
MEG GEOTECHNICAL ENGINEERING REPORT

**PROPOSED
CAMP BOW WOW**

NEW BRAUNFELS, COMAL COUNTY, TEXAS



**Geotechnical Engineering • Construction Materials Engineering &
Testing Environmental • Consulting • Forensics**

**GEOTECHNICAL ENGINEERING REPORT
Foundation and Pavement Recommendations
Proposed Camp Bow Wow
New Braunfels, Comal County, Texas**

**Prepared For
Mr. Frank Wetegrove,
Weta-Dawgs New Braunfels**

MEG Report No. 07-26-29114

July 2, 2026



July 2, 2026

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**Subject: Geotechnical Engineering Report
MEG Report No. 07-26-29114
Foundation and Pavement Recommendations
Proposed Camp Bow Wow
New Braunfels, Comal County, Texas**

Dear Mr. Wetegrove, :

Millennium Engineers Group, Inc. is pleased to submit the enclosed geotechnical engineering report that was prepared for the above subject project. This report addresses the procedures and findings of our geotechnical engineering study. Our recommendations should be incorporated into the design and construction documents for the proposed development.

We want to emphasize the importance that all our recommendations presented in this report and/or addendums to this report be followed. We look forward to continuing our involvement in the project by providing construction monitoring in accordance with the report recommendations and materials testing services during construction. We strongly recommend that we be a part of the preconstruction meeting to address any specific issues that are pertinent to this project.

Thank you for the opportunity to be of service to you in this phase of the project and we would like the opportunity to assist you in the upcoming phases of the project. If you have any questions, please contact our office at the address, telephone, fax or electronic address listed below.



Amos Emerson, P.E.
Geotechnical Department Manager



Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913



Quyet Thang Pham, Ph.D., P.E.
Geotechnical Engineer

*The seal appearing on this document was authorized by Quyet Thang Pham, P.E. 131836 on July 2, 2026.
Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act*

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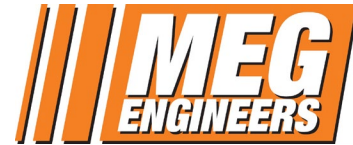
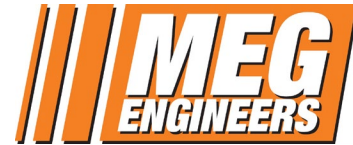
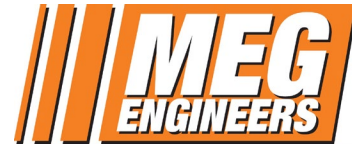


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1.0 INTRODUCTION

Millennium Engineers Group, Inc. (MEG) has completed and is pleased to submit this document that presents our findings as a result of a geotechnical engineering study of this project to our client. The project site is located at 1450 N Business Interstate Hwy 35, New Braunfels, TX 78130, USA approximately at Latitude: 29.707231, Longitude: -98.092784. The project location is shown on the Project Location Map, found in the Appendix section of this report. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendation, for foundation design and construction considerations.

Our scope of services for the project was outlined in MEG proposal No. 07-26-124G, dated May 5, 2026 and approved by Mr. Frank Wetegrove, on May 8, 2026.

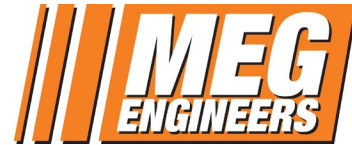
2.0 PROJECT DESCRIPTION

It is our understanding that the proposed Camp Bow Wow will accommodate the construction of a new parking area, and proposed building. It is also our understanding that the proposed construction for the approximately 14,000 square foot proposed building is proposed to be a one story structure. The site construction for the proposed structure is anticipated to be on a slab-on-grade or on-fill foundation provided expansive, soil-related movements will not impair the performance of the structure.

The site will also accommodate the construction of either a rigid or flexible pavement that will serve for light duty and/or heavy-duty traffic. Both flexible and rigid pavement types are viable and the selection on the type to be used will depend on the specific needs and criteria of this project site.

3.0 SCOPE AND LIMITATIONS OF STUDY

This engineering report has been prepared in accordance with accepted geotechnical engineering practices currently exercised by geotechnical engineers in this area. No warranty, expressed or implied, is made or intended. This report is intended for the exclusive use by the client and client's authorized project team for use in preparing design and construction documents for this project only. This report may only be reproduced in its entirety for inclusion in construction documents. This report in its entirety shall not be reproduced or used for any other purposes without the written consent of our firm. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.



The recommendations presented in this report are based on data obtained from the soil borings drilled at this site and our understanding of the project information provided to us by our client and other project team members, and the assumption that site grading will result in only minor changes in the existing topography. Subsurface soil conditions have been observed and interpreted at the boring locations only.

This report may not reflect the actual variations of the subsurface conditions across the subject site. It is important to understand that variations may occur due to real geologic conditions or previous uses of the site. The nature and extent of variations across the subject site may not become evident until specific design locations are identified and/or construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time during the design phase and/or construction phase, we should be notified immediately to determine if our opinions, conclusions and recommendations need to be reevaluated. It may be necessary to perform additional field and laboratory tests and engineering analyses to establish the engineering impact of such variations. These services are additional and are not a part of our project scope.

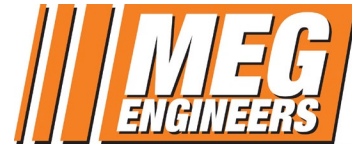
The engineering report was conducted for the proposed project site described in this report. The conclusions and recommendations contained in this report are not valid for any other project sites. If the project information described in this report is incorrect, is altered, or if new information becomes available, we should be retained to review and modify our recommendations. These services are additional and are not a part of our project scope.

Our scope of services was limited to the proposed work described in this report, and did not address other items or areas. The scope of our geotechnical engineering study does not include environmental assessment of the air, soil, rock or water conditions on or adjacent to the site. No environmental opinions are presented in this report. If the client is concerned with environmental risk at this project site, the client should perform an environmental site assessment.

If final grade elevations are significantly different from existing grades at the time of our field activities (more than plus or minus one (1) foot), our office should be informed about these changes. If desired, we will reexamine our analyses and make supplemental recommendations.

4.0 FIELD EXPLORATION PROCEDURES

Subsurface conditions at the subject site were evaluated by two (2) 5-foot soil borings for the parking area, and three (3) 20-foot soil borings for the proposed building. The Borings were drilled at the locations shown on the Borings Location Map, found in the Appendix section of this report. This location is approximate and distances were measured using a measuring wheel, tape, angles, and/or pacing from existing references. The structural soil borings were drilled in general accordance with American Society of Testing Materials (ASTM) D 420



procedures.

As part of our sampling procedures, the samples were collected in general conformance with ASTM D 1586 procedures. Representative portions of the samples were sealed in containers to reduce moisture loss, identified, packaged, and transported to our laboratory for subsequent testing. In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff. The geotechnical engineering properties of the strata were evaluated by a series of laboratory tests. The results of the laboratory and field-testing are tabulated on the boring logs and Summary of Soil Sample Analyses which are found in the Attachments section of this report.

Standard penetration test results are noted on the boring logs as blows per 12 inches of penetration. Three 6 inch increments are performed for each standard penetration test. The sum of the blows for the final two 6 inch increments is considered the "standard penetration resistance value" or "N-value." Where hard or very dense materials were encountered, the tests are terminated as follows: (1) when a total of 50 blows have been applied in any of the 6 inch increments, or (2) when a total of 100 blows have been applied, or (3) when there is no observed advance of the sampler in the application of 10 successive blows. The boring logs in the case of hard or very dense materials will be noted as follows: 50/3", where 50 is the number of blows applied in 3 inches of penetration, or 100/7½" where 100 is the number of blows applied in a total of 7 ½ inches of penetration, or 10/0", where 10 is the number of blows applied in 0 inches of penetration.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the Client.

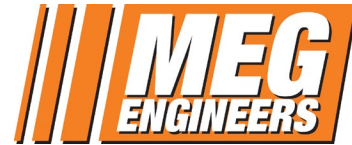
5.0 GENERAL SITE CONDITIONS

5.1 Site Description

The project site is located at 1450 N Business Interstate Hwy 35, New Braunfels, TX 78130, USA approximately at Latitude: 29.707231, Longitude: -98.092784. The project location is shown on the Project Location Map, found in the Appendix section of this report. At the time of our field operations, the subject site can be described as an undeveloped tract of land. The general topography of the site is relatively flat sloping down to the west with a visually estimated vertical relief of less than two (2) feet. Surface drainage is visually estimated to be good.

5.2 Subsurface Conditions

On the basis of our borings, two (2) generalized strata that possess similar physical and engineering characteristics can describe the subsurface stratigraphy at this site. Table 5.1



Approximate Subsurface Stratigraphy Depths summarizes the approximate strata range in our boring logs. These were prepared by visual classification and were aided by laboratory analyses of selected soil samples. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual details for each of the borings can be found on the boring logs in the appendix of this report.

Table 5.1 Approximate Subsurface Stratigraphy Depths

Stratum	Range in Depth, ft	Stratum Description
1	0.0 - 4.0	sandy fat CLAY to fat CLAY, brown, dry, med. stiff to hard
2	4.0 - 20.0	lean CLAY with sand to clayey SAND, brown, dry, hard to cemented

5.3 Groundwater Conditions

The dry auger drilling technique was used to complete the soil borings in an attempt to observe the presence of subsurface water. During our drilling operations we did not encounter the groundwater table below natural ground elevation for short term conditions. Table 5.2 Groundwater and Cave-In Depths summarize the approximate groundwater and cave in depths measured in our explorations. It should be noted that the groundwater level measurements recorded are accurate only for the specific dates on which measurement were obtained and does not show fluctuations throughout the year.

Fluctuations in Groundwater levels are influenced by variations in rainfall and surface water run-off from season to season. The construction process itself may also cause variations in the groundwater level. If the subsurface water elevation is critical to the construction process the contractor should check the subsurface water conditions just prior to construction excavation activities.



Table 5.2 Groundwater and Cave-In Depths

Boring No.	Depth to Subsurface Water, (Ft)	Depth to Cave-In, (Ft)
	Time of Drilling	Time of Drilling
B1	None	None
B2	None	None
B3	None	None
P1	None	None
P2	None	None

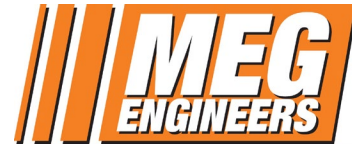
Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage may not be encountered during site earthwork activities. If groundwater seepage is encountered during site earthwork activities, it may be controlled using temporary earthen berms and/or conventional sump-and-pump dewatering methods.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

6.1 General

The analysis and recommendations presented in this report are applicable specifically to the proposed foundation structure. The data gathered from both the field and laboratory testing programs on soil samples obtained from the borings was utilized to establish geotechnical engineering parameters to develop recommendations for the proposed structure. The foundation system(s) considered in this report to provide support for the proposed structure must meet two independent criteria. One of the criteria is that the movement below the foundation structure due to compression (consolidation) or expansion (swell) of the underlying soils must be within tolerable limits. This criterion is addressed in the Soil Related Movements section of this report. The other criterion is that the dead and live loads must be distributed appropriately and the foundation structure designed with an acceptable factor of safety to minimize the potential for bearing capacity failure of the underlying soils.

Geotechnical and structural engineers in this general area consider soil movements or Potential Vertical Rise (PVR) of approximately one (1) inch or less to be within acceptable structural design tolerances for most structures but may be different depending on structure use and the desired performance of the foundation. Therefore, movements of the underlying soils are not eliminated and thus one should expect a slab foundation structure to exhibit differential vertical movements. However, structural engineers design slab foundations for the expected magnitude of soil movements without failure of the structure. More stringent soil movement criteria may be established but the owner should consider the exponential increase in cost required to design and construct a structure for such soil movements. Data obtained in this study indicate that the soils at this site have strength characteristics capable



of supporting the foundation and structure if designed appropriately. Stratum one (1) is composed of sandy fat CLAY to fat CLAY and has a high potential to exhibit volumetric changes (contraction and expansion). Stratum two (2) is composed of lean CLAY with sand to clayey SAND and has a moderate potential to exhibit volumetric changes. The potential for soil volumetric changes is dependent on variations in moisture contents of the underlying soils. Based on this data, this site is suitable for a slab foundation provided the subgrade is modified in accordance with the recommendations established in this report to reduce the potential for these soil volumetric changes.

6.2 Soil-Related Movements

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab foundation construction using the Texas Department of Transportation (TxDOT) procedures of test method TEX-124-E for determining Potential Vertical Rise (PVR). A PVR value of two (2) inches was estimated for the stratigraphic conditions encountered in our subsurface borings. A surcharge of 1 pound per square inch for the concrete slab, an active zone of 15 feet, and dry subsurface moisture conditions were assumed in estimating the above PVR values.

The following methods are generally acceptable for use in modifying the subgrade to reduce the potential for soil movements and volumetric changes below the foundation structure.

- Excavate expansive clay soils and replace with select fill.
- Chemical injection of expansive clay soils
- A combination of methods 1 and 2.

The method to be used is dependent on specific site conditions. At this site the grade will most likely need to be raised to obtain the proposed Finished Floor Elevation (FFE). As of the date of this report the CLIENT/OWNER has not provided the proposed FFE. We recommend that the project civil engineer evaluate the proposed FFE with our recommendations to ensure that the subgrade modifications presented in the report are not diminished or compromised. Adding select fill is generally the most cost effective method for reducing the potential for soil related movements. Therefore, we only discuss this method in this report but we can provide details for the other methods if requested.

Based on the data obtained, the assumed FFE of one and a half (1 1/2) feet above natural ground elevation, information provided by our client and our analysis of the site, we recommend the following modification (Table 6.1 Subgrade Modifications) of the subgrade at this area to accomplished finish floor elevation of the subgrade at this site. This method will maintain the potential for soil related movements to an approximate PVR value of less than one (1) inch, which is generally desired for projects of this type.

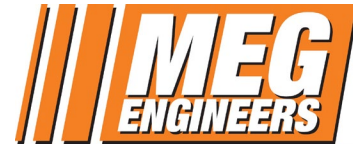


Table 6.1 Subgrade Modifications

Item	Description
Item 1	See and adhere to the Site Preparation Recommendations section of this report.
Item 2	Excavate existing soils to a depth of three (3) feet below natural ground elevation in accordance with the Site Preparation Recommendations section of this report.
Item 3	Condition and compact twelve (12) inches of subgrade below excavated soils in accordance with the Site Preparation Recommendations section of this report.
Item 4	Place select fill, (a minimum of one (1) foot above natural ground, for a total of four (4) feet select fill) condition and compact up to the proposed FFE in accordance with the Select Fill Recommendations section of this report.

The PVR method of estimating expansive, soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive, soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analyses of expansive, soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the calculated PVR values as a result of isolated changes in moisture content (such as leaks, landscape watering, etc.) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching and/or excavations.

6.3 Conventional Shallow Slab-on-Grade Foundation Design Criteria

As indicated previously a slab foundation may be used at this site in conjunction with the subgrade modifications listed under the Soils Related Movements section. We recommend the following soil bearing pressures, and dimensional criteria for the slab grade beams. These recommendations ensure proper utilization of soil bearing capacity of continuous beam sections in the slab-on-grade foundation and reduce the potential of water migration from the outside to beneath the slab foundation. For structural considerations the beams may need to be greater and should be evaluated and designed by the structural engineer. Where concentrated load areas are present the grade beams or slab may be thickened and widened to serve as spread footings. Soil bearing pressures and beam dimensional criteria are as follows:

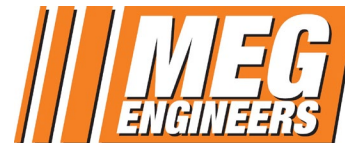


Table 6.2 Bearing Criteria

Grade Beams and Continuous Footings	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	30 inches
Maximum allowable bearing pressure:	1800 (PSF)
Spread Footings (square)	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	60 inches
Maximum allowable bearing pressure:	2100 (PSF)

The above-presented maximum allowable bearing pressures will provide a factor of safety of 3 with respect to the design soil strengths. For a slab foundation structure designed and constructed in accordance with the recommendations of this report, it is anticipated that total settlements will be in the order of one (1) inch or less. If lower anticipated total settlements are required for this project further mitigation may be required and MEG must be consulted for further recommendations.

Furthermore, the above design parameters are contingent upon the fill materials (if utilized) being selected and placed in accordance with the recommendations presented in the Select Fill Recommendations section of this report. Should select fill selection and placement differ from the recommendations presented herein, MEG should be informed of the deviations in order to reevaluate our recommendations and design criteria.

Excavations for slab on grade and spread footing foundations should be performed relatively clean and with an undisturbed bearing area. The bottom 6 inches of the excavation should be performed using a flat plate excavation bucket. The excavations should be neatly excavated. No foreign debris or disturbed soil should be left in the footing bottom. Should there be any abundance of foreign debris or disturbed soil found, it may be necessary to re-assess the fill site of its bearing capacity suitability. If the bearing area is found to be disturbed, the bearing area will require preparation and compaction for the entire depth of the disturbance in accordance with the Site Preparation and/or the Select Fill sections of this report.

The bearing surface of the grade beams and spread footings should be evaluated after excavation and immediately prior to concrete placement. We recommend that footing inspections be performed by a representative of MEG. The required inspections shall include inspecting for clean, dry (The moisture content should be within limits specified by the appropriate section in this report.) and undisturbed footing bottom, depth of footing, clearances from sides and size and spacing of reinforcing steel. Test results shall comply



with the recommendations of this geotechnical report and shall be verified by an on-site representative of MEG.

Over excavation, if necessary, for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over excavation depth below footing base elevation. The over excavation should then be backfilled up to the footing base elevation select fill placed in lifts of 8 inches or less in loose thickness and prepared and compacted in accordance with the Site Preparation and/or the Select Fill sections of this report. Equipment should not be operated and materials should not be placed or stockpiled within a horizontal distance equal to the excavation depth from the edge of the excavation. Excavations should not be placed next to existing structures or buried utilities/structures closer than a horizontal distance equal to the excavation depth unless some form of protection for the facilities is provided.

Water should not be allowed to accumulate at the bottom of the foundation excavation. Proper barriers such as berms or swales should be placed to divert any surface runoff away from excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed, properly prepared and cleaned. Excavations should not be left open overnight.

6.4 BRAB Design Criteria for Slab-on-Grade Foundations

Table 6.3 BRAB Values list the values for criteria developed by the Building Research Advisory Board (BRAB) for the design of shallow slab-on-grade foundations. On the basis of stratigraphy encountered and the anticipated site modifications discussed earlier, the design criteria are as follows:

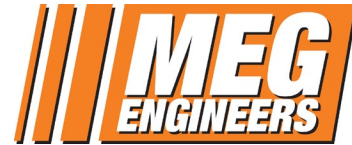
Table 6.3 BRAB Values

	Climatic Rating	Effective PI	Soil Support Index
Existing Conditions	15.0	28.0	0.85
Proposed Conditions	15.0	25.0	0.89

7.0 CONSIDERATIONS DURING CONSTRUCTION

7.1 Site Grading Recommendations

Site grading plans can result in changes in almost all aspects of foundation recommendations. We have prepared the foundation recommendations based on the existing ground surface; there is a two (2) foot surcharge addition for the stratigraphic conditions encountered at the time of our study. If site grading plans differ from existing



grades by more than plus or minus 1 foot, we must be retained to review the site grading plans prior to bidding the project for construction. This will enable us to provide input for any changes in our original recommendations that may be required as a result of site grading operations or other considerations.

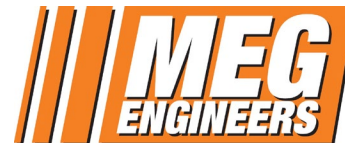
7.2 Site Drainage Recommendations

Drainage is one of the most important aspects to be addressed to ensure the successful performance of any foundation. Positive surface drainage should be implemented prior to, during and maintained after construction to prevent water ponding at or adjacent to the building facilities. It is recommended that the building and site design include rain gutters, downspouts and concrete gutters to channel runoff to paving or storm drains.

7.3 Site Preparation Recommendations

Building areas and all areas supporting select fill should be stripped of all vegetation and organic topsoil up to a minimum of 5 ft. beyond the building perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-structural areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least five (5) feet beyond the limits of the planned building perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted select fill in accordance with the recommendations presented under the Select Fill Recommendations section of this report. Proof rolling operations and any excavation/backfill activities should be observed by MEG representatives to document subgrade preparation.

Prior to fill placement, the exposed subgrade shall be prepared based on what option is selected from the foundation and pavement recommendations. The exposed subgrade should be prepared, moisture-conditioned by scarifying to a minimum depth as recommended in the foundation and pavement recommendations and recompacting to a minimum ninety-eight (98) percent of the maximum dry density as determined in accordance with ASTM D 698, moisture-density relationship. The moisture content of the subgrade should be maintained within the range of zero (0) percentage points below optimum to plus four (4) percentage points above the optimum moisture content until the fill is permanently covered. The soil should be properly compacted in accordance with these recommendations and tested by MEG personnel for compaction as specified.



7.4 Select Fill Recommendations

Materials used for select fill shall meet the following requirements:

1. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base; Type A, Grades 1 through 3.
2. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Types B or C, Grades 1 through 5 with a minimum plasticity index of 7.
3. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Type E, Grade 4 with a plasticity index between and inclusive of 7 and 15. Type E material shall be defined as Caliche (argillaceous limestone, calcareous or calcareous clay particles) and may contain stone, conglomerate, gravel, sand or granular materials when these materials are in situ with the caliche. Flexible Base (Type E, Grade 4) shall conform to the following requirements:

Table 7.1 Type E, Grade 4 Requirements

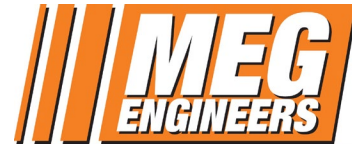
Retained on Sq. Sieve	Percent Retained
2"	0
1/2"	20-60
No. 4	40-75
No. 40	70-90
Max. PI:	15
Max. Wet Ball PI:	15
Wet Ball Mill Max Amount:	50
Wet Ball Increase, Max Passing No. 40 sieve	20

4. Soils classified according to USCS as SM, SC, GM, GC, CL, ML and combinations of these soils. The soils shall be relatively free of organic matter. In addition to the USCS classification, select materials shall have a liquid limit of less than 40 and a plasticity index between and inclusive of 10 and 17.
5. Soils classified, as CH, MH, OH, OL and PT, under the USCS are not considered suitable for use as select fill materials at this site.

Select fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum ninety-eight (98) percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of minus two (-2) percentage points below optimum to plus two (2) percentage points above the optimum moisture content until the fill is permanently covered. The select fill should be properly compacted in accordance with these recommendations and tested by MEG personnel for compaction as specified.

7.5 Site Fill Recommendations

Site fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum ninety-eight (98) percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be



maintained within the range of zero (0) percentage points below optimum to plus four (4) percentage points above the optimum moisture content until the fill is permanently covered. The site fill should be properly compacted in accordance with these recommendations and tested by MEG personnel for compaction as specified.

7.6 Back Fill Recommendations

Back fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum ninety-eight (98) percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of zero (0) percentage points below optimum to plus four (4) percentage points above the optimum moisture content until the fill is permanently covered. The back fill should be properly compacted in accordance with these recommendations and tested by MEG personnel for compaction as specified.

7.7 Utility Considerations

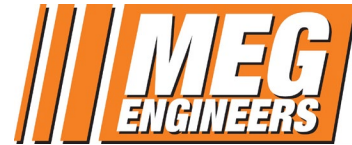
Utilities that project through the slab-on-grade, slab-on-fill, floating floor slabs, or any other rigid unit should be designed with some degree of flexibility or with sleeves. Such features will help reduce the risk of damage to utility facilities from soil movements related to shrinkage and expansion.

7.8 Utility Trench Recommendations

Bedding and initial backfill are buried around utility lines to support and protect the utility. The secondary backfill above the initial backfill also helps protect and support the foundation and/or pavement above. To ensure that settlement is not excessive in this secondary backfill we recommend the following:

Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base; Type A, Grades 1 through 3.

Place, moisture condition and compact the secondary backfill in accordance with the pertinent project requirements. Within the footprint of a building pad the secondary backfill should meet the same compaction requirements for select fill. Within the footprint of a pavement structure the secondary backfill should meet the same compaction requirements for the subgrade. When compaction of the subgrade is not specified it should meet the same compaction level of the adjacent natural ground. An alternative to compaction of secondary backfill is the use of flowable fill where secondary backfill is to be placed. If properly designed, the flowable fill can be excavated easily at a later date if necessary. No compaction and no testing is required when properly designed flowable fill is used.



7.9 Excavation, Sloping and Benching Considerations

If trenches are to extend to or below a depth of five (5) ft., the contractor or persons doing the trenching should adhere to the current Occupational Health and Safety Administration (OSHA) guidelines on trench excavation safety and protection measures. Other industry standards may be applicable. The collection of specific geotechnical data and development of a plan for trench safety, sloping, benching or various types of temporary shoring, is beyond the scope of this study.

7.10 Shallow Foundation Excavation Considerations

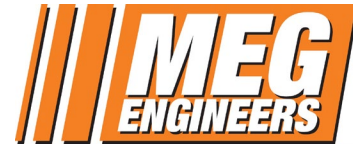
The Geotechnical Engineer or his representative prior to the placement of reinforcing steel and concrete should observe shallow foundation excavations. This is necessary to verify that the bearing soils at the bottom of the excavations are similar to those encountered during the subsurface soil exploration phase and that excessive loose materials and water are not present in the excavations. If soft pockets of soil are encountered in the foundation excavations, they should be removed and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevation.

7.11 Landscaping Considerations

Even though landscaping is a vital aesthetic component of any project, the owner, client and design team should be aware that placing trees or large bushes adjacent to any structure may distress the structure in the future. It is recommended that if any landscaping is to be placed adjacent to the structure in this project, it should be limited to small plants and shrubs. Trees and large bushes should be placed at a distance such that at their mature height, their canopy or "drip line" does not extend over the structures. The owner, client and design team should also be aware that if any watering is to be done in connection with the landscaping for this project it should be controlled, consistent and timely. Excessive or prolonged watering is not recommended. If watering is part of the landscaping plan, termination of watering for any extended period of time may also be detrimental to the structure. It is important that the moisture level in the subsurface soils remain constant so that shrinking and swelling of soils may be mitigated.

7.12 Perimeter Foundation Cap

We recommend that a cap of impervious fill be placed around the perimeter of the foundation to mitigate the intrusion of moisture into the soils surrounding the foundation. The top eighteen inches of fill around the foundation structure should be a low permeance clay cap to keep surface water away from the foundation. The low permeance clay cap should be sloped away from the foundation at a minimum slope of 2% and the surrounding areas should have positive drainage. The low permeance clay shall meet the USCS classification of CL and meeting the requirements in Table 7.2 Gradation Requirements and Table 7.3 Atterberg Limits Requirements. The low permeance clay shall be compacted to minimum of 95 percent



of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the subgrade should be maintained within the range of optimum to four (4) percentage points above the optimum moisture. If plantings are intended, add 4 to 6 inches of loam on top of the clay cap.

Table 7.2 Gradation Requirements

Sieve Size	Percent Passing(by dry weight)
1/2 inch	100
No 4	70-100
No. 200	50-100

Table 7.3 Atterberg Limits Requirements

Test / ASTM	Requirement
Atterberg Limits D4318	LL ≤ 45 20 ≤ PI ≤ 30

8.0 PAVEMENT SECTIONS RECOMMENDATIONS

8.1 General Information

The study was also performed to determine recommendations for the construction of a flexible pavement and these recommendations are presented in this report. The pavement recommendations are limited to samples taken from the existing soils within the roadway areas present at the site. The pavement design implemented for this project should be evaluated the civil engineer based on a traffic and design analysis for this project.

Recommendations for both flexible and rigid pavements are presented in this report for further evaluation by the project civil engineer. Both pavement types are viable and the selection of the type to be used will depend on the specific needs and criteria of this project site. Generally, flexible pavements have a lower initial construction cost when compared to rigid pavements. On the other hand a rigid pavement has lower maintenance cost throughout the life of the pavement structure as compared to flexible pavements. Flexible pavements generally require more frequent repairs and overlays at intervals from 6 to 10 years to meet the structural and functional requirements of the pavement during the design life. All pavements are very dependent on the condition of the soil platform on which they are supported and thus moisture conditions will play an important role in the performance of the pavement during its structure life. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.



After proof rolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the Site Preparation section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

8.2 Sulfate Content of Existing Soils

Sulfate testing was performed in accordance with TxDOT Tex-145-E as indicated below. A summary of these results are as follows:

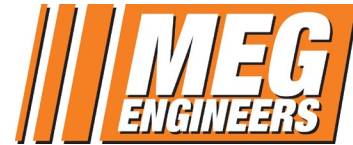
Table 8.1 Sulfate Content in Parts Per Million

Bore No.	Sample Start Depth, (ft)	Sample End Depth, (ft)	Sulfate Content, (PPM)
P1	0.5	2.0	20.0
P2	0.5	2.0	20.0

Below are listed general exposure levels of potential harm to concrete structures exposed to soils containing sulfates. These levels fall into three ranges based on Sulfate Concentration (SC) in the soil.

- Level 1 - Mild: SC < 3,000 ppm
- Level 2 - Moderate: 3,000 < SC < 8,000 ppm
- Level 3 - Severe: SC > 8,000 ppm

Laboratory test results indicate that the existing soils should be categorized as **Level 1** and contain a **mild** concentration of sulfates in the soils. Therefore, according to TxDOT policy, lime/cement treatment **may** be used for stabilization of the pavement subgrade for the levels indicated. We also want to point out that results obtained are only for the locations indicated. Sulfate concentrations may change significantly at other locations within the project site. We also want to point out that when the proposed grading requires excavation and/or fill of the site we recommend that additional testing be performed when the site has been brought to final grade at the subgrade level to determine sulfate concentration in the soils and determine appropriate subgrade stabilization. The civil engineer should evaluate the sulfate levels to appropriately make recommendations for mitigating sulfate and lime/cement reactions producing expansive by products. We recommend following the TxDOT policies for subgrade treatment for soils containing sulfates. These policies can be found on the TxDOT Construction Division website entitled "Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures" September 2005.



8.3 Soil Stabilization Recommendations

The plasticity index of the surface soils at this site is approximately forty (40) to forty-five (45) percent. The existing subgrade soils require lime stabilization to mitigate soil shrink and swell. We recommend the addition of five (5) percent lime by weight to the existing surface soils. We recommend that the existing soils be tested after the pavement areas have been excavated or filled to the top of the subgrade elevation to verify the soil stabilization requirements. The natural ground should then be prepared as stated in the Site Preparation Recommendations of the pavement section. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.

8.4 Design Methodology and Traffic Information

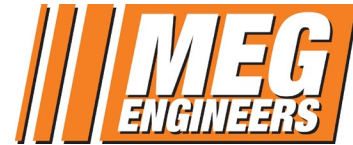
Our engineering analysis of the pavement type considered the information obtained from our soil borings, the field and laboratory testing, our past experience with similar soils and site conditions. Design of new pavements for the project has been based on the procedures outlined in the 1993 Guide for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO). The client did not provide projected ESALs. We recommend that the project Civil Engineer or a Traffic Engineer review the project for the appropriate traffic levels and design periods to ensure that they are appropriate and consistent with the specific project site requirements. The assumptions for traffic used in the pavement design analysis are as follows:

Table 8.2 Flexible Pavement Traffic Criteria Utilized

Criteria	Value
Reliability Level	80%
Standard Deviation	0.45
Initial Serviceability level	4.0
Terminal Serviceability level	2.0

Table 8.3 Rigid Pavement Traffic Criteria Utilized

Criteria	Value
Reliability Level	95%
Standard Deviation	0.35
Initial Serviceability level	4.0
Terminal Serviceability level	2.0



8.5 Recommended Pavement Sections

The proposed pavement section for entrances, drives and parking areas may be chosen from one of the following options in the tables below.

The selection process of the appropriate pavement option should consider the following:

- The client should consider the options presented as minimum pavement sections for the appropriate use and expected traffic levels. The civil engineer of record should evaluate the minimum pavement sections recommended with the appropriate class of pavement required for this project. The local government requirements should be met when they are more stringent than the minimum pavement sections recommended in our report.

Table 8.4 Flexible Pavement Options

Materials	Light Duty	Heavy Duty
Asphaltic Concrete (Inches)	2.0	3.0
Limestone (Inches)	6.0	8.0
Lime Treated Subgrade (Inches)	8.0	10.0

Light Duty Flexible Pavement option (ESALs = 40,000)

Heavy Duty Flexible Pavement option (ESALs = 285,000)

Table 8.5 Rigid Concrete Pavement Options

Materials	Light Duty	Heavy Duty
Reinforced Concrete Pavement (In)	6.0	8.0
Lime Treated Subgrade (In)	8.0	10.0

Light Duty Rigid Pavement option (ESALs = 40,000)

Heavy Duty Rigid Pavement option (ESALs = 285,000)

It is recommended that concrete pavements be reinforced. At a minimum, the reinforcing bars should be placed as follows:

Table 8.6 Longitudinal Drives and Entrances

Thickness (in)	Bar Size	Longitudinal Spacing (in)	Transverse Spacing (in)
<= 6.0	3.0	12.0	24.0
<= 8.0	5.0	11.0	22.0



Table 8.7 Parking Areas

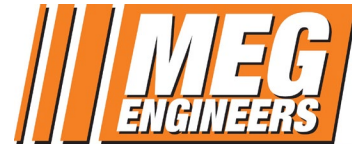
Thickness (in)	Bar Size	Longitudinal Spacing (in)	Transverse Spacing (in)
≤ 6.0	3.0	16.0	16.0
≤ 8.0	4.0	14.5	14.5

Longitudinal reinforcement should be placed at $\frac{1}{2}$ the slab depth $\pm \frac{1}{2}$ inch from the surface. At a longitudinal edge, the first two spacing's for longitudinal reinforcement shall be at $\frac{1}{2}$ the normal longitudinal spacing. At transverse construction joints, additional longitudinal reinforcement shall be placed at a spacing one half the normal longitudinal spacing for a length of 42 inches. At transverse joints, the first two spacing's for transverse reinforcement shall be at $\frac{1}{2}$ the normal transverse spacing. All reinforcement should be specified as deformed steel meeting the requirement of ASTM A-615 (Grade 60) or ASTM A-616 (Grade 60). Splices should be a minimum of 33 nominal bar diameters. Reinforcing should not extend across longitudinal and expansion joints. Dowels across longitudinal and expansion joints are recommended to be $\frac{7}{8}$ inch diameter, smooth bars with a length of 42 inches and spaced at a maximum 24 inches on center.

Longitudinal and transverse joints are recommended at a maximum spacing of 10 feet for pavements with a thickness of less than 6 inches and at a maximum spacing of 15 feet for pavements with a thickness of 6 inches or greater. The longitudinal and transverse joints should be formed or saw cut to a depth of $\frac{1}{3}$ of the slab depth for concrete containing siliceous coarse aggregate and $\frac{1}{4}$ of the slab depth for limestone aggregate. Sawing of joints should begin as soon as the concrete will not chip and ravel. It is recommended that longitudinal and expansion joints be doweled to promote load transfer. Expansion joint spacings are not to exceed a maximum of 75 feet and no expansion or contraction joints should be located within a swale or drainage collection area. Expansion joints are also needed to separate the concrete slab from fixed objects such as inlets, light standards and buildings.

It is recommended that the concrete pavement surface have a minimum slope of 0.015 ft/ft to provide adequate surface drainage. It is recommended that the concrete pavement should cure a minimum 7 days before allowing any traffic provided that adequate concrete strength has been attained as determined by the project Civil Engineer.

The curb shall be constructed in lengths equal to the adjoining pavement slab lengths, and expansion joints shall be provided in the curb opposite each transverse expansion joint in the pavement. Expansion joint material shall be of the same thickness, type and quality as specified for the pavement and shall be of the section as shown for the curb. All expansion joints shall be carried through the curb. Transverse contraction joints shall be sawed across the curb at the same time as sawing of the transverse contraction joints in the pavement are sawed. The curb shall be placed monolithically with the pavement for edge support and



reinforced with a minimum one (1) #5 rebar. A finish coat of mortar shall be applied on the exposed surfaces of monolithic curbs.

8.6 Garbage Dumpster Considerations

Within flexible pavement areas, it is recommended that reinforced concrete pads be provided in front of and beneath garbage dumpsters. Concrete paving is also recommended in areas where the dumpster trucks make turns with small radii to access the dumpsters. The pads should be a thickened concrete slab and reinforced similar to the concrete pavement recommendations or a minimum 10 inches thick.

9.0 PAVEMENT MATERIAL SPECIFICATIONS

9.1 Pavement Preparation Recommendations

Pavement areas should be stripped of all vegetation and organic topsoil up to a minimum of two (2) feet beyond the pavement perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-pavement areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least two (2) feet beyond the limits of the planned pavement perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted fill in accordance with the recommendations presented in TxDOT 2014 Specification Item 132 for density control and material requirements for Types A and B. If the fill is a clay it shall meet USCS Classification CL. Proof rolling operations and any excavation/backfill activities should be observed by MEG representatives to document subgrade preparation.

The exposed subgrade shall then be prepared based on what option is selected from the pavement recommendations. The soil should be worked in accordance with the recommendations and tested by MEG personnel for compaction as specified.

9.2 Hot Mix Asphaltic Concrete Surface

The asphaltic surface shall meet the requirements of the current TxDOT 2014 Specification Item 340 for Dense Graded Hot Mix Asphalt (small quantity) for projects with total production



of less than 5,000 tons and TxDOT 2014 Specifications Item 341 Dense Graded Hot Mix Asphalt for projects with total production of 5,000 tons or greater. The hot mix asphaltic surface will be compacted to between 3.0 and 8.5 percent in place air voids in conformance with the specification. It is recommended that the testing required by this specification be performed during production.

Table 9.1 Dense Grade Hot Mix Asphalt Additional Requirements

Test Procedure	Requirement
Target Design Laboratory Density, %	97.0 (for light duty areas)
	96.5 (for heavy duty areas)

9.3 Reinforced Concrete

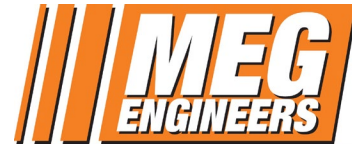
Concrete shall meet a minimum 28-day compressive strength of 3200 psi for light duty pavements and 4000 psi for medium and heavy duty pavements and a maximum water/cement ratio of 0.45. The concrete for concrete paving shall meet the requirements for Class P Concrete of TxDOT 2014 Specification Items 360 and 421. Aggregates used in the concrete design should meet the requirements of TxDOT 2014 Specification Item 421 or ASTM C33.

9.4 Limestone Base

The limestone base shall meet the requirements of TxDOT 2014 Specification Item 247 Type A, Grade 1 or 2. The flexible base shall be compacted to a minimum 98 percent of the maximum dry density as determined by the standard moisture density relation (ASTM D 698) at moisture contents ranging between minus two (-2) and plus two (+2) percentage points of the optimum moisture content. The base shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and not less than 5 ½ inches (4 inches compacted).

9.5 Lime Treated Subgrade

Lime stabilization of the soils may be used for soil shrink and swell mitigation and to increase the structural capacity of the subgrade as platform for the pavement. It is recommended that the subgrade plasticity index be verified after the site is stripped of the loose topsoil and the subgrade is exposed up to the subgrade elevation. Stabilization treatment of the subgrade soils may also be utilized to provide a platform for the base for resistance to moisture intrusion and changes. Prevention of moisture intrusion is extremely important to the life of a pavement. Increases in moisture content of the subgrade and the base will significantly reduce the material's structural ability to carry loads. The optimum lime content should reduce the PI of the soil to 20 or less and should result in a soil lime mixture with a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI. The lime should be blended with a mixing device such as a pulvermixer to produce a soil mixture passing water added and be allowed to cure for at least 48 hours. After curing the lime soil mixture it shall



pass the grading requirements of TxDOT 2014 Specification Item 260 and compacted to a minimum ninety-eight (98) percent of the maximum dry density determined in accordance with ASTM D 698 at moisture contents ranging from minus two (-2) percentage points below optimum to plus two (2) percentage points above optimum moisture content. If the in place gradation requirements can be achieved during the initial mixing, the remixing after the curing period can be eliminated. Please note that there is a relationship between the time of mixing of the lime and soils with the maximum dry density. Any mixture older than three (3) days will require determination of new moisture density relationships.

Portland cement may be considered instead of lime to treat the subgrade. See the cement treated subgrade section of this report.

10.0 OTHER CONSIDERATIONS

10.1 Drainage

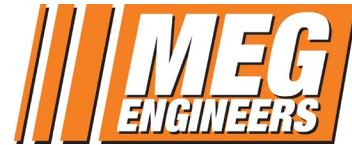
Adequate perimeter drainage is essential for long-term performance of any pavement structure. Infiltration of surface water from unpaved areas surrounding the pavement should be minimized. We do not recommend the placement of landscape beds on the paved areas. Such design features provide a potential for water to enter into the pavement section and the underlying soil subgrade. This is especially true with time in paved areas that have limited traffic and lead to accelerated asphalt oxidation and thus cracking. Water intrusion will result in the deterioration of the pavement materials with time as vehicular traffic passes over affected areas. Above grade planter boxes with drainage discharge onto the top of the pavement or directed into storm sewers should be considered if landscape features are to be used.

10.2 Curb & Gutters

Base material under curb and gutters and curbs shall be compacted to the same requirements as other areas. It is recommended that the base shall be placed below the curb & gutter and extended past the back of the curb & gutter a minimum of one and a half (1 ½) feet. The thickness of the base below the curb & gutter shall be the required pavement base thickness less six (6) inches. An adequate seal should be provided at all concrete- asphalt interfaces. It is recommended that a crack sealant compatible to both asphalt and concrete be used.

10.3 Maintenance

A maintenance plan is recommended for the long-term performance of the paved areas. Asphaltic pavements have a tendency to strip and become oxidized with exposure to the elements. Thus cracks may become present in the pavement. It is recommended that a



maintenance schedule of crack sealing, fog seals and overlays be used over the life of the pavement.

11.0 PROJECT REVIEW AND QUALITY CONTROL

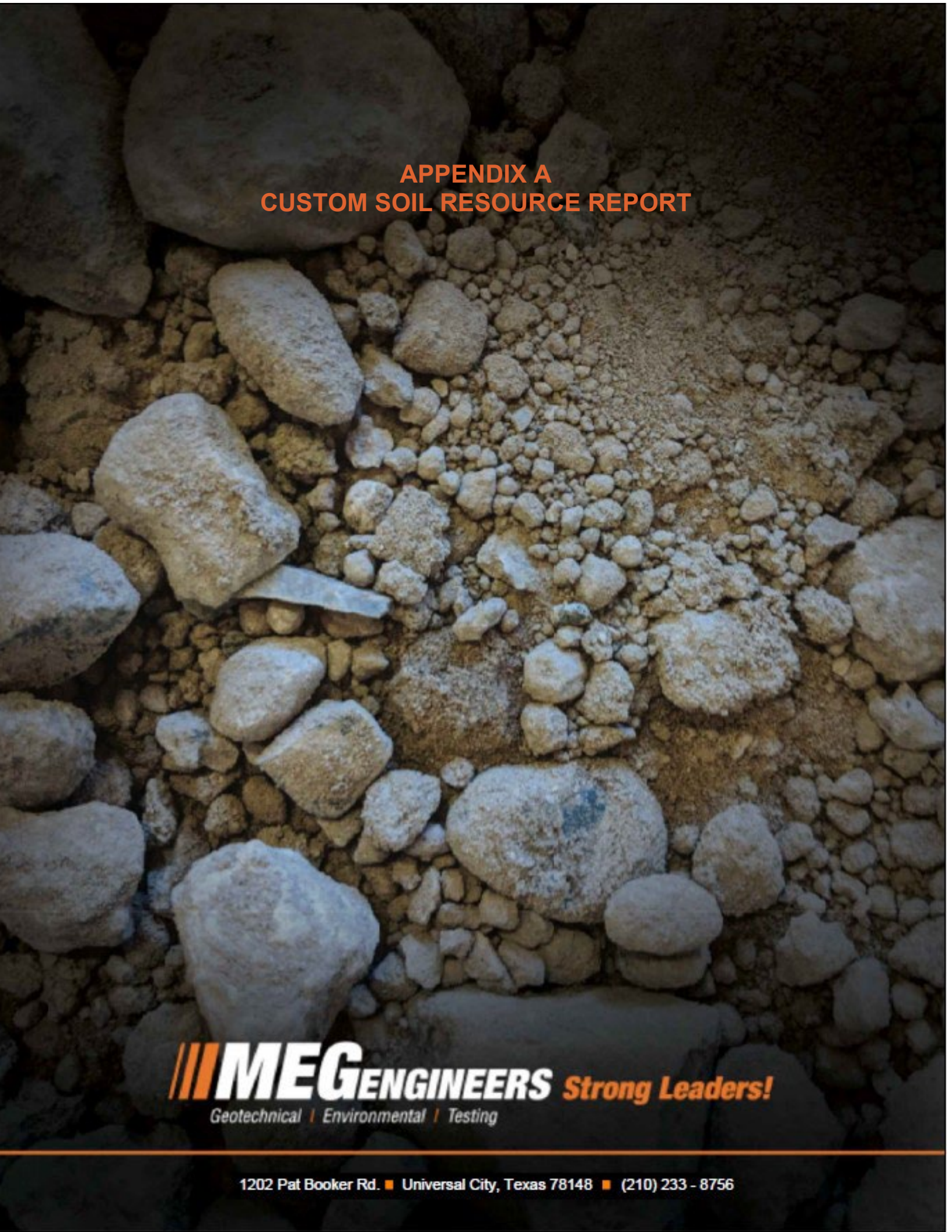
Each project site is unique and it is important that the appropriate design data, construction drawings, specifications, change orders and related documents be reviewed by the respective design and construction professionals participating in this project. The performance of foundations, construction building pads and/or parking areas for this project will depend on correct interpretation of our geotechnical engineering report and proper compliance of and adherence to our geotechnical recommendations and to the construction drawings and specifications.

It is important that MEG be provided the opportunity to review the final design and construction documents to check that our geotechnical recommendations are properly interpreted and incorporated in the design and construction documents. We cannot be responsible for misinterpretations of our geotechnical recommendations if we have not had the opportunity to review these documents. This review is an additional service and not part of our project scope.

MEG should be retained to provide construction materials testing and observation services during all phases of the construction process of this project. As the Geotechnical Engineer of Record, it is important to let our technical personnel provide these services to make certain that our recommendations are interpreted properly and to ensure that actual field conditions are those described in our geotechnical report. Since our personnel are familiar with this project, MEG's participation during the construction phase of this project would help mitigate any problems resulting from variations or anomalies in subsurface conditions, which are among the most prevalent on construction projects and often lead to delays, changes, costs overruns, and disputes. If the client does not follow all of our recommendations presented in this report and/or addendums to this report, the client assumes the responsibility and liability of such actions and will hold our firm harmless and without responsibility and liability for client's actions.

A construction testing frequency plan and budget needs to be developed for the required construction materials engineering and testing services for this project. Before construction, we recommend that MEG, the project design team members and the project general contractor meet and jointly develop the testing plan and budget, as well as review the testing specifications as it pertains to this project. A failure to implement a complete testing plan will negate the recommendations provided in this report.

MEG looks forward to the opportunity to provide continued support on this project.

The background of the entire page is a close-up photograph of soil and rocks. It shows a variety of rock sizes, from small pebbles to larger, smooth boulders, all in shades of tan and light brown. The soil is a fine, light-colored material filling the spaces between the rocks.

APPENDIX A CUSTOM SOIL RESOURCE REPORT

MEGENGINEERS *Strong Leaders!*
Geotechnical | Environmental | Testing

Soil Map—Comal and Hays Counties, Texas
(07-26-29114 - Camp Bow Wow)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Comal and Hays Counties, Texas

Survey Area Data: Version 22, Sep 5, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 16, 2023—Oct 18, 2023

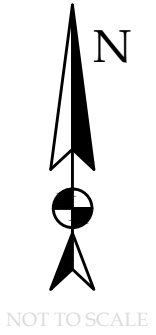
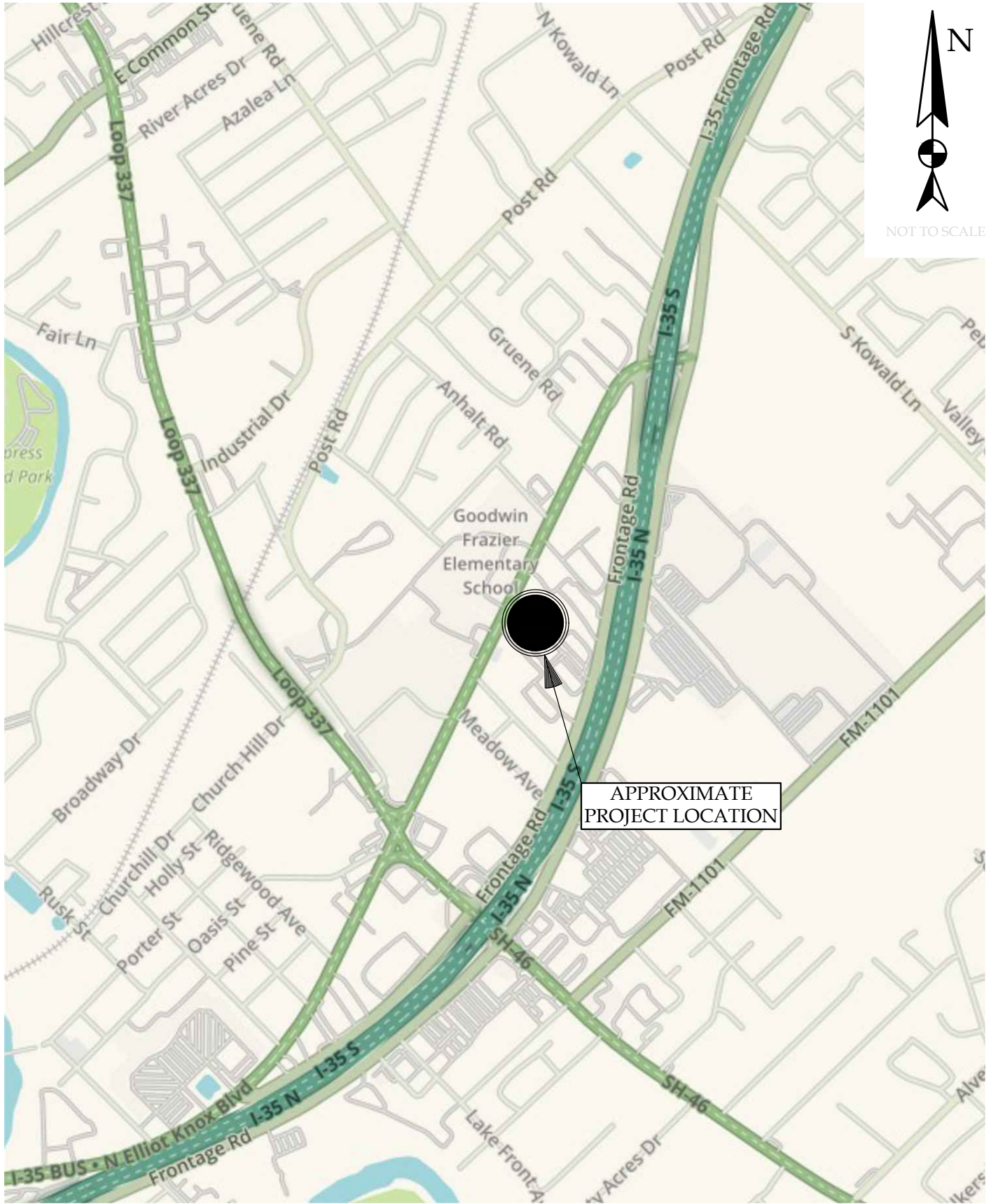
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KrA	Krum clay, 0 to 1 percent slopes	2.1	100.0%
Totals for Area of Interest		2.1	100.0%

APPENDIX B
PROJECT LOCATION, TOPOGRAPHIC AND BOREHOLE
LOCATION MAPS

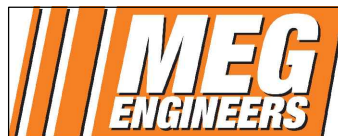
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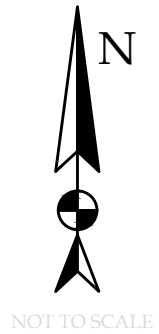
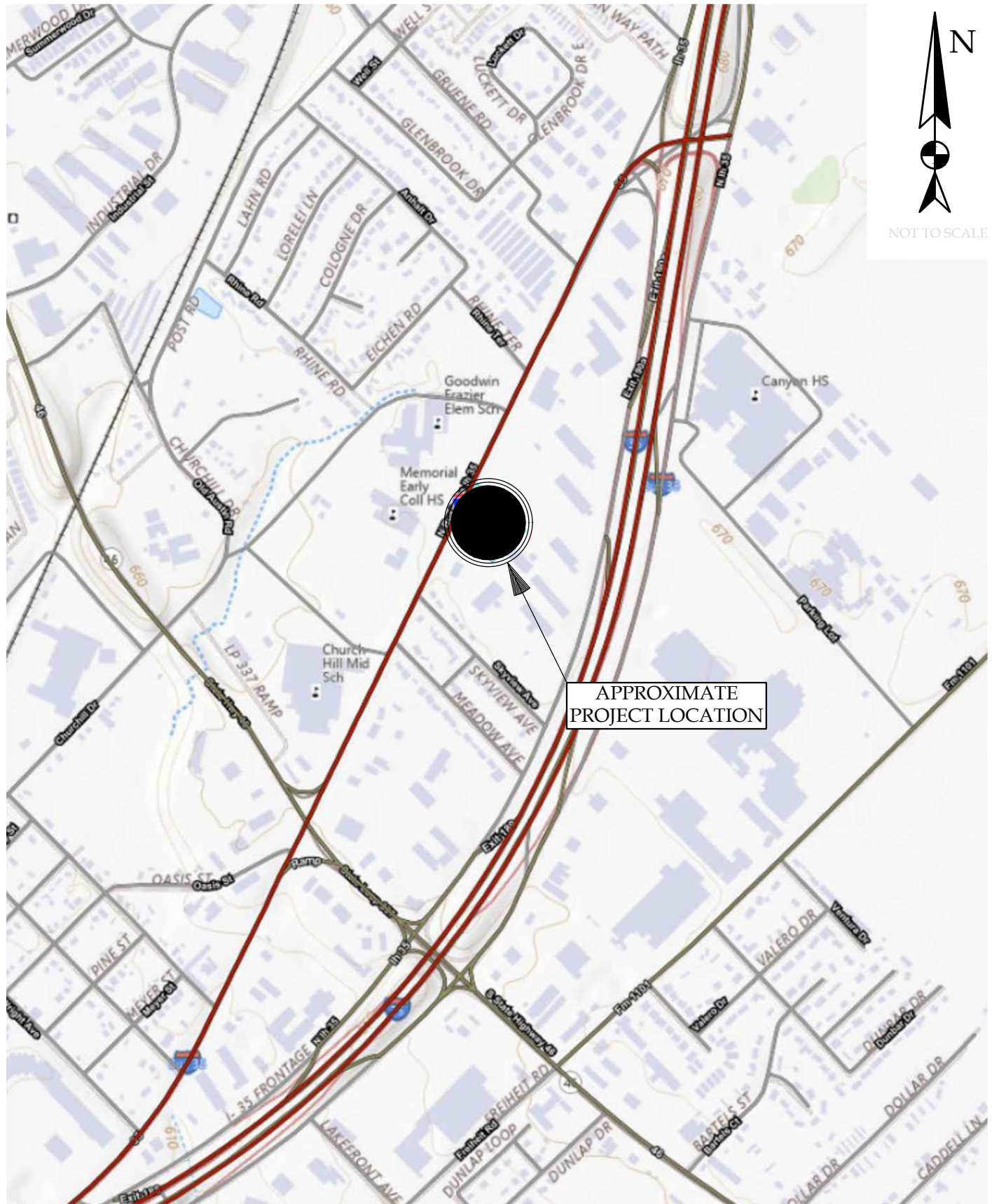
PROJECT SITE LOCATION MAP

PROPOSED
CAMP BOW WOW

NEW BRAUNFELS, COMAL COUNTY, TEXAS



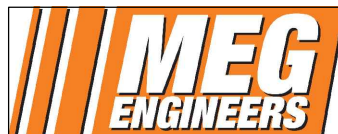
MILLENNIUM ENGINEERS GROUP, INC.
1202 PAT BOOKER ROAD
UNIVERSAL CITY, TEXAS 78148
WWW.MEGENGINEERS.COM
TEL: 512-729-0400
FAX: 512-729-0401



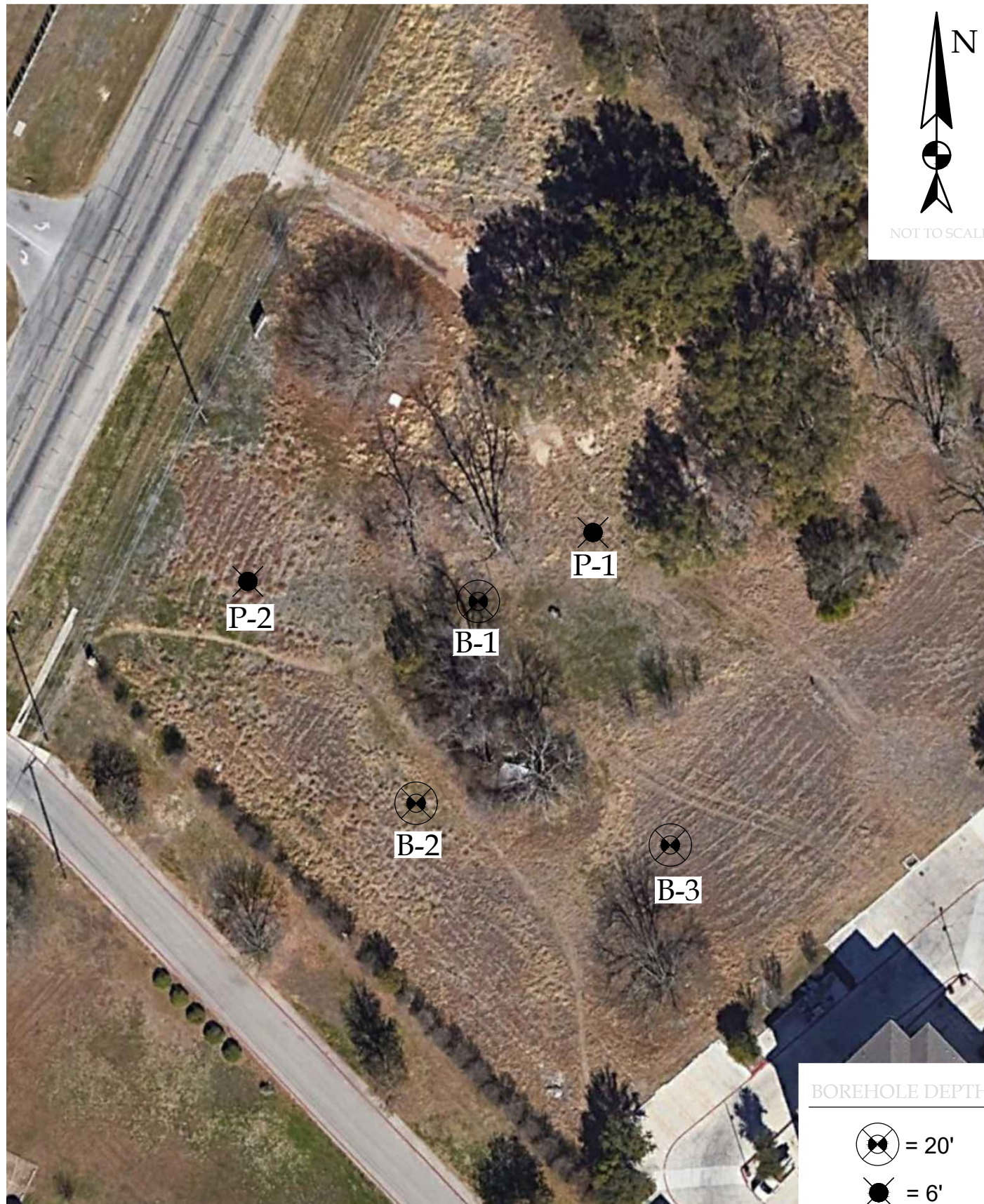
PROJECT TOPOGRAPHY MAP

PROPOSED
CAMP BOW WOW

NEW BRAUNFELS, COMAL COUNTY, TEXAS



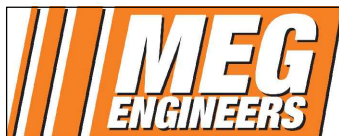
MILLENNIUM ENGINEERS GROUP, INC.
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PROJECT BOREHOLE LOCATION MAP

PROPOSED
CAMP BOW WOW

NEW BRAUNFELS, COMAL COUNTY, TEXAS



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APPENDIX C
PROJECT BORING LOGS AND PROFILE

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Project: Proposed Camp Bow Wow	Key to Log of Boring Sheet 1 of 1
Project Location: New Braunfels, Comal County, Texas	
Project Number: 07-26-29114	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13

COLUMN DESCRIPTIONS

- | | |
|---|---|
| <p>1 Elevation (feet): Elevation (MSL, feet).</p> <p>2 Depth (feet): Depth in feet below the ground surface.</p> <p>3 Sample Type: Type of soil sample collected at the depth interval shown.</p> <p>4 Sample Number: Sample identification number.</p> <p>5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.</p> <p>6 Material Type: Type of material encountered.</p> <p>7 Graphic Log: Graphic depiction of the subsurface material encountered.</p> <p>8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.</p> | <p>9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.</p> <p>10 LL, %: Liquid Limit, expressed as a water content.</p> <p>11 PI, %: Plasticity Index, expressed as a water content.</p> <p>12 Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.</p> <p>13 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.</p> |
|---|---|

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity COMP: Compaction test CONS: One-dimensional consolidation test LL: Liquid Limit, percent	PI: Plasticity Index, percent SA: Sieve analysis (percent passing No. 200 Sieve) UC: Unconfined compressive strength test, Qu, in ksf WA: Wash sieve (percent passing No. 200 Sieve)
---	--

MATERIAL GRAPHIC SYMBOLS

 Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)	 Clayey SAND to Sandy CLAY (SC-CL)
--	---

TYPICAL SAMPLER GRAPHIC SYMBOLS

 Auger sampler	 CME Sampler	 Pitcher Sample
 Bulk Sample	 Grab Sample	 2-inch-OD unlined split spoon (SPT)
 3-inch-OD California w/ brass rings	 2.5-inch-OD Modified California w/ brass liners	 Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

	Water level (at time of drilling, ATD)
	Water level (after waiting, AW)
	Minor change in material properties within a stratum
	Inferred/gradational contact between strata
	Queried contact between strata

GENERAL NOTES

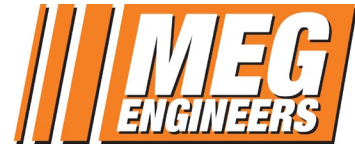
- Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
- Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure B-1

The background of the entire page is a close-up photograph of a soil sample. It shows a mixture of light-colored, sandy soil and numerous small, rounded, light-brown gravel particles. Several larger, irregularly shaped, light-colored rocks are scattered throughout the sample, particularly on the left side and bottom. The lighting is somewhat dim, creating a naturalistic look of a soil profile.

APPENDIX D
SUMMARY OF SOIL SAMPLE ANALYSIS

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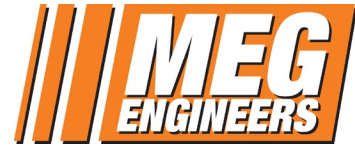


Bore Number B1

Sample ID	Start Depth (ft)	End Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Minus 200	Sulfates (ppm)
Sample 1	0.5	2.0	8.0	20.0	69.0	25.0	44.0		
Sample 2	2.5	4.0	21.0	18.0					
Sample 3	4.5	6.0	29.0	6.0	44.0	18.0	26.0		
Sample 4	6.5	8.0	33.0	6.0					
Sample 5	8.5	10.0	50/1	3.0				82.0	
Sample 6	13.5	15.0	50/1	2.0	22.0	12.0	10.0		
Sample 7	18.5	20.0	50/1	2.0				32.0	

Bore Number B2

Sample ID	Start Depth (ft)	End Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Minus 200	Sulfates (ppm)
Sample 1	0.5	2.0	20.0	17.0				65.0	
Sample 2	2.5	4.0	18.0	13.0	60.0	24.0	36.0		
Sample 3	4.5	6.0	41.0	7.0				13.0	
Sample 4	6.5	8.0	69.0	6.0	32.0	16.0	16.0		
Sample 5	8.5	10.0	50/1	6.0	31.0	12.0	19.0		
Sample 6	13.5	15.0	R						
Sample 7	18.5	20.0	R						



Bore Number B3

Sample ID	Start Depth (ft)	End Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Minus 200	Sulfates (ppm)
Sample 1	0.5	2.0	9.0	21.0	70.0	25.0	45.0		
Sample 2	2.5	4.0	20.0	20.0				85.0	
Sample 3	4.5	6.0	26.0	15.0	53.0	17.0	36.0		
Sample 4	6.5	8.0	61.0	6.0				82.0	
Sample 5	8.5	10.0	50/1	5.0	28.0	13.0	15.0		
Sample 6	13.5	15.0	R						
Sample 7	18.5	20.0	R						

Bore Number P1

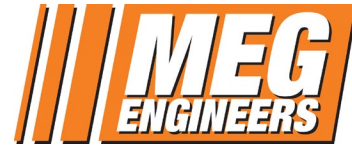
Sample ID	Start Depth (ft)	End Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Minus 200	Sulfates (ppm)
Sample 1	0.5	2.0	14.0	27.0	75.0	31.0	44.0		20.0
Sample 2	2.5	4.0	10.0	19.0				68.0	
Sample 3	4.5	6.0	13.0	13.0					

Bore Number P2

Sample ID	Start Depth (ft)	End Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Minus 200	Sulfates (ppm)
Sample 1	0.5	2.0	10.0	25.0	69.0	29.0	40.0		20.0
Sample 2	2.5	4.0	18.0	22.0					
Sample 3	4.5	6.0	30.0	16.0				87.0	

APPENDIX E
LABORATORY AND FIELD PROCEDURES

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Laboratory and Field Test Procedures

Soil Classification Per ASTM D2487-93:

This soil-testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content Per ASTM D2216-92:

This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under **MC** in the attached boring logs.

Soil Liquid Limit Per ASTM D4318-93:

The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **LL** in the attached boring logs.

Soil Plastic Limit Per ASTM D4318-93:

The soil Plastic Limit identifies lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **PL** in the attached boring logs.

Plasticity Index Per ASTM D4318-93:

This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. The test results are listed under **PI** in the attached boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D 1586:

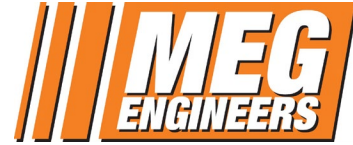
This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140-pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D 1586:

This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST) per ASTM D 1587:

This procedure is for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.



Dry Density (DD) per ASTM D 2937:

This procedure is for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (Uc) per ASTM D 2166:

This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve per ASTM D 1140:

This test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP):

This test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD):

The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance.

Recovery Ratio (REC):

The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs:

This is a summary of the above-described information at each boring location.