ECS Southwest, LLP

Geotechnical Engineering Report

City of Mesquite Street Improvements

Rollingwood Hills, Lee Street, and Lucas Boulevard
Mesquite, Texas

ECS Project Number 19:8333

September 21, 2021

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Mr. Justin Stoker, P.E.
Assistant Director of Public Works
City of Mesquite
1515 N. Galloway Avenue
Mesquite, Texas 75149

ECS Project No. 19:8333

Reference: Geotechnical Engineering Report
City of Mesquite Streets Improvements
Rollingwood Hills, Lee Street, and Lucas Boulevard
Mesquite, Texas

Dear Mr. Stoker:

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. 19:10616-GPr, dated February 4, 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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The electronic seal on this document was authorized by Michael P. Batuna No. 92147, on September 21, 2021

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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 roadway improvements. Further, our pavement and subgrade improvement recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- Based on our interpretation of the borings drilled for this study, the existing pavements generally consist of 1.5 to 6 inches of asphalt concrete (AC). One inch asphalt over 3.5 and 4 inches possible concrete pavement or cement treated base were noted in Borings B-04 and B-05. Eight inches of Portland Cement Concrete (PCC) pavement was noted in Borings C-04 and C-05. Sand and gravel fill (3 to 10 inches) was encountered in 14 borings. Below the pavement and gravel fill, soil fill and fat clay, were encountered in the borings.

- Groundwater seepage was not observed in borings during drilling and at the completion of drilling operations.

- Design values for the proposed pavement, subgrade preparation and stabilization, as well as materials specifications are provided in the report. Based on the anticipated traffic, the pavement section for the planned reconstruction may consist of 6 to 9 inches of Asphalt Concrete (AC) pavement for a 20-year design life. Eleven (11) inches of Portland Cement Concrete (PCC) pavement may be used for Lucas Boulevard (the future arterial roadway) with a 50-year design life. The AC and PCC pavements can be supported on lime stabilized subgrade, flexible base with geogrid, or cement treated RAP base.

- The potential vertical movement (PVM) of the site is estimated to be about 4 to 5 inches for Areas A and C, and about 3 to 4 inches for Area B under a dry soil condition. These potential movements reflect moisture changes in the soil that can occur over the life of the structure and after construction is complete.

- 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

The purpose of this study was to provide geotechnical information for the design and reconstruction of the street pavements in Mesquite, Texas. The recommendations developed for this report are based on project information provided by the client. 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 pavement improvements.

Our services were performed in general accordance with ECS Proposal No. 19:10616-GPr, dated February 4, 2021. The project was authorized by client on May 17, 2021. The terms of this agreement will be according to the Contract for Professional Engineering Services between the City of Mesquite and ECS Southwest, LLP.

This report contains the procedures and results of our subsurface exploration with soil borings 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 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.
- General recommendations for pavement design.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE

The proposed project consists of the pavement improvements of nine selected streets in three areas (Area A: Rollingwood Hills, Area B: Lee Street, and Area C: Lucas Blvd.) in Mesquite, Texas. The following is the list these nine selected streets and the lengths of the proposed sections.

(1) Area A – Rollingwood Hills: A total of 6,235 linear feet.

- Derby Lane (SH 352 to Military) – about 470 linear feet.
- Danbury Drive (SH 352 to Military) – about 595 linear feet.
- Woodbridge Way (SH 352 to Military) – about 990 linear feet.
- Rollingwood Dr (SH 352 to Military) – about 1,480 linear feet.
- Darien (SH 352 to Military) – about 1,120 linear feet.
- Ridgefield (SH 352 to Military) – about 1,580 linear feet.

(2) Area B – Lee Street:

- Lee Street (Ridgeview to Cascade) – about 3,600 linear feet.

(3) Area C – Lucas Blvd.: A total of 5,825 linear feet.

- Faithon P. Lucas Sr Blvd. (Creek Crossing to EastGlen), about 3,100 linear feet.
- Berry Road (Edwards Church to Faithon P. Lucas) about 2,725 linear feet.

The project locations are depicted in the attached Site Location Diagrams in Appendix A.

2.2 PROPOSED CONSTRUCTION

The following information was provided by the City of Mesquite and explains our understanding of the planned development of the street section.

Table 2.2.1 A Summary of Design Information

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Street Classification	Areas A and B are local residential streets. Area C is a collector road and will be upgraded to future arterial road
Existing Streets	Asphalt Concrete (AC) pavements excepts for the area of Borings C-04 and C-05 in Area C. Portland Cement Concrete (PCC) pavement was observed in Borings C-04 and C-05.
Type of the Proposed Streets	AC pavement for the proposed roadways and PCC pavement for Lucas Boulevard.
Design Life	20 year for AC pavement and 50 years for PCC pavement
Growth Factor	0% for Areas A and B; 2.5% for Area C
Streets Improvements	A total of nine streets within the City of Mesquite
Total Linear Foot	About 15,660 feet.

If ECS' understanding of the project is not *correct, please contact ECS so that we may review these changes and revise our recommendations, as appropriate.*

3.0 FIELD EXPLORATION

Our scope of work included drilling a total of 25 soil borings, including 11 borings for Area A, 5 borings for Area B, and 9 borings for Area C. These 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 subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil and rock strata. Please refer to the boring logs in Appendix B. Based on a review of available published geological maps, the Areas A and B are located within the Ozan formation (Ko). Area C is located within the Fluviatile Terrace Deposits (Qt) underlain by Ozan formation. The locations of the sites on the geologic map are depicted in the attached Regional Geology in Appendix A.

Ozan formation (Ko): 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 "limy" shale can weather into softer, clayey shale.

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.

Fluviatile Terrace Deposits (Qt): In the Fluviatile Terrace soil deposits have been transported to the areas where they lay by water instead of having been weathered from their original rock. They are often "flood plane" deposits at some of the lowest elevations in the region. Typically, water that deposits these soils first erodes portions of their original formation(s), then transports and leaves behind these types of deposits.

Soils commonly found in Fluviatile terrace deposits can vary from clays, silts and sands to coarse sands and gravels. Typically, the deposit profile has more-coarse material with depth. The clay soils found in these deposits can have high shrink/swell potential.

Based on the soil boings, the existing pavements generally consist of 1.5 to 6 inches of asphalt concrete (AC). One inch asphalt over 3.5 and 4 inches possible concrete pavement or cement treated base were noted in Borings B-04 and B-05. Eight inches of Portland Cement Concrete (PCC) pavement was noted in Borings C-04 and C-05. A summary of the thickness of the existing pavement section with gravel and sand fill encountered in the borings is shown in the following table.

Table 3.1.1 Existing Pavement Section at Boring locations

Boring Location	Asphalt Concrete (in.)	Portland Cement Concrete (in.)	Sand and Gravel Fill (in.)
A-01	2	-	10
A-02	3	-	9
A-03	2	-	10
A-04	2	-	-
A-05	2.5	-	3.5
A-06	2	-	10
A-07	2	-	10
A-08	2	-	10
A-09	2	-	10
A-10	2	-	-
A-11	2	-	10
B-01	2	-	6
B-02	1.5	-	3.5
B-03	2	-	6
B-04	1	3.5*	-
B-05	1	4*	-
C-01	6	-	-
C-02	5	-	-
C-03	5	-	-
C-04	-	8	3
C-05	-	8	-
C-06	5	-	-
C-07	5	-	-
C-08	5	-	-
C-09	5	-	12

*- possible Portland Cement Concrete (PCC) pavement or cement treated base/subbase

A summary of subsurface stratigraphy encountered in the borings is shown in Table 3.1.2 below.

Table 3.1.2 Subsurface Stratigraphy (Area A)

Approximate Depth to Bottom of Strata (feet)	Elevation of Bottom of Strata[1] (ft)	Stratum No.	Material Description	Consistency
2 to 8	503 to 523	I	FILL, LEAN CLAY, FAT CLAY, SNADY LEAN CLAY, AND CLAYEY SAND, brown, brownish gray	Firm to Hard
10[2]	489 to 528	II	FAT CLAY (CH), dark brown, brown, brownish gray, brownish yellow	Stiff to Hard

Table 3.1.3 Subsurface Stratigraphy (Area B)

Approximate Depth to Bottom of Strata (feet)	Elevation of Bottom of Strata[1] (ft)	Stratum No.	Material Description	Consistency
2	488 to 492	I	FILL, SANDY LEAN CLAY, LEAN CLAY, and FAT CLAY, brown, brownish gray	Very Stiff
10[2]	480 to 489	II	FAT CLAY (CH), dark brown, brown, brownish gray, brownish yellow	Very Stiff to Hard

Table 3.1.4 Subsurface Stratigraphy (Area C)

Approximate Depth to Bottom of Strata (feet)	Elevation of Bottom of Strata[1] (ft)	Stratum No.	Material Description	Consistency
2 to 6	440 to 448	I	FILL, CLAYEY SAND, LEAN CLAY, and FAT CLAY, brown, light brown, dark brown	Stiff to Hard
10[2]	432 to 442	II	FAT CLAY (CH), dark brown, brownish gray	Stiff

Note:

[1]Please note that the ground surface elevations were or were not surveyed by a licensed surveyor; these elevations are approximate based on dfwmaps.com. Elevation ranges are approximate +/- several feet.

[2]Boring termination depths

Please refer to the attached boring logs and laboratory data summary for a more detailed description of the subsurface conditions encountered as the stratification descriptions above are generalized for presentation purposes.

3.3 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 the excavation. Furthermore, visual observation of soil samples retrieved can often be used in evaluating the groundwater conditions.

Groundwater seepage was not observed in borings during drilling and at the completion of drilling operations.

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 as a result of changes in precipitation, evaporation, surface water runoff and other factors not immediately apparent at the time of his investigation. The groundwater conditions at this site are expected to be significantly influenced by surface water runoff and rainfall.

3.4 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. The soil samples were tested for moisture content, Atterberg limits, soluble sulfate, lime/pH series, and percent passing No. 200 sieve.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols. After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group 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.

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 on the basis of 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.

4.1 POTENTIAL VERTICAL MOVEMENTS

The soils encountered at this site are moderate to highly expansive. These soils are susceptible to shrink swell tendencies, occurring seasonally, throughout the life of the pavement 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) under a dry soil moisture condition will be about 4 to 5 inches for Areas A and C, and about 3 to 4 inches for Area B. 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 pavement after construction.

In order to minimize the impact of moisture changes within the subgrade soils and reduce potential for movements, the exposed subgrade during construction should be kept moist by adding moisture and covering the subgrade. Positive drainage should be conducted during all phases of construction. Regular pavement maintenance should be performed by routinely sealing all cracks and joints in the pavement. Subgrade treatment should be considered to reduce future movement potential. In addition, root barriers to about 5 feet below the existing grade along the edge of the pavement may be considered to reduce root penetration below the pavement that may affect long term pavement performance.

4.2 SOLUBLE SULFATE

Soluble sulfate tests were performed on selected samples to evaluate the potential for sulfate induced heave. The laboratory test results indicated that soluble sulfate concentrations were generally less than 3,000 ppm in the subgrade soils. This sulfate level is considered to have a low risk for sulfate induced heave upon lime stabilization.

In general, soil with soluble sulfate concentrations of 3,000 ppm or less, are not considered to require special treatment considerations when lime stabilized in accordance with TxDOT "Guidelines for Modification and Stabilization of Soils and Base for Use in Pavement Structures" (2005). We recommend that sulfate contents be confirmed by additional laboratory tests during the construction phase after final grading.

4.3 PAVEMENT SECTION

Based on the information provided by the City of Mesquite, the proposed street section is classified as local residential road for Area A, local residential collector for Area B, and future arterial street for the Area C. The proposed asphalt pavement street improvements for Areas A, B, and C will have 20-year design life. The proposed future arterial street improvements for Lucas Boulevard in Area C will have Portland Cement Concrete pavement with a 50-year design life. Traffic Studies were performed at five locations and were provided by the Client for this geotechnical investigation. Four of the traffic studies were performed in Area C and one traffic study was performed in Area B.

No traffic study was performed for Area A. Traffic data from Area B was used for Area A pavement design. A summary of the results from the traffic studies is shown in the following table.

Table 4.3.1 Results of Traffic Studies

Area	Location	ADT	Percent of Busses, Trucks, and Tractor Trailers	Percent of Passenger Cars, Vans, Pickups
C	SB at Lucas between Lochwood and Newsom	1,796	9	91
C	NB at Lucas between Lochwood and Newsom	1,642	5	95
C	SB at Berry between Lucas and Springwood	315	3	97
C	NB at Berry between Lucas and Springwood	274	10	90
B	SB at Lee between Crestridge and Valley View	274	13	87

Based on the information obtain from the Client, 2019 Engineering Design Manual by the City of Mesquite and our past experience, we use the design parameters summarized on the following Table 4.3.2 for the pavement design analysis.

Table 4.3.2: Design Parameters for Pavement

Design Parameters	Design Values			
Area No.	A	B	C	
Street Type	Residential		Arterial (Future)	
Street/Location	Rollingwood Hills	Lee Street	Lucas Boulevard	Berry Road
Growth Factor	0.0		2.5	
Truck Factor (ESALs/Heavy Truck)	1.7 (Assumed)			
Total ESALs (20-Year Design Life)	442,000		2,564,000	435,000
Pavement Type (20-Year Design Life)	Flexible		Flexible	Flexible
Total ESALs (50-Year Design Life)	N/A		9,784,000	N/A
Pavement Type (50-Year Design Life)	N/A		Rigid	N/A
Subgrade Soil Type	Clay Soils			
Unified Soil Classification System (USCS)	CH/CL			
Reliability (percentage)	85		90	
Overall Standard Deviation	0.45-Flexible; 0.35-Rigid			
Initial Pavement Serviceability	4.2-Flexible; 4.5-Rigid			
Terminal Pavement Serviceability	2.0		2.5	

Concrete Modulus of Rupture (psi) -28 Days	620
Concrete Modulus of Elasticity (psi) -28 days	4,000,000
Drainage Coefficient	1.0
Load Transfer Coefficient – Rigid	3.0
Layer Coefficient of Asphalt Surface Course	0.44
Layer Coefficient of Asphalt Base Course	0.41
Layer Coefficient (Asphalt Pavement)	0.12 (Lime Stabilized Subgrade) 0.14 (Flexible Base with Geogrid) 0.15 (Cement Treated RAP)
Modulus of Subgrade Reaction (psi/in) – k (PCC Pavement)	200 (Lime Stabilized Subgrade) 240 (Flexible Base with Geogrid) 240 (Cement Treated Base)

Pavement sections provided in this report were designed in general accordance with the AASHTO Guide for Design of Pavement Structures (1993). Based on our analysis and the calculations with the design parameters on the Table 4.3.2, the pavement reconstruction may be designed as asphalt concrete pavement section supported on lime stabilized subgrade, or flexible base with geogrid (Tensar BX1100 or similar), or cement treated RAP subgrade. The proposed asphalt concrete pavement sections are summarized in the following table.

Table 4.3.2: Asphalt Concrete (AC) Pavement Section (20-Year Design Life)

Area No.	Location	Design Life (year)	Asphalt Surface Course (inches)	Asphalt Base Course (inches)	Cement Treated RAP (inches)	Flexible Base with Geogrid (inches)	Lime Stabilized Subgrade (inches)
A	Rollingwood Hills	20	2	5	N/A	N/A	6
A	Rollingwood Hills	20	2	4	N/A	6	N/A
A	Rollingwood Hills	20	2	4	6	N/A	N/A
B	Lee Street	20	2	5	N/A	N/A	6
B	Lee Street	20	2	4	N/A	6	N/A
B	Lee Street	20	2	4	6	N/A	N/A
C	Lucas Blvd.	20	2	7	N/A	N/A	8
C	Lucas Blvd.	20	2	7	N/A	8	N/A
C	Lucas Blvd.	20	2	7	8	N/A	N/A
C	Berry Road	20	2	5	N/A	N/A	8

Area No.	Location	Design Life (year)	Asphalt Surface Course (inches)	Asphalt Base Course (inches)	Cement Treated RAP (inches)	Flexible Base with Geogrid (inches)	Lime Stabilized Subgrade (inches)
C	Berry Road	20	2	4	N/A	8	N/A
C	Berry Road	20	2	4	8	N/A	N/A

Table 4.3.3: Portland Cement Concrete (PCC) Pavement Section (50-Year Design Life)

Area No.	Location	Design Life (year)	Concrete Pavement Thickness (inches)	Cement Treated RAP (inches)	Flexible Base with Geogrid (inches)	Lime Stabilized Subgrade (inches)
C	Lucas Blvd.	50	11*	N/A	N/A	8
C	Lucas Blvd.	50	11*	N/A	8	N/A
C	Lucas Blvd.	50	11*	8	N/A	N/A

*- City's minimum PCC pavement thickness for Major Arterial roadway.

The soil below the pavement consist of moderate to high expansive Lean Clay (CL) and Fat Clay (CH). The lime stabilized subgrade may assist with the regular long-term maintenance of the roadway which should include crack sealing, joint sealing and slab repairs. We recommend the existing HMAC, cement treated recycled asphalt pavement (RAP) subgrade, and gravelly material be removed from the footprint of the proposed new pavement footprint before using lime to stabilize the clay fill and native soil.

For the design and construction of pavement, the subgrade should be prepared in accordance with the recommendations in the "Earthwork Operations" section of this report. An important consideration with 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.

4.3.1 Pavement Materials

According to 2019 Engineering Design Manual by the City of Mesquite and our past experience, we recommend that pavement be specified, constructed and tested to meet the following *requirements*:

1. Hot Mix Asphaltic Concrete: Item 340 of the TxDOT Standard Specifications, Type B Base Course (binder), Type D Surface Course. The coarse aggregate in the surface course should be crushed limestone rather than gravel.
2. Portland Cement Concrete: A minimum compressive strength of 4,000 psi at 28 days.
3. Reinforcing Steel: #4 bars at 18" centers both ways.
4. Concrete Pavement Joints:
    a. Transverse Joints shall be sawed on 15' centers. Use 18" #8 or #10 dowels (smooth bars) at 12" spacing per TxDOT concrete Pavement Details Contraction Design (CPCD-14)
    b. Longitudinal Joints shall be sawed based on the following:
    25' Width Saw Joint 3" from the center; 27' & 31' Width Saw Joint along the center
    c. Expansion Joints to be constructed a maximum of 500' to 700' apart on straight paving, and on all radii, PC, PT and CR or otherwise specified. Use at least 18" (#10) dowels for paving 8" thick or greater.
5. Lime Stabilized Subgrade: 8% Lime by dry weight of soil (about 48 lbs/sy for 8 inches; 36 lbs/sy for 6 inches)
6. Flexible Base Subgrade (TxDOT Item 247)
7. Cement Treated Subgrade (Public Works Construction Standards, NCTCOG, 4th Edition, Item 301.1 and 301.3) or TxDOT Item 275 (Cement Treatment – Road Mixed)
8. Sidewalk should be a minimum of 4" thick with #4 bars at 18" on center each way and a minimum compressive strength of 4,000 psi at 28 days.
9. Sidewalk Concrete Pavement Joints:
    a. For 4' Sidewalk: redwood expansion joints required at every 40'; dummy joints every 4'.
    b. For 5' Sidewalk: redwood expansion joints required at every 40'; dummy joints every 5'.
    c. Install ½" slip dowels (smooth) along lead walks and at barrier free ramps.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

In a dry and undisturbed state, the upper 1-foot of the majority of 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.

The site should be stripped. After stripping, cutting to the proposed grade, and prior to the placement of any structural fill, 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.

5.1.1 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade outside moisture conditioned soil zone should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying any localized yielding materials.

Where proofrolling identifies areas that are unstable or “pumping” subgrade those areas should be repaired prior to the placement of any subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting, moisture conditioning, or chemical stabilization. The situation should be discussed with ECS to determine the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in determining the cause of the observed unstable materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

5.2 EARTHWORK OPERATIONS

Prior to placement of any new fill, all subgrades should be scarified to a minimum depth of 6 inches, compacted to at least 95% of Maximum Dry Density as obtained by the Standard Proctor Method (ASTM D-698) and moisture conditioned at +3% or above the optimum value. All fills should be benched into the existing soils.

Soil moisture levels should be preserved (by various methods that can include covering with plastic, watering, etc.) until new fill, or pavements 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. Soil moisture levels can be preserved by various methods that can include covering with plastic, watering, etc. If the soil becomes desiccated, the affected material should be removed and replaced, or these materials should be scarified, moisture conditioned and recompacted.

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. A utility trench cut-off 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 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

This section is intended to outline the material requirements of those recommendations.

Lime stabilized subgrade: Lime stabilized on site clay should be used below the pavement. Lime application rate of 8% hydrated lime (about 48 lbs/sy for 8 inches; 36 lbs/sy for 6 inches) by dry weight of clay (TxDOT Item 260) 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 (TxDOT Item 260) and tested for gradation and lime solubility (pH) prior to final placement and compaction. Once appropriately mixed and mellowed, this material may then be placed and compacted at workable moisture contents within of at least +3 percent of optimum moisture content and compacted to at least 95% of the Maximum Dry Density as obtain using the Standard Proctor Method (ASTM D-698).

Please refer to the "General Recommendations for Quality Assurance (QA) Testing" table provided in the Appendix A of this report for specific requirements.

Flexible base material: The material may be used beneath pavements. Flexible base should meet the requirements of TxDOT Item 247, Type D, Grade 1-2, or NCTCOG Item 301.5. Recycled concrete meeting the gradation requirements of flexible base is also acceptable for use. The flexible base and recycled concrete should be compacted to at least 95% of maximum dry density at or above the optimum moisture content as obtained using the Standard Proctor Method (ASTM D-698).

Please refer to the "General Recommendations for Quality Assurance (QA) Testing" table provided in the Appendix A of this report for specific requirements.

Cement Treated Reclaimed Asphalt Pavement (RAP): The existing asphalt pavement sections including the cement treated recycled asphalt pavement (RAP) may be considered for the project. The existing pavement sections should be milled/crushed down or pulverized to fragments by using a pulverizing/mixing rototiller or similar equipment. We recommend that at least 6 inches of materials for residential and 8 inches for arterial street improvements including asphalt concrete, previous recycled asphalt, gravelly materials, and subgrade soils be mixed together. The particle size distribution of the pulverized material should be such that 100 percent passing the 1-3/4-in. sieve, 85 percent passing the 3/4-in. sieve, and at least 60 percent passing the No. 4 sieve.

The resulting mix should be cement stabilized (TxDOT Item 275) to the minimum depth of 6 to 8 inches and compacted to at least 95 percent of its maximum standard Proctor dry density (ASTM D 698) at a moisture content above the optimum moisture. We recommend 3 to 5 percent cement (TxDOT Item 275), by dry weight, for the treatment. The cement should be thoroughly mixed and blended with the pulverized mixture. The resulting mix should have a minimum unconfined compressive strength of 240 psi, as determined by TxDOT method Tex-120-E.

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 Client. If any of this information is inaccurate 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.

All construction activities should be conducted in accordance with the most recent City's Design Standards, as well as the latest edition of North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction and TxDOT specifications.

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.

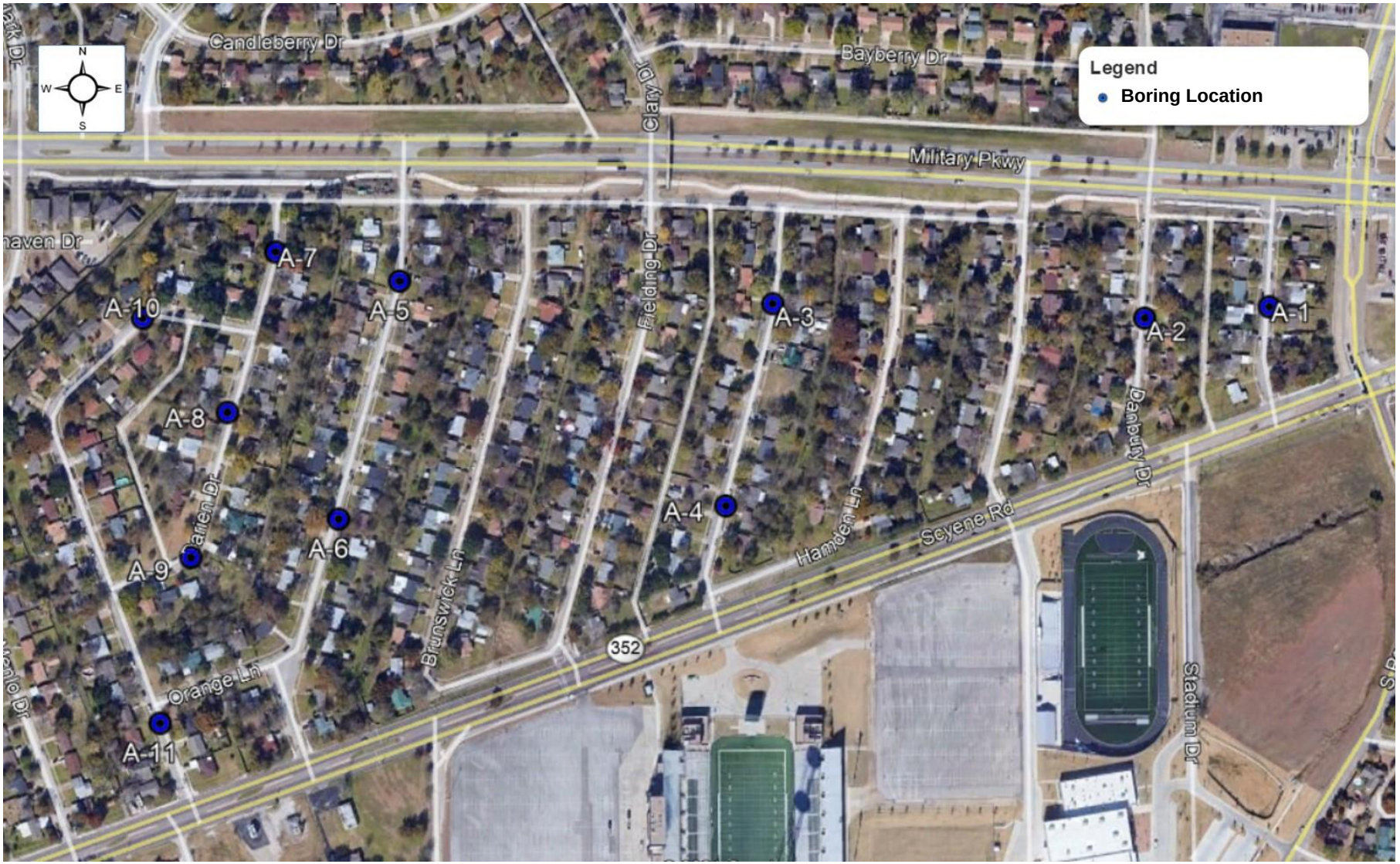
APPENDIX A – Figures

Site Location Diagram
Boring Location Diagram
Generalized Subsurface Soil Profile (From West to East)
Regional Geology
General Recommendations for Quality Assurance (QA) Testing

SITE LOCATION DIAGRAM
CITY OF MESQUITE STREET IMPROVEMENTS

ROLLINGWOOD HILLS, LEE STREET, AND LUCAS BOULEVARD
CITY OF MESQUITE, TEXAS

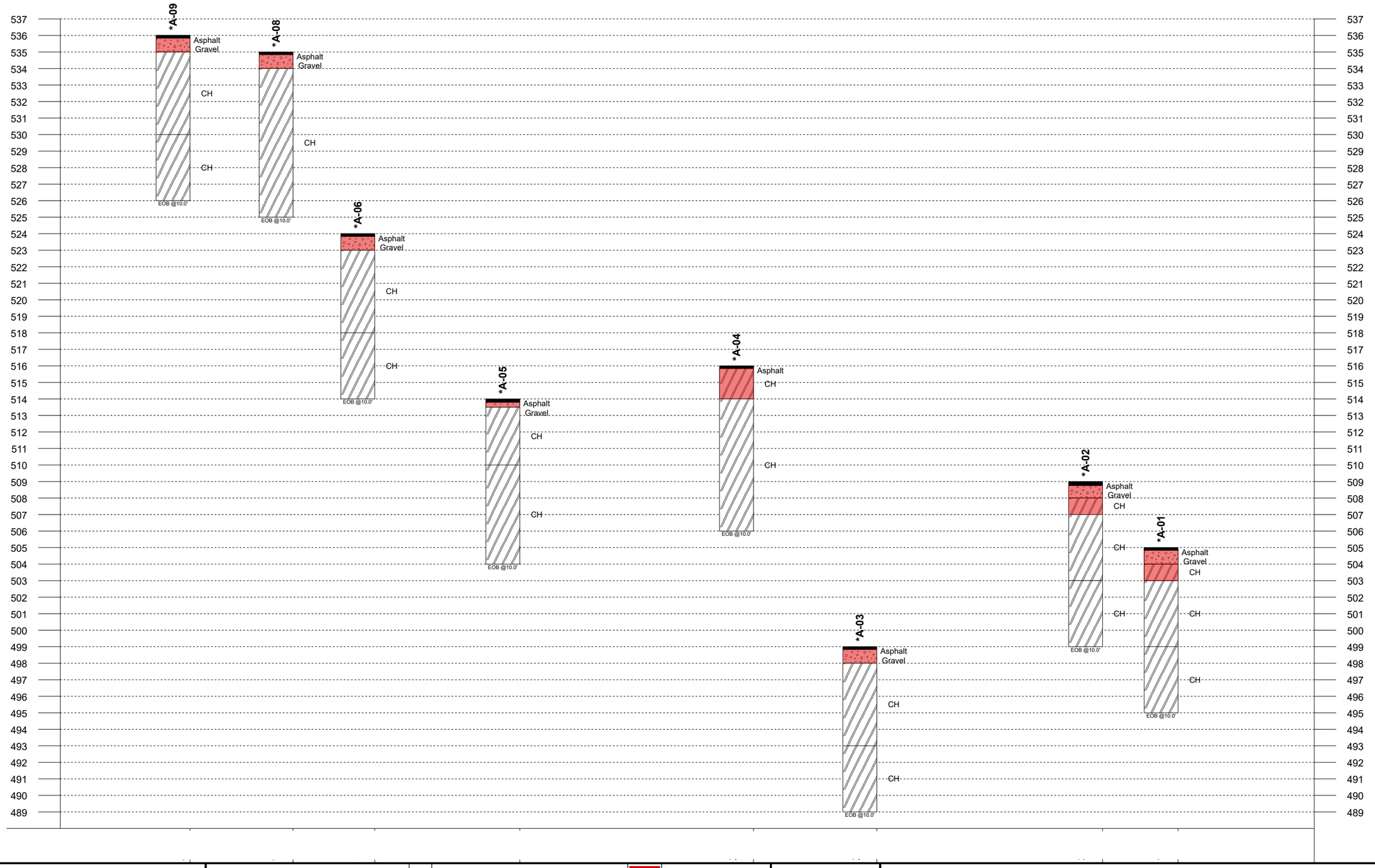
ENGINEER	MPB1
SCALE	AS NOTED
PROJECT NO.	19:8333
SHEET	1 OF 1
DATE	5/24/2021



Boring Location Diagram: Area A
City of Mesquite Street Improvements

Rollingwood Hills, Lee Street, and Lucas Boulevard
City of Mesquite, Texas

PE: MPB1
Project Manager: CT3
Project No.: 19:8333
Scale: Not to scale
Date: 6/21/2021
Sheet 1 of 1



Legend Key

- Asphalt
- Gravel or Conglo… 1
- Fat CLAY

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 X——●——△ [FINES CONTENT %]			
BOTTOM OF CASING	WL (First Encountered)	Fill	
LOSS OF CIRCULATION	WL (Completion)	Possible Fill	
	WL (Seasonal High Water)	Probable Fill	
	WL (Stabilized)	Rock	

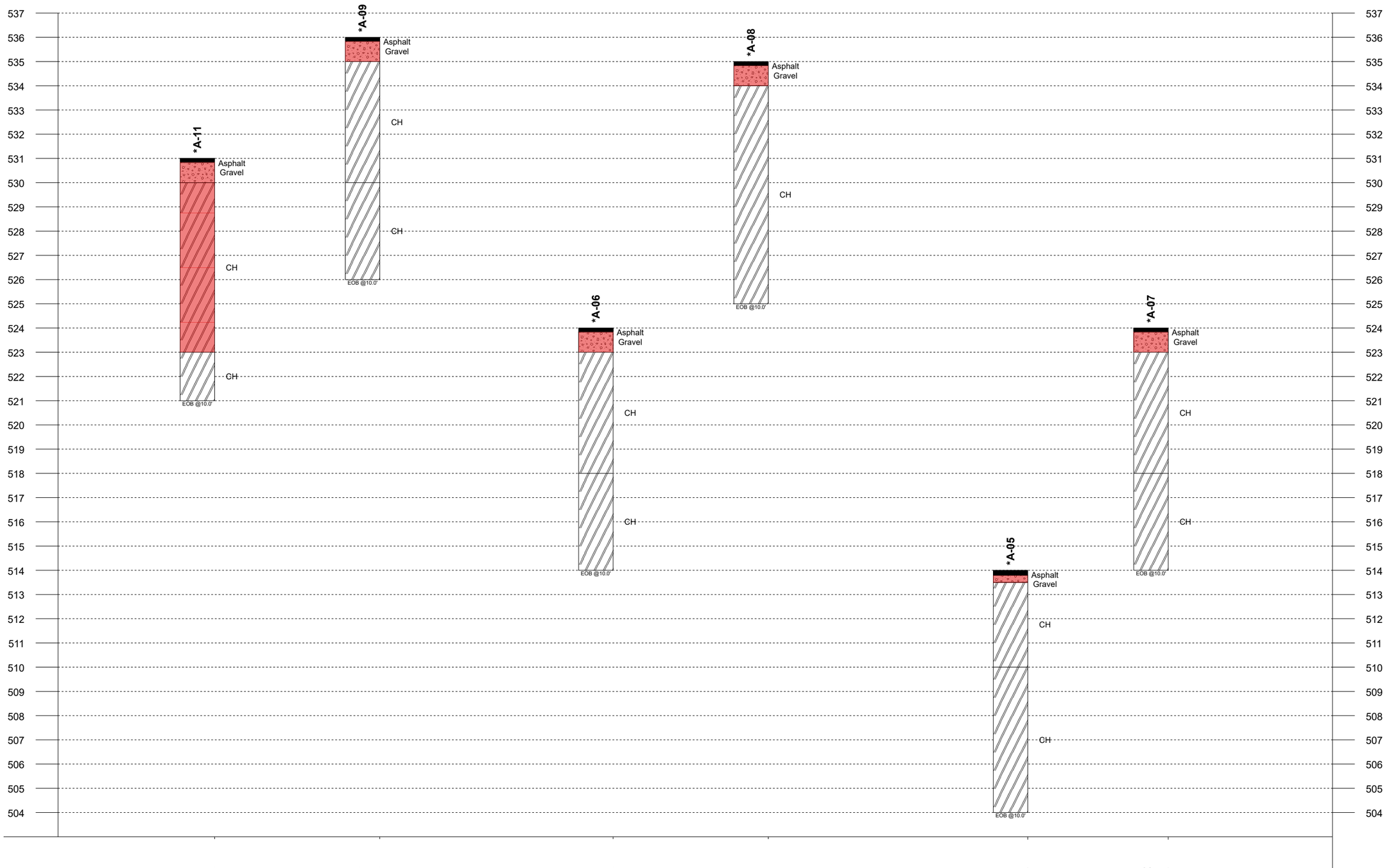
GENERALIZED SUBSURFACE SOIL PROFILE Section A-A'

City of Mesquite Streets Improvements

City of Mesquite

Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181

Project No: 19:8333 Date: 09/06/2021



Legend Key

- Asphalt
- Gravel or Conglo… 1
- Fat CLAY

Notes:

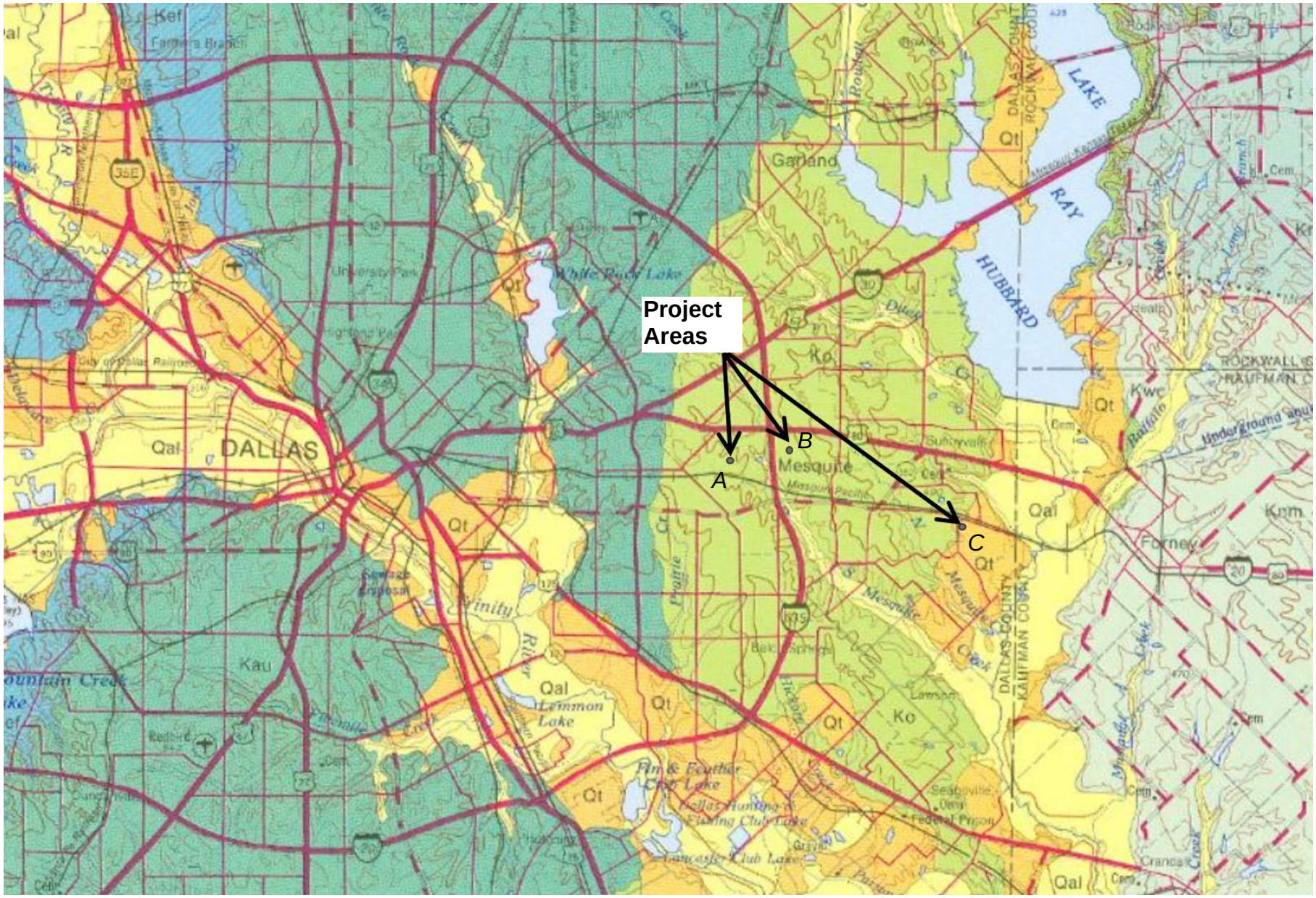
1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

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

GENERALIZED SUBSURFACE SOIL PROFILE Section B-B'

City of Mesquite Streets Improvements
City of Mesquite
Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181

Project No: 19:8333 Date: 09/06/2021



ECS	**Regional Geology Map**	**City of Mesquite** Mesquite, Texas	**Project No.:**	**19: 8333**
			PM:	**CT**
	ECS Southwest, LLP 3033 Kellway Drive, Suite 110, Carrollton, Texas 75006	**Ko & Qt**(Ozan Formation & Fluviatile terrace deposits)	**Scale:**	**N/A**
		SOURCE: Geology Atlas of Texas, Dallas Sheet, 1991	**Date:**	**6/21/2021**

General Recommendations for Quality Assurance (QA) Testing*

Item	Parameter	Test Method ASTM unless noted otherwise	Test Frequency or Observations	Requirements
General Earth Fill Below Paving & Structures	Standard Proctor Curve	D698	1 per soil type	--
	Atterberg Limits	D4318	1 per soil type	--
	-200 Mesh Sieve	D1140	1 per soil type	--
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 200 ft. of lane direction per 6 inch lift (2 tests minimum per lift per section)	Density $\geq$ 95% Moisture: PI < 20 (-2 to +5) PI > 20 (0 to +5)
Select Fill	Standard Proctor Curve	D698	1 per soil type	Lean Sandy Clay (CL) or Clayey Sand (SC)
	Atterberg Limits	D4318	1 per soil type	LL $\leq$ 35 6 $\leq$ PI $\leq$ 15
	-200 Mesh Sieve (P 200)	D1140	1 per soil type	P200 $\leq$ 50
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 200 ft. of lane direction per 6 inch lift (2 tests minimum per lift per section)	Density $\geq$ 95% Moisture: (-2 to +5)
Stabilized Subgrade	Standard Proctor Curve	D698	1 per soil type	--
	Atterberg Limits	D4318	1 per soil type	PI $\leq$ 15
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 200 ft. of lane direction (2 tests minimum)	Density $\geq$ 95% Moisture: +3%
	Gradation	D422	1 per 2 Density/Moisture tests	100% Passing 1-3/4" Sieve 60 % passing #4 Sieve
	Depth Check	Survey, drive probe or hand auger	1 per 2 Density/Moisture tests	Min. Specified

*Performed by the Construction Materials Engineering and Testing Company hired by owner.

Item	Parameter	Test Method ASTM unless noted otherwise	Test Frequency or Observations	Requirements
Trench Backfill Below Streets & Structures	Standard Proctor Curve	D698	1 per soil type	--
	Atterberg Limits	D4318	1 per soil type	--
	-200 Mesh Sieve	D1140	1 per soil type	--
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 250 ft. of lane direction per 12 inch lift (2 tests minimum per lift per section)	Density $\geq$ 95% Moisture: -1 to +4
Wall Backfill	Standard Proctor Curve	D698	1 per soil type	--
	Atterberg Limits	D4318	1 per soil type	LL $\leq$ 35 6 $\leq$ PI $\leq$ 15
	-200 Mesh Sieve (P 200)	D1140	1 per soil type	P200 $\leq$ 50
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 200 ft. of lane direction per 8 inch lift 6 inch lifts if hand-operated tampers are used (2 tests minimum per lift per section)	Density $\geq$ 95% Moisture: (-1 to +4)
Crushed Limestone Flexible Base (TxDOT Item 247)	Modified Proctor Curve	D1557	1 per material type	Type A, Grade 1 or better
	Atterberg Limits	D4318	1 per material type	LL $\leq$ 40 PI $\leq$ 12
	Sieve Analysis	D422	1 per material type	0-10 % Passing 1-3/4 inch 45-75 % Passing No. 4 60-85 % Passing No. 40
	Wet Ball Mill	TxDOT	1 per material type	Max. 45
	In Situ Density/Moisture Nuclear Gauge	D2922 D3017	1 per each 200 ft. of lane direction (Streets/Roads)	Density $\geq$ 95% (Modified) Moisture: -2 to +4%

Notes: 1. Table 1 is a guide for sampling and testing. Each of these items may not apply to the specified project.

2. Material changes, suspect areas, or other field conditions may require the engineer to increase testing and sampling frequencies.
3. Minimum of two tests per lift.
4. The moisture content ranges specified are to be considered as maximum allowable ranges. The contractor may have to maintain a more narrow range (within the maximum allowable) in order to consistently achieve the specified density for some soils or under some conditions.

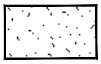
APPENDIX B – Field Operations

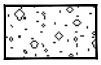
Reference Notes for Boring Logs
Subsurface Exploration Procedure
Boring Logs

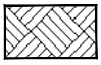
REFERENCE NOTES FOR BORING LOGS

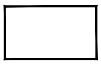
MATERIAL[1,2]

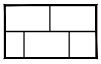

ASPHALT


CONCRETE


GRAVEL

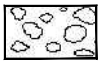

TOPSOIL

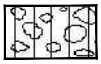

VOID


BRICK

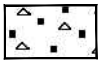

AGGREGATE BASE COURSE

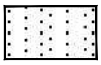

GW **WELL-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

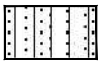

GP **POORLY-GRADED GRAVEL**
gravel-sand mixtures, little or no fines


GM **SILTY GRAVEL**
gravel-sand-silt mixtures

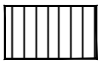

GC **CLAYEY GRAVEL**
gravel-sand-clay mixtures

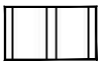

SW **WELL-GRADED SAND**
gravelly sand, little or no fines

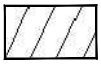

SP **POORLY-GRADED SAND**
gravelly sand, little or no fines


SM **SILTY SAND**
sand-silt mixtures

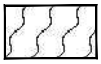

SC **CLAYEY SAND**
sand-clay mixtures

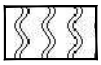

ML **SILT**
non-plastic to medium plasticity

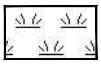

MH **ELASTIC SILT**
high plasticity


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, Q_P[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

GRAVELS, SANDS & NON-COHESIVE SILTS

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

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

WATER LEVELS[6]

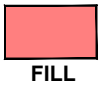

WL (First Encountered)


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 PROCEDURES

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 and sampling 25 borings to a depth of approximately 10 feet below the existing site grades, except for Boring C-05. Boring C-05 was terminated prior to the planned depth due to possible presence of utility backfill and subsequent underlying utility line.

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 on the boring logs were obtained from NCTCOG (www.dfwmaps.com), which provided elevation contours in 2-foot intervals.

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

Field logs of the soils encountered in the borings were maintained by the drilling crew. After recovery, each 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 and patched on the surface.

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6967216.8	**2543085.7**		**505.0**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(FILL) LEAN to FAT CLAYS, brownish gray, brown, moist, very stiff, with gravel and sand			
5	S-3	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff		500	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		495	
15							490	
20							485	
25							480	
30							475	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

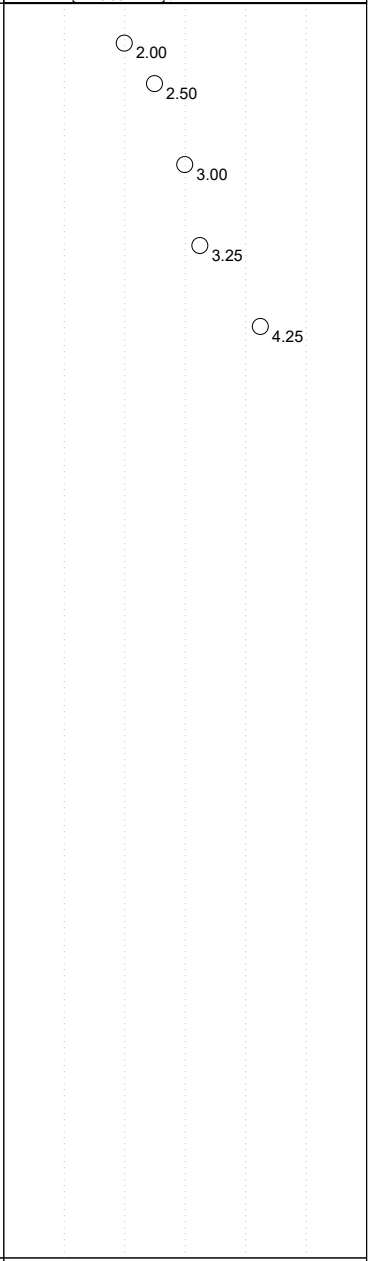
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Jun 08 2021**	CAVE IN DEPTH:	**N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Jun 08 2021**	HAMMER TYPE:	
⧩ WL (Seasonal High Water)	**N/A**	EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
⧩ WL (Stabilized)	**N/A**	**Truck**	**StrataBore**		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6967182.6	**2542776.1**		**509.0**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [3"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [9"], dark brown			
	S-2	ST	24	24	(FILL) LEAN to FAT CLAYS, brownish gray, brown, moist, very stiff, with gravel and sand			
5	S-3	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, stiff to very stiff		504	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		499	
15							494	
20							489	
25							484	
30							479	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

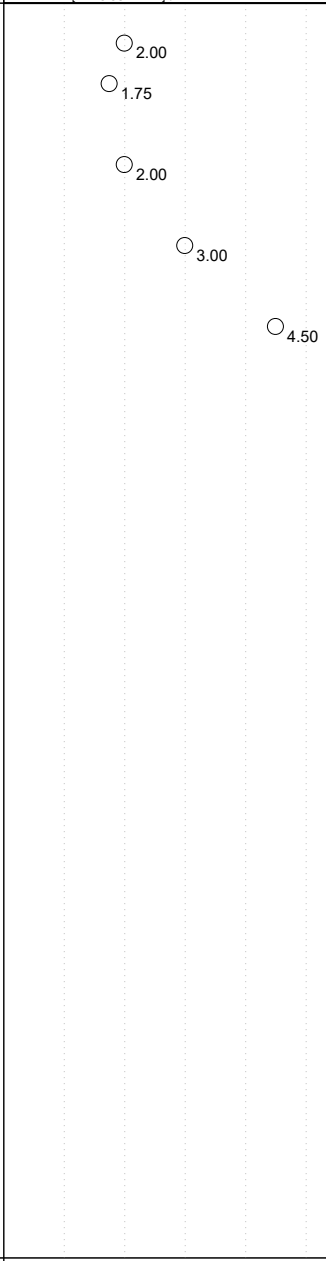
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Jun 08 2021**	CAVE IN DEPTH:	**N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Jun 08 2021**	HAMMER TYPE:	
⧩ WL (Seasonal High Water)	**N/A**	EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
⧩ WL (Stabilized)	**N/A**	**Truck**	**StrataBore**		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-03**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
City of Mesquite Streets Improvements	**StrataBore, LLC**		
SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**			LOSS OF CIRCULATION
NORTHING: **6967202.2**	EASTING: **2541855.7**	STATION:	SURFACE ELEVATION: **499.0**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff			
5	S-3	ST	24	24			494	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		489	
15							484	
20							479	
25							474	
30							469	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

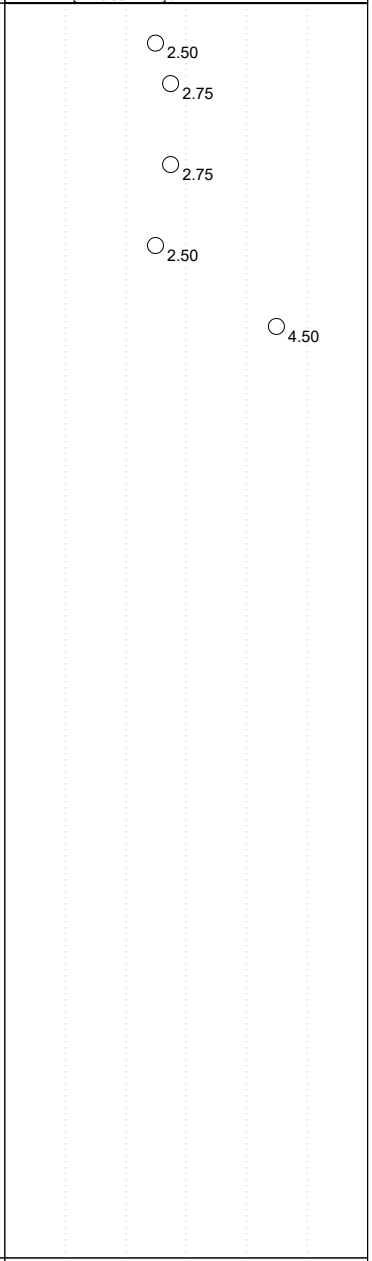
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StraraBore**	DRILLING METHOD:
▽ WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-04**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6966701.1	**2541748.4**		**516.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	ST	22	22	Asphalt [2"] (FILL) CLAYEY SAND to LEAN CLAY, brownish gray, brown, moist, firm, with gravel			
	S-2	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
5	S-3	ST	24	24			511	
	S-4	ST	24	24				
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		506	
15							501	
20							496	
25							491	
30							486	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

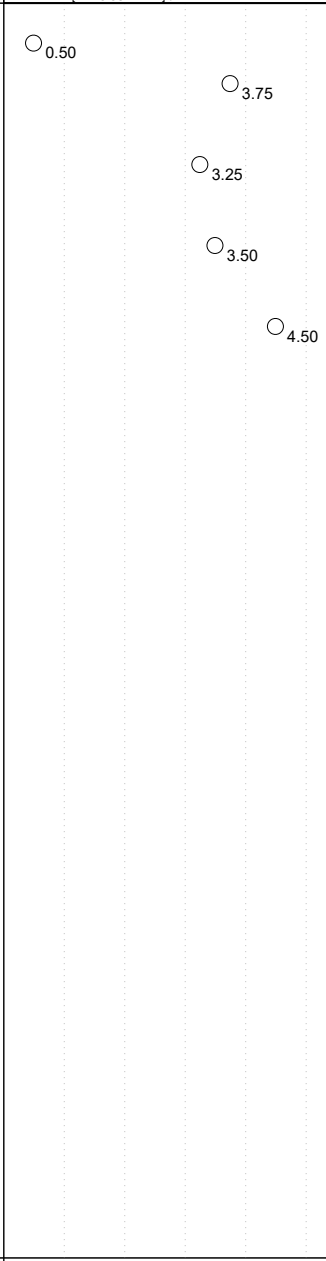
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
▽ WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-05**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
6967239.0	**2540931.5**		**514.0**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2.5"]			
	S-1	ST	18	18	(FILL) Gravel and Sand [3.5"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff to hard			
5	S-3	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff		509	
	S-4	ST	24	24				
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		504	
15							499	
20							494	
25							489	
30							484	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

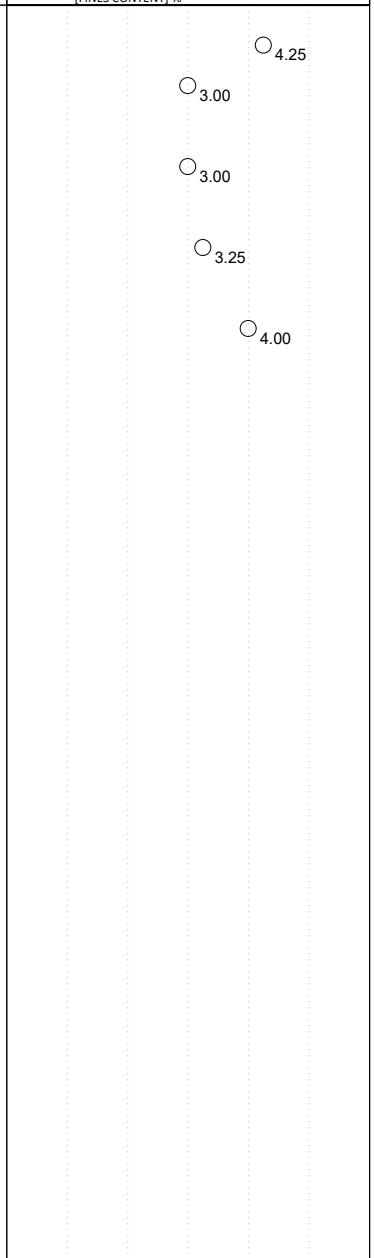
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
▽ WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-06**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6966651.1	**2540794.7**		**524.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	[(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff			
5	S-3	ST	24	24			519	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		514	
15							509	
20							504	
25							499	
30							494	

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

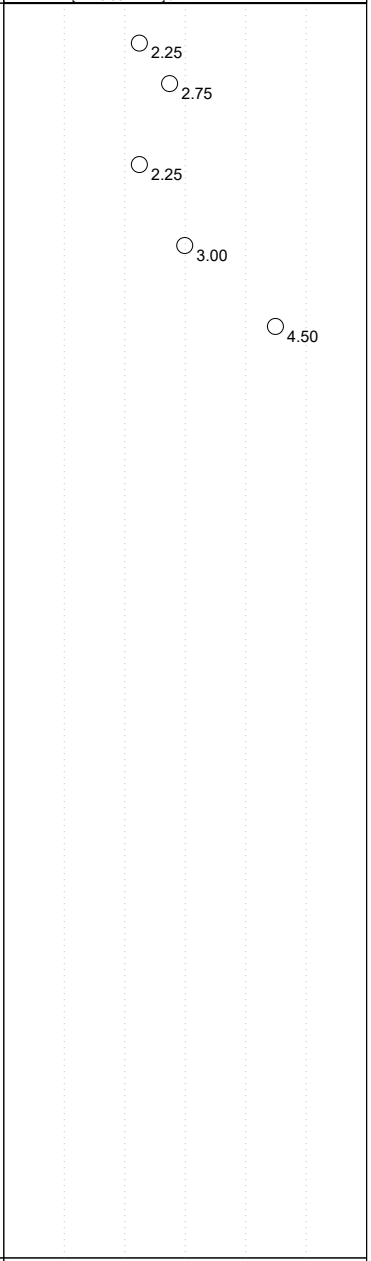
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Jun 08 2021**	CAVE IN DEPTH:	**N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Jun 08 2021**	HAMMER TYPE:	
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT:	LOGGED BY:	DRILLING METHOD:	
▽ WL (Stabilized)	**N/A**	**Truck**	**StrataBore**		

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-07**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6967303.1	**2540628.5**		**524.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff to hard			
5	S-3	ST	24	24			519	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		514	
15							509	
20							504	
25							499	
30							494	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

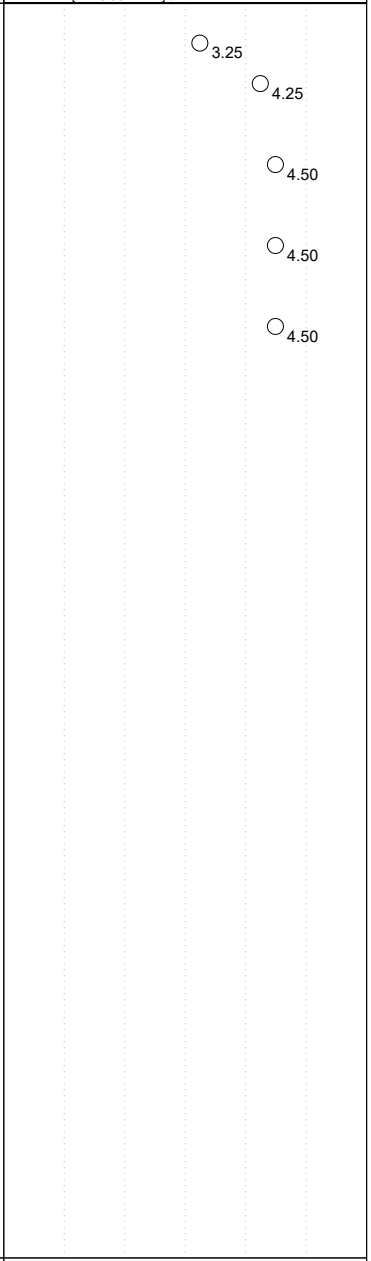
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

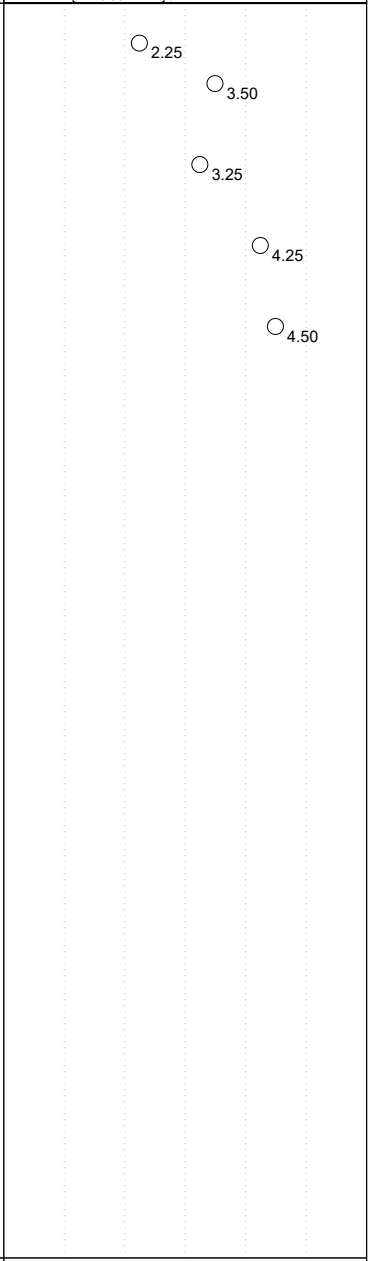
▽ WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
▽ WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-08**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
City of Mesquite Streets Improvements	**StrataBore, LLC**		
SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**			LOSS OF CIRCULATION
NORTHING: **6966866.4**	EASTING: **2540523.1**	STATION:	SURFACE ELEVATION: **535.0**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
5	S-3	ST	24	24			530	
	S-4	ST	24	24				
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		525	
15							520	
20							515	
25							510	
30							505	

Plastic Limit Water Content Liquid Limit
X——●——△
⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED:	**Jun 08 2021**	CAVE IN DEPTH:	**N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED:	**Jun 08 2021**	HAMMER TYPE:	
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:	
▽ WL (Stabilized)	**N/A**				

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-09**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
6966501.9	**2540303.0**		**536.0**

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"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) Gravel and Sand [10"], dark brown			
	S-2	ST	24	24	(CH) FAT CLAY, brown, dark brown, moist, very stiff			
5	S-3	ST	24	24			531	
	S-4	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		526	
15							521	
20							516	
25							511	
30							506	

3.25

3.50

2.75

3.75

4.25

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

WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-10**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
City of Mesquite Streets Improvements	**StrataBore, LLC**

SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:	BOTTOM OF CASING
6967070.0	**2540248.4**		**538.0**	

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	BG1	22	22	Asphalt [2"] (FILL), LEAN CLAY to CLAYEY SAND, brown, with gravel		538	
	S-2	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, very stiff to hard			
5	S-3	ST	24	24			533	
	S-4	ST	24	24				
	S-5	ST	24	24				
10					**END OF DRILLING AT 10.0 FT**		528	
15							523	
20							518	
25							513	
30							508	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

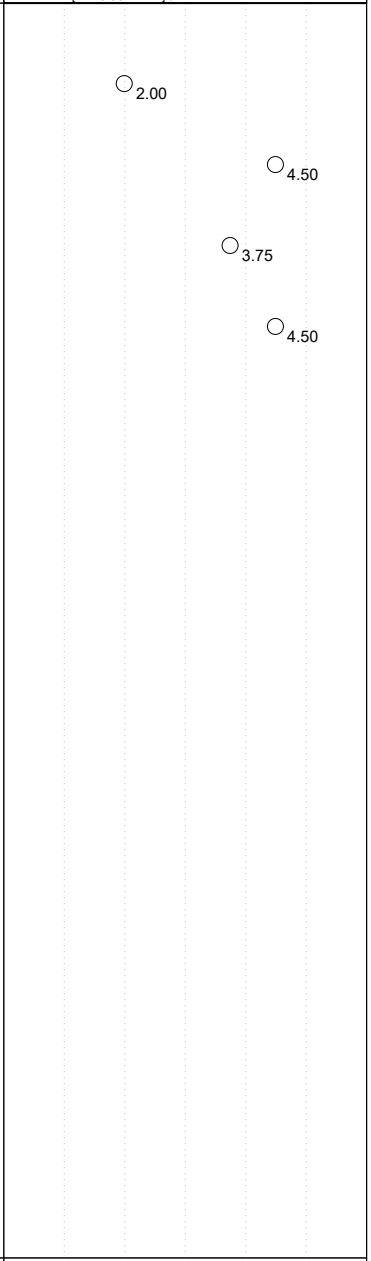
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



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

▽ WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
▼ WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
▽ WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
City of Mesquite	**19:8333**	**A-11**	**1 of 1**
PROJECT NAME:	DRILLER/CONTRACTOR:		
City of Mesquite Streets Improvements	**StrataBore, LLC**		
SITE LOCATION: **Rollingwood Hills, Lee St. & Lucas Blvd., Mesquite, Texas 75181**			LOSS OF CIRCULATION
NORTHING: **6966143.2**	EASTING: **2540366.2**	STATION:	SURFACE ELEVATION: **531.0**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Asphalt [2"]			
	S-1	ST	12	12	(FILL) SANDY LEAN CLAY, dark brown, with gravel and sand			
	S-2	ST	24	24	(FILL) FAT CLAY, brown, reddish brown, moist, very stiff to hard, with gravel			
5	S-3	ST	24	24			526	
	S-4	ST	24	24				
	S-5	ST	24	24	(CH) FAT CLAY, brownish gray, brownish yellow, moist, hard			
10					**END OF DRILLING AT 10.0 FT**		521	
15							516	
20							511	
25							506	
30							501	

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

3.00

4.50

4.50

4.50

4.50

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

WL (First Encountered)	**Dry**	BORING STARTED: **Jun 08 2021**		CAVE IN DEPTH: **N/A**
WL (Completion)	**Dry**	BORING COMPLETED: **Jun 08 2021**		HAMMER TYPE:
WL (Seasonal High Water)	**N/A**	EQUIPMENT: **Truck**	LOGGED BY: **StrataBore**	DRILLING METHOD:
WL (Stabilized)	**N/A**			

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary
Lime/pH Series Results

ECS Southwest, LLP

Carrollton, Texas

Laboratory Testing Summary

Date: 8/25/2021

Project Number: 19:8333 **Project Name: City of Mesquite Streets Improvements**

Project Engineer: CT **Principal Engineer: MPB** **Summary By: CT**

Boring Number	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Dry Unit Weight[5] (pcf)	Compressive Strength (tsf)	One-Dimensional Swell[6]			Soluble Sulfate[7] (ppm)
					LL	PL	PI				Final Moisture (%)	Surcharge (psf)	Swell (%)	
A-01	S-1	0-1	25.9	FILL				50.8						
	S-2	2-4	35.2	CH	87	28	59	96.9						< 3,000
A-02	S-2	2-4	36.7											< 3,000
	S-4	6-8	29.2	CH	87	28	59	92.0						
A-03	S-2	2-4	30.7	CH	75	25	50							< 3,000
A-04	S-1	1-2	12.8	FILL	26	16	10	33.8						< 3,000
A-05	S-2	2-4	30.5	CH	80	27	53							< 3,000
A-06	S-1	1-2	30.0					70.8						< 3,000
	S-3	4-6	28.9	CH	74	25	49	83.8						< 3,000
A-07	S-2	2-4	29.0											< 3,000
	S-4	6-8	23.2	CH	74	25	49							
A-08	S-2	2-4	31.1	CH	67	24	43	98.3						< 3,000
A-09	S-2	2-4	22.8	CH	53	21	32							< 3,000
A-10	S-2	2-4	31.5	CH	78	26	52							< 3,000
A-11	S-2	2-4	15.9	FILL	52	21	31	44.9						< 3,000
B-01	S-2	2-4	23.7											< 3,000
	S-3	4-6	22.6	CH	59	22	37	79.2						
B-02	S-2	2-4	26.7	CH	62	23	39							< 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 TEX 145E, 8 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

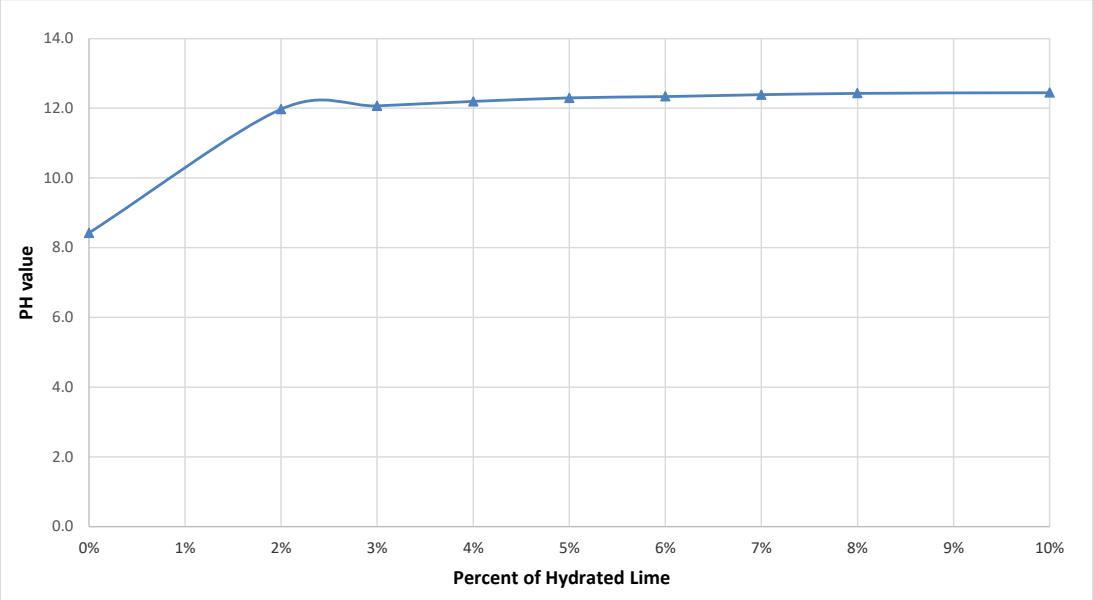
ECS Southwest, LLP
Dallas, TX

Project No: 19:8333
Project : City of Mesquite Streets Improvements
Source : A-01 at 2' - 4'
Sample Information: Fat Clay, dark brown (CH)

Date : 06/29/2021
Tested By : Kumara M

Lime pH Series Test

% of Hydrated Lime	Corrected pH	Remarks
0%	8.4	
2%	12.0	
3%	12.1	
4%	12.2	
5%	12.3	
6%	12.3	
7%	12.4	
8%	12.4	
10%	12.4	



APPENDIX D – Winpas Pavement Design Outputs

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency: City of Mesquite
Company: ECS Southwest, LLP
Contractor:
roject Description: Mesquite Streets Improvements
Location: Rollingwood Hills and Lee Street

Flexible Pavement Design/Evaluation

Structural Number	3.26		**Soil Resilient Modulus**	5,014.50	**psi**
Design ESALs	442,000		**Initial Serviceability**	4.20	
Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.44	1.00	2.00	0.88
Asphalt Treated Agg. Base	0.41	1.00	5.00	2.05
Bitum. Treated Agg. Base	0.12	1.00	6.00	0.72
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			ΣSN	3.65

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency: City of Mesquite
Company: ECS Southwest, LLP
Contractor:
roject Description: Mesquite Streets Improvements
Location: Rollingwood Hills and Lee Street

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Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.44	1.00	2.00	0.88
Asphalt Treated Agg. Base	0.41	1.00	4.00	1.64
Bitum. Treated Agg. Base	0.14	1.00	6.00	0.84
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			ΣSN	3.36

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency: City of Mesquite
Company: ECS Southwest, LLP
Contractor:
roject Description: Mesquite Streets Improvements
Location: Rollingwood Hills and Lee Street

Flexible Pavement Design/Evaluation

Structural Number	3.26		**Soil Resilient Modulus**	5,014.50	**psi**
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Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
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Asphalt Treated Agg. Base	0.41	1.00	4.00	1.64
Bitum. Treated Agg. Base	0.15	1.00	6.00	0.90
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			ΣSN	3.42