

January 24, 2018

Broadmoor, LLC
2740 North Arnoult Road
Metairie, Louisiana 70002

Attn: Mr. Daryl J. Matherne

Re: Geotechnical Engineering Report
Proposed Mixed-Use Building & Community Pool
Terra Bella Village
Covington, Louisiana
SE Project No. G17-106

Dear Mr. Matherne:

Stratum Engineering, LLC (SE) is pleased to submit our Geotechnical Engineering Report for the above referenced project. The report includes the results of our field exploration and laboratory testing, and recommendations for foundation design as well as general site development.

We appreciate the opportunity to perform this geotechnical study and look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,
STRATUM ENGINEERING, LLC



William "Dean" McInnis, P.E.
Project Manager

WDM/TYM:wdm



Tony Y. Maroun, P.E.
Principal

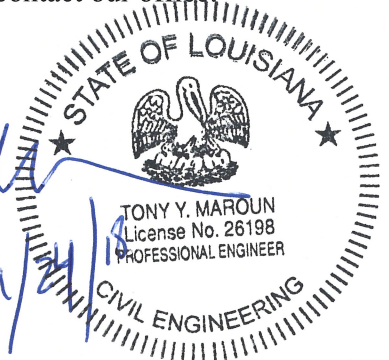


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EXECUTIVE SUMMARY

An exploration and evaluation of the subsurface conditions have been completed for the proposed Mixed-Use Building & Community Pool to be constructed at the Terra Bella Village in Covington, Louisiana.

The site of the proposed Mixed-Use Building is located near the entrance to the Terra Bella Village situated along the east side of Terra Bella Boulevard. The property is relatively flat and currently covered with short surface vegetation. The site of the proposed Community Pool is located within Phase 1A-9 of the subdivision in an undeveloped parcel located between the recently constructed Inglewood Terrace and Laura Lane. Limited topographic and grading information provided to us indicate the existing ground surface elevation in the Mixed-Use Building area is generally around +23.0 feet. Considering tentative finished floor elevation (FFE) of +24.25 feet, about one (1) to 1 ½ feet of fill will be required to reach the floor slab design grade. Grading information for the pool area was unavailable to us. However, we understand the pool area will be raised to elevation +25 feet requiring about one (1) to 1 ½ feet of fill to achieve the finished grade in the Pool House area.

The project will include the construction of a Community Pool and associated single story cabana structure having a total footprint of about 8,500 square feet. The pool depth will range between 4 and 5 feet. Additionally, we understand that a two (2) story mixed-use building having a total footprint of approximately 15,000 square feet is planned near the main entrance to the subdivision with a commercial/retail space on the ground floor and a residential space on the upper floor. The buildings will have wood frames and load bearing walls. Detailed structural loading information was also unavailable at the time this report was prepared. However, maximum column and wall loads were assumed to be less than 50 kips and 4 kips per linear foot, respectively.

A total of 4 borings were drilled to a depth of 20 feet below the existing ground surface in the mixed-use building, pool house, and pool areas. Based on the borings, the surface at the site is generally covered with 6 to 8 inches of silty topsoil with organics. The topsoil was generally underlain by medium silt with sand or stiff to very stiff silty clay to about 2 to 4 feet where a layer of firm to very stiff lean clay was encountered extending to around 12 to 17 feet. The borings were terminated in stiff fat clay at a depth of 20 feet, the maximum depth explored. Groundwater was measured between 11 ½ and 12 feet during the drilling operation.

Moisture sensitive silty soil generally covered the surface across the site. Depending on the site conditions at the time of construction, these moisture sensitive soils could become problematic and may have to be removed and replaced with compacted structural fill.

Furthermore, fat clay was noted near the surface in the pool area borings. Depending on the finished pool house grade, some cut and fill may be required to maintain a buffer zone of low plasticity structural fill below the floor slab and mitigate the expansive soil condition encountered at this location.

The subsurface soils at the site are fair in bearing quality and capable of supporting the structures on shallow foundations with floor slabs on grade provided the moisture sensitive silty surface material is removed and replaced with compacted structural fill. Spread footings and continuous footings, bearing at least two (2) feet below the finished grade in the naturally occurring stiff clay or on compacted structural fill, could be designed for maximum allowable bearing pressures of 2,500 psf and 2,000 psf, respectively, based on dead loads and design live loads. The floor slabs should be soil supported on a minimum of two (2) feet of compacted low plasticity structural fill to mitigate the expansive soil conditions encountered at the site. Details related to site development, foundation design and construction considerations are included in subsequent sections of this report.

The owner/designer should not rely solely on this Executive Summary and must read and evaluate the entire contents of this report prior to utilizing our engineering recommendations in preparation of design/construction documents.

PROJECT INFORMATION

Project Authorization

Stratum Engineering, LLC (SE) has completed a geotechnical exploration for the proposed Mixed-Use Building & Community Pool to be constructed at the Terra Bella Village in Covington, Louisiana. The exploration was accomplished in general accordance with SE Proposal No. G17-181, dated December 22, 2017.

Project Description

The project will include the construction of a Community Pool and associated single story cabana structure having a total footprint of about 8,500 square feet. Additionally, we understand that a two (2) story mixed-use building having a total footprint of approximately 15,000 square feet is planned near the main entrance to the subdivision with a commercial/retail space on the ground floor and a residential space on the upper floor. The buildings will have wood frames and load bearing walls. Detailed structural loading information was also unavailable at the time this report was prepared. However, maximum column and wall loads were assumed to be less than 50 kips and 4 kips per linear foot, respectively.

The geotechnical recommendations presented in this report are based on the available project information, building locations, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform SE in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. SE will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site to enable an evaluation of cost effective foundation systems for the proposed structures. A total of four (4) borings were drilled to a depth of 20 feet below the existing ground surface. Approximate locations of the borings are indicated on the Boring Location Plans included in the Appendix, which are reproductions of conceptual drawings provided to us by Broadmoor. The following table summarizes the borings drilled at the site:

Area	No. of Borings	Boring Depth, Feet
Mixed-Use Building	2	20
Pool & Pool House	2	20

Our scope of services included a reconnaissance of the project site, drilling the soil borings, select laboratory testing, and preparation of this geotechnical report. The report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and provides recommendations regarding the following:

- Foundation type, allowable bearing capacity, and an estimate of settlement;
- Equivalent fluid pressures for the pool;
- Seismic site classification;
- Site preparation, including subgrade preparation and fill compaction requirements;
- Factors influencing construction and performance of the proposed improvements.

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

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The site of the proposed Mixed-Use Building is located near the entrance to the Terra Bella Village situated along the east side of Terra Bella Boulevard. The property is relatively flat and currently covered with short surface vegetation. The site of the proposed Community Pool is located within Phase 1A-9 of the subdivision in an undeveloped parcel located between the recently constructed Inglewood Terrace and Laura Lane.

Limited topographic and grading information provided to us indicate the existing ground surface elevation in the Mixed-Use Building area is generally around +23.0 feet. Considering tentative finished floor elevation (FFE) of +24.25 feet, about one (1) to 1 ½ feet of fill will be required to reach the floor slab design grade. Grading information for the pool area was unavailable to us. However, based on conversations with Mr. Daryl Matherne of Broadmoor, LLC, the area will be raised to a finished elevation of +25 feet requiring about one (1) to 1 ½ feet of fill to achieve the finished grade in the Pool House area.

Drilling, Sampling, and Laboratory Testing Procedures

The borings were drilled with an All-Terrain Vehicle (ATV) mounted drill rig. Auger rotary drilling techniques were used to advance the borings. Samples were generally obtained continuously from the ground surface to a depth of ten feet and at maximum five foot intervals thereafter. Drilling and sampling techniques were accomplished in general accordance with ASTM Standards.

Undisturbed samples of cohesive soils were generally obtained using thin-wall tube sampling procedures in general accordance with the procedures for “Thin-Walled Tube Geotechnical Sampling of Soils” (ASTM D1587). These samples were extruded in the field with a hydraulic ram and were wrapped in aluminum foil prior to placement in a plastic wrapping to preserve moisture. The samples were transported to the laboratory in containers to prevent disturbance.

The laboratory testing program included supplementary visual classification and water content tests on all of the soil samples. In addition, selected samples were subjected to percent passing the #200 sieve testing and Atterberg Limits determination. Additional estimates of unconfined compressive strength were made using a hand penetrometer. The laboratory testing was performed in general accordance with ASTM Standard Procedures.

Subsurface Conditions

The site was characterized by a total of four (4) borings drilled across the property. Based on the borings, the surface at the site is generally covered with 6 to 8 inches of silty topsoil with organics. Based on the borings, the surface at the site is generally covered with 6 to 8 inches of silty topsoil with organics. The topsoil was generally underlain by medium silt with sand or stiff to very stiff silty clay to about 2 to 4 feet where a layer of firm to very stiff lean clay was encountered extending to around 12 to 17 feet. The borings were terminated in stiff fat clay at a depth of 20 feet, the maximum depth explored. However, at boring location B-2 drilled in the Pool House area, fat clays were encountered between 2 and 6 feet below the ground surface.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at the boring locations. These records include soil descriptions, stratification, penetration resistances, laboratory test data and locations of the samples. The stratification shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratification represents the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on the boring logs. The samples, which were not altered by laboratory testing, will be retained for 60 days from the date of this report and then will be discarded.

Groundwater Conditions

Groundwater was measured between 11 ½ and 12 feet during the drilling operations. However, it should be noted that groundwater levels will fluctuate with seasonal variations in rainfall, extended periods of drought and surface runoff. Perched water conditions may be encountered in the upper soils if earthwork construction takes place after extended periods of rain. Therefore, it is recommended that the actual groundwater level at the site be determined by the contractor at the time of the construction activities.

IBC Site Classification

The International Building Code (IBC), 2012 edition, was reviewed to determine the site classification for seismic design. Based on the soils encountered in the borings and our experience in the general vicinity, the site can be classified as Site Class “D”, as outlined in Section 1613.3.2 of the Building Code.

EVALUATION AND RECOMMENDATIONS

General

The type and depth of foundation suitable for a given structure primarily depends on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation and the criteria set by the Design Engineer with respect to vertical and differential movement which the structure can withstand without damage.

The results of the exploration indicate that moisture sensitive silty soils were encountered across the site and extended 2 to 3 feet below the surface and as deep as 4 feet at isolated locations. These near surface silty soils were relatively stable at the time of the field exploration. However, they are extremely sensitive to moisture and could lose their support capability if they become saturated requiring removal and replacement. Provided positive drainage is maintained at the site and the upper soils are protected, the proposed structures may be supported on a shallow foundation system bearing in the naturally occurring stiff clay or on compacted structural fill.

For budgetary purposes, it may be prudent to assume that at least 24 inches of the moisture sensitive silty soil inclusive of the topsoil will likely be removed should construction take place during the wet season or after a period of extended rain.

Potential Vertical Rise

Field and laboratory test results indicate that the soils encountered at a few locations across the site exhibit medium shrink and swell potential. Therefore, mitigation of the site condition will be necessary to maintain the potential vertical movement to less than one (1) inch, particularly in the Pool House and pool areas.

The estimated amount of vertical movement of a foundation or floor slab constructed on swelling clays is referred to as the Potential Vertical Rise (PVR). To reduce the potential for shrinkage and swelling of the site soils, it is important that consideration be given to reducing the potential for moisture changes of the site soils. At a minimum, positive drainage away from the new buildings should be provided. If positive drainage is not provided, water will pond around, or below, the structures and excessive total and differential movements may occur.

A Potential Vertical Rise (PVR) value of about one (1) inch was calculated using the TEX-124E method assuming an active zone of ten (10) feet which is typical for the area. Due to the characteristics of the clay soils encountered in the borings, it is recommended that at least two (2) feet of low swell potential compacted structural fill be provided under the building pads and extending for a distance of five (5) feet beyond the building perimeters to reduce the estimated PVR to less than 1 inch. Provisions of the buffer zone should be achieved by undercutting, raising the site grade or a combination of both.

Swelling or shrinkage occurs in the soils due to changes in moisture content. Ponding of water around the slabs may also result in reduction of soil strength, thereby causing movements. It is important to minimize the possibility of moisture content changes by considering the following precautions:

1. Direct surface runoff away from the structure by sloping the subgrade away from the slabs.
2. Extend paving or other impervious covering to the slab edges.
3. Extend downspouts so that the discharge is at least 5 feet from the slabs.
4. Further increase the fill thickness under the slabs.
5. If shrubs or bushes are placed next to the structures, an impervious membrane should be used to separate the slabs from the shrubs to limit any infiltration of water under the slabs. The minimum distance between a tree and the slabs should be about one-half the expected height of the tree.
6. Good rigidity of the structure foundations should be assured by stiffening the wall footings in order to minimize the detrimental effect of differential settlement.

Site Preparation

Site preparation is expected to include, but not be limited to, stripping of all topsoil with organics and other deleterious materials as well as undercutting the surficial silty soil as necessary to provide a stable subgrade. Based on the borings, about 6 to 8 inches of silty topsoil was encountered in the Mixed-Use Building area while about 10 to 12 inches was encountered in the pool area. However, the actual stripping and undercutting depths should be determined by a representative of the Geotechnical Engineer at the time of construction.

Furthermore, the silty material encountered below the topsoil extended generally about 2 feet below the surface and as deep as 4 feet below the surface at some of the boring locations. Depending on the site condition at the time of construction, the moisture sensitive silty soils could lose their support capabilities if subjected to high moisture and may need to be removed and replaced with compacted structural fill. Therefore, it will be prudent that adequate drainage be provided across the site to keep the near surface silty material drained and minimize the amount of undercut during construction.

The subgrade should be proofrolled using a single axle rubber tired vehicle weighing about 20 tons. Soils, which are observed to rut or deflect excessively under the moving load, should be undercut and replaced with properly compacted structural fill. The proofrolling and undercutting activities should be witnessed by a representative of the Geotechnical Engineer and should be performed during a period of dry weather.

After subgrade preparation and observation have been completed, the initial layer of fill should be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped and scarified subgrade soils. The structural fill may consist of sandy clays or clayey sands and should have a maximum liquid limit of 40 and a maximum plasticity index of 20 percent.

The fill should be placed in maximum lifts of eight (8) inches of loose materials and should be compacted within one (1) percentage point below and three (3) percentage points above the optimum moisture content. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. The fill should be compacted to at least 95 percent of the Standard Proctor maximum dry density as determined by ASTM D698 Standard Procedures. Adequate drainage should be provided prior to and during site work. The site should be graded to promote rapid runoff.

Shallow Footings

Provided the site is prepared as outlined above, the proposed structures may be supported on shallow foundations. Spread footings and continuous footings bearing at least two (2) feet below the finished grade in the stiff clay or compacted structural fill, could be designed for maximum allowable bearing pressures of 2,500 psf and 2,000 psf, respectively. Minimum dimensions of twenty-four (24) inches for column footings and eighteen (18) inches for continuous footings should be used in foundation design to minimize the possibility of a localized bearing failure. The above bearing capacities include a design factor of safety of 3.

The uplift resistance of shallow spread footings formed in open excavations should be limited to the weight of the foundation concrete and the soil above it. For preliminary design purposes, the uplift resistance can be computed by using a total unit weight of 115 pcf for the structural fill placed and compacted above the footing, and a unit weight of 150 pcf for the concrete. Concrete reinforcing steel should be properly sized to resist uplift forces. We recommend that a factor of safety of at least 1.5 be used when determining the allowable uplift resistance of spread footings.

Soil resistance to horizontal forces is developed by lateral earth pressures acting on the face of the footing and by friction or adhesion on the footing base. We recommend that the allowable passive pressure be computed for spread footings below grade using the following equation:

$$P_p = 2000 + 120H \text{ (Clay)}$$

where P_p is the lateral soil resistance in psf (pounds per square foot) and H is the depth in feet. For exterior footings, H is measured from one (1) foot below adjacent finished grade, provided that the adjacent finished grade extends level and at least beyond a point that makes a 45-degree angle from the bottom of the exterior footing to the finished ground surface.

The top foot of passive resistance at foundations should be neglected unless the ground surface around the footing is covered by concrete or pavement. The resistance to sliding of spread footings bearing in structural fill can be computed by multiplying the footing base contact area by a sliding friction factor of 0.38. Spread footings should also be sized to resist overturning due to moment forces.

The foundation excavations should be observed by a representative of SE prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of firm soils or adequately compacted fill as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with compacted structural fill or graded crushed stone, as determined by the Geotechnical Engineer.

Footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond prior to or after concrete placement. The foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

Settlement

Settlement of a spread footing designed for the recommended bearing pressure is estimated to be less than one (1) inch. Differential settlements could be 50 percent of the total settlement. While settlement of this magnitude is generally considered tolerable for the structures, the design of masonry or brick walls should include provisions for liberally spaced vertical control joints to minimize the effects of cosmetic cracking.

Floor Slabs

The soil supported floor slabs for the proposed buildings should bear on a minimum of two (2) feet of compacted low plasticity structural fill. Placement of the new fill and preparation of the subgrade should be performed in accordance with the Site Preparation section of the report to identify any soft or unstable soils which should be removed from the floor slab areas prior to additional fill placement and/or floor slab construction. Polyethylene sheeting should be placed between the fill and the floor slabs to act as a vapor barrier. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage.

Community Pool

When constructing a foundation system in an open excavation, some construction related issues should be considered including (1) stability of the excavation bottom; (2) maintaining a dry excavation bottom; and (3) stability of the side slopes which should be constructed in accordance with current OSHA regulations.

We understand that a community pool will be built in Phase 1A-9 of the development. The pool will be about 1,900 square feet and will be 4 to 5 feet deep. Although detailed grading information was not available at the time this report was prepared, we understand that the pool area will be raised to an elevation of +25 feet requiring the addition of about one (1) to 1 ½ feet of fill to reach the Pool House design grade. Furthermore, the pool will likely require 5 to 6 feet of cut to reach the pool bottom design grades.

Based on the soil conditions observed in boring B-1 drilled within the pool area, the soil at the bottom excavation consists of firm to stiff lean clay with a dry unit weight of about 96 to 97 pcf. A net allowable bearing pressure of about 3,000 psf was estimated at the bottom of the pool excavation using a factor of safety of 3.0.

Considering the assumed finished elevations surrounding the pool, up to a 7 foot high wall is anticipated for the pool. Typically pool walls are constructed without accounting for any earth pressure from the soil. Such pools should always remain full of water. If the pool is empty for a longer duration the walls may bulge and crack due to earth pressure. If it is desired to design the walls to resist the lateral earth pressures, equivalent hydrostatic lateral earth pressure values for both at-rest and active conditions are provided. The use of active or at-rest earth pressures depends on the amount of horizontal movement that can occur along the wall height. The walls should be designed for active earth pressures, if the top of the wall is not rigidly restrained, and the walls can deflect at the top. If the walls are restrained at the top, the at-rest earth pressure values should be used.

The walls should be designed for additional lateral loads due to surcharge and live loads. A minimum uniform surcharge pressure of 150 psf should be included in the design for the floor slab. The lateral pressure on the wall due to a uniform surcharge load can be taken as earth pressure coefficient values shown in the below table multiplied by surcharge pressure. Drainage systems should be provided near, or at the base of walls to collect and remove groundwater and prevent a buildup of hydrostatic pressure behind the walls. If provisions to prevent accumulation of water behind the walls are not provided, the walls should be designed to resist the full hydrostatic head in addition to the lateral earth pressures for the full height of the wall.

Since the type of backfill that will be placed behind the walls is unknown at this time, equivalent fluid pressure values for various types of fill are provided in the following table:

EQUIVALENT FLUID PRESSURES (PSF/FOOT)						
Type of Compacted Backfill Behind the Retaining System and Soil Parameters	Active Condition (Horizontal Backfill)			At Rest Condition (Horizontal Backfill)		
	Above W.T.	Below W.T.	K_a	Above W.T.	Below W.T.	K_o
Liquid limit less than 40 Plasticity Index of less than 18 Effective Friction Angle of 25° Unit weight of 125 pcf, Sandy Clay (CL)	51	25	0.41	72	36	0.58
Clayey Sands (SC) or Silty Sands (SM) Effective Friction Angle of 30° Unit weight of 125 pcf	42	21	0.33	63	31	0.50
Sands (SP) or Sand with silt (SP-SM) Less than 10% fines. Effective Friction Angle of 30° Unit weight of 115 pcf	38	18	0.33	58	27	0.50
Notes: a) The earth pressure values for the above water table condition correspond to the total unit weight of soil and earth pressure values. For the below water table (W.T) condition, the earth pressure values correspond to the buoyant or submerged unit weight of soil and does not include the hydrostatic fluid weight effect of 62.4 pcf. b) The values provided assume that the materials are compacted to at least 95 percent of the Standard Proctor maximum dry density (ASTM D698), within three percentage points of the optimum moisture content.						

CONSTRUCTION CONSIDERATIONS

It is recommended that SE be retained to provide observation and testing of construction activities involved in the foundations and related activities of this project. SE cannot accept any responsibility for any conditions which deviate from those described in this report, nor for the performance of the foundations, if not engaged to also provide construction observation and testing for this project.

Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at this site are extremely sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, an increase in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

The site contractor should be responsible for maintaining a firm and stable subgrade condition. Should the near surface soils become wet, the contractor should be prepared to mitigate these conditions by repeated aeration and exposure to sunlight or by admixture treatment. A representative of the Geotechnical Engineer should be present during the site work activities to evaluate the condition of the improved soil and verify the material is adequate prior to placement of additional fill.

Drainage and Groundwater Concerns

Water should not be allowed to collect in the foundation excavations, floor slab areas, or on the prepared subgrade in the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the buildings.

Groundwater was measured between 11 ½ and 12 feet during the drilling operations. However, it is possible that seasonal variations will cause fluctuations of the water table. Additionally, perched water may be encountered in discontinuous zones within the overburden soils, particularly after extended periods of rain. Any water accumulation should be removed from the excavations by pumping. If excessive and uncontrolled amounts of seepage occur, the Geotechnical Engineer should be consulted to provide additional recommendations, if necessary.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1928, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavation, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR, Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. SE does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by SE and design details furnished by Broadmoor, LLC. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, SE should be notified immediately to determine if changes in the foundation recommendations are required. If SE is not notified of such changes, SE will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated in to the design documents. At that time, it may be necessary to submit supplementary recommendations. If SE is not retained to perform these functions, SE will not be responsible for the impact of those conditions on the project. This report has been prepared for the exclusive use of Broadmoor, LLC for the specific application to the proposed Mixed-Use Building & Community Pool to be constructed at the Terra Bella Village in Covington, Louisiana.

APPENDIX



GENERAL SITE PLAN

GEOTECHNICAL ENGINEERING SERVICES
 PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
 TERRA BELLA VILLAGE
 COVINGTON, LOUISIANA

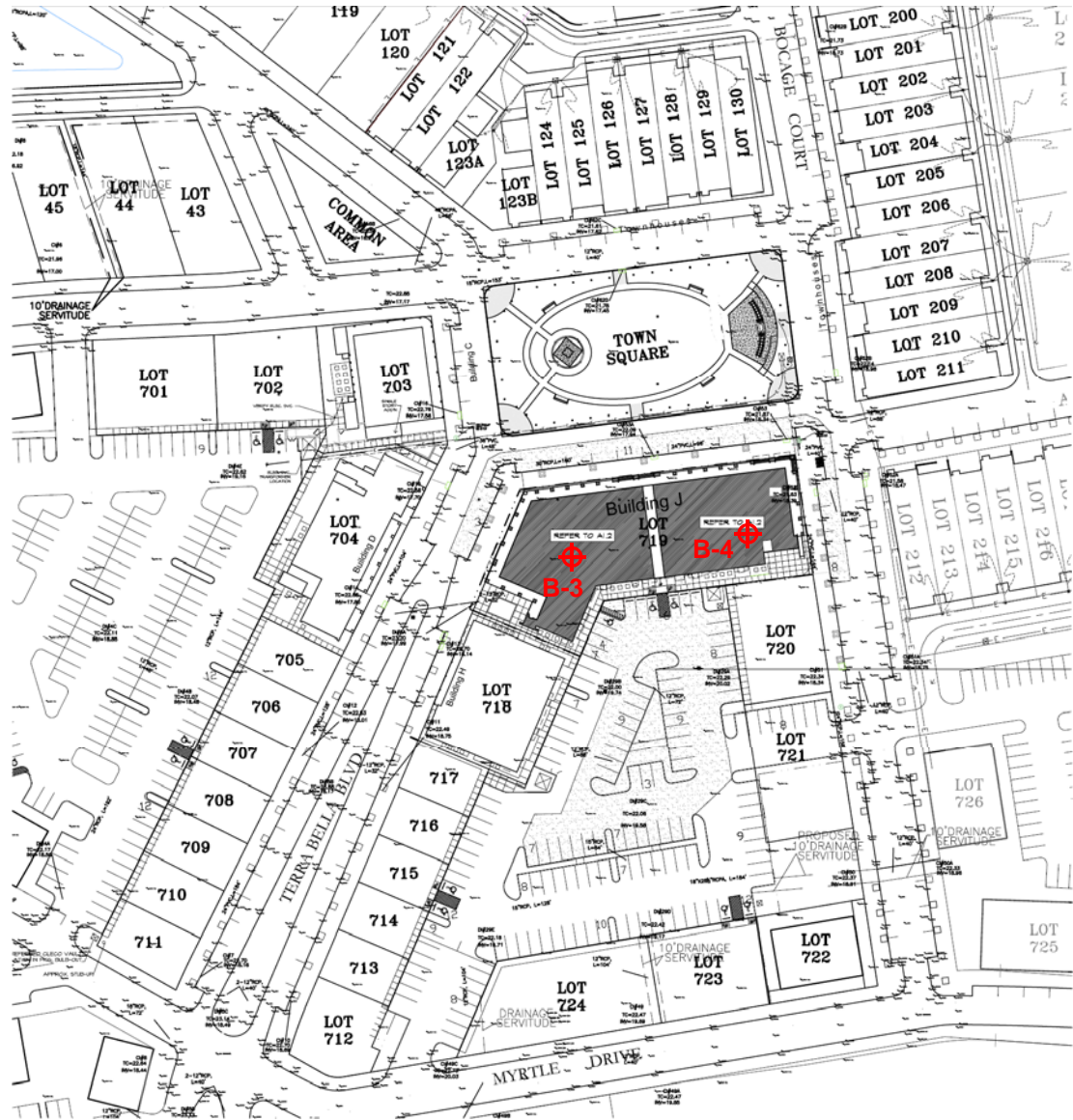


◆ = BORING LOCATION



**BORING LOCATION PLAN
(Community Pool Area)**

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
TERRA BELLA VILLAGE
 COVINGTON, LOUISIANA



◆ = BORING LOCATION



BORING LOCATION PLAN
(Mixed-Use Building Area)

GEOTECHNICAL ENGINEERING SERVICES
 PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
 TERRA BELLA VILLAGE
 COVINGTON, LOUISIANA



LOG OF BORING B-1
PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
TERRA BELLA VILLAGE
COVINGTON, LOUISIANA

TYPE OF BORING: AUGER ROTARY

LOCATION: POOL AREA

PROJECT NO.: G17-106

DEPTH, FT.	SOIL TYPE	SAMPLES	DESCRIPTION	N-BLOWS/FT.	UNCONFINED COMPRESSIVE STRENGTH tsf	HAND PENETROMETER tsf	TORVANE tsf	UNIT DRY WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE
			8" Silty Sandy Topsoil with organics			2.50			25	26	1	76
			Medium gray Silt with sand									
			Firm to stiff tannish gray Lean Clay		0.53	1.00		97	26			
5			- with ferrous nodules, 4' to 10'			1.00			26			
					1.05	1.25		96	28	44	27	
10			- with silt seams and sand lenses at 8'			1.25			29			
			▽									
			Stiff tannish gray Fat Clay		0.74	1.25		86	34			
15												
						1.75			33			
20			Boring terminated at 20 feet									
25												
30												
35												
40												
45												
50												

DEPTH OF BORING: 20 Feet
 DATE: 1/4/2018

GROUNDWATER: Encountered at 11 ½ Feet During Drilling



LOG OF BORING B-2
PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
TERRA BELLA VILLAGE
COVINGTON, LOUISIANA

TYPE OF BORING: AUGER ROTARY

LOCATION: POOL HOUSE AREA

PROJECT NO.: G17-106

DEPTH, FT.	SOIL TYPE	SAMPLES	DESCRIPTION	N-BLOWS/FT.	UNCONFINED COMPRESSIVE STRENGTH tsf	HAND PENETROMETER tsf	TORVANE tsf	UNIT DRY WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE
	[Hatched Soil Type]		8" Silty Sandy Topsoil with organics			1.25			30			
			Stiff gray Silty Clay									
			Firm tannish gray Fat Clay		0.58	0.75		94	28	59	41	
5			- stiff at 4'			1.75			26			
				Firm to stiff tannish gray Lean Clay with silt seams and sand lenses		0.59	1.00		90	31		
10						1.50		28	39	21		
	[Hatched Soil Type]		Firm to stiff tannish gray Fat Clay		0.64	1.00		91	29			
15			- with silt seams and sand lenses at 13'									
20			- stiff to very stiff at 18'			2.00			41			
			Boring terminated at 20 feet									
25												
30												
35												
40												
45												
50												

DEPTH OF BORING: 20 Feet
 DATE: 1/4/2018

GROUNDWATER: Encountered at 12 Feet During Drilling



LOG OF BORING B-3
PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
TERRA BELLA VILLAGE
COVINGTON, LOUISIANA

TYPE OF BORING: AUGER ROTARY

LOCATION: BUILDING J

PROJECT NO.: G17-106

DEPTH, FT.	SOIL TYPE	SAMPLES	DESCRIPTION	N-BLOWS/FT.	UNCONFINED COMPRESSIVE STRENGTH tsf	HAND PENETROMETER tsf	TORVANE tsf	UNIT DRY WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE	
	Diagonal Hatching		10" Silty Sandy Topsoil with organics			2.50			18				
			Very stiff gray Silty Clay - firm at 2'		0.62	0.75		104	18				
5	Diagonal Hatching		Stiff to very stiff tannish gray Lean Clay			1.75			22	37	21	90	
						1.18	2.00		102	23			
10							2.00			25			
	Diagonal Hatching		- firm to stiff with thin sand layers at 13'										
15						0.77	1.00		99	28			
	Diagonal Hatching		Stiff tannish gray Fat Clay with silt seams and sand layers			1.50			33				
20													
	Diagonal Hatching		Boring terminated at 20 feet										
25													
30													
35													
40													
45													
50													

DEPTH OF BORING: 20 Feet
 DATE: 1/4/2018

GROUNDWATER: Encountered at 12 Feet During Drilling



LOG OF BORING B-4
PROPOSED MIXED-USE BUILDING & COMMUNITY POOL
TERRA BELLA VILLAGE
COVINGTON, LOUISIANA

TYPE OF BORING: AUGER ROTARY

LOCATION: BUILDING J

PROJECT NO.: G17-106

DEPTH, FT.	SOIL TYPE	SAMPLES	DESCRIPTION	N-BLOWS/FT.	UNCONFINED COMPRESSIVE STRENGTH tsf	HAND PENETROMETER tsf	TORVANE tsf	UNIT DRY WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE
	[Diagonal Hatching]	[Diagonal Hatching]	12" Silty Sandy Topsoil with organics			1.75			20			
			Stiff gray Silty Sandy Clay - becomes tannish gray at 2'		1.15	1.25		108	17			
5	[Diagonal Hatching]	[Diagonal Hatching]	Stiff tannish gray Lean Clay with silt seams			1.75			22			
					1.32	2.00		108	22	41	25	
10			Stiff tannish gray Silty to Lean Clay				1.25			30		
			▽									
15					0.96	1.25		95	30			
			Stiff to very stiff tannish gray Fat Clay			2.00			32			
20			Boring terminated at 20 feet									
25												
30												
35												
40												
45												
50												

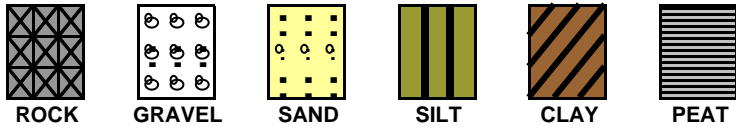
DEPTH OF BORING: 20 Feet
 DATE: 1/4/2018

GROUNDWATER: Encountered at 11 ½ Feet During Drilling



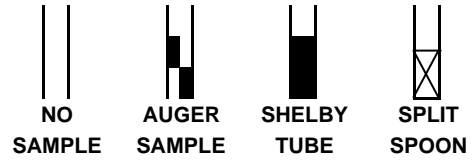
KEY TO TERMS AND SYMBOLS USED ON LOGS

SOIL TYPE



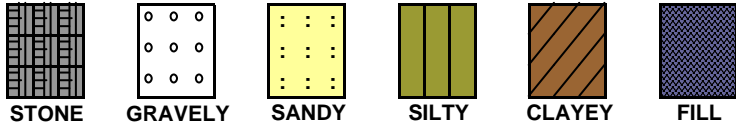
ROCK GRAVEL SAND SILT CLAY PEAT

SAMPLER TYPE

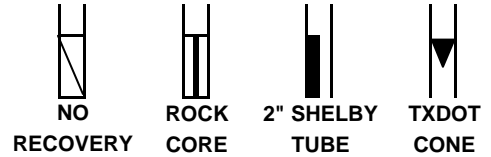


NO SAMPLE AUGER SAMPLE SHELBY TUBE SPLIT SPOON

MODIFIERS



STONE GRAVELY SANDY SILTY CLAYEY FILL



NO RECOVERY ROCK CORE 2" SHELBY TUBE TXDOT CONE

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

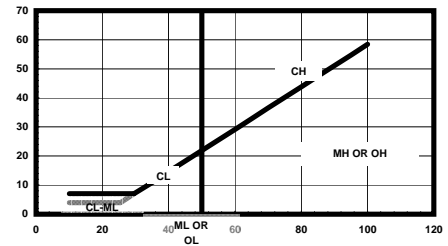
MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL & GRAVELLY SOILS	CLEAN GRAVEL	GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES	
		(LITTLE OR NO FINES)		GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
	LESS THAN 50% PASSING NO. 4 SIEVE	W/ APPRECIABLE FINES		GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	50% PASSING NO. 200 SIEVE	SANDS	CLEAN SANDS	SW	WELL GRADED SAND, GRAVELY SAND (LITTLE FINES)
			(LITTLE FINES)	SP	POORLY GRADED SANDS, GRAVELY SAND (L-FINES)
	MORE THAN 50% PASSING NO. 4 SIEVE	SANDS WITH APPRECIABLE FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
	FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR
					SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/ LOW PI
CL				INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY	
SILTS AND CLAYS		LIQUID LIMIT GREATER THAN 50	OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI	
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY	
		OH	FAT CLAYS		
		OH	ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT		
HIGHLY ORGANIC SOIL			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	
UNCLASSIFIED FILL MATERIALS				ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS AND MAN-MADE SOIL MIXTURES	

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	SHEAR STRENGTH IN TONS/FT ²
VERY SOFT	0. TO 0.125
SOFT	0.125 TO 0.25
FIRM	0.25 TO 0.5
STIFF	0.5 TO 1.0
VERY STIFF	1.0 TO 2.0
HARD	> 2.0 OR 2.0+

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	N-VALUE (BLOWS/FOOT)
VERY LOOSE	0-4
LOOSE	4-9
MEDIUM DENSE	10-29
DENSE	30-49
VERY DENSE	> 50 OR 50+



ABBREVIATIONS

- HP - HAND PENETROMETER UC - UNCONFINED COMPRESSION TEST
- TV - TORVANE UU - UNCONSOLIDATED UNDRAINED TRIAXIAL
- MV - MINIATURE VANE CU - CONSOLIDATED UNDRAINED

NOTE: PLOT INDICATES SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS



CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

	6"	3"	3/4"	4	10	40	200		
BOUL- -DERS	COBBLES	GRAVEL		SAND			SILT	CLAY	
		COARSE	FINE	COARSE	MEDIUM	FINE			
	152	76.2	19.1	4.76	2.0	0.42	0.075		0.002
GRAIN SIZE IN MM									