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JANUARY 6, 2023

ADDENDUM NO. 2

CONSTRUCTION MANAGER AT-RISK MESQUITE ANIMAL SHELTER & ADOPTION CENTER ADDITION

RFQ 2023-040

Proposers are directed to revise and incorporate into their responses the following answers to questions posed during the allowed proposal timeframe:

Question 1: What is the estimated cost of this project?
Answer: The estimated cost of project is $2M.

Question 2: Please provide geotechnical report for project?
Answer: Please reference enclosed ESC Southwest, LLP Geotechnical Engineering Report.

If you should have any other questions, do not hesitate to contact the Purchasing Office via email at purchasing@cityofmesquite.com.

Ryan Williams
Manager of Purchasing

ACCEPTANCE:

We, the undersigned, do hereby acknowledge receipt of this Addendum No. 2 to Solicitation RFQ 2023-040; Construction Manager At-Risk Mesquite Animal Shelter & Adoption Center and agree to the instructions herein written.

____
Company Name

____
Authorized Signature

____
Date

ECS SOUTHWEST, LLP

Geotechnical Engineering Report

Mesquite Animal Shelter

1650 Gross Road
Mesquite, Texas

ECS Project Number 19: 8506

November 10, 2021

November 10, 2021

Ms. Maria Martinez
Director of Neighborhood Services
City of Mesquite
1515 N Galloway Ave
Mesquite, Texas 75149

ECS Project No. 19: 8506

Reference: Geotechnical Engineering Report
Mesquite Animal Shelter
1650 Gross Road, Mesquite, Texas

Dear Ms. Martinez:

ECS Southwest (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the referenced project. Our services were performed in general accordance with ECS Proposal No. 19:11270-GP, dated August 4, 2021, and authorized by the client on October 6, 2021. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted. The report also contains our findings and recommendations for design and construction.

It has been our pleasure to be of service to you 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 the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southwest, LLP

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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 foundation recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The geotechnical exploration performed for this study consisted of a total of two (2) borings drilled to depths of approximately 5 to 35 feet below the existing site grades.

- The borings encountered fill clay soil at the surface that extend to a depth of 2 feet below the existing subgrade. Beneath the fill soils, fat and lean clay soils were encountered until the termination depth of approximately 5 in Boring P-1 and to a depth of 22.5 feet below existing site grade in Boring B-1. Overburden soils are underlain by gray shale and extend to the termination depth of 35 feet.

- Groundwater seepage was encountered at a depth of 6 feet in Boring B-1 during drilling and groundwater level was measured at a depth of 7 feet upon drilling completion.

- The proposed building addition at this site can be supported on straight drilled shafts bearing in the shale. Alternatively, the buildings can also be supported on a monolithic slab on grade foundation system with a conventionally reinforced slab on grade if some movement can be tolerated in the foundation system.

- Subgrade treatment of the high plasticity and expansive clay soils is necessary to reduce the potential for vertical movement in the building area. Specific details on addressing these high plasticity and expansive clay soils are presented in the body of the report.

- The potential vertical movement (PVM) of floor slabs situated near existing grade is estimated to be about 2 inches for dry moisture condition. The subgrade should be prepared to reduce movements to tolerable levels.

- 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 prevent misinterpretation of ECS recommendations, ECS should be retained to perform quality control testing and documentation during construction of the earthwork and foundations for the project.

1.0 INTRODUCTION

1.1 GENERAL

The purpose of this study was to provide geotechnical information for the design of foundations for the building addition on the west side of the existing building. Associated pavements, parking lots and utility improvements are also included in this project. The recommendations developed for this report are based on project information provided by the client.

Our services were provided in accordance with ECS Proposal No. 19:11270-GP, dated August 4, 2021, and authorized by the client on October 6, 2021.

This report contains the results of our subsurface explorations and geotechnical laboratory testing programs, site characterization, engineering analyses, and recommendations for the design and construction of the planned structures.

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 borings.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.
- Recommended foundation types.
- Recommendations for pavement.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The project site is located at the southeast corner of the intersection of Gross Road and Jane Street in Mesquite, Texas. Currently, the project site consists of an animal shelter facility building, associated pavement, parking lots, grass, and sparse trees. According to the NCTCOG (www.dfwmaps.com), which provided elevation contours in 2-feet intervals, the site slopes down from west (EL 474) to east (EL 468) with an overall topographic relief of about 6 feet.
The location is depicted in Figure 2.1.1 as shown below.

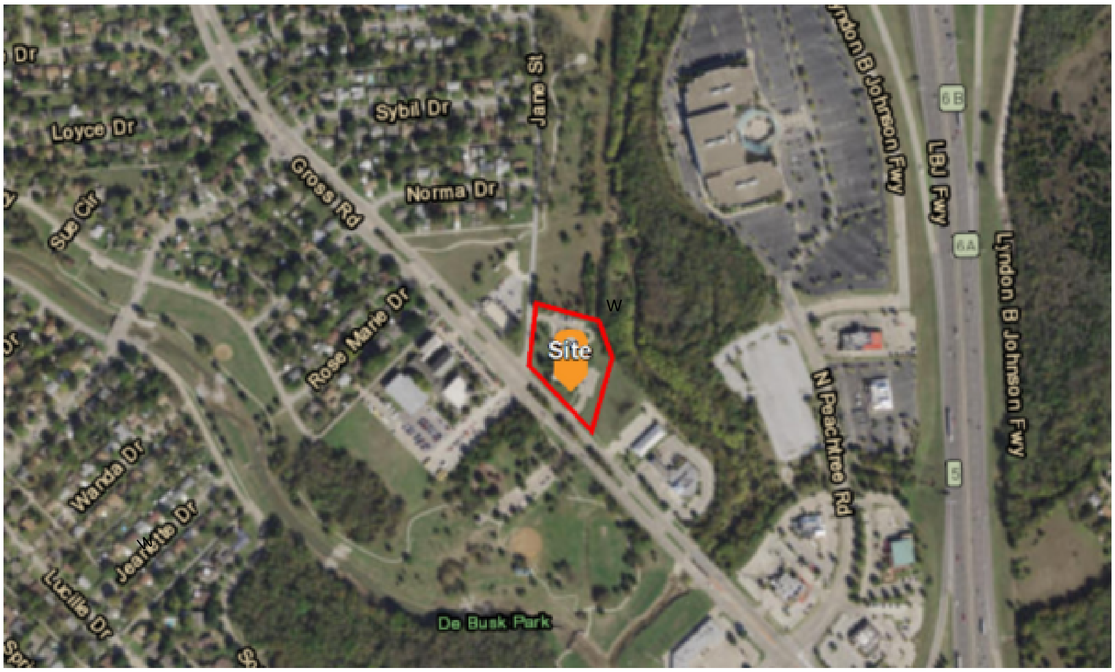


Figure 2.1.1 Site Location

2.2 PROPOSED CONSTRUCTION

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

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
# of Stories	Single story
Footprint	Approximately 4,000 sq ft.
Usage	Animal Shelter
Column Loads	Assumed to be less than 40 kips
Wall Loads	Assumed to be 3 kips per linear foot (klf)
Finish Floor Elevation (assumed)	Within 2 feet of existing site grades.

We also understand that associated street level pavements and utility improvements are also included in this project.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our scope of work included drilling two (2) borings. The boring locations were selected and identified in the field by ECS using the site plan provided. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The regional parent geologic mapping indicates that the site is underlain by the Ozan Formation ("lower Taylor Marl") (Ko) geologic formation and is in close contact with Alluvial Deposits (Qal). Alluvial deposits consist of clay, sand, and gravel. The Ozan Formation typically consists of relatively uniform, massive, calcareous shale (commonly referred to as marl). Because marl weathers easily, this rock typically cannot be seen in creek beds or outcrops, and soil is found instead. Upper portions of the marl can weather into softer, clayey marl.

Through chemical and mechanical weathering, this formation produces highly plastic clay soils. Soil above the marl is typically tan and gray, having a blocky structure. Shallower soils typically have a dark brown to black appearance. These clays can be calcareous with silt and sand content increasing incrementally toward the surface. Glauconitic, phosphate pellets, and hematite and pyrite nodules may appear within the soil matrix.

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

Table 3.2.1 Subsurface Stratigraphy

Approximate Depth to Bottom of Strata Below Grade (feet)	Elevation(*) (feet)	Stratum	Material Description	Consistency/ Condition
2	468	I(2)	FILL, LEAN CLAY WITH SAND, yellowish brown, gray, with calcareous nodules and aggregate fragments	Very Stiff to Hard
5 - 6	464 to 463	II(2)	(CL) LEAN CLAY, yellowish brown, gray	Very Stiff
13	457	III(3)	(CH) FAT CLAY, yellowish brown, gray	Stiff to Very Stiff
22.5	447.5	IV(3)	(CH) FAT CLAY, yellowish brown, gray, shaley	Hard
35(1)	435	V(3)	SHALE, gray	-

Notes: *Elevations are approximate.

(1) Depth to deepest boring termination.
(2) Stratum I and II encountered in all borings.
(3) Stratum III, IV, and V were encountered in Boring B-1.

3.2 GROUNDWATER OBSERVATIONS

Groundwater level observations were made in the borings during drilling operations. In auger drilling operations, water is not introduced into the borehole and the groundwater level can often be determined by observing water flowing into and out of the excavation. Furthermore, visual observation of soil samples retrieved can often be used in evaluating the groundwater conditions.

Groundwater seepage was encountered in the boring B-1 at a depth of 6 feet during drilling and groundwater level was measured at a depth of 7 feet upon drilling completion.

The highest groundwater observations are normally encountered in the late winter and early spring. Fluctuation in the location of the long-term water table may occur because of changes in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of his investigation. Therefore, the groundwater conditions at this site are expected to be significantly influenced by surface water runoff and rainfall.

The groundwater conditions encountered should be considered seasonal and essentially permanent. Fluctuations in the long-term groundwater table are expected to be around ±5 feet.

3.3 LABORATORY TESTING

The laboratory testing was performed by ECS on selected samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples obtained from the test borings in order to aid in classifying soils according to the Unified Soil Classification System and to quantify and correlate engineering properties. The soil samples were tested for moisture content, Atterberg limits, unconfined compression tests, soluble sulfate, chloride, pH, and swell tests.

An experienced geotechnical engineer visually classified each soil sample from the test borings based on texture and plasticity in accordance with the Unified Soil Classification System (USCS) ASTM D-2487 and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). After classification, the geotechnical engineer grouped the various soil types into the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to 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 any 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. While site grading information was not available at the time of preparing this report; we have assumed that the foundation elevations will be within 2 feet of the existing site elevations. If the finished floor elevations deviate from this assumed grade, the recommendations provided below should be evaluated by our office.

4.1 POTENTIAL VERTICAL MOVEMENTS

The clay soils encountered at this site are moderately to highly expansive. These soils are susceptible to shrink swell tendencies, occurring seasonally, throughout the life of the building with the changes in moisture content.

Based on test method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, and our experience with similar soils, we estimate potential vertical soil movements (PVM) are on the order of 2 inches, based on dry conditions. The actual movements could be greater if poor drainage, ponded water, and/or other unusual sources of moisture are allowed to saturate the soils beneath the structure after construction.

In order to achieve a uniform PVM across the building pads and minimize the risk associated with future movements, we recommend the following subgrade improvement options.

Table 4.1.1 Subgrade Improvements

Depth of Select Fill/ Flexible Base (feet)	Depth of Moisture Conditioning (feet)	Total Depth of Improved Zone (feet)	PVM (inch)
1	7	8	1.0
1	2	3	1.5

The improvements should extend at least 5 feet beyond the edge of the building pads and include any flatwork sensitive to movements such as sidewalks or pavements. These design parameters assume that positive drainage will be provided away from the structures and with moderate irrigation of surrounding lawn and planter areas with no excessive wetting or drying of soils adjacent to the foundations. Greater potential movements could occur with extreme wetting or drying of the soils due to ponding of water, plumbing leaks, or lack of irrigation.

4.2 ADJACENT CONSTRUCTION

Considering that the new construction will have movements independent of the existing adjacent structure, any new connections between the two structures should be relatively flexible to allow for this differential movement. It is very difficult to predict and eliminate these movements where new construction abuts existing structures. Our recommendations provided are intended to minimize future movements to more tolerable levels.

For any excavations next to the existing structure, careful consideration should be taken not to undermine existing foundations, slabs, or beams. If excavations advance below the bottom of a grade beam or footing, the excavation should first extend laterally 2 feet away from the bottom of the grade beam, then 1H:1V downward and outward thereafter. Similarly, if injection is used, the specialty contractor performing the injection should provide direction of how close these operations can get to existing structures, without causing swelling of the clays and movements in the existing facility. Alternatively, the building pad may be injected up to 10 feet away from the existing facility and the remaining 10 feet should be benched out and away as described previously.

The least amount of movement will be realized with a drilled pier and suspended slab foundation system.

4.3 FOUNDATION DESIGN

Based on the conditions encountered in the borings, the planned building addition can be supported by straight drilled shafts bearing on shale. As an alternative to drilled shaft foundation, the proposed buildings can also be supported on a post-tensioned monolithic slab-on-grade foundation system if some movement in the foundation system can be tolerated. Design parameters for these systems are presented below.

4.3.1 Straight Drilled Shafts – Axial Design Parameters

Axial design parameters for drilled straight shafts are presented in the following table.

Axial Design Parameters for Straight Drilled Shafts

Parameter	Recommendations
Bearing stratum	Gray Shale
Net allowable end bearing capacity (psf)[1]	30,000
Allowable skin friction in compression (gray shale) (psf)[2]	3,500
Allowable skin friction in tension (gray shale) (psf)[2]	2,500
Reduction in skin friction due to two closely located shafts	No reduction is required for straight drilled shafts with center-to-center spacing of 2.5 times diameter of larger shaft. For closely spaced shafts, the design skin friction varies linearly from the full value at 2.5 times diameters to 50% of the design value at 1.0 times shaft diameter.
Groups of 3 or more shafts spaced closer than 2.5 times shaft diameter	Should be evaluated by ECS. Alternative installation sequences will be required to allow for a minimum of 48 hours of concrete curing time, prior to installation of adjacent shafts.
Soil induced uplift[3]	Refer ***Section 4.3.2 Straight Drilled Shafts – Soil Induced Uplift Loads***.
Settlement[4]	Less than ½ inch.

Parameter	Recommendations
Minimum shaft diameter	18 inches.
Minimum shaft length to develop end bearing	7 feet or 2.5 times shaft diameter, whichever is greater.

Notes:

1. *A minimum penetration of 2 feet or one shaft diameter, whichever is greater, into bearing stratum is required to develop the end bearing.*
2. *The skin friction should be applied to that portion of the drilled shafts in direct contact with the bedrock below any temporary casing. In basement areas, the skin friction should be neglected in the initial 2 feet of penetration into shale.*
3. *The drilled shafts will be subject to uplift due to swelling of the expansive clays in contact with the drilled shafts. The drilled shafts must be designed with adequate embedment depth resist uplift forces and should be reinforced with sufficient, full-depth, vertical reinforcing steel to resist uplift forces.*
4. *Settlement will primarily be within the elastic range with a portion of settlement occurring during construction.*

4.3.2 Straight Drilled Shafts – Soil Induced Uplift Loads

The shafts situated in the expansive clays will be subject to uplift as a result of heave in the expansive clay soils. The magnitude of these loads varies with the elevation of the top of drilled shaft. For the conditions encountered at this site, soil induced uplift of 1,500 psf over the shaft perimeter for a depth of 10 feet. For subgrade soil that have been moisture conditioned in accordance with our recommendations, the uplift can be reduced to 750 psf.

4.3.3 Straight Drilled Shafts - Lateral Design Parameters

Drilled shafts may be subject to lateral loads. Lateral design parameters for drilled shafts are presented in the following tables for use in LPILE 2016 computer program, developed by Ensoft, Inc.

Drilled shafts may be subject to lateral loads. Lateral design parameters for straight drilled shafts in overburden soils are presented in the following table for use in LPILE 2016 computer program, developed by Ensoft, Inc.

LPILE Design Parameters for Soil

Soil Description	LPILE Material Type	Effective Unit Weight, (pcf)	Undrained Shear strength, (psf)	Friction Angle, (degrees)	K Value (pcf)	E_{50}
Upper 5 feet	Neglect	120	Neglect	Neglect	Neglect	Neglect
Clay Soil (below 5 feet)	Soft Clay	120	500	-	-	0.01

LPILE Design Parameters for Rock

Soil Description	LPile Material Type	Unit Weight, (pcf)	Uniaxial Compressive Strength, (psi)	Elastic Modulus, E_r (psi)	RQD (%)	Krm
Gray Marl	Weak Rock (Reese)	130	200	20,000	75	0.0005

4.3.4 Straight Drilled Shafts - Construction Considerations

The drilled shafts should be installed in accordance with American Concrete Institute's "Standard Specification for the Construction of Drilled Piers" (ACI 336). Recommendations provided in this report are based on proper construction procedures including maintaining a dry shaft excavation. We recommend that all drilled and underreamed shafts be observed by qualified geotechnical personnel, to verify proper shaft installation. Observations should include:

1. identification of the recommended belling depth
2. removal of all smear zones and cuttings
3. correct handling of groundwater seepage
4. shafts are within acceptable vertical tolerance and
5. other related items

Groundwater was not observed in the borings however could be observed during installation of the straight drilled shafts, particularly if construction proceeds during a wet period of the year. Rapid placement of steel and concrete will most probably permit shaft installation to proceed without casing. However, the seepage rates could be sufficient to require the use of temporary casing for proper installation of some of the shafts. If casing is used, it must be installed to a sufficient depth to ensure that an adequate seal is obtained. Typically, a casing penetration of 1 to 2 feet into the gray shale will provide a satisfactory seal.

After the satisfactory installation of the temporary casing, water and loose material should be removed prior to beginning the design penetration. The required penetration into the bearing material may be excavated through the casing. The design penetration should be measured from the top of gray shale, or below the bottom of temporary casing, whichever is deeper. Reinforcing steel and concrete should be placed immediately after the excavation has been completed, cleaned, and observed.

The concrete should have a slump between 5 and 7 inches and should be placed in a manner that prevents it from striking the reinforcing steel and sides of the excavation. Concrete placed in an excavation more than 10 feet should be placed in such a manner (using a tremie, centralizing chute, or by similar means) to prevent segregation of aggregates or to prevent concrete from striking the reinforcing steel. The concrete in the upper five feet of the shaft should be mechanically consolidated. Straight drilled shafts should be completed within 12 hours after design penetration into gray shale has begun.

Care should be taken to avoid creating an oversized cap ("mushroom") near the ground surface. A "mushroom" at the top of the drilled shaft could be lifted by expansive soils. Pier caps extending outside the nominal pier diameter (if used) should be constructed over void forms to reduce the potential for additional uplift forces.

4.3.5 Grade Beams/ Pier Caps

All grade beams should be supported by the drilled shafts and formed with a nominal 8-inch void beneath the beam. If moisture conditioning of subgrade is used, the void space can be reduced to 6 inches. This void is provided to isolate the grade beams from the underlying active clays. Cardboard carton forms can be used to create this void. A soil retainer should be provided to help prevent “in fill” of this void.

Cardboard void forms must have sufficient strength to support the weight of the grade beam during construction. The excavation in which the void box lays must remain dry. Care must be exercised during construction to prevent collapse of these cartons. Backfill material must not be allowed to enter the void carton area below the grade beams, since this reduces the void space in which the underlying soils need to swell.

Soils placed along the exterior of the grade beams should be on-site clay soils placed and compacted to at least 93% of the Maximum Dry Density at a minimum of 4 percentage points above optimum moisture content as obtained using the Standard Proctor Method (ASTM D-698). The purpose of this clay backfill is to reduce the opportunity for surface or subsurface water infiltration beneath the structure.

4.3.6 Monolithic Slab on Grade

As an alternative to drilled piers, if some movement is acceptable the planned addition may be supported on a monolithic slab-on-grade/grade beam structural foundation system on treated subgrade. This system may be designed with conventional reinforcing. The slab should be designed in accordance with WRI/CRSI “Design Slab-On-Ground Foundations”. The following design parameters are recommended for the slab-on-grade design method:

Table 4.3.6.1 Recommended BRAB/WRI Slab Parameters

Design Parameter	Design Values
Allowable Bearing Capacity	2,500
Design PI	27
Climatic Rating (Cw)	20
Unconfined Compressive Strength (tsf)	1.5
Soil-Climate Support Index (1-C)	0.12

A net allowable soil bearing pressure of 2,500 psf can be used to design can be used to design grade beams founded on the reworked or existing soils, as described in the section titled “Earthwork Operations”. Grade beams should have a minimum width of 12 inches to reduce the possibility of foundation bearing failure and excessive settlement due to local shear or "punching" failures. Additionally, the grade beams should extend at least 12 inches below final adjacent grade to utilize this bearing pressure. Fills should be sloped to drain surface water away from the structure. A soil modulus of subgrade reaction (ks) of 125 pci may be used in the design of the slab.

These design parameters assume that positive drainage will be provided away from the structures and with moderate irrigation of surrounding lawn and planter areas with no excessive wetting or drying of soils adjacent to the foundations. Greater potential movements could occur with extreme wetting/drying of the soils due to ponding of water, plumbing leaks or lack of irrigation.

Vapor Barrier: Before the placement of concrete, a 10-mil vapor barrier may be placed on top of the subgrade to provide additional protection against moisture penetration through the floor slab. Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction and ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth (predominantly soil subgrades) or Granular Fill ("cushion sand" or gravel) under Concrete Slabs for additional guidance on this issue.

4.4 FLOOR SLAB SYSTEMS IN CONJUNCTION WITH STRAIGHT DRILLED SHAFTS

The most positive method to reduce building movements to very low levels would be to structurally suspend these slabs above the active clays. We are providing both a suspended slab and slab on grade supported by straight drilled shafts.

4.4.1 Structural Floor Slabs

In lieu of providing any subgrade improvements the building slabs can be structurally suspend either using a crawl space or void cartons. If void cartons are used, then they should be at least 24 inches beneath the slab and all grade beams.

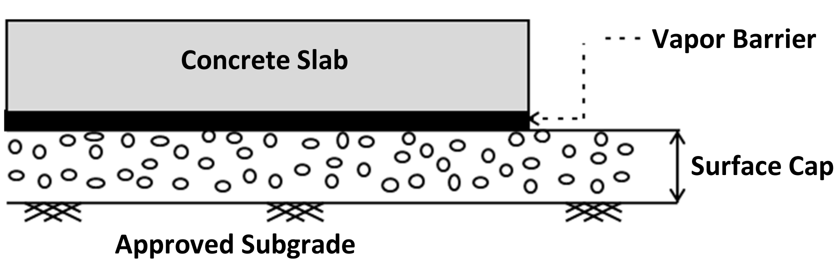
If a crawl space is provided below the floor slabs, adequate ventilation should also be provided. Additionally, if a crawl space will be primarily below the level of existing grade, a vertical moisture barrier should be considered around the perimeter of the structures. Adequate drainage should be provided should standing water infiltrate underneath the slabs.

The ground surface beneath suspended floors should be shaped and drained to prevent the ponding of water. A permanent sump pit should be considered.

4.4.2 Slab on Grade

In lieu of a suspended slab, the building may be designed to be supported by drilled shafts and a conventional slab on grade. In order to use a slab on grade, the building pad subgrade must be prepared for a maximum PVM of 1.0 inch.

The following graphic depicts our soil-supported slab recommendations:



1. Concrete Slab Thickness: 4 inches minimum
2. Concrete Slab Strength: 3,000 psi minimum

Subgrade Modulus: Provided subgrades are prepared as, discussed herein, we recommend that a modulus of subgrade reaction (k_s) of 125 pci be used, as applicable, for the design of the slab on grade.

Vapor Barrier: If floor treatments that are sensitive to moisture will be used, a vapor barrier of polyethylene sheeting or similar material should be placed beneath the slab to minimize moisture migration through the slab. If a vapor barrier is considered to provide moisture protection, special attention should be given to the surface curing of the slabs to minimize uneven drying of the slabs and associated cracking and/or slab curling. The use of a blotter or cushion layer above the vapor barrier can also be considered for project-specific reasons. Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction and ASTM E 1643 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.

Slab Isolation: If a slab on grade is used, we recommend that it be isolated from the foundations so differential movements of the structure will not induce shear stresses on the floor slab. For maximum effectiveness, temperature, and shrinkage reinforcements in slabs on ground should be positioned in the upper third of the slab thickness. The Wire Reinforcement Institute recommends the mesh reinforcement be placed 2 inches below the slab surface or upper one-third of slab thickness, whichever is closer to the surface. Adequate construction joints, contraction joints, and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage. Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction for additional information regarding concrete slab joint design.

4.5 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2015 requires site classification for seismic design based on the upper 100 feet of a soil profile. The methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the unconfined compressive strength (s_u) method; and the Standard Penetration Resistance (N-value) method. The Standard Penetration Resistance (N-value) method was used in classifying this site. The seismic site class definitions for the weighted average of shear wave velocity or SPT N-value in the upper 100 feet of the soil profile are shown in the following table:

Table 4.5.1: 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

Based on the 2015 International Building Code (IBC) Site Class Definitions, in our opinion the site soil can be characterized as Site Class C. Site Class C is described as very dense soil and soft rock for the top 100 feet of the site soil profile. Since the boring performed for this project was drilled to a maximum depth of approximately 35 feet, it is our opinion that the site should be defined as Site Class C.

The Mapped Spectral Response Acceleration at Short Periods and 1-Second Periods, S_s and S_1, respectively, are as follows for the project site. The approximate S_s and S_1 values, as shown below, are calculated through the United States Geological Survey's (USGS) Seismic Hazard Curves and Uniform Hazard Response Spectra program according to the 2015 IBC.

GROUND MOTION PARAMETERS [IBC 2015 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	0.097	F_a	1.2	$S_{MS}=F_aS_s$	0.117	$S_{DS}=2/3\ S_{MS}$	0.078
1.0	S_1	0.053	F_v	1.7	$S_{M1}=F_vS_1$	0.09	$S_{D1}=2/3\ S_{M1}$	0.06

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, ECS would be pleased to discuss additional testing capabilities in this regard.

4.6 PAVEMENT SECTIONS

As previously noted, the PVM of the site is about 2 inches. We are assuming that the existing PVR is acceptable for the planned pavements. Should these movements be unacceptable for the pavements, the recommendations included in this report to achieve more desirable future movements should be followed.

For the design and construction of exterior pavement, the subgrade should be prepared in accordance with the recommendations contained in this report. Our pavement section recommendations for "Fire Lane" pavements should accommodate occasional heavier loadings due to delivery vehicle and light truck traffic and may be considered for main drives, service drives and loading dock areas. Our pavement section recommendations for "Passenger" are for areas not receiving any truck traffic such as parking spaces or areas with less than 5% truck traffic.

Table 4.6.1: Pavement Sections – Private Drives and Parking

Material Designation	**Asphaltic Concrete Pavement**		**Portland Cement Concrete (PCC) Pavement**	
	Automobile Standard Duty	**Fire Lane Heavy Duty**	**Automobile Standard Duty**	**Fire Lane Heavy Duty**
Asphalt Surface Course	2 inches	2 inches	--	--
Asphalt Binder Course	3 inches	4 inches	--	--
Portland Cement Concrete	--	--	5 inches	6 inches
Subgrades	6 inches Re-worked	6 inches Lime stabilized	6 inches Re-worked	6 inches Lime stabilized

[1] Flexible base material may be substituted for the asphalt binder using a substitute ratio of 2.5 inches of flexible base for each inch of asphalt binder.
[2] In lieu of lime stabilization, the Portland cement concrete thickness should be increased by one inch (2 inches for public pavements).
[3] Granular base (or flex base) materials may be substituted with the lime stabilization at an equivalent thickness substitution.

Lime stabilization of the clay subgrade is recommended beneath pavements. A preliminary lime application rate of 8% hydrated lime by dry weight of clay can be used for budgeting purposes. The actual amount of lime required should be confirmed by additional laboratory tests (lime series) during the construction phase. The lime stabilized clay should be thoroughly mixed and appropriately mellowed for at least 48 hours and tested for gradation and lime solubility (pH) before final placement and compaction.

Once appropriately mixed and mellowed, this material may then be compacted to at least 95% of the Maximum Dry Density as obtained by the Standard Proctor Method (ASTM D698) at workable moisture contents of at least 3 percentage points above the optimum moisture content. Lime treatment should extend at least 1 foot beyond exposed pavement edges to reduce the effects of shrinkage and associated loss of subgrade support. Density tests should be performed at a frequency of 1 test per 5,000 square feet of pavement.

An important consideration of the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

Please note, the recommended pavement sections provided above are considered the minimum necessary to provide satisfactory performance based on the provided traffic loading. In some cases, jurisdictional minimum standards for pavement section construction may exceed those provided above.

Pavement should be specified, constructed and tested to meet the following requirements:

1. Reinforcing steel may consist of #3 reinforcing steel bars placed at 18 inches on center each way for pavements 6 inches or thicker and may be increased to 24 inches for the automobile/parking (5 inch) pavements. The reinforcing steel should be placed at mid-point of the pavement section.

2. Hot Mix Asphaltic Concrete: Item 340 of the TxDOT Standard Specifications, Type A or B Base Course (binder), Type D Surface Course. The coarse aggregate in the surface course should be crushed limestone rather than gravel.

3. Portland cement concrete should have a minimum compressive strength of 3,600 lbs. per sq. inch at 28 days. Concrete should be designed with 3 to 6 percent entrained air.

4. Crushed Limestone Base Material: Item 247 of the TxDOT Standard Specifications, Type A or B, Grade 2 or better. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 698) and within three

percentage points of the material's optimum moisture content.

Front-loading trash dumpsters frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of bituminous pavements and ultimately pavement failures and costly repairs. Therefore, we suggest that the pavements in trash pickup areas utilize an 8 inches thick Portland Cement Concrete (PCC) pavement section. Appropriate jointing should also be incorporated into the design of the PCC pavement. Reinforcing steel may consist of #4 reinforcing steel bars placed at 18 inches on center each way.

Proper joint placement and design are critical to pavement performance. Load transfer at all joints and maintenance of watertight joints should be accomplished by the use of proper joint seals and dowels. Control joints in new pavement should be sawed as soon as practical and preferably within 5 to 12 hours after placing concrete to control the location of cracks that form as the concrete cures. Longitudinal and transverse control joints should be sawed at about 15-foot spacing. Joints should be properly cleaned and sealed as soon as possible to avoid infiltration of water, small gravel, etc.

4.7 SOIL CORROSIVITY

Corrosion of metals is an electrochemical process involving oxidation (anodic) and reduction (cathodic) reactions on metal surfaces. For metals in soil or water, corrosion is typically a result of contact with soluble salts found in the soil or water. This process requires moisture to form solutions of the soluble salts. Factors that influence the rate and amount of corrosion include the amount of moisture, the conductivity of the solution (soil and/or water), the hydrogen activity of the solution (pH), and the oxygen concentration (aeration). Other factors such as soil organic content, soil porosity, and texture indirectly effect corrosion of metals in soil by affecting the other factors listed above.

Characterizing the corrosivity of an environment is complicated due to the interaction of the variables described above. For example, a metal buried in an aerated or disturbed soil with a particular resistivity and soluble chloride concentration generally will not experience the same amount of corrosion as a similar metal placed in the same soil in a compacted, less aerated state.

High acidity, pH of 5.5 or less, in soil or water is considered a corrosive condition. Soil or water with a pH of 5.5 or less can react with the lime in concrete to form soluble reaction products that can easily leach out of the concrete. The result is a more porous, weaker concrete. Acidic conditions often cause discoloration of the concrete surface. A yellowish or rusted color distributed over the concrete surface should be investigated.

For steel piping or structures, the following table can be considered as a guide to assessing corrosion severity of soils in contact with the pipe outside surface; however, the above discussion regarding multiple corrosion factors is recommended to be reviewed and considered.

Table 4.7.1 Soil Resistivity and Corrosion Potential

RESISTANCE CLASSIFICATION IN UNCOATED STEEL	SOIL RESISTIVITY, OHM-CM	CORROSION POTENTIAL
Low	0 - 2000	Severe
Medium	2000 - 10000	Moderate
High	10000 - 30000	Mild
Very High	>30000	None

These results are preliminary and provide information on the specific soils sampled and tested. Other soil at the site, and imported materials, may be more or less corrosive. Providing a detailed assessment of the corrosion potential of the site soil is not within our scope of work. A qualified corrosion specialist should be contacted if a detailed evaluation is required.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

In a dry and undisturbed state, the soil at the site will provide good subgrade support for fill placement and construction operations. However, these soils contain fines which are considered moderately erodible and are moisture and disturbance sensitive. 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. All erosion and sedimentation should be controlled in accordance with sound engineering practice and current jurisdictional requirements.

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, root mat, topsoil, existing pavements, and foundations, and soft or unsuitable materials from the 5-foot expanded building and pavement limits. In grassy areas of the site may have about 6 inches of topsoil. Deeper topsoil or organic laden soils may be present in flower beds and other landscaping areas. The root balls in large trees may extend deep and will require additional localized stripping depth to completely remove the organics.

The site preparation will involve demolition of the existing pavement and utilities currently occupying the site. Underground utilities which will be abandoned should be removed or at least filled with flowable concrete. Existing foundation elements, if present, should be removed or cut off at least 2 feet below the new structural elements and utilities.

ECS should be retained to verify that topsoil and unsuitable surficial materials have been removed prior to the placement of new fill or construction of structures.

5.1.2 Proofrolling

Outside of areas receiving PVR reduced subgrades, or to aid in further evaluating an area prior to the placement of concrete or new fill, proofrolling can be performed. The exposed subgrade should be examined by the Geotechnical Engineer or authorized representative. The exposed subgrade should be thoroughly proofrolled with previously approved construction equipment having a minimum axle load of 20 tons (e.g., fully loaded tandem-axle dump truck). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (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 any localized yielding materials. In the event that unstable or “pumping” subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of any subsequent structural fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting or moisture conditioning or chemical stabilization, should be discussed with the Geotechnical Engineer to determine the appropriate procedure with regard to the existing conditions causing the instability.

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

5.2 EARTHWORK OPERATIONS

Prior to placement of any new fill, all subgrades should be scarified to a minimum depth of 6 inches, moisture conditioned and compacted to at least 95% of Maximum Dry Density as obtained by the Standard Proctor Method (ASTM D698) moisture conditioned above the optimum value. All fills should be benched into the existing soils.

Imported soil used for general fill should not have a Plasticity Index (PI) of greater than the material encountered onsite. All general fill material, outside of the building subgrade improvements, should be moisture conditioned at or above optimum moisture content and compacted to at least 95% of the Maximum Dry Density as obtained by the Standard Proctor Method (ASTM D-698).

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. All fill soils should be placed in 8-inch loose lifts for mass grading operations and 4 inches for trench type excavations where walk behind or “jumping jack” compaction equipment is used.

Upon completion of the filling operations, care should be taken to maintain the soil moisture content prior to 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 of time 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 prevent 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 verify that adequate compaction is achieved. As a guide, one test per 2,500 square feet per lift is recommended in the building and 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 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 the more stringent specifications should be followed.

5.3 MATERIAL SPECIFICATIONS

Material specifications recommended for this project are provided below.

5.3.1 Moisture Conditioned Clay Fill

Within the planned building pads, and flatwork sensitive to movements, moisture conditioning should be performed as outlined in this report. Reworking of the existing clays, and all new clayey fill, is performed to increase the moisture of the clays to a level that reduces their ability to absorb additional water that could result in post-construction heave in these soils.

The moisture conditioning should consist of undercutting, scarifying and/or reworking, as required to achieve the required subgrade improvement. During this process, the clays should receive adequate amounts of water to ensure a uniform moisture content of at least +5% above the optimum moisture content. During the addition of water, the soils should be adequately mixed, and re-mixed, to ensure a uniform distribution of the moisture throughout the soil mass. Once appropriately mixed, the material should be compacted to at least 93% of the Maximum Dry Density as obtained using the Standard Proctor Method (ASTM D-698).

Outside of the moisture conditioned zone and where clay is used to establish site grades, we recommend that this material may be placed and compacted to at least 95% of the Maximum Dry Density as obtained using the Standard Proctor Method (ASTM D-698). These soils should be free of deleterious materials and be reworked to ensure a uniform distribution of water in order to achieve a uniform moisture content above the optimum moisture content.

Care should be taken to verify and preserve the specified moisture levels in the reworked clays prior to placement of concrete or new fill.

5.3.2 Select Fill

For the purposes of this report, Select Fill may consist of onsite or imported material that is free of debris and organic matter and have a Plasticity Index (PI) of 5 to 15, and contain 40 to 70 percent passing the No. 200 sieve.

This material should be placed and compacted at workable moisture contents at or above the optimum moisture content and compacted to at least 95% of the Maximum Dry Density as obtained using the Standard Proctor Method (ASTM D698).

5.3.3 Flexible Base

Flexible base should meet the requirements of TxDOT Item 247, Type D, Grade 1 or 2. Recycled concrete meeting the gradation requirements of flexible base is also acceptable for use. The flexible base and recycled concrete should be compacted to 95% of maximum dry density at or above the optimum moisture content as obtained using the Standard Proctor Method (ASTM D-698).

6.0 CLOSING

ECS has prepared this report of findings, evaluations, and recommendations to guide geotechnical-related design and construction aspects of the project.

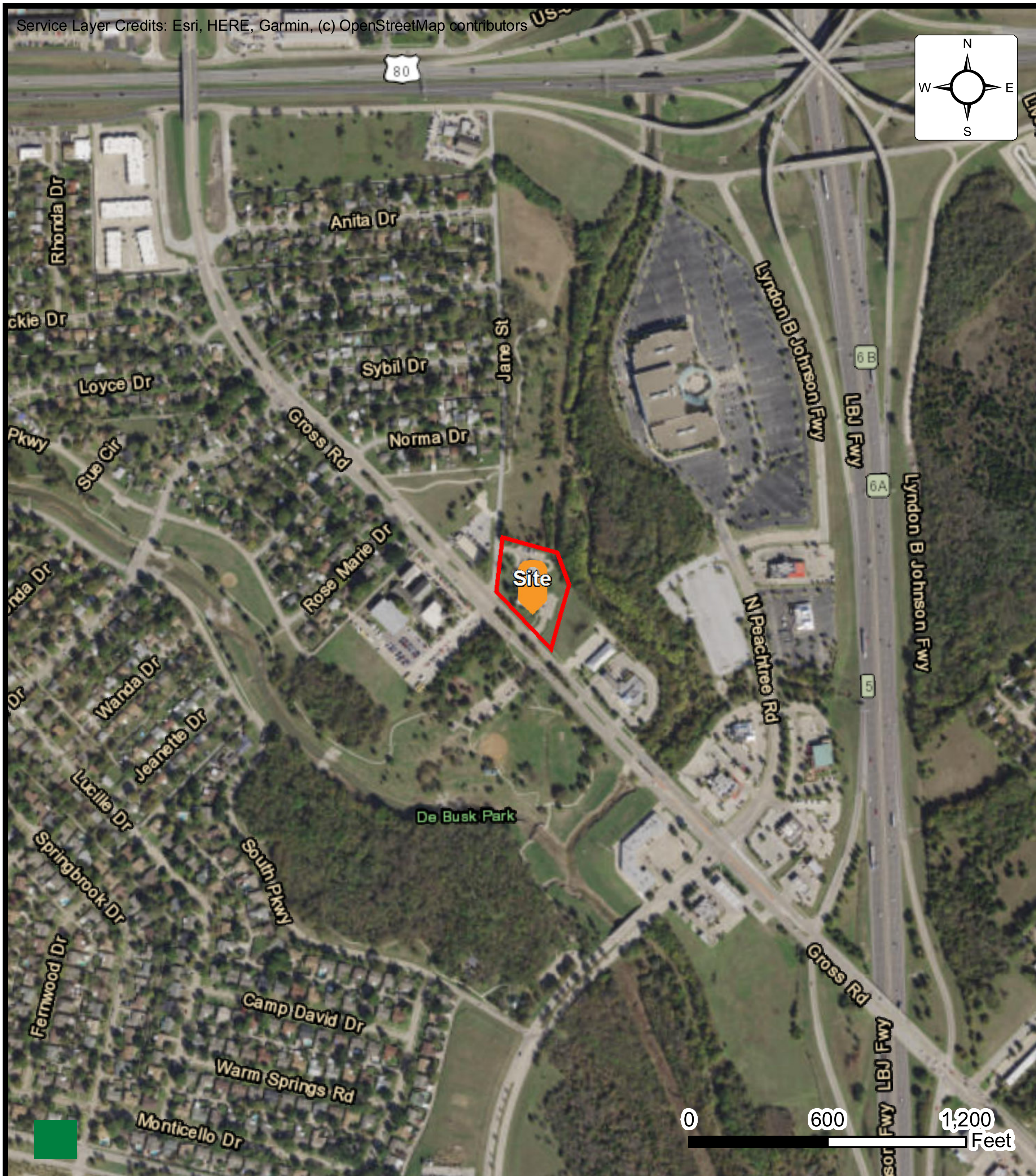
The description of the proposed project is based on information provided to ECS by the client. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately in order that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as 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 any 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 most sites between boring locations and also 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 will be necessary.

APPENDIX A – Figures

Site Location Map
Boring Location Diagram
Generalized Subsurface Soil Profile
Regional Geology

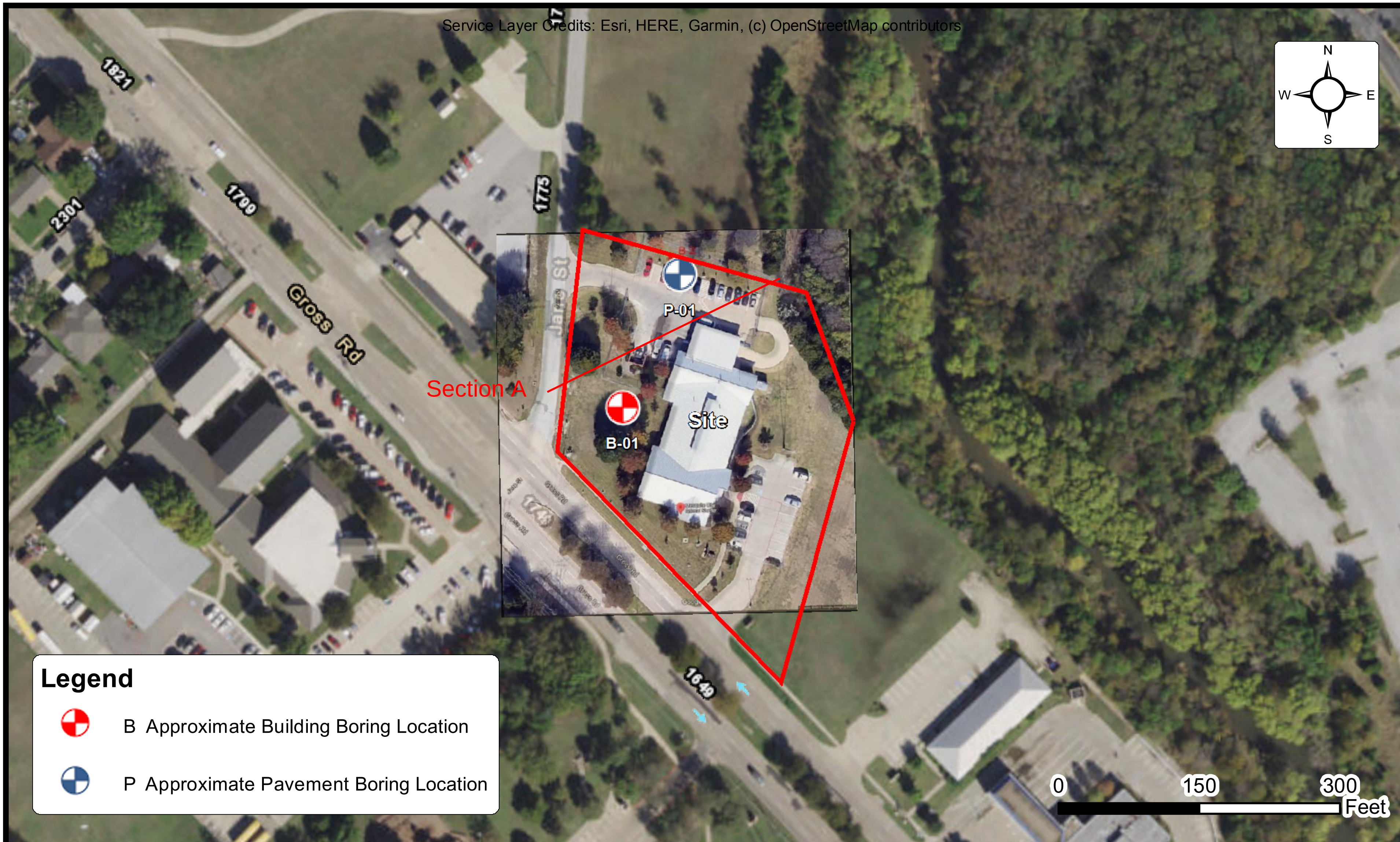


SITE LOCATION DIAGRAM
MESQUITE ANIMAL SHELTER

1650 GROSS RD, MESQUITE, TEXAS

CITY OF MESQUITE

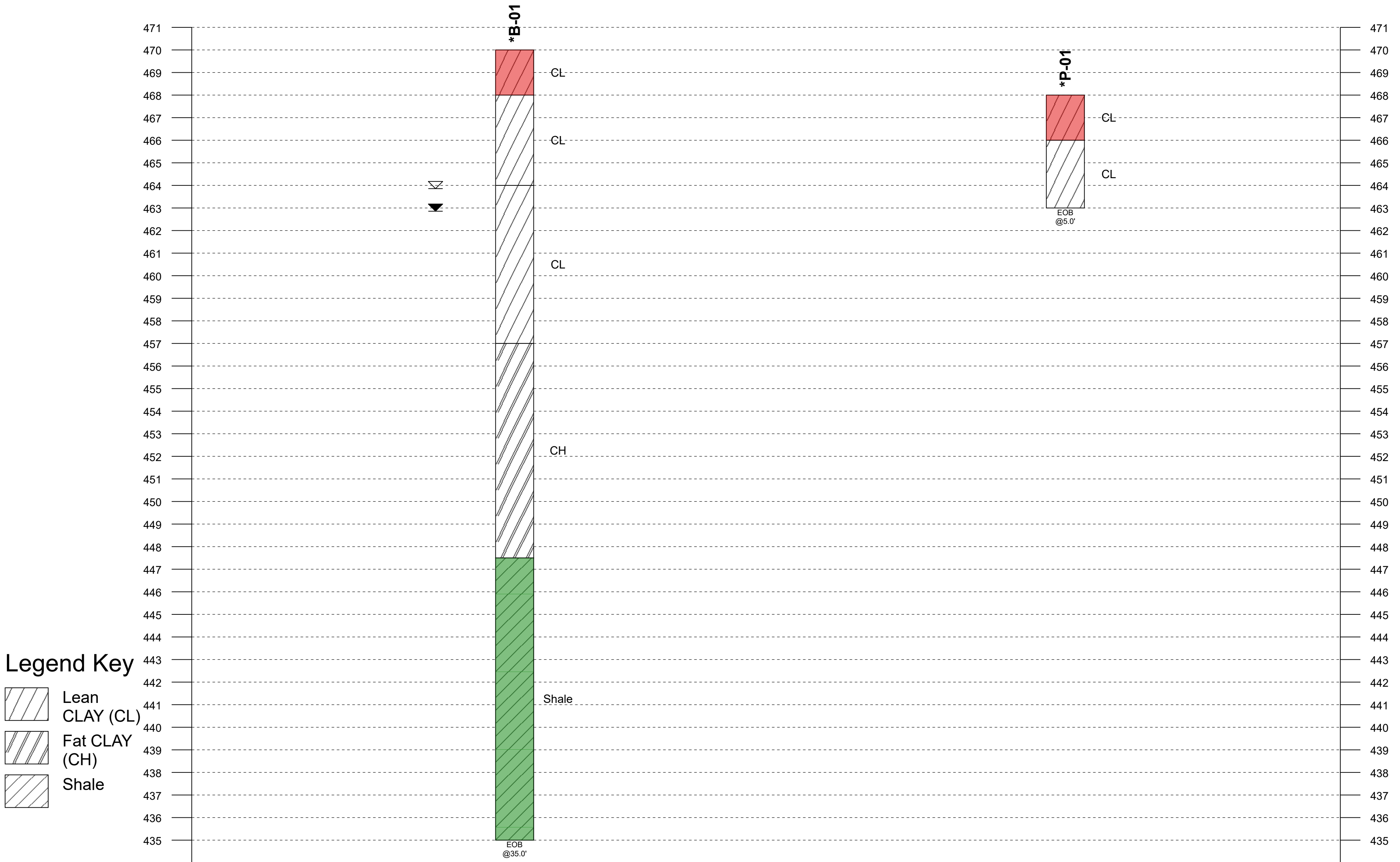
ENGINEER	MPB1
SCALE	AS NOTED
PROJECT NO.	19:8506
SHEET	1 OF 1
DATE	11/8/2021



BORING LOCATION DIAGRAM
MESQUITE ANIMAL SHELTER (MESQUITE, TX)

1650 GROSS RD, MESQUITE, TEXAS
CITY OF MESQUITE

ENGINEER	MPB1
SCALE	AS NOTED
PROJECT NO.	19:8506
SHEET	1 OF 1
DATE	11/8/2021



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit	WL (First Encountered)	Fill
[FINES CONTENT %]	WL (Completion)	Possible Fill
BOTTOM OF CASING	WL (Seasonal High Water)	Probable Fill
LOSS OF CIRCULATION	WL (Stabilized)	Rock

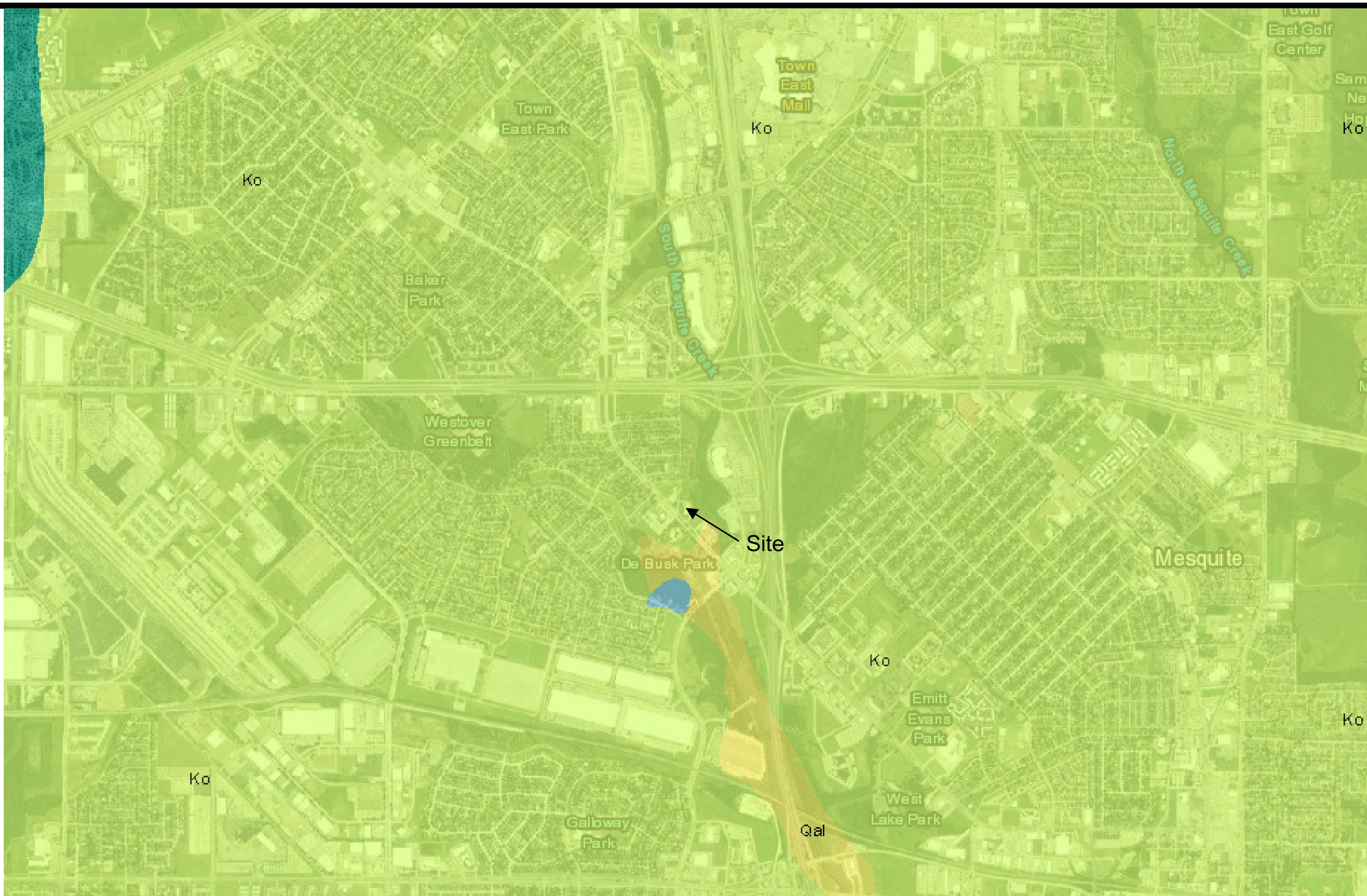
GENERALIZED SUBSURFACE SOIL PROFILE Section A

Mesquite Animal Shelter (Mesquite, TX)

City of Mesquite

1650 Gross Rd,, Mesquite, Texas 75149

Project No: 19:8506 Date: 11/11/2021



REGIONAL GEOLOGY
MESQUITE ANIMAL SHELTER (MESQUITE, TX)

(Ko) OZAN FORMATION AND (Qal) ALLUVIAL DEPOSITS

1650 GROSS ROAD, MESQUITE, TEXAS

CITY OF MESQUITE

ENGINEER	MF
SCALE	AS NOTED
PROJECT NO.	19:8506
SHEET	1 OF 1
DATE	11/8/2021

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Subsurface Exploration Procedure
Boring Logs B-01 and P-01

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	3 - 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.

SUBSURFACE 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 drilling a total of two borings drilled to depths of approximately 5 to 35 feet below the existing site grades. Boring B-1 was drilled to a depth of 35 feet for the proposed structure, and boring P-1 was drilled to a depth of about 5 feet for pavement. A truck-mounted drill rig with continuous flight augers was utilized to drill the borings.

The boring locations were determined by and identified in the field by ECS personnel using the supplied diagram. 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 obtained from NCTCOG website (dfwmaps.com).

Representative soil samples were obtained by means of the Shelby tube sampling procedures in accordance with ASTM Specifications D-1587, respectively. 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.

Texas Cone Penetrometer tests were performed to evaluate the load-carrying capacity of the rock encountered. These tests were performed in general accordance with test method Tex-132-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures. The results of these tests are shown on the attached boring logs at the depths of occurrence.

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:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8506**	**B-01**	**1 of 2**

PROJECT NAME:	DRILLER/CONTRACTOR:
Mesquite Animal Shelter (Mesquite, TX)	**Total Depth**

SITE LOCATION:
1650 Gross Rd,, Mesquite, Texas 75149

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6974168.9	**2543260.4**		**470.0**

LOSS OF CIRCULATION 100%
BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD REC
CALIBRATED PENETROMETER TON/SF
TEXAS CONE PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	Test results
	S-1	ST	24	24	FILL, LEAN CLAY, yellowish brown, gray, moist, very stiff, with calcareous nodules and aggregate fragments				3.75
	S-2	ST	24	24	(CL) LEAN CLAY, yellowish brown, gray, moist, very stiff,				4.00
5	S-3	ST	24	24			465		2.00
	S-4	ST	24	24	(CH) FAT CLAY WITH SAND, yellowish brown, gray, moist, stiff to very stiff				1.75
	S-5	ST	24	24					2.00
10							460		
	S-6	ST	24	24	(CH) FAT CLAY, yellowish brown, gray, moist, hard, shaley				4.50
15							455		
	S-7	ST	24	24					4.50
20							450		
					SHALE, gray				
25							445		100/ 4.25"
30									

CONTINUED ON NEXT PAGE

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

WL (First Encountered)	**6.00**	BORING STARTED: **Oct 20 2021**	CAVE IN DEPTH:
WL (Completion)	**7.00**	BORING COMPLETED: **Oct 20 2021**	HAMMER TYPE: **Auto**
WL (Seasonal High Water)		EQUIPMENT: **Truck** / LOGGED BY: **MF4**	DRILLING METHOD: **CFA**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: City of Mesquite	PROJECT NO.: 19:8506	BORING NO.: B-01	SHEET: 2 of 2
PROJECT NAME: Mesquite Animal Shelter (Mesquite, TX)	DRILLER/CONTRACTOR: Total Depth		
SITE LOCATION: 1650 Gross Rd,, Mesquite, Texas 75149			LOSS OF CIRCULATION
NORTHING: 6974168.9	EASTING: 2543260.4	STATION:	SURFACE ELEVATION: 470.0

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD REC

CALIBRATED PENETROMETER TON/SF

TEXAS CONE PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (N - Value)	TEXAS CONE
					SHALE, gray				100/ 3.25"
35					**END OF DRILLING AT 35.0 FT**		435		100/ 2.00"
40							430		
45							425		
50							420		
55							415		
60									

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

WL (First Encountered) 6.00	BORING STARTED: Oct 20 2021		CAVE IN DEPTH:
WL (Completion) 7.00	BORING COMPLETED: Oct 20 2021		HAMMER TYPE: Auto
WL (Seasonal High Water)	EQUIPMENT: Truck	LOGGED BY: MF4	DRILLING METHOD: CFA
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: City of Mesquite	PROJECT NO.: 19:8506	BORING NO.: P-01	SHEET: 1 of 1
PROJECT NAME: Mesquite Animal Shelter (Mesquite, TX)	DRILLER/CONTRACTOR: Total Depth		
SITE LOCATION: 1650 Gross Rd,, Mesquite, Texas 75149		LOSS OF CIRCULATION	
NORTHING: 6974327.1	EASTING: 2543317.6	STATION:	SURFACE ELEVATION: 468.00

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	CALIBRATED PENETROMETER TON/SF
	S-1	ST	24	24	FILL, LEAN CLAY WITH SAND, yellowish brown, gray, moist, very stiff, with calcareous nodules and aggregate fragments				2.75
	S-2	ST	24	24	(CL) LEAN CLAY, yellowish brown, gray, moist, very stiff				4.50
	S-3	ST	12	12					4.50
5					**END OF DRILLING AT 5.0 FT**		463		
10							458		
15							453		
20							448		
25							443		
30									

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

WL (First Encountered)	BORING STARTED: Oct 20 2021	CAVE IN DEPTH:
WL (Completion)	BORING COMPLETED: Oct 20 2021	HAMMER TYPE: Auto
WL (Seasonal High Water)	EQUIPMENT: Truck / LOGGED BY: MF4	DRILLING METHOD: CFA
WL (Stabilized)		

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary

ECS Southwest, LLP

Carrollton, Texas

Laboratory Testing Summary

Date: 10/28/2021

Project Number: 19:8506

Project Name: Mesquite Animal Shelter (Mesquite, TX)

Project Engineer: MF

Principal Engineer: MPB

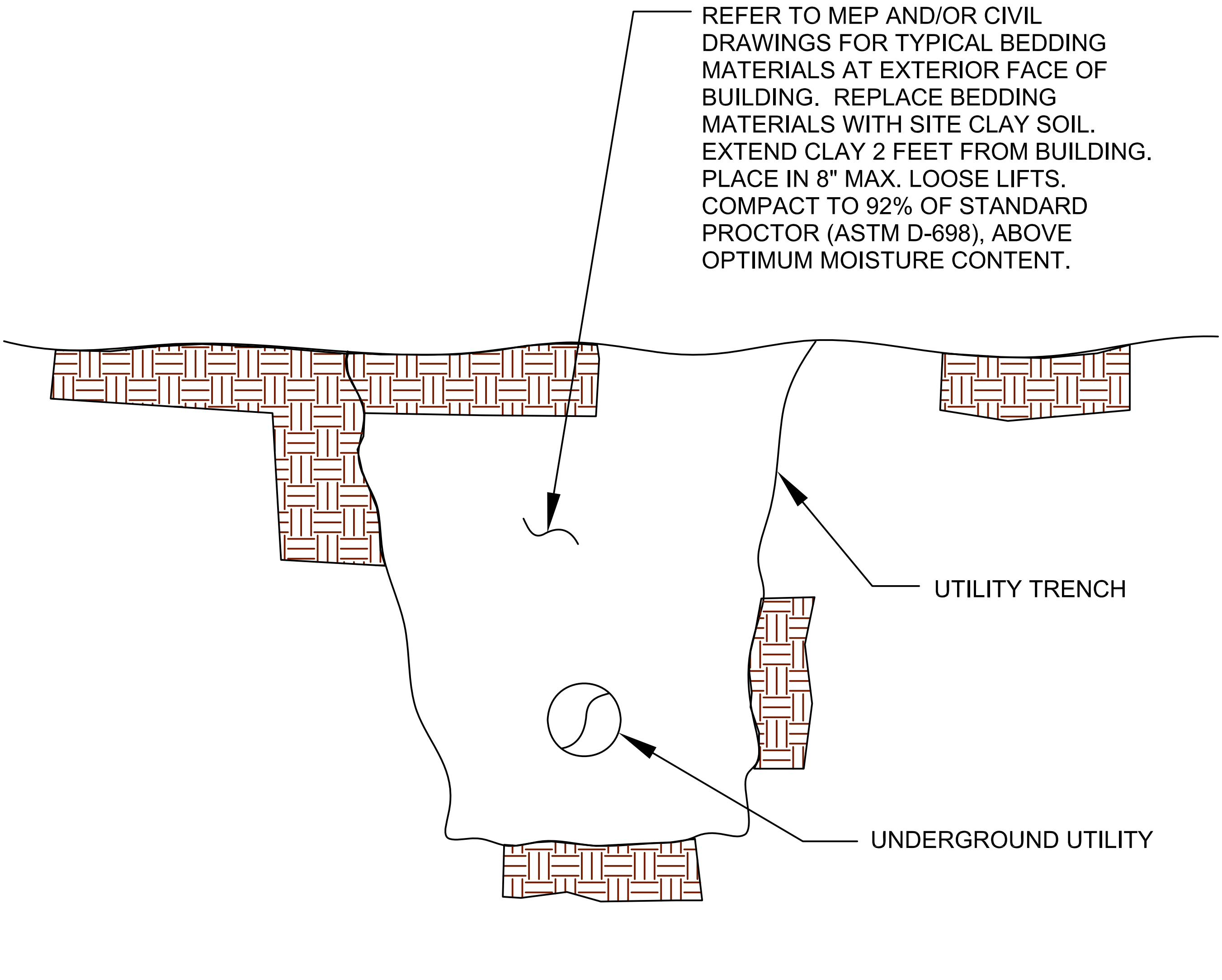
Boring Number	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve	Dry Unit Weight[5] (pcf)	Unconfined Compressive Strength (tsf)	One-Dimensional Swell[6]			pH	Chloride (ppm)	Sulfate (ppm)
					LL	PL	PI				Final Moisture (%)	Surcharge (psf)	Swell (%)			
B-01	S-2	2 - 4	9.5	CL	35	17	18				9.9	380	0.2			
	S-4	6 - 8	35.0													
	S-5	8 - 10	31.0	CH	59	22	37	70.4								
	S-6	13 - 15	25.0						98.7	2.1						
P-01	S-1	0 - 2	19.3	FILL	49	19	30	75.9						8.4	151.0	<3,000

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 422, 5. ASTM D 2937, 6. ASTM D4546, 7 ASTM D 2166

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, NP: Non Plastic

APPENDIX D – Supplemental Report Documents

Clay Plug at Utility Trench



TYPICAL DETAIL DIAGRAM	**CLAY PLUG AT UTILITY TRENCH**	ENGINEER	SCALE NTS
		DRAFTSMAN CLL	PROJECT NO.
		REVISIONS	SHEET 1 OF 1
			DATE 11/7/08