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REGISTERED ARCHITECT WILLIAM R. DUNCAN II 24968 STATE OF TEXAS
8-26-2024

ADDENDUM NO. 1

ISSUE DATE: August 26, 2024

PROJECT: Fire Station #9
City of Abilene, TX

The following are additions, deletions, clarifications or corrections and shall be made to the Plans, Specifications, and Contract Documents for the above referenced project. Bidder shall acknowledge receipt of this Addendum on the Construction Costs Form.

GENERAL

Item #G1 Change Bid Date to Tuesday September 10, 2024

Item #G2 All Questions and Substitution Requests will need to be received by 2:00 pm on Thursday August 29, 2024.

Item #G3 Attached is the Geotechnical Exploration report no. W232256 dated September 25, 2023 for Fire Station #9.

END OF ADDENDUM

GEOTECHNICAL EXPLORATION

FIRE STATION #9
Corner of E. Spur 707 and FM 707
Abilene, Texas
ALPHA Report No. W232256
September 25, 2023

Prepared for:

JACOB & MARTIN, LLC
3465 Curry Lane
Abilene, Texas 79606
Attention: Mr. Sam Hurley

Prepared By:

ALPHA TESTING

A Universal Engineering Sciences Company

ALPHA TESTING
A Universal Engineering Sciences Company

Geotechnical
Construction Materials
Environmental
TBPELS Firm No. 813

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September 25, 2023

Jacob & Martin, LLC
3465 Curry Lane
Abilene, Texas 79606

Attention: Mr. Sam Hurley

Re: Geotechnical Exploration
Fire Station #9
Corner of E. Spur 707 and FM 707
Abilene, Texas
ALPHA Report No. W232256

Attached is the report of the geotechnical exploration performed for the project referenced above. This study was authorized through by Mr. Sam Hurley on August 8, 2023 and performed in accordance with ALPHA Proposal No. 99484 dated August 8, 2023.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses were used to develop geotechnical recommendations to aid in design of shallow foundations and pavement.

ALPHA TESTING, LLC appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing during construction, please contact our office.

Sincerely,

ALPHA TESTING, LLC

STATE OF TEXAS
BRIAN J. HOYT
115748
LICENSED
PROFESSIONAL ENGINEER
September 25, 2023

Karina Cohuo
Geotechnical Project Manager

Brian J. Hoyt, P.E.
Regional Manager

BJH/kc
Copies: (1-PDF) Client

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ALPHA REPORT NO. W232256

1.0 PURPOSE AND SCOPE

The purpose of this geotechnical exploration is for ALPHA TESTING, LLC (ALPHA) to evaluate for Jacob & Martin, LLC (Client) some of the physical and engineering properties of subsurface materials at a selected location on the subject site with respect to formulation of appropriate geotechnical design parameters for the proposed construction. The field exploration was accomplished by securing subsurface samples from a single test boring performed at the site. Engineering analyses were performed from results of the field exploration and results of laboratory tests conducted on representative samples.

Also included are general comments pertaining to reasonably anticipated construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to evaluate subsurface conditions and to aid in ascertaining construction meets project specifications.

Recommendations provided in this report were developed from information obtained in a test boring depicting subsurface conditions only at the specific boring location and at the particular time designated on the log. Subsurface conditions at other locations may differ from those observed at the boring location, and subsurface conditions at the boring location may vary at different times of the year. The scope of work may not fully define the variability of subsurface materials and conditions that are present on the site.

The nature and extent of variations between the boring location and other locations on the site may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and possibly other tests.

2.0 PROJECT CHARACTERISTICS

We understand the project will consist of a fire station and pavement for associated parking and drives generally located on the southwest corner of FM 707 and East Spur 707 in Abilene, Texas. A site plan illustrating the general outline of the property is provided as Figure 1, the Boring Location Plan, in the Appendix.

At the time the field exploration was performed, the site was currently undergoing grading/clearing. We understand existing structures were demolished and cleared prior to our field investigation. No information regarding previous development on the site was provided to us.

We understand the building will be supported with shallow foundations and designed for about 1 inch of post-construction seasonal movement. No below grade slabs are planned. Pavement for the project will consist of portland cement concrete (PCC) or asphalt concrete (AC). Grading plans were not available at the time of this study. For the purpose of our analysis, we have assumed maximum cuts and fills of 2 ft will be required to achieve final grade within the building pad areas.

3.0 FIELD EXPLORATION

Subsurface conditions on the site were explored by drilling six (6) test borings. Three (3) test borings were drilled to a depth of about 20 ft and three (3) test borings were drilled to a depth of about 5 ft. The test borings were drilled in general accordance with ASTM D 420 using standard rotary drilling equipment. The approximate locations of the test borings are shown on the Boring Location Plan, Figure 1, enclosed in the Appendix. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Subsurface types encountered during the field exploration are presented on the Log of Boring sheets (boring logs) included in the Appendix. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, the boring logs contains both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

4.0 LABORATORY TESTS

Selected samples of the subsurface materials were tested in the laboratory to evaluate their engineering properties as a basis in providing information for foundation design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented on the Log of Boring sheets in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

Subsurface conditions encountered in Borings 1, 2 and 3 generally consisted of sandy clay, clayey sand and/or clayey gravel extending to the 20 ft termination depth of the borings. Subsurface conditions encountered in Borings 4, 5 and 6 generally consisted of clay or sandy clay extending to the 5 ft termination depth of the borings. More detailed stratigraphic information is presented on the Log of Boring sheets.

The granular materials (clayey sand and clayey gravel) encountered in the borings are relatively permeable and are anticipated to have a relatively rapid response to water movement. However, the clay and sandy clay encountered in the borings are considered relatively impermeable and are expected to have a relatively slow response to water movement. Therefore, several days of observation would be required to evaluate actual groundwater levels within the depths explored. The groundwater level at the site is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

No free groundwater was encountered in the borings. However, it is common to encounter seasonal groundwater in granular soils or from natural fractures in the clayey matrix, particularly during or after periods of precipitation. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the Boring Logs provided in the Appendix.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations were developed on the basis of the previously described Project Characteristics (Section 2.0) and General Subsurface Conditions (Section 5.0). Should the project criteria change, including the building location on the site, our office should conduct a review to determine if modifications to the recommendations are required.

The following design criteria was developed based on the assumption that cuts and fills required to achieve final grade will not exceed 2 ft. Cutting or filling on the site more than 2 ft can alter the recommended design parameters. Therefore, it is recommended our office be provided with a copy of final grading plans to verify appropriate design parameters are utilized for final design.

6.1 Demolition

As discussed in Section 2.0, we understand previously existing structures were demolished and cleared prior to our field investigation. Any areas disturbed from removal of the structures should be re-compacted under moisture-density compaction control as discussed in Section 6.2 or 7.3, as applicable. All foundation elements of the existing structures should be removed or cut off at least 1 ft below finished grade or 1 ft below the new structural elements, whichever is deeper. All abandoned utility lines should be either removed or positively sealed to prevent possible water seepage into the subsurface clay materials.

6.2 Potential Seasonal Movements and Subgrade Improvement

Our findings indicate the floor slabs for the buildings constructed within 2 ft of final grade could experience post construction seasonal movements of about 3 to 4 inches due to shrinking and swelling of active clay soils. This estimate of potential movement is based on the assumption that any fill used to raise the grade or backfill excavations of uncontrolled fill consists of onsite or similar soils with a plasticity index of 35 or less. Use of fill material with a higher plasticity index could result in potential movements exceeding our estimates.

Potential seasonal movements were estimated in general accordance with methods outlined by Texas Department of Transportation (TxDOT) Test Method Tex-124-E, from results of absorption swell tests and engineering judgment and experience. Estimated movements were calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between a "dry" condition and a "wet" condition as defined by Tex-124-E. Also, it was assumed a 1 psi surcharge load from the floor slab acts on the subgrade soils. Movements exceeding our estimates could occur if positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface moisture migration from off-site locations.

We understand it is desired to reduce potential movements of the foundation to about 1 inch. Potential movements of the foundation could be reduced to about 1 inch by placing a minimum 6½ ft of non-expansive material below the bottom of the floor slab. The non-expansive fill should also extend below any adjacent flatwork for which it is desired to reduce movements. Non-expansive fill material could consist of flexible base material or select fill as described in Section 7.3.

6.3 Spread Footings

Footings used to support the buildings are subject to similar potential movements as the floor slab, as discussed in Section 6.2 (about 3 to 4 inches). Subgrade improvement as discussed in Section 6.2 should be performed to reduce potential movement of footings to about 1 inch. Footings constructed as recommended herein could experience differential movements approaching total movements (about 1 inch).

Spread footings bearing on non-expansive fill can be designed using a net allowable bearing pressure of 2.0 kips per sq ft. Continuous footings should have a least dimension of 18 inches in width and spot footings should have a least dimension of 24 inches for bearing capacity considerations. Exterior footings should bear at a depth of at least 18 inches below final grade. Interior building footings can bear at a nominal depth below the floor slab.

Careful monitoring during construction is necessary to locate any pockets or seams of unsuitable materials which might be encountered in excavations for footings. Unsuitable materials encountered at the foundation bearing level should be removed and replaced with non-expansive material, lean concrete (at least 200 psi strength at 28 days), or structural concrete.

Resistance to sliding will be developed by friction along the base of the footings and passive earth pressure acting on the vertical face of the footing and a (possible) key installed in the base of the footings, if required. We recommend a coefficient of base friction of 0.3 be used along the bottom of the footing. The available passive earth resistance on the vertical face of the foundation and a (possible) key constructed in the base of the footing may be calculated using a uniform allowable passive earth pressure of 300 psf for footings bearing against cuts in undisturbed soils or against fill placed as recommended in Section 7.3. The passive resistance along the vertical face of the footing should be neglected within 2 ft of the final site grade.

6.4 Seismic Considerations

The Site Class for seismic design is based on several factors that include soil profile (soil or rock), shear wave velocity, and strength, averaged over a depth of 100 ft. Since our boring did not extend to 100-foot depths, we based our determinations on the assumption that the subsurface materials below the bottom of the boring were similar to those encountered at the termination depth of the boring. Based on Section 1613.3.2 of the 2012 International Building Code and Table 20.3-1 in the 2010 ASCE-7, we recommend using Site Class C (very dense soil or soft rock) for seismic design at this site.

6.5 Exterior Flatwork

Exterior flatwork constructed within 2 ft of existing grade could be subjected to potential seasonal movements as described in Section 6.2 (about 4 inches). In areas where flatwork movement is critical (such as, but not limited to, main entrances), subgrade improvement as discussed in Section 6.2 or Section 6.4 can be considered to reduce potential movements to about 1 inch.

6.6 Area Pavement

To permit correlation between information from the test boring and actual subgrade conditions exposed during construction, a qualified Geotechnical Engineer should be retained to provide subgrade monitoring and testing during construction. If there is any change in project criteria, the recommendations contained in this report should be reviewed by our office.

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials used and conventional thickness determination procedures. Pavement joining buildings should be constructed with a curb and the joint between the building and curb should be sealed. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, reinforcing steel, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications, but all were not included in the scope of this study. Normal periodic maintenance will be required for all pavement to achieve the design life of the pavement system.

Recommendations for portland cement concrete (PCC) and asphalt concrete (AC) pavement are provided below. These types of pavements are not considered equal in performance. Asphalt concrete pavement should be expected to have a shorter life and higher maintenance costs. Also, pavement in dumpster areas and areas receiving heavy truck traffic should consist of PCC.

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

6.6.1 Lime Stabilization of Pavement Subgrade

The exposed surface of the final pavement subgrade should be scarified to a depth of 6 inches and mixed with a minimum 7 percent hydrated lime (by dry soil weight) in conformance with TxDOT Standard Specifications Item 260. Assuming an in-place unit weight of 100 pcf for the pavement subgrade soils, this percentage of lime equates to about 32 lbs of lime per sq yard of treated subgrade. The actual amount of lime required should be confirmed by additional laboratory tests (ASTM C 977 Appendix XI) prior to construction. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content. Lime stabilization procedures should extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement.

Subgrade improvement could also consist of a minimum 6 inch layer of flexible base material. Flexible base used for pavement subgrade should consist of material meeting the requirements of TxDOT Standard Specifications Item 247, Type A, Grade 1-2. The flexible base should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 2 percentage points below to 2 percentage points above the material's optimum moisture content.

We recommend subgrade improvement procedures extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement.

Subgrade improvements of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Pavement and other flatwork will have the same potential for movement as slabs constructed directly on the existing undisturbed soils. Good surface drainage and perimeter drainage with a minimum slope of 2 percent away from the pavement is recommended. The use of sand as a leveling course below pavement and the use of an aggregate base course supported on expansive clays should be avoided. Normal maintenance of pavement should be expected over the life of the structures.

6.6.2 Portland Cement Concrete (PCC) Pavement

Following subgrade improvement as recommended in Section 6.6.1, PCC (reinforced) pavement sections are recommended in Table A.

TABLE B
Recommended PCC Pavement Sections

Paving Areas and/or Type	Subgrade Thickness, Inches	PCC Thickness, Inches
Parking Areas Subjected Exclusively to Passenger Vehicle Traffic,	Scarified and Compacted (native), 6	5
Drive Lanes, Fire Lanes, Areas Subject to Light Volume Truck Traffic,	See Section 6.6.1, 6	6
Dumpster Traffic Areas, Areas subject to Moderate Volume Truck Traffic,	See Section 6.6.1, 6	7

PCC should have a minimum compressive strength of 3,000 psi at 28 days in parking areas subjected exclusively to passenger vehicle traffic. We recommend a minimum compressive strength of 3,500 psi at 28 days for the drive lanes, fire lanes, and truck areas. Concrete should be designed with 4.5 ± 1.5 percent entrained air. Joints in concrete paving should not exceed 15 ft. Reinforcing steel should consist of No. 3 bars placed at 18 inches on-center in two directions.

Improvement of the pavement subgrade is recommended for drive lanes, fire lanes, and pavement subject to truck traffic. Improvement of the pavement subgrade is not required for pavements subjected exclusively to passenger vehicle traffic, although improvement in these areas would be generally beneficial to the long-term performance of the pavement. Improvement of the subgrade is described in Section 6.7.1.

Alternatively, mechanical improvement of the pavement clay subgrade could be eliminated by increasing the PCC thickness in the pavement sections presented in Table A by 1 inch. Prior to construction of pavement on unimproved clay subgrade soil, the exposed subgrade should be scarified to a depth of at least 6 inches and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of -1 to +3 percentage points of the material's optimum moisture content.

6.6.3 Asphalt Concrete Pavement

Subgrade preparation as described in Section 6.6.1 is required for asphalt concrete pavement. The minimum recommended asphalt concrete pavement sections to be constructed are provided in Table C.

TABLE C
Recommended Asphalt Pavement Sections

	Light-Duty 100,000 ESAL (inches)	**Moderate-Duty 300,000 ESAL (inches)**
HMAC Surface Course – Type D	2.0	2.0
HMAC Base Course – Type B	3.0	4.0
Improved Subgrade (See Section 6.6.1)	6.0	6.0

HMAC should conform to TxDOT Standard Specification Item 340 – Type D Surface Course) and TxDOT Standard Specification Item 340 – Type A or B Base Course. The coarse aggregate in the surface course should be composed of angular crushed limestone rather than smooth gravel.

6.7 Drainage and Other Considerations

Adequate drainage should be provided to reduce seasonal variations in the moisture content of foundation soils. All pavement and sidewalks within 10 ft of the structure should be sloped away from the building to prevent ponding of water around the foundation. Final grades within 10 ft of the structure should be adjusted to slope away from the structure at a minimum slope of 2 percent. **Maintaining positive surface drainage throughout the life of the structure is essential.**

In areas with pavement or sidewalks adjacent to the new structure, a positive seal must be maintained between the structure and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and flatwork is common. Normal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as resealing where necessary.

Several factors relate to civil and architectural design and/or maintenance, which can significantly affect future movements of the foundation and floor slab system:

- Preferably, a complete system of gutters and downspouts should carry runoff water a minimum of 5 feet from the completed structure.
- Large trees and shrubs should not be allowed closer to the foundation than a horizontal distance equal to roughly one-half of their mature height due to their significant moisture demand upon maturing.

- Moisture conditions should be maintained "constant" around the edge of the slab. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

- Planter box structures placed adjacent to the building should be provided with a means to assure concentrations of water are not available to the subsoil stratigraphy.

- The root systems from any existing trees at this site will have dried and desiccated the surrounding clay soils, resulting in soil with near-maximum swell potential. Clay soils surrounding tree/vine root mats in areas to be covered with grade slabs (including, but not limited to, pavement, sidewalks and equipment pads) should be removed to a depth of at least 1 ft below the root ball and compacted in-place with moisture and density control as described in Section 7.3.

Trench backfill for utilities should be properly placed and compacted as outlined in Section 7.4 and in accordance with requirements of local City standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structures.

7.0 GENERAL CONSTRUCTION PROCEDURES AND GUIDELINES

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Professional Engineering firm be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be reasonably anticipated until the course of construction. The guidelines offered in the following paragraphs are intended not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the boring.

7.1 Site Preparation and Grading

All areas supporting foundations, flatwork, pavement or areas to receive new fill should be properly prepared.

- After completion of the necessary stripping, clearing, and excavating, and prior to placing any required fill, the exposed soil subgrade should be carefully evaluated by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

- The exposed soil subgrade should be further evaluated by proof-rolling with a heavy pneumatic-tired roller, loaded dump truck or similar equipment weighing approximately 20 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil. Proof-rolling procedures should be observed routinely by a Professional

Engineer or his designated representative. Any undesirable material (organic material, wet, soft, or loose soil) exposed during proof-rolling should be removed and replaced with well-compacted material as outlined in Section 7.3.

- Prior to placement of any fill, the exposed soil subgrade should then be scarified to a minimum depth of 6 inches and re-compacted as outlined in Section 7.3.

If fill is to be placed on existing slopes (natural or constructed) steeper than six horizontal to one vertical (6:1), the fill materials should be benched into the existing slopes in such a manner as to provide a minimum bench width of five (5) feet. This should provide a good contact between the existing soils and new fill materials, reduce potential sliding planes, and allow relatively horizontal lift placements.

Even if fill is properly compacted as described in Section 7.3, fills in excess of about 10 ft are still subject to settlements over time of up to 1 to 2 percent of the total fill thickness. This should be considered when planning or placing deep fills.

The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations. Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

Due to the nature of the clayey and sandy soils found near the surface at the borings, traffic of heavy equipment (including heavy compaction equipment) may create pumping and general deterioration of shallow soils. Therefore, some construction difficulties should be anticipated during periods when these soils are saturated.

7.2 Foundation Excavations

All foundation excavations should be monitored to verify foundations bear on suitable material. The bearing stratum exposed in the base of all foundation excavations should be protected against any detrimental change in conditions. Surface runoff water should be drained away from excavations and not allowed to collect. All concrete for foundations should be placed as soon as practical after the excavation is made.

Prolonged exposure of the bearing surface to air or water will result in changes in strength and compressibility of the bearing stratum. Therefore, if delays occur, excavations should be slightly deepened and cleaned, in order to provide a fresh bearing surface.

7.3 Fill Compaction

Select Fill (Non-Expansive Fill): Select fill used as non-expansive fill should have a liquid limit less than 35, a plasticity index (PI) not less than 4 nor greater than 15. Select fill should not contain deleterious material and debris. Select fill should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of -1 to +3 percentage points of the material's optimum moisture content. The plasticity index and liquid limit of material used as select, non-expansive fill should be verified during fill placement using laboratory tests. Atterberg limits tests to verify the select, non-expansive fill shall be performed at a frequency of at least one test per 2 feet of thickness per 5,000 square feet. Atterberg limits shall be staggered between various lifts within each 5,000 square feet.

Flexible Base Material (Non-Expansive Fill): Flexible base material used as non-expansive fill for the building pad area should meet the requirements of TxDOT Item 247, Type A or D, Grade 1-2. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 698) and within -2 to +3 percentage points of the material's optimum moisture content.

The following recommendations pertain to general fill. Soil placed in the building pad should consist of non-expansive fill.

Clayey soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 93 and 97 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of 2 to 6 percentage points above optimum. Clayey materials used as fill should be processed such that the largest particle or clod is less than 6 inches prior to compaction.

Where mass fills are deeper than 10 ft, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D-698) and within 2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined herein.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift.

In general site grading areas where final fill slopes will be four horizontal to one vertical (4:1) or steeper and greater than 5 ft in height, field density and moisture content tests should be performed on each lift.

7.4 Utilities

Where utility lines are deeper than 10 ft, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within –2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as previously outlined. Density tests should be performed on each lift (maximum 12-inch thick) and should be performed as the trench is being backfilled.

Even if fill is properly compacted, fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when designing pavement over utility lines and/or other areas with deep fill.

If utility trenches or other excavations extend to or beyond a depth of 5 ft below construction grade, the contractor or others shall be required to develop an excavation safety plan to protect personnel entering the excavation or excavation vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, is beyond the scope of this study. Any such designs and safety plans shall be developed in accordance with current OSHA guidelines and other applicable industry standards.

7.5 Groundwater

Groundwater was not encountered in the borings. However, from our experience with similar subsurface conditions, shallow groundwater seepage could be encountered from the subsurface stratigraphy in excavations for foundations, utilities and other general excavations at this site. The risk of seepage increases with depth of excavation and during or after periods of precipitation. Standard sump pits and pumping may be adequate to control seepage on a local basis.

Where groundwater is encountered in granular soils, sump pits may not be adequate to control seepage and supplemental dewatering measures may be necessary to control groundwater seepage. Supplemental dewatering measures include (but are not limited to) submersible pumps in slotted casings and well points.

In any areas where cuts are made to establish final grades, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. In these areas, subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other de-watering devices on the site should be carefully addressed during construction. Our office could be contacted to visually observe final grades to evaluate the need for such drains.

8.0 LIMITATIONS

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. ALPHA, upon written request, can be retained to provide these services.

ALPHA is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined in Section 2.0. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained ALPHA's written acceptance of such intended use. Any such third party using this report after obtaining ALPHA's written acceptance shall be bound by the limitations and limitations of liability contained herein, including ALPHA's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design of any other structures except those specifically described in this report. In all areas of this report in which ALPHA may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by ALPHA. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release ALPHA from any liability resulting from the use of, or reliance upon, this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, ALPHA is not responsible for damages resulting from workmanship of designers or contractors. It is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

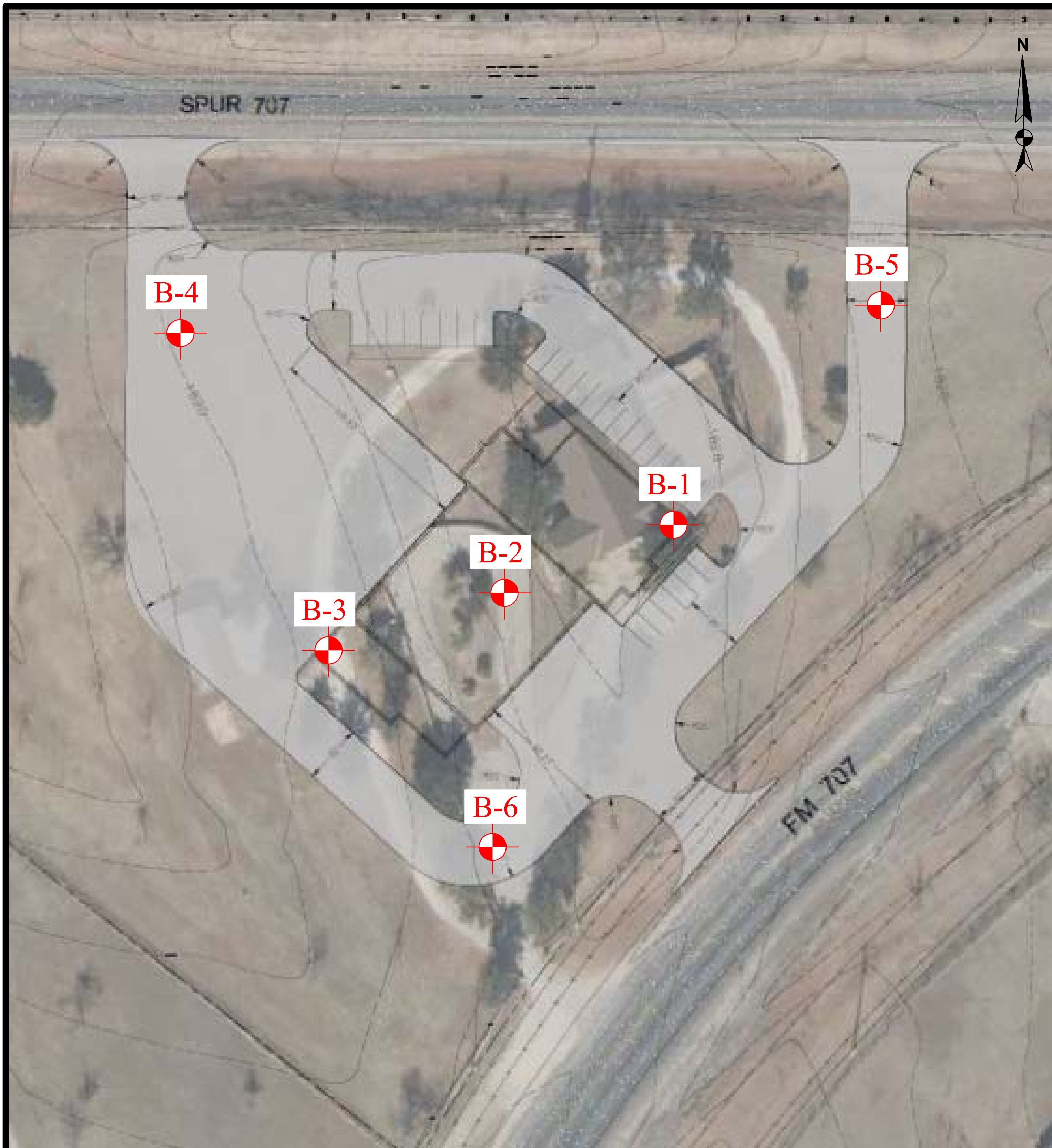
APPENDIX

A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, six (6) test borings were performed for this geotechnical exploration at the approximate location shown on the Boring Location Plan, Figure 1. The test boring locations were staked by using a handheld GPS unit or by pacing/taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plan provided during this study. The location of the test borings shown on the Boring Location Plan is considered accurate only to the degree implied by the methods used to define it.

Soil samples were obtained using split-spoon sampling procedures in accordance with ASTM Standard D 1586. Disturbed samples were obtained at selected depths in the borings by driving a standard 2-inch O.D. split-spoon sampler 18 inches into the subsurface material using a 140-pound hammer falling 30 inches. The number of blows required to drive the split-spoon sampler the final 12 inches of penetration (N-value) is recorded in the appropriate column on the Log of Boring sheets.

The boring logs are included in the Appendix. The log shows visual descriptions of subsurface strata encountered in the boring using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Samples not consumed by testing will be retained in our laboratory for at least 14 days and then discarded unless the Client requests otherwise.



GEOTECHNICAL EXPLORATION
FIRE STATION #9
CORNER OF E. SPUR 707 AND
FM 707
ABILENE, TEXAS
ALPHA PROJECT NO. W232256

ALPHA TESTING
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FIGURE 1

BORING LOCATION PLAN

B-1 METHODS OF LABORATORY TESTING

Representative samples were evaluated and classified by a qualified member of the Geotechnical Division and the boring logs were edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318) and percent material passing the No. 200 sieve tests (ASTM D 1140) were performed on selected samples. Results of these laboratory tests are provided on the Log of Boring sheets.

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BORING NO.: 1
Sheet 1 of 1

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Tan CLAYEY GRAVEL	X		54						4				
			X		50				29		5	61	19	42	
5		5.0	X		57						3				
		Tan and Gray SANDY CLAY	X		24				56		9	48	16	32	
10			X		43						8				
15			X		34						11				
20		20.0	X		61						10				
		TEST BORING TERMINATED AT 20 FT													

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BORING NO.: 2
Sheet 1 of 1

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Brown and Reddish Brown CLAYEY SAND with calcareous deposits	X		10				42		15	54	18	36	
			X		6						18				
		3.0													
		Brown CLAYEY GRAVEL	X		14				25		8	48	17	31	
5															
		6.0													
		Reddish Brown CLAY with limestone fragments	X		53						8				
			X		70						7				
10															
			X		41						12				
15															
			X		50/ 6"						11				
20		20.0													
		TEST BORING TERMINATED AT 20 FT													

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BORING NO.: 3
Sheet 1 of 1

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Reddish Brown SANDY CLAY with clayey sand seams and layers	X		12						10				
			X		30						10				
5			X		38						7				
			X		19				64		12	59	20	39	
10			X		35						11				
15			X		50/5"				47		8	52	17	35	
20		- with shaly clay at 18' (20.0)	X		67						7				
		TEST BORING TERMINATED AT 20 FT													

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BORING NO.: 4

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
- On Rods (ft): NONE
- After Drilling (ft): DRY
- After ___ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Red CLAY with gravel			11						6				
					18				78		7	44	18	26	
5		5.0			26						7				
		TEST BORING TERMINATED AT 5 FT													
10															
15															
20															

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BORING NO.: 5
Sheet 1 of 1

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Red SANDY CLAY with gravel	X		11				63		4	42	17	25	
			X		25						6				
			X		21						7				
5		5.0													
		TEST BORING TERMINATED AT 5 FT													
10															
15															
20															

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BORING NO.: 6
Sheet 1 of 1

PROJECT NO.: W232256

Client: Jacob & Martin, LLC - Abilene
Project: Fire Station #9
Start Date: 8/16/2023 **End Date:** 8/16/2023
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Abilene, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in):

GROUND WATER OBSERVATIONS
On Rods (ft): NONE
After Drilling (ft): DRY
After ___ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft, in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	UU Shear Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Swell, %
		Red SANDY CLAY with gravel	X		7						9				
			X		15				50		8	52	18	34	
5		5.0	X		26						10				
		TEST BORING TERMINATED AT 5 FT													
10															
15															
20															

ALPHA TESTING
WHERE IT ALL BEGINS

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

SOIL & ROCK SYMBOLS

- (CH), High Plasticity CLAY
- (CL), Low Plasticity CLAY
- (SC), CLAYEY SAND
- (SP), Poorly Graded SAND
- (SW), Well Graded SAND
- (SM), SILTY SAND
- (ML), SILT
- (MH), Elastic SILT
- LIMESTONE
- SHALE / MARL
- SANDSTONE
- (GP), Poorly Graded GRAVEL
- (GW), Well Graded GRAVEL
- (GC), CLAYEY GRAVEL
- (GM), SILTY GRAVEL
- (OL), ORGANIC SILT
- (OH), ORGANIC CLAY
- FILL

SAMPLING SYMBOLS

- SHELBY TUBE (3" OD except where noted otherwise)
- SPLIT SPOON (2" OD except where noted otherwise)
- AUGER SAMPLE
- TEXAS CONE PENETRATION
- ROCK CORE (2" ID except where noted otherwise)

RELATIVE DENSITY OF COHESIONLESS SOILS (blows/ft)

VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

SHEAR STRENGTH OF COHESIVE SOILS (tsf)

VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
FIRM	0.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

RELATIVE DEGREE OF PLASTICITY (PI)

LOW	4 TO 15
MEDIUM	16 TO 25
HIGH	26 TO 35
VERY HIGH	OVER 35

RELATIVE PROPORTIONS (%)

TRACE	1 TO 10
LITTLE	11 TO 20
SOME	21 TO 35
AND	36 TO 50

PARTICLE SIZE IDENTIFICATION (DIAMETER)

BOULDERS	8.0" OR LARGER
COBBLES	3.0" TO 8.0"
COARSE GRAVEL	0.75" TO 3.0"
FINE GRAVEL	5.0 mm TO 3.0"
COURSE SAND	2.0 mm TO 5.0 mm
MEDIUM SAND	0.4 mm TO 5.0 mm
FINE SAND	0.07 mm TO 0.4 mm
SILT	0.002 mm TO 0.07 mm
CLAY	LESS THAN 0.002 mm