ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

January 25, 2022

Joe Loidolt
2183 Flying Horse Club Drive
Colorado Springs, CO 80921

Re: Soil, Geology, and Geologic Hazard Study
Lot 1, Flying Horse North Filing No. 2
Quartz Creek Drive
El Paso County, Colorado

Dear Mr. Loidolt:

GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SW¼ of Section 36 Township 11 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 2.5-miles northeast of Colorado Springs city limits, south of Stagecoach Road and Shortwall Drive in the Flying Horse North subdivision 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 north, with steeper slopes along the northern side of the lot. A drainage is located north of the lot and two minor drainage swales are located on the lot. Water was not observed in the drainages at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included undeveloped agricultural land. The site contains field grasses, weeds, kinnikinic, and ponderosa pines. Site photographs taken January 7, 2022, are included in appendix A. Site mapping and test pit excavations were completed on January 7, 2022. Test Borings were drilled on December 17, 2021.

Total acreage of the proposed lot is 2.98-acres. One rural residential lot is proposed as part of the replat. The new lot will be serviced by an individual well and an on-site wastewater treatment system. The Site Plan with the proposed replat is presented in Figure 3.

The site was previously investigated as a part of a *Soil, Geology, Geologic Hazard, and Wastewater Study, Shamrock Ranch,* by Entech Engineering, Inc., dated February 26, 2015 (Reference 1), and the Soil, Geology, Geologic Hazard, and Wastewater Study, Flying Horse North, by Entech, dated February 22, 2016 (Reference 2). The site was recently investigation as part of a *Subsurface Soil Investigation*, by Entech, dated January 17, 2022, (Reference 3, Appendix B), and OWTS Site Evaluation, by Entech, dated January 4, 2022 (Reference 4). Information from these reports were used in evaluating the site.

LAND USE AND ENGINEERING GEOLOGY

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of potentially unstable slopes and potentially shallow groundwater areas. 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 bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements, and aerial photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on January 7, 2022.

Four test borings were drilled and two test pits were excavated on the site to determine general suitability of the soil characteristics for residential construction. The locations of the test borings and test pits are indicated on the Site Plan/Test Boring 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. Results of the laboratory testing are included in Appendix C.

SOIL AND GEOLOGIC CONDITIONS

Soil Survey

The Natural Resource Conservation Service (NRCS) (Reference 5, Figure 4), previously the Soil Conservation Service (Reference 6) has mapped one soil type on the site. Complete description of the soil type is presented in Appendix D. In general, the soils consist of sandy loam to gravelly loamy sand. The soils are described as follows:

Type	Description
26	Elbeth sandy loam, 8 – 15% Slopes

The soils have been described to have 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 consisted of thin layer of silty sand overlying silty to slightly silty and clayey sandstone. Bedrock was encountered at depths of 1 foot to 11 feet. The sands were encountered at medium dense states and moderate moisture conditions. The sample of sand tested had 32 percent of the soil size particles passing the No. 200 sieve. The sandstone was encountered at dense to very dense states and moderate moisture conditions. The samples of sandstone tested had 21 to 27 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing on a sample of the sand and sandstone resulted in non-plastic results. Highly expansive claystone and siltstone lenses are commonly interbedded in the Dawson Formation.

Groundwater

Groundwater was not encountered in the test borings which were drilled to depths of 15 to 20 feet. Groundwater is not anticipated to affect shallow foundations on the site. 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 8 miles west of the site is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northerly direction (Reference 7). The bedrock underlying the site consists of the Dawson Formation of Tertiary to Cretaceous Age. The Dawson Formation typically consists of coarse-grained arkosic sandstone with interbedded layers claystone or siltstone.

The geology of the site was evaluated using the *Geologic Map of the Black Forest Quadrangle,* by Thorson and Madole in 2003, (Reference 8, Figure 5). The Geology Map for the site is presented in Figure 6. One mappable unit was identified on this site which is described as follows:

Tkd **Dawson Formation of Tertiary to Cretaceous Age:** The materials consist of a thin layer of residual soils overlying the bedrock materials on-site. The residual soils were derived from the in-situ weathering of the bedrock on site. These materials typically consist of silty to clayey sand with potential areas of sandy clays. The bedrock consists of the Dawson Formation. The Dawson Formation typically consists of coarse-grained, arkosic sandstone with interbedded lenses of fine-grained sandstone, siltstone and claystone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Black Forest Quadrangle* distributed by the Colorado Geologic Survey in 2003 (Reference 8, Figure

5), The *Geologic Map of the Colorado Springs-Castle Rock Area,* distributed by the US Geological Survey in 1979 (Reference 9), and the *Geologic Map of the Denver 1° x 2° Quadrangle,* distributed by the US Geological Survey in 1981 (Reference 10). The test borings were used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

ENGINEERING GEOLOGIC HAZARDS

Mapping has been performed on this site to identify areas where various geologic conditions exist of which developers should be cognizant during the planning, design and construction stages where new construction is proposed. The engineering geologic hazards identified on this site include potentially unstable slopes, and potentially seasonal shallow groundwater area. Potential Hazards including expansive soils, have also been addressed. These hazards and recommended mitigation techniques are discussed as follows:

Expansive Soils

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. Expansive clays, if encountered beneath foundations, can cause differential movement in the structure foundation.

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

Drainage Areas

A drainage is located north of the lot and two minor drainage swales are located on the lot. Water was not observed in the drainages at the time of this investigation; however, these areas have the potential for seasonal shallow groundwater. These areas are indicated in the Geology/Engineering Geology Map (Figure 6). Due to the size of the proposed lot these areas can either be avoided or redirected around proposed structures or the proposed soil treatment area. The proposed building areas are not affected by these areas. The site does not lie within any floodplain zones according to the FEMA Map No. 08041CO315G dated December 7, 2018 (Figure 7, Reference 11). Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Slope Stability and Landslide Hazard

The majority of the slopes in the building areas on site are gently to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. However, the steeply sloping areas in the northern portion of the lot have been identified as potentially unstable slopes. This area is identified on the Engineering Geology Map, Figure 6. The recommendations for these areas are as follows:

- Potentially Unstable Slopes

  The area identified with this hazard includes the steep slopes along the northern side of the lot. These slopes are considered stable in their present condition; however, considerable care must be exercised in these areas not to create a condition which would tend to activate instability. Due to the lot size this area will be avoided by the proposed structures.

  Mitigation: Building should be avoided in these areas. Proper control of drainage at both the surface and the subsurface is extremely important. Areas of ponded water at the surface should be avoided. Utility trenches, basement excavations and other subsurface features should not be permitted to become water traps which may promote saturation of the subsurface materials. Drainage should not be permitted over the potentially unstable slope but directed in a non-erosive manner away from the slope. Irrigation above these slopes should be kept to a minimum to prevent saturation of the subsurface soils.

RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

Total acreage of the proposed lot is 2.98-acres. The existing geologic and engineering geologic conditions will impose minor constraints on development and construction. The geologic conditions on the site include potentially unstable slopes and potentially seasonal shallow groundwater, which can be satisfactorily mitigated through avoidance or proper engineering design and construction practices.

The upper granular soils encountered in the test borings on the site were encountered at medium dense, and the sandstone was encountered at dense to very dense states. Shallow sandstone bedrock was encountered at one foot in three of the test borings. High allowable bearing capacities should be expected in areas of shallow bedrock. Difficult excavation of the very dense sandstone should be expected.

The sandstone encountered in the test borings is considered to have low expansion potential, however, highly expansive claystone and siltstone are commonly interbedded in the sandstone of the Dawson Formation. Mitigation of expansive soils if encountered will be required. 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.

A drainage is located north of the lot and two minor drainage swales are located on the lot. Water was not observed in the drainages at the time of this investigation; however, these areas have the potential for seasonal shallow groundwater. These areas are indicated in the Geology/Engineering Geology Map (Figure 6). Due to the size of the proposed lots these areas can either be avoided or redirected around proposed structures or proposed soil treatment area. The proposed building areas are not affected by these areas.

The majority of the slopes in the building areas on site are gently to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. The steeply sloping areas in the

northern portion of the lot have been identified as potentially unstable slopes. These slopes are considered stable in their present condition; however, considerable care must be exercised in these areas not to create a condition which would tend to activate instability. Due to the lot size this area will be avoided by the proposed structures.

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 12), of the area of the site is not mapped with any potential aggregate resources. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 13), the site is 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 "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 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 in the area of 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 14). 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.

Joe Loidolt
Soils, Geology, and Geologic Hazard Study
Lot 1, Flying Horse North Filing No. 2
Quartz Creek Drive
El Paso County, Colorado

This report has been prepared for Joe Loidolt, 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.
Geologist

Reviewed by:

Joseph C. Goodell, P.E.
President

COLORADO LICENSED
JOSEPH COLLIN GOODELL
23725
1.25.22
PROFESSIONAL ENGINEER

LLL

Encl.

Entech Job No. 213271
AAprojects/2021/213271 sg&ghs

BIBLIOGRAPHY

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4. Entech Engineering, Inc., January 4, 2022. *OWTS Site Evaluation, Lot 1, Flying Horse North Filing No. 2, Quartz Creek Drive, El Paso County, Colorado.* Entech Job No. 213271.

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8. Thorson, Jon P. 2003. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 03-6.

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FIGURES

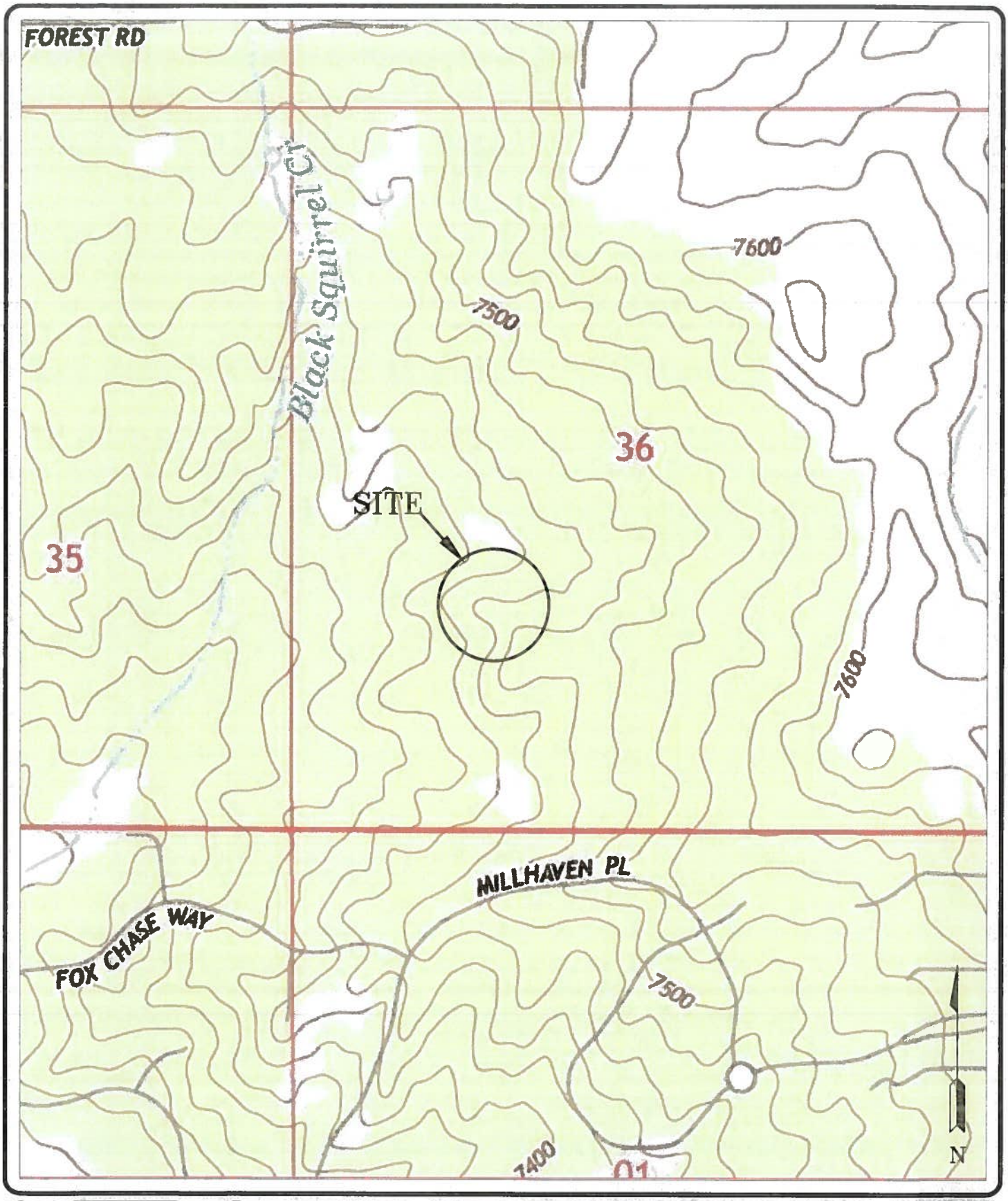
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

VICINITY MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

FIG NO.: 1



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505 ELKTON DRIVE
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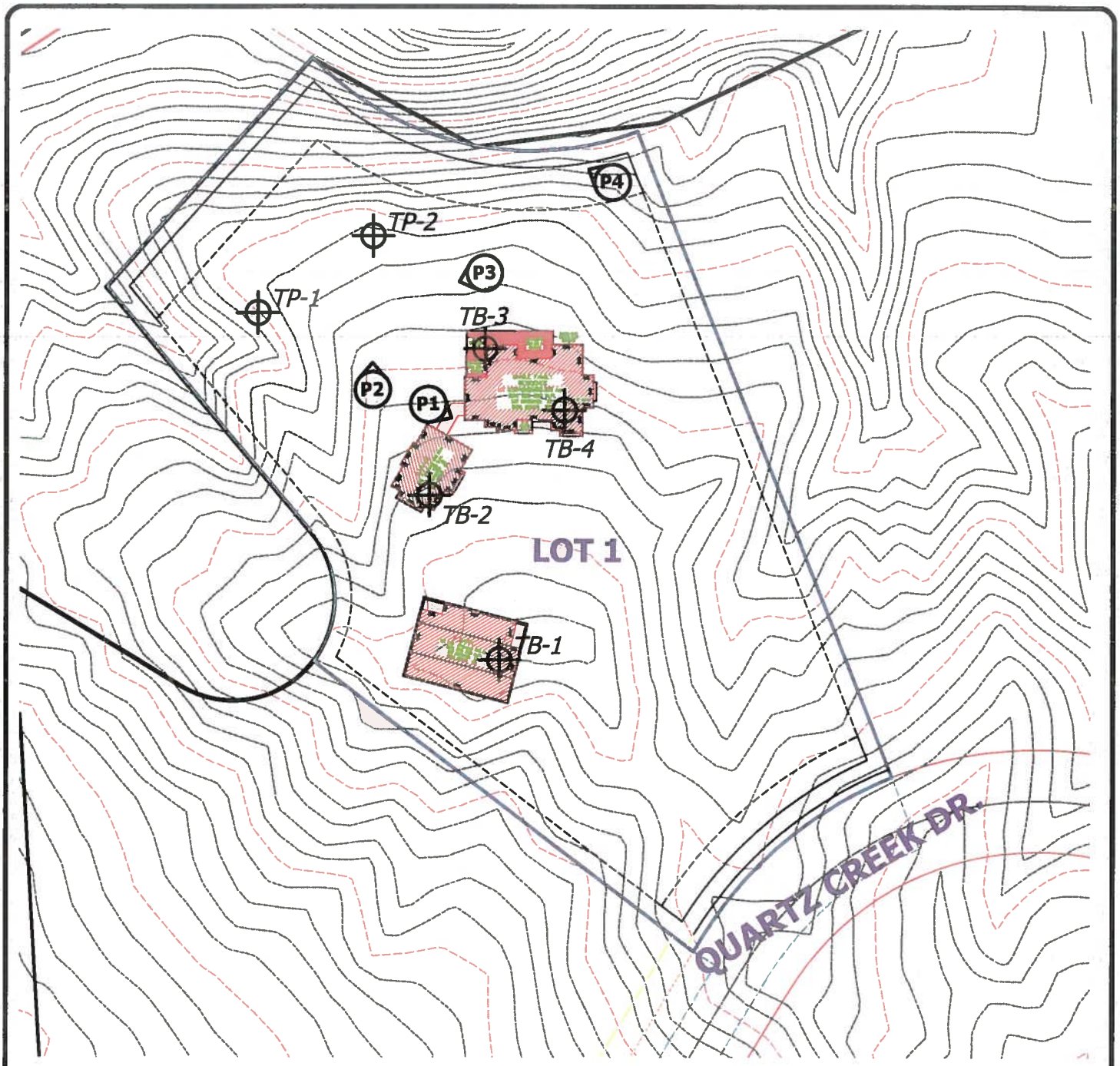
USGS MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

FIG NO.: 2



LEGEND:

TP- APPROXIMATE TEST PIT LOCATION AND NUMBER

P2 - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

N

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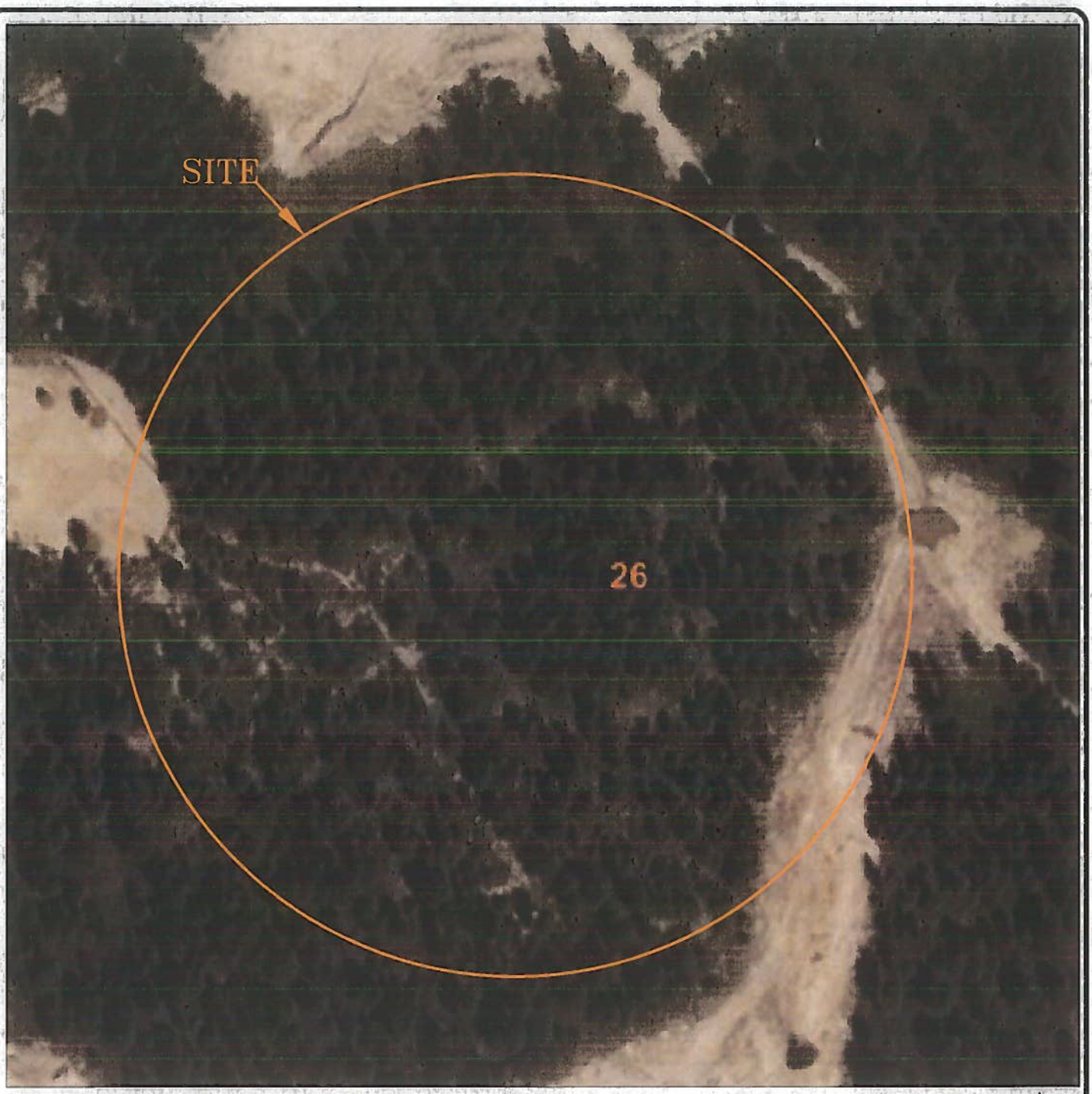
SITE MAP/TEST BORING LOCATION MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

FIG NO.: 3



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SOIL SURVEY MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

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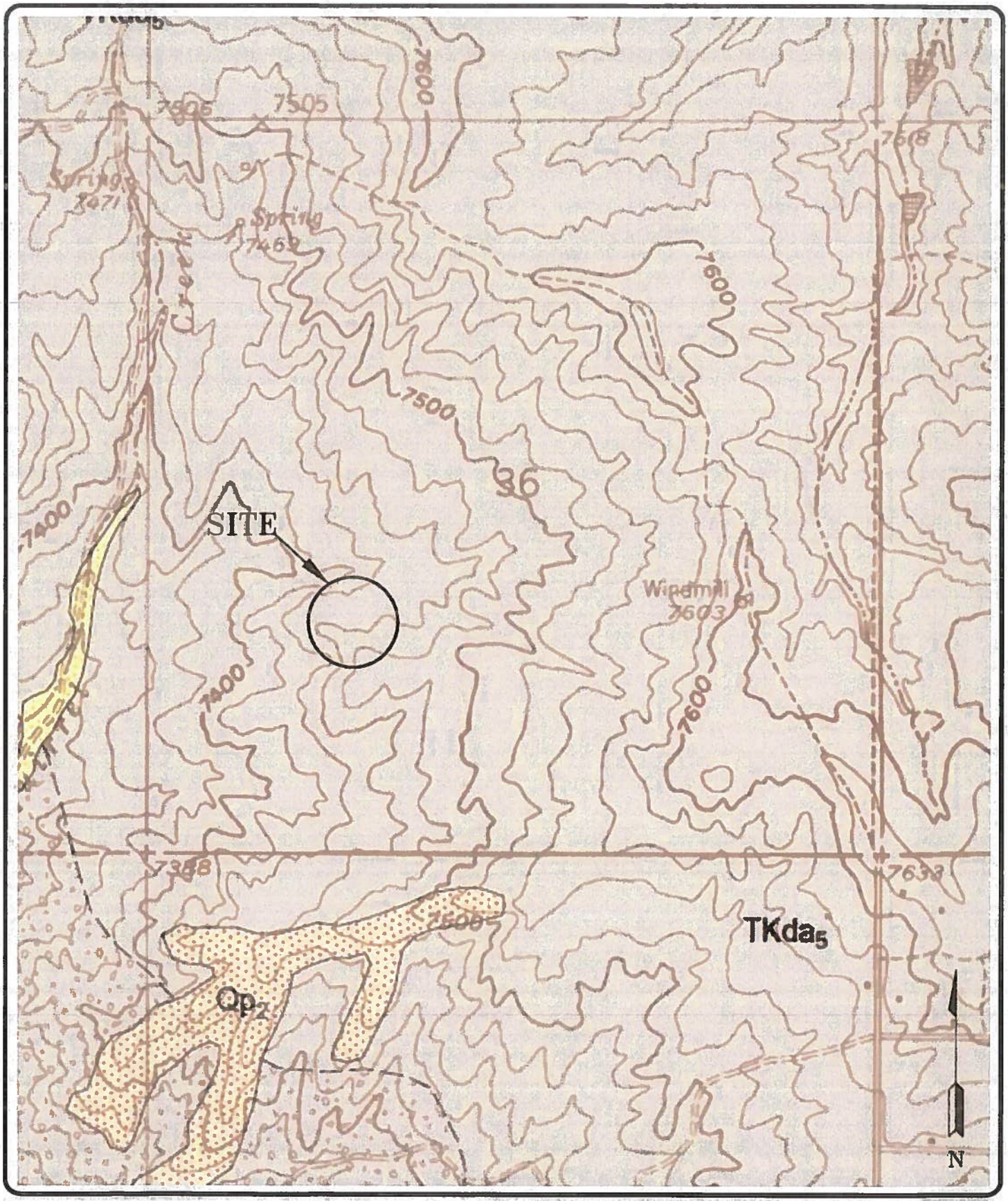
FIG NO.: 4



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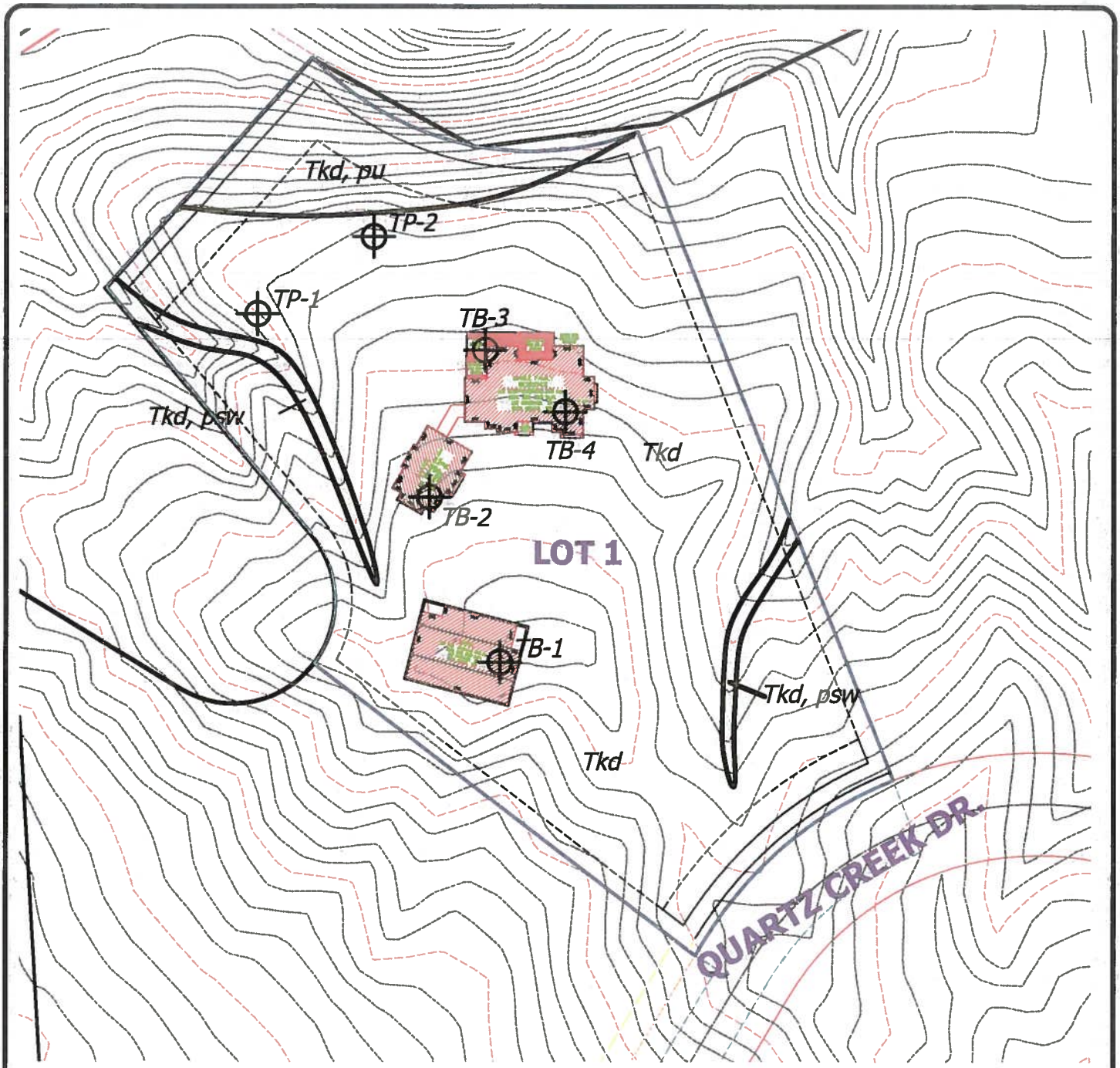
BLACK FOREST QUADRANGLE GEOLOGIC MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

FIG NO.: 5



Legend:

TKd - Dawson Formation of Tertiary to Cretaceous Age:
variable layer of residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone

psw - potentially shallow groundwater area

pu - potentially unstable slope

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GEOLOGY/ENGINEERING GEOLOGY MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

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JOB NO.: 213271

FIG NO.: 6

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FEMA FLOODPLAIN MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

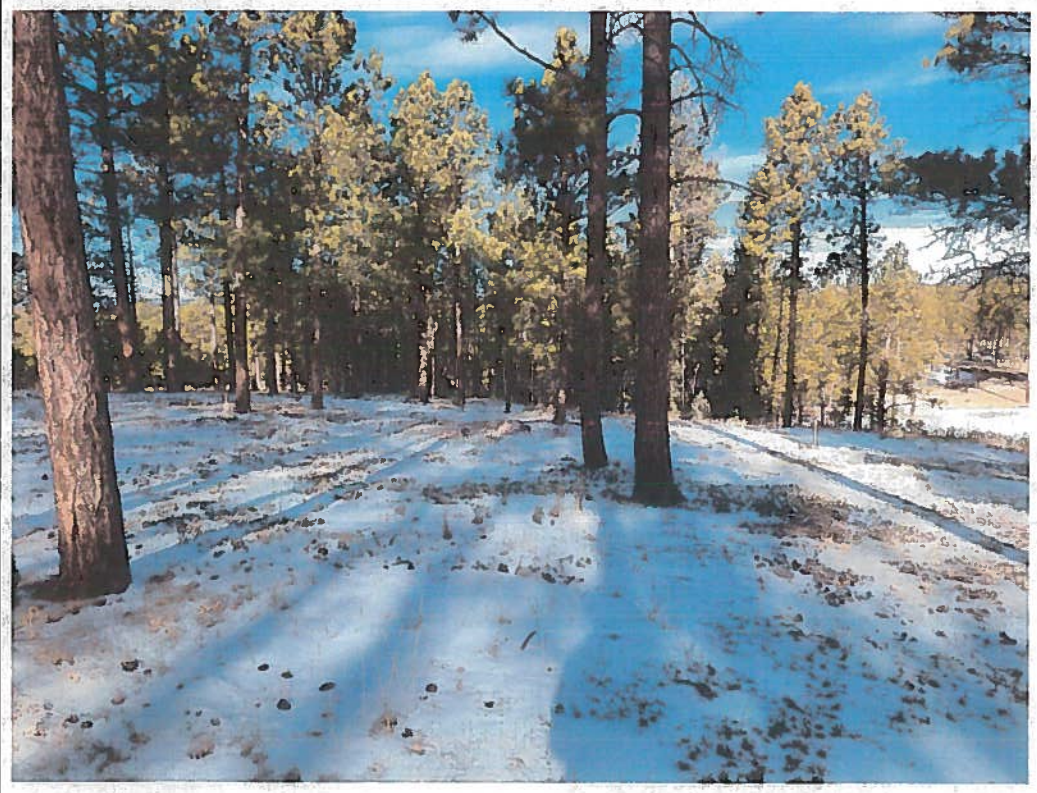
FIG NO.: 7

APPENDIX A: Photographs

1

Looking southeast from the proposed building area.

January 7, 2022

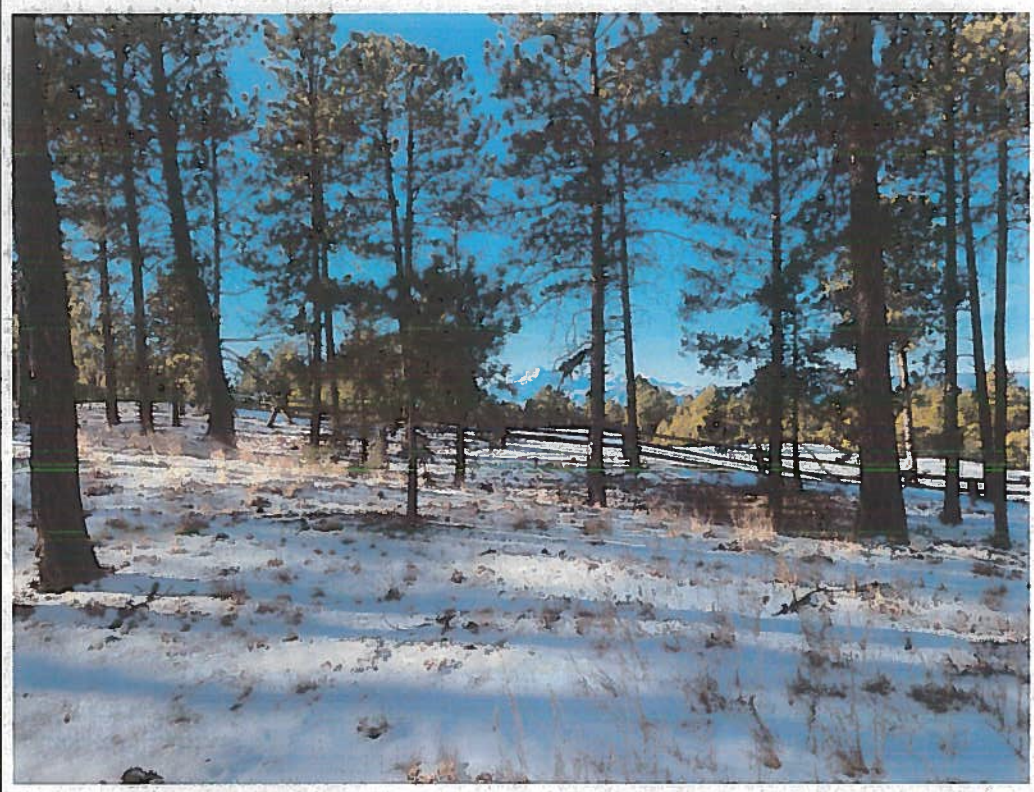


2

Looking north from the central portion of the site.

January 7, 2022

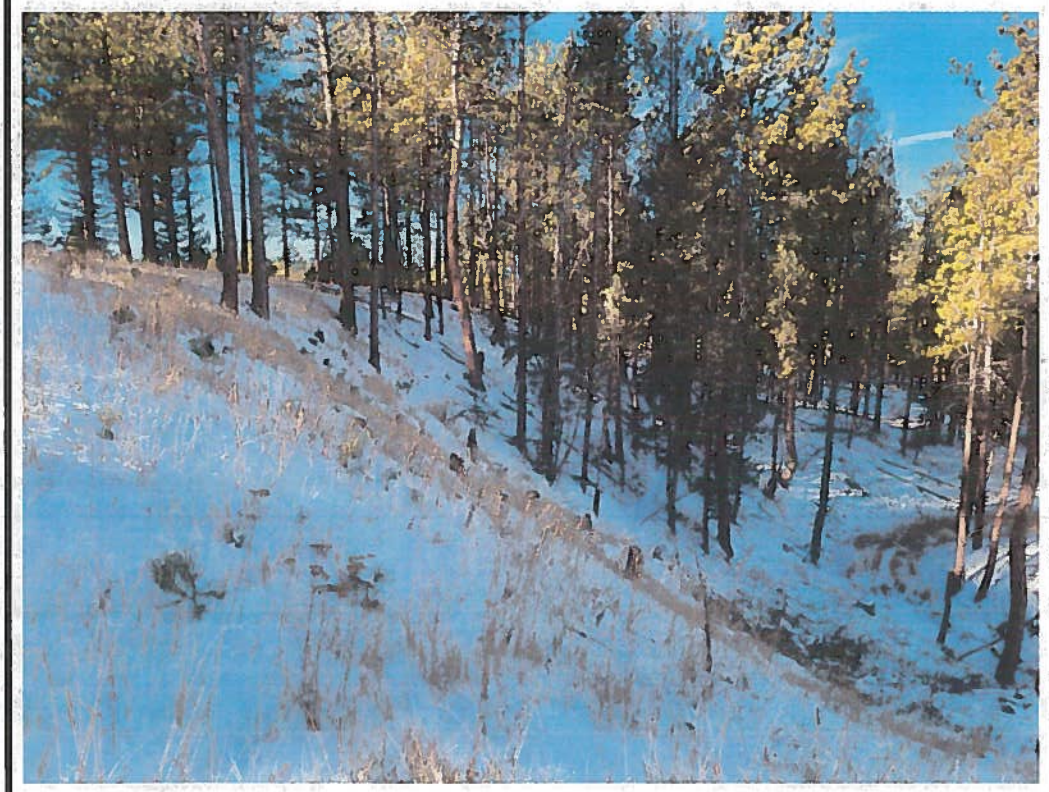
Job No. 213271



3

Looking west from the central portion of the lot.

January 7, 2022



4

Looking northwest along the potentially unstable slope in the northern side of the site.

January 7, 2022

Job No. 213271

APPENDIX B: Entech Engineering, Inc., Subsurface Soil Investigation, Job No. 213271

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January 25, 2022

Joe Loidolt
2138 Flying Horse Club Drive
Colorado Springs, CO 80921

Attn: Joe Loidolt

Re: Subsurface Soil Investigation
Lot 1, Flying Horse North Filing 2
Quartz Creek Drive
El Paso County, Colorado

Dear Mr. Loidolt:

Personnel of Entech Engineering, Inc. have drilled four shallow test borings at the site referenced above. Specific findings for the site are presented in this letter.

Soil Classification:

Soil types observed in the test borings were found to consist of silty sand over weathered to formational silty sandstone bedrock.

Allowable Bearing Capacity:

An allowable bearing pressure of 3000 psf is recommended for the medium dense to dense sands on this site with an equivalent hydrostatic fluid pressure (in the active state) of 40 pcf is recommended for the sands on this site. An allowable bearing pressure of 3500 psf is recommended for the undisturbed sandstone.

Soil Moisture Conditions:

Moist to dry.

Expansion Potential:

Low.

Fill:

None.

Special Considerations:

Highly expansive claystone is commonly interbedded in the sandstone in the area. If highly expansive materials are encountered at or within 4 feet of floor slab or foundation grades, removal and replacement may be required. The extent of overexcavation, if any will be determined at the time of the excavation observation.

The potential for a combination of high bearing very dense sandstone and moderate bearing sand exists on this site, depending on the conditions. The foundation should rest entirely on similar bearing materials. If a majority of the soils encountered at foundation levels is sandstone, the remainder of the foundation components should penetrate the lower bearing sands to sandstone or rest on compacted structural fill placed at 95% of its maximum Modified Proctor Dry Density ASTM-1557. If the majority of soil is sand, the sandstone should be overexcavated 2 feet and replaced with on-site sands or structural fill placed at 95% of its maximum Modified Proctor Dry Density ASTM-1557. The structural fill should be approved prior to hauling it to the site.

Excavation of site sand materials should be moderate/easy with rubber-tired equipment. Excavation of the sandstone bedrock may require track-mounted equipment. Site materials may be acceptable for use as structural fill, pending approval.

Foundation Type:

A spread footing (16")/stemwall foundation system is anticipated for this site. Point load bearing pads should be sized for the allowable bearing capacity given. **This does not constitute a foundation design.** The bottoms of exterior foundations should be located at least 30 inches below finished grade for frost protection.

Reinforcing:

Reinforcing should be designed to permit foundation walls to span a minimum of 10 feet under the design load. Foundation walls should be designed to resist an equivalent fluid pressure (in the active state) of 45 pcf.

Floor Slabs:

Floor slabs on grade, if any should be separated from structural portions of the building and allowed to float freely. Interior partitions must be constructed in such a manner that they do not transmit floor slab movement to the roof or overlying floor. Backfill placed below floor slabs should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D- 1557.

Drainage and Grading:

The ground surface must be sloped away from the building to provide positive drainage away from the foundation. We recommend an equivalent slope of 6 inches in the first 10 feet (5%) surrounding the structure, where possible, or as required to quickly remove surface water. Where a 5% slope cannot be achieved practically, such as around patios, at inside foundation corners, and between a house and nearby sidewalk, we believe it is desirable to establish as much slope as possible and to avoid irrigation in the area. Roof downspouts should discharge beyond the limits of backfill. We recommend providing splash blocks and downspout extensions to discharge runoff beyond the limits of backfill.

Homebuyers should maintain the surface grading and drainage installed by the builder to assure water is not directed toward the foundations and does not pond near the house. Landscaping should be carefully designed to minimize irrigation adjacent to the foundation. We do not recommend use of impervious plastic membranes below landscaped areas near foundations; geotextile fabrics can control weed growth while allowing evaporation. Plants used close to foundation walls should be limited to those with low moisture requirements; irrigated grass should not be located within 5 feet of the foundation. Sprinklers should not discharge water within 5 feet of foundations. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the potential for slab and foundation movements.

Subdrain:

A subsurface drain is recommended around portions of the structure which will have useable space located below the finished ground surface. Typical drain details are included with this letter.

Backfill:

Backfill should be compacted to 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. Backfill must be compacted by mechanical means. No water flooding techniques of any type should be used in the compaction of backfill on this site. Expansive soils are not to be used as foundation backfill.

Concrete:

Type II cement is recommended for all concrete on this site. Concrete should not be placed on frozen or wet ground. Care should be taken to prevent the accumulation and ponding of water in the footing excavation prior to the placement of concrete. If standing water is present in the excavation, it should be removed by installing sumps and pumping the water away from the building area. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and heating to prohibit freezing.

Open Foundation Excavation Observation:

The open foundation excavation should be observed prior to construction of the foundation in order to verify that no anomalies are present, that materials at the proper design bearing capacity have been encountered, and that no soft spots or debris are present in the foundation area.

Remarks:

The recommendations provided in this letter are based upon the observed soil parameters, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to minimize differential movement resulting from the heaving of expansive soils or resulting from settlement induced by the application of building loads. It must be recognized that the foundation may undergo movement. In addition, concrete floor slabs may experience

movement; therefore, adherence to those recommendations which would isolate floor slabs from columns, walls, partitions or other structural components is extremely important, if damage to the superstructure is to be minimized. Any subsequent owners should be apprised of the soil conditions and advised to maintain good practice in the future with regard to surface and subsurface drainage, framing of partitions above floor slabs, drywall and finish work above floor slabs, etc.

We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist

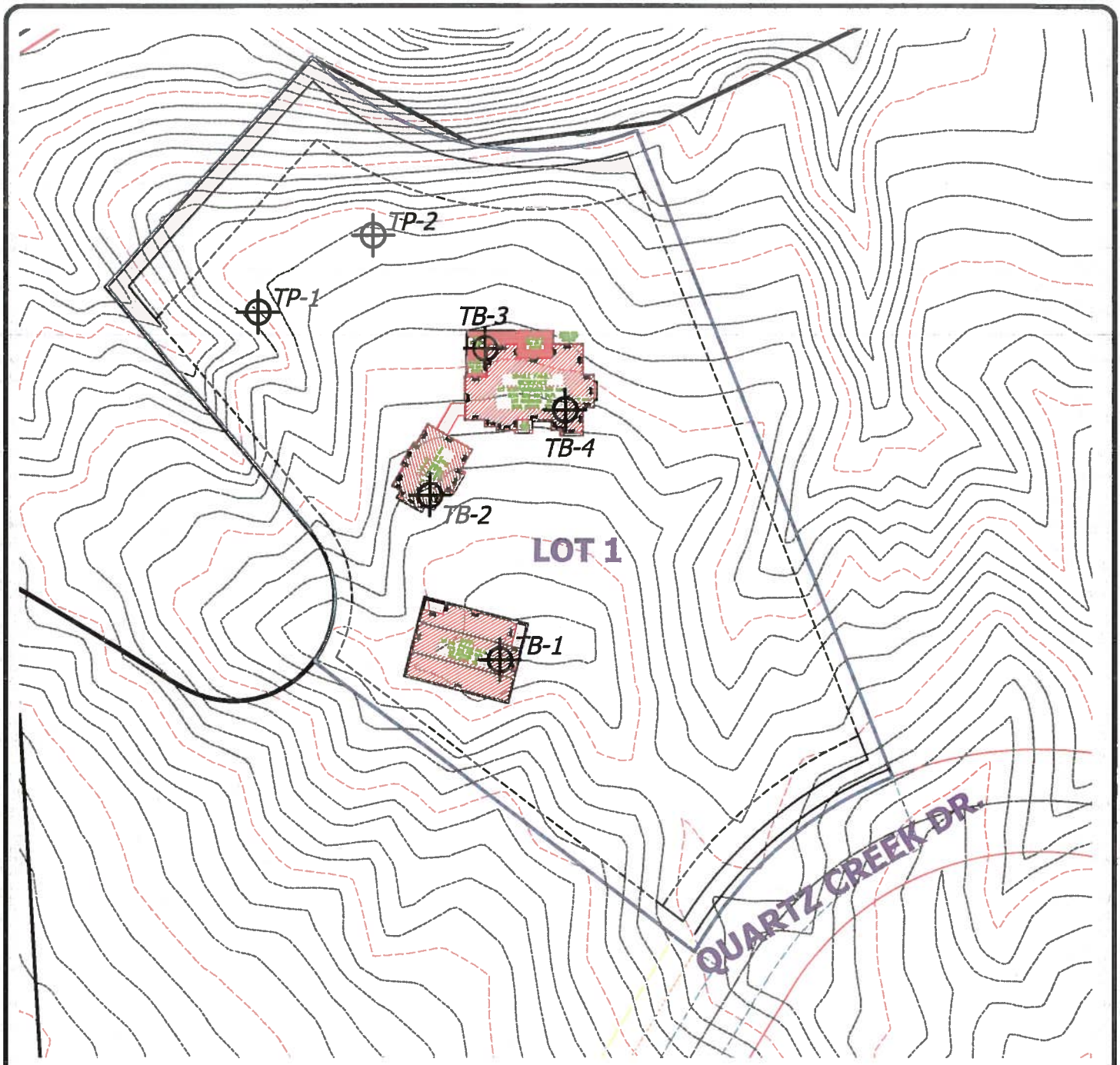
Reviewed by:

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

LLL

Encl.

Entech Job No. 213271
AAprojects/2021/213271 ssi



LEGEND:

⊕ TP- APPROXIMATE TEST PIT LOCATION AND NUMBER

N

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505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SITE MAP/TEST BORING LOCATION MAP
FLYING HORSE NORTH FILING NO. 2
LOT 1, QUARTZ CREEK DRIVE
EL PASO COUNTY, CO.
FOR: JOE LOIDOLT

DRAWN:	DATE:	CHECKED:	DATE:
LLL	1/13/22		

JOB NO.: 213271

FIG NO.: 1

TEST BORING NO. 1
DATE DRILLED 12/17/2021
Job # 213271

REMARKS

DRY TO 16', 12/17/21

SAND, SILTY, TAN

SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST

AUGER REFUSAL AT 16'

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	50/10"	5.7	2
5	50/6"	4.7	2
10	50/5"	5.4	2
15	50/4"	7.0	2
20			

TEST BORING NO. 2
DATE DRILLED 12/17/2021
CLIENT JOE LOIDOLT
LOCATION FLYING HORSE N., F-2, L-1

REMARKS

DRY TO 20', 12/17/21

SAND, SILTY, TAN

WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE TO DENSE, DRY TO MOIST

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	50	1.8	2
5	32	2.5	2
10	38	4.8	2
15	47	9.3	2
20	50	10.0	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 1/13/22

JOB NO.: 213271
FIG NO.: 2

TEST BORING NO. 3
DATE DRILLED 12/17/2021
Job # 213271

REMARKS

DRY TO 15', 12/17/21

SAND, SILTY, TAN

SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST

AUGER REFUSAL AT 15'

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50 / 11"	3.7	2
5			50	3.7	2
10			32	7.8	2
15			50 / 6"	7.9	2
20					

TEST BORING NO. 4
DATE DRILLED 12/17/2021
CLIENT JOE LOIDOLT
LOCATION FLYING HORSE N., F-2, L-1

REMARKS

DRY TO 17', 12/17/21

SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST

SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST

AUGER REFUSAL AT 17'

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			28	6.0	1
5			26	5.1	1
10			28	8.4	1
15			50 / 6"	7.0	2
20					

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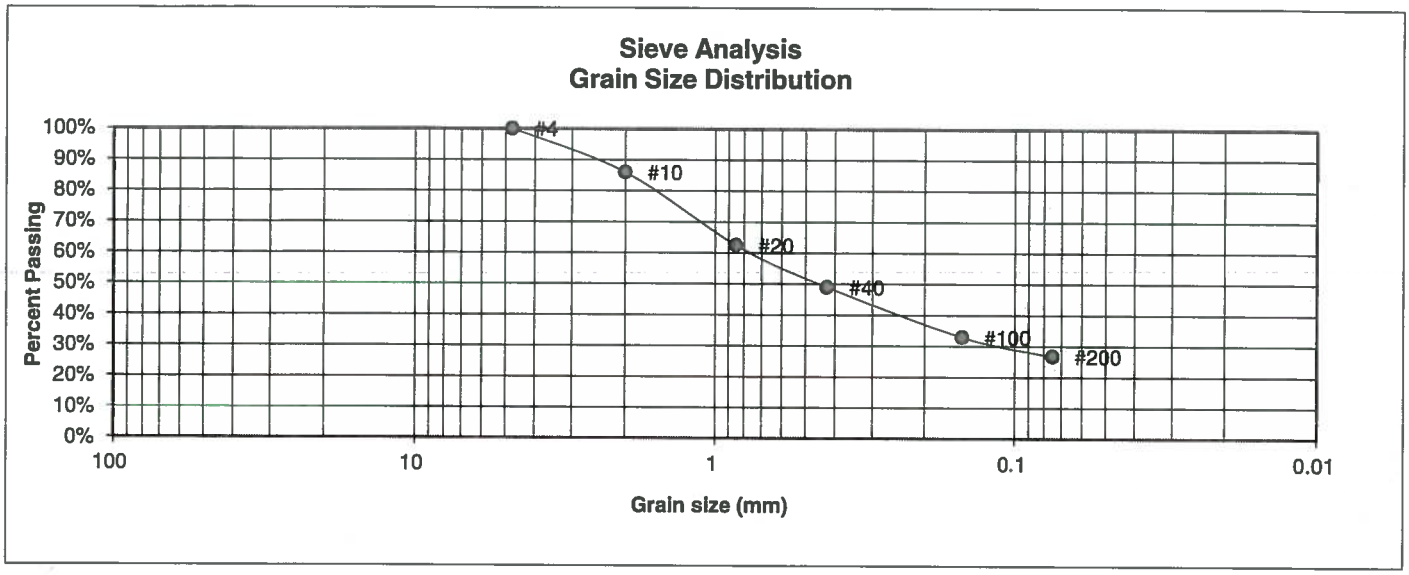
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KK	1/13/22

JOB NO.: 213271
FIG NO.: 3

UNIFIED CLASSIFICATION	SM	CLIENT	JOE LOIDOLT
SOIL TYPE #	2	PROJECT	FLYING HORSE N., F-2, L-1
TEST BORING #	1	JOB NO.	213271
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	86.0%
20	62.4%
40	49.0%
100	32.9%
200	26.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

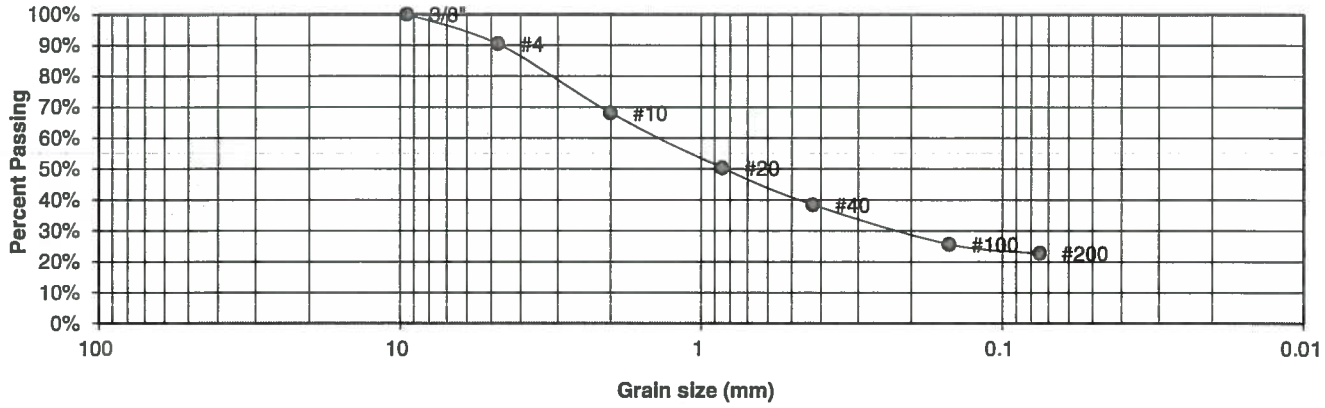
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/13/22

JOB NO.: 213271

FIG NO.: 4

UNIFIED CLASSIFICATION	SM	CLIENT	JOE LOIDOLT
SOIL TYPE #	2	PROJECT	FLYING HORSE N., F-2, L-1
TEST BORING #	2	JOB NO.	213271
DEPTH (FT)	10	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	90.4%
10	68.1%
20	50.3%
40	38.4%
100	25.6%
200	22.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

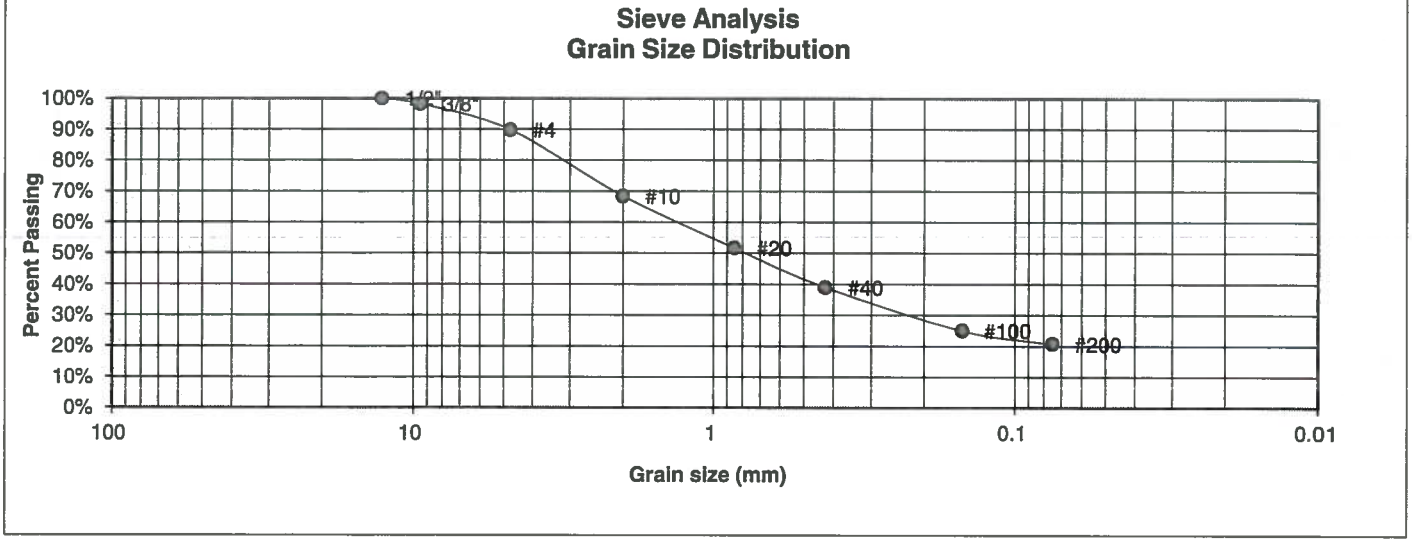
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/13/22

JOB NO.: 213271

FIG NO.: 5

UNIFIED CLASSIFICATION	SM	CLIENT	JOE LOIDOLT
SOIL TYPE #	2	PROJECT	FLYING HORSE N., F-2, L-1
TEST BORING #	3	JOB NO.	213271
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.2%
4	89.8%
10	68.4%
20	51.6%
40	38.9%
100	25.0%
200	20.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

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

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COLORADO SPRINGS, COLORADO 80907

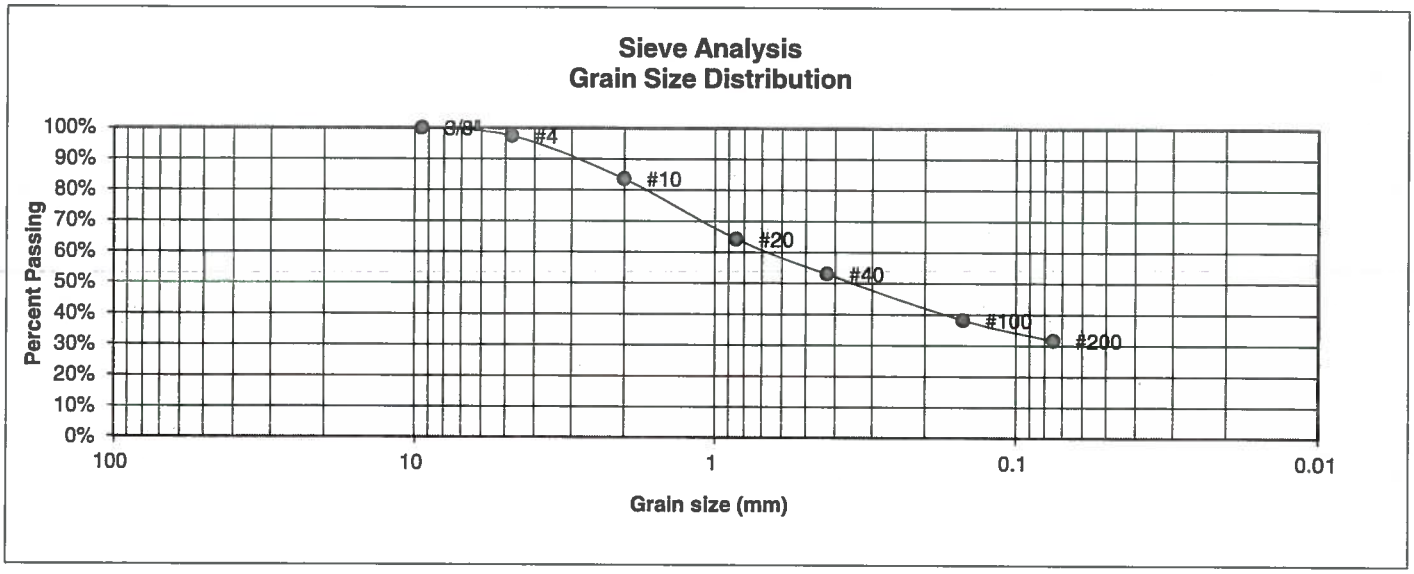
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/13/22

JOB NO.: 213271

FIG NO.: 6

UNIFIED CLASSIFICATION	SM	CLIENT	JOE LOIDOLT
SOIL TYPE #	1	PROJECT	FLYING HORSE N., F-2, L-1
TEST BORING #	4	JOB NO.	213271
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.4%
10	83.6%
20	64.3%
40	53.0%
100	38.2%
200	31.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/13/22

JOB NO.: 213271

FIG NO.: 7

CLIENT	JOE LOIDOLT	JOB NO.	213271
PROJECT	FLYING HORSE N., F-2, L-1	DATE	12/28/2021
LOCATION	FLYING HORSE N., F-2, L-1	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	2	SM	<0.01
TB-4	5	1	SM	<0.01

QC BLANK PASS

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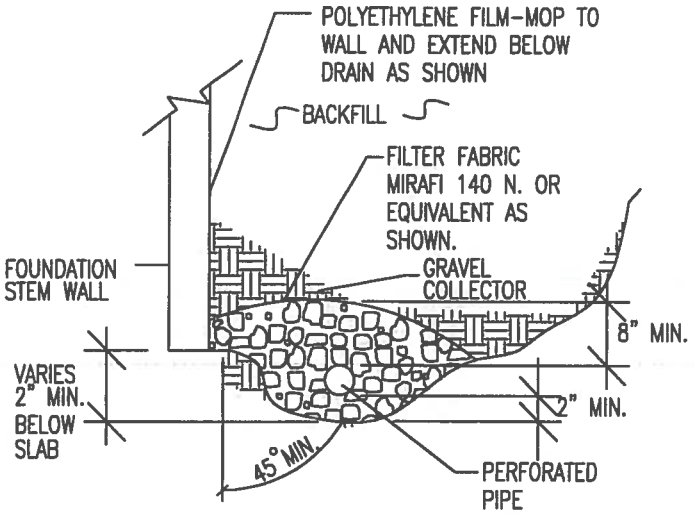
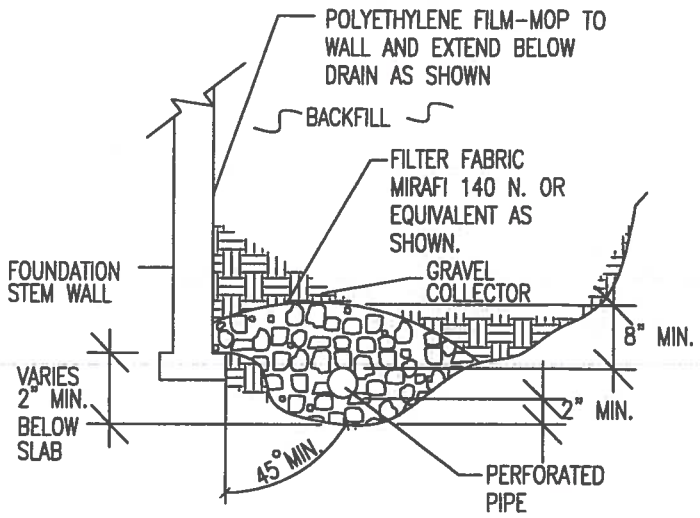
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/13/22

JOB NO.: 213271

FIG NO.: 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.

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PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:

JOB NO.: 21327

FIG NO.: 9

APPENDIX C: Soil Survey Descriptions

El Paso County Area, Colorado

26—Elbeth sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 367y
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Elbeth

Setting

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

Typical profile

A - 0 to 3 inches: sandy loam
E - 3 to 23 inches: loamy sand
Bt - 23 to 68 inches: sandy clay loam
C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 8 to 15 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: Moderate (about 7.1 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:

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 19, Aug 31, 2021