Geotechnical, Material Testing and MEP

PROJECT NO. A-2230240

DATE PREPARED: 09/18/2022

GEOTECHNICAL INVESTIGATION
FOR
PROPOSED BLUE ZONE RESORT
AT 1315 S CHURCH STREET
ROCKPORT, TX

REPORTED TO

COASTAL BEND OZ FUND, CEO & GENERAL PARTNER
HOUSTON, TX

PREPARED BY

BUILD ENGINEERING GROUP, LLC

Geotechnical Engineering – Construction Materials Testing – MEP

6363 San Felipe St., Houston, TX 77057 – 713.367.8188

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Project No: A-2230240
Report No: 01
September 18, 2022

John Berlet,
Houston, TX

GEOTECHNICAL INVESTIGATION
FOR
PROPOSED BLUE ZONE RESORT
AT 1315 S CHURCH STREET
ROCKPORT, TX

Build Engineering Group (BEG) has completed a geotechnical exploration for the above referenced project. This study was conducted per your authorization on August 30, 2022 (proposal number P-2230214).

This report describes the field exploration and laboratory testing followed by our engineering analysis. The results were used to develop recommendations to aid in design and construction of the proposed foundations and paving.

We appreciate and wish to thank you for this opportunity to assist you on this project. If we can be of further assistance, please contact our office.

Yours very truly,

Build Engineering Group
TBPE Reg. No. 20409

YUEYUE XIE
140157

Luna Xie

Luna Xie,
Geotechnical Engineer, P.E
Copy Submitted: (1) Client.

Al Abed

Al Abed,
Project Manager, Ph.D.

GEOTECHNICAL EXPLORATION

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1.0 INTRODUCTION

1.1 Project Description

It is planned to construct a resort at 1315 S Church Street, Rockport, Texas. Information regarding structural loads was not available at the time of this investigation. However, we anticipate light loading. We understand that shallow footing or slab on grade type foundation will be used to support the structural loading.

1.2 Scope of Work

The scope of this study are as follows:

- Subsurface soil and groundwater conditions on site based on 9 soil boreholes to a depth of 20-ft from the existing ground elevation.
- Engineering characterization of the subsurface materials encountered.
- Design criteria for shallow footing and slab on grade foundation system.
- Recommendations regarding site preparation and earthwork.

The scope of this study excludes any environmental assessment studies of soil, surface water or groundwater. Also, any slope stability analysis (for natural or constructed) and stability analysis of retaining wall are not within the scope of this study.

2.0 FIELD EXPLORATION AND SUBSURFACE CONDITIONS

2.1 Soil Boreholes

The soil conditions were explored by conducting 9 soil boreholes. Soil samples were obtained continuously at each borehole location from the ground surface to 10-ft and at five-ft intervals thereafter to the completion depth of the boreholes.

Soil samples obtained were visually classified and logged during retrieval. Information on field observation, classification of the soils encountered and strata limits are presented on the borehole logs shown in Appendix. Lines delineating subsurface strata on the borehole logs are approximate and the actual transition between strata may be gradual.

2.2 Groundwater Measurements

Boreholes were drilled without the aid of drilling water or fluid, to estimate the depth to perched or free-water conditions more accurately. Groundwater was encountered at depths of about 8 to 10 ft during drilling.

Fluctuations in groundwater generally occur as a function of seasonal moisture variation, temperature, groundwater withdrawal, atmospheric conditions and future construction activities that may alter the surface and sub drainage characteristics of this site.

The pressure and/or level of groundwater that might occur cannot be predicted accurately based upon short-term site investigation work. Most of the materials encountered in the boreholes are considered relatively impermeable and are anticipated to have a slow response to water movement.

The accurate evaluation of the hydrostatic water table requires long term observation of monitoring wells and/or piezometers. The installation of piezometers/monitoring wells was beyond the scope of our study. We recommend that BEG be immediately notified if a noticeable change in groundwater occurs from that mentioned in this report. We would be pleased to evaluate the effect of any groundwater changes on the design and construction sections of this report.

2.3 Laboratory Tests

Laboratory tests were conducted on selected representative samples of the major strata obtained from boreholes to further classify the soils and to evaluate the engineering properties of soil. ASTM D-2487 was used for classification of soils for engineering purposes. The laboratory tests were performed in general accordance with relevant ASTM standards as follows:

Laboratory Test	*ASTM Standard*
Visual Soil Classifications	ASTM D 2488
Atterberg Limits	ASTM D 4318
Natural Moisture Content	ASTM D 4643
% Passing No. 200 Sieve	ASTM D 1140

Based on the test results, soils samples were classified according to ASTM D 2487. In addition, undrained shear strengths of the cohesive soils were verified by hand penetrometer tests. The test results are presented on the borehole logs at representative sample depth.

All soil samples in the laboratory are stored for a period of 7 days following the submission of this report. The samples will be discarded after this period, unless BEG is instructed to retain samples.

3.0 FOUNDATIONS ON EXPANSIVE SOILS

3.1 Expansive Soils

Soil boreholes and laboratory tests indicates the presence of very low expansive characteristics of soils at the subject site. The subsoil has an effective Plasticity Index (PI) of 15. Expansive soils shrink when water is removed and swell when water is added. Foundations constructed on expansive soils are subject to uplifting forces caused by the swelling, if environmental or man-made conditions cause a change in the moisture level of the soil. The potential heave is influenced by the soil properties, overburden pressures, and to a great extent by soil moisture levels at the time of construction.

3.2 Potential Vertical Rise (PVR) and Subgrade Improvement for Floor Slab

Shrink and swell of foundation soils causes the foundation to move vertically. The potential vertical movement due to shrink/swell potential of the foundation soil is determined by the Texas Department of Transportation (TxDOT) Method 124-E in conjunction with engineering judgment and experience. The estimated movements were calculated assuming the moisture content of the in-situ soils, within the normal zone of seasonal moisture content change, varies between a ‘dry’ condition and a ‘wet’ condition as defined by TEX 124-E. The zone which has the potential for moisture variation due to seasonal changes is called as the active zone.

Considerably more movement will occur in areas where positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface migration from off-site locations.

Based on our calculations, the subsoils at the subject site have the Potential Vertical Rise (PVR) of about 1.0 inch. Surcharge load of 1 psi from the slab is assumed for PVR calculations. **This potential movement is based on any fill placed within the building pad area consisting of on-site soils or sandy clay, with a plasticity index of 20 or less, and meeting other general requirements discussed in Section 5.1.** Imported material used as fill in the building pad should consist of select fill as discussed in Section 5.1. Fill with a plasticity index greater than 15 in the building pad will increase potential slab movements and should not be utilized.

The PVR is estimated based on the current site grades and subsoil conditions. If cut and/or fill operations in excess of 3 ft are performed, the PVR value could change significantly.

In general, a soil-related potential seasonal movement on the order of about 1 inch is considered acceptable by local structural engineers and does not require soil improvement methods to reduce the magnitude further. It should be noted however, that the use of any floor slab-on-grade or slab foundation system will experience some vertical movement associated with seasonal moisture variations. In choosing this type of slab system, the Owner is accepting some post construction movement (about 1 inch) of the slab.

Due to the loose nature of subgrade materials (granular soils) beneath the existing ground surface, we recommend placing at least two (2) ft of compacted select fill or flexible base under all the foundation elements (grade beams and footings). The select fill should be compacted in accordance with Section 5.1.

The owner must fully understand that if the floor slab is placed on-grade, some movement and resultant cracking within the floor and interior wall partitions may occur. This upward slab movement and cracking usually is difficult and costly to repair and may require continued maintenance expense. A greater risk of unsatisfactory foundation performance exists with a slab-on-grade design than for a drilled shaft design.

The use of a vapor retarder should be considered beneath interior concrete floor slabs in areas with moisture sensitive flooring. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 for procedures and cautions about the use and placement of a vapor retarder.

4.0 DESIGN RECOMMENDATIONS

4.1 Foundations Type

Generally, lightly loaded foundations are designed and constructed on the basis of economics, risks, soil type, foundation shape and structural loading. The foundation systems are subdivided into two groups: deep support systems and shallow support systems. Each of these systems has an associated level of risk of damage that can occur to the building superstructure and architectural components due to differential foundation movements.

Building owners and/or developers need to be involved in the selection process of the foundation system. Most of the time, the foundation types are selected by the owner/builder, etc. Each of these systems also has an associated relative cost of construction. When comparing the various foundation systems, the level of risk is typically found to be inversely proportional to the level of cost. Many times, due to economic considerations, higher risks are accepted in foundation design. For example, shallow support systems typically have a relatively higher level of risk than deep support systems, but are often selected due to economics and affordability.

All the foundations must be stiffened in the areas where expansive soils are present, and trees have been removed prior to construction. It should be noted that these foundations are not designed to resist soil and foundation movements as a result of sewer/plumbing leaks, excessive irrigation, poor drainage and water ponding near the foundation system.

Foundations for the proposed structure should satisfy two independent design criteria. First, the maximum design pressure exerted at the foundation level should not exceed allowable net bearing pressure based on an adequate factor of safety with respect to soil shear strength. Secondly, the magnitude of total and differential settlements or heave under sustained foundation loads must be such that the structure is not damaged or its intended use impaired.

4.2 Shallow Foundation System

The proposed structural loads can be supported on spread footings. Spread footings can be seated at a depth of 2 ft below final grade on compacted select fill soils. Based on the results of field exploration, laboratory test data and bearing capacity theory, allowable net bearing pressures for spread footings supporting the building will be 1,500 psf. Foundations proportioned in accordance with these values will have a factor of safety of 3 with respect to shearing failure for total loadings. Footing weight below final grade can be neglected in determination of design loading.

Wall footings should have a least dimension of 12 inches in width and column footings should have a least dimension of 18 inches for bearing capacity considerations.

Based on our current groundwater observations, footing excavations should not encounter groundwater. Any water inflow must be pumped out using a sump-pump. The footing excavations should be free of loose material and water prior to concrete placements, and concrete should be poured as soon as possible.

Detailed observations of spread footing construction should be required by a qualified engineering technician to assure that the footings are founded in the proper bearing stratum, have the proper depth, have the correct size, and that all loose materials have been removed prior to concrete placement.

Lateral loads on spread footings may be resisted by soil friction and by the passive resistance of the soils. An allowable friction resistance of 300 psf may be used between the foundation bottom or concrete slabs and the supporting soils. A factor of safety of 2.0 was used in the design. An allowable net passive resistance of natural soils may be assumed to be equal to 100 psf per ft of depth below a depth of 2 ft from final grade. A one-third increase in the passive value may be used for wind loads. The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.

Foundation excavations should be protected against any significant change in soil moisture content and disturbance by construction activity. If concrete is not poured the same day, the excavation is completed, we recommend placement of a thin seal slab over the base of the excavation.

4.3 Slab-on-Grade Foundation – Alternative

A slab-on-grade foundation system may be considered to support the building. The slab foundation could experience soil-related potential seasonal movements up to 1.0 inch as discussed in Section 3.2.

The structural loads could be supported on a post-tensioned or concrete reinforced slab foundation**.** We recommend maintaining drainage, landscaping and vegetation as recommended in Section 4.6 of this report. If proper drainage, landscape or vegetation control is not maintained, foundation movement will occur.

To reduce cracking as normal movements occur in foundation soils, all grade beams and the floor slab should be adequately reinforced with conventional reinforcing steel. However, it is common to experience some minor cosmetic distress to structures with slab-on-grade foundation systems due to normal ground movements. A properly designed and constructed moisture barrier should be placed between the slabs and subgrade soils to retard moisture migration through the slabs.

4.3.1 Post-Tensioned Slab

Our recommendations for slab design parameters are based on the conditions encountered in the boreholes. Our recommendations for the design of post-tensioned slab or reinforced concrete slab-on-grade slabs are in general accordance with the PTI DC10.1-08, 3rd Edition with 2008 supplement. Our recommendations for post-tensioned slab or reinforced concrete slab-on-grade slabs are as follows:

GEOTECHNICAL EXPLORATION	
Design Condition	**Bearing Capacity**
Effective Plasticity Index (PI) = 15 Thornthwaite Moisture Index = -12 Required Subgrade Soil Shear Strength = 1,000 psf Subgrade Preparation according to Chapter 5.0 of this report.	Allowable Net Bearing Capacity: Dead Loads Only = 1,000 psf (FS = 3.0) Total Loads = 1,500 psf (FS = 2.0) Minimum Grade Beam Depth Below the Final Grade = 2-ft Minimum Grade Beam Width = 10-inches

PTI Parameters					
	PVR	y_m, inch		e_m, ft	
Subgrade Condition	inch	Center Lift	Edge Lift	Center Lift	Edge Lift
Existing Soil	1.0	1.0	1.2	8.7	4.5

It should also be noted that these foundations are not designed to resist soil and foundation movements as a result of non-climatic factors such as continued utility leaks, trees, slope, cut and fill sections, excessive irrigation, lack of maintenance, poor drainage and water ponding near the foundation system. Due to the presence of expansive soils on the site, we recommend the post-tensioned slab be stiffened such that minimum differential movements occur once a portion of the slab is lifted by the expansive soils. If no movement can be tolerated by the client, a structural slab with drilled shafts is recommended.

A bedding layer of leveling sand, one- to two-inch in thickness, may be placed beneath the floor slab. A layer of vapor retardant should be used above the sands to prevent moisture migration through the slab. The excavations for the grade beams should be free of loose materials prior to concrete placement.

Adjacent flatwork such as sidewalks and pavements should be designed in such a way as to allow for differential movements between flatwork and the exterior perimeter of the residence foundation.

Information was not available on whether fill will be used to raise site grade prior to slab construction. In the event that fill is placed on site, specifications should require placement in accordance with our recommendations given in the "Site Preparation" section. Lack of proper site preparation may result in additional stress and inferior slab performance. The on-site soils, free of root organics, are suitable for use as structural fill under a post-tensioned slab foundation. Sands should not be used as structural fill materials at this site (with the exception of top two-inch of leveling sand under the slab).

A detailed settlement analysis was not within the scope of this study. It is anticipated that grade beams and slabs designed using the recommended allowable bearing pressures will experience small settlements that will be within the tolerable limit for the proposed residence.

4.3.2 Conventionally Reinforced Slab

A conventionally reinforced slab-on-grade foundation may be designed using the Building Research Board Report No. 33 (BRAB) as a guideline. Alternatively, the foundation may be designed based on the Design of Slab-On-Ground Foundations published by the Wire Reinforcement Institute, Inc. (WRI, August 1981). These design parameters are presented in the table below.

Design of BRAB/WRI Slab-On-Grade Foundation System Potential Seasonal Movement = 1.0 inch		
Design Method	**BRAB**	**WRI**
Allowable Net Bearing Capacity: Dead Loads Only (FS = 3.0) Total Loads (FS = 2.0)	 1,000 psf 1,500 psf	 1,000 psf 1,500 psf
Minimum Grade Beam Depth Below the Final Grade	2 ft	2 ft
Minimum Grade Beam Width	10 inches	10 inches
Climatic Rating (Cw)	17	17
Effective Plasticity Index	15	15
Support Index (C)	1.0	--
Soil/Climatic Rating Factor (1-C)	--	0.0
Unconfined Compressive Strength (tsf)	1.0	--

Prolonged exposure of the bearing surface to air or water will result in changes in strength and compressibility of the bearing stratum. Therefore, if delays occur, grade beam excavations for slab foundations should be slightly deepened and cleaned to provide a fresh bearing surface.

4.4 Parking and Drive Areas

We understand that concrete paving is planned for parking areas subject to light/auto loading and heavy truck loading. Traffic information is not available at the time of this report preparation. Recommendations on pavement structures are provided in the following sections.

The results of our field and laboratory test data indicate that the surficial soils in the parking areas generally consist of silty sand (SM) soils. These soils have subgrade moduli, k, ranging from 100 to 140 pci and CBR values ranging from 3 to 5. Based on the subgrade soil properties, the recommended minimum concrete and asphalt pavement thicknesses for parking areas subject to auto/light traffic and heavy truck traffic loading are as follows:

Layers	Auto/Light Truck Traffic, in Up to 75,000 ESALs*	Service Drive, Dumpster Area or Moderate Truck Traffic, in Up to 1,400,000 ESALs	Heavy Volume Truck Traffic Up to 2,900,000 ESALs
Surface: Concrete Pavement	6	7	8
Subgrade: Lime-fly ash or Cement Stabilized	6	6	8

* ESAL: 18-Kip Equivalent Single Axle Load

The subgrade should be stabilized using lime-fly ash with 2% of lime and 8% fly ash by dry weight (TxDOT Specification Item 265). The application rates corresponding to these additive amounts would be 10 pounds of lime and 40 pounds of fly-ash per square yard, respectively, for each six inches of compacted thickness. The application rates will be approximately 13.5 pounds of lime and 53 pounds of fly-ash per square yard, respectively, for each eight inches of compacted thickness. The lime-fly ash stabilized subgrade should be compact to 95% of Maximum Standard Proctor Density (ASTM D 698) at a moisture content between optimum and +3% of optimum.

If cement modification is used, the subgrade should be stabilized using at least 4 percent Portland cement (by dry unit weight) in conformance with TxDOT Item 275. This percentage of cement equates to about 20 lbs of cement per square yard of subgrade treated for a depth of 6 inches or about 27 lbs of cement per square yard of subgrade treated for a depth of 8 inches. The soil-cement mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of -1 to +3 percentage points of the mixture's optimum moisture content.

Concrete compressive strength should be of 3500 psi at 28 days. The paving for the auto traffic should be reinforced with #4 bars at 20-inches on center-to-center each way. The paving for the heavy truck traffic should be reinforced with #4 bars at 18-inches center-to-center each way. Minimum Lab length shall be 22-inch. Suggested longitudinal and transverse joint spacing for concrete paving is 15-feet. The expansion joint spacing is approximately 80-feet. Steel used for reinforcements should be grade 60.

It should also be noted that these pavement recommendations are not designed to resist soil and pavement movements due to the presence of expansive soils. There is a potential for pavement movements and subsequent pavement cracks due to the expansive soils. If no movement is preferred, then soil remediation should be performed. Recommendations for soil remediation are provided in Section 3.2 of this report. In addition, the pavement should be maintained in accordance to the recommendations presented in Section 4.6 of this report. Normal maintenance of pavement should be expected over the life of the structures.

4.5 Foundation Maintenance

Long term performance of a structure depends not only on the proper design and construction, but also on the proper foundation maintenance program. A properly designed and constructed foundation may still experience distress from vegetation, trees, poor drainage or incorrectly controlled water sources, such as surface water, plumbing/sewer leaks, and excessive irrigation, water ponding near the foundation. Our general recommendations on foundation maintenance are presented in following sections of this report.

4.5.1 Site Drainage

It is recommended that positive site drainage is maintained throughout the life of the structure. The landscape and any sidewalk areas should be sloped away from the building (minimum of 10-ft) to direct surface water to suitable catch basins for disposal. A minimum of 6” for a distance of 5 ft away from the edge of foundation is recommended. If slope cannot be achieved when the exterior grade is above the floor grade or slopes toward the building, perimeter drains are required. The drains should be installed at a minimum of 12 inches below the bottom of the slab.

No ponding of surface water should be allowed near the structure and no area should allow entry of water under the slab.

Gutters are recommended to minimize water distributed near the foundation. Downspouts should either be extended a minimum of 5-ft from the foundation or connected to an underground drainage system away from the foundations. Due to mowing and aesthetics, running a drain pipe below grade to an exit grate or popup emitter is the best solution. This should be applied to all downspouts. If additional flower bed drains are added as part of a complete drainage plan, the downspouts could also connect to such drains.

Drains should be checked periodically to ensure that they remain functional and, if necessary, maintenance should be performed to improve drainage.

We recommend trees not be planted or existing trees left in place closer than the full height of the mature trees from the foundation. Tree stumps should not be left under the slabs during site preparation. This may result in future settlement and termite infestation.

5.0 CONSTRUCTION GUIDELINES

Some construction problems, particularly their extent and magnitude, and including the depth of overburden across the site cannot be anticipated until the construction is in progress.

Information was not available on whether a fill will be used to raise site grade prior to slab construction. In the event that fill is placed on the site, specifications and placement should be in accordance with our recommendations given below. Lack of proper site preparation may result in additional stress and poor slab performance.

5.1 Select Structural Fill

The select fill materials beneath the building area may consist of inorganic sandy clay soils with a liquid limit of less than 40 and a plasticity index between 10 and 20. Other types of fill available locally, and acceptable to the geotechnical engineer, can also be used. Cohesionless soils should not be used as select structural fill. The select fill should extend 5-ft beyond the building footprint. The select fill thickness should be uniform over the entire building footprint. Bank sand should not be used for this purpose.

The select fill should be placed in loose lifts and uniformly compacted to 95% of the maximum dry density as determined by ASTM D 698 (Standard Proctor). The moisture content at the time of compaction of subgrade soils should be between optimum and +3% of the Proctor optimum value. The lift thickness should not be more than eight inches in loose condition. The subgrade and fill moisture content and density must be maintained until floor slabs are completed. We recommend that these parameters be verified by field moisture and density tests at the time of construction.

5.2 Site Preparation

Our general recommendations for site preparations in the foundation and floor slab areas, based on our understanding of the subsurface conditions encountered in the boreholes, are summarized below or as otherwise required by the geotechnical engineer during construction site visits.

- Positive site drainage must be established at the beginning of the project to minimize ponding of surface water and limit construction difficulties with wet surface soils, or ingress into the foundation excavations. Standard sump pits and pumping may be adequate to control potential seepage into excavations.

- After completion of the necessary stripping, excavating and cleaning and prior to placing the required fill, the undesirable materials (organic wet, soft or loose materials) still in place should be removed. In general, remove all vegetation, tree roots, organic topsoil, existing foundations, paved areas and any undesirable materials from the construction area. Tree trunks and tree roots under the floor slabs should be removed to a root size of less than 0.5-inch. We recommend that the stripping depth be evaluated at the time of construction by a soil technician.

- Any on-site fill soils encountered during construction, must have records of successful compaction tests signed by a licensed professional engineer that confirms the use of the fill and record of construction and earthwork testing. These tests must have been performed on all the lifts for the entire thickness of the fill. In the event that no compaction test results are available, the fill soils must be removed, processed and recompacted in accordance with our site preparation recommendations. Excavation should extend at least two-feet beyond the structure and pavement area.

- The subgrade areas should then be proof rolled with a loaded dump truck or similar pneumatic-tired equipment with loads ranging from 25- to 50-ton. The proof rolling serves to compact surficial soils and to detect any soft or loose zones. The proof rolling should be conducted in accordance with TxDOT Standard Specification Item 216. Any soils deflecting excessively under moving loads should be undercut to firm soils and recompacted. Any subgrade stabilization should be conducted after site proof rolling is completed and approved by the geotechnical engineer. The proof rolling operations should be observed by an experienced geotechnician.

- After the proof rolling is completed and passed, scarify the subgrade, add moisture, or dry if necessary, and recompact to 95% of the maximum dry density as determined by ASTM D 698 (Standard Proctor). The moisture content at the time of compaction of subgrade soils should be between optimum and +3% of the Proctor optimum value. We recommend that the degree of compaction and moisture in the subgrade soils be verified by field density tests at the time of construction. We recommend a minimum of four field density tests per lift or one every 2,500 square feet of floor slab areas, whichever is greater.

- The backfill soils in the trench/underground utility, pavement and tree root excavation areas should consist of select structural fill materials, compacted to a minimum of 95% of standard proctor density (ASTM D 698). In the event of compaction difficulties, the trenches should be backfilled with cement-stabilized sand or other materials approved by the geotechnical engineer. Sand and gravel should not be used for utility line bedding in expansive soils. If possible, all utility trenches should be sloped to drain away from the foundation. As a minimum, a four-foot long clay plug or a concrete plug should be installed below the exterior grade beam where utility lines transition below the foundation.

- We recommend to follow quality control procedures during site preparation by a qualified engineer or engineer’s representative during the construction of the foundations. This quality control procedures should include, observation of the site stripping and the extent of excavation, verification of the type, depth and amount of stabilizer, if used, evaluation of the quality of fill and monitor the fill placement for all lifts.

5.3 Construction Considerations

The construction and maintenance of the post-tensioned slab foundations should be in accordance with the procedures presented in the publication "Construction and Maintenance Procedures Manual for Post-Tensioned Slabs-on-Ground, 3rd Edition, Post-Tensioning Institute, 2006".

- Cut or fill slopes should not be steeper than 4(H):1(V). If the height of cut or fill is more than 5-ft, then slope stability analysis may be required. The crest or toe of cut/fill slopes should be no closer than height of the slope or 10 feet, whichever is greater, from any foundation and no closer than 5 feet from the edge of any pavement.

- Properly detailed and constructed moisture/vapor retardant should be placed between the slab and subgrade soils to retard moisture migration through the slab. If a bedding layer of leveling sand one- to two-inches in thickness is placed beneath the floor slab, the vapor sheeting consisting of minimum six- (6) mil Polyethylene should be used above the sands. The moisture barrier should be properly stretched to maximize soil-slab interaction.

- BEG recommends that, prior to the concrete placement, the site and soil conditions used in the structural design of the foundation be verified during the engineer's site visit after all of the earthwork and site preparation have been completed.

- Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation.

- Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulges at the toe. Any potential stability problems should be reported to a geotechnical engineer promptly.

- Grade beams excavations should be free of all loose materials. The bottom of the excavations should be dry and hard.

- The exterior grade beams shall be extended about six-inches above the top soil (final grade).

- Minimum concrete strength should be 1,750 and 3,000 psi at 7 and 28 days, respectively, with a maximum slump of 5-inches. Concrete workability and durability can be improved by adding air to the concrete mix. The slump and strength values of the concrete should be verified by slump tests and compressive strength of concrete cylinder tests, respectively. We recommend four concrete cylinders be made for each slab. These cylinders should be tested after 7 and 28 days from placement date. Furthermore, these tests should be performed in accordance with the applicable ASTM test procedures.

- Construction site safety including means, methods and sequencing of construction operations are the sole responsibility of the contractor. The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. The slope height, inclination or excavation depths should in no case exceed those specified in the local, state and/or federal safety regulations, e.g. OSHA Health and Safety Standard for Excavations, 29, CFR Part 1926, or successor regulations.

- Construction surveillance and quality control tests should be planned to verify materials and placement in accordance with the specifications and recommendations in this geotechnical report. We recommend the following quality control procedures be followed by a qualified engineer or engineer's representative during the construction of the foundations: Monitor the grade beam foundation cleanness, depth, size, etc., Observe the foundation make-up after all of the earthwork and site preparation have been completed and prior to the concrete placement, verify placement of the reinforcing steel/tendons, monitor concrete placement, conduct slump tests and make concrete cylinders, monitor installation of drilled shafts if used, verify the shear strength of the soil and strata at drilled shafts bearing depth at the time of construction, conduct post-pour observations, including post-tensioned slab cable stress monitoring, if applicable, and conduct a post-construction site visit to evaluate the site grading, drainage and the presence of trees/vegetation near the structure. It is the responsibility of the Client to notify BEG when each phase of construction is taking place so that proper quality control and procedures are implemented.

5.4 Surficial Layer of Cohesionless Soils

Construction problems may arise due to the silty sand soils at the surface. These cohesionless soils are underlain by relatively impermeable clayey soils and may result in the formation of perched water table due to ponding of water on the clayey soils particularly during wet seasons. The cohesionless soils become soft when wet and may experience rutting or pumping. In order to prevent construction difficulties arising from these conditions, we recommend that the cohesionless soils be improved by aeration, improving drainage, stabilization or by removal and replacement with select fill. The depth of improvement is to about 2 ft or to the bottom of the cohesionless soils.

5.5 Previously Existed Structures and Paving

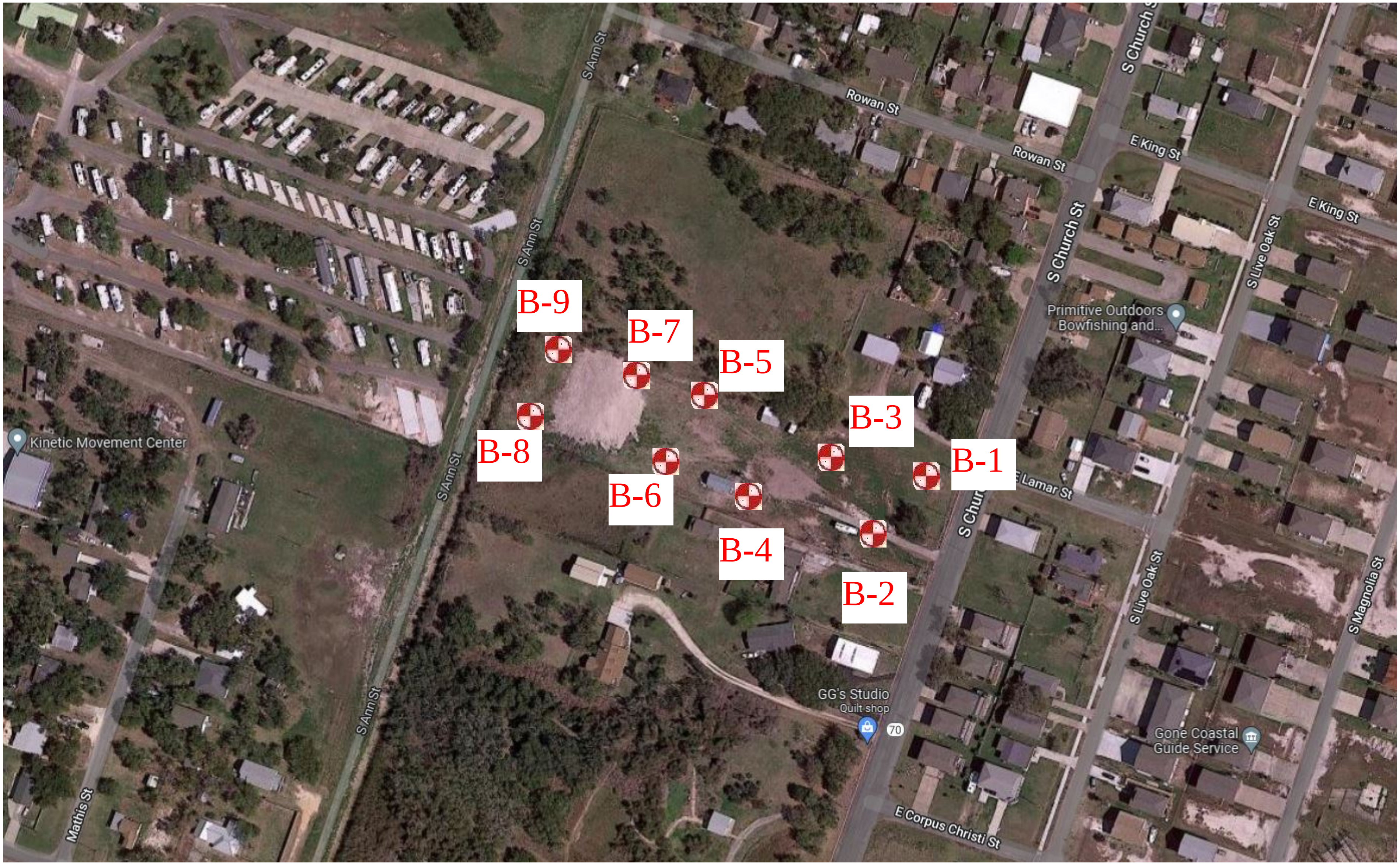
Based on our review of historical areal images, few structures were present at the project site and were demolished in the past. Any soil disturbed due to removal of pavement or structures should be re-compacted in accordance with recommendations provided in Section 5.1. Foundation elements of existing structures should be removed or cut off at least 2 ft below finished grade or 2 ft below the new structural elements, whichever is deeper. All abandoned utility lines should be either removed or positively sealed to prevent possible water seepage into subgrade soils.

6.0 LIMITATIONS

The recommendations described herein were conducted in a manner consistent with the generally accepted geotechnical engineering principles practiced contemporaneously under similar conditions in the locality of the project. Geotechnical engineering formulas and judgments are far from an exact science because of the multitude of unknown influential possibilities and the limitations of site investigation within an economical range. All recommendations in this report are interrelated and must be followed integrally. Any addendum to this report is valid only if in writing form and re-certified by BEG. No other expressed or implied warranty and guarantee are made other than that the work was performed in a proper and workmanlike manner. BEG is not responsible for damages resulting from workmanship of designers or contractors.

The recommendations presented in this report were developed from referenced samples obtained from a discrete number of soil test boreholes with limited cross sections. Soil type and properties across the site may vary at different times and may also differ from those observed at the borehole locations. The nature and extent of soil variations between the boreholes may not become evident until the time of construction. If these variations are noted during the construction, BEG should be contacted to evaluate and revise the design and construction recommendations in order to minimize construction delays and cost overruns. Due to changes in technology, the project site conditions, seasonal moisture variations, etc., this report and its recommendations may need to be revised 5 months from the issuance date. We recommend that the Client contact BEG to find out whether or not this report is applicable to the project after the above-mentioned time period.

This report was prepared for the sole and exclusive use by our Client for the property, specified on cover page and Plate 1, for which the investigation was conducted, based on the limited objectives and our understanding of information provided by the Client about the characteristics of the project. All reports, borehole logs, field data, laboratory test results, maps and other documents prepared by BEG as instruments of service shall remain the property of BEG. Reuse of these documents is not permitted without written approval by BEG. Any such third party using this report after obtaining BEG’s written acceptance shall be bound by the limitations of this study including BEG liability being limited to the fee paid to it for this report. BEG assumes no responsibility for conclusions, opinions or recommendations made by others based on the data in this report or for the unauthorized use of this report by other parties and for purposes beyond the stated project objectives and work limitations.



BuildEng

BUILD ENGINEERING GROUP, LLC
6363 San Felipe St., Houston, TX 77057
713.367.8188

PLAN OF BOREHOLES

Locations are approximate

Project: Proposed Resort, 1315 S Church St, Rockport, Texas

N

NOT TO SCALE

Boring Log

Boring No.
BH-1

Date
9/10/2022

Total Depth of Boring:
20 ft

Groundwater Depth:
10

Depth (feet)	Hand Penetrometer, tsf	Blow Counts (blows/foot)	Graphic Log	Lithology	Moisture Content (%)	Passing No. 200 Sieve	Liquid Limit	Plasticity Index
			░	Brown SILTY SAND (SM), with root fibers to 4', moist	8	16	NP	NP
2			░					
4		10	░					
6		11	░					
8		14	░					
10		12	░	Gray POORLY GRADED SAND (SP), wet	12	9	NP	NP
15		12	░					
20		18	░					

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░	Silty Sand	▧	Fat Clay	▦	Clayey Sand
▥	Sandy Silt	▨	Lean Clay	▤	Sandy Silty Clay

Boring Log

Boring No.
BH-2

Date	Total Depth of Boring:	Groundwater Depth:
9/10/2022	20 ft	8

Depth (feet)	Hand Penetrometer, tsf	Blow Counts (blows/foot)	Graphic Log	Lithology	Moisture Content (%)	Passing No. 200 Sieve	Liquid Limit	Plasticity Index
			░	Brown SILTY SAND (SM), with root fibers to 2', moist				
2			░					
		10	░					
4			░		13	21	NP	NP
		16	░					
6			░					
		15	░					
8			░					
		11	░	- wet 8' to 20'				
10			░					
		16	░					
15			░					
		20	░					
20			░					

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Boring Log: Sheet 1 of 1

░	Silty Sand	▧	Fat Clay	▓	Clayey Sand
▥	Sandy Silt	▨	Lean Clay	▤	Sandy Silty Clay

Boring Log

Date 9/10/2022	Total Depth of Boring: 20 ft	Boring No. **BH-3** Groundwater Depth: 8

Depth (feet)	**Hand Penetrometer, tsf**	**Blow Counts (blows/foot)**	**Graphic Log**	**Lithology**	**Moisture Content (%)**	**Passing No. 200 Sieve**	**Liquid Limit**	**Plasticity Index**
			░	Light gray SILTY SAND (SM), with root fibers to 2', moist	9	23	NP	NP
2			░					
4		10	░					
6		11	░					
8		14	░					
			░	- gray, wet 8' to 20'	12	9	NP	NP
10		12	░					
15		12	░					
20		18	░					

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Boring Log: Sheet 1 of 1

░	Silty Sand	▧	Fat Clay	▩	Clayey Sand
▥	Sandy Silt	▨	Lean Clay	▤	Sandy Silty Clay

Boring Log

		Boring No. **BH-4**
Date 9/10/2022	Total Depth of Boring: 20 ft	Groundwater Depth: 10

Depth (feet)	**Hand Penetrometer, tsf**	**Blow Counts (blows/foot)**	**Graphic Log**	**Lithology**	**Moisture Content (%)**	**Passing No. 200 Sieve**	**Liquid Limit**	**Plasticity Index**
			░	Light gray SILTY SAND (SM), with root fibers to 4', moist	9	21	NP	NP
2			░					
		11	░					
4			░					
		16	░					
6			░					
		20	░					
8			░					
		15	░	Dark gray POORLY GRADED SAND (SP), wet	15	8	NP	NP
10			░					
		19	░					
15			░					
		22	░					
20			░					

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Boring Log: Sheet 1 of 1

░ Silty Sand

▥ Sandy Silt

▧ Fat Clay

▨ Lean Clay

▓ Clayey Sand

▤ Sandy Silty Clay

Boring Log

		Boring No. **BH-5**
Date 9/10/2022	Total Depth of Boring: 20 ft	Groundwater Depth: 10

Depth (feet)	**Hand Penetrometer, tsf**	**Blow Counts (blows/foot)**	**Graphic Log**	**Lithology**	**Moisture Content (%)**	**Passing No. 200 Sieve**	**Liquid Limit**	**Plasticity Index**
			░	Dark gray SILTY SAND (SM), with gravels, root fibers to 4', moist				
2								
		14						
4					12	18	NP	NP
		12						
6				- light gray 6' to 20'				
		15						
8								
		16		- wet 8' to 20'				
10								
		18						
15								
		20						
20								

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Boring Log: Sheet 1 of 1

░ Silty Sand

▥ Sandy Silt

▧ Fat Clay

▨ Lean Clay

▩ Clayey Sand

▤ Sandy Silty Clay

Boring Log

Date 9/10/2022	Total Depth of Boring: 20 ft	Boring No. **BH-6** Groundwater Depth: 10

Depth (feet)	Hand Penetrometer, tsf	Blow Counts (blows/foot)	Graphic Log	Lithology	Moisture Content (%)	Passing No. 200 Sieve	Liquid Limit	Plasticity Index
2			░	Light gray SILTY SAND (SM), with root fibers to 4', moist	10	14	NP	NP
4		12	░					
6		14	░					
8		15	░					
10		17	░	Light gray POORLY GRADED SAND (SP), wet	17	11	NP	NP
15		18	░					
20		20	░					

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Boring Log: Sheet 1 of 1

░ Silty Sand	▧ Fat Clay	▩ Clayey Sand
▥ Sandy Silt	▨ Lean Clay	☰ Sandy Silty Clay

Boring Log

Date 9/10/2022	Total Depth of Boring: 20 ft	Boring No. **BH-7** Groundwater Depth: 10

Depth (feet)	**Hand Penetrometer, tsf**	**Blow Counts (blows/foot)**	**Graphic Log**	**Lithology**	**Moisture Content (%)**	**Passing No. 200 Sieve**	**Liquid Limit**	**Plasticity Index**
2 4 6 8		14 13 16	░	Light gray SILTY SAND (SM), with root fibers to 2', moist	15	18	NP	NP
10 15 20		12 15 18	░	Light gray POORLY GRADED SAND (SP), wet				

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Boring Log: Sheet 1 of 1

░ Silty Sand

▥ Sandy Silt

▧ Fat Clay

▨ Lean Clay

▓ Clayey Sand

▤ Sandy Silty Clay

Boring Log

Boring No.
BH-8

Date	Total Depth of Boring:	Groundwater Depth:
9/10/2022	20 ft	10

Depth (feet)	Hand Penetrometer, tsf	Blow Counts (blows/foot)	Graphic Log	Lithology	Moisture Content (%)	Passing No. 200 Sieve	Liquid Limit	Plasticity Index
2			░	Brown SILTY SAND (SM), with root fibers to 2', moist				
		12	░					
4			░		13	21	NP	NP
		13	░					
6			░					
		19	░					
8			░					
		12	░	- wet 9' to 20'				
10			░					
		14	░					
15			░					
		18	░					
20			░					

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Boring Log: Sheet 1 of 1

░	Silty Sand	▧	Fat Clay	▩	Clayey Sand
▥	Sandy Silt	▨	Lean Clay	▤	Sandy Silty Clay

Boring Log

Boring No.
BH-9

Date
9/10/2022

Total Depth of Boring:
20 ft

Groundwater Depth:
10

Depth (feet)	Hand Penetrometer, tsf	Blow Counts (blows/foot)	Graphic Log	Lithology	Moisture Content (%)	Passing No. 200 Sieve	Liquid Limit	Plasticity Index
			▒	Brown SILTY SAND (SM), with root fibers to 4', moist				
2			▒					
		11	▒		11	21	NP	NP
4			▒					
		12	▒					
6			▒					
		18	▒					
8			▒					
		13	▒	- wet 9' to 20'				
10			▒					
		18	▒					
15			▒					
		20	▒					
20			▒					

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Boring Log: Sheet 1 of 1

▒ Silty Sand

▥ Sandy Silt

▧ Fat Clay

▨ Lean Clay

▩ Clayey Sand

▤ Sandy Silty Clay