REPORT OF

GEOTECHNICAL ENGINEERING STUDY

SLIM CHICKENS RESTAURANT
CULEBRA ROAD & RANCH VIEW WEST
SAN ANTONIO, TEXAS

BEA PROJECT N. 12-22-0520

FOR

ALPHA TERRA ENGINEERING, INC.
8626 TESORO DRIVE, SUITE 810
SAN ANTONIO, TEXAS 78217

DECEMBER 1, 2022

BURGE ENGINEERING & ASSOCIATES
Geotechnical Engineering • Environmental • Testing

December 1, 2022

Mr. Earl McIntosh
Alpha Terra Engineering, Inc.
8626 Tesoro Drive, Suite 810
San Antonio, Texas 78217

RE: Geotechnical Engineering Study
Slim Chickens Restaurant
Culebra Road & Ranch View West
San Antonio, Texas
BEA Project No. 12-22-0520

Dear Mr. McIntosh:

Burge Engineering & Associates (BEA) has completed the subsurface exploration and geotechnical engineering analysis for the above-referenced project, in general accordance with BEA Proposal No. P12-22-286, dated November 15, 2022. Our report, which includes the results of our subsurface exploration program, laboratory testing program, and geotechnical engineering analysis, is enclosed with this letter.

Based on the results of the field exploration and laboratory testing programs, the site is considered suitable for the proposed development, provided that the recommendations enclosed in this report are followed.

We appreciate the opportunity to be of service to you during the design phase of this project. We look forward to continuing our involvement with this project during the construction phase by providing special inspection services that will be required by the City of San Antonio. If you have any questions regarding the information contained in this report or if we can be of further assistance to you, please feel free to contact us.

Respectfully submitted,
BURGE ENGINEERING & ASSOCIATES
Texas Registered Engineering Firm F-7740
Geotechnical Engineering Services

12/1/22

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PROJECT OVERVIEW

Project Location

This report presents the results of our subsurface exploration and engineering analysis for the proposed restaurant located on Lot 4 of the subdivision at the northwest intersection of Culebra Road and Ranch View West in San Antonio, Texas. The approximate site location is shown on the *Site Vicinity Map* provided in the Appendix.

Scope of Work

The conclusions and recommendations contained in this report are based on three (3) soil borings (B-1 through B-3) performed by BEA on November 29, 2022. Boring B-1 was drilled within the proposed building and extended to a termination depth of 20 feet below the existing ground surface elevation. Borings B-2 and B-3 were drilled in proposed pavement areas and extended to a termination depth of six (6) feet below the existing ground surface elevations.

Proposed Construction

Based on information provided to us, the project will include the design and construction of a single-story restaurant with a drive-through service. We anticipate that the structure will likely be supported by a monolithic slab-on-grade foundation system. The development will also include new pavements, a dumpster enclosure, underground utilities, and concrete flatwork. The proposed improvements are shown in relation to the borings on the *Boring Location Plan*, provided in the Appendix.

It should be noted that BEA was not provided with any structural information, existing or proposed grades, or a finished floor elevation. However, based on our site reconnaissance and our understanding of the proposed construction, we anticipate that cut/fill requirements for grading purposes will be approximately one (1) foot. BEA should be notified if cut/fill requirements differ within the building area, as this may affect the recommendations provided herein.

The *Boring Location Plan* was developed from the *Overall Site Plan Exhibit* (Sheet EX-1) prepared by KFW Engineers & Surveying, dated November 2022. Since existing topographic information was not provided on the above-noted site plan, the elevations are not noted on the boring logs. The borings were located in the field using pacing/taping procedures from the existing landmarks identified on the available plan.

Purposes of Exploration

The purposes of this study were to explore the subsurface soil and groundwater conditions at the site and to develop engineering recommendations to guide design and construction of the soil-supported elements of the project. We accomplished these purposes by:

1. reviewing available geologic and soil survey maps of the project area,

2. drilling three (3) borings to explore the subsurface soil and groundwater conditions,

3. performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties, and

4. analyzing the field and laboratory data to develop appropriate engineering recommendations.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with a standard, truck-mounted drill rig, which utilized continuous, solid-stem flight augers to advance the boreholes. No drilling fluid was used during the drilling program. Upon completion of the borings, the boreholes were backfilled with spoils generated during the drilling process and any additional material was mounded over the boreholes.

Representative samples of the subsurface soil were obtained employing both Shelby Tube samplers and split-spoon sampling procedures in general accordance with ASTM D-1587 and ASTM D-1586, respectively. The Shelby Tube sampler pushes a tube to collect an undisturbed sample of the soil using the weight of the drill rig, and extrudes the sample using a hydraulic ram. The split-spoon sampler collects relatively disturbed samples at selected depths in the borings with the split-spoon sampler by driving a standard two (2) inch outer diameter split-spoon sampler 18 inches into the subsurface material using a 140 pound hammer falling 30 inches. The number of blows required to drive the split-spoon sampler the final 12 inches of penetration (N-value) is recorded in the “SPT N-value” column of the boring logs. Where limited material was recovered, grab samples were collected directly of the cuttings.

The drilling crew maintained field logs of the soil encountered in the borings. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and delivered to our laboratory for further visual examination and laboratory testing.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications, moisture contents, a sieve analysis, and Atterberg Limits tests. Visual classifications conducted in the laboratory were performed by a licensed professional engineer. All data obtained from the laboratory tests are included on the respective boring logs in the Appendix.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). A brief explanation of the USCS is included with this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual. The soil samples will be retained in our laboratory for a period of 30 days, after which, they will be discarded unless other instructions are received by the client.

EXPLORATION RESULTS

Site Conditions

At the time of our field exploration, the subject property was undeveloped and vegetated with native grasses and overgrown brush. The property is relatively flat with fair drainage. The neighboring properties include a combination of residential developments and undeveloped land.

Regional Geology and Soil Survey

According to the Bureau of Economic Geology at The University of Texas at Austin, Geologic Atlas of Texas, San Antonio Sheet, the proposed site is located in the Uvalde Gravel, Q-Tu. The Uvalde Gravel is either Tertiary or Quaternary Age deposits that consist of caliche-cemented gravel with well-rounded cobbles of chert, quartz, limestone and igneous rock. Thickness ranges from several feet to approximately 20 feet.

The Soil Survey of Bexar County, Texas published by the United States Department of Agriculture, National Cooperative Soil Survey, indicates that the shallow soils in the general vicinity of the site are Lewisville Silty Clay, 1 to 3 percent slopes (LvB). This series consists of moderately deep, dark colored alluvial soils that occupy long, narrow sloping areas along major drainage ways. The surface layer is dark grayish brown silty clay or light clay and is about 24 inches thick. The subsurface layer, about 17 inches thick, is brown silty clay that is very firm but crumbly when moist. The underlying material is reddish yellow silty clay that contains large amounts of lime. Permeability is slow to moderate, and the capacity to hold water is good. Erosion can be a hazard if the surface is unprotected.

Soil Conditions

The natural, near surface deposits, which were studied by our field exploration program, are consistent with the local soil survey and regional geology. Below any surfacing materials (i.e., topsoil, fill material, etc.), the stratigraphy of the subsurface materials at this site can generally be described as presented in the table on the following page:

Stratum	Range in Depth (ft)	Soil Description and Classification
I	0 – 5	Firm to hard, dark grayish brown FAT CLAY (CH)
II	3 – 20	Very dense, light tan calcareous CLAYEY GRAVEL WITH SAND (GC) or very stiff to hard, tan or tan and light gray LEAN CLAY (CL) or SANDY LEAN CLAY (CL) with varying amounts of calcareous deposits and gravel

Stratum I – This stratum was comprised of firm to hard, dark grayish brown FAT CLAY (CH). Atterberg Limits tests conducted on representative samples of this stratum indicated this soil has Liquid Limits (LL's) ranging from 73 to 93 with corresponding Plasticity Indices (PI's) ranging from 49 to 62. Based on these measured indices, this stratum has a very high potential for large changes in volume if fluctuations in the clay's moisture content occur.

Stratum II – This stratum was comprised of very dense, light tan calcareous CLAYEY GRAVEL WITH SAND (GC) or very stiff to hard, tan or tan and light gray LEAN CLAY (CL) or SANDY LEAN CLAY (CL) with varying amounts of calcareous deposits and gravel. An Atterberg Limits test conducted on a representative sample of this stratum indicated this material to have a LL of 40 with a corresponding PI of 24. A representative sample of this stratum had 57 percent, by dry weight, retained on a No. 4 Sieve and 21 percent, by dry weight, passing a No. 200 Sieve. Based on these measured indices, this stratum has a low to high potential for changes in volume if fluctuations in the material's moisture content occur.

Groundwater Observations

Groundwater was not encountered during drilling operations. Observations for groundwater were made during sampling and upon completion of drilling. In dry auger drilling operations, water is not introduced into the boreholes, and groundwater position can often be determined by observing water flowing into or out of the borehole. Furthermore, visual observation of the samples retrieved during the drilling operations can often be used in evaluating the groundwater conditions. It should be noted that groundwater conditions can fluctuate due to seasonal and climatic variations, and should be measured (checked) prior to construction activities.

ANALYSIS AND RECOMMENDATIONS

The following recommendations are based on the three (3) borings performed at the site, laboratory test results, and the limited design information provided to us. Based on the available information and our understanding of the proposed construction, cut and fill requirements for grading purposes within the building pad are estimated to be approximately one (1) foot. We recommend that if there are any changes to the project characteristics as discussed in this report, BEA be retained to review them so it can be determined if changes to the recommendations are necessary.

Based upon our understanding of the proposed construction, this study includes recommendations for supporting the proposed structure on a monolithic slab-on-grade foundation system. The following sections discuss this foundation system, along with recommendations for design and construction of the pavements and utilities.

Expansive Soil Conditions

Based on the existing subsurface soil conditions, the project site is considered to be expansive, as defined by the 2018 International Building Code (IBC) Section 1803.5. Although we have provided measures to reduce the magnitude of movements, these measures are not as stringent as outlined by the IBC to classify the site as non-expansive.

The potential vertical rise (PVR) for the subsurface soil stratigraphy encountered in the boring drilled at this site was calculated using the Texas Department of Transportation (TxDOT) Method TEX-124-E. These calculations indicate a potential vertical movement of approximately two and three-quarter (2-¾) inches at the proposed structure area with a corresponding effective design plasticity index of 33. These calculations are based on the existing site conditions, an active zone of about 12 feet, and accounts for an approximate 1 psi of overburden pressure.

Due to the expansive soil conditions, we recommend that the potential differential movements associated with the existing site conditions be reduced using cut and fill modifications (CASES I or II), as identified in the following table:

Building Area / Boring No.	CASE	Minimum Cut/Fill Depth	PVR[1]	Effective Design PI[2]
Proposed Building / B-1	I	1-½ feet	1-½ inches	28
	II	2-½ feet	1 inch	25

Notes: (1) The PVR calculations are based on the existing clay being removed and replaced with select structural fill material having a maximum PI of 17. Any additional fill required for grading purposes should also consist of select structural fill material.
(2) The effective design PI is the weighted average of all PI values within the active zone utilizing a PI value no less than 15.

Typically, a PVR ranging between 1 and 1-½ inches is deemed acceptable for at-grade construction in this area. Although the grade-supported foundation can be designed structurally to withstand a higher PVR (>1-½ inches), the owner would have to accept the increased probability that foundation movement will occur, plumbing leaks may occur, and aesthetic issues will develop (i.e., cracking drywall, separations on exterior siding, sticking doorways and windows, etc.). In order to reduce the PVR to tolerable levels, we have provided options to over-excavate a portion of the expansive soil and replace it with select structural fill material. The over-excavation area should extend a minimum of three (3) feet beyond the horizontal limits of the proposed building footprint. In addition, entries into the structure and surrounding flatwork will be subjected to similar potential movements, unless the soil improvement is extended to include these areas.

Despite the design condition, this does not mean that foundation movements are eliminated. It only means that the monolithic foundation system can be structurally designed for the magnitude of movement without failure of the foundation system. However, this movement does not take into account the movement criteria that is required or perceived by the building owner/occupants. These "operational" performance criteria may be, and often are, more restrictive than the structural criteria or tolerances.

The recommendations for cut and fill modifications are provided in the *Subgrade Preparation and Earthwork Operations* section and *Slab-on-Grade Foundation System* section. We can also provide additional soil movement reduction options, upon request, if the design team and owner feel that more or less potential movement is deemed acceptable or required of the building. Furthermore, the recommendations presented in the study can be modified, if needed, once more detailed information of the final topography and the finished floor elevation for the proposed structure are established by the design team.

Slab-on-Grade Foundation System

The subsurface conditions encountered at the site are determined to be suitable for supporting the proposed structure on a monolithic slab-on-grade foundation system. Based on the anticipated structural loading and soil strength values, we recommend that the monolithic slab-on-grade foundation system be designed for a maximum net allowable end bearing capacity of 2,000 psf into native soil or compacted select structural fill material. At beam intersections, or as required at column locations, the grade beams may be widened to support additional loads. At these areas, the bearing capacity may be increased to 2,300 psf; however, the beams must be at least 30 inches in the smallest dimension and poured monolithically with the slab.

We recommend that the beams have a minimum width of 12 inches and extend a minimum of 18 inches into the compacted select structural fill material. The exterior grade beams should bear a minimum of 24 inches below the exterior finished grade. These recommendations are for proper development of bearing capacity for the continuous beam sections of the foundation system and are NOT based on structural considerations. Grade beam widths and depths for structural considerations may need to be greater than recommended herein and should be properly evaluated and designed by the structural engineer.

The table on the following page presents the design criteria published by the Building Research Advisory Board (BRAB), Wire Reinforcement Institute (WRI), and the Post-Tensioning Institute (PTI), 3rd Edition. These values were based on our understanding of the proposed project, our interpretation of the information and data collected as part of this study, the criteria publications, and on our past experience with similar projects.

Based on the soil conditions, the proposed structure may be supported using Type III reinforced slab-on-grade foundation system in accordance with BRAB (or suitable alternative).

Slab-on-Grade Design Criteria

Recommended BRAB, WRI, & PTI Criteria For Slab-on-Grade Foundation	Modified Conditions	
Design Criteria	**CASE I**	**CASE II**
Minimum Over-excavation	1-½ feet	2-½ feet
Minimum Select Fill Pad Thickness	1-½ feet	2-½ feet
Potential Vertical Rise (PVR)	1-½ inches	1 inch
Effective Design Plasticity Index (PI) / BRAB PI	28	25
Slope Correction Coefficient	1.0	1.0
Constant Soil Suction, pF	3.8	3.8
Climatic Rating (C_w)	17	17
Unconfined Compressive Strength (tsf)	2.0	2.0
Soil Support Index, c	0.86	0.90
Edge Moisture Variation Distance, e_m, Center	8.3 feet	8.5 feet
Edge Moisture Variation Distance, e_m, Edge	4.2 feet	4.3 feet
Thornthwaite Index (I_m)	-14	-14
Differential Soil Movement, y_m, Center Lift	0.5 inch	0.4 inch
Differential Soil Movement, y_m, Edge Lift	1.0 inch	0.8 inch

Following any over-excavation and site preparation processes and if required by final grade elevations, the proposed building pad should be built-up and leveled using additional select structural fill material, as detailed in the *Subgrade Preparation and Earthwork Operations* section.

For the monolithic slab-on-grade foundation system, designed and constructed as recommended in this report, post construction settlements should be one (1) inch or less. Settlement response of fill supported slabs is influenced more by the quality of construction than by soil-structure interaction. Therefore, it is essential that the recommendations for both the foundation and the building pad construction be strictly followed throughout the construction phase of the proposed building's foundation.

Seismic Considerations

According to the 2018 IBC (Section 1613.2.2), the site shall be classified in accordance with Chapter 20 of ASCE 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures. According to the ASCE 7-16 and IBC documents, the site classification is based on the subsurface soil/rock profile to a depth of 100 feet. Since the maximum depth explored for this study was 20 feet, we have assumed that the geologic formation condition extends to a depth of at least 100 feet. Based on the soil/rock profile encountered and these assumptions, the Site Class is "C" as defined by ASCE 7-16.

Subgrade Preparation and Earthwork Operations

After excavating to the desired depth within the building pad area, and prior to fill placement, the exposed subgrade surfaces should be observed by the Geotechnical Engineer or authorized representative. The following site preparation would be necessary for the monolithic slab-on-grade foundation system:

1) Existing vegetation, topsoil, and any existing loose materials should be stripped and removed from the proposed building footprint.

2) Following stripping operations, the floor slab area should be over-excavated as required and identified in the *Expansive Soil Conditions* section based on the design option selected by the owner and design team. The over-excavation area should extend a minimum of three (3) feet beyond the horizontal limits of the proposed building footprint. A qualified geotechnical engineer, or representative, should be on-site during earthwork operations to observe and approve any cut areas prior to fill placement.

3) Following excavation, the exposed subgrade soils should be scarified to a depth of six (6) inches, moisture-conditioned between optimum and +4 percentage points above optimum moisture content and compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D698.

4) Following approval of the subgrade, any select fill should be placed up to the required final building pad elevation. The select fill should be placed in eight (8) inch maximum thick loose lifts. The select fill should be moisture-conditioned between -3 and +3 percentage points of optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D698, Standard Proctor Method. A minimum of three (3) nuclear density tests should be performed per lift.

When placing the select fill, care should be taken to avoid water ponding in the select fill layer. This could cause post-construction movements, which exceed the estimated values. Care must be taken to prevent landscape watering, surface drainage, leaking utility lines or other sources of water from entering the select fill.

Any import or select fill should be an approved inorganic material, free of debris. The select fill material should be approved by the Geotechnical Engineer prior to importing on site. Select fill material should be placed in lifts not exceeding eight (8) inches in loose thickness, moisture-conditioned to within ±3 percentage points of the optimum moisture content, and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D698, Standard Proctor Method. Select fill material should have a Plasticity Index (PI) ranging between 5 and 17 and have a maximum particle size of three (3) inches.

The design team should consider the use of a vapor retarder (or damp-proofing) as required to meet moisture protection requirements of interior finishing materials for the proposed structure. However, where utilized, special consideration should be given to the surface curing of the slab in order to minimize uneven drying of the slab and associated cracking.

Pavement Design

General parking areas and drive areas will be provided primarily for general automobile traffic, and some heavy truck traffic for deliveries and trash pick up. No detailed information regarding the expected traffic loads were known at the time of our report preparation. Therefore, assumptions were made regarding the anticipated traffic conditions.

Our pavement analysis was generally based on the design procedure developed by AASHTO's *Guide for Design of Pavement Structures*, 1993, as well as the American Concrete Institute's (ACI's) *Commercial Concrete Parking Lots and Site Paving Design and Construction Guide,* ACI PRC-330-21.

Based on the site location and facility type, we utilized an effective pavement life of 20 years. Also for this analysis, we estimated a CBR (California Bearing Ratio) value of three (3) percent for the in-situ clay, which will likely be the predominant subgrade materials following rough grading operations. We estimated this CBR value since evaluation of CBR values by either field or laboratory testing was not included in the scope of our services. We selected this value based on our knowledge and experience with similar material. We suggest that additional testing, including CBR testing and Atterberg Limits, be conducted on the actual subgrade materials at the time of construction in order to verify the assumptions in this report.

The following design parameters and criteria were considered in our analyses:

- Resilient Modulus: 4,500 psi
- Reliability: 70 percent (or 90% for heavy duty sections)
- Overall Standard Deviation: 0.45 for flexible pavement
- Initial Serviceability: 4.2 for flexible pavement
- Terminal Serviceability: 2.0

The minimum recommended thicknesses for flexible pavement sections (asphaltic concrete) are presented in the following table. We have also provided a heavy-duty pavement section for the service drive that is to provide access to the adjacent development.

	Light Duty Pavement Section	**Medium Duty Pavement Section**	**Heavy Duty Pavement Section**
Pavement Material	**Thickness, (in)**	**Thickness, (in)**	**Thickness, (in)**
Type D, Hot Mix Asphaltic Concrete	1.5	2.0	2.5
Crushed Limestone Base	9	11	13
Compacted Subgrade	6	6	6

For the above pavement sections, we have calculated traffic loading conditions equal to or greater than 20,000 18-kip equivalent single-axle loads (ESALs) for the light-duty section, 84,000 for the medium-duty section, and 125,000 for the heavy-duty section. Typically, the light-duty section will meet the requirements for the parking spaces, while the medium-duty section will meet the requirements for the drive lanes and emergency vehicle access lanes, due to infrequency of loading. The heavy-duty section will provide additional capacity for the service drives to provide cross-access for the neighboring developments, as indicated on the available site plan.

Entrances to the new development as well as areas expected to require excessive maneuvering, such as dumpster areas or areas expected to accommodate repeated heavy truck traffic, should consist of the following rigid (concrete) pavement system. If the design team is considering the use of rigid pavement in-lieu of flexible pavement, then it is our recommendation that the rigid pavement be at least six (6) inches thick.

	Rigid Pavement Section
Pavement Material	**Thickness, (in)**
Reinforced Concrete	6
Crushed Limestone Base	Note 1
Compacted Subgrade	6

Notes 1.) Although not required as a structural layer, crushed limestone base may be used as a level-up course.

If our assumptions or the traffic loading conditions do not meet the intended use or if further information comes available, we would be happy to provide further design recommendations. The following paragraphs specify the pavement materials to be used to construct the proposed pavement areas:

Reinforced Concrete - Concrete should be designed to exhibit a flexural strength (third point loading) of at least 630 psi at 28 days (this is a compressive strength of about 4,000 psi). The flexural strength (M_r) may be approximated by the following formula from ACI 330R-08: $M_r=10\ (f_c')^{1/2}$, where f_c' is the average 28 day compressive strength of the concrete test cylinders. The actual relationship between flexural and compressive strength for the proposed mix should be evaluated in the laboratory.

Hot Mix Asphaltic Concrete Surface Course - The asphaltic concrete surface course should be plant mixed, hot laid Type D (Fine Graded Surface Course) meeting the 2014 Texas Department of Transportation (TxDOT) specification, Item 340 and specific criteria for the job mix formula. The mix should be designed for a stability of at least 40 and should be compacted to between 91 and 95 percent of the maximum theoretical density as determined in accordance with Tex-207-F. The asphalt cement content by percent of total mixture weight should fall within a tolerance of ± 0.3 percent asphalt cement from the specific mix design. In addition, the mix should be designed so that 75 to 85 percent of the voids in the mineral aggregate (VMA) are filled with asphalt cement.

Crushed Limestone Base - Base material should be composed of crushed limestone meeting the requirements of TxDOT Item 247, Grade 1-2, Type A. The base should be compacted to a minimum of 95 percent of the maximum dry density as determined by the standard moisture-density relationship (ASTM D 698) at -2 to +2 percentage points of optimum moisture content. The base material should be placed in loose lifts measuring no greater than eight (8) inch in thickness.

Compacted Subgrade - Subgrade should be moisture-conditioned between optimum and plus four (+4) percentage points of optimum moisture content and compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D-698.

If rigid pavement is used for the entire pavement area, then the following recommendations are provided for reinforcement and jointing.

Type of Joint	Joint Spacing	Joint Depth	Joint Width[2]
Contraction (Control)	15 feet each way	One-fourth (¼) of slab thickness	One-eighth (⅛) to one-fourth (¼) inch
Construction	At location of contraction joints	Full depth of pavement thickness	One-eighth (⅛) to one-fourth (¼) inch
Isolation	As required to isolate from structures	Full depth of pavement thickness	Three-fourths (¾) to one (1) inch
Expansion[1]	60 feet each way	Full depth of pavement thickness	Three-fourths (¾) to one (1) inch

Notes: 1.) Serious consideration should be given to the total elimination of expansion joints. In this region, drying shrinkage of concrete typically significantly exceeds anticipated expansion due to thermal affects. As a result, the need for expansion joints is eliminated. Construction of an unnecessary joint may be also become a maintenance problem.

2.) All joint widths should be as noted above or as required by the joint sealant manufacturer.

All construction and contraction joints shall have dowels. Dowel information varies with pavement thickness. The applicable dowel information is provided below:

Pavement Thickness:	6 inches
Dowels	¾-inch diameter
Dowel Spacing	12 inches o.c.
Dowel Length	14 inches long
Dowel Embedment	6 inches minimum

Distributed Steel: Steel reinforcement may consist of either steel bars or welded wire fabric (WWF) described below:

No. 3 reinforcing steel bars at 18 inches on center each way, Grade 60; or

WWF: W2.9 X W2.9, six (6) inches by six (6) inches, flat sheets only; or W1.4 X W1.4, four (4) inches by four (4) inches, flat sheets only.

Note: It is imperative that the distributed steel be positioned accurately in the pavement cross section. Properly supported, this is typically easier to accomplish with steel bars than with WWF.

General fill materials, whether coarse-grained or fine-grained, should have a maximum particle size of four (4) inches and be placed in lifts not exceeding eight (8) inches in loose thickness. Coarse-grained soils (SC, GC, or more granular) should be moisture-conditioned to within ± 3 percentage points of the optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D698. Fine-grained soils (CH, CL, ML, or MH) should be moisture-conditioned between 0 and +4 percentage points above optimum moisture content and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D698.

Proper perimeter drainage in and around pavement sections is very important, and should be provided so that infiltration of surface water from unpaved areas surrounding the pavement areas is minimized. We do not recommend installation of landscape beds or islands in the pavement. Water penetration usually results in degradation of the pavement section with time, and as vehicular traffic traverses the area of moisture infiltration. Above grade planter boxes, with drainage discharging onto the top of the pavement, or directed into storm sewers, should be considered if landscape features are desired. Additionally, if landscaping is used adjacent to the paved areas, the design team and owner should consider extending the curbs through the base and at least six (6) inches into the subgrade. This will help reduce migration of groundwater into the pavement base course from adjacent areas. A crack sealant compatible to both asphalt and concrete should be provided at all concrete-asphalt interfaces, and at all interfaces of existing/new pavement areas.

Cracking, particularly longitudinal cracking within one (1) to five (5) feet of the pavement edges, should be expected of asphalt pavements constructed on this site, particularly where high plasticity clays are encountered. The cracking occurs as the expansive soils adjacent to and below the pavements shrink and swell with seasonal moisture fluctuations. Therefore, proper maintenance, including sealing all cracks on a timely manner, should be conducted throughout the life of any asphalt pavements.

Utility Trench Recommendations

It is vital that all backfill being placed into utility trenches be moisture-conditioned and compacted to a degree that meets or exceeds the compaction of the adjacent areas, so that no settlement will occur. Additionally, it is important that proper backfill material be used. Generally, the material that is excavated from the trenches is stockpiled on site and subsequently used as backfill material in the trenches.

Additionally, it is our recommendation that all backfill material used in the utility trenches be moisture conditioned to within three (3) percentage points of the optimum moisture content and compacted to at least 98 percent of the maximum dry density as determined in accordance with ASTM D-698. Furthermore, it is our recommendation that the backfill material be placed in six (6) inch lifts. The backfill material should be tested for moisture content and compaction for each six (6) inch lift at a minimum frequency of one (1) test per 100 linear feet. For narrow trenches that would be too confined to sufficiently compact the backfill materials, it is our recommendation that a flowable fill material be used to backfill the trench.

Details regarding project safety, excavation/trench shoring, and other similar construction techniques or safety issues that require "means and methods" to accomplish the work is the sole responsibility of the project contractor. The contractor is responsible for development of an excavation plan, which will meet all state and federal requirements with regard to trench safety. BEA's comments and opinions do not relieve the contractor's responsibility to establish and maintain all aspects of site safety.

Note: Although the above recommendations are provided, local requirements may supersede these recommendations. It is the contractor's responsibility to adhere to any local requirements for installation and backfill of on-site utilities. Specifically, SAWS requires that water and sewer utilities are compacted to at least 98 percent of the maximum dry density.

General Construction Considerations

The site should be graded such that surface water runoff is directed away from any excavations during construction. In addition, site grading should allow for surface and roof drainage away from the structure during its design life. We suggest verifying final grades to document that effective drainage has been achieved.

The surface soils in this vicinity are moisture sensitive, and so any uncontrolled surface flow across the site could result in undesired infiltration and future difficulties with swell. For this reason, it is strongly urged that fill operations be performed in such a manner as to enhance natural water flow and control erosion.

Exposure to the environment may weaken the soils at the foundation bearing level if the excavation remains open for extended periods of time. Therefore, foundation concrete and select fill material should be placed as soon as possible after the excavation is completed. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete or select fill material. If rainfall becomes imminent while the bearing soils are exposed, we recommend that a 1-to 3-inch thick "mud-mat" of "lean" concrete be placed on the bearing soils.

In a dry and undisturbed state, the surficial soil at the site will provide sufficient subgrade support for fill placement and construction operations. However, when wet, these soils will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations which will help maintain the integrity of the soil.

Limitations

This report has been prepared to aid in the evaluation of subsurface conditions at this site and to assist design professionals in the geotechnical related design of this project. It is intended for use with regard to the specific project as described in this report. Any substantial differences in the project characteristics as discussed herein should be brought to our attention so that we may determine any effect on the recommendations provided in this report.

The scope of our study did not include an environmental assessment of the soil, rock, or water conditions either on or adjacent to the site. As such, no environmental opinions are presented in this report.

The opinions and conclusions expressed in this report are those of BEA and represent interpretation of the subsurface conditions based on tests and the results of our analyses. BEA is not responsible for the interpretation or implementation by others of recommendations provided in this report. This report has been prepared in accordance with generally accepted principles of geotechnical engineering practice and no warranties are included, expressed, or implied, as to the professional services provided under the terms of our agreement.

The analysis and recommendations submitted in this report are based upon the data obtained from the test borings performed at the locations indicated on the *Boring Location Plan*, and from other information described in this report. This report does not reflect any variations that may occur around the test borings. In the performance of the subsurface exploration, specific information is obtained at specific location and times. However, it should be noted that variations in soil conditions exist on most sites around the test boring locations, and conditions such as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction.

If variations appear evident, BEA should be allowed to perform on-site observations during the construction period and note characteristics and variations to determine if a re-evaluation of the recommendations in this report will be necessary.

Closing

We recommend that the construction activities be monitored on a call-out basis by a qualified Geotechnical Engineer, or representative. We also recommend that once the plans are prepared, BEA be retained to review them so it can be determined if changes to the recommendations are necessary or if additional recommendations are required.

APPENDIX

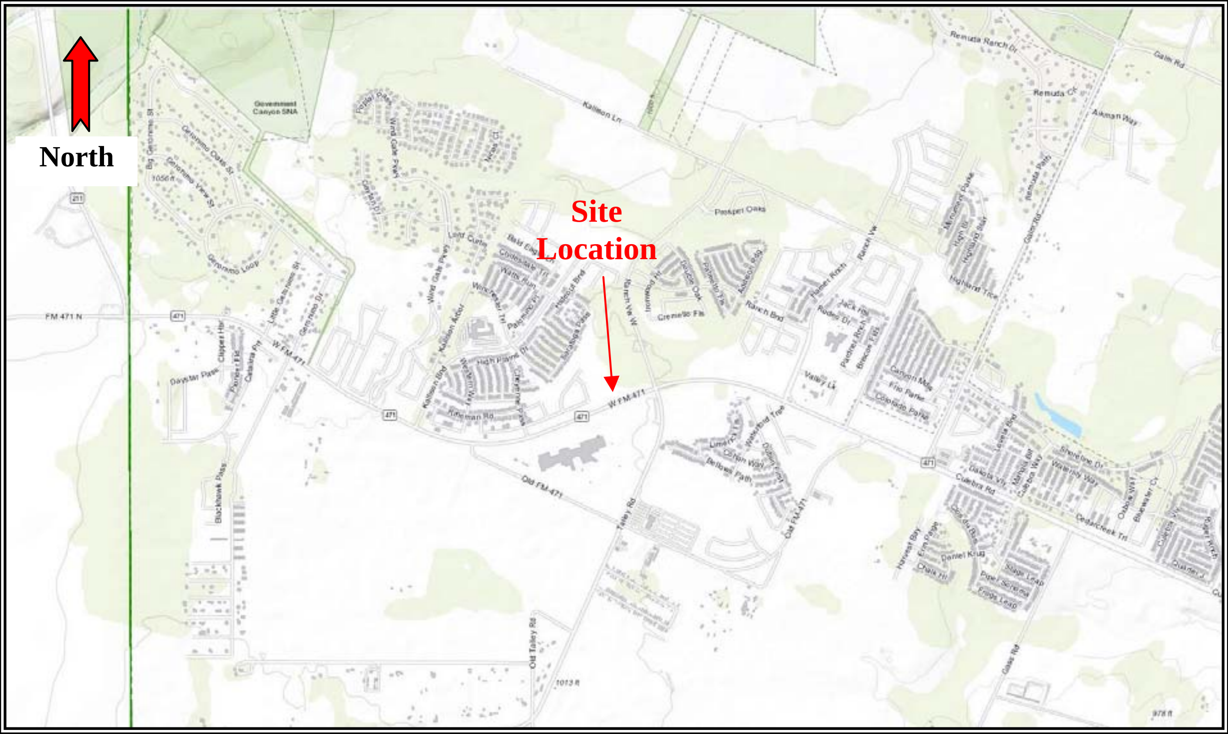
Figure 1: Site Vicinity Map

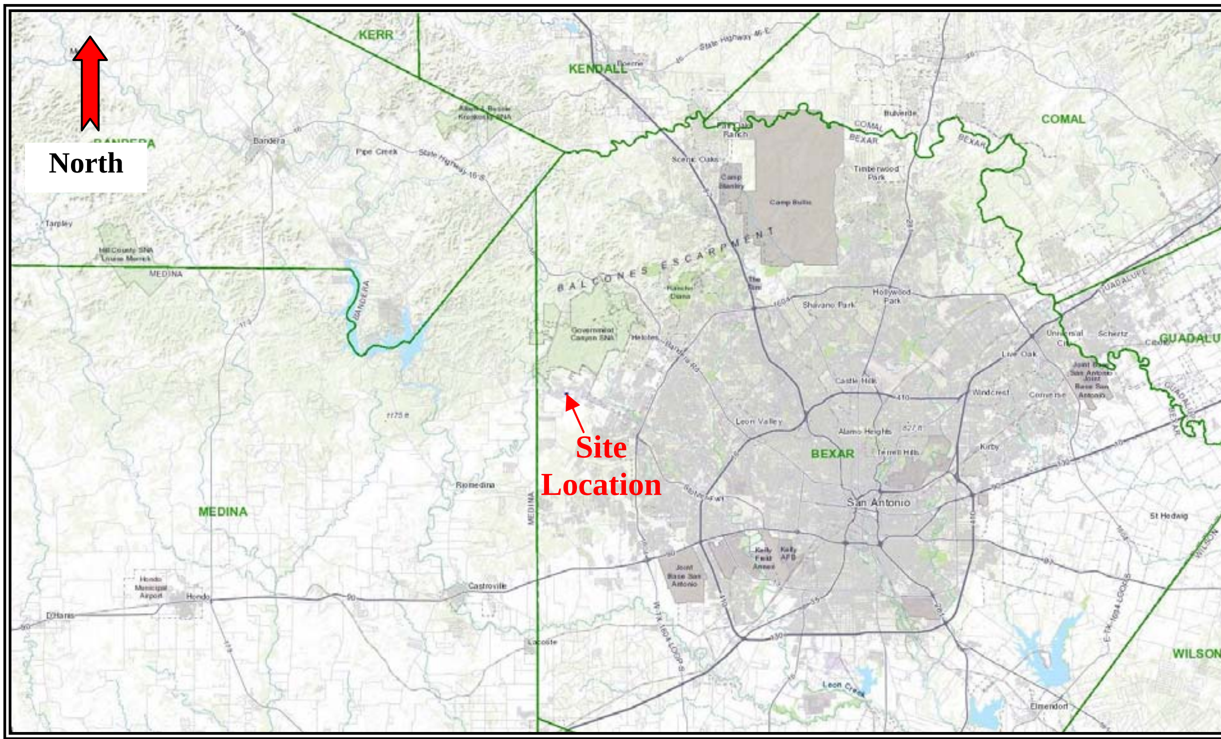
Figure 2: Boring Location Plan

Boring Logs (B-1 through B-3)

Soil Classification Chart

General Laboratory and Field Test Procedures

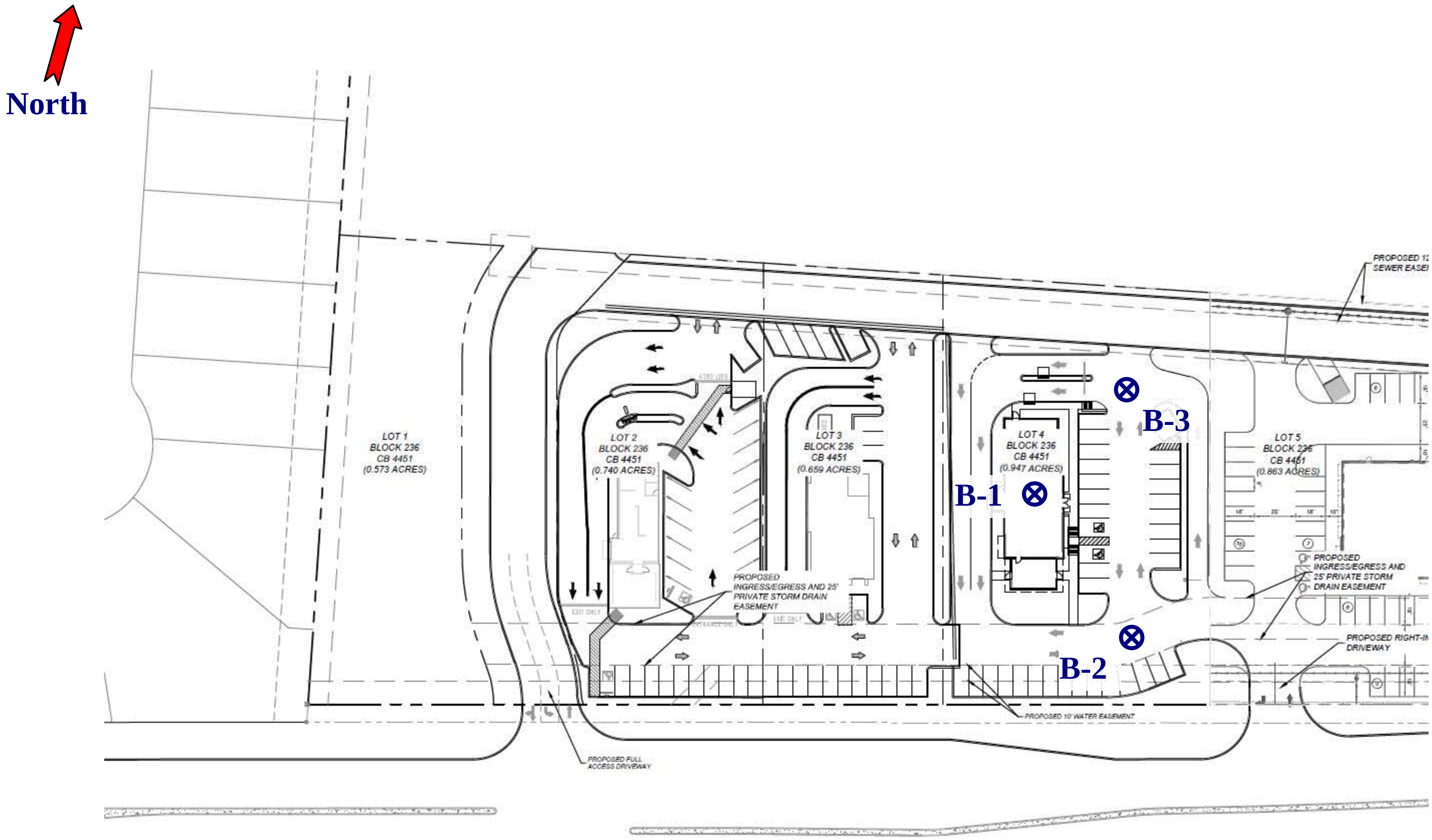




Geotechnical Engineering Study
Slim Chickens Restaurant
Culebra Road & Ranch View West
San Antonio, Texas
BEA Project No. 12-22-0520

FIGURE 1

SITE VICINITY MAP



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Culebra Road & Ranch View West
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FIGURE 2

BORING LOCATION PLAN

Burge Engineering & Associates
3453 North Pan Am Expressway, Suite 201
San Antonio, Texas 78219
Telephone: 210-646-8566
Fax: 210-590-7476

BORING NUMBER B-01

CLIENT Alpha Terra Engineering, Inc.
PROJECT NAME Slim Chickens Restaurant
PROJECT NUMBER 12-22-0520
PROJECT LOCATION Culebra Rd/Ranch View W., San Antonio, Tx
DATE STARTED 11/29/22 **COMPLETED** 11/29/22
GROUND ELEVATION
HOLE SIZE 5"
DRILLING CONTRACTOR BEA
GROUND WATER LEVELS:
DRILLING METHOD Dry Auger
AT TIME OF DRILLING ---
LOGGED BY R.J. **CHECKED BY** R. Burge
AT END OF DRILLING ---
NOTES Groundwater not encountered during drilling operations.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Stratum I - Stiff to hard, dark grayish brown FAT CLAY (CH)	ST 1			2.0		26	73	24	49	
			ST 2			4.5+		20				
5		Stratum II - Very dense, light tan calcareous CLAYEY GRAVEL WITH SAND (GC) - 57% gravel, 22% sand, & 21% fines from 4.5 to 6 feet	SS 3		19-26-35 (61)			8				21
		- grades to hard, light tan calcareous LEAN CLAY (CL) with some gravel from 6 to 17 feet	SS 4		30-26-32 (58)			7				
10			SS 5		25-25-35 (60)			8	40	16	24	
15			SS 6		22-25-35 (60)			10				
		- grades to hard, tan SANDY LEAN CLAY (CL) with some gravel below 17 feet	SS 7		50/3"			8				
20		Bottom of hole at 20.0 feet.										

Burge Engineering & Associates
3453 North Pan Am Expressway, Suite 201
San Antonio, Texas 78219
Telephone: 210-646-8566
Fax: 210-590-7476

BORING NUMBER B-02

CLIENT Alpha Terra Engineering, Inc.
PROJECT NAME Slim Chickens Restaurant
PROJECT NUMBER 12-22-0520
PROJECT LOCATION Culebra Rd/Ranch View W., San Antonio, Tx
DATE STARTED 11/29/22 **COMPLETED** 11/29/22
GROUND ELEVATION **HOLE SIZE** 5"
DRILLING CONTRACTOR BEA
GROUND WATER LEVELS:
DRILLING METHOD Dry Auger
AT TIME OF DRILLING ---
LOGGED BY R.J. **CHECKED BY** R. Burge
AT END OF DRILLING ---
NOTES Groundwater not encountered during drilling operations.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Stratum I - Firm to stiff, dark grayish brown FAT CLAY (CH)	SS 1		2-2-3 (5)			26	93	31	62	
			SS 2		3-6-7 (13)			25				
5		Stratum II - Very stiff, tan and light gray LEAN CLAY (CL) with trace calcaresous deposits	SS 3		5-9-12 (21)			19				
		Bottom of hole at 6.0 feet.										

Burge Engineering & Associates
3453 North Pan Am Expressway, Suite 201
San Antonio, Texas 78219
Telephone: 210-646-8566
Fax: 210-590-7476

BORING NUMBER B-03

CLIENT Alpha Terra Engineering, Inc.
PROJECT NAME Slim Chickens Restaurant
PROJECT NUMBER 12-22-0520
PROJECT LOCATION Culebra Rd/Ranch View W., San Antonio, Tx
DATE STARTED 11/29/22 **COMPLETED** 11/29/22
GROUND ELEVATION
HOLE SIZE 5"
DRILLING CONTRACTOR BEA
GROUND WATER LEVELS:
DRILLING METHOD Dry Auger
AT TIME OF DRILLING ---
LOGGED BY R.J. **CHECKED BY** R. Burge
AT END OF DRILLING ---
NOTES Groundwater not encountered during drilling operations.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0		Stratum I - Very stiff to hard, dark grayish brown FAT CLAY (CH)	SS 1		5-10-15 (25)			20	86	25	61	
		Stratum II - Very dense, light tan calcareous CLAYEY GRAVEL WITH SAND (GC)	SS 2		20-27-32 (59)			12				
5			SS 3		50/1"			9				
		Bottom of hole at 6.0 feet.										

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

General Laboratory and Field Test Procedures

Soil Classification per ASTM D2487
This soil testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content per ASTM D2216
This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under Moisture Content in the attached boring logs.

Soil Liquid Limit per ASTM D4318
The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil.

Soil Plastic Limit per ASTM D4318
The soil Plastic Limit identifies a lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil.

Plasticity Index per ASTM D4318
This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D1586
This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140 pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D1586
This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Minus No. 200 Sieve per ASTM D1140
This test method covers determination of the amount of material finer than a #200 sieve by washing. The results are stated as a percentage of the total dry weight of the sample.

Boring Logs: This is a summary of the above described information at each boring location.