ADDENDUM NO. 2 **DATE: July 09, 2026**

PROJECT: HARMONY SCIENCE ACADEMY BRIDGELAND PHASE II MIDDLE-HIGH SCHOOL

ARCHITECT: LDDBLUELINE, INC.
333 Cypress Run Ste. 350
Houston, TX 77094
Phone: 281.497.1040

ARCHITECT'S PROJECT NUMBER: 06-22-014

OWNER: HARMONY PUBLIC SCHOOLS
1255 Enclave Parkway
Houston, TX 77077

THIS ADDENDUM IS ISSUED TO ALERT ALL PARTIES OF CHANGES AND/OR SUPPLEMENTARY CLARIFICATION INFORMATION TO THE CONTRACT DOCUMENTS AS OUTLINED BELOW. THE FOLLOWING ITEMS TAKE PRECEDENCE OVER REFERENCED PORTIONS OF THE CONTRACT DOCUMENTS AND IN EXECUTING A CONTRACT, SHALL BECOME A PART THEREOF. WHERE ANY ITEM CALLED FOR IN THE DOCUMENTS IS SUPPLEMENTED HEREBY, THE ORIGINAL REQUIREMENTS SHALL REMAIN IN EFFECT. ALL SUPPLEMENTED CONDITIONS SHALL BE CONSIDERED AS ADDED TO THERETO. WHERE ANY ORIGINAL ITEM IS AMENDED, VOIDED OR SUPERSEDED HEREBY, THE PROVISIONS OF SUCH ITEMS NOT SO SPECIFICALLY AMENDED, VOIDED OR SUPERSEDED SHALL REMAIN IN EFFECT.

Summary:

The following addendum includes the geotechnical report, responses to substitution requests and responses to bidders questions.

Substitution Requests:

The following are responses to substitution requests received from potential bidders for the above referenced project.

1. Lockers MFG is an APPROVED manufacturer for Metal Lockers in Specification Section 105113.
2. Aluminum Techniques Inc is REJECTED as a manufacturer for Fabricated Metal Canopies in Specification Section 107317.
3. Sarnafil S327 – 80 mil membrane is REJECTED as a Roofing Membrane product in Specification Section 075423.
4. ALCP Series is an APPROVED product for Interior Expansion Joint Cover Assemblies for interior floors (concrete) in Specification Section 079513.
5. EWJ Series is an APPROVED product for Exterior Expansion Joint Cover Assemblies for exterior walls in Specification Section 079515.
6. EFLP Series is an APPROVED product for Interior Expansion Joint Cover Assemblies for interior floors (tile) in Specification Section 079513.
7. ELCD Series is an APPROVED product for Interior Expansion Joint Cover Assemblies for interior walls (gypsum) in Specification Section 079513.
8. ELCE Series is an APPROVED product for Interior Expansion Joint Cover Assemblies for interior ceilings (ACT) in Specification Section 079513.

9. ESFP-INF Series is an APPROVED product for Interior Expansion Joint Cover Assemblies for interior floors (carpet) in Specification Section 079513.
10. DynaForce 4+2 is an APPROVED product for Resilient Athletic Flooring in Specification Section 096566.

Bidders' Questions & Responses:

The following are responses to questions received from potential bidders for the above-referenced project.

1. *What is the specific window security film wanted for this project?*

Response: Please see Specification Section 08 8853 Security Glazing.

2. *The drawings/specifications call for galvanized stair handrails. As these handrails are located indoors, please confirm that galvanization is required.*

Response: The specification Section 05 51 05, 2.02 C and D calls for interior items to be shop/factory primed and for exterior items galvanized.

Specifications:

None

Drawings:

None

Documents:

Geotechnical Report prepared by Raba Kistner dated September 16, 2025

END OF ADDENDUM NO. 2

GEOTECHNICAL ENGINEERING STUDY

FOR

HARMONY PUBLIC SCHOOLS – BRIDGELAND CAMPUS PHASE II
12800 CREEKLAND VILLAGE DRIVE
CYPRESS, TEXAS

RABA KISTNER
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Project No. AHA25-024-00
September 16, 2025

Mr. Mehmed Milanovic, M.S.C.M., BArch
Director of Construction
Harmony Public Schools
9321 W Sam Houston Pkwy S
Houston, Texas 77099

RE: Geotechnical Engineering Study
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

Dear Mr. Milanovic:

Raba Kistner, Inc. (Raba Kistner) is pleased to submit this final report of our Geotechnical Engineering Study for the above-referenced project. The study was performed in accordance with **Raba Kistner** Proposal No. PHA25-037-00, dated May 23, 2025. The purpose of this study was to drill borings at the subject site, to perform laboratory testing on selected soil samples to classify and characterize subsurface conditions, and to provide foundation design and construction recommendations for the proposed Harmony Public Schools – Bridgeland Campus Phase II.

The following report contains our design recommendations and considerations based on our current understanding of design tolerances, and structural loads. If any of these parameters change, there may be alternatives for value engineering of the foundation systems, and **Raba Kistner** recommends that a meeting be held with Harmony Public Schools (CLIENT) and the design team to evaluate these alternatives.

We appreciate the opportunity to be of professional service to you on this project. Should you have any questions about the information presented in this report, please call. We look forward to assisting the CLIENT during the construction phase of the project by conducting construction materials engineering and testing services (quality assurance program).

Very truly yours,
RABA KISTNER, INC.

Halah Alkhassaki, E.I.T.
Graduate Engineer

Phu T. Tran, P.E.
Project Manager

STATE OF TEXAS
PHU THIEN TRAN
140136
LICENSED
PROFESSIONAL ENGINEER
9/16/2025

HA/PTT/JD
Attachments
Copies Submitted: Above (1-Electronic)

GEOTECHNICAL ENGINEERING STUDY

For

HARMONY PUBLIC SCHOOLS – BRIDGELAND CAMPUS PHASE II
12800 CREEKLAND VILLAGE DRIVE
CYPRESS, TEXAS

Prepared for

Harmony Public Schools
Houston, Texas

Prepared by

RABA KISTNER, INC.
Houston, Texas

PROJECT NO. AHA25-024-00
September 16, 2025

RABAKISTNER

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ATTACHMENTS

The following figures are attached and complete this report:

INTRODUCTION

Raba Kistner, Inc. (Raba Kistner) has completed the authorized subsurface exploration and foundation recommendations for the new facilities at Harmony Public Schools – Bridgeland Campus, to be located at 12800 Creekland Village Drive in Cypress, Texas. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendations for foundation and construction considerations.

PROJECT DESCRIPTION

Previous Study: **Raba Kistner** previously conducted a geotechnical study at the subject site for CLIENT. Please refer to **Raba Kistner** Report, Project No. AHA23-031-00, dated August 18, 2023. In our original geotechnical report, nineteen (19) borings, with depths ranging from about 10 ft to 35 ft, were completed at the site for proposed two, two-story, approximately 45,000 SF Elementary and Middle School/High School buildings each with associated parking and driveway areas. Since our original report was issued, the site layout has been modified by CLIENT, thus requiring additional field and laboratory investigation to provide geotechnical recommendations for the proposed Middle School/High School building and football/soccer field.

It is our understanding that the proposed project consists of the design and construction of new facilities for Harmony Public Schools Bridgeland Campus Phase II. The facilities will consist of a two-story, Middle School/High School building with associated parking and driveway areas, and a new football/soccer field with light poles to be located in between the two school buildings, and situated within a tract of land located at 12800 Creekland Village Drive in Cypress, Texas.

Foundation loads have not been provided at this time, but we anticipate the proposed structure is expected to create relatively light to moderate loads to be carried by shallow spread footings or drilled footings (drilled-and-underreamed and/or straight-sided piers). We have based our foundation recommendations on the assumption that column and strip loads will not exceed 100 kips and 5 kips per lineal ft, respectively. Floor systems consisting of slabs-on-ground or slabs-on-fill are expected to be preferred, provided soil-related, potential vertical movements will not cause structural performance problems.

LIMITATIONS

This engineering report has been prepared in accordance with accepted Geotechnical Engineering practices in the Southeast Texas area by Geotechnical firms conducting similar work under similar circumstances and is meant for the use of CLIENT and its representatives for design purposes. This report may not contain sufficient information for the purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations submitted in this report are based on the data obtained from nine (9) borings drilled at this site, our understanding of the project information provided to us by CLIENT, and the assumption that site grading will result in only minor changes in the existing topography. If the project information described in this report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

This report may not reflect the actual variations of the subsurface conditions across the site. The nature and extent of variations across the site may not become evident until construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our Geotechnical Engineering Study does not include an environmental assessment of the air, soil, rock, or water conditions either on or adjacent to the site. No environmental opinions are presented in this report. **Raba Kistner**'s scope of work does not include investigation, detection, or design related to the prevention of any biological pollutants. The term "biological pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproduct of any such biological organisms.

If final grade elevations are significantly different from those provided to us by others or by more than plus or minus 1-ft, our office should be informed about these changes. If needed and/or if desired, we will reexamine our analyses and make supplemental recommendations.

BORINGS AND LABORATORY TESTS

Subsurface conditions at the site were evaluated by 9 borings (designated as Borings B-1 through B-9) drilled at the locations shown on the Boring Location Map, Figure 1. The boring locations are approximate and were located in the field by a **Raba Kistner** representative based on a site plan provided by the CLIENT, and by measuring distances from existing references. Latitude-longitude values at the boring locations were estimated using Google Earth™. The coordinates are shown on the boring logs.

The borings were drilled to depths ranging from 5 ft to 35 ft below the ground surface elevation existing at the time of our study using a buggy-mounted drilling rig. The borings were drilled utilizing solid flight augers in combination with mud rotary drilling techniques. At completion of drilling, cement bentonite grout were used to backfill the open boreholes. During drilling operations, the following samples were collected:

Table 1 – Soil Sampling Methods and Quantities

Type of Sample	Number Collected
Undisturbed Shelby Tube (ST)	39
Split-Spoon Penetration Test (SPT)	23
Grab Sample (GS)	2

The ST and SPT samples were obtained in general accordance with American Society for Testing and Materials (ASTM) Standard Procedures. ST samples were recovered in cohesive soils using a thin-walled metal tube sampler (minimum 3-inch inside diameter) that complies with ASTM D1587 requirements. The SPT results are noted as "blows per foot" on the boring logs. The term "blows per foot" refers to the number of blows by a 30-inch free falling 140-Ib hammer required for 12-inches of penetration into the subsurface materials. Grab samples were collected from the auger cuttings during drilling. Representative portions of the samples were sealed in containers to reduce moisture loss, labeled, packaged, and transported to our laboratory for subsequent testing and classification.

In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff in general accordance with the Unified Soil Classification System (USCS). The geotechnical engineering properties of the strata were evaluated by the laboratory tests tabulated in Table 2:

Table 2 – Laboratory Test Quantities

Type of Test	Number Conducted
Natural Moisture Content (ASTM D2216)	64
Atterberg Limits (ASTM D4318)	21
Percent Passing a No. 200 Sieve (ASTM D1140)	30
Unconfined Compression (ASTM D2166)	8
Unconsolidated-undrained Triaxial Compression (ASTM D2166)	3

The laboratory tests are presented in graphical or numerical form on the boring logs illustrated on Figures 2 through 10, key to the classification of terms and symbols used on the logs is presented on Figure 11. The results of the laboratory and field testing are also tabulated in Figure 12 for ease of reference.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the CLIENT.

GENERAL SITE CONDITIONS

GEOLOGY

According to the Geologic Atlas of Texas, Houston Sheet (Revised 1982) shows the subject site to be located on the Lissie Formation. The upper part of the Pleistocene Lissie Formation is a fluvial deposit. It consists of clay, silt, sand, and very minor siliceous gravel of granule and small pebble size. The upper part contains abundant gravel northwestward, concretions of calcium carbonate, and iron oxide. It is locally calcareous, and iron-manganese oxides are common in the zone of weathering. The upper part's surface is fairly flat, gently rolling, and featureless except for numerous rounded shallow depressions and pimple mounds. The lower part of the formation consists of clay, silt, sand, and a minor amount of gravel. Slightly coarser gravel, and noncalcareous, iron oxide concretions are more abundant.

SEISMIC COEFFICIENTS

On the basis of the soil borings conducted for this investigation, the upper 100 feet of soil may be characterized as stiff soil and a **Class D** Site Class Definition (Chapter 20 of ASCE 7) has been assigned to this site.

On the basis of the Structural Engineers Association of California (SEAOC) website[1] which utilizes the ASCE 7-22 and International Building Code (IBC) and U.S. Seismic Design Maps to develop seismic design parameters, the following seismic considerations are associated with this site.

- **S_s = 0.067g**

[1]https://seismicmaps.org/

- **S_1 = 0.039g**
- **S_{ms} = 0.107g**
- **S_{m1} = 0.094g**
- **S_{DS} = 0.071g**
- **S_{D1} = 0.062g**

Based on the parameters listed above as well as Tables 1613.2.5(1) and 1613.2.5(2) of the 2021 IBC, the Seismic Design Category for both short period and 1 second response accelerations is **A**. As part of the assumptions required to complete the calculations, a Risk Category of "I or II or III" was selected.

STRATIGRAPHY

The subsurface conditions encountered at the boring locations are shown on the boring logs, Figures 2 through 10. The boring logs should be consulted for boring specific (detailed) stratigraphic information. These boring logs represent our interpretation of the subsurface conditions based on the field logs, visual examination of field samples by our personnel, and laboratory test results of selected field samples. Each stratum has been designated by grouping soils that possess similar physical and engineering characteristics. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual.

The subject site soils consist of cohesive, low plasticity to plastic, soft to hard consistency, sandy lean clay (CL) and semi-cohesive sandy silty clay (CL-ML). Measured moisture contents range from 6 to 18 percent. Measured plasticity indices (PI) range from 7 to 25 percent. Based on grain size analyses, the percentage of fines (percent passing a No. 200 sieve) within this stratum ranges from 53 to 68 percent. Based on unconfined compression and unconsolidated undrained triaxial compression test results, undrained shear strength values range from 0.14 to 0.54 tsf. The tested samples had dry unit weights ranging from 111 to 125 pcf. SPT N-values ranging from 7 to 26 blows per foot were recorded within the subject site soils.

Additionally, a layer of semi-cohesive clayey sand (SC) was encountered in Boring B-9 below the cohesive soils at depths of about 28 ft extending to a depth of approximately 35 ft. Measured moisture contents is 13 percent. Measured PI is 8 percent. Based on grain size analyses, the percentage of fines (percent passing a No. 200 sieve) within this layer is 48 percent.

GROUNDWATER

Groundwater was observed in most of the borings located within the proposed building and light pole footprints. Groundwater depth readings for these borings are listed in the following table:

Table 3 – Groundwater Depth Readings

Boring No.	Depth Groundwater Encountered during Drilling (ft)	Water Level Depth after 15 Minutes (ft)
B-4	20.0	19.5
B-7	6.0	5.5
B-8	8.0	7.5

Groundwater was not observed in the remaining Borings B-1 through B-3, B-5, B-6, and B-9 either during or immediately upon completion of the drilling operations. These borings remained dry during the field exploration phase.

Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage encountered during site earthwork activities and foundation construction may be controlled using temporary earthen berm and conventional sump-and-pump dewatering methods.

FOUNDATION ANALYSIS

EXPANSIVE SOIL-RELATED MOVEMENTS

The anticipated ground movements due to swelling of the underlying soils at the site were estimated for slab-on-grade construction using the empirical procedure, Texas Department of Transportation (TxDOT) Tex-124-E, Method for Determining the Potential Vertical Rise (PVR). A PVR value of about ½ inches was estimated for the stratigraphic conditions encountered in our project borings. A surcharge load of 1 psi (5-inch thick concrete slab and 6 inches of select fill above existing grade), an active zone of 8 ft, and dry moisture conditions were assumed in estimating the above PVR values.

The TxDOT method of estimating expansive soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive, soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analysis of expansive soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the estimated PVR values due to isolated changes in moisture content (such as due to leaks, landscape watering....) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching or excavations.

DRAINAGE CONSIDERATIONS

Water entering the fill surface during construction or entering the fill exposed beyond the building lines after construction may create problems with fill moisture control during compaction and increased access for moisture to the underlying expansive clays both during and after construction.

When overexcavation and select fill replacement is selected as a method to reduce the potential for expansive soil-related movements at any site, considerations of surface and subsurface drainage may be crucial to construction and adequate foundation performance of the soil-supported structure and track. Filling an excavation in relatively impervious plastic clays with relatively pervious select fill material creates a “bathtub” beneath the track and field, which can result in ponding or trapped water within the fill unless good surface and subsurface drainage is provided.

Several surface and subsurface drainage design features and construction precautions can be used to limit problems associated with fill moisture. These features and precautions may include but are not limited to the following:

- Installing berms or swales on the uphill side of the construction area to divert surface runoff away from the excavation/fill area during construction;
- Sloping of the top of the subgrade with a minimum downward slope of 1.5 percent out to the base of a dewatering trench located beyond the building perimeter;
- Sloping the surface of the fill during construction to promote runoff of rain water to drainage features until the final lift is placed;
- Sloping of a final, well maintained, impervious clay or pavement surface (downward away from the building) over the select fill material and any perimeter drain extending beyond the building lines, with a minimum gradient of 6-in. in 5-ft;
- Constructing final surface drainage patterns to prevent ponding and limit surface water infiltration at and around the building perimeter;
- Locating the water-bearing utilities, roof drainage outlets and irrigation spray heads outside of the select fill and perimeter drain boundaries; and
- Raising the elevation of the ground level floor slab.

Details relative to the extent and implementation of these considerations must be evaluated on a project-specific basis by all members of the project design team. Many variables that influence fill drainage considerations may depend on factors that are not fully developed in the early stages of design. For this reason, drainage of the fill should be given consideration at the earliest possible stages of the project.

FOUNDATION RECOMMENDATIONS

FOUNDATION CONSIDERATIONS

Review of the borings and test data indicate that the factors discussed below will affect foundation design and construction at this site.

- The estimated PVR is about half inch. Lightly-loaded shallow foundations would not be susceptible to excessive movement from shrink-swell with variation in soil moisture.
- Presence of sandy soils inhibits the use of deep foundations.

We recommend that the new building be supported on spread footings bearing on undisturbed natural soils or properly-compacted, suitable select fill materials. The floor slab could be grade-supported on properly-compacted, suitable select fill materials having the necessary thickness to achieve the final grade.

The foundation loads have not been provided to us at the time of this report. Therefore, we anticipate light to moderate loads for the building structure supported on the above-mentioned foundation system. We have based our foundation recommendations on the assumption that column and strip loads will be on the order of 100 kips and 5 kips per feet, respectively.

SITE GRADING

Site grading plans can result in changes in almost all aspects of foundation recommendations. We have prepared the foundation recommendations based on the existing and proposed finished floor elevations discussed throughout this report. If site grading plans differ from those discussed in this report by more than plus or minus 1-ft, **Raba Kistner** must be retained to review the site grading plans prior to bidding the project for construction. This will enable us to provide input for any changes in our original recommendations, which may be required as a result of site grading operations or other considerations.

SPREAD FOOTINGS

The proposed building structure may be supported on spread footings bearing on undisturbed natural soils or properly-compacted, suitable select fill materials at a minimum depth of 3 to 4 ft below final grade. Isolated square and strip footings can be sized for an allowable bearing capacity as shown in Table 4 below.

Table 4 – Allowable Net Bearing Pressure for Spread Footings

Foundation Depth[1]	Loading Conditions[2]		
	Sustained (F.S. of 3)	Total (F.S. of 2)	Transient (F.S. of 1.5)
3 feet	2,000 psf	3,000 psf	4,000 psf

Notes:

1. Foundation depth referenced from grade at the time of our study. Potential changes to site grade should be addressed during final design phase.
2. Refer to report text for additional information relating to loading conditions.
3. F.S. refers to Factor of Safety.

The bearing pressures in Table 4 assume that the subgrade is prepared in accordance with the recommendations outlined in the *Site Preparation* subsection of the *General Construction Considerations* section of this report.

Furthermore, the design parameters previously presented are contingent upon the fill materials being selected and placed in accordance with the recommendations presented in the *Select Fill* subsection of the *General Construction Considerations* section of this report. Should select fill selection and placement differ from the recommendations presented herein, **Raba Kistner** should be informed of the deviations to reevaluate our recommendations and design criteria.

Settlement Considerations

A detailed settlement analysis for the building foundations was beyond the scope of this study. However, based on our experience, we expect vertical settlements for isolated spread footings with the allowable sustained bearing pressure provided above to be on the order about 1 inch. Differential settlements are expected to be approximately half the total settlement for most subsurface conditions. We recommend that spread footings be spaced at a distance equal to or greater than the width of the largest adjacent footing.

Uplift Resistance

Resistance to vertical force (uplift) is provided by the weight of the concrete footing plus the weight of the soil directly above the footing. For this site, it is recommended that the ultimate uplift resistance be based on total unit weights for soil and concrete of 125 pcf and 150 pcf, respectively. The calculated ultimate uplift resistance should be reduced by a factor of safety of 1.2 to calculate the allowable uplift resistance.

Lateral Resistance

Horizontal loads acting on spread footings will be resisted by passive earth pressure acting on one side of the footing and by base adhesion for footings in cohesive soils. An allowable base sliding adhesion of 300 psf may be used for footings in contact with cohesion soil at the recommended footing depth. This value should provide a factor of safety of 2.0 with respect to the ultimate value.

Grade Beams

Grade beams interconnecting the footings may bear on natural undisturbed soils or properly prepared select fill and should be sized to support the design loads. Grade beams should have a minimum width and depth of 12-inches and 18-inches, respectively, and a maximum allowable bearing pressure of 1,800 psf.

Floor Slabs

We recommend that a vapor barrier comprised of polyethylene or polyvinylchloride (PCV) sheeting be placed between the supporting soils and the concrete floor slab. Vapor barrier / retarder shall meet the specifications for durability and permeance set forth in ASTM E1745.

DRILLED FOOTINGS, STRAIGHT-SHAFT PIERS – LIGHT POLES

Drilled footings, straight-shaft piers may also be considered to support the proposed light poles. Based on the laboratory results obtained from Boring B-3 through B-6, straight-shaft piers should be designed as friction units using an allowable side shear resistance of 400 psf for the portion of the shaft extending below a depth of 3 ft. This allowable side shear resistance was evaluated using a calculated factor of safety of at least 2.

Lateral Resistance

Resistance to lateral loads and the expected shaft behavior under the applied loading conditions will depend not only on subsurface conditions, but also on loading conditions, the pier size, and the engineering properties of the pile. As this information is not yet available, analysis of pile behavior is not possible at this time. Once structural loading is known, and preliminary pile sizes, concrete strength, and reinforcement is known, the piles should be analyzed to determine the resulting lateral deflection, maximum bending moment, ultimate bending moment, and whether a point of fixity develops. This type of analysis is typically performed utilizing a computer analysis program and usually requires a trial and error procedure to appropriately size the piers and meet project tolerances.

To assist the design engineer in this procedure, we are providing the following soil parameters for use in analysis. These parameters are in accordance with the input requirements of one of the more commonly used computer programs for laterally loaded piles, the “L-Pile” program. If a different program is used for analysis, different parameters may be required and different limitations may be required than what was assumed in selecting the parameters given below. Thus, if a program other than “L-Pile” is used, **Raba**

Kistner must be notified of the analysis method, so that we can review and revise our recommendations if required.

The soil-related parameters required for input into the "L-Pile" are summarized in Table 5:

Table 5: L-Pile Parameters for Lateral Resistance

Layer	Assumed Behavior for Analysis	Depth (ft)	c (psf)	ε_{50}	k_s (pci)	γ (pcf)	γ' (pcf)
I	Stiff Clay, without Free Water (Reese)	0 – 20	1,800	0.007	500	120	58

Where:

k_s = horizontal modulus of subgrade reaction (static)
ε_{50} = strain at 50 percent
γ = total unit weight
γ' = effective unit weight
c = undrained shear strength

The values presented in Table 5 for subgrade modulus and the strain at 50% are based on recommended values for the L-Pile program for the strength of materials encountered in our borings and are not necessarily based on laboratory test results.

The parameters presented in the above table do **not** include factors of safety. We recommend that a factor of safety of at least 2 be introduced to the analysis by doubling the applied lateral loads and moments.

FOUNDATION CONSTRUCTION CONSIDERATIONS

SITE DRAINAGE

Drainage is an important key to the successful performance of any foundation. Good surface drainage should be established prior to and maintained after construction to help prevent water from ponding within or adjacent to the building foundation and to facilitate rapid drainage away from the building foundation. Failure to provide positive drainage away from the structure can result in localized differential vertical movements in soil supported foundations and floor slabs (which can in turn result in cracking in the sheetrock partition walls and shifting of ceiling tiles, as well as improper operation of windows and doors).

Current ordinances, in compliance with the Americans with Disabilities Act (ADA), may dictate maximum slopes for walks and drives around and into new buildings. These slope requirements can result in drainage problems for buildings supported on expansive soils. We recommend that, on all sides of the building, the maximum permissible slope is provided away from the building.

Also to help control drainage in the vicinity of the structure, we recommend that roof/gutter downspouts and landscaping irrigation systems not be located adjacent to the building foundation. Where a select fill overbuild is provided outside of the floor slab/foundation footprint, the surface should be sealed with an impermeable layer (pavement or clay cap) to reduce infiltration of both irrigation and surface waters.

Careful consideration should also be given to the location of water bearing utilities, as well as to provisions for drainage in the event of leaks in water bearing utilities. All leaks should be immediately repaired.

As with any soil-supported structure, the satisfactory performance of the structure/courts is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the supporting granular pavement materials will greatly reduce the performance and service life of the track and field systems, even when the systems are constructed using either typical cross-section guidelines or design recommendations based on site-specific soils testing.

Surface and subsurface drainage considerations crucial to the performance of pavements and the track at this site include (but are not limited to) the following:

1) Known natural or man-made subsurface seepage at the site which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade French drains.
2) Final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. **Curbs should completely penetrate base materials and should be installed to sufficient depth to reduce infiltration of water beneath the curbs**.
3) Pavement surfaces should be maintained to help minimize surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

Other drainage and subsurface drainage issues are discussed in the *Expansive Soil-Related Movements* subsection of the *Foundation Analysis* section of this report and under the *Pavement Construction Considerations* section of this report.

SITE PREPARATION

Building areas and other areas to support select fill should be stripped of vegetation, roots, and other deleterious materials. After stripping and grubbing, the exposed subgrade should be thoroughly proofrolled in order to locate and densify any weak, compressible zones. A minimum of 5 passes of a fully-loaded dump truck or a similar heavily-loaded piece of construction equipment should be used for planning purposes. Proofrolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proofrolling should be removed and replaced with suitable, compacted on-site clays, free of organics, oversized materials, and degradable or deleterious materials.

Upon completion of the proofrolling operations and just prior to fill placement or slab construction, the exposed subgrade should be moisture conditioned by scarifying to a minimum depth of 6 in. and recompacting to a minimum of 95 percent of the maximum dry density as determined by ASTM D698. The moisture content of the subgrade should be maintained within 2 percentage points of the optimum moisture content until permanently covered.

WET WEATHER CONDITIONS

Earthwork contractors should be made aware of the moisture sensitivity of the near-surface soils and potential compaction difficulties. If construction is undertaken during wet weather conditions, the surficial soils may become saturated, soft, and unworkable. Installation of drainage trenches, reworking and/or recompaction of subgrade soils may be required. Additionally, subgrade stabilization techniques, such as chemical (cement, fly ash or hydrated lime) treatment, may be required to provide a more weather-resistant working surface during pad construction. Therefore, we recommend that consideration be given to construction during the dryer months. Alternatively, the Contractor should protect exposed areas once topsoil has been stripped, as well as provide positive drainage during earthwork operations.

SELECT FILL

Materials used as select fill for final site grading preferably should be inert cohesive/semi-cohesive sandy lean clays (CL)/clayey sands (SC) as classified according to the USCS, may be considered satisfactory for use as select fill materials at this site. Select fill materials shall have a maximum liquid limit not exceeding 40 percent, a plasticity index between 7 and 20 percent, and a maximum particle size not exceeding 4 in. or one-half the loose lift thickness, whichever is smaller. In addition, if these materials are utilized, grain size analyses and Atterberg Limits must be performed during placement at a minimum rate of one test each per 5,000 cubic yards of material due to the high degree of variability associated with pit-run materials.

If the above listed materials are being considered for bidding purposes, the materials should be submitted to the Geotechnical Engineer for pre-approval at a minimum of 10 working days or more prior to the bid date. Failure to do so will be the responsibility of the contractor. The contractor will also be responsible for ensuring that the properties of all delivered alternate select fill materials are similar to those of the pre-approved submittal. It should also be noted that when using alternative fill materials, difficulties may be experienced with respect to moisture control during and subsequent to fill placement, as well as with erosion, particularly when exposed to inclement weather. This may result in sloughing of beam trenches and/or pumping of the fill materials.

Soils classified as CH, MH, ML, SM, GM, OH, OL and Pt under the USCS are **not** considered suitable for use as select fill materials at this site. The native soils observed within the project borings might be considered suitable for use as select fill materials. However, additional samples should be recovered and tested for classification purposes at the time of construction.

Select fill should be placed in loose lifts not exceeding 8 in. in thickness and compacted to at least 95 percent of maximum density as determined by ASTM D698. The moisture content of the fill should be maintained within the range of 2 percentage points below to 2 percentage points above the optimum moisture content until final compaction.

DRILLED PIERS

Each drilled pier excavation must be examined by a **Raba Kistner** representative who is familiar with the geotechnical aspects of the soil stratigraphy, the structural configuration, foundation design details and assumptions, prior to placing concrete. This is to observe that:

- The shaft has been excavated to the specified dimensions at the correct depths established by the previously mentioned criteria;
- The shaft has been drilled plumb within specified tolerances along its total length; and
- Excessive cuttings, buildup and soft, compressible materials have been removed from the bottom of the excavation.

Concrete Placement

Concrete should be placed in the excavation shortly after drilling to reduce changes in the moisture content or the state of stress of the foundation materials. In any circumstance, the foundation excavation should not remain open for more than 2 hours prior to concrete placement. Based on the water level information gathered during the fieldwork, we do not anticipate water seepage into the pier holes. However, if more than 1-in. of perched water accumulates at the bottom of the excavation, the water should be pumped out before concrete placement. No foundation element should be left open overnight without concreting.

SHALLOW FOUNDATION EXCAVATIONS

Shallow foundation excavations should be observed by the Geotechnical Engineer or their representative prior to the placement of reinforcing steel and concrete. This is necessary to document that the bearing soils at the bottom of the excavations are similar to those encountered in the borings and that excessive soft/loose materials and water are not present in the excavations. If soft/loose pockets of soil are encountered in the foundation excavations, they should be removed and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevations.

Disturbance from foot traffic and from the accumulation of excess water can result in losses in bearing capacity and increased settlement. If inclement weather is anticipated at the time construction, consideration should be given to protecting the bottoms of beam trenches by placing a thin mud mat (layer of flowable fill or lean concrete) at the bottom of trenches immediately following excavation. This will reduce disturbance from foot traffic and will impede the infiltration of surface water. All necessary precautions should be implemented to protect open excavations from the accumulation of surface water runoff and rain.

EXCAVATION SLOPING AND BENCHING

If utility trenches or other excavations extend to or below a depth of 5 ft below construction grade, the Contractor or others shall be required to develop a trench safety plan to protect personnel entering the trench or trench vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, are beyond the scope of the current study. Any such designs and safety plans shall be developed in accordance with current Occupational Safety and Health Administration (OSHA) trench safety guidelines (29 CFR 1926 Subpart P Appendix A) and other applicable industry standards.

EXCAVATION EQUIPMENT

Our boring logs are not intended for use in determining construction means and methods and may therefore be misleading if used for that purpose. We recommend that earthwork and utility contractors interested in bidding on the work perform their own tests in the form of test pits or test piers to determine the quantities of the different materials to be excavated, as well as the preferred excavation methods and equipment for this site.

UTILITIES

Utilities which project through slab-on-grade, slab-on-fill, or any other rigid unit should be designed with either some degree of flexibility or with sleeves. Such design features will help reduce the risk of damage to the utility lines as vertical movements occur. These types of slabs will generally be constructed as monolithic, grid-type beam and slab foundations.

Our experience indicates that significant settlement of backfill can occur in utility trenches, particularly when trenches are deep, when backfill materials are placed in thick lifts with insufficient compaction, and when water can access and infiltrate the trench backfill materials. The potential for water to access the backfill is increased where water can infiltrate flexible base materials due to insufficient penetration of curbs, and at sites where geological features can influence water migration into utility trenches.

To reduce the potential for settlement in utility trenches, we recommend that consideration be given to the following:

- Backfill materials should be placed and compacted in controlled lifts appropriate for the type of backfill and the type of compaction equipment being utilized, and backfilling procedures should be tested and documented.
- Curbs should completely penetrate flexible base materials and be installed to a sufficient depth to reduce water infiltration beneath the curbs into the pavement base materials.

Utilities may be backfilled with onsite materials provided the backfill is placed and compacted as discussed herein. However, we recommend material suppliers/manufacturers be consulted concerning any requirements that they have regarding the performance or warranty restriction of their products (particularly the project plans and specifications). Additional requirements for surface preparations, support, and backfilling may also be recommended/required by the material manufacturer/supplier.

AREA FLATWORK

It should be noted that ground-supported flatwork such as walkways, driveways, courtyards, sidewalks, etc., will be subject to the same magnitude of potential soil-related movements as discussed previously (see *Expansive Soil-Related Movements* subsection of the *Foundation Analysis* section of this report) for this site. Thus, where these types of elements abut rigid foundations or isolated/suspended structures, differential movements should be anticipated. As a minimum, we recommend that flexible joints be provided where such elements abut the main structure to allow for differential movement at these locations. Where the potential for differential movement is objectionable, it may be beneficial to consider methods of reducing anticipated movements or to consider structurally suspending critical areas to match the adjacent buildings performance.

PAVEMENT RECOMMENDATIONS

We have developed pavement section thicknesses and construction recommendations for the parking and driveway areas based on the project design requirements, the pavement design parameters developed from project borings, and our experience with similar subgrade soils. Pavement design criteria and pavement design parameters for rigid pavement are listed below.

RIGID PAVEMENT

Concrete pavement design for parking lots was performed in accordance with the American Concrete Institute (ACI) *Guide for Design and Construction of Concrete Parking Lots* (ACI Committee 330R-01). Based on an effective modulus of subgrade reaction (k) value of 100 pci (8-inch deep treated subgrade), a concrete flexural strength of 500 psi, and the concrete thickness tables presented in Table 2.4 of ACI 330R, design concrete thicknesses for light-duty, medium-duty, and heavy-duty pavements are presented in Table 6.

Table 6 – Rigid Pavement Section

Pavement Use	Traffic Category	Concrete Thickness (inches)
Light-Duty (Car Parking)	Category A, ADTT=1	5
Medium-Duty (Drive Aisles)	Category A-1, ADTT=10	6
Heavy-Duty (Driveway & Truck Traffic Areas)	Category B, ADTT=25 Category C, ADTT=100	7

ADTT = Average Daily Truck Traffic. Trucks are defined as vehicles with at least six wheels; excludes panel trucks, pickup trucks, and other four-wheel vehicles.

Using the previously referenced modulus of subgrade reaction value and the foregoing traffic volumes, the following rigid pavement reinforcement may be preliminarily considered.

Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 12.5 ft by 12.5 ft (light-duty)
Maximum Individual Slab Dimension (Expansion Joint to Crack Control Joint)	= 15 ft by 15 ft (medium-duty and heavy-duty)
Reinforcement Size	= No. 3 Deformed Bars
Reinforcement Spacing	= 18 inches on-centers each way
Load Transfer at Joints, Dowel Size	= 5/8-inch, 3/4-inch, 7/8-inch diameter smooth bars for light-duty, medium-duty, and heavy-duty, respectively
Load Transfer at Joints, Dowel Length	= 14 inches (one end treated to slip)
Load Transfer at Joints, Dowel Spacing	= 12 inches on-centers along each joint

Rigid pavement thicknesses and reinforcing steel details should be finalized by the project's Civil Engineer. Traffic conditions are expected to vary at the site, with heavy traffic loads anticipated for the entrance driveways and lighter traffic loads throughout the parking areas.

PAVEMENT CONSTRUCTION CONSIDERATIONS

SITE PREPARATION

The pavement subgrade should be prepared in accordance with the recommendations presented in the *Site Preparation* subsection of the *Foundation Construction Considerations* section of this report.

DRAINAGE CONSIDERATIONS

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at this site include (but are not limited to) the following:

- known natural or man-made subsurface seepage at the site which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade drains;
- final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. Curbs should be installed to sufficient depth to reduce infiltration of water beneath the curbs; and
- pavement surfaces should be maintained to help reduce surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

PORTLAND CEMENT CONCRETE

The Portland Cement Concrete (PCC) used for pavements should be air-entrained to result in a 3.5 percent plus/minus 1 percent air, a slump range of 3 to 5 inches, and a minimum 28-day compressive strength of 3,000 psi. A liquid membrane-forming curing compound should be applied as soon as practical after broom finishing the concrete surface. The curing compound will help reduce the loss of water from the concrete. The reduction in the rapid loss in water will help reduce shrinkage cracking of the concrete.

LIME TREATMENT OF SUBGRADE

In cohesive soils, lime may be used to treat the subgrade soils. Lime treatment of the cohesive subgrade soils should be in accordance with the TxDOT Standard Specifications, Item 260. For estimating purposes, we recommend that 4 percent hydrated lime by dry soil weight be assumed for treatment. Assuming an average dry unit weight of 105 pcf for the pavement subgrade soils (based on the boring logs) and an 8-inch treatment depth, a preliminary application rate of 25 lbs/sy may be used. Prior to construction, we recommend that the optimum lime content of the subgrade soils be determined by appropriate laboratory testing. Lime-treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content within the range of optimum moisture content to three (3) percentage points above the optimum moisture content as determined by ASTM D698.

Recommendations provided herein include the use of lime treatment as a method to improve pavement subgrade conditions. We also recommend performing additional laboratory testing to determine the concentration of soluble sulfates in the subgrade soils, in order to investigate the potential for a recently reported adverse reaction to lime in certain sulfate-containing soils. The adverse reaction, referred to as sulfate-induced heave, has been known to cause cohesive subgrade soils to swell in short periods of time, resulting in pavement heaving and possible failure.

LIME-FLY ASH TREATMENT OF SUBGRADE

In semi-cohesive and cohesionless soils, lime-fly ash treatment of the subgrade soils should be performed to a depth of 8-in. and be in accordance with the TxDOT Standard Specifications, Item 265. Include fly ash in percentage amounts in lime or lime slurry and apply lime-fly ash in a single mix, single pass over lower PI soils. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing the stabilizing agent. For estimating purposes, we recommend that 2 percent hydrated lime and 8 percent fly ash by dry weight be assumed for treatment. For construction purposes, we recommend that the lime-fly ash content of the subgrade soils be determined by appropriate laboratory testing. The soil-lime-fly ash mixture should be moist-cured a minimum of 3 days before covering with pavement.

The selected Fly-Ash component should be in accordance with ASTM C618, Class C or F; and have a minimum CaO content of 20 percent. Lime-Fly Ash treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D698 at a moisture content within the range of optimum moisture content to three (3) percentage points above the optimum moisture content.

CEMENT TREATMENT OF SUBGRADE

Cement is another treatment option for sandy soils. Cement treatment of subgrade soils should be in accordance with TxDOT Standard Specifications Item 275. Subgrade soils should be treated to a minimum depth of 8-in. Cement may be mixed dry or in slurry form; the target cement content and optimum moisture content should be determined using TxDOT test method Tex-120-E. The stabilized mixture should result in a minimum compressive strength of 50 psi when compacted to a minimum density of 95 percent of the maximum dry density at moisture content within two (2) percentage points of the optimum moisture content (Tex-114-E/ASTM D558). For estimating purposes, the dosage rate for cement treatment could range from 5 to 9 percent, by dry unit weight, for sandy material.

CONSTRUCTION RELATED SERVICES

CONSTRUCTION MATERIALS TESTING AND OBSERVATION SERVICES

As presented in the attachment to this report, *Important Information About Your Geotechnical Engineering Report*, subsurface conditions can vary across a project site. The conditions described in this report are based on interpolations derived from a limited number of data points. Variations will be encountered during construction, and only the geotechnical design engineer will be able to determine if these conditions are different than those assumed for design.

Construction problems resulting from variations or anomalies in subsurface conditions are among the most prevalent on construction projects and often lead to delays, changes, cost overruns, and disputes. These variations and anomalies can best be addressed if the geotechnical engineer of record, **Raba Kistner,** is retained to perform construction observation and testing services during the construction of the project. This is because:

- **Raba Kistner** has an intimate understanding of the geotechnical engineering report's findings and recommendations. **Raba Kistner** understands how the report should be interpreted and can provide such interpretations on site, on the CLIENT's behalf.
- **Raba Kistner** knows what subsurface conditions are anticipated at the site.
- **Raba Kistner** is familiar with the goals of the CLIENT and project design professionals, having worked with them in the development of the geotechnical work scope. This enables **Raba Kistner** to suggest remedial measures (when needed) which help meet the CLIENT's and the design teams' requirements.
- **Raba Kistner** has a vested interest in client satisfaction, and thus assigns qualified personnel whose principal concern is client satisfaction. This concern is exhibited by the manner in which contractors' work is tested, evaluated and reported, and in selection of alternative approaches when such may become necessary.
- **Raba Kistner** cannot be held accountable for problems which result due to misinterpretation of our findings or recommendations when we are not on hand to provide the interpretation which is required.

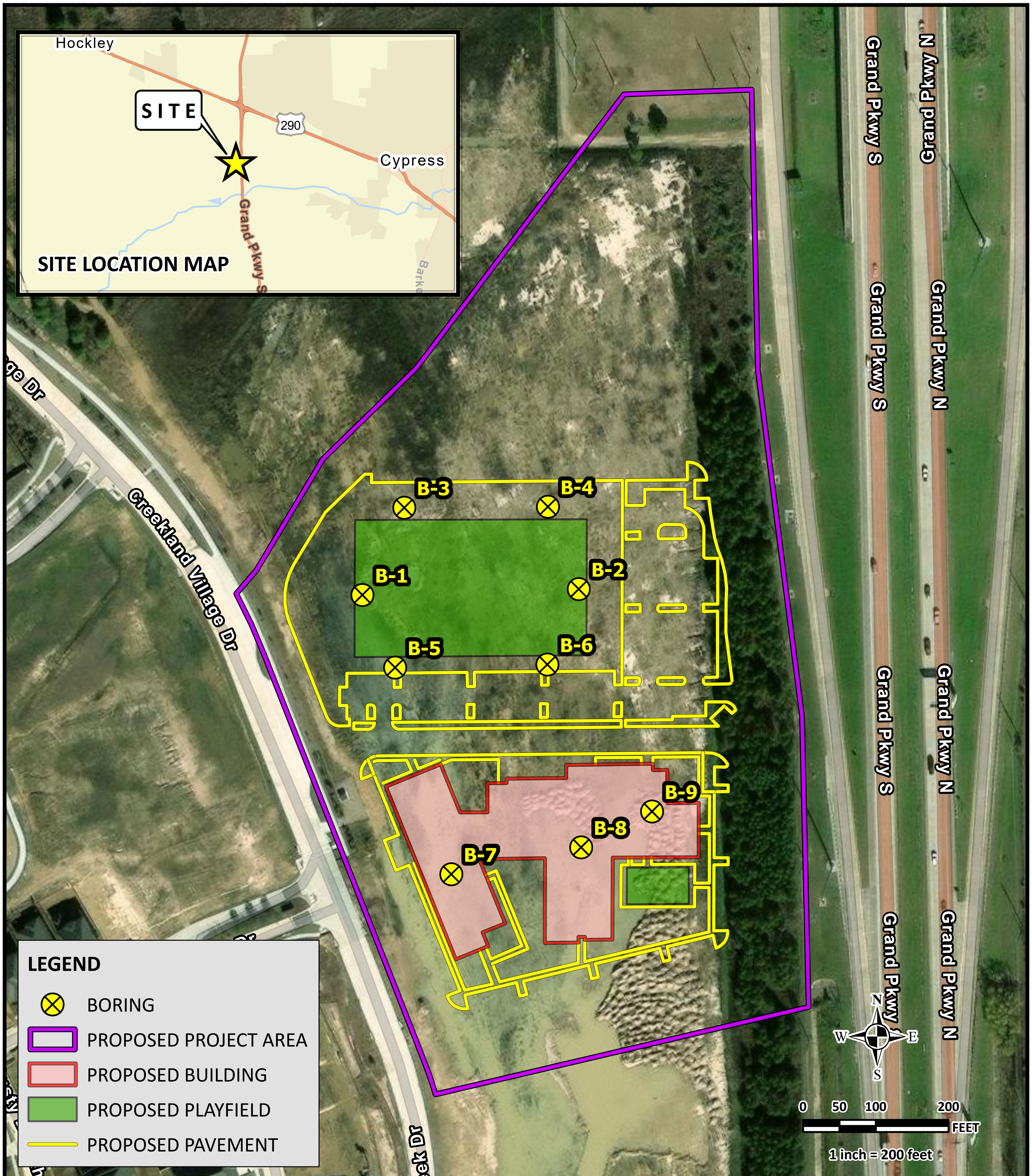
BUDGETING FOR CONSTRUCTION TESTING

Appropriate budgets need to be developed for the required construction testing and observation activities. At the appropriate time before construction, we advise that **Raba Kistner** and the project designers meet and jointly develop the testing budgets, as well as review the testing specifications as it pertains to this project.

Once the construction testing budget and scope of work are finalized, we encourage a preconstruction meeting with the selected contractor to review the scope of work to make sure it is consistent with the construction means and methods proposed by the contractor. **Raba Kistner** looks forward to the opportunity to provide continued support on this project and would welcome the opportunity to meet with the Project Team to develop both a scope and budget for these services.

* * * * * * * * * * * * * * * * * *

ATTACHMENTS



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TBPE Firm Number 3257

World Street Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

BORING LOCATION MAP

Harmony Public Schools
Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

PROJECT No.:	AHA25-024-00
ISSUE DATE:	7/9/2025
DRAWN BY:	BM
CHECKED BY:	HA
REVIEWED BY:	PTT

FIGURE

1

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

LOG OF BORING NO. B-1

Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.97501; W 95.77193

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (SURFACE ELEVATION: Existing grade, ft)	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT² (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) / PLASTIC LIMIT, WATER CONTENT, LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
0–5			SANDY LEAN CLAY (CL), firm to very stiff, brown and gray	11			13	67
5			Boring terminated at a depth of about 5 ft.					

NOTES:
1. Free water was not encountered during drilling.
2. Borehole was backfilled with cement bentonite grout.

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	5.0 ft	**DEPTH TO WATER:**	dry	**PROJ. No.:**	AHA25-024-00
DATE DRILLED:	6/20/2025	**DATE MEASURED:**	6/20/2025	**FIGURE:**	2

LOG OF BORING NO. B-2

Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.97501; W 95.77099

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: Existing grade, ft	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2 (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
			SANDY LEAN CLAY (CL), stiff to hard, dark brown and gray				8	63
				17				
5			Boring terminated at a depth of about 5 ft.					
			NOTES: 1. Free water was not encountered during drilling. 2. Borehole was backfilled with cement bentonite grout.					
10								
15								
20								
25								
30								
35								
40								

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	5.0 ft	**DEPTH TO WATER:**	dry	**PROJ. No.:**	AHA25-024-00
DATE DRILLED:	6/20/2025	**DATE MEASURED:**	6/20/2025	**FIGURE:**	3

LOG OF BORING NO. B-3

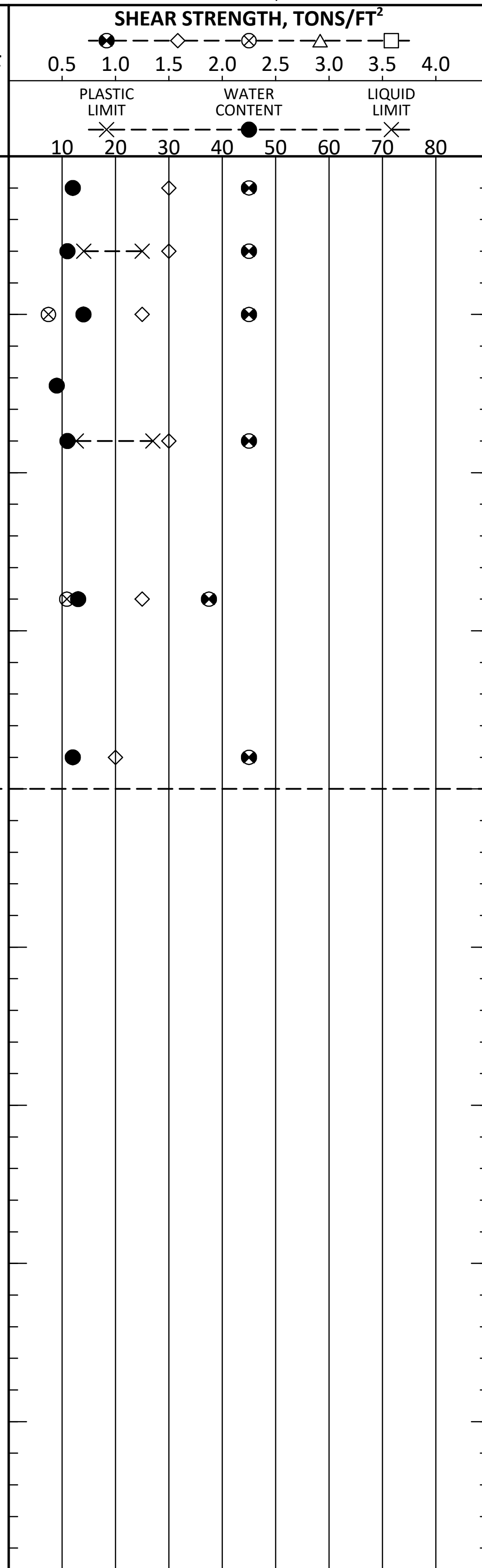
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.97531; W 95.77175

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: Existing grade, ft	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT² / PLASTIC LIMIT – WATER CONTENT – LIQUID LIMIT	PLASTICITY INDEX	% -200
0–20			SANDY LEAN CLAY (CL), firm to hard, dark brown and gray					
							11	67
5					116			
				14				57
							14	57
					122			
20			Boring terminated at a depth of about 20 ft.					



NOTES:
1. Free water was not encountered during drilling.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 20.0 ft	**DEPTH TO WATER:** dry	**PROJ. No.:** AHA25-024-00	
DATE DRILLED: 6/20/2025	**DATE MEASURED:** 6/20/2025	**FIGURE:** 4	

LOG OF BORING NO. B-4

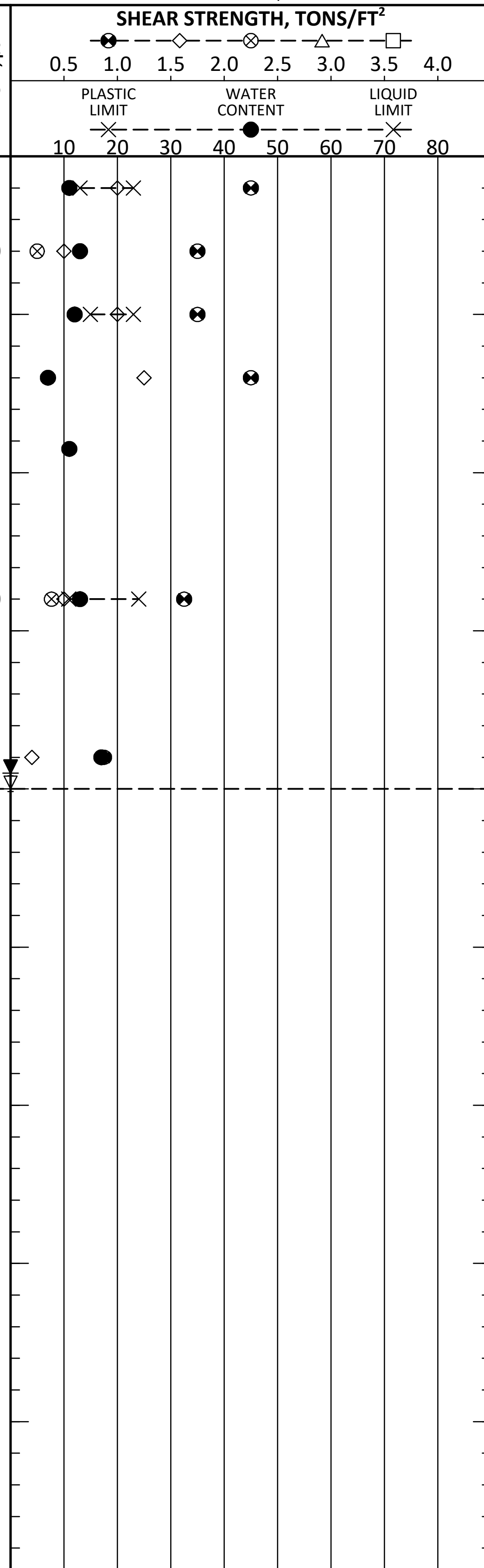
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.97530; W 95.77113

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing grade, ft				
			SANDY LEAN CLAY (CL), soft to hard, dark brown and gray			10	65
					120		
5						8	67
				14			56
10							
					120	13	58
15							
20			Boring terminated at a depth of about 20 ft.				
25							
30							
35							
40							



NOTES:
1. Free water was encountered at a depth of 20 ft during drilling, the water level rose to the 19.5 depth 15 minutes after the initial reading.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	20.0 ft	**DEPTH TO WATER:**	19.5 ft	**PROJ. No.:**	AHA25-024-00
DATE DRILLED:	6/20/2025	**DATE MEASURED:**	6/20/2025	**FIGURE:**	5

LOG OF BORING NO. B-5

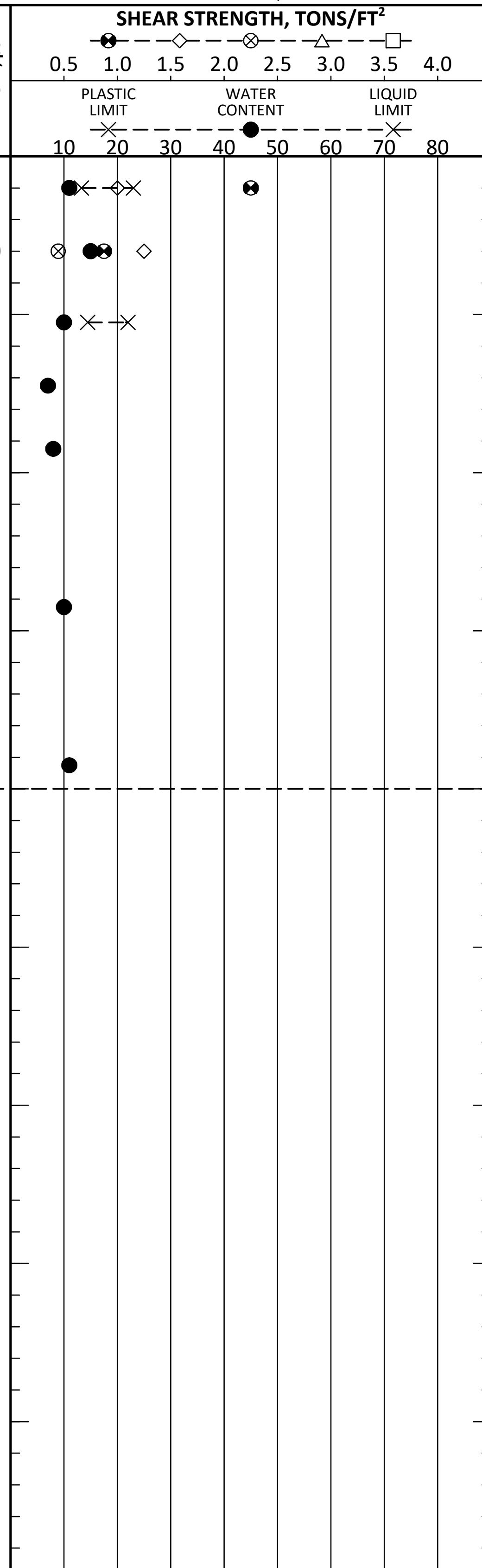
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.97473; W 95.77180

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: Existing grade, ft	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT² / PLASTIC LIMIT, WATER CONTENT, LIQUID LIMIT	PLASTICITY INDEX	% -200
0–20			SANDY LEAN CLAY (CL), firm to hard, dark gray, -w/ roots to 4 ft				10	62
					120			
5				10			8	67
				11				
				13				
10–15				14				57
				12				
20			Boring terminated at a depth of about 20 ft.					



NOTES:
1. Free water was not encountered during drilling.
2. Borehole was backfilled with cement bentonite grout.

DEPTH DRILLED: 20.0 ft
DATE DRILLED: 6/20/2025
DEPTH TO WATER: dry
DATE MEASURED: 6/20/2025
PROJ. No.: AHA25-024-00
FIGURE: 6

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-6

Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

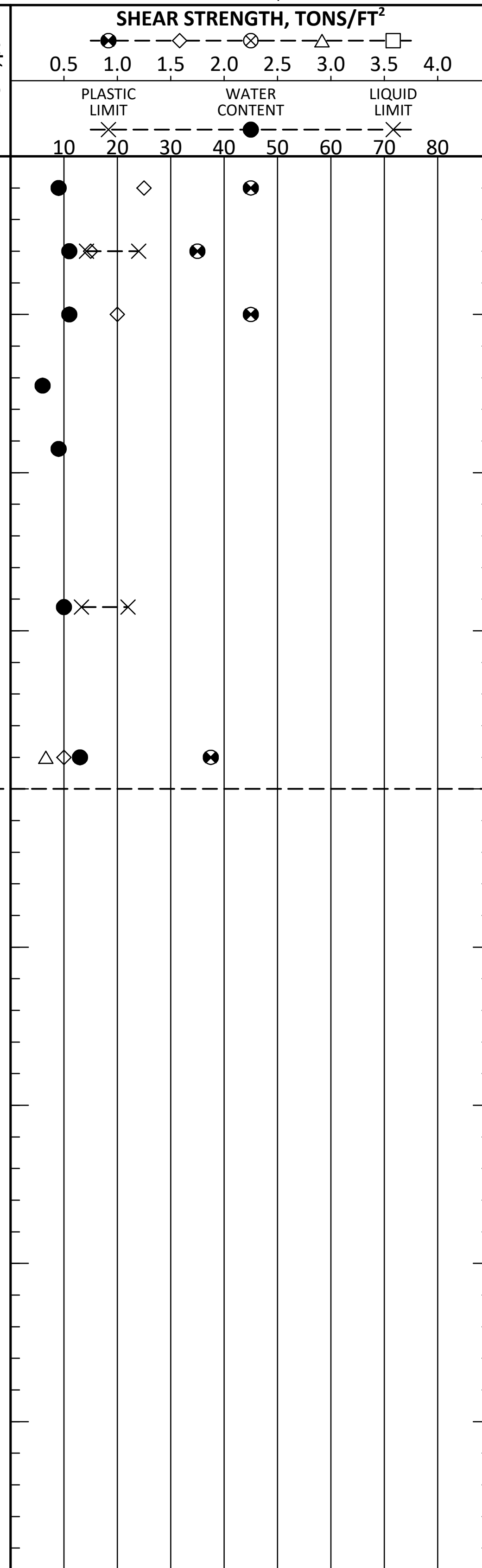
RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: N 29.97472; W 95.77113

SURFACE ELEVATION: Existing grade, ft

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	PLASTICITY INDEX	% -200
0–20			SANDY LEAN CLAY (CL), firm to hard, dark brown and gray				
~4						10	68
~7				20			53
~9				14			
~14				17		9	57
~19					121		



Boring terminated at a depth of about 20 ft.

NOTES:
1. Free water was not encountered during drilling.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 20.0 ft	**DEPTH TO WATER:** dry	**PROJ. No.:** AHA25-024-00	
DATE DRILLED: 6/20/2025	**DATE MEASURED:** 6/20/2025	**FIGURE:** 7	

LOG OF BORING NO. B-7

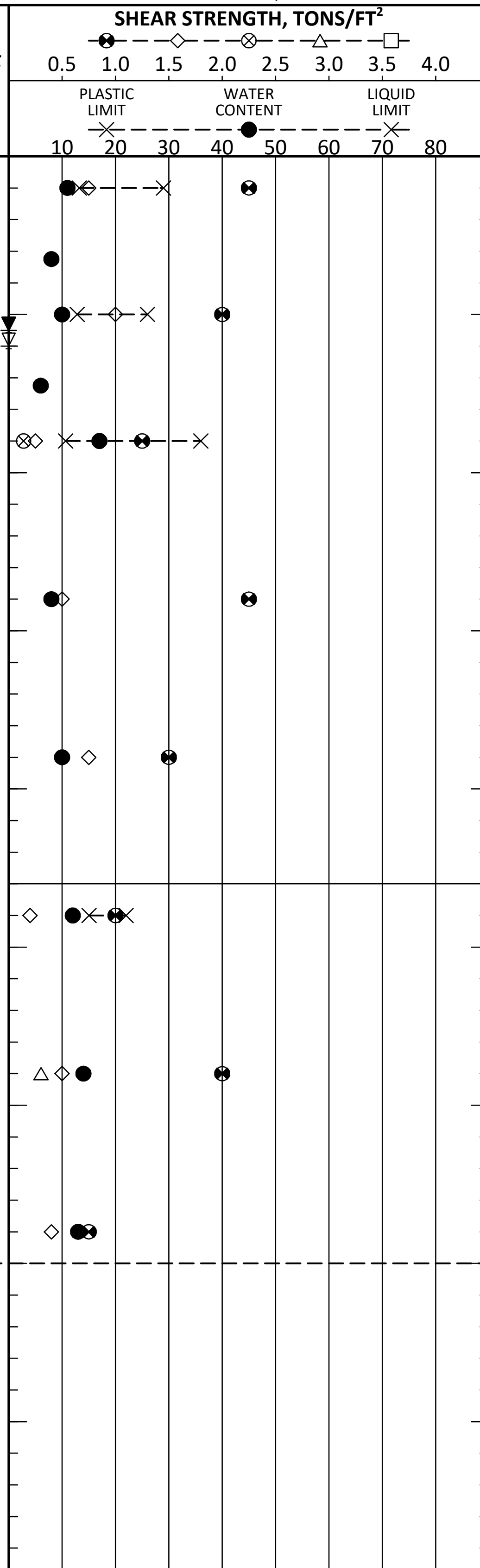
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.97397; W 95.77155

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing grade, ft				
			SANDY LEAN CLAY (CL), soft to hard, brown and gray			16	
			-w/ roots from 2 ft to 4 ft	7			67
5						13	
				15			56
					111	25	64
10							
15							
20							
			SANDY SILTY CLAY (CL-ML), soft to very stiff, brown			7	57
25							
					119		
30							
35			Boring terminated at a depth of about 35 ft.				
40							



NOTES:
1. Free water was encountered at a depth of 6 ft during drilling, the water level rose to the 5.5 depth 15 minutes after the initial reading.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 35.0 ft	**DEPTH TO WATER:** 5.5 ft	**PROJ. No.:** AHA25-024-00	
DATE DRILLED: 6/21/2025	**DATE MEASURED:** 6/21/2025	**FIGURE:** 8	

LOG OF BORING NO. B-8

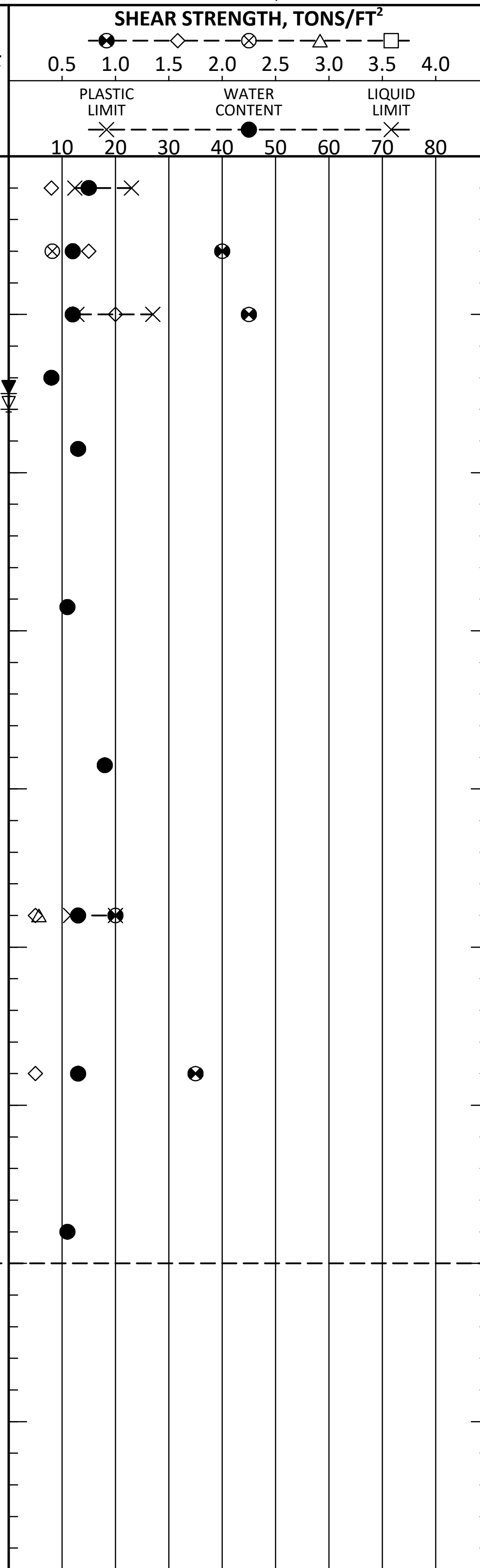
Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.97406; W 95.77098

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	PLASTICITY INDEX	% -200
	SURFACE ELEVATION: Existing grade, ft				
0–35	SANDY LEAN CLAY (CL), soft to hard, brown and gray, -w/ roots to 2 ft			11	61
			125		
5				14	64
					59
10		13			
15		21			59
20		14			
25			121	8	62
30					
35	Boring terminated at a depth of about 35 ft.				



NOTES:
1. Free water was encountered at a depth of 8 ft during drilling, the water level rose to the 7.5 depth 15 minutes after the initial reading.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	35.0 ft	**DEPTH TO WATER:**	7.5 ft	**PROJ. No.:**	AHA25-024-00
DATE DRILLED:	6/21/2025	**DATE MEASURED:**	6/21/2025	**FIGURE:**	9

LOG OF BORING NO. B-9

Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

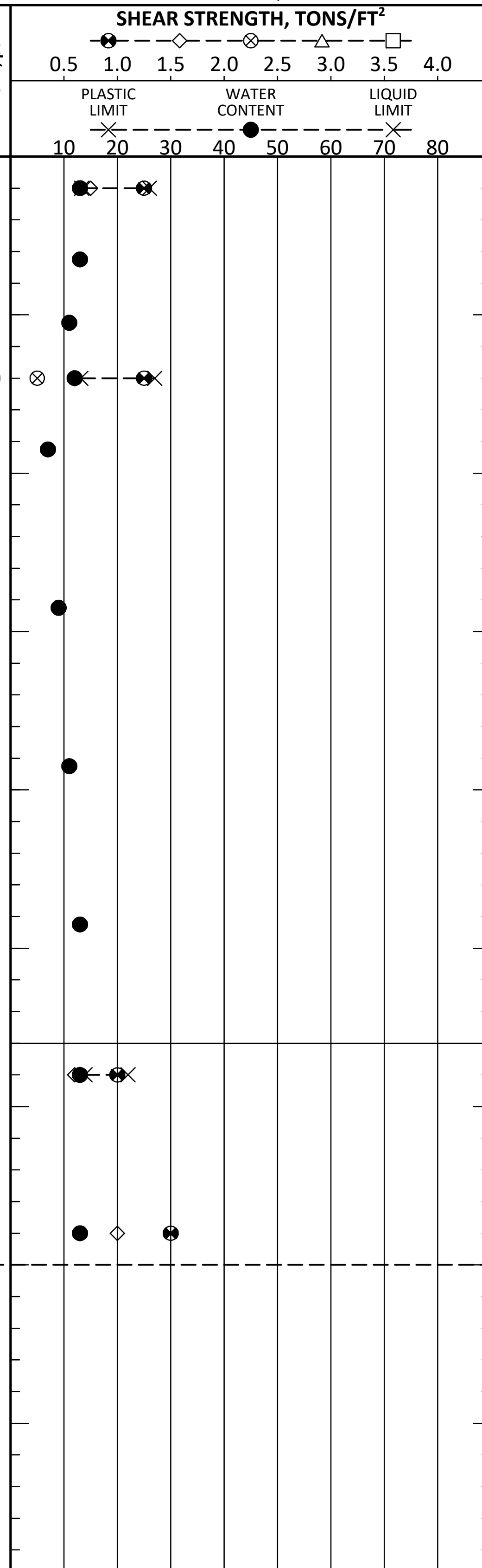
RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger & Mud Rotary

LOCATION: N 29.97419; W 95.77067

SURFACE ELEVATION: Existing grade, ft

DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	PLASTICITY INDEX	% -200
SANDY LEAN CLAY (CL), soft to very stiff, dark brown and gray -w/ roots and ferrous nodules to 2 ft			13	62
	19			68
	16			
		120	14	65
	15			62
	17			
	26			60
	17			
CLAYEY SAND (SC), gray			8	48
Boring terminated at a depth of about 35 ft.				



DEPTH, FT: 5, 10, 15, 20, 25, 30, 35, 40

NOTES:
1. Free water was not encountered during drilling.
2. Borehole was backfilled with cement bentonite grout.

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED: 35.0 ft	**DEPTH TO WATER:** dry	**PROJ. No.:** AHA25-024-00	
DATE DRILLED: 6/21/2025	**DATE MEASURED:** 6/21/2025	**FIGURE:** 10	

KEY TO TERMS AND SYMBOLS

MATERIAL TYPES

SOIL TERMS

- CALCAREOUS
- CALICHE
- CLAY
- CLAYEY
- GRAVEL
- GRAVELLY
- PEAT
- SAND
- SANDY
- SILT
- SILTY
- FILL

ROCK TERMS

- CHALK
- CLAYSTONE
- CLAY-SHALE
- CONGLOMERATE
- DOLOMITE
- IGNEOUS
- LIMESTONE
- MARL
- METAMORPHIC
- SANDSTONE
- SHALE
- SILTSTONE

OTHER

- ASPHALT
- BASE
- CONCRETE/CEMENT
- BRICKS / PAVERS
- WASTE
- NO INFORMATION

WELL CONSTRUCTION AND PLUGGING MATERIALS

- BLANK PIPE
- SCREEN
- BENTONITE
- CEMENT GROUT
- BENTONITE & CUTTINGS
- CONCRETE/CEMENT
- CUTTINGS
- GRAVEL
- SAND
- VOLCLAY

SAMPLE TYPES

- AIR ROTARY
- GRAB SAMPLE
- CORE
- GEOPROBE SAMPLER
- ROTOSONIC -DAMAGED
- MUD ROTARY
- NO RECOVERY
- NX CORE
- PITCHER
- ROTOSONIC -INTACT
- SHELBY TUBE
- SPLIT BARREL
- SPLIT SPOON
- TEXAS CONE PENETROMETER
- DISTURBED

STRENGTH TEST TYPES

- POCKET PENETROMETER
- TORVANE
- UNCONFINED COMPRESSION
- TRIAXIAL COMPRESSION UNCONSOLIDATED-UNDRAINED
- TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED

NOTE: VALUES SYMBOLIZED ON BORING LOGS REPRESENT SHEAR STRENGTHS UNLESS OTHERWISE NOTED

PROJECT NO. AHA25-024-00

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

RELATIVE DENSITY

Penetration Resistance Blows per ft	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE STRENGTH

Resistance Blows per ft	Consistency	Cohesion TSF
0 - 2	Very Soft	0 - 0.125
2 - 4	Soft	0.125 - 0.25
4 - 8	Firm	0.25 - 0.5
8 - 15	Stiff	0.5 - 1.0
15 - 30	Very Stiff	1.0 - 2.0
> 30	Hard	> 2.0

PLASTICITY

Plasticity Index	Degree of Plasticity
0 - 5	None
5 - 10	Low
10 - 20	Moderate
20 - 40	Plastic
> 40	Highly Plastic

ABBREVIATIONS

B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
BTEX = Total BTEX
TPH = Total Petroleum Hydrocarbons
ND = Not Detected
NA = Not Analyzed
NR = Not Recorded/No Recovery
OVA = Organic Vapor Analyzer
ppm = Parts Per Million

Qam, Qas, Qal = Quaternary Alluvium
Qat = Low Terrace Deposits
Qbc = Beaumont Formation
Qt = Fluviatile Terrace Deposits
Qao = Seymour Formation
Qle = Leona Formation
Q-Tu = Uvalde Gravel
Ewi = Wilcox Formation
Emi = Midway Group
Mc = Catahoula Formation
El = Laredo Formation
Kknm = Navarro Group and Marlbrook Marl
Kpg = Pecan Gap Chalk
Kau = Austin Chalk

Kef = Eagle Ford Shale
Kbu = Buda Limestone
Kdr = Del Rio Clay
Kft = Fort Terrett Member
Kgt = Georgetown Formation
Kep = Person Formation
Kek = Kainer Formation
Kes = Escondido Formation
Kew = Walnut Formation
Kgr = Glen Rose Formation
Kgru = Upper Glen Rose Formation
Kgrl = Lower Glen Rose Formation
Kh = Hensell Sand

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

SAMPLING METHODS

RELATIVELY UNDISTURBED SAMPLING

Cohesive soil samples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel samplers in general accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM D1586). Cohesive soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample integrity and moisture content.

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-in.-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

FILE NAME: AHA25-024-00.GPJ 7/9/2025

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-1	0.0 to 1.5	11	11						67		
	2.0 to 4.0		14	28	15	13				0.40	TV
	4.0 to 5.0		14							1.00	TV
B-2	0.0 to 2.0		11	22	14	8	CL		63	1.25	TV
	2.0 to 4.0		12							1.00	TV
	4.0 to 5.0	17	11								
B-3	0.0 to 2.0		12							1.50	TV
	2.0 to 4.0		11	25	14	11	CL		67	1.50	TV
	4.0 to 6.0		14					116		0.37	UC
	6.5 to 8.0	14	9						57		
	8.0 to 10.0		11	27	13	14	CL		57	1.50	TV
	13.0 to 15.0		13					122		0.54	UC
	18.0 to 20.0		12							1.00	TV
B-4	0.0 to 2.0		11	23	13	10	CL		65	1.00	TV
	2.0 to 4.0		13					120		0.25	UC
	4.0 to 6.0		12	23	15	8	CL		67	1.00	TV
	6.0 to 8.0		7							1.25	TV
	8.5 to 10.0	14	11						56		
	13.0 to 15.0		13	24	11	13	CL	120	58	0.38	UC
	18.0 to 20.0		17							0.20	TV
B-5	0.0 to 2.0		11	23	13	10	CL		62	1.00	TV
	2.0 to 4.0		15					120		0.45	UC
	4.5 to 6.0	10	10	22	14	8	CL		67		
	6.5 to 8.0	11	7								
	8.5 to 10.0	13	8								
	13.5 to 15.0	14	10						57		
	18.5 to 20.0	12	11								
B-6	0.0 to 2.0		9							1.25	TV
	2.0 to 4.0		11	24	14	10	CL		68	0.75	TV
	4.0 to 6.0		11							1.00	TV
	6.5 to 8.0	20	6						53		
	8.5 to 10.0	14	9								
	13.5 to 15.0	17	10	22	13	9	CL		57		
	18.0 to 20.0		13					121		0.33	UU
B-7	0.0 to 2.0		11	29	13	16				0.75	TV
	2.5 to 4.0	7	8						67		
	4.0 to 6.0		10	26	13	13				1.00	TV
	6.5 to 8.0	15	6						56		
	8.0 to 10.0		17	36	11	25	CL	111	64	0.14	UC

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial

PROJECT NO. AHA25-024-00

RABAKISTNER

FIGURE 12a

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Harmony Public Schools – Bridgeland Campus Phase II
12800 Creekland Village Drive
Cypress, Texas

FILE NAME: AHA25-024-00.GPJ 7/9/2025

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-7	13.0 to 15.0		8							0.50	TV
	18.0 to 20.0		10							0.75	TV
	23.0 to 25.0		12	22	15	7	CL-ML		57	0.20	TV
	28.0 to 30.0		14					119		0.30	UU
	33.0 to 35.0		13							0.40	TV
B-8	0.0 to 2.0		15	23	12	11	CL		61	0.40	TV
	2.0 to 4.0		12					125		0.41	UC
	4.0 to 6.0		12	27	13	14	CL		64	1.00	TV
	6.0 to 8.0		8						59		
	8.5 to 10.0	13	13								
	13.5 to 15.0	21	11						59		
	18.5 to 20.0	14	18								
	23.0 to 25.0		13	20	12	8	CL	121	62	0.28	UU
	28.0 to 30.0		13							0.25	TV
	33.0 to 35.0		11								
B-9	0.0 to 2.0		13	26	13	13	CL		62	0.75	TV
	2.5 to 4.0	19	13						68		
	4.5 to 6.0	16	11								
	6.0 to 8.0		12	27	13	14	CL	120	65	0.25	UC
	8.5 to 10.0	15	7						62		
	13.5 to 15.0	17	9								
	18.5 to 20.0	26	11						60		
	23.5 to 25.0	17	13								
	28.0 to 30.0		13	22	14	8	SC		48	0.60	TV
	33.0 to 35.0		13							1.00	TV

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial

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.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of 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.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

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