

October 30, 2020

Collier McGehee  
9845 Walker Road  
Colorado Springs, CO 80908



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
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Re: Soil, Geology, and Geologic Hazard Study  
16860 Thompson Road – 2 Lot Subdivision  
Parcel No. 51190-04-002  
El Paso County, Colorado

Dear Mr. McGehee:

### **GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION**

The site is located in a portion of the NW $\frac{1}{4}$  of the SW $\frac{1}{4}$  of Section 19, Township 11 South, Range 66 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located 8 miles east of Monument, Colorado, on Thompson Road, north of Hodgen Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the south. A drainage exists in the southern portion of the site that flows in an easterly direction through the property. Water was not observed flowing in the drainage in the southern portion of the site. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily low grasses, and field weeds. Site photographs, taken August 26, 2020, are included in Appendix A. The approximate locations and directions of the photographs are indicated on Figure 3.

Total acreage involved in the proposed development is 10.5 acres. Two single-family rural residential lots are proposed. Lot sizes are approximately 5 acres. The lots will be serviced by individual wells and on-site wastewater treatment systems.

### **LAND USE AND ENGINEERING GEOLOGY**

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of seasonal and potentially seasonal shallow groundwater areas, drainage areas, erosion, artificial fill, collapsible soils, and expansive soils. Based on the proposed development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either avoided or properly mitigated. All recommendations are subject to the limitations discussed in the report.

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Soils, Geology, and Geologic Hazard Study  
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## **SCOPE OF THE REPORT**

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

## **FIELD INVESTIGATION**

Our field investigation consisted of the preparation of a geologic map of bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements, and aerial photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on August 26, 2020.

Lot 2 was investigated by Entech Engineering, Inc. Two test borings were drilled in the proposed house location and two test pits were excavated in the proposed OWTS locations to determine general suitability for the use of on-site wastewater treatment systems and general soil characteristics for residential construction. The locations of the test pits are indicated on the Site Plan/Test Pit Location Map, Figure 3. The Test Boring and Test Pit Logs are presented in Appendix B.

Laboratory testing was also performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests included grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

## **PREVIOUS INVESTIGATIONS**

Lot 1 was previously investigated by Parr Engineering & Consulting, Inc. in a Subsurface Soil Investigation dated April, 22, 2019 (Reference 1, Appendix D), and a STA Soil Evaluation, dated February 27, 2017 (Reference 2, Appendix E). Information from these reports was also used in evaluating the site.

## **SOIL AND GEOLOGIC CONDITIONS**

### Soil Survey

The Natural Resource Conservation Service (NRCS) (Reference 3, Figure 4), previously the Soil Conservation Service (Reference 4) has mapped one soil type on the site. Complete

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descriptions of the soil type are presented in Appendix F. In general, they vary from sandy loam and loamy sand to clay loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
67	Peyton Sandy Loam, 5-9 % slopes

The soils have generally been described to have moderate permeabilities. Limitations on development include, limited ability to support a load, and frost action potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate erosion hazards (Reference 4).

### Soils

The soils encountered in the Test Borings and Test Pits can be grouped into two general soil types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a silt-sand (ML-CL), and sandy clay (CL) encountered in the upper 3 to 5 feet of the testing locations. These soils were encountered at stiff consistencies and at moist conditions. Samples tested had 50 to 63 percent of the soil size particles passing the No. 200 Sieve. The silty and clay soils in the area are known to have the potential for collapse or expansion.

Soil Type 2 is a weathered to formational silty sandstone (SM) encountered in all of testing locations at depths ranging from 1 to 5 feet. The sandstone was encountered at dense to very dense states and at moist conditions. Samples tested had 11 to 22 percent of the soil size particles passing the No. 200 Sieve. Highly expansive siltstone and claystone are commonly interbedded in the sandstone in this area.

The Test Boring and Test Pit Logs are presented in Appendix B, and the Laboratory test results from the test pits are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

### Groundwater

Groundwater was not encountered in any of the Test Borings which were drilled to 20 feet. Signs of seasonally occurring groundwater was observed at 7.5 feet in Test Pit No. 1. Areas of seasonal and potentially seasonal shallow groundwater have been mapped in the drainage on-site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

It should be noted that in the sandy materials on site, some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock or clays. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during

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construction on-site and deal with each individual problem as necessary at the time of construction.

### Geology

Approximately 11 miles west of the site is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northerly direction (Reference 5). The bedrock underlying the site consists of the Dawson Formation of Cretaceous Age. The Dawson Formation typically consists of coarse-grained arkosic sandstone with interbedded layers claystone or siltstone.

The geology of the site was evaluated using the *Geologic Map of the Black Forest*, by Thorson in 2003, (Reference 6, Figure 5). The Geology Map for the site is presented in Figure 6. Three mappable units were identified on this site which is described as follows:

- Qaf**      **Artificial Fill of Quaternary Age:** These are man-made fill deposits associated with the earthen dam in the southeastern portion of the site.
- Qal**      **Recent Alluvium of Quaternary Age:** These are recent stream deposits in the channel of the drainage in the southern portion of the site.
- Qc/Tkd**      **Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:** The materials consist of colluvial or residual soils overlying the bedrock materials on-site. The colluvial soils were deposited by the action of sheetwash and gravity. The residual soils were derived from the in-situ weathering of the bedrock on site. These materials typically consist of silty to clayey sand with potential areas of sandy clays. The bedrock consists of the Dawson Formation. The Dawson Formation typically consists of coarse-grained, arkosic sandstone with interbedded lenses of fine-grained sandstone, siltstone and claystone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Black Forest Quadrangle* distributed by the Colorado Geologic Survey in 2003 (Reference 6, Figure 5), The *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 7), and the *Geologic Map of the Denver 1° x 2° Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 8). The test borings and test pits were used in evaluating the site and is included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

### **ENGINEERING GEOLOGIC HAZARDS**

Mapping has been performed on this site to identify areas where various geologic conditions exist of which developers should be cognizant during the planning, design and construction stages where new construction is proposed. The engineering geologic hazards identified on

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this site include seasonal and potentially seasonal shallow groundwater areas, and an area of erosion. These hazards and recommended mitigation techniques are discussed as follows:

#### Expansive Soils

Expansive soils were not encountered on the site however, sandy clays were encountered on the site that could have expansion potential. Highly expansive claystone and siltstone are commonly interbedded in the sandstone of the Dawson Formation. Expansive clays, if encountered beneath foundations, can cause differential movement in the structure foundation.

Mitigation: Should expansive soils be encountered beneath the foundation; mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements.

#### Collapsible Soils

Collapsible highly silty soils were encountered in some of the test borings drilled on-site. These soils are typically highly sporadic in the area; therefore, none have been indicated on the map. Should collapsible soils be encountered beneath foundations, mitigation will be necessary.

Mitigation: Mitigation of collapsible soils typically involves overexcavation of the material 2 to 3 feet and recompaction with thorough moisture conditioning. The soils should be recompacted at a minimum of 95% of its maximum Proctor Dry Density ASTM D-1557 at 2% over the optimum moisture. Specific recommendations should be made on an individual bases at the time of construction.

#### Floodplain

The site is not mapped within any floodplains according to the FEMA Map No. 08041CO305G, dated December 7, 2018 (Figure 7, Reference 9). Areas of seasonal and potentially seasonal shallow groundwater were observed on the site (Figure 6). In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie within the drainage in the southern portion of the site. Water was not observed in the area at the time of this investigation, however, the potential for ponding of water does exist to the west of the earthen dam. These areas can likely be avoided or properly mitigated by development and are discussed below.

#### Potentially Seasonal Shallow Groundwater Area

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within a defined drainage and designated no-build area and can be avoided by the proposed

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16860 Thompson Road – 2 Lot Subdivision  
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development. Construction in any portions of these areas, if required, or immediately adjacent to these areas should follow these precautions.

**Mitigation:** Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. All organic material would be completely removed prior to any fill placement. **Specific drainage studies are beyond the scope of this report.**

#### Seasonal Shallow Groundwater Area

These are areas along east and west sides of the earthen dam in the southeastern portion of the site. Water was not observed in this area at the time of this investigation, however, the potential for ponding of water does exist to the west of the earthen dam. These areas also contain frost heave potential and highly organic soils.

**Mitigation:** Because areas mapped as seasonally shallow groundwater lie within a defined drainage where water can pond, we do not recommend structures be built within this area. Septic fields should be located a minimum of 25 feet away from the drainage or pond areas. Any construction in these areas should be done in a manner that does not create areas of ponded water near structures or the septic field. Structures adjacent to this area should follow the precautions for potentially seasonal shallow groundwater areas. No areas of the site are mapped within any floodplain zones according to the FEMA Map No. 08041CO305G, Figure 11 (Reference 10). Specific floodplain locations and drainage studies are beyond the scope of this report.

#### Areas of Erosion and Gullying

These are areas that are undergoing erosion by water and sheetwash producing gullies and rill erosion.

**Mitigation:** Due to the nature of the soils on this site, virtually all the soils are subject to erosion by wind and water. Other minor areas of erosion were observed on site other than those mapped, particularly where some rill erosion has occurred. Areas of erosion can occur across the entire site, particularly if the soils are disturbed during construction. Vegetation reduces the potential for erosion. The areas identified where erosion is actually taking place may require check dams, regrading and revegetation using channel lining mats to anchor vegetation. Further recommendations for erosion control are discussed under the "Erosion Control Section" of this report. Recommendations pertaining to revegetation may require input from a qualified landscape architect and/or the Natural Resource Conservation Service (previously Soil Conservation Service).

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## **RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING**

The proposed development will be rural-residential utilizing individual on-site wastewater treatment systems and water wells. Total acreage involved in the proposed subdivision is 10.5-acres. Two rural residential lots are proposed, and the proposed lot sizes are approximately 5 acres. The new lots will be serviced by individual wells and on-site wastewater treatment systems. The existing geologic and engineering geologic conditions will impose minor constraints on development and construction. The geologic conditions on the site include seasonal and potentially seasonal shallow groundwater areas, and erosion, which can be satisfactorily mitigated through avoidance or proper engineering design and construction practices.

The upper residual soils are typically at stiff to very stiff consistencies. Potentially expansive soils were encountered on portions of the site that may require mitigation. Foundations anticipated for the site are standard spread footings bearing on undisturbed sandstone or possibly in conjunction with overexcavation if expansive or collapsible soils are encountered at or within 4 feet of foundation grade. Areas of expansive and collapsible soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive or collapsible soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Areas of seasonal and potentially seasonal high groundwater areas were encountered on site. These areas lie within a no-build zone and will be avoided by construction. Structures should not block drainage swales or drainages. Should structures encroach on these areas, drains should be used to help prevent the intrusion of water into areas below grade. Additionally, foundations should penetrate a minimum of 3 feet for protection against frost heave.

In summary, the granular soils will likely provide suitable support for shallow foundations. The geologic conditions encountered on site can be mitigated with avoidance or proper engineering and construction practices.

## **ECONOMIC MINERAL RESOURCES**

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 10), the area is mapped as stream terrace deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 11), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 12), the area of the site has been mapped as "Little or No Potential" for industrial minerals. Considering the silty to clayey nature of the materials on the site and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

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16860 Thompson Road – 2 Lot Subdivision  
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According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 12), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as “Poor” for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 12).

The site has been mapped as “Fair” for oil and gas resources (Reference 12). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area lacked the essential elements for oil or gas.

## **EROSION CONTROL**

The soil types observed on the site are mildly to highly susceptible to wind erosion, and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation re-established, the potential for wind erosion should be considerably reduced.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on site, allowable velocities or unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

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16860 Thompson Road – 2 Lot Subdivision  
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El Paso County, Colorado

## CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some minor constraints on development and construction of the site. These conditions can be avoided by construction or mitigated through proper engineering design and construction practices. The proposed development and use are consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for new building sites and septic systems will be required prior to construction. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

This report has been prepared for Collier McGehee, for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

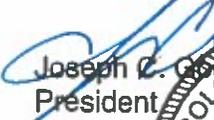
We trust that this report has provided you with all the information that you required. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

  
Logan L. Langford, P.G.  
Geologist

  
Joseph R. Good, Jr.  
President



  
Kristen A. Andrew-Hoeser, P.G.  
Senior Geologist

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Encl.

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AAprojects/2020/201695 sg&ghs

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Soils, Geology, and Geologic Hazard Study  
16860 Thompson Road – 2 Lot Subdivision  
Parcel No. 51190-04-002  
El Paso County, Colorado

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## TABLES

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT COLLIER McGEHEE  
 PROJECT 16860 THOMPSON ROAD  
 JOB NO. 201695

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	2	2-3			50.2						ML-SM	SILT-SAND
1	TP-1	3			62.5						CL	CLAY, SANDY
2	1	5			14.0						SM	SANDSTONE, SILTY
2	2	10			22.0						SM	SANDSTONE, SILTY
2	TP-1	7			10.9						SM-SW	SANDSTONE, SLIGHTLY SILTY

**Table 2: Summary Tactile Test Pit Results**

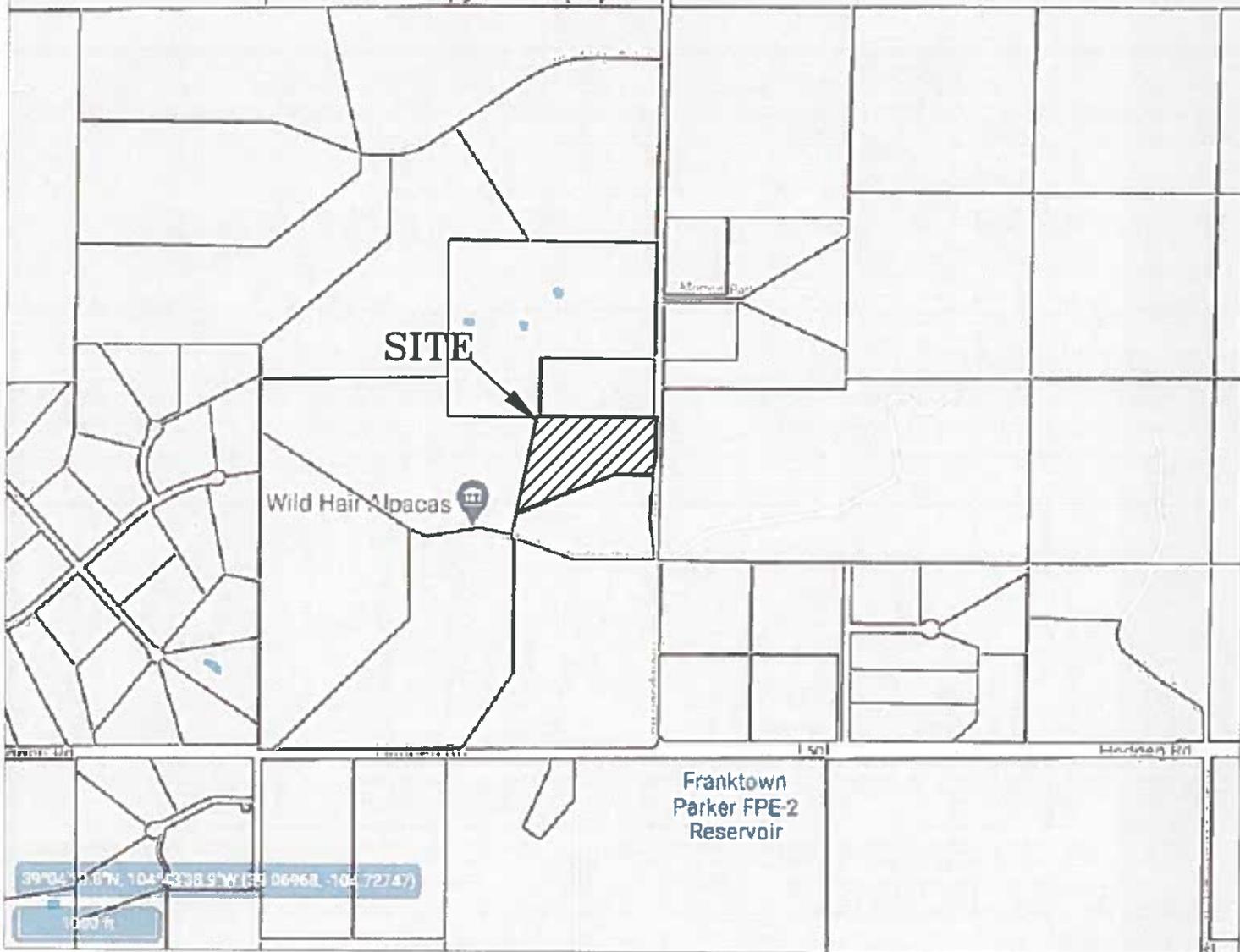
<b>Test Pit No.</b>	<b>USDA Soil Type</b>	<b>LTAR Value</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Seasonally Occurring Groundwater (ft.)</b>
1	4A*	0.15*	N/A	N/A
2	4A*	0.15*	N/A	N/A

\*- Conditions that will require an engineered OWTS

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## FIGURES

Franktown  
Parker FPE-5  
Reservoir



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VICINITY MAP  
16860 THOMPSON ROAD  
EL PASO COUNTY, CO.  
FOR: COLLIER MCGEHEE

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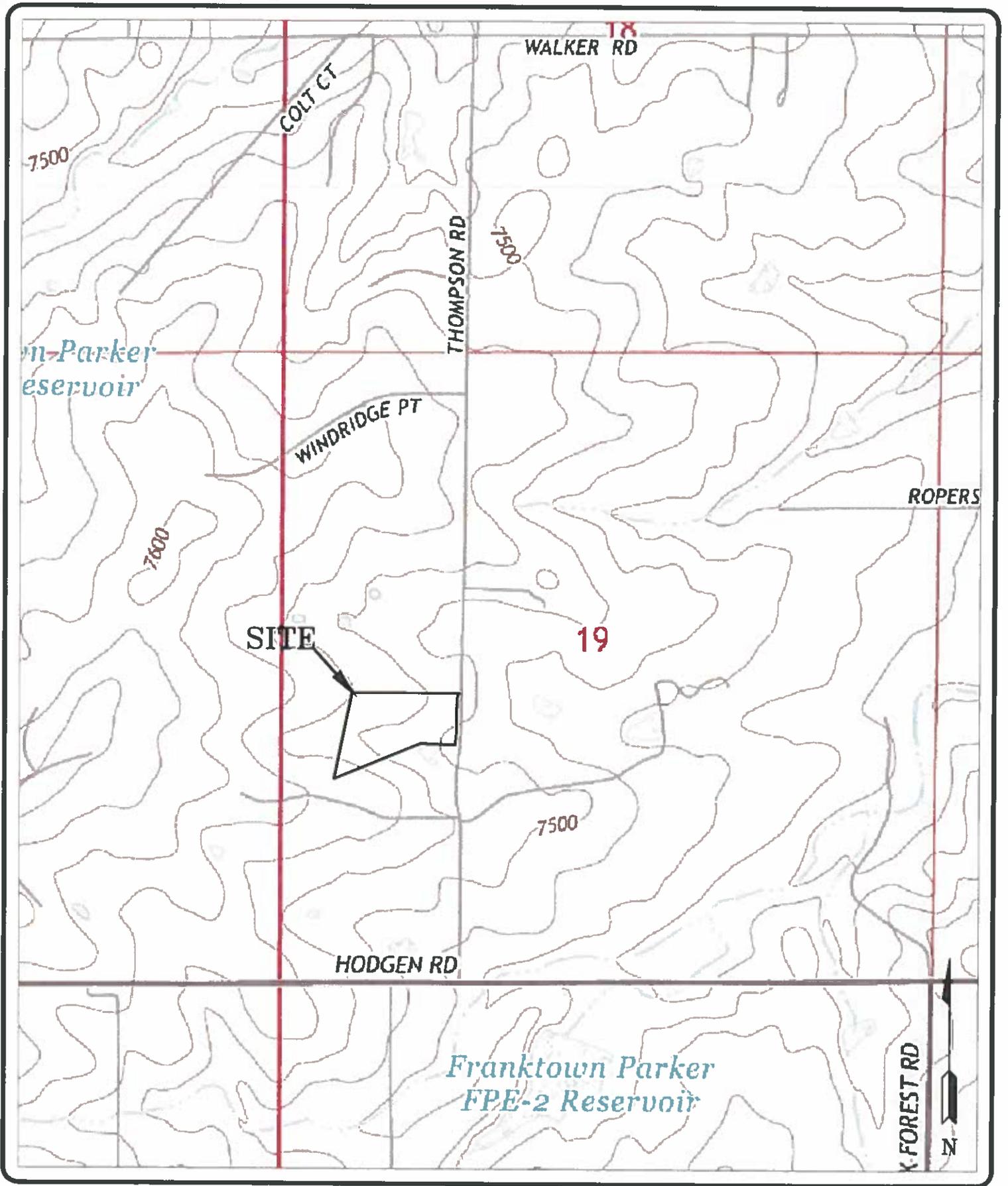
DATE:  
10/15/20

CHECKED:

DATE:

JOB NO.:  
201695

FIG NO.:  
1



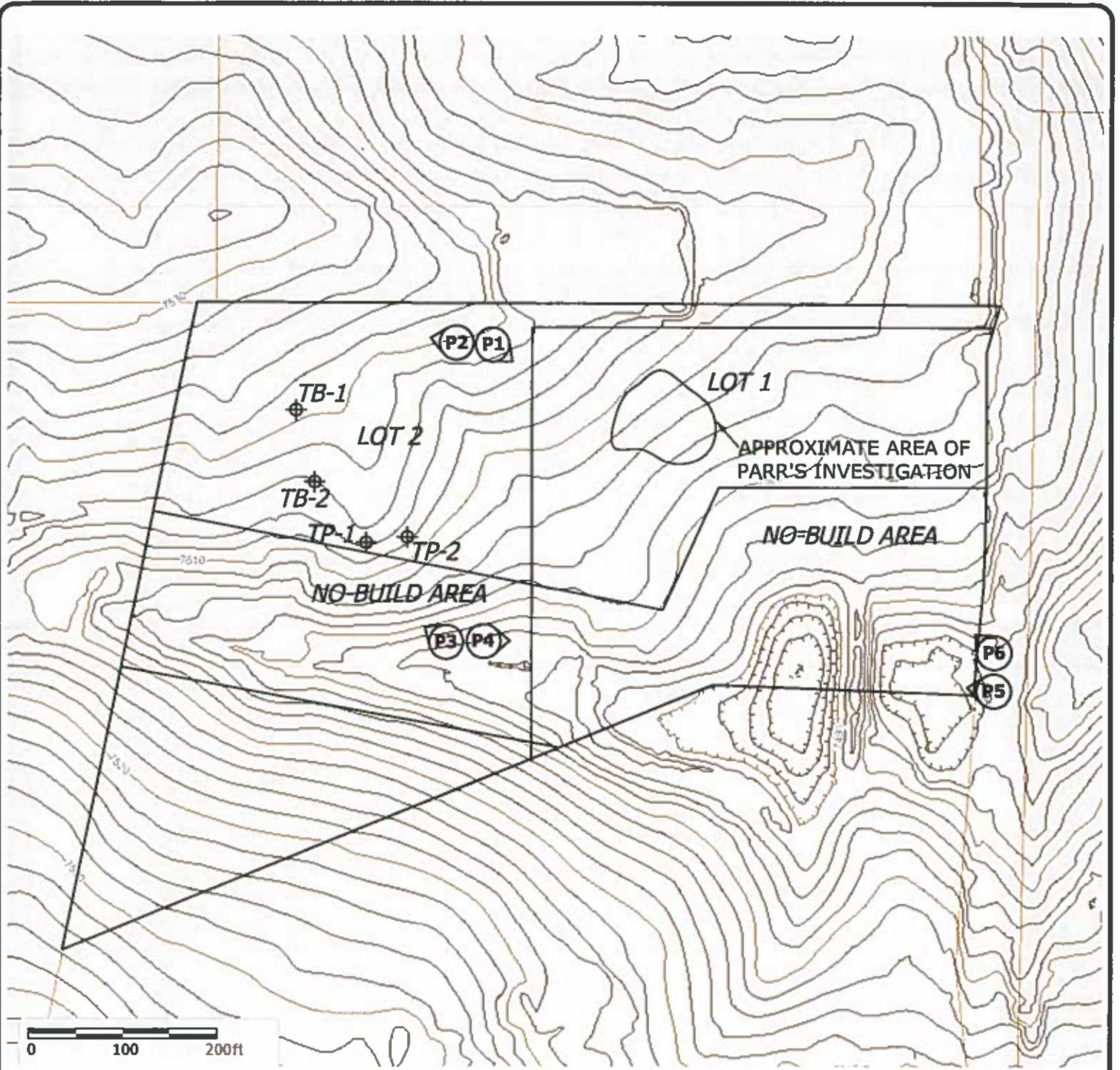

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USGS MAP  
16860 THOMPSON ROAD  
EL PASO COUNTY, CO.  
FOR: COLLIER MCGEHEE

DRAWN: LLL	DATE: 10/15/20	CHECKED:	DATE:
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JOB NO.:  
201695

FIG NO.:  
2



-  TP- APPROXIMATE TEST PIT LOCATION AND NUMBER
-  - APPROXIMATE TEST PIT LOCATION AND NUMBER



**ENTECH**  
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**SITE PLAN**  
16860 THOMPSON ROAD  
EL PASO COUNTY, CO.  
FOR: COLLIER MCGEEHEE

DRAWN: LLL	DATE: 10/15/20	CHECKED:	DATE:
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JOB NO:  
**201695**

FIG NO:  
**3**



Thompson Rd

67



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SOIL SURVEY MAP  
16860 THOMPSON ROAD  
EL PASO COUNTY, CO.  
FOR: COLLIER MCGEHEE

DRAWN:  
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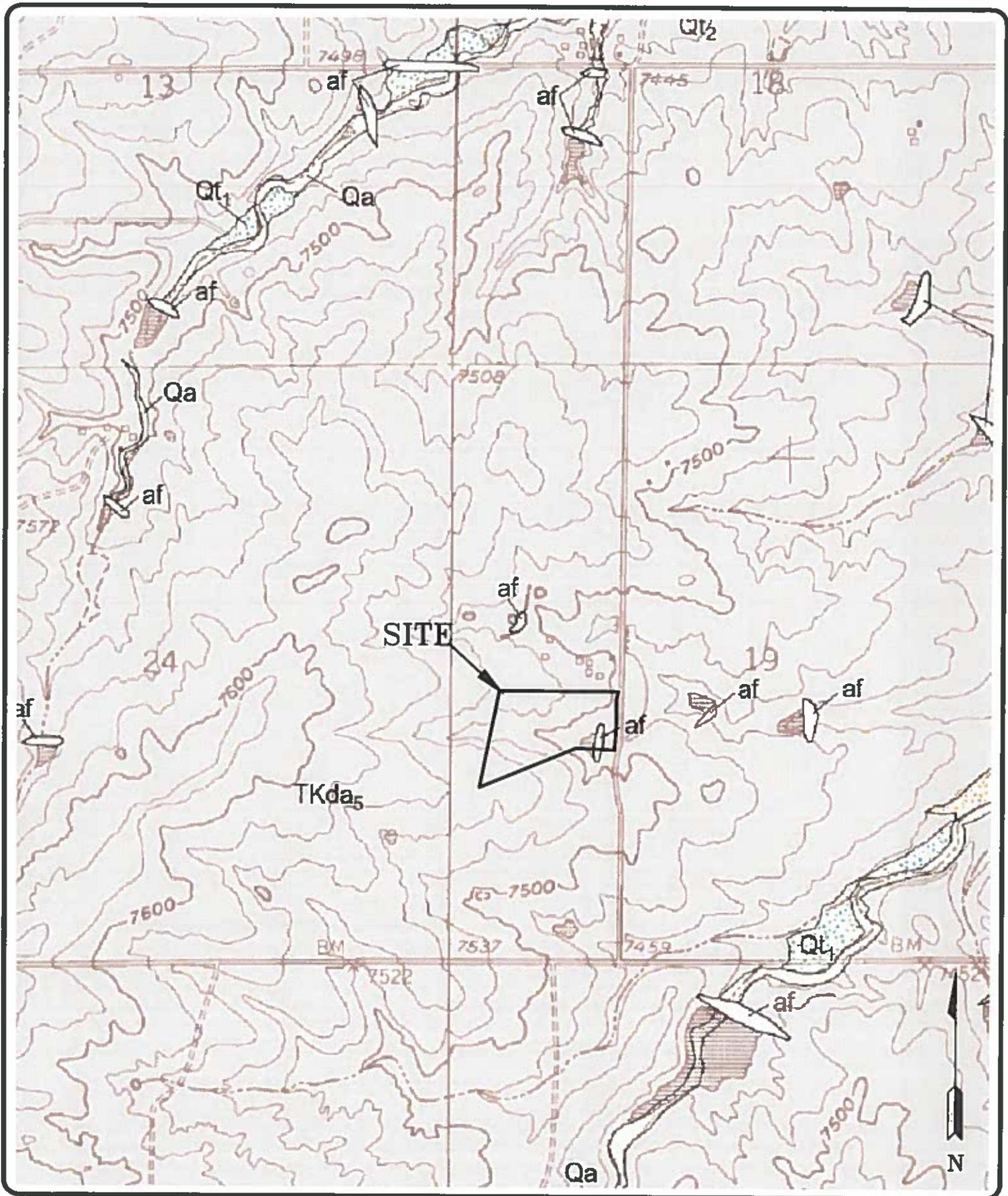
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JOB NO.:  
201695

FIG NO.:  
4



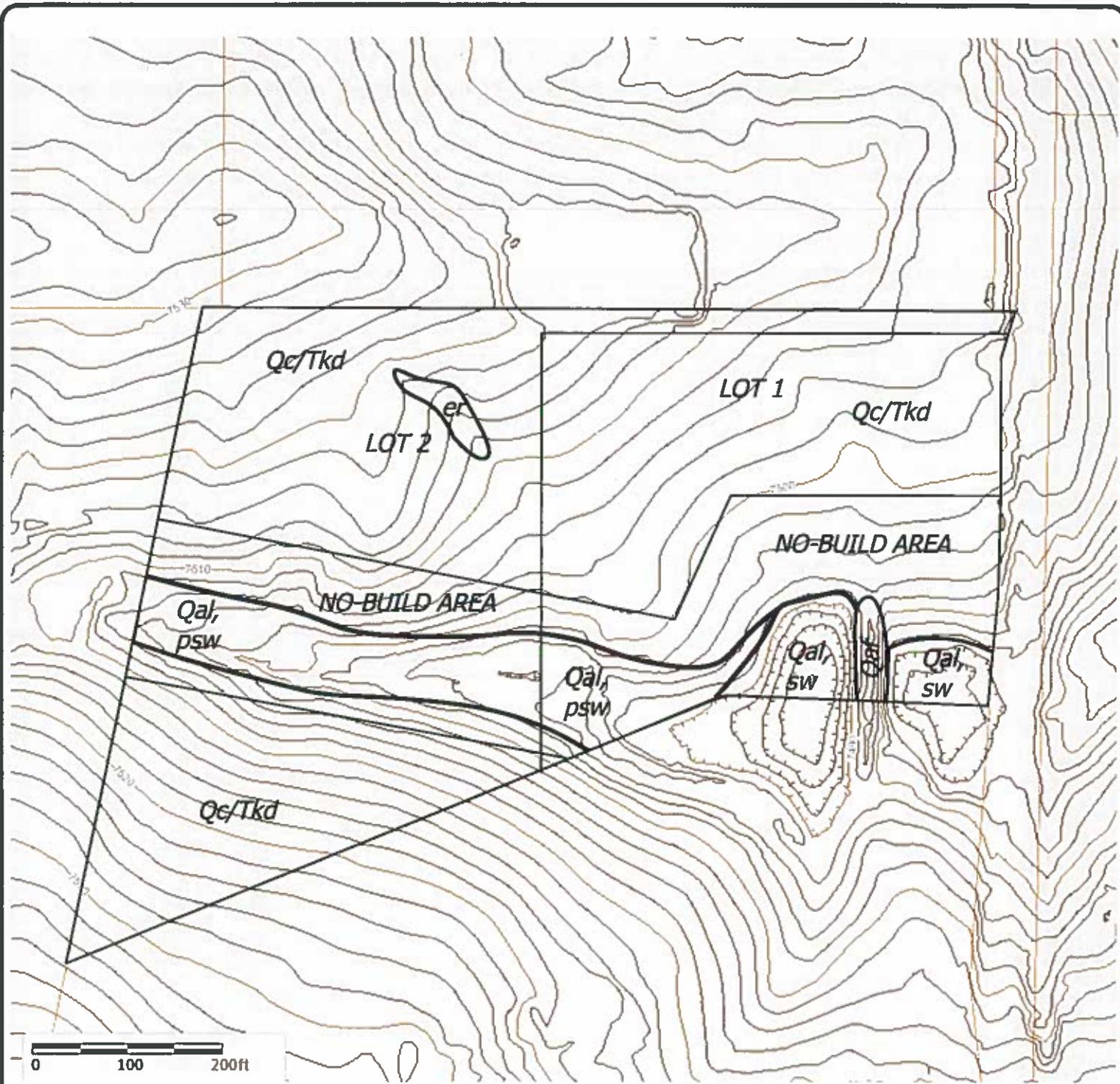

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**BLACK FOREST QUADRANGLE GEOLOGIC MAP**  
 16860 THOMPSON ROAD  
 EL PASO COUNTY, CO.  
 FOR: COLLIER MCGEHEE

DRAWN: LLL	DATE: 10/15/20	CHECKED:	DATE:
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JOB NO.:  
201695

FIG NO.:  
5



- Legend:**
- Qaf - Artificial Fill of Holocene Age:  
man-made fill deposits
  - Qal - Alluvium of Holocene and Pleistocene Age:  
recent alluvium associated with the drainages on site
  - QcTKd - Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:  
colluvial and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone
  - psw - potentially shallow groundwater area
  - sw - seasonal shallow groundwater area
  - er - areas of erosion



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**GEOLOGY/ENGINEERING GEOLOGY MAP**  
16860 THOMPSON ROAD  
EL PASO COUNTY, CO.  
FOR: COLLIER MCGEHEE

JOB NO.:  
201695

FIG NO.:  
6

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10/15/20

CHECKED:

DATE:



**ENTECH**  
**ENGINEERING, INC.**  
505 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-5599

**FEMA FLOODPLAIN MAP  
 18860 THOMPSON ROAD  
 EL PASO COUNTY, CO.  
 FOR: COLLIER MCGEHEE**

**JOB NO.:  
 201695**

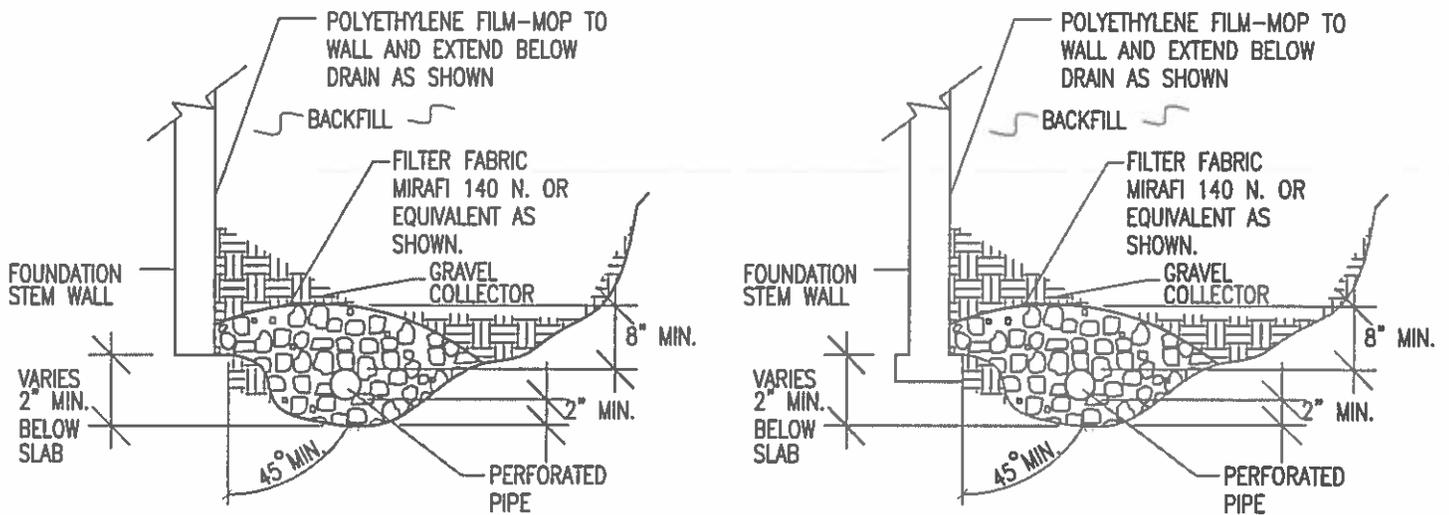
**FIG NO.:  
 7**

**DRAWN:  
 LLL**

**DATE:  
 10/15/20**

**CHECKED:**

**DATE:**



NOTES:

-GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS-85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

-PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4-INCH DIAMETER IS MOST OFTEN USED.

-ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON-PERFORATED PIPE.

-FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

-MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

-DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.



**ENTECH**  
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365 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5399

*PERIMETER DRAIN DETAIL*

DRAWN:

DATE:

DESIGNER:

CHECKED:

JOB NO.:

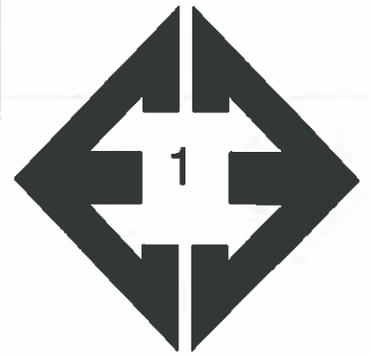
201695

FIG NO.:

8

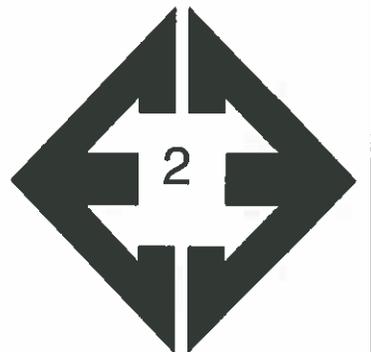
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**APPENDIX A: Photographs**



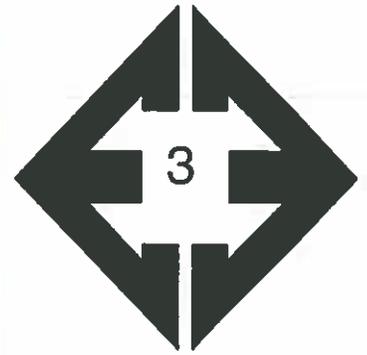
**Looking east from the northern portion of the site.**

August 26, 2020



**Looking west from the northern portion of the site.**

August 26, 2020



**Looking west from the drainage in the central portion of the site.**

August 26, 2020



**Looking east along the drainage in the central portion of the site.**

August 26, 2020



**Looking west along  
the drainage toward  
earthen dam in the  
southeastern side of  
the site.**

August 26, 2020



**Looking northwest  
from the southeastern  
side of site.**

August 26, 2020

---

## **APPENDIX B: Test Boring and Test Pit Logs**

TEST BORING NO. 1  
 DATE DRILLED 9/23/2020  
 Job # 201695

TEST BORING NO. 2  
 DATE DRILLED 9/23/2020  
 CLIENT COLLIER McGEHEE  
 LOCATION 16860 THOMPSON ROAD

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 9/23/20							DRY TO 20', 9/23/20						
SILT-SAND, TAN WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO VERY DENSE, DRY TO MOIST	5			48	2.1	2	6" TOP SOIL, SILT-SAND, TAN, STIFF, MOIST	5			20	5.6	1
				50	2.2	2	WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO VERY DENSE, MOIST	5			40	4.5	2
				11"									
	10			46	8.1	2		10			45	8.5	2
	15			50	8.8	2		15			50	7.9	2
				6"							11"		
	20			50	10.4	2		20			50	7.7	2
				11"							9"		



**ENTECH**  
 ENGINEERING, INC.  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE

CHECKED:

DATE:

LL

10/12/20

JOB NO:  
201695

FIG NO:

B-1

TEST PIT NO. 1  
 DATE EXCAVATED 8/26/2020  
 Job # 201695

TEST PIT NO. 2  
 DATE EXCAVATED 8/26/2020  
 CLIENT COLLIER MCGEHEE  
 LOCATION 16860 THOMPSON ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy clay, dark brown	1			ma	s	4A	topsoil sandy clay, dark brown	1			ma	s	4A
sandy clay, brown	2						sandy clay, brown	2					
	3							3					
highly weathered to formational silty sandstone, light brown	4			gr	w	3A		4					
	5						highly weathered to formational silty sandstone, light brown	5			gr	w	3A
	6							6					
	7							7					
*-signs of seasonally occurring groundwater at 7.5'	8			ma		3A		8			ma		3A
	9							9					
	10							10					

Soil Structure Shape

- granular - gr
- platy - pl
- blocky - bl
- prismatic - pr
- single grain - sg
- massive - ma

Soil Structure Grade

- weak - w
- moderate - m
- strong - s
- loose - l



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:

DATE:

CHECKED:

DATE:

ELL

10/9/20

JOB NO.:

201695

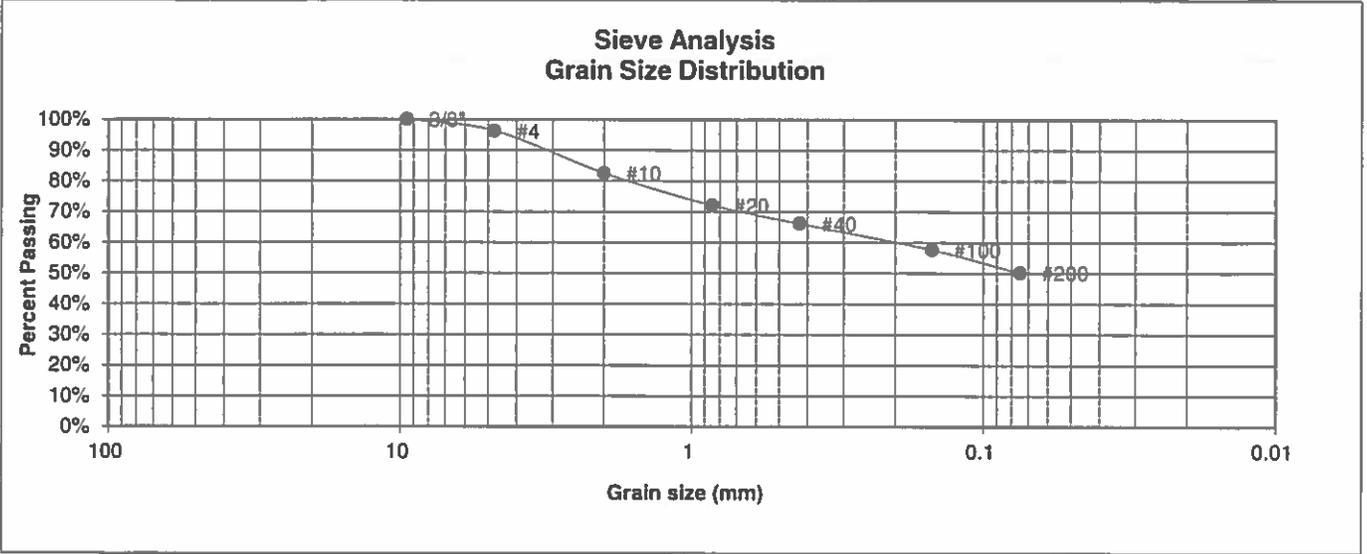
FIG NO.:

B-2

---

## **APPENDIX C: Laboratory Test Results**

BORING NO.	2	UNIFIED CLASSIFICATION	ML-SM	TEST BY	BL
DEPTH(ft)	2-3	AASHTO CLASSIFICATION		JOB NO.	201695
CLIENT	COLLIER McGEHEE				
PROJECT	16860 THOMPSON ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	82.5%
20	72.1%
40	66.1%
100	57.7%
200	50.2%

**Atterberg Limits**  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

**Swell**  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



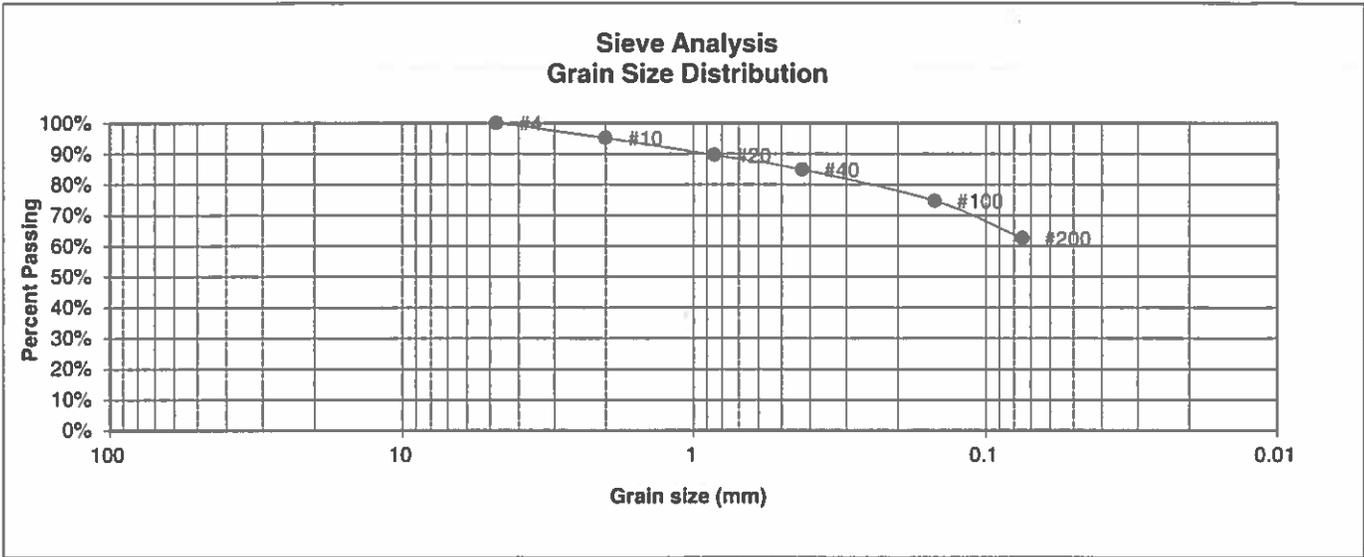
**ENTECH  
ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 10/9/20
--------	-------	-----------------	------------------

JOB NO:  
201695  
 FIG NO:  
C-1

BORING NO.	TP-1	<u>UNIFIED CLASSIFICATION</u>	CL	<u>TEST BY</u>	BL
DEPTH(ft)	3	<u>AASHTO CLASSIFICATION</u>		<u>JOB NO.</u>	201695
CLIENT	COLLIER McGEHEE				
PROJECT	16860 THOMPSON ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.1%
20	89.6%
40	84.9%
100	74.7%
200	62.5%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

Swell  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



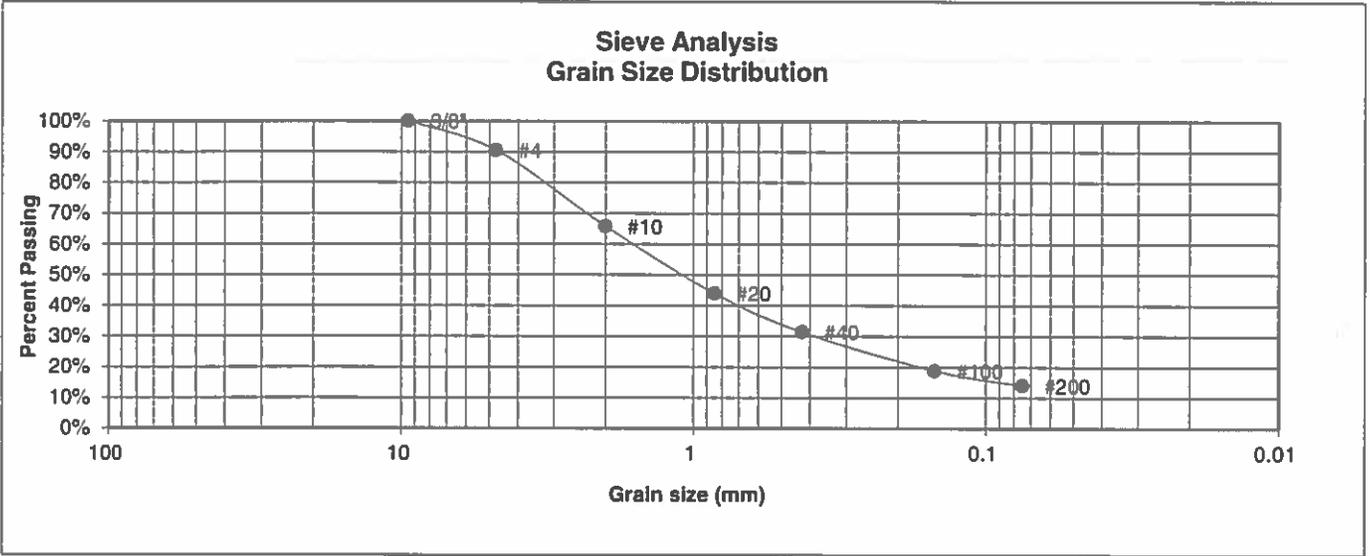
**ENTECH**  
**ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LL	10/9/20

JOB NO:  
201695  
 FIG NO:  
C-2

BORING NO.	1	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	5	AASHTO CLASSIFICATION		JOB NO.	201695
CLIENT	COLLIER McGEHEE				
PROJECT	16860 THOMPSON ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	90.5%
10	65.8%
20	44.0%
40	31.4%
100	18.8%
200	14.0%

**Atterberg Limits**  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

**Swell**  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



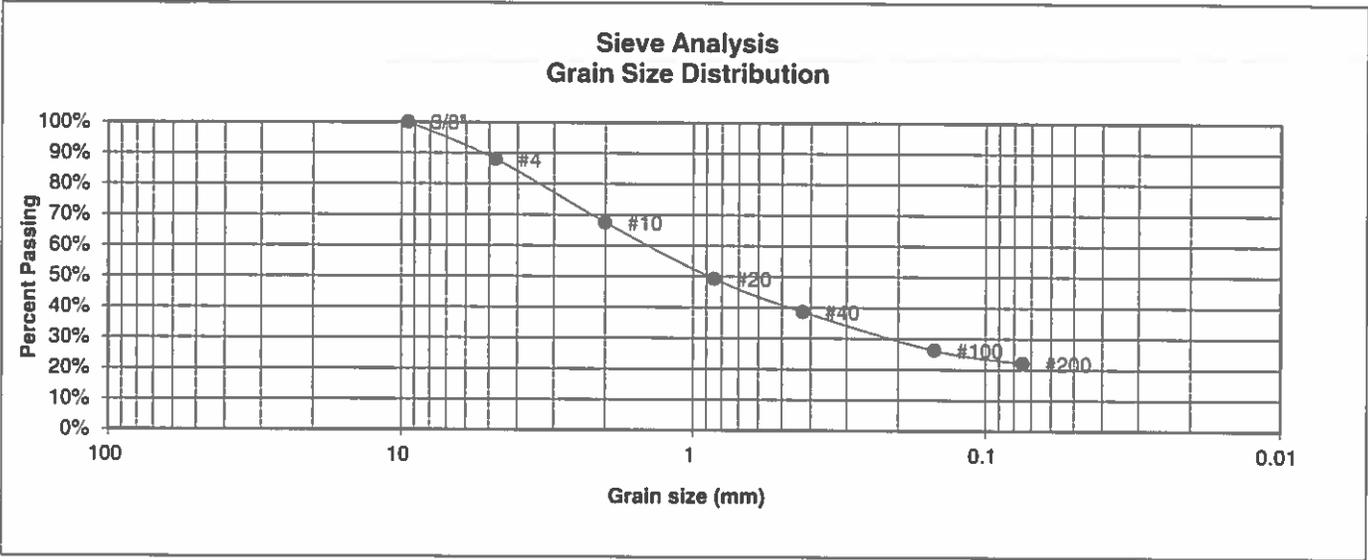
**ENTECH  
ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 10/9/20
--------	-------	-----------------	------------------

JOB NO.:  
201695  
FIG NO.:  
2-3

BORING NO.	2	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	10	AASHTO CLASSIFICATION		JOB NO.	201695
CLIENT	COLLIER McGEHEE				
PROJECT	16860 THOMPSON ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	88.0%
10	67.4%
20	49.3%
40	38.6%
100	26.2%
200	22.0%

**Atterberg Limits**  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

**Swell**  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS COLORADO 80907

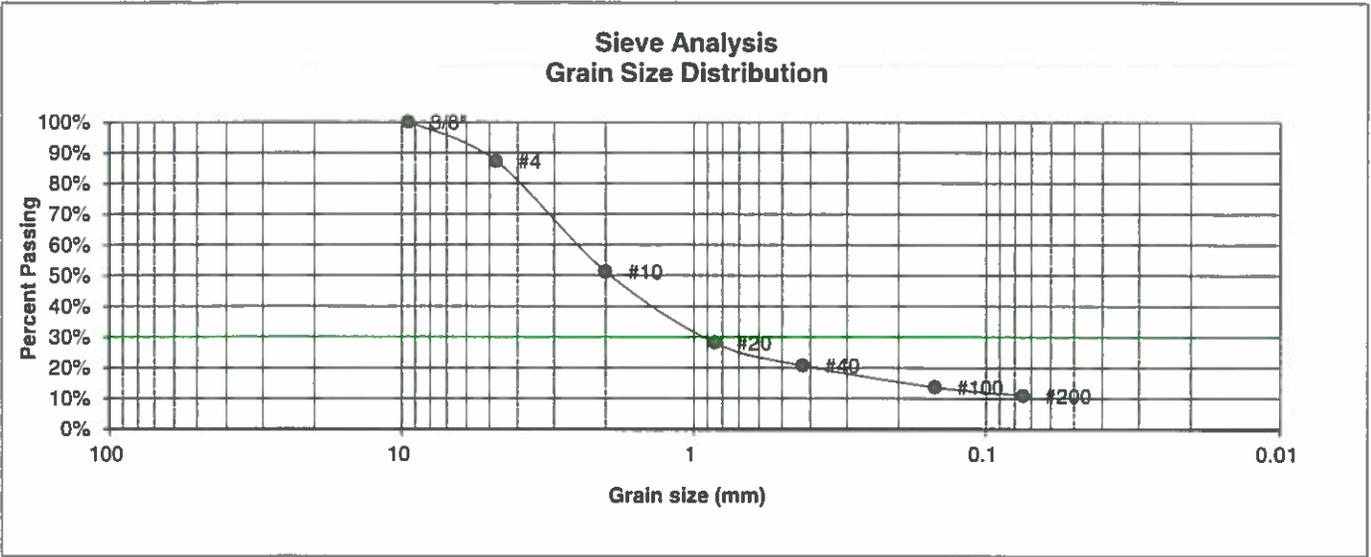
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	10/9/78

JOB NO.:  
201695

FIG NO.:  
E-4

BORING NO.	TP-1	<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>TEST BY</u>	BL
DEPTH(ft)	7	<u>AASHTO CLASSIFICATION</u>		<u>JOB NO.</u>	201695
<u>CLIENT</u>	COLLIER McGEHEE				
<u>PROJECT</u>	16860 THOMPSON ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	87.2%
10	51.2%
20	28.2%
40	20.7%
100	13.7%
200	10.9%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

Swell  
 Moisture at start  
 Moisture at finish  
 Moisture increase  
 Initial dry density (pcf)  
 Swell (psf)



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		ELL	10/9/20

JOB NO.:  
201695

FIG NO.:  
C-5

**APPENDIX D: Parr Engineering & Consulting, Inc. Subsurface Soil  
Investigation, Parr Job No. 19.144**



# PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal  
11590 Black Forest Road, Suite 10  
Colorado Springs, Colorado 80908  
Office: 719-494-0404

Structural Engineering & Consulting  
Geotechnical Engineering  
On-Site Wastewater Treatment Design  
Inspections & Technical Reports

April 22, 2019

JN 19.144

**Project:**     **Subsurface Soil Investigation**  
16860 Thompson Road  
Colorado Springs, CO 80908

Attached is a formal soils report for the project referenced above. Included in this report is a review of the soils investigation and analysis for this location. The purpose of our investigation was to evaluate the conditions of the subsurface soil in order to establish design and construction criteria for the proposed structure(s). A discussion of the results of our investigation with construction recommendations is also included. If revisions to the design of the proposed structure take place, it is advised that our firm be contacted immediately to review the changes and to determine if the revised plans are acceptable.

If you have any questions concerning this report please feel free to contact our office at 719-494-0404.

Sincerely,

Jared R. Dumke, P.E.



## Table of Contents

Table of Contents.....	2
Purpose and Scope of Study.....	3
Proposed Construction .....	3
Field Investigation .....	3
Laboratory Investigation .....	4
Subsurface Conditions .....	4
Foundation Recommendations .....	4
Foundation Recommendations (Cont.) .....	5
Structural Fill Gradation & Compaction.....	5
Foundation Walls .....	6
Open Excavation Observation.....	6
Floor System Recommendations .....	6
Surface Drainage .....	7
Subsurface Drainage .....	7
Limitations .....	8
Site Map .....	9
Laboratory Analysis – Sieve Analysis.....	10
Laboratory Analysis – Atterberg Limits .....	11
Laboratory Analysis – Liquid Limit Plot.....	12
Laboratory Analysis – Grain Size Distribution .....	13
Drill Log – Test Bore #1 .....	14

## **Purpose and Scope of Study**

This report presents the results of a subsurface exploration program to provide foundation recommendations for the proposed structure to be located on the parcel of land referenced above.

The exploration program was conducted in order to obtain information regarding the subsurface conditions. Soil samples were retrieved from a soil boring(s) and analyzed to provide data on the classification and engineering characteristics of the on-site soils. The results of the field and laboratory investigation are presented herein.

This report has been prepared to summarize the data obtained and to present our conclusion and recommendations based on the proposed construction and the subsurface conditions encountered. Design criteria and a discussion of the geotechnical engineering considerations related to the construction of the proposed structure are included.

**The information presented in this report is NOT intended to be used as a design. The foundation design requirements and all inspections associated with the foundation design is the responsibility of the Structural Engineer of Record.**

## **Proposed Construction**

Based on the information provided, the proposed construction will consist of a wood framed, single family residential structure supported on a reinforced concrete foundation system. We anticipate maximum structural loadings of 3000 pounds per lineal foot for distributive wall loads and 15 kips for concentrated column loads.

If the project features or loadings differ significantly from those above, our firm should be contacted to reevaluate the recommendations contained herein.

## **Field Investigation**

The field investigation for this project was conducted on April 16, 2019.

A 4" diameter exploratory boring was drilled to approximately 20 feet below grade in the area of the proposed construction. Standard penetration testing (SPT) was conducted during the drilling process.

*The SPT measures resistance to penetration of a standard split-spoon sampler that is driven by a 140 lbm hammer dropped from a height of 30 in. The number of blows required to drive the sampler a distance of 12 in. after an initial penetration of 6 in. is referred to as the N-value or standard penetration resistance in blows per foot.*

The representative samples obtained from the SPT split-spoon sampler are saved for subsequent laboratory examination and testing.

## Laboratory Investigation

The field samples obtained were analyzed and classified in the laboratory. Laboratory testing included standard property tests, natural water content, Atterberg limits and Expansion Index tests.

The laboratory testing was conducted in general accordance with ASTM specifications.

## Subsurface Conditions

The following tables summarize information obtained about the subsurface conditions encountered:

Soil Classification	Sample Depth	Gravel	Sand	Fines	LL <sup>1</sup>	PI <sup>2</sup>	EI <sup>3</sup>	Expansive Potential
Clayey Sand (SC)	5 ft.	0.5%	69.2%	30.2%	29	13	52	Medium

LL – Liquid Limit <sup>1</sup>

PI – Plasticity Index <sup>2</sup>

EI – Expansion Index <sup>3</sup>

Soil Classification	Sample Depth	SPT N-Value	Relative Density	Moisture Content	Clay Content	Expansive Index	Expansion Potential
Clayey Sand (SC)	5 ft.	13/46	Dense	9.6%	Medium	52	Medium
Clayey Sand (SC)	10 ft.	12/40	Medium Dense	8.9%	Medium	N/A	N/A
Clayey Sand (SC)	15 ft.	N/A	Medium Dense	10.5%	Medium	N/A	N/A
Clayey Sand (SC)	20 ft.	N/A	Medium Dense	11.8%	Medium	N/A	N/A

Ground water was not encountered during the time of our investigation. This may be due to lack of moisture received in the area and subsequently may rise due to seasonal changes, degree of irrigation and/or other factors.

## Foundation Recommendations

The information obtained indicates subsurface conditions consisting of soil with a medium potential for expansion at depths at and below the proposed bearing depth. Given the nature of the native soil conditions, the following foundation recommendations have been provided to minimize the potential for foundation movement.

### Option 1: Overexcavation & Compacted Fill

The native expansive soil shall be over excavated and replaced with properly compacted, offsite structural fill material to a depth of 4 feet minimum below the foundation elements. The fill material shall be compacted to minimum 95% Modified Proctor density. **All foundation elements bearing directly on structural fill material shall be designed for a maximum allowable bearing pressure of 1500 psf.**

## Foundation Recommendations (Cont.)

### **Option 2: Stem Wall Foundation with Voids on Native Soil**

The proposed structure may be founded on a balanced, stem-wall foundation system with voids placed on native soil. Foundation elements shall be designed for a maximum allowable bearing pressure of 2300 lb/ft<sup>2</sup> and a minimum dead load bearing pressure of 300 lb/ft<sup>2</sup>.

**It must be emphasized that foundation movement is likely with Options 1 & 2 if moisture changes occur to the soil located below the foundation elements. If structural movement can not be tolerated, other design options should be considered. Contact Parr Engineering and Consulting, Inc. to discuss.**

## Structural Fill Gradation & Compaction

Structural Fill shall consist of a well graded mixture of sound mineral aggregate particles void of debris containing sufficient proper quality binding materials to secure a firm, stable foundation when placed and compacted. When tested with laboratory sieves, the material shall meet the following gradation requirements:

Standard Sieve Size	% Passing (by Weight)
2 inch	100
No. 4	30-100
No. 50	10-60
No. 200	5-20

Colorado Department of Transportation approved class 4, 5, or 6 base course materials typically meet the above specifications. A report showing the gradation analysis and test results for the materials proposed for structural fill shall be provided to Parr Engineering for review and approval prior to placement.

Imported structural fill shall be placed in 8" maximum uniform lifts and compacted to a minimum 95% Modified Proctor Density (ASTM D-1557) near optimum moisture content.

Compaction testing and confirmation is required at 24" intervals max. Results of the testing must be provided to Parr Engineering & Consulting when complete.

## Foundation Walls

Foundation walls which are laterally supported and can be expected to undergo a minimal amount of deflection (“at-rest condition”) may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 65 pcf for onsite material.

All foundation walls should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials and equipment. The pressures recommended above assume a relatively horizontal backfill surface.

The onsite excavated materials may be used as foundation wall backfill. Backfill shall be carefully placed in uniform lifts and properly compacted near optimum moisture content. Care should be taken not to over compact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill will occur even if the material is placed correctly.

## Open Excavation Observation

It is assumed that the results in this report are representative of the subsurface conditions throughout the site. However, variations across the site are a possibility and will not become evident until the foundation excavation is complete.

A representative of Parr Engineering & Consulting shall be contacted to inspect the completed foundation excavation prior to the placement of any formwork. Please contact our office a minimum of 24 hours prior to the requested site visit. This report may be rendered null and void if the open excavation observation is not completed.

**The Open Excavation Observation Report will be billed additionally at the time services are complete and prior to the release of any documentation (either electronically or hard copy).**

## Floor System Recommendations

The natural on-site soils were determined to have a medium potential for expansion when inundated with water. If slab crack control is highly desired, a minimum 6" layer of gravel or aggregate base course shall be placed and compacted to at least 95% Modified Proctor Density (ASTM D-1557) prior to placement of a new slab-on grade. In addition, the new slab shall be reinforced with #3 bars @ 18" o.c. each way, or 4x4-W2.9xW2.9 W.W.F. (centered).

Floor Slabs should be provided with control joints to reduce damage that may occur as a result of shrinkage cracking. We suggest the spacing of the joints to be no more than 15 feet centers. The actual joint spacing should be based on the slab reinforcing design.

**Given the nature of the potentially expansive soil conditions, interior slabs supported directly on the native soil can be expected to move and crack when exposed to moisture and should be avoided if possible. If floor movement and cracking cannot be tolerated, interior floor slabs (i.e., basement floors) shall be elevated over a crawl space and designed as structural systems supported independently of the underlying soil.**

## Surface Drainage

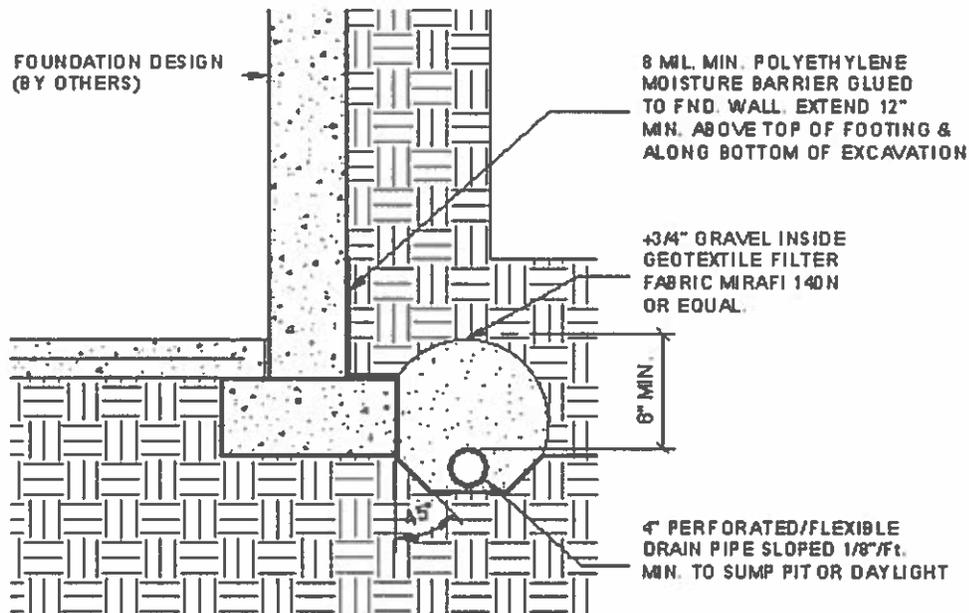
The following drainage precautions should be observed during the construction and maintained at all times after the residence has been completed.

- 1) Excessive wetting and drying of the foundation excavations and under slab areas should be avoided during construction.
- 2) The ground surface surrounding the exterior of the building should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 12 inches in the first 10 feet.
- 3) Roof downspouts and drains should discharge well beyond the limits of the backfill.
- 4) Landscaping which requires excessive watering should be located at least 10 feet from the house.
- 5) Plastic membranes should not be used to cover the ground surface adjacent to the foundation walls.

## Subsurface Drainage

A subsurface foundation drain or equivalent protection measure is recommended around the perimeter of all habitable or storage spaces located below grade (including crawlspace areas). Actual drain requirements to be determined at the time of the open hole inspection.

A subsurface drain is designed to redirect moisture around and away from the foundation system. However, it should be noted that a properly functioning drain does not completely eliminate the potential for foundation movement if exposed to subsurface moisture.



## Limitations

This report has been prepared with generally accepted soil and foundation engineering practices in this area for use by the client for design purposes. The conclusions and recommendations presented are based on data obtained from the exploratory excavation. The nature and extent of variation from the exploratory boring may not become evident until excavation is performed. If during construction, soil, rock and groundwater conditions appear to be different from those described herein, our office should be advised immediately so that reevaluation of the recommendations may be made.

Although all laboratory procedures were performed under optimal conditions, it should be noted that precautions should be taken to accommodate for certain sources of failure such as inconsistencies in the properties/characteristics of the on-site soil, variations in groundwater levels due to seasonal changes, etc.

**This report DOES NOT address the potential for geologic hazards or constraints (i.e., slope stability, landslides). It must be emphasized that such hazards and constraints are outside the scope of this investigation and must be investigated independently.**

**Site Map**



## Laboratory Analysis – Sieve Analysis

### SOIL CLASSIFICATION

Location of Site	16860 Thompson Road, 80908	Tested By:	R.Jaquet
Legal Description	N/A	Date Tested	04/17/19
Job Number	19.144	Collected By	J.Dumke
		Date Collected	04/16/19

### SITE INVESTIGATION

Test Hole Depth	20'-0"	Groundwater Table	N/A
Surface Layer Thickness	-	Volume of Soil Sample	1/2 cu.ft.
Soil System	Uniform	Visual Moisture Observation	Dry
Layer	Soil Type/Depth	Critical Layer	No. 1
Surface	-	Coloration	Tan
No. 1	SC/0 - 20'-0"	Gravel	Trace
No. 2	-	Organic Content	Little-None
No. 3	-		

### SIEVE ANALYSIS

Test Bore #:	TB #1	<b>Bulk</b>	Wet Weight of Soil (g)	524.3
Layer	No. 1		Dry Weight of Soil (g)	481.4
Depth of Sample	5'-0"		Natural Moisture Content	8.9%

Sieve #	Thickness (mm)	Mass Ret. (g)	% Ret.	% Pass	
4	4.750	2.6	0.5%	99.5%	Gravel
10	2.000	39.0	8.1%	91.4%	
40	0.425	149.1	31.0%	60.4%	Sand
60	0.250	47.1	9.8%	50.6%	
100	0.150	44.8	9.3%	41.3%	
200	0.075	53.2	11.1%	30.2%	
Pan	0.000	145.4	30.2%	0.0%	Fines
Pan	0.000		0.0%	0.0%	Organic

<b>Totals</b>	481.2	100.0%
---------------	-------	--------

% Gravel	0.5%	Retained on #200		$C_u = D_{60}/D_{10} =$	N/A
% Sand	69.2%			Passes #200	$C_c = D_{30}^2 / (D_{10})(D_{60}) =$
% Fines	30.2%				
% Organic	0.0%				
<b>Check</b>	<b>100.0%</b>				

## Laboratory Analysis – Atterberg Limits

### ATTERBERG LIMITS

#### LIQUID LIMIT - LL

Cup #	Tin Mass(g)			# Drops	Water Mass (g)	Solids Mass (g)	Water Content
	Empty	Wet Soil	Dry Soil				
1	13.7	60.1	49.3	16	10.8	35.6	0.30
2	13.5	68.8	54.8	6	14.0	41.3	0.34
3	13.6	65.5	53.8	23	11.7	40.2	0.29

Liquid Limit (from plot) = 0.29

#### PLASTIC LIMIT - PL

Cup #	Tin Mass(g)			Water Mass (g)	Solids Mass (g)	Plastic Limit (PL)
	Empty	Wet Soil	Dry Soil			
1	13.3	16.8	16.4	0.46	3.04	0.15
2	13.5	16.5	16.1	0.40	2.57	0.16
					Average	0.15

Plastic Limit = 0.15

Note: Liquid Limit, Plastic Limit and Plasticity Index values have been rounded to nearest whole number when expressing as a percentage.

#### PLASTICITY INDEX - PI

Plasticity Index = Liquid Limit - Plastic Limit

Plasticity Index = 0.13

### MOISTURE CONTENT

Depth	Tin Mass(g)			Water Mass (g)	Solids Mass (g)	Water Content
	Empty	Wet Soil	Dry Soil			
5'-0"	13.6	69.6	64.7	4.9	51.1	9.6%
15'-0"	13.4	83.2	76.6	6.6	63.1	10.5%
20'-0"	13.4	71.8	65.6	6.2	52.2	11.8%

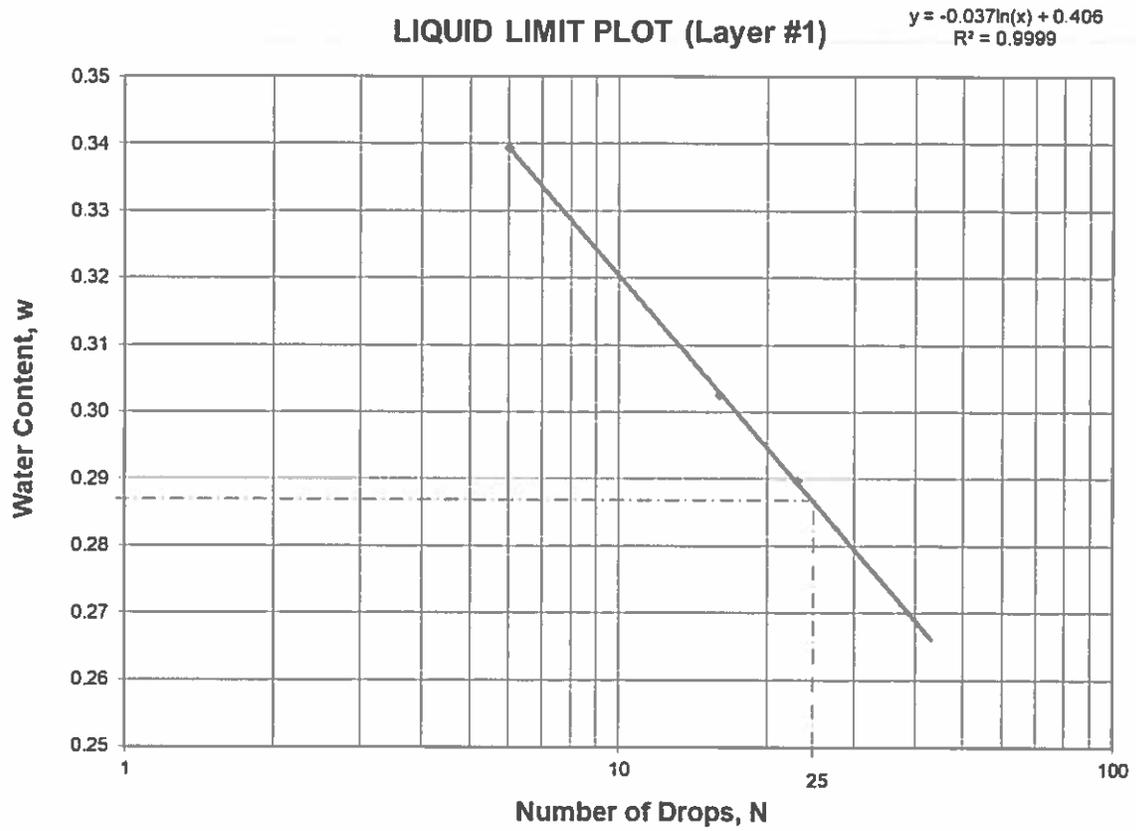
### CLASSIFICATION

Plasticity = Medium Plasticity

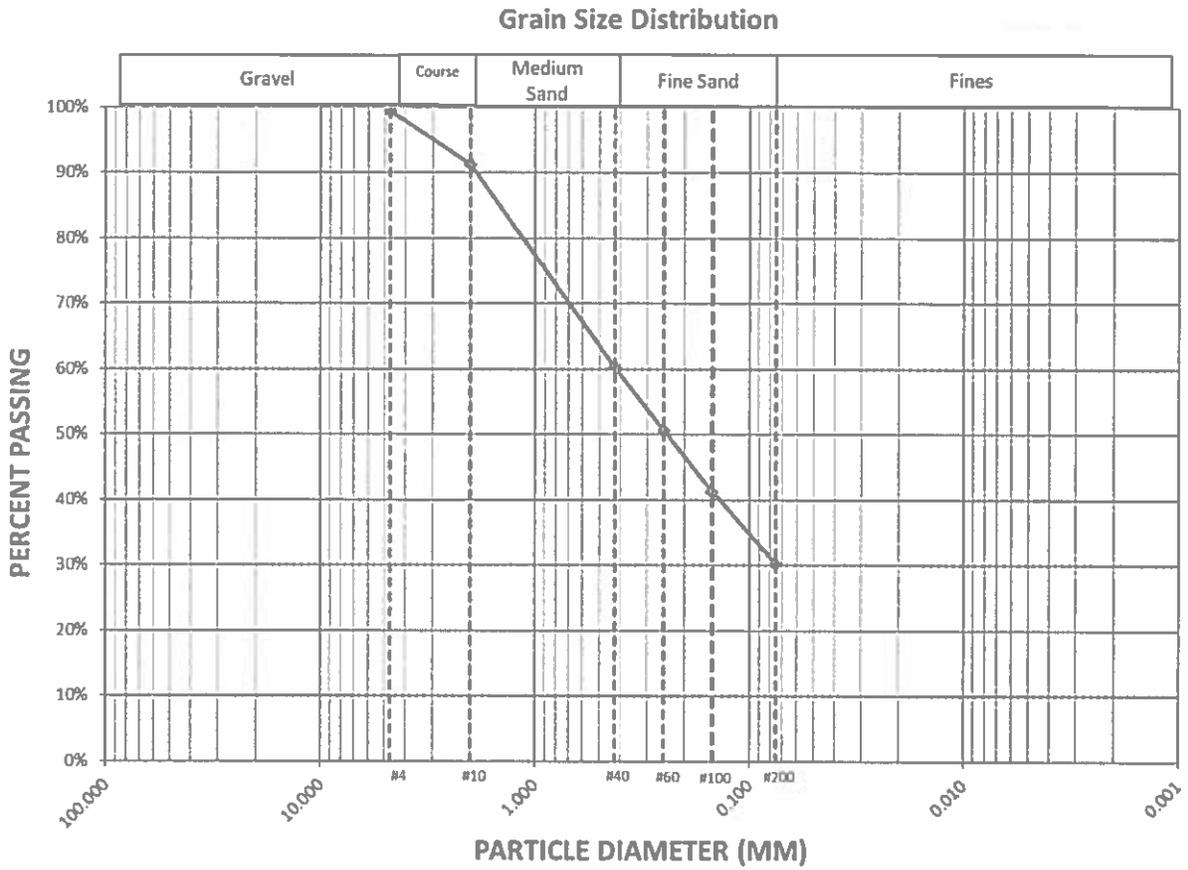
Group Symbol = SC

Group Name = Clayey Sand

**Laboratory Analysis – Liquid Limit Plot**



# Laboratory Analysis – Grain Size Distribution



# Drill Log – Test Bore #1

 <b>Parr Engineering &amp; Consulting, Inc.</b> 11590 Black Forest Road, Suite 10 Colorado Springs, Colorado 80908 Phone: 719-491-0404			<b>BORING LOG</b>		
			Job Number:	19.144	
			Date Drilled:	04/16/19	
			Boring #:	TB #1	
Driller:	J.Dumke	Total Depth:	20'-0"		
Logged By:	J.Dumke	Groundwater Elevation:	N/A		
Method:	Boring	Latitude:	39° 4'38.02"N		
Auger & Size:	4" Solid Stem	Longitude:	104°42'55.75"W		
Depth (ft.)	Sample Interval	SPT Blows/12"	16860 Thompson Road, 80908		Additional Notes
			Sand, Fine-Grained, Clay, Trace Gravel, Dense, Medium Plasticity, Tan, Moist, (SC)		
5		13/46	<div style="text-align: center; font-size: 48px; opacity: 0.5;">Page 1</div>		
10		12/40	Sand, Fine-Grained, Clay, Trace Gravel, Medium Dense, Medium Plasticity, Tan, Moist, (SC)		
15		Grab			
20		Grab			
			Total Depth= 20'-0"		
25					

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**APPENDIX E: Parr Engineering & Consulting, Inc. STA Soil  
Evaluation, Parr Job No. 17.112**



# PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal  
 11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908  
 Office: 719-494-0404 Cell: 719-659-1313

## STA SOIL EVALUATION

**Date:** February 27, 2017 **Job:** JN: 17.112

**Site Location:** 0 Thompson Road  
 Black Forest Road, CO 80908

**Purpose of Investigation:** To determine general subsurface soil conditions at the site location & to formulate design criteria for the proposed On-Site Wastewater Treatment system (OWTS)

**Field Procedure:** The materials in the various strata of the soil profile pit were visually classified in accordance with the U.S. Department of Agriculture (USDA) standards.



<b>Profile Pit</b>	Yes
<b>Perc Test</b>	-

**Date: (Profile Eval)** February 20, 2017  
**Excavator** G.Lauria  
**Evaluator** J. Dumke

**Depth to Groundwater (permanent or seasonal) Pit #1:** Not Reached  
**Depth to Groundwater (permanent or seasonal) Pit #2:** Not Reached

**Depth to Bedrock - Pit #1:** Not reached  
**Depth to Bedrock - Pit #2:** Not reached

**Other Terrain Features or Soil Conditions:** See Attached Site Map

**Endorsement:** Christopher L. Parr P.E.

Profile Pit 1	
<b>Latitude:</b>	39° 4' 37.15" N
<b>Longitude:</b>	104° 42' 55.54" W
Layer	Soil Type & LTAR
0 - 1'	Topsoil
1' - 5'	Type 4A (0.15)
5' - 8'	Type 4A (0.15)
-	-

Profile Pit 2	
<b>Latitude:</b>	39° 4' 37.15" N
<b>Longitude:</b>	104° 42' 56.67" W
Layer	Soil Type & LTAR
0 - 1'	Topsoil
1' - 8'	Type 4A (0.15)

Location	
Latitude:	Longitude:

<b>Perc #1</b>	N/A	Min./In.	-	-
<b>Perc #2</b>	N/A	Min./In.	-	-
<b>Perc #3</b>	N/A	Min./In.	-	-
	<b>Average:</b>	N/A	Min./In.	

**Recommendations:** (1) An Engineered On-Site Wastewater Treatment system (OWTS) is required for this location due to: (a) Soil Type 4A identified in the treatment zone of Profile Pits #1 and #2.



# PARR ENGINEERING & CONSULTING, INC.

Christopher L. Parr, P.E. Principal  
11590 Black Forest Road, Suite 10, Colorado Springs, CO 80908  
Office: 719-494-0404 Cell: 719-659-1313

## Google Site Map





**Parr Engineering & Consulting, Inc.**  
 11590 Black Forest Road, Suite 10  
 Colorado Springs, Colorado 80908  
 Phone: 719-494-0404

**Profile Pit - Log**

Job Number:	17.112
Date Evaluated:	02/20/17
Profile Pit#:	Pit #1

Excavator:	G. Lauria	Total Depth:	8'-0"
Logged By:	J. Dumke	STA Slope & Direction:	±4.0% S
Method:	Profile Pit	Latitude:	39° 4' 37.15" N
Auger & Size:	Mini Excavator	Longitude:	104° 42' 55.54" W

Depth (ft.)	Sample Interval	0 Thompson Road, 80908						
		USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay	Blocky	Massive	No	Type 4A (LTAR = 0.15) Treatment Level 1	<35%	10YR5/4 (Moist)
4								
6		Sandy Clay	Granular	Weak	No	Type 4A (LTAR = 0.15) Treatment Level 1	<35%	2.5Y6/3 (Moist)
8								
		Total Depth = 8'-0"						
10								

Evidence of Groundwater:	Not Reached
Depth to Bedrock:	Not Reached

**Additional Notes:**



**Parr Engineering & Consulting, Inc.**  
 11590 Black Forest Road, Suite 10  
 Colorado Springs, Colorado 80908  
 Phone: 719-494-0404

**Profile Pit - Log**

Job Number:	17.112
Date Evaluated:	02/20/17
Profile Pit#:	Pit #2

Excavator:	G. Lauria	Total Depth:	8'-0"
Logged By:	J. Dumke	STA Slope & Direction:	±4.0% S
Method:	Profile Pit	Latitude:	39° 4' 37.15" N
Auger & Size:	Mini Excavator	Longitude:	104° 42' 56.67" W

Depth (ft.)	Sample Interval	0 Thompson Road, 80908						
		USDA Soil Texture	USDA Soil Structure - Shape	Soil Structure Grade	Redoximorphic Features Present? (Y/N)	Soil Type (from Table 9 in O-14)	% Rock Frag.	Color
		Topsoil						
2		Sandy Clay	Blocky	Massive	No	Type 4A (LTAR = 0.15) Treatment Level 1	<35%	10YR5/4 (Moist)
4								
6								
8								
		Total Depth = 8'-0"						
10								

Evidence of Groundwater:	Not Reached
Depth to Bedrock:	Not Reached

**Additional Notes:**

## **APPENDIX F: Soil Survey Descriptions**

## El Paso County Area, Colorado

### 67—Peyton sandy loam, 5 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369d  
*Elevation:* 6,800 to 7,600 feet  
*Mean annual air temperature:* 43 to 45 degrees F  
*Frost-free period:* 115 to 125 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 85 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Peyton

##### Setting

*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam  
*Bt - 12 to 25 inches:* sandy clay loam  
*BC - 25 to 35 inches:* sandy loam  
*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 5 to 9 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Ecological site:* R049XB216CO - Sandy Divide  
*Hydric soil rating:* No

### Minor Components

#### Pleasant

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

#### Other soils

*Percent of map unit:*

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020