Geotechnical Engineering Report

KFC – Rockgate #3004
San Antonio, Texas
October 26, 2021
Terracon Project No. 90215227

Prepared for:
Desert de Oro Foods, Inc.
Kingman, AZ

Prepared by:
Terracon Consultants, Inc.
San Antonio, Texas

October 26, 2021

Terracon GeoReport

Desert de Oro Foods, Inc.
3845 Stockton Hill Road
Kingman, AZ 86409

Attn: Mr. Ron Kutil

Re: Geotechnical Engineering Report
KFC – Rockgate #3004
6807 West Military Drive
San Antonio, Texas
Terracon Project No. 90215227

Dear Mr. Kutil:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P90215227 dated August 10, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to work with you on this project and look forward to contributing to the ongoing success of this project by providing Materials Testing services during construction. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.
(Firm Registration No. F3272)

Carlos Cotilla
Staff Engineer

Mike T. Ghazawi, P.E.
Senior Principal

STATE OF TEXAS
M. GHAZAWI
90139
LICENSED
PROFESSIONAL ENGINEER

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

REPORT SUMMARY

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **General Comments** should be read for an understanding of the report limitations.

Based on the information obtained from our subsurface exploration, pertinent geotechnical considerations include the following:

- The subsurface soils consist of Fill material in the upper 4 feet underlain by Fat Clay (CH). The fill material was observed in boring B-2 only.
- Groundwater was not observed during the drilling operations.
- The Potential Vertical Rise (PVR) at this site is about 3½ inches in its present condition.
- A shallow slab-on-grade foundation may be considered to support the new building, provided the building pad is prepared as recommended in this report.
- The 2018 International Building Code IBC seismic site classification for this site is D.
- Both asphalt and concrete pavements can be considered for this site.

Geotechnical Engineering Report

KFC – Rockgate #3004
6807 West Military Drive
San Antonio, Texas
Terracon Project No. 90215227
October 26, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed restaurant to be located at 6807 West Military Drive in San Antonio, Texas. The purposes of these services are to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- earthwork
- seismic considerations
- groundwater conditions
- foundation design and construction
- pavement recommendations

The geotechnical engineering Scope of Services for this project included the advancement of four test borings to depths of 20 and 6 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 6807 West Military Drive in San Antonio, Texas. GPS coordinates of the site are: 29.4037°N, 98.62928°W. See **Site Location**
Existing Improvements	The project site is developed. The existing KFC restaurant will be demolished and replaced with a new restaurant.
Current Ground Cover	Concrete pavement.
Existing Topography	The site is relatively level.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions are as follows:

Item	Description
Information Provided	We have been provided a site plan by Mr. Charles Pope, AIA, with Charles William Pope & Associates via an email dated August 5, 2021.
Proposed Structures	The project includes the demolition of the existing restaurant and replacement with a new approximately ±2,900 sq. ft. KFC building.
Pavements	Both asphalt and concrete pavement would be considered.

GEOTECHNICAL CHARACTERIZATION

Subsurface Conditions

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. As part of our analyses, we identified the following model layers within the subsurface profile.

Model Layer #	Name	General Description
1	FILL – CLAYEY GRAVEL (GC) [1]	Brown, Loose to Medium Dense
2	FAT CLAY (CH) [2]	Dark Brown, Grayish Tan, Medium Stiff to Hard

1/ The FILL - CLAYEY GRAVEL (GC) soils are primarily granular in nature and are expected to possess a low potential for volumetric changes as a result of moisture fluctuations. ***This stratum may become water bearing and prone to sloughing.*** *Encountered in boring B-2 only.*

2/ The FAT CLAY (CH) materials could undergo moderate to very high volumetric changes (shrink/swell) should they experience changes in their in-place moisture content.

This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs and GeoModel can be found in the **Exploration Results** section of this report. It can be emphasized that the stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

Groundwater generally appears as either a permanent or temporary water source. Permanent groundwater is generally present year-round, which may or may not be influenced by seasonal and climatic changes. Temporary groundwater water is also referred to as a "perched" water source, which generally develops because of seasonal and climatic conditions.

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was not observed during the drilling operations. The borings were backfilled with soil cuttings and patched with concrete after the drilling operations were completed.

Seasonal variations such as amount of rainfall and runoff, climatic conditions and other factors generally result in fluctuations of the groundwater level over time. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The foundation contractor should check the groundwater conditions just before foundation excavation activities.

GEOTECHNICAL OVERVIEW

We understand that the proposed building will be supported by a shallow foundation system. The desired foundation system may be used at this site provided the building pad and foundations are designed and constructed as recommended in this report. Terracon would be pleased to discuss other foundation alternatives with you upon request.

The foundations being considered must satisfy two independent engineering criteria with respect to the subsurface conditions encountered at this site. One criterion is the foundation system must be designed with an appropriate factor of safety to reduce the possibility of a bearing capacity failure of the soils underlying the foundation when subjected to axial and lateral load conditions. The other criterion is that the movement of the foundation system due to compression (consolidation or shrinkage) or expansion (swell) of the underlying soils must be within tolerable limits for the structures.

Demolition Considerations

We understand that existing building at this site will be removed prior to construction. As a result, abandoned (or to be abandoned) underground utilities may be present within the footprint area of the planned structures. Utilities and associated backfill and granular bedding material can provide avenues for ground water to enter under the structure subgrade. We recommend that all abandoned utility lines (if any) be completely removed from the proposed structure areas. Abandoned pipes which remain underground should be grouted. In addition, the pavement materials may be reused as select fill for the new building pad provided it meets the requirements provided in the **Earthwork** section of this report.

Any below-grade utility removal associated with demolition will likely create large subsurface voids. It is very important that all subsurface voids formed from the removal of the utility be backfill completely with moisture conditioned, compacted, engineered fill as described in the **Earthwork** section of this report. It is our experience that improperly backfilled excavations can cause significant settlement under and around the proposed structures.

As an alternative to compacted soil backfill, a flowable fill material may be considered. Flowable fill, or slurry, when properly designed provides a competent subgrade and can still be readily excavated if the utilities require repair or maintenance. In addition, flowable fill does not need to be placed in lifts, compacted, or tested.

Expansive Soil Considerations

Based on our findings, the subsurface soils at this site generally exhibit low expansion potential. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of about 3½ inches in its present condition. The actual movements could be greater if inadequate drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structures after construction. In order to reduce soil movement beneath the floor slab, subgrade grade and building pad modifications will be required as discussed in this report. The desired slab foundation system may be used at this site provided the building pad and foundations are designed and constructed as recommended in this report.

EARTHWORK

The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations.

Existing Fill

As noted in **Geotechnical Characterization**, boring B-2 encountered existing fill to a depth of about 4 feet. We have no records to indicate the degree of compaction. Support of footings, floor slabs, and pavements, on or above existing fill soils is always a concern. The risk may be lessened by preparing the subgrade as recommended in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

Site Preparation

Construction operations may encounter difficulties due to the wet or soft surface soils becoming a general hindrance to equipment due to rutting and pumping of the soil surface, especially during and soon after periods of wet weather. If the subgrade cannot be adequately compacted to minimum densities as described in the **Fill Compaction Requirements** section of this report, one of the following measures may be required:

- removal and replacement with select fill.
- chemical treatment of the soil to dry and increase the stability of the subgrade.
- drying by natural means if the schedule allows

Prior to construction, all vegetation, any pavements, existing foundation, and loose topsoil, and any otherwise unsuitable materials should be removed from the construction area. The stripped materials consisting of vegetation and organic materials should be wasted from the site or used to revegetate landscaped areas or exposed slopes after completion of grading operations. Wet or dry material should either be removed, or moisture conditioned and recompacted. After stripping and grubbing, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a 15-ton roller or fully loaded dump truck. Soils that are observed to rut or deflect excessively (typically greater than 1-inch) under the moving load should be undercut and replaced with properly compacted on-site soils. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather.

Building Pad Preparation

The following building pad preparation recommendations should be performed for the proposed building prior to foundation construction. As previously mentioned, the existing PVR at this site is about 3½ inches. Recommendations for at-grade pad preparation to reduce the PVR to about 1 inch and provide uniform support to the grade supported slabs and flatwork for this project site are provided in the following sections.

- After completing stripping operations as discussed in the Site Preparation section, excavate about 6 feet of the onsite soil from the building pad area. Excavated clayey gravel fill soils should either be removed or may be stockpiled for later use. Oversized particles should be processed and crushed so that the maximum particle size is no larger than 3 inches. The building pad area is defined as the area that extends at least 3 feet (horizontal) beyond the perimeter of the proposed building and to the outside edge of any movement sensitive flatwork. The limits of the building pad should be indicated on the drawings for the project.

- After excavating to the depth specified above, the exposed subgrade should be proof rolled with a fully loaded dump or water truck to evidence any weak yielding zones. A Terracon geotechnical engineer or their representative should be present to observe proof rolling operations.

- Over-excavate any confirmed weak yielding zones, both vertically and horizontally, to expose competent soil. The upper 6 inches of the exposed subgrade should be moisture conditioned between 0 and +4 percentage points of the optimum moisture content and then compact to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698.

- Place 6 feet of select fill to achieve the Finished Building Pad Elevation (FBPE). The select fill should be placed in loose lifts of about 8 inches and compacted thickness not exceeding 6 inches. The material should be moisture conditioned between -2 and +3 percentage points of the optimum moisture content and then compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698.

- The upper 6 inches of the building pad may be constructed with granular select fill to provide an all-weathering surface course. This layer is to provide a working surface during wet weather conditions.

This method should result in 6 feet of select fill beneath the grade supported floor slab. If grades are to be raised, select fill should then be used to achieve the Finished Building Pad Elevation (FBPE).

Once the building is demolished, select fill may be present beneath the existing slab. The select fill may be stockpiled and tested prior to use, provided it meets the select fill criteria.

Details regarding select fill materials, placement and compaction are presented in the following sections **Fill Material Types** and **Fill Compaction Requirements**.

Fill Material Types

Earthen materials used for structural and general fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location of Placement
Imported Select fill	CL & GC (LL≤40) and (7≤PI≤20)	All locations and elevations. See note 3.
On-Site Soil	GC, CH	The GC soils meeting the select fill criteria can be used as select fill. See note 2. The CH soils are <u>not</u> suitable for use as select fill.
Granular Select Fill	Meet TxDOT Item 247 Type A, Grade 1-2 gradation requirements.	Upper 6 inches of the pad only for working surface.

1/ *Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.*

2/ *The existing base material if excavated may be used as granular select fill, provided the materials are 3 inches or less. GC soils can be used as Select Fill if they meet the criteria of Select Fill. If proposed to use, these materials should be stockpiled and tested prior to use.*

3/ *Lean Clay (CL) are soils having:*

- *At least 50 percent of total material passing on the No. 200 sieve,*
- *A Liquid Limit (LL) no greater than 40; and*
- *A Plasticity Index (PI) between 7 and 20.*

Clayey Gravel (GC) are soils having:

- *No particle sizes greater than 3 inches in any dimension;*
- *At least 50 percent of total material retained on the No. 200 sieve;*
- *A Liquid Limit (LL) no greater than 40; and*

A Plasticity Index (PI) between 7 and 20.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness	All fill should be placed in thin, loose lifts of about 8 inches, with compacted thickness not exceeding 6 inches.
Compaction of On-Site Soils, Select Fill and Granular Select Fill	95 percent of the material's Standard Proctor maximum dry density (ASTM D 698).

Item	Description
Moisture Content of On-Site fill soil, Select Fill and Granular Select Fill	The materials should be moisture conditioned between -2 and +3 percentage points of the optimum moisture content.
Moisture Content of On-Site Soils	The materials should be moisture conditioned between 0 and +4 percentage points of the optimum moisture content.

Pavement Reuse

A pulverized, uniform mixture of the existing asphaltic concrete and coarse aggregate base may be suitable for use as fill in the pavement area or as select fill in the upper 6 inches of the building pad. The material should have particles no larger than 2 inches, and be moisture conditioned to between -2 and +3 percentage points of optimum. The material should be placed in loose lifts of no more than 8 inches in thickness, and be compacted to at least 95 percent of the maximum density determined in accordance with ASTM D 698 to achieve compacted lifts of about 6 inches.

Grading and Drainage

Effective drainage should be provided during construction and maintained throughout the life of the new improvements. After pad construction, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

Flatwork and pavements will be subjected to post-construction movement. Maximum grades that are feasible should be used for paving and flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movements are deemed critical. Where paving or flatwork abuts the structure, joints should be effectively sealed and maintained to prevent surface water infiltration. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a grade of at least five percent for at least 10 feet from perimeter walls (except in areas where ADA ramps are required; these should comply with state and local regulations). Backfill against grade beams, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of construction debris to reduce the possibility of moisture infiltration.

Planters and other surface features which could retain water in areas adjacent to the structures should be properly drained, designed, sealed or eliminated. Landscaped irrigation adjacent to the foundation systems should be properly designed and controlled to help maintain a relatively constant moisture content within 5 feet of the structure.

Utility trenches are a common source of water infiltration and migration. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Utility trenches that penetrate beneath the structure should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the pad. We recommend constructing an effective clay "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soil's optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report. The combination of 10 mil poly and flowable fill backfill can be used in place of a clay plug.

Earthwork Construction Considerations

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively stable. However, the stability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unstable conditions develop, workability may be improved by scarifying and drying. Over excavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance.

All temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

SHALLOW FOUNDATIONS

A slab on grade beam foundation or a spread footing may be considered to support the structures at the project site.

Design Parameters – Slab on Grade Foundation

A slab and grade beam foundation may be considered to support the structures at this site. Parameters commonly used to design this type of foundation are provided on the table below. The slab foundation design parameters presented are based on the conventional method and the criteria published by the Wire Reinforcement Institute (WRI). These are essentially empirical design methods and the recommended design parameters are based on our understanding of the proposed project, our interpretation of the information and data collected as a part of this study, our area experience, and the criteria published in the WRI design manual.

Conventional Method	**Prepared Subgrade** [1]
Net allowable bearing pressure [2]	2,000 psf
Subgrade Modulus (k) with 6 inches of crushed limestone base.	100 pci
Potential Vertical Rise (PVR)	about 1 inch
WRI Method	
Design Plasticity Index (PI) [3]	26
Climatic Rating (C_w)	17
Soil-Climate Support Index (1-C)	0.11

1/ Based on preparing the pad preparation as discussed in this report.

2/ The net allowable bearing pressure provided above includes a Factor of Safety (FS) of at least 3.

3/ The WRI effective PI is equal to the near surface PI if that PI is greater than all of the PI values in the upper 15 feet.

We recommend that exterior grade beams be at least 30 inches below the finished exterior grade. These recommendations are for a proper development of bearing capacity for the continuous beam sections of the foundation system and to reduce the potential for water to migrate beneath the slab foundation. These recommendations are not based on structural considerations. Grade beam depths may need to be greater than recommended herein for structural considerations and should be properly evaluated and designed by the Structural Engineer. The grade beams or slab portions may be thickened and widened to serve as spread footings at concentrated load areas. The floor slab thickness should be designed by the Structural Engineer to carry fire truck loads.

For a slab foundation system designed and constructed as recommended in this report, post construction settlements should be less than 1 inch. Settlement response of a select fill supported slab is influenced more by the quality of construction than by soil-structure interaction. Therefore, it is essential that the recommendations for foundation construction be strictly followed during the construction phases of the pad and foundation.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slabs will support equipment sensitive to moisture. 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.

Design Parameters – Spread Foundation

Design recommendations for spread foundations for the proposed light poles are presented in the table below.

The spread footings can provide some uplift resistance for those structures subjected to wind or other induced structural loading. The uplift resistance of a spread footing may be computed using the effective weight of the soil above the spread footing along with the weight of the spread footing and structure. A soil unit weight of 120 pcf may be assumed for the soils placed above the footing, provided the fill is properly compacted.

Description	Parameters
Net allowable bearing pressure [1]	2,000 psf
Minimum dimensions	30 inches
Minimum embedment below finished grade for bearing	36 inches
Approximate heave or total settlement from foundation loads	<1 inch
Allowable Net passive pressure [2]	200 pcf, equivalent fluid density
Allowable coefficient of sliding friction	0.25

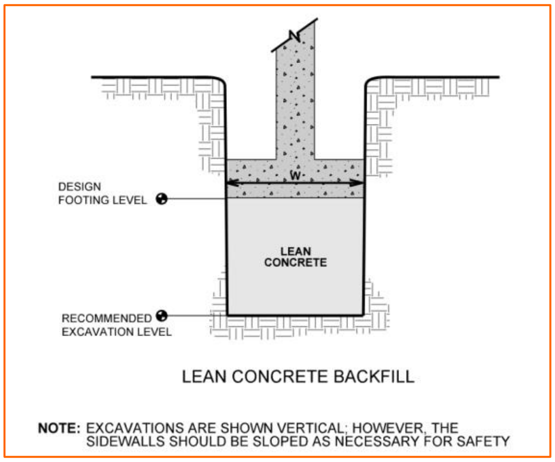
[1] The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any soft soils, if encountered, will be undercut and replaced with compacted select fill or footing bears in competent native soils. Based upon a minimum Factor of Safety of 3.

[2] The spread footing foundation excavation sides must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure values to be valid. If the loaded side is sloped or benched, and then backfilled, the allowable passive pressure will be significantly reduced. Passive resistance in the upper 12 inches of the soil profile should be neglected.

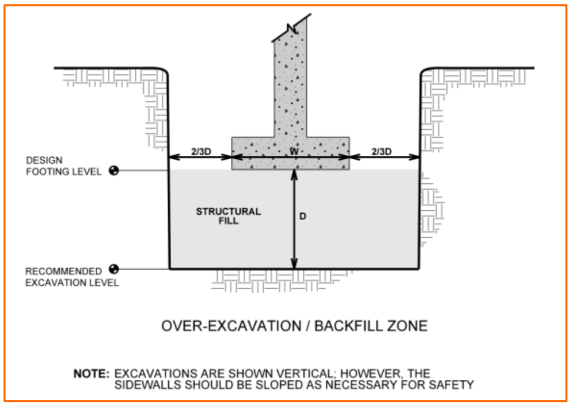
Foundation Construction Considerations

As noted in **Earthwork**, the grade beam footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with select fill placed, as recommended in the **Earthwork** section.



DEEP FOUNDATIONS

Drilled Piers Foundation

The light poles may be supported on a straight-sided drilled pier foundation system bearing at a depth no shallower than 10 feet below existing grade.

Drilled piers may be designed for net allowable bearing pressure of 4,000 psf. This bearing pressure include factor of safety against a bearing capacity failure of approximately 3. An allowable side shear value of 400 psf, with an assumed factor of safety of at least 2, may be used to aid in resisting axial compressive loads on the piers. The side shear should be neglected for the upper 4 feet of soil in contact with the pier shaft. Piers should not extend deeper than 20 feet below the existing grades at the time of our geotechnical field activities without contacting our office. Piers should be designed with a shaft diameter at least 18 inches to facilitate inspection.

The allowable end bearing and skin friction values presented in this report are based on center-to-center spacing of the pier foundations no closer than a horizontal distance of three shaft diameters (using the larger bearing diameter). A closer spacing may be considered but may effect (reduce) the axial capacity of the foundation depending on the spacing pattern of the foundations. Terracon can assist in evaluating the possibility of a closer spacing once a foundation layout has been determined.

In addition to the axial compressive loads on the piers, these piers will also be subjected to axial tension loads due to the expansive soil conditions and possibly due to other induced structural loading conditions. To compute the axial tension force due to the swelling soils along the pier shaft, the following equation may be used.

$$Q_u = 50 \cdot d$$

Where:
- Q_u = Uplift force due to expansive soil conditions in kips (k)
- d = Diameter of pier shaft in feet (ft)

This calculated force may be used to compute the longitudinal reinforcing steel required in the pier to resist the uplift force induced by the swelling clays. However, the cross-sectional area of the reinforcing steel should not be less than 1 percent of the gross cross-sectional area of the drilled pier shaft. The reinforcing steel should extend from the top to the bottom of the shaft to resist this potential uplift force.

The allowable uplift resistance of the straight sided drilled piers can be evaluated using the following equation:

$$Q_{ar} = 2.0 \cdot d \cdot D_p + 0.9\, W_p + P_{DL}$$

Where:
- Q_{ar} = Allowable uplift resistance of pier in kips (k)
- d = Diameter of pier shaft in feet (ft)
- D_p = Founding depth of pier in natural soils minus the upper 4 feet of shaft in contact with the soil in feet (ft)
- W_p = Weight of the drilled pier in kips (k)
- P_{DL} = Dead Load acting on the drilled pier in kips (k)

Settlement – For piers, total settlements, based on the indicated bearing pressures, should be about 1 inch or less for properly designed and constructed drilled piers. Settlement beneath individual piers will be primarily elastic with most of the settlement occurring during construction. Differential settlement may also occur between adjacent piers. The amount of differential settlement could approach 50 to 75 percent of the total pier settlement. For properly designed and constructed piers, differential settlement between adjacent piers is estimated to be less than ¾ of an inch. Settlement response of drilled piers is impacted more by the quality of construction than by soil-structure interaction.

Lateral Loading - The piers supporting the building and light poles may be subjected to lateral loading. The criteria for lateral load analysis is presented in **Table 1** are for use with the computer program LPILE. A number of methods, including hand solutions and computer programs, are available for calculating the lateral behavior of piles and drilled piers. The majority of these methods rely on "key" soil parameters such as soil elastic properties (E and k_s), strain at 50 percent of the principal stress difference (ε_{50}), undrained shear strength (c), and load-deflection (p-y) criteria. The *p-y* criteria, which are commonly used to model soil reaction, were developed from instrumented load tests and are generally considered to provide the best model of soil behavior under short-term lateral loading.

Factors of safety are not generally applied to the lateral load analysis. A performance criteria, or "limit state", are usually considered. For most foundations subjected to lateral loads, the pier foundation is designed with a limit of 1 inch of deflection at the top of the pier and 1 degree of rotation as measured from the vertical axis of the pier. The analysis is generally conducted using the working loads and the limit state values. The applied loads are then doubled to evaluate the deflection and rotation at the top of the pier to determine if the foundation will topple over under extreme overload. This overload condition may indicate that the foundation would deflect or rotate such that the tower will tilt but the foundation will not experience failure. Structural limits, such as moment capacity and shear, may control the design and should be evaluated by the Structural Engineer.

Drilled Pier Construction Considerations

The pier excavations should be augered and constructed in a continuous manner. Steel and concrete should be placed in the pier excavations immediately following drilling and evaluation for proper bearing stratum, embedment, and cleanliness. Under no circumstances should the pier excavations remain open overnight.

During the time of our drilling operations, subsurface water was not observed. Subsurface water levels are influenced by seasonal and climatic conditions which result in fluctuations in subsurface water elevations. Therefore, the contractor should be prepared to use temporary casing should water be encountered and/or sloughing of the excavation sidewalls occur. It is the responsibility of the foundation contractor to choose the casing, type, depth and method of installation.

All aspects of concrete design and placement should comply with the American Concrete Institute (ACI) 318 Code Building Code Requirements for Structural Concrete, ACI 336.1 Standard Specification for the Construction of Drilled Piers, and ACI 336.3R entitled Suggested Design and Construction Procedures for Pier Foundations. Concrete should be designed to achieve the specified minimum 28-day compressive strength when placed at a 7 inch slump with a ±1 inch tolerance. Adding water to a mix designed for a lower slump does not meet the intent of this recommendation. If a high range water reducer is used to achieve this slump, the span of slump retention for the specific admixture under consideration should be thoroughly investigated. Compatibility with other concrete admixtures should also be considered. A technical representative of the admixture supplier should be consulted on these matters.

Successful installation of drilled piers is a coordinated effort involving the general contractor, design consultants, subcontractors and suppliers. Each must be properly equipped and prepared to provide their services in a timely fashion. Several key items are:

- Proper drilling rig with proper equipment (including casing).
- Reinforcing steel cages tied to meet project specifications;
- Proper scheduling and ordering of concrete for the piers; and
- Monitoring of installation by design professionals.

Pier construction should be carefully monitored to assure compliance of construction activities with the appropriate specifications. A number of items recommended for monitoring during pier installation include those listed below.

- Pier locations
- Vertical alignment
- Competent bearing
- Steel placement
- Concrete properties and placement
- Casing removal (if required)
- Proper casing seal for subsurface water control

If the contractor has to deviate from the recommended foundations, Terracon should be notified immediately so additional engineering recommendations can be provided for an appropriate foundation type.

SEISMIC CONSIDERATIONS

Description	Value
2018 International Building Code Site Classification (IBC) [1]	D [2]

1/ The site class definition was determined using SPT N-values in conjunction with section 1613.3.2 in the 2018 IBC and Table 20.3-1 in the 2010 ASCE-7.

2/ Borings extended to a maximum depth of 20 feet, and this seismic site class definition considers that similar conditions continue below the maximum depth of the subsurface exploration.

PAVEMENTS

Both flexible and rigid pavement systems may be considered for the project. Based on our knowledge of the project, we anticipate that traffic loads will be produced primarily by automobile traffic, delivery and trash removal trucks.

Subgrade Preparation

Prior to construction, previous pavements, any vegetation, loose topsoil and any otherwise unsuitable materials should be removed from the new pavement areas. After stripping, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with a fully loaded dump truck. Wet, soft, low-density or dry material should either be removed or moisture conditioned and recompacted to the moisture contents and densities described in section **Fill Compaction Requirements** prior to placing fill.

Due to the presence of the expansive clay soil at the site, movement of pavement up to 3½ inches should be expected. If the movement of the pavement is not acceptable, then the pavement subgrade should be prepared similar to the structure pad provided in the **Pad Preparation** section of this report.

Design Recommendations

For this project Light and Heavy pavement section alternatives have been provided. Light is for areas expected to receive only car traffic. Heavy assumes areas with heavy traffic, such as trash pickup areas, delivery areas, main access drive and drive-through areas.

The flexible pavement section was designed in general accordance with the National Asphalt Pavement Association (NAPA) Information Series (IS-109) method (Class 1 for Light and Class 2 for Heavy). The rigid pavement section was designed using the American Concrete Institute (ACI 330R-01) method (Traffic Category A (ADTT=0) for Light and A-1 (ADTT=10) for Heavy). If heavier traffic loading is expected, Terracon should be provided with the information and allowed to review these pavement sections.

	FLEXIBLE PAVEMENT SYSTEM (inches)			
	Raw Subgrade		Modified Subgrade	
	Light Duty	Heavy Duty	Light Duty	Heavy Duty
Hot Mix Asphaltic Concrete	2.0	2.5	2.0	2.5
Granular Base Material [1]	10.0	14.0	6.0	10.0
Lime Treated Subgrade	---	---	6.0	6.0
Moisture Conditioned Raw Subgrade	6.0	6.0	---	---

1/ Asphaltic base material may be used in place of crushed limestone base material. Every 2.5 inches of crushed limestone base material may be replaced with 1 inch of asphaltic base material. However, the minimum thickness of the asphaltic base material is 4 inches.

	RIGID PAVEMENT SYSTEM (inches)			
	Raw Subgrade		Modified Subgrade	
	Light Duty	Heavy Duty	Light Duty	Heavy Duty
Reinforced Concrete	5.5	6.5	5.0	6.0
Lime Treated Subgrade	---	---	6.0	6.0
Moisture Conditioned Raw Subgrade	6.0	6.0	---	---

1/ Dumpster pad should be constructed as heavy duty rigid section.

Pavement areas that will be subjected to heavy wheel and traffic volumes, such as waste bin or "dumpster" areas, entrance/exit ramps, and delivery areas, should be a heavy duty rigid pavement section constructed of reinforced concrete. The concrete pavement areas should be large enough to properly accommodate the vehicular traffic and loads. For example:

- The dumpster pad should be large enough so that the wheels of the collection truck are entirely supported on the concrete pavement during lifting of the waste bin; and
- The concrete pavement should extend beyond any areas that require extensive turning, stopping, and maneuvering.

- The pavement design engineer should consider these and other similar situations when planning and designing pavement areas. Waste bin and other areas that are not designed to accommodate these situations often result in localized pavement failures.

The pavement section has been designed using generally recognized structural coefficients for the pavement materials. These structural coefficients reflect the relative strength of the pavement materials and their contribution to the structural integrity of the pavement. If the pavement does not drain properly, it is likely that ponded water will infiltrate the pavement materials resulting in a weakening of the materials. As a result, the structural coefficients of the pavement materials will be reduced and the life and performance of the pavement will be shortened. The Asphalt Institute recommends a minimum of 2 percent slope for asphalt pavements. The importance of proper drainage cannot be overemphasized and should be thoroughly considered by the project team.

Pavement Section Materials

Presented below are selection and preparation guidelines for various materials that may be used to construct the pavement sections. Submittals should be made for each pavement material. The submittals should be reviewed by the Geotechnical Engineer and appropriate members of the design team and should provide test information necessary to verify full compliance with the recommended or specified material properties.

- **Hot Mix Asphaltic Concrete Surface Course** - The asphaltic concrete surface course should be plant mixed, hot laid Type C or D Surface. Each mix should meet the master specifications requirements of 2014 TXDOT Standard Specifications Item 341, Item SS 3224 (2011) and specific criteria for the job mix formula. The mix should be compacted between 91 and 95 percent of the maximum theoretical density as measured by TEX-227-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. In addition, the mix should be designed so 75 to 85 percent of the voids in the mineral aggregate (VMA) are filled with asphalt cement. The grade of the asphalt cement should be PG 70-22 or higher performance grade. Aggregates known to be prone to stripping should not be used in the hot mix. If such aggregates are used measures should be taken to mitigate this concern. The mix should have at least 70 percent strength retention when tested in accordance with TEX-531-C.

  Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method TEX-207-F. The nuclear-density gauge or other methods which correlate satisfactorily with results obtained from project pavement specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required pavement specimens at their expense and in a manner and at locations selected by the Engineer.

- **Concrete** - Concrete should have a minimum 28-day design compressive strength of 4,000 psi.

- **Granular Base Material** - Base material may be composed of crushed limestone base meeting all of the requirements of 2014 TxDOT Item 247, Type A, Grade 1-2; including triaxial strength. The material should be compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D 1557 at moisture contents ranging from -2 and +3 percentage points of the optimum moisture content.

- **Lime Treated Subgrade** - Due to the presence of clay at this site, the subgrade may be modified with hydrated lime in accordance with TxDOT Item 260 in order to improve its strength and improve its load carrying capacity. We anticipate that approximately 6 percent hydrated lime will be required. This is equivalent to about 30 pounds of hydrated lime per square yard for a 6-inch treatment depth. However, the actual percentage should be determined by laboratory tests on samples of the clayey subgrade prior to construction. The optimum lime content should result in a soil-lime mixture with a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI and should reduce the Plasticity Index to 20 or less.

  The lime should initially be blended with a mixing device such as a Pulvermixer, sufficient water added, and be allowed to cure for at least 48 hours. After curing, the lime-soil should be remixed to meet the in-place gradation requirements of Item 260 and compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D 698 at moisture contents ranging from optimum and 4 percentage points above the optimum moisture content.

- **Moisture Conditioned Subgrade** - The subgrade should be scarified to a depth of 6 inches and then moisture conditioned and compacted as recommended in the Compaction Requirements section of this report.

Details regarding subgrade preparation, fill materials, placement and compaction are presented in **Earthwork** section under subsections **Fill Material Types** and **Fill Compaction Requirements**.

Pavement Joints and Reinforcement

The following is recommended for all concrete pavement sections in this report. Refer to ACI 330 "Guide for Design and Construction of Concrete Parking Lots" for additional information.

Item	Description
Distributed Reinforcing Steel	No. 3 reinforcing steel bars at 18 inches on-center-each-way, Grade 60. It is imperative that the distributed steel be positioned accurately in the pavement cross section, namely 2 inches from the top of the pavement.
Contraction Joint Spacing	12.5 feet each way for pavement thickness of 5 to 5.5 inches. 15 feet each way for pavement thickness of 6 inches or greater. Saw cut control joints should be cut within 6 to 12 hours of concrete placement.
Contraction Joint Depth	At least ¼ of pavement thickness.
Contraction Joint Width	One-fourth inch or as required by joint sealant manufacturer.
Construction Joint Spacing	To attempt to limit the quantity of joints in the pavement, consideration can be given to installing construction joints at contraction joint locations, where it is applicable.
Construction Joint Depth/Width	Full depth of pavement thickness. Construct sealant reservoir along one edge of the joint. Width of reservoir to be ¼ inch or as required by joint sealant manufacturer. Depth of reservoir to be at least ¼ of pavement thickness.
Isolation Joint Spacing	As required to isolate pavement from structures, etc.
Isolation Joint Depth	Full depth of pavement thickness.
Isolation Joint Width	½ to 1 inch or as required by the joint sealant manufacturer.
Expansion Joint	In this locale, drying shrinkage of concrete typically significantly exceeds anticipated expansion due to thermal affects. As a result, the need for expansion joints is eliminated provided all joints (including saw cuts) are sealed. Construction of an unnecessary joint may be also become a maintenance problem. <u>All</u> joints should be sealed. If all joints, including sawcuts, are not sealed then expansion joints should be installed.

All construction joints have dowels. Dowel information varies with pavement thickness as presented as follows:

Parameter	5 to 5½ inches	6 to 6½ inches
Dowels	⅝ inch diameter	¾ inch diameter
Dowel Spacing	12 inches on center	12 inches on center
Dowel Length	12 inches long	14 inches long
Dowel Embedment	5 inches	6 inches

Pavement Drainage and Maintenance

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent.
- Install joint sealant and seal cracks immediately.
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section.
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.
- Slope subgrade in landscape islands to low points should drain to an appropriate outlet.
- Edge drains are recommended along pavement/ landscape borders.

Sulfate Considerations

A sulfate test was performed on a selected sample collected from the borings to check for possible adverse reactions with lime treatment. Testing was not performed on all borings nor at all depths. Sulfate content concentrations for a boring along with its approximate depth and nearest boring number is as follows:

Boring No.	Approximate Depth, feet	Sulfate Content, mg/Kg
B-3	1.5-3	188

The test results indicate a sulfate value of about 188 mg/Kg. Based on the test results, the sulfate effect at this site is considered to be low.

The test results indicate that the sulfate concentrations in the soils are within levels deemed to be of a low risk for adverse reactions when mixed with a calcium-based additive TxDOT (>8,000 mg/Kg), the National Lime Association (>3,000 mg/Kg) and AASHTO (>5,000 mg/Kg). The American Concrete Institute (ACI) and the Texas Department of Transportation (TxDOT) provide guidance and specifications regarding sulfates in soil and groundwater. Concrete exposed to these materials is also subject to sulfate attack which can result in the deterioration of the concrete over time.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

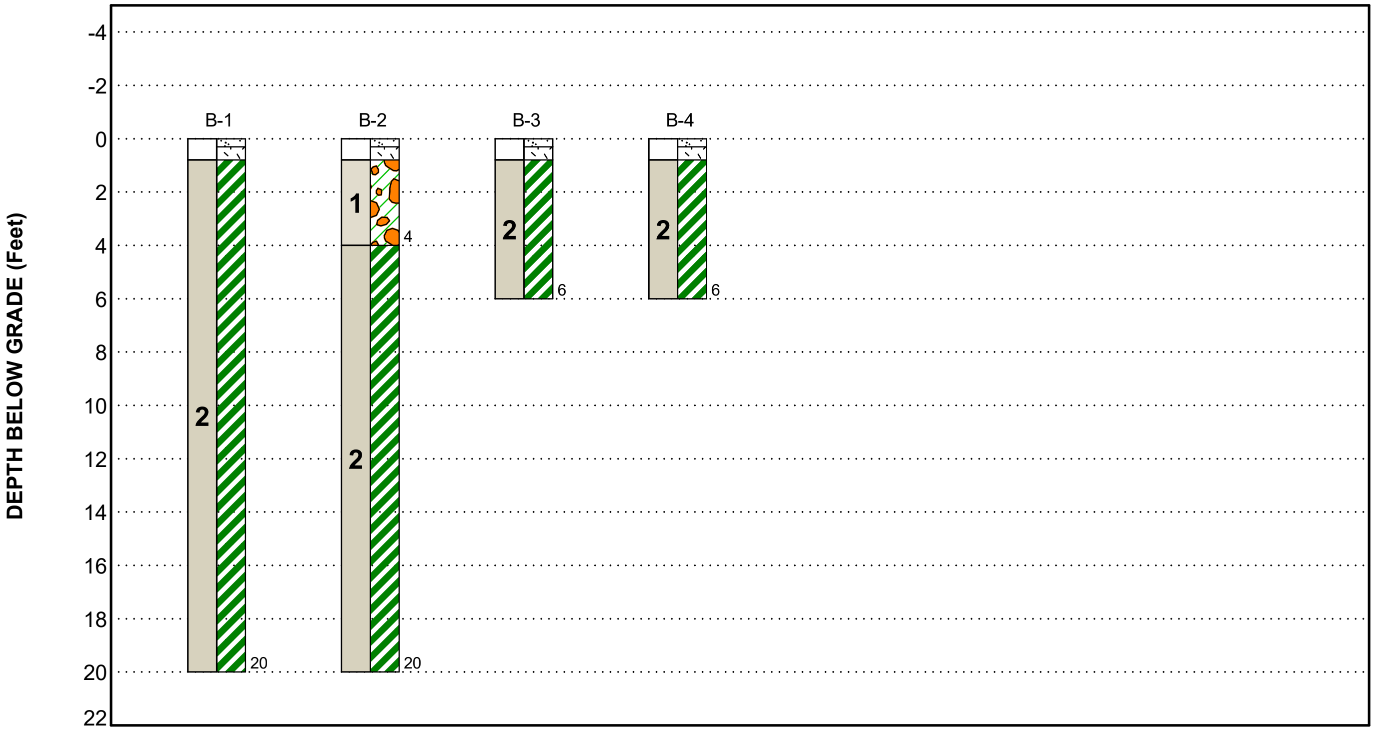
Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made. Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

Contents:

GEOMODEL

KFC - Rockgate #3004 ■ San Antonio, TX
Terracon Project No. 90215227



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	FILL - CLAYEY GRAVEL (GC)	Brown, Loose to Medium Dense
2	FAT CLAY (CH)	Dark Brown, Grayish Tan, Medium Stiff to Hard

LEGEND

- Concrete
- Base
- Fat Clay
- Clayey Gravel

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

TABLE

TABLE 1 (Borings B-1 and B-2)
LATERAL DESIGN PARAMETERS FOR UNDRAINED CONDITIONS

KFC – ROCKGATE #3004
6807 WEST MILITARY DRIVE
SAN ANTONIO, TEXAS
TERRACON PROJECT NO. 90215227

Layer	Depth to Bottom of Layer (feet)	Total Unit Weight (pcf)	Effective Unit Weight (pcf)	Undrained Shear Strength (psf)	Soil Strain Factor (ε_{50})	LPILE Soil Types	Friction Angle (degrees)	Subgrade Modulus, k (pci)
1	4	120	120	1,000	0.010	Stiff Clay without Free Water	---	430
2	10	120	120	2,000	0.007	Stiff Clay without Free Water	---	620
3	20	120	120	3,000	0.006	Stiff Clay without Free Water	---	820

1 Design depth to subsurface water is greater than 20 feet.

2 For uplift conditions, the computed skin friction should be multiplied 0.9 for clay.

3 Stratigraphy shown above is based on our interpretation of soil strength and may not correspond with the descriptive classifications shown on the boring log.

4 The lateral load criteria shown above are for use in the computer programs LPILE.

5 The depth to diameter ratio must exceed 4 to use $N_c = 9$. Otherwise, use $N_c = 6$.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
B-1	20	Proposed Building
B-2		
B-3	6	Pavement areas
B-4		

Boring Layout and Elevations: We use handheld GPS equipment to locate borings with an estimated horizontal accuracy of +/-20 feet.

Subsurface Exploration Procedures: We advanced the soil borings with a truck-mounted drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube and/or split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples.

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in this Appendix. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Moisture Content
- Atterberg Limits
- Soil Finer than No. 200 Mesh Sieve
- Sulfate Content Test

Final boring logs that were prepared represented the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION

KFC – Rockgate #3004 ■ San Antonio, Texas

October 26, 2021 ■ Terracon Project No. 90215227

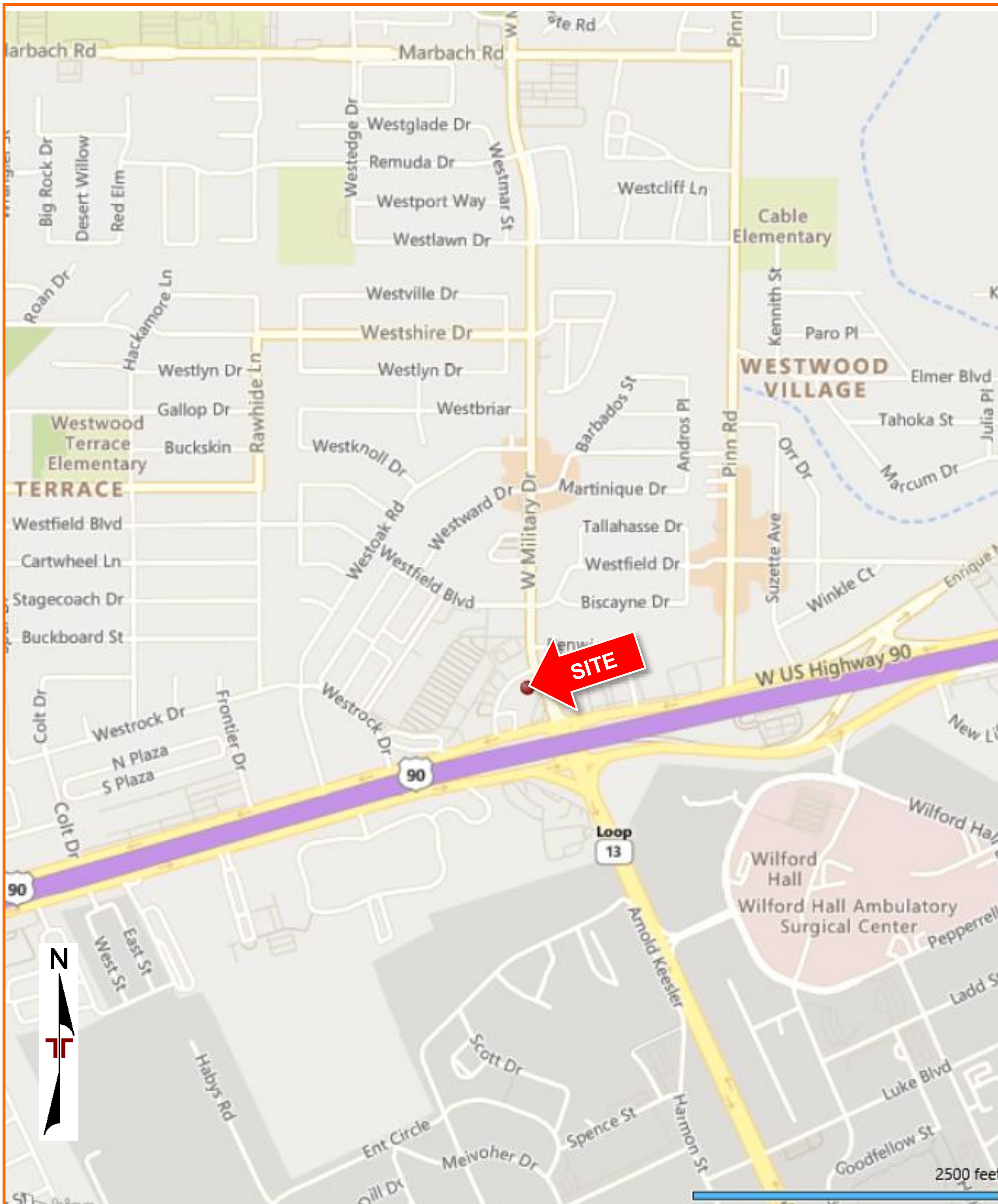


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

KFC – Rockgate #3004 ■ San Antonio, Texas
October 26, 2021 ■ Terracon Project No. 90215227

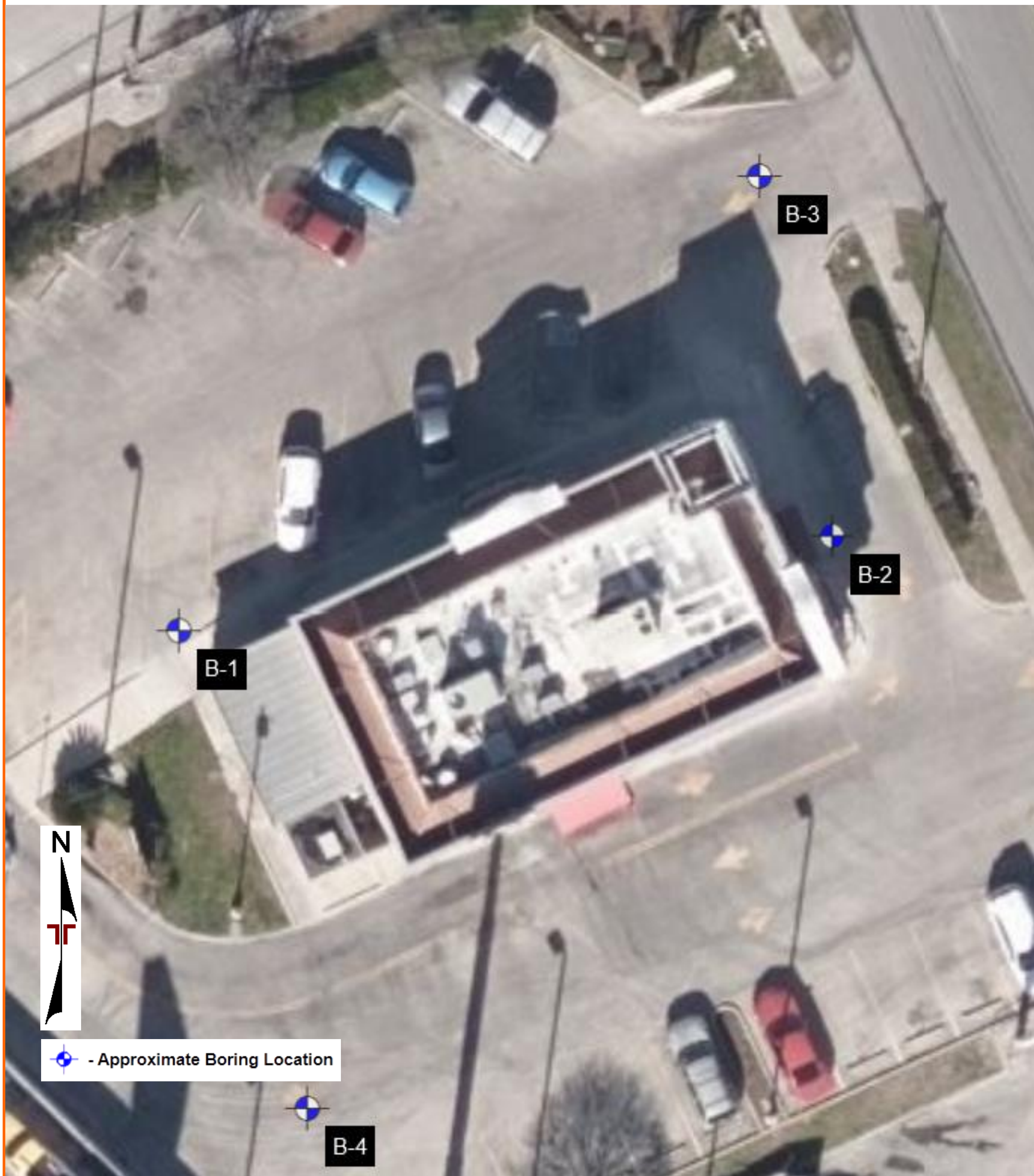


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS
NOT INTENDED FOR CONSTRUCTION PURPOSES

EXPLORATION RESULTS

Contents:

BORING LOG NO. B-1

PROJECT: KFC - Rockgate #3004

CLIENT: Desert de Oro Foods, Inc.
Kingman, AZ

SITE: 6807 West Military Drive
San Antonio, TX

LOCATION See Exploration Plan

Latitude: 29.4037° Longitude: -98.6294°

MODEL LAYER	DEPTH	Description	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.3	**3" Concrete thickness**					
	0.8	**6" Base Material thickness**					
2		**FAT CLAY (CH)**, dark brown, medium stiff to hard	X	4-4-3 N=7	23.0	59-23-36	
		- grayish tan below 2 feet	X	1-1-7 N=8	27.4		
			X	4-5-5 N=10	27.8	69-27-42	
			X	5-8-12 N=20	23.0		
			X	5-5-10 N=15	24.6	75-28-47	
			X	6-8-12 N=20	24.8		
	20.0	- reddish brown below 18 feet	X	21-18-12 N=30	22.1		
		Boring Terminated at 20 Feet					

Depth scale (Ft.): 5, 10, 15, 20

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
CFA

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 10-07-2021	Boring Completed: 10-07-2021
Drill Rig: CME 75	Driller:
Project No.: 90215227	

BORING LOG NO. B-2

PROJECT: KFC - Rockgate #3004

CLIENT: Desert de Oro Foods, Inc.
Kingman, AZ

SITE: 6807 West Military Drive
San Antonio, TX

LOCATION See Exploration Plan

Latitude: 29.4037° Longitude: -98.6291°

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		0.3	**3" Concrete thickness**							
		0.8	**6" Base Material thickness**							
1			**FILL - CLAYEY GRAVEL (GC)**, brown, loose to medium dense			X	5-3-5 N=8	8.1		25
						X	15-6-10 N=16	14.1		
		4.0								
2			**FAT CLAY (CH)**, grayish tan, stiff to hard	5		X	3-5-6 N=11	25.6		
						X	9-11-17 N=28	21.7	73-28-45	
				10		X	5-7-9 N=16	23.7		
				15		X	7-8-14 N=22	25.0	71-28-43	
			- reddish brown below 18 feet							
		20.0		20		X	14-15-38 N=53	20.7		
			Boring Terminated at 20 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
CFA

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 10-07-2021	Boring Completed: 10-07-2021
Drill Rig: CME 75	Driller:
Project No.: 90215227	

BORING LOG NO. B-3

PROJECT: KFC - Rockgate #3004

CLIENT: Desert de Oro Foods, Inc.
Kingman, AZ

SITE: 6807 West Military Drive
San Antonio, TX

LOCATION See Exploration Plan

Latitude: 29.4039° Longitude: -98.6291°

MODEL LAYER	GRAPHIC LOG	DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		0.3	**3" Concrete thickness**							
		0.8	**6" Base Material thickness**							
2			**FAT CLAY (CH)**, grayish tan, stiff			X	4-5-4 N=9	21.3	67-26-41	
						X	3-5-6 N=11	16.7		
		6.0		5		X	3-5-7 N=12	28.6		
			Boring Terminated at 6 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
CFA

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 10-07-2021	Boring Completed: 10-07-2021
Drill Rig: CME 75	Driller:
Project No.: 90215227	

BORING LOG NO. B-4

PROJECT: KFC - Rockgate #3004

**CLIENT: Desert de Oro Foods, Inc.
Kingman, AZ**

**SITE: 6807 West Military Drive
San Antonio, TX**

LOCATION See Exploration Plan

Latitude: 29.4035° Longitude: -98.6293°

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		0.3	**3" Concrete thickness**							
		0.8	**6" Base Material thickness**							
2			**FAT CLAY (CH)**, dark brown, stiff			X	4-4-4 N=8	23.3		
			- grayish tan below 3 feet			X	3-4-4 N=8	23.8		
		6.0		5		X	7-8-5 N=13	28.9		

Boring Terminated at 6 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
CFA

Abandonment Method:
Boring backfilled with Auger Cuttings
Surface capped with concrete

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 10-07-2021	Boring Completed: 10-07-2021
Drill Rig: CME 75	Driller:
Project No.: 90215227	

SUPPORTING INFORMATION

Contents:

GENERAL NOTES
DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Shelby Tube; Split Spoon	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $[Cc<1$ or $Cc>3.0]$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $[Cc<1$ or $Cc>3.0]$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A” line		CL	Lean clay [K, L, M]
			$PI < 4$ or plots below “A” line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N]
						Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K, L, M]
			PI plots below “A” line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P]
						Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains $\geq$ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.