Structural
Geotechnical

Materials Testing
Forensic

# SOILS AND GEOLOGY STUDY

## Canyon Creek Ranch
## El Paso County, Colorado

## PREPARED FOR:

**Gregg Cawlfield**
**5710 Vessey Road**
**Colorado Springs, CO 80908**

## JOB NO. 189360

**June 24, 2022**
**Revised January 9, 2025**

**Respectfully Submitted,**

**RMG – Rocky Mountain Group**

Kelli Zigler

**Kelli Zigler**
**Project Geologist**

**Reviewed by,**

**RMG – Rocky Mountain Group**

COLORADO REGISTERED
ANTHONY P. MUNGER
1/9/25
39818
PROFESSIONAL ENGINEER

**Tony Munger, P.E.**
**Geotechnical Project Manager**

# TABLE OF CONTENTS

# 1.0 GENERAL SITE AND PROJECT DESCRIPTION

## 1.1 Project Location

The project lies in a portion of the SW ¼ of the SW ¼ of Section 14 and in all of the all of the SE ¼ of the SW ¼ of Section 14, Township 12 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located northeast of the intersection of Mountain View Drive and Howells Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

## 1.2 Existing and Proposed Land Use

The site currently consists of one parcel (per the El Paso County Assessor's website) of approximately 23.96 acres:

- **Schedule No. 6214000112**, currently addressed as 11550 Parallax Heights, zoned *"RR-5 – Residential Rural",* and consists of 23.96 acres.

An existing single family residence resides near the southwestern corner of the property. The future zoning designation is to remain "*RR-5".*

## 1.3 Project Description

It is our understanding the existing 23.96-acre parcel is to be subdivided into three separate lots and two tracts. Proposed Lot 1 is to be 5.04 acres and is to retain the existing single-family residence, individual water supply well and on-site wastewater treatment system. Proposed Lots 2 and 3 are to be approximately 5.04 acres and 6.974 acres, respectively, and are each to contain a new single-family residence, individual water supply well and on-site wastewater treatment system once the subdivision is approved. Tracts A and B encompass Kettle Creek and are to be approximately 4.32 acres and 3.28 acres, respectively. The Tracts are to remain vacant (unimproved) land.

## 1.4 Previous Investigations

Reports of previous geotechnical engineering/geologic investigations for this site were available for our review and are listed below:

1. *Soils Report, Lot #2, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1147, dated October 25, 2021.
2. *Profile Pit Evaluation, Lot #2, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1147, dated October 25, 2021.
3. *Soils Report, Lot #3, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1148, October 21, 2021.
4. *Profile Pit Evaluation, Lot #3, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1148, October 21, 2021.
5. *Subsurface Soil Investigation for a Proposed Residence, 11550 Parallax Heights, Colorado Springs, CO,* prepared by Hildenbrandt & Associates, Inc., Project 060808, dated August 31, 2006.
6. *Excavation Inspection - Proposed Residence, 11550 Parallax Heights, El Paso County, CO,* prepared by Hildenbrandt & Associates, Inc., Project 060808, dated October 13, 2006.

# 2.0 QUALIFICATIONS OF PREPARERS

This Soils and Geology Study was prepared by a professional geologist as defined by Colorado Revised Statures section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler P.G., and Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 24 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Tony Munger, P.E. is a licensed professional engineer with over 24 years of experience in the construction engineering (residential) field. Mr. Munger holds a B.S. in Architectural Engineering from the University of Wyoming

# 3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical, geologic site conditions, and on-site wastewater treatment system (OWTS) feasibility and present our opinions of the potential effect of these conditions on the proposed development within El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8, last updated August 27, 2019. Applicable sections include 8.4.8 and 8.4.9, and the El Paso County Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

### 3.1 Scope and Objective

The scope of this study is to include a physical reconnaissance of the site and a review of pertinent, publically available documents including, but not limited to, previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc.

The objectives of our study are to:

- Identify geologic conditions present on the site
- Analyze potential negative impacts of these conditions on the proposed site development
- Analyze potential negative impacts to surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic conditions
- Provide our opinion of suitable techniques that may be utilized to mitigate any potential negative impacts identified herein

This report presents the findings of the study performed by RMG-Rocky Mountain Group relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document

### 3.2 Site Evaluation Techniques

The information included in this report has been compiled from several sources, including:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Subsurface exploration by others
- Visual and tactile characterization of representative site soil and rock samples
- Geologic research and analysis
- Site plan prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

### 3.3 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

# 4.0 SITE CONDITIONS

### 4.1 Existing Site Conditions

The site is partially developed with an existing single-family residence with well and septic located on proposed Lot 1. The remainder of the site is undeveloped, vacant land. The site is generally located northeast of the intersection of Mountain View Drive and Howells Road in El Paso County, Colorado and comprises approximately 23.96 acres. The site is currently zoned RR-5, residential rural and is to remain RR-5 in the future. Adjacent properties to the north, south, east, and west are zoned RR-5. Kettle Creek comes down from the north along the northern extension of the property and then parallels the northern property boundary of the site. The banks of Kettle Creek have significant slopes/drop-offs, up to 50 feet in areas, to the bottom of the creek.

### 4.2 Topography

Based on our site reconnaissance on April 29, 2022 and USGS 2022 topographic map of the Monument, Black Forest, Falcon NW, and 2019 USGS Pikeview Quadrangles, the site generally slopes down to the north towards Kettle Creek with an overall elevation change of approximately 70 feet. Kettle Creek, a major stream, runs through the site along the northern property boundary. Additional drainage swales are located across the property and run north towards Kettle Creek, as shown in Figure 3, Engineering and Geology Map.

### 4.3 Vegetation

The site vegetation primarily consists of native grasses and weeds with dense stands of ponderosa pine trees.

### 4.4 Aerial Photographs and Remote-Sensing Imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site was vacant, undeveloped land prior to the existing single-family residence being built in 2006 on proposed Lot 1.

## 5.0 SUBSURFACE SOIL INVESTIGATIONS

One site-specific soil report was completed for each new lot. The subsurface conditions below proposed Lots 2 and 3 were investigated by Geoquest, LLC on September 30, 2021 as part of the site-specific *Soils Reports* referenced above and included in Appendix C.

### 5.1 Drilling (by others)

The original soil report for the existing residence that is to remain on proposed Lot 1, was obtained from the Pikes Peak Regional Building website. Additionally, two soil reports were completed, one for each future residences on Lots 2 and 3. Each report is discussed briefly in some detail below and are included in Appendix C.

Lot 1 – Existing Residence
Two test borings were performed on August 21, 2006. The soils reportedly encountered in Test Boring (TB-1) consisted of tan to gray and brown silty to gravelly sand extending to the 15-foot termination depth of the boring. TB-2 encountered similar soils to 13 feet below the surface overlying sandstone that extended to the 15-foot termination depth of the boring. Groundwater was reportedly not encountered at the time of drilling.

Proposed Lot 2 (Future Residence)
Two test holes were performed on September 30, 2021. The soils reportedly encountered in the test borings consisted of 4-inches of topsoil overlying fine-course grained sand, with low moisture and clay content extending to approximately 1 foot in TB-1 and to 1.5 feet in TB-2. Underlying the sand, sandstone extended to the 15-foot termination depths of the borings. The sandstone was encountered with low to moderate moisture and low to moderate clay content. Groundwater was reportedly not encountered at the time of drilling.

Proposed Lot 3 (Future Residence)
Two test holes were performed on September 30, 2021. The soils reportedly encountered in the test borings consisted of 6-inches of topsoil overlying fine-course grained sand, with low to moderate moisture and low clay content extending to approximately 2 foot in TB-1 and to 2 feet in TB-2. Underlying the sand, sandstone extended to the 15-foot termination depths of the borings. The sandstone was encountered with moderate moisture and clay content. Groundwater was reportedly not encountered at the time of drilling.

**5.2 Laboratory Testing (by others)**

Lot 1 – Existing Residence
The soils were estimated to have a low swell potential. Based on the excavation inspection removal and replacement of expansive soils was not completed. Due to the site grades and looser material encountered at the shallow excavation depths it was recommended that the entire basement and walkout trench be deepened by 12 inches and recompleted.

Lots 2 and 3 – Future Residences
**Lot 2** reportedly encountered a clayey sand (SC) material that was tested for expansion and/or consolidation potential. The expansion potential of the clayey sand was 0.8%. The report noted, *"that vertical slab movement up to three inches should be expected of soils of low expansion potential and for compacted structural fill after the removal of the expansive soils. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor shall be installed".*

A 4-foot overexcavation was recommended to extend 4 feet below the bottom of foundation elevation and 4 feet laterally from the location of the foundation walls.

**Lot 3** reportedly encountered a clayey sand (SC) material that is unsuitable for bearing of foundations. The expansion potential of the clayey sand material was not noted in the report. An overexcavation and replacement of the on-site material was not presented but it was noted that the foundation components should bear on soils of similar bearing capacity.

**5.3 Test Pit Excavations (by others)**

Two test pits were performed on each Lot 2 and 3. The test pits were to explore the subsurface soils surrounding the existing On-site Wastewater Treatment Systems. The number of test pits is in accordance with Regulations of the El Paso County Board of Health, Chapter 8, On-site Wastewater Treatment Systems (OWTS) as required by 8.5.D.3.a.

The test pits on Lot 2 reportedly encountered 6 inches of topsoil overlying USDA soil texture sandy loam (Soil Type 2). The soils were not cemented and contained 6 to 10% rock. Bedrock and groundwater were not encountered. The *Profile Pit* report stated, the septic system to be installed on this site need not be by a Colorado Licensed Engineer. A conventional system is approved for this site, however it should be noted that if the subsurface conditions change considerably or the location of the proposed field changes, one should contact Geoquest immediately to determine whether the conditions are adequate for the system as designed or whether a new septic system needs to be designed.

The test pits on Lot 3 reportedly encountered similar soils as Lot 2. The report indicated approximately 8 inches of topsoil overlain by sandy loam (Soil Type 2A) extending to 22 to 28 inches. Underlying the

sandy loam, sandy clay loam (Soil Type 3A) was encountered and extended 5 feet, the bottom of the test pits. Groundwater was not encountered. Due to the bedrock conditions encountered between 22 to 28 inches, the septic system to be installed on this site shall be designed by a Colorado Licensed Engineer.

Due to the age of the reports, it is our understanding both the *Profile Pit Evaluations* will likely need to be "updated" for the use of permitting for the future residences.

### 5.4 Groundwater

Groundwater was reportedly not encountered by others at the time of drilling or when observing test pits.

We do understand surface and subsurface water elevations will fluctuate throughout the year. The previous soil reports, completed in August 2006 and September 2021, provide a window of the groundwater depth through the years. Overall, the borings were drilled during the "drier" season (summer) and groundwater was not encountered. However, it should be noted that in granular soils and bedrock, some perched water conditions might be encountered due to the variability of the soil/bedrock. Isolated sand and gravel layers within the soil, even those of limited thickness and width, can carry water in the subsurface. Groundwater may also flow atop the underlying bedrock. If future construction was proposed on either lot, builders and planners should be cognizant of the potential for the occurrence of subsurface water conditions during on-site construction, in order to evaluate and mitigate each individual problem as necessary.

Fluctuations in groundwater and subsurface moisture conditions will occur due to variations in rainfall, irrigation, changes in surface drainage patterns, and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

## 6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the central portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 8.3 miles west of the site. The Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern portion of a large structural feature known as the Denver Basin. In general, the geology at the site consists of Holocene-aged arkosic loamy colluvium and sheetwash alluvium overlying sandstone of the Dawson Formation Facies Unit Three.

### 6.1 Subsurface Soil Conditions

Based on the Geoquest reports referenced above, the on-site soil on proposed lot 2 is anticipated to be silty sand and clayey sand and the on-site soil on proposed lot 3 is anticipated to be clayey sand with underlying silty sand.

### 6.2 Bedrock Conditions

Bedrock (as defined by USDA) was encountered in the profile pit excavations for proposed lot 3 performed by Geoquest, LLC for the property. In general, the bedrock beneath the site is considered to be part of the Dawson formation. The Dawson formation is thick-bedded to massive, generally light colored arkose. The sandstones are poorly sorted with variable clay contents. The sandstone is generally permeable, well drained, and has good foundation support characteristics. The Dawson sandstone is generally not considered a limiting layer for OWTS.

### 6.3 U.S. Soil Conservation Service

The USDA/NRCS soil survey identifies the site soils as:

- 41 – Kettle Gravelly Loamy Sand, 8 to 40 percent slopes. Properties of the loamy sand include somewhat excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.

The USDA Soil Survey Map is presented below.


### 6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, we identified the geologic conditions (listed below) affecting the development, as shown on the Engineering and Geology Map, Figure 3.

The site generally consists of Holocene-aged arkosic loamy colluvium and sheetwash alluvium overlying sandstone of the Dawson Formation Facies Unit Three. Four geologic units were mapped at the site as:

- *cac – Arkosic loamy colluvium and sheetwash alluvium (Holocene)* – unit is comprised of silt and sand
- *Tkda3 – Dawson Formation Facies Unit Three (Paleocene)* – Unit consists of sub-equal amounts of thick and very thick-bedded, massive and cross-bedded, white, tan, and light-gray arkose and pebbly arkose; thin to thick beds of light-green to olive-gray clay-rich, fine- to medium-grained micaceous and feldspathic sandstone; and thin to thick beds of dark-gray to greenish-gray sandy claystone. Facies unit three may have occasional thin, poorly developed, paleosols; reported coaly strata are not exposed at the surface. Unit is 500 to 600 feet thick in the area.
- *Sw –Seasonally wet area* – this area is confined to Kettle Creek's basin.
- *Psw – Potentially seasonally wet area* – these areas are confined to the drainage swales that carry seasonal surface water to Kettle Creek during heavy precipitation events.

- *"No Build Zone"* – Areas that contain slopes greater than 30% within the Kettle Creek drainageway (and a 50-foot setback) are to be considered a "No Build Zone".

**6.5 Engineering Geology**

Two engineering geology units were mapped at the site as:

- *2A* – Stable Alluvium, colluvium and bedrock on gentle to moderate slopes (5-12%)
- *7A*- Physiographic floodplain where erosion and deposition presently occur and is generally subject to recurrent flooding. Includes 100-year floodplain along major streams where floodplain studies have been conducted.

The map unit descriptions for these units are provided by Charles Robinson and Associates (1977).

**6.6 Structural Features**

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed by RMG on the site or in the surrounding area.

**6.7 Surficial (Unconsolidated) Deposits**

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site. Talus accumulations were observed on the site within the low lying dry ravine area in the form of accumulations at the base of the slopes in sheet and cone-like features.

**6.8 Features of Special Significance**

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were observed on the property. It is our understanding that construction is not anticipated to be within the badland/ravine features located on the property. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the study site or surrounding areas.

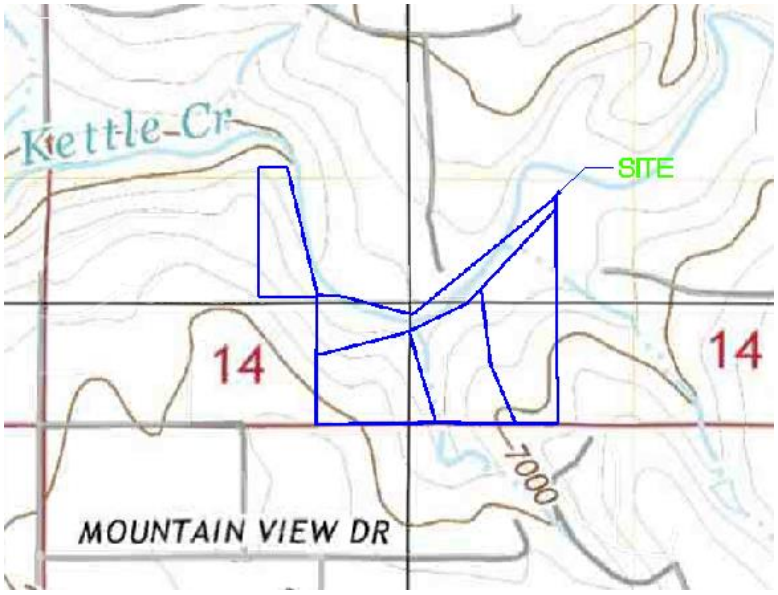
Features indicating creep, slump, or slide masses in bedrock and surficial deposits were also not observed on the property. The banks of Kettle Creek are steep to vertical and should be avoided with new construction. Additional discussion on the steep banks is included in Section **8.5 Unstable or Potentially Unstable Slopes.**

**6.9 Drainage of Water and Groundwater**

The overall topography of the site slopes down to the north. It is anticipated the direction of surface water and groundwater is to flow in the same direction. Groundwater was not reported in the test holes performed for the *Soils Reports* by Geoquest, LLC, referenced above, and is not anticipated to affect shallow foundations. A subsequent groundwater check after drilling was also not recorded. According to CGS – Colorado Geological Survey, groundwater will fluctuate depending on the season, variations in rainfall, new development, proximity to drainages, etc. Groundwater measurements in test borings are limited to the time of year measured (a snapshot) and are inherently inaccurate in predicting depth to groundwater during the engineering life of a structure/development. At this time, there is not enough

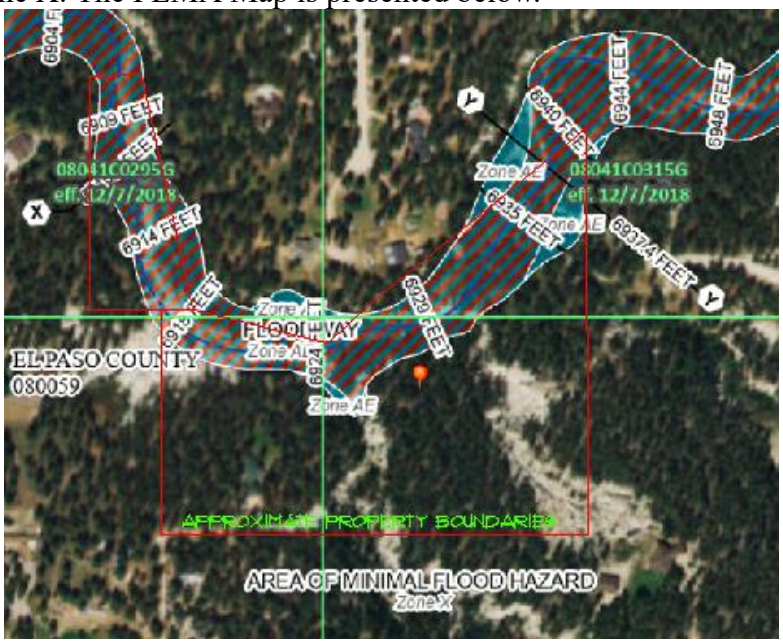
conclusive evidence to preclude basement construction (e.g. elevated moisture conditions, redoximorphic features) or recommend a groundwater-monitoring program to observe seasonal fluctuations. However, if construction is not to occur within years, a follow up test boring to verify the groundwater conditions do/don't exist would be prudent for the future homeowners.

Multiple natural drainage/ravine features traverse the site from south to north towards Kettle Creek. The drainage/ravine features were dry at the time of site recon performed by RMG. The USGS Topo Map is presented below.




**6.10 Flooding and Surface Drainage**

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel Nos. 08041C0295G, 08041C0315G, 08041C0507G, 08041C0526G and the online ArcGIS El Paso County Risk Map, the site lies within a 100-year floodplain and regulatory floodway that traverses the site from the northeast to the northwest along the northern boundary of the property. The remainder of the site is within the boundaries of Zone X. The FEMA Map is presented below.



Zone X is defined by FEMA as an area of minimal flood hazard that is determined to be outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood.

# 7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1* indicates the site is identified as Eolian Deposits consisting of wind-blown sand. The tract is underlain primarily by the Dawson Arkose, a sedimentary formation of Tertiary age related to uplift and erosion of the Front Range.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the Denver Basin Coal Region, the tract identifier is 41-17. However, the area of the site has been mapped “Poor" for coal resources. In this part of the Denver coal region, coal resources are locally present within the lower part of the Laramie Formation of Upper Cretaceous age. This area is not prospective for metallic mineral resources. No oil and gas wells are drilled in the area. Nearby, G. Schoonmaker drilled the Rainbow Valley #1x to a depth of 2,400 feet, 900 feet into the Cretaceous Pierre Formation in 1967. No shows were recorded; therefore, the well was plugged and abandoned. The sedimentary rocks in this area appear to contain all of the essential elements; however, existing geological control is insufficient to determine the presence of a trap or reservoir. Alluvial deposits are commonly mined in the region for sand and gravel. Two sand and gravel mining operations in the vicinity of the tract exist and have active permits from the Colorado Division of Mineral and Geology (DMG). Alluvial deposits containing gravel and/or sand cover approximately 21 acres of tract 41-17. Assuming a mineable thickness of 15 feet, this represents 761,000 tons of potentially useable resource. The quality of the resource has not been determined.

# 8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between geologic hazards and constraints. A *geologic hazard* is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A *geologic constraint* is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic constraints were considered in the preparation of this report and are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Ground Subsidence and Abandoned Mining Activity
- Landslides
- Rockfall
- Groundwater Springs or Seeps
- Shallow Groundwater Tables
- Ponding water
- Steeply Dipping Bedrock

- History of Landfill or Uncontrolled/Undocumented Fill Placement
- Valley Fill
- Downhill/Down-slope Creep
- Soil Slumps and Undercutting
- Corrosive Minerals

The following sections present the geologic conditions that have been identified on the property:

**8.1 Compressible Soils**

Based on the Geoquest, LLC Soils *Report* for proposed Lot 3 referenced above and our experience with similar materials in this area, the on-site soils generally possess low compressibility potential. Foundation design and construction are typically adjusted for collapsible soils. If compressible soils are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation
Mitigation of compressible soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on compressible soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing this slab movement.

If compressible soils are encountered during construction, mitigation of these compressible soils should follow the recommendations presented in the lot-specific *Soils Report* performed by Geoquest, LLC for proposed Lot 3.

**8.2 Expansive Soils/Bedrock**

Based on the Geoquest, LLC *Soils Report* for proposed Lot 2 referenced above and our experience with similar materials in this area, the on-site soils generally possess low swell potential. The Dawson formation is known to have seams of interbedded claystone that have moderate to high swell potential in some locations. It is anticipated that expansive soils may be encountered at depths that may affect residential foundations. If these materials are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation
Foundation design and construction are typically adjusted for expansive soils. Mitigation of expansive soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on expansive soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing slab movement.

If expansive soils or bedrock are encountered during construction, mitigation of these expansive soils should follow the recommendations presented in a lot-specific *Soils Report* performed by Geoquest, LLC for proposed Lot 2.

### 8.3 Flood Prone Areas

Based on our review of the available FEMA community panel maps and the online ArcGIS El Paso County Risk Map, the site lies within the 100-year floodway of Kettle Creek.

Mitigation
The proposed build sites, as presented on the *Canyon Creek Ranch Drainage Plan for Existing Conditions*, prepared by Land Development Consultants, Inc., indicates that no construction is to be within the FEMA 100-year floodplain.

### 8.4 Scour, Erosion, Accelerated Erosion Along Creek Banks and Drainageways

Scour generally refers to a localized loss of soil, often around foundation elements. Erosion generally refers to lowering the ground surface over a wide area.

Visible evidence of erosion and scour along the ravine drainage channels within proposed lots 2 and 3 was not observed. Due to the current alignment of the ravine drainage channels and the configuration of the site, the drainage channels run perpendicular to Kettle Creek and the northern boundary of the site. As such, it is our opinion that additional drainage improvements (beyond those indicated on the *Canyon Creek Ranch Drainage Plan for Existing Conditions*, prepared by Land Development Consultants, Inc.) may be required prior to the driveway installation for Lot 2.

Mitigation
Significant care should be taken (both during construction and in the final grading of the lot) to divert surface drainage and downspout discharge water around the proposed structures to a location that will not significantly alter the overall drainage of the development or result in the need for additional drainage mitigation measures at the time of construction on nearby lots.

Stormwater and snowmelt runoff from parking (driveway) areas should be directed towards drainage channels and away from slopes, both during construction activities and upon completion of site development.

It should be the responsibility of the future homeowner(s) to periodically observe the ravine drainage channels that parallel the proposed lots to identify signs of new or localized erosion. Areas undergoing active erosion should be promptly corrected and restored to ensure the continuing stability of the development.

It is our understanding limited construction is proposed to be within the eastern existing ravine drainage channel located on proposed Lot 3. Based on our conversations with the civil engineer, it is our understanding that they will match the existing Creek View Road elevation and fill in the ravine as required to build up for the roadway. The fill is to be provided with a culvert to allow passage for the drainage waters. JR Engineering is also proposing walls to accommodate the increased road width. Currently there are four separate retaining walls proposed. Two of the walls are to be placed within the drainageway designated as Ravine 2, between Lot 3 and the eastern property boundary. The other two walls are to be placed within the drainageway designated as Ravine 1, in Lot 3. The walls are to be segmented block ranging in height up to approximately 8 feet.

The construction of the retaining walls and placement of fill shall be performed in accordance with recommendations provided by the geotechnical engineer of record, in coordination with the civil/drainage engineer. The retaining walls and associated culverts shall be designed and constructed in such a way that they don't impede the flow of surficial runoff water within the drainageway.

### 8.5 Unstable or Potentially Unstable Slopes

Kettle Creek creates a "U" shape north of the property boundary. The banks along Kettle Creek are vertical in places across the property. The banks of Kettle Creek are comprised of competent sandstone bedrock that is weathering in place from surficial water temporarily pouring over the top of the banks during heavy precipitation events. Although not designated on the *Final Plat*, Kettle Creek is encompassed within Tract A and Tract B with two intermittent drainageways branching off to the south from Kettle Creek. With the two "branches" of Kettle Creek, one located between Lots 1 and 2 and a second along the eastern quarter of Lot 3, consideration will need to be taken in the placement of the residence and OWTS. The banks of Kettle Creek have slopes at or greater than 30%. Generally, slopes greater than 30% are considered "No Build" zones.

Mitigation

The location of the proposed new residences on Lots 2 and 3 are finalized. It is our understanding that the banks and slopes along Kettle Creek are not to be regraded in preparation of the building pads prior to construction of the proposed residences. Based on conversations with the owner/developer the new residences are not to encroach within the banks of the creek. Since the residences were to be set back from the banks of the creek, a slope stability analysis was not performed as part of this investigation. However, based on our experience with similar soils/bedrock and conditions within this region, the banks of Kettle Creek are currently stable at approximately a 2:1 (H:V) slope. The proposed location of the future residences on Lots 2 and 3 are denoted on the *Final Plat.*

We recommend a "No-Build Zone" be established for the slopes that are greater than 30% along the banks of Kettle Creek, as well as a minimum 50-foot setback from the top of the creek banks and drainageways. The "No-Build Zone" is depicted on Figure 5. As currently shown, the location of the future residences meets this recommendation. If future structures are to encroach within this "No-Build Zone", additional review and/or slope stability analyses may be required.

Coordinate with surveyor to update plat to show 50' setback.

### 8.6 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are located near the Ute Pass Fault, which is greater than 10 miles from the subject site. Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.202g for a short period ($S_s$) and 0.057g for a 1-second period ($S_1$). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

### 8.7 Radon

Radon is a gas that can move feely within the soil and air can become trapped in structures constructed on the soil. Radon is a byproduct of the natural decay of uranium and radium. Trace amounts of radioactive nuclides are common in the soils and bedrock that underlie this region and site.

***"Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels".*

Northern El Paso County and the 80908 zip code in which the site is located, has an EPA assigned Radon Zone of *1*. A radon Zone of *1* predicts an average indoor radon screening level greater than 0.4 pCi/L (picocuries per liter), which is above the recommended levels assigned by the EPA. *The EPA recommends corrective measures to reduce exposure to radon gas.*

All of the State of Colorado is considered EPA Zone 1 based on the information provided at https://county-radon.info/CO/El_Paso.html. Elevated hazardous levels of radon from naturally occurring sources are not anticipated at this site.

Mitigation

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Passive radon mitigation systems are also available.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is recommended that the residence be tested after they are enclosed and commonly utilized techniques are in place to minimize the risk.

# 9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in section 8 of this report) found to be present at this site include faults and seismicity and radon. Geologic conditions (as described in section 8 of this report) found to be present at this site include potentially compressible soils, expansive soils, and flood prone areas. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

# 10.0 ADDITIONAL STUDIES

The findings, conclusions, and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test holes, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. Site-specific *Soils Reports* have been completed by Geoquest, LLC and are attached and included in Appendix B.

# 11.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are considered typical for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and suitable construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. A typical perimeter drain detail is presented in Figure 7. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

We believe the sandy clay loam will classify as Type A material and the sandy loam will classify as Type B material as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A and B materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and 1:1 (horizontal to vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction, which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

It is important for the Owner(s) of the property to read and understand this report, and to carefully familiarize themselves with the geologic hazards associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

***The foundation systems for the proposed single-family residential structures and any retention/detention facilities should be designed and constructed based upon the recommendations developed in the site-specific Soils Reports prepared by Geoquest, LLC included as Appendix B.***

# 12.0 CLOSING

This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by

implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **Gregg Cawlfield** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test holes, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

# FIGURES

# APPENDIX A

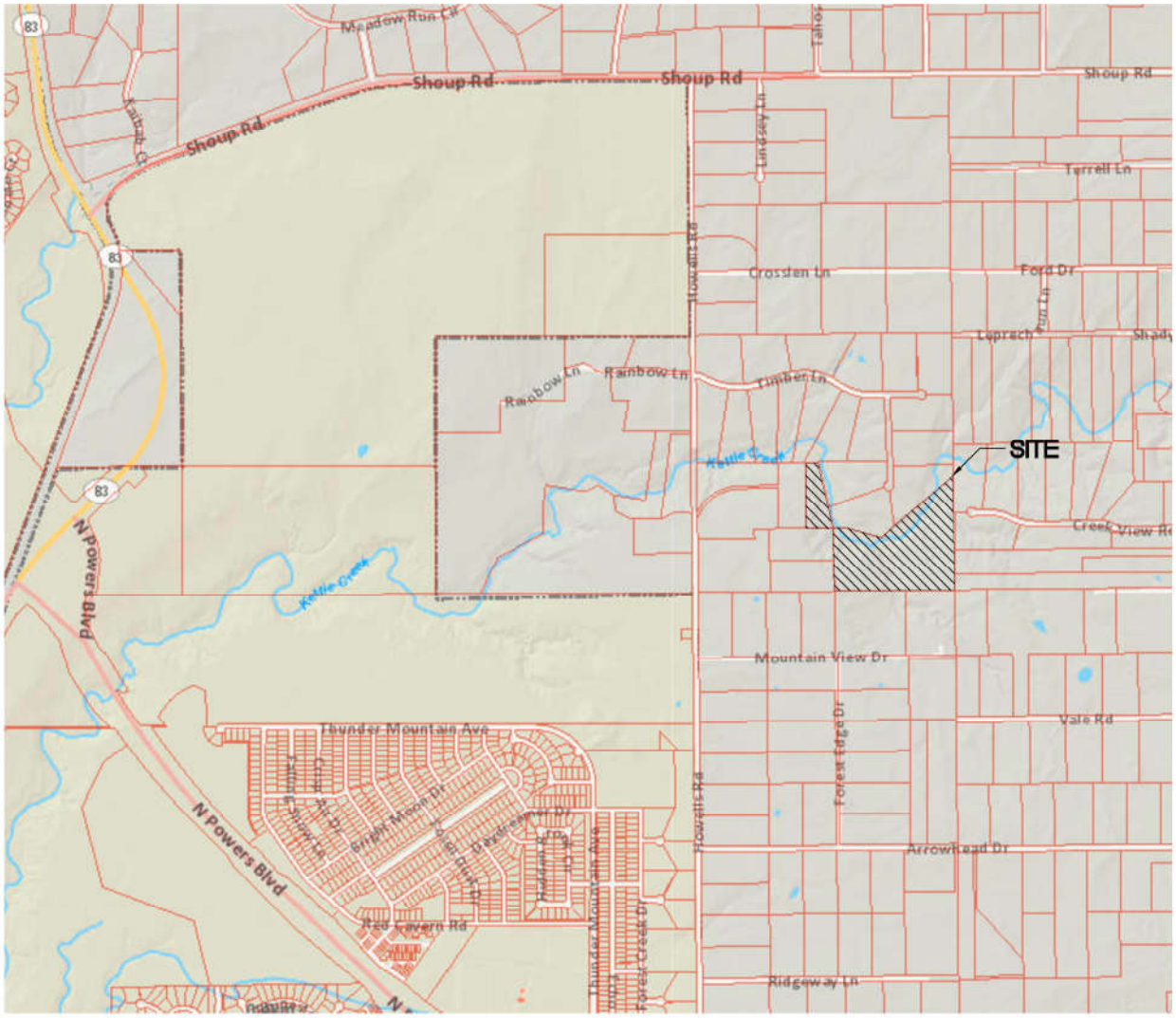
Additional Reference Documents


1. *Canyon Creek Ranch Final Plat Map, El Paso County, Colorado,* prepared by Land Development Consultants Inc., dated December 20, 2020.
2. *Canyon Creek Ranch Drainage Plan for Existing Conditions, El Paso County, Colorado,* prepared by Land Development Consultants Inc., dated March 22, 2022.
3. *Soils Report for Gregg Cawlfield, Lot #2, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1147, dated October 25, 2021.
4. *Soils Report for Gregg Cawlfield, Lot #3, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1148, dated October 21, 2021.
5. *Profile Pit Evaluation for Gregg Cawlfield, Lot #2, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1147, dated October 25, 2021.
6. *Profile Pit Evaluation for Gregg Cawlfield, Lot #3, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1148, dated October 21, 2021.
7. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0295G,* 08041C0315, 08041C0507G, and 08041C0526G, Federal Emergency Management Agency (FEMA), effective December 7, 2018.
8. *Topographic Map of the Falcon NW Quadrangle, El Paso County, Colorado,* USGS, 2022.
9. *Topographic Map of the Monument Quadrangle, El Paso County, Colorado,* USGS, 2022.
10. *Topographic Map of the Pikeview Quadrangle, El Paso County, Colorado,* USGS, 2019.
11. *Topographic Map of the Black forest Quadrangle, El Paso County, Colorado,* USGS, 2022.
12. *Surficial Geologic Map of the Denver 1-degree X 2-degree Quadrangle, Colorado. U.S. Geological Survey, Moore, D.W., Straub, A.W., Berry, M.E., Baker, M.L., and Brandt, T.R., MF-2388, 2001*
13. *Geologic Map of the Monument Quadrangle, El Paso County, Colorado,* Thorson, J.P., and Madole, R.F., Colorado Geological Survey, Open-File Report OF02-04, 2004.
14. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado,* Thorson, J.P., Colorado Geological Survey, Open-File Report OF03-06, 2003.
15. *Geologic Map of the Falcon NW 7.5 Minute Quadrangle, El Paso County, Colorado,* Madole, R.F., Colorado Geological Survey, Open-File Report OF03-08, 2003.
16. *Geologic Map of the Pikeview Quadrangle, El Paso County, Colorado,* Thorson, J.P., Carroll, C. J., and Morgan, M.L., Colorado Geological Survey, Open-File Report OF01-03, 2002.
17. *Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
18. *Map of Potential Geologic Hazards and Surficial Deposits,* compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
19. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
20. El Paso County Assessor Website
    https://property.spatialest.com/co/elpaso/#/property/6214000112
    Schedule No. 6214000112
21. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, 2017, and 2019.
22. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.
23. Kirkham, R.M., and Ladwig, L.R., 1979, Coal resources of the Denver and Cheyenne basins, Colorado: Colorado Geological Survey Resource Series 5, 70 p., 5 plates

24. Keller, J.W., Phillips, R.C., and Morgan, Karen, 2002, Digital inventory of industrial mineral mines and mine permit locations in Colorado: Colorado Geological Survey Information Series IS-62, CD ROM.
25. Mason, G. T., and Arndt, R. E., 1996, Mineral resource data system (MRDS): U.S. Geological Survey Digital Data Series DDS-20 (CD-ROM).
26. Bryant, Bruce, McGrew, L.W., and Wobus, R.A., 1981, Geologic Map of the Denver 1-degree by 2-degree quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series, Map I-1163, scale 1:250,000
27. Scott, Glenn R., Taylor, R.B., Epis, R.C., and Wobus, R.A., 1978, Geologic Map of the Pueblo 1-degree by 2-degree quadrangle, south-central Colorado: U.S. Geological Survey Miscellaneous Investigations Series, Map I-1022, scale 1:250,000
28. Carroll, C.J., and Bauer, M.A., 2002, Historic Coal Mines of Colorado: Colorado Geological Survey Information Series 64, CD ROM.
29. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*
30. The *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1*

# APPENDIX B

*Soils Reports for Gregg Cawlfield, Lot #2 and #3, 0 Creek View Road, El Paso County, Colorado*, prepared by Geoquest, LLC, Job No. 21-1147 and 21-1148, dated October 21 and October 25, 2021.




NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
Southern Colorado, Denver Metro, Northern Colorado

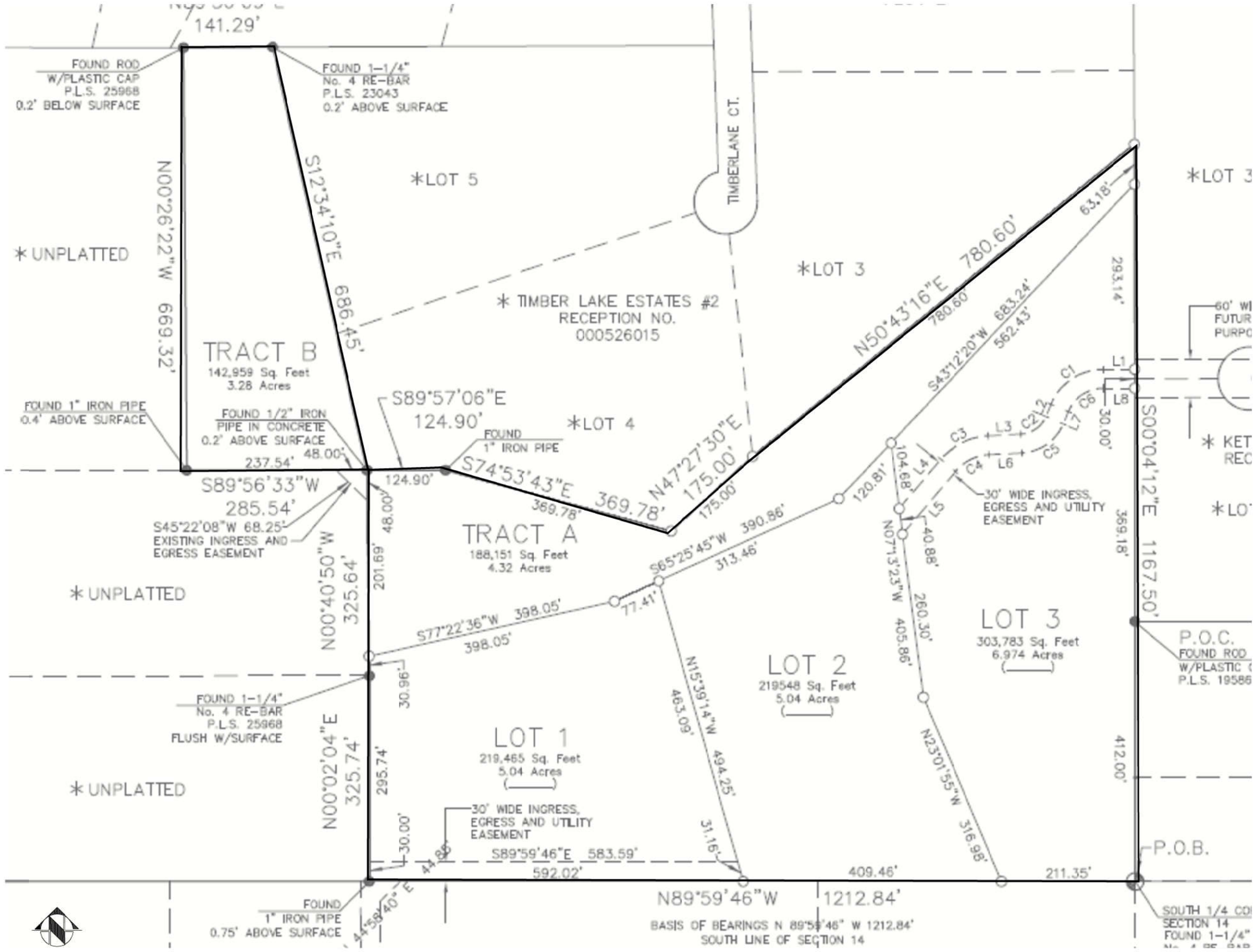
# SITE VICINITY MAP

CANYON CREEK RANCH
EL PASO COUNTY, COLORADO
GREGG CAWLFIELD

JOB No. 189360

FIG No. 1

DATE 6-24-2022




REFERENCE
NOT TO SCALE

JOB No. 189360

RMG
Materials Testing
Forensics
Civil / Planning
Architecture
Structural
Geotechnical

**Engineers / Architects**


SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

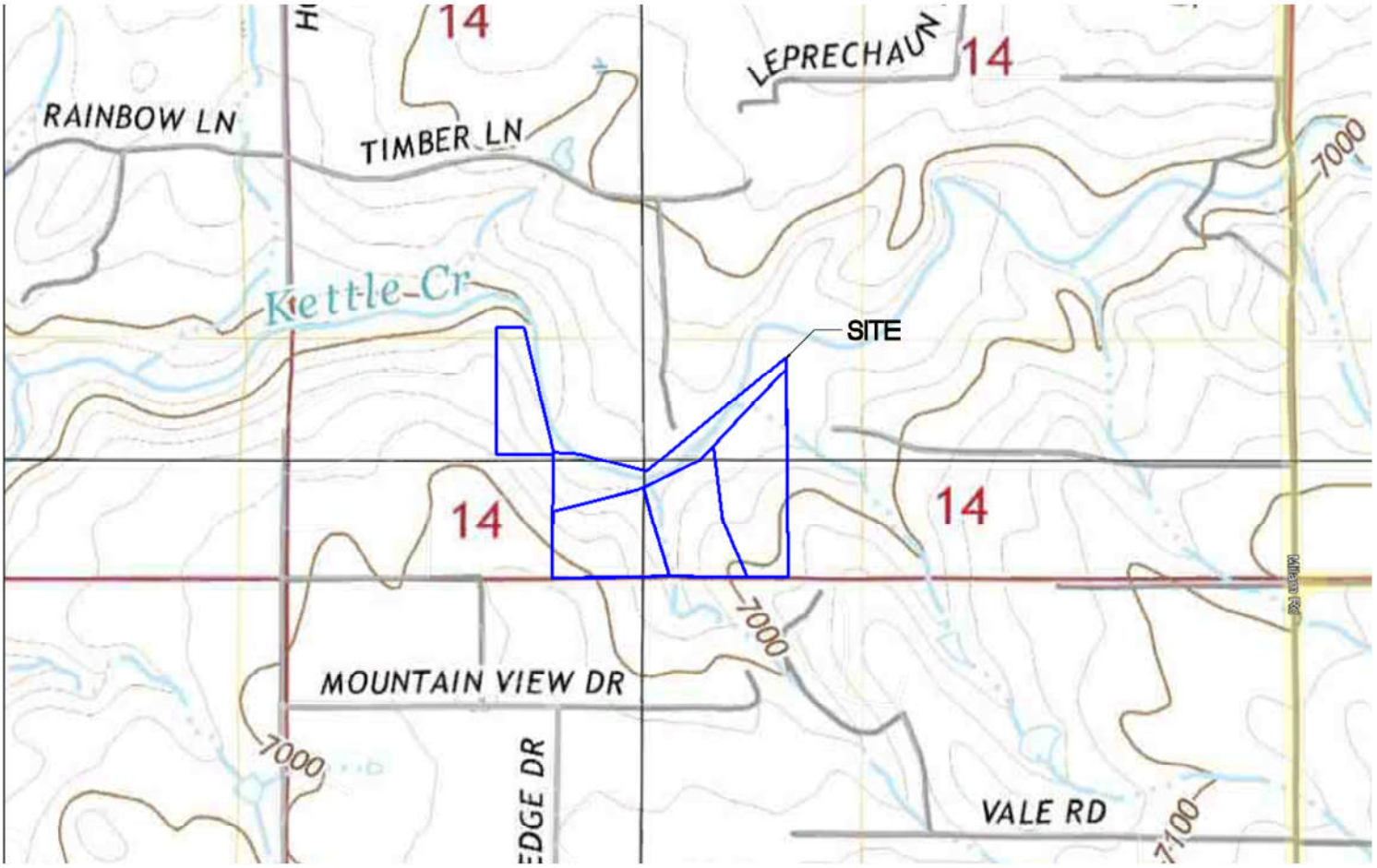

# 0 CREEK VIEW ROAD
# CANYON CREEK RANCH

EL PASO COUNTY, COLORADO
GREGG CAWFIELD

| | |
|---|---|
| ENGINEER: | TPM |
| DRAWN BY: | KCR |
| CHECKED BY: | TPM |
| ISSUED: | 6-6-2022 |

PROPOSED
LOT LAYOUT
MAP

SHEET No.
FIG-2




NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

# USGS TOPO MAP

CANYON CREEK RANCH
EL PASO COUNTY, COLORADO
GREGG CAWLFIELD

JOB No. 189360

FIG No. 3

DATE 6-24-2022


41 - Kettle Gravelly Loamy Sand, 8 to 40 Percent Slopes

NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

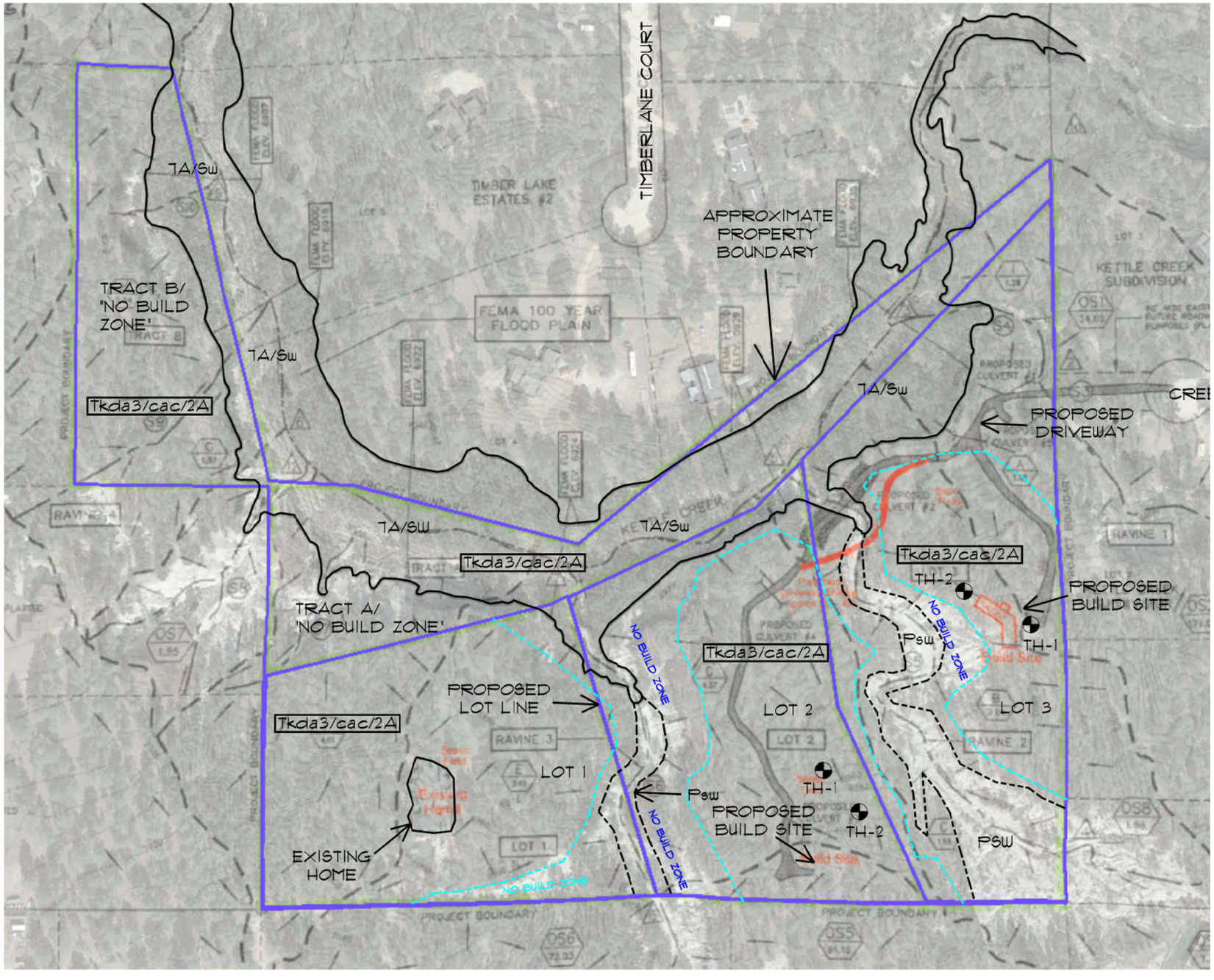
# USDA SOIL SURVEY MAP

CANYON CREEK RANCH
EL PASO COUNTY, COLORADO
GREGG CAWLFIELD

JOB No. 189360

FIG No. 4

DATE 6-24-2022




REFERENCE
NOT TO SCALE

Geologic Conditions

cac - Arkosic loamy colluvium and sheetwash alluvium (Holocene)

Tkda3 - Dawson Formation Facies Unit Three (Paleocene)

Sw - Seasonally wet area, Kettle Creek FEMA 100-Year Floodplain

Psw - Potentially seasonally wet area

"No Build Zone' - Areas that contain slopes greater than 30% within the Kettle Creek drainageway and a 50-foot setback from the top of the creek banks and drainageways

Engineering Conditions

2A - Stable alluvium, colluvium and bedrock on gentle to moderate slopes (5% to 12%)

7A - Physiographic Floodplain where erosion and deposition presently occur and is generally subject to recurrent flooding. Includes 100-year floodplain along major streams where floodplain studies have been conducted

⊕ DENOTES APPROXIMATE LOCATION OF TEST HOLES PERFORMED BY GEOQUEST, LLC, JOB NO. 21-1147 AND 21-1148, DATED 30 SEPTEMBER, 2021

JOB No. 189360

RMG
Materials Testing
Forensics
Civil / Planning
Architecture
Structural
Geotechnical
Engineers / Architects
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100.
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

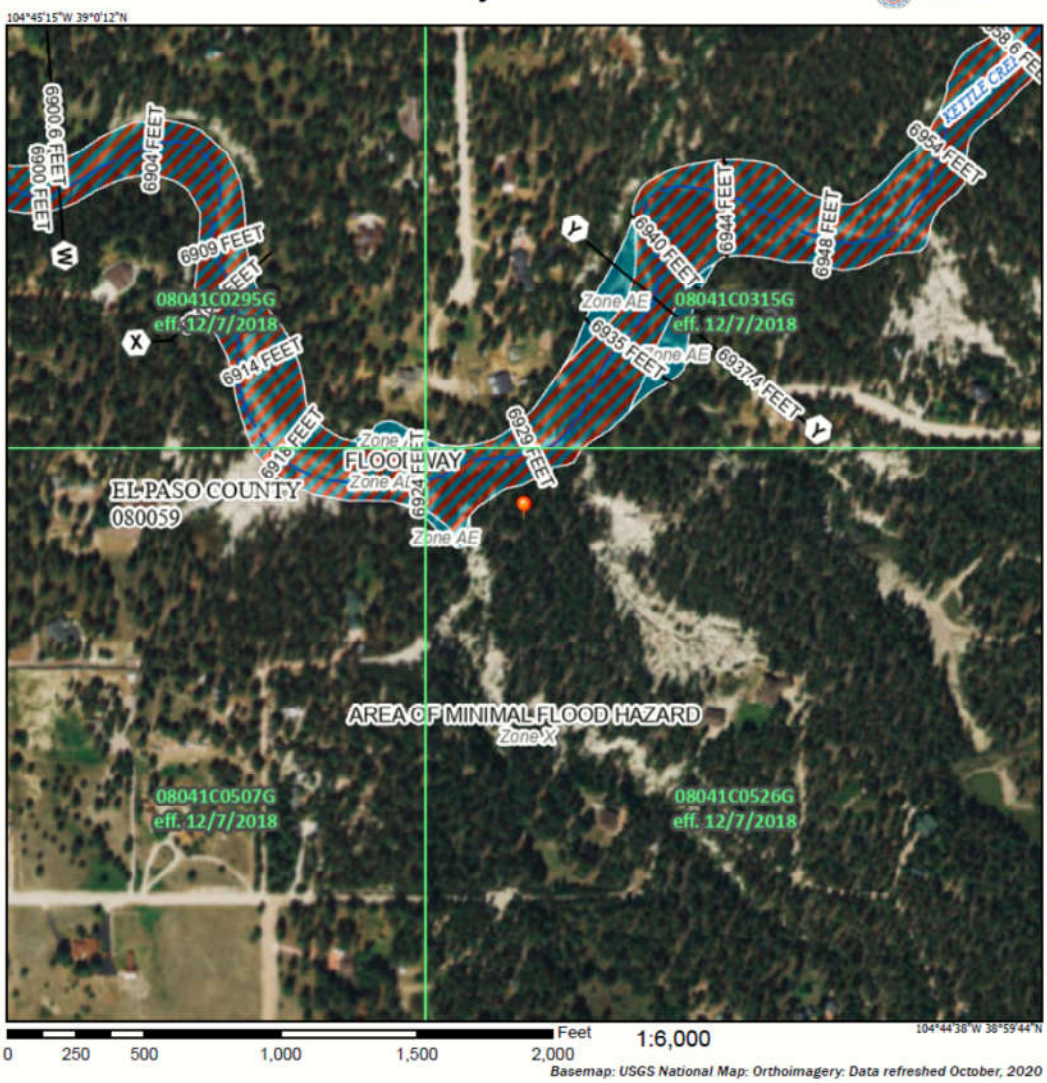
CANYON CREEK RANCH
EL PASO COUNTY, COLORADO
GREGG CAWFIELD

| | |
|---|---|
| ENGINEER: | TPM |
| DRAWN BY: | KCR |
| CHECKED BY: | TPM |
| ISSUED: | 6-24-2022 |
| REVISED: | 12-26-2024 |
| REVISED: 1-9-2025 Include 'No Build Zone' | |

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-3

# National Flood Hazard Layer FIRMette




FEMA

## Legend

SEE FIG REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- SPECIAL FLOOD HAZARD AREAS
  - Without Base Flood Elevation (BFE) Zone A, V, A99
  - With BFE or Depth Zone AE, AO, AH, VE, AR
  - Regulatory Floodway
- OTHER AREAS OF FLOOD HAZARD
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
  - Future Conditions 1% Annual Chance Flood Hazard Zone X
  - Area with Reduced Flood Risk due to Levee. See Notes. Zone X
  - Area with Flood Risk due to Levee Zone D
- OTHER AREAS
  - NO SCREEN Area of Minimal Flood Hazard Zone X
  - Effective LOMRs
  - Area of Undetermined Flood Hazard Zone D
- GENERAL STRUCTURES
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- OTHER FEATURES
  - 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
  - Coastal Transect
  - Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
- MAP PANELS
  - Digital Data Available
  - No Digital Data Available
  - Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/27/2022 at 3:39 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

NOT TO SCALE


Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

**Engineers / Architects**
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

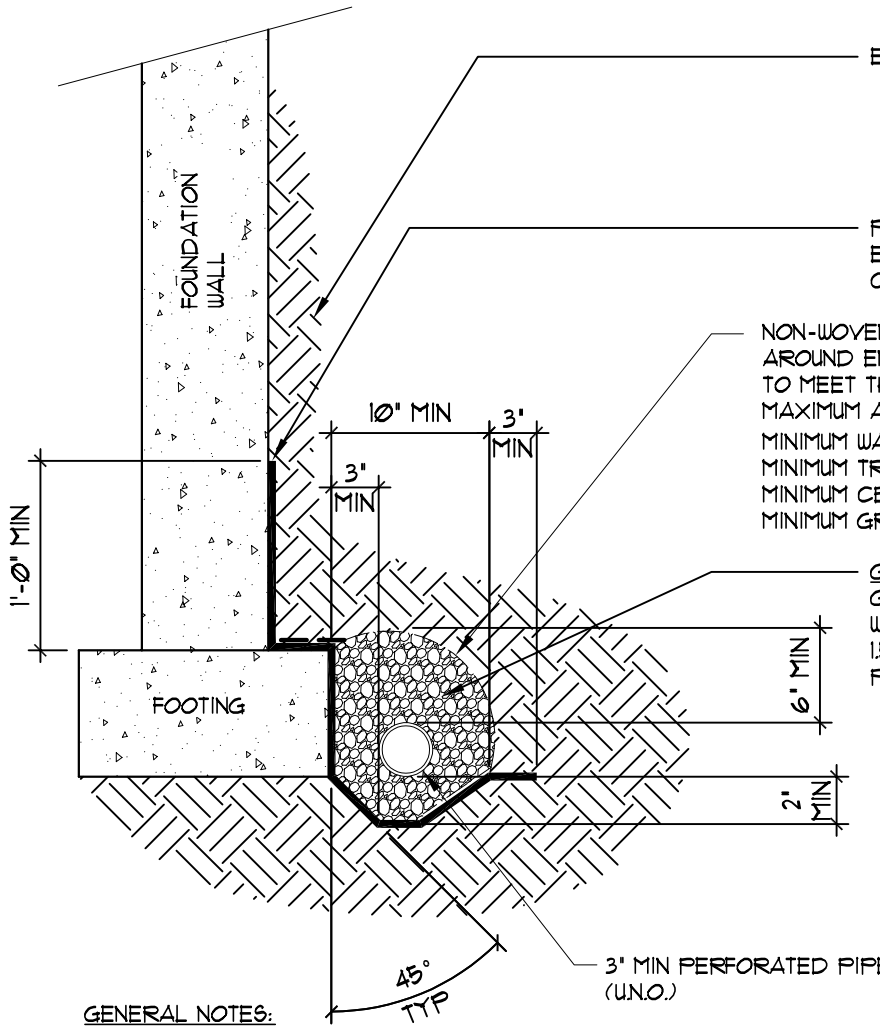

# FEMA MAP

CANYON CREEK RANCH
EL PASO COUNTY, COLORADO
GREGG CAWLFIELD

JOB No. 189360

FIG No. 6

DATE 6-24-2022




GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

**Engineers / Architects**
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
Southern Colorado, Denver Metro, Northern Colorado

# PERIMETER DRAIN

FIG No. 7

25 October 2021

GEOQUEST, LLC
6825 Silver Ponds Heights #101
Colorado Springs, CO 80908
(719) 481-4560

Gregg Cawlfield
4310 Saxton Hollow Road
Colorado Springs, Colorado 80908

RE: Soil Test Receipt, 0 Creek View Road, Geoquest #21-1147

To Whom It May Concern:

Thank you for choosing Geoquest, LLC to perform the Soils Report for the property at the above location.

The attached Soils Report provided by Geoquest, LLC, has been prepared in accordance with the standard of practice. This report does not address possible geologic hazards, environmental hazards, or drainage that exist on-site. There are specific requirements for the design and construction of the foundation of a structure at the location noted in the report. Some of these requirements are placed on the homeowner of the property and may be outside of the builders' control. **Accordingly, we are requiring both the builder and the homeowner to sign this letter indicating both parties have accepted a copy of the report, have read and understood the contents, and know they each have specific responsibilities. Failure to follow the recommendations and requirements of the report by any party can result in unsatisfactory performance of the foundation or building components. The Builder and Owner understand the risks, as noted in the Soils Report, and accept all risk, including movement of slabs.**

After the excavation has been completed an **Open Hole Observation and Compaction Testing are required** to be performed by the Soils Engineer. **After the Final Compaction Test is complete, the owner/builder should inform the Foundation Engineer of any changes to the soil conditions or allowable bearing. The Open Hole Observation and Compaction Tests are an additional cost.**

**Geoquest, LLC, will not provide any documentation for site inspections until we have received this letter with the required signatures.** If the property is being developed as a speculative investment and no homeowner has been contracted to purchase the property, you can indicate that under the homeowner signature line. Upon the sale of the property the builder understands that both this letter and a copy of the Soils Report shall be provided to the buyer, and a homeowner signed copy returned to Geoquest, LLC.

If you have any questions, feel free to contact us at (719) 481-4560.

Sincerely,

Charles E. Milligan, P.E.

Builder Representatives

Homeowner(s)

_____ _____

_____ _____

GEOQUEST, LLC

6825 Silver Ponds Heights #101
Colorado Springs, CO 80908
(719) 481-4560

# SOILS REPORT

## FOR

## GREGG CAWLFIELD

**JOB #21-1147**

Lot #2,
0 Creek View Road,
El Paso County,
Colorado

COLORADO REGISTERED
CHARLES E. MILLIGAN
34608
25 Oct 21
PROFESSIONAL ENGINEER

Sincerely,

Charles E. Milligan, P.E.

**TABLE OF CONTENTS**

## INTRODUCTION

**The owners must be made aware of the contents of this report. If there are any questions or concerns regarding the information in this report, please call Geoquest, LLC.** It is the responsibility of the contractor on this project to make subsequent homeowners aware of the contents of this report. This is to ensure that the recommendations and requirements of the report, especially regarding the surface drainage, are acknowledged and followed. This report is prepared for **Gregg Cawlfield, owner, on Lot #2, 0 Creek View Road, El Paso County, Colorado.** This report is prepared with the understanding that a single-family residence is planned for this site. The site does not have existing structures.

## CONCLUSIONS

**This Over-Excavation Scheme may be revised or rescinded pending the results of the Open Hole Observation. If the Over-Excavation Scheme is rescinded, a bearing of 5,000 pounds per square foot will be used. If the bottom of the excavation becomes unstable, the use of 1' to 2' of 4" to 8" ballast rock will be required.**

A satisfactory foundation for this structure is a properly designed shallow foundation system consisting of foundation components resting directly on over-excavated and replaced materials. This over-excavation and replaced materials scheme is necessary due to the low expansive on-site material. This over-excavation and replaced materials scheme will reduce, but not eliminate the potential for movement with moisture fluctuations in the unstable subgrade soils. Since those materials will remain in-place beneath the fill, a potential remains that moisture changes in these deeper unstable materials will cause some movement in the overlying fill and structure. **Vertical slab movement of up to three inches should be expected of soils of low expansion potential and for compacted structural fill after the removal of the expansive soils. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor system shall be installed.** This material has a swell potential of approximately **0.8% expansion potential with a dead load of 2,700 pounds per square foot (ASTM D-4546). The over-excavated area shall extend to a minimum depth of 4 feet below the bottom of the foundation elevation and 4 feet laterally from the location of the foundation walls.** The material to be compacted in the excavation shall meet or exceed CDOT Class 5 or Class 6 Road Base per CDOT 2019 Standard Specifications Table 703-2. This material shall be compacted to a minimum of 95% of its Modified Proctor density **(ASTM D-1557). Modified Proctor testing (additional cost) will be required on a sample of the replacement material to be used for this over-excavation scheme. Two 5-gallon valid samples of the soil to be used, must be provided for testing (unless a previous proctor test can be provided) at least 2 weeks prior to the placement and compaction of the material.** The compressibility of the over-excavated and replaced material shall be taken to be low. A maximum allowable bearing capacity for the over-excavated and replaced material is a presumptive value of **1,500 pounds per square foot.** This bearing capacity is calculated with a safety factor of three. The type of foundation configuration used depends on the building loads applied. The depth of foundation elements shall be determined by the foundation engineer but should be at least as deep as the minimum depth required by the governing building authority. **The laboratory testing revealed that the on-site soil is silty sand and clayey sand (U.S.C.S. Classification Symbol SM, SC). The unit weight of equivalent fluid soil pressure of this material is 45 (SM) and 85 (SC) pounds per cubic foot. The native SC is not suitable and shall not be used as backfill material around the perimeter of the foundation.** The actual equivalent fluid soil pressure was not determined. The expected values are from ASCE 7-10, Table 3.2-1. **Foundation components should bear on soils of similar bearing capacity. Foundation components bearing on dissimilar soils should be avoided. The owners shall be made aware that movement will definitely occur if surface or subsurface water is allowed to collect around the foundation or in the over-excavated area.**

## GENERAL

The investigation was made to reveal important characteristics of the soils and of the site influencing the foundation design. Also evaluated during the investigation were subsurface conditions which affect the depth of the foundation and subsequent loading design, such as ground water levels, soil types, and other factors which affect the bearing capacity of the soils. Design loadings are based on soils characteristics and represent the maximum permissible loads for these conditions. The bearing capacity is calculated with a safety factor of three.

## FIELD AND LABORATORY INVESTIGATION

Two exploratory holes were drilled on September 30, 2021, at the locations shown on the enclosed site map. The location of these test holes was determined by Gregg Cawlfield. The test holes were drilled with a 3-inch diameter auger. At intervals anticipated to be the foundation depths, and as determined by the soils conditions, the drill tools were removed, and samples were taken by the use of a 2 inch "split barrel" sampler connected to a 140-pound drop-hammer. This hammer is dropped 30 inches to drive the penetration sampler into the soil **(ASTM D-1586).** The depths and descriptions of the materials encountered in each test boring at which the samples were taken are shown on the enclosed log sheets. All samples were classified both in the field and in the laboratory to evaluate the physical and mechanical properties of the materials encountered.

## TOPOGRAPHY

The topography of this site is that of an incline sloping down towards the west at 26%.

## WEATHER

The weather at the time of the soil examination consisted of cloudy skies with moderate temperatures.

## DESIGN AND CONSTRUCTION CONSIDERATIONS

Slabs-on-grade may move and crack. Vertical slab movement of up to three inches should be expected for soils of low expansion potential and for compacted structural fill after removal of expansive soils. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor system shall be installed. The native materials encountered during the exploratory testing are not suitable for the support of residential construction. If compaction is not performed, settlement may occur causing cracking of foundation walls and floors. Personnel of Geoquest, LLC shall inspect the base of the over-excavation prior to any placement of any fill materials. All backfill material and over excavated and replaced material shall be properly tested by Geoquest, LLC at the time of installation of said material. Soil located beneath concrete walls shall be compacted to at least 95% Modified Proctor density **(ASTM D-1557)**. Soil located beneath concrete slabs shall be compacted to at least 85% Modified Proctor density. Special care is to be taken to re-compact the material above utility lines to a minimum of 85% Modified Proctor density. During construction, conditions that could cause settlement shall be eliminated. Interior non-bearing partition walls shall be constructed such that they do not transmit floor slab movement to the roof or overlying floor. The gap or void (1.5-inch min.) installed in these non-bearing partitions may require re-construction over the life of the structure to re-establish the gap or void to allow for vertical slab movement. Stairwells, doorways, and sheeted walls should be designed for this movement.

The following are general recommendations of on-grade slabs:

1. Slabs shall be placed on a minimum of three feet of road base material and be tested to meet Modified Proctor density of 85%. All loose or soft spots shall be thoroughly excavated and replaced with non-expansive soil. **Up to 3 inches of movement of the slabs and exterior concrete can be expected.**

2. Slabs shall be separated from all foundation walls, load bearing members, and utility lines.

3. At intervals not to exceed 12 feet in each direction, provide control joints to reduce problems with shrinkage and curling as recommended by the American Concrete Institute **(ACI 360R-10)**. Moisten the ground beneath the slab prior to the placement of concrete.

4. All concrete placed must be cured properly as recommended by the American Concrete Institute **(ACI 360R-10)**. Separate load bearing members from slabs, as discussed above. Care must be exercised to prevent excess moisture from entering the soil under the structure, both during and after construction.

5. Due to the exposure of exterior concrete to variations in moisture fluctuations, heaving and cracking of exterior slabs-on-grade should be expected. Placement of at least 3 feet of non-expansive fill beneath the slabs can help to reduce the impact of differential movement and cracking but may not eliminate movement. Exterior concrete shall slope away from the structure a minimum of 2% grade.

6. **The clayey sand (SC) has been tested for its expansion and/or consolidation potential. This material has a 0.8% expansion potential with a dead load of 2,700 pounds per square foot.** Basement slabs, garage slabs, and all concrete floor slabs, exert a very low dead-load pressure on the soil. Since this soil contains a small amount of swell potential, slabs will crack and heave or settle if excess water is allowed to penetrate the subgrade. For example, column openings to pads below the placed slab, if exposed to precipitation during construction, will conduct water to the subgrade, possibly causing it to expand. Also, if the slab is placed with concrete too wet, expansion may occur. We recommend 3,000 psi concrete placed at a maximum slump of 4 inches.

**RECOMMENDATION REMARKS**

The recommendations provided in this report are based upon the observed soil parameters, anticipated foundation loads and accepted engineering procedures. The recommendations are intended to minimize differential movement resulting from the heaving of expansive soil or from the settlement induced by the application of loads. **It must be recognized that the foundation will undergo some movement on all soil types.** In addition, concrete floor slabs will move vertically, therefore, adherence to those recommendations which isolate floor slabs from columns, walls, partitions or other structural components is extremely important, if damage to the superstructure is to be minimized. Any subsequent owners should be apprised of the soil conditions and advised to maintain good practice in the future with regard to surface and subsurface drainage and partition framing, drywall and finish work above floor slabs.

Geoquest, LLC does not assure that the contractor and/or homeowner will comply with the recommendations provided in this report. Geoquest, LLC provides recommendations only and does not supervise, direct or control the implementation of the recommendations.

**Failure to follow the recommendation provided by Geoquest, LLC and follow observation requirements may jeopardize the construction project and Geoquest, LLC shall be absolved from any and all responsibility for any damages arising from the failure to obtain proper site observation and follow recommendations.**

**COLD TEMPERATURE CONSIDERATIONS**

1. Concrete shall not be placed upon wet or frozen soil.

2. Concrete shall be protected from freezing until it has been allowed to cure for at least 7 days after placement in forms.

3. Snow or other frozen water shall not be allowed in the forms during placement of concrete.

4. Concrete shall be cured in forms for at least 72 hours.

5. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.

6. The site shall be kept well drained at all times. Ponding of water should be avoided in the excavation area.

## SURFACE DRAINAGE

After construction of foundation walls, the backfill material shall be well compacted to 80% Modified Proctor density, to reduce future settlement. Any areas that settle after construction shall be filled to eliminate ponding of water adjacent to the foundation walls. **The finished grade shall have a positive slope away from the structure with an initial slope of 6 inch in the first 10 feet.** If a 10 foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum of 5 feet from the foundation and sloped parallel with the wall at a 2% grade to intercept the surface water and carry it around and away from the structure. Homeowners shall maintain the surface grading and drainage installed by the builder to prevent water from being directed in the wrong direction. All downspouts shall have extensions that will remove runoff to the outside of the backfilled areas. Shrubs and plants requiring minimal watering shall be established in this area. Irrigated grass shall not be located within 5 feet of the foundation. Sprinklers shall not discharge water within 5 feet of the foundation. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the likelihood of floor slab and foundation movement.

All exterior grading and location of downspouts and their performance shall be inspected by Geoquest, LLC. **The native clayey sand (SC) material is not suitable and shall not be used as backfill material around the perimeter of the foundation.** If on-site soils are not suitable for the backfill, the backfill material shall consist of clean non-cohesive granular soils or road base material as described previously. Imported material is to be approved by Geoquest, LLC prior to placement. **We recommend imported granular backfill with a maximum unit weight of 45 pounds per cubic foot**. It is the responsibility of the contractor to schedule all inspections.

## SUBSURFACE DRAINAGE

Perimeter drains are required around all walls of the habitable or usable area portion of the structure that are below finished grade including all common wall(s) adjacent to the basement. Crawlspaces, slab on grade, and walkout areas need not be drained unless specified at the time of the Open Hole Observation. Perimeter drains may be required during the open hole due to high moisture or grade that slopes toward the excavation. The final determination of the necessity for perimeter drains will be made at the time of the Open Hole Observation. An Exterior Drain Detail is provided in this report. Drains should daylight away from the structure or discharge to a sump pump. Even if drains are not required, areas below grade may experience moisture problems if unusual conditions are present in the future.

## REINFORCING

The concrete foundation walls shall be properly reinforced as per the specific design for this foundation by a **Colorado Registered Professional Engineer. Exact requirements are a function of the design of the structure. Questions concerning the specific design requirements shall be referred to the design engineer.**

## FOOTING DESIGN

The design for footings, pads, and/or piers for this structure is determined by applying the dead load and full live load to the foundation walls.

## CONSTRUCTION DETAILS

It is necessary with any soils investigation to assume that the materials from the test holes are representative of the materials in the area. On occasion variations in the subsurface materials do occur, therefore, should such variations become apparent during construction, the owner is advised to contact this office for a determination as to whether these variations will affect the design of the structure's foundation. If anomalies are observed during the excavation for the structure, this office should be contacted to determine whether this may adversely affect the design.

**MINIMUM MATERIALS SPECIFICATIONS**

1. Minimum materials specifications of the concrete, reinforcing, etc., shall be determined by the Professional Foundation Design Engineer.

2. Compact beneath foundation walls a minimum of 95% Modified Proctor density to prevent settlement.

3. Compact all backfill material located around the perimeter of the foundation to 80% Modified Proctor density.

4. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.

5. The site shall be kept well drained at all times.

**OPEN HOLE OBSERVATION (added cost)**

**If anyone other than Geoquest, LLC performs the Open Hole Observation and/or compaction testing, that person/company assumes liability for the soils, and any possible changes to the foundation design.**

The owner, or a representative of the construction company shall contact **Geoquest, LLC** a minimum of **24 hours** prior to excavating for the foundation. An Open Hole Observation must be performed on each individual structure prior to the placement of concrete, and preferably prior to the placement of forms in the excavated area. **The failure to request or obtain an Open Hole Observation prior to the placement of foundation components may result in this Soils Report being declared null and void.** This is to ensure that soft areas, anomalies, etc., are not present in the foundation region. At the time of the open hole observation the **foundation type recommendations, maximum allowable bearing capacity may be revised** according to soil conditions found at that time. If revisions are made to the Soils Report due to the soil conditions of the excavation, **the Foundation Design Engineer must be notified of all revisions.**

**COMPACTION TESTING (added cost)**

Geoquest, LLC shall perform compaction testing on the replaced material. Soil shall be compacted in maximum 6-inch lifts. Testing shall be performed at intervals not to exceed 24 inches (or as required by the design engineer). Modified Proctor Density must be provided to Geoquest, LLC prior to compaction testing, see below.

The owner, or a representative of the construction, shall contact Geoquest, LLC a **minimum of 24 hours prior to the time the compaction test is requested. The failure to properly compact and/or obtain proper compaction testing may result in this Soils Report being declared null and void.**

**MODIFIED PROCTOR DENSITY TESTING (added cost)**

**Modified Proctor Density test must be provided to Geoquest, LLC prior to compaction testing.** If a Proctor cannot be provided, a Modified Proctor Density test must be completed prior to compaction testing. Two 5-gallon valid samples of the soil to be used, must be provided for testing, at least 2 weeks prior to the placement and compaction of the material.

**The failure to provide this data may result in this Soils Report being declared null and void.**

**FINAL OBSERVATIONS (added cost)**

The owner, or a representative of the construction company, shall contact Geoquest, LLC at the time final grading and landscaping procedures are completed. This is to ensure that sprinkler systems are not installed adjacent to the structure and that only shrubs or plants that require minimal watering are established in this area. All exterior grading as well as the location of downspouts and their performance shall be inspected by Geoquest, LLC. Any additional landscaping or grading changes performed by subsequent contractors and/or owners shall be inspected and approved. It is the responsible of the contractor and/or owner to schedule all these inspections at the appropriate times. **The failure to obtain this inspection may result in this Soils Report being declared null and void.**

**LIMITATIONS**

This report is issued based on the understanding that the owner or his representative will bring the information, data, and recommendations contained in this report to the attention of the project engineer and architect, in order that they may be incorporated into the plans for the structure. It is also the owner's responsibility to ensure that all contractors and sub-contractors carry out these recommendations during the construction phase.

This report was prepared in accordance with generally accepted professional geotechnical/engineering methods. However, Geoquest, LLC makes no other warranty, express or implied, as to the findings, data, specifications, or professional advice rendered hereunder. **Due to circumstances outside of Geoquest, LLC's control, including improper construction, failure to follow recommendations, and unforeseen events, the Limits of Liability extend only to fees rendered for the professional services provided.**

This report is considered valid as of the present date. The owner acknowledges, however, that changes in the conditions of the property might occur with the passage of time, such as those caused by natural effects or man-made changes, both on this land and on abutting properties. Further, changes in acceptable tolerances or standards might arise as the result of new legislative actions, new engineering advances, or the broadening of geotechnical knowledge. Thus, certain developments beyond our control may invalidate this report, in whole or in part.

This report and its recommendations do not apply to any other site than the one described herein and are predicated on the assumption that the soil conditions do not deviate from those described. In the event that any variations or undesirable conditions should be detected during the construction phase or if the proposed construction varies from that planned as of this report date, the owner shall immediately notify Geoquest, LLC in order that supplemental recommendations can be provided, if so required.

This report excludes possible environmental issues, geologic hazards, flooding, or any other natural or man-made hazards that affect this site. These are outside the scope of work, for this report.

## APPENDIX

GEOQUEST, inc
481-4560

# DRILL LOGS

JOB #: 21-1147

TEST BORING
NO.: TH-1

DATE: 9/30/2021

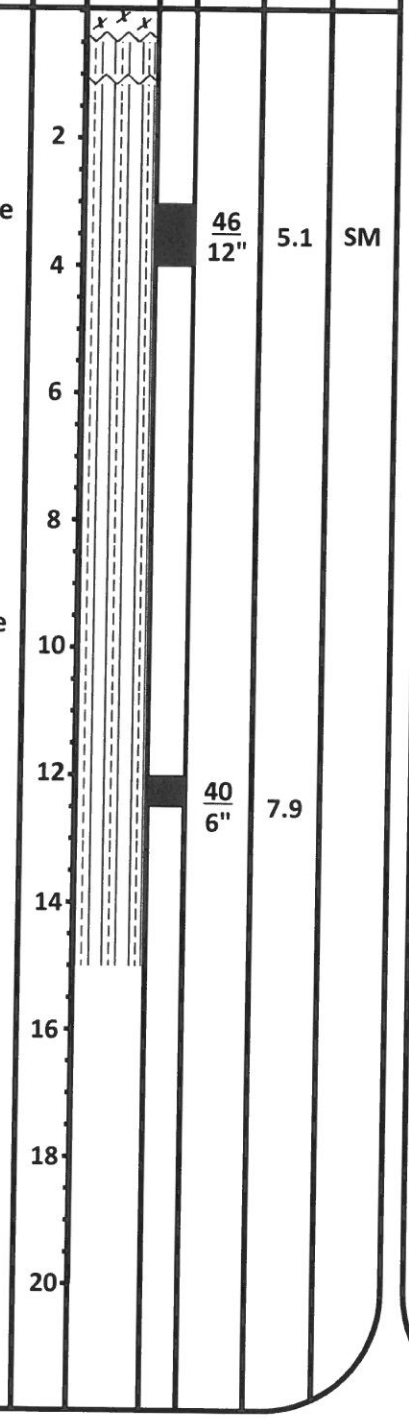
**0"-4" Topsoil**

**4"-1' Sand**

Fine-coarse grained
Moderate density
Low-moderate moisture content
Low-moderate clay content
Low plasticity
Light Yellowish Brown color

**1'- 15' Sandstone (SM)**

Fine-coarse grained
Very high density
Low-moderate moisture content
Low clay content
Low plasticity
Grey color




JOB #: 21-1147

TEST BORING
NO.: TH-2

DATE: 9/30/2021

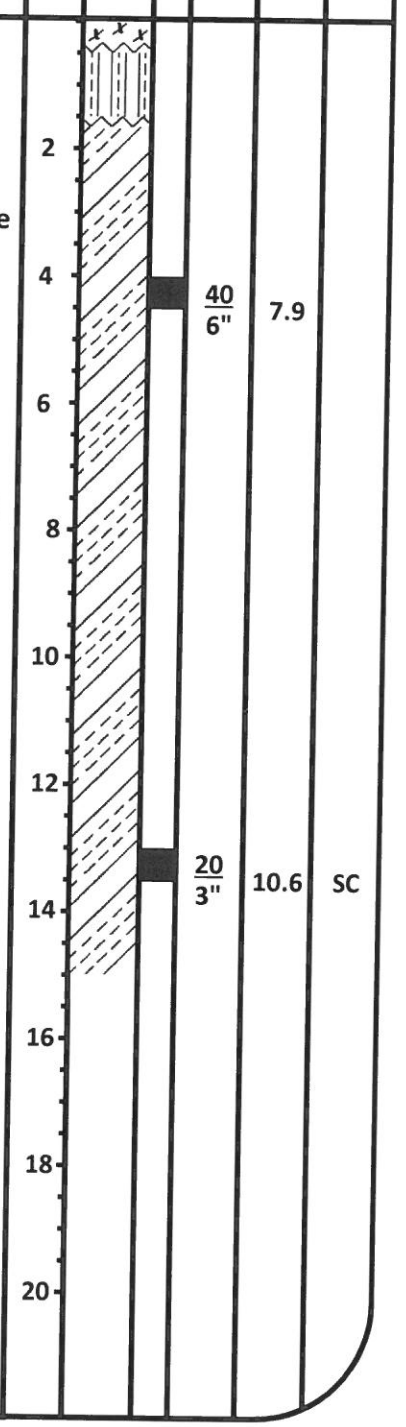
**0"-4" Topsoil**

**4"-18" Sand**

Fine-coarse grained
Moderate density
Low-moderate moisture content
Low-moderate clay content
Low plasticity
Light Yellowish Brown color

**18"- 15' Sandstone (SC)**

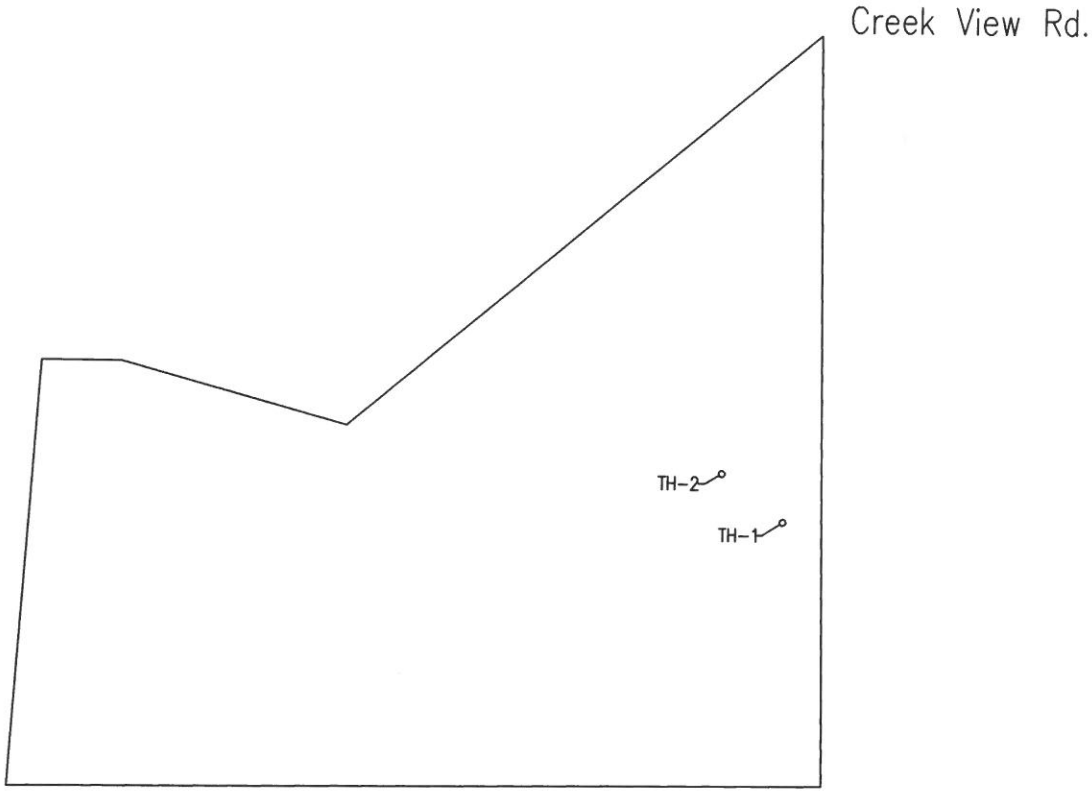
Fine-coarse grained
Very high density
Moderate moisture content
Moderate clay content
Moderate plasticity
Grey color



# GEOQUEST LLC

**SITE MAP**

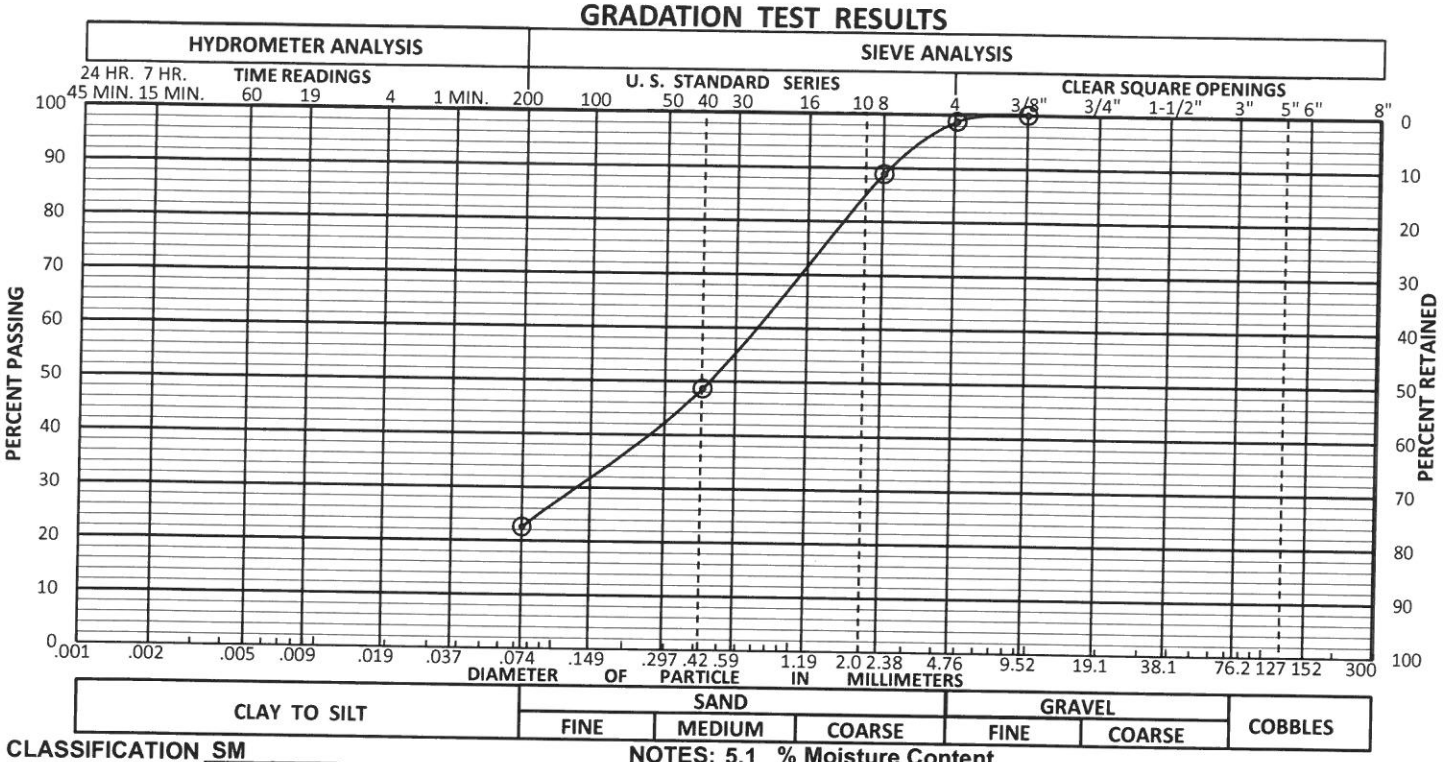
Lot 2
0 Creek View Rd.
El Paso County
Colorado
Job #21-1147




N

0 100 200 300
GRAPHIC SCALE IN FEET
SCALE: 1" = 300'

# GEOQUEST LLC
## GRADATION TEST RESULTS




**CLASSIFICATION** SM

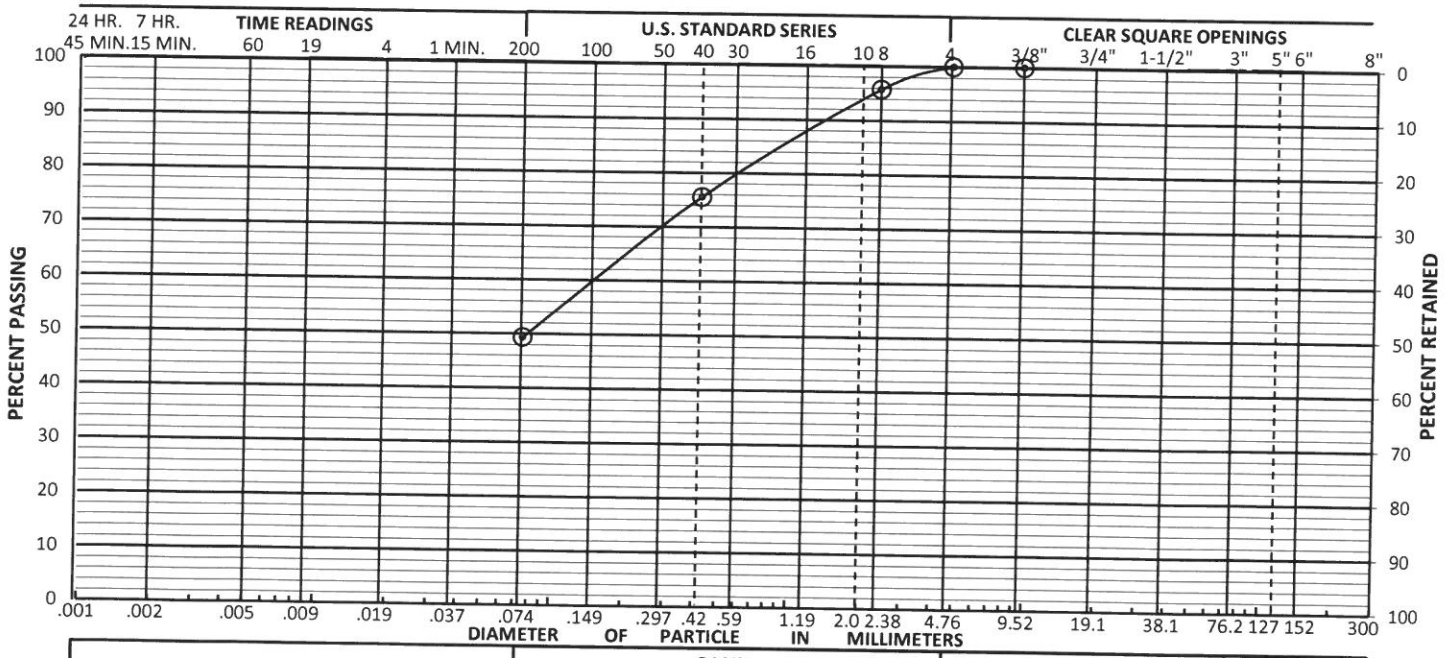
**GRAVEL** 1.2 %

**SAND** 76.2 %

**FINES** 22.6 %

**SAMPLE #** 1 **HOLE #** TH-1 **DEPTH** 3 **FEET**

**NOTES:** 5.1 % Moisture Content




**CLASSIFICATION** SC

**GRAVEL** 0.0 %

**SAND** 50.7 %

**FINES** 49.3 %

**SAMPLE #** 1 **HOLE #** TH-2 **DEPTH** 13 **FEET**

**NOTES:** 10.6% Moisture Content

LL = 25.9

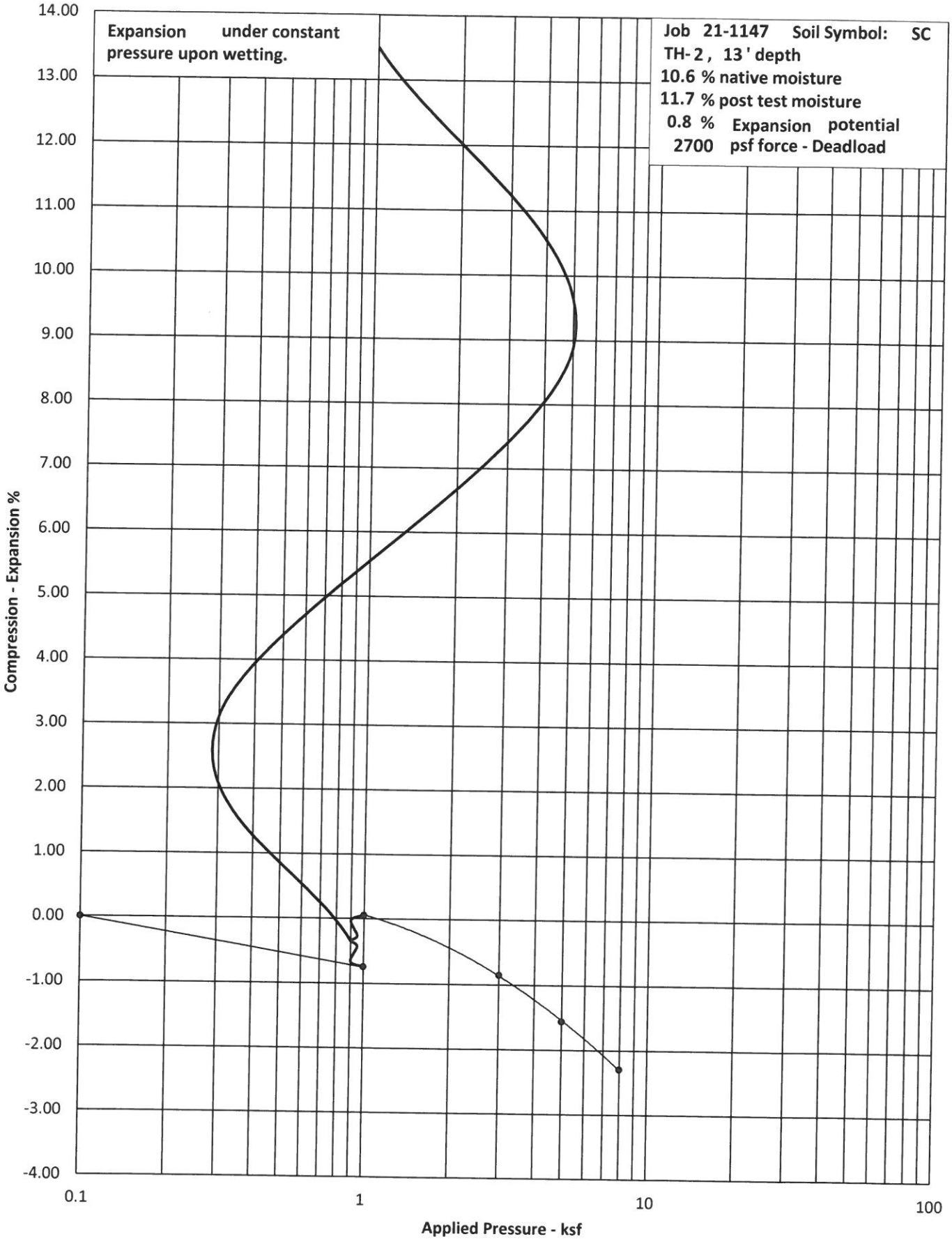
PL = 17.9

PI = 8.0

Job #: 21-1147 By: MJ 9/30/2021

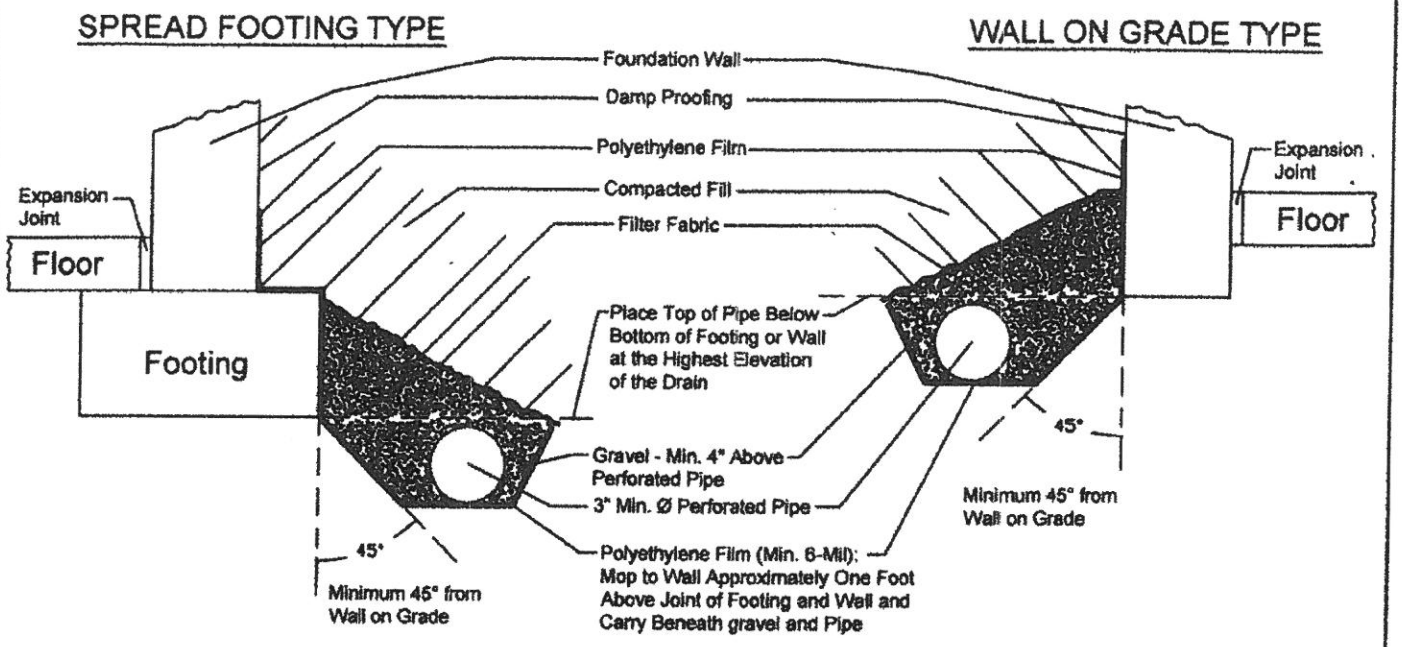
GEOQUEST LLC

**SWELL-CONSOLIDATION TEST RESULTS**



GEOQUEST, LLC
481-4560

# EXTERIOR DRAIN DETAIL




1. Gravel to be Not More Than 1-1/2" and Not Less Than 1/2" Diameter.

2. Perforated Pipe Diameter Varies With Expected Seepage. 3"Ø and 4"Ø are Most Common. ABS and PVC are Most Common Materials for Pipe. We approve the use of an "EZ Flow Drainage System" by Infiltrator. All specifications in this drain detail are still applicable.

3. Pipe to be Laid out in a Minimum Slope of 1" in 10'.

4. Gravity Outfall is Desired if Possible. Portion of Pipe in Area Not Drained Shall be Non-Perforated. Daylight Must be Maintained Clear of Debris in Order to Function Properly.

5. If Gravity Outfall is Not Possible, Provide a Sump With Operational Pump. Pump May Not Connect to Any Sanitary or Storm Sewer.

6. Soil Backfill Should be Compacted to at Least 80% of the Modified Proctor Denisty in the Upper Three Feet of Fill.

7. Filter Fabric to be Mirafi 140s or Approved Equivalent. Roofing Felt and Sheet Plastic are Not Acceptable.

8. Drain Pipe Shall be Laid Below Protected Area, as Shown in The Detail Above.

9. Mop Polyethylene Film to Wall Approximately One Foot Above Joint of Footing and Wall (Do Not Pull Plastic Tight) and Carry Beneath Gravel and Pipe.

10. The Polyethylene Film Shall be Continued to the Edge of the Excavation.

20 October 2021

GEOQUEST, LLC
6825 Silver Ponds Heights #101
Colorado Springs, CO 80908
(719) 481-4560

Gregg Cawlfield
4310 Saxton Hallow Road
Colorado Springs, Colorado 80908

RE: Soil Test Receipt, 0 Creek View Road, Geoquest #21-1148

To Whom It May Concern:

Thank you for choosing Geoquest, LLC to perform the Soils Report for the property at the above location.

The attached Soils Report provided by Geoquest, LLC, has been prepared in accordance with the standard of practice. This report does not address possible geologic hazards, environmental hazards, or drainage that exist on-site. There are specific requirements for the design and construction of the foundation of a structure at the location noted in the report. Some of these requirements are placed on the homeowner of the property and may be outside of the builders' control. **Accordingly, we are requiring both the builder and the homeowner to sign this letter indicating both parties have accepted a copy of the report, have read and understood the contents, and know they each have specific responsibilities. Failure to follow the recommendations and requirements of the report by any party can result in unsatisfactory performance of the foundation or building components. The Builder and Owner understand the risks, as noted in the Soils Report, and accept all risk, including movement of slabs.**

After the excavation has been completed an **Open Hole Observation is required** to be performed by the Soils Engineer. **After the Open Hole Observation is complete, the owner/builder should inform the Foundation Engineer of any changes to the soil conditions or allowable bearing. The Open Hole Observation is an additional cost.**

**Geoquest, LLC, will not provide any documentation for site inspections until we have received this letter with the required signatures.** If the property is being developed as a speculative investment and no homeowner has been contracted to purchase the property, you can indicate that under the homeowner signature line. Upon the sale of the property the builder understands that both this letter and a copy of the Soils Report shall be provided to the buyer, and a homeowner signed copy returned to Geoquest, LLC.

If you have any questions, feel free to contact us at (719) 481-4560.

Sincerely,

Charles E. Milligan, P.E.

Builder Representatives

Homeowner(s)

_____ _____

_____ _____

GEOQUEST, LLC
6825 Silver Ponds Heights #101
Colorado Springs, CO 80908
(719) 481-4560

# SOILS REPORT

## FOR

## GREGG CAWLFIELD

**JOB #21-1148**

Lot #3,
0 Creek View Road,
El Paso County,
Colorado

COLORADO LICENSED
CHARLES E. MILLIGAN
34608
21 Oct 21
PROFESSIONAL ENGINEER

Sincerely,

Charles E. Milligan, P.E.

**TABLE OF CONTENTS**

## INTRODUCTION

**The owners must be made aware of the contents of this report. If there are any questions or concerns regarding the information in this report, please contact Geoquest, LLC.** It is the responsibility of the contractor on this project to make subsequent owners aware of the contents of this report. This is to ensure that the recommendations and requirements of the report, especially regarding the surface drainage, are acknowledged and followed. This report is prepared for **Gregg Cawfield, owner, on Lot #3, 0 Creek View Road, El Paso County, Colorado.** This report is prepared with the understanding that a single-family residence is planned for this site. The site does not have existing structures.

## CONCLUSIONS

A satisfactory foundation for this structure is a properly designed shallow foundation system consisting of foundation components resting directly on undisturbed materials. Foundation components resting directly on undisturbed native materials shall be designed for a loading of not greater than **5,000 pounds per square foot. Any design by any engineer is subject to revision based on the results of the open hole observation.** The compressibility of this material is low. This bearing capacity is calculated with a safety factor of three. The type of foundation configuration used depends on the building loads applied. The depth of foundation elements shall be determined by the foundation engineer but should be at least as deep as the minimum depth required by the governing building authority. **The laboratory testing revealed that the on-site soil is clayey sand with underlying silty sand (U.S.C.S. Classification Symbol SC, SM). The unit weight of equivalent fluid soil pressure of this material is 85 (SC) and 45 (SM) pounds per cubic foot. The native SC is not suitable and shall not be used as backfill material around the perimeter of the foundation.** The actual equivalent fluid soil pressure was not determined. The expected values are from ASCE 7-10, Table 3.2-1. **Foundation components should bear on soils of similar bearing capacity. Foundation components bearing on dissimilar soils should be avoided. The owners shall be made aware that movement will occur if surface or subsurface water is allowed to collect around the foundation wall.**

## GENERAL

The investigation was made to reveal important characteristics of the soils and of the site influencing the foundation design. Also evaluated during the investigation were subsurface conditions that affect the depth of the foundation and subsequent loading design, such as ground water levels, soil types, and other factors which affect the bearing capacity of the soils. Design loadings are based on soils characteristics and represent the maximum permissible loads for these conditions. The bearing capacity is calculated with a safety factor of three.

## FIELD AND LABORATORY INVESTIGATION

Two exploratory holes were drilled on September 30, 2021, at the locations shown on the enclosed site map. The location of these test holes was determined by Gregg Cawlfield. The test holes were drilled with a 3-inch diameter auger. At intervals anticipated to be the foundation depths, and as determined by the soils conditions, the drill tools were removed, and samples were taken by the use of a 2-inch split barrel sampler connected to a 140-pound drop-hammer. This hammer is dropped 30 inches to drive the penetration sampler into the soil **(ASTM D-1586).** The depths and descriptions of the materials encountered in each test boring at which the samples were taken are shown on the enclosed log sheets. All samples were classified both in the field and in the laboratory to evaluate the physical and mechanical properties of the materials encountered.

**TOPOGRAPHY**

The topography of this site is that of an incline sloping down towards the west at 22%.

**WEATHER**

The weather at the time of the soil examination consisted of cloudy skies with moderate.

**DESIGN AND CONSTRUCTION CONSIDERATIONS**

Slabs-on-grade may move and crack. Vertical slab movement of up to one and a half inches should be expected for native soils with low expansion potential. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor system should be installed. If compaction is not performed, settlement may occur causing cracking of foundation walls and floors. Soil located beneath concrete walls shall be compacted to at least 95% Modified Proctor density **(ASTM D-1557)**. Soil located beneath concrete slabs shall be compacted to at least 85% Modified Proctor density. Special care is to be taken to re-compact the material above utility lines to a minimum of 85% Modified Proctor density. During construction, conditions that could cause settlement shall be eliminated. Interior non-bearing partition walls shall be constructed such that they do not transmit floor slab movement to the roof or overlying floor. The gap or void (1.5 inch min.) installed in these non-bearing partitions may require re-construction over the life of the structure to re-establish the gap or void to allow for vertical slab movement. Stairwells, doorways, and sheeted walls should be designed for this movement.

The following are general recommendations of on-grade slabs:

1. Slabs shall be placed on well-compacted, non-expansive materials, and all soft spots shall be thoroughly excavated and replaced with non-expansive fill materials as stated above.

2. Slabs shall be separated from all foundation walls, load bearing members, and utility lines.

3. At intervals not to exceed 12 feet in each direction, provide control joints to reduce problems with shrinkage and curling as recommended by the American Concrete Institute **(ACI 360R-10)**. Moisten the ground beneath the slab prior to the placement of concrete.

4. All concrete placed must be cured properly as recommended by the American Concrete Institute **(ACI 360R-10)**. Separate load bearing members from slabs, as discussed above. Care must be exercised to prevent excess moisture from entering the soil under the structure, both during and after construction.

5. Due to the exposure of exterior concrete to variations in moisture fluctuations, heaving and cracking of exterior slabs-on-grade should be expected. Placement of at least 3 feet of non-expansive fill beneath the slabs can help to reduce the impact of differential movement and cracking but may not eliminate movement. Exterior concrete shall slope away from the structure a minimum of 2% grade.

6. The clayey sand (SC) has been analyzed for its expansion and/or consolidation potential. Basement slabs, garage slabs, and all concrete floor slabs, however, exert a very low dead-load pressure on the soil. Since this soil contains at least a small amount of swell potential, slabs will crack and heave or settle if excess water is allowed to penetrate the sub-grade. For example, column openings to pads below the placed slab, if exposed to precipitation during construction, will conduct water to the sub-grade, possibly causing it to expand. Also, if the slab is placed with concrete too wet, expansion may occur. We recommend 3,000 psi concrete placed at a maximum slump of 4 inches.

**RECOMMENDATION REMARKS**

The recommendations provided in this report are based upon the observed soil parameters, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to minimize differential movement resulting from the heaving of expansive soil or from the settlement induced by the application of loads. **It must be recognized that the foundation will undergo some movement on all soil types.** In addition, concrete floor slabs will move vertically, therefore, adherence to those recommendations which isolate floor slabs from columns, walls, partitions or other structural components is extremely important if damage to the superstructure is to be minimized.

Any subsequent owners should be apprised of the soil conditions and advised to maintain good practice in the future with regard to surface and subsurface drainage and partition framing, drywall and finish work above floor slabs.

Geoquest, LLC does not assure that the contractor and/or homeowner will comply with the recommendations provided in this report. Geoquest, LLC provides recommendations only and does not supervise, direct or control the implementation of the recommendations.

**Failure to follow the recommendation provided by Geoquest, LLC and follow observation requirements may jeopardize the construction project and Geoquest, LLC shall be absolved from any and all responsibility for any damages arising from the failure to obtain proper site observation and follow recommendations.**

**COLD TEMPERATURE CONSIDERATIONS**

1. Concrete shall not be placed upon wet or frozen soil.

2. Concrete shall be protected from freezing until it has been allowed to cure for at least 7 days after placement in forms.

3. Snow or other frozen water shall not be allowed in the forms during placement of concrete.

4. Concrete shall be cured in forms for at least 72 hours.

5. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.

6. The site shall be kept well drained at all times. Ponding of water should be avoided in the excavation area.

**SURFACE DRAINAGE**

After construction of foundation walls, the backfill material shall be well compacted to 80% Modified Proctor density, to reduce future settlement. Any areas that settle after construction shall be filled to eliminate ponding of water adjacent to the foundation walls. **The finished grade shall have a positive slope away from the structure with an initial slope of 6 inch in the first 10 feet.** If a 10 foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum of 5 feet from the foundation and sloped parallel with the wall at a 2% grade to intercept the surface water and carry it around and away from the structure. Homeowners shall maintain the surface grading and drainage installed by the builder to prevent water from being directed in the wrong direction. All downspouts shall have extensions that will remove runoff to the outside of the backfilled areas. Shrubs and plants requiring minimal watering shall be established in this area. Irrigated grass shall not be located within 5 feet of the foundation. Sprinklers shall not discharge water within 5 feet of the foundation. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the likelihood of floor slab and foundation movement.

All exterior grading and location of downspouts and their performance shall be inspected by Geoquest, LLC. **The native clayey sand (SC) material is not suitable and shall not be used as backfill material around the perimeter of the foundation.** If on-site soils are not suitable for the backfill, the backfill material shall consist of clean non-cohesive granular soils or road base material as described previously. Imported material is to be approved by Geoquest, LLC prior to placement. **We recommend imported granular backfill with a maximum unit weight of 45 pounds per cubic foot**. It is the responsibility of the contractor to schedule all inspections**.**

**SUBSURFACE DRAINAGE**

Perimeter drains are required around all walls of the habitable or usable area portion of the structure that are below finished grade including all common wall(s) adjacent to the basement. Crawlspaces, slab on grade, and walkout areas need not be drained unless specified at the time of the Open Hole Observation. Perimeter drains may be required during the open hole due to high moisture or grade that slopes toward the excavation. The final determination of the necessity for perimeter drains will be made at the time of the Open Hole Observation. An Exterior Drain Detail is provided in this report. Drains should daylight away from the structure or discharge to a sump pump. Even if drains are not required, areas below grade may experience moisture problems if unusual conditions are present in the future.

**REINFORCING**

The concrete foundation walls shall be properly reinforced as per the specific design for this foundation by a **Colorado Registered Professional Engineer. Exact requirements are a function of the design of the structure. Questions concerning the specific design requirements shall be referred to the design engineer.**

**FOOTING DESIGN**

The design for footings, pads, and/or piers for this structure is determined by applying the dead load and full live load to the foundation walls.

**CONSTRUCTION DETAILS**

It is necessary with any soils investigation to assume that the materials from the test holes are representative of the materials in the area. On occasion variations in the subsurface materials do occur, therefore, should such variations become apparent during construction, the owner is advised to contact this office for a determination as to whether these variations will affect the design of the structure's foundation. If anomalies are observed during the excavation for the structure, this office should be contacted to determine whether the layers will adversely affect the design.

**MINIMUM MATERIALS SPECIFICATIONS**

1. Minimum materials specifications of the concrete, reinforcing, etc., shall be determined by the Professional Foundation Design Engineer.
2. Compact beneath foundation walls a minimum of 95% Modified Proctor density to prevent settlement.
3. Compact all backfill material located around the perimeter of the foundation to a minimum of 80% Modified Proctor density.
4. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.
5. The site shall be kept well drained at all times.

**OPEN HOLE OBSERVATION (added cost)**

**If anyone other than Geoquest, LLC, performs the Open Hole Observation, that person/company assumes liability for the soils, and any possible changes to the foundation design.**

The owner, or a representative of the construction company shall contact **Geoquest, LLC** a minimum of **24 hours** prior to excavating for the foundation. An Open Hole Observation must be performed on each individual structure prior to the placement of concrete, and preferably prior to the placement of forms in the excavated area. **The failure to request or obtain an Open Hole Observation prior to the placement of foundation components may result in this Soils Report being declared null and void.** This is to ensure that soft areas, anomalies, etc., are not present in the foundation region. At the time of the open hole observation the **foundation type recommendations, maximum allowable bearing capacity may be revised** according to soil conditions found at that time. If revisions are made to the Soils Report due to the soil conditions of the excavation, **the Foundation Design Engineer must be notified of all revisions.**

**COMPACTION TESTING (added cost)**

Geoquest, LLC shall perform compaction testing on any replaced material. Soil shall be compacted in maximum 6-inch lifts. Testing shall be performed at intervals not to exceed 24 inches (or as required by the design engineer). Modified Proctor Density must be provided to Geoquest, LLC prior to compaction testing, see below.

The owner, or a representative of the construction, shall contact Geoquest, LLC a **minimum of 24 hours prior to the time the compaction test is requested. The failure to properly compact and/or obtain proper compaction testing may result in this Soils Report being declared null and void.**

**MODIFIED PROCTOR DENSITY TESTING (added cost)**

**Modified Proctor Density test must be provided to Geoquest, LLC prior to compaction testing.** If a Proctor cannot be provided, a Modified Proctor Density test must be completed prior to compaction testing. Two 5-gallon valid samples of the soil to be used, must be provided for testing, at least 2 weeks prior to the placement and compaction of the material.

**The failure to provide this data may result in this Soils Report being declared null and void.**

**FINAL OBSERVATIONS (added cost)**

The owner, or a representative of the construction company, shall contact Geoquest, LLC at the time final grading and landscaping procedures are completed. This is to ensure that sprinkler systems are not installed adjacent to the structure and that only shrubs or plants that require minimal watering are established in this area. All exterior grading as well as the location of downspouts and their performance shall be inspected by Geoquest, LLC. Any additional landscaping or grading changes performed by subsequent contractors and/or owners shall be inspected and approved. It is the responsible of the contractor and/or owner to schedule all these inspections at the appropriate times. **The failure to obtain this inspection may result in this Soils Report being declared null and void.**

**LIMITATIONS**

This report is issued based on the understanding that the owner or his representative will bring the information, data, and recommendations contained in this report to the attention of the project engineer and architect, in order that they may be incorporated into the plans for the structure. It is also the owner's responsibility to ensure that all contractors and sub-contractors carry out these recommendations during the construction phase.

This report was prepared in accordance with generally accepted professional geotechnical/engineering methods. However, Geoquest, LLC makes no other warranty, express or implied, as to the findings, data, specifications, or professional advice rendered hereunder. **Due to circumstances outside of Geoquest, LLC's control, including improper construction, failure to follow recommendations, and unforeseen events, the Limits of Liability extend only to fees rendered for the professional services provided.**

This report is considered valid as of the present date. The owner acknowledges, however, that changes in the conditions of the property might occur with the passage of time, such as those caused by natural effects or man-made changes, both on this land and on abutting properties. Further, changes in acceptable tolerances or standards might arise as the result of new legislative actions, new engineering advances, or the broadening of geotechnical knowledge. Thus, certain developments beyond our control may invalidate this report, in whole or in part.

This report and its recommendations do not apply to any other site than the one described herein and are predicated on the assumption that the soil conditions do not deviate from those described. In the event that any variations or undesirable conditions should be detected during the construction phase or if the proposed construction varies from that planned as of this report date, the owner shall immediately notify Geoquest, LLC in order that supplemental recommendations can be provided, if so required.

This report excludes possible environmental issues, geologic hazards, flooding, or any other natural or man-made hazards that affect this site. These are outside the scope of work, for this report.

## APPENDIX

GEOQUEST, LLC
481-4560

# DRILL LOGS

**JOB #: 21-1148**

**TEST BORING NO.: TH-1**

**DATE: 9/30/2021**

| DEPTH (in ft.) | SYMBOL | SAMPLES | BLOW COUNT | WATER % | SOIL TYPE |
|---|---|---|---|---|---|
| 0"-6" Topsoil | | | | | |
| 6"-2' Sand<br>Fine-medium grained<br>Moderate density<br>Low-moderate moisture content<br>Low clay content<br>Low plasticity<br>Light Yellowish Brown color | 2<br>4<br>6 | | 25/3" | 6.4 | |
| 2'- 8' Sandstone<br>Fine-medium grained<br>Very high density<br>Moderate moisture content<br>Moderate clay content<br>Moderate plasticity<br>Grey color | 8<br>10<br>12 | | 20/3" | 10.1 | SM |
| 8'- 15' Sandstone (SM)<br>Fine-coarse grained<br>Very high density<br>Moderate moisture content<br>Low-moderate clay content<br>Low-moderate plasticity<br>Light Greyish Brown color | 14<br>16<br>18<br>20 | | | | |

**JOB #: 21-1148**

**TEST BORING NO.: TH-2**

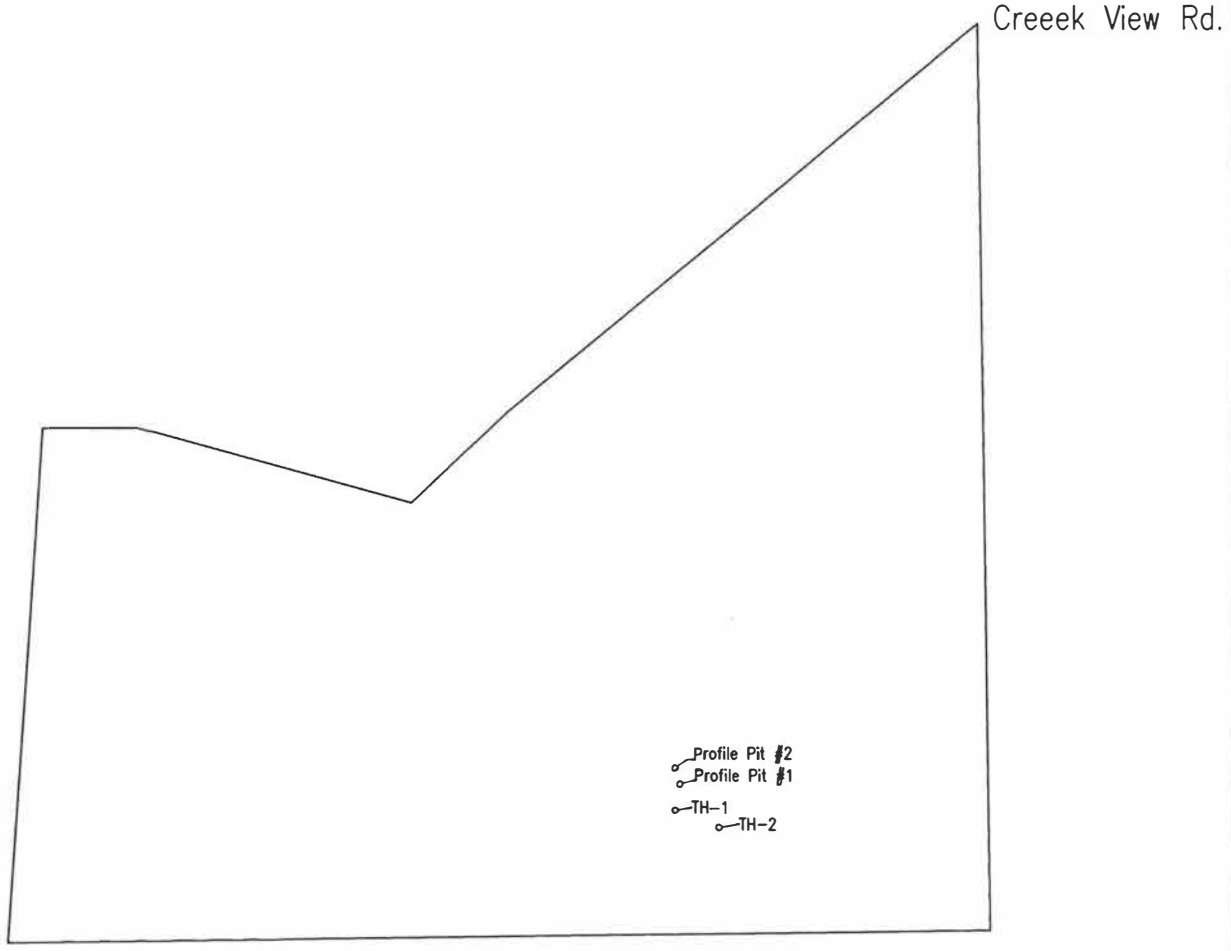
**DATE: 9/30/2021**

| DEPTH (in ft.) | SYMBOL | SAMPLES | BLOW COUNT | WATER % | SOIL TYPE |
|---|---|---|---|---|---|
| 0"-6" Topsoil | | | | | |
| 6"-2' Sand<br>Fine-medium grained<br>Moderate density<br>Moderate moisture content<br>Low clay content<br>Low plasticity<br>Light Yellowish Brown color | 2<br>4<br>6 | | 32/6" | 10.1 | SC |
| 2'- 9' Sandstone (SC)<br>Fine-medium grained<br>Very high density<br>Moderate moisture content<br>Moderate clay content<br>Moderate plasticity<br>Grey color | 8<br>10<br>12 | | Bag 12" | 9.8 | |
| 9'- 15' Sandstone<br>Fine-coarse grained<br>Very high density<br>Low-moderate moisture content<br>Low-moderate clay content<br>Low-moderate plasticity<br>Light Greyish Brown color | 14<br>16<br>18<br>20 | | | | |

GEOQUEST LLC

**SITE MAP**

Lot 3
0 Creek View Rd.
El Paso County
Colorado
Job# 21-1148

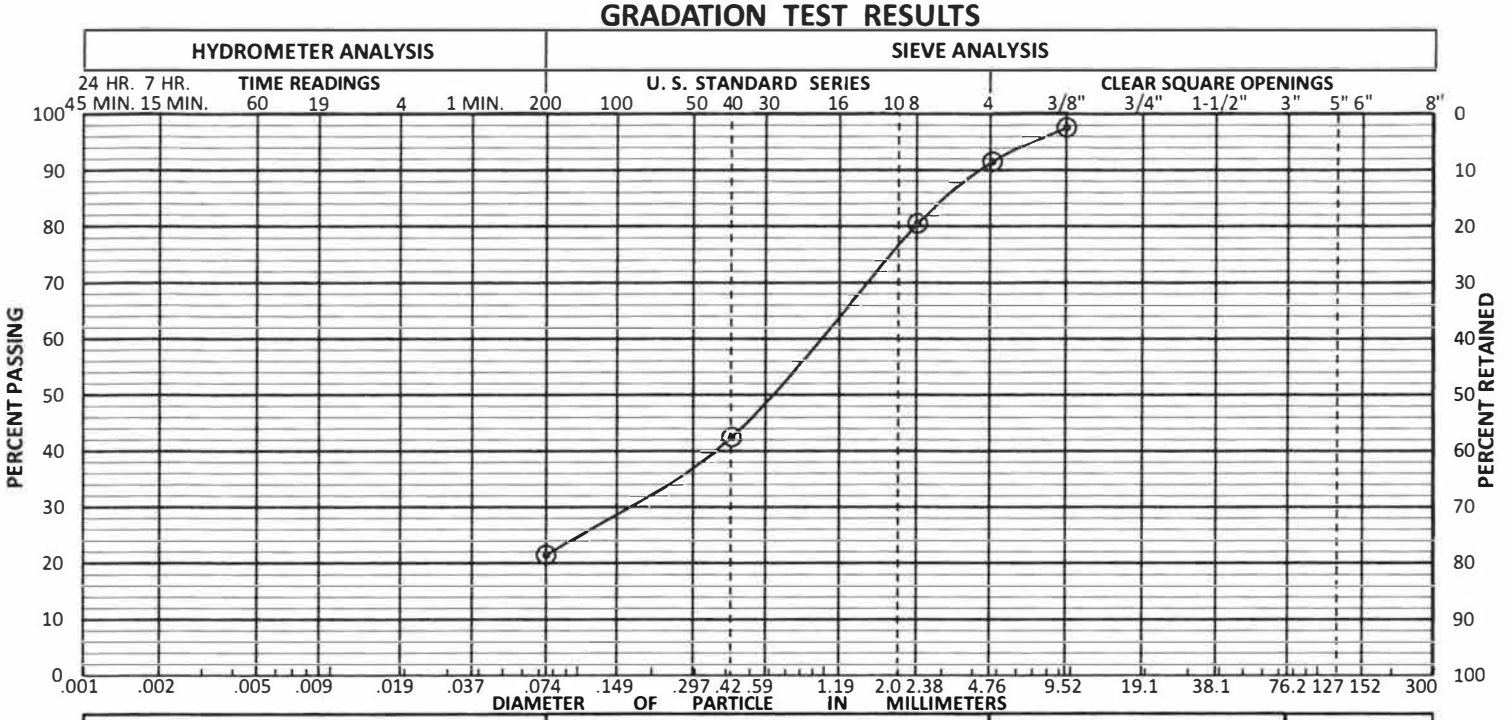



Location from Southeast Lot Corner to Profile Pit #1:
N. 64° W. – 439'
Location from Profile Pit #1 to Profile Pit #2:
N. 17° W. – 22'
GPS Coordinates:
Pit 1; N. 38° 59' 55.60" W. 104° 45' 55.36"
Pit 2; N. 38° 59' 58.80" W. 104° 44' 55.45"

N

0 50 150 250
GRAPHIC SCALE IN FEET
SCALE: 1" = 250'

# GEOQUEST LLC
## GRADATION TEST RESULTS




**CLASSIFICATION** SM

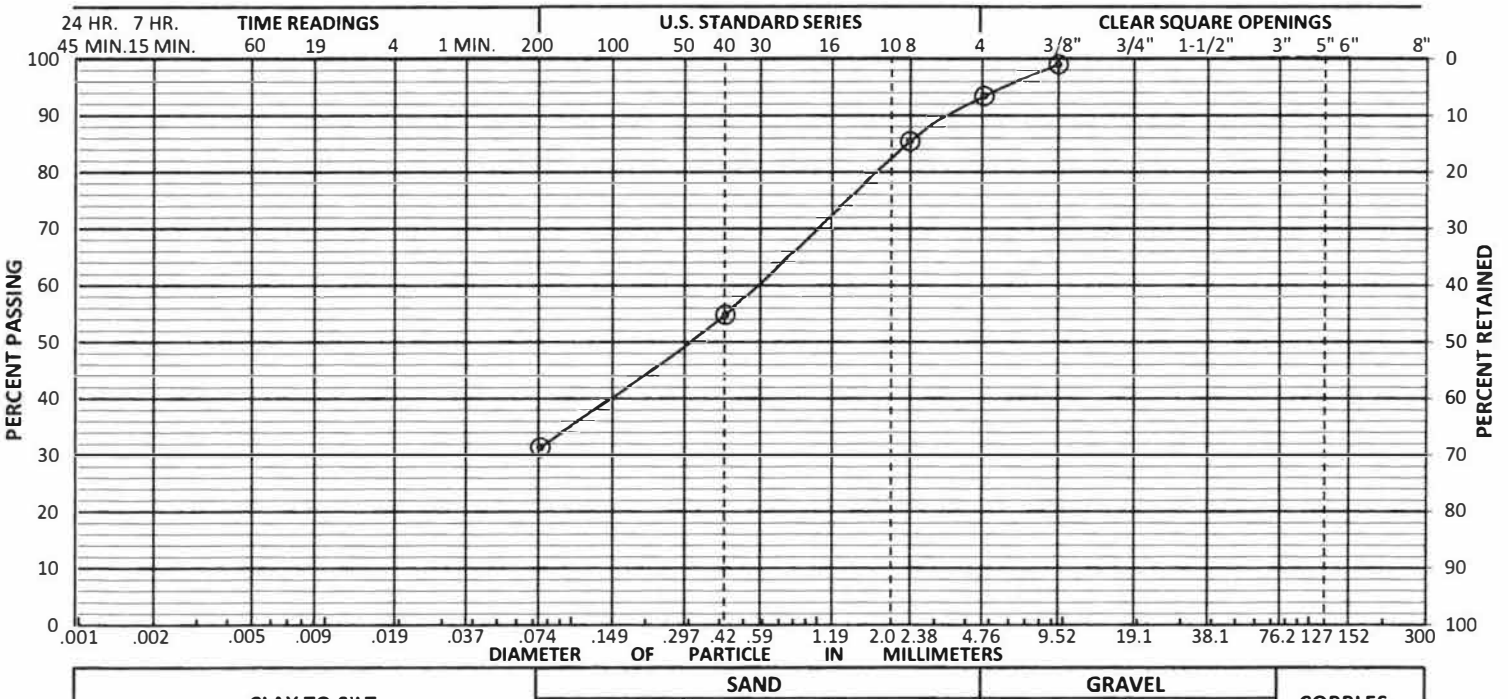
**GRAVEL** 8.5 %

**SAND** 70.0 %

**FINES** 21.5 %

**SAMPLE #** 1 **HOLE #** TH-1 **DEPTH** 12 **FEET**

**NOTES:** 10.1 % Moisture Content




**CLASSIFICATION** SC

**GRAVEL** 6.6 %

**SAND** 62.1 %

**FINES** 31.3 %

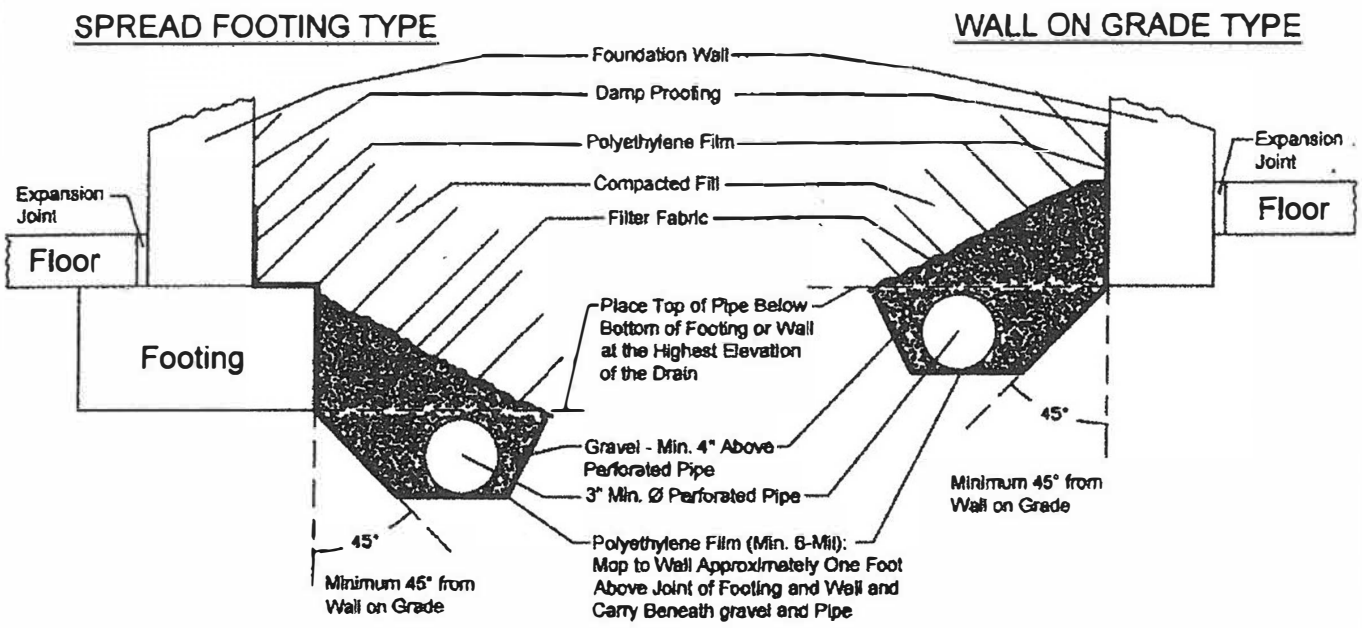
**SAMPLE #** 1 **HOLE #** TH- 2 **DEPTH** 4 **FEET**

**NOTES:** 10.1 % Moisture Content

**Job #:** 21-1148 **By:** MJ 9/30/2021

GEOQUEST, LLC
481-4560

# EXTERIOR DRAIN DETAIL




1. Gravel to be Not More Than 1-1/2" and Not Less Than 1/2" Diameter.

2. Perforated Pipe Diameter Varies With Expected Seepage. 3"Ø and 4"Ø are Most Common. ABS and PVC are Most Common Materials for Pipe. We approve the use of an "EZ Flow Drainage System" by Infiltrator. All specifications in this drain detail are still applicable.

3. Pipe to be Laid out in a Minimum Slope of 1" in 10'.

4. Gravity Outfall is Desired if Possible. Portion of Pipe in Area Not Drained Shall be Non-Perforated. Daylight Must be Maintained Clear of Debris in Order to Function Properly.

5. If Gravity Outfall is Not Possible, Provide a Sump With Operational Pump. Pump May Not Connect to Any Sanitary or Storm Sewer.

6. Soil Backfill Should be Compacted to at Least 80% of the Modified Proctor Denisty in the Upper Three Feet of Fill.

7. Filter Fabric to be Mirafi 140s or Approved Equivalent. Roofing Felt and Sheet Plastic are Not Acceptable.

8. Drain Pipe Shall be Laid Below Protected Area, as Shown in The Detail Above.

9. Mop Polyethylene Film to Wall Approximately One Foot Above Joint of Footing and Wall (Do Not Pull Plastic Tight) and Carry Beneath Gravel and Pipe.

10. The Polyethylene Film Shall be Continued to the Edge of the Excavation.