 - 4
		Very Thin Bedded	0.4 - 1
		Laminated	< 0.4
DEGREE OF WEATHERING			
Slightly Weathered - Slight decomposition of Parent material in joints and seams.			
Weathered - Well-developed and decomposed joints and seams.			
Highly Weathered - Rock highly decomposed, may be extremely broken.			
BEDROCK DISCONTINUITIES			
Bedding Planes Planes dividing the individual layers, beds or strata of rocks.			
Joints Fractures in rock, generally more or less vertical to the bedding.			
Seams Applies to bedding planes with an unspecified degree of weathering.			



PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT)				
SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	MEDIUM STIFF	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

BORING LOG SYMBOLS

SURFACE MATERIALS



TOPSOIL



FILL MATERIAL



ASPHALTIC CONCRETE



CONCRETE



GRANULAR BASE

COHESIVE SOILS



SILT



CLAYEY SILT



LEAN CLAY



LEAN TO FAT CLAY



FAT CLAY

LARGE GRANULAR SOILS



CLAYEY GRAVEL



SILTY GRAVEL



POORLY GRADED GRAVEL



WELL GRADED GRAVEL



COBBLES & BOULDERS

GRANULAR SOILS



SANDY SILT



SILTY SAND



FINE SAND



POORLY GRADED SAND



WELL GRADED SAND



GRAVELLY SAND

BEDROCK UNITS



SHALE



FISSILE SHALE



SANDSTONE



LIMESTONE



COAL

WEATHERED BEDROCK



JOINT OR VOID



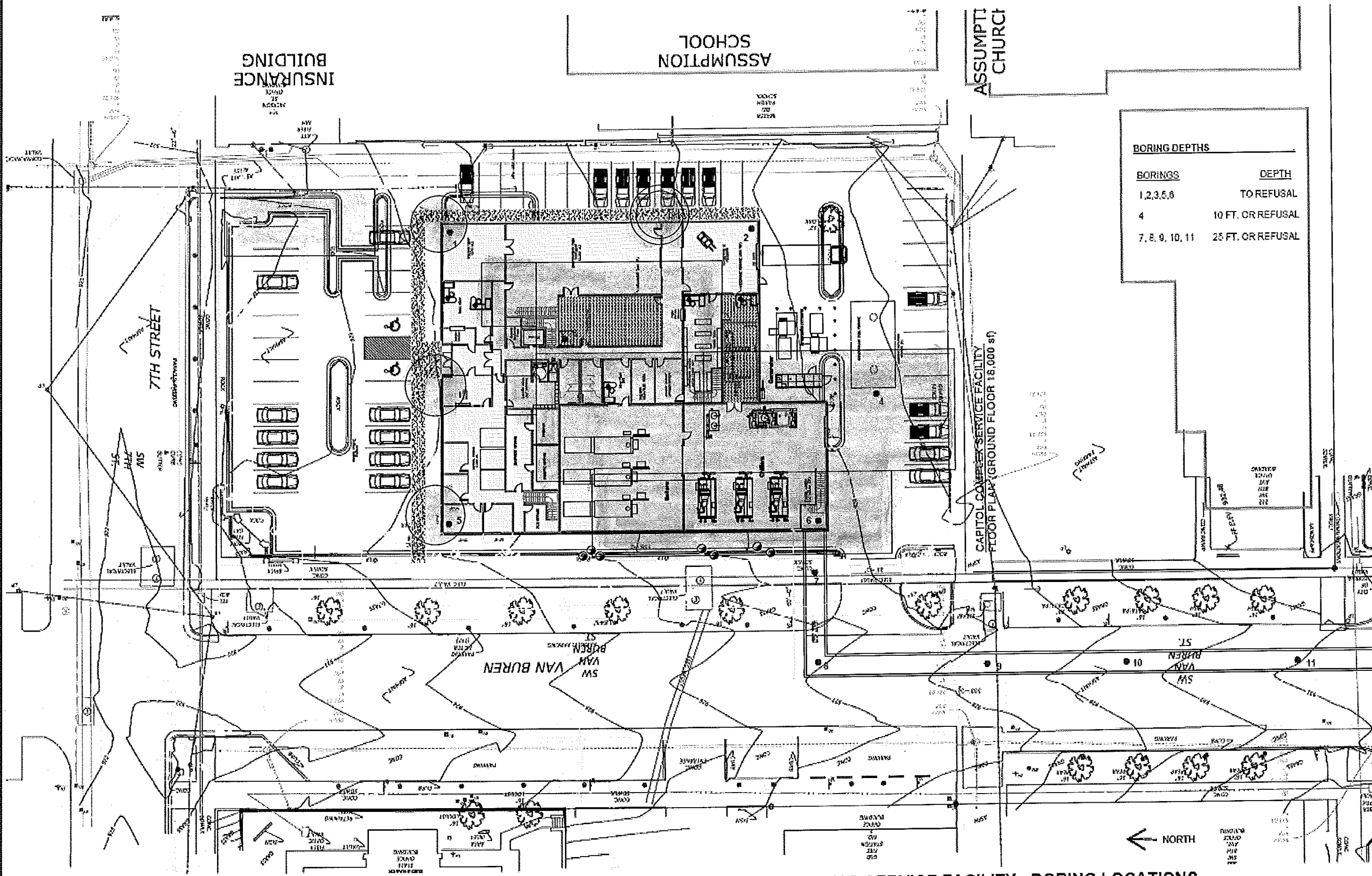
WEATHERED SHALE



WEATHERED SANDSTONE



WEATHERED LIMESTONE



BORING DEPTHS	
BORINGS	DEPTH
1,2,3,5,8	TO REFUSAL
4	10 FT. OR REFUSAL
7, 8, 9, 10, 11	25 FT. OR REFUSAL

NEW ENERGY & SERVICE FACILITY - BORING LOCATIONS
NOT TO SCALE

DEPARTMENT OF ADMINISTRATION

OFFICE OF FACILITIES & PROCUREMENT MANAGEMENT

DESIGN & CONSTRUCTION

800 S.W. JACKSON, SUITE 700 TOPEKA, KANSAS 66612

PHONE: 785.296.8899 FAX: 785.296.3456

PROJECT #:

PROJECT TITLE

AGENCY NAME

BUILDING NUMBER(S)

DATE (INSERT DATE). DRAWN BY (INSERT NAME)

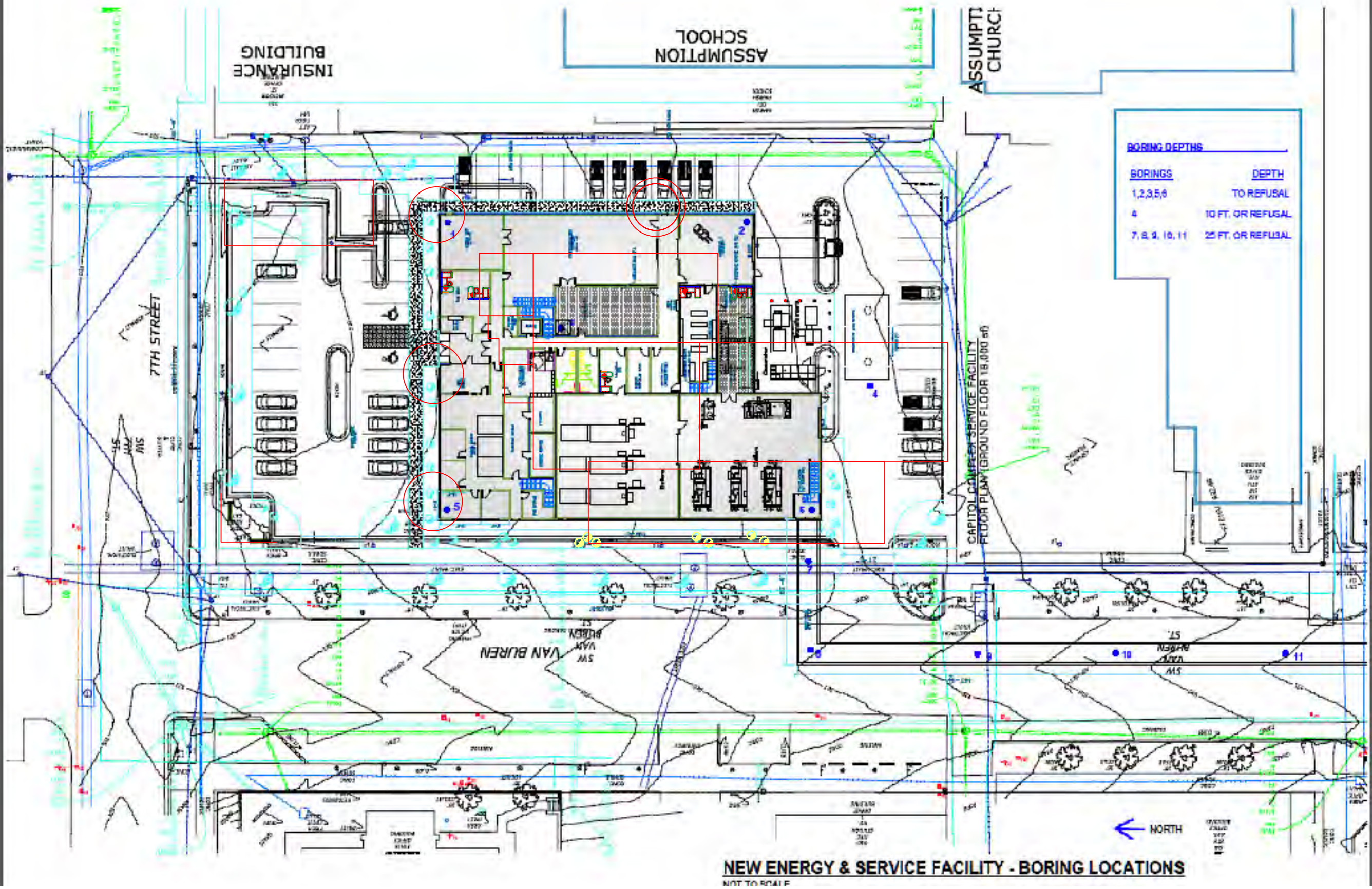
SHEET CONTENT

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SHEET NO.

ORIGINAL CONTRACT DOCUMENTS

					DEPARTMENT OF ADMINISTRATION OFFICE OF FACILITIES & PROCUREMENT MANAGI DESIGN & CONSTRUCTION 800 S.W. JACKSON, SUITE 700 TOPEKA, KANSAS 66612 PHONE: 785.296.8899 FAX: 785.296.3456		
					PROJECT #: PROJECT TITLE AGENCY NAME BUILDING NUMBER(S) DATE [INSERT DATE], DRAWN BY [INSERT NAME]		
					SHEET CONTENT		
					A - 000000		
					SHEET NO.		
					ORIGINAL CONTRACT DOCUMENTS		



DEPARTMENT OF ADMINISTRATION
OFFICE OF FACILITIES & PROCUREMENT MANAGER
DESIGN & CONSTRUCTION
800 S.W. JACKSON, SUITE 700 TOPEKA, KANSAS 66612
PHONE: 785.296.8899 FAX: 785.296.3456

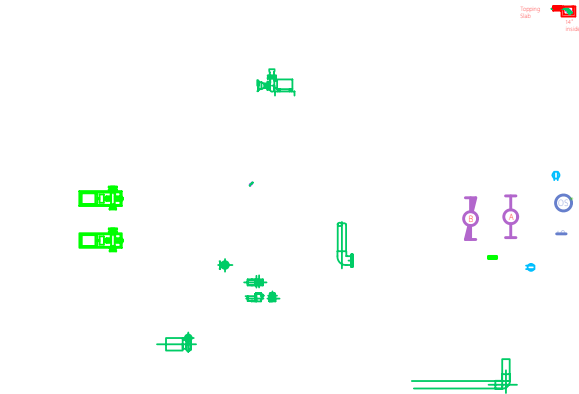
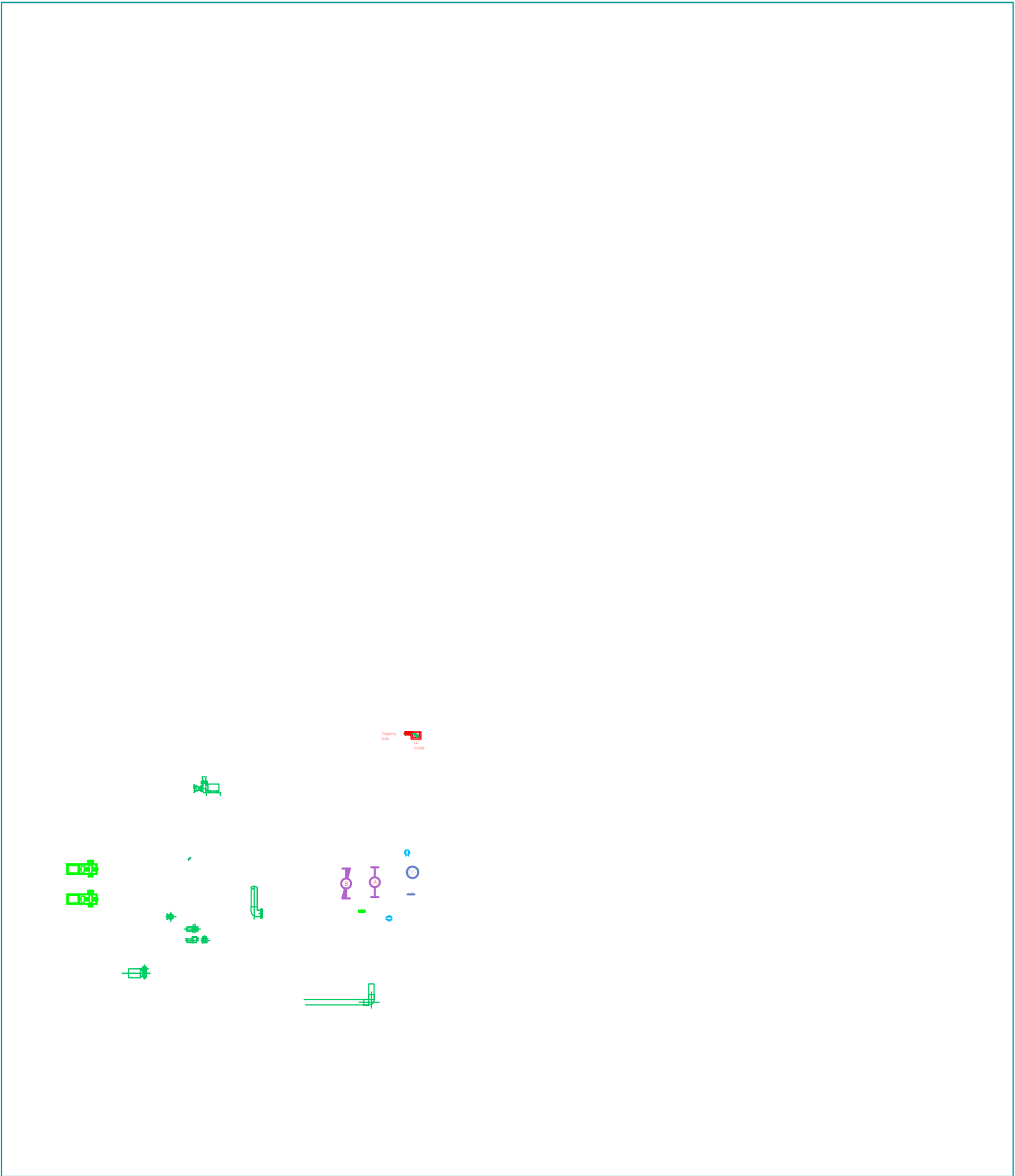
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AGENCY NAME
BUILDING NUMBER(S)
DATE [INSERT DATE], DRAWN BY [INSERT NAME]

SHEET CONTENT

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SHEET NO.

ORIGINAL CONTRACT
DOCUMENTS



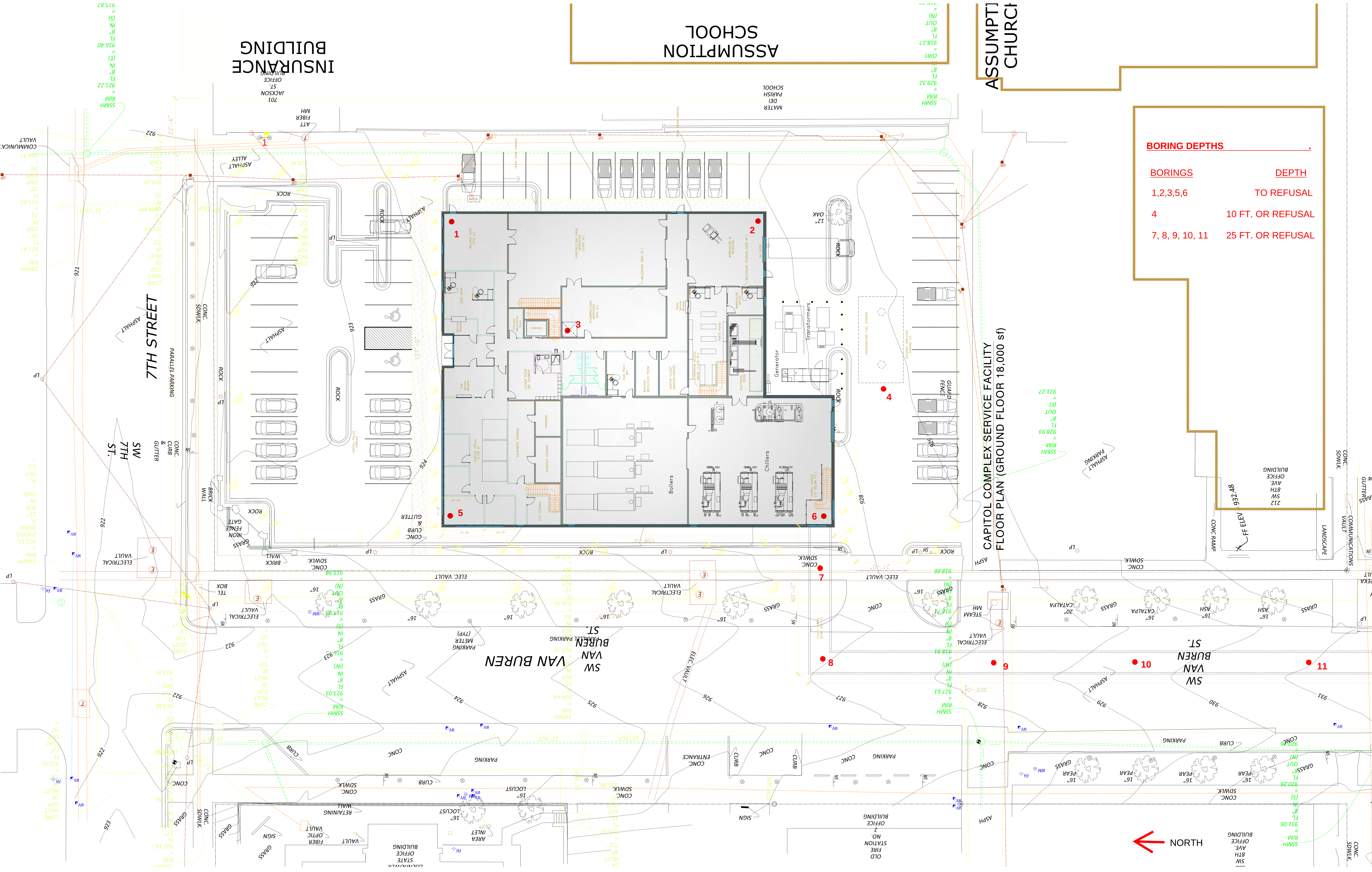
CCR:
PROJECT TITLE:

SHEET NUMBER:

DEPARTMENT OF ADMINISTRATION
OFFICE OF FACILITIES & PROCUREMENT
MANAGEMENT
DESIGN & CONSTRUCTION

DRAWN BY:
ENTER NAME
DATE:

A1
OF



BORING DEPTHS	
BORINGS	DEPTH
1,2,3,5,6	TO REFUSAL
4	10 FT. OR REFUSAL
7, 8, 9, 10, 11	25 FT. OR REFUSAL

NEW ENERGY & SERVICE FACILITY - BORING LOCATIONS
NOT TO SCALE