Revised: April 8, 2021
January 19, 2021

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
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Delroy Johnson
14502 Highway 83
Colorado Springs, CO 80919

Re: Soil, Geology, and Geologic Hazard Study
Johnson Subdivision No. 1
Parcel No. 61000-00-157
14502 Highway 83
El Paso County, Colorado

Dear Mr. Johnson:

GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SW¼ of Section 34 Township 11 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 1-mile northeast of Colorado Springs city limits, southwest of Kaessner Lane and Highway 83 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, with steeper slopes along a ridge that bisects the site trending NW-SE. The several minor drainage swales are located on 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, kinnikinic, and ponderosa pines. An existing house with a water well and septic system are located on Lot 1, which will remain. Site photographs taken December 9, 2020, are included in appendix A. Site mapping and test pit excavations were completed on December 9, 2020. Test Borings were drilled on December 18, 2020.

Total acreage involved in the proposed subdivision is 28.62-acres. Four rural residential lots are proposed as part of the replat. The proposed lot sizes range from 5.01-acres to 13.63-acres. An existing house is located on Lot 1 which will remain. The new lots will be serviced by individual wells and on-site wastewater treatment systems. The Site Plan with the proposed replat is presented in Figure 3.

LAND USE AND ENGINEERING GEOLOGY

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of downslope creep. 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 December 9, 2020.

Six test borings were drilled on the site to determine general suitability of the soil characteristics for residential construction. The locations of the test borings 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 1, Figure 4), previously the Soil Conservation Service (Reference 2) has mapped two 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
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 and 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. The sandstone was encountered at very dense states and moderate moisture conditions. The samples of sandstone tested had 10 to 21 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing on a sample of clayey sandstone resulted in a liquid limit of 26 and a plastic index of 8, and non-plastic results for the silty sandstone. 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 feet. Groundwater is not anticipated to affect shallow foundations on the majority of 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 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 claystone or siltstone.

The geology of the site was evaluated using the *Geologic Map of the Monument Quadrangle,* by Thorson and 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 Monument 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 Denver 1° x 2° Quadrangle,* distributed by the US Geological Survey in 1981 (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 downslope creep areas. Potential Hazards including expansive soils and minor drainage swales, have also been addressed. These hazards and recommended mitigation techniques are discussed as follows:

Expansive Soils

Expansive soils were not encountered on the site. 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

Several minor drainage swales exist on the site. No water was observed flowing in the drainage swales 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). Due to the size of the proposed lots these areas can either 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. 08041CO295G dated December 7, 2018 (Figure 7, Reference 7). Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Downslope Creep Areas

The area identified with this hazard includes the steeper slopes along the ridges across the site. In these areas we would anticipate lateral and vertical movement of the near surface soils in the downslope direction. These areas will be avoided by the proposed structures; however, they are acceptable for building sites with the following constraints on construction.

Mitigation: This type of movement will increase lateral pressures against foundation walls on the uphill side of structures. The design of foundations in these areas should account for this additional pressure. A lateral pressure detail is shown in Figure 8. Where possible in areas of downslope creep, structures should be designed to be as compact and rigid as possible. This will help them better tolerate the vertical and lateral movements to which the foundation system may be subjected with minimal damage. Long, rambling, irregular structures should be avoided in these areas as they are associated with a much greater potential for damaging differential movement. Due to lot size, it is anticipated that the majority of the downslope creep areas can be avoided as building sites. Reinforcement or tie beams in the foundation may be necessary where the structures encroach on the downslope creep area. Any cuts steeper than 3:1 should be retained by walls designed for the sloping conditions.

RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

The proposed development will be rural-residential utilizing individual on-site wastewater treatment systems and water wells. Total acreage involved in the proposed subdivision is 28.62-acres. Four rural residential lots are proposed as part of the replat. The proposed lot sizes range from 5.01-acres to 13.63-acres. An existing house is located on Lot 1 which 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 conditions on the site include downslope creep, 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 states, and the sandstone was encountered at very dense states. Shallow sandstone bedrock was encountered at one foot in all 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.

Minor drainage swales exist on the site. No water was observed flowing in these drainages, however, the potential for seasonal shallow groundwater exists in these areas during periods of high runoff. According to the development plan, these areas will 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.

Areas of downslope creep were observed across the site, and are indicated on Figure 6. The areas identified with this hazard includes the steeper slopes along the ridges across the site. In these areas we would anticipate lateral and vertical movement of the near surface soils in the downslope direction. These areas will be avoided by the proposed structures; however, structures may encroach on these areas. In areas of downslope creep, structures should be designed to be as compact and rigid as possible. Foundations may require tie-beams or additional foundation reinforcement in these areas. Foundations should be designed to step up the slopes to avoid deep cuts. Deep cuts should be avoided on all steeper sloping areas of the site. Any retaining walls should be designed for the global slope stability by a qualified professional engineer. This includes cuts made for terracing in backyards.

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 Delroy Johnson, 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

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

Reviewed by:

COLORADO LICENSED
JOSEPH COLLIN GOODE
23725
4/8/21
PROFESSIONAL ENGINEER

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

LLL/lll

Encl.

Entech Job No. 202746
AAprojects/2020/202746 sg&ghs-rev

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TABLE

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT DELROY JOHNSON
PROJECT 14502 HIGHWAY 83
JOB NO. 202746

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	10			13.3						SM	SANDSTONE,S ILTY
1	2	2-3			15.8						SM	SANDSTONE, SILTY
1	3	5			21.0	26	8	<0.01			SC	SANDSTONE, CLAYEY
1	4	10			11.4						SM-SW	SANDSTONE, SLIGHTLY SILTY
1	5	5			9.5						SM-SW	SANDSTONE, SLIGHTLY SILTY
1	6	2-3			19.3	NV	NP	0.00			SM	SANDSTONE, SILTY

FIGURES

N

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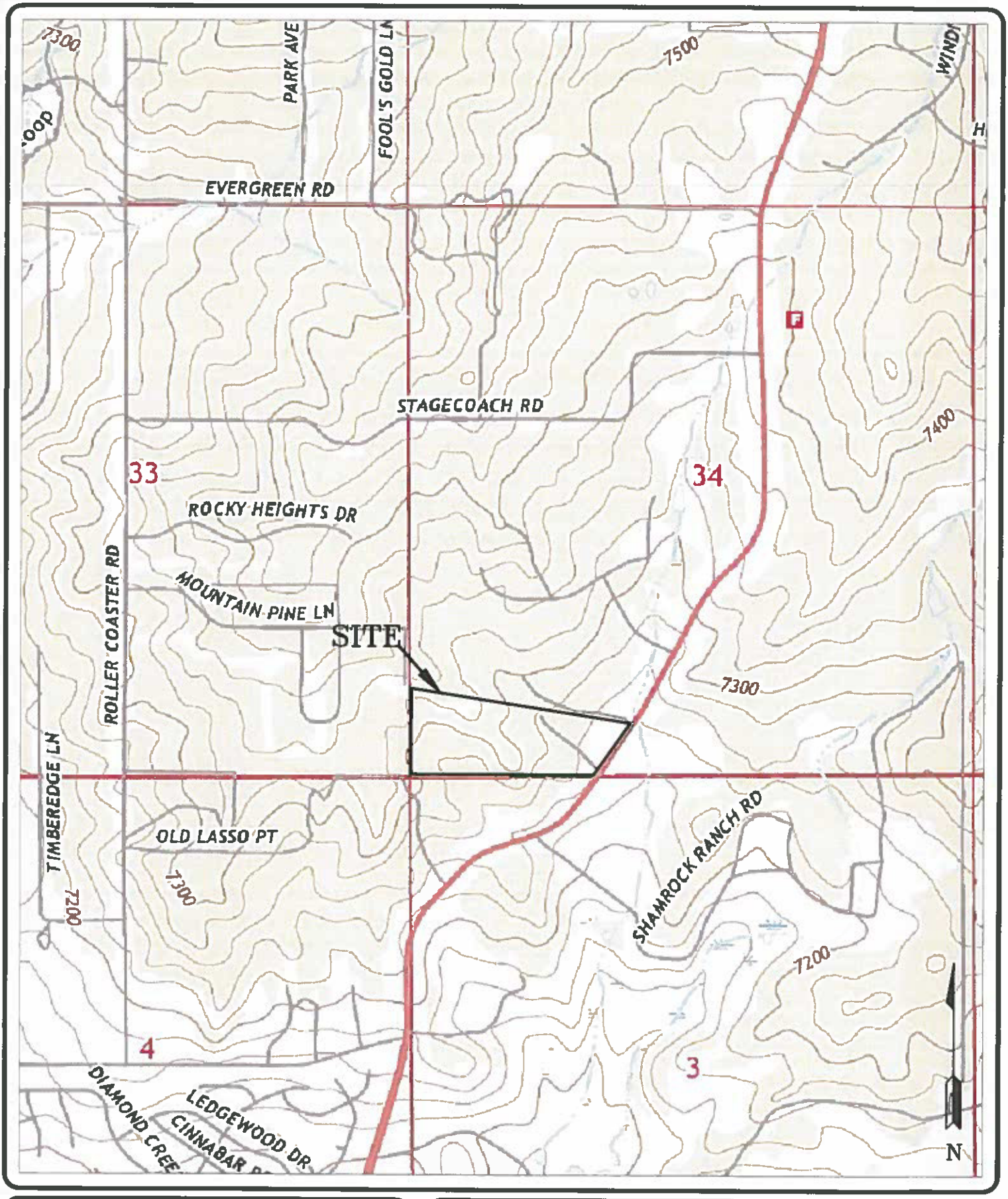
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

VICINITY MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/18/20		

JOB NO.: 202746

FIG NO.: 1



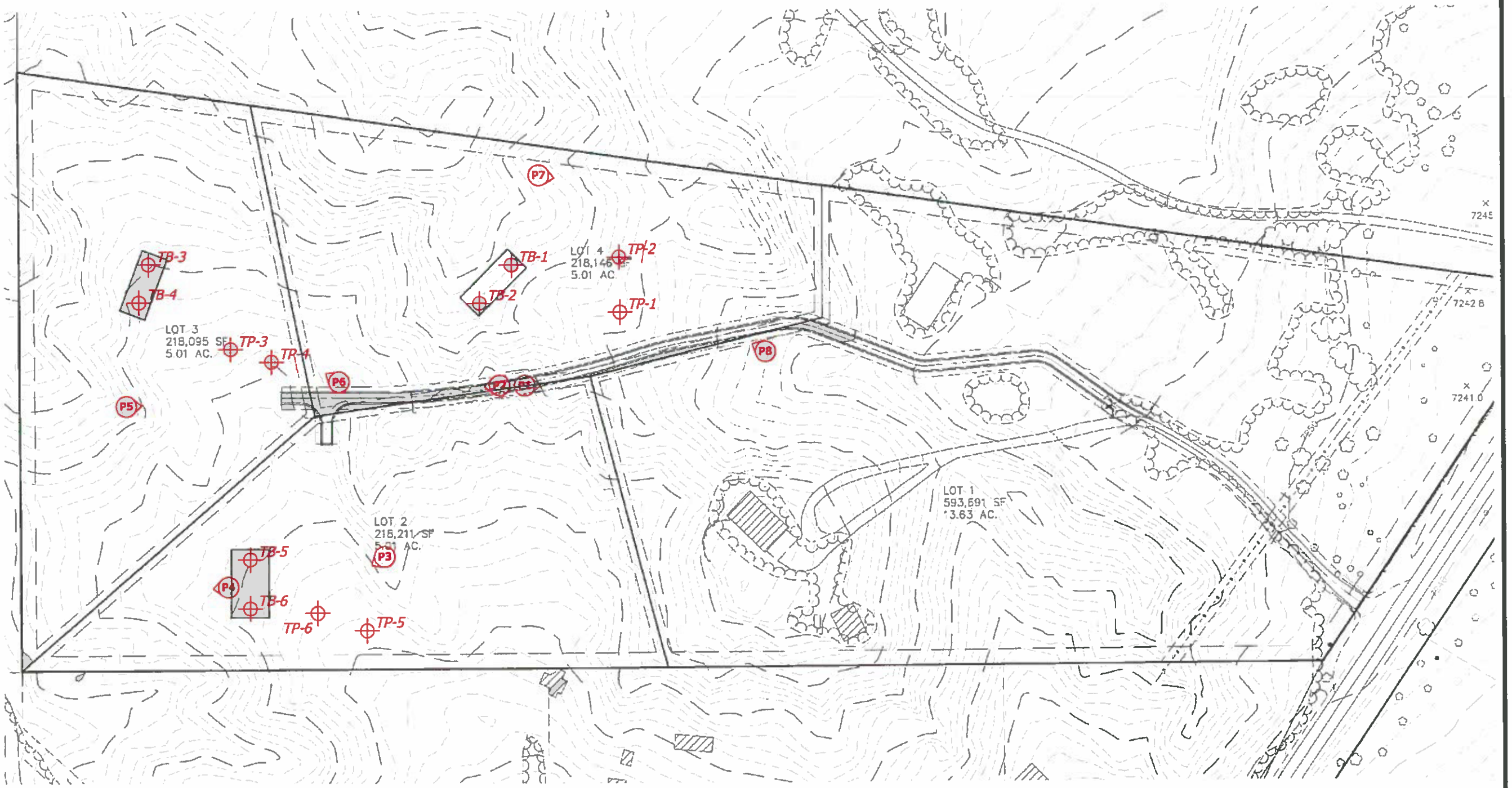
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

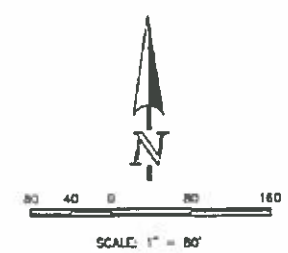
USGS MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/18/20		

JOB NO.: 202746

FIG NO.: 2





CLASSIC CONSULTING

JOHNSON SUBDIVISION NO. 1
LOT LAYOUT

DESIGNED BY	MAW	SCALE	DATE

- approximate test pit location and number

REVISION	BY

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

SITE PLAN/TESTING LOCATION MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN: LLL
CHECKED:
DATE: 12/16/20
SCALE: AS SHOWN
JOB NO.: 202746
FIGURE No.: 3

N

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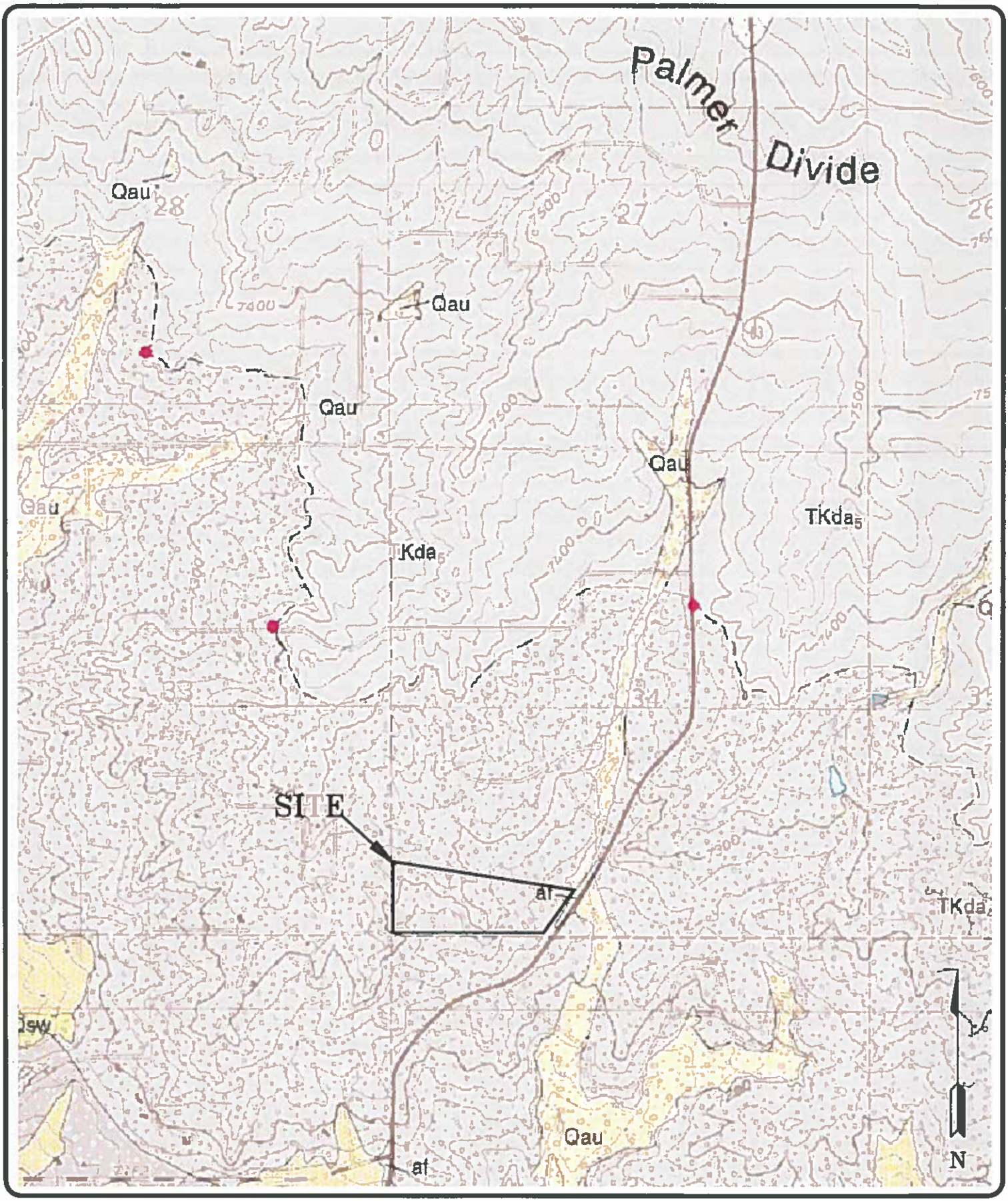
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SOIL SURVEY MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/18/20		

JOB NO.: 202746

FIG NO.: 4



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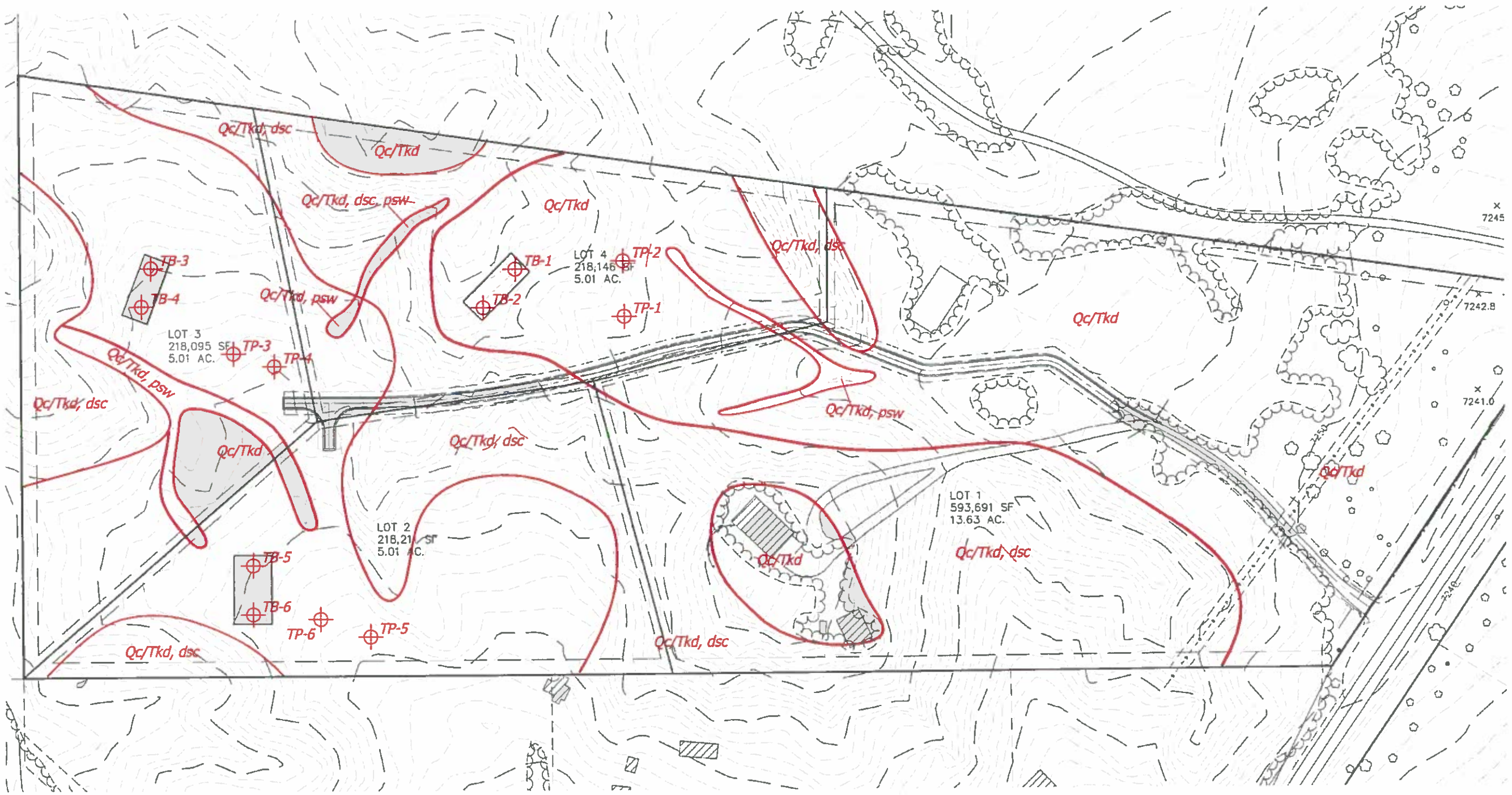
COLORADO SPRINGS, CO. 80907 (719) 531-5599

MONUMENT QUADRANGLE GEOLOGIC MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/18/20		

JOB NO.: 202746

FIG NO.: 5



N

80 40 0 80 160

SCALE: 1" = 80'

CLASSIC CONSULTING

JOHNSON SUBDIVISION NO. 1
LOT LAYOUT

DESIGNED BY	MAW	SCALE	DATE 12,

Legend:

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

dsc - downslope creep
psw - potentially seasonal shallow groundwater area

REVISION	BY

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

GEOLOGY/ENGINEERING GEOLOGY MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN: LLL
CHECKED:
DATE: 3/31/21
SCALE: AS SHOWN
JOB NO.: 202746
FIGURE No.: 6

N

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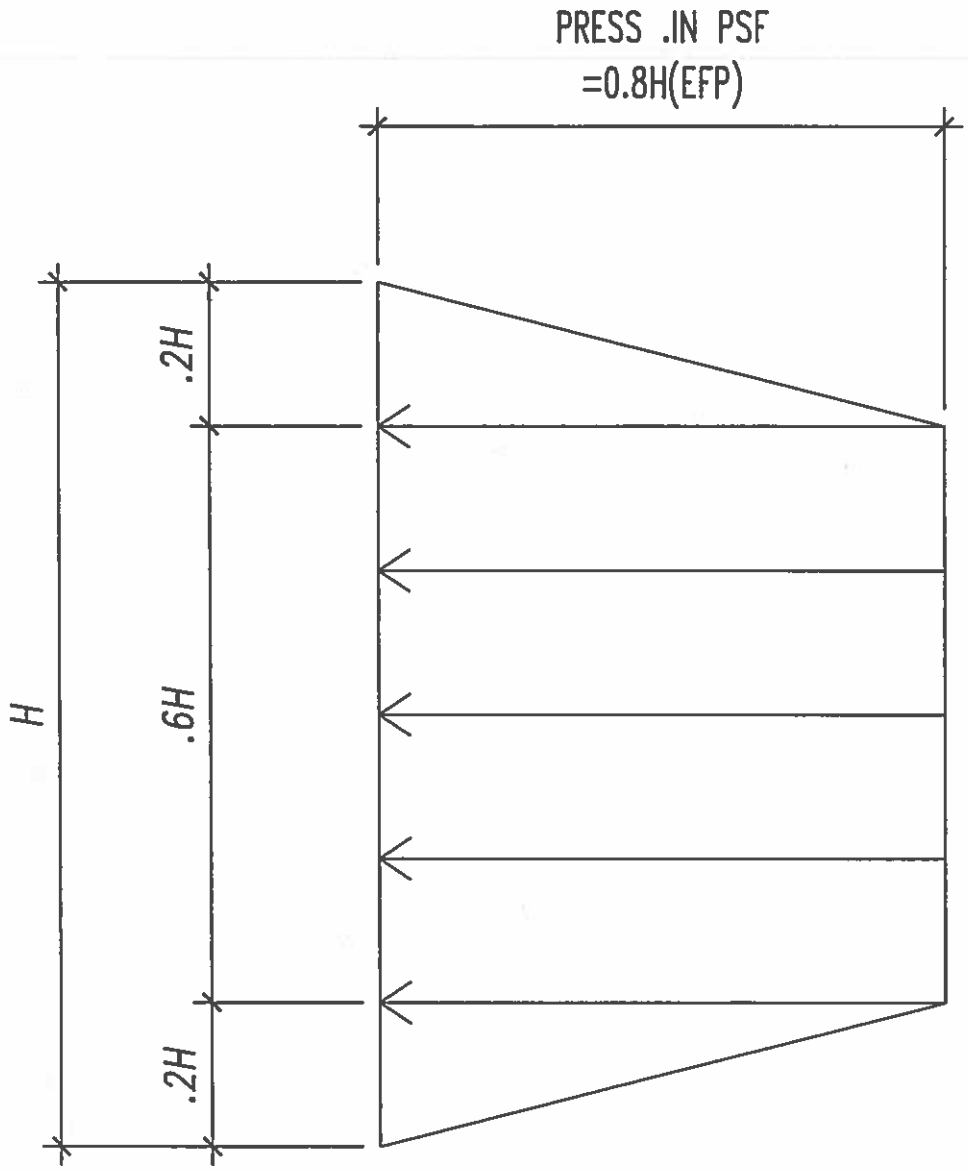
305 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

FEMA FLOODPLAIN MAP
JOHNSON SUBDIVISION NO. 1
14502 HIGHWAY 83
EL PASO COUNTY, CO.
FOR: DELROY JOHNSON

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/18/20		

JOB NO.: 202746

FIG NO.: 7



PRESSURE DISTRIBUTION

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

LATERAL PRESSURE DISTRIBUTION
AREA WITH CREEP

DRAWN BY:	DATE DRAWN:		
R MCBRIDE	03/13/13		

JOB NO.: 202746

FIG. NO.: 8

APPENDIX A: Photographs

1

Looking east along proposed roadway through the central portion of the site.

December 9, 2020

2

Looking west along proposed roadway through the central portion of the site.

December 9, 2020

Job No. 202746

3

Looking southwest from the central portion of Lot 2.

December 9, 2020

4

Looking west from the southwestern portion of the site.

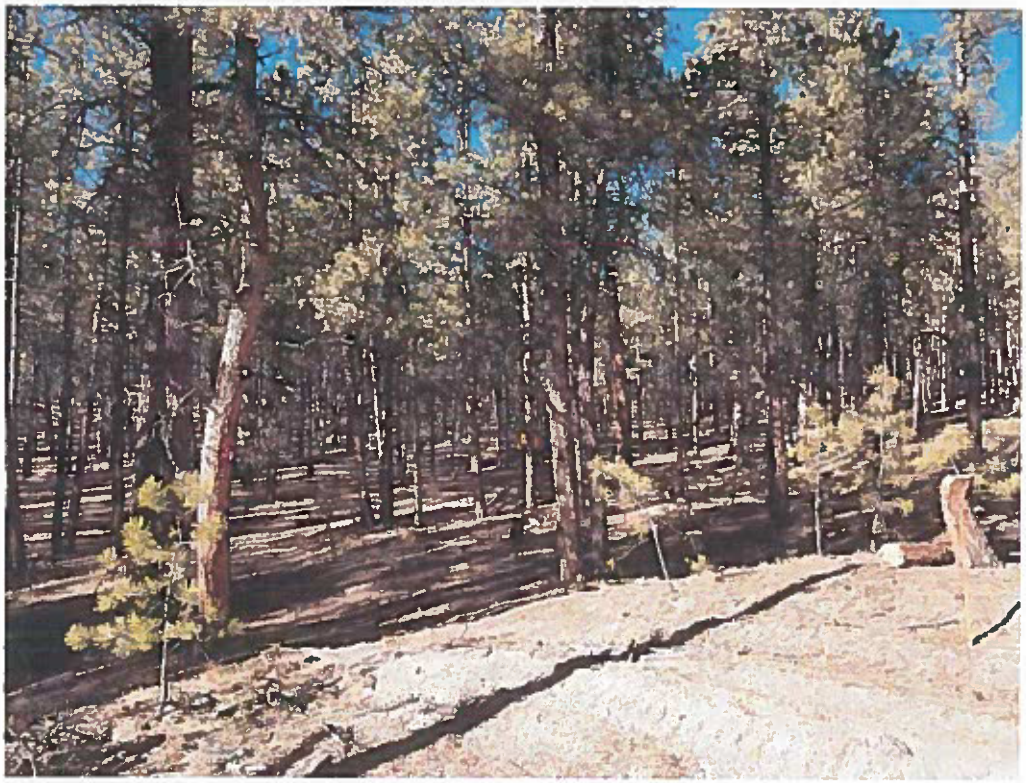
December 9, 2020

Job No. 202746

5

Looking east from the west central portion of the site.

December 9, 2020

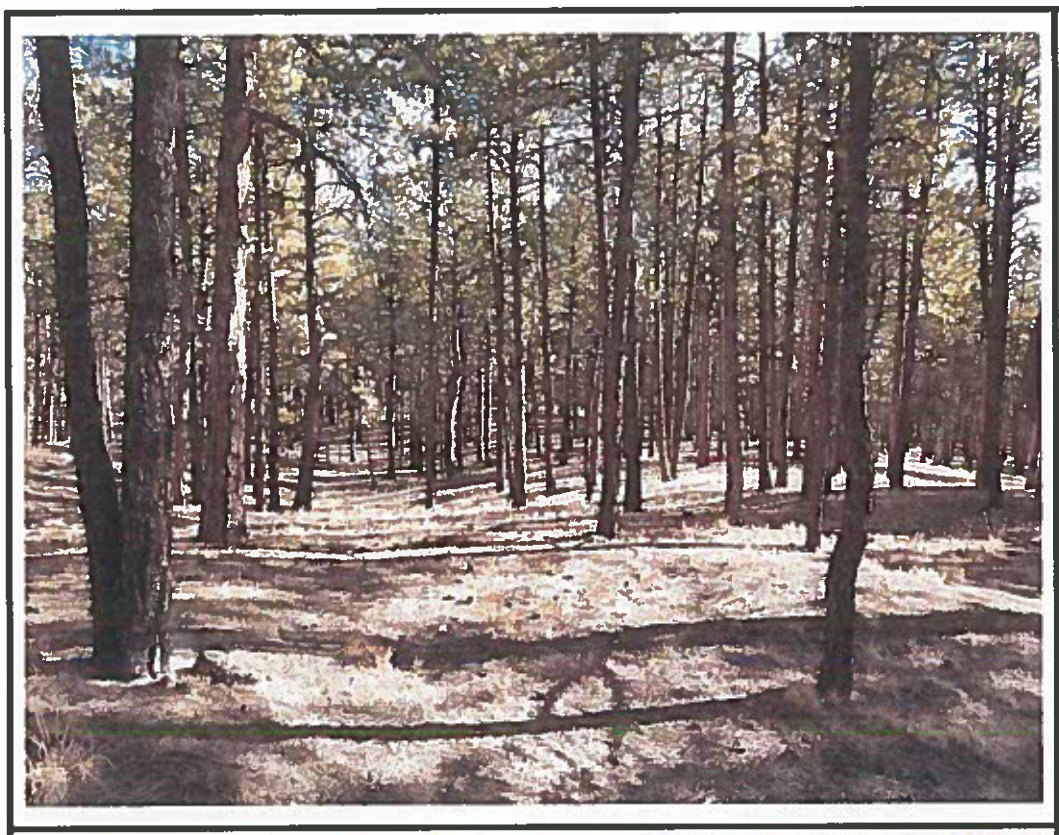


6

Looking northwest towards Lot 3 from west end the proposed road.

December 9, 2020

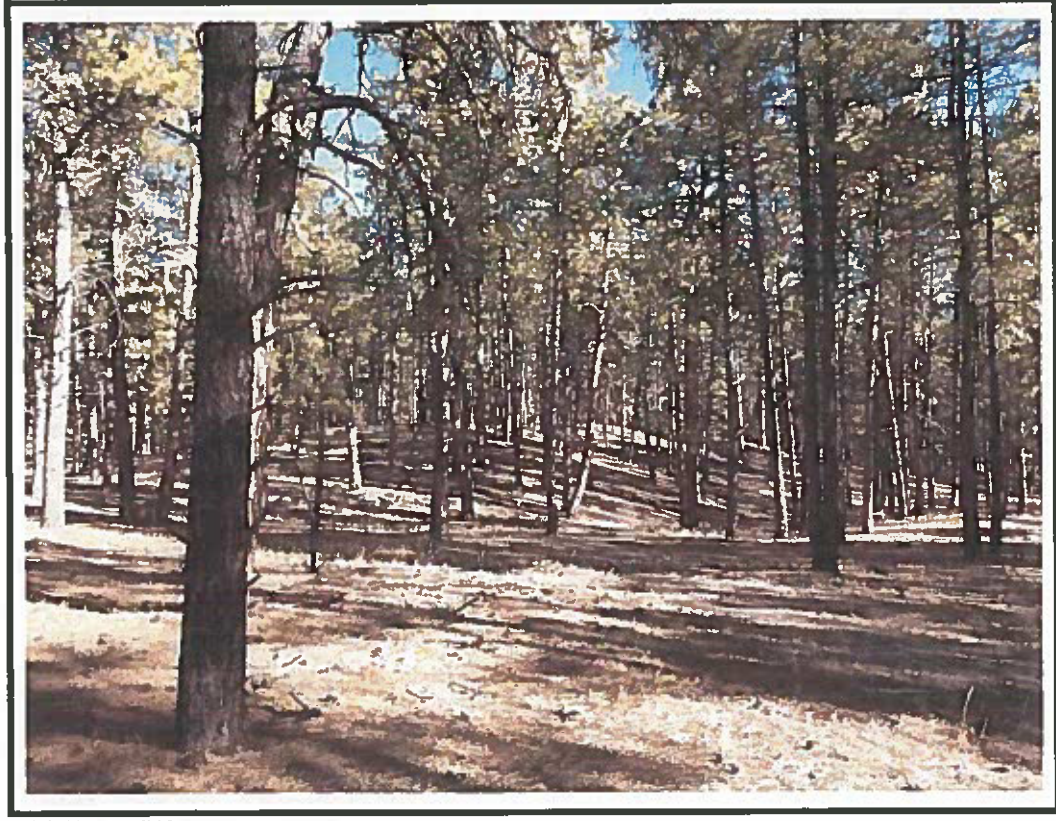
Job No. 202746



7

Looking south along head of minor drainage in the southern portion of the site.

December 9, 2020



8

Looking northwest from the east central portion of site.

December 9, 2020

Job No. 202746

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 12/18/2020
Job # 202746

REMARKS

LOT 4

DRY TO 15',
12/18/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, BROWN SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, DRY TO MOIST				
		■	50 / 7"	2.8	1
5		■	50 / 11"	3.6	1
10		■	50 / 6"	6.9	1
15		■	50 / 4"	7.5	1
20					

TEST BORING NO. 2
DATE DRILLED 12/18/2020
CLIENT DELROY JOHNSON
LOCATION 14502 HIGHWAY 83

REMARKS

LOT 4

DRY TO 15',
12/18/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, BROWN SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST				
		■	50 / 8"	4.2	1
5		■	50 / 6"	5.8	1
10		■	50 / 4"	7.3	1
15		■	50 / 4"	6.7	1
20					

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COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 12/18/2020
Job # 202746

REMARKS

LOT 3

DRY TO 15',
12/18/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			47	4.1	1
5			46	4.1	1
10			50 / 6"	8.9	1
15			50 / 4"	6.6	1
20					

SAND, SILTY, BROWN
WEATHERED TO FORMATIONAL
SANDSTONE, SILTY TO CLAYEY,
FINE GRAINED, TAN, DENSE TO
VERY DENSE, MOIST

TEST BORING NO. 4
DATE DRILLED 12/18/2020
CLIENT DELROY JOHNSON
LOCATION 14502 HIGHWAY 83

REMARKS

LOT 3

DRY TO 15',
12/18/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50 / 11"	2.4	1
5			50 / 3"	8.1	1
10			50 / 4"	8.5	1
15			50 / 3"	8.8	1
20					

SAND, SILTY, BROWN
SANDSTONE, SLIGHTLY SILTY,
FINE TO COARSE GRAINED, TAN,
VERY DENSE, DRY TO MOIST

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 1/6/21

JOB NO.: 202746
FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 12/18/2020
Job # 202746

REMARKS LOT 2 DRY TO 15', 12/18/20	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, BROWN SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO VERY DENSE, DRY TO MOIST				46	4.6	1
	5			50/4"	7.9	1
	10			50/4"	8.3	1
	15			50/4"	10.4	1
	20					

TEST BORING NO. 6
DATE DRILLED 12/18/2020
CLIENT DELROY JOHNSON
LOCATION 14502 HIGHWAY 83

REMARKS LOT 2 DRY TO 15', 12/18/20	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, BROWN WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST TO DRY				34	3.8	1
	5			50/5"	2.9	1
	10			50/4"	6.8	1
	15			50/4"	10.7	1
	20					

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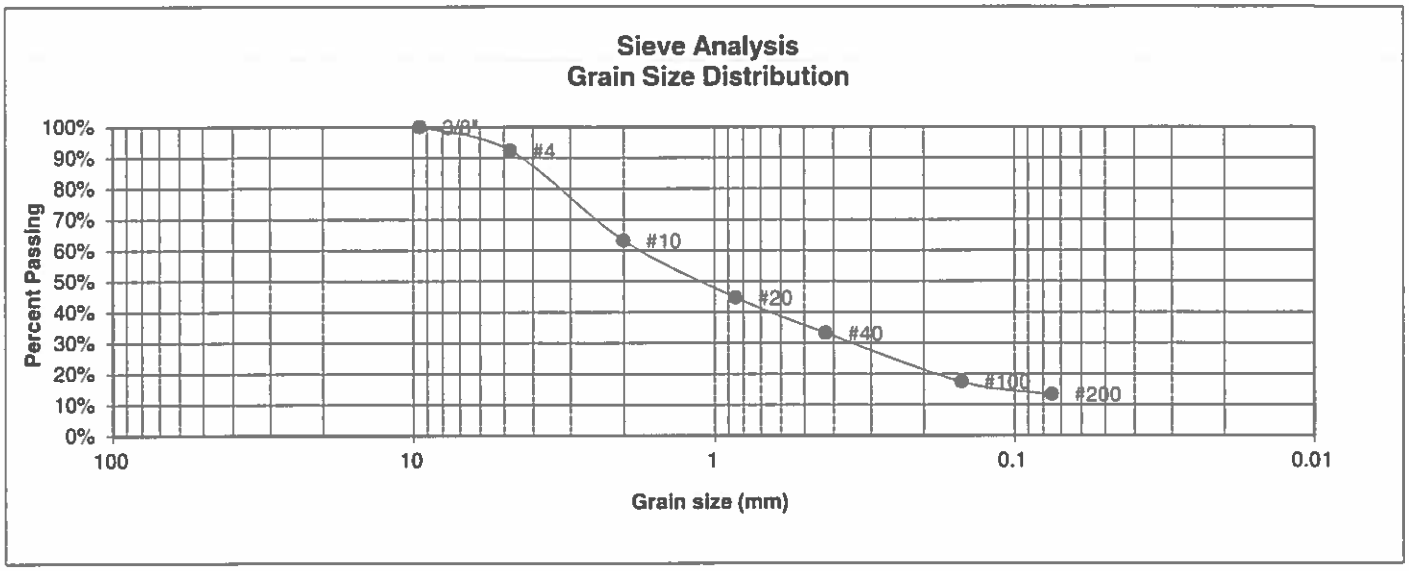
TEST BORING LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 1/6/21

JOB NO. 202746
FIG NO. B-3

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	1	JOB NO.	202746
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.4%
10	63.2%
20	44.7%
40	33.2%
100	17.4%
200	13.3%

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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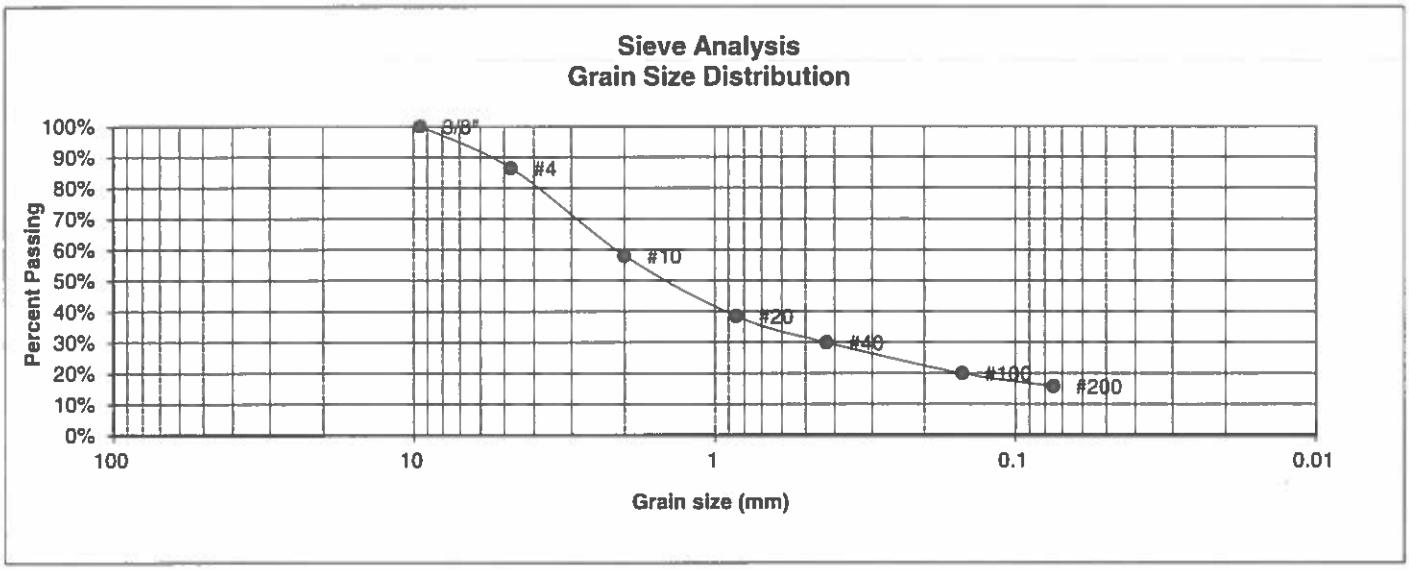
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO: 202746

FIG NO: C-1

UNIFIED CLASSIFICATION	SM	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	2	JOB NO.	202746
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	86.5%
10	58.0%
20	38.5%
40	29.9%
100	19.9%
200	15.8%

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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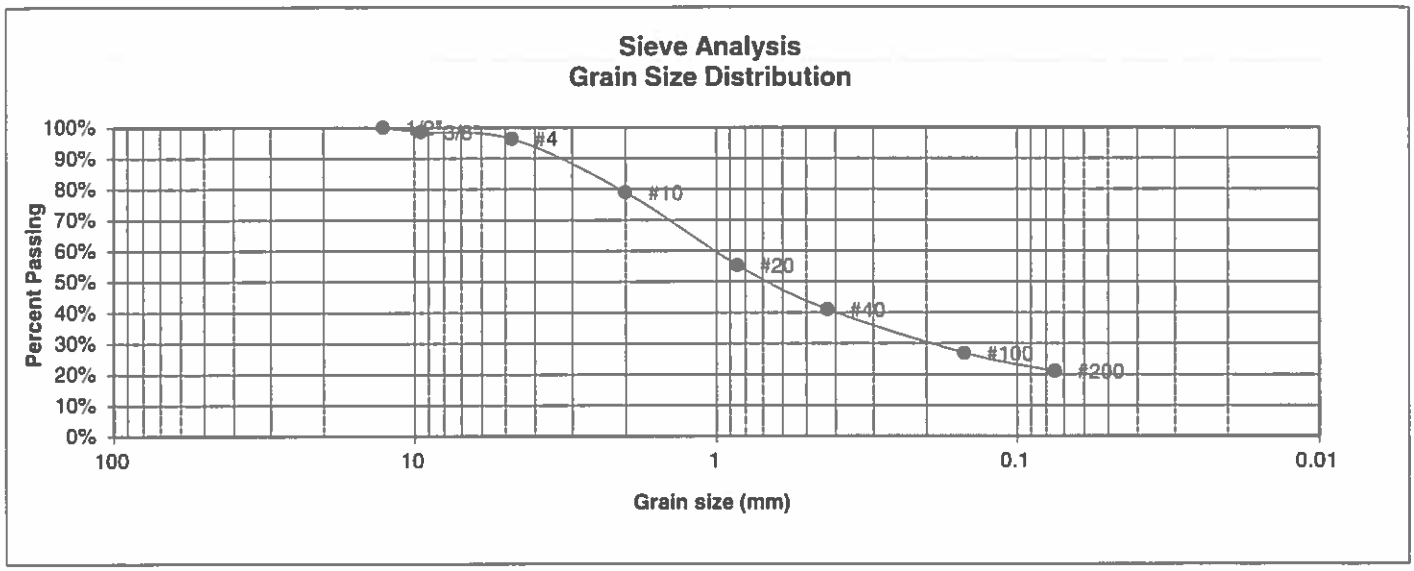
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
		LLL	1/6/21

JOB NO. 202746

FIG NO. C-2

UNIFIED CLASSIFICATION	SC	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	3	JOB NO.	202746
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.6%
4	96.4%
10	79.0%
20	55.3%
40	41.0%
100	26.9%
200	21.0%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	26
Plastic Index	8

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

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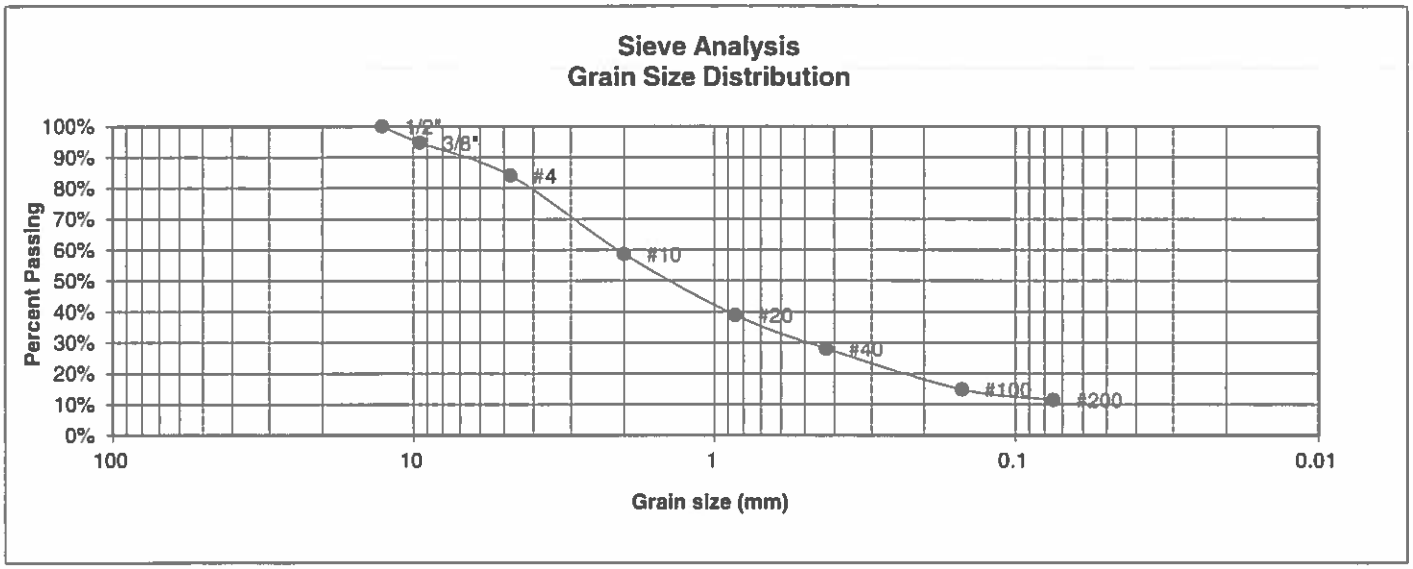
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746

FIG NO.: C-3

UNIFIED CLASSIFICATION	SM-SW	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	4	JOB NO.	202746
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	94.7%
4	84.1%
10	58.6%
20	38.9%
40	28.0%
100	14.8%
200	11.4%

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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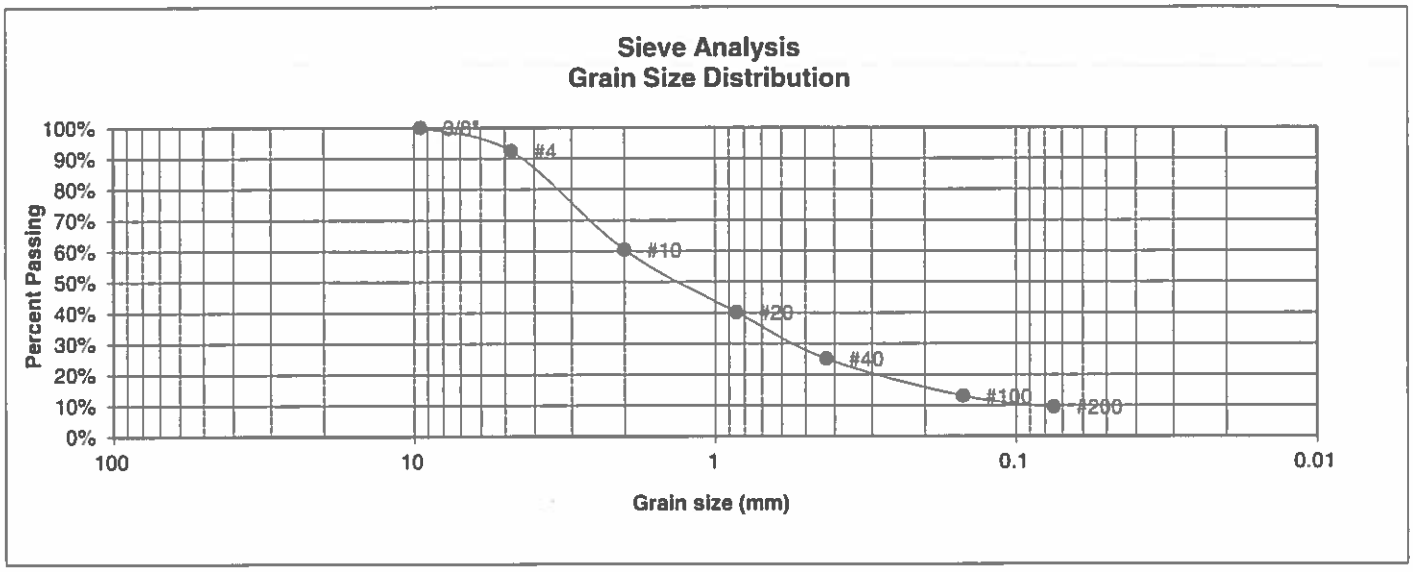
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746

FIG NO.: C-4

UNIFIED CLASSIFICATION	SM-SW	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	5	JOB NO.	202746
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.4%
10	60.4%
20	40.1%
40	25.1%
100	13.0%
200	9.5%

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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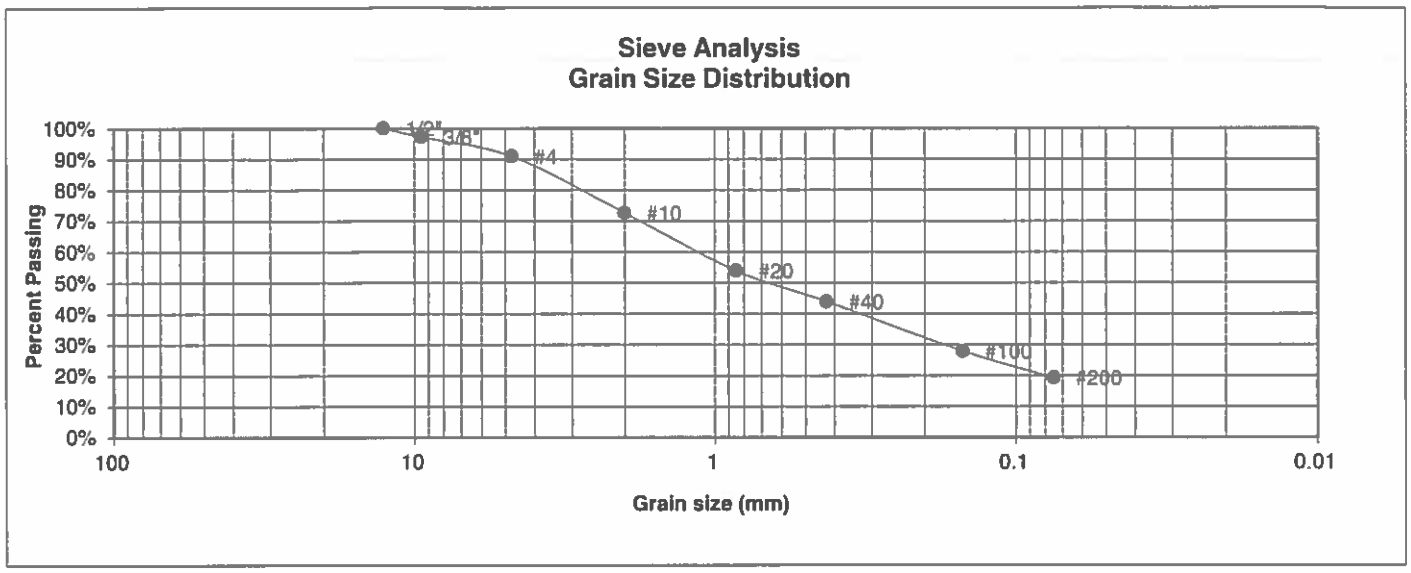
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746

FIG NO.: C-5

UNIFIED CLASSIFICATION	SM	CLIENT	DELROY JOHNSON
SOIL TYPE #	1	PROJECT	14502 HIGHWAY 83
TEST BORING #	6	JOB NO.	202746
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.2%
4	90.9%
10	72.6%
20	53.9%
40	43.9%
100	27.9%
200	19.3%

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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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746

FIG NO.: C-6

CLIENT	DELROY JOHNSON	JOB NO.	202746
PROJECT	14502 HIGHWAY 83	DATE	12/23/2020
LOCATION	14502 HIGHWAY 83	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-3	5	1	SC	<0.01
TB-6	2-3	1	SM	0.00

QC BLANK PASS

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LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	1/6/21

JOB NO.: 202746

FIG NO.: C-7

APPENDIX D: Soil Survey Descriptions

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