ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
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May 26, 2021
Revised: September 21, 2021

Sally Bartels
3647 Tuscanna Gove
Colorado Springs, CO 80920

Re: Soil, Geology, and Geologic Hazard Study
Koinonia Ranch
Parcel No. 52190-00-059
6170 Old Ranch Road
El Paso County, Colorado

Dear Ms. Bartels:

GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SW¼ of Section 19 Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located immediately north of Colorado Springs city limits, north of Old Ranch Road and approximately ¾ mile west of Black Forest Road, 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 south-southeast. A minor drainage swale is located in the northern portion of the property. 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 and rural residential. The site contains field grasses, weeds, and ponderosa pines. The existing house with a water well and septic system located on proposed Lot 5 will remain. Site photographs taken May 21, 2021, are included in appendix A. Site mapping and test pit excavations were completed on May 21, 2021. Test Borings were drilled on December 22, 2020.

Total acreage involved in the proposed subdivision is 39.09-acres. Six rural residential lots and an open space, Tract A, are proposed as part of the subdivision. The proposed lot sizes range from 5.16-acres to 6.65-acres. The existing house located on Lot 5 will remain. The new lots will be serviced by individual wells and on-site wastewater treatment systems. The Site Plan is presented in Figure 3.

LAND USE AND ENGINEERING GEOLOGY

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of potentially seasonal shallow groundwater. Based on the proposed development plan, it appears that these areas will have 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 May 21, 2021.

Two test borings and three test pits were drilled on the site to determine general suitability of the soil characteristics for residential construction. The locations of the test borings/pits are indicated on the Site Plan/Test Boring Location Map, Figure 3. The Test Boring and Test Pit 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 1, Figure 4), previously the Soil Conservation Service (Reference 2) has mapped three soil types on the site. Complete descriptions of the soil types are presented in Appendix D. In general, the soils consist of sandy loam to gravelly loamy sand. The soils are described as follows:

Type	Description
40	Kettle gravelly, loamy sand, 3 – 8% Slopes
41	Kettle gravelly, loamy sand, 8 – 40% Slopes
71	Pring coarse sandy loam, 3 – 8% 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 silty sand overlying silty sandstone. Bedrock was encountered at depths of 3 to 7 feet in the test borings. The upper sands were encountered at dense to very dense states and dry to moist conditions. The sandstone was encountered at very dense states and moderate moisture conditions. The samples of sand tested had 16 percent of the soil size particles passing the No. 200 sieve. The samples of sandstone tested had 12 to 31 percent of the soil size particles passing the No. 200 sieve. The silty sand and sandstone typically have low expansion potential. Highly expansive claystone and siltstone lenses are commonly interbedded in the sandstone in the area.

Groundwater

Groundwater was not encountered in the test borings which were drilled to depths of 12 to 20 feet. Groundwater is not anticipated to affect shallow foundations on the majority of the site. An area of potentially seasonal shallow groundwater has been mapped on the site and is discussed later in this report. 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 10 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 3). 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 of claystone or siltstone.

The geology of the site was evaluated using the *Geologic Map of the Falcon NW Quadrangle,* by Madole in 2003, (Reference 4, 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:

Qc/Tkd **Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:** The materials consist of colluvial or residual soils overlying the bedrock materials on-site. The colluvial soils were deposited by the action of sheetwash and gravity. The residual soils were derived from the in-situ weathering of the bedrock on site. These materials typically consist of silty to clayey sand with potential areas of sandy clays. The bedrock consists of the Dawson Formation. The Dawson Formation typically consists of coarse-grained, arkosic sandstone with interbedded lenses of fine-grained sandstone, siltstone and claystone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon NW Quadrangle* distributed by the Colorado Geologic Survey in 2003 (Reference 4, Figure 5), the *Geologic Map of the Colorado Springs-Castle Rock Area,* distributed by the US Geological Survey in 1979 (Reference 5), and the *Geologic Map of the Pueblo 1° x 2° Quadrangle,*

distributed by the US Geological Survey in 1978 (Reference 6). The test borings 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 seasonal shallow groundwater, as indicated on the Engineering Geology Map, Figure 6. Potential Hazards including expansive soils and minor drainage swales, have also been addressed below. These hazards and recommended mitigation techniques are discussed as follows:

Expansive Soils

Expansive soils were not encountered in the test borings or pits. 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 minor drainage area exists in the northern portion of the site. No water was observed flowing in the drainage at the time of the investigation, however, these areas have the potential for seasonal shallow groundwater. These areas are indicated in the Geology/Engineering Geology Map (Figure 6) and are discussed below. Due to the size of the proposed lots these areas can be avoided or redirected around proposed structures or proposed soil treatment areas. 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. 08041CO527G dated December 7, 2018 (Figure 7, Reference 7). Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Potentially Seasonal Shallow Groundwater Area

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. These areas lie within a defined drainage and can be avoided by the proposed development. Construction in any portions of these areas, if required, or immediately adjacent to these areas should follow these precautions.

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

RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

The proposed development will be rural-residential utilizing individual on-site wastewater treatment systems and water wells. Seven rural residential lots are proposed. The lot sizes range from 5.16-acres to 6.65-acres. The existing house located on Lot 5 will remain. The new lots will be serviced by individual wells and on-site wastewater treatment systems. The existing geologic and engineering geologic conditions will impose minor constraints on development and construction. The geologic constraints on the site include 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 dense to very dense states, and the sandstone was encountered at very dense states. Sandstone bedrock was encountered at 3 to 7 feet in 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 exists in the northern portion of the site. No water was observed flowing in the drainage, however, the potential for seasonal shallow groundwater exists in these areas during periods of high runoff. According to the development plan and lot size, these areas can be avoided by the structures. Structures should not block drainages. Grading should direct surface waters around structures and roadways to prevent areas of ponded water.

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 8), 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 9), the site is not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), 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 10), 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 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

EROSION CONTROL

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

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

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

CLOSURE

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

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

This report has been prepared for Sally Bartels, 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
Geologist

Reviewed by:

Joseph C. Goode, P.E.
President

COLORADO LICENSED
JOSEPH COLLIN GOODE
23725
PROFESSIONAL ENGINEER
9/21/22

KAH

Encl.

Entech Job No. 202498
AAprojects/2020/202498 sg&ghs-rev

BIBLIOGRAPHY

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7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041CO527G.

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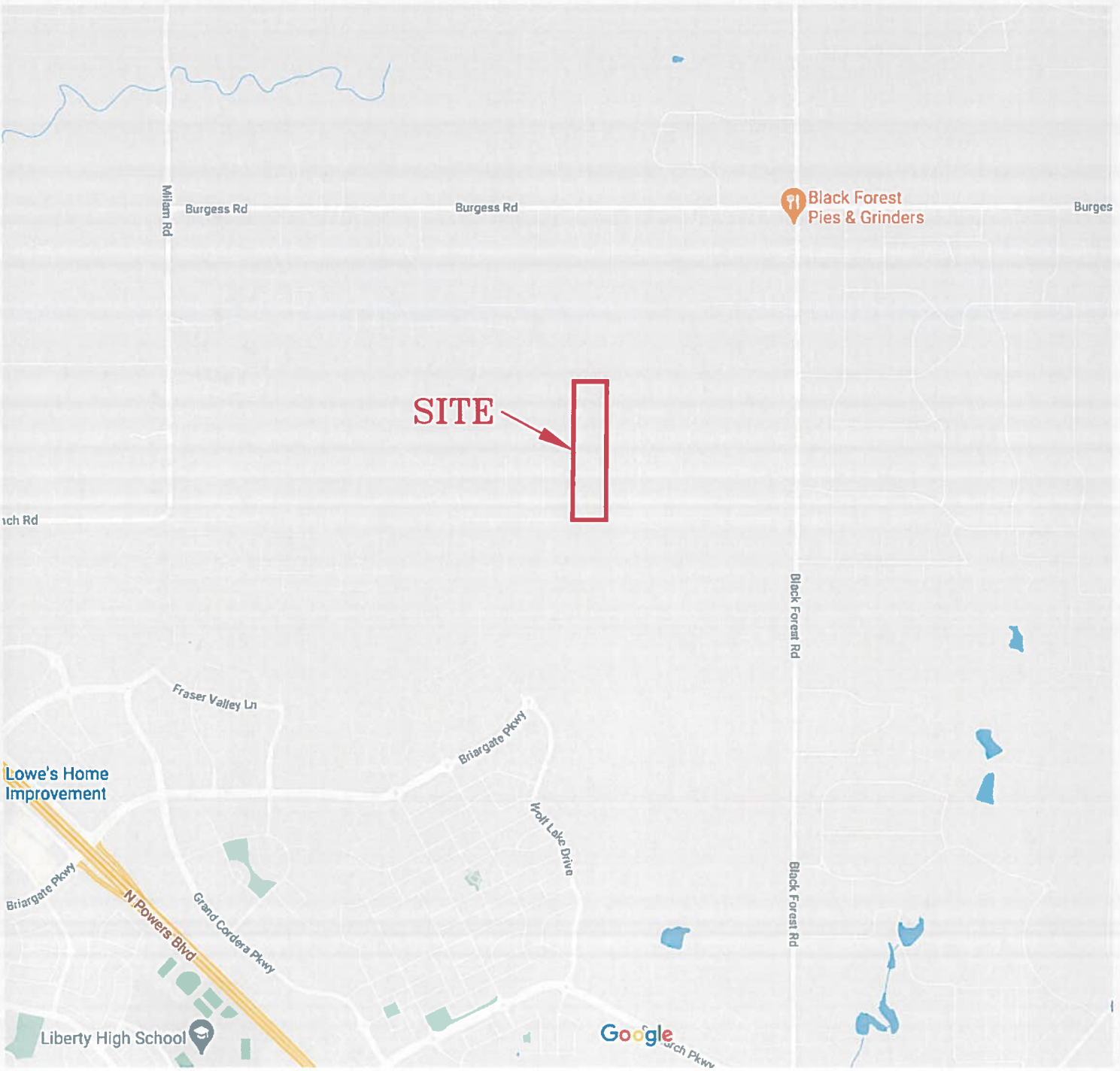
FIGURES



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505 ELKTON DRIVE
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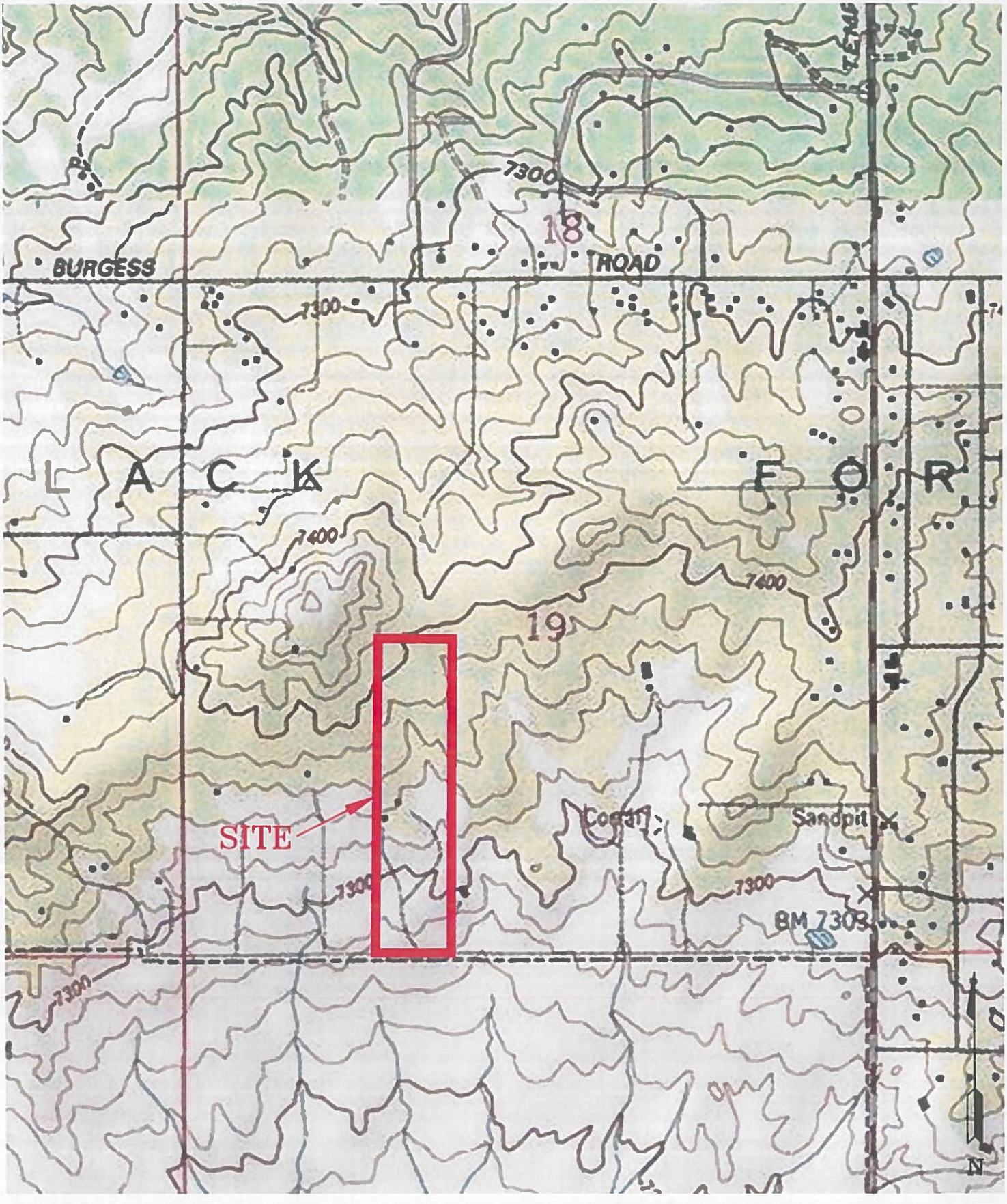
VICINITY MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN:	DATE:	CHECKED:	DATE:
JAC	05/24/21	KAH	05/24/21

JOB NO.: 202498

FIG NO.: 1



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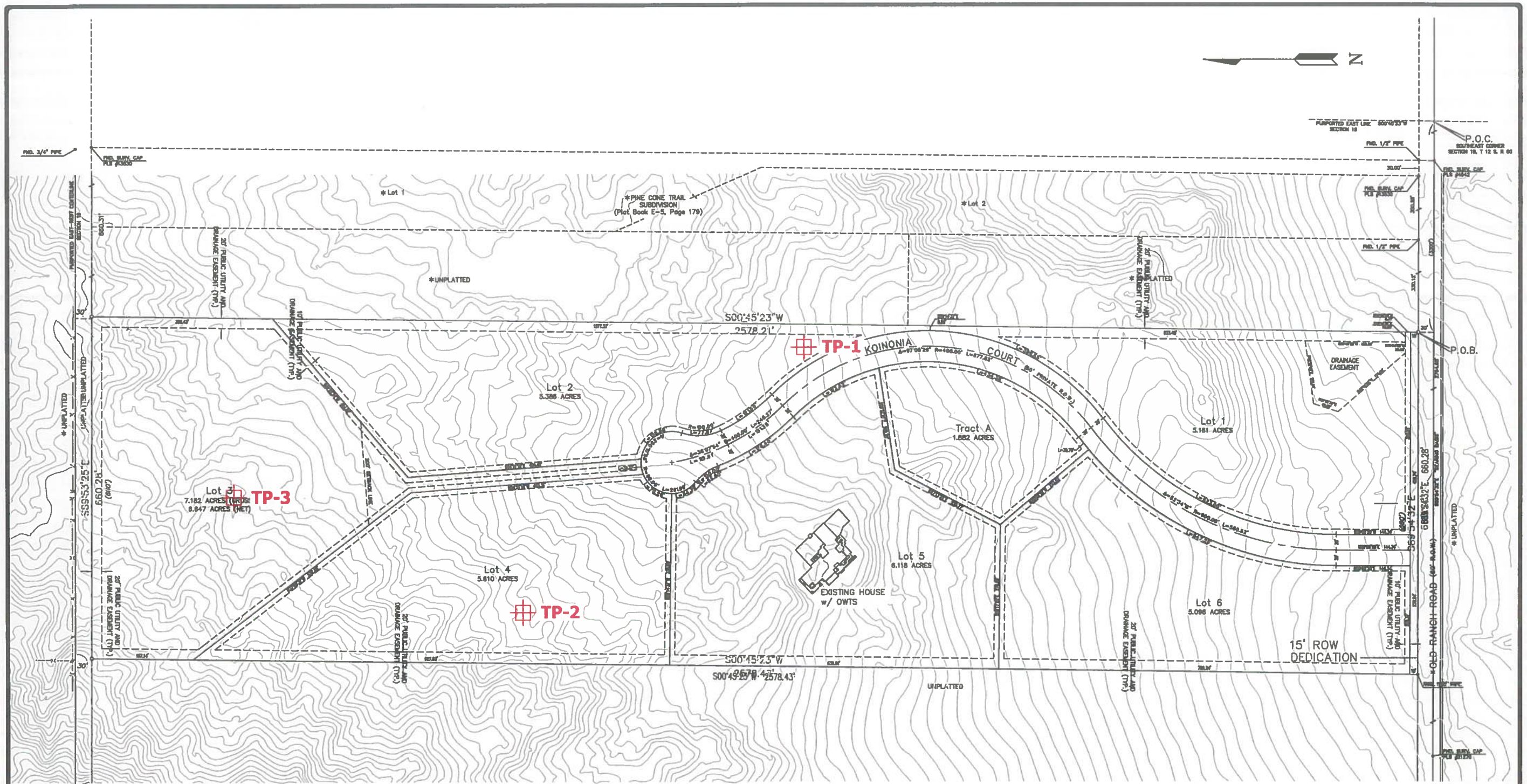
USGS MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN:	DATE:	CHECKED:	DATE:
JAC	05/24/21	KAH	05/24/21

JOB NO.: 202498

FIG NO.: 2



TP- APPROXIMATE TEST PIT LOCATIONS AND NUMBERS

REVISION	BY

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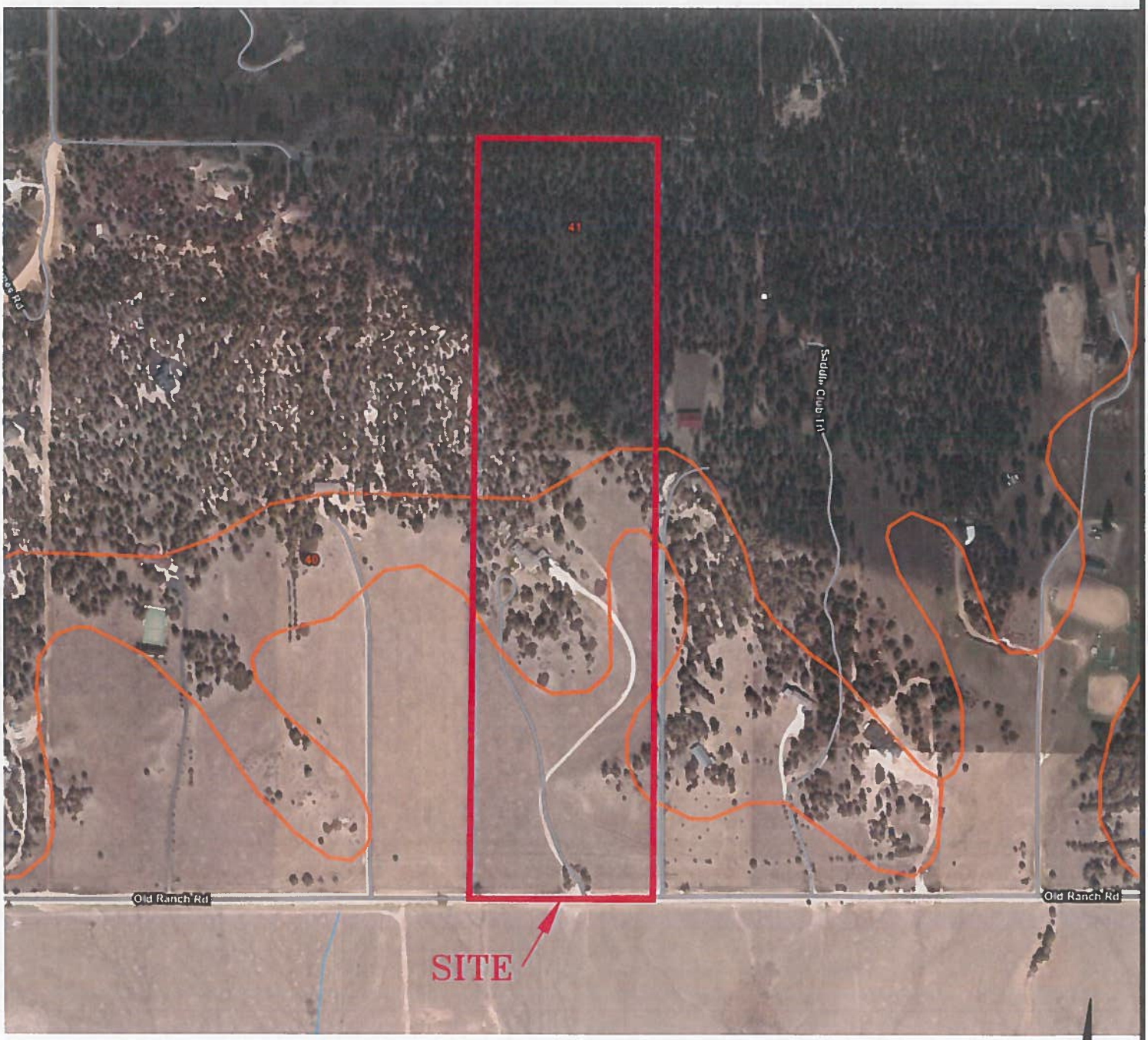
COLORADO SPRINGS, CO. 80907

SITE PLAN/TEST PIT MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN	JAC
CHECKED	
DATE	05/24/21
SCALE	AS SHOWN
JOB NO.	20249B
FIGURE No.	3



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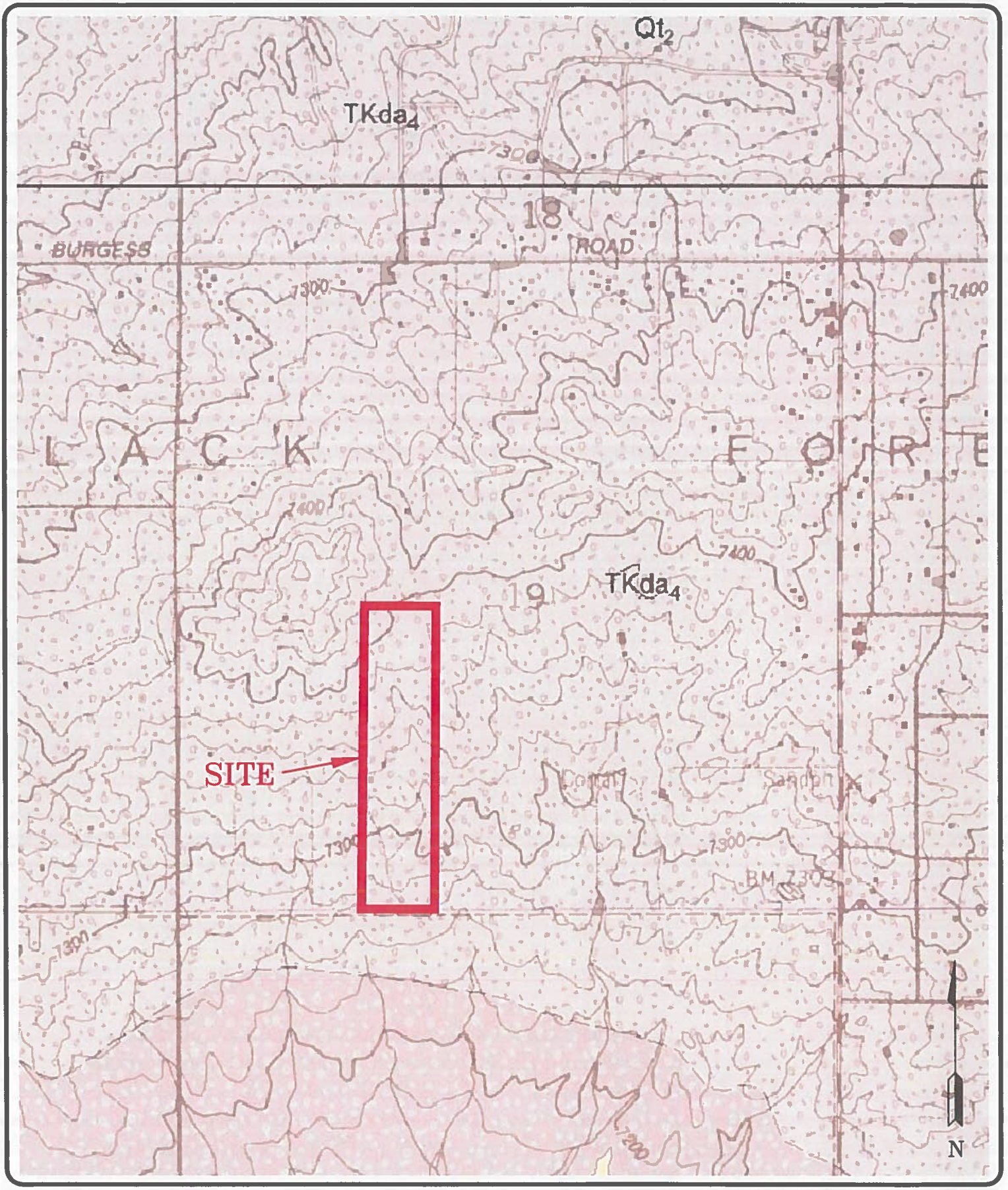
SOIL SURVEY MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN:	DATE:	CHECKED:	DATE:
JAC	05/24/21	KAH	05/24/21

JOB NO.: 202498

FIG NO.: 4



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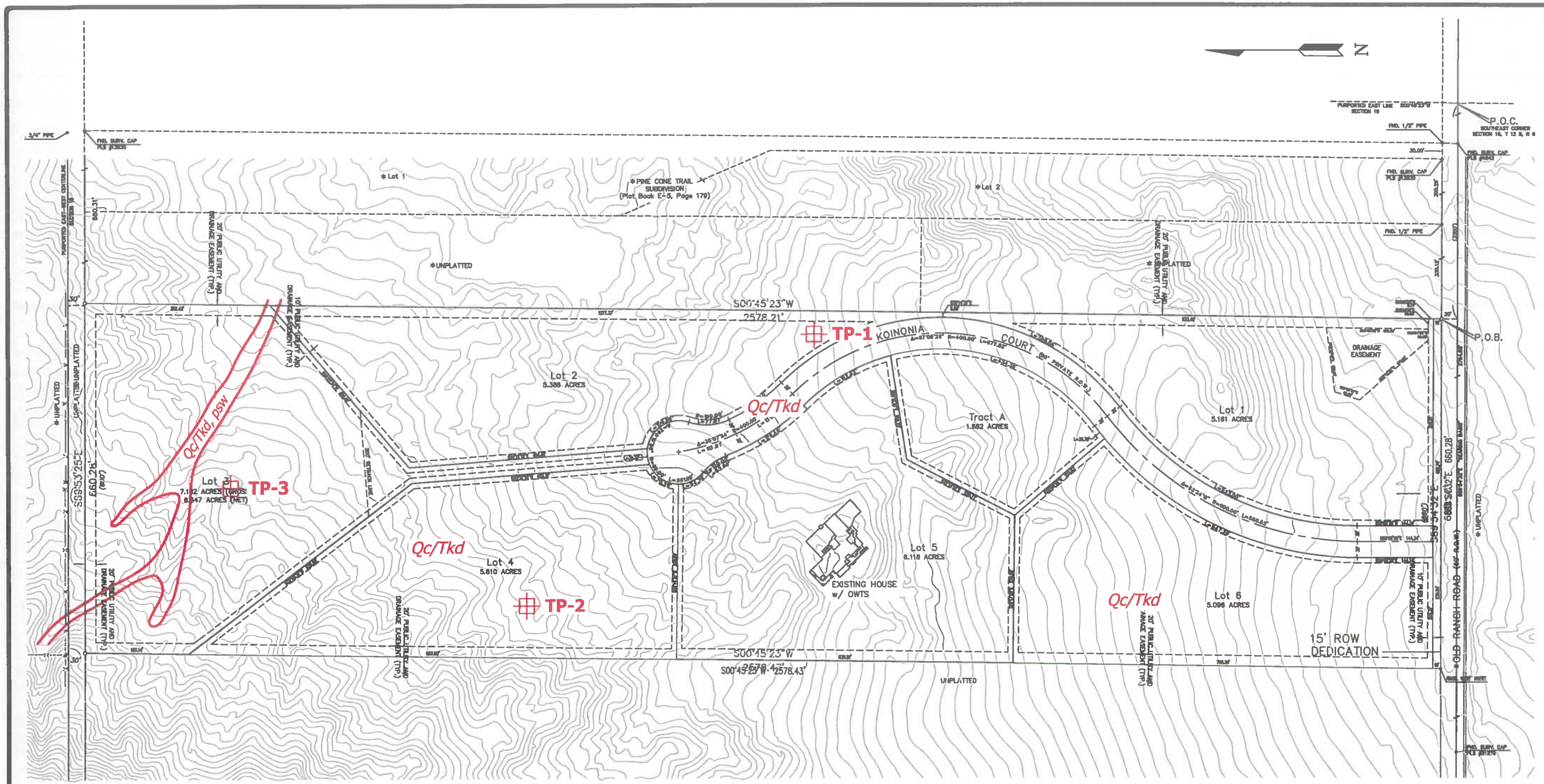
FALCON NW QUADRANGLE GEOLOGIC MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN:	DATE:	CHECKED:	DATE:
JAC	05/24/21	KAH	05/24/21

JOB NO.: 202498

FIG NO.: 5



Legend:

Qc/TKd - Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age: colluvial and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone

psw - potentially seasonal shallow groundwater area

REVISION	BY

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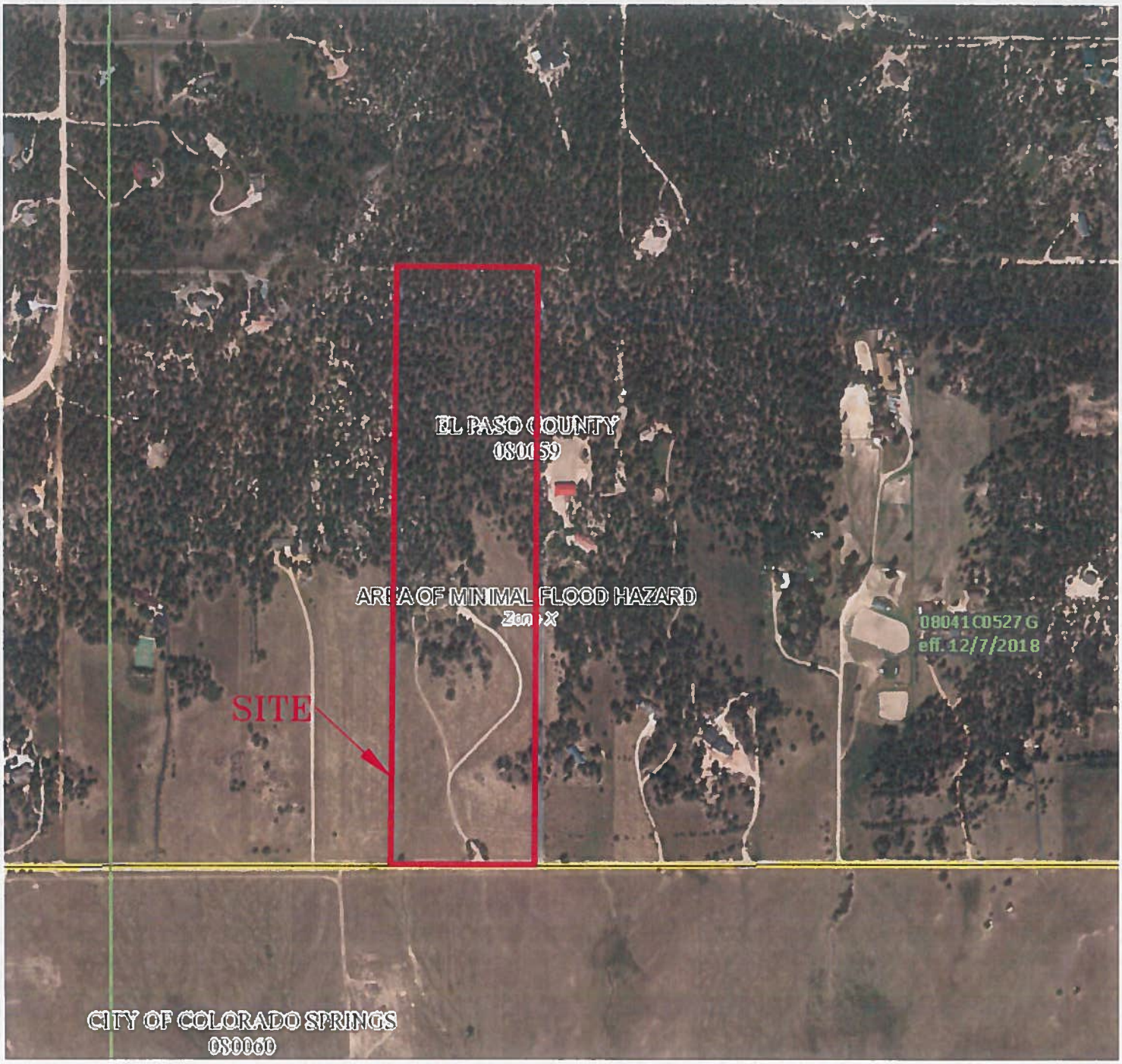
COLORADO SPRINGS, CO. 80907

GEOLOGY/ENGINEERING GEOLOGY MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

DRAWN	JAC
CHECKED	KAH
DATE	05/24/21
SCALE	1:200
JOB NO.	202498
FIGURE No.	6



N

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FLOODPLAIN MAP
SGWW
6170 OLD RANCH ROAD
EL PASO COUNTY, CO.
FOR: SALLY BARTELS

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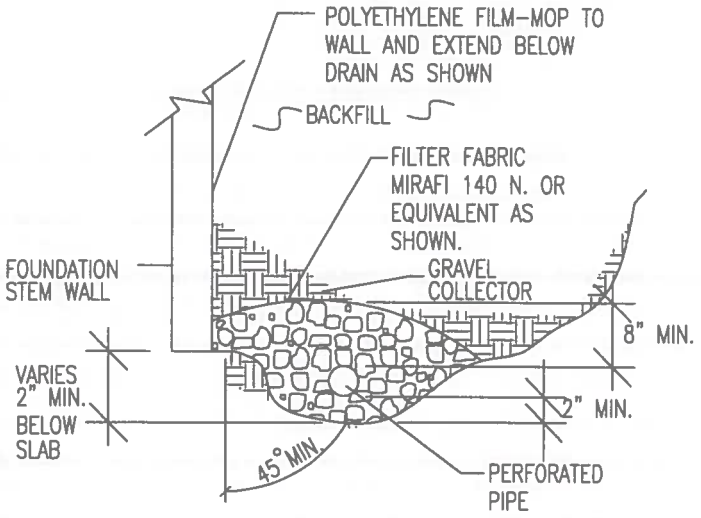
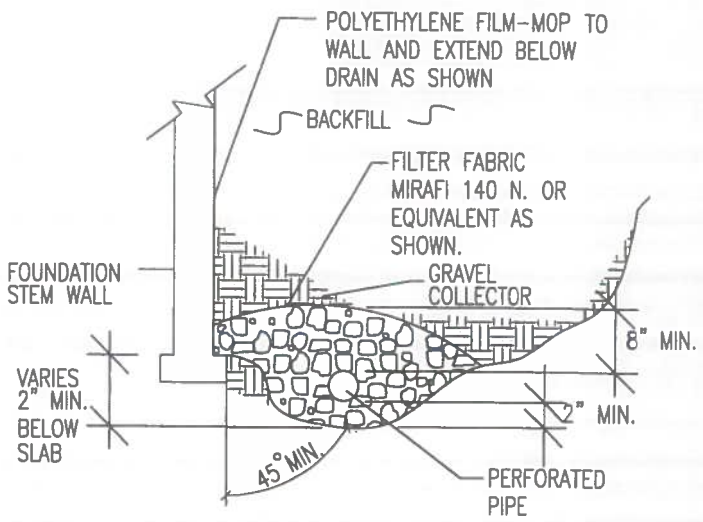
JAC	05/24/21	KAH	05/24/21

JOB NO.: 202498

FIG NO.: 7





NOTES:

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

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

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

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

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

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

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PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:

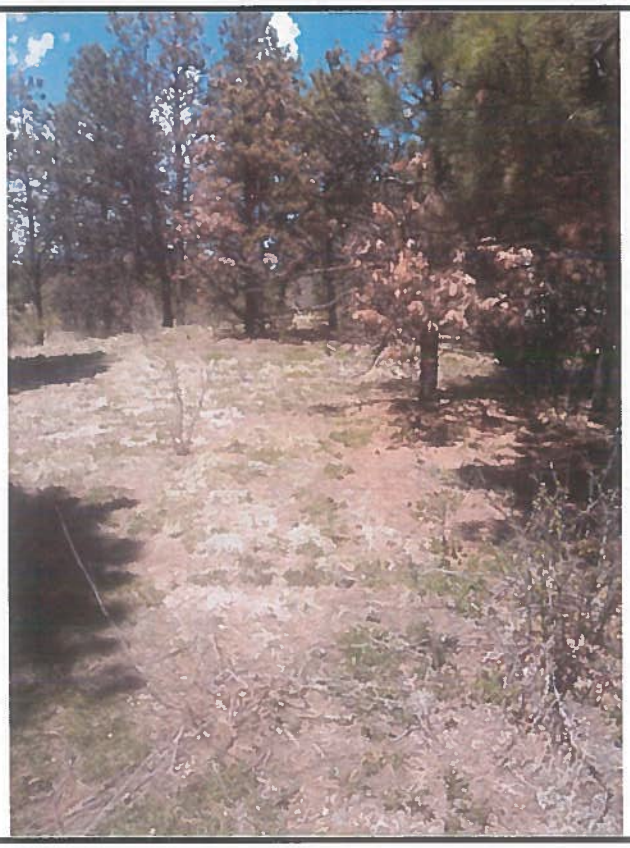
JOB NO.: 202498
FIG NO.: 8

APPENDIX A: Photographs

1

Looking west from the east-central portion of the site.

May 21, 2021



2

Looking northeast from the western portion of the site.

May 21, 2021

Job No. 202498

3

Looking southeast from the western portion of the site.

May 21, 2021

4

Looking southeast down drainage in the northern portion of the site.

May 21, 2021

Job No. 202498

5

Looking south from the north-central portion of the site.

May 21, 2021

6

Looking north from the south-central portion of the site.

May 21, 2021

Job No. 202498

APPENDIX B: Test Boring Logs and Test Pit Logs

TEST BORING NO. 1
DATE DRILLED 12/22/2020
Job # 202498

REMARKS

DRY TO 20', 12/22/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			32	3.0	
5			50	6.9	
10			50/4"	12.5	
15			50/9"	10.1	
20			50/4"	12.7	

6" TOPSOIL, SAND, SILTY, FINE TO COARSE GRAINED TO TAN, DENSE TO VERY DENSE, MOIST

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

TEST BORING NO. 2
DATE DRILLED 12/22/2020
CLIENT SALLY BARTELS
LOCATION 6170 OLD RANCH ROAD

REMARKS

DRY TO 12', 12/22/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50/11"	2.4	
5			50/11"	4.8	
10			50/4"	10.3	
			*	8.6	
15					
20					

12" TOPSOIL, SAND, SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, DRY

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

* - BULK SAMPLE TAKEN

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COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			5/25/21

JOB NO.: 202498

FIG NO.: B-1

TEST PIT NO. 1
DATE EXCAVATED 5/20/2021
Job # 202498

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy clay loam, brown, moist	1					
	2					
	3					
sandy loam, fine to coarse grained, yellowish brown, moist	4			gr	m	2
	5					
	6			gr	m	2
	7					
	8					
	9					
	10					

TEST PIT NO. 2
DATE EXCAVATED 5/20/2021
CLIENT Salley Bartels
LOCATION 6170 Old Ranch Road

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy clay loam, brown, moist	1					
sandy clay loam, fine to coarse grained, dark brown, very moist	2			ma		3A
	3					
gravelly sandy loam, fine to very coarse grained, pale brown, moist, residual soils	4			gr	m	R-1
	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

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TEST PIT LOG

DRAWN:	DATE:	CHECKED	DATE:
jhr	5/26/21		5/27/21

JOB NO.: 202498
FIG NO.: B-2

TEST PIT NO. 3
DATE EXCAVATED 5/20/2021
Job # 202498

DATE EXCAVATED 5/20/2021
CLIENT Sally Bartels
LOCATION 6170 Old Ranch Road

REMARKS

Refusal due to bedrock @ 48"

topsoil, sandy clay loam, brown, moist

sandy clay loam, fine to coarse grained, reddish brown, moist

Silty Sandstone

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1					
2					
3			ma		3A
4					
5					
6					
7					
8					
9					
10					

REMARKS

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA 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

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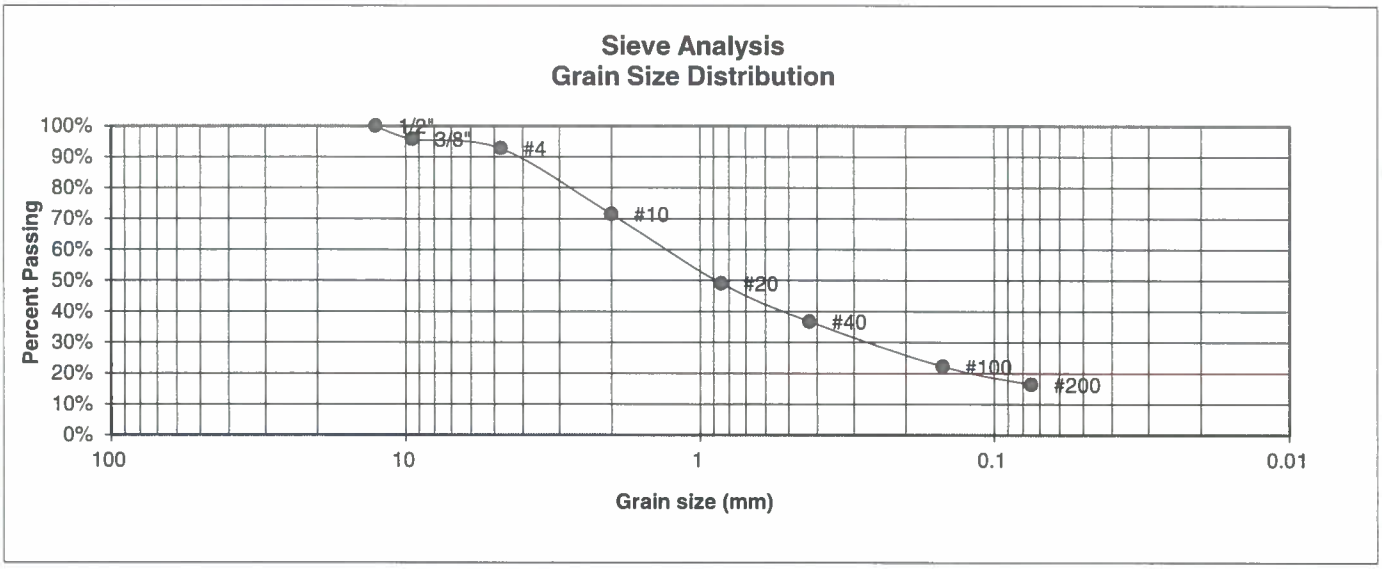
TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
jhr	5/26/21		5/27/21

JOB NO.: 202498
FIG NO.: B-3

APPENDIX C: Laboratory Test Results

BORING NO.	1	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	2-3	AASHTO CLASSIFICATION		JOB NO.	202498
CLIENT	SALLY BARTELS				
PROJECT	6170 OLD RANCH ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.8%
4	92.7%
10	71.4%
20	49.1%
40	36.7%
100	22.2%
200	16.4%

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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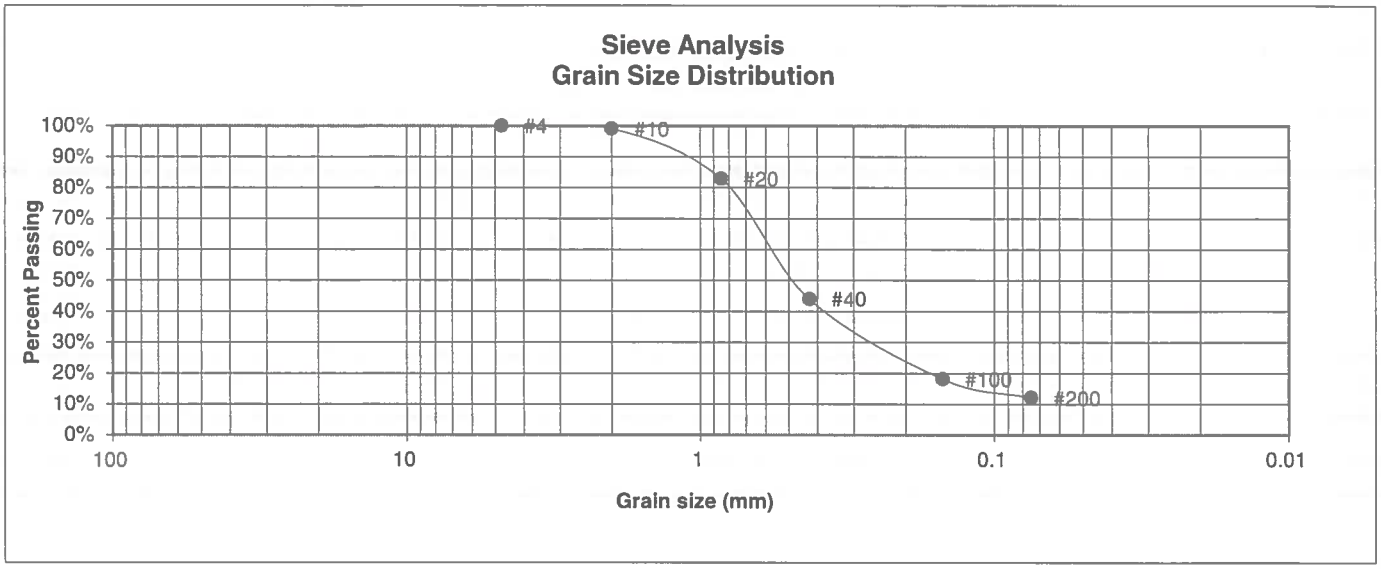
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			5/25/21

JOB NO.: 202498

FIG NO.: C-1

BORING NO.	1	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	15	AASHTO CLASSIFICATION		JOB NO.	202498
CLIENT	SALLY BARTELS				
PROJECT	6170 OLD RANCH ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.0%
20	82.9%
40	44.0%
100	18.1%
200	12.1%

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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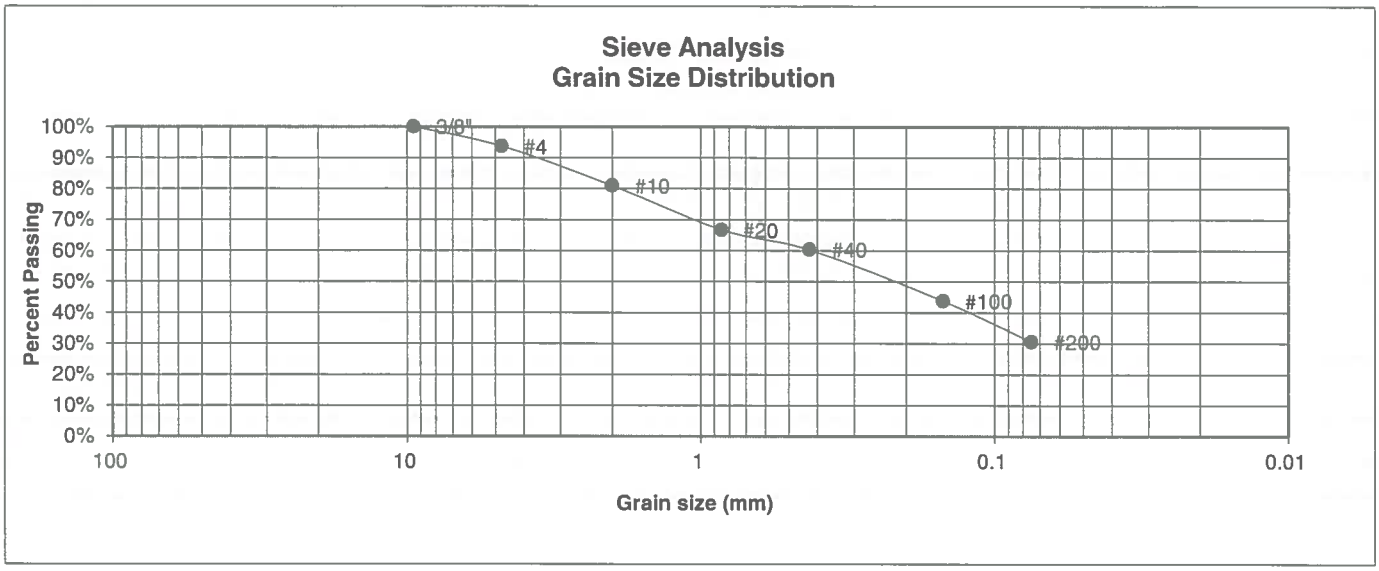
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 5/25/21

JOB NO.: 202498

FIG NO.: C-2

BORING NO.	2	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	5	AASHTO CLASSIFICATION		JOB NO.	202498
CLIENT	SALLY BARTELS				
PROJECT	6170 OLD RANCH ROAD				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.7%
10	81.0%
20	66.7%
40	60.4%
100	43.8%
200	30.6%

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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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			5/25/21

JOB NO.: 202498

FIG NO.: C-3

APPENDIX D: 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
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 capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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
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 capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Pring

Setting

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

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well 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 capacity: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020