GEOTECHNICAL STUDY
PROPOSED IVY KIDS FACILITY
ON CROSS CREEK BEND LANE
FULSHEAR, TEXAS

TGC REPORT NO. 903113
APRIL 1, 2019

PREPARED FOR
CESU INVESTMENTS, LLC
4210 PENSACOLA OAKS LANE
SUGAR LAND, TEXAS 77479

PREPARED BY
TEXAS GEOTECHNICAL CONSULTANTS, LLC.
HOUSTON, TEXAS

TEXAS GEOTECHNICAL CONSULTANTS, LLC

Geotechnical | Environmental | Materials Testing

Date: April 1, 2019

Job No: 903113

CESU Investments, LLC
4210 Pensacola Oaks Lane
Sugar Land, Texas 77479

Attention: Mr. and Mrs. Guthikonda

Reference: Geotechnical Study
Proposed Ivy Kids Facility
On Cross Creek Bend Lane
Fulshear, Texas

Dear Mr. and Mrs. Guthikonda:

Texas Geotechnical Consultants, LLC (TGC), is pleased to submit this report for the geotechnical investigation at the above referenced location. Our findings, analysis and recommendations are submitted herein.

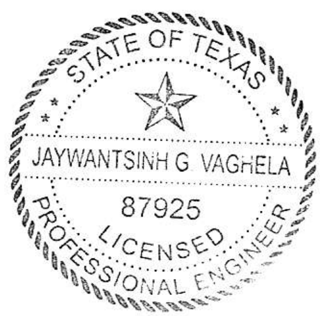
It has been a pleasure working with you on this project and look forward to working with you on your future projects. Should you have any questions regarding this report, please call us at (281) 407-6335.

TEXAS GEOTECHNICAL CONSULTANTS, LLC.

TBPE FIRM NO. F-14495

Jay Vaghela, MSCE, P.E.

Project Manager



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1.0 INTRODUCTION

This investigation was authorized by Mr. Suresh Guthikonda of CESU Investments, LLC, with the acceptance of TGC Proposal No. GP19-0302 dated March 4, 2019. It is planned to build a new Ivy Kids facility on Cross Creek Bend Lane in Fulshear, Texas. We understand that the new building will be approximately 16,000 square feet and will be one storied. There will be associated parking and drives. Although the building column or wall loading information is not currently known to us, it is anticipated that the maximum column loads will be less than 100 kips and the maximum wall loads will be less than 2 kips/feet. This report includes results of the field investigation, laboratory testing, geotechnical engineering analysis and recommendations for the design and construction of proposed building, parking and drives.

2.0 PROJECT SCOPE

The purpose of this geotechnical investigation was to explore the subsurface and ground water conditions at the site, perform laboratory tests on the sampled soils and develop geotechnical engineering recommendations for the design and construction of the proposed new building and parking and drives.

Our scope of services included the following:

- Drilling three (3) soil borings to a depth of 20 feet each for the building and two (2) soil borings to a depth of 5 feet each for the parking and drives.
- Observation of ground water conditions in the borings at the time of drilling.
- Obtaining samples at select depths for performing laboratory tests.
- Performing select laboratory tests on selected soil samples for determining the soils moisture, strength and expansion potential.
- Develop a log of borings by incorporating the field and laboratory data.
- Performing geotechnical engineering analysis and developing foundation design and construction recommendations for the project.

Our scope of work did not include any chemical testing or environmental sampling of the soils. Any information regarding odors in soil samples, soil colors, textures, etc., on the logs of borings or in the report are given for informational purposes only. A geologic fault study to evaluate the potential of surface faulting at this site was also beyond the scope of this study.

3.0 SITE CONDITIONS

The site is relatively flat with a topographic variation of less than 3 feet. The site drainage appears to be fair. The project site is currently vacant and covered with grass.

4.0 FIELD EXPLORATION

At the request of the client, the soil conditions were explored by three (3) soil borings drilled to a completion depth of twenty (20) feet each and two (2) soil borings drilled to a completion depth of five (5) feet each. Boring locations as drilled for this geotechnical exploration are approximately shown on Plate 1. Undisturbed samples were obtained continuously at the boring location to a depth of ten (10) feet and then at five (5) feet intervals thereafter.

Dry auger drilling methods were generally adopted to drill the soil borings to more accurately observe the depth of groundwater. In cohesive soils, undisturbed soil samples were collected using a conventional 3-inch O.D. Shelby tube in general accordance with ASTM D1587. Cohesionless soils were sampled using split spoon sampler in general accordance with ASTM D1586. Standard penetration test (SPT) were performed in the granular soils. All soil samples were examined, classified and logged in the field. Cohesive soil strengths were estimated in the field using a hand penetrometer.

5.0 LABORATORY TESTING

In addition to the field exploration, supplemental laboratory testing was performed to verify field information and obtain additional pertinent engineering characteristics of the soils. Samples obtained from the field were again examined and classified in the lab. Additional testing was performed on selected samples to determine the moisture, shear strength and atterberg limits of the soils. The results of laboratory tests are presented on the borings logs in Plates 2 through 6 of this report.

Soil samples obtained during testing will be stored for a period of 14 calender days subsequent to the submittal of this report. Unless requested otherwise in writing, the soil samples will be discarded.

6.0 SOIL STRATIGRAPHY

Based on the soil boring and the results of the field and laboratory test data, a generalized soil profile is presented below.

Table 1: Generalized Soil Profile

Stratum No.	*Starting Depth, feet*	*Ending Depth, feet*	*Soil Description*
I	0	13	Lean Clay (CL), stiff to hard, dark gray, gray, tan, light brown, brown and redish brown, with sand pockets and layers and root organics.
II	13	17	Clayey Sand (SC), light brown, with lean clay layers, dry.
III	17	20	Silty Sand (SM), dense, tan.

It should be noted that it is often difficult to distinguish between fill sols and apparently similar natural soils in the absence of foreign matter. The lean clay (CL) of stratum I are non- to moderately expansive with plasticity indices (PI's) ranging from 10 to 28. These soils are stiff to hard with hand penetrometer readings ranging from 2.0- to 4.5 tsf. The moderately expansive (PI>20) lean clay (CL) soils are expected to undergo a moderate shrink/swell potential with changes in moisture contents. These moderately expansive lean clay (CL) soils are not suitable for use as select fill in their present condition. These soils once lime stabilized using 5 % lime by dry weight should be suitable for use as select fill. However, these soils in their present condition (and free of any debris, organics or other deleterious materials) should be suitable for use as random fill material.

A more detailed stratigraphy is presented on log of borings B-1 through B-5 (Plates 2 through 6). Definition of terms and key to symbols used in the boring log is presented on Plate 7.

7.0 GROUNDWATER INFORMATION

The soil borings were dry augered to observe the presence of any perched water or ground water. The levels where perched or groundwater were encountered in the borings are shown on the respective boring logs. Groundwater was not encountered in the borings at the time of drilling.

It should also be noted that fluctuations in groundwater levels generally occur as a function of seasonal rainfall variations, groundwater removal, temperatures, topography, surface and subdrainage features around the site.

It should also be noted that a detailed hydrogeological investigation of the proposed project area is beyond the scope of this investigation. An accurate evaluation of the groundwater in the low permeability clays and silt require long term observations in monitoring wells or piezometers. Their installation was not in our scope of work. Groundwater levels should be verified prior to starting any excavations that may be affected by it such as utilities, drilled piers, etc. TGC should be contacted if any significant change is observed in the groundwater then that mentioned in this report. We can then evaluate the effect of any groundwater changes on the design or construction recommendations given in this report.

8.0 POTENTIAL VERTICAL RISE

The upper stratum of soil at this site generally consists of non- to moderately expansive lean clays (CL). These moderately expansive lean soils have a moderate potential for expansion and shrinkage with increases and decreases in moisture content. When these soils receive an increase in its moisture content, they swell or expand. When these soils dry up resulting in a decrease in its moisture content, they settle or shrink. This swelling or shrinking of these soils with changes in its moisture content will affect any building foundation placed on it. There are several methods used to calculate the potential vertical rise (PVR), which is the total amount that the soil is expected to swell or shrink. These methods have different assumptions. Some assume a linear change in moisture content with depth, assuming higher moisture changes at the top and lower moisture changes at deeper depths. Some methods are more conservative and assume constant moisture change throughout the active zone of soil. Here the active zone of soil is defined as the depth of soils up to which changes in moisture content is expected.

In most normal cases, a linear variation of moisture with depth is an appropriate assumption. However, in cases where very negative drainage will result in ponding of water adjoining the foundation at the site or for cases where there is a water leak, the more conservative assumption of constant change in moisture with depth would be more appropriate.

The test method known as TEX-124-E assumes a constant variation in moisture with depth, i.e it assumes that the soils down to the active zone gets saturated. The TEX-124-E method is generally preferred by designers in the area as it may offset risks associated with future unknowns with site drainage or pipe conditions.

Based on Test Method TEX-124-E by the Texas State Department of Highways and Public Transportation, Materials and Tests Division, the soil conditions at this site has a potential vertical rise (PVR) of about 1.0 inch.

9.0 FOUNDATION RECOMMENDATIONS

Foundations for the structures should satisfy three separate design requirements as mentioned here. 1) The maximum foundation loads should not exceed the allowable bearing pressures given in the report. 2) The total and differential settlements under sustained loads should not exceed the settlement tolerance limit of the structure. 3) The total and differential heaving should not exceed the movement tolerance limit of the structure.

The foundation for the proposed building may consist of a floor slab supported on drilled piers or a floating slab foundation supported at grade. Our recommendations for these foundation types are given below.

9.1 DRILLED PIERS

Drilled piers with underreams (bell) may be used for the building foundation. Drilled piers founded at the depths of 10 feet may be designed for an allowable bearing pressure of 3000 psf for dead plus sustained live loads and 4500 psf for total loads. The given values include a factor of safety of 3 and 2, respectively.

An underream to shaft ratio of 3 to 1 may be used for the drilled piers. Seams, pockets or layers of silt or sands or the presence of slickensides in the clay stratum may cause the underream to slough. In the event of underream sloughing, the ratio should be reduced to 2 to 1 by increasing the shaft diameter. If sloughing still continues then straight sided shafts may have to be used. In this event the diameter of the straight shaft must be made equal to the diameter of the designed underream to obtain the same compressive capacity.

Based on the groundwater readings, groundwater is not likely to be encountered during shallow drilled pier excavations. However, it should be noted that fluctuations in groundwater level occurs as a result of seasonal rainfall variations, temperature, drainage changes, etc. In the event that groundwater is encountered, all standing water in the drilled pier excavations should be pumped out and the drilled pier concrete poured as soon as possible after the completion of the excavation. A casing or slurry method may be required for drilled pier installations below the groundwater depth.

The uplift capacity of drilled and underreamed piers may be taken as:

$$Qu = 0.785 * Nu * C * (D^2 - d^2)$$

Here: Qu = Ultimate Uplift Capacity in tons (or kips or pounds)

Nu = Dimensionless factor = 3.5 * (H/D) $\leq$ 9

C = Undrained cohesion in tsf (or ksf or psf) – use 1.0 tsf for design purposes

D = Diameter of underream, feet

d = Diameter of shaft, feet

H = Depth of pier, feet

A factor of safety of 2.0 for transient and wind loads and 3.0 for sustained loads is recommended for the uplift capacity.

The lateral capacity of drilled piers may be calculated using passive resistance of soils. An allowable passive resistance of 1000 psf in lean clay soils may be taken for design purposes. The passive resistance in the top 2 feet should be neglected for design purposes. The lateral capacity may also be analyzed using computer programs such as LPile Plus. A horizontal modulus of subgrade reaction, k, of 400 pci may be taken in natural lean clay soils for design purposes.

The minimum clear spacing of 3 underreams diameters center to center is recommended. If the spacing between the two underreams is less than 3, then stress concentrations will occur between the two piers. Use of lower allowable bearing pressures may be required. TGC should be contacted if the spacing is significantly closer from that recommended above.

9.1.1 Floor Slabs Supported on Drilled Piers

Since the PVR of onsite soils is about 1.0 inch, the floor slabs may be supported on grade. The subgrade soils should be properly compacted as outlined in the "site preparation" section of this report. Positive drainage must be developed and maintained all around the building at all times.

9.2 FLOATING SLAB FOUNDATION

A floating slab foundation at this site may be an engineered post-tensioned slab (Ref. 1) or ribbed & reinforced (conventionally reinforced) slab (Ref. 2) with a perimeter footing and interior thickened sections.

Minimum Grade Beam Depth Below Final Grade: 18 inches

Grade Beam Allowable Bearing Pressure

Total Loads	: 1800 psf			
Dead + Sustained Live Loads	: 1200 psf			
Atterberg Limits	: LL=37;		PL=16;	PI=21
Thornwaite Moisture Index	: Im	=	18	
Constant Suction Value	: PF	=	3.45	
Edge Moisture Variation	: em	=	9.0	ft.(Center lift)
	: em	=	5.8	ft. (Edge lift)
Estimated Differential Swell	: Ym	=	0.8	inch (Center lift)
	: Ym	=	0.7	inch (Edge lift)
Support Index	: C	=	0.85	

9.3 FOUNDATION SETTLEMENT

A detailed settlement analysis was not within the scope of our work. It is anticipated that foundations designed based on the allowable bearing pressures and other recommendations as given in this report will experience settlements which should be within the allowable limits of the proposed structure.

10.0 PAVEMENT

10.1 GENERAL

We understand that the pavement for parking areas and drives will consist of concrete or asphalt paving. The traffic likely to use the pavement will generally consist of light automobile vehicles and medium trucks. The heaviest vehicle will consist of a daily garbage truck. The paving will be supported on existing soils. The top 6 inches of onsite soils under the paving should be lime-fly ash stabilized using 3% lime and 7% fly ash by dry weight. Alternatively, 10% cement may also be used for the stabilization.

For the purpose of recommendations given below the light, medium and heavy vehicles should be considered based on the following weights.

Light Vehicle	up to 5,000 lbs
Medium Vehicle	5,000 lbs to 20,000 lbs
Heavy Vehicle	greater than 20,000 lbs

The concrete and asphalt paving section thickness are given below.

10.2 CONCRETE PAVEMENT

The concrete paving thickness for the different paving areas may be taken as given below.

Paving Area	Paving Thickness
Light and Medium Vehicle Parking	5 inches
Light and Medium Vehicle Drives	6 inches
Heavy Vehicle Drive	7 inches

The concrete for the garbage dumpster pad where the garbage trucks stops and moves back and forth should be 7 inches thick. The top 6 inches must be stabilized as given in section 10.1.

The 5 inch thick concrete pavement may be reinforced using No.4 bars spaced at 24 inches center in both directions. The 6 and 7 inch thick concrete pavement may be reinforced using No. 4 bars spaced at 18 inches and 15 inches center, respectively, in both directions. Other suitable thicknesses and spacing acceptable to the designer may also be used.

10.3 ASPHALT PAVEMENT

The asphalt paving section thickness for the different parking areas may be taken as given below.

Paving Area	HMAC	Base	Stabilized Subbase
Light and Medium Vehicle Parking	2 inch	6 inch	6 inch
Light and Medium Vehicle Drives	2 inch	8 inch	6 inch
Heavy Vehicle Drive	3 inch	8 inch	8 inch

The garbage dumpster pad where the garbage trucks stops and moves back and forth should be of concrete as given in section 10.2. The subbase/subgrade soils must be stabilized as given in section 10.1.

The base may consist of crushed limestone, gravel or crushed concrete. The HMAC should consist of TXDOT Type D, Standard Item 340.

11.0 SITE PREPARATION

The site has a potential for development of a condition called "perched water" wherein the water ponds within the surface sand and silt pockets and layers especially when they are underalined or surrounded by relatively impermeable lean clays. The surface silts and sands are firm when dry but may become extremely soft when wet. These soils may then have to be aerated, chemically stabilized or replaced with select fill. The following system of construction procedures is recommended:

1. In general remove all surface organics, organic topsoil, roots, existing foundations and paving and all unsuitable materials from all structure and paving areas.
2. Proof roll the subgrade with a loaded dump truck, scraper or similar pneumatic-tired equipment to detect any wet, soft, or pumping areas. Soils deflecting excessively during proofrolling should be undercut to firm soils and recompacted. Treat the wet or pumping soils with drying or stabilizing agents as necessary or remove and replace them with a suitable fill material. Any existing fill material should have records of passing densities for all lifts or should be excavated, reprocessed and recompacted as below.
3. Scarify the subgrade, add moisture or dry as necessary and compact the subgrade to a minimum of ninety-five (95) percent of its maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). The moisture content should be plus or minus 2 percent of the optimum moisture.
4. Structural fill material within the structure area should be a lean clay (CL) having a plasticity index (P.I.) of ten (10) to twenty (20) and a liquid limit of 25 or more. Fill materials should be placed in six (6) to eight (8) inch loose lifts and compacted at plus or minus 2 percent of optimum moisture content to ninety-five (95) percent of their maximum dry density as determined by the Standard Proctor Compaction Test.
5. Establish positive site drainage. Install storm drainage structures if required.

6. The backfill soils in the utility trenches may consist of select fill mentioned in Item 4. In the event of compaction difficulties, cement sand may be used as backfill material. Due to the high permeability and potential for surface water intrusion from these soils to under the building slab, bank sand should not be used as backfill material for the utility trenches under the building and minimum 5 feet outside the building area.
7. The subgrade and fill moisture content and density must be maintained until the placement of floor slabs or pavement. Verification of this should be done prior to slab or pavement placement. Scheduling of the building slab pour as soon as possible after the subgrade and fill compaction would help in minimizing moisture and density changes due to drying, wetting or disturbance of these soils.

12.0 VEGETATION CONTROL

12.1 Existing Trees

Existing trees roots absorb moisture from their surrounding soils. This results in formation of pockets of isolated dry soils around the tree roots with a moisture content significantly lower than the soil moisture contents away from these roots. When the trees are cut, the roots die and stop absorbing moisture from their surrounding soils. With time and seasonal rainfall as well as by capillary action, these dry pockets of soils will undergo increases in moisture content and as a result heave. If the tree is cut and a building or paving is immediately constructed on it, then these isolated areas of dry soils will heave more than the soils at other areas of the building/paving or site. This will result in differential heaving under the structure or pavement. Where large trees are cut and building built over it, the slab should be stiffened to resist the higher differential heave. Alternatively, a safer option would be to structurally support the building slab on deeper footings with a void space larger than the anticipated maximum heave of the drier soils. Positive drainage should be developed and maintained all around the building at all times.

12.2 New Trees

New trees should be avoided near the building slab especially larger trees. No tree should be planted closer than 20 feet or half the canopy diameter of fully matured trees. Alternatively, root barriers may be used to prevent the migration of tree roots underneath the buildings. Use of large shrubs should be avoided immediately adjacent to the building slab.

13.0 SITE DRAINAGE

Final site drainage is very critical for long term performance of the proposed structure and pavement.

1. In general, set top of concrete at least eight inches above final adjacent soil grade for damp proofing.
2. Provide adequate drainage away from foundations (minimum ten percent slope in the first five feet). The bottom of any drainage swale should not be located within four feet of the foundations. Pervious planting beds should slope away from the foundations at least two inches per foot. Planting bed edging shall allow water to drain out of the beds. Water must not be allowed to pond anywhere close to the building or pavement.
3. Gutters or extended roof eaves may be used, especially under all roofs valleys. All extended eaves or gutter down spouts should extend at least two feet away from the foundations and past any adjacent planting beds. Roof drains should preferably discharge to storm sewers by closed pipe or extended away from the structures by 5 feet or as far as possible.
4. Any plumbing leaks must be repaired immediately.
5. Sprinkler systems if used should be used all around the building to provide a uniform water application system. Sprinkler systems should be located a minimum of five feet from the building edge.
6. Moisture conditions should be maintained "constant" around the edge of the building or pavement. Ponding of water or excessive drying should not be allowed in planter beds or anywhere adjacent to the building or pavement edge.
7. Large trees and shrubs should not be planted closer than 20 feet or half the canopy diameter of mature trees or shrubs.

14.0 CONSTRUCTION OBSERVATIONS

Texas Geotechnical Consultants, LLC. (TGC) recommends implementation of a comprehensive quality control program under the supervision of a Professional Engineer. Structural integrity and stability is particularly dependent on quality foundation installation.

Construction inspection and quality control tests should be planned to verify materials and placement with accordance with the specifications. TGC should be retained to review the foundation drawings and specifications to verify that the recommendations outlined in this report have been properly interpreted and implemented. Proofrolling, subgrade compaction, fill placement, drilled footing construction and concrete strength should be monitored.

15.0 LIMITATIONS OF STUDY

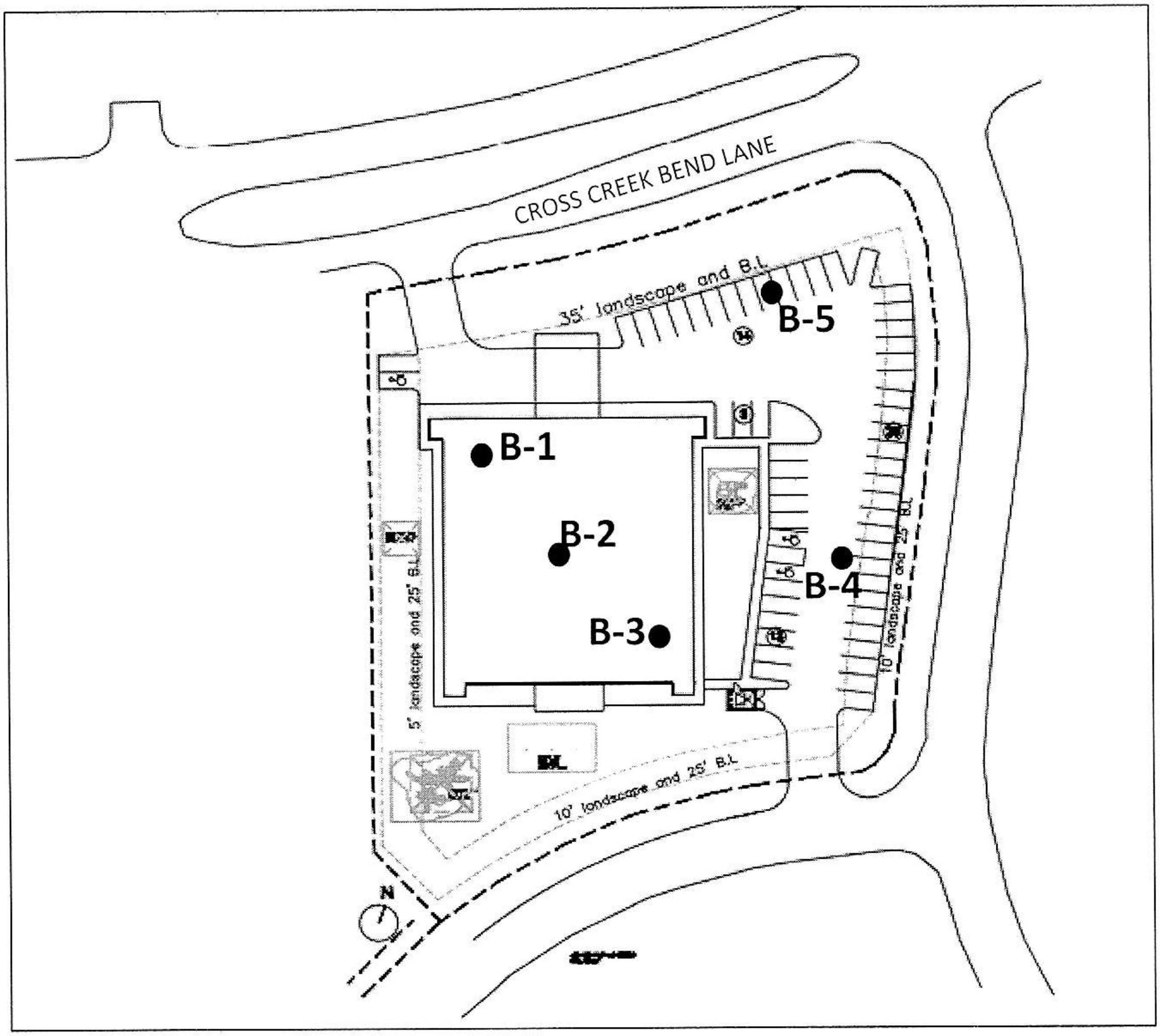
The analysis and recommendations submitted in this report are based upon the data obtained from the five (5) borings drilled at the site. Soil conditions may vary across the site. If significant variations are noted during construction, TGC should be contacted to evaluate the effect of these variations on the recommendations given in this report.

TGC states that the findings, recommendations or professional opinions or advice contained in this report (and that may be given henceforth in connection with this project) have been made and this report prepared in general accordance with generally accepted professional engineering practice in the field of geotechnical engineering as based on the location, size and type of project. No other warranties, either written or verbal, are implied or expressed.

This report has been prepared for the exclusive use of the owner, the project architect, the project structural engineer and contractors for the specific application to the project on Cross Creek Bend Lane in Fulshear, Texas.

16.0 REFERENCES

1. "Design and Construction of a Post-Tensioned Slab-On-Ground", 3rd Edition, Post-Tensioning Institute, Phoenix, Arizona, 2004 (with 2008 supplement).
2. Snowden, Walter L (1981), Design of Slab-On-Ground Foundation, Snowden, Inc., Austin, Texas.
3. Joseph E. Bowles (1982), Foundation Analysis and Design, 3rd ed., McGraw-Hill Book Company.



Note: Boring Locations shown are Approximate.

Project Name: Proposed Ivy Kids at Crosscreek Bend Lane, Fulshear, Texas TGC Report No. 903113 Date: 03-17 -2019 Scale: Not to Scale	BORING LOCATION PLAN

TEXAS GEOTECHNICAL CONSULTANTS, LLC.

LOG OF BORING B-1

Project: Proposed Ivy Kids
On Cross Creek Bend Lane
Fulshear, Texas

Client: CESU Investments, LLC

Date: 3/17/2019
Job Number: 903113
Boring Method: Dry Auger
Elevation: Existing
Driller: Drill-Tex

FIELD DATA					LABORATORY DATA							
Depth (Feet)	Samples	Soil Types	SPT (Blows Per Feet)	SOIL DESCRIPTION	Moisture Content, %	Plasticity Index	Liquid Limit	UC Shear Strength, tsf	TV Shear Strength, tsf	Hand Penetrometer, tsf	200 Sieve, %	Unit Dry Weight, pcf
1		CL		Lean Clay (CL), very stiff, dark gray and brown, with sand pockets and root organics	10	14	29		2	3		
2												
3				hard, tan and browns below 2 feet	10			2.1	2.5	4.5		112
4												
5				tan, gray and light brown below 4 feet	15	28	47		2.5	4.5		
6												
7				gray, tan and reddish brown below 6 feet	14				2.5	4.5		
8												
9					13	25	43		2.5	4.5		
10												
11												
12												
13												
14		SC		Clayey Sand (SC), light brown, dry	7.7					3		
15												
16												
17												
18		SM		Silty Sand (SM), dense, tan								
19					3.1							
20			30									
				Boring terminated at 20 feet								

REMARKS:
UC Shear Strength = Unconfined Compression Shear Strength
TV Shear Strength = Torvane Shear Strength

GROUNDWATER: dry

Hole Caved: no

PLATE 2

TEXAS GEOTECHNICAL CONSULTANTS, LLC. — LOG OF BORING B-2

Project:	Proposed Ivy Kids On Cross Creek Bend Lane Fulshear, Texas	**Date:** 3/17/2019	
		Job Number: 903113	
		Boring Method:	Dry Auger
Client:	CESU Investments, LLC	**Elevation:**	Existing
		Driller:	Drill-Tex

FIELD DATA					LABORATORY DATA							
Depth (Feet)	Samples	Soil Types	SPT (Blows Per Feet)	SOIL DESCRIPTION	Moisture Content, %	Plasticity Index	Liquid Limit	UC Shear Strength, tsf	TV Shear Strength, tsf	Hand Penetrometer, tsf	200 Sieve, %	Unit Dry Weight, pcf
1		CL		Lean Clay (CL), very stiff, dark gray and brown, with sand pockets and root organics	9.3				2	3.5		
2												
3				hard, tan and browns below 2 feet	11	12	27		2.5	4.5		
4												
5					12				2.5	4.5		
6												
7				gray, tan and reddish brown below 6 feet	13	26	44		2.5	4.5		
8												
9					13				2.5	4.5		
10												
11												
12												
13												
14		SC		Clayey Sand (SC), light brown, with lean clay layers, dry	5.3	7	21			2.3		
15												
16												
17												
18		SM		Silty Sand (SM), dense, tan								
19					3.2							
20			32									
				Boring terminated at 20 feet								

REMARKS:
UC Shear Strength = Unconfined Compression Shear Strength
TV Shear Strength = Torvane Shear Strength

GROUNDWATER: dry

Hole Caved: no

PLATE 3

TEXAS GEOTECHNICAL CONSULTANTS, LLC.

LOG OF BORING B-3

Project: Proposed Ivy Kids
On Cross Creek Bend Lane
Fulshear, Texas

Client: CESU Investments, LLC

Date: 3/17/2019
Job Number: 903113
Boring Method: Dry Auger
Elevation: Existing
Driller: Drill-Tex

FIELD DATA / **LABORATORY DATA**

Depth (Feet)	Samples	Soil Types	SPT (Blows Per Feet)	SOIL DESCRIPTION	Moisture Content, %	Plasticity Index	Liquid Limit	UC Shear Strength, tsf	TV Shear Strength, tsf	Hand Penetrometer, tsf	200 Sieve, %	Unit Dry Weight, pcf
1		CL		Lean Clay (CL), very stiff, dark gray and brown, with sand layers and root organics	7.7	20	36		2.5	4		
2				hard, tan and browns below 2 feet								
3					8.9				2.5	4.5		
4												
5					16	13	28		2.5	4.5		
6				gray, tan and reddish brown below 6 feet								
7					14				2.5	4.5		
8												
9					10	15	31	1.9	2.5	4.5		115
10												
11												
12												
13												
14		SC		Clayey Sand (SC), light brown, with lean clay layers	13					2.5		
15												
16												
17												
18		SM		Silty Sand (SM), dense, tan								
19					3							
20			30									
				Boring terminated at 20 feet								

REMARKS:
UC Shear Strength = Unconfined Compression Shear Strength
TV Shear Strength = Torvane Shear Strength

GROUNDWATER: dry

Hole Caved: no

PLATE 4

TEXAS GEOTECHNICAL CONSULTANTS, LLC.		LOG OF BORING B-4
Project:	Proposed Ivy Kids On Cross Creek Bend Lane Fulshear, Texas	**Date:** 3/17/2019 **Job Number:** 903113 **Boring Method:** Dry Auger
Client:	CESU Investments, LLC	**Elevation:** Existing **Driller:** Drill-Tex

FIELD DATA | **LABORATORY DATA**

Depth (Feet)	Samples	Soil Types	SPT (Blows Per Feet)	SOIL DESCRIPTION	Moisture Content, %	Plasticity Index	Liquid Limit	UC Shear Strength, tsf	TV Shear Strength, tsf	Hand Penetrometer, tsf	200 Sieve, %	Unit Dry Weight, pcf
		CL		Lean Clay (CL), very stiff, dark gray and brown, with sand layers and root organics								
1					5.4				2	3		
2				tan and brown below 2 feet								
3					9.6	21	37		2	3.3		
4												
5					22				2	3.5		
				Boring terminated at 5 feet								

REMARKS:
UC Shear Strength = Unconfined Compression Shear Strength
TV Shear Strength = Torvane Shear Strength

GROUNDWATER: dry

Hole Caved:

TEXAS GEOTECHNICAL CONSULTANTS, LLC.

LOG OF BORING B-5

Project: Proposed Ivy Kids
On Cross Creek Bend Lane
Fulshear, Texas

Client: CESU Investments, LLC

Date: 3/17/2019
Job Number: 903113
Boring Method: Dry Auger
Elevation: Existing
Driller: Drill-Tex

FIELD DATA					LABORATORY DATA							
Depth (Feet)	Samples	Soil Types	SPT (Blows Per Feet)	SOIL DESCRIPTION	Moisture Content, %	Plasticity Index	Liquid Limit	UC Shear Strength, tsf	TV Shear Strength, tsf	Hand Penetrometer, tsf	200 Sieve, %	Unit Dry Weight, pcf
1		CL		Lean Clay (CL), very stiff, dark gray and brown, with sand layers and root organics	15	10	25		2	3.3		
2				stiff below 2 feet								
3					12				1	2		
4				hard, tan and brown below 4 feet								
5					18				2.5	4		
				Boring terminated at 5 feet								

REMARKS:
UC Shear Strength = Unconfined Compression Shear Strength
TV Shear Strength = Torvane Shear Strength

GROUNDWATER: dry

Hole Caved:

PLATE 6

TERMS USED ON BORING LOGS

SOIL GRAIN SIZE

U.S.STANDARD SIEVE

6"	3"	¾"	#4	#10	#40	#200		
BOULDER	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
152	76.2	19.1	4.76	1.00	0.420	0.074	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

STRENGTH OF COHESIVE SOILS

Consistency	Undrained Shear Strength, Kips Per Sq. ft
Very Soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

RELATIVE DENSITY OF COHESIONLESS SOILS

(From Standard Penetration Tests)

Very Loose	< 4 bpf
Loose	5-10 bpf
Medium Dense	11-30 bpf
Dense	31-50 bpf
Very Dense	>50 bpf

(bpf= blow per foot, ASTM D 1586)

SPLIT BARREL SAMPLER DRIVING RECORD

Blows per Foot	Description
25	25 blows driving sampler 12 inches after initial 6 inches of seating.
50/7"	50 blows driving sampler 7 inches after initial 6 inches of seating.
50/3"	50 blows driving sampler 3 inches after initial 6 inches of seating.

Note: To avoid damage to sampling tool, driving is limited to 50 blows during or after seating interval.

DRY STRENGTH ASTM D2488

None	Dry Specimen crumbles into powder with mere pressure of handling
Low	Dry Specimen crumbles into powder with some finger pressure
Medium	Dry Specimen breaks into pieces or crumbles with considerable pressure
High	Dry Specimen cannot be broken with finger pressure, can be broken between Thumb and hard surface
Very High	Dry Specimen cannot be broken between the thumb and hard surface

MOISTURE CONDITION ASTM D2488

Dry	Absence of Moisture
Moist	Damp but no visible water
Wet	Visible free water

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy. The degree of slickensidedness depends upon the spacing of slickensides and the easiness of breaking along these planes.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt usually more or less vertical
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample
Paring	Inclusion of less than 1/8 inch thick extending through the sample
Seam	Inclusion of 1/8 inch to 3 inches thick extending through the sample
Layer	Inclusion of greater than 3 inches thick extending through the sample
Laminated	Soil sample composed of alternating partings or seams of different soil types
Calcareous	Having appreciable quantities of calcium material
Ferrous	Having appreciable quantities of ferrous or iron nodules