Preliminary Soils Survey
Blue Ridge Ranch Subdivision, Unit 7
San Antonio, Texas

InTEC Project No. S251007
January 23, 2025

5419 N Loop 1604 E
San Antonio, Texas 78247

Integrated Testing and Engineering Company of San Antonio, L.P.
12028 Radium, San Antonio, Texas 78216—Phone: (210) 525 9033—Fax: (210) 525 9032—www.InTEC-SA.com

InTEC Integrated Testing and Engineering Company of San Antonio, L.P.
Geotechnical & Environmental Engineering • Construction Services • Geologic Assessment

January 23, 2025

D. R. Horton, Inc.
5419 N Loop 1604 E
San Antonio, Texas 78247

Attention: **Mr. David Brodbeck, P.E.**

Re: Preliminary Soils Survey
Blue Ridge Ranch Subdivision, Unit 7
San Antonio, Texas

InTEC Project No. S251007

Ladies & Gentlemen:

Integrated Testing and Engineering Company of San Antonio (InTEC) has completed a **preliminary soil and foundation engineering report** at the above referenced project site. The results of the exploration are presented in this report.

We appreciate and wish to thank you for the opportunity to be of service to you on this project. If we can be of additional assistance during the materials testing-quality control phase of construction, please call us.

Sincerely,
InTEC of San Antonio

Murali Subramaniam, Ph. D., P.E.
Vice President

STATE OF TEXAS
MURALI SUBRAMANIAM
102417
LICENSED
PROFESSIONAL ENGINEER
InTEC of SAN ANTONIO
F-7623

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EXECUTIVE SUMMARY

The soil conditions at the location of **Blue Ridge Ranch Subdivision, Unit 7 in San Antonio, Texas** were obtained from a limited number of **five borings drilled to a depth of 15 feet each**. Laboratory tests were performed on selected specimens to evaluate the engineering characteristics of various soil strata encountered in the borings. Our findings and recommendations based on the field investigations and the laboratory tests are summarized below:

- The subsurface soils at the boring locations consist of dark brown sandy clays and tan silty clays with chert, gravel, and marl seams.
- The results of our laboratory testing and engineering evaluation indicate that the underlying shallow clays are **moderately plastic in character.** Potential vertical movement or settlement on the order of **2 ½ to 3 ¼ inches** is estimated.
- The proposed residential structures may be supported by stiffened grid type beam and slab foundation or post-tensioned beam and slab foundation.
- Ground water was not encountered in the borings at the time of drilling.

Detailed descriptions of subsurface conditions, engineering analysis, and preliminary design recommendations are included in this report.

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INTRODUCTION

General

This report presents the results of our **Preliminary Soil Survey for Blue Ridge Ranch Subdivision, Unit 7 in San Antonio, Texas.** This project was authorized by **Ms. Leslie Ostrander, P.E.**

Purpose and Scope of Services

The purpose of our preliminary geotechnical investigation was to evaluate the site's subsurface and ground water conditions and provide **preliminary geotechnical engineering recommendations** for the planning and development phase of the project. Our scope of services includes the following:

1) drilling and sampling of five borings – to a depth of 15 feet each;
2) evaluation of the in-place conditions of the subsurface soils through field penetration tests;
3) observation of the ground water conditions during drilling operations;
4) performing laboratory tests such as Atterberg limits and Moisture content tests;
5) review and evaluation of the field and laboratory test programs during their execution with modifications of these programs, when necessary, to adjust to subsurface conditions revealed by them;
6) compilation, generalization and analysis of the field and laboratory data in relation to the project requirements;
7) estimation of potential vertical movements;
8) preparation of preliminary recommendations for the planning and development phase of the project;
9) preparation of a written preliminary geotechnical engineering report for use by the members of the Evaluation team in their preparation of planning and development documents.

The Scope of Services **did not include pavement study, slope stability, or any environmental assessment** for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the Boring Logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client.

Project Description

The proposed project involves the development of Blue Ridge Ranch Subdivision, Unit 7 in San Antonio, Texas. The scope of this project includes preparation of preliminary geotechnical engineering recommendations for the single-family residential structures at the above referenced project site. Proposed finish grade elevations or cut and fill information or building locations were not available for our review at the time of our investigation.

The site is located east of Loop 410 and north of New Sulphur Springs Road in San Antonio, Texas. A review of the aerial maps indicates that the site contains numerous trees / vegetation. A review of the topographic map indicates the site generally slopes from the north to the south. The geologic map indicates that the site is located within Ewi, Wilcox Group, formation. The soil maps indicate that the site is underlain by clays and sandy soils. Sandstone and siltstone should be anticipated during construction, especially during utility trench excavations.

SUBSURFACE EXPLORATION

Scope

The field exploration to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site, drilling the borings, performing Standard Penetration Tests, and obtaining Split Barrel samples.

Five soil test borings were drilled at the approximate locations shown on the Boring Location Plan, Plate 1, included in the Illustration section of this report. These borings were **drilled to a depth of 15 feet each below the presently existing ground surface**. Boring locations were selected by the project geotechnical engineer and established in the field by the drilling crew using normal taping procedures.

Drilling and Sampling

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional solid stem augers were used to advance the holes and samples of the subsurface materials were obtained **using a Split Barrel sampler.** The samples were identified according to boring number and depth, encased in polyethylene plastic wrapping to protect against moisture loss, and transported to our laboratory in special containers.

Field Tests and Water Level Measurements

Penetration Tests – During the sampling procedures, **Standard Penetration Tests were performed** in the borings in conjunction with the split-barrel sampling. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling thirty inches, required to advance the split-spoon sampler one foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three successive increments of six inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Water Level Measurements – Ground water was not encountered in the borings at the time of drilling. In relatively pervious soils, such as sandy soils, the indicated elevations are considered reliable ground water levels. In relatively impervious soils, the accurate determination of the ground water elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the ground water table and volumes of water will depend on the permeability of the soils.

Field Logs

A field log was prepared for each boring. Each log contained information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as silt, clay, gravel or sand and observations of ground water. It also contained an interpretation of subsurface conditions between samples. **Therefore, these logs included both factual and interpretive information.**

Presentation of the Data

The final logs represent our interpretation of **the contents of the field logs for the purpose delineated by our client.** The final logs are included on **Plates 2 thru 6** included in the Illustration section. A key to classification terms and symbols used on the logs is presented on **Plate 7.**

LABORATORY TESTING PROGRAM

Purpose

In addition to the field exploration, a supplemental laboratory testing program was conducted to determine additional **pertinent engineering characteristics** of the subsurface materials necessary in evaluating the soil parameters.

Laboratory Tests

All phases of the laboratory testing program were performed **in general accordance with the indicated applicable ASTM Specifications** as indicated in Table No. 1.

Table No. 1 – Laboratory Test Procedures

Laboratory Test	Applicable Test Standard
Liquid Limit, Plastic Limit and Plasticity Index of the Soils	ASTM D 4318
Moisture Content	ASTM D 2216

In the laboratory, each sample **was observed and classified by a geotechnical engineer.** As a part of this classification procedure, the natural water contents of selected specimens were determined. Liquid and plastic limit tests were performed on representative specimens to determine the plasticity characteristics of the different soil strata encountered.

Presentation of the Data

The tests were conducted in the laboratory to evaluate the engineering characteristics of the subsurface materials. The results of all these tests are presented on appropriate Boring Logs. These laboratory test results were used to classify the soils encountered generally according to the Unified Soil Classification System (ASTM D 2487).

GENERAL SUBSURFACE CONDITIONS

Soil Stratigraphy

The soils underlying the site may be grouped into **two generalized strata** with similar physical and engineering properties. The lines designating the interface between soil strata on the logs represent approximate boundaries. Transition between materials may be gradual. The soil stratigraphy information at the boring locations are presented in **Boring Logs, Plates 2 thru 6.**

The engineering characteristics of the underlying soils, based on selected samples that were tested, are summarized and presented in the following paragraph.

The underlying dark brown sandy clays and tan silty clays are moderately plastic with tested liquid limit values varying from 37 to 47 and plasticity index values ranging from 22 to 28. The results of Standard Penetration Tests performed within these clays varied from 12 to 34 blows per foot.

The above description presented is of a generalized nature to highlight the major soil stratification features and soil characteristics. Please refer to Boring Logs for soil stratigraphy information at a particular boring location.

Ground Water Observations

Ground water was not encountered in the borings at the time of drilling. Short term field observations generally do not provide accurate ground water levels. The contractor should check the subsurface water conditions prior to any excavation activities. The low permeability of the soils would require several days or longer for ground water to enter and stabilize in the bore holes. Ground water levels will fluctuate with seasonal climatic variations and changes in the land use.

It is not unusual to encounter shallow ground water during or after periods of rainfall. The surface water tends to percolate down through the surface soils until it encounters a relatively impervious layer.

FOUNDATIONS ON EXPANSIVE SOIL

General

There are many plastic clays **that swell considerably** when **water is added to them and then shrink with the loss of water.** Foundations constructed on these clays are **subjected to large uplifting forces caused by the swelling.**

In the characterization of a building site, two major factors that contribute to potential shrink-swell problems must be considered. Problems can arise if a) **the soil has expansive or shrinkage properties** and b) the environmental conditions that cause **moisture changes to occur in the soil.**

Evaluation of the Shrink-Swell Potential of the Soils

Subsurface sampling, laboratory testing and data analysis is used in the evaluation of the shrink-swell potential of the soils under the foundations.

The Mechanism of Swelling

The mechanism of swelling in expansive clays is complex and is influenced by a **number of factors.** Basically, expansion is a result of changes in the soil-water system that disturbs the internal stress equilibrium. Clay particles in **general have negative electrical charges** on their surfaces and positively charged ends. The negative charges are balanced by actions in the soil water and give rise to an electrical interparticle force field. In addition, adsorptive forces exist between the clay crystals and water molecules, and Van Der Waals surface forces exist between particles. Thus, there exists an internal electro-chemical force system **that must be in equilibrium with the externally applied stresses and capillary tension in the soil water.** If the soil water chemistry is changed either by changing the amount of water or the chemical composition, the interparticle force field will change. If the change in internal forces is not balanced by a corresponding change in the state of stress, **the particle spacing will change** so as to adjust the interparticle forces until equilibrium is reached. **This change in particle spacing manifests itself as a shrinkage or swelling.**

Antecedent Rainfall Ratio

This is a measure of the local climate and is defined as **the total monthly rainfall for the month of and the month prior to laying the slab divided by twice the average monthly rate measured for the period.** The intent of this ratio is to give a relative measure of ground moisture conditions at the time the slab is placed.

Thus, if a slab is placed at the end of a wet period, the slab should be expected to experience some loss of support around the perimeter as the wet soil begins to dry out and shrink. The opposite effect could be anticipated if the slab is placed at the end of an extended dry period; as the wet season occurs, uplift around the perimeter may occur as the soil at the edge of the slab gains in moisture content.

Age of Slab

The length of time since the slab was cast provides an indication of the type of swelling of the soil profile that can be expected to be found beneath the slab.

Initial Moisture Condition and Moisture Variation

Volume change in an expansive soil mass is the result of increases or decreases in water content. The initial moisture content influences the swell and shrink potential relative to possible limits, or ranges, in moisture content. Moisture content alone is useless as an indicator or predictor of shrink-swell potential. **The relationship of moisture content to limiting moisture contents such as the plastic limit and liquid limit must be known.**

If the moisture content is below or near plastic limit, the soils have high potential to swell. It has been reported that **expensive soils with liquidity index*** in the range of **0.20 to 0.40 will tend to experience little additional swell.**

The availability of water to an expansive soil profile is influenced by many environmental and man-made factors. Generally, the upper few feet of the profile are subjected to the widest ranges of moisture variation, and is least restrained against movement by overburden. **This upper stratum of the profile is referred to as the active zone.** Moisture variation in the active zone of a natural soil profile is affected by climatic cycles at the surface, and fluctuating groundwater levels at the lower moisture boundary. The surficial boundary moisture conditions are changed significantly simply by placing a barrier such as a building floor slab or pavement between the soil and atmospheric environment. **Other obvious and direct causes of moisture variation result from altered drainage conditions or man-made sources of water, such as irrigation or leaky plumbing.** The latter factors are difficult to quantify and incorporate into the analysis, but should be controlled to the extent possible for each situation. **For example, proper drainage and attention to landscaping are**

$$* \quad \text{LIQUIDITY INDEX} = \frac{\text{NATURAL WATER CONTENT} - \text{PLASTIC LIMIT}}{\text{LIQUID LIMIT} - \text{PLASTIC LIMIT}}$$

taken simple means of minimizing moisture fluctuations near structures, and should always be into consideration.

Man Made Conditions That Can Be Altered

There are a number of factors that can influence whether a soil might shrink or swell and the magnitude of this movement. **For the most part, either the owner or the designer has some control over whether the factor will be avoided altogether or if not avoided, the degree to which the factor will be allowed to influence the shrink-swell process.**

Lot Drainage This provides a measure of the slope of the ground surface with respect to available free surface water that may accumulate around the slab. **Most builders are aware of the importance of sloping the final grade of the soil away from the structure so that rain water is not allowed to collect and pond against or adjacent to the foundations.** If water were allowed to accumulate next to the foundation, it would provide an available source of free water to the expansive soil underlying the foundation. Similarly, surface water drainage patterns or swales must not be altered so that runoff is allowed to collect next to the foundation.

Topography **This provides a measure of the downhill movement that is associated with light foundations built on slopes in expansive soil areas.** The designer should be aware that as the soil swells, it heaves perpendicularly to the ground surface or slope, but when it shrinks, it recedes in the direction of gravity and gradually moves downslope in a sawtooth fashion over a number of shrink-swell cycles. In addition to the shrink-swell influence, the soil will exhibit viscoelastic properties and creep downhill under the steady influence of the weight of the soil. Therefore, if the building constructed on this slope is not to move downhill with the soil, it must be designed to compensate for this lateral soil influence.

Pre-Construction Vegetation **Large amount of vegetation existing on a site before construction may have desiccated the site to some degree, especially where large trees grew before clearing. Constructing over a desiccated soil can produce some dramatic instances of heave and associated structural distress and damage as it wets up.**

Post-Construction Vegetation The type, amount, and location of vegetation that has been allowed to grow since construction can cause localized desiccation. **Planting trees or large shrubs near a building**

can result in loss of foundation support as the tree or shrub removes water from the soil and dries it out. Conversely, the opposite effect can occur if flowerbeds or shrubs are planted next to the foundation and these beds are kept well-watered or flooded. This practice can result in swelling of the soil around the perimeter where the soil is kept wet.

Summation

It is beyond the scope of this investigation to do more than point out that the above factors have a definite influence on the amount and type of swell to which a slab-on-ground is subjected during its useful life. **The design engineer must be aware of these factors as he develops his design and make adjustments as necessary according to the results of special measurements or from his engineering experience and judgment.**

DESIGN ENGINEERING ANALYSIS

Foundation Design Considerations

Review of the data from limited number of borings and test data indicates that the factors presented will affect the foundation design and construction at this site.

1) The underlying soils are moderately plastic in character.

2) Structures supported at shallow depths will be subjected to potential vertical movements or settlement on the order of **2 ½ to 3 ¼ inches** at the existing grade elevation of the borings.

3) If the finish grade elevation is higher than the existing grade level, compacted crushed limestone should be used to raise the grade.

4) The select fill should be placed in lifts and compacted as recommended under *Select Fill* in the “Construction Guidelines” section in this report.

5) The strengths of the underlying soils are adequate to support shallow foundations.

6) Ground water was not encountered in the borings at the time of drilling.

Vertical Movements

The potential vertical rise (PVR) for slab-on grade construction at the boring locations had been estimated using Texas Department of Transportation Test Method TXDOT-124-E. This method utilizes the liquid limits, plasticity indices, and in-situ moisture contents for soils in the seasonally active zone, estimated to be about twelve feet in the Project area.

The estimated PVR value is based on the proposed floor system applying a sustained surcharge load of approximately 1.0 lb. per square inch on the subgrade materials. **Potential vertical movement on the order of 2 ½ to 3 ¼ inches was estimated at the existing grade elevations at the boring locations.** These PVR values will be realized if the subsoils are subjected to **moisture changes from the dry soil moisture conditions to wet soil moisture conditions.** TxDOT method of estimating potential vertical movements of the expansive clays is based on empirical correlations utilizing measured plasticity index values and assumed seasonal fluctuations in moisture content. Higher or lower PVR values may be estimated using other methods. However, the TxDOT method is the most widely used in the project area.

If cut and fill operations in excess of 6 inches are performed, the PVR values could change significantly. Higher PVR values than the above-mentioned values will occur in areas where water is allowed to pond for extended periods.

The potential vertical movement estimated and stated based on provision and maintenance of positive drainage to divert water away from the structures and the pavement areas. If the drainage is not maintained, ponding on water will occur, the wetted front may move below the assumed fifteen feet depth; the resulting potential vertical movement will be much greater than 2 to 3 times the stated value. Utility line leaks may contribute water and cause similar movements to occur.

The PVR value of **2 ½ to 3 ¼ inches** is based on the current site grades. If cut and fill operations in excess of 6 inches are performed, the PVR values could change significantly.

If the proposed finish grade elevation is higher than the existing grade level, compacted crushed limestone select fill should be used to raise the existing grade level. The select fill should be placed and compacted as recommended under *Select Fill* in the "Construction Guidelines" section in this report.

At a minimum, the existing sandy clay soils should be proof rolled.

Coping with problems of shrink/swell due to expansive clays is a "fact of life" in the Texas region of south western U.S.A. Support of the building on deep underreamed footings with a structurally suspended floor slab (12 inch void) will provide a foundation system with the least risk for distress due to shrink/swell of the clays. It should be noted that expansive clay does not shrink/swell without changes in moisture content, and thus good site design is very important to minimize foundation movements.

It is our experience that support of the walls and columns on stiffened grid type beam and slab foundation or post tensioned beam and slab foundation will provide reasonable performance of the foundation if the clay subsoils are wet at the time of earthwork construction. However, some shrink/swell will probably occur causing some cracks in the floor slab and interior walls due to the foundation system because the subsoil conditions between borings are unknown, the moisture content of the clays and groundwater conditions at the time of construction are unknown, and construction practices can adversely affect the supporting properties of the subsoils.

Flatwork

Ground supported flatwork adjacent to the buildings will be subjected to the movements due to shrink / swell of the underlying soils. Differential movement between the flatwork and the building may result in a trip hazard. Reducing the potential vertical movements as described in the *Vertical Movements* section will reduce the different movement described above.

PRELIMINARY RECOMMENDATIONS

General

The following preliminary recommendations are based on the data obtained from our field and laboratory tests, our past experience with geotechnical conditions similar to those at this site, and our engineering design analysis.

Surface drainage is very important around the residences and in the pavement areas. The surface water should be drained as fast as possible around the residences and roadways. If enough slopes are not available for a good surface drainage, gratings and pipes may be used to carry the water and drain the area fast. In some areas, a) where surface water gets into the subsurface and b) water travels laterally within the underlying gravel layers should be collected by French Drains and disposed of in the drain areas.

Foundation Selection

The type and depth of foundation suitable for a given structure primarily depends on several factors: the subsurface conditions, climatic conditions, site topography, site drainage, the function of the structure, the loads it may carry and the cost of the foundation. Additional considerations may include acceptable performance criteria set by the owner, architect, or structural designer with respect to vertical and differential movements, which the structure can withstand without damage.

Based on the above-mentioned conditions, stiffened grid type beam and slab foundations and post-tensioned beam and slab foundations may be considered to support the proposed residential structures at this site.

Stiffened grid type beam and slab foundation or Post-tensioned slab-on-grade foundation may be used to support the structures provided all of the items (a) thru (e) are followed:

(a) the anticipated potential vertical movements presented in the *Vertical Movements* section are acceptable to the owner,

(b) the owner (after discussing the resulting corresponding potential movements and their effect on the performance of the structures with the project structural engineer and the project architect) determines that the anticipated movements will not adversely affect the performance of the proposed structures,

(c) the subgrade is thoroughly proof rolled,

(d) all the recommendations presented in the “Construction Guidelines” section are followed, and

(e) if any fill is placed within the building pad area, InTEC should be called to evaluate the effect of fill on the foundation recommendations.

Stiffened Grid Type Beam and Slab Foundations

It is desirable to design the foundations system utilizing the simplifying assumption that the loads are carried by the beams. The grade beams should be founded at a depth of 18 inches below finished subgrade elevation on or within undisturbed existing soils or compacted select fill. Design Plasticity Index values at the boring locations are presented in Table No. 2. Preliminary stiffened grid type beam and slab foundation parameters are presented in Table No. 3 in the following page.

Table No. 2 – Design Plasticity Index Values

Boring Location	Design Plasticity Index
B-1	33
B-2	33
B-3	33
B-4	33
B-5	33

Table No. 3 – Preliminary Stiffened Grid Type Beam and Slab Foundation Parameters

Design Plasticity Index	Net Allowable Bearing Capacity (psf)	Unconfined Compressive Strength (tsf)	Soil Support Index	Climatic Rating
33 *	1,500	0.7	0.66	17

(*) at the Boring Locations

Notes:

- Existing sandy clay soils should be densified.
- The grade beams should be founded on or within proof rolled natural undisturbed soils or compacted select fill.
- Allowable Bearing Capacity values as shown above are recommended for grade beams founded at a minimum depth of 18 inches below final subgrade elevation.
- The grade beams should be a minimum of 10 inches width.
- The parameters are based on existing grade (undeveloped tract) and limited number of borings drilled at the site. The parameters may change after any cut and fill operations.

The preliminary soil recommendations in this report are presented for planning and evaluation purposes and should not be used for final design purposes. The recommendations presented in this preliminary report may be different from the recommendations after site development and after all the final soil borings are done.

Post-Tensioned Beam and Slab Foundations

Post-tensioned slab-on-grade foundations may also be used to support the proposed residences**.** Differential vertical movements should be expected for shallow type foundations at this site **due to expansive soil conditions which were encountered.** Differential vertical movements will be estimated for both the center lift and edge lift conditions for post-tensioned slab-on grade construction at this site. These movements were estimated using the procedures and criteria discussed in the Post-Tensioning Institute Manual entitled "Design of Post Tensioned Slabs-on-Ground-Third Edition Manual. We recommend that the structural engineer consider the assumptions and limitations of the method while establishing minimum PTI design parameters for foundation system design to account for the relatively low Ym values produced when analyzing certain soil conditions. The estimated preliminary PTI parameters for the residential structures are provided in Table No. 4 in the following page.

Table No. 4 – Preliminary Post Tension Parameters

Existing Soils	
Center Lift, Ym values, Inches	
Grade beams founded at a depth of 18 inches below final grade elevation	1.6
Edge Lift, Ym values, Inches	
Grade beams founded at a depth of 18 inches below final grade elevation	2.3
Center Lift (Em values, ft)	8.2
Edge Lift (Em values, ft)	4.5
Allowable Bearing Capacity (psf)	1,500

Notes:

- Existing sandy clay soils should be densified.
- The grade beams should be founded on or within proof rolled natural undisturbed soils or compacted select fill.
- Allowable Bearing Capacity values as shown above are recommended for grade beams founded at a minimum depth of 18 inches below final subgrade elevation.
- The grade beams should be a minimum of 10 inches wide.
- The parameters are based on existing grade (undeveloped tract) and limited number of borings drilled at the site. The parameters may change after site development.

The above values are based on limited number of borings and are preliminary in nature. The above recommendations should not be used for final design purposes. Design PTI differential movement (Ym) for the soil conditions encountered at the site will be calculated and presented in the report after additional borings are performed for final soil and foundation analysis investigation.

The thickness of the clay stratum may vary within a building footprint area. If proper drainage is not maintained, resulting potential vertical movements will be much greater than 2 or 3 times the anticipated vertical movements. Significant differences in fill thicknesses from one side of the structure to the other side may result in larger than anticipated differential movements. As a result of such conditions, the differential vertical movements experienced may be greater than the anticipated total vertical movements. If such conditions exist or are anticipated, then the above recommended post tension parameters may need to be reevaluated.

The Post-Tensioning Institute (PTI) method incorporates numerous design assumptions associated with the derivation of required variables needed to determine the soil design criteria. **The PTI method of predicting differential soil movement is applicable only when site moisture conditions are controlled by the climate alone** (i.e. not improper drainage or water leaks). **The performance of a slab and movement magnitudes can be significantly influenced by yard maintenance, water line leaks, and trees present before and after construction.**

Moisture Barrier

We recommend placement of a polyethylene moisture barrier under soil supported floor slab to reduce the possibility of moisture migration through the slab.

Utilities

Utilities which project through slab-on-grade floors should be designed with either some degree of flexibility or with **sleeves in order to prevent damage to these lines should vertical movement occur.**

Utility excavations may encounter ground water. The ground water can be handled by sump and pump method of dewatering systems.

Deep excavations may encounter ground water which may flow through the gravel fill surrounding the pipeline; this water may be near the ground surface at lower points in the subdivision. The gravel should be extended to a nearby creek or drainage feature and pressure head should be relieved by day lighting at the ground surface.

Contraction, Control, or Expansion Joints

Contraction, control or expansion joints should be designed and placed in various portions of the structure. Properly planned placement of these joints will assist in controlling the degree and location of material cracking which normally occurs due to soil movements, material shrinkage, thermal affects, and other related structural conditions.

Lateral Earth Pressure

InTEC is not aware of proposed retaining walls at this site. **Some of the grade beams may act as retaining structures in addition to transferring vertical loads such as step down garages. Some cantilever retaining walls may be needed at this site**. The following equivalent fluid density values may be used for preliminary calculations.

Table No. 5 – Equivalent Fluid Density Values

Backfill Material	Equivalent Fluid Density PCF Active Condition	At Rest condition
a. Crushed Limestone	40	55
b. Clean Sand	45	60
c. On-site clays	75	95

These equivalent fluid densities do not include the effect of seepage pressures, surcharge loads such as construction equipment, vehicular loads or future storage near the walls. If the basement wall or cantilever retaining wall can tilt forward to generate "active earth pressure" condition, the values under active condition should be used. For rigid non-yielding walls which are part of the building, the values "at rest condition" should be used.

The compactive effort should be controlled during backfill operations. Over-compaction can produce lateral earth pressures in excess of at-rest magnitudes. Compaction levels adjacent to below-grade walls should be maintained between 95 and 98 percent of standard Proctor (ASTM D 698) maximum dry density.

The backfill behind the wall or step down garages should be drained properly. The simplest drainage system consists of a drain located near the bottom of the wall. The drain collects the water that enters the backfill and this may be disposed of through outlets in the wall called "weep holes". To ensure that the drains are not clogged by fine particles, they should be surrounded by a granular filter. In spite of a well-constructed toe drain, substantial water pressure may develop behind the wall if the backfill consists of clays or silts. A more satisfactory drainage system, consisting of a back drain of 12 inches to 24 inches wide gravel may be provided behind the wall to facilitate drainage.

The maximum toe pressure for footings founded two feet below finish grade elevation should not exceed 1,500 pounds per square feet. An adhesion value of 600 pounds per square foot may be used under the wall footings to check against sliding. This adhesion value is applicable for retaining wall bases supported on the existing clay soils.

Some retaining wall bases may be supported on or within compacted select fill material. For these wall bases, a coefficient of sliding friction value of 0.4 is recommended.

If passive pressure is required at any location, we should be informed. We can provide the passive pressure for that particular condition after considering the rigidity and soil-structure interaction characteristics of that structure.

CONSTRUCTION GUIDELINES

Construction Monitoring

As Geotechnical Engineer of Record for this project, InTEC should be involved in monitoring the foundation installation and earth work activities. Performance of any foundation system is not only dependent on the foundation design, but is strongly influenced by the quality of construction. Please contact our office prior of construction so that a plan for foundation and earthwork monitoring can be incorporated in the overall project quality control program.

Site Preparation

Site preparation will consist of **preparation of the subgrade, and placement of select structural fill.** The project geotechnical **engineer InTEC should approve the subgrade preparation, the fill materials, and the method of fill placement and compaction.**

In any areas where soil-supported floor slabs or pavement are to be used, vegetation and all loose or excessively organic material should be stripped to a minimum depth of six inches and removed from the site. Subsequent to stripping operations, the subgrade should be proof rolled in the presence of InTEC prior to fill placement and recompacted to **95 percent of the maximum dry density as determined by ASTM D 698 test method within one percent below or three percent above optimum moisture content.** Each lift should be tested by InTEC for compaction compliance and approved before placement of the subsequent lifts. The exposed subgrade should not be allowed to dry out prior to placing structural fill.

If cut and fill operations are performed underneath the building pad, a uniform fill thickness is recommended. Significant differences in fill thicknesses from one side of the structure to the other side may result in larger than anticipated differential movements.

Voids caused by site preparation, such as removal of trees, should be replaced with select structural fill and compacted in accordance with the select fill compaction recommendations.

Sandy soils should be anticipated within the project site and may be difficult to compact. Clayey soils may be mixed with the sandy soils to achieve proper compaction.

Compaction

Any loose or wet materials should be removed and wasted. The fill placement in the low areas should not be in a "bowl shape". The sides of the fill area should be "squared up" and the excavated bottom should be proof rolled as described in *Proof Rolling* section of this report. On site material, with no deleterious material, may be used to raise the grade. After proof rolling operation, the fill should be placed in 6 inch lifts and compacted to a minimum of **95 percent of the maximum dry density as determined by ASTM D 698 test method within optimum and three percent above optimum moisture content.** Each lift should be tested by InTEC for compaction compliance and approved before placement of the subsequent lifts. The exposed subgrade should not be allowed to dry out prior to placing structural fill. It is recommended that any given lot does not straddle filled areas and natural areas to help reduce differential movement of the structures.

The excavation boundaries should be set such that building areas do not straddle fill and natural areas. The anticipated potential vertical movement may be significantly affected after the cut and fill operations are performed in this area.

Proof Rolling

Proof rolling should be accomplished in order to locate and densify any weak compressible zones under the building and pavement areas and prior to placement of the select fill or base.

A minimum of 10 passes of a 25 ton pneumatic roller should be used for planning purposes. The operating load and tire pressure should conform to the manufactures specification to produce a minimum ground contact pressure of 90 pound per square inch. Proof rolling should be performed under the observation of InTEC. The soils that yield or settle under proof rolling operations should be removed, dried and compacted or replaced with compacted select fill to grade.

Density tests should be conducted as specified under *Control Testing and Filed Observation* after satisfactory proof rolling operation.

Select Fill

Any select structural fill used under the building should have a liquid limit less than 40 and a plasticity index in between 5 and 20 and be crushed limestone. The fill should contain no particles greater than 3 inches in diameter. **The percent passing Sieve No. 200 should be less than 30 percent**.

Crushed limestone with sufficient fines to bind the aggregate together is a suitable select structural fill material. The fill materials should be placed in loose lifts not to exceed 8 inches thick (6-inches compacted) and compacted to 95 percent of the maximum dry density as determined by ASTM D 1557 procedure at a moisture content within 3 percent of the optimum water content.

General Fill

General fill materials may consist of clean on-site material or any clean imported fill material. The purpose of a general fill is to provide soils with good compaction characteristics that will provide uniform support for any non-habitable structures that are not movement sensitive. The general fill material should be free of any deleterious material, construction debris, organic material, and should not have gravels larger than 6 inches in maximum dimension. The top two feet of fill material used underneath pavement areas should not have gravels larger than 3 inches in maximum dimension.

It should be understood that the use of the general fill may result in greater than anticipated potential vertical movements and differential movements. If the greater potential vertical movements or differential soil movements cannot be tolerated, then select fill material should be used and should conform to the Select Fill recommendations.

General Fill Compaction

The general fill materials should be placed in lifts not to exceed 8 inches thick and compacted to a minimum of 95 percent of the maximum dry density as determined by test method ASTM D 698 at a moisture content within 3 percent of the optimum water content. Each lift should be compacted and tested by a representative of a geotechnical laboratory to verify compaction compliance and approved before placement of the subsequent lifts.

Ground Water

In any areas where significant cuts (2-ft or more) are made to establish final grades for building pads, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other dewatering devices on building pads should be carefully addressed during construction. Our office could be contacted to visually inspect final pads to evaluate the need for such drains.

The ground water seepage may happen several years after construction if the rainfall rate or drainage changes within the project site or outside the project site. If seepage run off occurs towards the building an engineer should be called on to evaluate its effect and provision of French Drains at this location.

Excavation Slopes

Excavations that extend to or below a depth of 5-ft below construction elevations will require the site work contractor to develop a trench safety plan. Any such designs and safety plans should be developed in accordance with all applicable current Occupational Safety and Health Administration (OSHA) guidelines.

Drainage

Ground water seepage was not encountered in the borings at the time of drilling. However, minor ground water seepage may be encountered within the proposed building foundations and grading excavations at the time of construction, especially after periods of heavy precipitation. **Small quantities of seepage may be handled by conventional sump and pump methods of dewatering.**

Temporary Drainage Measures

Temporary drainage provisions should be established, as necessary, to minimize water runoff into the construction areas. If standing water does accumulate, it should be removed by pumping as soon as possible.

Adequate protection against sloughing of soils should be provided for workers and inspectors entering the excavations. This protection should meet O.S.H.A. and other applicable building codes.

Temporary Construction Slopes

Temporary slopes on the order of 1.5H to 1V may be provided for excavations through Strata I sandy clays.

Fill slopes on the order of 1.5H to 1V may be used provided a) the fill materials are compacted as recommended and b) the slopes are temporary.

Fill slopes should be compacted. Compacting operations shall be continued until the slopes are stable but not too dense for planting on the slopes. Compaction of the slopes may be done in increments of 3 to 5-ft in fill height or the fill is brought to its total height for shallow fills.

Permanent Slopes

Maximum permanent slope of 1V to 3H is recommended in Stratum I clays. In areas where people walk on sloped areas, a slope of 1V to 5H is recommended.

Time of Construction

If the foundation slab is installed during or after an extended dry period, the slab may experience greater movement around the edges when the soil moisture content increases, such as due to rain or irrigation. Similarly, a slab installed during or after a wet period may experience greater movement around the edges during the subsequent drying of the soils.

Control Testing and Field Observation

Subgrade preparation and select structural fill placement should be monitored by the project geotechnical engineer or a representative of InTEC. As a guideline, at least one in-place density test should be **performed for each 3,000 square feet of compacted surface lift.** However, a minimum of three density tests should be performed by InTEC on the subgrade or per lift of compaction. Any areas not meeting the required compaction should be re-compacted and retested until compliance is met.

Foundation Construction and Field Observation

It is recommended that all grade beam excavations be extended to the final grade and grade beams constructed as soon as possible to minimize potential damage to the bearing soils. Exposure to environment may weaken the soils at the bearing level if the foundation excavation remains open for long periods of time. The foundation bearing level should be free of loose soil, ponded water or debris. The bearing level should be inspected by InTEC and approved before placement of concrete.

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusions during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation and replaced prior to placement of concrete.

DRAINAGE AND MAINTENANCE

Final drainage is very important for the performance of the proposed structures and the pavement. Landscaping, plumbing, and downspout drainage is also very important. It is vital that all roof drainage be **transported away from the building** so that no water ponds around the buildings which can result in soil volume change under the buildings. **Plumbing leaks should be repaired as soon as possible in** order to minimize the magnitude of moisture change under the slab. Large trees and shrubs should not be planted in the immediate vicinity of the structures, since root systems can cause a substantial reduction in soil volume in the vicinity of the trees during dry periods.

Adequate drainage should be provided to reduce seasonal variations in moisture content of foundation soils. **All pavement and sidewalks within 10-ft of the structures should be sloped away from the structures to prevent ponding of water around the foundations.** Final grades within 10-ft of the structures should be adjusted to slope away from structures preferably at a minimum slope of 3 percent. Maintaining positive surface drainage throughout the life of the structures is essential.

In areas with pavement or sidewalks adjacent to the new structures, a positive seal must be provided and maintained between the structures and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. **Post-construction movement of pavement and flat-work is not uncommon.** Maximum grades practical should be used for paving and flatwork to prevent areas where water can pond. In addition, allowances in final grades should take into consideration post construction movement of flatwork particularly if such movement would be critical. **Normal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.**

Several factors relate to civil and architectural design and/or maintenance which can significantly affect future movements of the foundation and floor slab systems:

1. Where positive surface drainage cannot be achieved by sloping the ground surface adjacent to the buildings, a complete system of gutters and downspouts should carry runoff water a minimum of 10-ft from the completed structures.

2. Planters located adjacent to the structures should preferably be **self-contained**. Sprinkler mains should be located a minimum of five feet from the building line.

3. Planter box structures placed adjacent to building should be provided with a means to assure concentrations of water are not available to the subsoils stratigraphy.

4. Large trees and shrubs should not be allowed closer to the foundations than a horizontal distance equal to roughly their mature height due to their significant moisture demand upon maturing.

5. Moisture conditions should be maintained **"constant" around the edge of the slabs.** Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

6. **Roof drains should discharge on pavement** or be extended away from the structures. Ideally, roof drains should discharge to storm sewers by closed pipe.

Trench backfill for utilities should be properly placed and compacted as outlined in this report and in accordance with requirements of local City Standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should be prevented from becoming a conduit and allowing an access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water traveling in the trench backfill and entering beneath the structures.

The PVR values estimated and stated under *Vertical Movements* are based on provision and maintenance of positive drainage to divert water away from the structures and the pavement areas. If the drainage is not maintained, the wetted front may move below the assumed twelve feet depth, and resulting **PVR will be much greater than 2 or 3 times the stated values under *Vertical Movements*. Utility line leaks may contribute water and cause similar movements to occur. If drainage is modified in the future or if additional landscaping is done in the vicinity of the structure or if a new structure is constructed in the vicinity of this structure, the effect of such improvements on this project structure should be reevaluated.**

Dry Periods

Close observations should be made around foundations during extreme dry periods to ensure that adequate watering is being provided to keep soil from separating or pulling back from the foundation.

LIMITATIONS

The preliminary analysis and recommendations submitted in this report are based upon the data obtained from a limited number of **five borings**. This report may not reflect the exact variations of the soil conditions across the site.

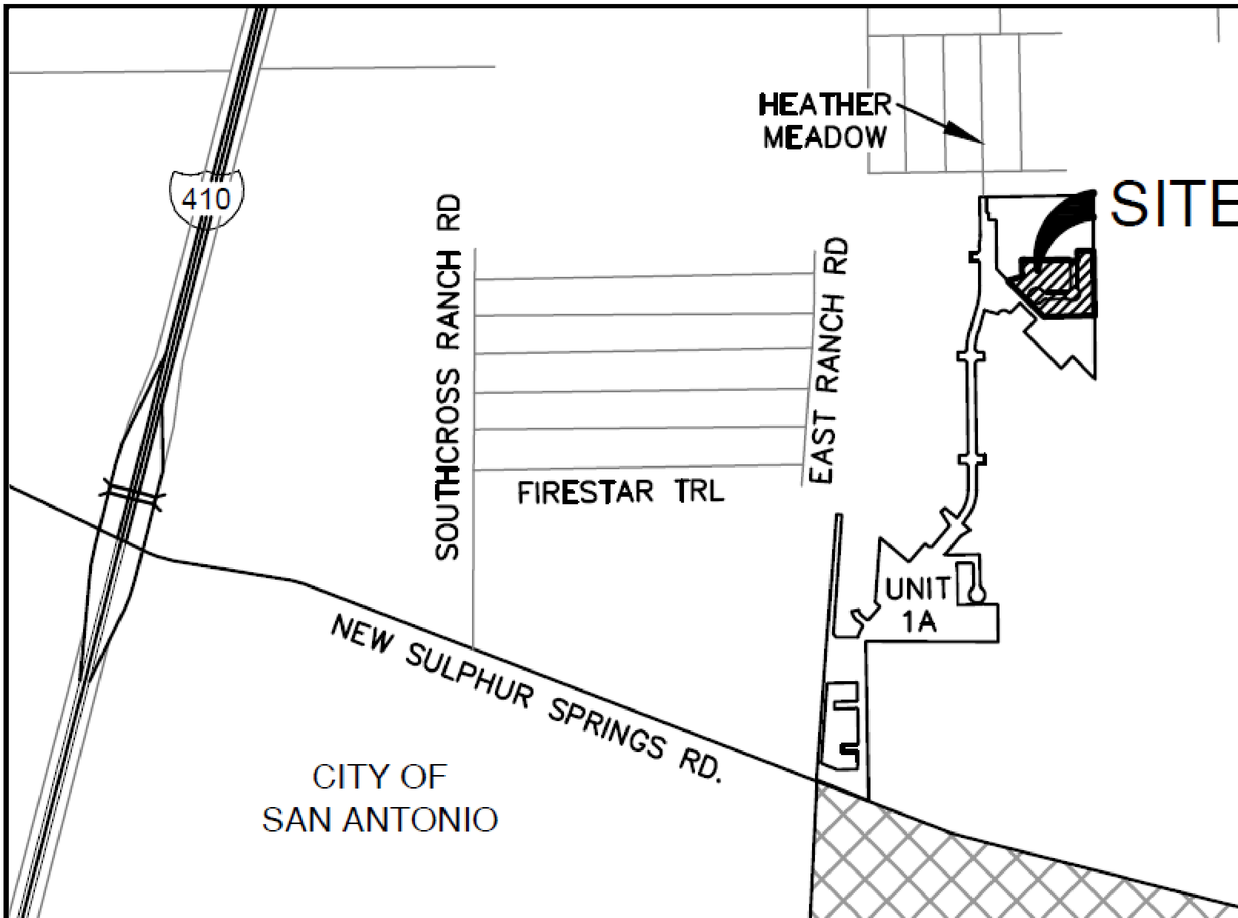
Sandy Clay and Silty Clay soils are anticipated. The information contained in this report and on the Boring Logs are not intended to provide the contractor with all the information needed for proper selection of equipment, means and methods, or for cost and schedule estimation purposes. The use of information contained in the report for bidding purposes should be done at the contractor's option and risk.

The project geotechnical engineer declares that the findings, preliminary recommendations or professional advice contained herein have been made and this report prepared in accordance with generally accepted professional engineering practice in the fields of geotechnical engineering and engineering geology. The recommendations presented in this report should be reevaluated by InTEC if cut and fill operations are performed or if any changes are made to drainage conditions. No other warranties are implied or expressed.

This report is considered to be preliminary in nature and the recommendations presented in this report are for the purposes of preliminary site evaluation and should not be used for final design and construction. We recommend that additional investigation be performed for foundation design recommendations.

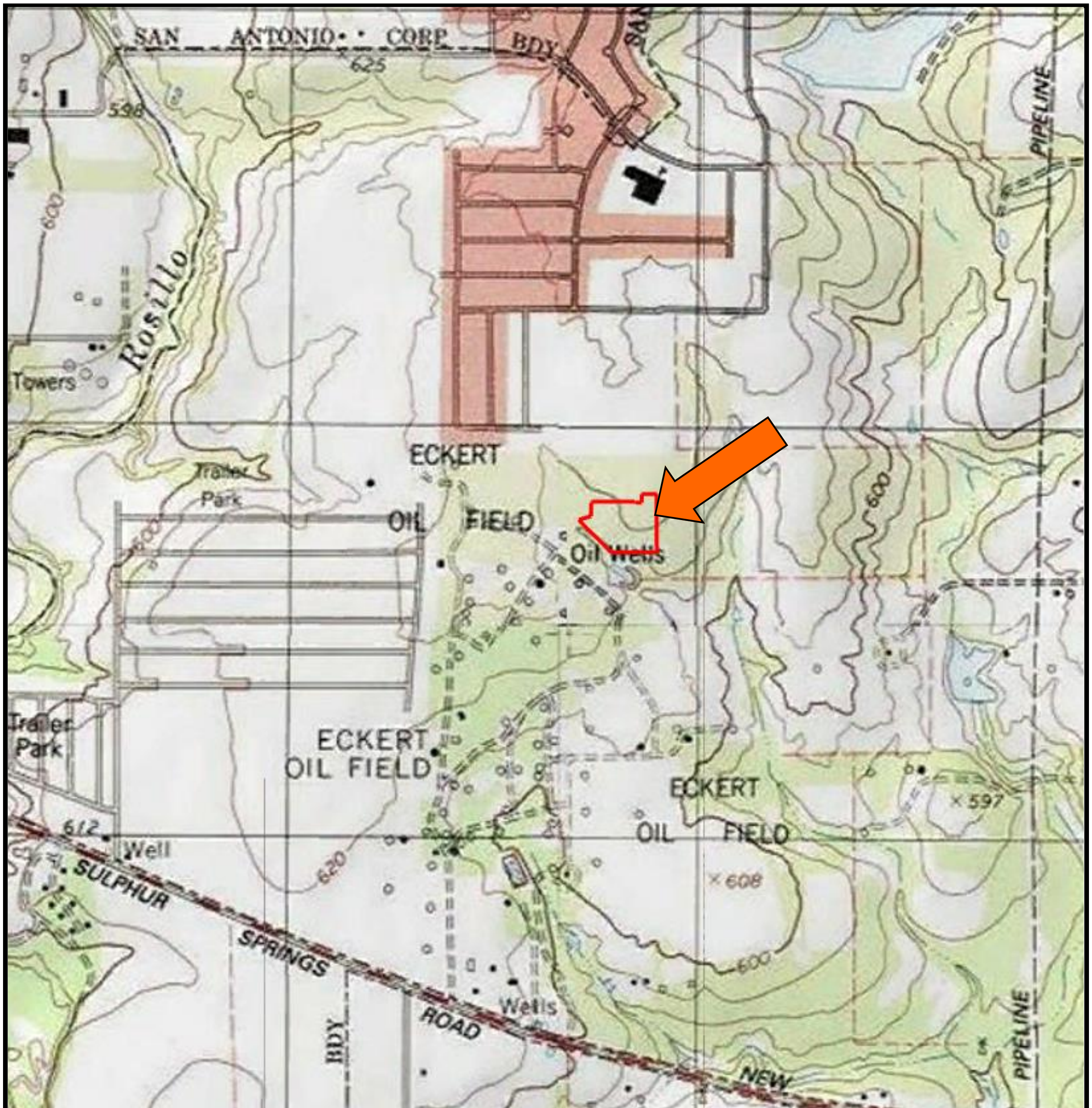
This report has been prepared for the exclusive use of **D. R. Horton, Inc.** for the purposes of **Preliminary Soil Survey for Blue Ridge Ranch Subdivision, Unit 7 in San Antonio, Texas**

Illustration Section



Preliminary Soils Survey Blue Ridge Ranch Subdivision, Unit 7 San Antonio, Texas	**Vicinity Map**	
	InTEC Project Number: **S251007**	Date: 01/09/2025

Preliminary Soils Survey Blue Ridge Ranch Subdivision, Unit 7 San Antonio, Texas	**Aerial Map—Approximate Location**	
	InTEC Project Number: **S251007**	Date: 01/09/2025



Preliminary Soils Survey
Blue Ridge Ranch Subdivision, Unit 7
San Antonio, Texas

Topographic Map—Approximate Location

InTEC Project Number: **S251007**	Date: 01/09/2025

Ewi—Wilcox Group

mostly mudstone with varying amounts of sandstone and lignite; in uppermost and lowermost parts commonly glauconitic; mudstone. massive to thin bedded, some silt and very fine sand laminae, pale brown to yellowish brown in upper part, medium to dark gray, weathering yellowish gray in lower part; sandstone in upper part, medium to fine grained, light gray to pale yellowish brown, in lower part very fine grained, yellowish brown to moderate brown, lignite mostly near middle; lower boundary not readily mappable because of gradation into Midway Group (contact taken from sources shown on Index to Geologic Mapping): thickness about 440-1200 feet

Preliminary Soils Survey Blue Ridge Ranch Subdivision, Unit 7 San Antonio, Texas	**Geologic Map—Approximate Location**	
	InTEC Project Number: **S251007**	Date: 01/09/2025

Bexar County, Texas

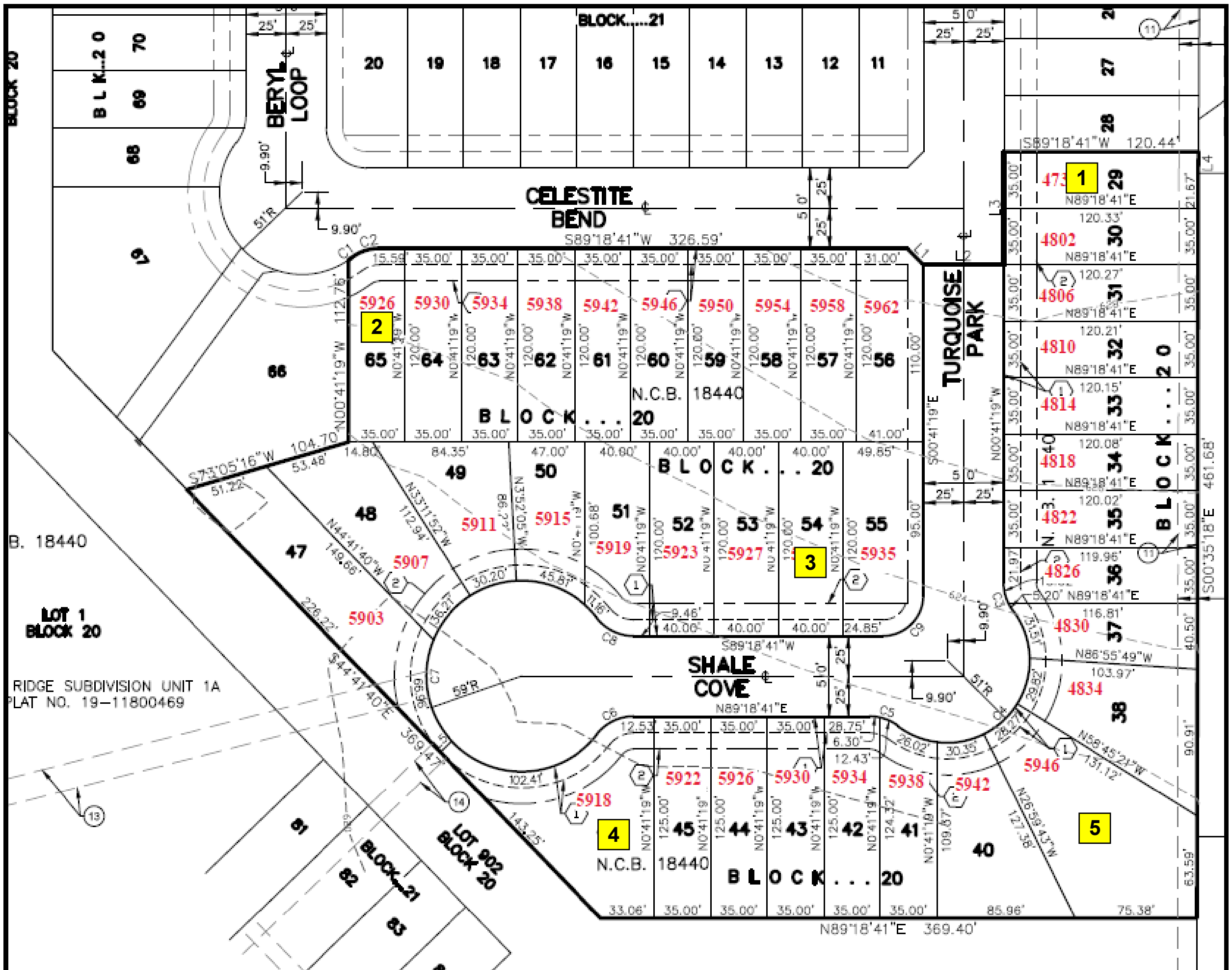
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
SaB—San Antonio clay loam, 1 to 3 percent slopes														
San antonio	100	C	0-10	Clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	95-98-100	95-98-100	95-98-100	70-78- 85	35-40 -45	15-20-25
			10-38	Clay, clay loam	CH, CL	A-7-6	0- 0- 0	0- 0- 0	95-98-100	90-95-100	90-95-100	75-85- 95	48-57 -65	25-32-39
			38-60	Clay loam, sandy clay loam	CH, CL	A-7-6	0- 0- 0	0- 2- 3	92-96-100	90-95-100	90-95-100	70-78- 85	41-51 -60	20-28-35
SaC—San Antonio clay loam, 3 to 5 percent slopes														
San antonio	100	C	0-6	Clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	95-98-100	95-98-100	95-98-100	70-78- 85	35-40 -45	15-20-25
			6-28	Clay, clay loam	CH, CL	A-7-6	0- 0- 0	0- 0- 0	95-98-100	90-95-100	90-95-100	75-85- 95	48-57 -65	25-32-39
			28-60	Clay loam, sandy clay loam	CH, CL	A-7-6	0- 0- 0	0- 2- 3	92-96-100	90-95-100	90-95-100	70-78- 85	41-51 -60	20-28-35

Preliminary Soils Survey
Blue Ridge Ranch Subdivision, Unit 7
San Antonio, Texas

Soil Map—Approximate Location

InTEC Project Number: **S251007**

Date: 01/09/2025

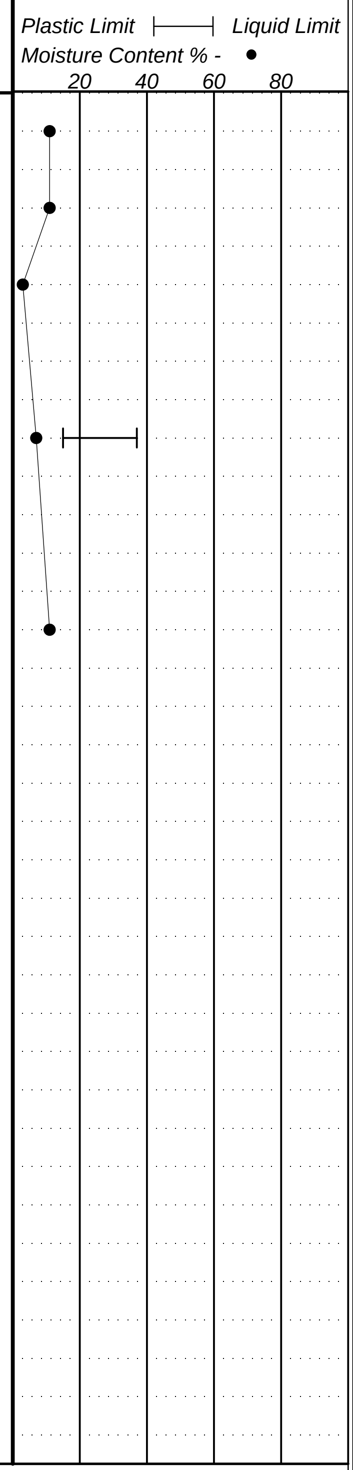


Preliminary Soils Survey Blue Ridge Ranch Subdivision, Unit 7 San Antonio, Texas	**Approximate Boring Locations**	
	InTEC Project Number: **S251007**	Date: 01/09/2025

PROJECT: **Blue Ridge Ranch, Unit 7** **PROJECT NO:** **S251007**
LOCATION: San Antonio, Texas **DATE:** 01/14/2025
CLIENT: D. R. Horton, Inc.

BORING NO. B-1

DEPTH (feet)	SYMBOL	SAMPLES	SOIL DESCRIPTION	% MINUS 200 SIEVE	UNIT DRY WT IN PCF	S.S. BY P.P	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
0			Stiff to Very Stiff Dark Brown Sandy Clay							
		SS					14			
		SS					20			
			Tan Silty Clay -with Gravel and Chert from 4 to 6-ft -with Marl Seams							
5		AU								
		AU							37	22
10										
		AU								
15										
20										
25										
30										
35										



Notes:

Ground Water Observed: No

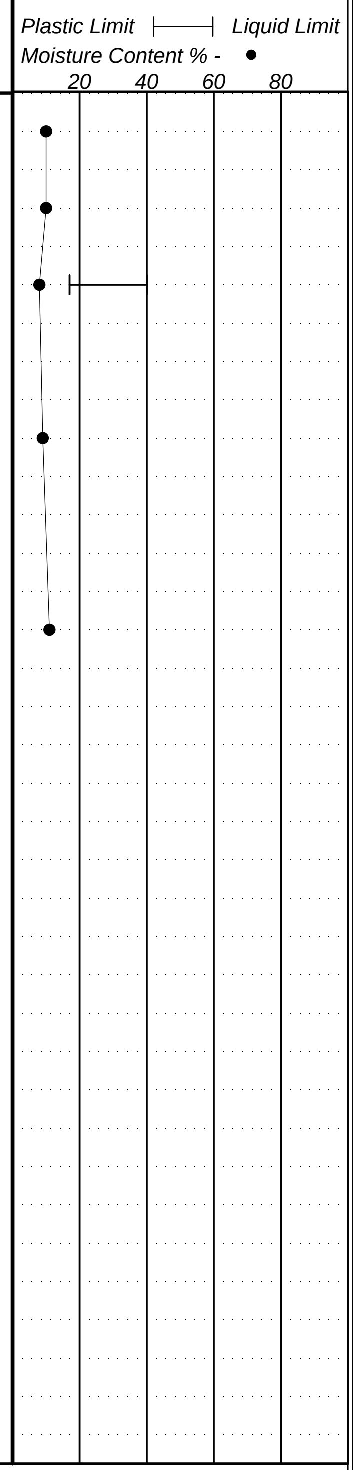
Completion Depth (ft): 15

S.S by P.P - Shear Strength in TSF by Hand Penetrometer
S.S. - Split Spoon Sample
S.T. - Shelby Tube Sample
HA - Hand Auger
AU - Auger Sample

PROJECT: **Blue Ridge Ranch, Unit 7** **PROJECT NO:** **S251007**
LOCATION: San Antonio, Texas **DATE:** 01/14/2025
CLIENT: D. R. Horton, Inc.

BORING NO. B-2

DEPTH (feet)	SYMBOL	SAMPLES	SOIL DESCRIPTION	% MINUS 200 SIEVE	UNIT DRY WT IN PCF	S.S. BY P.P	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
0			Stiff to Very Stiff Dark Brown Sandy Clay							
		SS					17			
		SS					21			
5		SS	Tan Silty Clay -with Gravel and Chert from 4 to 6-ft -with Marl Seams				33		40	23
10		AU								
15		AU								
20										
25										
30										
35										



Notes:

Ground Water Observed: No

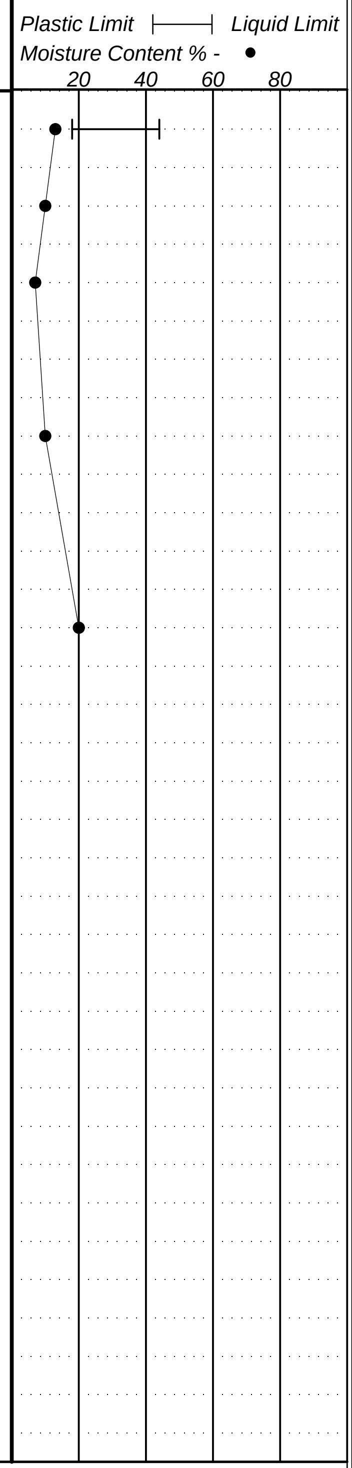
Completion Depth (ft): 15

S.S by P.P - Shear Strength in TSF by Hand Penetrometer
S.S. - Split Spoon Sample
S.T. - Shelby Tube Sample
HA - Hand Auger
AU - Auger Sample

PROJECT: **Blue Ridge Ranch, Unit 7** **PROJECT NO:** **S251007**
LOCATION: San Antonio, Texas **DATE:** 01/14/2025
CLIENT: D. R. Horton, Inc.

BORING NO. B-3

DEPTH (feet)	SYMBOL	SAMPLES	SOIL DESCRIPTION	% MINUS 200 SIEVE	UNIT DRY WT IN PCF	S.S. BY P.P	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
0			Stiff to Very Stiff Dark Brown Sandy Clay							
		SS					12		44	26
		SS					18			
5		SS	Tan Silty Clay -with Gravel and Chert from 4 to 6-ft -with Marl Seams				27			
		AU								
10										
		AU								
15										
20										
25										
30										
35										



Notes:

Ground Water Observed: No

Completion Depth (ft): 15

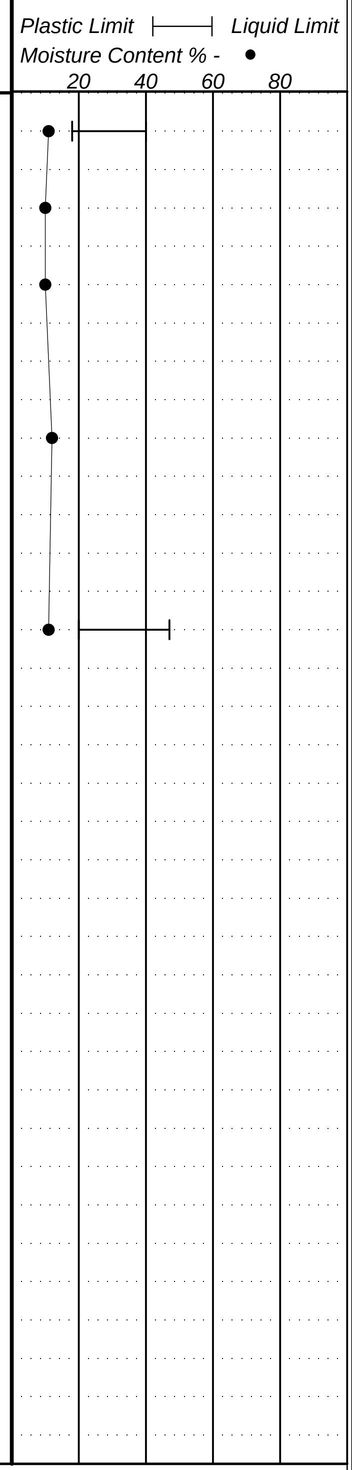
S.S by P.P - Shear Strength in TSF by Hand Penetrometer
S.S. - Split Spoon Sample
S.T. - Shelby Tube Sample
HA - Hand Auger
AU - Auger Sample

PROJECT: **Blue Ridge Ranch, Unit 7** **PROJECT NO:** **S251007**
LOCATION: San Antonio, Texas **DATE:** 01/14/2025
CLIENT: D. R. Horton, Inc.

inTEC

BORING NO. B-4

DEPTH (feet)	SYMBOL	SAMPLES	SOIL DESCRIPTION	% MINUS 200 SIEVE	UNIT DRY WT IN PCF	S.S. BY P.P	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
0			Stiff to Very Stiff Dark Brown Sandy Clay							
		SS					13		40	22
		SS					21			
5		SS	Tan Silty Clay -with Gravel and Chert from 4 to 6-ft -with Marl Seams				34			
10		AU								
15		AU							47	27
20										
25										
30										
35										



Notes:

Ground Water Observed: No

Completion Depth (ft): 15

S.S by P.P - Shear Strength in TSF by Hand Penetrometer
S.S. - Split Spoon Sample
S.T. - Shelby Tube Sample
HA - Hand Auger
AU - Auger Sample

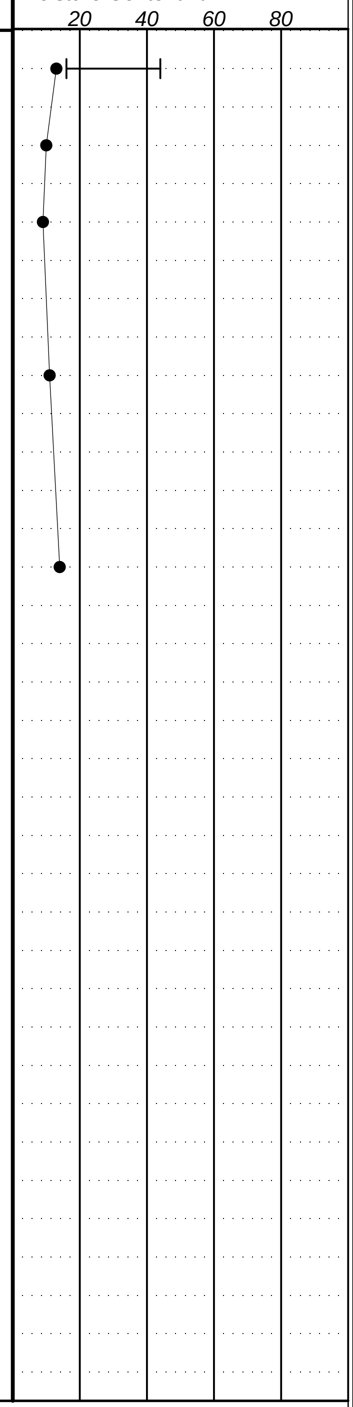
PROJECT: **Blue Ridge Ranch, Unit 7** **PROJECT NO:** **S251007**
LOCATION: San Antonio, Texas **DATE:** 01/14/2025
CLIENT: D. R. Horton, Inc.

inTEC

BORING NO. B-5

DEPTH (feet)	SAMPLES	SOIL DESCRIPTION	% MINUS 200 SIEVE	UNIT DRY WT IN PCF	S.S. BY P.P	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
0		Stiff to Very Stiff Dark Brown Sandy Clay							
	SS					14		44	28
	SS					17			
5	SS	Tan Silty Clay -with Gravel and Chert from 4 to 6-ft -with Marl Seams				20			
10	AU								
15	AU								
20									
25									
30									
35									

Plastic Limit ├──┤ *Liquid Limit*
Moisture Content % - ●



Notes:

Ground Water Observed: No

Completion Depth (ft): 15

S.S by P.P - Shear Strength in TSF by Hand Penetrometer
S.S. - Split Spoon Sample
S.T. - Shelby Tube Sample
HA - Hand Auger
AU - Auger Sample

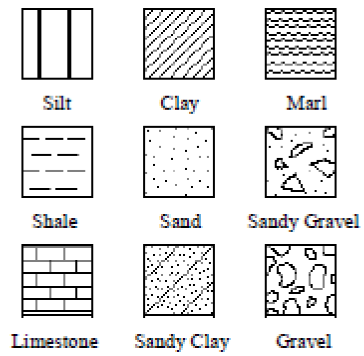
KEY TO CLASSIFICATIONS AND SYMBOLS

Soil Fractions

Component	Size Range
Boulders	Greater than 12"
Cobbles	3" - 12"
Gravel	3" - #4 (4.76mm)
Coarse	3" - ¾"
Fine	¾" - #4
Sand	#4 - #200 (0.074mm)
Coarse	#4 - #10 (2.00mm)
Medium	#10 - #40 (0.42mm)
Fine	#40 - #200 (0.074mm)
Silt and Clay	Less than #200

Soil or Rock Types

(Shown in symbols column)
(Predominate Soil Types Shown Heavy)



TERMS DESCRIBING SOIL CONSISTENCY

Description (Cohesive Soils)	Unconfined Compression TSF	Blows/Ft. Std. Penetration Test	Description (Cohesionless Soils	Blows/Ft. Std. Penetration Tests
Very Soft	0.25	<2	Very Loose	0 – 4
Soft	0.25 – 0.50	2 – 4	Loose	4 – 10
Firm	0.50 – 1.00	4 – 8	Medium Dense	10 – 30
Stiff	1.00 – 2.00	8 – 15	Dense	30 – 50
Very Stiff	2.00 – 4.00	15 – 30	Very Dense	50
Hard	>4.00	>30		

SOIL STRUCTURE

Calcareous	Containing deposits of calcium carbonate; generally nodular.
Slickenside	Having inclined planes of weakness that are slick and glossy in appearance.
Laminated	Composed of thin layers of varying color and texture.
Fissured	Containing shrinkage cracks frequently filled with fine sand or silt. Usually more or less vertical.
Interbedded	Composed of alternate layers of different soil types.
Jointed	Consisting of hair cracks that fall apart as soon as the confining pressure is removed.
Varved	Consisting of alternate thin layers of sand, silt or clay formed by variations in sedimentations during the various seasons of the year, of often exhibiting contrasting colors when partially dried. Each layer is generally less than ½" in thickness.
Stratified	Composed of, or arranged in layers (usually 1 inch or more)
Well-graded	Having a wide range of grain sizes and substantial amount of all intermediate particle sizes.
Poorly or Gap-graded	Having a range of sizes with some intermediate sizes missing.
Uniformly-graded	Predominantly of one grain size.

Appendix

Preliminary Soils Survey Blue Ridge Ranch Subdivision, Unit 7 San Antonio, Texas	InTEC Project Number: **S251007**	Date: 01/09/2025

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org