GEOTECHNICAL ENGINEERING REPORT

Northlake Subdivision Phase 1 -
Streets and Preliminary Foundation
Burshard Road
San Antonio, Texas

PSI Project No. 0312-3143-R5

PREPARED FOR:

Lennar
100 North East Loop 410, Suite 1155
San Antonio, Texas 78216

November 14, 2024

BY:

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November 14, 2024

Lennar
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Attn: Mr. Richard Mott

RE: GEOTECHNICAL ENGINEERING REPORT
Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road
San Antonio, Texas
PSI Project No. 0312-3143-R5

Dear Mr. Mott:

Professional Service Industries, Inc. (PSI), an Intertek company, is pleased to submit this Revised Geotechnical Engineering Report for the above-referenced project. This revised report includes the results from the field and laboratory investigation along with recommendations for use in preparation of the appropriate design and construction documents for this project.

PSI appreciates the opportunity to provide this Revised Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. PSI also has great interest in providing materials testing and inspection services during the construction of this project and will be glad to meet with you to further discuss how we can be of assistance as the project advances.

If there are questions pertaining to this report, or if PSI may be of further service, please contact us at your convenience.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Texas Board of Professional Engineers Certificate of Registration # F003307

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November 14, 2024

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1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI), an Intertek company, has completed a field exploration and geotechnical evaluation for the proposed Northlake Subdivision Phase 1 - Streets and Preliminary Foundation project. Mr. Richard Mott, representing Lennar, authorized PSI's services on February 22, 2024, by signing PSI Proposal No. 418889. PSI's proposal contained a proposed scope of work, lump sum fee, and PSI's General Conditions.

1.2 PROJECT DESCRIPTION

Based on information provided by the Client and PSI's review of a site plan entitled "Northlake Subdivision Preliminary Lot Layout", prepared by Colliers Engineering & Design, dated May 23, 2023, and the results of this geotechnical investigation a summary of our understanding of the proposed project is provided below in the following Project Description table.

TABLE 1.1: PROJECT DESCRIPTION

Project Items	Approximately 12,000 lineal feet of subdivision streets
Pavement for Parking and Drives	Flexible Asphalt (HMAC)
Design Traffic Load	Type A without Bus: 100,000 ESALs Type B: 2,000,000 ESALs Secondary Arterial: 3,000,000 ESALs

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials encountered during the field investigation. If the information presented above is incorrect, please inform PSI so that the recommendations presented in this report can be amended, as necessary. PSI will not be responsible for the implementation of provided recommendations if not notified of changes in the project.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to evaluate the subsurface conditions at the site and develop geotechnical engineering recommendations and guidelines for use in preparing the design and other related construction documents for the proposed project. The scope of services included drilling soil borings, performing laboratory testing, and preparing this geotechnical engineering report.

This report briefly outlines the available project information, describes the site and subsurface conditions, and presents the following:

- General site development and subgrade preparation recommendations.
- Estimated potential soil movements associated with collapsing, shrinking and swelling soils and methods to reduce these movements.
- Recommendations for site excavation, fill compaction, and the use of on-site and imported fill material under pavements.
- Preliminary recommendations for building pad preparation for ground-supported slabs based on the existing conditions.

- Preliminary recommendations for the design of foundations for supporting the proposed structures, which may include Wire Reinforcing Institute (WRI) and Post-Tensioning Institute (PTI) design criteria for slab-on-grade foundations designed for the existing conditions.
- Seismic design site classification per the 2018 International Building Code.
- Recommendations for the design of flexible asphaltic pavement systems for the proposed residential streets per the City of San Antonio Pavement Design Standards.

The scope of services for this geotechnical exploration did not include an environmental, mold nor detailed seismic/fault assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. The report also does not include a detailed settlement analysis or slope stability analysis.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE DESCRIPTION

The following table provides a generalized description of the existing site conditions based on visual observations during the field activities, as well as other available information.

TABLE 2.1: SITE DESCRIPTION

Site Location	Latitude: 29.3342°; Longitude: -98.3361°
Site History	Undeveloped Land
Existing Site Ground Cover	Trees and/or Grass
Existing Grade/Elevation Changes	Sloping down in all directions from high area near the center of the site
Site Geology (Geologic Atlas of Texas)	Wilcox Group (Epa)
Site Boundaries/Neighboring Development	Undeveloped property surrounds the site
Ground Surface Soil Support Capability for Operational Stability and Site Access	Anticipated to be Firm Enough for Field Equipment when Dry

2.2 FIELD EXPLORATION

Field exploration for the project consisted of drilling a total of **fourteen (14) borings**. The boring design element, approximate depths and drilling footage are provided in the following table.

TABLE 2.2: FIELD EXPLORATION SUMMARY

Design Element	Number of Borings	Boring Depth (ft)	Drilling Footage (feet)
Streets	14	15	210
TOTAL:	**14**	**---**	**210**

The boring locations were selected by PSI personnel and located in the field using a recreational-grade GPS system. Elevations of the ground surface at the boring locations were not provided and should be surveyed by others prior to construction, if required. We have estimated ground surface elevations at the boring locations from the topographic survey provided (or from Google Earth) and estimate an approximate 1-foot accuracy. The references to elevations of various subsurface strata are based on depths below existing grade at the time of drilling. The approximate boring locations are depicted on the Boring Location Plan provided in the Appendix.

TABLE 2.3: FIELD EXPLORATION DESCRIPTION

Drilling Equipment	Truck-Mounted Drilling Equipment
Drilling Method	Continuous Flight-Auger
Field Testing	Standard Penetration Test (ASTM D1586)
Sampling Procedure	ASTM D1586
Sampling Frequency	Continuously to a Depth of 10 Feet
Frequency of Groundwater Level Measurements	During and After Drilling
Boring Backfill Procedures	Soil Cuttings and asphalt patching
Sample Preservation and Transportation Procedure	General Accordance with ASTM D4220

During field activities, the encountered subsurface conditions were observed, logged, and visually classified (in general accordance with ASTM D2487). Field notes were maintained to summarize soil types and descriptions, water levels, changes in subsurface conditions, and drilling conditions.

2.3 LABORATORY TESTING PROGRAM

PSI supplemented the field exploration with a laboratory testing program to determine additional engineering characteristics of the subsurface soils encountered. The laboratory testing program included:

TABLE 2.4: LABORATORY TESTING PROGRAM

Laboratory Test	Procedure Specification
Visual Classification	ASTM D2488
Moisture Content	ASTM D2216
Atterberg Limits	ASTM D4318
Material Finer than No. 200 Sieve	ASTM D1140
California Bearing Ratio (CBR)	ASTM D1883

The laboratory testing program was conducted in general accordance with applicable ASTM Test Methods. The results of the laboratory tests are provided on the Boring Logs in the Appendix. Portions of samples not altered or consumed by laboratory testing will be discarded 60 days from the date shown on this report.

2.4 SITE GEOLOGY

We reviewed the **San Antonio Sheet of the Geologic Atlas of Texas** in an effort to determine the geologic setting of the project site and surrounding areas. The Geologic Atlas of Texas was developed by the Bureau of Economic Geology at The University of Texas using aerial photography, data from various oil and gas exploration companies, and very limited ground reconnaissance. Our review indicates that the project is located in the **Wilcox Group (Ewi)** of Tertiary Geologic Age. The San Antonio Sheet generally describes the **Wilcox Group** as mostly mudstone, with various amounts of sandstone, lignite, ironstone concretions, glauconitic; thickness about 1,000 ft. sand, mudstone, clay, mudstone conglomerate, thickness as much as 300 ft. lower part mostly mudstone, thickness about 500 +- ft. Total thickness roughly 1,400-1,800 ft.

2.5 SUBSURFACE CONDITIONS

The results of the field and laboratory investigation have been used to develop a generalized subsurface profile at the project site. The following subsurface descriptions highlight the major subsurface stratification features and material characteristics.

TABLE 2.5: GENERALIZED SUBSURFACE PROFILE TABLE

Top (ft)	Bot. (ft)	Soil Type	ω (%)	LL (%)	PI	-200 Sieve (%)	N
0	2.5 – 13.5	Fat Clay with Sand Clayey Sand Clayey Sand with Gravel Sandy Lean Clay Sandy Lean Clay with Gravel Silty Sand Clayey Gravel with Sand	4 – 16	NP – 73	NP – 52	14 – 75	4 – 44
2.5 – 13.5	15	Fat Clay Fat Clay with Sand Clayey Sand Clayey Sand with Gravel Silty Sand Sandstone	3 – 19	24 – 67	4 – 52	16 – 93	8 – 50/0”

Note:

1. *ω = Moisture Content (%)*
2. *LL= Liquid limit (%)*
3. *PI = Plasticity Index*
4. *-#200 Sieve = % Passing the #200 Sieve*
5. *N = Standard Penetration Test blow count (blows/foot)*

The material properties for the sandstone were obtained by laboratory testing, however, these tests were performed on grab samples from cuttings where the rock and rock-like materials had been broken down to its finer constituent materials. Therefore, the reported properties reflect the nature of broken-down rock or rock-like material, which was considered in the analysis and recommendations provided in this report.

The boring logs included in the Appendix should be reviewed for specific information at the boring locations. The boring logs include soil descriptions, stratifications, locations of the samples, and field and laboratory test data. The descriptions provided on the logs only represent the conditions at the specific boring location. The stratifications represent the approximate boundaries between subsurface materials. The actual transitions between strata may be more gradual and less distinct. Variations will occur and should be expected across the site.

2.5.1 GROUNDWATER INFORMATION

Water level measurements were performed during drilling and after completion of drilling. Specific information concerning groundwater is noted on each boring log presented in the Appendix of this report. Groundwater **was not** encountered during the field investigation of this site.

Groundwater levels fluctuate seasonally as a function of rainfall, proximity to creeks, rivers and lakes, the infiltration rate of the soil, seasonal and climatic variations and land usage. In relatively pervious soils, such as sandy soils, the indicated depths are a relatively reliable indicator of groundwater levels. In relatively

impervious soils, water levels observed in the borings may not provide a reliable indication of groundwater elevations, even after several days. If a detailed water level evaluation is required, observation wells or piezometers can be installed at the site to monitor water levels.

The groundwater levels presented in this report were measured at the time of PSI field activities. The contractor should be prepared to control groundwater, if encountered during construction activities.

3.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

3.1 GEOTECHNICAL DISCUSSION

Based upon the information gathered from the soil borings and laboratory testing, the clay soils encountered at this site within the seasonally active zone (estimated to extend to a depth of approximately 15 feet below the existing ground surface) have a **low to moderate** potential for expansion. PSI recommends the expansive potential (i.e. Potential Vertical Movement (PVM)) of these soils be addressed in the design and construction of this project to reduce the potential for foundation movements.

The following design recommendations have been developed based on the previously described project characteristics and subsurface conditions encountered. If there are changes in the project criteria, PSI should be retained to determine if modifications in the recommendations will be required. The findings of such a review would be presented in a supplemental report. Once final design plans and specifications are available, a general review by PSI is recommended to observe that the conditions assumed in the project description are correct and to verify that the earthwork and foundation recommendations are properly interpreted and implemented within the construction documents.

3.2 POTENTIAL VERTICAL MOVEMENT OF EXPANSIVE SOILS (PVM)

The soils encountered at the soil boring locations exhibit a **low to moderate** potential for volumetric changes, due to fluctuations in soil moisture content. PSI has conducted laboratory testing on the soils to estimate the expansive soil potential with soil moisture variations. These soil moisture variations are based on historical climate change data for a particular site. Determining the soil potential for shrinking and swelling, combined with historical climate variation, aids the engineer in quantifying the soil movement potential of the soils supporting the floor slab and shallow foundations based on climate variations. Shrink/swell movement procedures using two soil modeling systems, the Post Tensioning Institute's (PTI) "Design of Post-Tensioned Slabs-on-Ground, 3rd Edition" and Texas Department of Transportation (TxDOT) method TEX-124-E, were utilized to approximate the Potential Vertical Movement (PVM) for this location.

The anticipated shrink/swell movement (PVM) is a soil movement estimated in consideration of soil properties and climatic moisture changes at a particular geographic location. Foundations on expansive soils are designed with sufficient stiffness to resist these soil movements to an acceptable magnitude.

3.2.1 SHRINK/SWELL MOVEMENT (PVM) ESTIMATE

Based on laboratory testing results and the TEX-124-E and the PTI methods, the potential vertical movement within the proposed project area was estimated to be approximately **1 inch.**

It is not possible to accurately quantify actual soil moisture changes and resulting shrink/swell movements. The PVM and referenced structural movement values provided should be considered approximate values based on industry standard practice and experience. Extreme soil moisture variations could occur due to unusual drought severity, leaking water or sewer lines, perched groundwater infiltration, or seasonal springs. Also, soil transpiration from trees located adjacent to or previously underneath the building, downspouts directing roof discharge under the foundation, poor drainage or irrigation line breaks could lead to excessive movements.

Therefore, because of these unknown factors, the shrink/swell potential of soils can often be significantly underestimated using the previously mentioned methods of evaluating PVM.

The unknown factors previously mentioned cannot be determined at the time of the geotechnical study. Therefore, estimated shrink/swell movements are calculated only in consideration of historical climate data related to soil moisture variations from climate changes. Movements in excess of those estimated should be anticipated and regular maintenance should be provided to address these issues throughout the life of the structure.

3.3 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

The following sections outline geotechnical design requirements for the recommended foundation options.

3.3.1 STIFFENED BEAM AND SLAB-ON-GROUND FOUNDATION (WAFFLE SLAB) RECOMMENDATIONS

A waffle slab type foundation is generally used to support relatively light structures where soil conditions are relatively uniform and where uplift and settlement can be tolerated. The intent of a stiffened beam and slab-on-grade foundation is to allow the structure and foundation to move with soil movements while providing sufficient stiffness to limit differential movements within the superstructure to an acceptable magnitude. The foundation may be designed using the Design of Slab-On-Ground Foundations published by the Wire Reinforcement Institute, Inc. (August 1981, updated March 1996). Alternately, the foundation may be designed using the 3rd Edition of the Design of Post-Tensioned Slabs-on-Ground published by the Post-Tensioning Institute (PTI DC10.1-08). The following table is applicable for a conventionally reinforced "Waffle Slab" based on the sites exiting conditions.

TABLE 3.1: WRI WAFFLE SLAB DESIGN PARAMETERS

Effective Plasticity Index	25
Soil/Climatic Rating Factor (1–C)	0.12
Allowable Bearing Pressure for Grade Beams	2,500 psf
Bearing Stratum at Bottom of Grade Beams	Compacted Select Fill or Reconditioned Fill
Penetration of Perimeter Beams Below Final Exterior Grade	At least 24 inches

PSI is providing PTI design values for the Structural Engineer's design. These design values are estimated from the "Volflo" computer program in consideration of the soil conditions in the building area, an improved foundation pad having a 1-inch PVM and local experience. The following table is applicable for a conventionally reinforced or post-tensioned slab-on-grade based on the sites exiting conditions.

TABLE 3.2: PTI WAFFLE SLAB DESIGN PARAMETERS

Edge Moisture Variation Distance Center Lift, e_m Edge Lift, e_m	 9.0 feet 4.8 feet
Differential Soil Movement Center Lift, y_m Edge Lift, y_m	 -1.0 inches 1.2 inches
Allowable Bearing Pressure for Grade Beams	2,500 psf
Bearing Stratum at Bottom of Grade Beams	Compacted Select Fill or Reconditioned Fill
Penetration of Perimeter Beams Below Final Exterior Grade	At least 30 inches

Utilities that project through slab and grade beam foundations should be designed either with some degree of flexibility or with sleeves in order to prevent damage to these lines as a result of vertical movement. Contraction, control or expansion joints should be designed and placed in interior wall partitions to minimize and control wall cracking as a result of foundation movements. Properly planned placement of these joints will assist in controlling the degree and location of material cracking which normally occurs due to material shrinkage, thermal affects, soil movements and other related factors.

3.4 SITE SEISMIC DESIGN RECOMMENDATIONS

For the purposes of seismic design, based on the encountered site conditions and local geology, PSI interpreted the subsurface conditions to satisfy the **Site Class C** criteria for use at this site as defined by the International Building Code (IBC). The site class is based on the subsurface conditions encountered at the soil borings, the results of field and laboratory testing, experience with similar projects in this area, and considering the site prepared as recommended herein. The table below provides recommended seismic parameters for the project based on IBC 2018/ASCE 7-16.

TABLE 3.3: RECOMMENDED DESIGN SEISMIC PARAMETERS

Project/Structure Centroid Coordinates (WGS84 - Decimal Degree)	**29.2226°; -98.3343°**
Seismic Parameter	**IBC 2018/ASCE 7-16**
Site Class	**C**
Risk Category	II
0.2 sec (S_S)	0.053
1.0 sec (S_1)	0.022
Site Coefficient 0.2sec, F_a	1.6
Site Coefficient 1.0 sec, F_v	2.4
0.2 sec (S_{DS})	0.046
1.0 sec (S_{D1})	0.022

4.0 PAVEMENT DESIGN RECOMMENDATIONS

4.1 PAVEMENT DESIGN PARAMETERS

PSI understands that flexible pavements will be considered for this project. Therefore, pavement design recommendations based on the criteria presented in the *City of San Antonio Pavement Design Standards* (revised January 2017), a traffic loading of 100,000 18-kip Equivalent Single Axle Loads (ESALs) for flexible pavement was evaluated for a street classification of Local Type A streets without bus traffic. A traffic load of 2,000,000 18-kip ESALs for flexible pavement was evaluated for a street classification of Local Type B/Collector streets. A traffic load of 3,000,000 18-kip ESALs for flexible pavement was evaluated for a street classification of Primary and Secondary Arterial streets. PSI utilized the "AASHTO Guide for Design of Pavement Structures" published by the American Association of State Highway and Transportation Officials to evaluate the pavement thickness recommendations in this report. This method of design considers pavement performance, traffic, roadbed soil, pavement materials, environment, drainage, and reliability. Each of these items is incorporated into the design methodology. PSI is available to provide laboratory testing and engineering evaluation to refine the site-specific design parameters and sections, upon request.

PSI collected bulk soil samples of the native soils encountered at the site to conduct Atterberg Limits, Percent Finer than the No. 200 Sieve, and California Bearing Ratio (CBR) test. The results for the Moisture Density Relationship and the CBR Tests are presented in the Appendix. The following table presents the results from our laboratory testing performed on the native soil.

TABLE 4.1: NATIVE SOIL TEST SUMMARY

Material	Liquid Limit (ASTM D4318)	Plasticity Index (ASTM D4318)	Percent Passing No. 200 Sieve	Laboratory CBR Value (ASTM D1883)
Clayey Sand	27	11	26	6.6

Based on the results of the laboratory testing, PSI has provided recommended pavement sections for pavements constructed on an improved subgrade. Details regarding the basis for this design are presented in the table below.

TABLE 4.2: PAVEMENT DESIGN PARAMETERS AND ASSUMPTIONS

City of San Antonio Local Type A Street	
Reliability, percent	70
Initial Serviceability Index, Flexible Pavement	4.2
Terminal Serviceability Index	2.0
Design Traffic Loading, Flexible Pavement, without bus	100,000 equivalent single axle loads (ESALs)
Standard Deviation, Flexible Pavement	0.45
Subgrade California Bearing Ratio (CBR)	6.6
Subgrade Modulus of Subgrade Reaction, k in pci	100
City of San Antonio Collector and Local Type B Street	
Reliability, percent	90
Initial Serviceability Index, Flexible Pavement	4.2

Terminal Serviceability Index	2.0
Design Traffic Loading, Flexible Pavement	2,000,000 equivalent single axle loads (ESALs)
Standard Deviation, Flexible Pavement	0.45
Subgrade California Bearing Ratio (CBR)	6.6
Subgrade Modulus of Subgrade Reaction, k in pci	100
City of San Antonio Primary and Secondary Arterials	
Reliability, percent	95
Initial Serviceability Index, Flexible Pavement	4.2
Terminal Serviceability Index	2.0
Design Traffic Loading, Flexible Pavement	3,000,000 equivalent single axle loads (ESALs)
Standard Deviation, Flexible Pavement	0.45
Subgrade California Bearing Ratio (CBR)	6.6
Subgrade Modulus of Subgrade Reaction, k in pci	100

Asphaltic concrete pavements founded on top of expansive soils will be subjected to PVM soil movements estimated and presented in this report. These potential soil movements are typically activated to some degree during the life of the pavement. Consequently, pavements can be expected to crack and require periodic maintenance to reduce damage to the pavement structure.

During the paving life, maintenance to seal surface cracks within asphalt paving should be undertaken to achieve the desired paving life. Perimeter drainage should be controlled to prevent or retard influx of surface water from areas surrounding the paving. Water penetration leads to paving degradation. Water penetration into base or subgrade materials, sometimes due to irrigation or surface water infiltration leads to pre-mature paving degradation. Curbs should be used in conjunction with asphalt paving to reduce potential for infiltration of moisture into the base course. Curbs should extend the full depth of the base course and should extend at least 3 inches into the underlying clayey subgrade. The base layer should be tied into the area inlets to drain water that may collect in the base.

Material specifications, construction considerations, and section requirements are presented in following sections.

The presented recommended pavement sections are based on the field and laboratory test results for the project, local pavement design practice, design assumptions presented herein and previous experience with similar projects. The project Civil Engineer should verify that the ESAL and other design values are appropriate for the expected traffic and design life of the project. PSI should be notified in writing if the assumptions or design parameters are incorrect or require modification.

4.2 Pavement Section Recommendations

PSI anticipated that the roadways and parking areas will be used primarily by passenger vehicles and delivery vehicles. PSI is providing parking and drive area sections based on experience with similar facilities constructed on similar soil conditions for the design traffic loading anticipated.

4.2.1 Flexible Pavement

Recommendations for flexible asphaltic concrete pavement for roadways and parking areas are provided below.

FIGURE 4.1: FLEXIBLE PAVEMENT TYPICAL SECTION

TABLE 4.3: FLEXIBLE PAVEMENT SECTION OPTIONS

Material	Thicknesses				
Traffic Type	Type A	Type B	Collector	Option 1 Arterial	Option 2 Arterial
Design Traffic Loading, ESALs	100,000	2,000,000	2,000,000	3,000,000	3,000,000
Hot Mix Asphaltic Concrete, Type D	--	--	--	--	2”
Hot Mix Asphaltic Concrete, Type C	3”	4”	4”	4”	--
Hot Mix Asphaltic Concrete, Type B	--	--	--	--	8.5”
Import Flexible Base	8”	14”	14”	18”	--
Compacted Subgrade	8”	8”	8”	8”	8”

4.2.2 GENERAL PAVEMENT DESIGN AND CONSTRUCTION RECOMMENDATIONS

TABLE 4.4: PAVEMENT DESIGN AND CONSTRUCTION RECOMMENDATIONS

Minimum Undercut Depth	6 inches or as needed to remove roots
Low-Density Soil Treatment	**After clearing and grubbing, remove/replace upper 12 inches of exposed soils in maximum 9-inch loose lifts. moisture-condition and compact as Subgrade in Table 4.5.**
Reuse Excavated Soils	Must be free of roots and debris and meet material requirements of intended use
Exposed Subgrade Treatment	**After moisture conditioning and recompacting the low-density subgrade soils, proof-roll with rubber-tired vehicle weighing at least 20 tons. A representative of the Geotechnical Engineer should be present during proof-roll.**
Proof-Rolled Pumping and Rutting Areas	Excavate to firmer materials and replace with compacted general or select fill under direction of a representative of the Geotechnical Engineer
General Fill	**Materials free of roots, debris, and other deleterious materials with a maximum rock size of 4 inches with a CBR greater than 6.6**
Minimum General Fill Thickness	As required to achieve grade
Maximum General Fill Loose Lift Thickness	9 Inches

Flexible Base	COSA Item 200
Maximum Flexible Base Loose Lift Thickness	9 Inches
Hot Mix Asphaltic Concrete	COSA Item 205 Type C COSA Item 205 Type D COSA Item 205 Type B

TABLE 4.5: COMPACTION AND TESTING RECOMMENDATIONS FOR PAVEMENT AREAS

Location	Material	Density Test Method	Soil Type	Percent Compaction	Optimum Moisture Content	Testing Frequency
Pavement Areas	Subgrade, General Fill Soil, Low PI Material	Tex-114-E	PI ≥ 25	94% to 98%	0 to +4%	1 per 10,000 SF; min. 3 tests
			PI < 25	≥ 95%	0 to +4%	
	Flexible Base Material	TEX-113-E	COSA Item 200	≥ 95%	±3%	1 per 5,000 SF; min. 3 per lift

5.0 CONSTRUCTION CONSIDERATIONS

Geotechnical Engineer Involvement at the Time of Construction – Foundation pad preparation recommendations on expansive clay sites in this area depend on the soil moisture conditions that exist due to the prevailing climate at the time of construction as well as the expansive properties of the clay.

It is recommended that the foundation pad recommendations presented in this report be confirmed immediately prior to construction by the Geotechnical-Engineer-of Record (GER). Wetter climate conditions near the time of construction can lead to a significant reduction in pad preparation requirements which can often be a substantial percentage of site development cost.

Having a Geotechnical Engineer retained to review the earthwork recommendations in the Construction Documents and be an active participant in team meetings near the time of construction can often result in project cost savings. Therefore, PSI recommends that an AASHTO accredited 3rd party laboratory with qualified professional engineers who specialize in geotechnical engineering be retained to provide observation and testing of construction activities involved in the foundations, earthwork, pavements and related activities of this project. As the GER, PSI's services can be retained as the 3rd party laboratory. PSI's participation would be advantageous to the project flow and value engineering during construction since we are most familiar with the existing soil conditions at the site.

The geotechnical engineer often does not have available all design information at the time of writing the original report since the report is done very early in the design process. The GER can be of great benefit immediately prior to construction since definitive information regarding the location of the building, surrounding flatwork, pavements, planned landscaping, and drainage features is available at that time. The GER can then write Supplement letters to the original geotechnical report often resulting in less risk and significant project cost savings.

PSI cannot accept responsibility for conditions which deviate from those described in this report, nor for the performance of the foundations or pavements if not engaged to also provide construction observation and materials testing for this project. The PSI geotechnical engineer of record should also be engaged by the Design Team during construction, even if periodic on-call testing is contracted with PSI Construction Services.

5.1 INITIAL SITE PREPARATION CONSIDERATIONS

5.1.1 SUBGRADE PREPARATION FOR SITE WORK OUTSIDE BUILDING PAD AND PAVEMENT AREAS

Grade adjustments outside of the foundation pad and pavement areas can be made using select or general fill materials. The clean excavated onsite soils may also be reused in areas not sensitive to movement.

TABLE 5.1: SUBGRADE PREPARATION FOR NON-STRUCTURAL - GENERAL FILL

Minimum Undercut Depth	6 inches or as needed to remove roots, organic and/or deleterious materials
Exposed Subgrade Treatment	Proof-roll subgrade with rubber-tired 20-ton (loaded) construction equipment Alternate Equipment can be used with Geotechnical Engineer Approval
Proof-Rolled Pumping and Rutting Areas	Excavate to firmer materials and replace with compacted general or select fill under direction of a representative of the Geotechnical Engineer
General Fill Type	Any clean material free of roots, debris and other deleterious material with a maximum particle size of 4 inches
Maximum General Fill Loose Lift Thickness	8 inches

TABLE 5.2: FILL COMPACTION RECOMMENDATIONS OUTSIDE OF BUILDING AND PAVEMENT AREAS

Location	Material	Test Method for Density Determination	Plasticity Index	Percent Compaction	Optimum Moisture Content	Testing Frequency
Outside of Structure / Pavement Areas	General Fill	ASTM D698	PI ≥ 25	94% to 98%	0 to +4%	1 per 10,000 SF; min. 3 per lift
			PI < 25	≥ 95%	0 to +4%	

5.1.2 EXISTING SITE CONDITIONS

The following table outlines construction considerations in consideration of demolition of existing paving, procedures for abandoning old utility lines and removing trees.

TABLE 5.3: CONSIDERATIONS FOR DEMOLITION, ABANDONING UTILITIES AND TREE REMOVAL

Existing Pavement	
Former paving located within footing of proposed structures	Remove concrete and/or HMAC surface course and base entirely or review impact on case by case basis
Former paving located within footprint of proposed new paving	Remove concrete and/or HMAC surface course and evaluate if base can be reused
Abandoned Utilities	
Utilities of former structures located within new footprint of proposed structure	Remove pipe, bedding and backfill and then replace with select fill placed using controlled compaction
Utilities of former structures located outside of footprint of proposed structure	Abandon in place using a grout plug
Tree Removal	

Trees located within proposed building footprint; roadways, parking, and sidewalk areas; and within 15 feet of building area	Remove root system for full vertical and lateral extent and extend removal for at least 3 feet beyond presence of root fragments and replace void with compacted general fill or flowable fill

5.2 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

Soils are sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork, foundation, and construction activities during dry weather. A relatively all-weather compacted crushed limestone cap having a thickness of at least 6 inches should be provided as a working surface.

5.3 EXCAVATION OBSERVATIONS

Excavations should be observed by a representative of PSI prior to continuing construction activities in those areas. PSI needs to assess the encountered materials and confirm that site conditions are consistent with those discussed in this report. This is especially important to identify the condition and acceptability of the exposed subgrades under foundations and other structures that are sensitive to movement. Soft or loose soil zones encountered at the bottom of the excavations should be removed to the level of competent soils as directed by the Geotechnical Engineer or their representative. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with compacted select fill or lean concrete.

After opening, excavations should be observed, and concrete should be placed as quickly as possible to avoid exposure to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. Excavations left open for more than 48 hours should be protected to reduce evaporation or entry of moisture.

5.4 DRAINAGE CONSIDERATIONS

Water should not be allowed to collect in or adjacent to foundation excavations, on foundation surfaces, or on prepared subgrades within the construction area during or after construction. Proper drainage around grade supported sidewalks and flatwork is important to reduce potential movements. Excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Providing rapid, positive drainage away from the building reduces moisture variations within the underlying soils and will aid in reducing the magnitude of potential movements.

5.5 EXCAVATIONS AND TRENCHES

Excavation equipment capabilities and field conditions may vary. Geologic processes are erratic and large variations can occur in small vertical and/or lateral distances. Details regarding “means and methods” to accomplish the work (such as excavation equipment and technique selection) are the sole responsibility of the project contractor. The comments contained in this report are based on small diameter borehole observations. The performance of large excavations may differ as a result of the differences in excavation sizes.

The sandstone stratum at this site is hard. Excavations penetrating the sandstone and sandstone removal as part of site grading will likely require high-powered, heavy-duty rock excavation equipment.

The Occupational Safety and Health Administration (OSHA) Safety and Health Standards (29 CFR Part 1926, Revised October 1989), require that excavations be constructed in accordance with the current OSHA guidelines. Furthermore, the State of Texas requires that detailed plans and specifications meeting OSHA standards be prepared for trench and excavation retention systems used during construction. PSI understands that these regulations are being strictly enforced, and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, State, and Federal safety regulations.

PSI is providing this information as a service to the client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, State, and Federal safety or other regulations. A trench safety plan was beyond the scope of our services for this project.

6.0 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by the client for the proposed project. If there are revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional Geotechnical Engineering practices in the local area. No other warranties are implied or expressed. This report may not be copied without the expressed written permission of PSI.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that the engineering recommendations have been properly incorporated in the design documents. At this time, it may be necessary to submit supplementary recommendations. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

This report has been prepared for the exclusive use of Lennar for specific application to the proposed Northlake Subdivision Phase 1 - Streets and Preliminary Foundation project to be constructed at Burshard Road in San Antonio, Texas.

APPENDIX

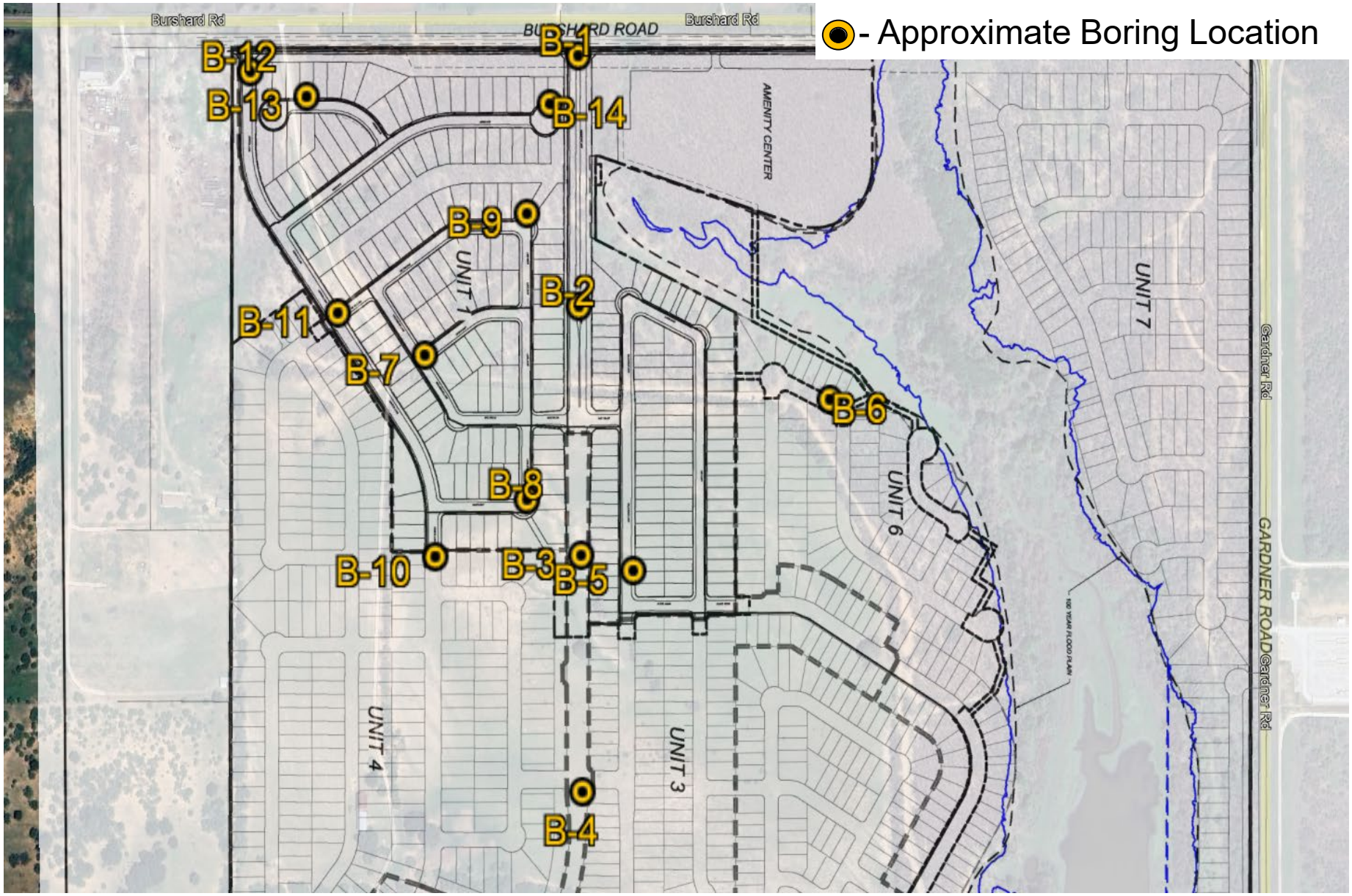
intertek psi
3 Burwood Lane, San Antonio, Texas
(210) 342-9377 FAX (210) 342-9401

Site Vicinity Map

Proposed Northlake Subdivision Phase 1 Streets
Burshard Road
San Antonio, Texas
PSI Project No.: 0312-3143

NOT TO SCALE

N



intertek psi
3 Burwood Lane, San Antonio, Texas
(210) 342-9377 FAX (210) 342-9401

Boring Location Plan

Proposed Northlake Subdivision Phase 1 Streets
Burshard Road
San Antonio, Texas
PSI Project No.: 0312-3143

NOT TO SCALE

N

CBR Results

CALIFORNIA BEARING RATIO - ASTM D1883

Project Name: Northlake Subdivision Phase 1 Date: 1/30/2024
Project Number: 0312-3143
Material Description: Clayey Sand (SC)

Number of Blows/Lift:	5	Wt. Hammer (lbs):	5.5
Maximum Lab Dry Density (pcf):	111.1	Drop (in):	12
95% of Max Dry Density (pcf):	105.5	Opt. Moisture:	14.4
		Piston Area (in^2):	3.00

Equipment ID: 17CBR311

CBR Mold Information

Wt. of Mold (g):	7142
Weight of Mold & Soil (g):	10991
Weigh of Soil (g):	3849
Wet Density (pcf):	113.11
Dry Density (pcf):	**98.60**
Volume of Mold (ft^3):	0.075

Compaction and Moisture Data

Compaction		Molded Moisture		
			Before	After
Wt. of Mold:		Tare ID:	1	5
Mold Dia:		Wet + Tare:	299.83	356.45
Mold Height:		Dry + Tare:	262.35	311.77
Spacer Disc		Tare:	8.29	8.26
Height:		% Moist	14.752	14.721

Soaking Data

Date	Time	Days	Reading	Swell (%)
4/1/2024	11:37 AM	0	0.242	--
4/2/2024	10:25 AM	1	0.244	0.83%
4/3/2024	9:50 AM	2	0.244	0.83%
4/4/2024	11:02 AM	3	0.244	0.83%
4/5/2024	8:02 AM	4	0.245	1.24%

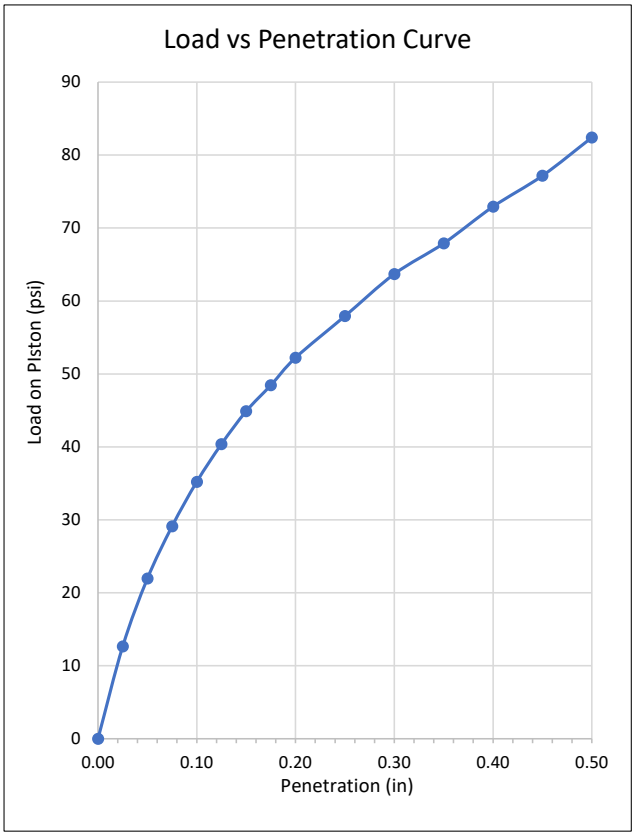
After Moisture Top 1"

Tare ID:	333
Wet + Water:	297.4
Dry + Tare:	264.49
Tare:	95.89
% Moisture:	**19.5**

Actual Compaction:	**89%**

Compaction Test Results

Penetration (in/mm)		Reading Data Ratio @ 1.3mm/0.05 in per minute		
		Load (lb)	Total psi	CBR
0.000	0.000	0.0	0.0	
0.025	0.635	37.9	12.6	
0.050	1.270	65.8	21.9	
0.075	1.910	87.3	29.1	
0.100	2.540	105.6	35.2	3.5
0.125	3.180	121.1	40.4	
0.150	3.810	134.6	44.9	
0.175	4.450	145.3	48.5	
0.200	5.080	156.6	52.2	3.5
0.250	6.350	173.7	57.9	
0.300	7.620	191.0	63.7	
0.350	8.890	203.6	67.9	
0.400	10.160	218.7	72.9	
0.450	11.430	231.4	77.2	
0.500	12.700	247.1	82.4	



CALIFORNIA BEARING RATIO - ASTM D1883

Project Name: Northlake Subdivision Phase 1 Date: 1/30/2024
Project Number: 0312-3143
Material Description: Clayey Sand (SC)

Number of Blows/Lift:	10	Wt. Hammer (lbs):	5.5
Maximum Lab Dry Density (pcf):	111.1	Drop (in):	12
95% of Max Dry Density (pcf):	105.545	Opt. Moisture:	14.4
		Piston Area (in^2):	3.00

Equipment ID: 16CBR311

CBR Mold Information

Wt. of Mold (g):	7140
Weight of Mold & Soil (g):	11251
Weigh of Soil (g):	4111
Wet Density (pcf):	120.81
Dry Density (pcf):	**105.28**
Volume of Mold (ft^3):	0.075

Compaction and Moisture Data

Compaction		Molded Moisture		
			Before	After
Wt. of Mold:		Tare ID:	D	26
Mold Dia:		Wet + Tare:	262.46	317.88
Mold Height:		Dry + Tare:	229.8	278.07
Spacer Disc		Tare:	8.23	8.22
Height:		% Moist	14.740	14.753

Soaking Data

Date	Time	Days	Reading	Swell (%)
4/1/2024	10:50 AM	0	0.164	--
4/2/2024	10:25 AM	1	0.167	1.83%
4/3/2024	9:50 AM	2	0.168	2.44%
4/4/2024	11:02 AM	3	0.168	2.44%
4/5/2024	8:01 AM	4	0.168	2.44%

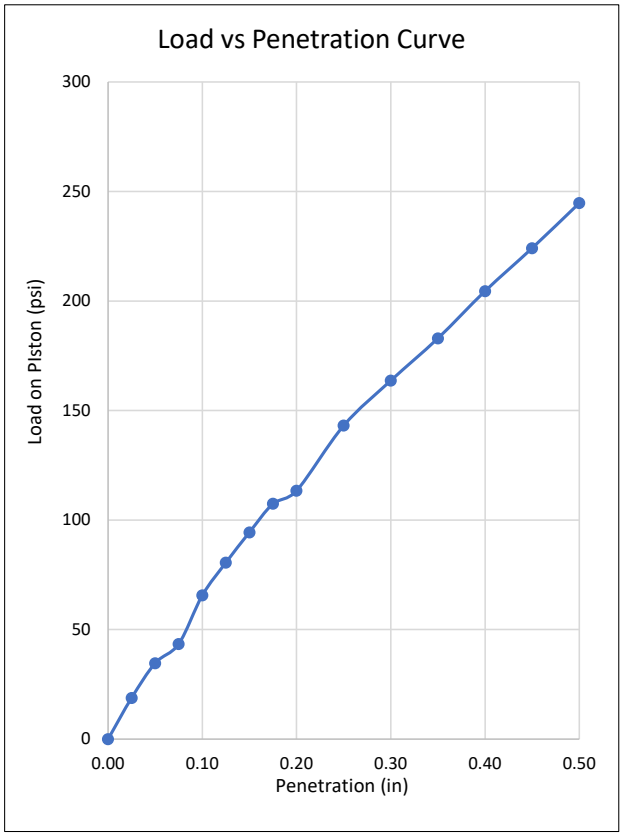
After Moisture Top 1"

Tare ID:	139
Wet + Water:	303.95
Dry + Tare:	270.18
Tare:	85.87
% Moisture:	**18.322**

Actual Compaction:	**95%**

Compaction Test Results

Penetration (in/mm)		Reading Data Ratio @ 1.3mm/0.05 in per minute		
		Load (lb)	Total psi	CBR
0.000	0.000	0.0	0.0	
0.025	0.635	56.5	18.8	
0.050	1.270	104.0	34.7	
0.075	1.910	130.4	43.5	
0.100	2.540	196.8	65.6	6.6
0.125	3.180	241.6	80.6	
0.150	3.810	283.1	94.4	
0.175	4.450	322.3	107.5	
0.200	5.080	340.0	113.4	7.6
0.250	6.350	429.2	143.1	
0.300	7.620	490.8	163.7	
0.350	8.890	548.7	183.0	
0.400	10.160	613.3	204.5	
0.450	11.430	672.2	224.2	
0.500	12.700	733.8	244.7	



CALIFORNIA BEARING RATIO - ASTM D1883

Project Name: Northlake Subdivision Phase 1 Date: 1/30/2024
Project Number: 0312-3143
Material Description: Clayey Sand (SC)

Number of Blows/Lift:	30	Wt. Hammer (lbs):	5.5
Maximum Lab Dry Density (pcf):	111.1	Drop (in):	12
95% of Max Dry Density (pcf):	105.545	Opt. Moisture:	14.4
		Piston Area (in^2):	3.00

Equipment ID: 15CBR311

CBR Mold Information

Wt. of Mold (g):	7126
Weight of Mold & Soil (g):	11425.5
Weigh of Soil (g):	4299.5
Wet Density (pcf):	126.35
Dry Density (pcf):	**109.93**
Volume of Mold (ft^3):	0.075

Compaction and Moisture Data

Compaction		Molded Moisture		
			Before	After
Wt. of Mold:		Tare ID:	T	E
Mold Dia:		Wet + Tare:	322.84	312.82
Mold Height:		Dry + Tare:	282.07	273.26
Spacer Disc Height:		Tare:	8.33	8.3
		% Moist	14.894	14.931

Soaking Data

Date	Time	Days	Reading	Swell (%)
4/1/2024	10:05 AM	0	0.17	--
4/2/2024	10:25 AM	1	0.161	-5.29%
4/3/2024	9:50 AM	2	0.162	-4.71%
4/4/2024	11:02 AM	3	0.162	-4.71%
4/5/2024	8:15 AM	4	0.162	-4.71%

After Moisture Top 1"

Tare ID:	Aztlan
Wet + Water:	262.95
Dry + Tare:	239
Tare:	88.92
% Moisture:	**15.958**

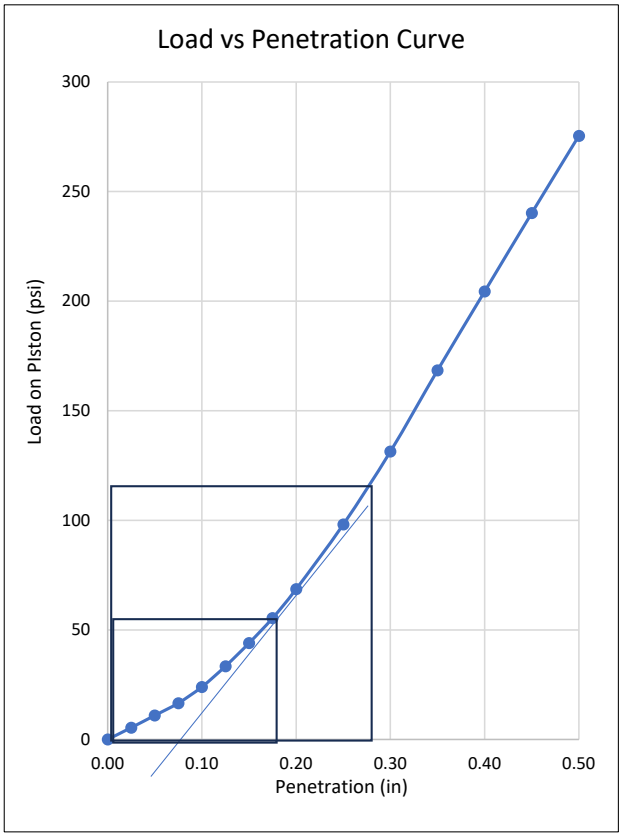
Actual Compaction:	**99%**

Adjusted CBR

Penetration (in/mm)		Total psi	CBR
0.108	2.74	55.3	5.53
0.208	5.28	120.5	8.03

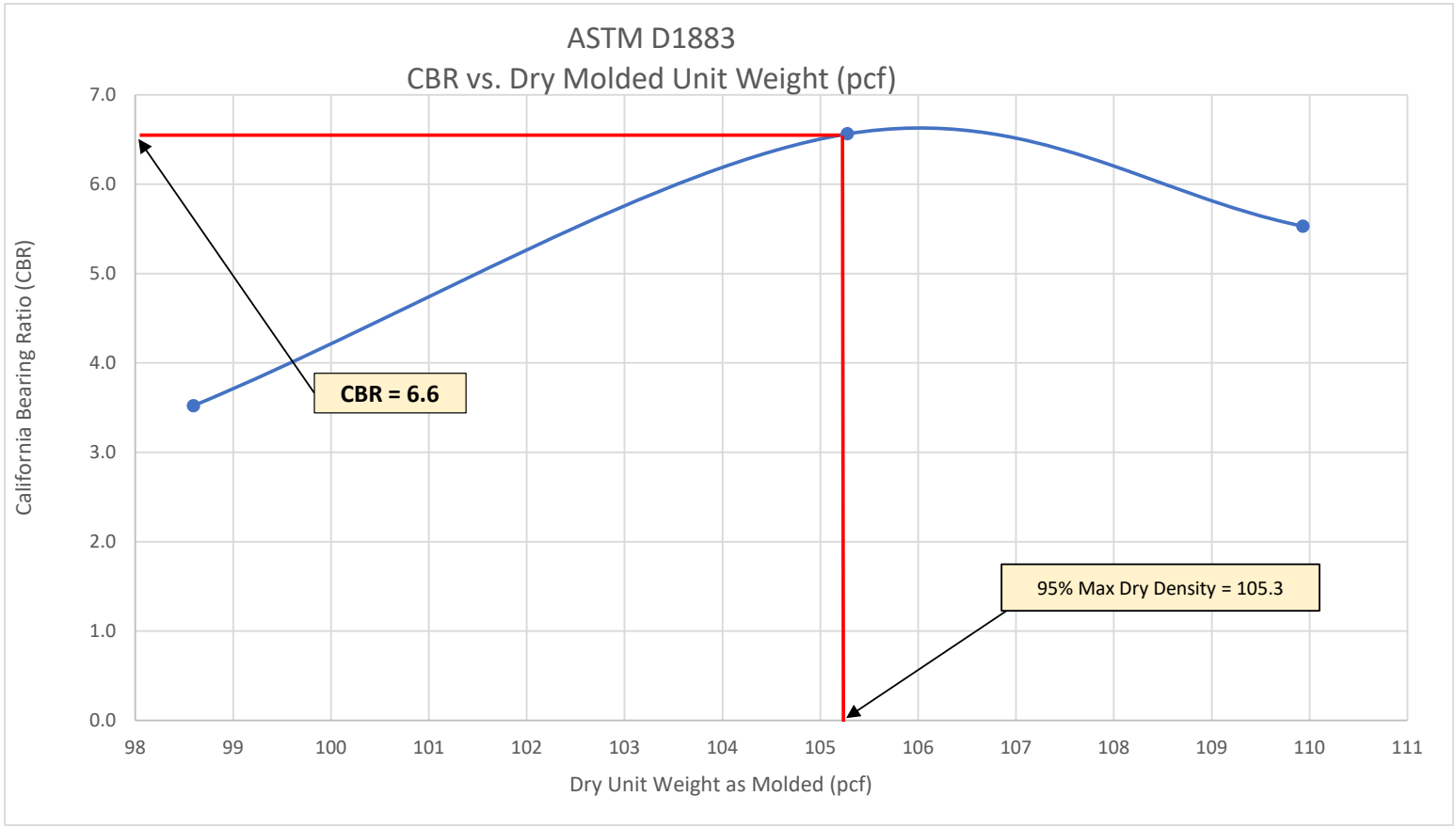
Compaction Test Results

Penetration (in/mm)		Reading Data Ratio @ 1.3mm/0.05 in per minute		
		Load (lb)	Total psi	CBR
0.000	0.000	0.0	0.0	
0.025	0.635	16.2	5.4	
0.050	1.270	32.9	11.0	
0.075	1.910	49.8	16.6	
0.100	2.540	72.0	24.0	
0.125	3.180	100.3	33.4	
0.150	3.810	131.9	44.0	
0.175	4.450	166.1	55.4	
0.200	5.080	205.8	68.6	
0.250	6.350	294.2	98.1	
0.300	7.620	394.0	131.4	
0.350	8.890	505.1	168.4	
0.400	10.160	613.0	204.4	
0.450	11.430	720.3	240.2	
0.500	12.700	826.0	275.5	



Test No.	Blows/lift	Dry Unit Weight	% Compact.	Water Content %	CBR at 0.1 in	CBR at 0.2 in
1	5	98.60	89%	19.5	3.5	3.5
2	10	105.28	95%	18.3	6.6	7.6
3	30	109.93	99%	16.0	5.5	8.0

95% Max Dry Density (pcf)	105.3	Selected CBR Value	6.6	Clayey Sand (SC)



Boring Logs

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-01

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				FAT CLAY (CH) with SAND, brown, stiff	14	0	75	14			52	12	40		
				FAT CLAY (CH), red tan, very stiff to hard	9			27							
5					12			27							
					17	1	93	33			65	13	52		
					12			36							
10															
					17			36							
15															
				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ○ UNC CMP (TSF) ●
2.0 4.0 6.0
PL WC LL
20 40 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-02

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				CLAYEY SAND (SC), brown, loose to dense	13			4								
					7	3	21	7			24	17	7			
5				- Transitions to a red tan color at 4.5 feet.	8			24								
					5			36								
					6			35								
10																
					3	0	25	36			24	19	5			
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-03

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				CLAYEY SAND (SC) with GRAVEL, brown, medium dense	9	25	48	15			47	14	33		
				FAT CLAY (CH), red tan, very stiff to hard	11			22							
5					10			25							
					13			43							
					14	0	91	45			67	18	49		
10															
					19			45							
15				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ○ UNC CMP (TSF) ●
2.0 4.0 6.0
PL WC LL
20 40 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24
intertek psi

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-04

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				SANDY LEAN CLAY (CL), brown, hard	11			34							
					12	0	53	30			47	16	31		
5					9			44							
				SILTY SAND (SC), red tan, loose to medium dense	8	0	30	8			27	23	4		
					6			8							
10															
					9			11							
15				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ○ UNC CMP (TSF) ●
2.0 4.0 6.0
PL 20 WC × 40 LL 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24
intertek psi

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-05

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				CLAYEY SAND (SC), brown, medium dense	6			10								
					5			11								
5					6	1	33	14			27	12	15			
					8			16								
					11			22								
10																
				SILTY SAND (SM), red tan, medium dense	4	1	24	20			24	20	4			
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-06

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				CLAYEY SAND (SC), brown, loose to medium dense	13	12	40	12			52	24	28		
				- Transitions to a red tan color at 2.5 feet	8	0	19	10			31	17	14		
5					18			10							
				SILTY SAND (SM), red tan, dense	4			36							
					4	0	23	38			24	20	4		
10															
					4			40							
15				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ○ UNC CMP (TSF) ●
2.0 4.0 6.0
PL WC LL
20 40 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24
intertek psi

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-07

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				SILTY SAND (SM), brown, loose	6			4								
					6	3	16	7			NP	NP	NP			
5				CLAYEY SAND (SC), red tan, medium dense to very dense	16			16								
					15	0	41	50			33	19	14			
					8			52								
10																
					7	0	26	53			30	17	13			
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

intertek psi

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-08

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				CLAYEY SAND (SC), brown, medium dense	5	9	40	14			73	21	52		
				SANDSTONE, red tan, hard	11			50/0"							
5				CLAYEY SAND (SC), red tan, medium dense to dense	13			26							
					9	0	49	33			42	16	26		
				SANDSTONE, red tan, hard	8			50/1"							
10															
				SILTY SAND (SM), red tan, dense	5	0	22	36			35	27	8		
15				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ● UNC CMP (TSF)
2.0 4.0 6.0
PL WC LL
20 40 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24
intertek psi

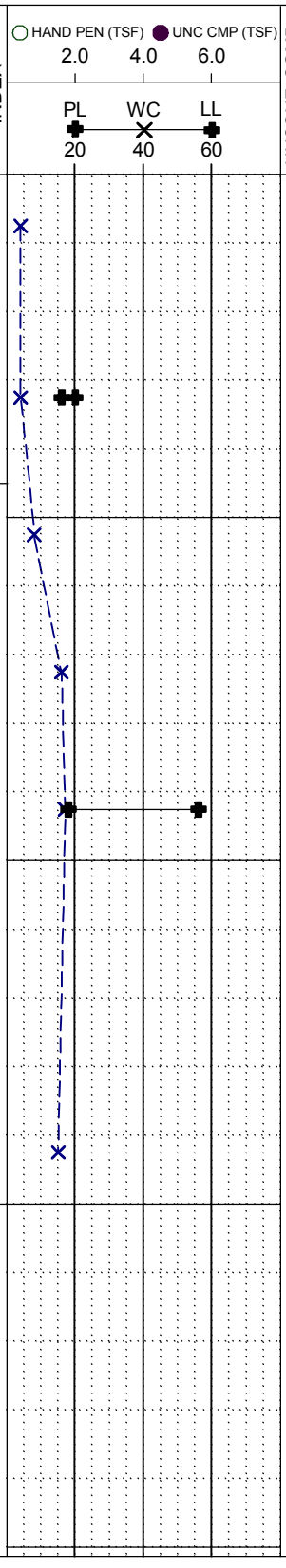
DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-09

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				SILTY SAND (SM), brown, loose to medium dense	4			8							
					4	3	14	10			20	16	4		
5				FAT CLAY (CH) with SAND, red tan, very stiff to hard	8			20							
					16			34							
10					17	1	80	35			56	18	38		
					15			46							
15				Boring terminated at approximately 15 feet.											
20															



COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-10

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				CLAYEY SAND (SC) with GRAVEL, brown, medium dense to dense	11	22	45	14			58	15	43			
				- Transitions to a red tan color at 2.5 feet	11			32								
5					10	20	49	20			43	14	29			
				SANDSTONE, red tan, hard	10			50/0"								
					9			50/0"								
10																
					3	33	26	50/0"			31	16	15			
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-11

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				CLAYEY GRAVEL (GC) with SAND, brown, medium dense	8	56	25	16			62	19	43			
				CLAYEY SAND (SC) with GRAVEL, red tan, dense	8	19	35	30			40	16	24			
5				CLAYEY SAND (SC), red tan, dense	4			34								
					5			36								
10					3	0	16	34			28	17	11			
					3			36								
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-12

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				SANDY LEAN CLAY (CL), brown, stiff to hard	16			12								
					12	1	65	30			48	15	33			
5				SANDSTONE, red tan, hard	13			50/4"								
					11			50/1"								
10					14			50/0"								
				SANDY LEAN CLAY (CL), red tan, hard	16	5	63	50			48	15	33			
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-13

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) / UNC CMP (TSF) 2.0 4.0 6.0 PL 20 WC 40 LL 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:												
				CLAYEY SAND (SC), brown, loose	4			6								
					6	2	25	8			32	16	17			
5				SANDSTONE, red tan, hard	7	34	27	50/3"			40	13	27			
					7			50/0"								
10					4			50/0"								
					3			50/0"								
15				Boring terminated at approximately 15 feet.												
20																

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

Northlake Subdivision Phase 1 - Streets and Preliminary Foundation
Burshard Road San Antonio, Texas
Project No. 0312-3143

BORING B-14

LOCATION: See Boring Location Plan

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation:											
				SANDY LEAN CLAY (CL) with GRAVEL, brown, very stiff	10	17	51	27			44	13	31		
				SANDSTONE, red tan, hard	5			50/0"							
5				FAT CLAY (CH), red tan, very stiff to hard	19			38							
					16			45							
					18			59							
10															
					18	0	90	38			57	17	41		
15				Boring terminated at approximately 15 feet.											
20															

HAND PEN (TSF) ○ UNC CMP (TSF) ●
2.0 4.0 6.0
PL WC LL
20 40 60

COMPLETION DEPTH: 15.0 Feet
DATE: 3/11/24

DEPTH TO GROUND WATER
SEEPAGE (ft.): NONE ENCOUNTERED
END OF DRILLING (ft.): NONE ENCOUNTERED
DELAYED WATER LEVEL (FT): NONE ENCOUNTERED

KEY TO TERMS AND SYMBOLS USED ON LOGS

ROCK CLASSIFICATION

RECOVERY

DESCRIPTION OF RECOVERY	% CORE RECOVERY
Incompetent	< 40
Competent	40 TO 70
Fairly Continuous	70 TO 90
Continuous	90 TO 100

ROCK QUALITY DESIGNATION (RQD)

DESCRIPTION OF ROCK QUALITY	RQD
Very Poor (VPo)	0 TO 25
Poor (Po)	25 TO 50
Fair (F)	50 TO 75
Good (Gd)	75 TO 90
Excellent (ExInt)	90 TO 100

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	N-VALUE (Blows/Foot)	SHEAR STRENGTH (tsf)	HAND PEN VALUE (tsf)
Very Soft	0 TO 2	0 TO 0.125	0 TO 0.25
Soft	2 TO 4	0.125 TO 0.25	0.25 TO 0.5
Firm	4 TO 8	0.25 TO 0.5	0.5 TO 1.0
Stiff	8 TO 15	0.5 TO 1.0	1.0 TO 2.0
Very Stiff	15 TO 30	1.0 TO 2.0	2.0 TO 4.0
Hard	>30	>2.0 OR 2.0+	>4.0 OR 4.0+

SOIL DENSITY OR CONSISTENCY

DENSITY (GRANULAR)	CONSISTENCY (COHESIVE)	THD (BLOWS/FT)	FIELD IDENTIFICATION
Very Loose (VLo)	Very Soft (VSo)	0 TO 8	Core (height twice diameter) sags under own weight
Loose (Lo)	Soft (So)	8 TO 20	Core can be pinched or imprinted easily with finger
Slightly Compact (SlCmpt)	Stiff (St)	20 TO 40	Core can be imprinted with considerable pressure
Compact (Cmpt)	Very Stiff (VSt)	40 TO 80	Core can only be imprinted slightly with fingers
Dense (De)	Hard (H)	80 TO 5"/100	Core cannot be imprinted with fingers but can be penetrated with pencil
Very Dense (VDe)	Very Hard (VH)	5"/100 to 0"/100	Core cannot be penetrated with pencil

DEGREE OF PLASTICITY OF COHESIVE SOILS

DEGREE OF PLASTICITY	PLASTICITY INDEX (PI)	SWELL POTENTIAL
None or Slight	0 to 4	None
Low	4 to 20	Low
Medium	20 to 30	Medium
High	30 to 40	High
Very High	>40	Very High

BEDROCK HARDNESS

MORHS' SCALE	CHARACTERISTICS	EXAMPLES	APPROXIMATE THD PEN TEST	
5.5 to 10	Rock will scratch knife	Sandstone, Chert, Schist, Granite, Gneiss, some Limestone	Very Hard (VH)	0" to 2"/100
3 to 5.5	Rock can be scratched with knife blade	Siltstone, Shale, Iron Deposits, most Limestone	Hard (H)	1" to 5"/100
1 to 3	Rock can be scratched with fingernail	Gypsum, Calcite, Evaporites, Chalk, some Shale	Soft (So)	4" to 6"/100

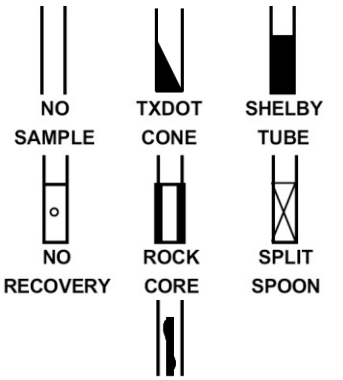
MOISTURE CONDITION OF COHESIVE SOILS

DESCRIPTION	CONDITION
Absence of moisture, dusty, dry to touch	DRY
Damp but no visible water	MOIST
Visible free water	WET

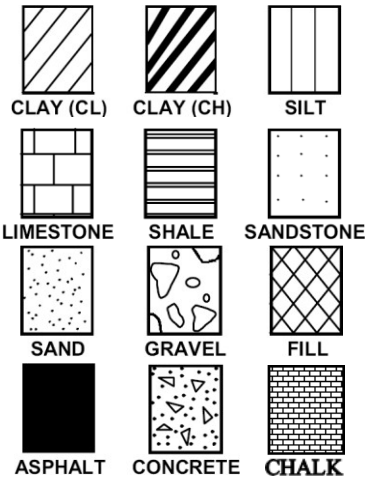
RELATIVE DENSITY FOR GRANULAR SOILS

APPARENT DESNITY	SPT (BLOWS/FT)	CALIFORNIA SAMPLER (BLOWS/FT)	MODIFIED CA. SMAPLER (BLOWS/FT)	RELATIVE DENSITY (%)
Very Loose	0 to 4	0 to 5	0 to 4	0 to 15
Loose	4 to 10	5 to 15	5 to 12	15 to 35
Medium Dense	10 to 30	15 to 40	12 to 35	35 to 65
Dense	30 to 50	40 to 70	35 to 60	65 to 85
Very Dense	>50	>70	>60	85 to 100

SAMPLER TYPES



SOIL TYPES



ABBREVIATIONS

PL – Plastic Limit
LL – Liquid Limit
WC – Percent Moisture

Q_P – Hand Penetrometer
Q_U – Unconfined Compression Test
UU – Unconsolidated Undrained Triaxial

Note: Plot Indicates Shear Strength as Obtained By Above Tests

WATER SEEPAGE

WATER LEVEL AT END OF DRILLING

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

6"	3"	3/4"	4	10	40	200	
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY / CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

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Everything you need from start to finish – Assurance, Testing, Inspection, and Certification

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Environmental Consulting & Geotechnical Services

Assuring site and subsurface conditions meet the criteria for purchase, development and construction.

Building Systems Consulting

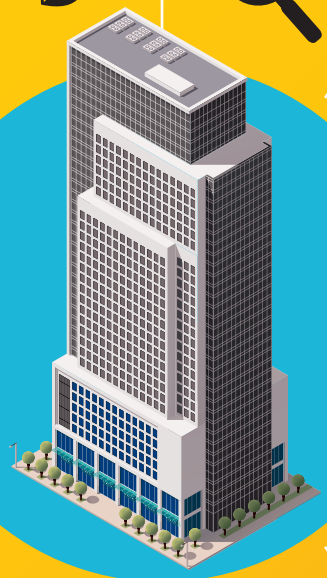
Industry professionals provide a variety of acoustic, fire, AV, roofing system and enclosure consulting services to ensure proper design and installation of a building's critical systems.

Decommissioning & Due Diligence

Supporting the redevelopment and transfer of property assets via environmental and property assessments and engineering services.

Building Product & Construction Materials Testing

Providing testing for virtually all types of building products, construction materials, and systems for safety, retail, code, and performance purposes.



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Providing a variety of building systems testing, inspection, and consulting services to optimize the value and life of the property asset.

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The ETL and Warnock Hersey Marks show a product or system's conformance to code and ensures the on-going verification of compliance.

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Assessing a building or facility for a variety of sources (air, asbestos, lead, mold) to minimize the risk of factors adverse to human health.

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As a leader in providing comprehensive solutions to industries around the globe, Intertek-PSI prides itself on bringing the expertise and services necessary for our clients to meet all of their needs across their entire operation. **Our Assurance, Testing, Inspection, and Certification (A.T.I.C.)** suite of services ensures that whatever your needs may be – assurance, testing, inspection, certification, or all of the above, that those needs will be met by Intertek-PSI.

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