ECS SOUTHWEST, LLP

Geotechnical Engineering Report

Golden Chick - Talley Road

Talley Road and Culebra Road
San Antonio, Texas

ECS Project No. 20:1653

April 25, 2023

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April 25, 2023

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ECS Project No. 20:1653

Reference: Geotechnical Engineering Report
Golden Chick - Talley Road
Talley Road and Culebra Road
San Antonio, Texas

Dear Mr. Legg:

ECS Southwest, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Michael Legg Architecture during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

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APPENDICES

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal geotechnical recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the geotechnical report in its entirety.

- In general, the proposed development at the site is considered geotechnically feasible provided the recommendations of this report are implemented in the design and construction of the project. The predominant geotechnical and geological considerations that need to be addressed at the site is the expansive clays.

- Groundwater was not encountered in the test borings. For specific subsurface information refer to the Boring Logs in Appendix B.

- We have estimated potential heave utilizing the TxDOT PVR Method (Tex-124-E) to be about 4 inches. Therefore, mitigation of the expansive soil-related movements to approximately 1 inch is recommended. Recommendations for reducing PVR to ¾ inch is also provided in the report.

- The proposed building foundation can be supported by a shallow foundation system provided our recommended earthwork remediation is performed as recommended. The slabs may be reinforced with either conventional reinforcing steel or post-tensioned cables. A net allowable bearing capacity of 3,000 psf is recommended for design.

- Rigid Concrete and/or Flexible Asphalt pavements can be used at this site. Our report includes our recommended pavement sections for light-duty areas, moderate-duty, and heavy-duty pavements to accommodate heavier loadings for truck access.

- It is recommended that ECS conduct a geotechnical review of the project plans (prior to issuance for construction) to check to see that ECS' geotechnical recommendations have been properly interpreted and implemented.

- To avert misinterpretation of our recommendations, ECS should be retained to perform quality control testing and documentation during construction of the earthwork and foundation for the project.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of a building foundation for the proposed Golden Chick. The project is planned to include utilities, and parking lot and drives. The recommendations developed for this report are based on project information supplied by Mr. Michael Legg with Michael Legg Architecture.

Our services were provided in accordance with our Proposal No. 20:1576-GP, dated March 14, 2023, which includes our Terms and Conditions of Service. On April 6, 2023, Mr. Michael Legg authorized our services by signing the Proposal Acceptance form of the proposal.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- A final copy of our soil test boring logs.
- Recommendations for site preparation, grading, and drainage.
- Recommendations for foundation design and construction.
- Recommendations for pavement design and construction.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The project site is located south of the intersection of Talley Road and Culebra Road in San Antonio, Texas. The site is approximately 675 feet south of the intersection within approximately a 1-acre lot. Based on our review of historical aerial photographs from Google Earth Pro, the site appears to have been undeveloped and was covered in underbrush and grasses up to about 2023. During our site visit it was observed that the project site has been cleared of underbrush and grasses and graded for development.

A review of Google Earth Pro elevation information indicates that the site slightly slopes downward from about elevation EL 1006 feet at the western edge to about elevation El 1003 feet at the eastern edge. The site location is shown both in the following figure and on the Site Location Diagram included in Appendix A.

Site Location

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed building and related infrastructure*:*

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Building Footprint	2,000 square feet
# Of Stories	1-Story
Usage	Food Service
Framing	Wood Framed
Column Loads	Anticipated 50 kips (Full Dead and Factored Live)
Wall Loads	Anticipated 1 to 3 kips per linear foot (klf)
Finish Floor Elevation	Anticipated within ±2 feet of existing site grades

If ECS' understanding of the project is not correct, especially if the structural loads are different, please contact ECS so that we may review these changes and revise our recommendations as appropriate.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Site Exploration Procedure. Our scope of work included drilling 3 borings. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The Geologic Atlas of Texas, San Antonio Sheet, indicates that the site is underlain by the Uvalde Gravel (T-Qu) Formation. The Uvalde Gravel formation consists of caliche-cemented gravels, boulders (up to 1-foot in diameter), well-rounded cobbles of chert, some cobbles of quartz, limestone, and igneous rock. The formation topographically occupies high areas that are not associated with present drainage. The formation forms extensive deposits in Medina and Uvalde Counties, which may correlate with the Willis Formations of the Seguin Sheet. Gravel thickness ranges from several feet to ± 20 feet. Intervening scraps between Uvalde Gravels and the Leona Formation are covered by several feet of gravel slope wash.

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil strata. Please refer to the boring logs in Appendix B.

STRATUM	APPROXIMATE RANGE OF DEPTH (FEET)	MATERIAL DESCRIPTION	PI (1) RANGE	N (2) RANGE	PP (3) RANGE
I	0 to 8½	(CH) FAT CLAY, dark brown	44 to 56	---	4.50
II	6 to 15	(CH) SANDY FAT CLAY, (CH) GRAVELLY FAT CLAY, light brown	37 to 44	14 to 23	4.50
III	13½ to 15	(CL-ML) SANDY SILTY CLAY WITH GRAVEL, light brown	6.0	30	---

Notes: (1) Plasticity Index
(2) Standard Penetration Test (SPT) Value, blows per foot
(3) Pocket Penetrometer (PP), tons per square foot

3.2 GROUNDWATER OBSERVATIONS

Groundwater level observations were made in the borings during drilling operations. In auger rotary drilling operations, water is not introduced into the borehole and the groundwater position can often be found out by observing water flowing into the excavation. Furthermore, visual observation of soil samples retrieved can often be used in evaluating the groundwater conditions. Groundwater was not observed during or upon completion of drilling the borings at the site. Upon completion of field operations, the boreholes were backfilled with soil cuttings generated during our field operations.

Water levels in open excavations may require several hours to several days to stabilize depending on the permeability of the soils and that groundwater levels at the site may be subject to seasonal conditions, recent rainfall, drought, or temperature effects. Clays are generally not conducive to the presence of groundwater; however, gravels, sands and silts, and open fractures and solution features; where present, can store and transmit “perched” groundwater flow or seepage.

The groundwater conditions at this site are expected to be significantly influenced by surface water runoff and rainfall and should be evaluated just prior to construction. Specifically, rainfall that enters the site, either directly from overland flow or adjacent properties, begins to percolate through surficial soils and within granular seams and fissures. This groundwater flow continues downhill with the water table occasionally surfacing to form wet springs and intermittent streams. In low-lying areas and areas adjacent to existing creeks or ponds, shallow groundwater tables can be present continuously.

3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples in general accordance with the following standards:

LABORATORY TEST	TEST STANDARD
Moisture Content	ASTM D2216
Sieve Analyses	ASTM D1140
Atterberg Limits	ASTM D4318

The samples were visually classified on the basis of texture and plasticity in general accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS)). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The USCS classification symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

Samples not tested in the laboratory are planned to be stored for a period of 60 days subsequent to submittal of this report and discarded after this period, unless we receive alternate instructions regarding their disposition.

4.0 DESIGN RECOMMENDATIONS

The following recommendations have been developed based on the previously described project characteristics and subsurface conditions. If there are changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS should be consulted so that the recommendations of this report can be reviewed. Site grading information was not provided during the preparation of this report; however, we have considered that the finished ground surface elevations are planned to be within ±2 feet of the existing site elevations. If the finished ground surface elevations deviate from this grade, the recommendations provided below should be evaluated by our office.

4.1 POTENTIAL VERTICAL RISE & SUBGRADE IMPROVEMENTS

Structural damage and/or cosmetic/operational distress can be caused by volume changes in clay soils. The expansive clays found at this site are capable of swelling and shrinking in volume dependent on potentially changing soil water conditions during or after construction. Clays can shrink when they lose water and swell (increase in volume) when they gain water. The potential of expansive clays to shrink and swell is related to; amongst other things, the Plasticity Index (PI). Clays with a higher PI generally have a greater potential for soil volume changes due to moisture content variations.

We have estimated potential heave for this site utilizing the TxDOT PVR method (Tex-124-E). The Tex-124-E method provides an estimate of potential vertical rise (PVR) using the liquid limits, plasticity indices, grain size analyses, and water contents of the soils. The PVR is estimated in the seasonally active zone, which can be up to about 15 feet in the site vicinity.

Estimated PVR values are based upon anticipated typical changes in soil moisture content from a dry to wet condition; however, soil movements in the field depend on the actual changes in moisture content. Thus, actual soil movements could be less than that calculated if little soil moisture variations occur or could exceed the estimated values if actual soil moisture content changes are greater than anticipated. These conditions can occur as the result of excessive droughts, flooding, "perched" groundwater infiltration, poor surface-drainage, excessive irrigation adjacent to the building foundation, and/or leaking irrigation lines or plumbing.

We estimate the existing PVR at the site to be approximately 4 inches. To mitigate the soil expansion potential at this site, the planned building pad area can be prepared by undercutting the existing ground as required, and then either filling to the proposed pad grade with properly compacted select fill or filling to the proposed pad grade with a combination of moisture-conditioned soils and overlain with select fill cap. We have developed site improvement options for both 1 inch and ¾ inch PVR and is presented in the table below.

Design PVR (inches)	Select Fill Option Pad Thickness (feet)	Moisture-Conditioned Fill Option Pad Thickness	
		Moisture-Conditioned Fill (feet)	Select Fill Cap (feet)
¾	7	8	1½
1	6	7	1½

In this general area, it is common for structural and geotechnical engineers to consider a PVR of approximately 1 inch to be within desirable tolerances for a building founded on properly designed slab-on-grade foundation system. However, this movement does not take into consideration the movement criteria required or perceived by the facility owner or occupants. These "operational" performance criteria may be, and often are, more restrictive than the structural criteria or tolerances.

Grade-supported foundation or floor slab movements that approach 1 inch may cause doors to stick, cracks in sheetrock or brittle floor covering, cracks in exterior finishes and other forms of cosmetic distress. Measures can and should be taken during the design and construction of the facility to help limit the extent and severity of these types of distress. However, these magnitudes of movement typically do not cause "structural distress."

Where movement sensitive flatwork is planned to be constructed adjacent to the building, consideration should be given to reducing the PVR value in the flatwork areas to reduce differential movements and associated door jamming, tripping hazards, etc. Doweling the flatwork to the building foundation at common openings can further help reduce the potential for differential movements and trip hazards.

4.2 SHALLOW FOUNDATIONS

The planned building can be supported on a shallow footing foundation or a beam and slab-on-grade foundation system.

4.2.1 Spread Footing Foundation

After improving the as-built PVR to ¾ inch, the proposed building can be supported by a shallow footing foundation. A net allowable bearing capacity of 3,000 psf can be used for design of footings at least 12 inches wide and 18 inches deep bearing on compacted select fill. For resistance to lateral loads, a coefficient of friction of 0.32 between the base of the foundation elements and underlying ground surface.

In addition, for footings cast directly against excavation sidewalls, a passive resistance substantially similar to an equivalent fluid weighing 230 pounds per cubic foot acting against the foundation may be used to resist lateral forces. The passive resistance should be neglected in the upper 18 inches unless the ground immediately in front of the footing is covered with concrete or impervious pavement. The recommended lateral resistance values are ultimate values, and an adequate factor of safety should be used in design.

Where utility trenches are located adjacent to the foundation, the bottom of the footing should be located below an imaginary 1:1 (horizontal to vertical) plane projected upward from the nearest bottom edge of the utility trench.

The uplift resistance of a shallow foundation formed in an open excavation can be limited to the weight of the foundation concrete and the soil above it. For design purposes, the ultimate uplift resistance should be based on effective unit weights of 105 and 150 pcf for soil and concrete, respectively. This value should be reduced by an appropriate factor of safety to arrive at the allowable uplift load. If there is a chance of submergence, the buoyant unit weights should be used.

Post-construction estimated total and differential (over a 40-foot distance) settlements for the foundation constructed as recommended herein are anticipated to be about 1 inch and ½ inch, respectively. Contraction, control, or expansion joints should be designed and placed in various portions of the structure. Properly planned placement of these joints can assist in controlling the degree and location of material cracking which normally occurs due to material shrinkage, thermal effects, soil movements, and other related structural conditions.

Footing excavations should have firm bottoms and be free from excessive slough prior to concrete or reinforcing steel placement. The foundation excavations should be observed by ECS prior to placement of reinforcing steel or concrete to observe the exposed ground conditions.

4.2.2 Beam and Slab-on-Grade Foundation

The rigidity of a slab-on-grade foundation system can reduce the effects of differential soil movement due to compression of soils due to structural loads or shrink-swell due to expansive soils. This type of slab can be designed with conventionally reinforced perimeter and interior stiffening grade beams, and/or with post-tensioning adequate to provide sufficient rigidity to the slab element. The grade beam width and depth should be established by the project Structural Engineer. Grade beams may be thickened and widened at column or load bearing wall locations to support concentrated load areas, if necessary. Grade beams and floor slabs should be reinforced as required to reduce cracking and support bending moments caused by loading and minor movements of foundation soils.

The design values below are based on the subsurface conditions encountered during this exploration and the recommendations for building pad grading provided herein. If the project information changes, we should be contacted to review; and if necessary, provide alternate design parameters based on the changed conditions. These parameters are provided to assist the Structural Engineer in design of a foundation that is stiffened using grade beams (ribs), post tensioning, or a combination thereof.

POST-TENSIONED SLAB PARAMETERS PTI 3RD EDITION WITH 2008 SUPPLEMENTS		
Design Parameter	**¾-Inch PVR Design Values**	**1-Inch PVR Design Values**
e_m Edge	4.7 Feet	4.6 Feet
e_m Center	9.0 Feet	9.0 Feet
y_m Edge	1.21 Inches	1.21 Inches
y_m Center	0.84 Inches	0.88 Inches

BRAB/WRI SLAB PARAMETERS		
Design Parameter	**¾-Inch PVR Design Values**	**1-Inch PVR Design Values**
Effective PI	26	28
Climatic Rating	17	17
Unconfined Compressive Strength (TSF)	1.5	1.5
Soil-Climate Support Index (1-C)	0.11	0.15

Grade beams and widened column areas at least 12 inches wide and 18 inches deep can be designed using a net allowable bearing capacity of 3,000 psf. To utilize the parameters listed above, the subgrade should be prepared in accordance with Section 5.0 “Site Construction Recommendations” sections of this report, including improving the as-built PVR to 1 inch or better.

The foundation at this site should be expected to undergo some vertical movements. These movements can potentially cause cosmetic distress and should be accounted for in the design process. Contraction, control, or expansion joints should be designed and placed in various portions of the structure. Properly planned placement of these joints can assist in controlling the degree and location of material cracking which normally occurs due to material shrinkage, thermal effects, soil movements, and other related structural conditions.

Where moisture sensitive floor coverings or equipment are planned to be installed, we recommend that at least a 10-mil vapor retarder be used beneath the slabs. The vapor retarder should conform to ASTM E1745, Class C or better and should have a maximum water vapor permeance of 0.044 when tested in accordance with ASTM E96. Consideration to specifying a thicker, more durable vapor retarder should also be made where anticipated construction traffic dictates. Please refer to the latest edition of ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials and ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs for additional guidance on this issue.

4.2.3 Perimeter Conditions

The upper 18 inches of soil placed along the exterior of the structure should consist of clayey soils placed and compacted in accordance with this report. The purpose of this clay backfill is to reduce the opportunity for surface or subsurface water infiltration beneath the structure. This clay layer may be replaced with asphalt or concrete pavement that extends to the edge of the structure foundation. Additionally, where penetrations into the structure such as utility trenches occur, a clay plug (or a synthetic alternative) should be placed at the building lines to reduce the opportunity for infiltrating water, regardless of the selected building pad materials.

Positive drainage away from the structure should also be provided. Soil areas within 10 feet of the building should slope at a minimum of 5 percent away from the structure. Adjacent pavements and concrete hardscape should slope at 1½ to 2 percent away from the structure. Roof leaders and downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system.

Additionally, irrigation of lawn and landscaped areas should be moderate, with approximately no excessive wetting or drying of soils around the perimeter of the structure allowed. Trees and bushes/shrubs planted near the perimeter of the structure can withdraw large amounts of water from the soils and should be planted at least one-half their anticipated mature height away from the building. Where flatwork is placed against or near the structure, a positive seal should be installed and adequately maintained to reduce water intrusion.

Routine maintenance is required in an effort to ensure that the recommendations contained in this report are followed and maintained. Greater potential movements could occur with extreme wetting or drying of the soils due to poor drainage, ponding of water, plumbing leaks, lack of irrigation, and/or lack of routine maintenance, etc.

4.3 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2018 requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The seismic site class definitions for the average of shear wave velocity or SPT-N-value in the upper 100 feet of the soil profile are shown in the table below:

SEISMIC SITE CLASSIFICATION

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N value (bpf)
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60
E	Soft Soil Profile	Vs < 600 fps	<15

ECS utilized the SPT-N-value to classifying the site. in our opinion the site soil and rock can be characterized as Site Class D. The site class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. Our deepest borings at the project site extended to depths of 15 feet beneath the existing ground surface, whereas IBC site classifications are based on characterization of the upper 100 feet of the soil profile.

Ground Motion Parameters: In addition to the seismic site classification, ECS has identified the design spectral response acceleration parameters following the IBC methodology. The Mapped Reponses were estimated from the USGS website https://seismicmaps.org/. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted at the far-right end of the following table.

GROUND MOTION PARAMETERS [IBC 2018 Method]								
Period (sec)	**Mapped Spectral Response Accelerations (g)**		**Values of Site Coefficient for Site Class**		**Maximum Spectral Response Acceleration Adjusted for Site Class (g)**		**Design Spectral Response Acceleration (g)**	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.049	F_a	1.6	$S_{MS}=F_aS_s$	0.078	$S_{DS}=2/3\,S_{MS}$	0.052
1.0	S_1	0.02	F_v	2.4	$S_{M1}=F_vS_1$	0.048	$S_{D1}=2/3\,S_{M1}$	0.032

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

4.4 PAVEMENT SECTIONS

ECS has prepared the following recommendations for the design and construction of both flexible and rigid pavement systems for use on the subject project. The "AASHTO Guide for Design of Pavement Structures" published by the American Association of State Highway and Transportation Officials was used to develop 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.

We have based our analysis on the following ESAL information and pavement-related subgrade design parameters, which are considered to be typical for the area. A CBR (California Bearing Ratio) value of 2.5 percent was selected for design purposes. The CBR value was estimated based on ECS's knowledge and experience with similar soils and projects in this area.

Reliability	70
Initial Serviceability Index, Flexible Pavements	4.2
Initial Serviceability Index, Rigid Pavements	4.5
Terminal Serviceability Index, All Pavements	2.0
Standard Deviation, Flexible Pavements	0.45
Standard Deviation, Rigid Pavements	0.35

Based on the design parameters listed above, we developed recommendations for “light-duty,” “moderate-duty” and “heavy-duty” pavement sections. “Light-duty” pavements are intended for general parking areas with passenger vehicles only and have an approximate capacity of 20,000 ESAL. “Moderate-duty” pavements are intended for areas subject to channelized traffic and fire lanes and have an approximate capacity of 80,000 ESAL. “Heavy-duty” pavements are intended for areas subject to heavier vehicles with extensive turning, starting, and stopping, such as pavement aprons associated with trash enclosures, and have an approximate capacity of 250,000 ESAL. If the owner or other members of the design team feel that the ESAL values used for design are not appropriate, ECS should be notified in writing, so new information can be reviewed, and if necessary, the pavement recommendations revised accordingly.

The minimum recommended thickness for both hot mixed asphalt concrete (HMAC) and reinforced Portland cement concrete (PCC) pavement sections are presented in the table below for the described “light,” “moderate” and “heavy” traffic conditions.

RECOMMENDED PAVEMENT SECTION OPTIONS					
Component	**Light-Duty 20,000 ESALs**		**Moderate-Duty 80,000 ESALs**		**Heavy-Duty 250,000 ESALs**
	Rigid	**Asphalt**	**Rigid**	**Asphalt**	**Rigid**
Portland Cement Reinforced Concrete (PCC)	5 in.	---	5.5 in.	---	6.5 in.
Hot Mixed Asphalt Concrete (HMAC)	---	2 in.	---	3 in.	---
Crushed Limestone Base (CLB)	---	8.5 in.	---	9 in.	---
Compacted Subgrade	6 in.	6 in.	6 in.	6 in.	6 in.

The pavement sections described above are for general-purpose usage for the anticipated subgrade conditions and were designed using the AASHTO Pavement and Analysis System. An aggressive maintenance program to keep joints and cracks sealed to inhibit moisture infiltration can help extend the pavement life.

We recommend that rigid pavement sections be used in heavy truck traffic areas. The concrete pavement should extend throughout the areas that require extensive turning and maneuvering of the delivery vehicles, etc. Waste dumpster pad, loading areas and other heavily loaded pavement areas that are not designed to accommodate these conditions often experience localized pavement failures, particularly if flexible pavement sections are used.

4.4.1 Pavement Materials

Recommendations regarding material requirements for the various pavement sections are summarized below:

Portland Cement Concrete - Concrete used for paving should have a minimum compressive strength of 3,500 psi at 28-days. The air content at the point of placement should range from 2 to 4 percent. The concrete pavements should be reinforced and jointed per current ACI recommendations.

Hot Mix Asphalt Concrete (HMAC) Surface Course - The asphalt concrete surface course should be plant-mixed, hot laid Type D (Fine Graded Surface) or Type C (Coarse Graded Surface Course) meeting the specifications requirements of TxDOT Item 340 and specific criteria for the job mix formula. The mix should be compacted to between 92 and 97 percent of the maximum theoretical density as established by Tex-227-F.

Crushed Limestone Base Course - Crushed limestone base should be placed in maximum 6-inch compacted lifts. The base materials should be compacted to at least 98 percent of the maximum dry density as established by TxDOT Tex-113-E. Flexible base materials should be moisture conditioned to between -2 and +3 percentage points of the optimum moisture content during compaction. Flexible base materials should meet the requirements specified in 2014 TxDOT Standard Specification Item 247, Type A, Grade 1-2.

4.4.2 Rigid Pavement Considerations

Joints are typically placed in rigid pavements to control cracking, to facilitate construction, and to isolate a section of pavement from a structure or an adjacent pavement section. Joints used to control cracking are typically known as contraction or control joints as they are intended to control cracking that arises out of the shrinkage of concrete as it cures. Construction joints are used to provide clean breaks between pavement sections that result from the construction process. Isolation joints (or expansion joints) are used to separate the pavement from other structures or pavements and typically include the use of compressible materials in the joint as opposed to contraction or construction joints. Contraction joints should be spaced approximately no greater than 15 feet between the nearest parallel joints with joint depths of at least ¼ of the slab thickness. Contraction and construction joints should be approximately no wider than ⅛ of an inch whereas isolation joints may be up to 1 inch wide.

Steel reinforcement is commonly used where subgrade conditions are not likely to provide uniform support to the concrete pavement. Generally, sites with expansive soils present are often unable to provide such support to rigid pavement sections. Therefore, reinforcing steel can be used to span between construction and isolation (expansion) joints and should consist of at-minimum No. 3 bars spaced 18 inches on-centers each way. The rebar should be Grade 60 steel.

As with steel reinforcement, in situations where the subgrade may not provide uniform support to the pavement, dowels are commonly used to transfer loads across joints. Smooth dowels can be used for this purpose and should be utilized as recommended in the following table.

Dowel Design Information				
Slab Thickness, In.	**Dowel Diameter, In.**	**Min. Dowel Embedment Each Side, In.**	**Min. Dowel Length, In.**	**Dowel Spacing On-Centers, In**
5.0	⅝	5	10	12
5.5	¾	6	12	12
6.5	⅞	7	16	12

The joint and reinforcing design of a rigid pavement system is largely a function of geometry for the pavement area. The proper length of concrete panels (defined as the distance between discontinuous pavement sections, e.g., between construction or isolation joints, or a combination of the two) and the location of contraction, construction, and isolation (expansion) joints are not included as a function of the above concrete pavement guidelines. Rather, these features should be established based on the geometry and construction sequencing of the pavement. Actual joint spacing should be based on actual pavement areas and final panel lengths so that joints are evenly spaced. Joints should be designed to form approximately square panels where geometrically feasible.

The values provided herein are guidelines and the recommendations selected by the project Civil Engineer and guidelines not provided or mentioned herein should not exceed the American Concrete Institute (ACI) 330R recommendations.

4.4.3 Pavement Drainage, Subdrainage, and Trenching

Longitudinal cracks and apparent distress due to expansive soils may appear in the pavement after construction and the introduction of landscape irrigation. These cracks and distress are not pavement failures with respect to traffic support, although they may be aesthetically undesirable. In addition, without regular maintenance, the cracks can allow additional moisture intrusion and rapid degradation of the pavement section. The pavement sections are primarily designed to support the traffic and cannot resist the forces generated by swelling soils.

Positive drainage should be provided on and around pavement areas to avoid ponding of water. Irrigation of lawn and landscaped areas adjacent to the pavements should be moderate, with approximately no excessive wetting or drying of soils. If landscaped islands are provided, they should be designed to restrict excess water from migrating to the pavement subgrade by using self-contained beds, vertical moisture barriers, and/or edge drains. Curbs should extend through the flexible base course and at least 4 inches into the underlying subgrade. Good perimeter surface drainage guiding surface water away from the pavement area is also recommended.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

In a dry and undisturbed state, the soils at the site can provide good subgrade support for fill placement and construction operations. However, when wet, this soil can degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations, which would help maintain the integrity of the soil. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

The soils at the site are moisture and disturbance-sensitive and contain fines that are considered moderately erodible. Therefore, the contractor should carefully plan his operation to reduce exposure of the subgrade to weather and construction equipment traffic and provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surficial soils. Erosion and sedimentation should be controlled per sound engineering practice and current jurisdictional requirements.

In preparing the site for construction, loose, or soft soils, vegetation, organic soil, existing pavements, foundations or utilities, or similar materials should be removed from proposed structural and paving areas, and areas receiving new fill.

After stripping and required cuts have been completed, the subgrade soils should be scarified, moisture conditioned and compacted to at least 95 percent of the maximum dry density as established by ASTM D698 to a depth of at least 8 inches. The soils should be moisture conditioned to between optimum and +4 percentage points of the optimum moisture content just prior to compaction.

5.1.1 Removals, Stripping and Grubbing

The subgrade preparation should consist of stripping and grubbing, as discussed above, 10 feet from the perimeter of the building and 5 feet beyond pavement limits and the toe of fills. ECS should be called to check that topsoil and other surficial materials have been removed before the placement of fill or construction of structures.

Appropriate diligence should be exercised to properly backfill removed below-grade structures. Abandoned subsurface utilities and permeable backfills should be removed and/or grouted a sufficient distance from the proposed building to avert the conduit of water beneath the proposed structure.

5.1.2 Proof Rolling

After stripping and grubbing, cutting to the proposed grade, and before compacting the subgrade or placing of structural fill, the exposed subgrade should be reviewed by the Geotechnical Engineer or authorized representative. The exposed subgrade should be proof rolled with previously consented construction equipment having a minimum axle load of 25 tons (e.g., amply loaded tandem-axle dump truck). The areas subject to proof rolling should be traversed by the equipment in two perpendiculars (orthogonal) directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. This procedure is intended to assist in identifying localized yielding materials. If yielding or “pumping” subgrade is identified by the proof rolling, those areas should be marked for repair before the compacting the subgrade or placing fills or other construction materials. Subgrade repair methods, such as undercutting, moisture conditioning or lime/cement treatment, should be discussed with the Geotechnical Engineer to identify the appropriate procedure about the existing conditions causing the yielding.

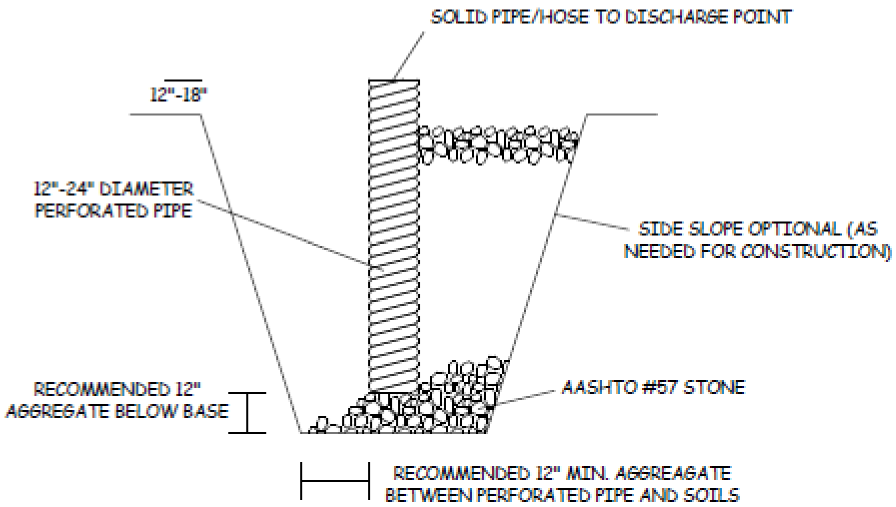
If the area is deemed too small for a piece of equipment to traverse, the excavated area should be probed by the Geotechnical Engineer or authorized representative.

5.1.3 Site Temporary Dewatering

The contractor should make their own assessment of temporary dewatering needs based upon the limited subsurface groundwater information presented in this report. Soil sampling is not continuous, and soil and groundwater conditions may vary between sampling intervals (typically 5 feet). If the contractor believes additional subsurface information is needed to assess dewatering needs, they should obtain such information at their own expense. ECS makes no warranties or guarantees regarding the adequacy of the provided information to establish dewatering requirements; such recommendations are beyond our scope of services.

Dewatering systems are an important component of many construction projects. Dewatering systems should be selected, designed, and maintained by a qualified and experienced (specialty or other) contractor familiar with the succinct geotechnical and other aspects of the project. The failure to properly design and maintain a dewatering system for a given project can result in delayed construction, unnecessary foundation subgrade undercuts, detrimental phenomena such as "running sand" conditions, internal erosion (i.e., "piping"), the migration of "fines" down-gradient towards the dewatering system, localized settlement of nearby infrastructure, foundation, slabs-on-grade, pavements, etc. Water discharged from site dewatering systems should be discharged in accordance with local, state, and federal requirements.

Strategies for Addressing Perched Groundwater: The typical primary strategy for addressing perched groundwater seeping into excavations is pumping from trenches (or French drains) and sump pits with sump pumps. A typical drain (in a sump pit or along a French drain) is depicted below. The inlet of the sump pump is placed at the bottom of the corrugated pipe and the discharge end of the sump is directed to an appropriate stormwater drain.



Sump Pit/Pump Diagram

A typical French drain consists of an 18 to 24-inch wide by 18- to 24-inch-deep bed of AASHTO #57 (or similar open-graded aggregate) aggregate wrapped in a medium duty, non-woven geotextile and (sometimes) containing a 6-inch diameter, Schedule 40 PVC perforated or slotted pipe. Actual dimensions should be as identified necessary by ECS during construction. After the installation has been completed, the geotextile should be wrapped over the top of the aggregate and pipe followed by placement of backfill. The top of the drain should be positioned at least 18 inches below the design subgrade elevations. Drains should not be routed within the expanded building limits.

Pumping wells or a vacuum system could also be used to address perched groundwater. These techniques often are only effective during the initial depletion of the perched water quantity and may quickly be ineffective at addressing accumulation of water from rain, snow, etc.

5.2 EARTHWORK OPERATIONS

To mitigate soil expansion potential in the building area, it is recommended that the building pad be improved according to report section 4.1 “Potential Vertical Rise & Subgrade Improvements.” After the stripping and removal operations, fill placement to finished pad grade should extend at least 5 feet beyond the building perimeters and beneath adjacent movement sensitive concrete flatwork. The upper 18 inches of fill outside of the building area should consist of a properly compacted low permeability clay soil to reduce infiltration of moisture into the adjacent select fill materials.

After stripping and grubbing, undercutting/removals, subgrade preparation (including proof rolling) and evaluation has been completed, fill placement may begin. Fills in the building pad area should consist of materials meeting the requirements of the Select Fill and Moisture-Conditioned Fill sections below. Fills in pavement and landscape areas can consist of materials meeting the requirements of the General Fill section below. Consideration should be given to creating an “all weather” working surface with the upper 6 inches of the select fill building pad. Such a working surface should consist of compacted TxDOT Item 247 Type A, Grade 1-2 Flexible Base material. The use of an “all weather” working surface can significantly improve the accessibility of the site to construction traffic during periods of wet weather.

Soil moisture levels should be preserved (by various methods that can include covering with plastic, watering, etc.) until new fill, pavements, or slabs are placed. Upon completion of the filling operations, care should be taken to maintain the soil moisture content before the construction of floor slabs and pavements. If the soil becomes desiccated, the affected material should be removed and replaced, or these materials should be scarified, moisture conditioned, and re-compacted.

Utility cuts should not be left open for extended periods and should be properly backfilled. Backfilling should be accomplished with properly compacted on-site soils, rather than granular materials. If granular materials are used, a utility trench cut-off at the building line is recommended to help inhibit water from migrating through the utility trench backfill to beneath the proposed structure.

Field density and moisture tests should be performed on each lift as necessary to check that adequate compaction is achieved. As a guide, one test per 2,500 square feet per lift is recommended in the building area (two tests minimum per lift), and one test per 10,000 square feet per lift is recommended for paving areas (two tests minimum per lift). Utility trench backfill should be tested at a rate of one test per lift per each 150 linear feet of the trench (two tests minimum per lift). Certain jurisdictional requirements may require testing in addition to that noted previously. Therefore, these specifications should be reviewed, and more stringent specifications should be followed.

5.2.1 General Fill

General fill should consist of on-site or imported soils, provided they meet the requirements described below. General fill materials should be without organics, construction debris, deleterious materials, and should be without rocks larger than 4 inches in greatest dimension. General Fill should have a Plasticity Index of 30 and lower. Proposed general fill should be evaluated and tested by ECS prior to placement in the field.

ECS recommends that general fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Lift thickness should be decreased when using light compaction equipment. General fill should be compacted to at least 95% of the maximum dry density at moisture contents within the range of optimum to +4 percentage points of the optimum moisture content (ASTM D698).

5.2.2 Select Fill

Select fill materials should be without organics, construction debris, deleterious materials, and should be without rocks larger than 4 inches in greatest dimension. Select fill should have a Plasticity Index of between 5 and 20. Select fill should be evaluated and tested by ECS prior to placement in the field.

ECS recommends that select fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Select fill should be compacted to at least 95% of the maximum dry density at moisture contents within the range of -1 to +3 percentage points of the optimum moisture content (ASTM D698).

5.2.3 Moisture-Conditioned Fill

Moisture-conditioned fill materials should be without organics, construction debris, deleterious materials, and should contain less than 15 percent gravel (material retained on the No. 4 sieve by dry unit weight). Material proposed for use as moisture-conditioned fill should be relatively consistent in composition and should be evaluated and tested by ECS in the laboratory prior to placement in the field. Some of the soils explored at the site may not meet the above criteria for use as moisture-conditioned fill for PVR reduction and some selective grading should be anticipated if this method of PVR mitigation is to be utilized.

ECS recommends that moisture-conditioned fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Moisture-conditioned fill for the purposes of PVR reduction in the building pad should be compacted to between 95% of the maximum dry density at moisture contents ranging from optimum to +4 percentage of the optimum moisture content (ASTM D698).

If the moisture-conditioned fill option is implemented to reduce the PVR, the earthwork contractor should be aware that there is a high probability that soils placed in the building pad can be compacted at well above their optimum moisture content. Soils compacted several percentage points above their optimum moisture content are typically soft and susceptible to rutting, and appropriate construction equipment capable of maneuvering on soft ground conditions should be considered.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain open for too long a time. Therefore, concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing and Slab Subgrade Observations: The soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. It is important to have ECS observe the foundation and slab subgrade prior to placing concrete, to confirm the bearing and subgrade soils and bedrock are what was anticipated.

5.4 UTILITY INSTALLATIONS

5.4.1 Utility Subgrades

The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or inadequate materials encountered should be removed and replaced with compacted General Fill or pipe stone bedding material.

5.4.2 Utility Backfilling

The granular bedding material (often AASHTO #57 stone) should be at least 4 inches thick, but not less than that specified by the Civil Engineer's project drawings and specifications. We recommend that the bedding materials be placed up to at least the springline of the pipe. Utility trenches in the building pad should be backfilled above the utility bedding and shading materials with similar materials to original building pad construction, and general fill materials outside the building pad area. The backfill materials should be placed in lifts not to exceed 8 inches loose measure, or 6 inches compacted measure. Thinner lifts may be required when using handheld compaction equipment. Backfill materials should be moisture-conditioned and compacted in accordance with the moisture conditioned fill, select fill and general fill sections of this report. Where the building pad has been constructed using moisture-conditioned soils and a select fill cap, care should be exercised to separate out these materials during trenching and place them back in a similar manner to original building pad construction. Mixing of these two soil types should be averted.

5.4.3 Utility Connections

Flexible connections should be considered where utilities connect to the building or pass-through building foundation/slab to allow for the anticipated Potential Vertical Rise differential. This could be provided by special flexible connections, pipe sleeving with appropriate waterproofing, or other methods.

5.5 EXCAVATION SAFETY

Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining steady temporary excavations and slopes. 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. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region.

No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Michael Legg Architecture. If this information is untrue or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

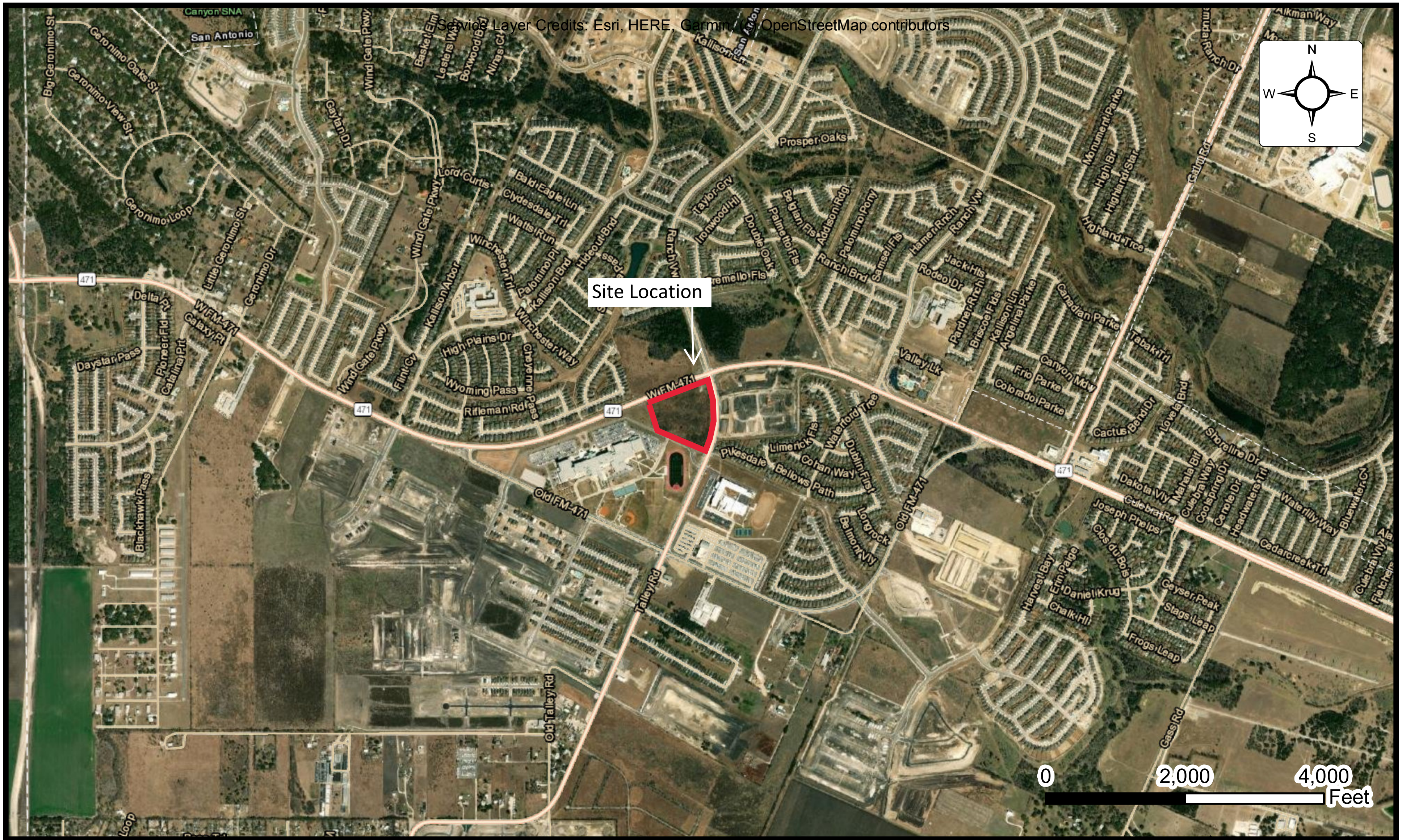
Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings and tests performed at the locations as indicated on the Boring Location Diagram and other information referenced in this report. This report does not reflect variations, which may occur between the borings. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in subsurface conditions exist on many sites between boring locations and such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, after performing on-site observations during the construction period and noting characteristics and variations, a reevaluation of the recommendations for this report can be necessary.

APPENDIX A – Diagrams & Reports

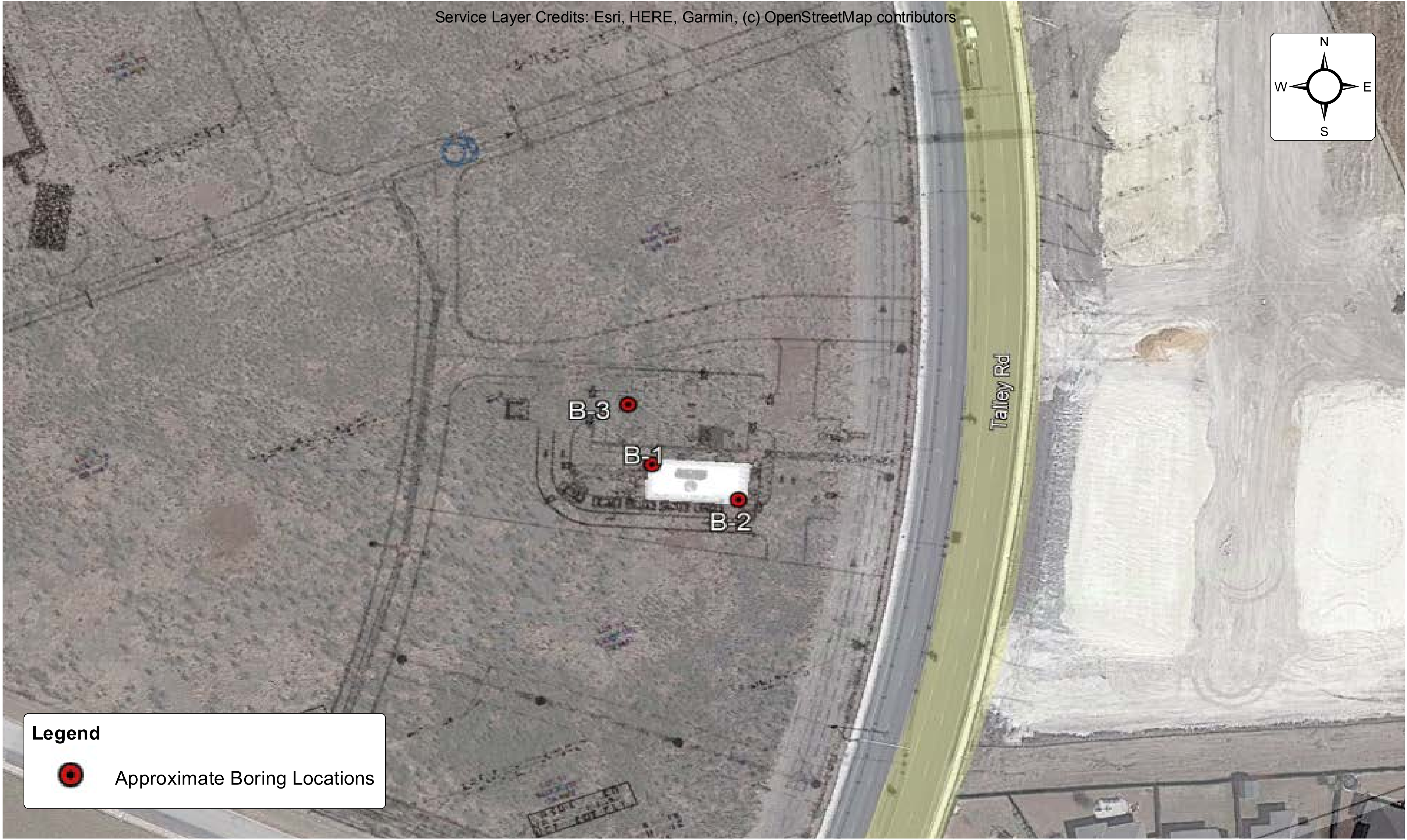
Site Location Diagram
Boring Location Diagram
Site Geologic Map



SITE LOCATION DIAGRAM
GOLDEN CHICK - TALLEY ROAD

CULEBRA ROAD AND TALLEY ROAD, SAN ANTONIO, TEXAS
MICHAEL LEGG ARCHITECTURE

ENGINEER	REW
SCALE	AS NOTED
PROJECT NO.	20:1653
FIGURE	1 OF 1
DATE	4/17/2023



Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors

BORING LOCATION DIAGRAM
GOLDEN CHICK - TALLEY ROAD

CULEBRA ROAD AND TALLEY ROAD, SAN ANTONIO, TEXAS
MICHAEL LEGG ARCHITECTURE

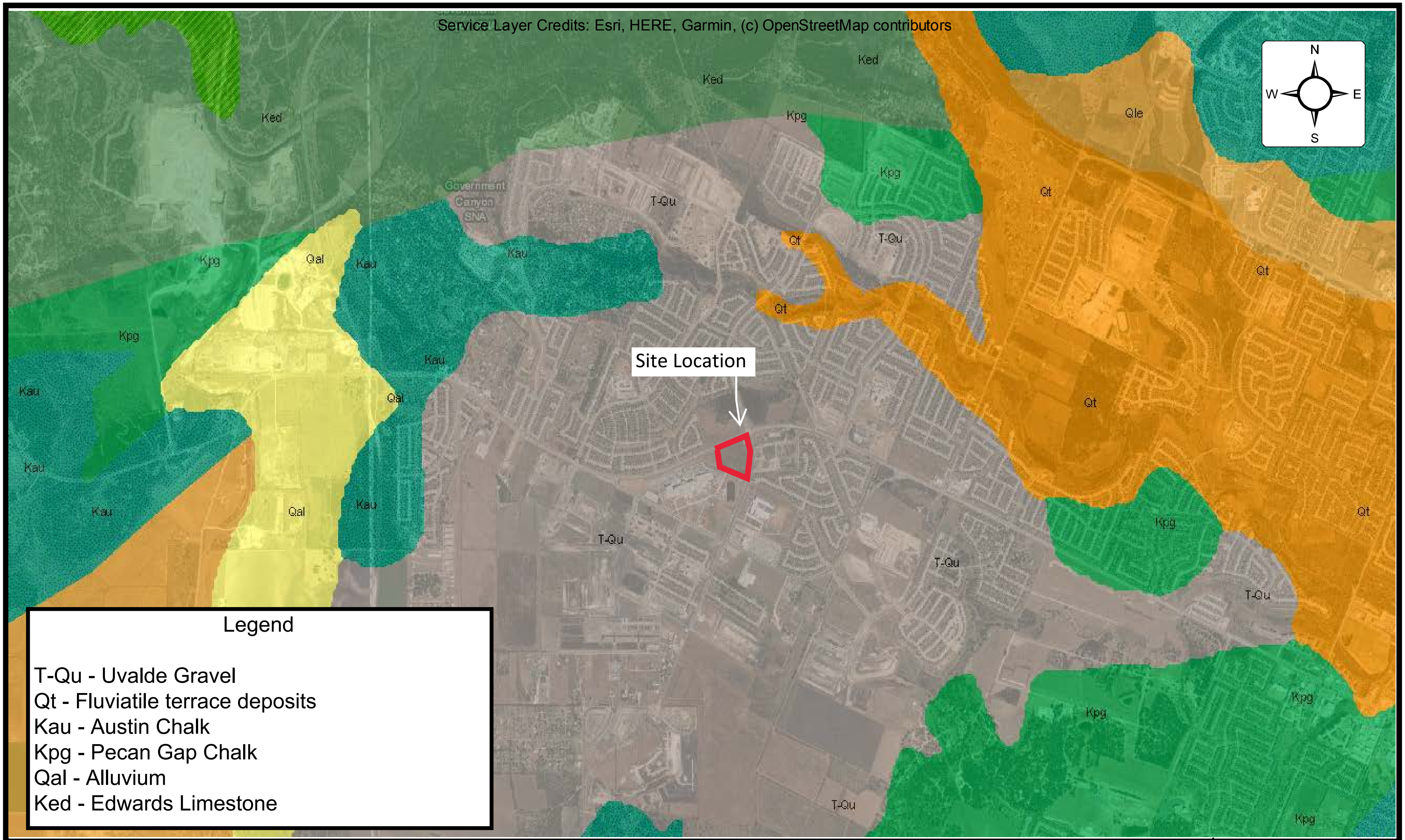
ENGINEER
REW

SCALE
NTS

PROJECT NO.
20:1653

FIGURE
1 OF 1

DATE
4/17/2023



Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors

Legend

T-Qu - Uvalde Gravel
Qt - Fluviatile terrace deposits
Kau - Austin Chalk
Kpg - Pecan Gap Chalk
Qal - Alluvium
Ked - Edwards Limestone

ECS

SITE GEOLOGIC DIAGRAM
GOLDEN CHICK - TALLEY ROAD

CULEBRA ROAD AND TALLEY ROAD, SAN ANTONIO, TEXAS
MICHAEL LEGG ARCHITECTURE

ENGINEER
REW

SCALE
AS NOTED

PROJECT NO.
20:1653

FIGURE
1 OF 1

DATE
4/17/2023

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Site Exploration Procedure
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

■		**ASPHALT**
░		**CONCRETE**
░		**GRAVEL**
▨		**TOPSOIL**
□		**VOID**
▦		**BRICK**
○		**AGGREGATE BASE COURSE**
▒	**GW**	**WELL-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
○	**GP**	**POORLY-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▥	**GM**	**SILTY GRAVEL** **gravel-sand-silt mixtures**
▧	**GC**	**CLAYEY GRAVEL** **gravel-sand-clay mixtures**
▪	**SW**	**WELL-GRADED SAND** **gravelly sand, little or no fines**
⁘	**SP**	**POORLY-GRADED SAND** **gravelly sand, little or no fines**
▥	**SM**	**SILTY SAND** **sand-silt mixtures**
▨	**SC**	**CLAYEY SAND** **sand-clay mixtures**
▥	**ML**	**SILT** **non-plastic to medium plasticity**
▥	**MH**	**ELASTIC SILT** **high plasticity**
▨	**CL**	**LEAN CLAY** **low to medium plasticity**
▨	**CH**	**FAT CLAY** **high plasticity**
≀	**OL**	**ORGANIC SILT or CLAY** **non-plastic to low plasticity**
≀	**OH**	**ORGANIC SILT or CLAY** **high plasticity**
⁂	**PT**	**PEAT** **highly organic soils**

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay (“Fines”)		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: “Silty”)*	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL (First Encountered)
▼	WL (Completion)
▼	WL (Seasonal High Water)
▽	WL (Stabilized)

FILL AND ROCK

🟥	🟪	▫	🟩
FILL	**POSSIBLE FILL**	**PROBABLE FILL**	**ROCK**

---

[1] Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2] To be consistent with general practice, “POORLY GRADED” has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3] Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). “N-value” is another term for “blow count” and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7] Minor deviation from ASTM D 2488-17 Note 14.

[8] Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SITE EXPLORATION PROCEDURE

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field and laboratory data to assist in the determination of geotechnical recommendations.

The subsurface conditions were explored by 3 borings drilled to an approximate depth ranging from 5 to 15 feet below the existing site grades. A truck-mounted drill rig with continuous-flight augers was utilized to drill the borings. The boring locations were determined and identified in the field by ECS personnel using the boring locations provided. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. The ground surface elevations noted in this report were estimated using Google Earth Pro.

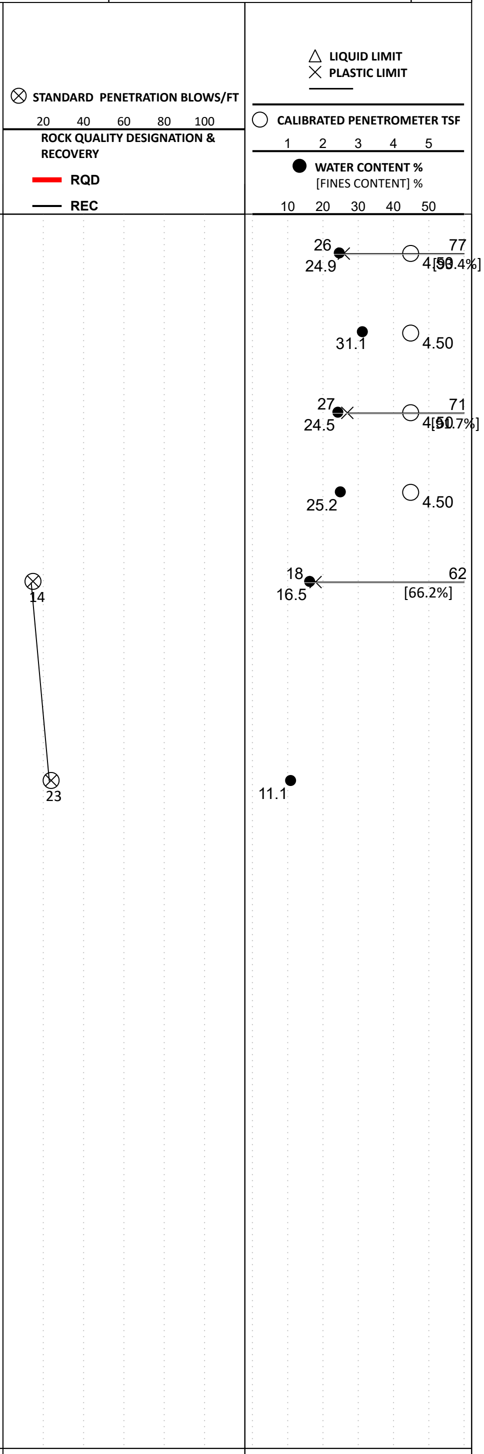
Standard Penetration Tests (SPTs) were performed to obtain representative samples and penetration resistance measurements in general accordance with ASTM D1586. Soil samples were obtained at various intervals with the 1.625-inch inside diameter, 2-inch outside diameter, Split-Barrel sampler. The Split-Barrel sampler was first seated 6 inches to penetrate loose cuttings, and then was driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler each 6-inch increment was recorded. The penetration resistance "N-value" is defined as the number of hammer blows required to drive the sampler the final 12 inches and is indicated on the test boring logs. In very dense materials such as weathered rock material, the SPT test is usually stopped after 50 blows from the hammer and the measurement is recorded as 50 blows per distance penetrated (i.e., 50 over 3 inches).

Shelby tubes sampling procedure in general accordance with ASTM D1587 was used to obtain soil samples. In the Shelby tube sampling procedure, a thin-walled, steel seamless tube with sharp cutting edges is pushed hydraulically into the soil, and a relatively undisturbed sample is obtained. Samples were removed from samplers in the field, visually classified, and appropriately sealed in sample containers to preserve their in-situ moisture contents. Samples of cohesive soil were tested with a calibrated hand "pocket" penetrometer. In this test, the unconfined compressive strength of a soil sample is estimated to be a maximum of 4.5 tons per square foot (tsf) by measuring the resistance of the soil sample to the penetration of a small diameter, calibrated, spring-loaded cylinder.

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each geotechnical soil sample was removed from the sampler and visually classified. Representative portions of each soil sample were then wrapped in plastic and transported to our laboratory for further visual examination and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with auger cuttings to the existing ground surface.

CLIENT: **Michael Legg Architecture**	PROJECT NO.: **20:1653**	BORING NO.: **B-01**	SHEET: **1 of 1**
PROJECT NAME: **Golden Chick - Talley Road**	DRILLER/CONTRACTOR: **Ideal Drilling**		
SITE LOCATION: **Culebra Road and Talley Road, San Antonio, Texas, 78254**		LOSS OF CIRCULATION	100%
NORTHING: **2984466.9**	EASTING: **851106.2**	STATION:	SURFACE ELEVATION: **1005.00**
		BOTTOM OF CASING	▶

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	ST	24	24	(CH) FAT CLAY, dark brown, hard			
	S-2	ST	24	24				
5	S-3	ST	24	24			1000	
	S-4	ST	24	24				
10	S-5	SS	18	18	(CH) GRAVELLY FAT CLAY, light brown, stiff to very stiff, with calcareous seams		995	5-7-7 (14)
	S-6	SS	18	18				8-10-13 (23)
15					**END OF BORING AT 15 FT**		990	
20							985	
25							980	
30							975	



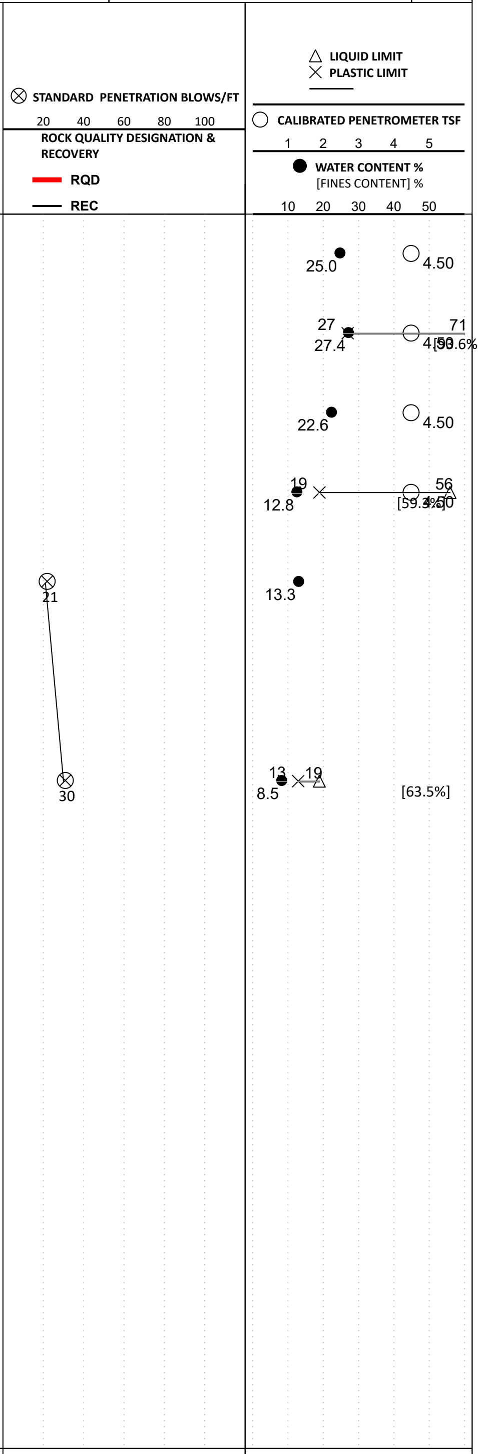
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Apr 11 2023**	CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Apr 11 2023**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY:
▽ WL (Stabilized)	DRILLING METHOD: **ST Shelby Tube / SS Split Spoon**	

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Michael Legg Architecture**	PROJECT NO.: **20:1653**	BORING NO.: **B-02**	SHEET: **1 of 1**
PROJECT NAME: **Golden Chick - Talley Road**	DRILLER/CONTRACTOR: **Ideal Drilling**		
SITE LOCATION: **Culebra Road and Talley Road, San Antonio, Texas, 78254**	LOSS OF CIRCULATION		
NORTHING: **2984458.8**	EASTING: **851124.5**	STATION:	SURFACE ELEVATION: **1003.00**
BOTTOM OF CASING			

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	ST	24	24	(CH) FAT CLAY, dark brown, hard			
	S-2	ST	24	24				
5	S-3	ST	24	24			998	
	S-4	ST	24	24	(CH) SANDY FAT CLAY, light brown, very stiff to hard, with calcareous seams and gravel			
	S-5	SS	18	18				8-9-12 (21)
10							993	
	S-6	SS	18	18	(CL-ML) SANDY SILTY CLAY WITH GRAVEL, light brown, very stiff			11-14-16 (30)
15					**END OF BORING AT 15 FT**		988	
20							983	
25							978	
30							973	



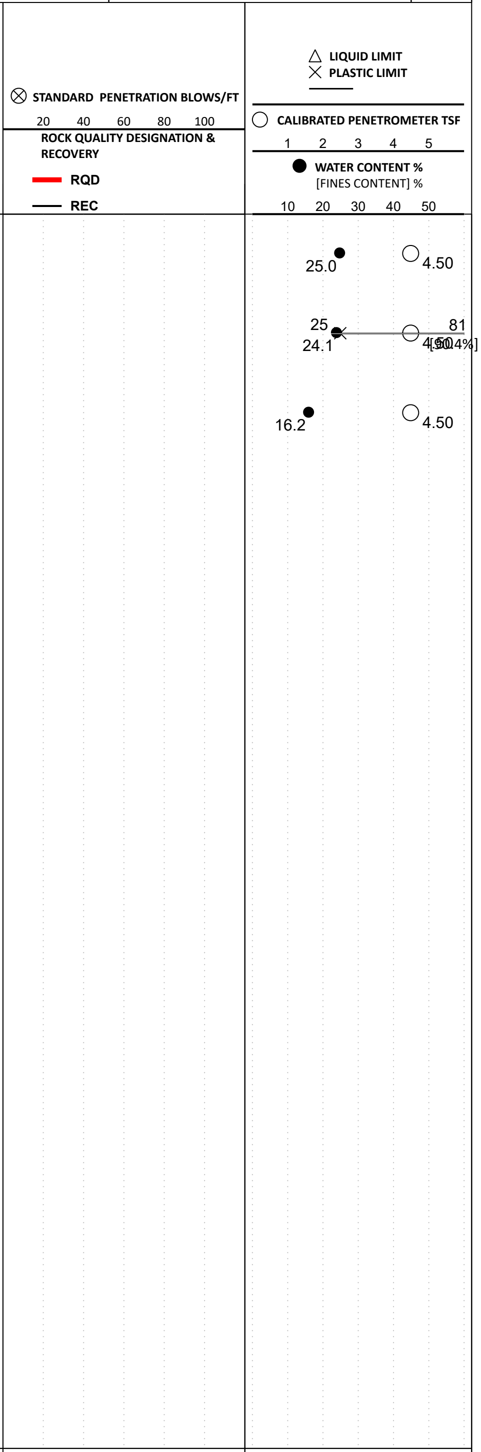
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Apr 11 2023**		CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Apr 11 2023**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY:	DRILLING METHOD: **ST Shelby Tube / SS Split Spoon**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Michael Legg Architecture**	PROJECT NO.: **20:1653**	BORING NO.: **B-03**	SHEET: **1 of 1**
PROJECT NAME: **Golden Chick - Talley Road**	DRILLER/CONTRACTOR: **Ideal Drilling**		
SITE LOCATION: **Culebra Road and Talley Road, San Antonio, Texas, 78254**		LOSS OF CIRCULATION	100%
NORTHING: **2984480.9**	EASTING: **851101.1**	STATION:	SURFACE ELEVATION: **1009.00**
		BOTTOM OF CASING	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	ST	24	24	(CH) FAT CLAY, dark brown, hard			
	S-2	ST	24	24				
5	S-3	ST	24	24			1004	
					END OF BORING AT 6 FT			
10							999	
15							994	
20							989	
25							984	
30							979	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Apr 11 2023**		CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Apr 11 2023**		HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY:	DRILLING METHOD: **ST Shelby Tube**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary
Particle Size Distribution

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-01	S-1	0-2	24.9		77	26	51	93.4					
B-01	S-2	2-4	31.1										
B-01	S-3	4-6	24.5		71	27	44	91.7					
B-01	S-4	6-8	25.2										
B-01	S-5	8.5-10	16.5	CH	62	18	44	66.2					
B-01	S-6	13.5-15	11.1										
B-02	S-1	0-2	25.0										
B-02	S-2	2-4	27.4		71	27	44	93.6					
B-02	S-3	4-6	22.6										
B-02	S-4	6-8	12.8	CH	56	19	37	59.3					

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Golden Chick - Talley Road
Client: Michael Legg Architecture

Project No.: 20:1653
Date Reported: 4/20/2023

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received
ARobles	ARobles	ARobles	

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-02	S-5	8.5-10	13.3										
B-02	S-6	13.5-15	8.5	CL-ML	19	13	6	63.5					
B-03	S-1	0-2	25.0										
B-03	S-2	2-4	24.1	CH	81	25	56	90.4					
B-03	S-3	4-6	16.2										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Golden Chick - Talley Road
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Project No.: 20:1653
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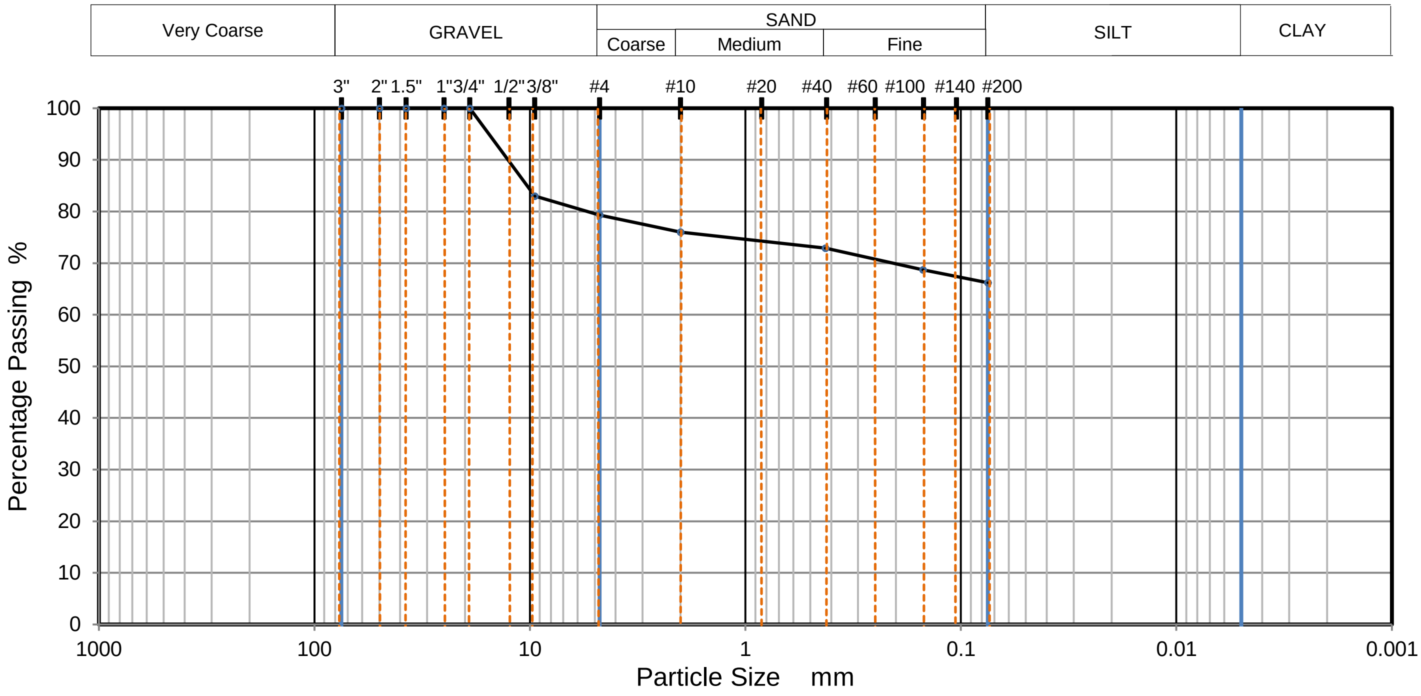
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received
fzuniga	fzuniga	fzuniga	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	83.0		
#4	79.3		
#10	76.0		
#40	72.9		
#100	68.7		
#200	66.2		

Dry Mass of sample, g	257.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	20.7
Coarse Sand, #4 to #10 sieve	3.3
Medium Sand, #10 to #40	3.1
Fine Sand, #40 to #200	6.7
Fines <#200	66.2

USCS	CH	Liquid Limit	62	D90	12.640	D50		D10	
AASHTO	A-7-6	Plastic Limit	18	D85	10.310	D30		Cu	
USCS Group Name	Gravelly fat clay	Plasticity Index	44	D60		D15		Cc	

Project: Golden Chick - Talley Road
Client: Michael Legg Architecture
Sample Description:
Sample Source: B-01

Project No.: 20:1653
Depth (ft): 8.5 - 10
Sample No.: S-5
Date Reported: 4/19/2023

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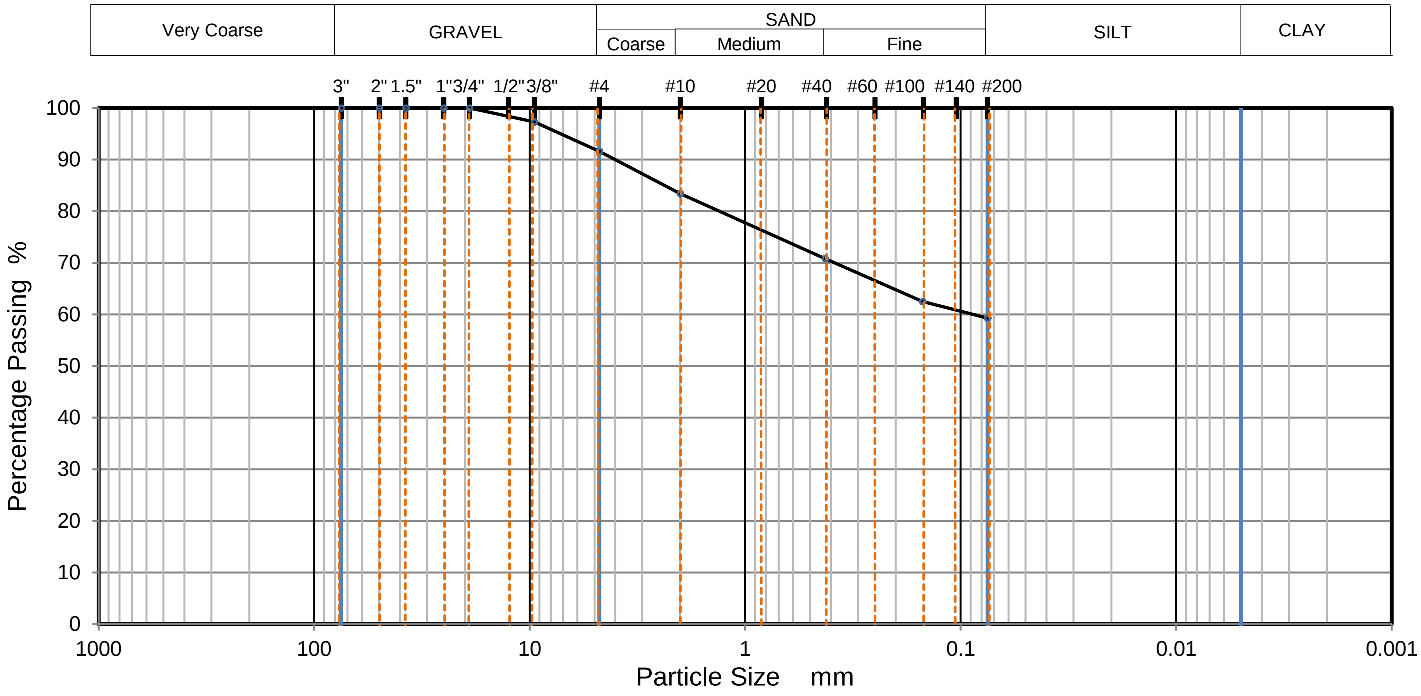
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	97.3		
#4	91.6		
#10	83.4		
#40	70.8		
#100	62.5		
#200	59.3		

Dry Mass of sample, g	267.8

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	8.4
Coarse Sand, #4 to #10 sieve	8.2
Medium Sand, #10 to #40	12.6
Fine Sand, #40 to #200	11.5
Fines <#200	59.3

USCS	CH	Liquid Limit	56	D90	4.012	D50		D10	
AASHTO	A-7-6	Plastic Limit	19	D85	2.368	D30		Cu	
USCS Group Name	Sandy fat clay	Plasticity Index	37	D60	0.087	D15		Cc	

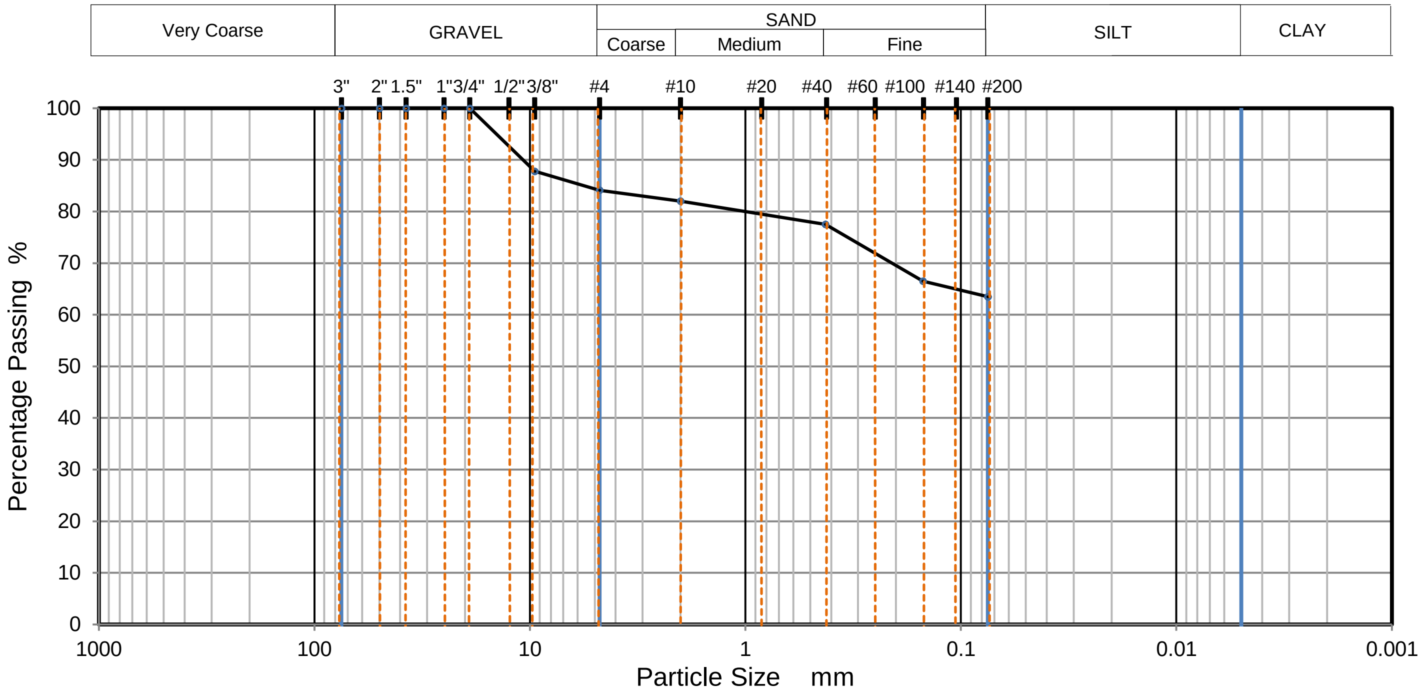
Project: Golden Chick - Talley Road
Client: Michael Legg Architecture
Sample Description:
Sample Source: B-02

Project No.: 20:1653
Depth (ft): 6 - 8
Sample No.: S-4
Date Reported: 4/19/2023

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	87.8		
#4	84.1		
#10	82.0		
#40	77.5		
#100	66.5		
#200	63.5		

Dry Mass of sample, g	270.8

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	15.9
Coarse Sand, #4 to #10 sieve	2.1
Medium Sand, #10 to #40	4.5
Fine Sand, #40 to #200	14.0
Fines <#200	63.5

USCS	CL-ML	Liquid Limit	19	D90	10.760	D50		D10	
AASHTO	A-4	Plastic Limit	13	D85	5.622	D30		Cu	
USCS Group Name	Sandy silty clay with gravel	Plasticity Index	6	D60		D15		Cc	

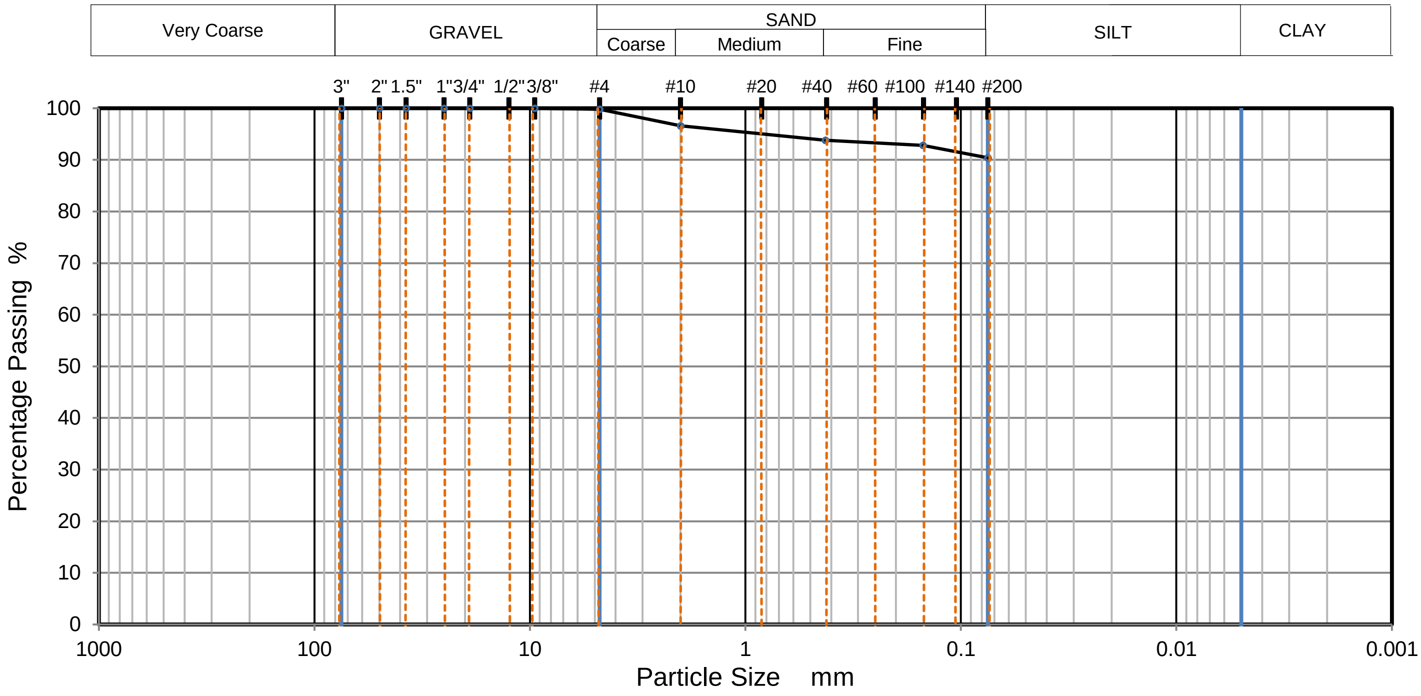
Project: Golden Chick - Talley Road
Client: Michael Legg Architecture
Sample Description:
Sample Source: B-02

Project No.: 20:1653
Depth (ft): 13.5 - 15
Sample No.: S-6
Date Reported: 4/19/2023

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	100.0		
#4	99.8		
#10	96.6		
#40	93.8		
#100	92.8		
#200	90.4		

Dry Mass of sample, g	243.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	0.2
Coarse Sand, #4 to #10 sieve	3.2
Medium Sand, #10 to #40	2.8
Fine Sand, #40 to #200	3.4
Fines <#200	90.4

USCS	CH	Liquid Limit	81	D90		D50		D10	
AASHTO	A-7-6	Plastic Limit	25	D85		D30		Cu	
USCS Group Name	Fat clay	Plasticity Index	56	D60		D15		Cc	

Project: Golden Chick - Talley Road
Client: Michael Legg Architecture
Sample Description:
Sample Source: B-03

Project No.: 20:1653
Depth (ft): 2 - 4
Sample No.: S-2
Date Reported: 4/19/2023

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles		