GEOTECHNICAL INVESTIGATION

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

PROJECT NO. 21-DG6426

Prepared for:

CW 9 SAN MARCOS LLC
11110 Zimmerman Lane
Austin, Texas 78726

Prepared by:

GEOSCIENCE ENGINEERS, LLC.
Dallas, Texas

June 2021

GeoScience

Project No. 21-DG6426

June 3, 2021

CW 9 SAN MARCOS LLC
11110 Zimmerman Lane
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Geoscience Engineers, LLC. is pleased to submit this geotechnical investigation for the above referenced project located in San Marcos, Texas. This report briefly describes the procedures employed in our subsurface exploration and presents the results of our investigation.

Our Construction Materials Testing Division can provide the materials testing services that will be required during the construction phase of this project. We will be pleased to discuss a scope of work and submit a proposal for these services upon request.

We appreciate the opportunity to be of assistance on this project. Please feel free to contact us if you have any questions or if we can be of further service.

Respectfully,

Geoscience Engineers, LLC.
Firm Reg. #F-11285 DBE # IMDB51637Y121

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CONTENTS

Pages

ILLUSTRATIONS

Pages

INTRODUCTION

Project Description

This report presents the results of the geotechnical investigation performed at the site of the referenced project located in San Marcos, Texas. Based on the project information provided, it is our understanding that construction will consist of Car Wash and Gas Station, gas pumps canopies and the associated paving and parking areas. Information regarding structural loads was not available at the time of this investigation; however, we anticipate the loads will be light. It is expected that the finished floor elevation of the proposed buildings will be above surrounding ground surface. Grading plans and other information regarding the referenced project were not available at the time of this investigation.

Site Description

The site of the proposed project is located at northeast corner of Chisos Street & IH 35 S in the City of San Marcos, Texas. At the time of this investigation, the site was undeveloped land covered with vegetation. Based on visual observation the site slopes gently downwards towards IH -35 service Road. The general location and orientation of the site is shown in the Illustrations section of this report.

Purposes and Scope of Work

The principal purposes of this investigation were:

1). Developing subsurface soil and rock stratigraphy at the boring locations.

2). Evaluating soil swell potential and alternatives to reduce the soil movement.

3). Providing recommendations for foundation design parameters.

4). Providing pavement recommendations and

5). Providing site preparation recommendations.

Report Format

The first sections of the report describe the field and laboratory phases of the study. The remaining sections present our recommendations to guide design and preparation of plans and specifications. Boring logs and laboratory test results are presented in the **Illustrations** section of this report.

FIELD INVESTIGATION

The field portion of this study consisted of drilling and sampling six (6) test borings, test boring B-1 drilled in the car wash building and test borings B-2 and B-3 drilled in the C-store building to a depth of 20 feet, whereas test boring B-4 and B-5 in the gas station canopies on either side of the c-store to ad depth of 10 feet. Test boring B-6 drilled in the paving area to a depth of 5 feet. The approximate locations of the borings are shown on the Boring Location Plan - Plate A. Boring Logs with descriptions of the soils encountered are presented on Plates 1 to 6. Soil strata boundaries shown on the boring logs are approximate.

The borings were advanced using continuous flight augers. Undisturbed cohesive soil samples were obtained using a 3-inch diameter thin-walled tube sampler pushed into the soil. The undrained compressive strength of cohesive soils was estimated in the field using a calibrated pocket penetrometer.

All soil samples were extruded from the samplers in the field, visually classified, and placed in appropriate containers to prevent loss of moisture or disturbance during transfer to the laboratory. The borings were drilled using dry auger procedures to observe the water level (if any) at the time of the exploration. These water level observations are recorded on the boring logs.

LABORATORY TESTING

Engineering properties of the foundation soils were evaluated in the laboratory by tests performed on representative soil samples. A series of moisture content determinations were performed to develop soil moisture profiles and to aid in evaluating the uniformity of soil conditions at the boring locations. Liquid and Plastic limit tests (collectively termed "Atterberg limits"); dry unit weight determinations and the percentage passing the number 200 sieve tests were performed on the selected soil samples from the borings to confirm visual classification and to evaluate soil volume change potentials. Unconfined compressive strength was performed on the clay samples. The results of these tests are presented on the boring logs.

Review

Descriptions of strata made in the field were modified in accordance with results of laboratory tests and visual examination in the laboratory. All recovered soil samples were examined, classified, and described in accordance with ASTM D 2487, ASTM D 2488, and Unified Soil Classification procedures. Classifications of the soils and finalized descriptions of soil strata are shown on the attached boring logs.

GENERAL SUBSURFACE CONDITIONS

Stratigraphy

Based on our interpretations, the overall subsurface stratigraphy at the locations of the test borings drilled for this study consists of clay soils.

More specifically, the subsurface stratigraphy within the depths of the test borings drilled consisted of dark brown CLAY from existing ground surface elevation to a depth of 8 feet in the test borings B-1 to B-5 and to the completion depth of test boring B-6. Tan and gray CLAY soils were encountered at a depth of 8 feet in the test borings B-1 to B-5 and remained visible to the completion depths of the test borings drilled.

Detailed descriptions of the subsurface stratigraphy encountered at the locations of the test borings drilled for this study are included in the **Illustrations** section of this report.

Subsurface Water Conditions

The borings were advanced using auger drilling methods in order to observe groundwater seepage levels. At the time of this investigation, NO subsurface groundwater seepage was encountered in any of the test borings drilled for this study. However, it should be noted that future construction activities may alter the surface and subsurface drainage characteristics of this site. As such, we suggest re-verifying the depth to groundwater just prior to and during construction. Based on short-term observations, it is not possible to accurately predict the magnitude of subsurface water fluctuations that might occur. In addition, it is not uncommon to detect water seepage occurring in soils fractures, particularly after periods of heavy rainfall.

ANALYSIS AND RECOMMENDATIONS

Construction Consultation and Monitoring

We recommend that *Geoscience* be given the opportunity to review the final design drawings and specifications in order to evaluate if recommendations in this report have been properly interpreted. Wide variations in soil conditions are known to exist between the borings, particularly at this site. Further unanticipated variations in subsurface conditions may become evident during construction. During excavation and foundation phases of the work, we recommend that a reputable geotechnical engineering firm be retained to provide construction surveillance services in order to 1) observe compliance with the geotechnical design concepts, specifications, and recommendations, and 2) to observe subsurface conditions during construction to verify that the conditions are as anticipated, based on the findings of this investigation.

Soil Movement

The near surface natural soils encountered at this site exhibited Plasticity Indices of 44 to 50. Based on the plasticity indices, these soils are considered as *extremely highly expansive* in nature. The magnitude of the moisture induced vertical movement was calculated using the Department of Transportation method in conjunction with current moisture content condition and using the laboratory data from the results of swell tests performed on the selected samples. Based on the aforementioned methods, the estimated moisture induced Potential vertical movement (PVR) of the soils at the location of the test borings drilled is on the order of 3 to 3.5 inches however, if the dry condition prevails at the time of construction, then the PVR of the soils can be higher than 6 inches which.

Considerably more movement will occur in areas where water ponding is allowed to occur during and/or after construction –or- if the thickness of the clay soils is greater than that encountered in the test boring –or- fill soils other than select fill soils are planned for use. Site grading may also increase or decrease the potential for the movement.

The PVR can vary with prolonged wet or dry period as such we recommend that moisture content for the upper 10 feet of the soils within the building pad and PVR should be evaluated prior to the construction.

To reduce the soil potential vertical movement (PVR) to less than one inch, we recommend the subgrade soils should be improved by adopting one of the following methods:

Moisture conditioning the subgrade soils:

Remove the existing subgrade soils from the building pads area to a depth 12 feet below existing grade elevation and stockpile. We recommend additional 5 feet of the area be extended beyond the building line and should include all the areas sensitive to the soil movement. The exposed surface area should be scarified to a depth of 6 inches and compacted to 95 and 100 percent of maximum dry density with moisture content between optimum and 4 points above optimum. Previously removed soils should be placed back in the building pad area in 6 to 8 inches loose lifts and mixed to form homogenous material and each lift should be compacted to 93 to 98 percent of maximum dry density with a minimum moisture content of 4 points above optimum.

The upper 2 feet of the soils should consist of select fill soils –or- flex base materials –or- lime stabilized onsite soils.

In the event that select fill soil is planned to be used as a cap, then it should be placed in 6 to 8 inches loose lifts and compacted between 95 and 100 percent of the maximum dry density as per ASTM D 698 with moisture contents within three points of optimum moisture as per ASTM D 698. We recommend select fill soils not be extended beyond the building line; however, the perimeter outside the grade beam should be capped with high plasticity index clay soils in order to retard any water seepage underneath the foundation.

If the flex base is used as a cap atop of moisture conditioned soils, then the flex base should be placed in 6 to 8 inches loose lifts compacted to a minimum of 98 percent of maximum dry density as per ASTM D-698 and the moisture content should be between -2 to +3 percent points above optimum.

In the event that lime stabilization to the existing subgrade is planned as a cap, then it should be stabilized with a minimum of 36 pounds per square yard of lime for 6-inch-thick soil (lime series test is required).

The lime stabilized soils should be compacted to a minimum of 95 percent of maximum dry density with the moisture content between optimum and 4 points above optimum. Field density tests should be taken at the rate of one test per every 300 linear feet or 5,000 square feet whichever is lesser per lift.

Field density tests should be taken at the rate of at least one test per each 2,500 square feet, per lift, in the area of all compacted fill. For areas where hand tamping is required, the testing frequency should be increased to approximately one test per lift, per 100 linear feet of area.

We recommend that during moisture conditioning the swell tests should be performed to ensure that the percent swell tested on the sample is less than 1%. Also, upon completion of moisture conditioning process, post improvement testing will be required and a certification from the testing laboratory should be obtained to ensure that the swell potential of the soils has been adequately reduced for the design of the slab foundation.

Construction of the building slab should start shortly upon completion of the subgrade improvement process. Moisture loss of the improved soils should not be allowed to occur between the time the improvement procedures are completed and the start of the construction.

-OR-

Chemical or water pressure injection:

To reduce the potential vertical movement of soils to one inch, remove the subgrade soils to a depth of 2 feet below the finished grade elevation. Chemical or water pressure injection to the subgrade soils should then be performed to a depth of 10 feet below finished grade elevation to pre-swell the subsurface soils. For improvement of subgrade soils by chemical or water pressure injection, we recommend extending the building pad to an additional 5 feet beyond the building line and should cover all areas that are sensitive to soil movement. The number of injections required generally depends on the rate at which the soils absorb chemical or water, initial moisture condition and hardness of the soils, and the amount of reduction that is desired and can be tolerated by the slab foundation. We recommend <u>at least 4 passes</u> of chemical, or water pressure injection should be performed prior to the testing. Upon completion of chemical or water pressure injection, post-injection testing will be required to ensure that the swell potential of the soils has been adequately reduced for the design of the slab foundation.

A full-time laboratory technician from our Firm should be present throughout the injection operations. Upon completion of chemical or water pressure injection, post-injection testing will be required to ensure that the percent swell tested on the sample is less than 1%. Undisturbed samples should be obtained at every one-foot interval to the total injected depth from 1 test hole per 2500 square feet. Adjustments in the testing program should be at the discretion of the testing engineer. A minimum of two free swell tests should be performed per test hole. Samples will be tested at the approximate overburden pressure of the sample depth. No swell should be higher than one percent on the sample tested. Also, a certification from the testing laboratory should be obtained to ensure that the swell potential of the soils has been adequately reduced for the design of the slab foundation.

The chemical or water pressure injected soils should be capped with two feet of select fill soils –or- flex base materials -or- onsite limes stabilized soils.

In the event that select fill soil is planned to be used as a cap, then it should be placed in 6 to 8 inches loose lifts and compacted between 95 and 100 percent of the maximum dry density as per ASTM D 698 with moisture contents within three points of optimum moisture as per ASTM D 698. We recommend select fill soils not be extended beyond the building line; however, the perimeter outside the grade beam should be capped with high plasticity index clay soils in order to retard any water seepage underneath the foundation.

If the flex base is used as a cap atop of improved soils, then the flex base should be placed in 6 to 8 inches loose lifts compacted to a minimum of 98 percent of maximum dry density as per ASTM D-698 and the moisture content should be between -2 to +3 percent points above optimum.

In the event that lime stabilization to the existing subgrade is planned as a cap, then it should be stabilized with a minimum of 36 pounds per square yard of lime for 6-inch-thick soil (lime series test is required).

Field density tests should be taken at the rate of at least one test per each 2,500 square feet, per lift, in the area of all compacted fill. For areas where hand tamping is required, the testing frequency should be increased to approximately one test per lift, per 100 linear feet of area.

Construction of the building slab should start shortly upon completion of the subgrade improvement process. Moisture loss of the injected soils should not be allowed to occur between the time the improvement procedures are completed and the start of the construction.

In order to protect the adjacent structures, we recommend that chemical/water pressure injection should be performed if the adjacent structures a minimum of 20 feet away from the line of the proposed building.

FOUNDATION TYPE

The foundation recommendations provided in the report are based on the soil information obtained from the test borings accessible to the drill rig. During construction if the soils at the other location of building are found to be different than encountered at the location of the test borings then, our recommendations provided in this report will not valid and additional drilling of the test borings will be required.

A. Drilled and Under-Reamed Pier Type Foundation System

The structural loads can be supported by auger excavated, under-reamed, steel reinforced, cast-in-place concrete piers. These piers should extend to a depth of 17 feet below existing ground surface or final grade (whichever is deeper). The piers may be sized using an allowable net end bearing pressure of 4000 psf. This bearing capacity includes a factor of 2.5. The under-reamed piers should have a bell to shaft diameter ratio ranging between 2.5 and 3 to 1. The bearing capacity should be reduced for piers closer than 3-bell diameters center-to-center.

Soil Induced Uplift Loads

The piers should be provided with enough steel reinforcement to resist the uplift pressures that will be exhibited by the near surface soils. We recommend the uplift pressures be approximated on the order of 1,800 pounds per square foot of shaft area over an average depth of 10 feet. The uplift can be neglected in the event high plasticity index clay soils are removed and replaced with select fill soils. The uplift can be reduced to 1000 psf for the depths of moisture conditioned or chemical or water pressure injected soils. To resist the net tensile load, the shaft must contain sufficient continuous vertical reinforcement to the full depth of the pier.

Foundation piers designed and constructed in accordance with the information provided in this report will have a factor of safety in excess of 2.5 against shear type failure and will experience minimal settlement (less than one inch).

Pier Installation

The construction of all piers should be observed by experienced geotechnical personnel during construction to ensure compliance with design assumptions and to verify: (1) the bearing stratum; (2) the minimum penetration; (3) the removal of all smear zones and cuttings; (4) that groundwater seepage is correctly handled; and (5) that the shafts are vertical and within acceptable tolerance levels. Our firm is available to provide these services upon request.

Reinforcing steel and concrete should be placed immediately after the excavation has been completed and observed. In no event should a pier excavation be allowed to remain open for more than 8 hours. Concrete should be placed in such a manner to prevent segregation of the aggregates.

In the event that perched water seepage is encountered at the time of the pier drilling operations and the depth of water at the bottom of the shaft cannot be maintained to less than 3 inches, temporary casing of the piers will be required. It should be noted that prior to the placement of concrete, any water in the pier hole should be removed using a pump.

B. Shallow Footings

The foundation of the proposed building can also be supported by spread footings. The spread footings should be installed at a minimum depth of 3 feet from the finished grade elevation installed within the moisture conditioned or chemical or water pressure injected soils or density-controlled select fill soils or flex base material. The spread footings can be designed using a net allowable bearing pressure of 2,500 psf for flex base (a minimum of 2.5 feet of flex base is required below the installation depth of the footings, which is highly recommended). A net allowable bearing capacity of 1,500 psf can be used for moisture conditioned or chemical or water pressure injected soils. These values include a factor of safety of 2.5 with respect to the un-drained shear strength of the foundation soils.

The bottom of the spread footings should be free of any loose and/or soft materials prior to concrete placement. Any areas at the bottom of the footings where soft spots are noted we recommend a) the bottom of the grade beams either is rolled or compacted by re-working with the optimum moisture with a hand compactor. Each foundation excavation should be evaluated by a geotechnical engineer to ensure that the foundation bears within hard stratum - Or - b) reduce the allowable soil bearing capacity. At the time of such evaluation, it may be necessary to perform compaction testing or hand penetrometer probe test in the base of the foundation excavation to assure that the above recommendations are adhered.

Grade Beams

Grade beams should be structurally connected into the top of the piers or spread footings. If a ground-supported beam is used, then the subgrade soils should be improved by moisture conditioning or chemical or water pressure injection methods as per the procedures outlined in previous sections of this report. The grade beam should be a minimum of 2 feet deep and 12 inches wide.

Alternatively, the grade beam can be suspended. A minimum void space of 10 inches should be provided beneath the beams in conjunction with pier type of foundation system. This void space allows movement of the soils below the grade beams without distressing the structural system. Structural cardboard forms are typically used to provide the void beneath grade beams. Cardboard forms used must have sufficient strength to support the concrete during construction.

Our experiences indicate that major distress in grade beams will occur if the integrity of the void box is not maintained during construction. The excavation in which the void box lays must remain dry. Cardboard cartons can easily collapse during concrete placement if the cardboard becomes wet. Backfill material must not be allowed to enter the carton area below grade beams as this reduces the void space that underlying soils need to swell.

Floor Systems

In conjunction with piers and spread footings, two types of floor systems may be considered for use at this site:

i) Suspended Slab in conjunction with pier type of foundation system - The most positive floor system for pier type foundation systems in areas with expansive soils consists of a suspended floor system. The floor system of the proposed building should be structurally supported on the foundation piers and a minimum void space of 10 inches provided between the bottom of the slab and underlying soils.

ii) Ground Supported Slab - In conjunction with piers or spread footings, a ground-supported slab may be considered for use at this site, provided the risk of some post-construction movement is acceptable. A ground-supported slab, if used, then the subgrade soils should be improved by moisture conditioning or chemical or water pressure injection methods as per the procedures outlined in previous sections of this report.

Based on the *Terzaghi's* Bearing Capacity theory a net allowable soil bearing pressure 1,500 psf for moisture conditioned or chemical or water pressure injected soils and 2,000 psf for select fill soils or flex base materials. These bearing pressures include a factor of safety of 2.5 with respect to shear failure. Floor slabs should be adequately reinforced to minimize any future cracking as normal movements occur in the foundation soils. Also, a moisture barrier of polyethylene sheeting or similar material should be placed between the slab and the subgrade soils to retard moisture migration through the slab. It should be understood that a soil-supported foundation system will experience some movement over time.

Gas Tank Pit Excavation

Based on the subsurface stratigraphy encountered at the boring locations, clay soils will be exposed at the tank dept. based on unit weight and pocket penetrometer the soils are stiff to hard in consistency and will not slough however, we recommend that the excavations must be performed as per OSHA's guidelines and under the supervision of a contractor-designated Competent Person. A "Competent Person" as defined by OSHA (Occupational Safety and Health Administration Standard, 29 CFR Part 1926.650 to .652 Subpart P – Excavations), must evaluate the excavations at the time of the construction activity to safeguard workers.

Building Pad Preparation

Prior to placing any additional fill material, all existing vegetation, debris, and loose soils should be removed until hard stratum is encountered.

For a suspended floor system – After removal of all above referenced items, all exposed surfaces should then be scarified to a depth of 6 inches watered as required and compacted to between 95 and 100 percent of the maximum dry density as defined by ASTM D 698 (Standard Proctor Test) at a moisture content between the optimum moisture value and 4 points above optimum. Additional fill, if is required, should consist of clean soils compacted to resist the initial concrete loads. Placement of select fill soils is not required for suspended floor system.

For ground supported floor system - after removal of all referenced items, the subgrade soils should be improved by moisture conditioning or chemical or water pressure injection methods as per the procedures outlined in previous sections of this report. Additional fill soils if required should consist of select fill soils.

Select Fill materials should be placed in six (6) to eight (8)-inch loose lifts at moisture contents between optimum and 3 percentage points above optimum. Each lift compacted to between 95 and 100 percent of the maximum dry density as defined in ASTM D 698. Field density tests should be taken at the rate of one test per every 2,500 square feet per lift, or a minimum of 3 tests per lift in the area of all compacted fill. For areas where hand tamping is required, the testing frequency should be increased to approximately one test per lift, per 100 linear feet of area.

Select Fill

"Select fill," as referred to in this report, should consist of clayey sands free of organic materials with a Plasticity Index between 6 and 16, a Liquid Limit of 38 or less, and between 15 and 45 percent passing a No. 200 sieve. Placement and compaction of the select fill should be performed in accordance with the **"Building Pad Preparation"** section of this report. It is preferable to place the select fill above the surrounding ground surface.

Flex Base

TxDOT 247 Type 1.

PAVEMENT RECOMMENDATION

General

Specific wheel loading and traffic volume characteristics were not available at the time of this investigation. However, we have assumed that light passenger vehicle traffic will be most predominant in the parking areas and the relatively heavier fire truck traffic will occur in the drive areas area around and behind the structure, and in the fire lane. Based on assumed loading conditions, we have developed the following Portland Cement concrete pavement design sections for use at this site.

	Minimum Thickness (inches)
Parking	
Portland Cement Concrete	5
Lime Stabilized Subgrade Soils	6
Compacted Subgrade Soils	6
Driveway	
Portland Cement Concrete	6
Lime Stabilized Subgrade Soils	6
Compacted Subgrade Soils	6

Prior to the placement of any fill in the pavement area, we recommend all existing vegetation; debris and loose soils should be removed until hard stratum is encountered.

The exposed surface should then be proof rolled with heavy equipment. The exposed subgrade should be scarified to a depth of 6 inches water as required and compacted to 95 and 100 percent of maximum dry density as defined by ASTM D 698 (Standard Proctor Test), at moisture content between optimum and 4 points above optimum.

The upper six inches of subgrade soils should then be stabilized with lime. We estimate approximately 8 to 10 percent of hydrated lime (36 to 42 lbs/yard for 6-inch-thick-soil) will be required to stabilize the subgrade soils (to reduce the plasticity index to 15 or less). It should be noted that after the final grade is complete, the actual amount of lime required should be calculated by lime series test in the laboratory.

The lime stabilized soils should be compacted to a minimum of 95 percent of maximum dry density with the moisture content between optimum and 4 points above optimum. Field density tests should be taken at the rate of one test per every 300 linear feet or 5,000 square feet whichever is lesser per lift.

In the event that lime stabilization of the subgrade soils is not economically feasible, then the thickness of the concrete can be increased by an additional one inch or city standards.

Design of the concrete pavement should specify a minimum 28-day concrete compressive strength of 3,500 psi for all the pavement and 4,000 psi for the fire lane with 4 percent to 6 percent entrained air. The concrete should be placed within one and one-half hours of batching. During hot weather, the concrete placement should follow ACI 311 Hot Weather concreting and in no case should the concrete temperature be allowed to exceed 95°F. To avoid excessive heat periods, consideration should be given to limiting concrete placement to a time of day that will minimize large differences in the ambient and concrete temperature.

Past experience indicates that pavements with sealed joints on 15 to 20-foot spacings, cut to a depth of at least one-quarter of the pavement thickness, generally exhibit less uncontrolled post-construction cracking than pavements with wider spacings. As a minimum, expansion joints should be used wherever the pavement abut a structural element subject to a different magnitude of movement, e.g., light poles, retaining walls, existing pavement, building walls, or manholes. After construction, the construction and expansion joints should be inspected periodically and resealed, if necessary. The pavement should be reinforced using at least No. 3 bars; 24 inches on center should be used.

LANDSCAPING

Trees will remove water from the soil and, as a result, may cause the soil to shrink; therefore, in areas where pavement is planned, trees should either:

a). not be planted closer than the mature tree height from the building.

b). have a controlled irrigation system, or

c). be planted in containers.

Excess water ponding on or beside roadways, sidewalks and structural slabs may cause an unacceptable heave to these structures. To reduce this potential heave, good surface drainage should be established, and sprinkler systems should be designed and operated to minimize saturation of soil adjacent to these structures. Sprinkler mains next to buildings are not recommended.

Bedding soils for plants may collect and direct water underneath the buildings and pavements; therefore, care should be taken to ensure that water entering the bedding soils drains away from these structures. If positive drainage away from these structures cannot be achieved, an impermeable synthetic membrane should be considered to reduce the risk of water migrating beneath the buildings and pavements. An 18-inch-deep vertical water barrier along the pavement edge fronting landscaped areas may be desirable to help prevent irrigation water from having ready access to the soils beneath the pavement. Special attention should be given to provide good drainage from plantings inside the building courtyards and planter boxes.

The completed landscaping should be carefully inspected to verify that plantings properly drain. Soil in plantings may settle, which will tend to pond water, or plantings may block entrances to surface drains. Therefore, maintaining positive drainage from landscape irrigation will be an ongoing concern.

SITE GRADING and DRAINAGE

All grading should provide positive drainage away from the proposed structures and should prevent water from collecting or discharging near the foundations. Water must not be permitted to pond adjacent to the structures during or after construction.

Surface drainage gradients should be designed to divert surface water away from the buildings and edges of pavements and towards suitable collection and discharge facilities. Unpaved areas and permeable surfaces should be provided with steeper gradients than paved areas. Pavement drainage gradients within 5 feet of buildings should be constructed with a minimum slope of one inch per foot to prevent negative drainage gradients (ponding water conditions) from developing due to differential upward pavement movements. Sidewalk drainage gradients should be along maximum slopes allowed by local codes.

Roofs should be provided with gutters and downspouts to prevent the discharge of rainwater directly onto the ground adjacent to the building foundations. Downspouts should not discharge into any landscaped bed near the foundations. Downspouts should discharge directly into storm drains or drainage swales, if possible. Roof downspouts and surface drain outlets should discharge into erosion-resistant areas, such as paving or rock riprap. Recessed landscaped areas filled with pervious sandy loam or organic soil should not be used near the foundation. Landscaped beds should be elevated above a compacted and well-graded clay surface. Sealed planters are preferred. All trees should be a minimum of one-half their mature height away from the building or pavement edges to reduce potential moisture losses. Water permitted to pond in planters, open areas, or areas with unsealed joints next to structures can result in on-grade slab or pavement movements, which exceed those, indicated in this report.

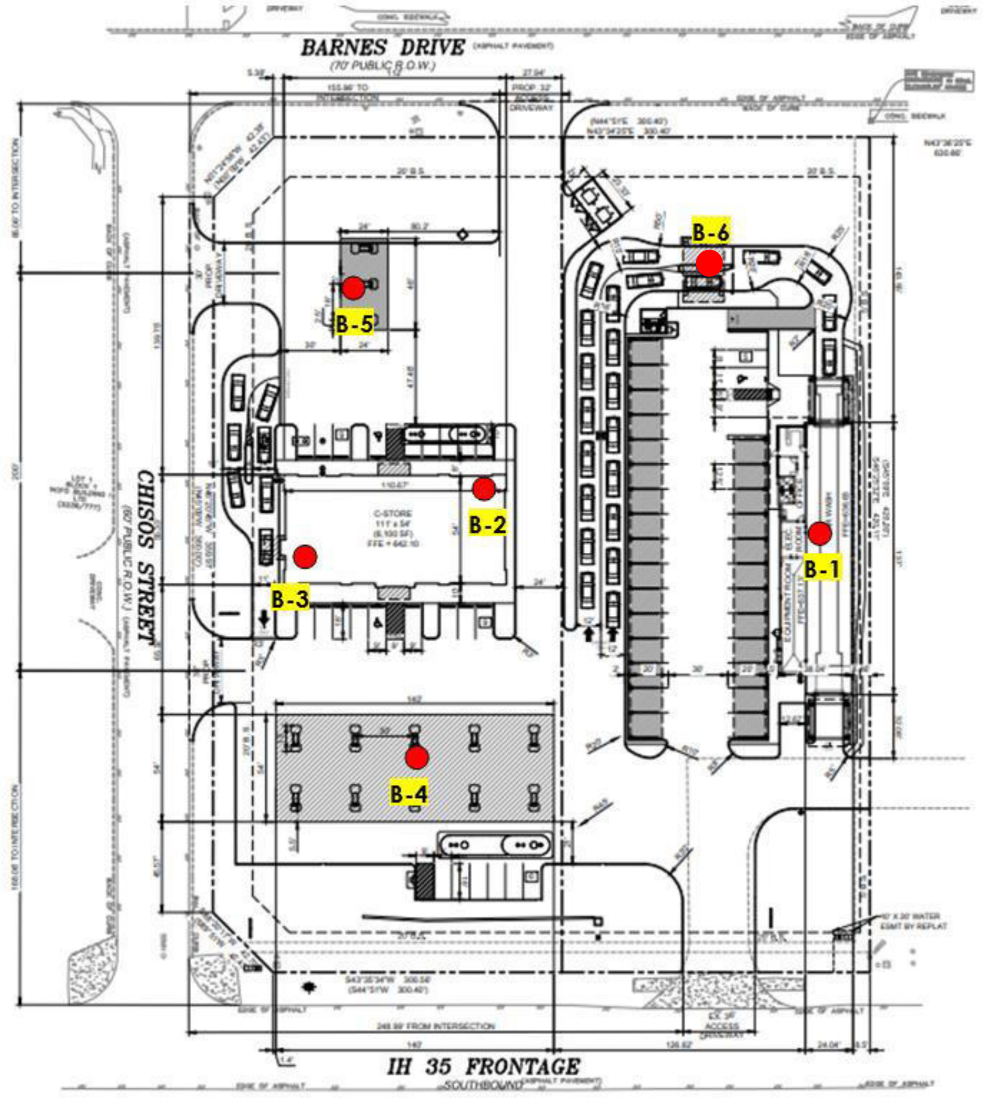
Exterior sidewalks and pavements will be subject to some post construction movement as indicated in this report. These potential movements should be considered during preparation of the grading plan. Flat grades should be avoided. Where concrete pavement is used, joints should be sealed to prevent the infiltration of water. Some post-construction movement of pavement and flatwork may occur. Particular attention should be given to joints around the building. These joints should be periodically inspected and resealed where necessary. It should be noted that due to deeper depth of fill soils some settling of the fill soils may occur in future.

CLOSURE

It should be noted that some variations in soil and moisture conditions may exist between boring locations. Statements in this report as to subsurface variations over given areas are intended as estimations only, based upon the data obtained from specific boring locations.

The results, conclusions, and recommendations contained in this report are directed at, and intended to be utilized within the scope of work outlined in this report. The report is not intended for use in any other manner. *Geoscience Engineers, LLC.*, makes no claim or representation concerning any activity or condition falling outside the specified purposes for which this report is directed; said purposes being specifically limited to the scope of work as defined herein. Inquiries regarding scope of work, activities and/or conditions not specifically outlined herein, should be directed to *Geoscience Engineers, LLC*.

ILLUSTRATIONS



● Approximate Boring Location

Proposed Car Wash & GAS STATION
IH 35 and Chisos Street
San Marcos, Texas

PROJECT NO. 21-DG6426

PLATE- A

LOG OF BORING NO. B-1

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 20
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						LABORATORY DATA							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P2.25		Dark Brown CLAY (CH)	33							
	▨	■	P1.5			32	69	24	45	90	1.5	73	
	▨	■			-brown and tan below 2.5'								
	▨	■				14							
5	▨	■	P1.5										
	▨			8									
	▨				Tan and gray CLAY(CH)								
	▨	■				21							
10	▨	■	P2.50										
	▨	■	P3.0										
	▨	■				25	74	24	50	97	2.2	85	
15	▨												
	▨	■	P4.5										
	▨	■		20		22							
20													
25													
30													

■	◧	⊠	◫	◪	⧅
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-2

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 20
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						LABORATORY DATA							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P2.27		Dark Brown CLAY (CH)	30							
	▨	■	P1.75			31	70	26	44	90	1.2	88	
	▨	■	P4.5										
5	▨	■	P1.75			35							
	▨			8									
	▨				Tan and gray CLAY(CH)								
10	▨	■	P2.75			23							
15	▨	■	P2.25			27							
	▨	■	P4.5										
20	▨	■		20		26	74	24	50	98	2.4	81	
25													
30													

■	◧	⊠	◫	◩	⧄
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

GeoScience Incorporated

LOG OF BORING NO. B-3

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 20
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						LABORATORY DATA							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P1.75		Dark Brown CLAY (CH)	34							
	▨	■	P1.50			32							
	▨	■	P1.25										
5	▨	■	P1.75			32	72	26	46	90	1.1		
	▨			8									
	▨				Tan and gray CLAY (CH)								
10	▨	■	P1.50			27							
15	▨	■	P3.25			17							
20	▨	■	P2.0	20		23							
25													
30													

■	◧	☒	◫	◪	⧄
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-4

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 10
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						LABORATORY DATA							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P2.0		Dark Brown CLAY (CH)	29	73	26	47				
	▨	■	P2.25										
	▨	■	P2.75			27	73	26	47	95	1.9		
5	▨	■	P4.0			24							
	▨			8									
	▨	■	P3.75		Tan and gray CLAY (CH)								
10	▨	■		10		24							
15													
20													
25													
30													

■	◧	☒	◫	◩	⍂
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-5

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 10
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						LABORATORY DATA							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P2.0		Dark Brown CLAY (CH)	37							
	▨	■	P2.25			31	70	25	45				
	▨	■	P1.75										
5	▨	■	P2.0			30							
	▨			8									
	▨	■	P4.0		Tan and gray CLAY (CH)								
10				10		23	75	26	49	98			
15													
20													
25													
30													

■	◧	☒	◫	◩	⧅
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

LOG OF BORING NO. B-6

Proposed "Car Wash and Gas Station"
IH 35 and Chisos Street
San Marcos, Texas

Project No. 21-DG6426

Location: See Location Plan
Surface Elevation: Unknown
Drilling Method: CFA
Date Boring Drilled: 5/6/21
Completion Depth: 4.5
Groundwater Information:
Seepage Encountered During Drilling: None
Upon Completion: Dry

FIELD DATA						**LABORATORY DATA**							
DEPTH (ft.)	SOIL & ROCK SYMBOL	SAMPLE TYPE	P: HAND PEN., TSF T: THD, BLOWS/FT. N: SPT, BLOWS/FT.	STRATUM DEPTH (FT.)	DESCRIPTION OF STRATUM	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	UNIT DRY WEIGHT (PCF)	UNCONFINED STRENGTH (TSF)	% PASSING NO. 200 SIEVE	SOIL SUCTION TEST (TOTAL CM. OF WATER)
0	▨	■	P3.25		Dark Brown CLAY (CH)	30							
	▨	■	P3.5			27				96			
	▨	■	P4.5	4.5		21	70	25	45				
5													
10													
15													
20													
25													
30													

■	◧	☒	◫	◪	⧄
TUBE SAMPLE	AUGER SAMPLE	SPLIT-SPOON	ROCK CORE	THD CONE PEN.	NO RECOVERY

REMARKS:

SUMMARY OF FREE SWELL TESTS

Boring Number	B-4
Sample Depth (ft.)	4.5-6
Initial Moisture Content (%)	24.5
Final Moisture Content (%)	30.1
Applied Surcharge Pressure (psf)	625
Vertical Swell (%)	6.7
Liquid Limit	73
Plastic Limit	26
Plasticity Index	47

*Samples were air dried prior to the test.

PLATE 7