Report of Geotechnical Engineering Investigation
Stapleton Ridge
(Single Family)
Louisville, Kentucky
Patriot Project No. 5-14-0965

Prepared For:

American Structurepoint, Inc.
7260 Shadeland Station
Indianapolis, Indiana 46256

Prepared By:

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August 26, 2014

PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

August 26, 2014

American Structurepoint, Inc.
7260 Shadeland Station
Indianapolis, Indiana 46256

Attention: Ms. Brittany Heidenreich, EI

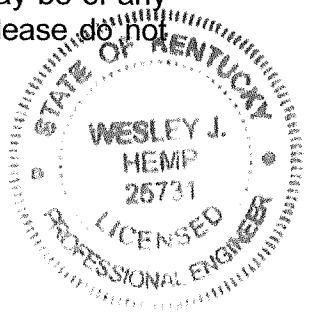
RE: Report of Geotechnical Engineering Investigation
Stapleton Ridge
(Single Family)
Louisville, Kentucky
Patriot Project Number 5-14-0965

Dear Brittany:

Submitted herewith is the report of our subsurface investigation for the above-referenced project. This investigation was completed in general accordance with our Proposal Number PLG14-0022R dated March 25, 2014.

This report includes detailed and graphic logs of the thirty-four (34) soil test borings drilled at the proposed site. Also included in the report are the results of laboratory tests performed on samples obtained from the site, and geotechnical recommendations pertinent to the site development, foundation design, and construction.

We appreciate the opportunity to have performed this geotechnical engineering investigation and are looking forward to working with you during the construction phase of the project. If you have any questions regarding this report or if we may be of any additional assistance regarding any geotechnical aspect of the project, please do not hesitate to contact our office.



Respectfully submitted,
Patriot Engineering and Environmental, Inc.

Amanda Hopf, E.I.	Wesley J. Hemp, P.E.	Ronald W. Spivey, P.E.
Geotechnical Engineer	Senior Project Engineer	Principal/ Sr. Project Engineer

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REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

Redwood at Aiken Road
(Single Family)
Louisville, Kentucky
Patriot Project No. 5-14-0456

1.0 INTRODUCTION

1.1 General

The proposed project consists of the design and construction of single family apartments to be located in Louisville, KY. The results of our geotechnical engineering investigation for the project are presented in this report. This investigation was carried out in general accordance with *Patriot's* Proposal No. PLG14-0022R dated March 25, 2014.

1.2 Purpose and Scope

The purpose of this investigation was to determine the general near surface and subsurface conditions within the project area and to develop the geotechnical engineering recommendations necessary for the design and construction of the structures. This was achieved by drilling soil test borings at thirty-four (34) locations and offset borings at three (3) locations and by conducting laboratory tests on samples taken from the borings. This report contains the results of our findings, an engineering interpretation of these results with respect to the available project information, and recommendations to aid in the design and construction of the proposed apartments.

2.0 PROJECT INFORMATION

The proposed project will include the design and construction of one hundred and sixteen (116) "single family" apartment structures to be located south of Aiken Road immediately west of Floyds Fork River in Louisville, Kentucky. The structures will be single story apartment buildings on slab-on-grade construction. Additionally, the project will include associated parking and drive areas along with the extension of an existing pond. No structural loading information has been provided. The proposed maximum amount of fill for the site is approximately four (4) feet.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The proposed site consists mostly of a large and small open field in Louisville, Kentucky. The large open field is bordered by trees to the north, south, and west and a house and barns to the east. The small open field is bordered by trees to the northeast, an existing pond to the southeast, a house and barns to the northwest, and an open grassy area to the southwest. A section of the site is covered by trees and brush that was partially cleared to perform soil borings. Aiken Road is located north of the proposed site and Floyds Fork River to the east. At the time of this investigation, the site was generally covered in ankle-high weeds. No ponded water was observed at the time of this investigation.

3.2 Site Geology

A review of the Kentucky Geological Survey Interactive GIS indicates the majority of the soil profile is alluvium of Quaternary age. This soil profile consists primarily of sand, silt, clay, and gravel. Also located within the proposed site is the Drakes Formation of Upper Ordovician age. This formation consists primarily of limestone, dolomite, and shale. The limestone and dolomite are dark gray to olive gray and weather to light gray to grayish orange, very fine to medium grained. The map shows that this formation has a low to non-karst potential with no identified sinkholes located directly adjacent to the project site. No sinkholes or other solution features were observed within the project area during our site visit.

3.3 Subsurface Conditions

Our interpretation of the subsurface conditions is based upon widely spaced soil borings drilled at the approximate locations shown on the Boring Location Map in Appendix A. The following discussion is general; for more specific information, please refer to the boring logs presented in Appendix A. It should be noted that the dashed stratification lines shown on the soil boring logs indicate approximate transitions between soil types. In situ stratification changes could occur gradually or at different depths. All depths discussed below refer to depths below the existing ground surface.

The parcel is covered with topsoil, a surficial layer of material that is a blend of silts, sands, and clays, with varying amounts of organic matter. The topsoil layer is about 8 inches thick at the boring locations.

The borings generally encountered slightly moist to very moist, very soft to very stiff silty clay (CL), slightly moist to very moist, stiff highly plastic (CH) fat clay, and slightly moist to moist, medium stiff to very stiff clayey silt (ML). Alluvial soil was encountered in all borings except boring B-27. The following table represents the depths alluvial soils encountered in each boring. Marly soils consisting of very soft to medium stiff silty clay materials were encountered in borings B-4, B-5, B-9, B-10, B-11, B-19, B-33 at depths ranging from 8.5 feet to 13.3 feet, 6.0 feet to 12.0 feet, 3.5 feet to 9.0 feet, 6.0 feet to 8.5 feet, 8.5 feet to 13.5 feet, 8.5 feet to 13.5 feet, and 13.5 feet to 16.4 feet, respectively.

Table 1 – Alluvial Soil Depth Ranges

Boring	Depth Range (ft.)	Boring	Depth Range (ft.)	Boring	Depth Range (ft.)
B-1	0.7-6.0	B-13	0.7-6.0	B-25	0.7-3.5
B-2	0.7-6.0	B-14	0.7-6.0	B-26	0.7-6.0
B-3	0.7-3.5	B-15	0.7-3.5	B-27	NONE
B-4	0.7-6.0	B-16	0.7-3.5	B-28	0.7-6.0
B-5	0.7-3.5	B-17	0.7-6.0	B-29	0.7-6.0
B-6	0.7-3.5	B-18	0.7-3.5	B-30	0.7-3.5
B-7	0.7-3.5	B-19	0.7-6.0	B-31	0.7-3.5
B-8	0.7-3.5	B-20	0.7-6.0	B-32	0.7-3.5
B-9	0.7-3.5	B-21	0.7-3.5	B-33	0.7-6.0
B-10	0.7-3.5	B-22	0.7-3.5	B-34	0.7-3.5
B-11	0.7-3.5	B-23	0.7-3.5		
B-12	0.7-6.0	B-24	0.7-3.5		

The following table represents the refusal depths of all the borings. All depths are given as feet below the existing ground surface. It should be noted that auger refusal can be encountered on limestone floaters or buried boulders; therefore, the depth to bedrock may be deeper than the auger refusal depths.

Table 2 – Refusal Depths					
Boring	**Refusal Depth (ft.)**	**Boring**	**Refusal Depth (ft.)**	**Boring**	**Refusal Depth (ft.)**
B-1	9.0	B-13	10.2	B-25	12.2
B-2	14.0	B-14	14.5	B-26	11.5
B-3	10.0	B-15	14.5	B-27	7.6
B-4	13.3	B-16	12.1	B-28	10.0
B-5	12.0	B-17	12.4	B-29	11.0
B-6	12.2	B-18	9.6	B-30	11.8
B-7	9.0	B-19	13.5	B-31	7.6
B-8	8.6	B-20	12.0	B-32	10.0
B-9	9.0	B-21	9.2	B-33	16.4
B-10	9.5	B-22	11.0	B-34	7.7
B-11	14.3	B-23	8.8		
B-12	13.0	B-24	8.0		

Standard Penetration Test blow counts (N-values) ranged from 2 blows per foot (bpf) to greater than 50 blows per one inch in these soils. Compressive strengths as estimated with a calibrated hand penetrometer ranged from less than 0.25 to greater than 4.5 tons per square foot (tsf) in these soils, while natural moisture contents ranged from 7 to 32 percent.

3.4 Groundwater Conditions

The following table represents the depths water was encountered in the test borings during drilling and upon completion of drilling operations.

Table 3 – Water Depths								
Boring	During Drilling Depth (ft.)	After Auger Removal Depth (ft.)	Boring	During Drilling Depth (ft.)	After Auger Removal Depth (ft.)	Boring	During Drilling Depth (ft.)	After Auger Removal Depth (ft.)
B-1	Dry	Dry	B-13	Dry	Dry	B-25	Dry	Dry
B-2	Dry	Dry	B-14	Dry	Dry	B-26	Dry	Dry
B-3	Dry	Dry	B-15	Dry	12.0	B-27	Dry	Dry
B-4	9.0	9.0	B-16	Dry	Dry	B-28	Dry	Dry
B-5	8.5	8.0	B-17	Dry	Dry	B-29	Dry	Dry
B-6	Dry	Dry	B-18	Dry	Dry	B-30	Dry	Dry
B-7	Dry	8.5	B-19	Dry	Dry	B-31	Dry	Dry
B-8	Dry	Dry	B-20	Dry	Dry	B-32	Dry	Dry
B-9	Dry	8.5	B-21	Dry	Dry	B-33	Dry	Dry
B-10	6.0	5.0	B-22	Dry	Dry	B-34	Dry	Dry
B-11	8.5	6.0	B-23	Dry	Dry			
B-12	Dry	Dry	B-24	Dry	Dry			

The term groundwater, for the purpose of this report, pertains to any water that percolates through the naturally occurring soil materials found on site. This includes any overland flow that permeates through a given depth of soil, perched water, and water that occurs below the "water table", a zone that remains saturated and water-bearing year round.

It should be recognized that fluctuations in the groundwater level should be expected to occur due to variations in rainfall and other environmental or physical factors at the time measurements are made. **The true static groundwater level can only be determined through observations made in cased holes over a long period of time, the construction of which was beyond the scope of this investigation.**

4.0 DESIGN RECOMMENDATIONS

4.1 Basis

Our recommendations are based on data presented in this report, which include soil borings, laboratory testing and our experience with similar projects. Subsurface variations that may not be indicated by a dispersive exploratory boring program can exist on any site. If such variations or unexpected conditions are encountered during construction, or if the project information is incorrect or changed, we should be informed immediately since the validity of our recommendations may be affected. Refer to Appendix B for additional qualifications and contractual considerations.

4.2 Foundations

4.2.1 Spread Footings

The proposed facility can be supported on spread footings bearing on native medium stiff to very stiff silty clay (CL), clayey silt (ML) or new structural fill overlying the same at normal shallow depths after some remediation. **Highly plastic (CH) fat clays should be over-excavated to a minimum depth of 24 inches below the foundation bearing elevation**

Additionally, soft soils that will not provide suitable support for structure foundations will likely be encountered in some foundation areas, such as the vicinity of borings B-4, B-5, B-9, B-10, B-11, B-25, and B-33. Any soft to very soft soils should be removed prior to construction of foundation elements or placement of grade-raise fill in foundation areas.

It should be noted that the grade-raise fill and structural loads could cause unacceptable settlement to occur at various locations throughout the site due to marl material (which can be highly compressible) encountered in seven (7) of the borings at various depths and thicknesses. Two (2) consolidation tests were performed on Shelby tube samples taken in the marl layer in B-5 and B-10 from 6.0 feet to 8.0 feet. (See the figure in appendix A.) The attached boring plan depicts locations and depths where marl material was encountered; however, it is possible that marl soils could exist between boring locations at areas not identified during this investigation.

Footings bearing on native medium stiff to stiff clay of low plasticity or on new structural fill may be proportioned using a net allowable soil bearing pressure not exceeding ***1,100*** pounds per square foot (psf) for column footings and ***1,000*** psf for strip (wall) footings. **However, total and differential settlements may exceed 1 inch and ¾ inch, respectively, at various locations due to the underlying marl layer as described in the following section. Please refer to the attached boring plan for more information in regards to boring locations where marl was encountered.**

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise the stress overlap must be considered in the design.

All exterior foundations and foundations in unheated areas should be located at a depth of at least 24 inches below final exterior grade for frost protection. We recommend that strip footings be at least 18 inches wide and column footings be at least 24 inches wide. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both during construction and after construction is complete.

4.2.2 Preloading & Spread Footing Foundations

We have analyzed the subsurface conditions for the purpose of developing recommendations for spread footing construction. However, when considering the significant depth and thickness of soft and loose, highly compressible clay soils within the proposed building pad area, the amount of grade-raise fill to be placed, and the anticipated structural loading conditions, utilization of over-excavation and replacement methods would likely be impractical and/or cost-prohibitive.

Thus, we recommend that the building lots be preloaded to induce settlement prior to construction of the residential dwellings. ***However, our preliminary analysis indicates that greater than 5 inches of settlement could be expected after placement of grade-raise fill and structure foundations, and the time frame to achieve a sufficient amount of consolidation settlement would likely be several months to one (1) year without the installation of wick drains to achieve 90 percent consolidation.*** Additionally, the load required to achieve sufficient settlement would be at least 1,000 pounds per square foot (psf). Nonetheless, properly designed and monitored preloading will allow the dwellings to be supported on spread footings using net allowable bearing pressure of 2,000 pounds per square foot (psf).

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise the stress overlap must be considered in the design.

All exterior foundations and foundations in unheated areas should be located at a depth of at least 24 inches below final exterior grade for frost protection. We recommend that strip footings be at least 18 inches wide and column footings be at least 24 inches wide. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both during construction and after construction is complete.

4.3 Slabs-on-Grade

In general, the shallow subgrade soils encountered during our investigation are suitable for floor slab support. **We recommend that any highly plastic (CH) fat clay and/or soft/very soft material encountered be over-excavated to a <u>minimum</u> depth of 24 inches below the granular base course and replaced with approved compacted structural fill.**

We recommend that all floor slabs be designed as "floating", that is, fully ground supported and not structurally connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slab because of differential movements between the slab and the foundation. Although the movements are estimated to be within the tolerable limits for the structural safety, such movements could be detrimental to the slabs if they were rigidly connected to the foundations.

The building floor slabs should be supported on a minimum 6-inch thick, granular base course, bearing on a suitably prepared subgrade (refer to Section 5.0 Construction Considerations). The granular base course is expected to help distribute loads and equalize moisture conditions beneath the slab. All slabs should be liberally jointed and designed with the appropriate reinforcement for the anticipated loading conditions.

4.4 Modulus of Subgrade Reaction

Provided that a minimum of 6 inches of crushed stone base is placed below the floor slab, a modulus of subgrade reaction, "K_{30}", value of 100 pounds per cubic inch (pci) is recommended for the design of ground supported floor slabs. It should be noted that the "K_{30}" modulus is based on a 30-inch diameter plate load test.

4.5 Pavements

The near surface soils encountered during our investigation are generally suitable for pavement support. **We recommend that any highly plastic (CH) fat clay and/or soft/very soft material encountered be over-excavated to a minimum depth of 24 inches below the granular base course and replaced with approved compacted structural fill.**

Based upon the near surface soil encountered in the borings, we recommend using a CBR value of ***3.0*** for flexible pavement design purposes. It should be recognized though, that the recommended CBR value is based on empirical relationships only, and laboratory CBR tests may determine a higher allowable CBR value.

Based on a 20-year design life, an equivalent single axle load (ESAL) value of 20,000 for heavy duty pavement, respectively, an annual growth rate of 3%, a reliability factor of 0.9, a subgrade drainage factor of 1.0, initial and terminal serviceability values of 4.0 and 2.0, and the previously discussed soil subgrade CBR

value, the following pavement thickness designs are recommended. The heavy duty ESAL is based on 1,794 passenger vehicles per day, 1 garbage truck per week, 1 delivery truck per day, and 1 moving truck per year per traffic information furnished by the Client.

Table 4 – Recommended Pavement Section Thicknesses

Type	Pavement Thickness (inches)		Crushed Stone Thickness (inches)
Concrete	4.5		6.0
Asphalt (Heavy Duty)	Surface	1.0	9.0
	Base	3.0	
Asphalt (Light Duty)	Surface	1.0	6.0
	Base	2.0	

If the resultant pavement thickness using any of these parameters is too great, this office should be contacted to determine if performance of a laboratory CBR test is appropriate.

If construction is performed during a wet or cold period, the contractor will need to exercise care during the grading and fill placement activities in order to achieve the necessary subgrade soil support for the pavement system (See Section 5.0 for Construction Considerations). The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly in order to provide good base drainage. To minimize the effects of groundwater or surface water conditions, the base section for the roadway should be sufficiently high above adjacent ditches and properly graded to provide pavement surface and pavement base drainage.

Our recommendations are based on the assumption that the paved areas will be constructed on proofrolled natural soils, or on structural fill overlying the same. Serviceable pavements can be achieved by different combinations of materials and thickness, varied to provide roughly equivalent strengths. In addition, local practice for existing pavement construction should be reviewed for other blends, combinations of materials that have been found satisfactory, and for applicable minimum standards.

4.6 Pond Liner

Boring B-34 was drilled in the area of the proposed retention pond and encountered moderately permeable to low permeability soils that should be generally suitable for use as pond liner. Pond side slopes should be no steeper than 3(H) to 1(V) and should be seeded as soon as possible after completion of grading to prevent erosion and sloughing.

The soil conditions encountered in our borings should be readily excavated using conventional earthwork equipment. It is that possible that groundwater will be encountered at normal retention pond depths, depending upon the weather and season.

4.7 Seismic Considerations

We have reviewed Section 1615 of the 2013 Kentucky Building Code (modified 2012 International Building Code) with respect to the subsurface conditions disclosed by our geotechnical investigation and the following recommendations and comments are presented for your use in developing the seismic design criteria for the structural design. For structural design purposes, we recommend using a **Site Class of C** as defined by the 2013 Kentucky Building Code. Other earthquake resistant design parameters should be applied consistent with the minimum requirements of the Kentucky Building Code. The Site Class was based on clay with an average undrained shear strength of 500 psf to a depth maximum depth of 10 feet edrock with an average shear wave velocity of 3,000 feet per second to a depth of 100 feet.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

All areas that will support foundations, floors, pavements or newly placed structural fill must be properly prepared. All loose surficial soil or "topsoil" and other unsuitable materials must be removed. Unsuitable materials include **highly plastic (CH) fat clay**, fill materials, frozen soil, **relatively soft material**, relatively wet soils, deleterious material, soils that exhibit a high organic content.

Prior to construction of floor slabs or pavements or the placement of new structural fill, the exposed subgrade must be evaluated by the Patriot representative, which will include proofrolling of the subgrade. Proofrolling should

consist of repeated passes of a loaded, pneumatic-tired vehicle such as a tandem-axle dump-truck or scraper. The proofrolling operations should be observed by a *Patriot* representative, and the proofrolling vehicle should be loaded as directed by *Patriot*. Any area found to rut, pump, or deflect excessively should be compacted in-place or, if necessary, undercut and replaced with structural fill, compacted as specified below.

Care must be exercised during grading and fill placement operations. The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential problem depends to a great extent on the weather conditions prevailing during construction. The contractor must exercise discretion when selecting equipment sizes and also make a concerted effort to control construction traffic and surface water while the subgrade soils are exposed. We recommend that heavy construction equipment (i.e., dump trucks, scrapers, etc.) be rerouted away from the building and pavement areas. Minor remediation and repair of unsuitable subgrade conditions in the haul road areas prior to pavement or building pad construction should be anticipated. Exposed subgrade materials damaged or degraded by moving construction equipment should be repaired by undercutting and replacing with properly compacted new soil fill as outlined in the following paragraphs. Therefore, we recommend that site grading operations be performed during a dry season, if at all possible.

If project schedules preclude site grading during optimal weather conditions, our experience shows that typical silty clay soil during wet seasons (i.e., late fall through early spring) has a moisture content well above optimum required for compaction. The higher moisture content in the upper soil profile can easily cause degradation of the soil under normal construction traffic. Routine aeration methods do not adequately dry wet soil to meet optimum moisture for compaction under these conditions. During poor weather conditions, lime modification is usually the most cost effective subgrade stabilization (below 40° F). Where determined to be appropriate by laboratory testing, the lime should be incorporated into the existing on-site soil at a typical rate of approximately 5 percent by dry weight of soil to a depth of approximately 14 to 16 inches. The soil/lime mixture should be properly moistened in order to initiate the hydration of the lime, thoroughly mixed and then recompacted. The 5 percent rate is most common; however, some soil with lower clay content may require additional lime or cement. We recommend that appropriate laboratory

analysis be performed to determine the appropriate admixture and quantity. All soil modification should be performed by a specialty contractor with specific experience in the application of lime or cement stabilization methods.

If soil modification is required to stabilize the natural subgrade soil prior to the placement of grade raise fill, we recommend that all subsequent cohesive grade raise fill be modified similar to that of the natural subgrade. It has been our experience that untreated cohesive structural fill placed on top of stabilized soil may become unstable over time due to excessive moisture accumulation. The underlying stabilized soil acts as a barrier to natural water seepage into the soil profile, thereby trapping the water within the structural fill to the point of saturation.

5.2 Foundation Excavations

Upon completion of the foundation excavations and prior to the placement of reinforcing steel, a *Patriot* representative should check the exposed to confirm that a bearing surface of adequate strength has been reached and that no highly plastic (CH) of fill soils are encountered. The cavity should be backfilled with structural fill as defined below, or the footing can be poured at the excavated depth. Structural fill used as backfill beneath footings should be limited to lean clay (CL) or DGA placed and compacted in accordance with this report.

As was previously discussed, marl soils were encountered in seven (7) of the test borings for this investigation. However, it is possible that marl may exist between boring locations at areas not identified during this study. Thus, we recommend that each individual lot be subject to further geotechnical evaluation (which would include additional test borings) to determine if marl is present for areas not subjected to pre-loading.

If it is necessary to support spread footings on structural fill, the fill pad must extend laterally a minimum distance beyond the edge of the footing. The minimum structural pad width would correspond with a point at which an imaginary line extending downward from the outside edge of the footing at a 1H:2V slope intersects the surface of the natural soil. For example, if the depth to the bottom of excavation is 4 feet below the bottom of the foundation, the excavation would need to extend laterally beyond the edge of the footing at least 2 feet, as shown in Illustration A found at the conclusion of this report.

Excavation slopes should be maintained within OSHA requirements. In addition, we recommend that any surcharge fill or heavy equipment be kept at least 5 feet away from the edge of the excavation. Construction traffic on the exposed surface of the bearing soils will potentially cause some disturbance of the subgrade and consequently loss of bearing capacity. However, the degree of disturbance can be minimized by proper protection of the exposed surface.

5.3 Structural Fill and Fill Placement Control

Structural fill, defined as any fill that will support structural loads, should be clean and free of organic material, debris, deleterious materials and frozen soils. Samples of the proposed fill materials should be tested prior to initiating the earthwork and backfilling operations to determine the classification, natural and optimum moisture contents, maximum dry density and overall suitability as a structural fill. *Structural fill should have a liquid limit less than 40 and a plasticity index less than 20, an organic content of less than 4%, maximum particle size of 3 inches, and a maximum dry density of no less than 95 psf as determined by the standard proctor test (ASTM D698).*

All structural fill placed beneath floor slabs and above foundation bearing elevation should be compacted to at least 95 percent of its maximum Standard Proctor dry density (ASTM D-698). This minimum compaction requirement should be increased to 100 percent of the maximum Standard Proctor dry density for fill supporting footings, provided foundations are designed as outlined in Recommendations, Section 4.2.

It may be necessary to scarify and recompact the near surface soil prior to placement of the pavement sections. Any fill placed or recompacted within 1 ft of the base of the pavement section should also be compacted to at least 100 percent of the Standard Proctor maximum dry density. This can be reduced to 95 percent for engineered fill placed more than 1 ft below the base of the pavement section.

Fill placement control and field density (compaction) testing should be conducted by a *Patriot* representative during construction. Fill placement inspection should involve full-time observation of newly placed materials during fill and/or backfill operations to control lift thickness, material quality and compaction effort. Field density testing should be performed in accordance with ASTM D2922, nuclear gauge method, or ASTM 1556, sand-cone method. The frequency of testing should produce a minimum

of one (1) density test result per 2,500 square feet, per material-lift, and as necessary to adequately represent the area and compaction effort.

To achieve the recommended compaction of the structural fill, we suggest that the fill be placed and compacted in layers not exceeding eight inches in loose thickness. A Patriot soils engineer or his representative should monitor all fill placements.

5.4 Groundwater

Groundwater was encountered in borings B-4, B-5, B-7, B-9, B-10, B-11 and B-15 during drilling and/or upon the completion of drilling operations. The remaining borings did not encountered water during drilling and upon completion of drilling operations. Refer to Table 3 or the boring logs for more detailed information on the water depths encountered.

Groundwater inflow into shallow excavations above the groundwater table is expected to be adequately controlled by conventional methods such as gravity drainage and/or pumping from sumps. More significant inflow can be expected in deeper excavations below the groundwater table requiring more aggressive dewatering techniques, such as well or wellpoint systems. For groundwater to have minimal effects on the construction, foundation excavations should be constructed and poured in the same day, if possible.

6.0 INVESTIGATIONAL PROCEDURES

6.1 Field Work

A total of 34 borings were performed at the project site on July 14, 2014, July 15, 2014, July 16, 2014, and July 17, 2014 at the approximate locations shown on the Boring Location Plan in Appendix A. All borings were staked using a hand held GPS with accuracy of +/- 15 feet. The borings encountered auger refusal at the following depths: B-1, B-7, and B-9 at 9.0 feet; B-2 at 14.0 feet; B-3, B-28, and B-32 at 10.0 feet; B-4 at 13.3 feet; B-5 and B-20 at 12.0 feet; B-6 and B-25 at 12.2 feet; B-8 at 8.6 feet; B-10 at 9.5 feet; B-11 at 14.3 feet; B-12 at 13.0 feet; B-13 at 10.2 feet; B-14 and B-15 at 14.5 feet; B-16 at 12.1 feet; B-17 at 12.4 feet; B-18 at 9.6 feet; B-19 at 13.5 feet; B-21 at 9.2 feet; B-22 and B-29 at 11.0 feet; B-23 at 8.8 feet; B-26 at 8.0 feet; B-26 at 11.5 feet; B-27 and B-31 at 7.6 feet; B-30 at 11.8 feet; B-33 at 16.4 feet; and B-34 at 7.7 feet. All depths are given as feet below the existing ground surface. Three (3) offset borings

were performed to obtain undisturbed Shelby tube samples from borings B-5, B-9, and B-10.

The borings were advanced using 3¼" I.D. (inside diameter) hollow-stem augers. Samples were recovered in the undisturbed material below the bottom of the augers using the standard drive sample technique in accordance with ASTM D 1586. A 2" O.D. by $1^3/_8$" I.D. split-spoon sampler was driven a total of 18 inches with the number of blows of a 140-pound hammer falling 30 inches of penetration is the Standard Penetration Test result commonly referred to as the N-value (or blow-count). Split-spoon samples were recovered at 2.5-foot intervals, beginning at a depth of 1 foot below the existing surface grade, extending to a depth of 10 feet, and at 5-foot intervals thereafter to the termination of the boring. Water levels were monitored at each borehole location during drilling and upon completion of the boring. The boreholes were backfilled with auger cuttings prior to demobilization for safety considerations.

Upon completion of the boring program, all of the samples retrieved during drilling in this sampling program were returned to *Patriot*'s soils testing laboratory where they were visually examined and classified. A laboratory generated log of each boring was prepared based upon the driller's field log, laboratory test results, and our visual classification. Test boring logs and a description of the classification system are included in Appendix A in this report. Indicated on each log are the primary strata encountered, the approximate depth of each stratum change, depth of sample, the Standard Penetration Test results, groundwater conditions, and select laboratory test data. The laboratory logs were prepared for each boring giving the appropriate sample data and the textural description and classification.

6.2 Laboratory Testing

Representative samples recovered in the borings were selected for testing in the laboratory to evaluate their physical properties and engineering characteristics. Laboratory analyses included:

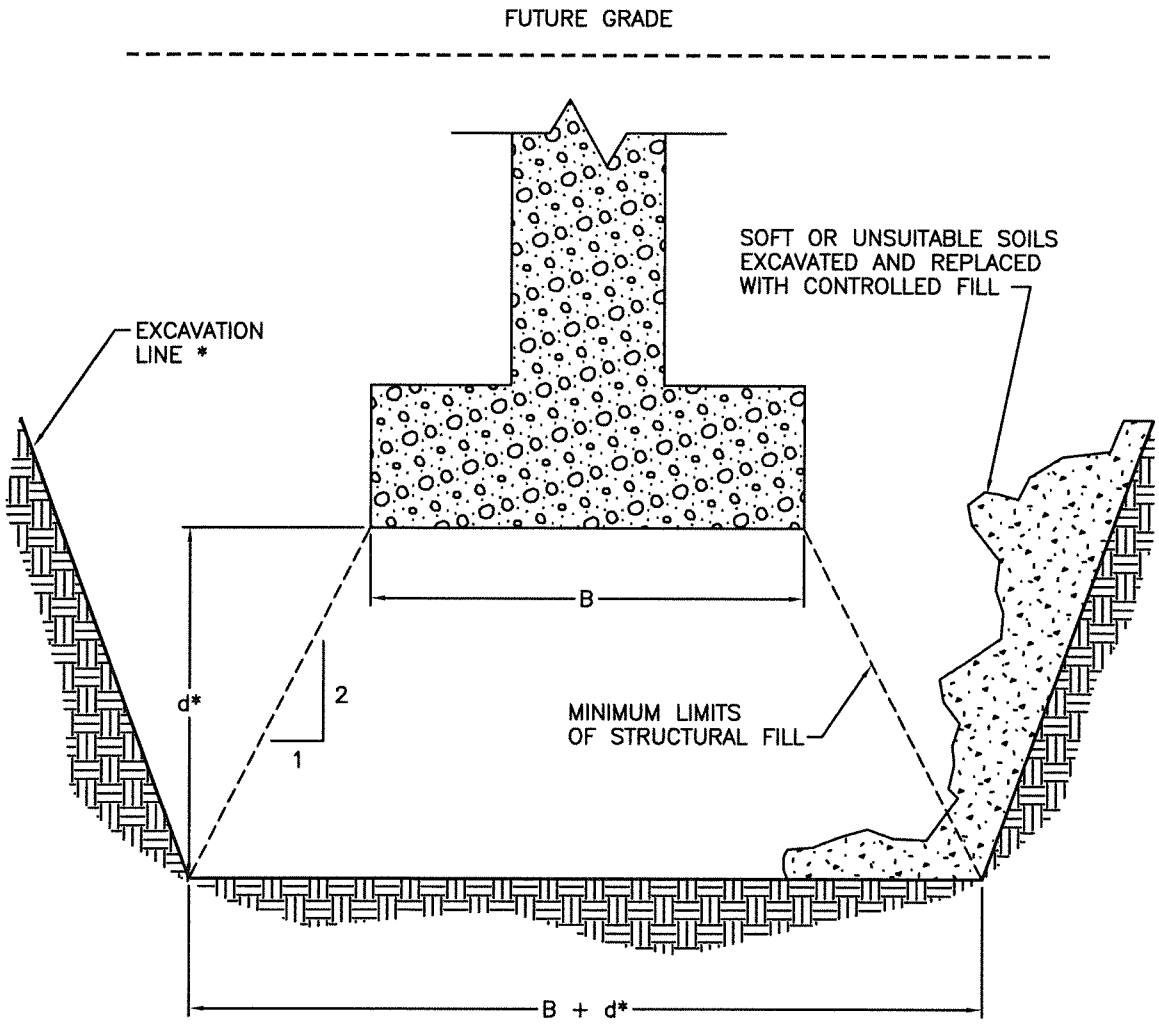
- Natural moisture content determinations (ASTM D 2216).
- An estimate of the unconfined compressive strength (q_u) of the cohesive soil samples utilizing a calibrated hand penetrometer.
- Determination of calcium carbonate content using sequential Loss of Ignition Test (ITM No. 507).

- One-Dimensional consolidation test (ASTM D2435).

The results of all laboratory tests are shown on the boring logs.

7.0 ILLUSTRATION

See Illustration A on the following page. The illustration is presented to further visually clarify the Construction Considerations presented in Section 5.2.



*d IS DEPTH TO SUITABLE SOILS

* IN COMPLIANCE WITH OSHA STANDARDS

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4735 Poplar Level Road, Suite 1
(502)961-5652 FAX (502)961-9256

Excavation for Footings In an Area of Fill ILLUSTRATION A

job. no.: PAT–UC

figure: 1

APPENDIX A

Site Vicinity Map

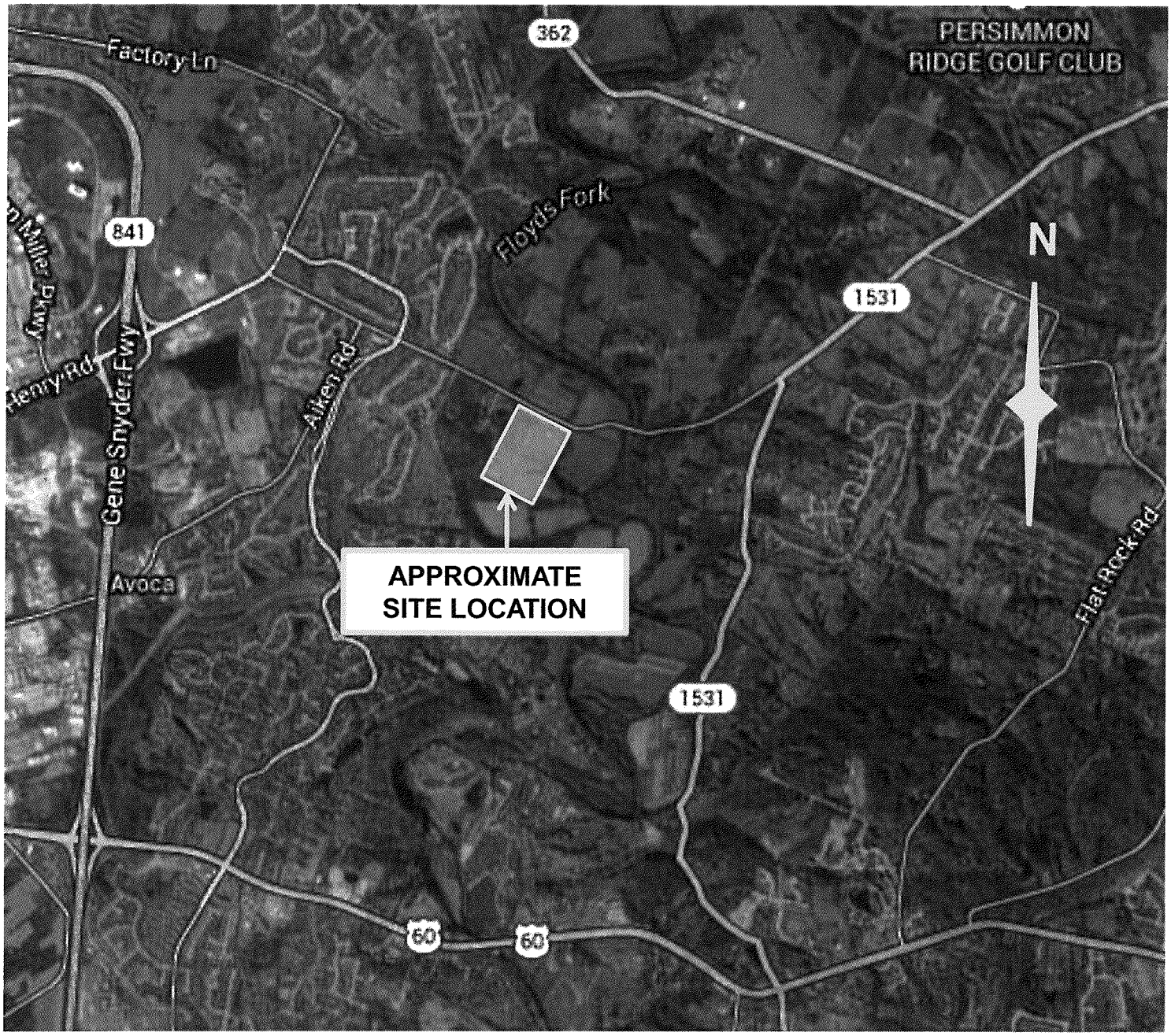
Boring Location Plan

Consolidation Test Results

Boring Logs

Boring Log Key

Unified Soils Classification (USCS)



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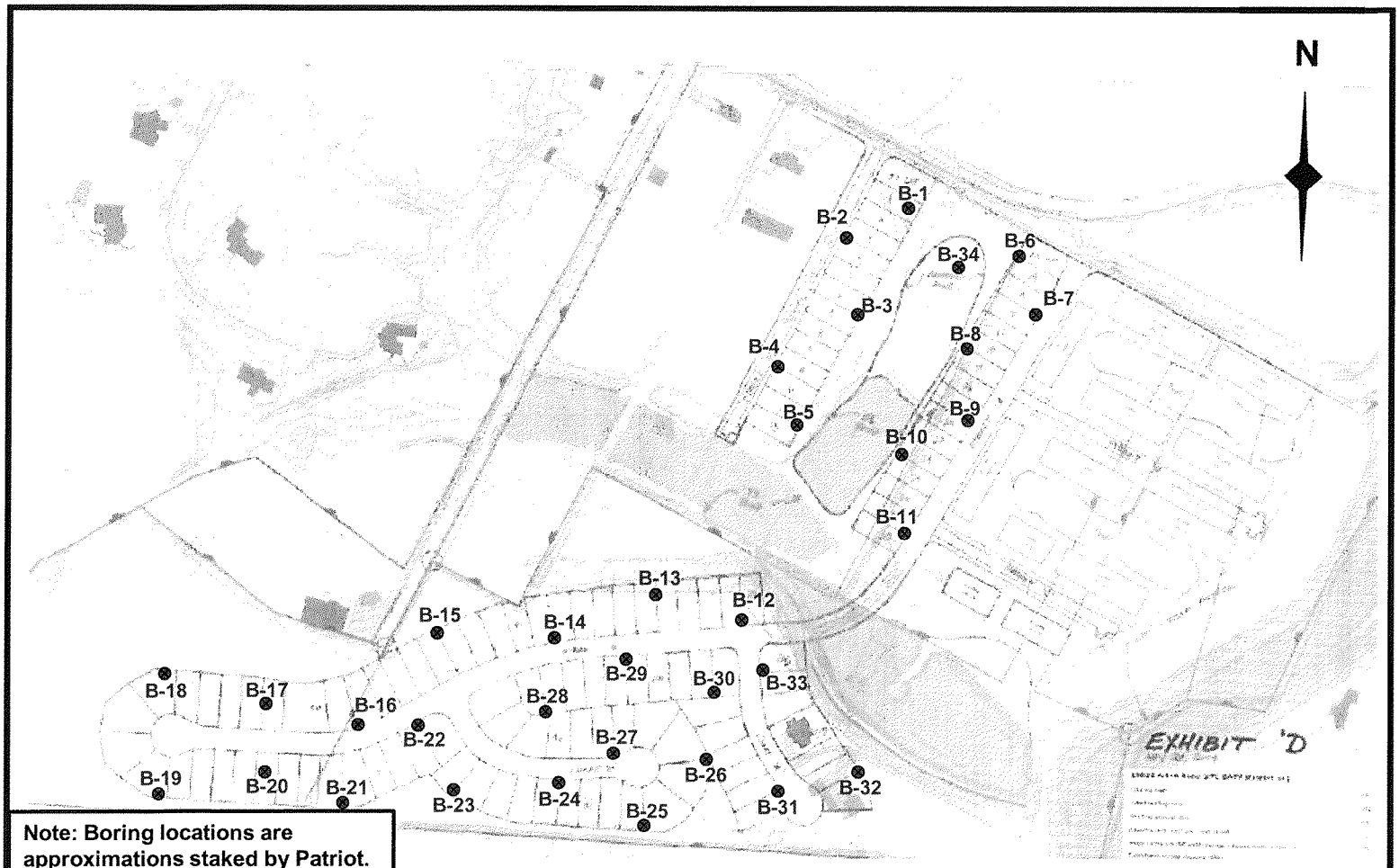
Site Vicinity Map

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Project No.: 5-14-0965

Figure: 1



Note: Boring locations are approximations staked by Patriot. Drawing not to scale.

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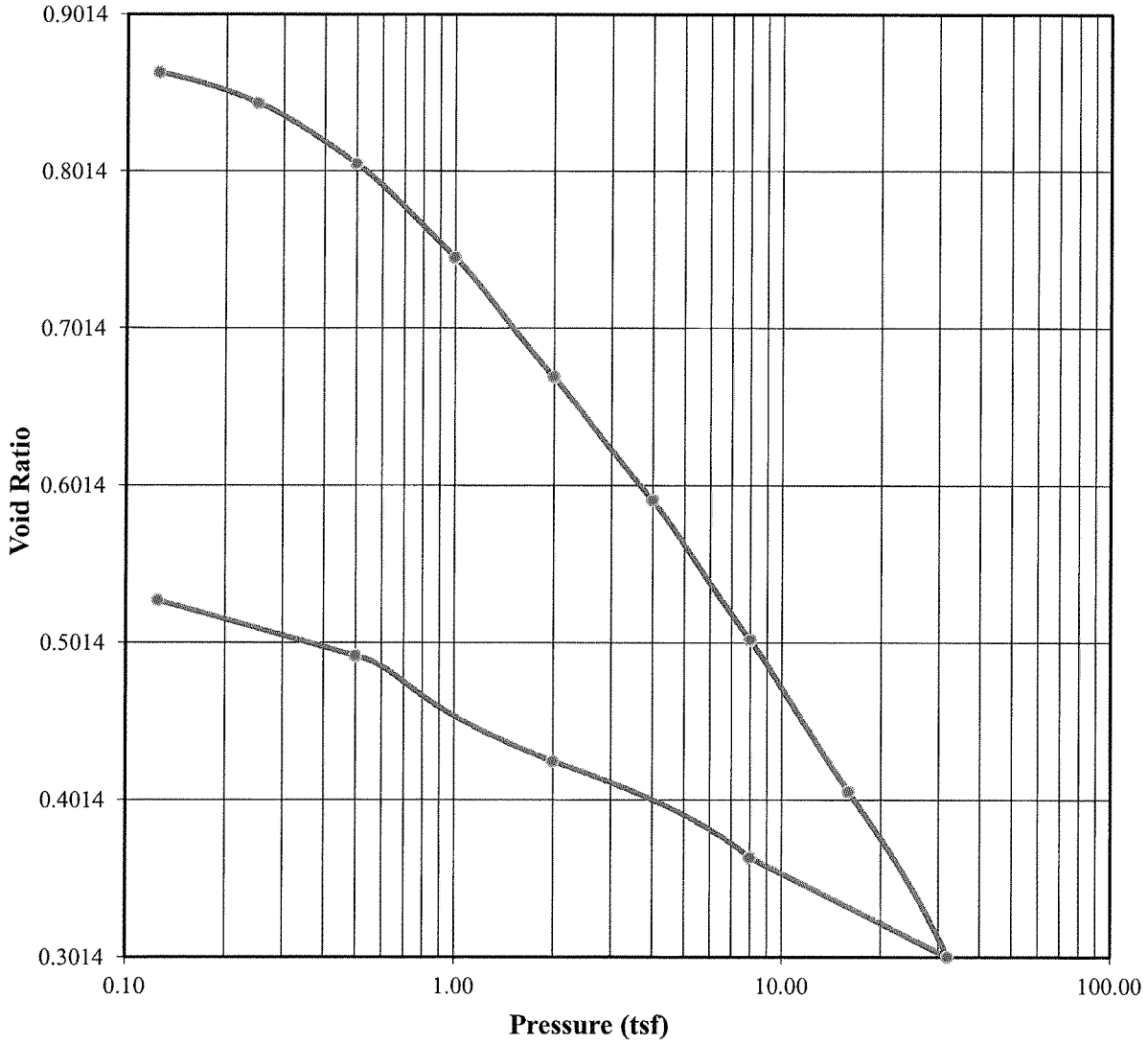
Boring Location Map
Stapleton Ridge
(Single Family)
Louisville, Kentucky

Project No.: 5-14-0965 | **Figure:** 2

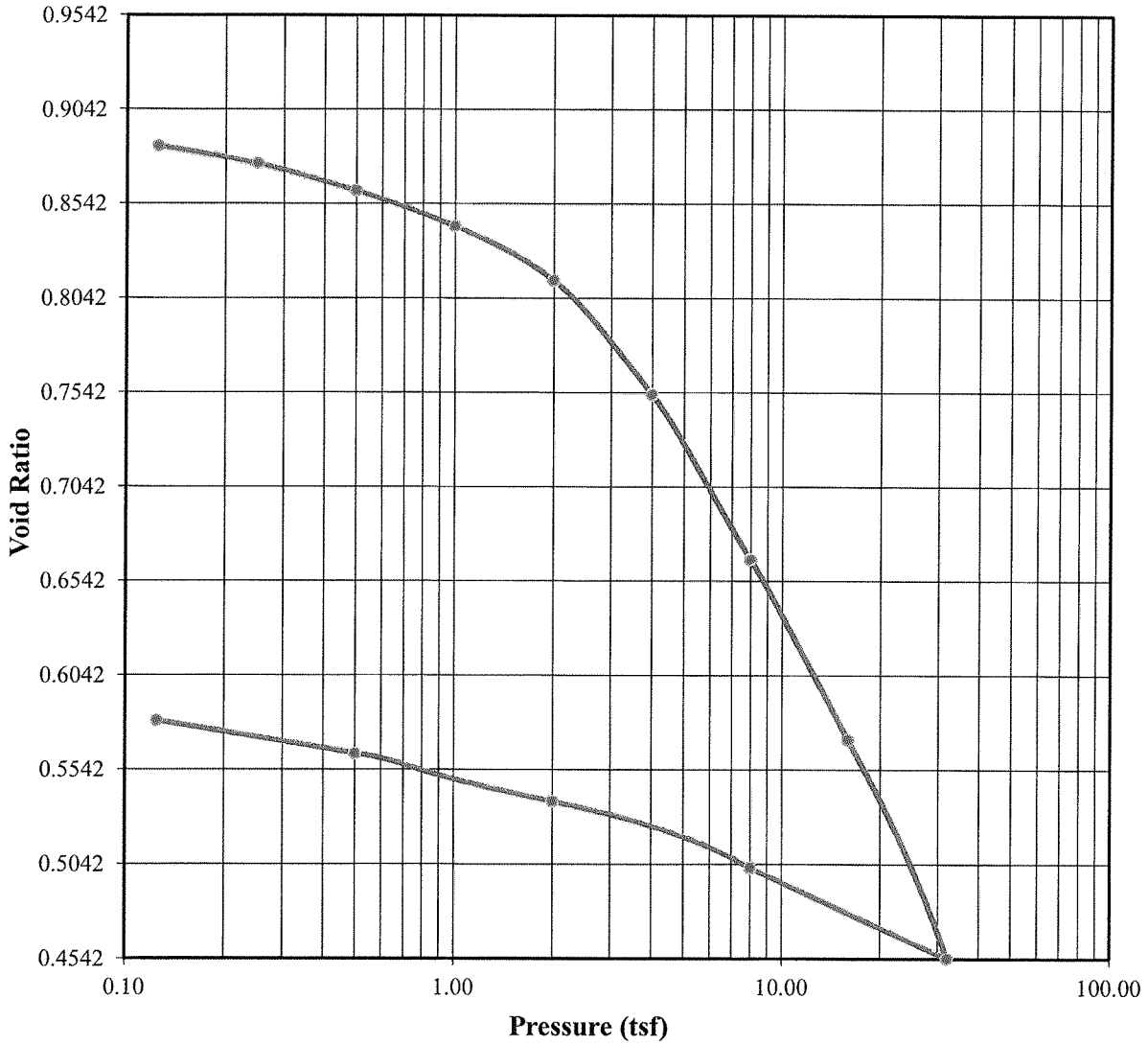
Consolidation Test
Test Results



	Before	After				
			Liquid Limits:		**Test Date:**	7/31/2014
Moisture (%):	24.83	26.24	**Plastic Limits:**			
Dry Density (pcf):	91.70	101.00	**Plasticity Index (%):**			
Saturation (%):	77.75	102.23				
Void Ratio:	0.8836	0.5310	**Specific Gravity:**	2.767	Measured	

Soil Description:	Brown and gray CLAY with little marl		
Project Number:	5-14-0965	**Depth:** 6.0-8.0 feet	**Remarks:**
Sample Number:		**Boring Number:** B-5	
Project:	Stapleton Ridge		
Client:	American Structurepoint		
Location:			

Consolidation Test
Test Results



	Before	After				
Moisture (%):	27.95	21.31	**Liquid Limits:**		**Test Date:**	7/28/2014
Dry Density (pcf):	91.98	109.89	**Plastic Limits:**			
Saturation (%):	86.98	101.14	**Plasticity Index (%):**			
Void Ratio:	0.8982	0.5822	**Specific Gravity:**	2.798	Measured	
Soil Description:	Brown and gray MARL with trace sand and trace shell fragments					
Project Number:	5-14-0965		**Depth:** 6.0-8.0 feet		**Remarks:**	
Sample Number:			**Boring Number:** B-10			
Project:	Stapleton Ridge					
Client:	American Structurepoint					
Location:						

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LOG OF BORING B-1

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.916'
Drilling Method	: HSA		: West -85deg. 28.154'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, light brown, moist, stiff to very stiff with traces of roots and black oxides (ALLUVIAL)	1	100	1/4/6	2.5	17	
5						2	100	5/8/9	>4.5	16	
			CL		SILTY CLAY, orangish brown/gray/dark brown, slightly moist, stiff	3	100	4/4/5	3.0	20	
			ML		CLAYEY SILT, grayish brown, slightly moist	4	17	(50/3")	-	12	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 9.0 feet. Boring Terminated at 9.0 feet.						
15											

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LOG OF BORING B-2

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.904'
Drilling Method	: HSA		: West -85deg. 28.179'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, medium stiff to stiff (ALLUVIAL)	1	100	2/3/4	-	20	
						2	100	4/6/6	3.25	23	
5			CL		SILTY CLAY, brown/dark brown, moist, stiff	3	100	4/5/7	-	25	
			CH		CLAY, brown, moist, stiff with traces of black oxides	4	100	2/5/7	3.0	22	
10			CL		SILTY CLAY, grayish brown, moist	5	11	(50/2")	>4.5	19	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 14.0 feet. Boring Terminated at 14.0 feet.						
15											

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LOG OF BORING B-3

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.874'
Drilling Method	: HSA		: West -85deg. 28.171'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff with traces of roots (ALLUVIAL)	1	100	3/5/5	>4.5	18	
			CL		SILTY CLAY, brown, moist, stiff with traces of oxides	2	100	3/4/5	3.25	22	
5			CH		CLAY, brown, moist, stiff with a trace of oxides and little shells	3	100	4/5/6	1.25	24	
			ML		CLAYEY SILT, light gray, slightly moist, hard with traces of weathered limestone	4	61	26/(50/5")	-	10	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 10.0 feet. Boring Terminated at 10.0 feet.						
15											

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LOG OF BORING B-4

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.853'
Drilling Method	: HSA		: West -85deg. 28.211'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	2/4/5	4.25	18	
5			CL			2	100	3/5/6	3.0	20	
			CL		SILTY CLAY, grayish brown, moist, medium stiff	3	100	3/3/3	1.5	26	
		▼	CL		SILTY CLAY, orangish brown with some light gray, very moist, soft (MARL)	4	100	2/1/3	0.5	32	
10											
15					Auger Refusal at 13.3 feet. Boring Terminated at 13.3 feet.						

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LOG OF BORING B-5

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.831'
Drilling Method	: HSA		: West -85deg. 28.200'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	5/5/5	>4.5	20	
			CL		SILTY CLAY, brown with a little gray, moist, stiff	2	100	5/6/6	-	26	
5											
			CL		SILTY CLAY, brown with some gray, very moist, soft to medium stiff with traces of shells (MARL)	3	100	2/1/3	0.75	28	Undisturbed Shelby tube obtained form 6.0 to 8.0 feet from offset boring. Marl content = 14%
			CL			4	100	8/3/2	-	23	
10											
15					Auger Refusal at 12.0 feet. Boring Terminated at 12.0 feet.						

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LOG OF BORING B-6

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.900'
Drilling Method	: HSA		: West -85deg. 28.095'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, medium stiff (ALLUVIAL)	1	100	3/3/4	-	21	
			CL		SILTY CLAY, brown, moist, stiff with traces of oxides and chert	2	100	3/5/8	3.5	22	
5			CH		CLAY, brown, moist, stiff with a trace of oxides and little shells	3	100	5/6/7	>4.5	23	
			CL		SILTY CLAY, light gray, moist, stiff with traces of weathered limestone	4	100	6/4/5	-	13	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 12.2 feet. Boring Terminated at 12.2 feet.						
15											

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LOG OF BORING B-7

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.877'
Drilling Method	: HSA		: West -85deg. 28.084'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, brown/light gray, slightly moist, medium stiff (ALLUVIAL)	1	100	3/3/4	-	21	
5			CL		SILTY CLAY, dark brown/light gray, moist, stiff	2	100	3/5/8	3.5	22	
			CH		CLAY, brown/light gray, moist, stiff	3	100	5/6/7	>4.5	23	
		▽	CL		SILTY CLAY, grayish brown, moist with traces of weathered limestone	4	100	6/4/5	-	13	
10					Auger Refusal at 9.0 feet. Boring Terminated at 9.0 feet.						
15											

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LOG OF BORING B-8

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.865'
Drilling Method	: HSA		: West -85deg. 28.118'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, grayish brown, slightly moist, very stiff (ALLUVIAL)	1	100	6/9/11	4.25	18	
			CL		SILTY CLAY, brown/light gray, moist, stiff with traces of oxides	2	100	6/7/8	2.75	20	
5			CH		CLAY, gary/brown, slightly moist, stiff	3	100	4/5/7	1.75	19	Groundwater was not encountered during drilling, nor upon completion.
			CL		SILTY CLAY, brown, moist	4	6	(50/1")	-	13	
10					Auger Refusal at 8.6 feet. Boring Terminated at 8.6 feet.						
15											

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LOG OF BORING B-9

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.835'
Drilling Method	: HSA		: West -85deg. 28.113'

Water Levels
- ▼ During Drilling
- ▽ After Completion
- ◆ After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff with traces of oxides (ALLUVIAL)	1	67	5/6/6	>4.5	23	
5			CL		SILTY CLAY, grayish/orangish brown, very moist, medium stiff to very soft with traces of chert (MARL)	2	100	4/3/4	1.0	25	
						3	100	1/1/1	0.5	29	Undisturbed Shelby tube obtained from 6.0 to 8.0 feet from offset boring. Marl content = 37%
		▽	CL		SILTY CLAY, grayish brown, moist with traces of weathered limestone	4	6	(50/2")	-	20	
10					Auger Refusal at 9.0 feet. Boring Terminated at 9.0 feet.						
15											

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LOG OF BORING B-10

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.821'
Drilling Method	: HSA		: West -85deg. 28.146'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	3/4/5	-	23	
			CL		SILTY CLAY, brown/dark brown, very moist, medium stiff (MARL)	2	100	3/3/4	1.25	27	
5		▽ ▼	CL		SILTY CLAY, grayish brown, very moist, soft with little shells (MARL)	3	100	2/1/2	<0.25	32	Undisturbed Shelby tube sample obtained from 6.0 to 8.0 feet from offset boring. Marl content = 55%
			LS		WEATHERED LIMESTONE, dark gary with some brown silty clay	4	33	12/(50/1")	-	20	
10					Auger Refusal at 9.5 feet. Boring Terminated at 9.5 feet.						
15											

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LOG OF BORING B-11

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/14/2014	Location	: North 38deg. 15.821'
Drilling Method	: HSA		: West -85deg. 28.146'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, dark gray, very moist, very soft (ALLUVIAL)	1	100	2/1/1	0.5	32	
			CL		SILTY CLAY, brown, moist, medium stiff (ALLUVIAL)	2	100	2/3/3	-	22	
5		▽	CL		SILTY CLAY, light brown, very moist, medium stiff with traces of oxides	3	100	2/3/4	-	25	
		▼	CL		SILTY CLAY, grayish brown, very moist, soft with traces of shells (MARL)	4	100	1/1/3	-	23	
10			SH		SHALE, weathered, gray	5	33	12/(50/1")	4.25	13	
					Auger Refusal at 14.3 feet. Boring Terminated at 14.3 feet.						
15											

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LOG OF BORING B-12

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.756'
Drilling Method	: HSA		: West -85deg. 28.221'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, light brown, slightly moist, stiff (ALLUVIAL)	1	100	3/4/5	-	14	
						2	100	6/7/8	2.0	15	
5			ML		CLAYEY SILT, light brown, moist, very stiff with traces of black oxides	3	100	8/10/11	-	18	
			CL		SILTY CLAY, brown, moist, stiff with traces of black oxides and shells	4	100	5/7/8	-	20	Groundwater was not encountered during drilling, nor upon completion.
10											
15					Auger Refusal at 13.0 feet. Boring Terminated at 13.0 feet.						

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LOG OF BORING B-13

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.763'
Drilling Method	: HSA		: West -85deg. 28.264'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, light brown, slightly moist, stiff (ALLUVIAL)	1	100	3/4/5	2.25	14	
5						2	100	5/5/5	-	15	
			CL		SILTY CLAY, gray and orangish brown, slighty moist, very stiff	3	100	5/5/12	>4.5	17	
10			CL		CLAYEY SILT, light gray, slightly moist, very stiff with traces of weathered limestone	4	89	7/14/(50/5")	-	15	Groundwater was not encountered during drilling, nor upon completion.
15					Auger Refusal at 10.2 feet. Boring Terminated at 10.2 feet.						

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LOG OF BORING B-14

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.746'
Drilling Method	: HSA		: West -85deg. 28.313'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, medium stiff (ALLUVIAL)	1	100	2/3/4	-	19	
						2	100	2/3/3	-	22	
5			CL		SILTY CLAY, light brown, slightly moist, stiff with traces of oxides	3	100	3/4/6	-	23	
			CH		CLAY, grayish and orangish brown, moist stiff	4	100	6/6/8	4.25	22	
10			CL		SILTY CLAY, light gray, moist, stiff with traces of weathered limestone	5	61	5/(50/5")	2.0	19	Groundwater was not encountered during drilling, nor upon completion.
15					Auger Refusal at 14.5 feet. Boring Terminated at 14.5 feet.						

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LOG OF BORING B-15

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.747'
Drilling Method	: HSA		: West -85deg. 28.370'

Water Levels
▼ During Drilling
▽ After Completion
◆ After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, medium stiff (ALLUVIAL)	1	100	3/3/3	-	18	
			CL		SILTY CLAY, light brown/dark brown, slightly moist, medium stiff	2	100	2/2/4	-	23	
5											
			CH		CLAY, light brown, moist to very moist, stiff with traces of oxides	3	100	3/5/9	3.25	24	
		▽				4	100	3/5/7	4.0	28	
10											
			CL		SILTY CLAY, grayish brown, saturated, medium stiff with traces of weathered limestone	5	44	5/(50/3")	1.0	15	
15					Auger Refusal at 14.5 feet. Boring Terminated at 14.5 feet.						

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LOG OF BORING B-16

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.710'
Drilling Method	: HSA		: West -85deg. 28.407'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	3/4/5	1.5	16	
			ML		CLAYEY SILT, light brown, moist, medium stiff (ALLUVIAL)	2	100	3/3/3	-	21	
5											
			CL		SILTY CLAY, light brown, moist to very moist, medium stiff to stiff, with traces of oxides	3	100	3/3/5	-	25	
						4	100	5/5/7	2.25	23	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 12.1 feet. Boring Terminated at 12.1 feet.						
15											

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LOG OF BORING B-17

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.721'
Drilling Method	: HSA		: West -85deg. 28.456'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff with traces of black oxides (ALLUVIAL)	1	100	4/5/6	-	18	
						2	100	4/4/5	-	21	
5			CH		CLAY, brown, moist, stiff with traces of black oxides	3	100	3/6/6	3.25	23	
			CL		SILTY CLAY, light brown/dark brown, very moist, stiff	4	100	3/4/5	2.75	29	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 12.4 feet. Boring Terminated at 12.4 feet.						
15											

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LOG OF BORING B-18

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/17/2014	Location	: North 38deg. 15.727'
Drilling Method	: HSA		: West -85deg. 28.502'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	3/5/5	3.75	19	
5			CL		SILTY CLAY, light brown, moist, medium stiff with traces of black oxides	2	100	2/3/4	-	21	
			CL		SILTY CLAY, orange/grayish brown, very moist, stiff	3	100	5/6/7	3.75	26	
			CL		SILTY CLAY, light gray, moist, hard with traces of weathered limestone	4	44	33/(50/3")	-	7	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 9.6 feet. Boring Terminated at 9.6 feet.						
15											

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LOG OF BORING B-19

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.707'
Drilling Method	: HSA		: West -85deg. 28.509'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, brown, moist, stiff (ALLUVIAL)	1	100	3/5/6	2.75	17	
						2	100	4/5/6	-	19	
5			CL		SILTY CLAY, light brown/dark brown, moist, very stiff with little shells	3	100	5/8/9	>4.5	26	
			CL		SILTY CLAY, gray, very moist, medium stiff with little shells (MARL)	4	100	3/3/4	-	32	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 13.5 feet. Boring Terminated at 13.5 feet.						
15											

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LOG OF BORING B-20

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.702'
Drilling Method	: HSA		: West -85deg. 28.459'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, brown to light brown, moist, stiff (ALLUVIAL)	1	100	5/6/6	-	18	
						2	100	4/5/6	3.5	19	
5			CL		SILTY CLAY, brown, moist, stiff	3	100	4/5/6	3.25	24	
			CH		CLAY, light gray/orange, moist, stiff	4	100	2/4/6	3.75	24	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 12.0 feet. Boring Terminated at 12.0 feet.						
15											

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LOG OF BORING B-21

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.679'
Drilling Method	: HSA		: West -85deg. 28.411'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, light brown, slighty moist, medium stiff (ALLUVIAL)	1	100	4/4/4	-	18	
			CL		SILTY CLAY, light brown/dark brown, moist, stiff with traces of black oxides	2	100	4/5/6	4.0	24	
5			CH		CLAY, gray/orange, moist, stiff	3	100	4/4/6	3.0	26	
			ML		CLAYEY SILT, dark gray, moist with traces of weathered limestone	4	39	14/(50/1")	-	14	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 9.2 feet. Boring Terminated at 9.2 feet.						
15											

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LOG OF BORING B-22

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.712'
Drilling Method	: HSA		: West -85deg. 28.376'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, orange/gray, moist, stiff (ALLUVIAL)	1	100	3/4/5	1.75	21	
			ML		CLAYEY SILT, light gray/black, moist, stiff with traces of black oxides	2	100	3/8/10	3.5	20	
5			CL		SILTY CLAY, orangish brown/gray, very moist, stiff with traces of black oxides and shells (MARL)	3	100	3/5/5	2.75	25	
			CL		SILTY CLAY, light gray, moist, stiff	4	100	3/5/5	3.5	27	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 11.0 feet. Boring Terminated at 11.0 feet.						
15											

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LOG OF BORING B-23

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.686'
Drilling Method	: HSA		: West -85deg. 28.359'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, light grayish brown, moist, medium stiff (ALLUVIAL)	1	100	3/4/5	1.75	21	
5			CL		SILTY CLAY, gray/orangish brown, moist, stiff with traces of black oxides	2	100	3/8/10	3.5	20	
			CH		CLAY, gray/orangish brown, moist, stiff with traces of black oxides	3	100	3/5/5	2.75	25	
			ML		SILT, lgith gray, slightly moist	4	100	3/5/5	3.5	27	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 8.8 feet. Boring Terminated at 8.8 feet.						
15											

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LOG OF BORING B-24

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.692'
Drilling Method	: HSA		: West -85deg. 28.308'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, gray with some brown, moist, medium stiff with traces of black oxides (ALLUVIAL)	1	100	1/3/5	-	22	
			CH		CLAY, grayish brown, moist, stiff	2	100	4/5/6	4.0	20	
5			CL		SILTY CLAY, light gray, very moist, stiff	3	100	5/5/7	1.5	17	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 8.0 feet. Boring Terminated at 8.0 feet.						
10											
15											

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LOG OF BORING B-25

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.676'
Drilling Method	: HSA		: West -85deg. 28.265'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, gray/orangish brown, moist, soft (ALLUVIAL)	1	100	1/1/2	-	25	
			CL		SILTY CLAY, gray, moist, stiff with traces of black oxides	2	100	3/4/5	3.5	24	
5											
			CH		CLAY, orange/gray, moist, stiff	3	100	4/5/6	3.0	26	
						4	100	3/5/7	2.5	23	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 12.2 feet. Boring Terminated at 12.2 feet.						
15											

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LOG OF BORING B-26

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.705'
Drilling Method	: HSA		: West -85deg. 28.235'

Water Levels
- ▼ During Drilling
- ▽ After Completion
- ◆ After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, brown, slightly moist, medium stiff with traces of black oxides (ALLUVIAL)	1	100	3/3/3	-	15	
						2	100	2/3/3	1.5	21	
5			CH		CLAY, brown, moist, stiff with traces of black oxides	3	100	6/6/8	3.25	21	
			CH		CLAY, light brown, moist, stiff	4	100	3/4/6	2.5	26	
10											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 11.5 feet. Boring Terminated at 11.5 feet.						
15											

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LOG OF BORING B-27

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.704'
Drilling Method	: HSA		: West -85deg. 28.235'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CH		CLAY, light brown, moist, stiff with traces of oxides	1	100	8/6/4	>4.5	18	
5			ML		CLAYEY SILT, light gray to brown, slightly moist, very stiff with traces of weathered limestone	2	100	6/13/13	2.5	18	
						3	28	(50/5")	>4.5	13	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 7.6 feet. Boring Terminated at 7.6 feet.						
15											

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LOG OF BORING B-28

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.718'
Drilling Method	: HSA		: West -85deg. 28.315'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, gray/orangish brown, moist, medium stiff (ALLUVIAL)	1	100	4/4/4	-	22	
5			ML		CLAYEY SILT, brown with some gray, moist, stiff (ALLUVIAL)	2	100	2/4/6	1.75	19	
			CH		CLAY, brown, moist, stiff with traces of oxides and shells	3	100	7/5/7	3.0	23	
10			CL		SILTY CLAY, brown, moist, stiff	4	-	4/5/(50/5")	0.75	18	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 10.0 feet. Boring Terminated at 10.0 feet.						
15											

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LOG OF BORING B-29

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.740'
Drilling Method	: HSA		: West -85deg. 28.277'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, light grayish brown, moist, stiff (ALLUVIAL)	1	100	3/4/6	3.0	18	
5			CL		SILTY CLAY, brown, slightly moist, stiff with traces of black oxides (ALLUVIAL)	2	100	5/5/4	-	19	
			CL		SILTY CLAY, light brown, very moist, stiff with little weathered limestone	3	100	4/7/7	3.25	18	
10						4	100	5/7/8	2.5	22	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 11.0 feet. Boring Terminated at 11.0 feet.						
15											

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LOG OF BORING B-30

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.728'
Drilling Method	: HSA		: West -85deg. 28.234'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, gray/orangish brown, moist, stiff (ALLUVIAL)	1	100	3/6/6	3.75	19	
5			CL		SILTY CLAY, brown, slightly moist, very stiff with traces of black oxides	2	100	4/7/9	4.25	22	
			CH		CLAY, brown with some gray, moist, stiff	3	100	2/4/6	3.0	28	
10						4	100	5/5/7	2.25	28	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 11.8 feet. Boring Terminated at 11.8 feet.						
15											

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PATRIOT ENGINEERING and Environmental Inc.

Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Louisville KY, Dayton OH, Nashville TN, Carmi, IL and New Orleans, LA

LOG OF BORING B-31

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.692'
Drilling Method	: HSA		: West -85deg. 28.202'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, brown, moist, stiff (ALLUVIAL)	1	100	4/5/6	3.25	25	
			CH		CLAY, brown, moist, stiff with traces of black oxides	2	100	4/4/5	-	25	
5			CH		CLAY, gray/orangish brown, moist	3	56	4/(50/4")	3.25	21	Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 7.6 feet. Boring Terminated at 7.6 feet.						
10											
15											

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PATRIOT ENGINEERING and Environmental Inc.

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LOG OF BORING B-32

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/16/2014	Location	: North 38deg. 15.700'
Drilling Method	: HSA		: West -85deg. 28.2162'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		SILTY CLAY, gray/orangish brown, moist, medium stiff (ALLUVIAL)	1	100	2/3/3	-	24	
			CL		SILTY CLAY, light gray/brown, mist, stiff with traces of black oxides	2	100	3/5/6	3.0	17	
5			CH		CLAY, gray, moist, stiff with traces of oxides and chert	3	100	4/5/5	2.75	21	
			ML		CLAYEY SILT, grayish brown, slightly moist, very stiff	4	78	10/10/(50/3")	3.5	18	Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 10.0 feet. Boring Terminated at 10.0 feet.						
15											

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PATRIOT ENGINEERING and Environmental Inc.

Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Louisville KY, Dayton OH, Nashville TN, Carmi, IL and New Orleans, LA

LOG OF BORING B-33

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.737'
Drilling Method	: HSA		: West -85deg. 28.2211'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			ML		CLAYEY SILT, brown to light grayish brown, slightly moist, stiff to very stiff	1	100	4/6/7	3.0	15	
						2	100	7/8/11	-	18	
5			ML		CLAYEY SILT, brown with some gray, slightly moist, very stiff with traces of black oxides	3	100	9/9/10	>4.5	19	
			CH		CLAY, brown/dark brown, slightly moist, stiff	4	100	4/5/7	>4.5	22	
10											
			CL		SILTY CLAY, grayish brown, very moist, soft with traces of weathered limestone (MARL)	5	100	2/2/2	-	23	
15											Groundwater was not encountered during drilling, nor upon completion.
					Auger Refusal at 16.4 feet. Boring Terminated at 16.4 feet.						

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PATRIOT ENGINEERING and Environmental Inc.

Indianapolis, Terre Haute, Evansville, Fort Wayne, Lafayette, Louisville KY, Dayton OH, Nashville TN, Carmi, IL and New Orleans, LA

LOG OF BORING B-34

Stapleton Ridge
(Single Family)
Louisville, Kentucky

Client Name	: American Structurepoint Inc.	Driller	: R. Mathes
Project Number	: 5-14-0965	Sampling	: Splitspoon
Logged By	: A. Hopf	Drill Rig	: B-53
Start Date	: 7/15/2014	Location	: North 38deg. 15.896'
Drilling Method	: HSA		: West -85deg. 28.2115'

Water Levels
- During Drilling
- After Completion
- After 24 Hours

Depth in Feet	Surf. Elev.	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					Topsoil (8")						
			CL		CLAYEY SILT, brown, moist, medium stiff (ALLUVIAL)	1	100	1/3/4	1.0	22	Atterberg Limits: LL=44, PL=31, PI=21
5			CH		SILTY CLAY, light brown, slightly moist, stiff	2	100	5/6/7	3.25	23	Atterberg Limits: LL=63, PL=25, PI=38
			CH		CLAY, gray/brown, moist with traces of weathered limestone	3	50	4/7/(50/3")	2.75	24	Atterberg Limits: LL=56, PL=26, PI=30 Groundwater was not encountered during drilling, nor upon completion.
10					Auger Refusal at 7.7 feet. Boring Terminated at 7.7 feet.						
15											

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PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	-4 blows/ft. or less
Loose	-5 to 10 blows/ft.
Medium Dense	-11 to 30 blows/ft.
Dense	-31 to 50 blows/ft.
Very Dense	-51 blows/ft. or more

Grain Size Terminology

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Small	4.76mm to ¾"	#4 to ¾"
Sand: Coarse	2.00mm to 4.76mm	#10 to #4
Medium	0.42mm to 2.00mm	#40 to #10
Fine	0.074mm to 0.42mm	#200 to #40
Silt	0.005mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005mm	Smaller than #200

RELATIVE PROPORTIONS FOR SOILS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Unconfined Compressive Strength (tons/sq. ft.)	Field Identification (Approx.) SPT Blows/ft.
Very Soft	Less than 0.25	0 - 2
Soft	0.25 – < 0.5	3 - 4
Medium Stiff	0.5 - < 1.0	5 - 8
Stiff	1.0 - < 2.0	9 -15
Very Stiff	2.0 - < 4.0	16 - 30
Hard	Over 4.0	> 30

Classification on logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0" O.D., $1^{3/8}$" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for **Patriot** to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.).

Strata Changes - In the column "Soil Descriptions" on the drill log the horizontal lines represent strata changes. A solid line (———) represents an actually observed change, a dashed line (- - - - -) represents an estimated change.

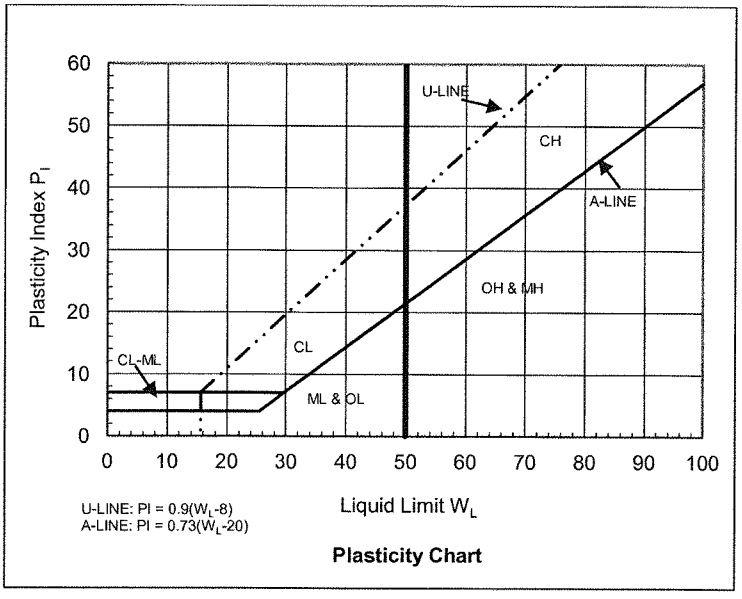
Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Groundwater symbols: ▼-observed groundwater elevation, encountered during drilling; ∇-observed groundwater elevation upon completion of boring.

PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

Unified Soil Classification

Major Divisions			Group Symbol		Typical Names	Classification Criteria for Coarse-Grained Soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U \geq 4$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{D^2_{30}}{D_{10} D_{60}}$
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW ($C_U < 4$ or $1 > C_C > 3$)		
		Gravels with fines (appreciable amount of fines)	GM	$\frac{d}{u}$	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Above A line with $4 < P_I < 7$ are borderline cases requiring use of dual symbols	
			GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line or $P_I > 7$		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U \geq 6$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{(D_{30})^2}{D_{10} D_{60}}$
			SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW ($C_U < 6$ or $1 > C_c > 3$)		
		Sands with fines (appreciable amount of fines)	SM	$\frac{d}{u}$	Silty sands, sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Limits plotting in hatched zone with $4 \leq P_I \leq 7$ are borderline cases requiring use of dual symbols	
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with $P_I > 7$		
Fine-grained soils (more than half of material is smaller than No. 200)	Silt and clays (liquid limit <50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5-12% - Borderline cases requiring dual symbols		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit >50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays or high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		PT		Peat and other highly organic soils			



Plasticity Chart

APPENDIX B

General Qualifications

and

Standard Clause for Unanticipated Subsurface Conditions

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.