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

November 16, 2023

T-Bone Construction
1310 Ford Street
Colorado Springs, CO 80915

Attn: Mike Thibault

Re: Soils and Geology Study
305 Pine Oaks Road
Parcel No. 75250-00-014
El Paso County, Colorado
Entech Job No. 231440

Dear Mr. Thibault:

The project consists of subdividing 17-acres into two rural residential lots. The existing home and out buildings on Lot 1 will remain, and a new residence is proposed for Lot 2. The site is located west of the intersection of Pine Oaks Road and Highway 115, in El Paso County, Colorado.

GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SE¼ of the NE¼ of Section 25, Township 15 South, Range 67 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located immediately south of Colorado Springs city limits, west of Pine Oaks Road and Highway 115 in El Paso County, Colorado. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is gradually to moderately sloping to the northeast with steeper slopes along the northern and eastern side of the site. The proposed building area is gradually sloping to the northeast. Several minor drainage swales are located in the eastern portion of the site. A depression associate with an old gravel pit is located west of the existing house on Lot 1. Water was not observed in the drainage swales at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included undeveloped and a rural residential development. Site photographs, taken September 20, 2023, are included in Appendix A.

Total acreage involved in the proposed subdivision is 17-acres. Two rural residential lots are proposed. The proposed lot sizes range from 8.17 to 8.9-acres. The existing residence, outbuilding, on-site wastewater treatment system, and water well located on proposed Lot 1, will remain. The new lot will be serviced by a water cistern and on-site wastewater treatment system. The Site Plan with the proposed replat is presented in Figure 3.

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 potentially expansive soils, and areas potential seasonally shallow groundwater. Based on the proposed development plan, it appears that these areas will have some minor impacts 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.

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 any 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. (Entech) on September 20, 2023.

Two test borings and two test pits were excavated on the site to determine general suitability for the use of on-site wastewater treatment systems and general soil characteristics. The locations of the test borings are indicated on the Site Plan/Test Pit Location Map, Figure 3. The Test Boring Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

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.

SOIL AND GEOLOGIC CONDITIONS

Soil Survey

The Natural Resource Conservation Service (NRCS) (Reference 1, Figure 4), previously the Soil Conservation Service (Reference 2) has mapped three soil types on the site. Complete descriptions of the soil types are presented in Appendix D. In general, the soils consist of sandy loam to gravelly loamy sand. The soils are described as follows:

Type	Description
13	Bresser sandy loam, 5 to 9 percent slopes
17	Chaseville gravelly sandy loam, 8 to 40 percent slopes
38	Jarre-Tecolote, 8 to 65 percent slopes

The soils have been described to have moderate to rapid permeabilities. The soils are described as well suited for use as homesites. Possible hazards with soils erosion are present

on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate erosion hazards (Reference 2).

Soils

The soils encountered in the test borings and test pits consisted of a layer of slightly silty to clayey sand and sandy clay. Bedrock was not encountered in the test boring which were drilled to 20 feet. The upper sands were encountered at medium dense states and moist to dry conditions. The sand soils exhibit a low expansion potential.

Groundwater

Groundwater or signs of seasonally occurring water were not encountered in the test borings or test pits, which were drilled to 20 feet and excavated to 8 feet. It is anticipated groundwater will not affect shallow foundations on the site. Areas of potential seasonally shallow groundwater have been mapped in minor drainage swales in the eastern portion of the site that are discussed in the following sections. Fluctuations in groundwater conditions may occur due to variations in rainfall or other factors not readily apparent at this time. Isolated sand layers within the soil profile can carry water in the subsurface. Contractors should be cognizant of the potential for the occurrence of subsurface water features during construction.

Geology

Approximately ½ mile 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 the southwestern extent of a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northeasterly direction (Reference 3). The bedrock underlying the site consists of the Pierre Shale Formation of Cretaceous Age. The Pierre Shale Formation typically consists of claystone and shale deposited in a marine environment associated with the Cretaceous Seaway. The claystone and shale are typically expansive.

The geology of the site was evaluated using the *Geologic Map of the Cheyenne Mountain Quadrangle,* by Rowley et. al. in 2003, (Reference 4, Figure 5). The Geology Map for the site is presented in Figure 6. Two mappable units were identified on this site which is described as follows:

Qls **Landslide Deposits of Quaternary Age:** This is a small older slide feature. No signs of recent movement were observed. The slide materials consist of silty to clayey sands and gravels. It appears that portions of the colluvium or Verdos Alluvium have slid along the bedrock surface. The majority of the main slide mass is dormant and fairly stable in its present state; however, the steeper sloping areas have been mapped with potentially unstable slopes.

Qv **Verdos Alluvium of Quaternary Age:** These are stream terrace deposits that cap the hillsides north of the site. These materials consist of reddish brown silty sand and gravels and may contain some cobble and boulder-size materials. Much of the material in the Verdos Alluvium was derived from the Pikes Peak Granite to the west.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Cheyenne Mountain Quadrangle* distributed by the Colorado Geologic Survey in 2003

(Reference 4, Figure 5), The *Geologic Map of the Colorado Springs-Castle Rock Area,* distributed by the US Geological Survey in 1979 (Reference 5), and the *Geologic Map of the Pueblo 1° x 2° Quadrangle,* distributed by the US Geological Survey in 1978 (Reference 6). 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 constraints/hazards identified on this site include potentially expansive soils, areas of potential seasonally shallow groundwater, older landslide deposits, downslope creep, and potentially unstable slopes. These hazards and recommended mitigation techniques are discussed as follows:

Expansive Soils – Constraint

Expansive soils were not encountered in the test borings. Bedrock underlying the site consist of the Pierre Shale Formation of Cretaceous Age, which is typically expansive. Bedrock was not encountered in the test borings. Expansive soils or bedrock 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.

Potential Seasonally Shallow Groundwater Area – Constraint

The site is not mapped within any floodplains according to the FEMA Map No. 08041CO905G, dated December 7, 2018 (Figure 7, Reference 7). Areas of potential seasonally 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 along minor drainage swales located in the eastern and southern portions of the site. Water was not observed in any of the drainages at the time of our site investigation. These areas can likely be avoided by development. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed.
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. If shallow groundwater is encountered, underslab drains or interceptor drains may be necessary Figures 9 and 10. Specific drainage details and recommendations should be made once building locations and plans are finalized. 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.**

Landslide Hazard, and Slope Stability

Slopes observed on the site are gradually sloping to the northeast with steeper slopes located in the northern and eastern portions of the site. An older landslide deposit has been mapped in the northwestern portion of the site as indicated on the *Geologic Map of the Cheyenne Mountain Quadrangle* distributed by the Colorado Geologic Survey in 2003 (Reference 4, Figure 5). The slopes in the building area of the site are gradually sloping to the northeast and no signs of instability were observed on the site. Areas of downslope creep have been mapped in the eastern portion of the site, and potentially unstable slopes along the northern side of the site and are discussed below.

- Downslope Creep Areas – Constraint

  The slopes in the western portion of the lot have been identified as downslope creep areas on the Geology/Engineering Geology Map, Figure 6. This area is located in the eastern portion of the site and will be avoided by future site development. The slopes were traversed to observe any signs of recent movement or failures. The slopes appeared to be stable in their current state based on our site observations. In areas within and adjacent to the area mapped as downslope creep we would anticipate to potential for accelerated lateral and vertical movement of the near surface soils in a downslope direction.

  Mitigation: The design of the foundation in this area should account for the sloping conditions. A lateral pressure diagram for the design of walls in sloping areas is included in Figure 7. Foundation stiffeners such as tie-beams, buttresses or additional reinforcement are recommended. The excavation and any fill placed on the site should be benched into the slope and native soils. Slopes in the building area should be constructed at no steeper than 3:1 unless held by engineer-designed retaining walls designed for the global slope stability.

- Potentially Unstable Slopes – Hazard

  The slopes in the northern portion of the site have been identified as potentially unstable areas on the Geology/Engineering Geology Map, Figure 6. The slopes were traversed to observe any signs of recent movement or failures. The slopes appeared to be stable in their current state based on our site observations. An older landslide deposits has been mapped in the northwestern portion of the site (Reference 4, Figure 5). These areas should be avoided by future development unless analyzed for slope stability.

Areas of Erosion – Constraint

These are areas that are undergoing erosion by water and sheetwash producing gullies and rill erosion and primarily located along portions of the minor drainage swales in the eastern portion of the site. These areas are to be avoided by the proposed site development.

Mitigation: Due to the nature of the soils on this site, virtually all the soils are subject to erosion by wind and water. 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 Section "Erosion Control" 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).

Faults – Hazard

The closest fault is the Rampart Range Fault, located approximately ½ mile west of the site (Reference 3). No faults are mapped in the site itself. Previously, Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. Additionally, the International Residential Code (IRC), 2003, currently places this area in Seismic Design Category B, also a low seismic risk. According to a report by the Colorado Geological Survey by Kirkman and Rogers, Bulletin 43 (1981) (Reference 8), this area should be designed for Zone 2 due to more recent data on the potential for movement in this area and any resultant earthquakes.

Radon – Hazard

Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 9). Average Radon levels for the 80926-zip code is 14.8 pCi/l. The following is a table of radon levels in this area:

80826	
0 < 4 pCi/l	0.00%
4 < 10 pCi/l	0.00%
10 < 20 pCi/l	100.00%
> 20 pCi/l	0.00%

Mitigation:
The potential for high radon levels is present for the site. Build-up of radon gas can usually be mitigated by providing increased ventilation of basement and crawlspace and sealing joints. **Specific requirements for mitigation should be based on site specific testing.**

RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

The proposed development will consist of two rural residential lots. The proposed lot sizes range from 8.17 to 8.9-acres. The existing residence, outbuildings, on-site wastewater treatment system, and water well located on proposed Lot 1, will remain. The new lot will be serviced by a water cistern and on-site wastewater treatment system. The existing geologic and engineering geologic conditions will impose minor constraints on development and construction. The geologic conditions on the site potentially expansive soils, areas of potential seasonally shallow groundwater, older landslide deposits, downslope creep, and potentially unstable slopes, which can be satisfactorily mitigated through avoidance or proper engineering design and construction practices.

The upper granular soils encountered in the test borings and test pits on the site were encountered at medium dense states. Expansive soils were not encountered in the test borings, however, highly expansive claystone and siltstone are commonly interbedded in the sandstone of the Dawson Formation. 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. These soils will not prohibit development.

Areas of potential seasonally 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. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie along minor drainage swales located in the northern portion of the site. Water was not observed in any of the drainages at the time of our site investigation. Subsurface perimeter drains are recommended should structures encroach on this area. Typical drain details are presented in Figure 8. If shallow groundwater is encountered, underslab drains or interceptor drains may be necessary Figures 9 and 10. Specific drainage details and recommendations should be made once building locations and plans are finalized. Septic systems are not recommended in in these areas due to the potential for shallow groundwater. Any grading in theses areas should be done to direct surface flow around construction to avoid areas of ponded water. All organic material should be completely removed prior to any fill placement. Specific drainage studies are beyond the scope of this report. The site is not mapped within any floodplains according to the FEMA Map No. 80841C0320G (Figure 7, Reference 7).

Bedrock was encountered in the test borings at depths ranging from the 1 to 4 feet. Shallow bedrock will be encountered across the majority of this site. Where shallow bedrock is encountered, excavation/grading may be difficult requiring track-mounted excavators with ripper attachments. Bedrock will likely be encountered in the proposed building excavations. In areas of shallow bedrock, the potential for perched groundwater conditions exist. Where perched groundwater is encountered, underslab drains or interceptor drains may be necessary Figures 9 and 10.

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), of the area of the site is with U4 – upland deposits, unevaluated resource, probably aggregate resource. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 11), the site is mapped with U4 – upland deposits, unevaluated resource, probably aggregate resource. 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.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 12), the site is not mapped within the Denver Basin Coal Region. 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 may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from

rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

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.

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. The majority of these conditions can be avoided by construction. Others can be 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 T-Bone Construction, 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.

Logan L. Langford, P.G.
Senior Geologist

Reviewed by:

COLORADO REGISTERED JOSEPH COLLIN GOODE JR. 23725 PROFESSIONAL ENGINEER

Joseph C Goode Jr. Digitally signed by Joseph C Goode Jr. Date: 2023.11.16 15:54:19 -07'00'

Joseph C. Goode, Jr., P.E.
President

LLL
Encl.

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6. Scott, Glen R.; Taylor Richard B.; Epis, Rudy C; and Wobus, Reinhard A. 1978. *Geologic Structure Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado*. Sheet 2. U.S. Geologic Survey. Map I-1022.

7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041CO905G.

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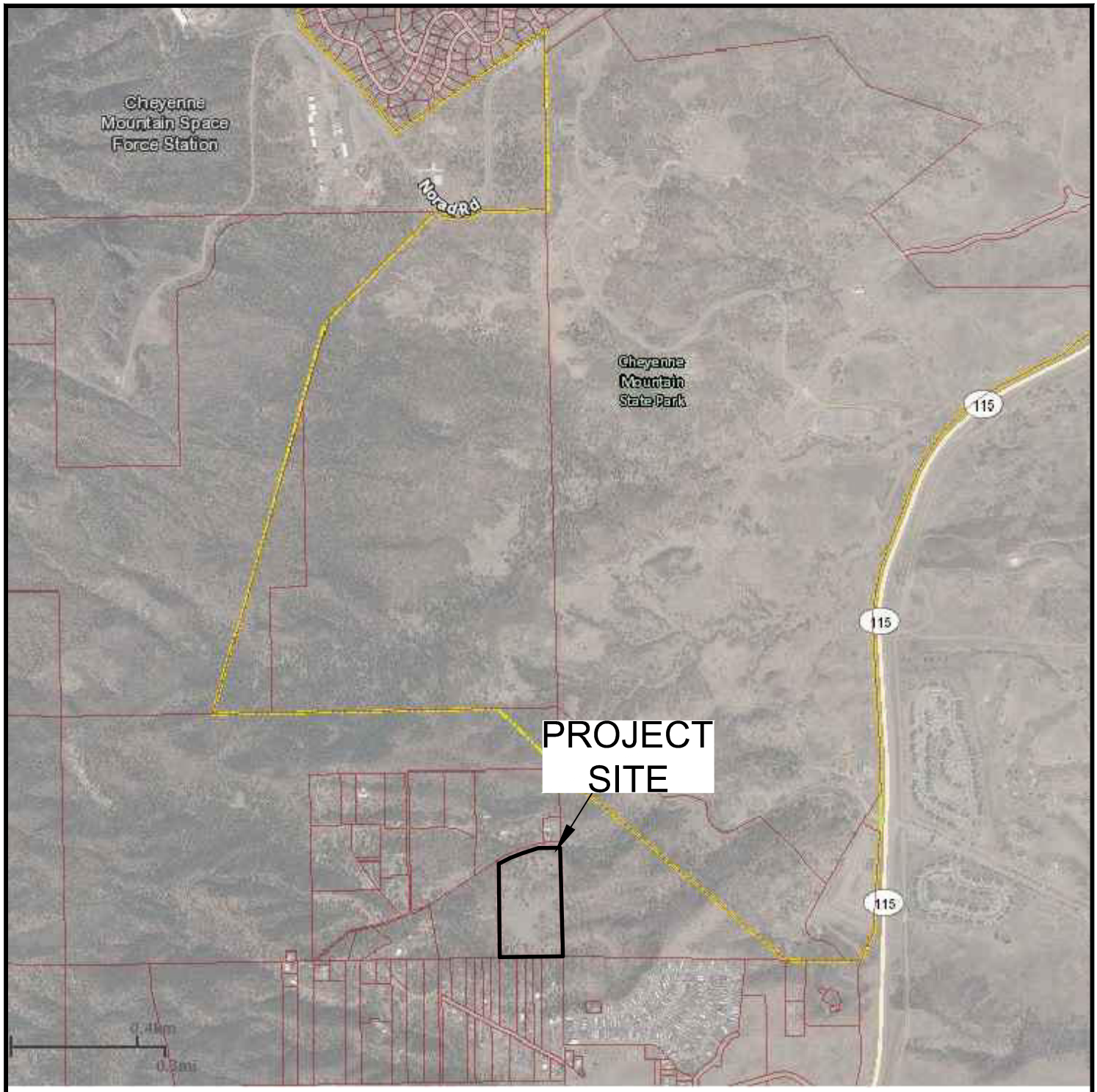
FIGURES



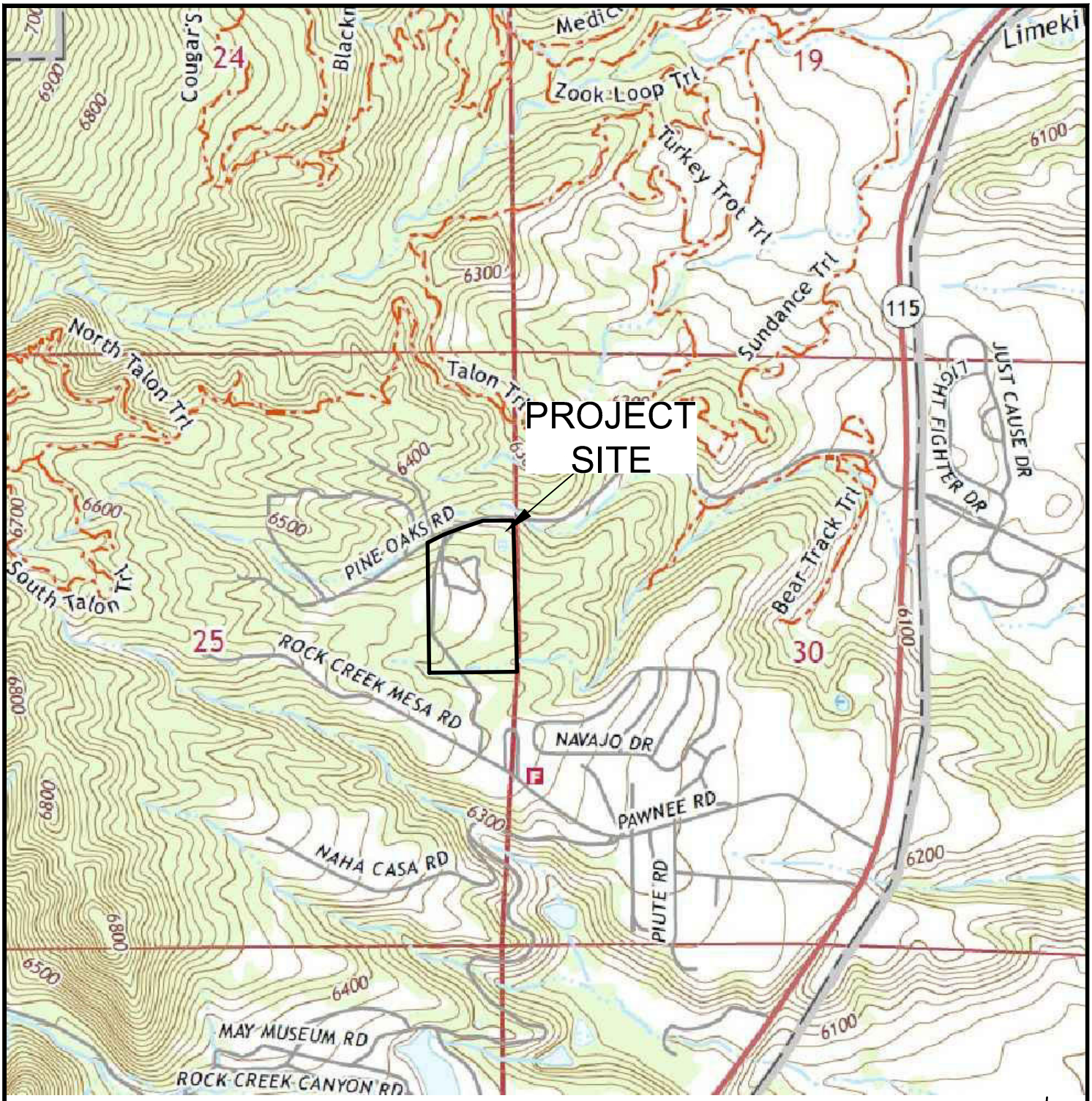
ENTECH ENGINEERING, INC.

VICINITY MAP

305 PINE OAKS ROAD
EL PASO COUNTY, CO
T-BONE CONSTRUCTION

JOB NO.
231440

FIG. 1



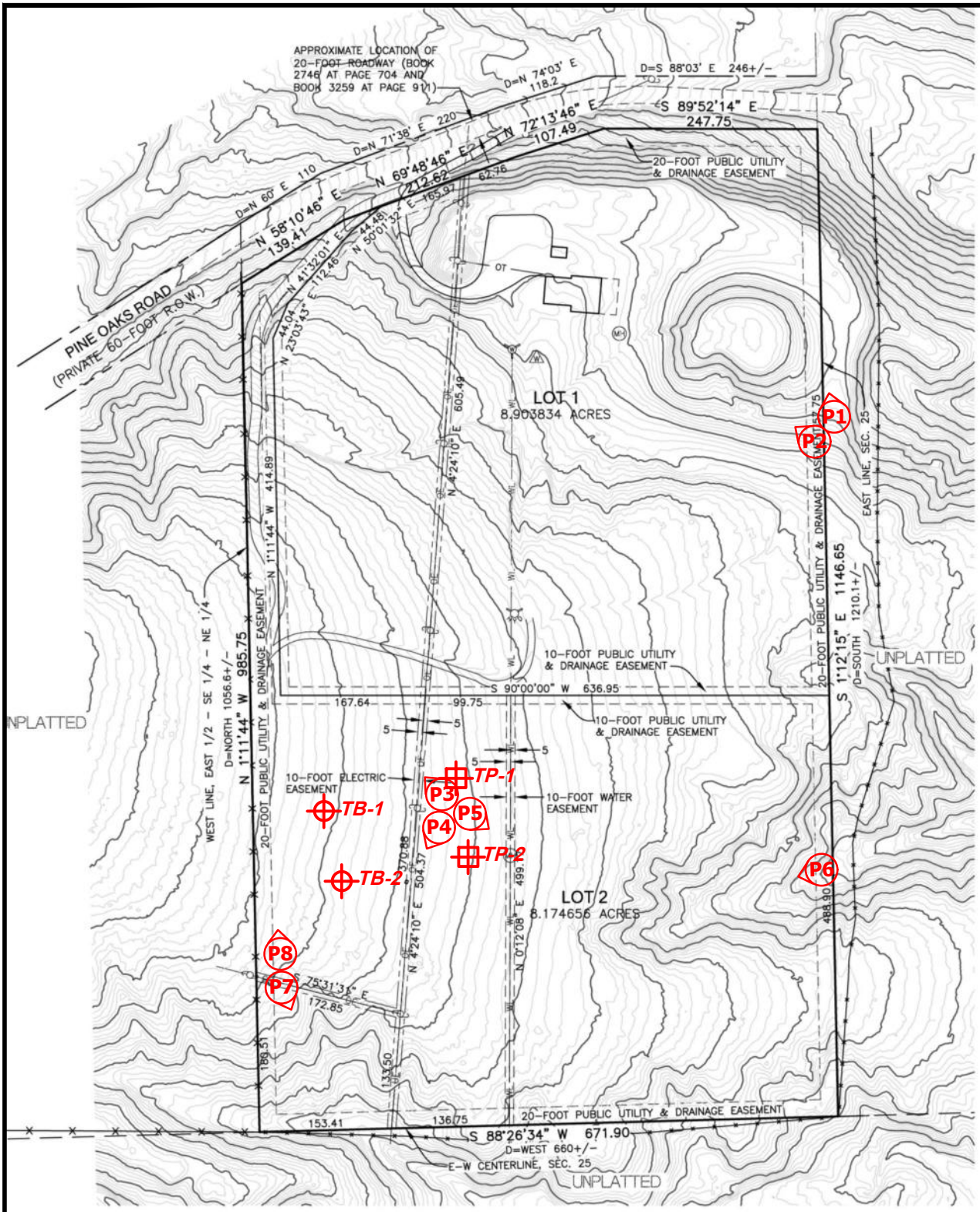
ENTECH ENGINEERING, INC.

USGS TOPOGRAPHY MAP

ADDRESS
COLORADO SPRINGS, COLORADO
CLIENT

JOB NO.
231532

FIG. 2



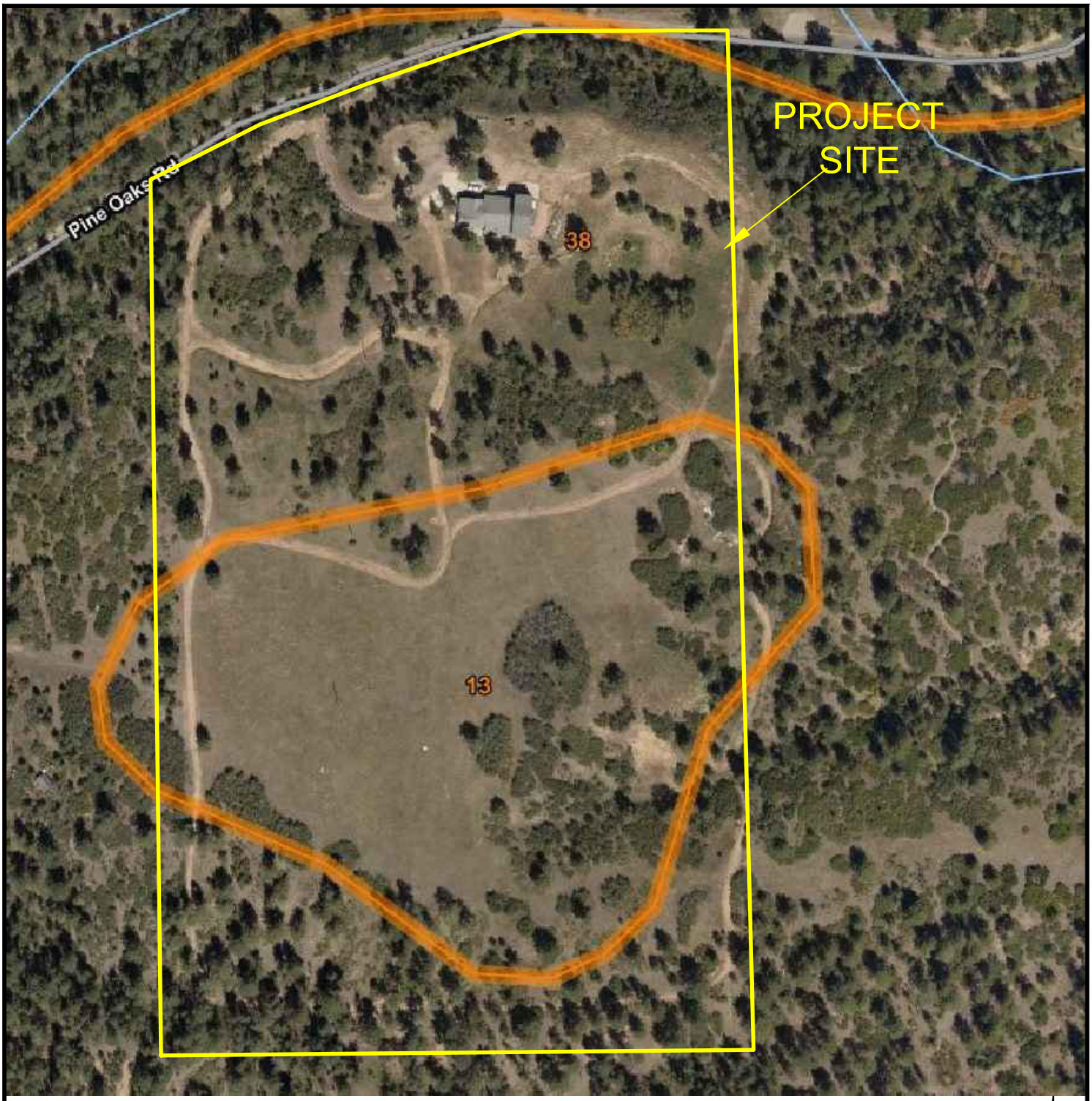
ENTECH ENGINEERING, INC.

EXPLORATION AND SITE PLAN

305 PINE OAKS ROAD
EL PASO COUNTY, CO
T-BONE CONSTRUCTION

JOB NO.
231440

FIG. 3



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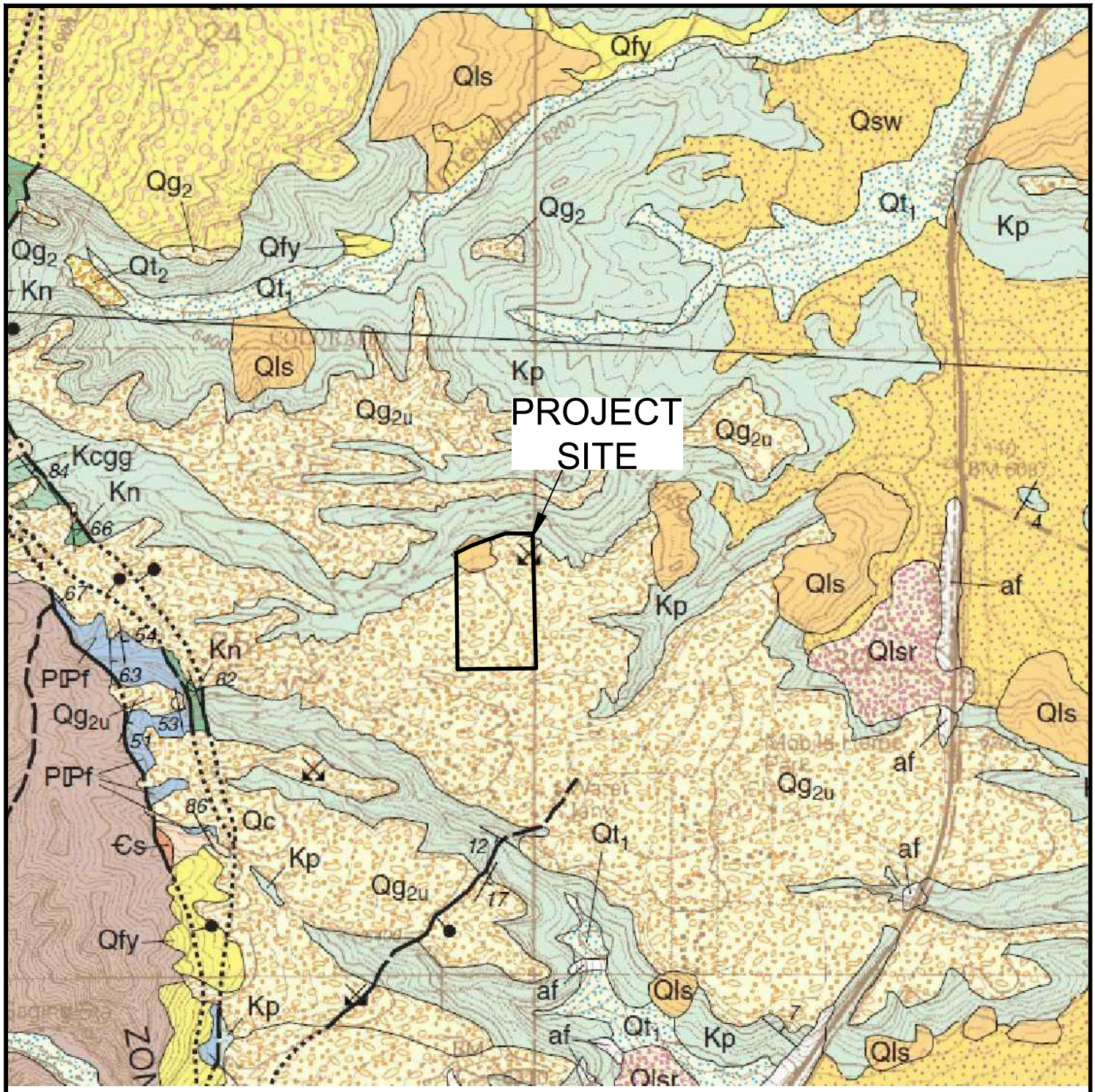
ENTECH ENGINEERING, INC.

SOIL SURVEY MAP

305 PINE OAKS ROAD
EL PASO COUNTY, COLORADO
T-BONE CONSTRUCTION

JOB NO.
231440

FIG. 4



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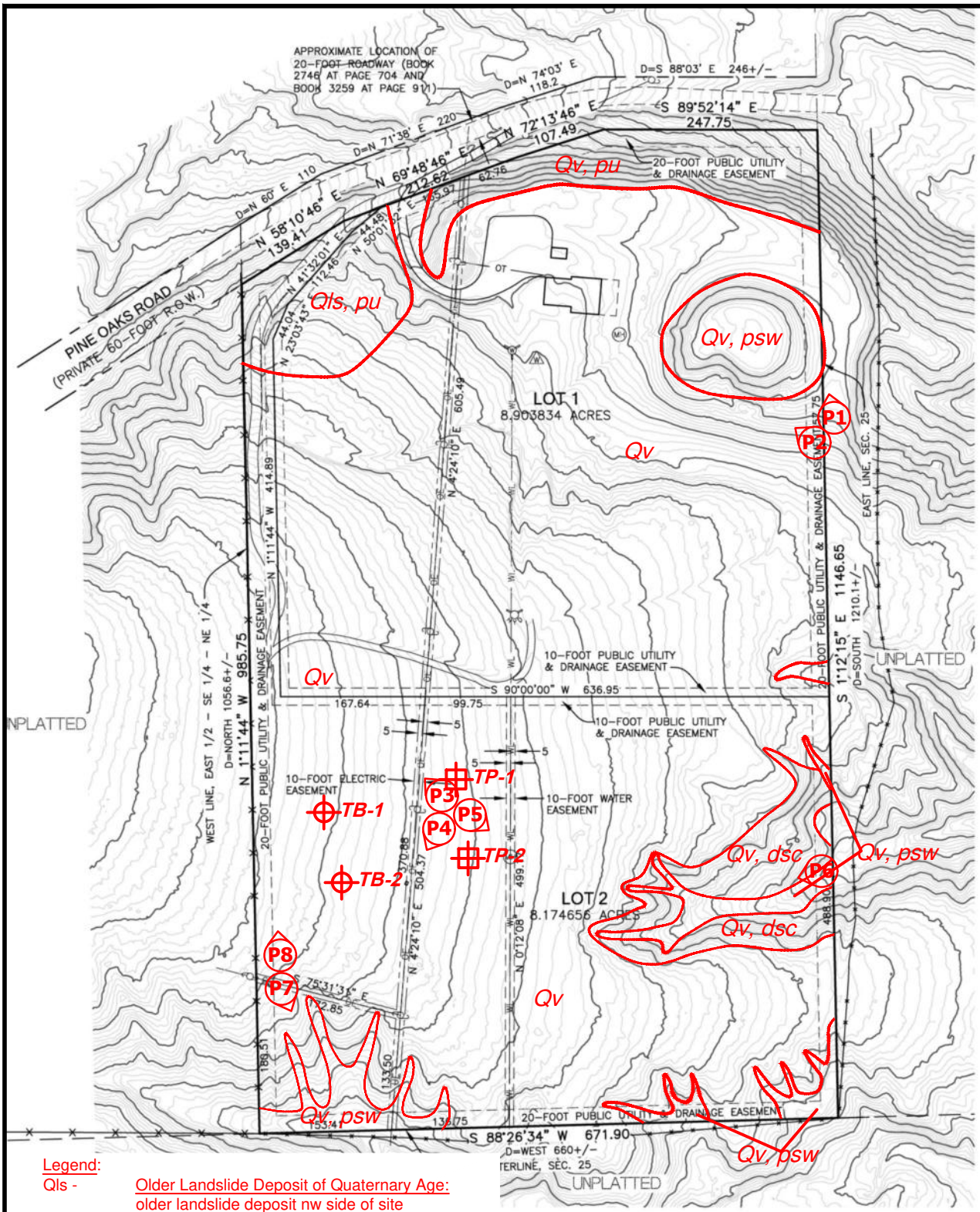
ENTECH ENGINEERING, INC.

CHEYENNE MOUNTAIN QUADRANGLE GEOLOGIC MAP

305 PINE OAKS ROAD
EL PASO COUNTY, COLORADO
T-BONE CONSTRUCTION

JOB NO. 231440

FIG. 5



Legend:

Qls - Older Landslide Deposit of Quaternary Age:
older landslide deposit nw side of site

Qv- Verdo Alluvium of Quaternary Age:
red-brown sandy stream terrace deposits

dsc - downslope creep area
pu - potentially unstable slope
psw - potentially seasonal shallow groundwater area

GRAPHIC SCALE
100 0 50 100

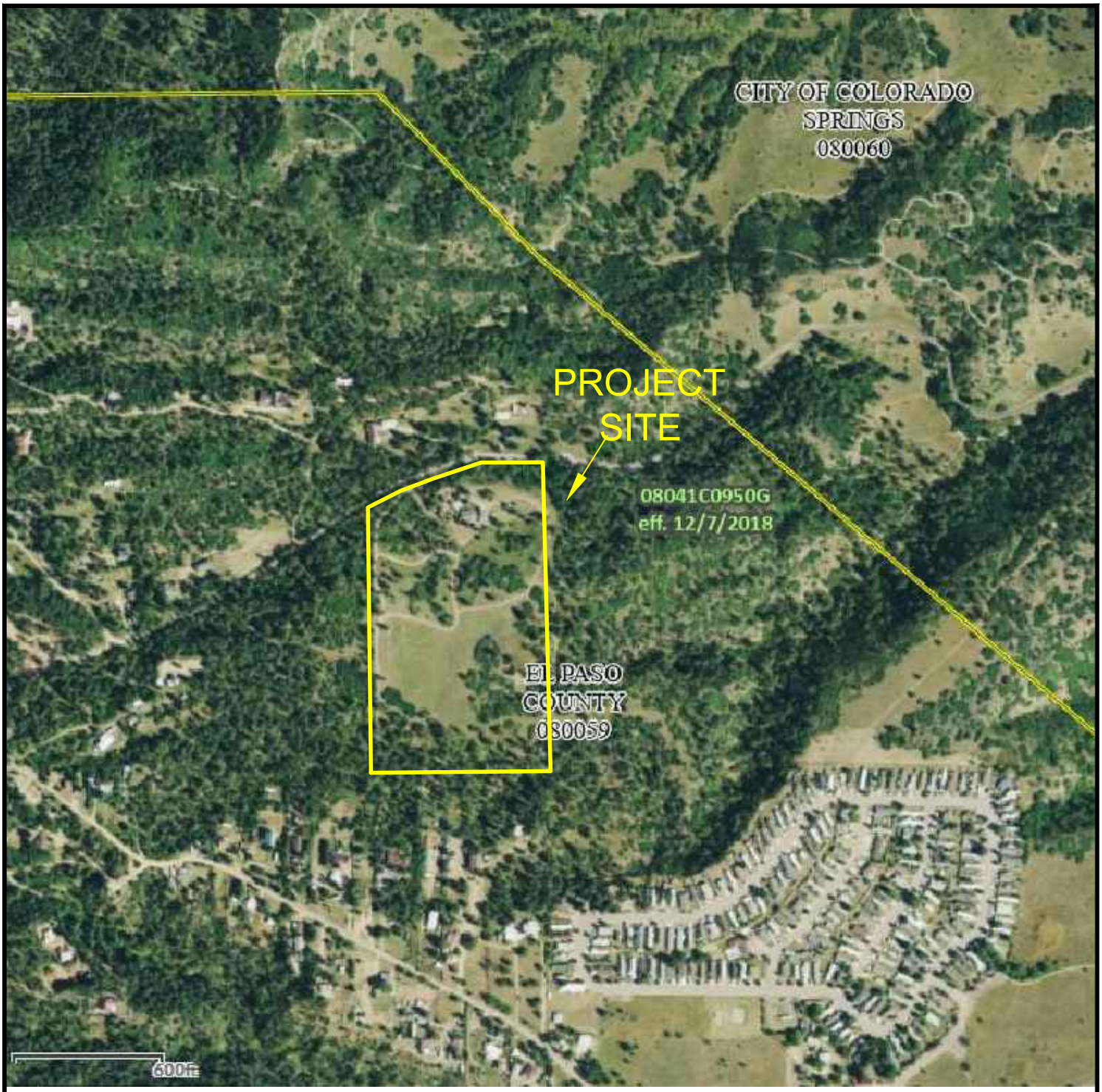
ENTECH ENGINEERING, INC.

GEOLOGY/ENGINEERING GEOLOGY MAP

305 PINE OAKS ROAD
EL PASO COUNTY, CO
T-BONE CONSTRUCTION

JOB NO.
231440

FIG. 6



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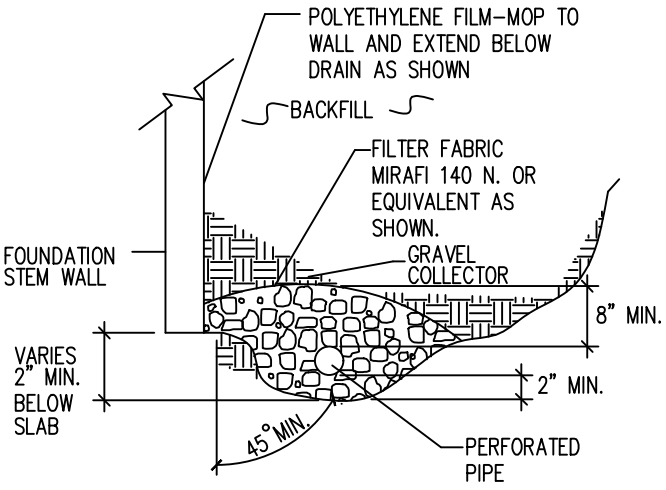
ENTECH ENGINEERING, INC.

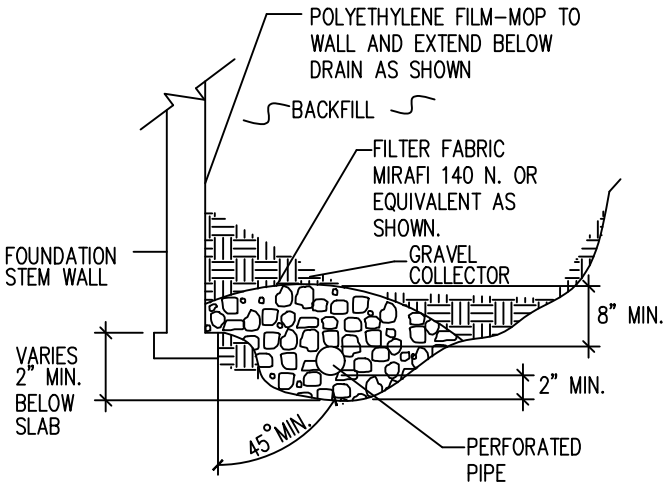
FEMA FLOODPLAIN MAP

305 PINE OAKS ROAD
EL PASO COUNTY, COLORADO
T-BONE CONSTRUCTION

JOB NO.
231440

FIG. 7





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 ENGINEERING, INC.

PERIMETER DRAIN DETAIL

305 PINE OAKS ROAD
EL PASO COUNTY, COLORADO
T-BONE CONSTRUCTION

JOB NO. 231440

FIG. 8

APPENDIX A: Photographs

1

Looking north from the northeast side of the site.

September 20, 2023

2

Looking northwest from the northeast side of the site.

September 20, 2023

Job No. 231440

3

Looking northwest from the central portion of the Lot 2.

September 20, 2023

4

Looking southwest from the central portion of the Lot 2.

September 20, 2023

Job No. 231440

5

Looking southeast from the central portion of the Lot 2.

September 20, 2023

6

Looking west towards minor drainage area from the southeastern side of the site.

September 20, 2023

Job No. 231440

7

Looking south from the southwestern side of the site.

September 20, 2023

8

Looking north from the southwestern side of the site.

September 20, 2023

Job No. 231440

APPENDIX B: Test Boring & Test Pit Logs

TEST BORING 1
DATE DRILLED 9/13/2023

REMARKS

DRY TO 20', 9/13/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SLIGHTLY SILTY, RED BROWN, MEDIUM DENSE to LOOSE, MOIST to DRY			15	5.2	
5			15	1.2	
CLAYEY LENS 10			8	10.1	
15			18	2.8	
SAND, CLAYEY, RED BROWN, LOOSE, MOIST 20			9	5.1	

TEST BORING 2
DATE DRILLED 9/13/2023

REMARKS

DRY TO 20', 9/13/23

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SLIGHTLY SILTY, RED BROWN, MEDIUM DENSE to LOOSE, MOIST to DRY			7	4.8	
5			11	2.9	
CLAYEY LENS 10			13	11.0	
15			15	9.3	
20			11	16.9	

ENTECH ENGINEERING, INC.

TEST BORING LOGS

305 PINE OAKS ROAD
T-BONE

JOB NO.
231440

FIG. B-1

TEST PIT 1
DATE EXCAVATED 9/20/2023
REMARKS

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type	
1						topsoil, sandy clay loam, brown, moist
2						
3			bl	s	4	sandy clay, fine to medium grained, dark brown, moist
4						
5						
6			gr	s	3	sandy clay loam, fine to coarse grained, dark grown, moist
7						
8						
9						
10						

TEST PIT 2
DATE DRILLED 9/20/2023
REMARKS

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type	
1						topsoil, sandy clay loam, brown, moist
2						
3			bl	s	4	sandy clay, fine to medium grained, dark brown, moist
4						
5						
6			gr	s	3	sandy clay loam, fine to coarse grained, dark grown, moist
7						
8						
9						
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.

TEST PIT LOGS

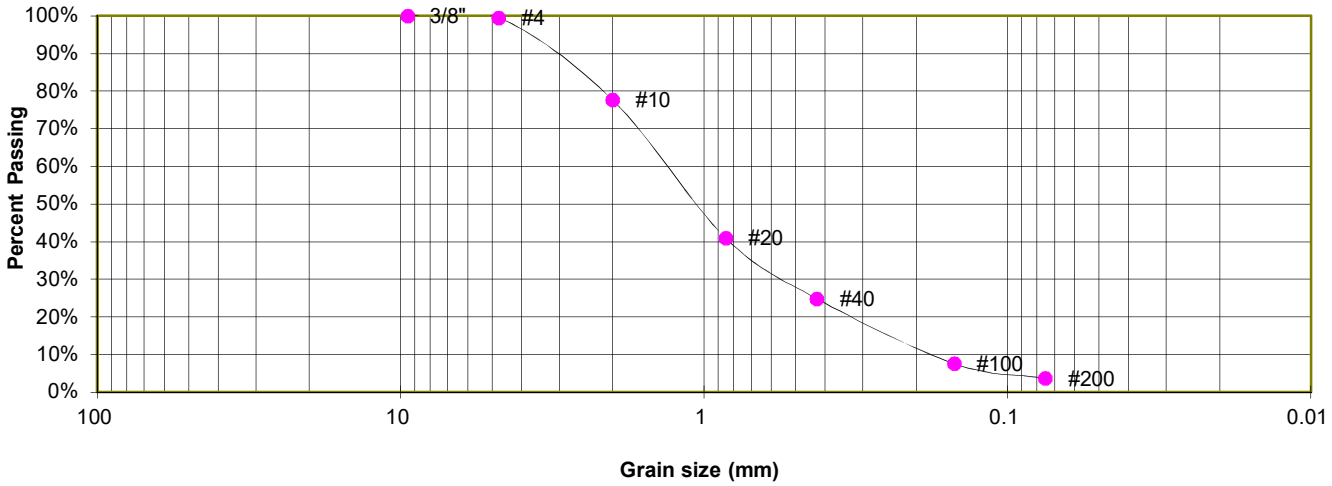
305 PINE OAKS ROAD
T-BONE

JOB NO.
231440

FIG. B-2

APPENDIX C: Laboratory Test Results

TEST BORING	1	SOIL DESCRIPTION	SAND, SLIGHTLY SILTY
DEPTH (FT)	5		



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.5%
10	77.6%
20	41.0%
40	24.9%
100	7.6%
200	3.7%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW

ENTECH ENGINEERING, INC.

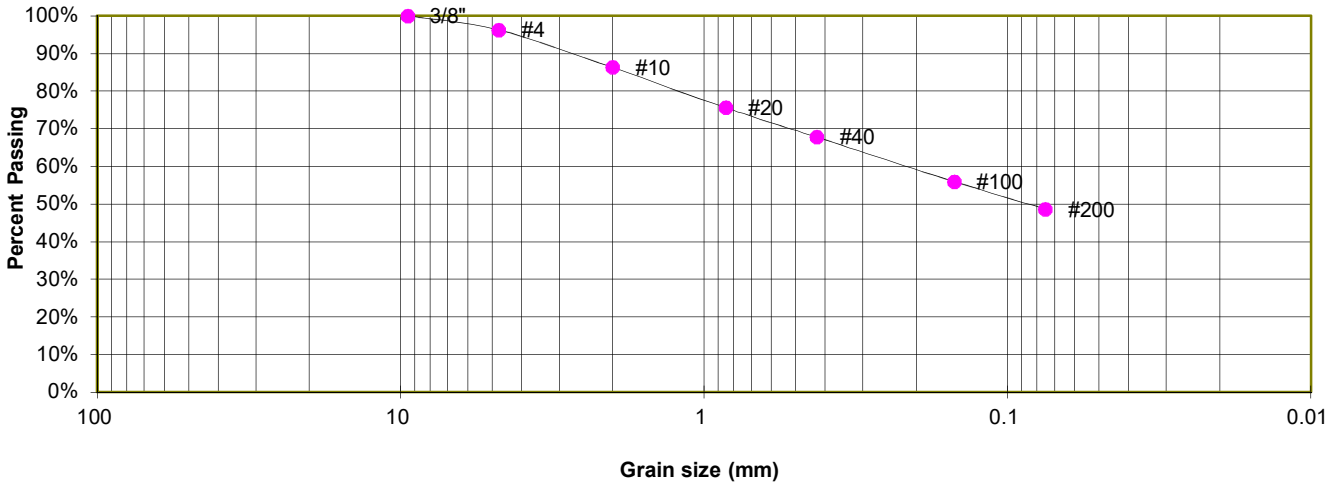
LABORATORY TEST RESULTS

305 PINE OAKS ROAD
T-BONE

JOB NO.
231440

FIG. C-1

TEST BORING	2	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	10		



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	86.3%
20	75.6%
40	67.8%
100	56.0%
200	48.7%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SC

ENTECH ENGINEERING, INC.

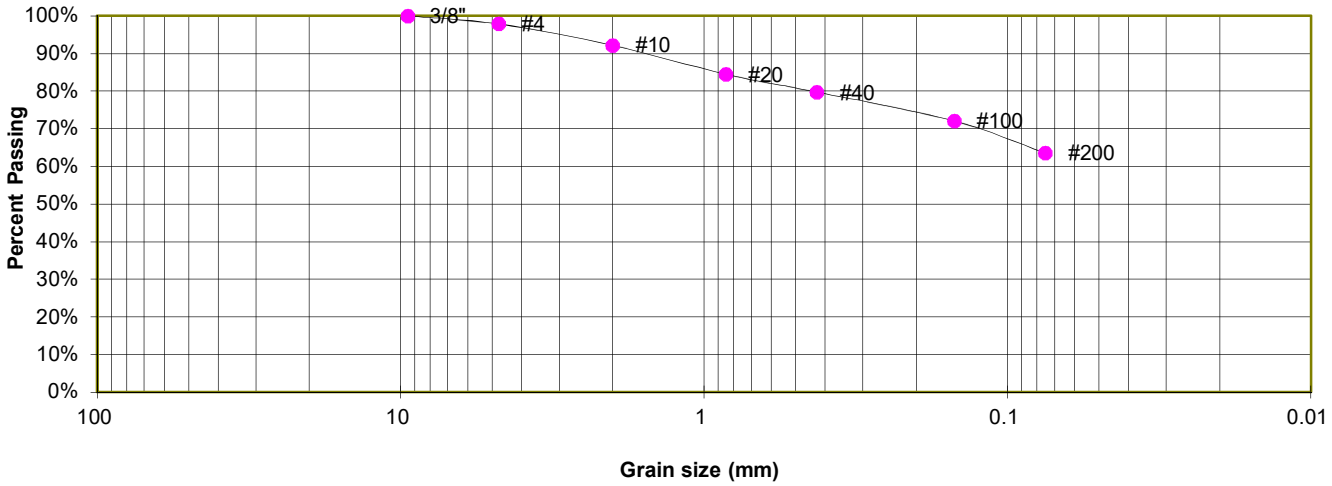
LABORATORY TEST RESULTS

305 PINE OAKS ROAD
T-BONE

JOB NO.
231440

FIG. C-2

TEST BORING	TP-1	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	2.5		



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.9%
10	92.2%
20	84.5%
40	79.8%
100	72.1%
200	63.6%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

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LABORATORY TEST RESULTS

305 PINE OAKS ROAD
T-BONE

JOB NO.
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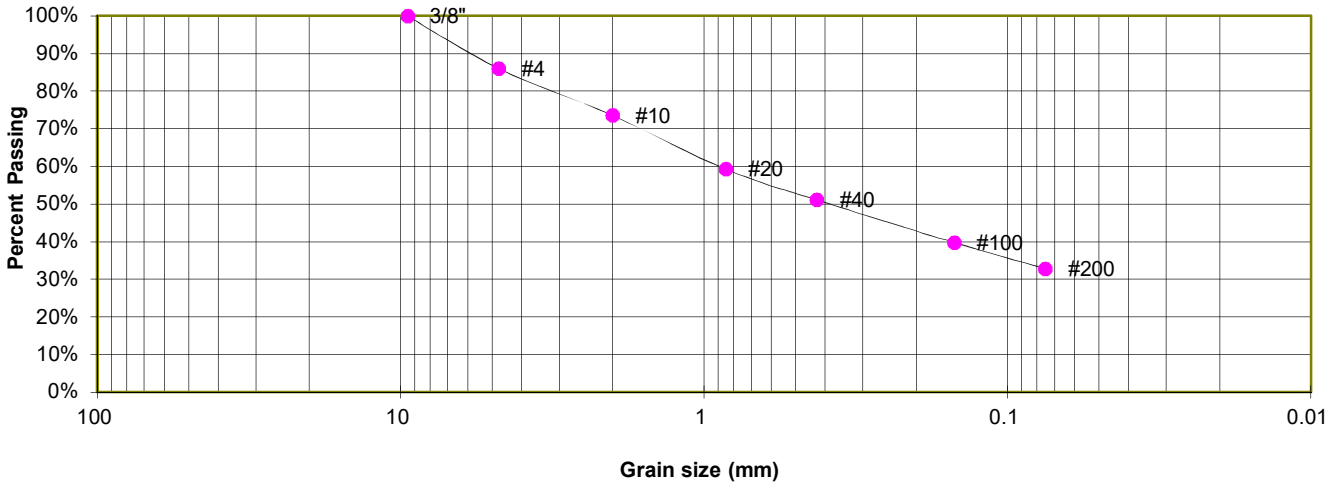
FIG. C-3

TEST BORING	TP-2	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	6.5		



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	86.0%
10	73.5%
20	59.3%
40	51.1%
100	39.8%
200	32.8%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SC

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

305 PINE OAKS ROAD
T-BONE

JOB NO.
231440

FIG. C-4

APPENDIX D: Soil Survey Descriptions

El Paso County Area, Colorado

13—Bresser sandy loam, cool, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlpk
Elevation: 5,500 to 6,960 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Bresser, cool, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser, Cool

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

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 to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Ascalon

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Truckton

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

17—Chaseville gravelly sandy loam, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 367m
Elevation: 6,100 to 7,000 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Chaseville and similar soils: 99 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chaseville

Setting

Landform: Terraces, alluvial fans, hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose

Typical profile

A1 - 0 to 6 inches: gravelly sandy loam
A2 - 6 to 19 inches: very gravelly sandy loam
C1 - 19 to 40 inches: extremely gravelly loamy coarse sand
C2 - 40 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

38—Jarre-Tecolote complex, 8 to 65 percent slopes

Map Unit Setting

National map unit symbol: 368c
Elevation: 6,700 to 7,500 feet
Frost-free period: 90 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Jarre and similar soils: 40 percent
Tecolote and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Jarre

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 5 inches: gravelly sandy loam
Bt - 5 to 22 inches: gravelly sandy clay loam
2C - 22 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 8 to 30 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 supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Tecolote

Setting

Landform: Alluvial fans
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 3 inches: very stony loam
E - 3 to 12 inches: very gravelly loamy sand
Bt - 12 to 45 inches: extremely gravelly sandy clay loam
C - 45 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 65 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R048AY255CO - Pine Grasslands
Hydric soil rating: No

Minor Components

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 21, Aug 24, 2023