

GEOTECHNICAL ENGINEERING REPORT

**TRAVIS TOWN CENTER
RETAIL/ COMMERCIAL DEVELOPMENT
S.H. 130 AND S.H. 45
PFLUGERVILLE, TEXAS**

**Terracon Project No. 96065338-C
April 3, 2007**

Prepared for:

**NEW QUEST PROPERTIES
Houston, Texas**

Prepared by:

**TERRACON CONSULTANTS, INC.
Geotechnical Engineering Division
Austin, Texas**

April 3, 2007

New Quest Properties
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Houston, Texas 77040

Attention: Mr. Rene Paul Joubert

Re: Geotechnical Engineering Report
Proposed Retail/Commercial Development
Travis Town Center
S.H. 130 and S.H. 45
Pflugerville, Texas
Terracon Project No. 96065338-C

Terracon

Consulting Engineers & Scientists


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Dear Mr. Joubert:

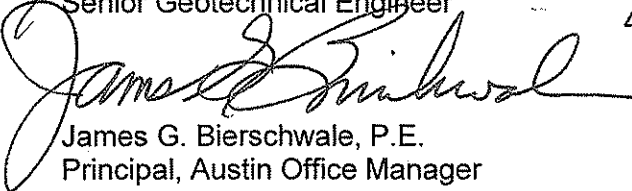
Enclosed is our geotechnical engineering report for the above referenced project. Separate reports have been issued to the client for the Home Depot and Super Target phases of the Travis Town Center retail development. We trust that this report is responsive to your project needs. Please contact us if you have any questions or if we can be of further assistance.

We appreciate the opportunity to work with you on this project and look forward to providing additional geotechnical engineering and construction materials testing services in the future.

Sincerely,
TERRACON CONSULTANTS, INC.


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4/3/07

Electronic Copies to: Addressee (4)
New Quest Properties; Mr. James Ngu

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GEOTECHNICAL ENGINEERING REPORT

TRAVIS TOWN CENTER RETAIL/ COMMERCIAL DEVELOPMENT S.H. 130 AND S.H. 45 PFLUGERVILLE, TEXAS

**Terracon Project No. 96065338-C
April 3, 2007**

INTRODUCTION

This report presents the results of our geotechnical engineering services for the proposed construction of the Travis Town Center retail development in Pflugerville, Texas. This project was authorized by Mr. Rene Joubert through signature of Terracon's "Agreement for Services" on December 21, 2006. The scope of work was in general accordance with Terracon Proposal No. 9605G2603, dated December 18, 2006.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions;
- groundwater conditions;
- foundation design and construction;
- lateral earth pressures;
- floor slab design and construction;
- pavement design and construction;
- earthwork; and
- drainage.

The recommendations contained in this report are based upon information provided by the client, the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures and our understanding of the proposed project.

PROJECT DESCRIPTION

The project consists of the construction of a retail shopping center located on the southwest corner of the intersection of SH 130 (FM 685) and SH 45 (Wilke Lane) in Pflugerville, Texas. The development when complete will include a Home Depot store, a Super Target Store, a 24 Hour Fitness facility and numerous retail, restaurant and commercial buildings and associated paving. This report only includes the proposed retail structures associated with development of Tract 3, Tract 11 and Tract 30, the associated paving, and the main access drives through the development. Based on the site plan provided by the client the development of these tracts will consist of the

construction of nine retail outlets in Tract 3, one building in Tract 11 and one building in Tract 30. We anticipate all of the structures are to be single story buildings constructed using tilt wall, steel frame or CMU block construction. At the time this report was prepared the anticipated structural loading for the planned buildings was not known. The site location, project layout and boring locations are located in Appendix A on Figures 1, 2 and 3, respectively. Geotechnical reports for the planned Home Depot and Super Target facilities were previously issued in separate reports dated March 13 (draft) and March 19, 2007, respectively.

It is anticipated both rigid concrete and flexible asphaltic concrete paving will be utilized for the project. Both light duty and heavy duty pavement sections will be evaluated. Light duty paving refers to parking lots used by customers and employees. Heavy duty paving refers to high traffic areas such as access drives and delivery areas used by panel trucks and tractor trailers. It is our understanding some of the main access drives through the project are to be designed and constructed in general accordance with the City of Pflugerville pavement design criteria.

SCOPE OF SERVICES

Our scope of services for this project consisted of:

1. Drilling test borings at selected and accessible locations within the project site to evaluate subsurface stratigraphy and groundwater conditions.
2. Performing geotechnical laboratory tests on recovered samples to evaluate the physical and engineering properties of the strata encountered.
3. Engineering analyses to develop design and construction recommendations with respect to:
 - Foundation design and construction;
 - Pavement design guidelines; and
 - Site, subgrade, and fill preparation.

SITE EXPLORATION PROCEDURES

The scope of the services performed for this project included site reconnaissance by a geotechnical field technician, a subsurface exploration program, laboratory testing and engineering analyses.

The field drilling program was delayed for approximately two weeks due to access issues caused by wet weather which rendered the site inaccessible to conventional truck-mounted drilling rigs. An all terrain vehicle mounted drill rig (ATV/Buggy Rig) was utilized at the site for approximate one week to continue the field exploration program while the site was inaccessible to standard truck mounted drill rigs. Drilling operations for the project were finished March 9, 2007.

Field Exploration

A total of 27 borings were completed for this study. The borings were located in the field using hand-held Global Positioning System (GPS) equipment. The hand-held GPS equipment generally has an accuracy of about 20 feet. The boring locations and depths are summarized below:

- Buildings 10 borings (B-59 and B-86 through B-94) to depths ranging from about 10 feet to 20 feet;

- Paving 3 borings (B-95 through B-97) to a depth of approximately 6 feet.
- Drives 14 borings (B-30, B-34 and B-98 through B-110) ranging in depths from about 3 feet to 7½ feet.

Truck-mounted and All-Terrain-Vehicle (ATV) mounted drilling equipment were used to advance the borings at the approximate boring locations shown on Figure 3. An ATV mounted drill rig was utilized when the site became inaccessible to standard truck mounted drill rigs because of wet weather conditions. However, drilling production with the ATV rig is considerably slower than that of a truck mounted rig. Boring depths were measured from the existing ground surface at the time of our field activities. The ground surface elevations at the boring locations were approximated from topographic contours on a site plan provided to Terracon by New Quest Properties.

Soil samples of the material encountered were generally recovered using thin-walled, open-tube samplers (Shelby-tubes) in general accordance with the appropriate ASTM standards. Pocket penetrometer tests were performed on samples of cohesive soils in the field to serve as a general measure of consistency.

Soils/rock for which good quality thin-walled tube samples could not be obtained were sampled by means of the Standard Penetration Test (SPT). This test consists of measuring the number of blows required for a 140-pound hammer free falling 30 inches to drive a standard split-spoon sampler 12 inches into the subsurface material after being seated 6 inches. This blow count or SPT "N" value is used to estimate the engineering properties of the stratum.

Once rock was encountered, shallow pavement borings were generally terminated and deeper building borings were typically advanced with Nx coring equipment. Visual classifications of all of the samples were performed in the field and percentages of Recovery and Rock Quality Designation (RQD) were calculated from recovered rock cores. (Recovery is defined as the percentage of core recovered as a function of the length of core run drilled. The RQD is a modified measurement of core recovery which indirectly takes into account fractures and/or softening in the rock mass by summing up only pieces of sound core which are four inches or greater in length as a percentage of the total core run.)

All soil and rock samples were removed from samplers in the field, visually classified, tagged for identification, sealed to reduce moisture loss, and taken to the laboratory for further examination, testing, and classification.

The Logs of Boring, which include the soil/rock descriptions, types of sampling used, and additional field data, for this study are presented on Figure 4 through Figure 48 of the Appendix. Criteria for the "Unified Soil Classification System" and "General Notes" defining terms, abbreviations and descriptions used on the boring logs are presented on Figure 49 through Figure 51.

Laboratory Testing

Samples obtained during the field program were visually classified in the laboratory by a geotechnical engineer. A testing program was conducted on selected samples, as directed by the geotechnical engineer, to aid in classification and evaluation of engineering properties required for analyses.

Results of the laboratory tests are presented on the Logs of Boring, located on Figures 3 through 16 of the Appendix, and/or are discussed in the following section. Laboratory test results were used to classify the soils encountered as generally outlined by the Unified Soil Classification System.

Sample Disposal

All samples were returned to our laboratory in Austin, Texas. Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

SITE AND SUBSURFACE CONDITIONS

Surface Conditions

Based on visual observations made during our site reconnaissance and field exploration program, and topographic information provided to us by the client the surface conditions observed at the site are as follows;

- The site is currently vacant land and appears to have been used for agricultural purposes in the past.
- The site generally slopes downward toward the south and east with approximately 15 feet of grade change over Tract 3, ten feet of grade change over Tract 11 and about 4 feet of grade change over Tract 12. Changes in elevations are based on the topographic map provided by the client.
- Ground cover across the majority of the site generally consists of grass and weeds approximately five to eight feet in height, with some small stands of trees situated along the fence lines and in the vicinity of the creek beds and the existing stock pond.

Area Geology

Based on our review of available geological information (¹ Bureau of Economic Geology, Austin 1981) and the results of our field program, the site lies within an area of the Austin Group of Upper Cretaceous Age. The Austin Group is generally comprised of tan to gray chalky limestone and marl. The Austin Chalk is commonly overlain by a variable thickness of moderate to high plasticity clayey soil.

Subsurface Conditions

The generalized subsurface stratigraphy at the site, as evaluated from our field exploration and laboratory testing programs, is tabulated below. We should note that stratification boundaries shown below and on the enclosed boring logs and cross-sectional profiles represent approximate locations of changes in soil/rock types; in-situ, the transition of materials may be gradual.

¹ "Geologic Atlas of Texas - Austin Sheet", Bureau of Economic Geology, The University of Texas at Austin, 1974.

Stratum	Range In Depth* (ft)	Soil/Rock Description And Classification
I	0 – 5	Medium stiff to hard dark brown to brown clay (CH), high expansive potential
II	1 – 6½	Very stiff to hard light tan to tan and light gray silty clay with limestone fragments (CL), low to moderate expansive potential (severely weathered limestone)
III	3 – 20	Light tan to gray weathered limestone (Austin Chalk Formation), low expansive potential

*Approximate depth below ground surface.

The Stratum I dark brown to brown clay soils typically exhibit a high potential for volumetric change during moisture variations, as indicated by measured plasticity indices of 31 to 49 percent. In-situ moisture contents ranged from about 2 to 16 percent wet of the corresponding plastic limits. Measured pocket penetrometer values of this stratum ranged from about 1.0 to 4 tons per square foot (tsf). Percentage of fines (percent passing No. 200 sieve) ranging from 78 to 91 percent was measured for these soils.

The Stratum II light tan to tan and gray silty clay soils generally exhibit a low to moderate shrink/swell potential, with measured plasticity indices of 4 to 23 percent. In-situ moisture contents varied from about 2 to 7 percent dry of the corresponding plastic limits. The percentage of fines varied from 43 to 82 percent. Measured pocket penetrometer values of this stratum generally ranged from about 1.5 tsf to greater than 4.5 tsf, and measured SPT "N" values ranged from 64 blows per foot of penetration to 50 blows for about two inches of penetration. The very high SPT "N" values are most likely indicative of limestone seams and gravel within these soils or the top of the limestone formation.

The Stratum III generally consists of light tan to tan and gray limestone of the Austin Group. The measured uniaxial compressive strength of intact rock cores varied from 83 kips per square foot (ksf) to 264 ksf. Measured values of Recovery and RQD ranged from 45 to 100 percent and zero to 96 percent, respectively.

Groundwater Conditions

The borings were dry augered to depths of about 3 to 6 feet below existing grade, and were drilled to completed depths using air rotary techniques to facilitate rock coring. Groundwater was observed in boring B-59 only, at a depth of about 7 feet below the existing ground surface.

The subsurface water level observed is most likely the result of seepage from perched water generally situated at the soil/limestone interface as observed in other borings completed within the Travis Town Center Development. We anticipate that groundwater at the site should typically be in the form of zones of seepage traveling within pervious seams of the on-site soils, in fissures/fractures in the limestone, and/or along the soil/limestone interface. Variations in the groundwater level at the site are possible due to seasonal and climatic variations. Our field program was performed during periodic wet weather in the Central Texas area.

As observed during the Travis Town Center field exploration, extended rainfall will likely result in areas or isolated spots of perched groundwater in the near-surface soils until the soils have had an opportunity to dry out sufficiently. This perched subsurface water will most likely result in seepage into excavations and cuts penetrating into the limestone during construction.

Please note that these groundwater measurements for the project are considered short-term, since the borings are open for a limited time period. On a long-term basis, the groundwater levels will vary and may be present at various depths across the site. Groundwater conditions should be evaluated prior to construction.

ENGINEERING RECOMMENDATIONS

The following recommendations are based upon the data obtained in our field and laboratory programs, project information provided to us, and our experience with similar subsurface and site conditions.

Geotechnical Considerations

Based on the information provided by the client, with the exception of the building located south of the planned Super Target on tract 11, rough grading and Finished Floor Elevations (FFE) for the proposed structures will require excavations ranging in depth between approximately 2½ to 14 feet below the existing grade. The building on tract 11 is to be constructed at the same FFE as the planned Super Target (elevation 745.6 feet) and will require approximately two feet of excavation on the northeast corner and approximately four feet of fill on the southwest corner of the proposed structure. In areas where fill will be required and/or the surficial expansive clay is left in place there will be a potential for movement (expansion and/or consolidation) of the natural clay and fill material, the magnitude of the movement will be a function of the thickness of the remaining clay, quality of the fill material, the compaction effort during placement, and the fill depth. This potential can be reduced provided the recommendations presented in this report are observed, however, it cannot be completely eliminated. The client should be aware that the geotechnical recommendations may need to be revised if the FFE's are changed significantly.

Highly expansive soils are observed on this site. Results of the Atterberg Limits tests indicate that the near-surface subgrade soils at this site generally exhibit a very high plasticity and will likely experience significant expansion and contraction due to changes in moisture content. Based upon the Texas Department of Transportation (TxDOT) Method TEX-124-E, we estimate that the project site exhibits a Potential Vertical Rise (PVR) as high as approximately 1¾ to 2½ inches, if present in a dry condition. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and cracking in the structures should be anticipated. The severity of cracking and other damage such as uneven floor slabs will probably increase if any modification of the site results in excessive wetting or drying of the expansive soils.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the floor slab. The corresponding decrease in the potential soil movement is primarily a function of fill pad thickness and the moisture levels of the clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. The level of subgrade preparation should be based on the performance desired

by the owner, taking into consideration the effects which foundation movements could have upon the structure.

Based on the field and laboratory data available, along with our previous experience, it is our opinion that either a shallow footing or straight-sided drilled pier foundation systems may be considered to support the planned tilt wall structures and larger retail buildings. Shallow footings or monolithic slab-on-grade foundations may be considered to support the smaller lighter structures provided the building subgrade is prepared as recommended in this report. Recommendations for these types of foundation systems are presented in the following subsections, along with other geotechnical engineering considerations for this project.

Spread Footing Foundation System

Principal column and wall loads for the proposed structures may be supported on spread footings. Due to the excavation requirements for the proposed FFE's we anticipated the surficial Stratum I clay and Stratum II silty clay will often be completely excavated from the planned building pad areas.

In the event any Stratum I material remains in the building pad areas, because of the expansive potential of the Stratum I dark brown to brown clay soils, we recommend those soils be completely removed from all building and spread footing areas such that spread footings do not bear on or over these soils. (The Stratum I soils were observed to be up to about 2 to 4 feet thick at our boring locations and up to 6 feet in other areas of the site, including the Target store area.) Spread footings should be placed to bear at least 24 inches below final grade in properly compacted select fill soils or on competent Stratum III limestone but not a combination of both. For a structure designed to bear on select fill, if shallow limestone is encountered, spread footing areas should be over-excavated such that at least 12 inches of properly compacted select fill is placed below the bottom of the footing; this excavation requirement is to reduce the potential for differential settlement between spread footings. A net allowable total load bearing pressure of 3,000 psf may be used for footings designed and constructed in properly placed and compacted select fill. For shallow footings bearing on competent Stratum III limestone a net allowable total load bearing pressure of 6,000 psf may be used for to evaluate footing design.

The ultimate uplift capacity of a spread footing is limited to the weight of the footing foundation plus the weight of any backfilled soils directly above the footing. A total unit weight of 125 pounds per cubic foot should be utilized for backfilled soils selected and placed as specified in the "Earthwork" subsection. A factor of safety of at least 1.5 should be applied to the above uplift forces when calculating uplift resistance.

Lateral loads transmitted to the footings should be resisted by a combination of soil-concrete friction on the base of the footing and passive pressure on the side of the footing. For footings bearing on properly compacted select fill or Stratum III limestone, a coefficient of sliding resistance of 0.4 may be used to compute lateral frictional resistance along the bottom surface of the footing, up to a maximum allowable frictional resistance of 500 psf. To resist lateral forces, a net allowable passive resistance of 1,000 psf may be utilized for portions of footings extending at least 18 inches below the adjacent ground surface. If the pavement is provided up to or above the edge of the footings or for footings constructed within the interior of the building, the allowable passive pressure may be used for the entire depth of the footing. If the footing is formed during construction, the open space between the footing and the in-situ soils should be backfilled with concrete. Also, care should be taken to avoid disturbance of the footing bearing area since loose material could increase settlement and decrease resistance to lateral loading.

Maximum post-construction total settlements of spread footings designed as outlined above should be about one inch, assuming proper construction practices. Maximum differential settlements between footings may approach one-half of the total settlement value (or about ½ inch). The settlement response of the footings will be more dependent upon the quality of construction than upon the soil-structure interaction.

Drilled Pier Foundation System

As an alternative to spread footings, principal column and wall loads for the proposed structures may be supported on drilled (straight-sided) piers embedded at least 3 feet into the Stratum III Austin Group limestone. The piers should be designed for a net allowable total load bearing pressure of 40,000 pounds per square foot (psf). In addition, a net allowable side friction value of 3,000 psf (for both compressive and tensile loading conditions) may be utilized for shaft portions embedded into the limestone beyond the three-foot minimum penetration.

Although pier shaft diameters will vary depending on the load criteria, we recommend a minimum shaft diameter of 18 inches based on our experience with local construction practices. We also recommend a minimum pier length of at least 5 feet for those piers consisting entirely of limestone (which may occur in areas where significant cuts are required) due to near-surface fracturing that may occur during site preparation. At locations where highly weathered/fractured rock or clayey/marly layers are observed, the piers should be extended through such secondary features to bear into more competent limestone. (For example, if a one-foot thick clay layer is observed within the rock for a pier with a design embedment of 5 feet, the embedment into limestone should be extended to 6 feet.) Due to the fact that many of the piers will extend deeper as discussed above, the contract documents should include unit rates for additional drilled pier footage at various pier diameters. The construction budget for this project should also include overages due to the likelihood of additional costs associated with the above.

Maximum post-construction total settlements of drilled piers designed as outlined above should be about ½ inch, assuming proper construction practices. Maximum differential settlements between piers may approach the total settlement values. The settlement response of the piers will be more dependent upon the quality of construction than upon the response of the limestone to the foundation loads.

Soil-related uplift does not appear to be a concern at this site provided building pads are prepared as recommended in this report. However, we do recommend that the minimum percentage of reinforcing steel be no less than 0.5 percent of the gross shaft area and extend over the full length of the pier.

For adjacent piers bearing in the Stratum III limestone, we recommend a minimum edge-to-edge spacing of at least 1 pier diameter (or 2 pier diameters center-to-center) based on the larger diameter of the two adjacent piers. In locations where this minimum spacing criterion cannot be accomplished, Terracon should be contacted to evaluate the locations on a case-by-case basis.

For resistance of lateral loads associated with applied shear and moment conditions on the piers, the following values of allowable lateral resistance may be utilized, based on penetration into the Stratum III Austin Group limestone.

Pier Penetration into Limestone, ft.	Allowable Lateral Resistance, psf
1 – 4	5,000
4 – 10	10,000
10+	20,000

We should note that analyzing lateral loads utilizing lateral bearing capacities only (and not considering pier bending or displacement) can be a somewhat simplified (and in some cases conservative) method of lateral load analysis. A number of methods are available for calculating the lateral behavior of rigid and semi-rigid drilled piers. A method whereby subgrade reaction/shaft response is modeled using data from instrumented load tests is generally considered to provide the best model of subgrade behavior under short-term lateral loading. Terracon has the experience and capability to perform such an analysis and would be pleased to do so for this project if desired.

Grade Beams and/or Tilt-Wall Panels

Grade beams and/or tilt-wall panels spanning between drilled piers or spread footings may be cast at grade provided the subgrade in the beam/panel areas is prepared as outlined in the "Floor Slab Design" subsection below. The beams/panels should be designed to span across the supporting foundations without subgrade support.

We recommend that on-site Stratum I dark brown to brown clay soils be utilized for backfill adjacent to tilt-wall panels or grade beams at the exterior of the buildings (to reduce potential infiltration of surface water into the subgrade in these areas). The clay backfill should be compacted to at least 95 percent of the ASTM D 698 dry density at a moisture content at or above optimum moisture.

Floor Slabs

As mentioned earlier, the near-surface clay soils at this site could induce significant movement upon grade-supported floor slabs due to their potential to undergo volumetric change during variations in in-situ moisture conditions. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of moisture contents after construction is complete. Based upon the Texas Department of Transportation (TxDOT) Method TEX-124-E, we estimate that the existing project site exhibits a Potential Vertical Rise (PVR) as high as approximately 1¾ to 2¾ inches, based on the existing stratigraphy, if present in a dry condition. Such soil conditions could induce significant movement upon floor slabs designed in conjunction with a drilled pier or spread footing foundation systems. Floor slabs associated with the drilled pier or spread footing foundations may be supported at grade, provided subgrade preparation is implemented to reduce the shrink/swell potential of the subgrade soils.

Due to the shrink/swell potential of the near-surface Stratum I dark brown clayey soils, we recommend that the Stratum I soils be completely excavated and removed from the proposed building areas. Following excavation of the expansive clays, properly compacted select fill material should be placed under the building areas to achieve the finished pad elevation. If the Stratum III limestone is encountered during excavation of the surficial soils, the select fill pad thickness may be reduced, however, the limestone should be over-excavated such that a minimum of 8 inches of select fill is placed under all areas of the floor slab. Material and compaction requirements for select fill soils are outlined in the "Earthwork" section of this report. The above subgrade preparation should result in an estimated post-construction PVR of about one inch or less.

Just prior to placement of select fill, the exposed soil subgrade should be scarified to a depth of 6 inches, moisture adjusted, and recompact to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density. Exposed Stratum II light tan to tan silty clay subgrade areas should be moisture conditioned to between -3 and +3 percent of optimum moisture content. Exposed soil subgrade areas should not be allowed to dry out or become saturated prior to the placement of select fill. Moisture conditioning is not required in exposed limestone subgrade areas.

Only soils meeting our select fill requirements should be utilized for fill applications within the building areas. We suggest the use of crushed limestone base in the upper six (6) to eight (8) inches of the fill pads from a standpoint of construction access during wet weather, as well as from a standpoint of slab support. This suggestion is primarily to provide a better working surface for construction workers, equipment and traffic in the construction area, especially during and after periods of wet weather, and is not intended to function as a capillary break or moisture barrier for the slabs.

The interior of the buildings should be constructed to be as tolerable to movement as possible. Although the indicated preparation options are anticipated to reduce cracking in the floor slab, differential movements at entryways may cause difficulty in opening and closing doors. If the floor slab is doweled into the perimeter grade beams to control movement, the resulting soil pressures may cause cracks to develop inside of the dowel bars, adjacent to the exterior walls. However, if the floor is not doweled at these locations, a "trip hazard" could result due to the resulting differential movements at entryways, and difficulty in opening and closing doors could develop.

We should also note that the potential movement values indicated are based upon moisture variations in the subgrade due to circumstances such as moisture increases due to rainfall and loss of evapotranspiration. In circumstances where significant water infiltration beneath the floor slab occurs (such as a leaking utility line or water seepage from outside the building resulting from poor drainage), movements in isolated floor slab areas could potentially be in excess of those indicated in this report.

Monolithic Slab-On-Grade Foundations

The proposed lighter buildings may be supported on monolithic slab-on-grade foundations, either conventionally reinforced or post-tensioned. Presented below are design parameters commonly used in the Central Texas area for a monolithic slab-on-grade foundation design for subsurface conditions such as those observed at the site based on the FFE and final grading information provided to Terracon for the site. Should FFE's provided for the report change significantly, Terracon should be notified to review and modify and/or verify our recommendations in writing. To reduce the post-construction PVR to about one inch or less at the planned building locations we recommend the following:

Estimated Potential Vertical Rise (PVR)	2¾ inches (about 1 inch)
Net Allowable Bearing Pressure:	
Total Load	2,500 psf
Dead Load	1,700 psf
Average Design Plasticity Index (PI)	30
Climatic Rating (C _w)	18
Unconfined Compressive Strength	1.0 tsf
Soil Support Index (C)	0.84

Edge Moisture Variation Distance, e_m (Center Lift)	5½ feet
Edge Moisture Variation Distance, e_m (Edge Lift)	3 feet
Differential Soil Movement, y_m (Center Lift)	2¼ inches (1 inch)
Differential Soil Movement, y_m (Edge Lift)	¾ inch (½ inch)
Slab-Subgrade Coefficient of Friction, μ	0.75

* The values given above in parentheses may be utilized provided the subgrade preparation for foundation construction is performed as discussed in the following paragraphs.

All comments related to excavation of on-site clay and to material and placement specifications for select fill and the preparation of the underlying subgrade previously outlined in the "Floor Slabs" subsection of this report should remain applicable for Monolithic Slab-on-Grade Foundation system subgrade preparation.

The parameters indicated for the above design conditions are based on criteria published by the Post Tensioning Institute (PTI, 2nd Edition) and the Building Research Advisory Board (BRAB), combined with our previous experience with similar subsurface conditions in the vicinity of the site. The PTI and BRAB methods are essentially empirical design techniques and the parameters provided are based on our interpretation of the project soil borings and criteria published in the respective design manuals. The edge moisture variation distances (e_m) are based on the Thornthwaite Moisture Index (I_m) chart provided in the PTI design manual and physical properties of the subgrade soils. Selection of these parameters, as well as differential soil movements (y_m), can result in a range of values in the Central Texas area and is often performed using computerized programs. Final design values for post-tensioned slabs should be reviewed and selected by the foundation design engineer. We should note that moisture variations in the subgrade soils due to poor drainage, leakage of utilities, etc. could induce volumetric changes resulting in movements which are in excess of those estimated by the PVR and PTI procedures.

We recommend that grade beams extend at least 18 inches below final grade. This recommendation is to reduce surface water migration below the foundation elements and to develop proper end bearing and is not based on structural considerations. The grade beam width and depth should be properly evaluated by the structural engineer. Grade beams may be thickened and widened at column locations to serve as spread footings at concentrated load areas.

Maximum post-construction settlements for the monolithic slab-on-grade foundation described in this subsection should be approximately one inch or less, assuming proper construction and site preparation. The settlement response of the monolithic slab-on-grade foundation will be influenced more by the quality of construction and select fill placement than soil-structure interaction.

The potential movement values indicated are based upon moisture variations in the subgrade due to circumstances such as moisture increases due to rainfall and loss of evapotranspiration. In circumstances where significant water infiltration beneath the floor slab occurs (such as leaking utility line or water seepage from outside the building resulting from poor drainage), movements in isolated floor slab areas could potentially be in excess of those indicated in this report.

Exposed ground should be sloped at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. After building construction and landscaping, 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 Areas

For any flatwork areas outside of the main structures (sidewalks, ramps, loading docks, etc.) which are considered to be movement-sensitive by the design team or are expected by the owner to perform the same as the main structure, subgrade preparation methods as discussed above should be implemented. This will be particularly important on surrounding flatwork (e.g., sidewalks, ramps, paving, etc.) immediately adjacent to the structures. If these adjacent flatwork areas are not prepared as stated above for the building areas, the estimated PVR for these areas should approach those indicated above for in-situ conditions. If the soils swell in these areas, this could result in significant movement and/or distress to the adjacent sidewalks and paving and possibly result in reversed drainage (flow of runoff towards the buildings) around the perimeter of the buildings and/or trip hazards at doorways or other entrances. We recommend the limits and extent of subgrade preparation be clearly noted on the plans to promote more accurate cost estimates during the bidding process. In our past experience, subgrade preparation under exterior flatwork areas is often neglected on plans and during bidding, which can then result in change orders later during construction.

Foundation Construction

Spread Footings and Monolithic Slab-on-Grade Foundations

The footings and grade beams for shallow foundations should be neat excavated, if possible. If neat excavation is not possible, the foundations should be properly formed. If a toothed bucket is used, excavation with this bucket should be stopped approximately 6 inches above final grade and the foundation excavation completed with a smooth-mouthed bucket or by hand labor. In limestone subgrade areas, excavation with rock-trenching equipment or similar equipment capable of excavating limestone may be necessary. Debris in the bottom of the excavation should be removed prior to steel placement. The foundation excavation should be sloped sufficiently to create internal sumps for runoff collection and removal. If surface runoff water or groundwater seepage accumulates at the bottom of the foundation excavation, it should be collected, removed, and not allowed to adversely affect the quality of the bearing surface.

If utilized, the post-tensioned slab-on-grade construction technique should be carefully monitored by qualified personnel. The sophistication of this construction procedure requires careful attention to details such as concrete integrity and anchorages, along with tendon spacing, support, covering, and stressing. Poor construction could result in a non-functional slab foundation system.

Drilled Pier Foundations

Drilled pier foundations should be augered and constructed in a continuous manner. Concrete should be placed in the pier excavations following drilling and evaluation for proper bearing stratum, embedment, and cleanliness. The piers should not be allowed to remain open overnight before concrete placement. Surface runoff or groundwater seepage accumulating in the excavation should be pumped out and the condition of the bearing surface should be evaluated immediately prior to placing concrete. The drilling equipment should be capable of readily penetrating the Stratum III Austin Group limestone observed at the site.

As observed in our field program, zones of groundwater inflow and/or sloughing soils are a possibility during pier construction. Thus, we recommend that provisions be incorporated into the plans and specifications to utilize casing to control sloughing and/or groundwater seepage during pier construction should it occur. A unit rate (cost per foot) for casing should be provided as a

separate line item in the construction budget. If casing is utilized, removal of the casing should be performed with extreme care and under proper supervision to minimize mixing of the surrounding soil and water with the fresh concrete. Concrete should be poured with a tremie and should exhibit a six inch slump with a \pm one inch tolerance. Under no circumstances should loose soil be placed in the space between the casing and the pier sidewalls.

If groundwater seepage occurs, the use of casing should help to minimize groundwater inflow into the pier excavation. If seepage persists even after casing installation, the water should be pumped out of the excavation immediately prior to placing concrete. If groundwater inflow is too severe to be controlled by pumping, the concrete should be tremied to the full depth of the excavation to effectively displace the water. In this case, a "clean-out" bucket should be utilized to remove loose soil and/or rock fragments from the pier bottom before placing steel and concrete.

Foundation Construction Monitoring

The performance of the foundation system for the proposed structure will be highly dependent upon the quality of construction. Thus, we recommend that the foundation installation be monitored by Terracon to identify the proper bearing strata and depths and to help evaluate foundation construction. We would be pleased to develop a plan for foundation monitoring to be incorporated in the overall quality control program.

Lateral Earth Pressures

Presented below are at-rest, active, and passive earth pressure coefficients for various backfill types adjacent to below-grade walls, such as in truck dock areas, or conventional site retaining walls. At-rest earth pressures are recommended in cases where little wall yield is expected (such as structural below-grade walls). Active earth pressures may be utilized in cases where the walls can exhibit a certain degree of horizontal movement (such as cantilevered retaining walls).

Backfill Type	Estimated Total Unit Weight (pcf)	Lateral Earth Pressure Coefficients		
		At Rest (K _o)	Active (K _a)	Passive (K _p)*
Crushed Limestone	140	0.45	0.3	3.5
Clean Sand	120	0.5	0.35	3.0
Clean Gravel	120	0.45	0.3	3.0
On-site Stratum II/III Crushed/Processed Soil/Rock **	130	0.5	0.35	3.0

* Passive coefficients represent ultimate values. Appropriate safety factors should be applied.

** Contingent upon preparation of the on-site Stratum II soils and/or Stratum III limestone as recommended in the "Earthwork" subsection.

The above values do not include a hydrostatic or ground-level surcharge component. The effect of surcharge loads, where applicable, should be incorporated into wall pressure diagrams by adding a pressure component equal to the applicable lateral earth pressure coefficient times the surcharge load to the full height of the wall. We do not recommend the use of on-site Stratum I clay material as backfill behind below-grade or retaining wall structures.

The compactive effort should be controlled during backfill operations. Overcompaction can produce lateral earth pressures in excess of at-rest magnitudes. Compaction levels adjacent to below-grade walls should be maintained between 95 and 100 percent of Standard Proctor (ASTM D 698) maximum dry density.

For retaining walls or below-grade wall footings bearing on undisturbed natural clay subgrade or properly compacted select fill, a coefficient of sliding resistance of 0.4 (maximum allowable sliding resistance of 500 psf) and a maximum footing bearing capacity of 2,500 psf should be considered. For wall footings bearing on intact, competent Stratum III limestone subgrade, an allowable coefficient of sliding resistance of 0.7 (maximum of 1,500 psf) and a maximum bearing footing capacity of 4,000 psf should be considered. All retaining walls should be checked against failure due to overturning, sliding, and overall slope stability. Such an analysis can only be performed once the dimensions of the wall are known. In addition, the expansive potential of the Stratum I dark brown to brown clayey soils should be considered in the design of retaining wall footings bearing upon these soils.

A wall drain is recommended for collection and removal of surface water percolation along the base of the walls. Proper control of surface water percolation will help to prevent buildup of higher wall pressures. In unpaved areas, the final 12 inches of backfill should preferably consist of cohesive soil to help to reduce percolation of surface water into the backfill.

A drain system should be provided along the base of the retaining walls or below-grade walls, if constructed. The drains should extend the full depth of the walls, with the exception of the surficial 18 inches which should consist of clay cap if not sealed by an impermeable surface such as asphalt or concrete, and extend to a minimum depth of 18 inches below the floor slab elevation. The entire wall drain system should be designed to gravity flow toward common out fall areas or sumps for collection and removal of water. Perforated collector pipes with a minimum diameter of 4 inches should be provided for all sections of the wall drains. The pipes should be continuously wrapped in filter fabric (Mirafi 140 N or equivalent). Measures (such as waterproofing membranes, moisture barriers, etc.) should be taken to minimize the possibility of moisture infiltration through the retaining walls and below grade walls, into confined areas, and into other areas which may be sensitive to high humidity environments.

Pavement Design

Paving areas are to consist of general paving made up of delivery and loading areas, parking areas and access drives for customers and employees, and main entrance and access drives. It is our understanding main entrance and access drives in the development are to be designed in accordance with the City of Pflugerville pavement design criteria. Design criteria and pavement section recommendations for general paving areas and main access drives are presented in the following sections

General Pavement Areas

Both flexible and rigid pavement systems may be considered for this project. Detailed traffic loads and frequencies were not available. However, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with occasional delivery trucks in minor driveways and panel trucks, tractor trailers and garbage trucks in delivery drives and loading areas. Tabulated below are the assumed traffic frequencies and loads used to design pavement sections for this project.

Pavement Type	Traffic Design Index	Description
Parking Areas (Light Duty):	DI-1	Light traffic – Few vehicles heavier than passenger cars, panel, and pick-up trucks; no regular use by heavily loaded two-axle trucks or lightly loaded larger vehicles. (EAL* < 5)
Minor Driveways (Medium Duty):	DI-2	Medium to light traffic – Similar to DI-1, including not over 50 heavily loaded two-axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles. (EAL = 6 – 20)
Entrance Drives, Delivery Drives, Loading Areas:	DI-3	Medium traffic – Including not over 300 heavily loaded two-axle trucks plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day. (EAL = 21 – 75)

* Equivalent daily 18-kip single axle load applications.

Listed below are pavement component thicknesses which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. Pavement sections provided have been evaluated assuming that the pavement subgrade consists of either the Stratum I and Stratum II clayey soils or the Stratum III limestone. The pavement design sections assume the clay subgrade is prepared as outlined in the “Moisture Conditioned Subgrade” portion of the “Pavement Material Requirements” section of this report. We should note that the pavement systems given below were derived based on general characterization of the subgrade. No specific testing (such as CBR, resilient modulus, etc.) was performed for this project to evaluate the support characteristics of the subgrade. Based on our experience with similar subgrade conditions, available laboratory test results, and CBR testing completed in the Target paving area a CBR of 3.0 was to evaluate pavement design cross-sections.

As an option, lime treatment of the near-surface clay subgrade soils should be considered for the flexible pavement systems, for it will help to enhance the support characteristics of the subgrade as well as to provide a barrier to reduce moisture infiltration into the underlying clay subgrade. The lime treatment also helps to reduce the shrink/swell potential of the lime-treated layer. Sulfate testing completed on surficial clay materials on the project site indicate soluble sulfate levels to be low, requiring no special application criteria. However, we recommend after rough grading has been completed and prior to lime treatment, the exposed clay subgrade should be checked for sulfate content. (Excessive sulfate in clay soils can result in poor performance of lime-treated subgrade.)

FLEXIBLE PAVEMENT SYSTEM

Component	Material Thickness, Inches		
	DI-1	DI-2	DI-3
Asphaltic Concrete (Type D HMAC)	1.5	2	3
Crushed Limestone Base*	9 (7)	10 (7)	10 (8)
Moisture Conditioned Subgrade	6	6	6

- * The crushed limestone base thickness may be reduced by 2 inches if the clay subgrade is lime-treated to a depth of 8 inches in-place of moisture conditioning.
- ** The values in parenthesis may be utilized if exposed subgrade consist of limestone.

RIGID PAVEMENT SYSTEM

Component	Material Thickness, Inches		
	DI-1	DI-2	DI-3
Reinforced Concrete*	5.0	6 (5)	7 (6)
Moisture Conditioned Subgrade**	6.0	6	6

- * The concrete thickness may be reduced by ½ inch if the clay subgrade is lime-treated to a depth of 8 inches in-place of moisture conditioning, but under no circumstances should be less than 5 inches thick.
- ** The values in parenthesis may be utilized if exposed subgrade consist of limestone. A thin course of crushed limestone base or clean sand at least 1 to 2 inches thick is recommended under the reinforced concrete in exposed limestone subgrade areas

- Reinforcing Steel: #3 bars spaced at 18 inches on centers in both directions.
- Control Joint Spacing: In accordance with ACI 330R, control joints should be spaced no greater than 12.5 feet for 5-inch thick concrete and no greater than 15 feet for concrete greater than or equal to 6 inches thick. If sawcut, control joints should be cut within 6 to 12 hours of concrete placement. Sawcut joint depths should be at least ¼ of the slab thickness.
- Expansion Joint Spacing: Maximum of 125 feet.
- Dowels at Expansion Joints: ¾ inch smooth bars, 18 inches in length, with one end treated to slip, spaced at 12 inches on centers at each joint.

Main Entrance and Access Drives

We understand that the proposed main access drives in the development are to be designed in accordance with the City of Pflugerville pavement design criteria. Based on information provided by the client and the City of Pflugerville the planned access drives are to be classified as "Minor Collectors", with 60-foot Right-of-Ways (ROW) and 40-foot pavement widths. We anticipate that traffic will consist primarily of passenger vehicles combined with some panel truck, delivery trucks and tractor trailers. Both flexible and rigid pavement systems may be considered for this project.

As required by the City of Pflugerville, the pavement design calculations were performed utilizing the guidelines in the 1993 AASHTO Guide for Design of Pavement Structures using the structural number system. Design parameters were provided by the City of Pflugerville and approximated based on our previous experience with similar projects in the area. The design parameters that were utilized for the roadway design are tabulated below. If any of the parameters (or any other input parameters not discussed in this section) are known to be inaccurate, Terracon should be contacted so that we may reevaluate the pavement sections.

Roadway Classification	Minor Collector
Initial Average Daily Traffic (vehicles/day)	5,000
Percent Trucks in Average Daily Traffic.	8.6
Total Equivalent 18-kip Single Axle Load Applications (ESAL)	1,240,000

Listed below are pavement component thicknesses which may be used as a guide for pavement systems at the site for the traffic classification and design parameters stated herein. Pavement sections provided have been evaluated assuming the pavement subgrade consists of either the Stratum I and Stratum II clayey soils or the Stratum III limestone. The pavement design sections assume the clay subgrade is prepared as outlined in the "Moisture Conditioned Subgrade" portion of the "Pavement Material Requirements" section of this report. We should note that the pavement systems given below were derived based on general characterization of the subgrade. No specific testing (such as CBR, resilient modulus, etc.) was performed for this project to evaluate the support characteristics of the subgrade. Based on our experience with similar subgrade conditions, available laboratory test results, and CBR testing completed in the Target paving area a CBR of 3 was to evaluate pavement design cross-sections.

It is our understanding the City of Pflugerville requires lime treatment of the near-surface clay subgrade soils for all pavement systems unless excess levels of soluble sulfates are present. Excessive sulfate in clay soils can result in poor performance of lime-treated subgrade. Lime treatment of the clay will help to enhance the support characteristics of the subgrade as well as to provide a barrier to reduce moisture infiltration into the underlying clay subgrade. The lime treatment also helps to reduce the shrink/swell potential of the lime-treated layer. Sulfate testing completed on surficial clay materials on the project site indicate soluble sulfate levels to be low, requiring no special application criteria. However, we recommend after rough grading has been completed and prior to lime treatment, the exposed clay subgrade should be checked for sulfate content. Lime treatment of the subgrade is not required in areas with where the exposed subgrade consists of limestone.

FLEXIBLE PAVEMENT SYSTEM

Component		Material Thickness, Inches
		Minor Collector
Asphaltic Concrete	Type D HMAc	1½
	Type C HMAc	2
Crushed Limestone Base*		13 (10)
Lime Treated Subgrade**		8

* The values in parenthesis may be utilized if exposed subgrade consist of limestone.

** Lime treatment is not required in areas with where the exposed subgrade consists of limestone

RIGID PAVEMENT SYSTEM

Component		Material Thickness, Inches
		Minor Collector
Reinforced Concrete		7½ (7)*
Lime Treated Subgrade**		8

* The value in parenthesis may be utilized if exposed subgrade consist of limestone. A thin course of crushed limestone base or clean sand at least 1 to 2 inches thick is recommended under the reinforced concrete in exposed limestone subgrade areas.

** Lime treatment is not required in areas with where the exposed subgrade consists of limestone

- Reinforcing Steel: #3 bars spaced at 18 inches on centers in both directions.
- Control Joint Spacing: In accordance with ACI 330R, control joints should be spaced no greater than 12.5 feet for 5-inch thick concrete and no greater than 15 feet for concrete equal to or greater than 6 inches thick. If sawcut, control joints should be cut within 6 to 12 hours of concrete placement. Sawcut joint depths should be at least ¼ of the slab thickness.
- Expansion Joint Spacing: Maximum of 125 feet.
- Dowels at Expansion Joints: ¾ inch smooth bars, 18 inches in length, with one end treated to slip, spaced at 12 inches on centers at each joint.

Pavement Material Requirements

Presented below are our recommended material requirements for the various pavement sections.

Hot Mix Asphaltic Concrete (HMAc) Surface Course – The asphaltic concrete surface course should be plant mixed, hot laid Type D (Fine-Graded Surface Course) meeting the master specifications requirements in TxDOT Item 340. The mix should be designed for a stability of at least 35 and should be compacted to

between 91 and 96 percent of the maximum theoretical density as measured by ASTM D 2041.

Reinforced Concrete – Concrete should be designed to exhibit a flexural strength (third-point loading) of at least 500 psi at 28 days. As an option, a 28-day compressive strength of 3,500 psi may be utilized.

Crushed Limestone Base – Base material should be composed of crushed limestone meeting the requirements of TxDOT Item 247, Type A, Grade 1. The base should be compacted to a minimum of 95 percent of the maximum dry density as determined by the modified moisture/density relation (ASTM D 1557) at -3 to +3 percent of optimum moisture content. (As an option, compaction to at least 100 percent of the TEX-113-E maximum dry density may be considered.)

Lime-Treated Subgrade – If the lime treatment option is performed, the subgrade should be treated with lime meeting the requirements of TxDOT 2004 Standard Specifications Item 264. Lime treatment may be accomplished by either the dry placement or slurry placement process.

We anticipate that approximately 5 to 8 percent hydrated lime will be required to treat the subgrade soils. Prior to the application of lime to the subgrade, the optimum percentage of lime to be added should be determined based on Plasticity Index (TEX-112-E) and/or pH (ASTM D 6276) laboratory tests conducted on mixtures of the subgrade soils with lime. Subgrade soil samples should be obtained from the pavement area at the proposed final subgrade elevation.

The lime should initially be blended with a mixing device such as a Pulvermixer, sufficient water added, and allowed to cure for at least 48 hours. After curing, mixing should continue until the gradation requirements of TxDOT 2004 Standard Specifications Item 260.4 are met. The mixture should then be moisture adjusted and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698.

Moisture Conditioned Subgrade – Exposed soil subgrade areas should be scarified to a depth of 6 inches, moisture conditioned, and recompact to at least 95 percent of the maximum dry density as determined by ASTM D 698. Clay soils should be moisture conditioned to between optimum and +4 percent of optimum moisture content. Care should be taken such that the subgrade does not dry out or become saturated prior to pavement construction. Moisture conditioning is not required in exposed limestone subgrade areas.

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade such as the Stratum I clayey soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is, therefore, important to minimize moisture changes in the subgrade to reduce shrink/swell movements.

Proper perimeter drainage should be provided so that infiltration of surface water from unpaved areas surrounding the pavement is minimized, or if this is not possible, curbs should extend through the base and into the subgrade. We should note that post-construction subgrade movements and some cracking of asphaltic pavements is common for clayey subgrade conditions such as those observed at this site.

Waste dumpster areas should be constructed of reinforced concrete. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted. Dumpster areas that are not designed in this manner often experience localized failures due to large wheel loading imposed during waste collection.

On most projects, rough site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas; dry weather may desiccate some areas; rainfall and surface water saturates some areas; heavy traffic from concrete and other delivery vehicles disturbs the subgrade; and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrade should be carefully evaluated as the time for pavement construction approaches. This is particularly important in and around utility trench cuts. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving.

Excavation

Excavation operations should be expected to penetrate into Austin Group limestone. Zones of limestone with significant compressive strength should be expected near the ground surface at the site, which could require sawcutting, jackhammering, milling, hoe-ramming, or similar techniques to excavate.

Our comments on excavation are based on our experience with the rock formation and examination of the core samples. Rock excavation depends on not only the rock hardness, weathering and fracture frequency, but also the contractor's equipment, capabilities, and experience. Therefore, it should be the contractor's responsibility to determine the most effective methods for excavation. The above comments are intended for informational purposes for the design team only and may be used to review the contractor's proposed excavation methods.

Sulfate Evaluation

Composite samples of the near surface Stratum I and Stratum II material were also tested for water soluble sulfates. The sample locations and results are tabulated below.

Sample No.	Boring No. & Sample Depth	Soil Type	Total Sulfates (ppm)
S-1	B-30 (0 to 2 feet) B-34 (0 to 2 feet) B-109 (0 to 2 feet)	Dark Brown to Brown Clay	210
S-2	B-30 (2 to 3 feet) B-34 (2 to 4 feet) B-109 (4 to 6 feet)	Tan to Light Tan Silty Clay	107

S-3	B-96 (0 to 2 feet) B-105 (0 to 2 feet) B-107 (0 to 2 feet)	Dark Brown to Brown Clay	180
S-4	B-96 (4 to 6 feet) B-105 (2 to 4 feet) B-107 (2 to 3 feet)	Tan to Light Tan Silty Clay	44
S-5	B-99 (0 to 1 feet) B-101 (2 to 4 feet)	Dark Brown to Brown Clay	156
S-6	B-99 (2 to 3½ feet) B-101 (4 to 6 feet)	Tan to Light Tan Silty Clay	40

Evaluation of the test results is based on Table 4.3.1, ACI 318, 2004 given below.

Sulfate Exposure	Water Soluble Sulfates (SO ₄) in soil (percent by weight)	Sulfate (SO ₄) in water (ppm)	Cement Type
Negligible	0.00 ≤ SO ₄ < 0.10	0 ≤ SO ₄ < 150	-
Moderate	0.10 ≤ SO ₄ < 0.20	150 ≤ SO ₄ < 1500	II, IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)
Severe	0.20 ≤ SO ₄ < 2.00	1500 ≤ SO ₄ < 10,000	V
Very Severe	SO ₄ > 2.00	SO ₄ > 10,000	V plus pozzolan

The test results indicate that soluble sulfate levels at the site are negligible and deterioration of concrete caused by sulfates attack does not appear to be an issue. Therefore, Cement Type C150 Type I or equivalent may be used. In Central Texas, Type I and II Cements are most commonly used.

Earthwork

Construction areas should be stripped of all vegetation, topsoil, etc. Site stripping could frequently loosen limestone rocks and boulders, which should be excavated and removed from the construction area. Roots of large bushes and trees to be removed within construction areas should be grubbed to full depths, including the dry soils surrounding the roots. Once final subgrade elevations have been achieved, the exposed subgrade, if soil, should be proofrolled with at least a 15-ton roller or equivalent equipment to detect weak areas. Weak areas detected during proofrolling, as well as zones of fill containing debris or organics and voids resulting from removal of tree roots, boulders, etc., should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Exposed limestone subgrade areas should be cleaned sufficiently and any voids filled with crushed limestone base material. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access. Please note that additional subgrade preparation specific to building foundations, pavements, etc. are located in the sections of this report which address these topics.

Fill Compaction Requirements

All fill material should be placed in uniform compacted lifts not exceeding 6 inches in thickness (maximum loose lift thickness of about 8 inches), unless noted otherwise in this report. Fill should be compacted to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density at a moisture content ranging between -3 and +3 percent of optimum moisture content, unless stated otherwise.

Imported Select Fill

Imported select fill material to be utilized within the building limits should consist of crushed limestone base material meeting the requirements of the Texas Department of Transportation (TxDOT) 2004 Standard Specifications Item 247, Type A, Grade 3 or a low-plasticity clayey soil with a plasticity index between 7 and 20 percent, a maximum gravel percentage (percent retained on the No. 4 sieve) of 40 percent, and rocks no larger than 3 to 4 inches in their largest dimension. As an alternative, low-plasticity granular fill material which does not meet these specifications may be utilized only if approved by Terracon.

Use of On-Site Processed Soils/Limestone as Select Fill within Building Area

Excavated Stratum II silty clay and/or Stratum III limestone from cut areas of the site may be considered for use as select fill in the building area provided that it is processed such that a relatively well-graded grain size distribution with a maximum rock size of 4 inches is achieved. In addition, the plasticity index of the minus No. 40 sieve fraction should generally be 20 percent or less. Please note that segregation of higher plasticity surficial Stratum I soils, as well as clayey/marly zones within the limestone, will be necessary to keep the plasticity indices within tolerable limits. In some situations, the difference between more highly plastic clay and lower plasticity silty clay soils, as well as the presence of the clayey/marly zones within the limestone, may not be readily distinguishable without the performance of appropriate laboratory testing. If the surficial Stratum I soils and highly plastic clayey/marly zones are not removed, the material may be unsuitable for use as select fill. (It may be beneficial to the contractor for budgeting/planning purposes to initiate a test pit program within proposed borrow areas prior to construction to further investigate the possibility for reusing the on-site limestone. If desired, Terracon would be pleased to coordinate such a program with the earthwork contractor.) After initial processing of on-site material, samples should be submitted to Terracon for approval of proper gradation, plasticity index, and maximum rock size prior to use as select fill.

Maximum loose lift thickness should be 8 inches (corresponding to a lift thickness of about twice the maximum rock size). It should be noted that with larger rock sizes, in-place density testing is often not practical and full-time monitoring of fill placement and particle distribution in the fill body, together with proofrolling of each lift, may be required. Evaluation of fill containing larger rock sizes can often be difficult even with full-time monitoring and the possibility of settlement of the fill body (which could impact structural performance) can increase. Under no circumstances should rocks larger than 3 inches be allowed in the uppermost 3 feet of building pad fill. In addition, we should note that the use of rock fill containing rock sizes in excess of 3 inches in their largest dimension in areas where grade beams are planned could increase the difficulty of trenching and excavation. In areas where grade beams are planned, we highly recommend that the maximum rock size be limited to no greater than 3 inches for the full depth of the beams into the fill pad to reduce the potential for construction difficulties during excavation.

It has been our experience that proper processing of excavated limestone often involves such processes as breaking down of larger rock with equipment, screening, removal of clay layers, etc.

The Contractor's proposed methods of processing these materials should be reviewed prior to initiation of construction to check that these methods will produce an acceptable select fill material with a proper grain size distribution.

Use of On-Site Material for Fill in Pavement, Landscape, or General Areas

Excavated on-site soils, if free of organics and debris, may be considered for use as fill in pavement, landscape, or general areas. Stratum I dark brown to brown clay soils should be compacted to the density indicated in the "Fill Compaction Requirements" subsection at a moisture content between optimum and +4 percent of optimum moisture. Stratum II tan to reddish tan silty clay soils should be compacted to the density indicated in the "Fill Compaction Requirements" subsection at a moisture content between -3 and +3 percent of optimum moisture.

Excavated Stratum III limestone from the site may also be considered for fill in these areas provided the criteria stated below are satisfied. We should note that the use of rock fill in areas where underground utilities areas are planned also will likely result in construction difficulties during trenching and excavation of the utility alignments. If utilities are to be placed in areas that are planned to receive rock fill, we recommend that the maximum rock size be limited to no greater than 3 inches for the full depth of the rock fill in these areas to reduce the potential for construction difficulties during utility trench excavation.

- The maximum lift height recommended is 1.5 feet, which will be controlled by the maximum boulder size. A maximum nominal rock size of 9 inches should be maintained.
- The largest nominal rock size of any given lift shall not exceed one-half of the lift height.
- The upper 12 inches of the fill placement shall be composed of lifts no more than 6 inches in compacted thickness (8-inch loose lift thickness) and contain no rocks larger than 3 inches in their largest dimensions.
- The rock fill shall be of sufficient size distribution such that no voids are present between larger rock sizes during placement.
- Such a rock fill placement operation should be continuously monitored by Terracon personnel to check that the fill operation is in accordance with the recommendations stated herein. (In-place density testing for such a fill operation is often not practical.)

Wet Weather Considerations

Construction following wet weather periods may encounter difficulties due to the wet or soft surface soils becoming a general hindrance to equipment. If the subgrade cannot be adequately compacted to minimum densities as described previously, one of the following measures should be considered: 1) removal and replacement with select fill, 2) treatment of the soil with lime or cement to dry and improve the stability of the subgrade, or 3) drying by natural means if the schedule allows. In our experience with similar soils in this area, it is our opinion that lime or cement treatment is the most efficient and effective method to increase the supporting value of wet and weak subgrade. Terracon should be contacted for additional recommendations if such treatment of the soils is needed.

Utilities

Care should be taken that utility trenches are not left open for extended periods, and they are properly backfilled. The compaction effort and type of fill placed above the utility line bedding will depend on whether the surface above the line is within the general fill areas or building or pavement areas.

Prior to any filling operations, samples of the proposed borrow 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 check that proper levels of compaction are being attained.

Building Pad Area

Utility trenches in the building pad area should be backfilled with select fill soils. The select fill soils should be compacted as discussed in the "Earthwork" section of this report. Cement stabilized sand or flowable fill may be considered as a suitable alternative to select fill where compaction of select fill would not be efficient because of the size or location of an excavation.

Pavement Areas

Within the pavement areas, the backfill should consist of properly compact backfill material within 12 inches of the final subgrade elevation. On-site soils may be used to achieve final subgrade elevation below the upper 12 inches. The on-site soils should be compacted to 95 percent of Standard Proctor (ASTM D 698) maximum dry density.

General or Landscape Fill Areas

On-site soils may be used to backfill utility trenches in general fill areas. The on-site soils should be compacted to a minimum of 90 percent of Standard Proctor (ASTM D 698) maximum dry density.

Drainage

The performance of the selected foundation systems for the proposed structures will not only be dependent upon the quality of construction, but also upon the stability of the moisture content of the near surface soils. Therefore, we highly recommend that the site drainage be developed so that ponding of surface runoff near the structure does not occur. Accumulation of water near the structure may cause significant moisture variations in the subgrade adjacent the structure, thus increasing the potential for structural distress. In addition, the owner and/or builder should be made aware that placing large bushes and trees adjacent to the structure may cause significant moisture variations in the soils underlying the structure. Where paving or flatwork abuts the structure, care should be taken that the joint is properly sealed and maintained. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that the subgrade should be sloped to provide positive drainage away from the building.

It is recommended that the building perimeter be sealed against moisture penetration. Landscaped irrigation adjacent to the foundation system should be minimized or eliminated. Watering of vegetation in parking lot islands and adjacent to drives and parking areas should be performed in a timely and controlled manner and prolonged watering should be avoided. Roof drains should discharge on pavement or be extended away from the structure. Ideally, roof drains should discharge to storm sewers by closed pipe. Special care should be taken to insure that underground utilities do not develop leaks with time.

The upper portion of utility excavations should be backfilled with properly compacted clayey soils to minimize infiltration of surface water. A clay "plug" should be provided on the exterior of the building to prevent water from gaining access to the subgrade beneath the structure.

GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation installation, and other construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

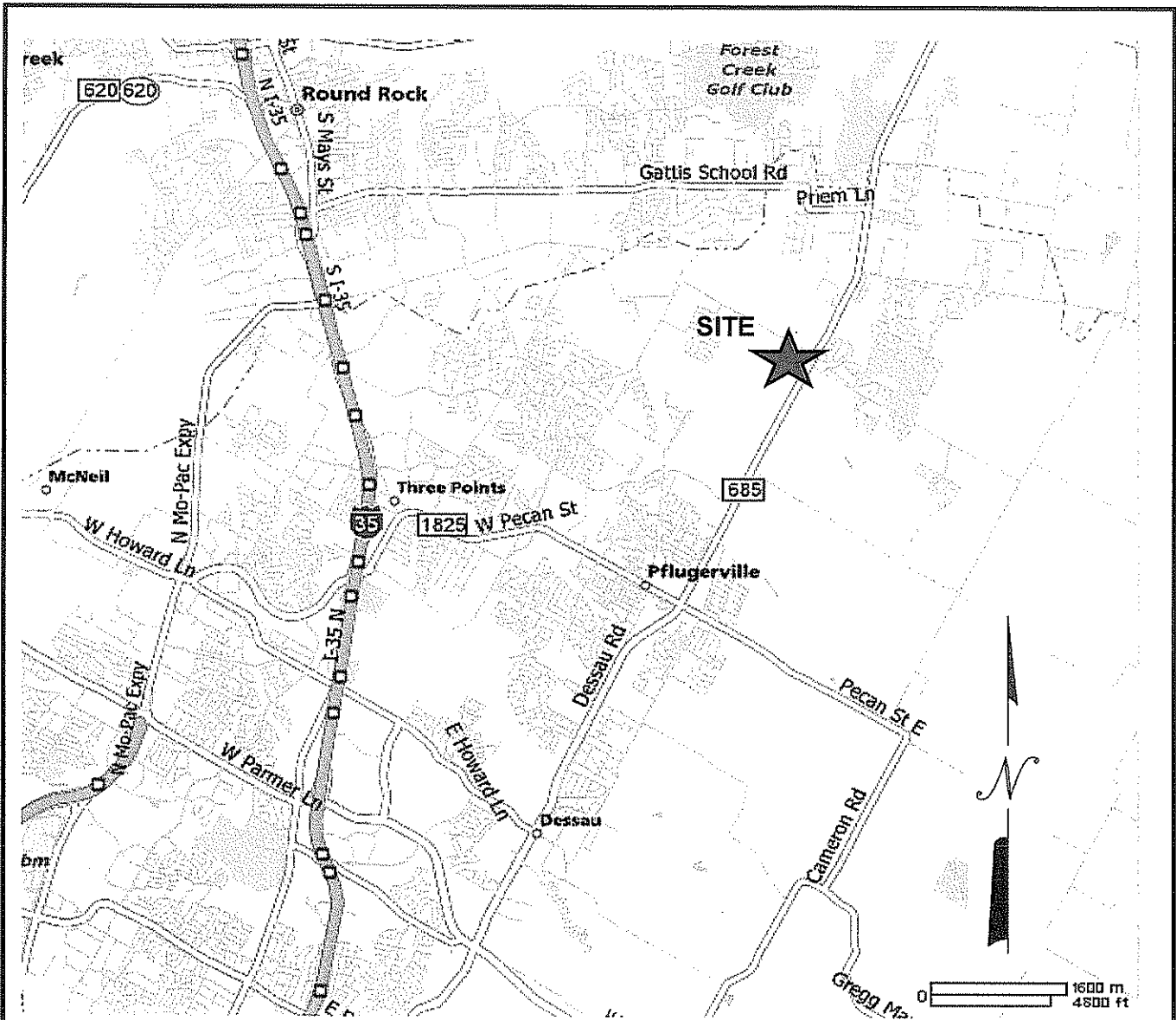
The scope of services for this project does not include, either specifically or by implication, any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential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

For any excavation construction activities at this site, all Occupational Safety and Health Administration (OSHA) guidelines and directives should be followed by the Contractor during construction to provide a safe working environment. In regards to worker safety, OSHA Safety and Health Standards require the protection of workers from excavation instability in trench situations.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

	<u>FIGURE</u>
VICINITY PLAN	1
PROJECT LAYOUT	2
BORING LAYOUT	3
LOGS OF BORING	4 through 31
UNIFIED SOIL CLASSIFICATION SYSTEM	32
GENERAL NOTES	33
DESCRIPTION OF ROCK PROPERTIES	34



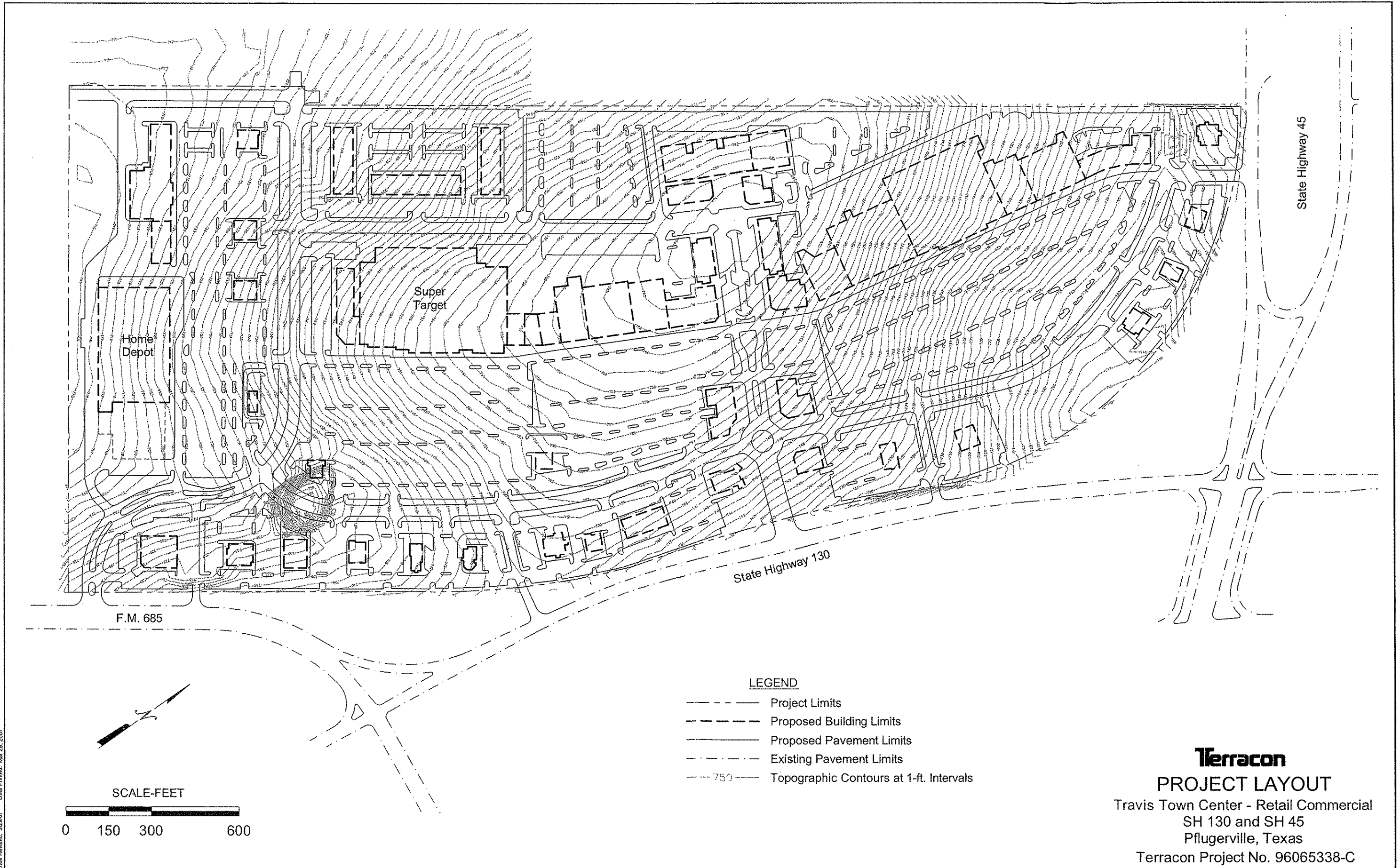
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VICINITY MAP

Travis Town Center
 Retail/Commercial Development
 SH 130 and SH 45
 Pflugerville, Texas

Terracon Project No. 96065338C

Figure 1



Date Revises: 3/23/07 Date Printed: Mar 29, 2007

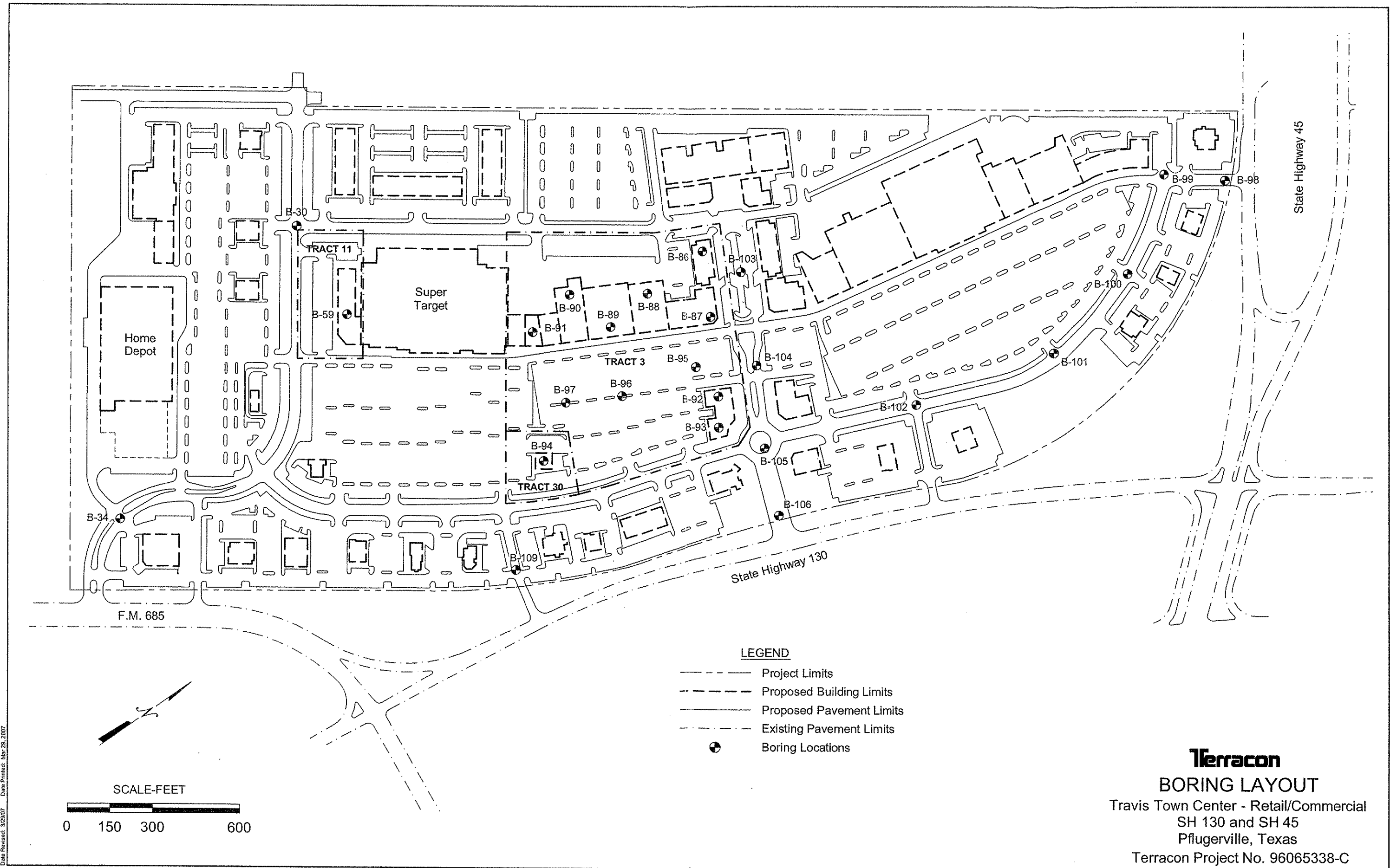
- LEGEND**
- Project Limits
 - Proposed Building Limits
 - Proposed Pavement Limits
 - Existing Pavement Limits
 - 750 ----- Topographic Contours at 1-ft. Intervals

SCALE- FEET

0 150 300 600

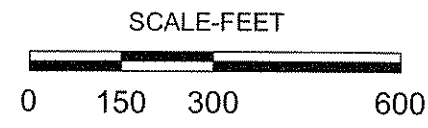
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PROJECT LAYOUT
 Travis Town Center - Retail Commercial
 SH 130 and SH 45
 Pflugerville, Texas
 Terracon Project No. 96065338-C

Figure 2



Date Revised: 3/23/07 Date Printed: Mar 29, 2007

- LEGEND**
- Project Limits
 - Proposed Building Limits
 - Proposed Pavement Limits
 - Existing Pavement Limits
 - ⊗ Boring Locations



Terracon
BORING LAYOUT
 Travis Town Center - Retail/Commercial
 SH 130 and SH 45
 Pflugerville, Texas
 Terracon Project No. 96065338-C

Figure 3

LOG OF BORING NO. B-30

CLIENT: New Quest Properties Houston, Texas	PROJECT: Travis Town Center
BORING LOCATION: See Figure 3	SITE: S.H. 130 and S.H. 45 Pflugerville, Texas

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS				
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM. TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %
Approx. Surface Elevation: 734.0 ft												
2.0	FAT CLAY Brown	732.0	CH	ST			32					
3.0	LEAN SILTY CLAY Light tan, with traces of limestone gravel Boring Terminated at 3 feet	731.0	CL	SS	50/6		15	45	23	80		

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL. REMARKS: Dry Augered 0 to 7.5 feet

WATER LEVEL OBSERVATIONS, FEET			Terracon	DATE DRILLED	Page 1 of 1
WL	▽	▽		1/25/2007	
WL	▽	▽		PROJECT NUMBER	
WL			96065338	FIGURE	4

LOG OF BORING NO. B-34

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS						
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 724.0 ft														
2.0	FAT CLAY Brown to dark brown	722.0	CH	ST										
4.5	LEAN SILTY CLAY Tan, with some limestone fragments	719.5	CL	ST										
	Boring Terminated at 4.5 feet	5	CL	SS	50/1.25									

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 4.5 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

5

LOG OF BORING NO. B-59

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS						
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 745.0 ft													
2.0	FAT CLAY Very stiff, dark brown, with calcareous deposits	743.0	CH	ST		2.5		27		57	35	78	
4.0	LEAN SILTY CLAY Very stiff, tan, with limestone fragments and calcareous deposits	741.0		RC			21 0						
	LIMESTONE (Austin Group) Tan, with weathered and clay seams and lenses	▽		RC			57 27		132				219.4
	-with some tan clay layers about 12 to 13 feet			RC			100 80		125				192.7
	-gray below 16.5 feet			RC			100 40						
20.0	Boring Terminated at 20 feet	725.0											

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 2.5 feet; Air Rotary 2.5 to 20 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽ 7.0	WD	▽
WL	▽	WD	▽
WL			



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FIGURE
61

LOG OF BORING NO. B-86

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 764.0 ft														
2.0	FAT CLAY Dark brown to brown	762.0	CH	ST		3.0		24	99					
3.0	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	761.0	CL	ST		2.5								
	LIMESTONE (Austin Group) Tan, with weathered and clay seams, layers and lenses			RC			80 23							
	-with some tan clay layers about 12 to 13 feet			RC			100 56		128				215.4	
	-gray below 18.5 feet			RC			83 68		127				244.6	
20.0	Boring Terminated at 20 feet	744.0		RC			92 83							

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 2.5 feet; Air Rotary 2.5 to 20 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE
7

LOG OF BORING NO. B-87

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 763.0 ft														
2.0	FAT CLAY Dark brown to brown	761.0	CH	ST		2.5								
4.0	LEAN SILTY CLAY Tan to lo light tan, with some limestone fragments	759.0	CL	ST		1.5		22						
	LIMESTONE (Austin Group) Tan, with weathered and clay seams, layers and lenses													
					5									
						RC					65 18		129	159.4
					10									
						RC					60 14			
					15									
						RC					100 48			
					20									
						RC					100 44			
20.0	Boring Terminated at 20 feet	743.0												

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 4 feet; Air Rotary 4 to 20 feet

WATER LEVEL OBSERVATIONS, FEET		
WL	▽	N/E
WL	▽	▽
WL		



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FIGURE

8

LOG OF BORING NO. B-89

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS						
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 762.0 ft													
	FAT CLAY Dark brown to brown	0	CH	ST	2.0								
4.0	758.0	4.0	CH	ST	2.0			25	68	45	90		
	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	4.5	CL	ST	4.5+			20	109				
4.5	757.5	5		RC				$\frac{86}{10}$					
	LIMESTONE (Austin Group) Tan to light tan, with weathered and clay seams, layers and lenses			RC				$\frac{100}{15}$					
	-with shell fragments about 15 to 18.5 feet			RC				$\frac{100}{81}$					
	-gray, with some shell fragments below 16.5 feet			RC				$\frac{100}{69}$					
20.0	742.0	20											
Boring Terminated at 20 feet													

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 4.5 feet; Air Rotary 4.5 to 20 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE
10

LOG OF BORING NO. B-90

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS						
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
	Approx. Surface Elevation: 760.0 ft												
//	FAT CLAY Dark brown	2.0 758.0	CH	ST		3.5		29		57	37		
//	LEAN SILTY CLAY Tan, with traces of limestone gravel	3.5 756.5	CL	ST		2.5							
■	LIMESTONE (Austin Group) Tan, with weathered and clay seams and lenses	5		RC			75 0						
■		10		RC			100 43		129				229.5
■	-with some tan clay layers about 12 to 13 feet	15		RC			87 43		123				82.7
■	-gray below 16 feet	20		RC			85 72						
	Boring Terminated at 20 feet	20 740.0											

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 3 feet; Air Rotary 3 to 20 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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LOG OF BORING NO. B-91

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
	Approx. Surface Elevation: 759.0 ft													
//	FAT CLAY Dark brown to brown	2.5	CH	ST	2.5				32	88				
//	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	3.5	CL	ST	2.0				29					
□	LIMESTONE (Austin Group) Tan to light tan, with weathered and clay seams, layers and lenses	5		RC				100 15						
□		10		RC				100 42						
□	-with some tan clay layers about 12 to 13 feet	15		RC				100 33						
□	-gray below 15 feet -with tan marly clay layer about 15.5 to 16 feet	20		RC				100 49						
	Boring Terminated at 20 feet	20												

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 3 feet; Air Rotary 3 to 20 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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LOG OF BORING NO. B-92

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS				
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %
Approx. Surface Elevation: 756.0 ft												
2.0	FAT CLAY Dark brown to brown	754.0	CH	ST		2.5						
3.0	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	753.0	CL	ST		4.5+			14	35	15	43
	LIMESTONE (Austin Group) Tan, with weathered and clay seams, layers and lenses			RC			90 0					
				RC			100 81		122			102.8
10.0	Boring Terminated at 10 feet	746.0										

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 2.5 feet; Air Rotary 2.5 to 10 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

13

LOG OF BORING NO. B-93

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % /RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 753.5 ft													
2.0	FAT CLAY Dark brown to brown	751.5	CH	ST		3.0		27	55	34			
3.0	LEAN SILTY CLAY Tan to light tan, with limestone fragments	750.5	CL	ST		4.5+		17					
	LIMESTONE (Austin Group) Tan, with weathered and clay seams, layers and lenses			RC			75 10						
				RC			96 75		124			113.0	
10.0	Boring Terminated at 10 feet	743.5											

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 2.5 feet; Air Rotary 2.5 to 10 feet

WATER LEVEL OBSERVATIONS, FEET		
WL	▽	N/E
WL	▽	
WL		



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FIGURE

14

LOG OF BORING NO. B-94

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 753.0 ft														
2.0	FAT CLAY Dark brown	751.0	CH	ST		3.0								
5.0	LEAN SILTY CLAY Tan	748.0	CL	ST		4.5		18	43	23	82			
14.0	LIMESTONE Tan, weathered, with some clay seams and layers	▽ 739.0		RC			45 25		119			88.3		
	Boring Terminated at 14 feet			RC			100 31							

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL. REMARKS: Dry Augered 0 to 5 feet; Air Rotary 5 to 14 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽ 8.0	WD	▽
WL	▽	WD	▽
WL			



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FIGURE

15

LOG OF BORING NO. B-95

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % /RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 760.0 ft														
3.0	FAT CLAY Dark brown clay	757.0	CH	ST		3.5								
6.0	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	754.0	CL	ST										
	Boring Terminated at 6 feet		5	CL	ST		4.5+		13					

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 5 feet

WATER LEVEL OBSERVATIONS, FEET		
WL	▽	N/E
WL	▽	▽
WL		

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FIGURE
16

LOG OF BORING NO. B-96

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 760.0 ft														
3.0	FAT CLAY Dark brown to brown	757.0	CH	ST		3.5								
5.0			CH	ST		4.0		28						
6.0	LEAN SILTY CLAY Tan to light tan, with limestone fragments	754.0	CL	ST		4.0								
	Boring Terminated at 6 feet		5	CL	ST		4.5+							

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 6 feet

WATER LEVEL OBSERVATIONS, FEET		
WL	▽	N/E
WL	▽	▽
WL		

Terracon

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FIGURE
17

LOG OF BORING NO. B-97

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 758.0 ft													
2.0	FAT CLAY Dark brown to brown	756.0	CH	ST		3.0							
6.0	LEAN SILTY CLAY Tan to light tan	752.0	CL	ST		4.0	18	107					
	Boring Terminated at 6 feet												

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 6 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE 18

LOG OF BORING NO. B-98

CLIENT: New Quest Properties Houston, Texas	PROJECT: Travis Town Center
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BORING LOCATION: See Figure 3	SITE: S.H. 130 and S.H. 45 Pflugerville, Texas
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Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 726.0 ft													
4.0	FAT CLAY Dark brown clay	722.0	CH	ST		1.0							
5.0			CH	ST		2.0		29	72	49			
6.0	LEAN SILTY CLAY Tan to light tan, with some limestone fragments	720.0	5	CL	ST	4.5+							
Boring Terminated at 6 feet													

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 5 feet

WATER LEVEL OBSERVATIONS, FEET WL ∇ ∇ N/E WL ∇ ∇ WL 		DATE DRILLED 3/8/2007 PROJECT NUMBER 96065338	Page 1 of 1 FIGURE 19
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LOG OF BORING NO. B-99

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 722.5 ft													
1.0	FAT CLAY Dark brown	721.5	CH	ST		2.5							
3.5	LEAN SILTY CLAY Tan to light tan, with trace of limestone gravel	719.0	CH	ST		4.5+	14	33	14				
	Boring Terminated at 3.5 feet		CL	SS	50/6								

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 3.5 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

20

LOG OF BORING NO. B-100

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 721.0 ft														
5.0	FAT CLAY Dark brown to brown	716.0	CH	ST		2.5		46						
5.0			CH	ST		2.5								
6.0	LEAN SILTY CLAY Tan, with trace of limestone fragments	715.0	CH	ST		4.0								
6.0	Boring Terminated at 6 feet		CL	ST		4.0								

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL. REMARKS: Dry Augered 0 to 6 feet

WATER LEVEL OBSERVATIONS, FEET		Terracon	DATE DRILLED	Page 1 of 1
WL	▽		2/26/2007	FIGURE
WL	▽		PROJECT NUMBER	
WL		96065338	21	

LOG OF BORING NO. B-102

CLIENT: New Quest Properties Houston, Texas	PROJECT: Travis Town Center
BORING LOCATION: See Figure 3	SITE: S.H. 130 and S.H. 45 Pflugerville, Texas

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINIUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
	Approx. Surface Elevation: 741.0 ft													
2.0	FAT CLAY Brown to dark brown, with calcareous nodules	739.0	CH	ST		3.0		31						
4.5	LEAN SILTY CLAY Tan to light tan	736.5	CL	ST		2.5								
	Boring Terminated at 4.5 feet		CL	SS	50/6									

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL. REMARKS: Dry Augered 0 to 4.5 feet

WATER LEVEL OBSERVATIONS, FEET WL <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> N/E WL <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> WL <input type="checkbox"/> <input type="checkbox"/>		DATE DRILLED 2/26/2007 PROJECT NUMBER 96065338	Page 1 of 1 FIGURE 23
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LOG OF BORING NO. B-103

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 764.0 ft														
3.0	761.0	5	CH	ST		2.5		24	98					
FAT CLAY Dark brown to brown														
6.0	758.0		CH	ST		3.5								
LEAN SILTY CLAY Tan to light tan, with trace of limestone fragments														
			CL			3.5								
			CL	ST		4.5+								
Boring Terminated at 6 feet														

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 6 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

24

LOG OF BORING NO. B-104

CLIENT: New Quest Properties Houston, Texas	PROJECT: Travis Town Center
BORING LOCATION: See Figure 3	SITE: S.H. 130 and S.H. 45 Pflugerville, Texas

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % /RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
Approx. Surface Elevation: 760.0 ft														
2.0	<u>FAT CLAY</u> Brown, with trace of calcareous nodules	758.0	CH	ST		3.5	28							
5.0	<u>LEAN SILTY CLAY</u> Tan to light tan, with trace of limestone gravel	755.0	CL	ST		4.5								
	Boring Terminated at 5 feet	5	CL	SS	64	4.5+								

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 5 feet

WATER LEVEL OBSERVATIONS, FEET		DATE DRILLED	Page 1 of 1
WL	▽	2/26/2007	FIGURE 25
WL	▽	PROJECT NUMBER	
WL	▽	96065338	



LOG OF BORING NO. B-105

CLIENT: New Quest Properties Houston, Texas	PROJECT: Travis Town Center
BORING LOCATION: See Figure 3	SITE: S.H. 130 and S.H. 45 Pflugerville, Texas

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS							
			USCS SYMBOL	TYPE	SPT OR TYDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % /RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %
	Approx. Surface Elevation: 751.0 ft													
2.0	FAT CLAY Brown, with trace of calcareous nodules 749.0	2.0	CH	ST		3.0								
4.0	LEAN SILTY CLAY Tan to light tan, with trace of limestone gravel 747.0 Boring Terminated at 4 feet	4.0	CL	ST		4.5+	15							
			CL	SS	64/12									

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 4 feet

WATER LEVEL OBSERVATIONS, FEET	<h1 style="font-size: 2em; margin: 0;">Terracon</h1>	DATE DRILLED	Page 1 of 1
WL <input checked="" type="checkbox"/>		2/26/2007	<h2 style="font-size: 1.5em; margin: 0;">FIGURE</h2>
WL <input checked="" type="checkbox"/>		PROJECT NUMBER	
WL <input type="checkbox"/>		96065338	

LOG OF BORING NO. B-106

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 742.0 ft													
2.0	FAT CLAY Brown	740.0	CH	ST		3.0		22		49	31		
4.0	LEAN SILTY CLAY Light tan to white, with trace of limestone fragments	738.0	CL	ST		4.5+							
	Boring Terminated at 4 feet		CL	SS	50/4								

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL. REMARKS: Dry Augered 0 to 3 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

27

LOG OF BORING NO. B-107

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES				TESTS											
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF	FAILURE STRAIN, %				
	Approx. Surface Elevation: 762.0 ft																	
2.0	FAT CLAY Brown	760.0	CH	ST		3.5			26	98								
3.0	LEAN SILTY CLAY Tan, with trace of limestone fragments	759.0	CL	ST		4.5												
	Boring Terminated at 3 feet		CL	SS	50/6													

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 3 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

28

LOG OF BORING NO. B-108

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
Approx. Surface Elevation: 753.0 ft													
2.0	FAT CLAY Dark brown to brown	751.0	CH	ST		3.0	24						
4.5	LEAN SILTY CLAY Tan to light tan, with trace of limestone fragments	748.5	CL	ST		4.0	14	34	4				
	Boring Terminated at 4.5 feet		CL	SS	70/12								

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 4.5 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	∇	∇	N/E
WL	∇	∇	
WL			



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FIGURE

29

LOG OF BORING NO. B-109

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS					
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM., TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, KSF
	Approx. Surface Elevation: 748.5 ft												
3.0	FAT CLAY Dark brown to brown	745.5	CH	ST				33	61	37	91		
			CH										
			CL										
6.5	LEAN SILTY CLAY Light tan, with traces of limestone fragments	742.0	5	CL	ST			17					
7.5	LIMESTONE (Austin Group) Tan, with weathered and clay seams and lenses Boring Terminated at 7.5 feet	741.0		CL	SS	50/2							

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 7.5 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

30

LOG OF BORING NO. B-110

CLIENT: **New Quest Properties
Houston, Texas**

PROJECT: **Travis Town Center**

BORING LOCATION: **See Figure 3**

SITE: **S.H. 130 and S.H. 45
Pflugerville, Texas**

Graphic Log	DESCRIPTION	DEPTH, FEET	SAMPLES					TESTS				
			USCS SYMBOL	TYPE	SPT OR TXDOT CPT BLOWS/INCH	CALIBRATED HAND PENETROM. TSF	RECOVERY, % / RQD, %	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %
Approx. Surface Elevation: 755.0 ft												
2.0	FAT CLAY Very stiff, dark brown, with limestone fragments	753.0	CH	ST		3.0						
4.0	LEAN SILTY CLAY Very stiff, tan, with limestone fragments, seams and layers	751.0	CL	ST		3.5		19	34	13		
6.0	LIMESTONE (Austin Group) Tan, severely weathered	749.0		RC				100 0				
Boring Terminated at 6 feet												

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL AND ROCK TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry Augered 0 to 6 feet

WATER LEVEL OBSERVATIONS, FEET			
WL	▽	▽	N/E
WL	▽	▽	
WL			



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FIGURE

31

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils More than 50% retained on the 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
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GP	Poorly graded gravel ^F
			Fines classify as CL or CH	GM	Silty 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 ^F
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	SP	Poorly graded sand ^F
			Fines Classify as CL or CH	SM	Silty sand ^{G,H,I}
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}
	Silt and Clays Liquid limit 50 or more	inorganic	Liquid limit - oven dried < 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried	OH	Organic silt ^{K,L,M,O}
		organic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}
			PI plots below "A" line	MH	Elastic Silt ^{K,L,M}
Highly organic soils	Primarily organic matter, dark in color, and organic odor	Liquid limit - oven dried < 0.75	OH	Organic clay ^{K,L,M,P}	
		Liquid limit - not dried	PT	Peat	

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels 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.

^DSands 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

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

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

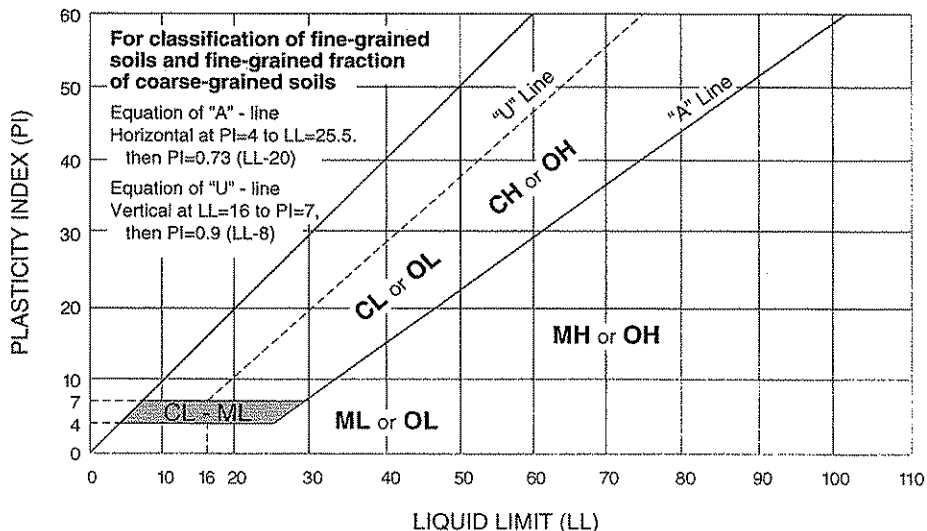
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^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.



Terracon

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1- ³ / ₈ " I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
TC:	TxDOT Cone Penetrometer Test	HA:	Hand Auger
CF:	Continuous Flight Auger	RC:	Rock Core
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For TxDOT cone penetrometer (TC) the penetration value is reported as the number of blows required to advance the sampler 12 inches or penetration in inches after 100 blows using a 170-pound hammer falling 24 inches, reported as "blows per foot," or inches per 100 blows and is not considered equivalent to the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified 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.

CONSISTENCY OF FINE-GRAINED SOILS

<u>Unconfined Compressive Strength, Qu, psf</u>	<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>Consistency</u>
< 500	<2	Very Soft
500 - 1,000	2-3	Soft
1,001 - 2,000	4-6	Medium Stiff
2,001 - 4,000	7-12	Stiff
4,001 - 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

<u>Standard Penetration or N-value (SS) Blows/Ft.</u>	<u>TxDOT Cone Penetrometer (TC) Blows/Ft.</u>	<u>Relative Density</u>
0 - 3	0-8	Very Loose
4 - 9	8-20	Loose
10 - 29	20-80	Medium Dense
30 - 49	80 to 5"/100	Dense
50+	5"/100 to 0"/100	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

<u>Major Component of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Term(s) of other constituents</u>	<u>Percent of Dry Weight</u>
Trace	< 5
With	5 - 12
Modifiers	> 12

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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FIGURE 33

GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock^a

Spacing	Joints	Bedding/Foliation	
Less than 2 in.	Very close	Very thin	
2 in. – 1 ft.	Close	Thin	
1 ft. – 3 ft.	Moderately close	Medium	
3 ft. – 10 ft.	Wide	Thick	
More than 10 ft.	Very wide	Very thick	

Rock Quality Designator (RQD) ^b		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

- a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
 b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
 U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

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FIGURE 34