Please address the following CGS comment:
Entech recommends that buildings be located a minimum of 3 feet above groundwater levels and that septic fields not be placed in areas with potential shallow groundwater (pp. 7–8). CGS is concerned that groundwater conditions have not been adequately characterized to determine the suitability of the proposed building and OWTS locations, particularly on Lot 2. The feasibility of basement construction has also not been addressed.

CGS recommends that basements be prohibited unless a minimum one-year groundwater monitoring study is completed and demonstrates that seasonal groundwater levels can be adequately accommodated. Monitoring should extend through winter, spring, summer, and fall to characterize seasonal groundwater fluctuations, as groundwater observations obtained during a single geotechnical investigation may not represent seasonal high groundwater conditions. Groundwater conditions and their potential impacts on proposed building sites and OWTS locations should be evaluated prior to final plat approval.

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

SOILS AND GEOLOGY STUDY
PINERY CIRLCE – 3 LOT SUBDIVISION
PARCEL NO. 52054-00-041
EL PASO COUNTY, COLORADO



Prepared for:
Alan Greaves
3880 Inspiration Drive
Colorado Springs, Colorado 80917

November 21, 2025

G, INC.

Reviewed by:

COLORADO LICENSED
JOSEPH COLLIN GOODE
23725
PROFESSIONAL ENGINEER

Digitally signed by Joseph C. Goode Jr.
Date: 11/21/25

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

Entech Job No. 251507
LLL/JCG

PCD No.

Table of Contents

1 SUMMARY..... 1

2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION..... 1

3 SCOPE OF THE REPORT..... 2

4 FIELD INVESTIGATION..... 2

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY..... 3

5.1 General Geology..... 3

5.2 Soil Conservation Survey..... 3

5.3 Site Stratigraphy..... 4

5.4 Soil Conditions..... 5

5.5 Groundwater..... 5

6 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS..... 6

6.1 Relevance of Geologic Conditions to Land Use Planning..... 9

7 ECONOMIC MINERAL RESOURCES..... 10

8 EROSION CONTROL..... 11

9 ROADWAY, EMBANKMENT, and STORMWATER DETENTION FACILITY CONSTRUCTION RECOMMENDATIONS..... 12

10 CLOSURE..... 12

11 REFERENCES..... 14

FIGURES

Figure 1: Vicinity Map
Figure 2: USGS Map
Figure 3: Site and Exploration
Figure 4: Soil Survey Map
Figure 5: Geologic Map of the Black Forest Quadrangle
Figure 6: Geology/Engineering Geology Map
Figure 7: Floodplain Map
Figure 8: USFWS Wetlands Map
Figure 9: Perimeter Drain Detail
Figure 10: Underslab Drainage Layer (Capillary Break)
Figure 11: Interceptor Drain Detail

APPENDIX A: Site Photographs
APPENDIX B: Test Boring and Test Pit Logs
APPENDIX C: Laboratory Test Results
APPENDIX D: Soil Survey Descriptions
APPENDIX E: Existing OWTS Records

1 SUMMARY

Project Location

The project site is located within the SE¼ of Section 5, Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located just south of the Palmer Divide approximately 4 miles north-northeast of Colorado Springs city limits within the Black Forest burn scar. The location of the site is as shown in the Vicinity Map (Figure 1).

Project Description

Verify

Verify

A three-lot rural residential subdivision is proposed for the 15-acre parcel. The proposed lots are to be 5 acres and will be serviced by individual water wells and on-site wastewater treatment systems (OWTS). A residence was previously located on proposed Lot 3, and portions or the existing retaining wall, previous septic system and water well remain on the site. The well is located on Lot 2 and the previous septic system components are located on portions of Lots 2 and 3.

Scope of Report

This report presents the results of our geologic evaluation and treatment of engineering geologic hazard study with respect to the proposed subdivision.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development; however, geologic conditions in certain areas will impose some minor constraints on development and land use. These include areas of artificial fill, potentially expansive soils, seasonal shallow and shallow groundwater areas, drainage areas, shallow bedrock, and the potential for elevated radon levels. These conditions are discussed in greater detail in this report.

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

2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The topography of the site is generally gradually sloping to the southwest with moderate slopes to the north along the Kettle Creek drainage in the northwestern portion of the site. The drainage generally flows in southwesterly direction, and water was not observed flowing in the drainages

Typical comment: Verify, please do a global search and replace.

Typical comment: Verify, please do a global find and replace. Then, revise the recommendations as necessary.

. The site boundaries are indicated in the USGS Map (Figure 2). ed rural residential. The previous residence on the site was lost in the Black Forest fire in 2013. The site primarily contains field grasses and weeds with Ponderosa Pines along the northern side of the site. Site photographs are included in Appendix A.

The project is to consist of the subdividing of 15 acres into a 3-lot rural residential subdivision. The proposed lots are approximately 5 acres and will be serviced by individual water wells and on-site wastewater treatment systems (OWTS). A residence was previously located on proposed Lot 3, and portions of the existing retaining wall, previous septic system and water well remain. The proposed lot configuration is shown in the Site and Exploration Plan (Figure 3).

3 SCOPE OF THE REPORT

The scope of the report includes a general geologic analysis utilizing published geologic data. Detailed site-specific mapping was conducted to obtain general information with respect to major geographic and geologic features, geologic descriptions, and their effects on the development of the property in accordance with the El Paso Land Development Code.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The site was also evaluated using the Web Soil Survey from the Natural Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS). The position of mappable units within the subject property is shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air 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 on September 8, 2025. Site photographs are included in Appendix A.

Three (3) test borings were drilled and three (3) tactile test pits were excavated across the project site to determine the classification and engineering characteristics of the soils. The borings were drilled to depths of 20 feet using a truck-mounted, continuous flight auger drilling rig supplied and operated by Entech, and the test pits were excavated to depths of 3.5 to 6 feet where shallow bedrock was encountered.

The locations of the test borings and test pits are indicated on the Site and Exploration Plan (Figure 3). The Test Boring and Test Pit Logs are included in Appendix B, and Laboratory Test Results are included in Appendix C. The results of the testing will be discussed later in this report.

Laboratory testing was performed to classify and determine the engineering characteristics of the soils. Laboratory tests included moisture content testing (ASTM D2216), grain-size analysis (ASTM D422), and Atterberg Limits testing (ASTM D4318). Swell testing included one-dimensional swell/consolidation testing. Results of the laboratory testing are included in Appendix C.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

The site lies in the western portion of the Great Plains Physiographic Province just south of the Palmer Divide. A major structural feature known as the Rampart Range Fault lies approximately 12 miles to the west. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northeasterly direction (Reference 1). The rocks in the area of the site are sedimentary in nature and typically Tertiary to Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation of Tertiary to Cretaceous Age. Overlying this formation are unconsolidated deposits of residual, colluvial, alluvial, and man-placed fill of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. Some colluvial soils deposited by gravity and sheetwash exist. The alluvial soils were deposited by water along the drainage in the northwestern portion of site. Man-placed fill exists as remnants associated the previous residence that was lost in the Black Forest fire in 2013. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3), has mapped two soil types on the site (Figure 4). In general, it is a sandy loam. The soils are described as follows:

Exhibit 1: Soil Survey Description

Type	Description
40	Kettle gravelly loamy sand, 3 to 8% slopes
41	Kettle gravelly loamy sand, 8 to 40% slopes

Complete descriptions of each soil type are presented in Appendix D. The soil has generally been described as having moderately high permeabilities. Limitations on development include limited ability to support a load, shrink-swell potential, slopes, and frost action potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soil has been described to have moderate erosion hazards.

5.3 Site Stratigraphy

The Geologic Map of the Black Forest Quadrangle showing the site is presented in Figure 5 (Reference 4). The Geology Map prepared for the site is presented in Figure 6. Three mappable units were identified on this site that are described as follows:

Qal **Alluvium of Quaternary Age:** These are modern stream deposits associated with the Kettle Creek drainage in the northwestern portion of the site. These materials generally consist of silty to clayey sands and gravel.

Qaf **Artificial Fill of Quaternary Age:** These are man-placed fill deposits associated with the previous residence located on proposed Lot 3. Other areas of fill may exist on the site other than those mapped.

Tkd **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone, and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consist of clayey sands and sandy clays. Areas of colluvial soils may exist on some of the slopes on site. These materials are derived from the bedrock materials and have been re-deposited by the action of sheetwash and gravity.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Black Forest Quadrangle* distributed by the Colorado Geological Survey in 2003 (Reference 4), 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 Denver 1^0 x 2^0 Quadrangle*, distributed by the

US Geological Survey in 1981 (Reference 1). The Test Borings and Test Pit Logs used in evaluating the site are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the test borings drilled on the site can be grouped into two general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 classified as a silty sand (SM). The sand was encountered in the borings at the existing surface and extending to depths of 1 to 18 feet below the existing grade surface (bgs). The sand was encountered at medium dense to dense states and moist conditions.

Soil Type 2 classified as highly weathered sandstone or dense silty to clayey sand when classified as a soil (SM, SC). The sandstone was encountered in all test borings at depths ranging from the 1 to 18 feet bgs and extending to the termination of the borings (20 feet).

The test boring logs and laboratory test results pertaining to this investigation are included in Appendix B.

5.5 Groundwater

Groundwater was not encountered in any of the test borings which were drilled to 20 feet during or subsequent to drilling. Redoximorphic features were encountered in TP-1 and TP-3 at depths of 1.5 to 5 feet bgs, and groundwater was encountered at 2.5 feet in TP-2. Areas of seasonally shallow groundwater and shallow water have been mapped in the drainages and some low-lying areas on the site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors including development of the site and surrounding areas.

For the sandy materials on site, it should be noted that 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 monitor potential occurrences of such subsurface water features during construction on-site and mitigate as necessary at the time of construction.

6 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to produce a Geology/Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions the developers should monitor during the planning, design, and construction stages of the project. No significant geologic hazards were identified on the site; however, the following constraints have been identified on the site: artificial fill, potentially expansive soils, seasonal shallow and shallow groundwater areas, drainage areas, shallow bedrock, and the potential for elevated radon levels. These constraints and the recommended mitigation techniques include:

Artificial Fill – Constraint

These are areas of man-place fill associated with previous residence that was located on proposed Lot 3.

Mitigation: The fill on this site is considered uncontrolled for construction purposes. Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of the Modified Procter (ASTM D1557) maximum dry density.

Expansive Soils – Constraint

The site is classified in an area of low swell potential according to the *Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 6). These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. The sand and sandstone soils are anticipated to exhibit low expansion potentials. If potentially expansive materials are found during excavation, they will need to be mitigated. These occurrences should be identified and mitigated on an individual basis.

Mitigation: Should expansive soils be encountered beneath foundations; 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 the Modified Proctor (ASTM D1557) maximum dry density is a suitable mitigation, which is common in the area. Overexcavation depths of 3 to 5 feet may be necessary depending on soil conditions. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement have been

successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be made after additional investigation of each building site.

Drainage and Flood Plain Areas – Constraint

The site is not located within any floodplain zones according to FEMA Map No. 08041C0315G (Figure 6, Reference 7). It is mapped as a having a 1% annual chance of flooding. Specific drainage studies and floodplain locations are beyond the scope of this report.

The topography of the site is generally gradually sloping to the southwest with moderate slopes to the north along the Kettle Creek drainage in the northwestern portion of the site. The drainage generally flows in southwesterly direction, and water was not observed flowing in the drainages at the time of this investigation.

The Kettle Creek Drainage in the northwest portion of the site has been included in the National Wetlands Inventory as a Freshwater Wetland habitat classified as **R4SBC** (Riverine intermittent – R4; Stream Bed – SB, Seasonally Flooded – C,) (Figure 8, Reference 8). This area lies within a drainage easement and will be avoided by construction.

Seasonally Shallow and Seasonal Shallow Groundwater Areas – Constraint

In these areas, we would anticipate periodic high subsurface moisture conditions and frost heave potential on a seasonal basis. The Kettle Creek drainage in the northwestern portion of the site has been identified as seasonally shallow groundwater. Redoximorphic features were observed in the test pits at depths ranging from 1.5 to 5 feet bgs, and groundwater was encountered in TP-2 at 2.5 feet. Test borings drilled in proposed house locations were dry during and subsequent to drilling to depths of 20 feet. Any structures in or adjacent to these areas should follow the mitigation discussed below.

Mitigation: We anticipate that structures will not be located in these zones. Foundations must have a minimum 30-inch depth for frost protection. Buildings should be a minimum of 3 feet above groundwater levels. Subsurface perimeter drains are recommended for any usable below-grade areas including crawlspaces. Should groundwater be encountered within 3 feet of foundation grade, additional drains that could include but are not limited to interceptor drains, underslab drains (capillary break), and overexcavation drains may be needed. Typical drain details are presented in Figures 9 to 11. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Structures should not block drainages. All

organic material should be completely removed prior to any fill placement. Septic fields should not be placed in areas where there is the potential for shallow groundwater.

Slope Stability and Landslide Susceptibility – Hazard

The majority of the slopes on the site are gradually to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. It is recommended that any future grading or fill slopes be 3:1 or flatter.

Debris Flow Susceptibility – Hazard

The site is not located within an area of debris flow susceptibility according to the *Debris Flow Susceptibility Map of El Paso County, Colorado* by McCoy et al. in 2018 (Reference 10).

Bedrock – Constraint

Bedrock was encountered in the test borings at depths ranging from 1 to 18 feet. A Summary of the Depth to Bedrock is included in Table B-1. Shallow bedrock will likely be encountered in excavations across the site. Where claystone or sandstone are encountered, excavation/grading may be difficult requiring track excavators.

Radon – Hazard

Radon is a colorless, tasteless radioactive gas with a United States Environmental Protection Agency (EPA) specified action level of 4.0 picocuries per liter (pCi/L) of air. Radon gas has a very short half-life of 3.8 days. Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 11). The average radon level for the 80908 zip code is 3.40 pCi/l. The following is a table of radon levels in this area:

Average Radon Levels for the 80908 Zip Code	
0 < 4 pCi/L	50.00%
4 < 10 pCi/L	50.00%
10 < 20 pCi/L	0.00%
> 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.**

6.1 Relevance of Geologic Conditions to Land Use Planning

We understand that the development will be rural residential. It is our opinion that the existing geologic and engineering geologic conditions will impose some minor constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages and potential shallow groundwater on site which can be avoided or mitigated. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper residual soils are typically found at medium dense to dense states. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Foundations anticipated for the site are standard spread footings on granular soils or in conjunction with overexcavation in areas of expansive soils. Areas containing sands and arkosic sandstone will have high allowable bearing conditions. Difficult excavation should be anticipated in areas of shallow bedrock.

Expansive layers may also be encountered in the soil and bedrock on this site. Areas of expansive soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development. Bearing capacities of 2000 to 2400 psf for granular soils or structural fill, and 3000 to 3500 psf for undisturbed sandstone are anticipated. Site-specific subsurface investigations will need to be conducted and recommendations provided prior to construction.

Subsurface perimeter drains are recommended for any below-grade usable areas including crawlspaces. Should groundwater be encountered within 3 feet of foundation grade, additional drains may include interceptor drains, under slab drains (capillary break), and overexcavation drains. Typical drain details are presented in Figures 9 – 11. Specific recommendations should be made once building plans/locations have been determined and additional site investigation is completed.

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance. Investigation of the individual lots and building sites is recommended prior to construction.

7 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 12), portions of the area are 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 13), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 14), the area of the site has been mapped as "Good Potential" for industrial minerals. It is possible that sand materials on site could be an aggregate resource. However, considering the silty to clayey nature of many of these materials, the abundance of similar materials throughout the region, and the proximity to developed land, they would be considered to have little significance as an economic resource.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 14), 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 near the site. No metallic mineral resources have been mapped on the site (Reference 14).

The site has been mapped as "Fair" for oil and gas resources (Reference 13). No oil or gas fields have been discovered near the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, they may not be considered a significant resource. Hydraulic fracturing is a new method 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.

8 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.

Regarding 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 synthetic channel lining materials available 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 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.

9 ROADWAY, EMBANKMENT, and STORMWATER DETENTION FACILITY CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed driveways and embankments. Groundwater may be encountered along drainages and low-lying areas. If excavations encroach on the groundwater level, unstable soil conditions may be encountered. Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

Any areas to receive fill should have all topsoil, organic material, or debris removed. Prior to fill placement, Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1 or flatter. The

subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of the Modified Proctor (ASTM D1557) maximum dry density. These materials should be placed at a moisture content conducive to compaction, usually 0 to +/-2% of the Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any imported materials prior to placing or hauling them to the site. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

10 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these conditions 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. Construction and design personnel should be made familiar with the contents of this report. Additional investigation is recommended as plans are generated prior to construction on individual building sites.

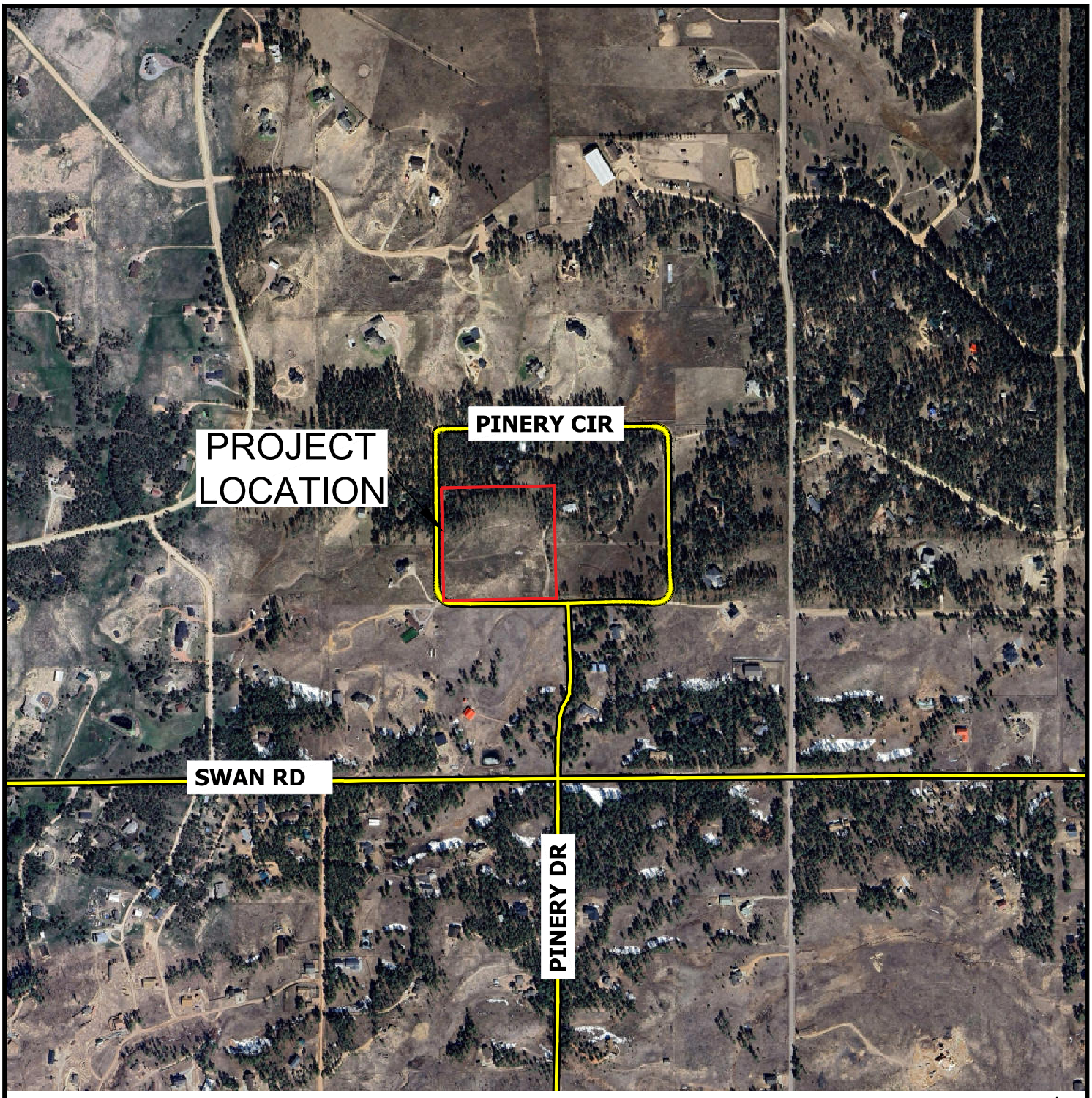
This report has been prepared for Alan Greaves for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty, expressed or implied, is made.

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

11 REFERENCES

1. Bryant, Bruce, McGrew, Laura W., and Wobus, Reinhard A. 1981. *Geologic Structure Map of the Denver 1° x 2° Quadrangle, North-Central Colorado*. U.S. Geologic Survey. Map 1-1163.
2. Natural Resource Conservation Service, June 20, 2007. *Web Soil Survey.* United States Department Agriculture, hhtp://web soil survey.nrcs.usda.gov.
3. United States Department of Agriculture Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado.*
4. Thorson, Jon P. 2003. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*. Colorado Geological Survey. Open-File Report 03-6.
5. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor, Colorado*. USGS, Map I-857-F.
6. Bryant, Bruce, McGrew, Laura W., and Wobus, Reinhard A. 1981. *Geologic Map of the Denver 1° x 2° Quadrangle, North-Central Colorado*. U.S. Geologic Survey. Map 1-1163.
7. Hart, Stephen S. 1974. *Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado*. Colorado Springs-Castle Rock Map. Colorado Geological Survey. Environmental Geology 7.
8. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041C0305G.
9. U.S. Fish & Wildlife Service, May 1, 2020. *National Wetlands Inventory*. Department of the Interior, fws.gov/wetlands/data/Mapper.html.
10. McCoy, KM; Morgan, ML; Berry, KL. 2018. *Debris Flow Susceptibility Map of El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 18-11.
11. Colorado Geological Survey. 1991. *Results of the 1987-88 EPA Supported Radon Study in Colorado.* Open-file Report 91-4.
12. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps.*
13. Schwochow, S.D., Shroba, R.R., and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties*. Colorado Geological Survey. Special Publication 5-B.
14. Keller, John W., TerBest, Harry, and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board*. Colorado Geological Survey. Open-File Report 03-07.

FIGURES



N

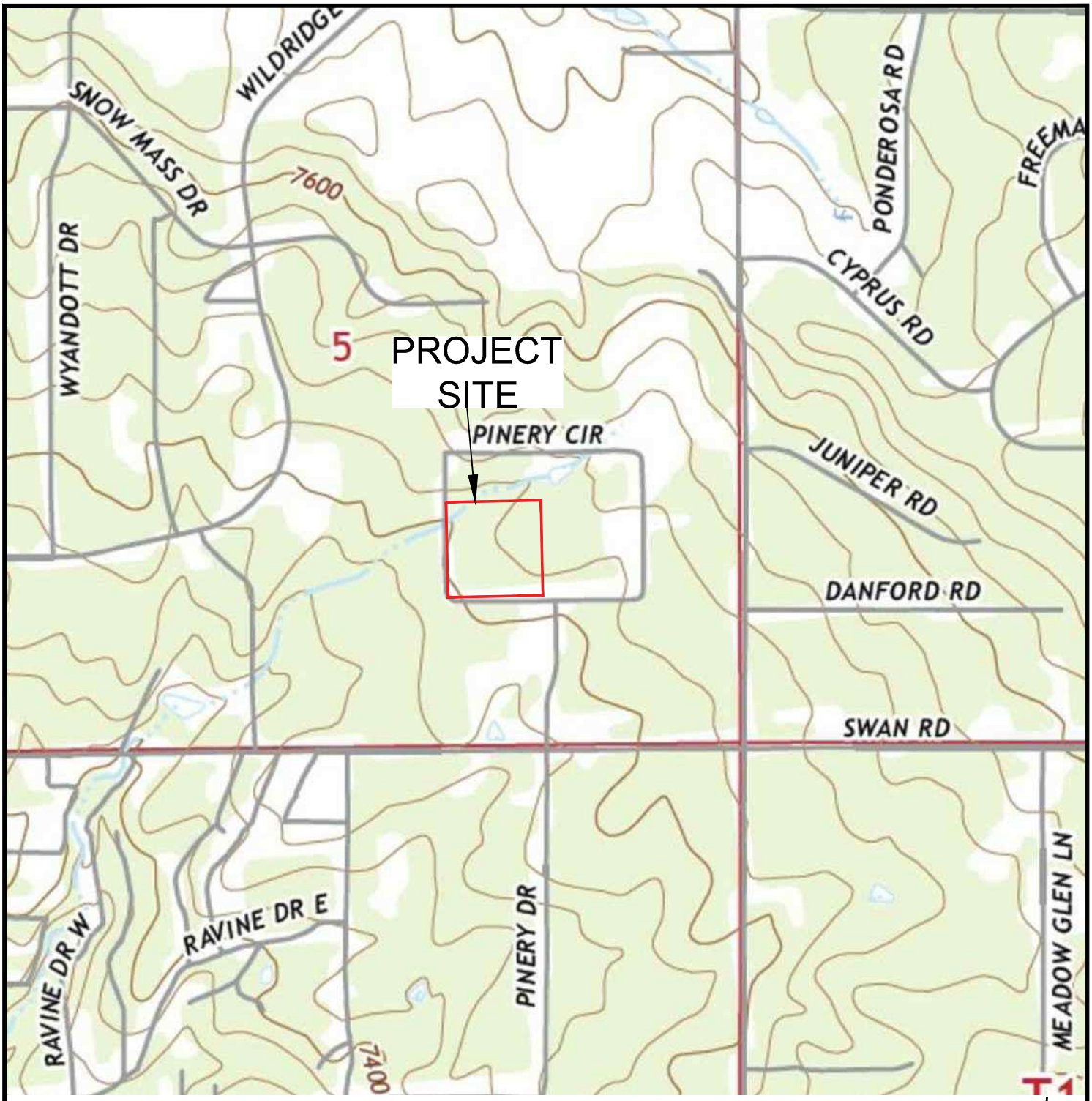
ENTECH ENGINEERING, INC.

VICINITY MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 1



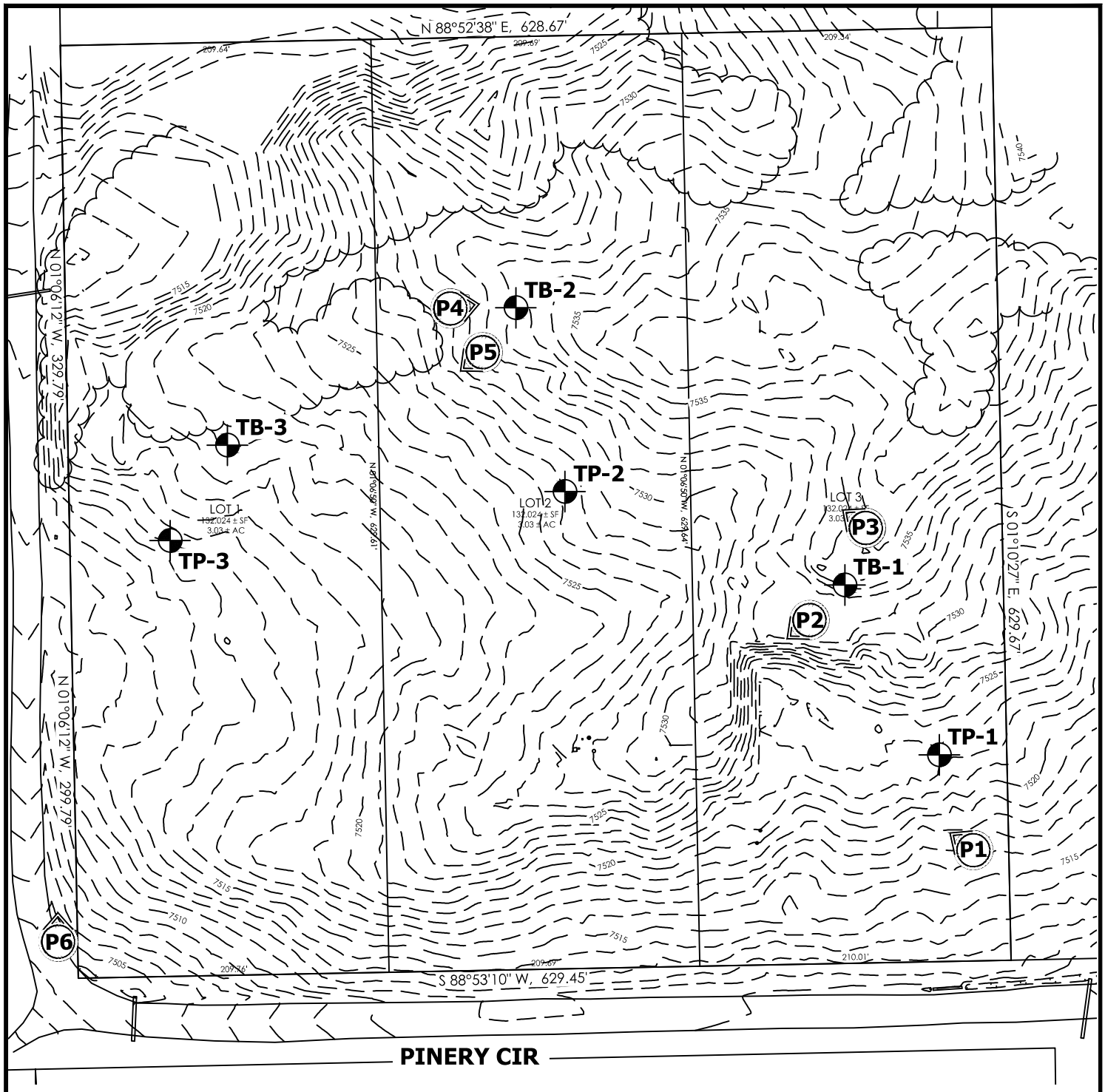
ENTECH ENGINEERING, INC.

USGS TOPOGRAPHY MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 2



- APPROXIMATE TEST BORING LOCATION AND NUMBER

P2 - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

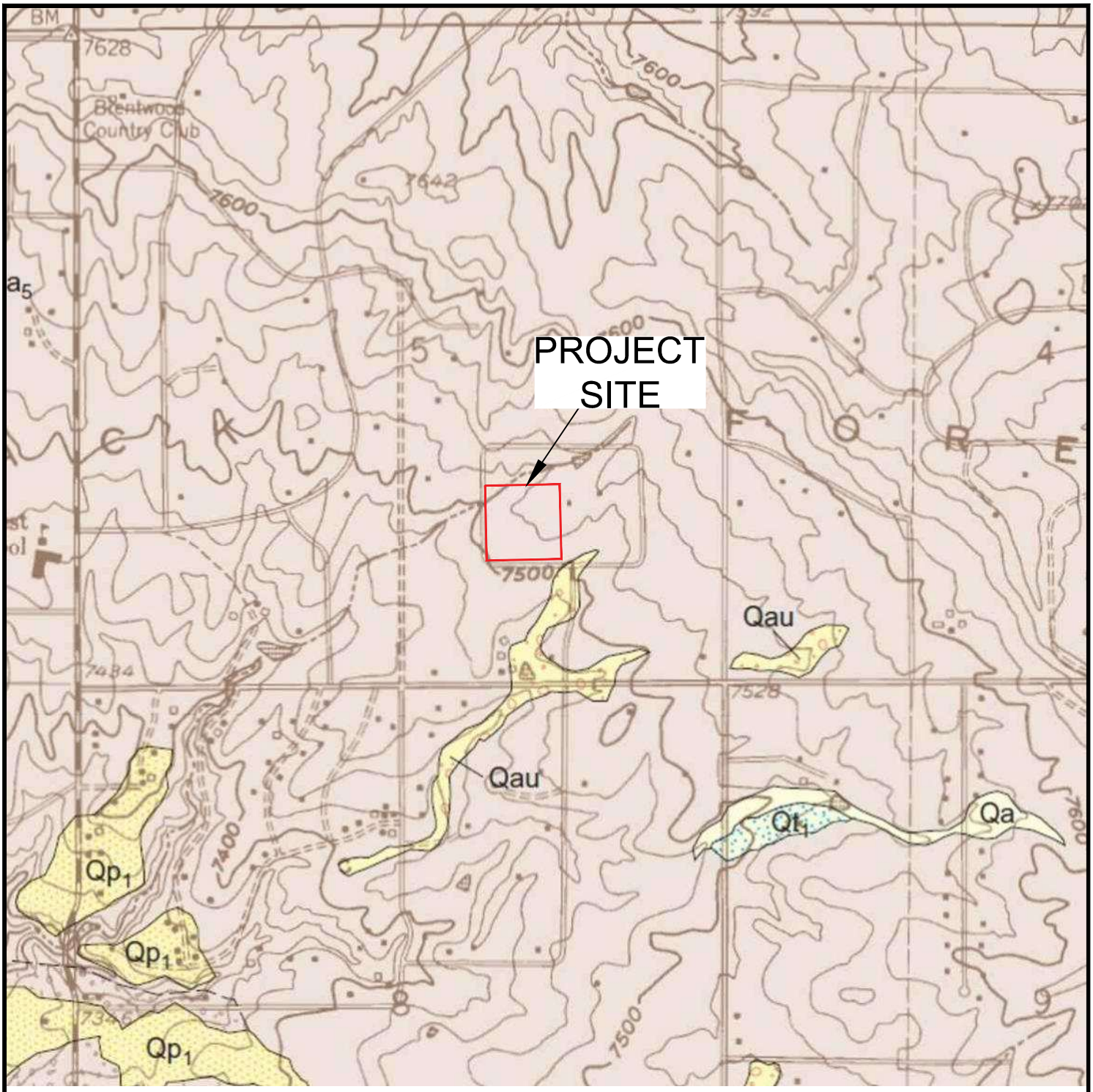
ENTECH ENGINEERING, INC.

SITE AND EXPLORATION MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 3

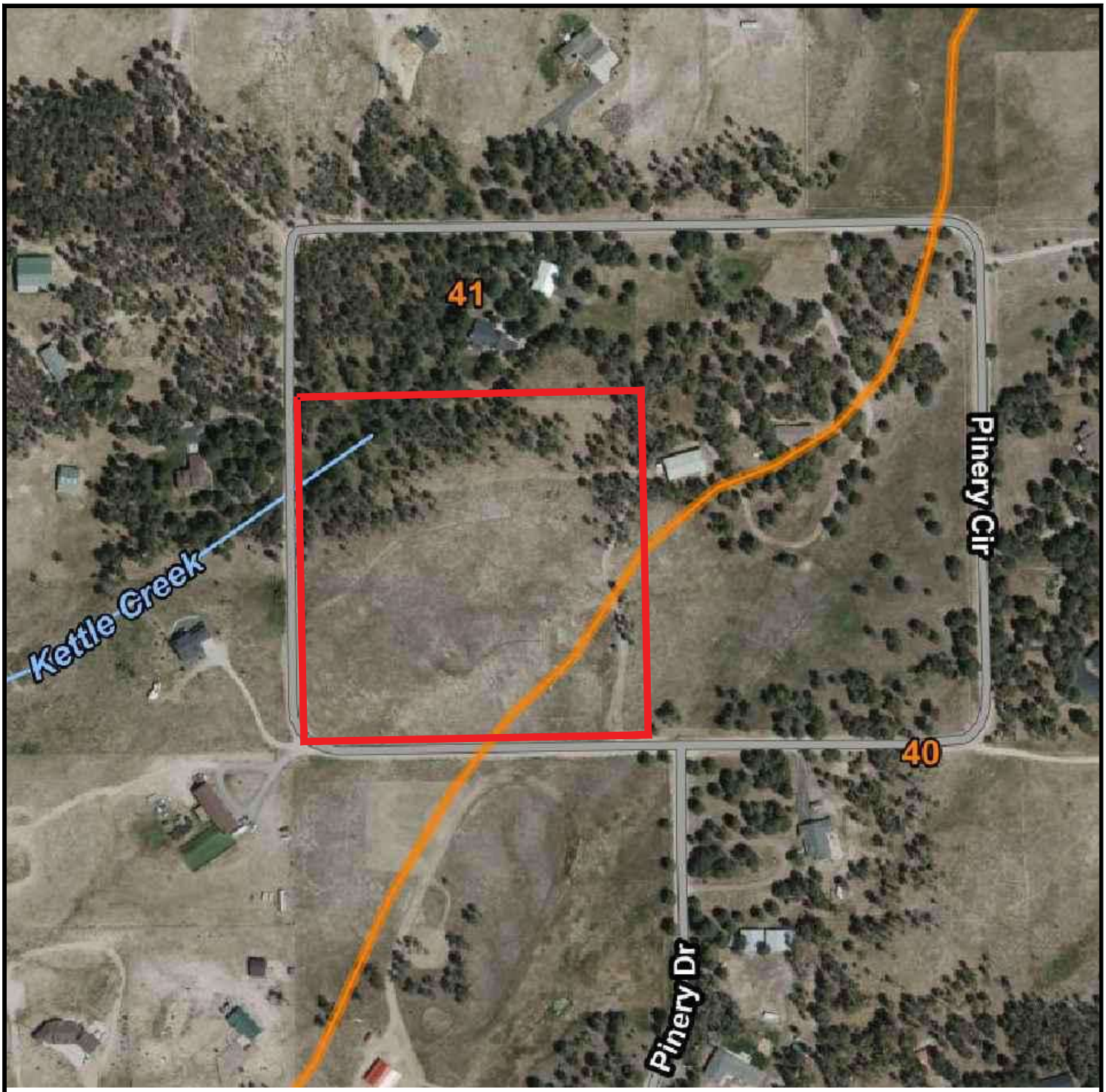


ENTECH ENGINEERING, INC.

GEOLOGIC MAP OF THE BLACK FOREST QUADRANGLE
PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 5



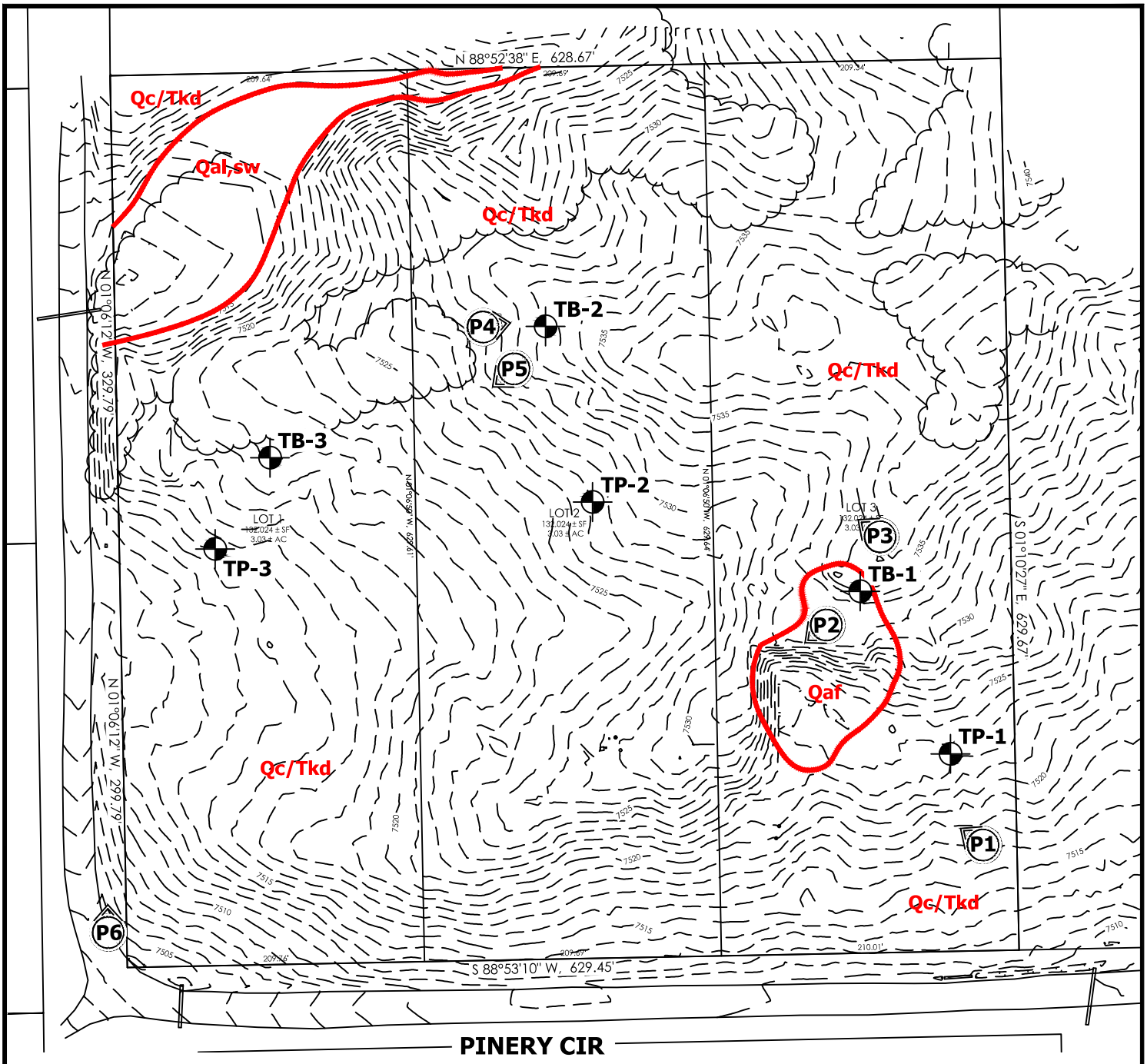
ENTECH ENGINEERING, INC.

SOIL SURVEY MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 4



Legend

Qaf - **Artificial Fill Deposits of Holocene Age**
Man-made fill deposits

Qc/Tkd - **Colluvium of Quaternary Age Overlying the Dawson Formation of Tertiary to Cretaceous Age:**
Sheetwash and residual soil deposits overlying arkosic sandstone with interbedded siltstone and claystone

Qal - **Recent Alluvium of Holocene Age:**
Recent water deposited materials

sw - Seasonally wet

⊕ - APPROXIMATE TEST BORING LOCATION AND NUMBER

N

ENTECH ENGINEERING, INC.

GEOLOGY/ENGINEERING GEOLOGY MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 6



N

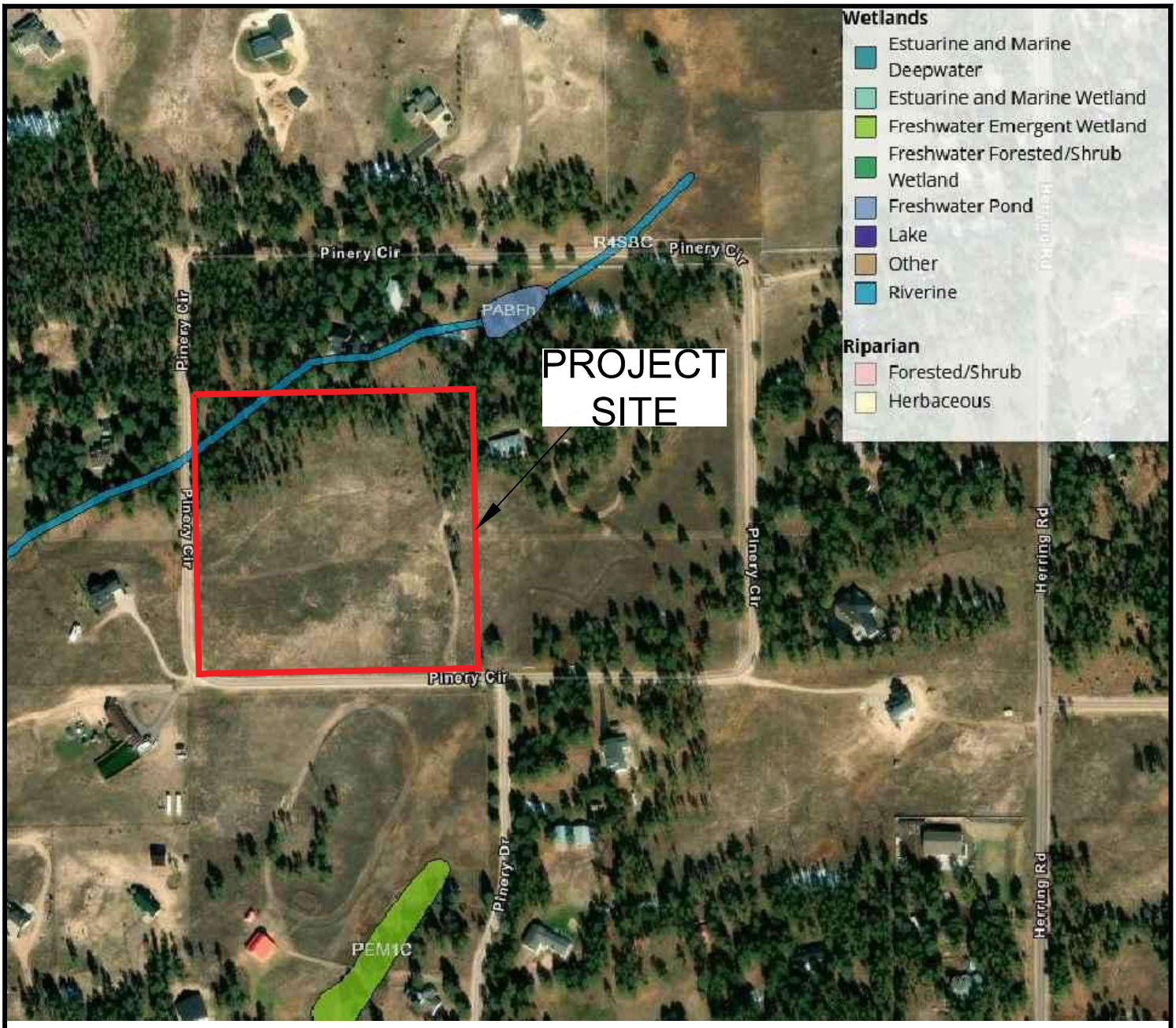
ENTECH
ENGINEERING, INC.

FEMA FLOODPLAIN MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 7



N

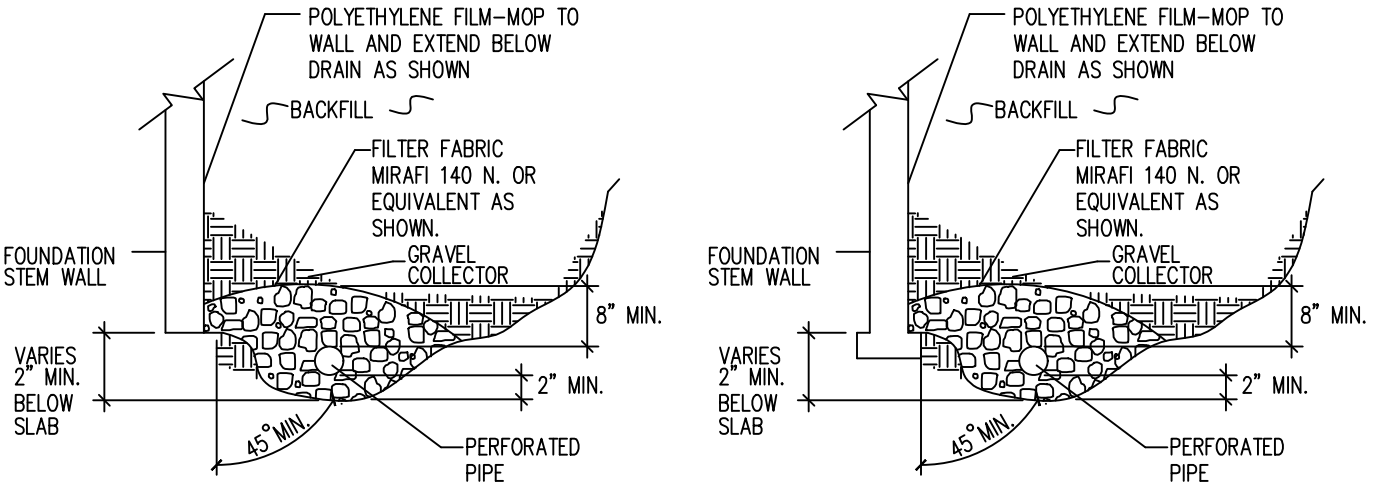
ENTECH ENGINEERING, INC.

USFWS WETLANDS MAP

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 8



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.

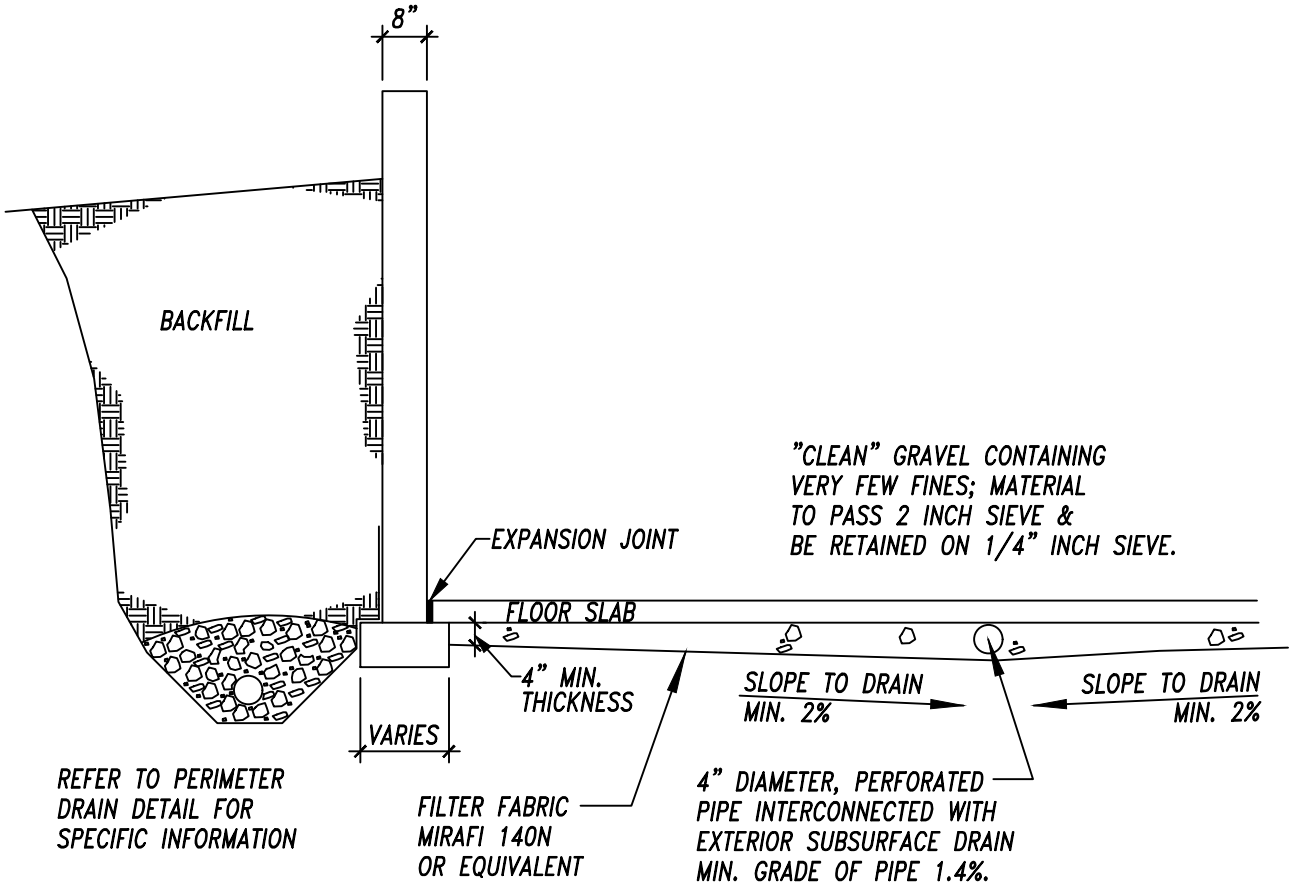
ENTECH ENGINEERING, INC.

PERIMETER DRAIN DETAIL

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 9



ENTECH ENGINEERING, INC.

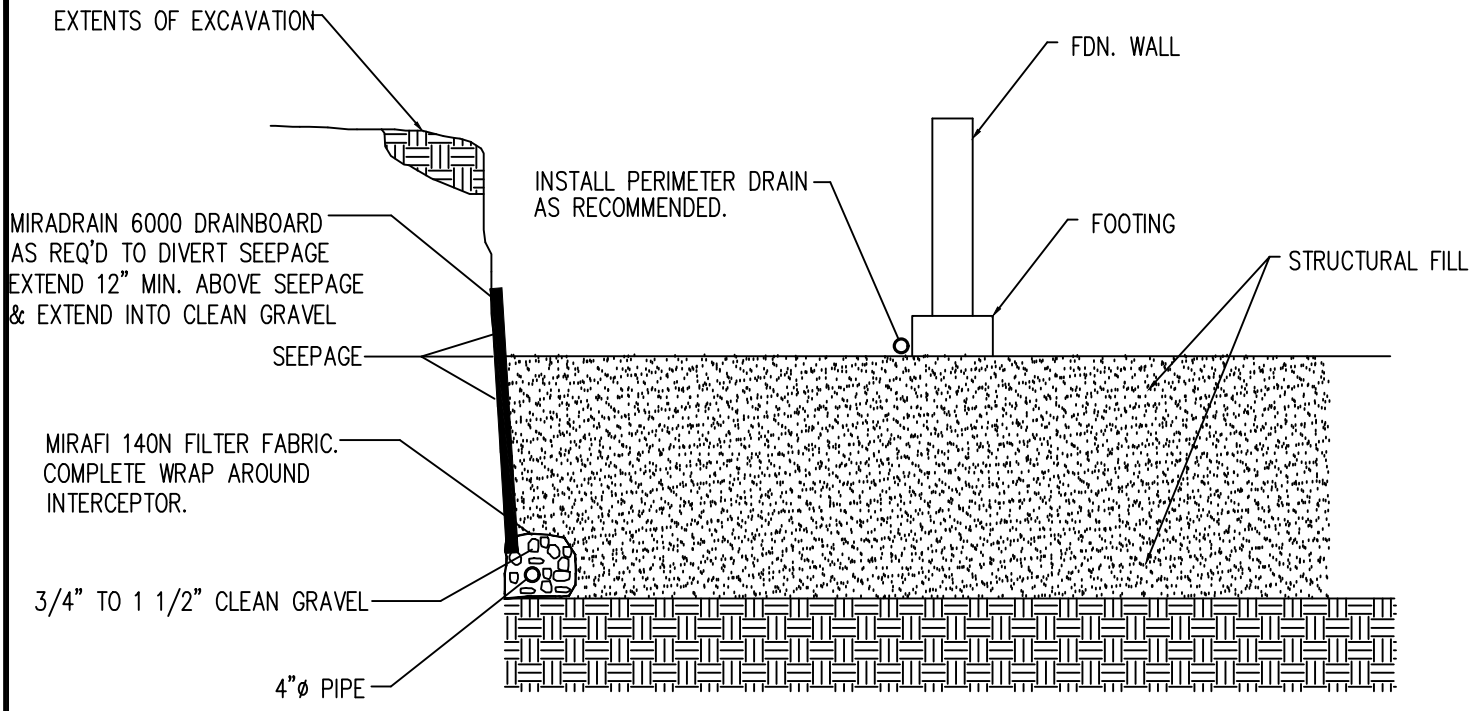
TYP. UNDERSLAB DRAINAGE LAYER (CAPILLARY BREAK)

PINERY CIRCLE - 3 LOT SUBDIVISION

ALAN GREAVES

JOB NO. 251507

FIG. 10



NOTE:
EXTEND INTERCEPTOR DRAIN TO UNDERDRAIN OR TO SUMP.
BENCH DRAIN INTO NATIVE SOILS 12 INCHES MINIMUM.

INTERCEPTOR DRAIN DETAIL

N.T.S.

ENTECH ENGINEERING, INC.

INTERCEPTOR DRAIN DETAIL

PINERY CIRCLE - 3 LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. 11

APPENDIX A: Site Photographs



1

Looking northwest from the southeastern portion of the site.

September 8, 2025



2

Looking southwest from the eastern portion of the site.

September 8, 2025

Job No. 251507



3

Looking north from the eastern portion of the site.

September 8, 2025



4

Looking east from the northern portion of the site.

September 8, 2025

Job No. 251507



5

Looking south from the northern portion of the site.

September 8, 2025



6

Looking north from the southwestern portion of the site.

September 8, 2025

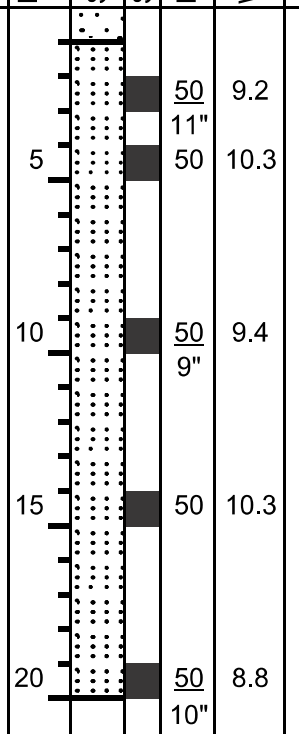
Job No. 251507

APPENDIX B: Test Boring and Test Pit Logs

TEST BORING 1
DATE DRILLED 9/11/2025

REMARKS

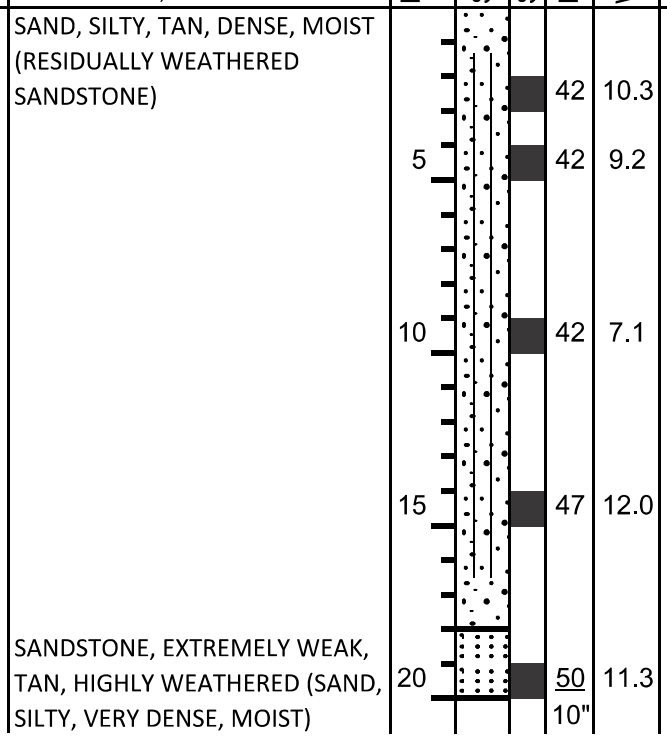
DRY TO 20', 9/12/25



TEST BORING 2
DATE DRILLED 9/11/2025

REMARKS

DRY TO 20', 9/12/25



ENTECH ENGINEERING, INC.

TEST BORING LOGS

PINERY CIRCLE
ALAN GREAVES

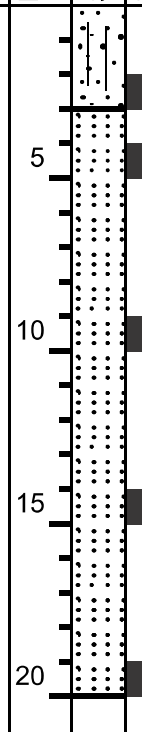
JOB NO.
251507

FIG. B-1

TEST BORING 3
DATE DRILLED 9/11/2025

REMARKS

DRY TO 20', 9/12/25



Depth (ft)	Samples	Blows per foot	Watercontent %
		19	11.6
5		50/11"	7.1
10		50/11"	7.5
15		50/9"	10.4
20		50/10"	12.7

SAND, SILTY, TAN, MEDIUM DENSE, MOIST

SANDSTONE, VERY WEAK, LIGHT RED to TAN, HIGHLY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

ENTECH ENGINEERING, INC.

TEST BORING LOGS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. B-2

TEST PIT 1
DATE EXCAVATED 9/18/2025

REMARKS

redoximorphic features at 1.5'

topsoil, sandy clay loam, dark brown, moist

sandy clay, fine grained, grayish brown, moist (residually weathered clayey sandstone, Dawson Formation)

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
2			ma	sl	4A

TEST PIT 2
DATE EXCAVATED 9/18/2025

REMARKS

water at 2.5'

topsoil, sandy clay, dark brown,

gravelly sand, fine to coarse grained, light brown, wet

sandy clay, fine grained, grayish brown, moist weathered clayey sandstone, Dawson Formation)

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
2			sg		1
					R1
3			ma	sl	4A

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
structureless - sl

ENTECH ENGINEERING, INC.

TEST PIT LOGS

PINERY CIRCLE - 3-LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. B-4

TEST PIT 3
DATE EXCAVATED 9/18/2025
REMARKS

redoximorphic features at 5'

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type	
						topsoil, sandy clay, dark brown, moist
1						
2						gravelly sandy loam, fine to coarse grained, light brown, moist
3			gr	m	2 R1	
4						
5			ma	sl	4A	sandy clay, fine grained, light brown, moist weathered clayey sandstone, Dawson Formation)
6						
7						
8						
9						
10						

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	Soil Type
1					
2					
3					
4					
5					
6					
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

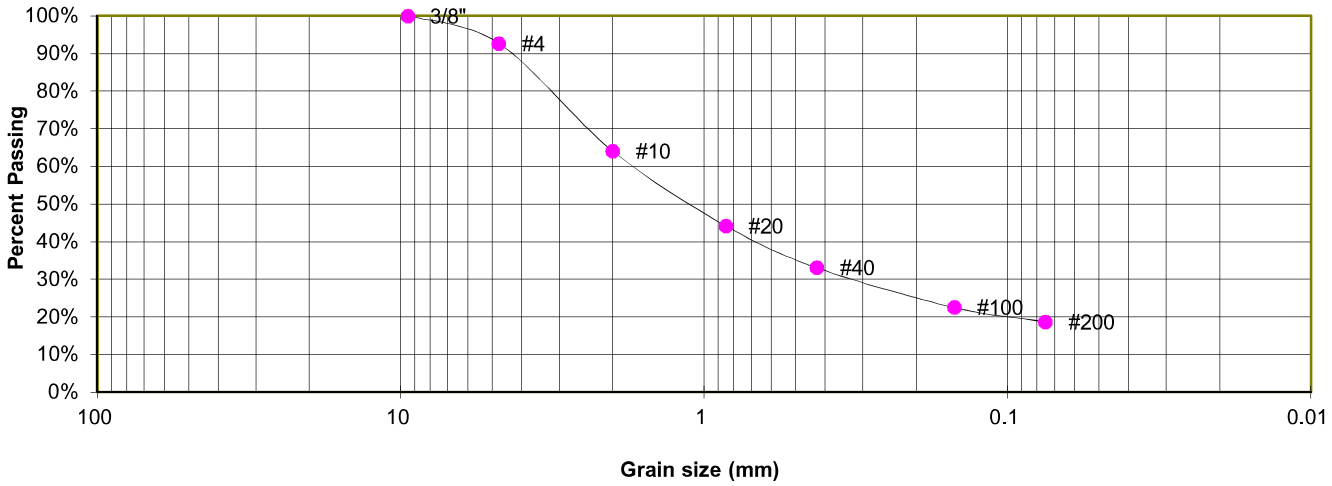
PINERY CIRCLE - 3-LOT SUBDIVISION
ALAN GREAVES

JOB NO. 251507

FIG. B-5

APPENDIX C: Laboratory Test Results

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	5	LOT #	0



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.7%
10	64.1%
20	44.2%
40	33.1%
100	22.5%
200	18.7%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

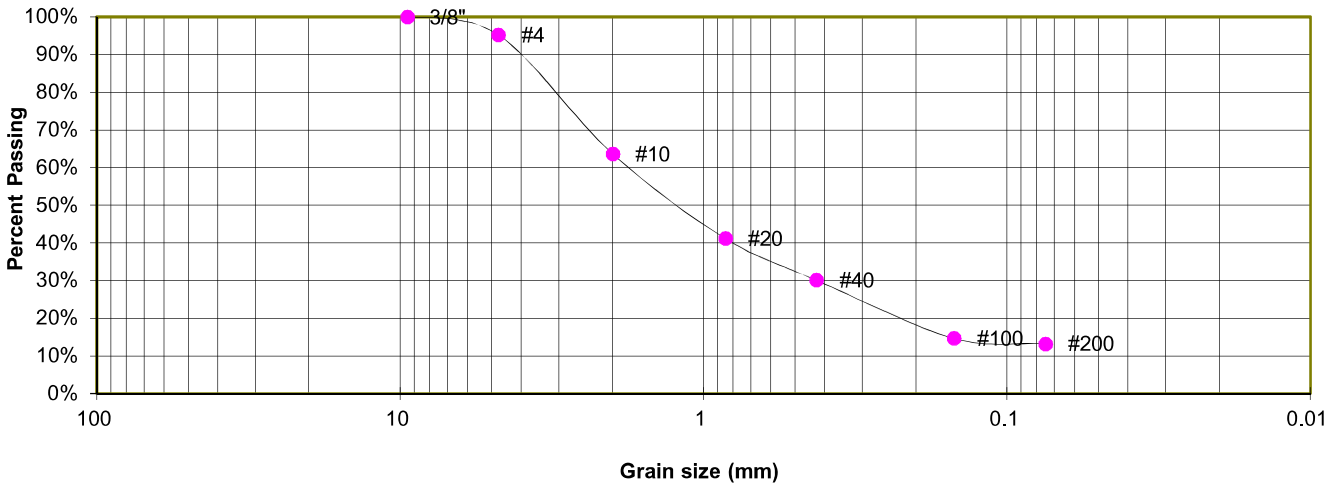
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-1

TEST BORING	2	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	10	LOT #	0



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.3%
10	63.7%
20	41.2%
40	30.1%
100	14.6%
200	13.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

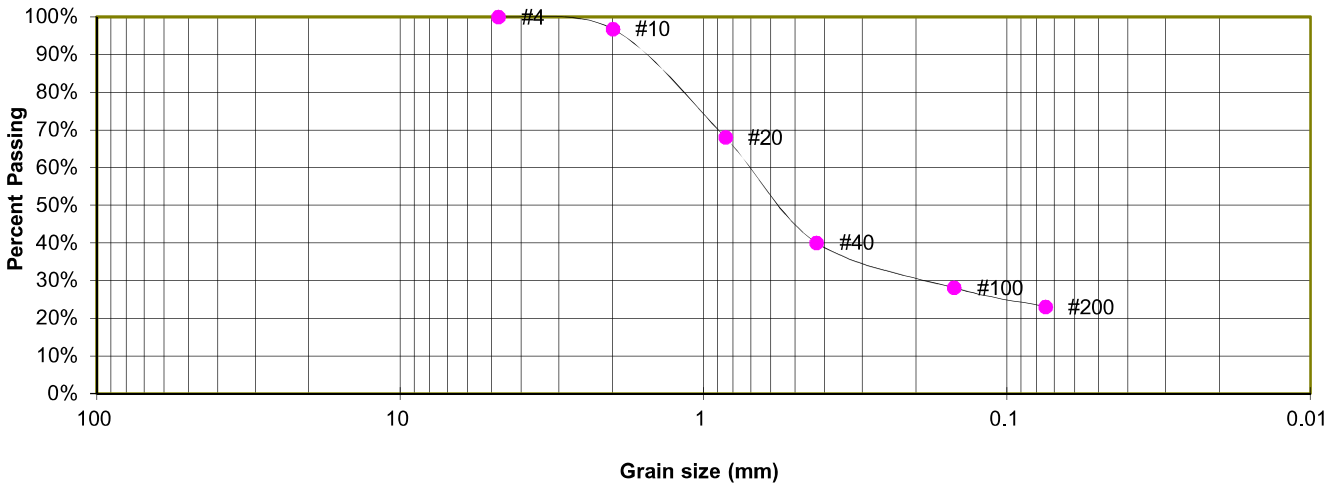
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-2

TEST BORING	3	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	2-3	LOT #	0



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.8%
20	68.1%
40	40.1%
100	28.1%
200	23.0%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

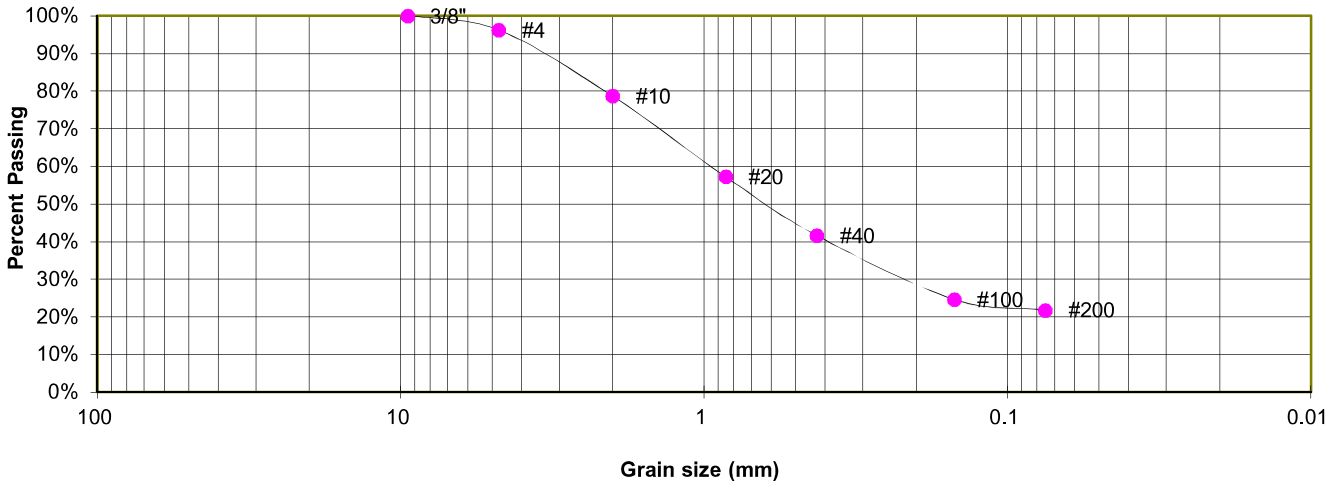
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-3

TEST BORING	TP-1	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	2	LOT #	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	78.7%
20	57.3%
40	41.6%
100	24.7%
200	21.8%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

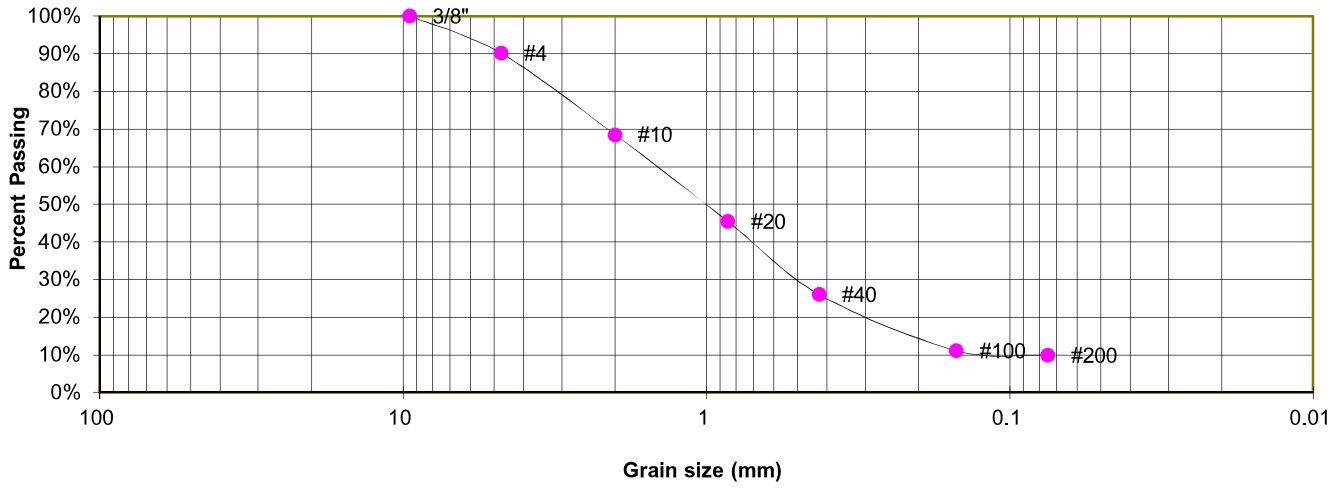
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-4

TEST BORING	TP-2	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	2	LOT #	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	90.1%
10	68.5%
20	45.5%
40	26.1%
100	11.1%
200	9.9%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

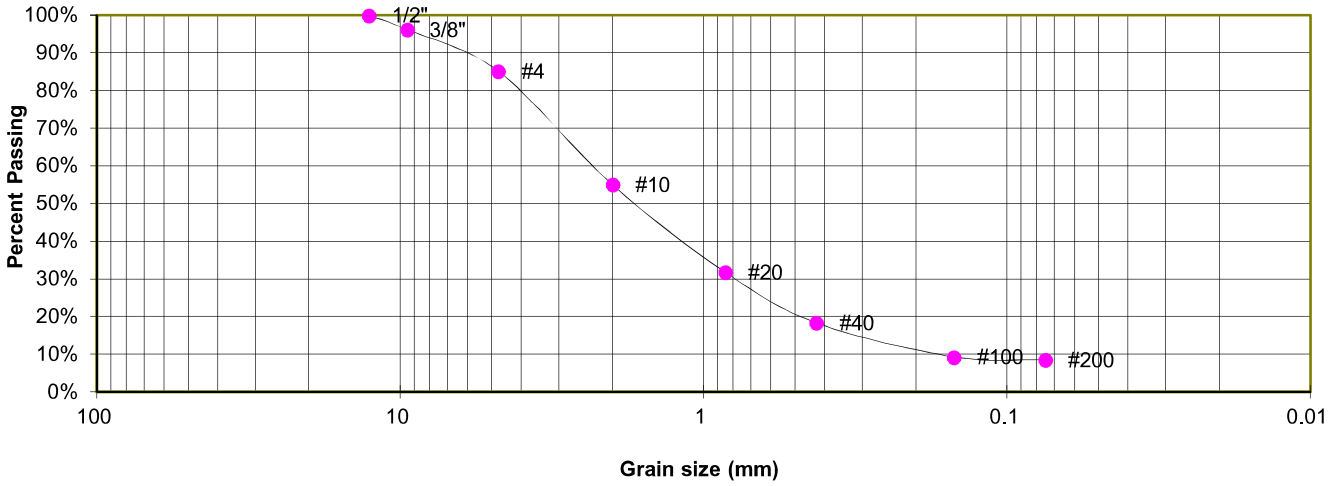
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO.
251507

FIG. C-5

TEST BORING	TP-3	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	3	LOT #	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.2%
4	85.1%
10	55.0%
20	31.8%
40	18.3%
100	9.3%
200	8.5%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

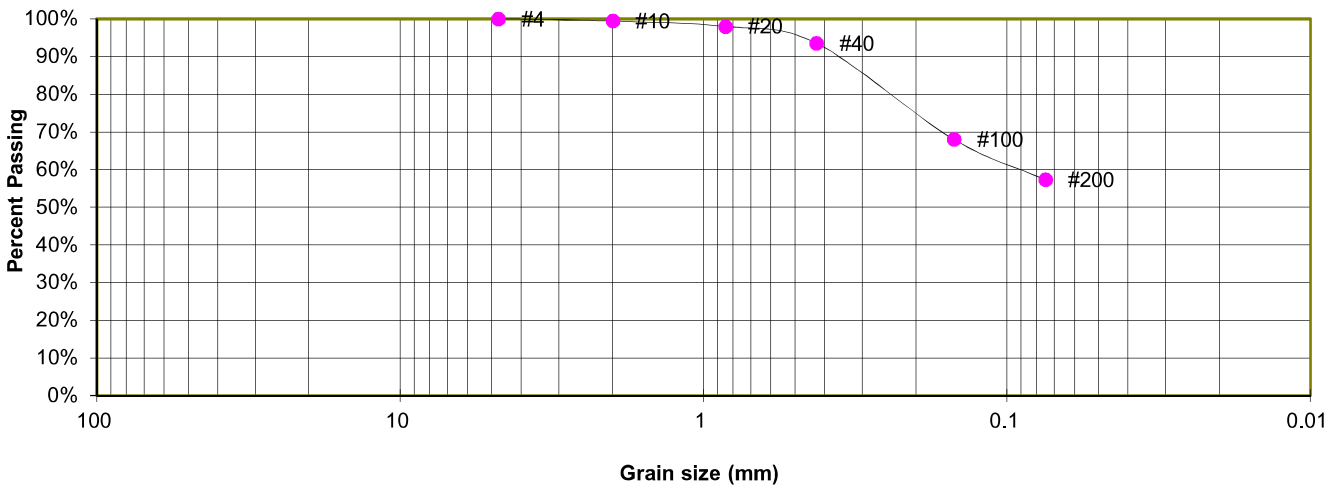
LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-6

TEST BORING	TP-3	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	5	LOT #	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	98.0%
40	93.6%
100	68.0%
200	57.3%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

PINERY CIRCLE
ALAN GREAVES

JOB NO. 251507

FIG. C-7

APPENDIX D: USDA Soil Survey Descriptions

El Paso County Area, Colorado

40—Kettle gravelly loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 368g
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
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: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
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 22, Sep 3, 2024

El Paso County Area, Colorado

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely 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: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
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 22, Sep 3, 2024