

**GREENBAUM ASSOCIATES, INC.**  
**GEOTECHNICAL & MATERIALS ENGINEERS**

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December 22, 2021

Ms. Laura Barlow  
LDG Development, LLC  
1469 S. 4th St.  
Louisville, KY 40208

**SUBJECT: GEOTECHNICAL REPORT  
RESIDENTIAL DEVELOPMENT  
8300 COOPER CHAPEL ROAD  
LOUISVILLE, KENTUCKY  
GREENBAUM PROJECT NUMBER 21-273G**

Dear Ms. Barlow:

Attached is the report of the geotechnical investigation that we carried out for the above referenced multi-family residential development. Soils at this site are competent to support spread footings designed based on an allowable net bearing capacity of up to 3,000 pounds per square foot. Bedrock is relatively shallow across the site and fat clay frequently overlies the bedrock. Further detail on foundations and other geotechnical considerations are provided in the body of the attached report.

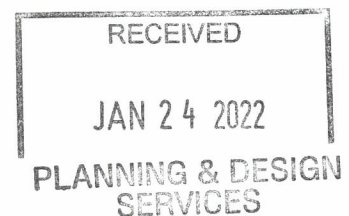
If you have any questions regarding this report, please call.

Sincerely,

**GREENBAUM ASSOCIATES, INC.**

*Sandor R. Greenbaum*

Sandor R. Greenbaum, P.E.  
Principal Engineer



*21-MSUB-0024*

**GEOTECHNICAL INVESTIGATION**

**FOR**

**RESIDENTIAL DEVELOPMENT**

**8300 COOPER CHAPEL ROAD**

**LOUISVILLE, KENTUCKY**

**FOR**

**LDG DEVELOPMENT LLC**

**1469 SOUTH 4<sup>TH</sup> STREET**

**LOUISVILLE, KY 40208**

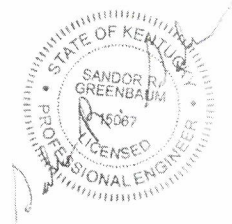
**BY**

**GREENBAUM ASSOCIATES, INC.**

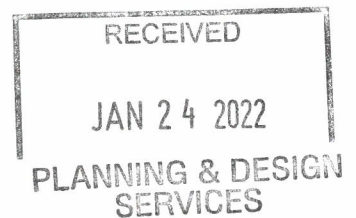
**994 LONGFIELD AVENUE**

**LOUISVILLE, KENTUCKY 40215**

**DECEMBER 22, 2021**



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21-MSUB-0024

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Boring Location Plan (1 sheet)

Site Geology (1 sheet)

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**1.0 Introduction**

LDG Development intends build a residential development to be located at 8300 Cooper Chapel Road in Louisville, Kentucky. The proposed development is for multi-family buildings at the center of the development surrounded by single-family residences. A boring location plan is included in the appendix of this report that shows the approximate locations of the borings and the proposed development. A site location plan is also included in the appendix of this report.

Most of the site is covered by tall weeds with much of the western portion covered by woods. Elevation varies from about 670 in the southeast portion of the site to below 580 at the stream that passes north to south across the western portion of the site. A number of karst features are present to the east of the stream, over the western portion of the site.

We were contracted by LDG Development to carry out a geotechnical investigation directed at determining the foundation support characteristics of the materials upon which these buildings and associated pavement will be supported. Work was coordinated through Ms. Laura Barlow of LDG Development.

**2.0 General Geology**

Soils at this site are shown by the Kentucky Geological Survey to be residuum, the residual product of weathering of the local bedrock. Bedrock is shown to be the Louisville Limestone over the bulk of the site with the underlying Waldron Shale and Laurel Dolomite exposed along the stream on the west side of the site (see included drawing of Site Geology). The Geological Survey describes the Louisville Limestone as:

Dolomitic limestone and dolomite, yellowish-gray, light-olive-gray, pale yellowish brown to very pale orange, very fine grained, argillaceous in part; stylolitic, very thin to thin bedded in upper part, very thick bedded near base; irregular rubbly bedding common, typified in exposures along Kentucky Turnpike; locally shaly in 10 foot zone about 20 feet above base; contains calcite filled pockets and thin veinlets of calcite; chert rare in lower beds but common in discontinuous 0.2 foot thick layers in uppermost few feet. Unit reportedly thickest in vicinity of abandoned quarry 1-mile due east of Hubers Kenlite Station. Supports broad westward dipping surface east of Kentucky Turnpike; outcrop areas locally marked by narrow, steep walled

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solution cavities and small sinks; some beds form continuous persistent ledges rimming steep walled stream valleys. One such ledge top approximately 40 feet above the base, another at about 60 feet above the base. Dolomitized fossils common as casts are abundant in some layers; include brachiopods, horn corals, colonial corals, chain corals, and algal mat remains. Basal contact with underlying shale distinct to gradational over as much as 2 feet.

The Geological Survey describes the Waldron Shale as:

Shale, medium gray, olive gray, and greenish gray to medium bluish gray, weathers yellowish gray; dolomitic, pyritic; near base of quarry exposure at north border of quadrangle unit contains dolomitized brachiopods, small crinoid stems, trilobite fragments, and dark to brownish gray organic discs less than 1 mm in diameter that resemble the palynomorph Tasmanites. Weathers in gentle slopes, locally forms bench; contact probably conformable. Soils on unit belong mainly to Beasley Series.

The Geological Survey describes the Laurel Dolomite as:

Dolomite and minor shale in three distinct parts: Uppermost part is dolomite, light olive gray to olive gray with dark gray mottling, weathers yellowish gray to grayish orange; finely crystalline to medium crystalline (0.02 to 0.25 mm); distinguished by even "quarry stone" bedding ranging in thickness from 0.2 to 2.8 feet; locally contains interbedded and intermixed oolitic dolomite in upper 1.5 feet; some beds contain stylolites. Bedding planes commonly accentuated by thin shale partings; burrows common. Middle part is moderate brown and medium gray to medium light gray dolomite that weathers yellowish gray to pale yellowish orange; mottled, vuggy, without distinct partings; calcitic; contains dolomitized brachiopods, cephalopods, trilobites; planar bedded finely crystalline limestone (calclutite) near base. Middle and basal parts of unit form massive ledges marked by honeycombed surface. Basal part, in descending order, is shale, dolomite, and shaly dolomite. Shale is dark greenish gray, weathers grayish yellow; dolomitic, calcareous; in a single bed 1.5 to 2.5 feet thick. Dolomite and shaly dolomite are greenish gray to light olive gray, weather same to grayish orange; finely crystalline to medium crystalline (0.02 to 0.25 mm); beds 0.3 to 2.0 feet thick. Basal contact gradational through as much as 3 feet with dolomitic shale and shaly dolomite of underlying formation; contact commonly coincides with break in slope. Soils developed on formation commonly include Russellville, Dickson, and Crider Series. Thickness of residuum generally ranges from 5 to 12 feet on uplands.

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**3.0 Investigation**

Twenty-seven borings were carried out across the site by standard penetration procedures to refusal on bedrock. A Diedrich D-25 track-mounted drill rig was used to carry out the borings through the use of 3 ¼-inch inside diameter hollow stem augers and an automatic hammer. The boring locations were staked using a nylon tape from existing topography, so boring locations are only as accurate as this method allows.

The standard penetration procedure involves driving a standard 2-inch diameter split spoon in the formation at selected intervals using a 140-pound hammer falling through 30 inches. The blow counts for each 6 inches of drive, to a total of 18 inches, are recorded and the number of blows for the 12 inches after the first 6 inches is a standard measure of the condition of the soil. As the split spoon is removed from the ground, it retrieves a sample of the soil in a disturbed condition. Nevertheless, this sample is suitable for certain classification tests and is representative of the soils at the depth tested.

Soil samples were returned to the laboratory where a program of testing was carried out. This testing included a grain size analysis, an Atterberg Limits' test and a natural moisture determination.

Grain size determination arrives at a curve of grain size against that fraction of the soil that is finer than that particular grain size. It also allows the determination of the clay fraction, silt fraction, sand fraction, etc. in any particular soil sample. Based on this division of grain sizes, the field soils classifications are refined and the boring logs adjusted. In the case of fine-grained soils, the soils are largely silt and clay; thus requiring that the soils be suspended in an aqueous medium and the rate at which the particles drop out is measured in order to arrive at the grain size distribution. Silt and clay grains are so fine that sieve analysis alone will not function in this range. The coarse fraction of this sample is separated from the fine and run through a nest of sieves in order to further detail the grain size distribution in the coarse range. In this case only the sieve analysis portion of the test was performed since little sand and silt was present in the soil samples selected for testing.

The Atterberg Limits' determination arrives at those moisture contents at which the soil turns from a solid state to a plastic condition (the Plastic Limit) and then from a plastic condition to a liquid condition (The Liquid Limit). The points in question are arrived at by standard procedures that accept specific cohesive and flow properties of the soil as standards for these limits. Knowing the moisture content of the soil in relation to these limits provides a broad measure of the soil

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strength and soil characteristics. The arithmetic difference between these two limits is called the Plasticity Index and all three together are used for classifying the soils in a number of standard systems.

The natural moisture determination arrives at the in-situ moisture content of the soil and is useful for correlating the strength of various samples of like texture and in conjunction with the Atterberg limits, gives a strong measure of the strength range the soils are likely to be found in.

## **4.0 Findings**

### **4.1 Boring Results**

This site is generally covered by about 5- to 6-inches of topsoil. Below this, soil is moist, stiff, brown or brown and gray mottled, lean clay or moist, medium dense, brown, silt. Soils near the bedrock are frequently moist, stiff to very stiff, tan, fat clay. Since bedrock is shallow, fat clay can sometimes be quite shallow as well. Auger refusal was encountered between 1.0- and 8.3-feet depth. Groundwater was not encountered in any borings but may be present seasonally.

The tables below and continued on at the top of the following page provide a tabulation of N-values as measured by the standard penetration test, corrected for the energy of the automatic hammer, along with depth to auger refusal.

<b>Depth</b>	<b>B-01</b>	<b>B-02</b>	<b>B-03</b>	<b>B-04</b>	<b>B-05</b>	<b>B-06</b>	<b>B-07</b>	<b>B-08</b>	<b>B-09</b>
1 – 2.5 feet	12	50/3"	23	20	12	12	12	10	13
3.5 – 5 feet	12		25	20	18	50/3"	14	10	
6 – 7.5 feet	21			50/4"	50/3"			50/0"	
Auger Refusal	7.7'	1.6'	5.5'	6.3'	6.3'	4.5'	5.7'	6.0'	4.4'

<b>Depth</b>	<b>B-10</b>	<b>B-11</b>	<b>B-12</b>	<b>B-13</b>	<b>B-14</b>	<b>B-15</b>	<b>B-16</b>	<b>B-17</b>	<b>B-18</b>
1 – 2.5 feet	14	14	10	13	10	8	13	8	10
3.5 – 5 feet	16	20	17	17	12	50/0"	14		
6 – 7.5 feet		50/3"	13	50/1"	13				
Auger Refusal	6.0'	6.3'	8.3'	6.1'	8.3'	4.5'	5.8'	3.0'	3.5'

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Depth	B-19	B-20	B-21	B-22	B-23	B-24	B-25	B-26	B-27
1 – 2.5 feet		31	14	14	50/0"	50/3"	50/5"		50/2"
3.5 – 5 feet			17	21					
6 – 7.5 feet				26					
Auger Refusal	0.7'	3.0'	6.0'	7.6'	1.5'	3.9'	3.2'	1.0'	3.3'

#### 4.2 Laboratory Results

A sample of soil from shallow depth was tested and classified and was found to be lean clay. The result of this testing is summarized in the table below with more detailed results provided in the appendix of this report. Moisture content is shown graphically on the boring logs.

Soil Sample	Grain Size Distribution			Atterberg Limits			Soil Classification	
	Percent Sand	Percent Silt	Percent Clay	Liquid Limit	Plastic Limit	Plasticity Index	Unified	AASHTO
B-07 @ 1' – 2.5'	7	44	49	42	21	21	CL	A-7-6

#### 4.3 Seismicity

By the 2018 edition of the Kentucky/2015 International Building Code, this is a Very Dense Soil and Soft Rock Profile, Site Class C. The Spectral Response Acceleration Coefficients, for this area, as provided by U.S.G.S., FEMA Design Parameters are:

$$S_S = 0.200 \text{ g}$$

$$S_{MS} = 0.240 \text{ g}$$

$$S_{DS} = 0.160 \text{ g}$$

$$S_1 = 0.105 \text{ g}$$

$$S_{M1} = 0.177 \text{ g}$$

$$S_{D1} = 0.118 \text{ g}$$



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**5.0 Recommendations**

**5.1 Foundations**

These buildings may be supported on spread footings bearing on shallow soil or structural fill placed in accordance with section 5.3 of this report. These foundations may be designed based on an allowable net bearing capacity of up to 3,000 pounds per square foot.

Rock is relatively shallow across the site, as shallow as 1- to 3-feet in several locations. Where rock is encountered in foundation bearing surfaces it should be removed to a depth at least one foot below the foundation bearing surface and refilled with lean clay or sand compacted to between 88 and 92 percent of the soils maximum dry density as measured by the Standard Proctor (ASTM D-698). This will act as a cushion that will transition from soil bearing foundations to foundations bearing near bedrock to limit distress in the building. Otherwise, cracks could develop in the building where foundations go from soil bearing to rock bearing due to a rapid change in settlement.

Once foundation bearing surfaces are exposed, an engineer or senior engineering technician from this office should be present to view all bearing surfaces to determine the presence of soft soils. Where soft areas are encountered, undercut will need to extend to firm material or to a level determined to be acceptable by the geotechnical engineer and should be refilled with either lean concrete ( $f_c' = 2,000$  psi) or open-graded stone such as Number 57 stone.

Soil bearing foundations exposed to weather must bear at least 30 inches below finished grade in order to insulate the bearing strata from freezing. Interior foundations protected from freezing are exempt from this requirement. Continuous footings must be at least 16 inches wide and isolated footings must be at least 24 inches wide.

Settlement of foundations designed based on the above criteria should be below that which is considered acceptable for this type of construction; that is total settlement should be less than one inch and differential settlement should be less than three quarters of an inch.

For shallow foundations, friction along the base of the footing can be used to resist lateral forces. A friction coefficient of 0.35 may be used, which assumes that the footing concrete is placed directly against the natural cut faces. The coefficient of friction value recommended is an ultimate value and a minimum factor of safety of 1.5 must be applied when determining the allowable sliding resistance.

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## 5.2 Slab-On-Grade

Prior to placement of the fill in the slab area, the subgrade must be proofrolled and carefully examined by a geotechnical engineer for areas of soft or loose soil. If soft or loose soils are encountered, they must be undercut and refilled in accordance with instructions given by the geotechnical engineer's on-site representative. Undercut and refill in soft areas consists of excavating to a depth up to two feet below subgrade elevation and refill should be with "Surge Rock", 6-inch minus or Number 3 stone. Large rock should not be used in areas where trenching will be required to install piping or conduit.

Should fat clay be found to be in the subgrade of slab-on-grade, there are two means of preventing the problem of softening and swelling below the slab. These are:

- Lean clay should be used as fill in the top foot in fill areas and the top foot of soil in cut areas should be replaced with lean clay where fat clay is found to be present.
- The slab subgrade should be treated with 5 percent lime to at least 12 inches depth to modify the fat clay so that it is no longer subject to unacceptable volume change.

A slab-on-grade that is structurally separated from the walls, columns and foundations is preferable, though thickened slab may be used. Separation of slab-on-grade from foundations will minimize the stress caused by possible differential settlement between the slabs and the foundations and between adjacent slabs. A vapor barrier must be incorporated into the design and at least four inches of Dense Graded Aggregate (DGA) should underlie the slab. The floor slab may be designed based on a Modulus of Subgrade Reaction of 105 kips per cubic foot.

## 5.3 Site Preparation and Earthwork

Prior to fill placement all vegetation and topsoil (soil containing more than 4 percent organic content) must be removed from below the area to be filled. Where trees or bushes have been present, the entire rootball should be removed and the resulting excavation should be refilled with soil compacted as described in this section of the report. Then, prior to placement of fill, the exposed subgrade should be proofrolled by a fully loaded tri-axle truck to delineate any yielding or rutting areas that may require treatment such as undercut and refill or drying.

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All fill should be placed in lifts not exceeding 8 inches in uncompacted thickness and must be compacted to at least 98 percent of the soils maximum dry density as determined by the Standard Proctor (ASTM D-698). Soil moisture content should be within 2 percent of optimum as determined from the Standard Proctor.

Soil from any off-site borrow sources should be tested and approved by this office prior to being used on the site. Satisfactory borrow materials are those falling in one of the following classifications: GC, SM, SC, ML, or CL. Soil types MH, CH and OH soils and peat are unsatisfactory borrow materials.

Fill should be placed in horizontal lifts where fill is to be placed on a slope, horizontal benches should be cut into the slope to allow placement of horizontal lifts of soil. Fill slopes must not exceed two horizontal to one vertical, preferably 2.5- or 3-horizontal to one vertical to allow for mowing of the slopes with common equipment.

The site should be maintained in a well-drained condition both during and after construction. Site grading should provide for drainage of surface run-off away from the proposed buildings and pavement.

The placement of compacted fill should be carried out by an experienced excavator with the proper materials. The excavator must be prepared to adapt his procedures, equipment and materials to the type of project, to weather conditions, and the structural requirements of the engineer. Methods and materials used in summer may not be applicable in winter; soil used in proposed fill may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of this site. These needs should be addressed in the project drawings and specifications.

During freezing conditions, the fill must **not** be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer determines that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

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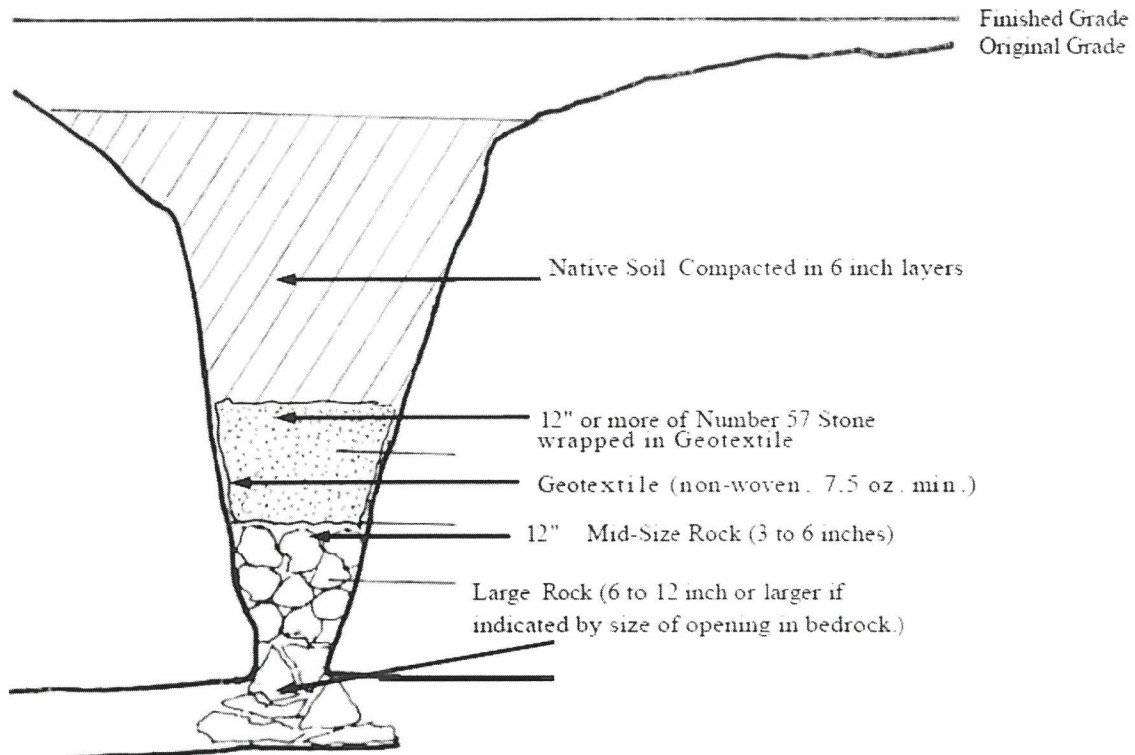
It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before **and** after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze **after** the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt) in the fill, the more critical is the need for protection from freezing.

The contractor should be required to adjust the moisture content of the soil to within a narrow range near the optimum moisture content (as defined by the applicable Proctor or AASHTO Test). In general, fill should be placed within 2% of optimum moisture. The need for moisture control is more critical as the percentage of fines increases. Naturally occurring cohesive/semi-cohesive soil are often much wetter than the optimum. Placing and attempting to compact such soils to the specified density may be difficult. Even if compacted to the specified density, excessively wet soils may not be suitable as pavement subgrades due to pumping under applied load. This is especially true when wet cohesive/semi-cohesive soil is used as backfill in utility trenches and like situations. Excessively wet soil in thick fill sections may cause post-construction settlement beyond that estimated for fill placed at or near ( $\pm 2\%$ ) the optimum moisture content.

#### **5.4 Dealing with Karst**

Several karst features are shown on the topographic survey of the site and were observed by a geotechnical engineer when boring locations were staked. If construction is to take place in the areas of these potential karst features are present, it will be necessary to expose the bedrock at these locations to determine if they are truly karst features or are due to another cause and, where karst features are present, install a filter in any crevices or openings in the bedrock. A diagram of a typical treatment of a karst feature using a filter is provided at the top of the following page. Treatment should be on a case-by-case basis under the guidance of a geotechnical engineer. We are available to assist you with the design of the filter at each of these locations. Such a filter will allow water to pass into the opening in the bedrock, but prevent erosion of soil, thus preventing subsidence at that location and making construction possible.

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## 5.5 Earth Pressures

Any retaining walls should be constructed with a drainage blanket of sand or a synthetic drainage material. Synthetic drainage media should be available from suppliers of geotextile. The wall should be drained at its base by a perforated PVC underdrain or weepholes at a spacing of not more than 10 feet. Where a relatively thin drainage blanket is used, the retaining wall should be designed based on a coefficient of active earth pressure ( $K_a$ ) of 0.36 and a soil unit weight ( $\gamma_w$ ) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 47 pounds per cubic foot. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45-degree angle, the retaining wall may be designed based on a coefficient of active earth pressure ( $K_a$ ) of 0.27 and a soil unit weight ( $\gamma_w$ ) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 35 pounds per cubic foot.

However, where the wall is restrained from movement, as in the case of building basement walls bearing against the basement slab or building frame, the wall must be designed based on the "at rest" earth pressure. The coefficient of "at

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rest" earth pressure ( $K_0$ ) is 0.47 with a soil unit weight ( $\gamma_w$ ) of 130 pounds per cubic foot in the case of a thin drainage blanket behind the wall, resulting in an equivalent fluid of 61 pounds per cubic foot unit weight. Where granular backfill completely fills the area defined by a plane extending upward from the base of the wall at a 45-degree angle, the retaining wall may be designed based on a coefficient of "at rest" earth pressure ( $K_0$ ) of 0.43 and a soil unit weight ( $\gamma_w$ ) of 130 pounds per cubic foot. This results in an equivalent fluid pressure of 56 pounds per cubic foot.

The table below summarizes the design earth pressures.

	Active Earth Pressure Coefficient ( $K_a$ )	Passive Earth Pressure Coefficient ( $K_p$ )	Coefficient of Earth Pressure at Rest ( $K_0$ )	Equivalent Fluid Pressure on Cantilever Walls	Equivalent Fluid Pressure on Braced Walls
Fill Material/Local Soils	0.36	2.77	0.47	47 pcf	61 pcf
Granular Backfill	0.27	3.69	0.43	35 pcf	56 pcf

Surcharge above the wall will add additional load. A uniform surcharge must be multiplied by the appropriate coefficient of earth pressure to determine the additional load applied to the wall.

Any retaining wall design must use appropriate factors of safety. It is critical that drainage be provided as mentioned earlier in this section in order to avoid hydrostatic pressure. Hydrostatic pressure would increase pressure against the wall substantially.

## 5.6 Light- and Heavy-Duty Pavement

Pavement subgrade should be examined and proofrolled as described under "Floor Slabs". If soft areas are encountered, the soft soils will need to be undercut and refilled in accordance with the instructions of the geotechnical engineer's on-site representative. Subgrade stabilization was discussed in section 5.2 for slab-on-grade. The same approach should be taken for pavement subgrade, but the requirement for a stable, non-yielding subgrade is even more important in the case of asphalt pavement.

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A pavement analysis was conducted using a life cycle of 20 years and a cumulative 18-kip equivalent single axle load of 20,000 for light traffic loads and 160,000 for moderate traffic loads. Recommendations are provided for both flexible and rigid pavement systems. However, rigid pavement should be used in special truck traffic areas, such as those areas which receive frequent traffic by garbage trucks. The concrete pavement should extend throughout the areas that require extensive turning and maneuvering of garbage trucks or other heavy trucks. Heavily loaded pavement areas that are not designed to accommodate these conditions often experience localized pavement failures, particularly if flexible pavement sections are used.

The minimum recommended thickness for both hot mixed asphalt concrete (HMAC) and reinforced Portland cement concrete (PCC) pavement sections are presented in the table at the top of the following page for the described light, moderate and special traffic condition.

<b>Recommended Pavement Section</b>					
<b>Component</b>	<b>Light</b>		<b>Moderate</b>		<b>Special</b>
	<b>Rigid</b>	<b>Flexible</b>	<b>Rigid</b>	<b>Flexible</b>	<b>Rigid</b>
Reinforced Portland Cement Concrete (PCC)	5 inches		6 inches		7 inches
Hot Mixed Asphalt Concrete (HMAC)		3 inches		4 inches	
Crushed Limestone Base (Dense Graded Aggregate)	4 inches	8 inches	4 inches	8 inches	4 inches

The Portland cement concrete should be air-entrained and conform to ASTM C-94 (Standard Specifications for Ready-Mixed Concrete) and have a minimum compressive strength of 4,000 pounds per square inch. Reinforcing should meet the requirements of ACI.

Hot mix asphalt concrete and Dense Graded Aggregate should meet the requirements of the Kentucky Transportation Cabinet. The top inch and a half of asphalt should be a surface mix, the remainder being a base mix.

### **5.7 Temporary Earth Slopes or Cuts**

Temporary earth cuts necessary to construct foundations or utility lines should be no deeper than 4 feet without benching or sloping. Cuts deeper than this should be sloped no steeper than one horizontal to one vertical or should have benches every 2 feet of height equating to this slope. If vertical faces deeper than

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4 feet are used, bracing designed for short term loads may be used. Excavations should comply with OSHA regulations.

**5.8 Limitations**

We strongly recommend that bearing surfaces and compaction be monitored by Greenbaum Associates, Inc. Our technicians will be available to further assist you in providing these and other normally specified quality control services. The report is preliminary until such time as these examinations are completed to confirm conditions consistent with those discovered in the investigation.

The conclusions and recommendations offered in this report are based on the subsurface conditions encountered in the borings. No warranties can be made regarding the continuity of conditions between or beyond borings. If, during construction, soil conditions are encountered that differ from those indicated in this report, a representative of Greenbaum Associates, Inc. should inspect the site to determine if design modification is required. In addition, only two borings were performed, this being a preliminary study. Additional borings and analysis will be required prior to final design and construction.

This study was directed at specific buildings and pavement at specific locations on this site to be constructed within a reasonably short period after this study. Use for any other location, structures or substantial changes in construction period may invalidate the recommendations. The geotechnical engineer should be consulted relative to any substantial change in these.

This study is directed at mechanical properties of the soils and includes no sampling, testing or evaluation for environmental considerations.





**LDG Development,  
LLC**



**Greenbaum  
Associates, Inc.**

**Site Location Plan**

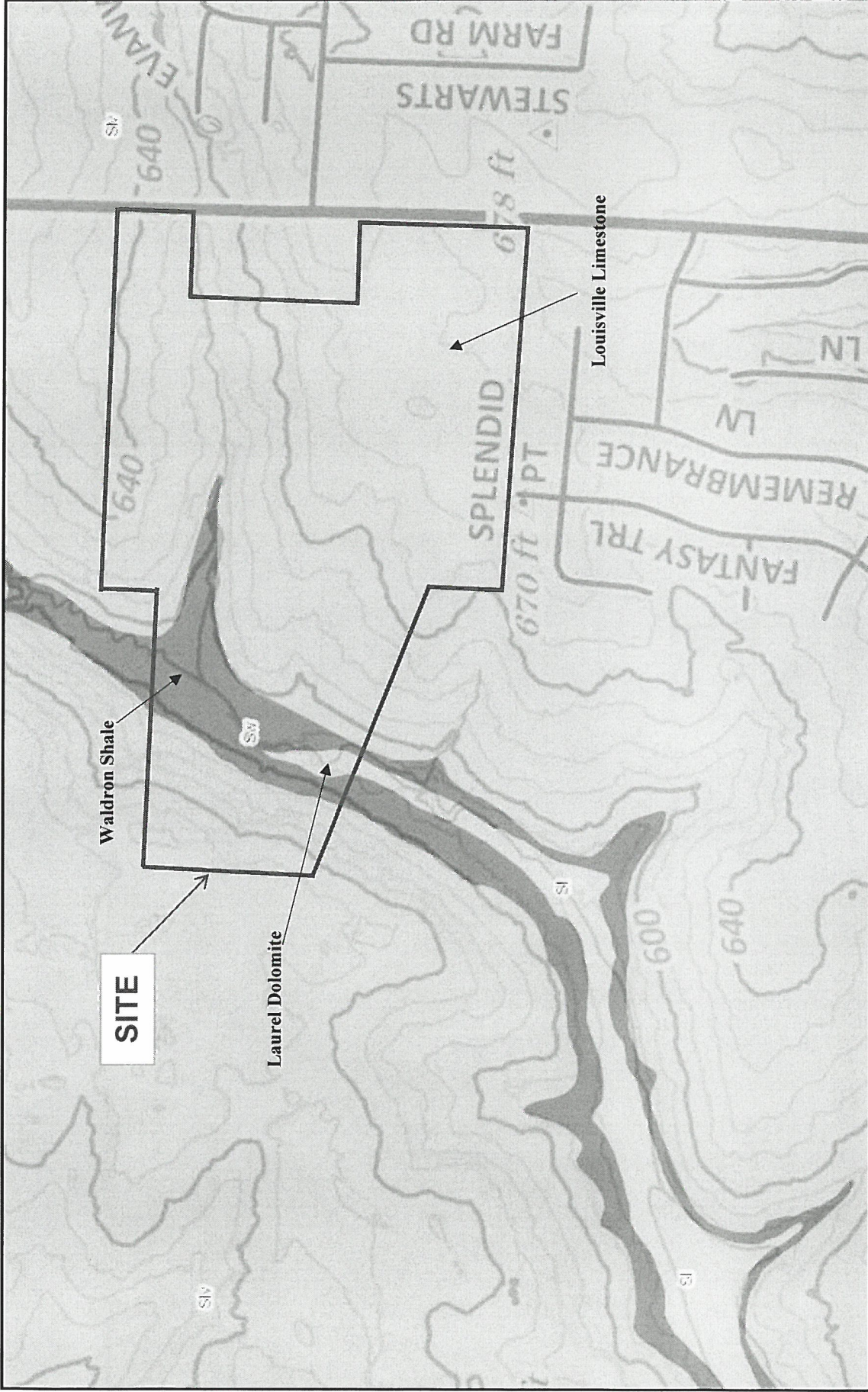
Residential Development  
8300 Cooper Chapel Rd., Louisville, KY  
Greenbaum Project Number: 21-273G



**Boring Location Plan**  
 Proposed Apartment Complex  
 8300 Cooper Chapel Road, Louisville, KY  
 Greenbaum Project Number: 21-273G

**Greenbaum Associates, Inc.**

**LDG Development, LLC**



**LDG Development, LLC**



**Greenbaum  
Associates, Inc.**

**Site Geology**  
Residential Development  
8300 Cooper Chapel Road, Louisville, KY  
Greenbaum Project Number: 21-273G

## SOIL DESCRIPTION TERMINOLOGY

Soils are identified and classified in this report according to the Unified Classification System with the following modifiers:

### RELATIVE DENSITY OF GRANULAR SOILS

<u>Description</u>	<u>Blows/Foot</u>
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	81+

### CONSISTENCY OF COHESIVE SOILS

<u>Description</u>	<u>N-value</u>	<u>g<sub>u</sub> (tsf)</u>
Very Soft	0 to 2	0 to 0.25
Soft	3 to 4	0.26 to 0.50
Medium Stiff	5 to 8	0.51 to 1.0
Stiff	9 to 15	1.1 to 2.0
Very Stiff	16 to 30	2.1 to 4.0
Hard	>30	4.1 to 8.0
Very Hard		8.1+

### PARTICULAR SIZES

<u>Components</u>	<u>Size or Sieve No.</u>
Boulders	over 12 inches
Cobbles	3 to 12 inches
Gravel - Coarse	$\frac{3}{4}$ to 3 inches
Fine	No. 4 to $\frac{3}{4}$ inch
Sand - Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
Fines (silt and clay)	Finer than No. 200

### SOIL MOISTURE

	<u>Descriptive Term</u>
Dry	Dry of Standard Proctor Optimum
Damp	Moist (sand only)
Moist	Near Standard Proctor Optimum
Wet	Wet of Standard Proctor Optimum
Saturated	Free Water in Sample

## ROCK DESCRIPTION TERMINOLOGY

The Rock Quality Determination (Deere et. Al., 1969) method of determining rock quality as reported here was obtained by summing up the total length of core recovered in each run, counting only those pieces of core which are four inches (10 cm.) in length or longer and which are hard and sound. The sum is then represented as a percentage over the length of the run. If the core is broken by handling or by the drilling process, the fresh broken pieces are fitted together and counted as one piece provided that they the requisite length of four inches (10 cm.). RQD is reported as a percentage.

### RELATIONSHIP BETWEEN RQD AND ROCK QUALITY

<u>RQD (%)</u>	<u>Description of Rock Quality</u>
0 to 25	Very Poor
26 to 50	Poor
51 to 75	Fair
76 to 90	Good
91 to 100	Excellent



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-01</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>7.7</b>	Rock: <b>0</b> Total Depth: <b>7.7</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/13/21 - 12/13/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE
							● (blows/ft)											
							10	20	30	40	50	60	70	80	90			
					Topsoil (6 inches)	Ground												
					Moist, Stiff, Tan, Fat Clay with Ferromagnesian Nodules	CH										9		
	SPT																	
																9		
	SPT																	
5					Same, Very Stiff	CH										16		
	SPT																	
					AUGER REFUSAL @ 7.7 FEET													

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-01</b>
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**Greenbaum Associates Inc**  
**Louisville, Ky 40215 502-361-8447**

Client: LDG Development, LLC	<b>HOLE No. B-02</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>1.6</b>	Rock: <b>0</b> Total Depth: <b>1.6</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/13/21 - 12/13/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
	●				Topsoil (5 inches)	Ground		
	▲				Moist, Brown, Fat Clay with Limestone			
	X				AUGER REFUSAL @ 1.6 FEET			>> ● 50/3"

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-02</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-03</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>5.5</b>	Rock: <b>0</b>
		Total Depth: <b>5.5</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/13/21 - 12/13/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
					Moist, Medium Dense, Brown, Silt			
	SPT						●	18
					Moist, Very Stiff, Tan, Fat Clay			
5	SPT						●	19
					AUGER REFUSAL @ 5.5 FEET			

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">B-03</div>
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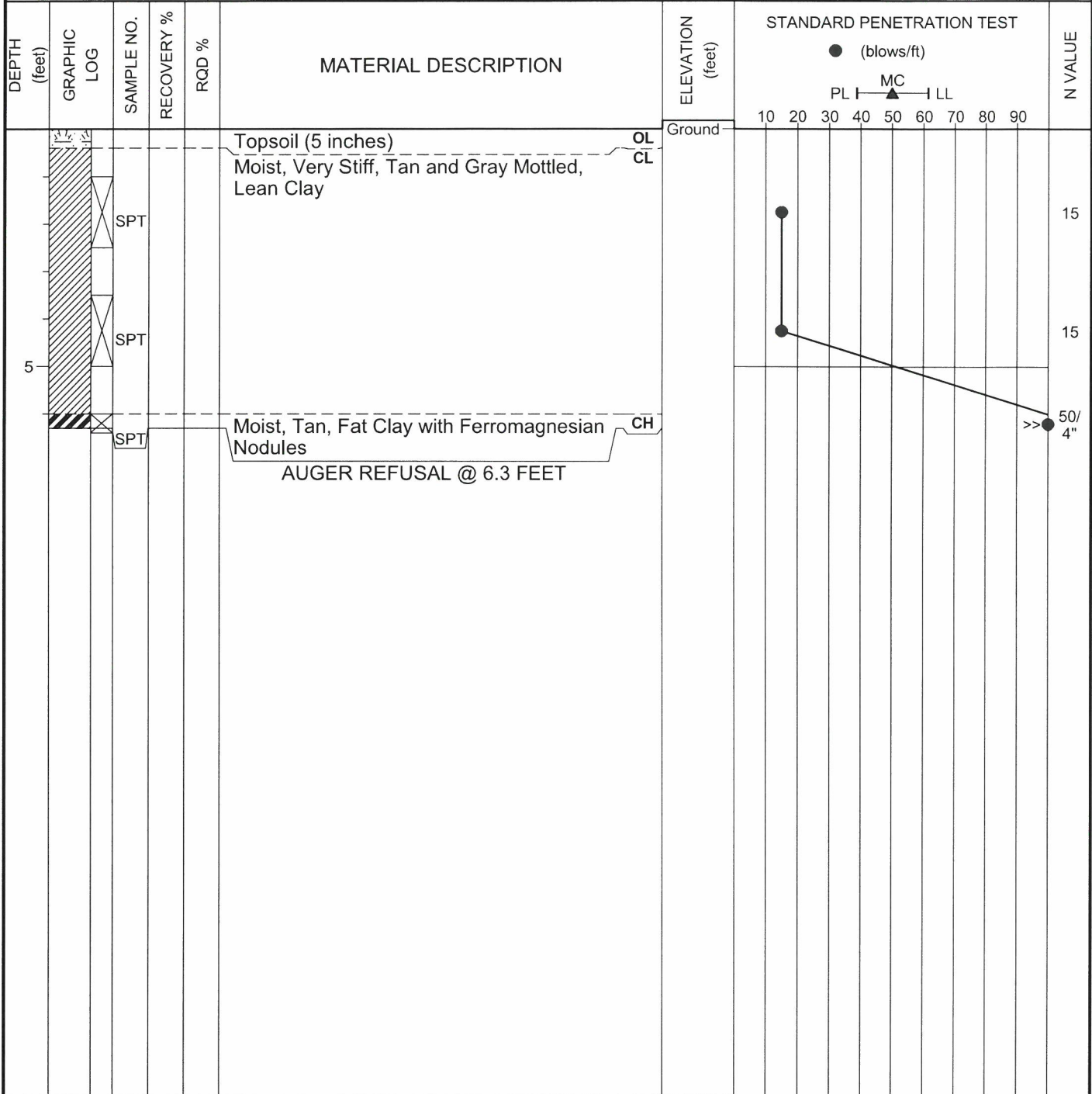
LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-04</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6.3</b>	Rock: <b>0</b>
Total Depth: <b>6.3</b>		
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/13/21 - 12/13/21</b>



LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-04</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-05</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6.3</b>	Rock: <b>0</b> Total Depth: <b>6.3</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
	X				Moist, Stiff, Tan and Gray Mottled, Lean Clay		●	9
	X				Same, Very Stiff		●	14
5	X				AUGER REFUSAL @ 6.3 FEET		●	50/3"

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-05</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-06</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>4.5</b>	Rock: <b>0</b> Total Depth: <b>4.5</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RCD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
					Moist, Medium Dense, Brown, Silt			9
					Moist, Medium Stiff, Brown Fat Clay with Weathered Limestone			>> 50/3"
					AUGER REFUSAL @ 4.5 FEET			

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-06</b>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-07</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>5.7</b>	Rock: <b>0</b> Total Depth: <b>5.7</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
					Moist, Stiff, Brown, Lean Clay			
	SPT						●	9
	SPT						●	11
5					<b>AUGER REFUSAL @ 5.7 FEET</b>			

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-07</b>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-08</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6</b>	Rock: <b>0</b> Total Depth: <b>6.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	ROD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (6 inches)	Ground		
					Moist, Stiff, Brown, Lean Clay			
	SPT						●	8
					Moist, Brown, Fat Clay			
	SPT						●	8
5								
	SPT				AUGER REFUSAL @ 6.0 FEET		●	50/0"

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

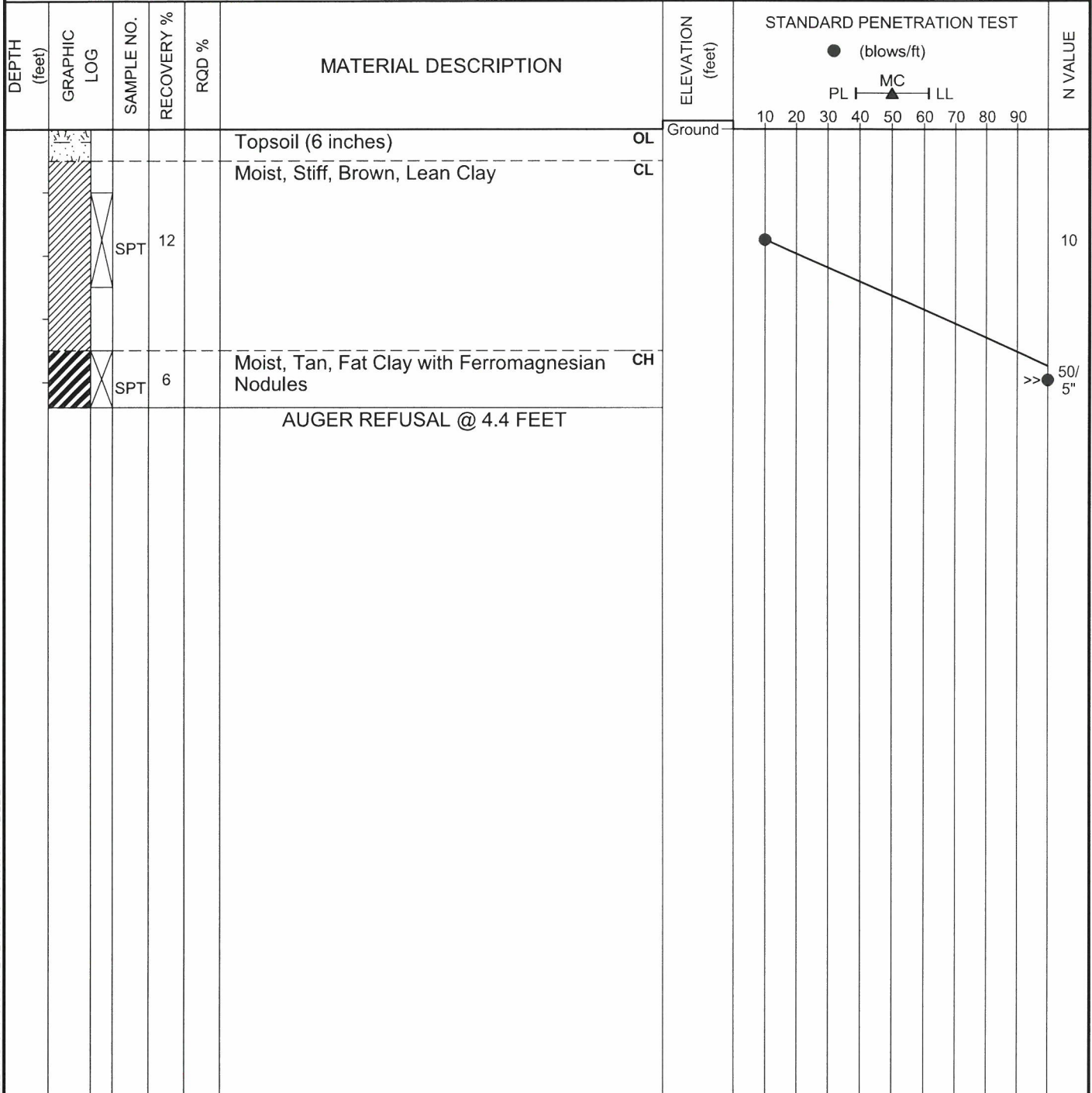
<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <p style="text-align: center;"><b>B-08</b></p>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-09</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>4.4</b>	Rock: <b>0</b>
Total Depth: <b>4.4</b>		
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>



LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <div style="text-align: right; font-weight: bold; font-size: 1.2em;">B-09</div>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-10</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6</b>	Rock: <b>0</b> Total Depth: <b>6.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE
							● (blows/ft)											
							10	20	30	40	50	60	70	80	90			
					Topsoil (6 inches)	Ground												
					Moist, Medium Dense, Tan and Gray Mottled, Silt	ML										11		
					Moist, Very Stiff, Tan, Fat Clay with Ferromagnesian Nodules	CH										12		
5					AUGER REFUSAL @ 6.0 FEET													

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <p style="text-align: center;"><b>B-10</b></p>
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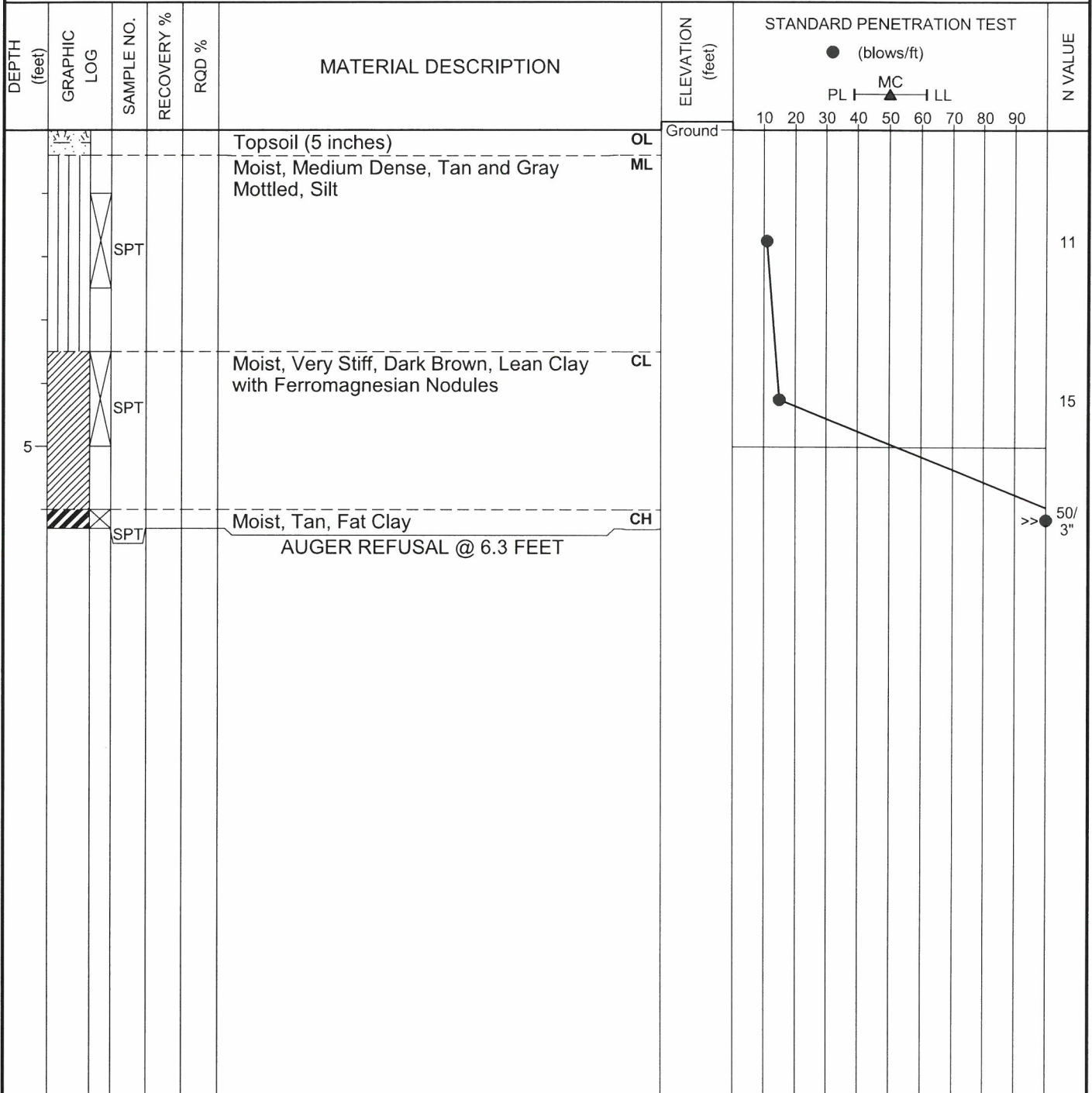
LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-11</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6.3</b>	Rock: <b>0</b> Total Depth: <b>6.3</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>



LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-11</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-12</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>8.3</b>	Rock: <b>0</b>
		Total Depth: <b>8.3</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE		
							● (blows/ft) PL   MC   LL 10 20 30 40 50 60 70 80 90													
					Topsoil (6 inches)	Ground														
					Moist, Loose, Tan, Silt	ML														
	SPT																			8
					Same, Medium Dense, Tan and Gray Mottled	ML														
	SPT																			13
5																				
	SPT																			10
					AUGER REFUSAL @ 8.3 FEET															

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">B-12</div>
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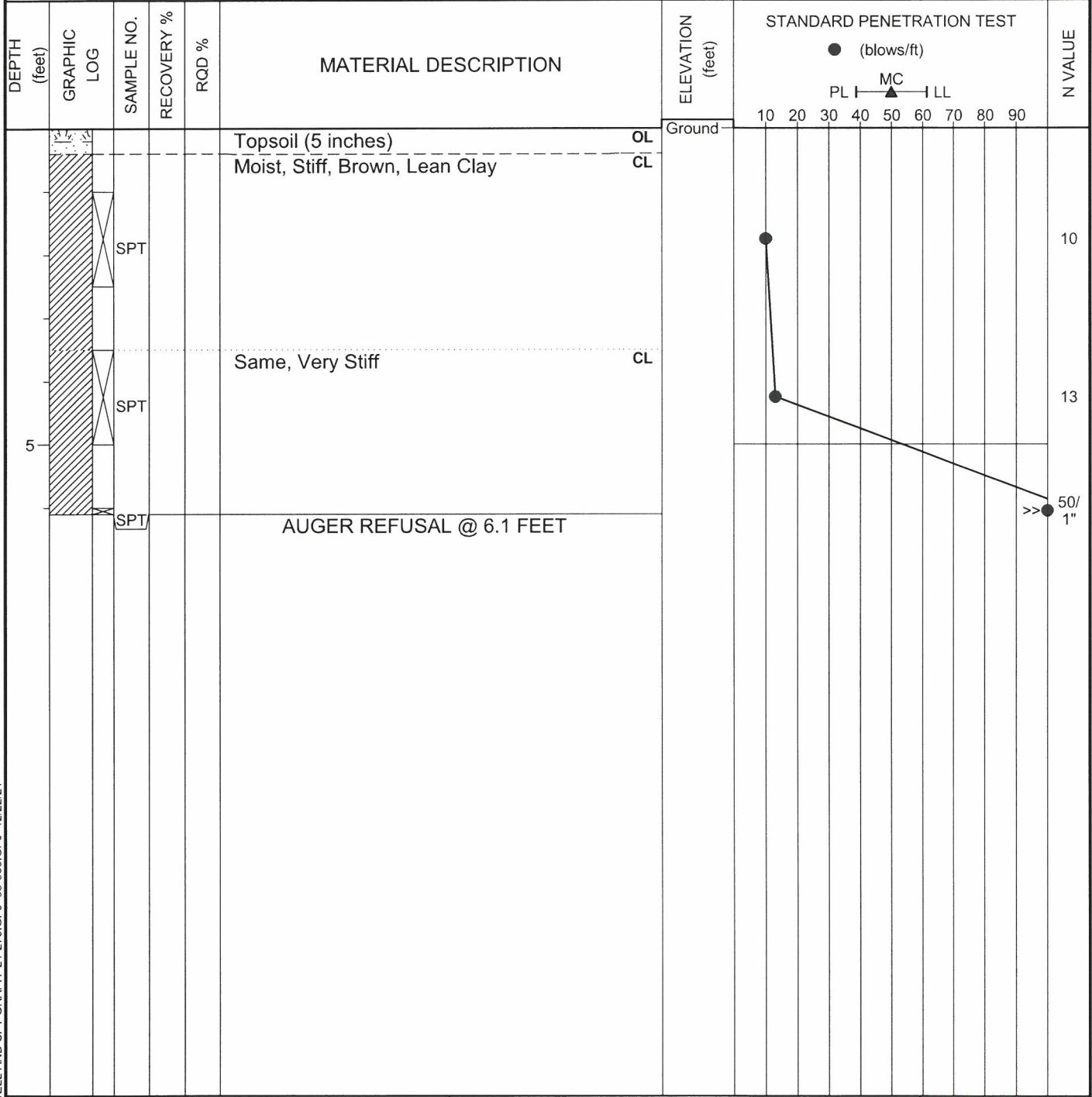




**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-13</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6.1</b>	Rock: <b>0</b> Total Depth: <b>6.1</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>



LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-13</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-14</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>8.3</b>	Rock: <b>0</b> Total Depth: <b>8.3</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE
							● (blows/ft)											
							10	20	30	40	50	60	70	80	90			
					Topsoil (6 inches)	Ground												
					Moist, Stiff, Brown, Lean Clay	CL												
	SPT															8		
					Moist, Stiff, Reddish Brown, Fat Clay	CH												
	SPT															9		
5																		
	SPT															10		
					AUGER REFUSAL @ 8.3 FEET													

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-14</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-15</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>4.5</b>	Rock: <b>0</b> Total Depth: <b>4.5</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
					Moist, Loose, Brown, Silt			
	SPT						●	6
					Moist, Medium Stiff, Brown, Lean Clay			
	SPT						●	50/
					AUGER REFUSAL @ 4.5 FEET			

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-15</b>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-16</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>5.8</b>	Rock: <b>0</b> Total Depth: <b>5.8</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE		
							● (blows/ft) PL   MC   LL 10 20 30 40 50 60 70 80 90													
					Topsoil (5 inches)	Ground														
					Moist, Medium Dense, Brown, Silt	OL ML														
	SPT						●													10
	SPT						●													11
5																				
					AUGER REFUSAL @ 5.8 FEET															

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-16</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-17</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3</b>	Rock: <b>0</b> Total Depth: <b>3.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE			
							(blows/ft) PL   MC   LL 10 20 30 40 50 60 70 80 90														
					Topsoil (5 inches)	OL	Ground														
					Moist, Medium Stiff, Brown, Lean Clay	CL															
	SPT							●													6
					AUGER REFUSAL @ 3.0 FEET																

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-17</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-18</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3.5</b>	Rock: <b>0</b> Total Depth: <b>3.5</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)											N VALUE		
							10	20	30	40	50	60	70	80	90					
					Topsoil (5 inches)	Ground														
					Moist, Stiff, Brown, Lean Clay															
	SPT						●													8
					AUGER REFUSAL @ 3.5 FEET															

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-18</b>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-19</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>.7</b>	Rock: <b>0</b> Total Depth: <b>0.7</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST ● (blows/ft) PL   MC   LL 10 20 30 40 50 60 70 80 90	N VALUE
					Topsoil (8 Inches) <span style="float: right;">OL</span>	Ground		
					AUGER REFUSAL @ 0.7 FEET			

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <span style="font-size: 1.2em;"><b>B-19</b></span>
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**Greenbaum Associates Inc**  
**Louisville, Ky 40215 502-361-8447**

Client: LDG Development, LLC	<b>HOLE No. B-20</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3</b>	Rock: <b>0</b> Total Depth: <b>3.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (4 inches)	Ground		
	SPT				Moist, Hard, Brown, Lean Clay with Sand and Limestone		●	24
					AUGER REFUSAL @ 3.0 FEET			

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-20</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-21</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>6</b>	Rock: <b>0</b> Total Depth: <b>6.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/14/21 - 12/14/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)											N VALUE		
							10	20	30	40	50	60	70	80	90					
					Topsoil (5 inches)	Ground														
					Moist, Stiff, Brown, Lean Clay															
	SPT																			11
					Same, with Weathered Limestone															
	SPT																			13
5																				
					AUGER REFUSAL @ 6.0 FEET															

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-21</b>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-22</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>7.6</b>	Rock: <b>0</b>
		Total Depth: <b>7.6</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST										N VALUE		
							● (blows/ft) PL   MC   LL 10 20 30 40 50 60 70 80 90												
					Topsoil (5 inches)	Ground													
					Moist, Stiff, Reddish Brown, Lean Clay with Ferromagnesian Nodules	CL													
	SPT																		
					Moist, Very Stiff, Reddish Brown, Fat Clay with Ferromagnesian Nodules	CH													
5	SPT																		
					Same, with Weathered Limestone	CH													
	SPT																		
					AUGER REFUSAL @ 7.6 FEET														

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">B-22</div>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-23</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>1.5</b>	Rock: <b>0</b> Total Depth: <b>1.5</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (5 inches)	Ground		
	X				Moist, Brown, Lean Clay with Weathered Limestone			
	X				AUGER REFUSAL @ 1.5 FEET			>> ● 50/0"

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">B-23</div>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-24</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3.9</b>	Rock: <b>0</b>
		Total Depth: <b>3.9</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
					Topsoil (4 inches)	Ground		
	SPT				Moist, Medium Stiff, Brown, Lean Clay			50/ 3"
					AUGER REFUSAL @ 3.9 FEET			

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> NX - Rock Core, 2-1/8" CU - Cuttings CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>DRILLING METHOD</b> RW - Rotary Wash RC - Rock Core	Hole No. <div style="text-align: center; font-weight: bold; font-size: 1.2em;">B-24</div>
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**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-25</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3.2</b>	Rock: <b>0</b>
		Total Depth: <b>3.2</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE
							(blows/ft)											
							10	20	30	40	50	60	70	80	90			
					Topsoil (5 inches)	Ground												
					Moist, Reddish Brown, Lean Clay with Weathered Limestone													
	SPT															50/5"		
					AUGER REFUSAL @ 3.2 FEET													

<b>SAMPLER TYPE</b> SS - Split Spoon ST - Shelby Tube HQ - Rock Core, 2-1/2"	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger CFA - Continuous Flight Augers DC - Driving Casing	<b>Hole No.</b> <div style="text-align: right; font-weight: bold; font-size: 1.2em;">B-25</div>
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LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21



**Greenbaum Associates Inc**  
 Louisville, Ky 40215 502-361-8447

Client: LDG Development, LLC	<b>HOLE No. B-26</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>1</b>	Rock: <b>0</b> Total Depth: <b>1.0</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST											N VALUE			
							● (blows/ft) PL  —▲—  LL MC														
							10	20	30	40	50	60	70	80	90						
	[Hatched Box]				Topsoil (6 inches)	OL	Ground														
	[Hatched Box]				Moist, Brown, Lean Clay	CL															
					AUGER REFUSAL @ 1.0 FEET																

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <div style="text-align: center; font-size: 1.2em;"><b>B-26</b></div>
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**Greenbaum Associates Inc**  
**Louisville, Ky 40215 502-361-8447**

Client: LDG Development, LLC	<b>HOLE No. B-27</b>
Project: Multi-Family Residential Dev., 8300 Cooper Chapel Rd., Louisville, KY	Sheet 1 of 1
Project No.: 21-273G	

Boring Location: <b>See Boring Location Plan</b>	Surface Elevation: <b>Ground</b>	Station: <b>n/a</b>
Drilling Equipment: <b>D-25 Track Mounted w/ Auto Hammer</b>	Drilling Method: <b>3 1/4 Inch Hollow Stem Auger</b>	
Depth to water immediately: <b>Dry</b>	Overburden: <b>3.3</b>	Rock: <b>0</b> Total Depth: <b>3.3</b>
Logged By: <b>L. Van Nevel</b>	Driller: <b>R. Gonzales</b>	Date Logged: <b>12/15/21 - 12/15/21</b>

DEPTH (feet)	GRAPHIC LOG	SAMPLE NO.	RECOVERY %	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	STANDARD PENETRATION TEST (blows/ft)	N VALUE
	● (blows/ft)				Topsoil (6 inches)	Ground		
					Moist, Brown, Lean Clay			
	PL   MC   LL							
							10 20 30 40 50 60 70 80 90	
	SPT							>> ● 50/2"
					AUGER REFUSAL @ 3.3 FEET			

LOG WITH WELL AND SPT GRAPH 21-273.GPJ 08-053.GPJ 12/22/21

<b>SAMPLER TYPE</b> SS - Split Spoon      NX - Rock Core, 2-1/8" ST - Shelby Tube      CU - Cuttings HQ - Rock Core, 2-1/2"      CT - Continuous Tube	<b>DRILLING METHOD</b> HSA - Hollow Stem Auger      RW - Rotary Wash CFA - Continuous Flight Augers      RC - Rock Core DC - Driving Casing	Hole No. <b>B-27</b>
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# CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

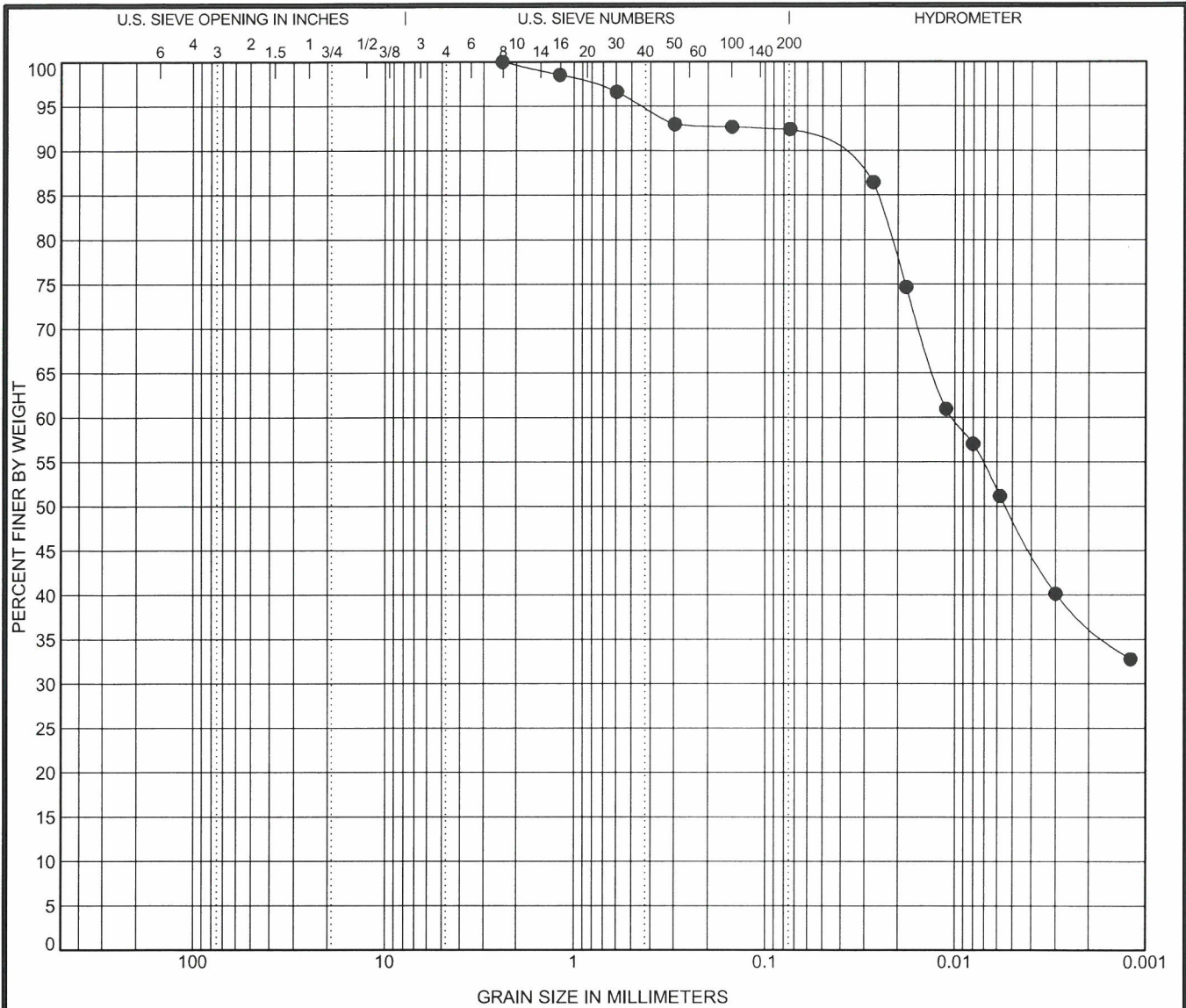
ASTM D2487 and D2488

Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria				
<b>Coarse-grained soils (More than half of material is larger than No. 200 sieve size)</b>	<b>Gravels (More than half of coarse fraction larger than No. 4 sieve)</b>	<b>Clean Gravels</b> (Little or no fines)	<b>GW</b>	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent More than 12 percent 5 to 12 percent	$C_u = D_{60}/D_{10}$ greater than 4 $C_u = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 and 3		
			<b>GP</b>	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		
		<b>Gravels with fines</b> (Appreciable amount of fines)	<b>GM<sup>a</sup></b>	d		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line with P. I. less than 4	Above "A" line with P. I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols
				u		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line with P. I. greater than 7	
		<b>Sands (More than half of coarse fraction is smaller than No. 4 sieve size)</b>	<b>Clean Sands</b> (Little or no fines)	<b>SW</b>		Well-graded sands, gravelly sands, little or no fines	<b>Borderline cases requiring dual symbols<sup>b</sup></b> GW, GP, SW, SP GM, GC, SM, SC	$C_u = D_{60}/D_{10}$ greater than 6 $C_u = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 and 3
				<b>SP</b>		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
	<b>Sands with fines</b> (Appreciable amount of fines)		<b>SM<sup>a</sup></b>	d	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. < 4		Limits plotting in hatched zone with P.I. between 4 and 7 are <i>borderline</i> cases requiring use of dual symbols
				u	<b>SC</b>	Clayey sands, sand-clay mixtures		
	<b>Fine-grained soils (More than half material is smaller than No. 200 sieve)</b>	Silts and clays (Liquid limit less than 50)	<b>ML</b>	Inorganic silts and very fine sands, silty or clayey fine sands, or clayey silts with slight plasticity	<p style="text-align: center;">Plasticity Chart</p>			
			<b>CL</b>	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
<b>OL</b>			Organic silts and organic siltyclays of low plasticity					
Silts and clays (Liquid limit less than 50)		<b>MH</b>	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts					
		<b>CH</b>	Inorganic slays of high plasticity, fat clays					
		<b>OH</b>	Organic clays of medium to high plasticity, organic silts					
Highly organic soils		<b>Pt</b>	Peat and other highly organic soils					

<sup>a</sup> Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits :suffix d used when L. L. is 28 or less and the P. I. is 6 or less; the suffix u used when L. L. is greater than 28.

<sup>b</sup> Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For examples: GW-GC, well-graded gravel-sand mixture with clay binder.





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-07 1.5	LEAN CLAY(CL)	42	21	21		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-07 1.5	2.38	0.01			0.0	7.6	43.7	48.7

US GRAIN SIZE 21-273.GPJ GREENBAUM.GDT 12/22/21

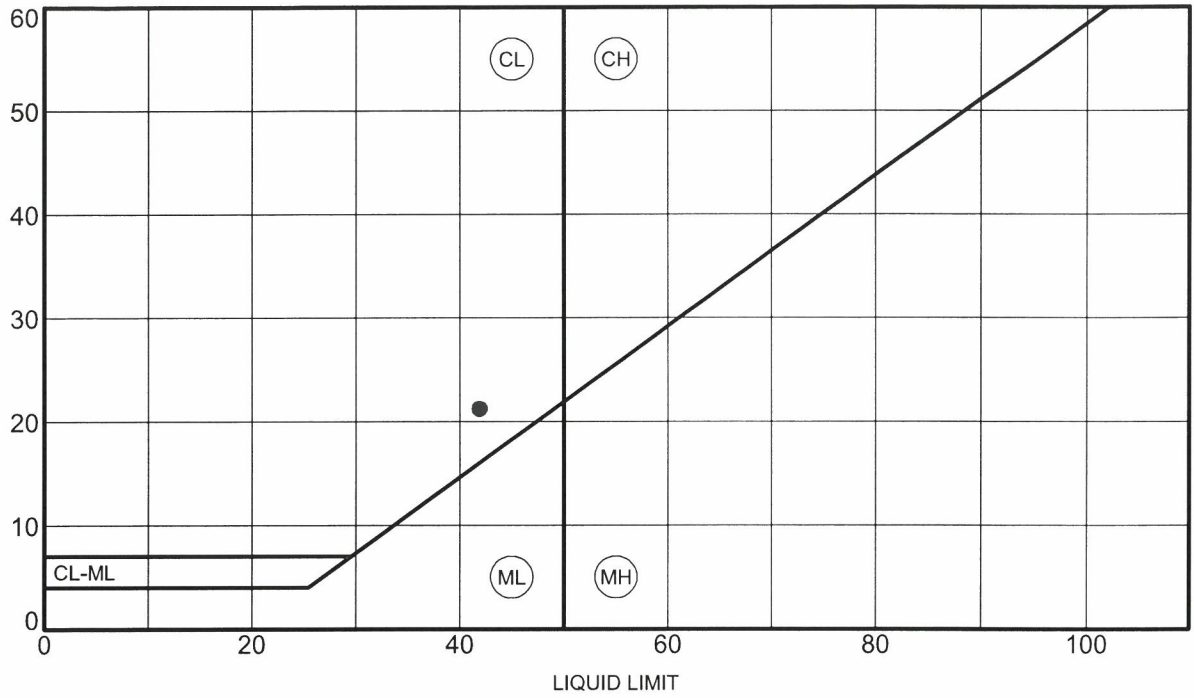


**Greenbaum Associates Inc**  
 Louisville, Ky 40215  
 502-361-8447

**GRAIN SIZE DISTRIBUTION**

Project: Multi-Family Residential Dev.,  
 Location: 8300 Cooper Chapel Rd., Louisville, KY  
 Number: 21-273G

P  
L  
A  
S  
T  
I  
C  
I  
T  
Y  
  
I  
N  
D  
E  
X



Specimen Identification	LL	PL	PI	Fines	Classification
● B-07	1.5	42	21	21	92 LEAN CLAY (CL)

US ATTERBERG LIMITS 21-273.GPJ GREENBAUM.GDT 12/22/21



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**ATTERBERG LIMITS' RESULTS**  
 Project: Multi-Family Residential Dev.,  
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