



**Subsurface Exploration and Foundation Analysis
Proposed New Lift Station
Guajolote Ranch Subdivision
San Antonio, Texas**

InTEC Project No. S261713
March 09, 2026



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March 09, 2026

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Attention: **Mr. Roy Olivarez**
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Re: Subsurface Exploration and Foundation Analysis
Proposed New Lift Station
Guajolote Ranch Subdivision
San Antonio, Texas

InTEC Project No. S261713

Ladies & Gentlemen:

Integrated Testing and Engineering Company of San Antonio (InTEC) has completed a **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



InTEC of SAN ANTONIO
F-7623

04/14/2026

EXECUTIVE SUMMARY

The soil conditions at the location of the **proposed new Lift Station at Guajolote Ranch Subdivision in San Antonio, Texas** were explored by **drilling four borings to depths of 7 to 50 feet**. Laboratory tests were performed on selected specimens to evaluate the engineering characteristics of various soil strata encountered in the borings.

- The results of our exploration, laboratory testing, and engineering evaluation indicate the soils at the site consist of Stratum I dark brown clays to limited thickness underlain by Stratum II weathered limestone to limestone with caliche, gravel, and silty clay seams, which is underlain by gray marl and gray clay strata.
- **Estimated potential vertical rise (PVR)** using TxDOT Test Method TEX-124-E ranges from **1 to 1 ¼ inches** at the current site grades. These values are based on standard modeling assumptions and **should not be interpreted as exact predictions of future movement**.
- Recommendations for lift station design and construction are presented for the following installation methods: Open-cut excavation, Retained excavation, and Caisson installation. Slab on grade and mat foundation recommendations are presented for generator and equipment pads.
- **Groundwater seepage was encountered at an approximate depth of 42-ft in Boring B-1 at the time of drilling.**
- Asphalt and concrete pavement recommendations are presented.
- The effectiveness of the recommended foundation system depends on **proper drainage, moisture control, construction practices**, and long-term **post-construction maintenance**. Some slab tilt and cosmetic cracking may still occur due to natural variability in subsurface conditions and soil behavior.

This summary is intended for general guidance only. **Detailed descriptions, analysis, assumptions, and recommendations** are included in the full report and should be reviewed in their entirety. The contents of this report are based on **site conditions at the time of exploration**, and **any deviation from those conditions may require reevaluation** by the geotechnical engineer.

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INTRODUCTION

General

This report presents the results of our **subsurface exploration and foundation analysis at the location of the proposed new Lift Station at Guajolote Ranch Subdivision in San Antonio, Texas**. This project was authorized by **Mr. Roy Olivarez**.

Purpose and Scope of Services

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

- 1) drilling and sampling of four borings – to depths of 7 to 50 feet;
- 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 recommendations for the design and construction phase of the project;
- 9) preparation of a written geotechnical engineering report for use by the members of the design team in their preparation of design, contract documents and specifications.

The Scope of Services **did not include either slope stability analysis 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 the new Lift Station at Guajolote Ranch Subdivision in San Antonio, Texas.

- The proposed lift station project consists of a wet well to be founded approximately 41-ft below existing grade elevation, equipment & generator pads, light poles, and the associated parking and drive areas.
- Lift station structural information is not available for our review at this time.
- Wet Well elevation information:
 - Existing Grade Elevation: 1314
 - Finish Grade Elevation: 1318.5
 - Anticipated Fill thickness: 4.5-ft
 - Top of Wet Well Elevation: 1319.3
 - Invert of Wet Well Elevation: ~ 1273 - 1278
- Limestone was encountered in the borings. Karst features can form in limestone, dolomite, or gypsum by dissolution. A geophysical study of the site would indicate the presence and potential impact of Karst features, caves, or significant cavities on the building performance and construction delays. A geophysical investigation could be performed if evaluation of potential karst features is considered necessary for design. Geophysical study is not within the scope of this investigation.

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.

Four soil borings were drilled at the project site. The borings were **drilled to depths of 7 to 50 feet below the presently existing ground surface**. The boring locations were selected by the project civil engineer and established in the field by the drilling crew using normal taping procedures.

Drilling and Sampling

The soil borings were performed with a truck mounted 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 – **Groundwater seepage was encountered at an approximate depth of 42-ft in Boring B-1 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 Log

A field log was prepared for the borings. The logs 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, the logs include 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 5** included in the Illustration section. A key to classification terms and symbols used on the logs is presented on **Plate 6.**

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 Testing 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

In summary, the following tests presented were conducted in the laboratory to evaluate the engineering characteristics of the subsurface materials. The results of all these tests are presented on the Boring Logs. These laboratory test results were used to classify the soils encountered 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 to four 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 the **Boring Log, Plates 2 thru 5**.

The engineering characteristics of the underlying soils, based on the results of the laboratory tests performed on selected samples, are summarized, and presented in the following paragraph.

Dark brown clays, gray clay, gray marl, tan weathered limestone to limestone, and light tan weathered limestone to limestone underlie the project site. The soils are moderately plastic to highly plastic with tested liquid limit values varying from 18 to 34 and plasticity index values ranging from 4 to 20. The results of Standard Penetration Tests performed within these soils varied from 31 to greater than 50 blows per foot.

Soil stratigraphy may vary across the site. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of InTEC. We may revise the recommendations after evaluating the significance of the changed conditions. If the construction crew encounters, at the time of grade beam excavations or during utility trench excavations, conditions such as abundant gravel, fill material, or sand seams, please contact InTEC.

Ground Water Observations

Groundwater seepage was encountered at an approximate depth of 42-ft in Boring B-1 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 hole. Ground water levels will fluctuate with seasonal climatic variations and changes in the land use.

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

FOUNDATIONS ON EXPANSIVE SOIL

General

Subsurface conditions at the project site consist primarily of **limestone and marl strata overlain locally by gray clay soils**. Limestone formations generally exhibit minimal shrink-swell potential; however, the clay soils encountered above and between the limestone layers may undergo **volume changes with variations in moisture content**.

Structures founded on or within clay soils may therefore be subjected to **uplift or differential movements associated with seasonal moisture changes**. The magnitude of these movements depends on the plasticity of the clay soils, the thickness of the clay strata, and changes in soil moisture conditions over time.

Project Implications

Based on the subsurface conditions encountered:

- Foundations bearing directly on **limestone** are expected to experience **minimal shrink-swell related movement**.
- Foundations bearing within **clay strata**, such as may occur at the **lift station location**, could experience **minor volume changes** if moisture conditions vary significantly.
- Moisture variations may occur due to rainfall infiltration, changes in surface drainage, irrigation, or leaking utilities.

Moisture Control

Because expansive soil behavior is largely controlled by moisture fluctuations, the following measures are important to reduce potential foundation movement:

- Maintain **positive drainage away from structures**.
- Avoid ponding of surface water near foundations.
- Control irrigation and landscaping adjacent to foundations.
- Prevent leaks in underground utilities.
- Maintain consistent moisture conditions around structures.

With proper site preparation and moisture control, the potential effects of expansive soils on the proposed structures can generally be **managed within acceptable performance limits**.

A general discussion of expansive soil behavior is provided in **Appendix A** for reference.

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DESIGN ENGINEERING ANALYSIS

Foundation Design Considerations

A review of the borings and laboratory test results indicates that the following factors will influence foundation design and construction at this site:

1. The subsurface conditions generally consist of Stratum I dark brown clays of limited thickness, underlain by Stratum II weathered limestone to limestone containing caliche, gravel, and silty clay seams, which in turn is underlain by gray marl and gray clay strata.
2. Structures supported on or within the underlying soils may be subjected to potential vertical movements on the order of approximately 1 to 1¼ inches.
3. Select fill should be placed and compacted in accordance with the recommendations provided under Select Fill in the Construction Guidelines section of this report.
4. Groundwater seepage was encountered at an approximate depth of 42 feet in Boring B-1 at the time of drilling.

Vertical Movements

The **Potential Vertical Rise (PVR)** for slab-on-grade construction at the proposed structure location was estimated using **Texas Department of Transportation Procedure TxDOT-124-E**. This method utilizes **liquid limit, plasticity index, and in-situ moisture content data** obtained from soils within the **seasonally active zone**, which is estimated to extend to a depth of approximately **10 feet at the project site**.

The estimated PVR value assumes that the proposed floor system applies a **sustained surcharge load of approximately 1.0 pound per square inch (psi)** to the subgrade soils.

Based on this analysis, **potential vertical movement on the order of approximately 1 to 1¼ inches** was estimated at the **existing ground surface elevation**. These movements could occur if the underlying soils experience moisture increases from **average moisture conditions to wet moisture conditions**.

The PVR estimates are based on the **existing site grades**. If **cut or fill operations exceeding approximately 6 inches** are performed, the estimated PVR values may change. Higher PVR values may also occur in areas where **surface water is allowed to pond for extended periods**.

Where the **existing ground surface is below the proposed finished floor elevation**, **compacted crushed limestone select fill** should be used to raise grades. The select fill should be placed and compacted as recommended under **Select Fill** in the **Construction Guidelines** section of this report. Each lift of fill should be **tested for compaction compliance and approved by InTEC** prior to placement of subsequent lifts.

Site Grading and Pad Preparation

A review of the existing and proposed site grades indicates that finished grades across the project site will be raised approximately **2 to 6 feet above existing ground surface**.

Slab-on-grade foundations are anticipated for the proposed **generator and equipment pads**.

Based on the subsurface conditions encountered, the following **earthwork procedures** are recommended:

- Remove **Stratum I clay soils** within the building pad areas to expose the underlying **limestone stratum**. The prepared building pad should extend a **minimum of 3 feet beyond the perimeter grade beams**.
- Excavate the pad areas sufficiently to allow placement of a **minimum 24-inch thickness of uniform select fill** beneath the proposed slabs.
- **Select fill** should be used to raise grades within the building pad areas. **On-site milled material** may be used provided it meets the select fill requirements specified in this report.
- Select fill should be placed in **maximum 6-inch compacted lifts** and compacted to at least **95 percent of the maximum dry density**, as determined by **ASTM D698 (Standard Proctor)**.
- Compaction should be performed at a moisture content between **1 percent below optimum and 3 percent above optimum moisture content**.

FOUNDATION RECOMMENDATIONS

General

The following foundation recommendations are based on the results of the subsurface exploration, laboratory testing, and engineering analyses performed for this project, as well as our experience with similar soil conditions in the area.

Proper **surface drainage** is critical for satisfactory performance of the proposed structures and pavements. Surface water should be directed away from structures and paved areas as rapidly as practical. Positive drainage should be maintained at all times to prevent ponding of water adjacent to foundations.

Where surface drainage is limited, **drainage structures such as swales, catch basins, pipes, or area drains** may be required to remove surface water. In locations where water may infiltrate subsurface granular layers and migrate laterally, **subsurface drainage systems (e.g., French drains)** may be required to collect and discharge the water to suitable drainage outlets.

Subsurface conditions encountered during construction may differ from those observed in the borings. If soil conditions encountered in foundation excavations differ from those described in this report, **InTEC should be notified so that the foundation recommendations can be reviewed and revised if necessary.**

Foundation Selection

The type and depth of foundation suitable for a given structure depend on several factors, including:

- subsurface soil and rock conditions
- site grading and drainage conditions
- structural loads
- tolerable movements for the structure
- construction considerations and cost

Based on the subsurface conditions encountered at this site, the following foundation systems were evaluated:

- Slab-on-grade foundations for generator and equipment pads

- Mat foundation for the lift station structure
- Straight shaft drilled piers for light pole foundations

The recommended foundation systems and design parameters are described in the following sections.

LIFT STATION FOUNDATIONS

Subsurface Conditions

Based on the boring performed near the lift station location, the subsurface profile consists of gray marl overlying gray clay at the anticipated foundation depth.

Approximate elevations are summarized below:

Item	Elevation
Existing Grade	~1314
Finished Grade	1318.5
Estimated Fill	~4.5 ft
Top of Wet Well	1319.3
Invert Elevation	~1273–1278
Gray Marl	~1277–1291
Gray Clay	~1264–1277
Groundwater Observation	~1272

The lift station mat foundation is anticipated to bear within the **gray clay stratum**.

Groundwater

Groundwater seepage was observed at approximately **42 feet below ground surface** during drilling. Short-term observations made during drilling do not necessarily represent stabilized groundwater levels. Groundwater levels may fluctuate due to:

- seasonal rainfall
- site drainage conditions

- changes in land use

The contractor should verify groundwater conditions prior to excavation and be prepared to implement temporary **dewatering measures** if required

Foundation Parameters

It is our understanding that the lift station structure will be supported on a **mat foundation**.

Recommended design parameters are:

Parameter	Value
Net Allowable bearing capacity	2,500 psf
Subgrade modulus	150 pci
Factor of Safety	2.5

These values assume the bearing surface consists of **competent gray clay** and that the foundation excavation is protected from disturbance.

Foundation subgrade should be **observed by InTEC prior to placement of reinforcing steel and concrete**.

Excavation options for the lift station include: (a) open-cut, (b) retained excavation, and (c) caisson. These excavation procedures and their effect on design and construction of the lift station are discussed in the following paragraphs.

OPEN-CUT INSTALLATION FOR LIFT STATION

Open-cut excavation is one method of constructing below-grade structures such as lift stations. This method typically provides the greatest construction access and generally has the least impact on structural design. However, it requires sufficient site area for excavation slopes and temporary construction access.

The following considerations apply to open-cut excavation at this site.

Sideslope Stability Temporary excavation slopes of approximately **1H:1V** may be used in limestone and marl materials where space permits. Excavation slopes should be evaluated and adjusted by the contractor based on observed field conditions.

Localized instability or sloughing may occur where weaker materials or seams are encountered. If unstable conditions develop, corrective measures such as flattening slopes or installing temporary shoring may be required.

Adequate berm space should be provided at the crest of slopes to accommodate minor sloughing during construction.

Dewatering may typically be controlled using **localized sump pumping** or similar temporary dewatering methods.

The contractor should verify groundwater conditions prior to excavation and provide appropriate dewatering measures as necessary.

Bottom Stability Based on the subsurface conditions encountered, the excavation bottom is expected to consist of **marl or limestone materials**, which should provide adequate stability for construction.

However, the excavation base should be protected from **disturbance, excessive wetting, or construction traffic**. If soft or unstable conditions are encountered at the excavation bottom, they should be evaluated by the geotechnical engineer.

Lateral Earth Pressures Lift station walls constructed using open-cut methods will be subjected to lateral earth pressures from placed backfill materials.

The magnitude of these pressures depends primarily on:

- type of backfill material
- compaction effort
- wall rigidity
- construction method

Granular backfill materials are generally preferred because they drain more readily and produce lower lateral earth pressures than cohesive soils.

Recommended backfill materials include sands or select granular soils with **less than 25 percent passing the No. 200 sieve**.

Cohesive soils with **plasticity indices greater than approximately 20** are generally not recommended as backfill materials adjacent to structure walls.

Backfill should typically be placed in **lifts not exceeding approximately 12 inches** and compacted using vibratory or pneumatic equipment.

Equivalent fluid pressures for various backfill materials are provided in **Table 2**.

Table No. 2 – Equivalent Fluid Density Values

Soil Type	Compactive Effort (%)	Equivalent Fluid Density (pcf)	
		Above Water Table	Below Water Table*
Select cohesive backfill (7 <= PI <= 20)	88 to 92	65	95
	93 to 98	85	105
Non-select cohesive backfill (PI > 20)	88 to 92	75	105
	93 to 98	100	115
Bank Sand (Fines content < 25%)	88 to 92	55	89
	93 to 98	75	98
* These magnitudes include a water component, if applicable			

Surcharge loads adjacent to the lift station excavation, such as construction equipment or stored materials, should be considered in the design of the structure walls.

Lateral surcharge pressures may typically be estimated as **0.4q to 0.5q**, where *q* is the applied surcharge load.

Uplift Based on the subsurface conditions encountered during drilling, a permanent groundwater table is not anticipated at the lift station elevation. Therefore, **hydrostatic uplift forces are not expected to control the design**. However, temporary groundwater conditions during construction should be considered.

RETAINED EXCAVATION

Where site constraints limit the use of open-cut excavation, a **retained excavation system** may be used.

Retained excavation systems may include:

- soldier piles with lagging
- drilled shaft walls
- sheet pile systems

Driven sheet piles may be difficult to install at this site due to the presence of **limestone strata**.

Temporary bracing systems such as **cross-lot bracing or tiebacks** may be used depending on excavation geometry.

Bottom stability considerations are similar to those described for open-cut excavation.

Lateral earth pressure design for retained excavations depends on:

- wall geometry
- bracing conditions
- soil stratification
- groundwater conditions

Where structural walls are cast directly against the retention system, lateral earth pressures are typically governed by **in situ soil conditions** rather than placed backfill.

CAISSON INSTALLATION FOR LIFT STATION

The caisson construction method eliminates the need for large excavation slopes or temporary shoring.

Under this approach, a cylindrical excavation is drilled and a reinforced concrete structure is constructed within the excavation.

Typical diameters for lift station caisson installations range from 10 to 12 feet.

The cylindrical wall acts as a retaining structure and should be designed for lateral earth pressures using the parameters provided in Table 2.

This method reduces surface disturbance but requires careful control of excavation alignment and depth during drilling.

Light Pole Foundation

Straight shaft drilled piers may be used to support the proposed light poles. It is our understanding that the light poles will be constructed approximately at the existing ground surface elevation or compacted select fill.

Based on the subsurface conditions encountered in the borings, **weathered limestone to limestone containing caliche, gravel, and silty clay seams** is expected at the anticipated foundation depth.

Foundation Depth

- Drilled piers **embedded approximately 7 feet into limestone** may be used to support the proposed light poles.
- If deeper embedment depths are required based on structural loading, InTEC should be contacted to review the design.

Bearing Capacity

Drilled piers bearing in limestone may be designed using the following parameters:

- **Allowable End Bearing Capacity:** 15,750 psf
- **Allowable Skin Friction:** 1,600 psf side resistance (for the 7-ft embedded into limestone)

These values assume the pier bases are founded in **competent limestone** and that the excavation base is not disturbed prior to concrete placement.

Uplift Forces

Moisture variations in the near-surface expansive soils may result in vertical soil movements that can generate **uplift forces along drilled pier shafts**.

The uplift force acting along the shaft may be estimated using:

$$F_u = 20d$$

Where:

- **F_u** = uplift force (kips)
- **d** = shaft diameter (feet)

Each drilled pier should be reinforced with sufficient **tension steel** to resist the **net uplift force minus the sustained structural load** acting on the pier. As a minimum, the pier reinforcement should consist of **tension steel equal to 1 percent of the pier cross-sectional area**, or greater if required by structural design.

Lateral Resistance

The lateral capacity and deflection behavior of the drilled piers may be evaluated using **LPILE or similar soil-structure interaction software**.

Recommended soil (LPILE) parameters for preliminary analysis are provided in **Table 3**.

Table No. 3 – L-Pile Parameters

Depth Range, Feet	Shear Strength, TSF	Soil Modulus, PCI	ε 50	γ PCF
1 – 10	2.5	1500	0.001	120
Friction angle, φ = 33°				

Generator and Equipment Foundations

Stiffened grid beam-and-slab foundations or mat foundations may be used to support the proposed generator and equipment pads provided the recommendations in this report are followed.

These foundation systems are considered feasible provided the anticipated potential vertical movements described in the Vertical Movements section are acceptable to the project design team.

Prior to foundation construction:

- The subgrade should be proof-rolled to evaluate near-surface soil conditions.
- Any unstable or soft areas observed during proof-rolling should be removed and replaced with properly compacted select fill.
- All recommendations presented in the Construction Guidelines section of this report should be followed.

For design purposes, the foundation system may be analyzed assuming that the primary structural loads are carried by the grade beams.

Grade beams or mat foundations should be founded at least 18 inches below final grade elevation and supported on properly compacted select fill or competent natural soils.

Recommended design parameters for slab-on-grade foundations are presented in Table 4.

Table No. 4 – Stiffened Grid Type Beam and Slab Foundation Parameters

Soil Condition	Net Allowable Bearing Capacity (psf)	Unconfined Compressive Strength (tsf)	Design Plasticity Index Value	Soil Support Index	Climatic Rating
Compacted Subgrade (PVR of 1 to 1 ¼ inches)	2,000	1.0	22	0.72	17

Notes:

- Grade beams should be founded **on or within properly compacted select fill**.
- The allowable bearing capacity values listed above are applicable for **foundations founded a minimum of 18 inches below final grade elevation**.
- If **marl or limestone** is encountered at depths shallower than 18 inches, **embedment of at least 6 inches into the limestone stratum** may be considered adequate to achieve the recommended bearing capacity.
- The **bearing stratum should be observed and verified by InTEC** prior to placement of reinforcing steel and concrete.
- A **minimum grade beam width of 12 inches** is recommended.

Mat Foundation

Mat foundations may be supported on **properly prepared building pads consisting of compacted select fill**.

The following design parameters may be used for mat foundation design:

- **Net Allowable Bearing Capacity:** 2,750 psf
- **Subgrade Modulus:** 250 pci
- **Factor of Safety:** 2.5

These values assume the building pad is prepared in accordance with the recommendations presented in the **Site Grading and Pad Preparation** and **Construction Guidelines** sections of this report.

To reduce the potential for differential movement associated with expansive soils, the building pad should include a **minimum of 2 feet of properly compacted select fill beneath the entire building footprint**, including areas beneath thickened mat or grade beam zones.

The structural engineer should design the mat foundation to accommodate the **anticipated soil movements described in the Vertical Movements section of this report**.

The thickness of the select fill layer should remain uniform beneath the structure unless modifications are reviewed and approved by the geotechnical engineer.

Seismic Design Criteria

The following seismic design criteria are presented based on the International Building code 2021 (IBC 2021) Section 1613 - Earthquake Loads. These criteria include the seismic site class and the spectral acceleration values and presented in Table No. 5.

Table No. 5 – Seismic Design Criteria

Site Class Site class definition was determined based on Standard Penetration Test values – Table 1613.5.2 IBC 2021	D
Maximum considered earthquake 0.2 sec spectral response acceleration for site class C - Figure 1613.5(1) IBC 2021	$S_s = 0.07g$
Maximum considered earthquake 1.0 sec spectral response acceleration for site class C – Figure 1613.5(2) IBC 2021	$S_1 = 0.029g$

Note: The 2021 International Building Code (IBC) requires a site soil profile determination based on 100-ft depth for seismic site classification. The seismic site class definition considers that the same soils continue below the maximum depth of our boring. Deeper boring will be required to confirm the conditions below the maximum depth of our boring.

PAVEMENT GUIDELINES

General

Proposed pavements for this project are anticipated to include parking areas and drive lanes. The following recommendations provide guidance for pavement design and construction based on:

- Subsurface conditions encountered during this investigation
- Previous experience with similar soils in the region
- Typical pavement performance under comparable loading conditions

The recommended pavement sections assume:

- Proper site grading and drainage
- Surface water is directed away from pavement areas
- Water is not allowed to infiltrate the pavement structure through surface ponding, edge infiltration, or unsealed cracks
- Regular pavement maintenance is performed

The pavement design thicknesses provide adequate structural capacity to distribute wheel loads to the underlying subgrade. However, pavements constructed over expansive clay subgrades may still experience cracking or deformation due to shrink–swell behavior of the soils.

If pavement areas are subjected to heavy construction traffic during site development, thicker pavement sections may be required.

Moisture Control

Moisture variations within the subgrade are a primary cause of pavement distress in expansive soil conditions. The following measures should be implemented to reduce moisture-related movements:

- Provide **positive drainage** away from pavement areas.
- Prevent water infiltration through joints and cracks.
- Maintain sealed joints and cracks throughout the service life of the pavement.
- Avoid ponding adjacent to pavement edges.

Based on local experience, pavements typically perform better under the following conditions:

- Pavement slopes of **1 percent or greater**
- Pavements located **higher than adjacent landscape areas**
- Pavement areas **without underground utilities**
- Pavements designed to minimize water infiltration into pavement layers

Periodic maintenance such as **crack sealing and joint maintenance** should be anticipated.

Common Pavement Distress Mechanisms

Alligator Cracking

“Alligator cracking” may occur when the base layer becomes very wet and loses strength. This condition may develop when water infiltrates beneath pavement edges or through cracks.

Water infiltration commonly occurs where aggregate base is placed beneath curbs. To reduce this risk:

- Extend curbs **at least 6 inches into the clay subgrade**
- Provide **proper edge drainage**
- Install perimeter drains where necessary

Localized weak or poorly compacted areas within pavement layers can also contribute to this distress.

Longitudinal Cracking

Longitudinal cracks commonly occur **1 to 4 feet inside pavement edges** in areas underlain by expansive clay soils. These cracks typically develop due to differential moisture changes near pavement edges.

Potential mitigation measures include:

- Vertical moisture barriers along pavement edges
- Adjacent paved surfaces such as sidewalks
- Proper drainage control
- Minimizing irrigation near pavement edges

Periodic Maintenance

The pavements constructed on clay subgrades such as the one encountered at this site will be subjected to swell and shrinkage related movements. Hence, **periodic maintenance such as crack sealing and surface finishing should be anticipated and performed.**

Pavement Sections

Parking areas and drives may be designed with either a flexible or rigid pavement. Pavement sections for both rigid and flexible types are recommended as follows for drive areas and parking areas. Marl to limestone or compacted select fill subgrades are anticipated. Pavement recommendations are based on anticipated pavement subgrades. If the subgrade condition is different, please contact us.

Table No. 6 – Concrete Pavement

	Parking Areas	Drive Areas	Heavy Duty
Reinforced Concrete (inches)	5	6	8
Subgrade – See Notes Below	See Notes	See Notes	See Notes

Table No. 7 – Asphalt Pavement

	Parking Areas	Drive Areas
Hot Mix Asphaltic Concrete-HMAC (inches)	2	3
Aggregate Base (inches)	8	8
Subgrade – See Notes Below	See Notes	See Notes

Heavy-duty sections are recommended for areas subjected to frequent traffic such as:

- Entry/exit drive lanes
- Trash collection areas
- Drive-through lanes

These sections are also appropriate for areas expected to support **emergency vehicles weighing up to approximately 85,000 pounds**

Notes:

- The recommendations are based on anticipated subgrade material, marl to limestone. If cut and fill are performed, please let InTEC know.
 - Fill is anticipated at this site to raise the grade. On-site milled limestone material is anticipated to be placed and compacted in lifts.
 - **Select fill** should be used to raise grades within the pavement areas. **On-site milled material may be used**, provided it meets the select fill requirements specified in this report.
 - Select fill should be placed in **maximum 6-inch compacted lifts** and compacted to at least **95 percent of the maximum dry density**, as determined by **ASTM D698 (Standard Proctor)**.
- The flexible pavement recommendations are based on input parameters presented in Table No. 8. If recommendations for different inputs are needed, please contact us.
- Recommendations presented in the tables above do not apply to traffic areas with heavy truck or repetitive truck traffic areas.
- Subgrade treatment:
 - Fill is anticipated within the pavement areas. Fill should be installed as described above.
 - Final pavement subgrade should be proof rolled prior to placement of aggregate base or concrete.
- Pavement section recommendations are based on subgrades prepared as described in this report. If water is allowed to get underneath the asphalt / concrete or if moisture content of the base or subgrade changes significantly, then pavement distress will occur. Deeper curbs, curbs extending a minimum 6 inches into subgrade, will help reduce the moisture getting underneath the pavement.
- The pavement can experience cracking and deformation due to shrinkage and swelling characteristics of the soils as described in the Vertical Movements section of this report.

Table No. 8 – Input Parameters – Flexible Pavement Section Calculation

Parameter	Flexible Pavement Parking Areas	Flexible Pavement Drive Areas
ESAL	20,000	40,000
Reliability Level	R-70	R-70
Serviceability Loss	2.0	2.0
Standard Deviation	0.45	0.45
Service Life	20 years	20 years
Subgrade CBR	4.0	4.0

Pavement Subgrade Preparation

All organic materials and compressible surface soils should be removed prior to pavement construction.

The exposed subgrade should be:

- Proof rolled to identify soft areas
- Reworked and compacted as necessary
- Protected from drying or disturbance prior to base placement

Base material should be placed **as soon as practical** following subgrade preparation.

Base Course

Aggregate base for asphalt pavement should consist of **crushed limestone conforming to TxDOT Item 247,**

Type A, Grade 1 or 2. The base course should be:

- Placed in lifts
- Compacted to **at least 95 percent of maximum dry density**
- Moisture conditioned between **1 percent below optimum and 3 percent above optimum**

Asphaltic Concrete

Hot-mix Asphaltic pavement materials and placement should conform to all applicable City of San Antonio Construction Guidelines.

Concrete Pavement

Concrete material and installation should follow City of San Antonio Construction Guidelines. Minimum compressive strength value of 4,400 psi is recommended.

Concrete pavement slabs should be provided with adequate steel reinforcement. Proper finishing of concrete pavements requires the use of sawed and sealed joints which should be designed in accordance with current Portland Cement Association guidelines. Dowel bars should be used to transfer loads at transverse joints. Related civil design factors such as drainage, cross-sectional configurations, surface elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required, especially for open jointed areas which may allow surface water infiltration into the subgrade.

Table No. 9 – Concrete Pavement Reinforcement

Reinforcement:	#3 reinforcing steel bars (grade 60) at 18 inches on center each way (at 12 inches on center each way for 8 inch thick concrete)
Contraction joint spacing:	10 feet each way for 5 inch thick concrete 12 feet each way for 6 inch thick concrete 15 feet each way for 8 inch thick concrete The saw cuts should be planned based on features such as inlets, manholes, valves, etc. The saw cuts are recommended to be made the same day.
Contraction joint depth:	At least one-fourth (¼) of pavement thickness
Contraction joint width:	One-fourth (¼) inch or as required by joint sealant manufacturer
Expansion joint:	Expansion joints are not recommended
Isolation joint:	Features such as concrete inlet structures, man-holes, and valve covers should be isolated using isolation joints.

Perimeter Drainage

Proper drainage should be provided around pavement areas to minimize infiltration of surface water beneath the pavement.

Recommended practices include:

- Sloping adjacent ground away from pavement
- Extending curbs into the subgrade
- Providing vegetated or stabilized slopes adjacent to pavement
- Sealing asphalt–concrete interfaces

If berms are used, slopes should be no flatter than 1V:8H, while drainage slopes may be as steep as 1V:3H.

CONSTRUCTION GUIDELINES

The following recommendations are provided to assist the contractor and design team during earthwork and foundation construction. Proper construction procedures are critical to achieving the performance assumptions used in the geotechnical design.

Construction Monitoring

InTEC should be retained to monitor critical phases of construction including:

- Subgrade preparation
- Proof rolling operations
- Structural fill placement
- Foundation excavations

Performance of the recommended foundation systems depends not only on proper design but also on **adequate construction quality control**.

InTEC should be notified prior to construction so that monitoring services can be incorporated into the project quality control program.

Site Preparation

Site preparation should include removal of vegetation, organic materials, and loose surface soils in areas planned for structures, pavements, or fill placement.

Minimum requirements include:

- Strip vegetation and organic material to a depth of at least 6 inches.
- Remove abandoned utilities or properly grout and seal them.
- Expose and prepare the subgrade surface.
- Proof roll exposed subgrade prior to fill placement.

The exposed subgrade should be compacted to (a) Minimum 95% of maximum dry density (ASTM D698) and (b) Moisture content: -1% to +3% of optimum. Exposed subgrade should be protected from drying or disturbance prior to placement of fill.

Proof Rolling

Proof rolling should be performed to evaluate the stability of the prepared subgrade.

Recommended procedure:

- Equipment: **25-ton pneumatic roller**
- Minimum **10 passes**
- Tire pressure adjusted to produce approximately **90 psi ground contact pressure**

Proof rolling should be observed by InTEC.

Areas exhibiting excessive deflection, pumping, or rutting should be:

- Over-excavated
- Replaced with select fill
- Recompacted and re-tested

Maintain positive drainage throughout construction to avoid ponding or construction delays.

Fill Placement

Fill used for grade raising should consist of approved on-site soils or imported materials free of organic or deleterious materials.

General fill placement requirements:

Item	Requirement
Maximum lift thickness	6 inches compacted
Compaction	≥ 95% ASTM D698
Moisture	Optimum to +3%

Each lift should be tested and approved prior to placement of subsequent lifts.

Fill areas should be benched or squared to avoid “bowl-shaped” placement that could promote settlement or differential movement.

Where possible, building pads should be constructed with uniform fill thickness to reduce differential foundation movements.

Select Fill

Select fill is recommended beneath structures and other movement-sensitive improvements.

Recommended properties:

Property	Requirement
Liquid Limit	< 40
Plasticity Index	5 – 20
Percent passing No.200 sieve	< 30%
Maximum particle size	3 inches

Placement requirements:

Item	Requirement
Lift thickness	≤ 6 inches compacted
Compaction	≥ 95% ASTM D698
Moisture range	±2% of optimum

Each lift should be tested by InTEC prior to placement of the next lift.

General Fill

General fill may consist of **clean on-site material or approved imported soil**.

Material should be free of:

- Organic matter
- Construction debris
- Deleterious materials

Maximum particle size:

- **6 inches** for general fill
- **3 inches** within the upper **2 feet beneath pavement areas**

Use of general fill beneath structures may increase the potential for differential movement compared to select fill. Where movement-sensitive structures are planned, **select fill should be used instead.**

Placement requirements:

Item	Requirement
Lift thickness	≤ 6 inches compacted
Compaction	≥ 95% ASTM D698
Moisture range	±2% of optimum

Each lift should be tested by InTEC prior to placement of the next lift.

Drainage

Groundwater was encountered at an approximate depth of 42-ft in boring location B-1 during drilling. However, seepage may occur at shallower depths during construction following heavy rainfall. Minor groundwater seepage may be controlled using **sump and pump methods.**

Proper site drainage should be maintained throughout construction to prevent:

- Ponding
- Saturation of prepared subgrades
- Construction delays

Temporary Drainage Measures

Temporary drainage measures should be implemented during construction to divert runoff away from excavation areas and prepared building pads.

Standing water should be removed promptly.

Excavations should comply with **OSHA safety requirements** for worker protection.

Construction Slopes

- Temporary Slopes: 1H:1V.
- Fill Slopes: 1H:1V
- Permanent Slopes: Max 3H:1V
- Pedestrian Areas: 5H:1V preferred

Time of Construction

The moisture condition of the subgrade at the time of foundation construction can influence post-construction movements.

- Foundations constructed during **dry conditions** may experience uplift when soils later gain moisture.
- Foundations constructed during **wet conditions** may experience settlement or loss of support as soils dry.

Proper moisture conditioning during construction is therefore important.

Ground Water

Where excavations exceed approximately **2 feet below existing grade**, seasonal seepage may occur along natural fissures or stratigraphic contacts. If seepage is observed, subsurface drainage systems such as **French drains** may be required.

Groundwater conditions may also change in the future due to:

- rainfall patterns
- nearby development

- changes in site drainage

If seepage is observed after construction, engineering evaluation may be required.

Control Testing and Field Observation

Compaction testing should be performed during fill placement.

Recommended testing frequency:

- **One density test per 3,000 square feet per lift**
- **Minimum three tests per lift**

Areas failing to meet compaction requirements should be reworked and retested.

Foundation Construction and Field Observation

Foundation excavations should be observed by the geotechnical engineer prior to concrete placement.

The exposed bearing surface should be:

- free of loose soils
- free of standing water
- free of debris

Foundations should be constructed promptly after excavation to avoid deterioration of the bearing surface.

Drilled Pier Construction

Field Observations Each drilled pier should be inspected prior to concrete placement to verify:

- Required depth and diameter
- Clean bearing surface
- Plumb shaft alignment
- Removal of loose material from the base

Concrete should be placed **as soon as possible after excavation**.

Pier excavations should not remain open overnight without approval.

Surface run off or ground water seepage accumulating in the excavation should be pumped out and the condition of the bearing surface should be evaluated immediately prior to placing concrete.

Groundwater and Casing Groundwater seepage was observed at approximately 42 feet depth in Boring B-1. Groundwater may be encountered at shallower depths during construction.

Temporary casing may be required where:

- groundwater seepage occurs
- unstable soils are encountered

If groundwater inflow cannot be controlled by pumping, tremie concrete placement should be used.

If casing is utilized, removal of the casing should be performed with extreme care under proper supervision to minimize mixing of the surrounding soil and water with the concrete.

Variation in drilled shaft depths should be anticipated at this site. Contract documents should include pay items for constructing drilled shafts on a unit price basis.

Drilling Equipment **High power and high torque drilling equipment will be required to drill through hard limestone encountered at this site.** Hard limestone and marl should be anticipated at this site. The information presented in the Boring Logs should not be used as a basis for selecting drilling equipment or for budgeting purposes by the contractor.

DRAINAGE AND MAINTENANCE

Proper drainage and long-term moisture management are **critical** to the performance of the proposed structures and pavements, particularly due to the presence of **expansive soils** at the site. Seasonal or localized changes in moisture content can lead to **unpredictable slab and foundation movements**, especially if water is allowed to collect near building perimeters or utility corridors.

Roof Drainage & Plumbing

- All roof drainage must be directed **at least 10 feet away** from the foundation using gutters, downspouts, and splash blocks or extensions.
- If positive surface slope cannot be provided, closed pipe systems discharging to a storm sewer are preferred.
- Plumbing leaks, especially beneath the slab or within utility trenches, must be identified and repaired **immediately** to prevent localized swelling and loss of support.

Lot Grading & Flatwork

- Final grading should slope away from the structure at a **minimum of 5%** for the first 10 feet (where practical) or equivalent drainage measures.
- Pavements, sidewalks, and patios within this zone should follow the same slope guideline and be designed to **accommodate post-construction movement**, especially in fill areas or expansive clay zones.
- Joints between slabs and structures should be **sealed and inspected regularly**. Water should not be allowed to pond in planters, depressions, or along unsealed joints.

Landscaping & Vegetation

- **Large trees and deep-rooted plants** should not be planted within a horizontal distance equal to their mature height from the foundation.
- Planters adjacent to the structure should be self-contained and designed to prevent moisture infiltration to foundation soils.

- Irrigation systems and sprinkler mains should be located a **minimum of 5 feet** away from buildings, and designed to prevent overwatering near foundations.

Utility Trenches

- Trenches for utilities often include granular bedding, which can act as **conduits for water** to reach the building pad.
- All trenches must be properly compacted and should include **cut-off collars or clay plugs** where lines cross building footprints to prevent subsurface water migration.

Long-Term Maintenance and Considerations

- The **PVR (Potential Vertical Rise)** values estimated in this report assume that all drainage systems are installed and maintained properly. Failure to do so may result in **actual movements 2–3 times greater** than those predicted.
- During **extended dry periods**, observe the perimeter of the structure. If soil is pulling away from the foundation, **controlled watering** should be applied to avoid sudden moisture shifts when rain returns.

Any future modifications to drainage, site grading, landscaping, or nearby construction should be carefully evaluated for impact on foundation performance.

LIMITATIONS

The exploration and analysis of the subsurface conditions reported herein are considered sufficient to form a reasonable basis for the foundation design. **The recommendations submitted are based upon the available soil information and design details furnished by the Project Manager.**

Four borings were drilled at selected locations across the project site. Subsurface conditions may vary between boring locations and may change over time. If conditions encountered during construction differ from those described, **InTEC must be notified promptly** to evaluate whether revisions are needed.

The data and interpretations presented are professional opinions, not exact representations of all subsurface conditions. These recommendations are **confirmation-dependent** and should be reviewed by InTEC during construction to validate assumed conditions.

This report is **not intended to inform means, methods, or construction logistics** such as equipment selection, cost estimation, or contractor scheduling. If the report is used for bidding or other unintended purposes, it is done **solely at the contractor's risk.**

Revisions may be required if:

- the proposed structure or grading is changed;
- drainage or site use is altered;
- significant cut and fill activities are performed; or
- excessive time has passed since the field exploration.

The geotechnical engineer affirms that the findings and advice herein are consistent with the standard of care for geotechnical engineers practicing in this region. However, **no other warranties, express or implied, are provided.**

This report has been prepared for the exclusive use of **Lennar Homes** and their design team for the design evaluation for the **proposed new Lift Station at Guajolote Ranch Subdivision in San Antonio, Texas.**

SUMMARY

Lift Station Foundation

The lift station structure is anticipated to be supported on a mat foundation bearing in gray clay at depth.

Recommended design parameters (Bearing stratum – Gray Clay):

Parameter	Recommended Value
Net Allowable Bearing Capacity	2,500 psf
Subgrade Modulus	150 pci
Factor of Safety	2.5

Key considerations:

- Foundation excavation should bear on competent gray clay.
- The bearing surface should be observed and approved by the geotechnical engineer prior to concrete placement.
- Temporary groundwater seepage may occur during construction; temporary dewatering measures may be required.
- Excavation for the lift station may be constructed using open-cut, retained excavation, or caisson installation methods depending on site constraints.

Generator and Equipment Foundations

Generator pads and equipment foundations may be supported on either:

- **Stiffened grid beam-and-slab foundations**, or
- **Mat foundations**

Recommended parameters for slab-on-grade foundations:

Parameter	Recommended Value
Net Allowable Bearing Capacity	2,000 psf
Unconfined Compressive Strength	1.0 tsf
Design Plasticity Index	22
Soil Support Index	0.72
Climatic Rating	17

Additional recommendations:

- Foundations should bear **at least 18 inches below final grade**.
- Foundations should be supported on **properly compacted select fill**.
- If limestone is encountered at shallower depths, **minimum 6 inches embedment into limestone** may be used.
- Minimum **grade beam width: 12 inches**.

For mat foundations supporting equipment pads:

Parameter	Recommended Value
Net Allowable Bearing Capacity	2,750 psf
Subgrade Modulus	250 pci
Factor of Safety	2.5

A **minimum 2-ft thickness of compacted select fill** should be provided beneath the foundation footprint.

Light Pole Foundations

Light poles may be supported on **straight shaft drilled piers bearing in limestone**.

Recommended parameters:

Parameter	Recommended Value
End Bearing Capacity	15,750 psf
Side Resistance	1,600 psf
Minimum Embedment	7 ft into limestone

Piers should be reinforced to resist potential uplift forces associated with expansive soil movements

Pavement Recommendations – Summary

Proposed pavements consist of parking areas and drive lanes. Pavements may be constructed using either **rigid (concrete)** or **flexible (asphalt)** pavement systems.

The recommendations assume:

- Pavement subgrade consisting of **marl, limestone, or compacted select fill**
- Proper drainage away from pavement areas
- Prevention of moisture infiltration beneath the pavement structure.

Recommended Pavement Sections

Concrete Pavement

Application	Thickness
Parking Areas	5 inches reinforced concrete
Drive Areas	6 inches reinforced concrete
Heavy Duty Areas	8 inches reinforced concrete

Reinforcement:

- **#3 bars at 18 inches each way**
- **#3 bars at 12 inches each way for 8-inch pavement**

Concrete strength:

- **Minimum 4,400 psi**

Asphalt Pavement

Application	Asphalt	Base
Parking Areas	2 in HMAC	8 in crushed limestone base
Drive Areas	3 in HMAC	8 in crushed limestone base

Design assumptions:

Parameter	Value
Design Life	20 years
Reliability	70%
Subgrade CBR	4
ESAL	20,000 – 40,000

Pavement Subgrade Preparation

Prior to pavement construction:

- Remove organic or compressible soils.
- Proof roll exposed subgrade to identify weak areas.
- Rework and compact subgrade as required.
- Place base material as soon as practical after preparation.

Subgrade compaction:

- Minimum 95% Standard Proctor (ASTM D698)
- Moisture: -1% to +3% of optimum

Construction Guidelines – Summary

Proper construction procedures are essential for satisfactory performance of the recommended foundations and pavements.

Site Preparation

- Remove vegetation and organic materials.
- Strip **minimum 6 inches** of surface soils.
- Remove abandoned utilities.
- Prepare exposed subgrade prior to fill placement.

Proof Rolling

Proof rolling should be performed using:

- **25-ton pneumatic roller**
- **Minimum 10 passes**
- Approximate **90 psi ground contact pressure**

Areas exhibiting pumping, rutting, or excessive deflection should be:

- Over-excavated
- Replaced with select fill
- Recompacted and retested.

Fill Placement

Fill should consist of approved on-site or imported materials.

General requirements:

Requirement	Value
Lift Thickness	≤ 6 inches
Compaction	≥ 95% ASTM D698
Moisture	Optimum to +3%

Each lift should be **tested and approved prior to placement of the next lift.**

Select Fill Requirements

Recommended properties:

Property	Requirement
Liquid Limit	< 40
Plasticity Index	5 – 20
Passing No.200	< 30%
Maximum Particle Size	3 inches

Placement:

- Maximum **6-inch lifts**
- **95% Standard Proctor compaction**
- Moisture **±2% of optimum**

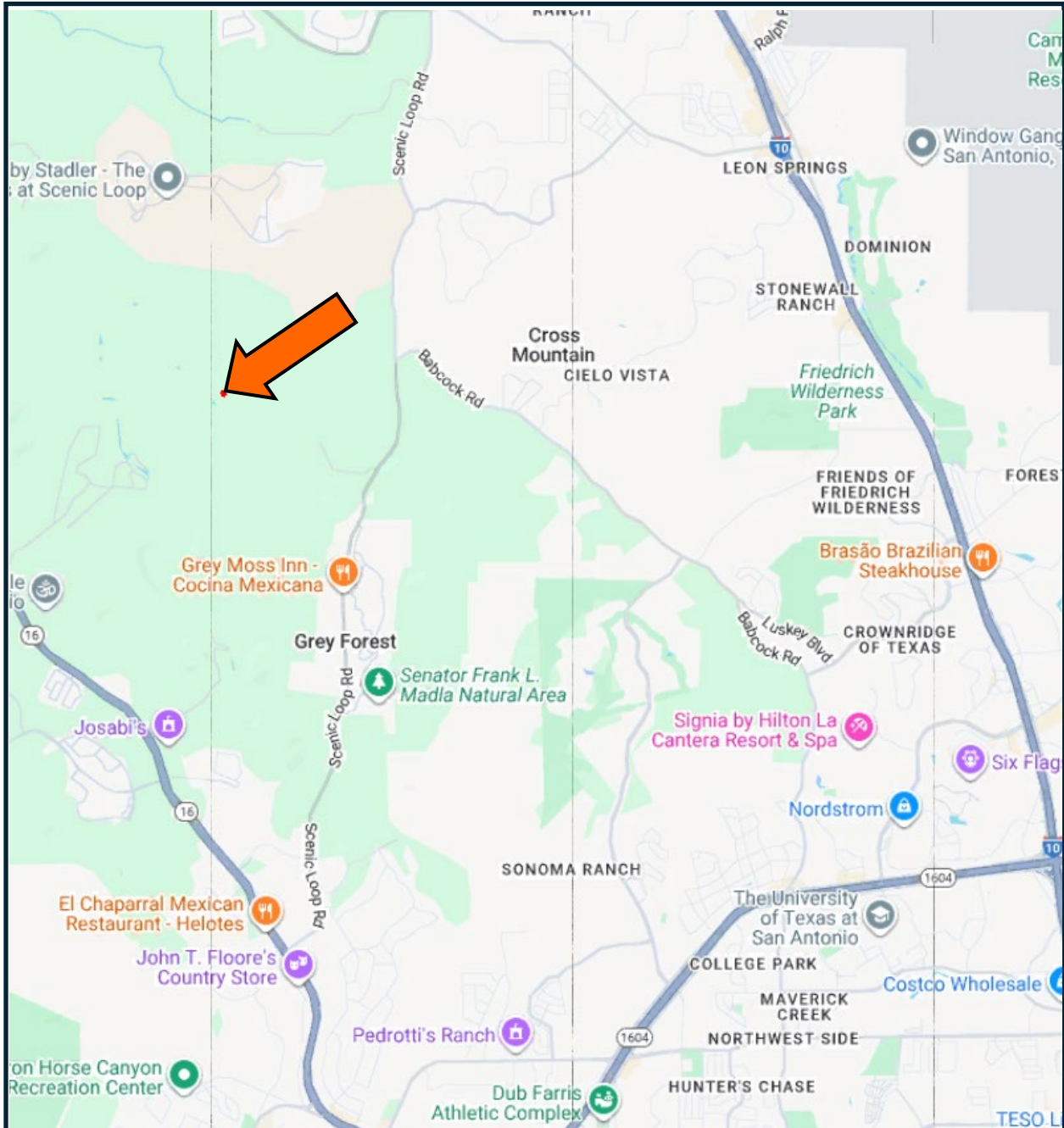
Illustration Section

Description	Plate No.
Vicinity Map	Plate 1A
Aerial Map	Plate 1B
Topographic Map	Plate 1C
Geologic Map	Plate 1D
Soil Map	Plate 1E
Edwards Aquifer Map	Plate 1F
Bexar County Karst Map	Plate 1G
Approximate Boring Locations	Plate 1H
Boring Logs	Plates 2 - 5
Keys to Classifications and Symbols	Plate 6
Information on Geotechnical Report	Appendix

Subsurface Exploration and Foundation Analysis
 Proposed New Lift Station
 Guajolote Ranch Subdivision
 San Antonio, Texas

InTEC Project Number
S261713

Date:
 01/26/2026



Subsurface Exploration and Foundation Analysis Proposed New Lift Station Guajolote Ranch Subdivision San Antonio, Texas	Vicinity Map	
	InTEC Project Number S261713	Date: 01/26/2026

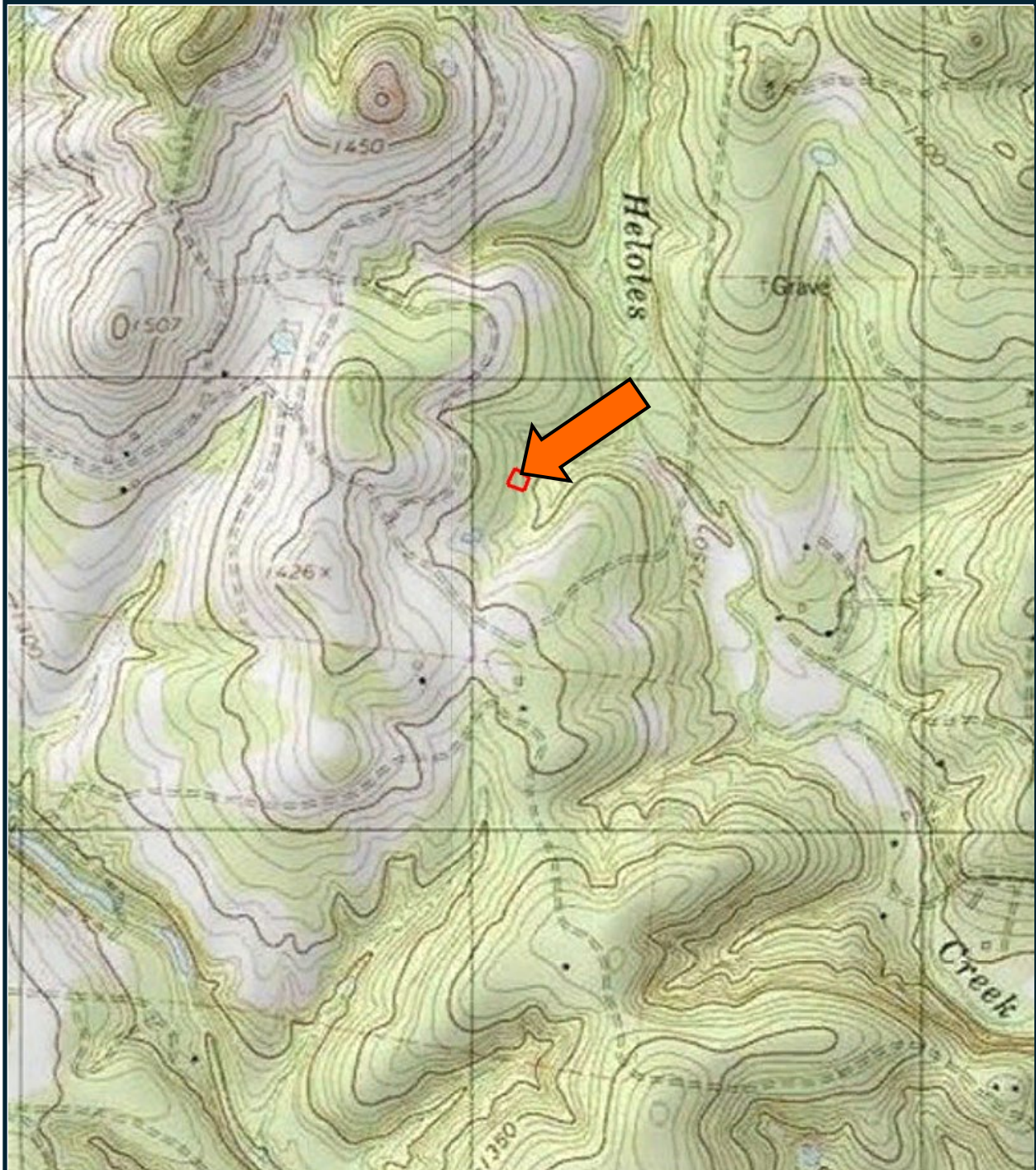


Subsurface Exploration and Foundation Analysis
Proposed New Lift Station
Guajolote Ranch Subdivision
San Antonio, Texas

Aerial Map – Approximate Location

InTEC Project Number
S261713

Date:
01/26/2026

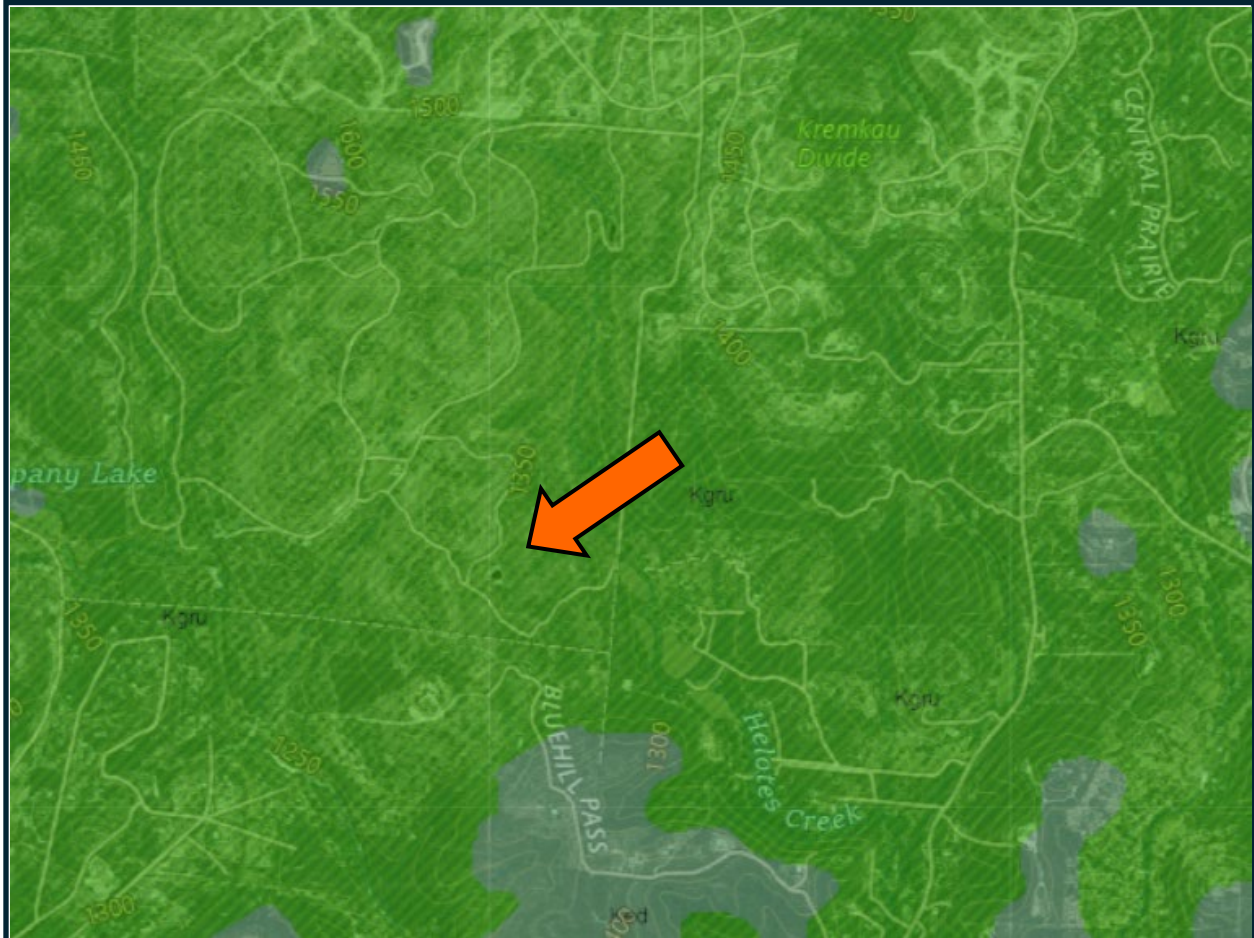


Subsurface Exploration and Foundation Analysis
 Proposed New Lift Station
 Guajolote Ranch Subdivision
 San Antonio, Texas

Topographic Map – Approximate Location

InTEC Project Number
S261713

Date:
 01/26/2026



Kgru – Upper Glen Rose Formation

Limestone, dolomite, and marl as alternating resistant and recessive beds forming stairstep topography; limestone, aphanitic to fine grained, hard to soft and marly, light gray to yellowish gray; dolomite, fine grained, porous, yellowish brown; marine megafossils include molluscan steinkerns, rudistids, oysters, and echinoids. Upper part, Kgru, relatively thinner bedded, more dolomitic, and less fossiliferous; thickness about 400 feet. Thickness of Glen Rose Formation 900 feet

Subsurface Exploration and Foundation Analysis
 Proposed New Lift Station
 Guajolote Ranch Subdivision
 San Antonio, Texas

Geologic Map – Approximate Location

InTEC Project Number
S261713

Date:
 01/26/2026



Bexar County, Texas

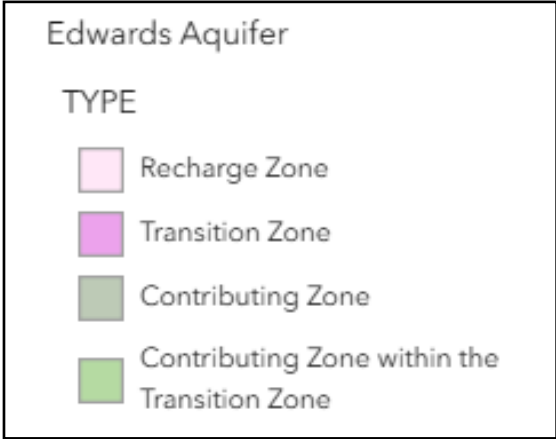
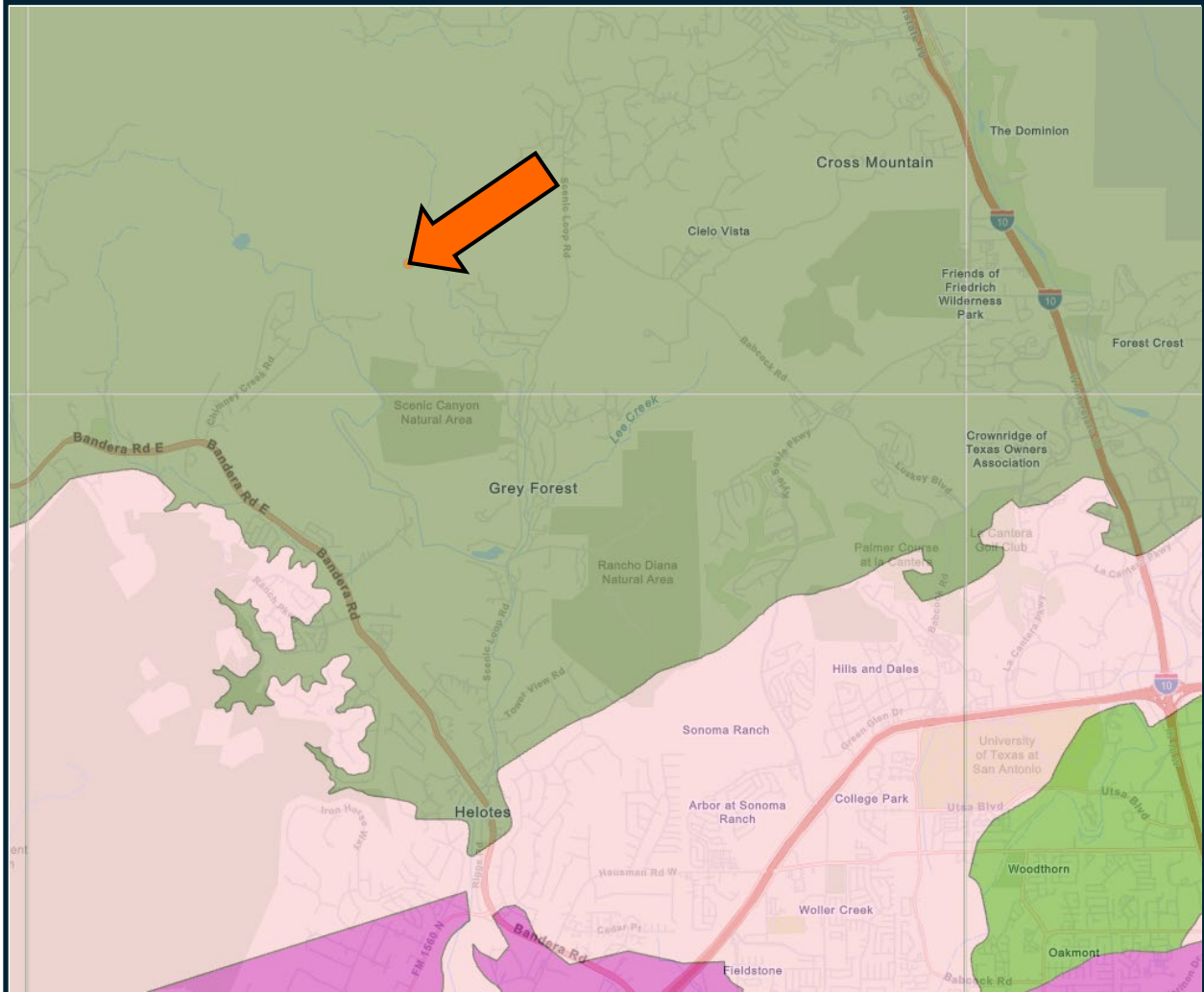
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
TaC—Eckrant very cobbly clay, 5 to 15 percent slopes														
Eckrant	90	D	0-4	Very cobbly clay	CH, GC	A-7-6	0- 3- 12	9-23- 45	49-59- 80	46-58- 79	43-55- 79	37-48- 79	49-60 -70	25-31-42
			4-12	Very cobbly clay, very cobbly clay loam, cobbly clay, extremely cobbly silty clay	CH, CL, GC	A-2-7, A-7-6	0- 2- 21	27-46- 63	21-50- 83	18-48- 82	15-46- 82	13-41- 82	45-61 -70	23-32-43
			12-30	Bedrock	—	—	—	—	—	—	—	—	—	—

Subsurface Exploration and Foundation Analysis
 Proposed New Lift Station
 Guajolote Ranch Subdivision
 San Antonio, Texas

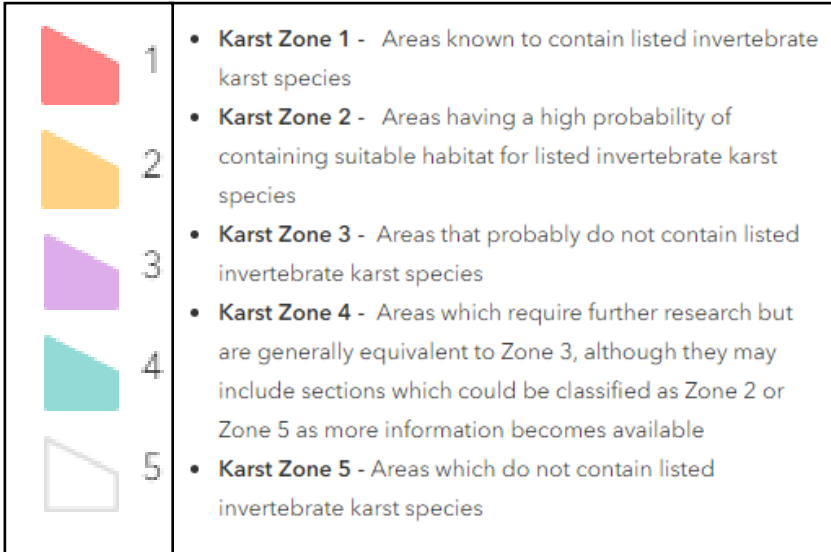
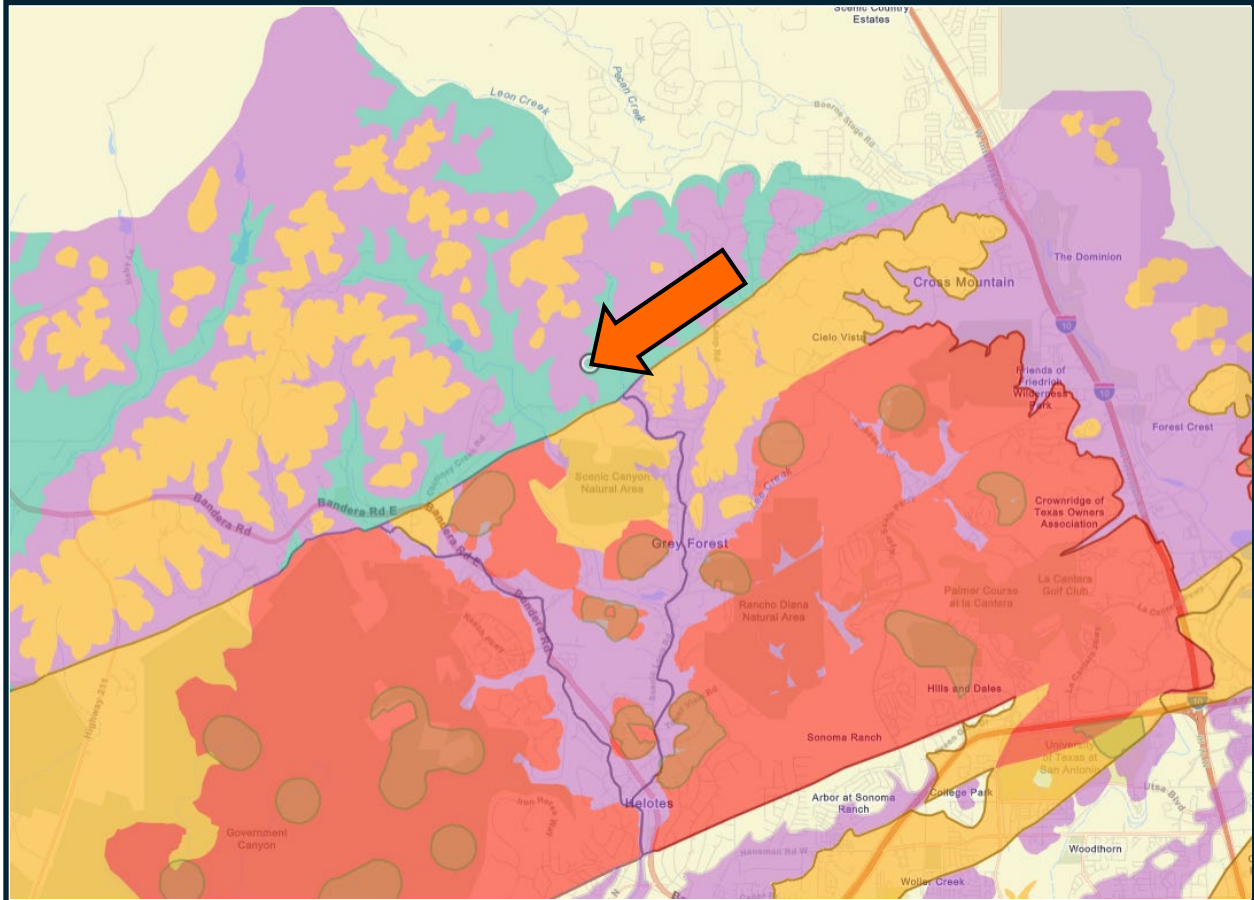
Soil Map – Approximate Location

InTEC Project Number
S261713

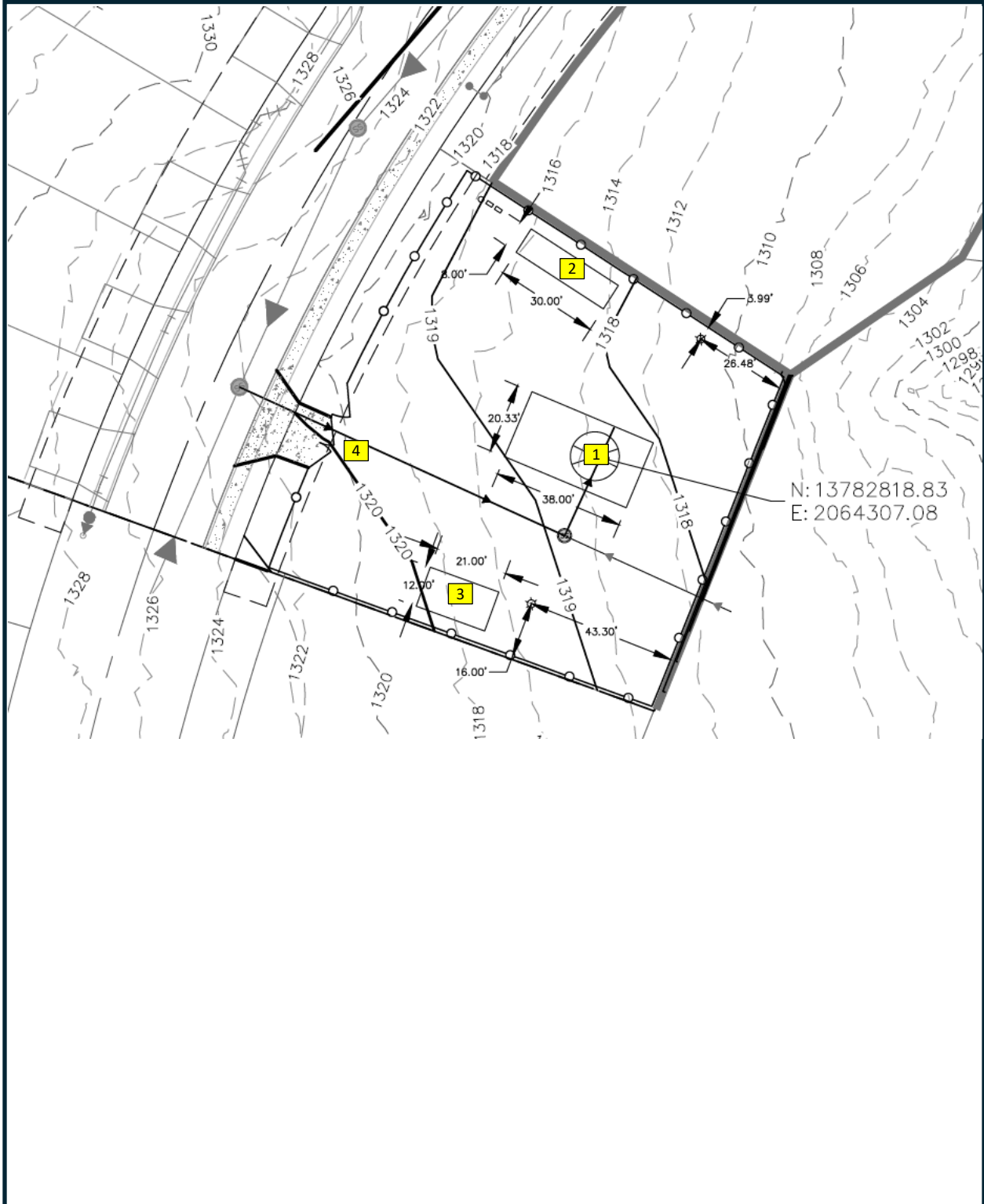
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Subsurface Exploration and Foundation Analysis Proposed New Lift Station Guajolote Ranch Subdivision San Antonio, Texas	Edwards Aquifer Map	
	InTEC Project Number S261713	Date: 01/26/2026



Subsurface Exploration and Foundation Analysis Proposed New Lift Station Guajolote Ranch Subdivision San Antonio, Texas	Bexar County Karst Map	
	InTEC Project Number S261713	Date: 01/26/2026



Subsurface Exploration and Foundation Analysis Proposed New Lift Station Guajolote Ranch Subdivision San Antonio, Texas	Approximate Boring Locations	
	InTEC Project Number S261713	Date: 01/26/2026

PROJECT: Lift Station - Guajolote Ranch
LOCATION: San Antonio, Texas
CLIENT: Lennar Homes

PROJECT NO: S261713
DATE: 02/25/2026



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	Plastic Limit Moisture Content % -	Liquid Limit Moisture Content % -
0												
0		SS	Dark Brown Clay				31		31	12	●	—
0		SS	Tan Weathered Limestone to Limestone				50/4"				●	—
5		AU	-with Caliche								●	—
5		AU	-with Gravel						19	06	●	—
5		AU	-with Silty Clay Seams								●	—
10		SS					50/5"				●	—
15		SS					73		18	04	●	—
20		SS					50/4"				●	—
25		SS	Gray Marl				58				●	—
25		SS	-with Caliche								●	—
25		SS	-with Clay Seams								●	—
30		AU							34	20	●	—
35		AU							24	11	●	—
40		SS	Gray Clay				38		25	12	●	—
42	▼		-Water Seepage at 42-ft									
45		AU									●	—
48		AU	-Moist Sample at 48-ft								●	—
50		AU									●	—
55												
60												
65												
70												

Notes:

Ground Water Observed: 42-ft

Completion Depth (ft): 50

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

Plate: 2

PROJECT: Lift Station - Guajolote Ranch
LOCATION: San Antonio, Texas
CLIENT: Lennar Homes

PROJECT NO: S261713
DATE: 02/26/2026



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	Plastic Limit Liquid Limit Moisture Content % - •				
											20	40	60	80	
0															
		SS	Dark Brown Clay				58/10								
		SS	Light Tan Weathered Limestone to Limestone				50/3"								
5		AU	-with Caliche						20	09					
		AU	-with Gravel												
10		AU	-with Silty Clay Seams												
15		AU													
20															
25															
30															
35															
40															
45															
50															
55															
60															
65															
70															

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

Plate: 3

PROJECT: Lift Station - Guajolote Ranch
LOCATION: San Antonio, Texas
CLIENT: Lennar Homes

PROJECT NO: S261713
DATE: 02/26/2026



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	Plastic Limit — Liquid Limit Moisture Content % - •				
											20	40	60	80	
0															
		SS	Dark Brown Clay				63/10"								
		SS	Light Tan Weathered Limestone to Limestone												
5		AU	-with Caliche				53								
		AU	-with Gravel												
10		AU	-with Silty Clay Seams						19	06					
15		AU													
20															
25															
30															
35															
40															
45															
50															
55															
60															
65															
70															

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

Plate: 4

PROJECT: Lift Station - Guajolote Ranch
LOCATION: San Antonio, Texas
CLIENT: Lennar Homes

PROJECT NO: S261713
DATE: 02/26/2026



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	Plastic Limit ——— Liquid Limit Moisture Content % - •				
											20	40	60	80	
0															
		SS	Dark Brown Clay				50/8"								
		AU	Light Tan Weathered Limestone to Limestone												
5		AU	-with Caliche and Gravel												
		AU	-with Clay Seams												
10															
15															
20															
25															
30															
35															
40															
45															
50															
55															
60															
65															
70															

Notes: Ground Water Observed: No Completion Depth (ft): 7










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

Plate: 5

KEY TO CLASSIFICATIONS AND SYMBOLS

<u>Soil Fractions</u>		<u>Soil or Rock Types</u> (Shown in symbols column) (Predominate Soil Types Shown Heavy)		
<u>Component</u>	<u>Size Range</u>			
Boulders	Greater than 12"			
Cobbles	3" - 12"	Silt	Clay	Marl
Gravel	3" - #4 (4.76mm)			
Coarse	3" - 3/4"	Shale	Sand	Sandy Gravel
Fine	3/4" - #4			
Sand	#4 - #200 (0.074mm)	Limestone	Sandy Clay	Gravel
Coarse	#4 - #10 (2.00mm)			
Medium	#10 - #40 (0.42mm)			
Fine	#40 - #200 (0.074mm)			
Silt and Clay	Less than #200			

TERMS DESCRIBING SOIL CONSISTENCY

Description (Cohesive Soils)	Unconfined Compression TSE	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 1/2" 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.

Subsurface Exploration and Foundation Analysis
Proposed New Lift Station
Guajolote Ranch Subdivision
San Antonio, Texas

InTEC Project Number
S261713

Date:
01/26/2026

Appendix

Subsurface Exploration and Foundation Analysis
Proposed New Lift Station
Guajolote Ranch Subdivision
San Antonio, Texas

InTEC Project Number
S261713

Date:
01/26/2026

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.**



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