



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
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**GEOLOGIC HAZARD INVESTIGATION
SPRINGS RANCH
TAX SCHEDULE NOS. 53301-00-009,
AND 53301-00-020
COLORADO SPRINGS, COLORADO**

Prepared for:

Elite Properties of America, Inc.
6385 Corporate Drive, Suite 200
Colorado Springs, CO 80919

Attn: Jim Bouton

September 5, 2019

Job No. 191264

**LAND USE REVIEW DIVISION
PLANNING & COMMUNITY DEVELOPMENT DEPARTMENT**



CITY OF COLORADO SPRINGS

APPLICATION FORM FOR GEOLOGIC HAZARD REPORT

Applicant: Elite Properties of America, Inc. Telephone 719-592-9333 Fax _____

Address: 6385 Corporate Drive, Suite 200 Zip Code 80919 e-mail jboulton@classichomes.com

Premises Involved: Development Plan/Subdivision Plat Name: Springs Ranch

Tax Schedule No(s). 53301-00-009 and 53301-00-020

(This can be obtained from the El Paso County Tax Assessor located at 27 E. Vermijo Avenue on the 2nd Floor; phone: 520-6600 or at their web site <http://www.land.elpasoco.com>)

GEOLOGIC HAZARD REPORT REQUIRED: (FIVE (5) PRELIMINARY COPIES)

An application review fee will be required to accompany these applications (make checks payable to City of Colorado Springs). The fee schedule is as follows:

Review of Geologic Hazard Reports	<u>City Planning Fee:</u> \$300 plus any Colorado Geological Survey Review Cost Over \$300
	<u>City Engineering Fee:</u> \$284

The following documents have been included and considered as part of this report (checked off by individual(s) preparing the geologic report):

Development Plan: _____

Landscape Plan (if applicable): _____

Grading Plan: _____

Drainage Report (necessary if debris and/or mud flow hazard is present): _____

ENGINEERS STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of Section 504 of the Geologic Hazards Ordinance of Colorado Springs. I am qualified as:

Professional Geologist as defined by CRS 34-1-201(3); or,

Professional Engineer as defined by Board Policy Statement 50.2 - "Engineering in Natural Hazard Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. Board authority as defined by CRS 12-25-107(1).

Submitted by: *Kristen A. Andrew-Hoeser* Date: 9/5/19
Kristen A. Andrew-Hoeser, P.G., Entech Engineering, Inc.

This Geologic Hazard Study is filed in accordance with the Zoning Code of the Code of the City of Colorado Springs, 2001, as amended.

City Engineer Date

City Planning Director Date

September 5, 2019

Elite Properties of America, Inc.
6385 Corporate Drive, Ste. 200
Colorado Springs, CO 80919



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ENGINEERING, INC.

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COLORADO SPRINGS, CO 80907
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Attn: Jim Boulton

Re: Geologic Hazard Investigation
Springs Ranch
Tax Schedule Nos. 53301-00-009 and 53301-00-020
Colorado Springs, Colorado

Dear Mr. Boulton:

As requested, personnel of Entech Engineering, Inc. have investigated the above-referenced site to evaluate the conditions with respect to geology and geologic hazards affecting development of the site. The site is located to the north of Carefree Circle North between Tutt Boulevard and Peterson Road, in the eastern portion of Colorado Springs, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The site is located in a portion of the E½ of Section 30, Township 13 South, Range 65 West, of the 6th Principal Meridian in Colorado Springs, Colorado. The topography of the site is generally gradually sloping to the south and west with some moderate slopes along the drainage west of the site. Sand Creek is located along the western edge of the site and flows in a southerly direction. Water was observed flowing in the creek at the time of our site observations. The approximate location of the site is shown on the USGS Map, Figure 2. Site photographs taken August 27, 2019, are included in Appendix A. The locations and directions of these photographs are indicated on Figure 3.

The site is zoned as R1-6 (single-family residential, 6000 sq-ft, agricultural), and does not lie in the Hillside Overlay (Reference 1). The site is currently occupied by a golf course with existing residential development to the north, east, and south and the Sand Creek Drainage to the west. Vegetation consists of golf course grasses with areas of field grasses and weeds with scattered trees located along the edges of the golf course. The proposed development is to consist of a single-family residential development and associated site improvements. The proposed Site Plan is presented in Figure 4. The overall site plan for the golf course is presented in Figure 4A. Minimal site grading is anticipated.

A Preliminary Subsurface Soil Investigation was performed on the site by Entech Engineering, Inc., dated August 30, 2019 (Reference 2). The Preliminary Subsurface Soil Investigation consisted of drilling seven test borings on the site. The test boring locations are indicated on Figure 3. The Test Boring Logs are included in Appendix B. Laboratory Test Results are included in Appendix C and are summarized in Table 1. Information from this report was used in evaluating the site.

The scope of this report includes a geologic analysis of the site utilizing published geologic data, subsurface soils information and site-specific mapping of major geologic features, and identification of geologic hazards with respect to proposed development with recommended mitigation techniques.

Elite Properties of America, Inc.
Geologic Hazard Investigation
Springs Ranch
Tax Schedule Nos. 53301-00-009 and 53301-00-020
Colorado Springs, Colorado

GEOLOGIC CONDITIONS

The geology of the site was evaluated using the *Preliminary Subsurface Soil Investigation* by Entech Engineering (Reference 2), the *Geologic Map of the Falcon NW Quadrangle* by Madole, distributed by the Colorado Geological Survey (CGS) in 2003 (Reference 3, Figure 5), the *Reconnaissance Geologic Map of Colorado Springs* by Scott and Wobus, 1973 (Reference 4), the *Geologic Map of Colorado Springs – Castle Rock Area* by Trimble and Machette, 1979 (Reference 5), and site-specific mapping of the site. The Geology Map prepared for the site is presented in Figure 6.

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 the southern edge of a large structural feature known as the Denver Basin. The rocks in this area are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site consists of the Dawson Formation. Overlying this formation are alluvial soils of Quaternary Age. Six mappable units were identified on this site which are described as follows:

- Qal** **Recent Alluvium of Holocene Age:** These are recent stream deposits actively being deposited along Sand Creek. They typically consist of silty to clayey sands and clays and may contain areas of highly organic soils and/or debris. This formation correlates with Qay₁ in the CGS mappings.
- Qaf** **Artificial Fill of Holocene Age:** These are man-made fill deposits associated with drainage improvements along Sand Creek.
- Qp** **Piney Creek Alluvium of Holocene Age:** These materials consist of low stream terrace deposits. The Piney Creek Alluvium typically consists of silty to clayey sands and is usually highly stratified, containing lenses of silt or clay. This formation correlates with Qay₂ in the CGS mappings.
- Qb** **Terrace Alluvium of Pleistocene Age:** These materials consist of middle stream terrace deposits. The Broadway Alluvium typically consists of silty to clayey gravelly sands. This deposit is usually highly stratified and may contain lenses of silt and clay. This formation correlates with Qam in the CGS mappings.
- Qes/Tkd** **Eolian Sand of Quaternary Age overlying the Dawson Formation of Tertiary to Cretaceous Age:** These consist of wind-blown sand deposits encountered in the test borings and observed on the site. They typically consist of silty sands and have low density. The eolian sands were observed as a variable layer above the Dawson Formation.
- Tkd** **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson formation typically consists of arkosic sandstone with interbedded layers of siltstone and claystone. Overlying the Dawson Formation is a variable layer of residual soils derived from the in-site weathering of the bedrock materials on-site. The materials typically consist of silty to clayey sands and sandy clays.

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SOILS

Three soil and bedrock types were encountered in the test borings drilled for the subsurface investigation (Reference 2) Type 1: slightly silty to silty and clayey sand (SM-SW, SM, SC), Type 2: sandy clay (CL), and Type 3: silty to very clayey sandstone bedrock (SM, SC). Each soil type was classified in accordance with the Unified Soil Classification System (USCS) using the laboratory testing results and the observations made during drilling.

Soil Type 1 classified as slightly silty to silty sand and clayey sand (SW-SM, SC, SM). The sand was encountered in all of the test borings at the existing ground surface and extending from 7 feet below the existing ground surface and to the termination of the test borings, 20 feet bgs. Standard Penetration Testing conducted on the sand resulted in N-values ranging between 4 to 35 blows per foot (bpf), which indicated loose to dense states. Moisture content and grain size testing resulted in moisture contents of 2 to 27 percent with 11 to 34 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits testing performed on a sample resulted in a liquid limit of 27 and plastic index of 11. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 classified as sandy clay (CL). The sandy clay was encountered in Test Boring No. 2 underlying Soil Type 1 at a depth of 14 feet, extending to 19 feet bgs. Standard Penetration Testing conducted on the sandy clay resulted in an N-value of 22 blows per foot (bpf) which indicates stiff consistencies. Moisture content and grain size testing resulted in a moisture content of 28 percent with 74 percent of the soil size particles passing the No. 200 sieve on one sample tested. Atterberg Limits testing performed on the sample resulted in a liquid limit of 43 and plastic index of 19. Swell/Consolidation testing resulted in no volume change, indicating no expansion potential. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 3 classified as silty sandstone and very clayey sandstone (SM, SC). The sandstone was encountered in Test Boring Nos. 1, 2, and 4 underlying Soil Types 1 and 2 at depths of 7 to 19 feet and extending to the termination of the test borings, 15 to 20 feet bgs. Standard Penetration Testing conducted on the sandstone resulted in N-values of 44 to greater than 50 blows per foot (bpf) which indicates dense to very dense states. Moisture content and grain size testing resulted in moisture contents of 11 to 27 percent with 24 to 46 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits testing performed on a sample of very clayey sandstone resulted in a liquid limit of 43 and plastic index of 29, and a test on a sample of silty sandstone resulted in non-plastic results. Swell/Consolidation testing resulted in a consolidation of 0.3 percent, indicating a low consolidation potential. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

GROUNDWATER

Depth to groundwater was measured in each of the borings at the conclusion and subsequent to drilling. Groundwater was encountered in all of the seven test borings at depths ranging from 11 to 20 feet. Groundwater depths are indicated on the Test Boring Logs, Appendix B. It is anticipated groundwater should not affect the final construction on the majority of the site if the excavation depths are kept shallow for the foundations. Unstable soil conditions should be

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expected where excavations approach the groundwater level. Soil stabilization using shot rock or geogrids can be used to stabilize excavations. The Sand Creek floodplain lies immediately west of the site. These areas are discussed in the following sections.

Water will also be encountered in deep utility trench excavations. Groundwater will affect the installation of drilled piers, should they be used. Casing of drill holes should be expected. It should be noted that groundwater levels could change due to seasonal variations, changes in land runoff characteristics and future development of nearby areas.

ENGINEERING GEOLOGIC HAZARDS

The geologic hazards identified on this site, include the potential for artificial fill, loose soils, expansive soils, and a floodplain which are indicated on the Geology/Engineering Geology Map, Figure 6. In accordance with the Geologic Hazards Ordinance of the City of Colorado Springs, the following geologic hazards have been addressed:

Artificial Fill

Artificial fill was observed immediately adjacent to the site and may be encountered in other areas of the site associated with the original golf course grading. Areas of fill other than those mapped may be encountered. Uncontrolled fill encountered beneath foundations or floor slabs, should be removed and recompact to a minimum of 95 percent of its Maximum Modified Proctor Dry Density, ASTM D-1557.

Expansive Soils

The site is classified in an area of low swell potential according to *the Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 6). Expansive soils were encountered in the test borings drilled on-site. These clays can cause differential movement in foundations or floor slabs.

Mitigation:

Should expansive soils be encountered at or near foundation grade, mitigation will be necessary. Overexcavation and replacement with non-expansive soils at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. An overexcavation depth of 4 feet is anticipated, if required. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays.

Landslide Hazard

The site is not mapped within any past landslide deposits according to the *Map of Potential Areas of Landslide Susceptibility in Colorado Springs* by White and Wait, 2003, distributed by The Colorado Geological Survey (Reference 7, Figure 7). The majority of the site is gently to moderately sloping. The slopes along Sand Creek immediately west of the site are moderately steep. No unstable slopes or past or recent landslide features were observed on the site.

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Bedrock by Himmelreich and Noe in 1999 (Reference 11), the site lies east of the area mapped with steeply dipping bedrock (>30°). The bedrock in this area is gently dipping in a northeasterly direction according to the *Geologic Structure Map of the Pueblo 1x2 Quadrangle, South-Central Colorado* (1978) (Reference 12).

Radon

Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 13). Average Radon levels for the 80922-zip code has only one reading which was in the 0 < 4 pCi/l range. Adjacent zip codes 80915 and 80917 have averages of 2.15 and 2.56 pCi/l respectively. The following is a table of radon levels in this area:

<u>80915</u>		<u>80917</u>	
0 < 4 pCi/l	87.50%	0 < 4 pCi/l	76.47%
4 < 10 pCi/l	12.50%	4 < 10 pCi/l	23.53%
10 < 20 pCi/l	0.00%	10 < 20 pCi/l	0.00%
> 20 pCi/l	0.00%	> 20 pCi/l	0.00%

Mitigation:

While the majority of these readings are not excessive, the potential for high radon levels is present for the site. Build-up of radon gas can usually be mitigated by providing increased ventilation of basement and crawlspace and sealing joints. Specific requirements for mitigation should be based on site specific testing.

RELEVANCE OF GEOLOGIC CONDITIONS TO DEVELOPMENT

The proposed development is to consist of single-family residential development with associated site improvements. It is our opinion that the existing geologic and engineering geologic conditions will have some constraints on the proposed development and construction. The most significant problems affecting development will be that associated with the floodplain which can be avoided. Other conditions, such as expansive or loose soils or artificial fill can be satisfactorily mitigated through proper engineering design and construction practices. According to the development plan, the proposed building areas appear to be outside the floodplain zone.

Subsurface soil conditions encountered in the test borings drilled across the site generally consisted of sands and clays overlying sandstone bedrock. Fill may be encountered in the area of the golf course and along drainage improvements associated with Sand Creek. Expansive soils may be encountered that require removal and replacement with compacted non-expansive soils. Loose soils were also encountered that will require recompaction if encountered beneath foundations. These soils will not prohibit development.

According to the FIRM Map No. 08041CO539G (Reference 9, Figure 8) the Sand Creek drainage west of the site is in a floodplain zone. Based on the Concept Plan (Figure 4A), the building areas appear to lie outside the floodplain zone. Structures immediately adjacent to the drainage may require subsurface perimeter drains to help prevent the intrusion of water into areas below grade. Final floodplain locations should be determined in the Drainage Study. Finished floors must be located a minimum of one foot above the floodplain level. Specific drainage studies and exact floodplain locations are beyond the scope of this report.

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Debris Fans

Based on site observations, debris fans were not observed on the site.

Subsidence

Based on a review of a Subsidence Investigation Report for the Colorado Springs area by Dames and Moore, 1985 (Reference 8), the site is not undermined. The closest underground mines in the area are approximately 2 miles to the southwest and the area is not mapped within any potential subsidence zones.

Groundwater

Groundwater was encountered in the test borings at depths ranging from 11 to 20 feet. It is anticipated groundwater will not affect shallow foundations on the majority of the site. Groundwater may affect deep utility trench excavation and installation of drilled piers, should they be used. Casing of drill holes will likely be necessary. Unstable conditions should be expected where excavations approach the groundwater level. Stabilization using geogrids or shotrock may be necessary to stabilize the excavation. The foundation excavation should be kept shallow to maintain a minimum separation of 3 feet between the bottom of the footings and the groundwater table. Fluctuations in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Isolated sand layers within the variable soil profile, sometimes only a few feet in thickness and width, can carry water in the subsurface. Water may also flow on top of the bedrock. Builders should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site.

Floodplain and Drainage Areas

The Sand Creek Drainage immediately west of the site lies within a floodplain according to the FIRM Map, No. 08041CO539G (Reference 9, Figure 8). Based on the concept plan, it appears the proposed building areas appear to be outside the floodplain area. Final floodplain locations are conditional upon the approval of the Drainage Study. Finished floors must be a minimum of one foot above the floodplain level. Any site grading considered should be modified to direct surface flows around the structures or roads, or carried off-site so as to not produce any areas of ponded water around structures. Additionally, subsurface perimeter drains may be required, particularly for structures adjacent to the floodplain. Typically, perimeter drain details are presented in Figure 9. Specific drainage studies and exact floodplain locations are beyond the scope of this report.

Faults

The closest fault is the Rampart Range Fault, located approximately 10 miles to the west of the site. No faults are mapped on the site itself. Previously, Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. Additionally, the Uniform Building code (UBC), 1997 currently places this area in Seismic Risk Zone 1. According to a report by the Colorado Geological Survey by Robert M. Kirkman and William P. Rogers, Bulletin 43 (1981) (Reference 10), this area should be designed for Zone 2 due to more recent data on the potential for movement in this area, and any resultant earthquakes.

Dipping Bedrock

The bedrock underlying the site is the Dawson Formation of Tertiary to Cretaceous Age. According to the map of *Areas Susceptible to Differential Heave in Expansive, Steeply Dipping*

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Springs Ranch
Tax Schedule Nos. 53301-00-009 and 53301-00-020
Colorado Springs, Colorado

In summary, development of the site can be achieved if the above-mentioned site conditions are mitigated. These items can be mitigated through proper design and construction or avoidance. Additional recommendations have been made in the Preliminary Subsurface Soil Investigation by Entech Engineering, Inc. (Reference 2).

CLOSURE

It should be pointed out that because of the nature of data obtained by random sampling of such variable nonhomogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Construction and design personnel should be made familiar with the contents of this report.

This report has been prepared for Elite Properties of America, Inc., for application to the proposed project in accordance with generally accepted geologic, soil and engineering practices. No other warranty expresses 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 us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:



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

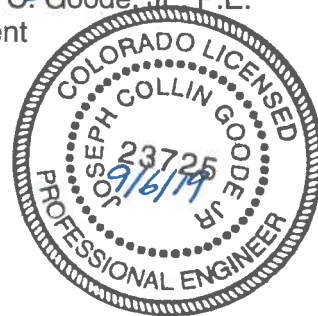
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Encl.

Entech Job No. 191264
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Joseph C. Goode, Jr. P.E.
President



BIBLIOGRAPHY

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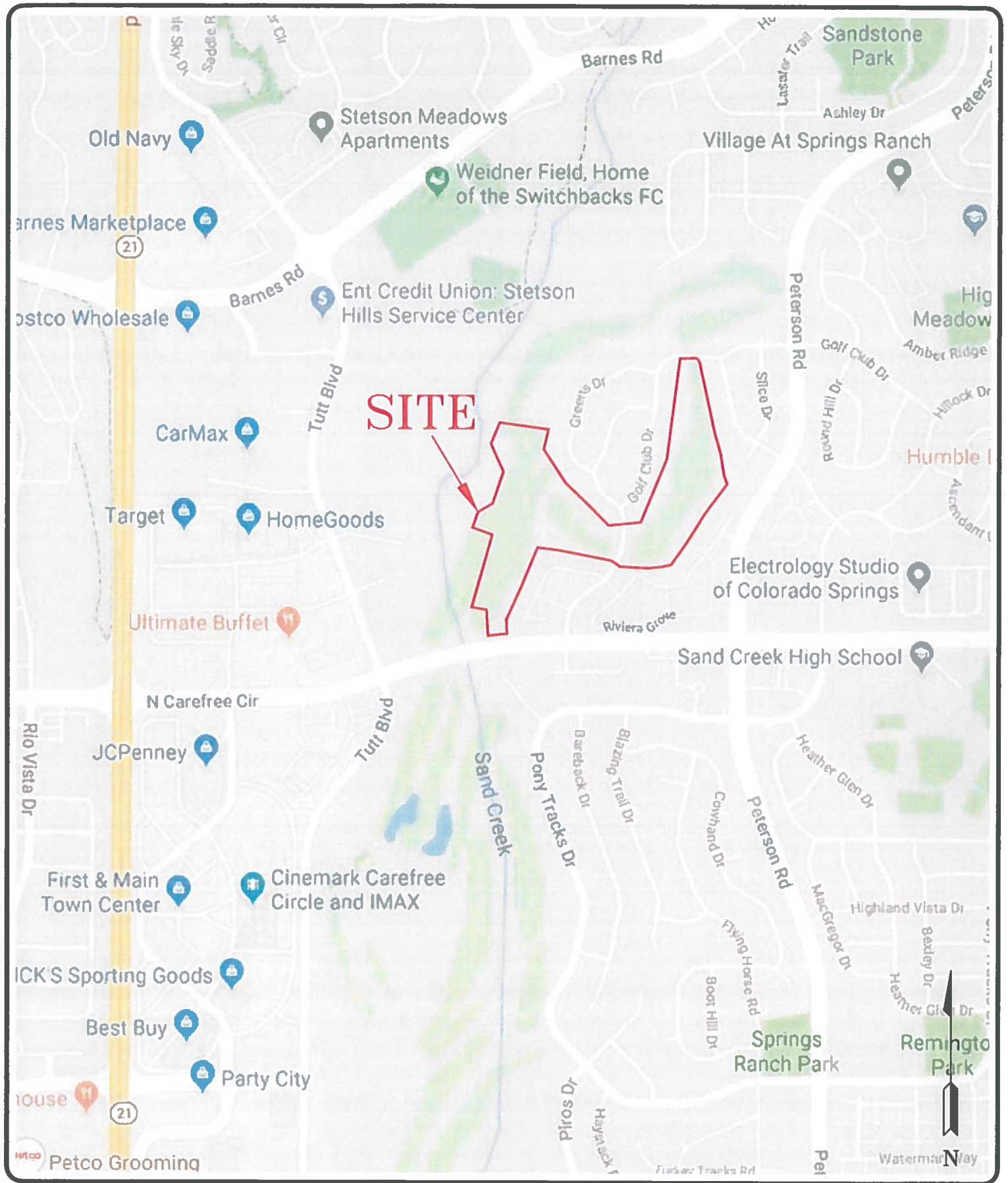

TABLE

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

CLIENT ELITE PROPERTIES
 PROJECT SPRINGS RANCH
 JOB NO. 191264

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	2-3			34.1	27	11				SC	SAND, CLAYEY
1	3	10			20.4			<0.01			SM	SAND, SILTY
1	5	5			10.5						SM-SW	SAND, SLIGHTLY SILTY
1	7	20			11.7						SM-SW	SAND, SLIGHTLY SILTY
2	2	15	12.7	101.0	73.6	43	19	<0.01		0.0	CL	CLAY, SANDY
3	1	20	10.0	99.5	46.3	46	20	<0.01		-0.3	SC	SANDSTONE, VERY CLAYEY
3	4	10			24.3	NV	NP	0.00			SM	SANDSTONE, SILTY

FIGURES

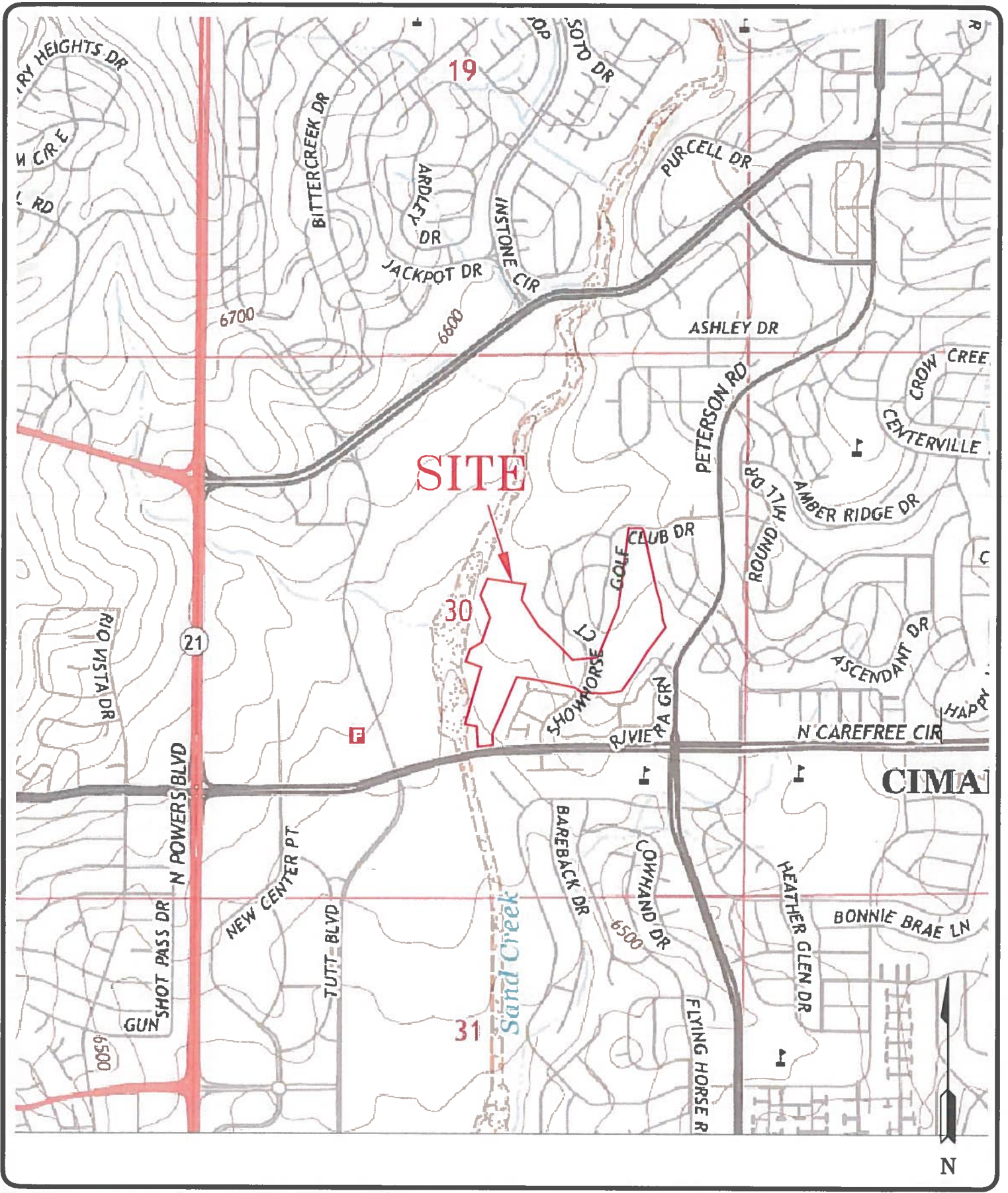
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**VICINITY MAP
SPRINGS RANCH
COLORADO SPRINGS, CO.
FOR: ELITE PROPERTIES**

DRAWN: KAH	DATE: 8/30/19	CHECKED: L	DATE: 9/5/19
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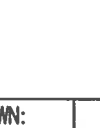
JOB NO.:
191264

FIG NO.:
1



SITE

CIMA



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

USGS MAP
 SPRINGS RANCH
 COLORADO SPRINGS, CO.
 FOR: ELITE PROPERTIES

JOB NO.:
 191264

FIG NO.:
 2

DRAWN:
 KAH

DATE:
 8/30/19

CHECKED:

DATE:
 9/5/19




-  TB - APPROXIMATE TEST BORING LOCATION AND NUMBER
-  - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER



DATE	8/30/19
BY	AS SHOWN
SCALE	10:1
PROJECT	101204
REVISED	3

TEST BORING LOCATION MAP
 SPRINGS RANCH
 COLORADO SPRINGS, CO.
 FOR: ELITE PROPERTIES



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

REVISION	BY						

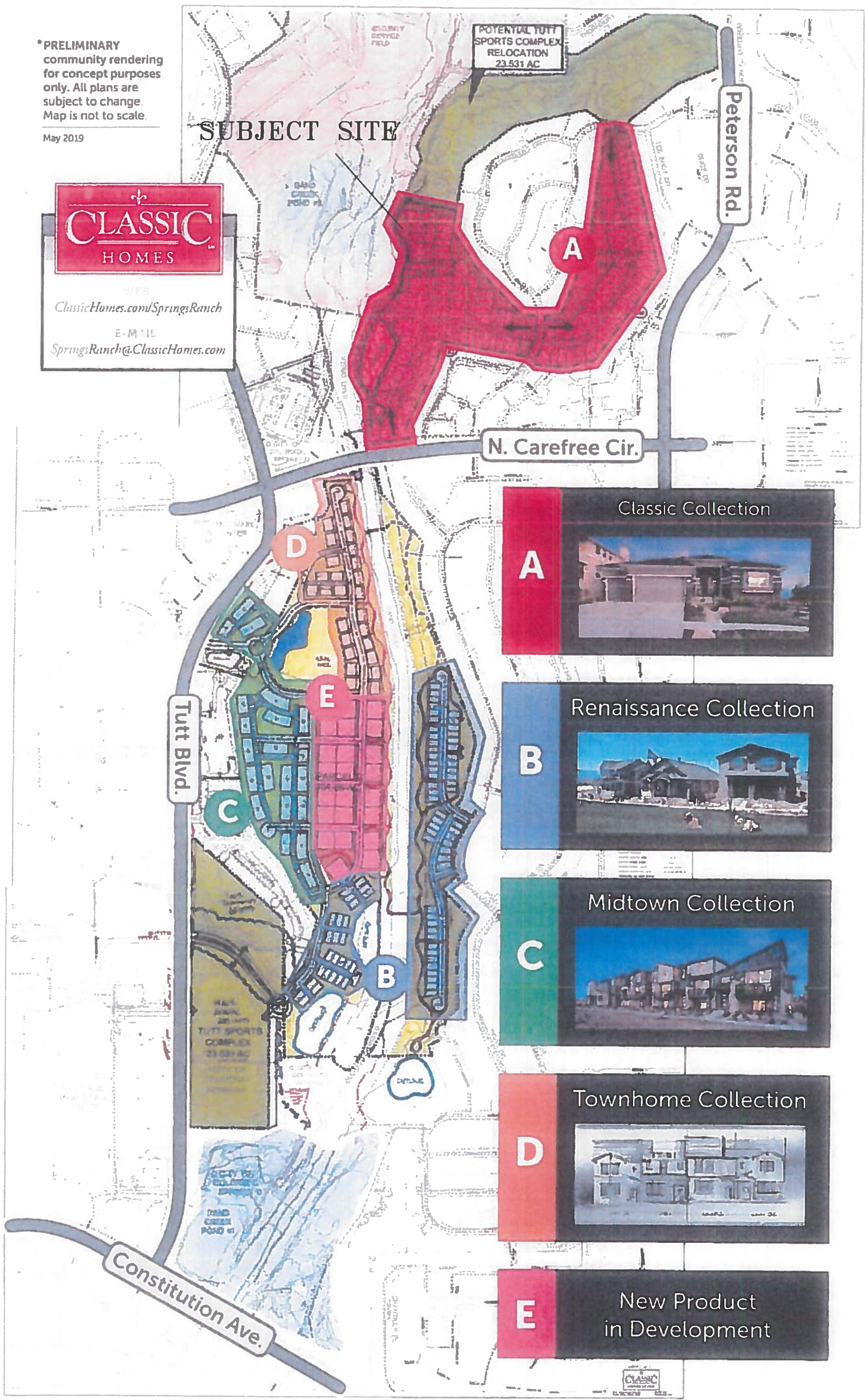
*PRELIMINARY
community rendering
for concept purposes
only. All plans are
subject to change.
Map is not to scale.

May 2019



WEB
ClassicHomes.com/SpringsRanch
E-MAIL
SpringsRanch@ClassicHomes.com

SUBJECT SITE



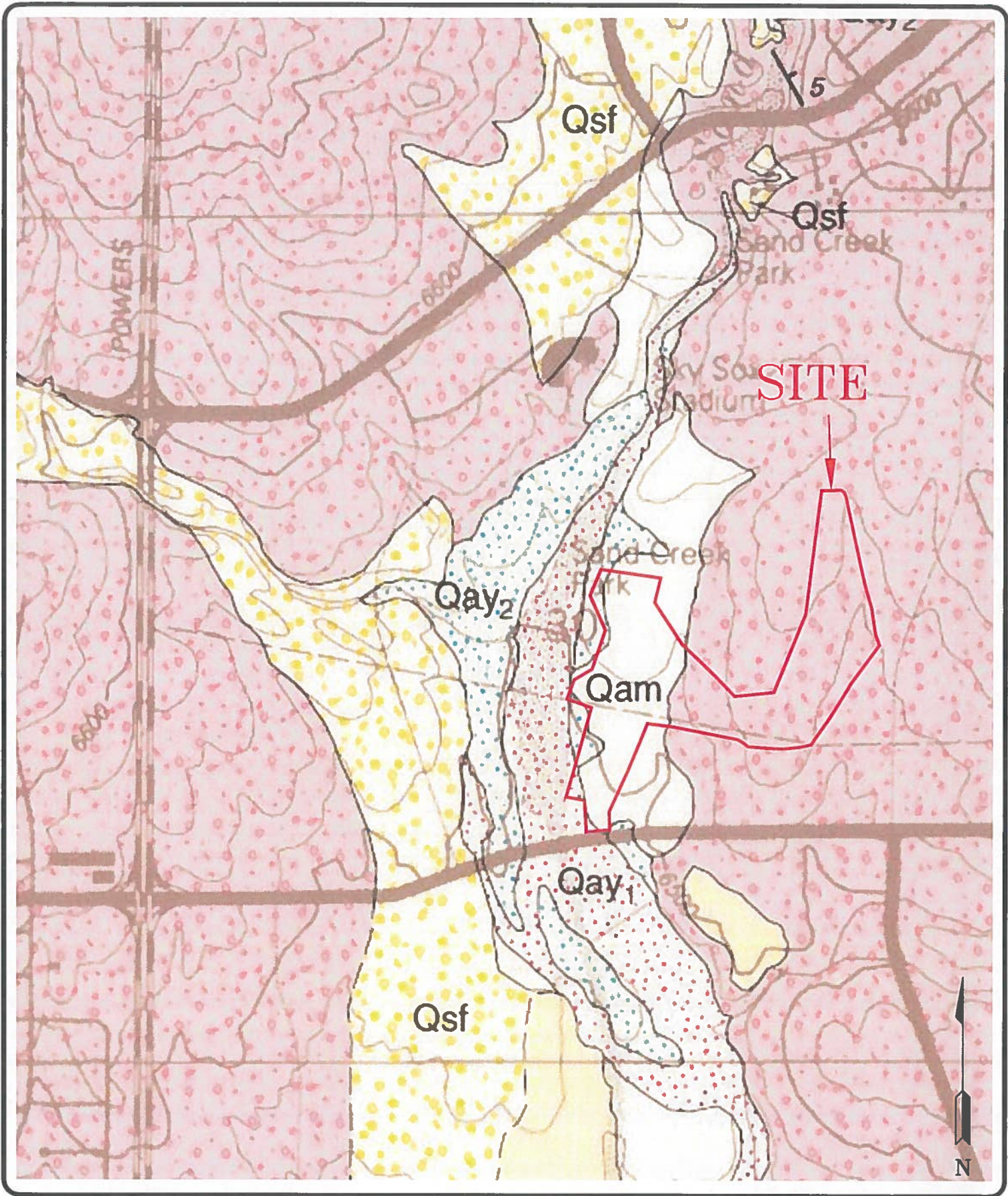
OVERALL SITE PLAN
SPRINGS RANCH
COLORADO SPRINGS, CO.
FOR: ELITE PROPERTIES



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

DATE	8/30/19
SCALE	AS SHOWN
BY	KAH
CHECKED	KAH
NO. 1	191204
NO. 2	191204
NO. 3	191204
NO. 4	191204
NO. 5	191204
NO. 6	191204
NO. 7	191204
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NO. 47	191204
NO. 48	191204
NO. 49	191204
NO. 50	191204
NO. 51	191204
NO. 52	191204
NO. 53	191204
NO. 54	191204
NO. 55	191204
NO. 56	191204
NO. 57	191204
NO. 58	191204
NO. 59	191204
NO. 60	191204
NO. 61	191204
NO. 62	191204
NO. 63	191204
NO. 64	191204
NO. 65	191204
NO. 66	191204
NO. 67	191204
NO. 68	191204
NO. 69	191204
NO. 70	191204
NO. 71	191204
NO. 72	191204
NO. 73	191204
NO. 74	191204
NO. 75	191204
NO. 76	191204
NO. 77	191204
NO. 78	191204
NO. 79	191204
NO. 80	191204
NO. 81	191204
NO. 82	191204
NO. 83	191204
NO. 84	191204
NO. 85	191204
NO. 86	191204
NO. 87	191204
NO. 88	191204
NO. 89	191204
NO. 90	191204
NO. 91	191204
NO. 92	191204
NO. 93	191204
NO. 94	191204
NO. 95	191204
NO. 96	191204
NO. 97	191204
NO. 98	191204
NO. 99	191204
NO. 100	191204

REVISION BY



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FALCON NW QUADRANGLE GEOLOGY MAP
 SPRINGS RANCH
 COLORADO SPRINGS, CO.
 FOR: ELITE PROPERTIES

DRAWN:
 KAH

DATE:
 8/30/19

CHECKED:

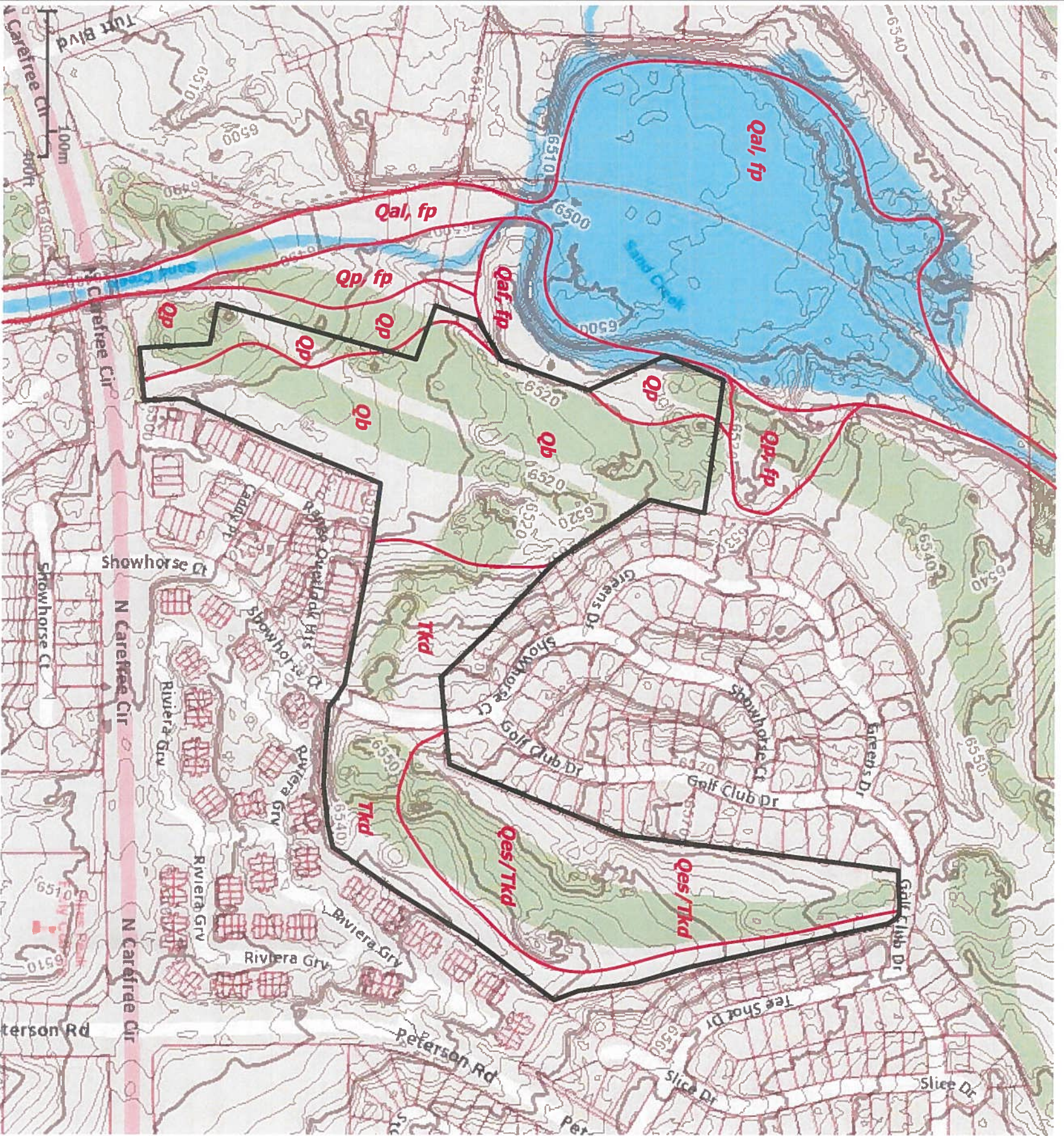
[Signature]

DATE:

9/5/19

JOB NO.:
 191264

FIG NO.:
 5




- Legend:**
- Qal -
 - Qaf -
 - Qp -
 - Qp -
 - Qes/TKd -
 - TKd -
 - fp -

Recent Alluvium of Holocene Age:
 recent stream deposits
 Artificial Fill of Holocene Age:
 man-made fill deposits
Artificial Fill of Holocene Age:
 Piney Creek Alluvium of Holocene Age:
 lower stream terrace deposited sands
 Broadway Alluvium of Pleistocene Age:
 middle stream terrace deposited sands
Eolian Sand of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:
 Formation of Tertiary to Cretaceous Age:
 wind-blown sands overlying sandstone
Dawson Formation of Tertiary to Cretaceous Age:
 Arkosic sandstone with claystone and siltstone
 floodplain - floodway areas



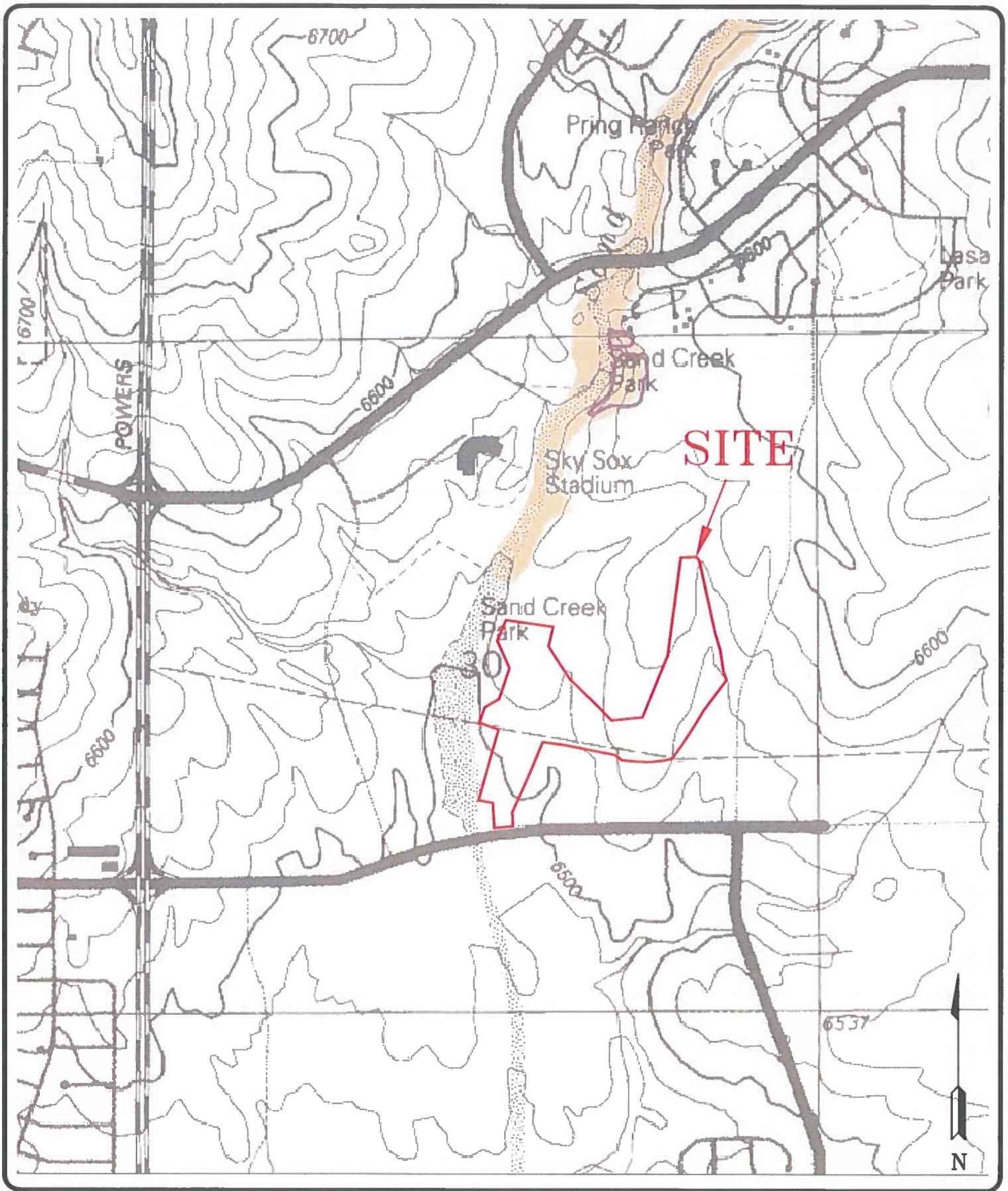
DATE	8/30/19
SCALE	AS SHOWN
DRAWN BY	1/1/2014
CHECKED BY	1/1/2014
PROJECT NO.	6

GEOLOGY/ENGINEERING GEOLOGY MAP
SPRINGS RANCH
COLORADO SPRINGS, CO.
FOR: ELITE PROPERTIES



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LANDSLIDE SUSCEPTIBILITY MAP
SPRINGS RANCH
COLORADO SPRINGS, CO.
FOR: ELITE PROPERTIES

DRAWN:
 KAH

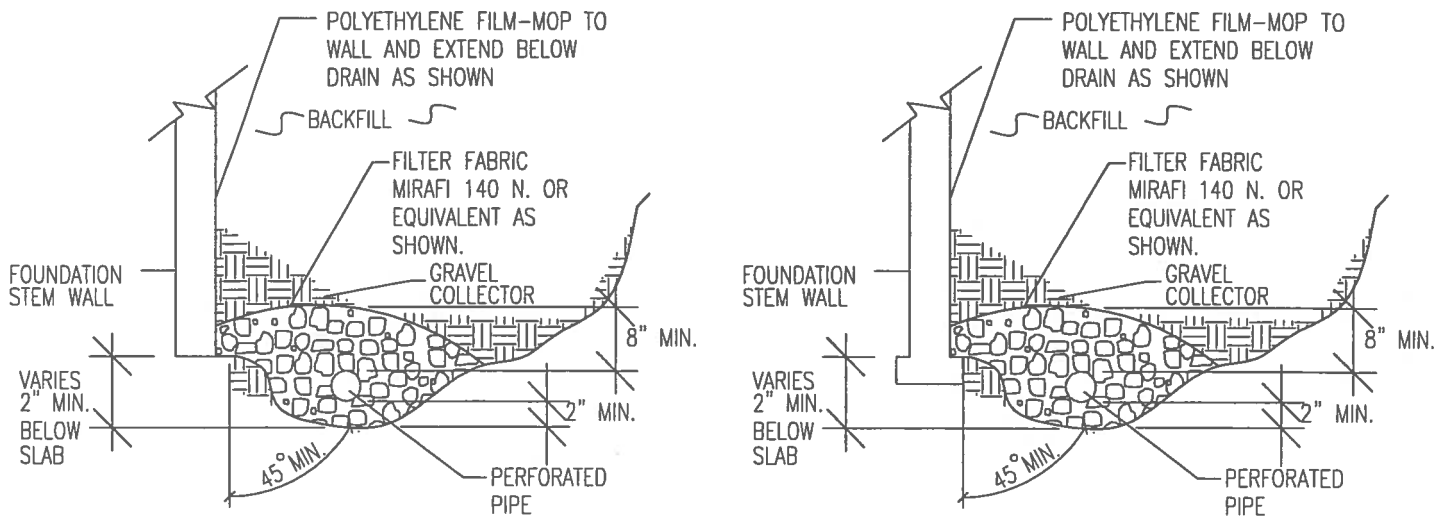
DATE:
 8/30/19

CHECKED:
h

DATE:
 9/5/19

JOB NO.:
 191264

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 OUTFALL IS NOT AVAILABLE.



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PERIMETER DRAIN DETAIL

DRAWN:

DATE:

9/5/19

DESIGNED:

DS

CHECKED:

[Signature]

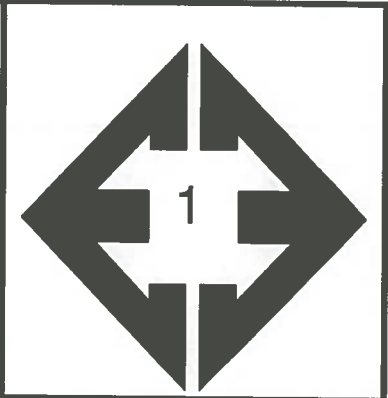
JOB NO.:

191264

FIG NO.:

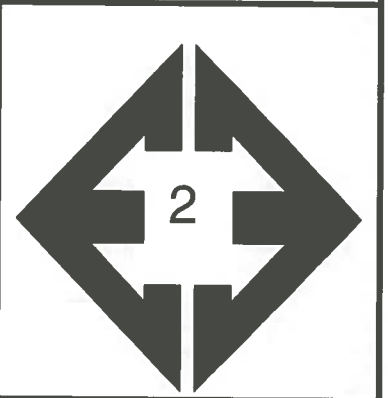
9

APPENDIX A: Site Photographs



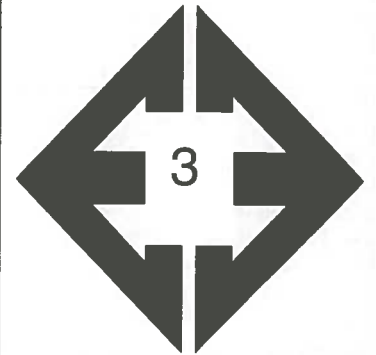
**Looking south from
the northeast portion
of the site.**

August 27, 2019



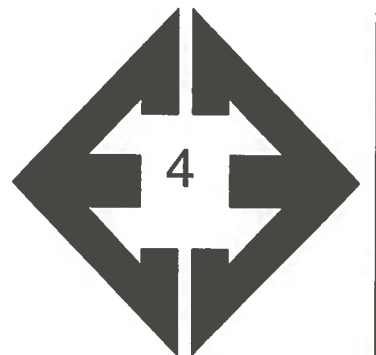
**Looking north from the
east-central portion of
the site.**

August 27, 2019



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

August 27, 2019



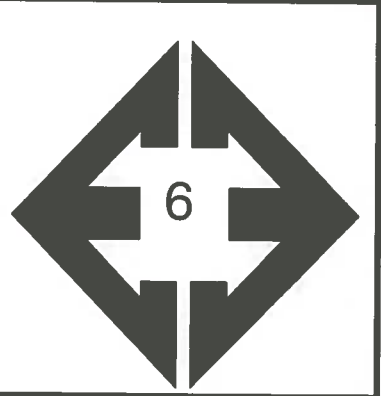
**Looking south from
the east-central
portion of the site.**

August 27, 2019



**Looking northeast
from the south-central
portion of the site.**

August 27, 2019



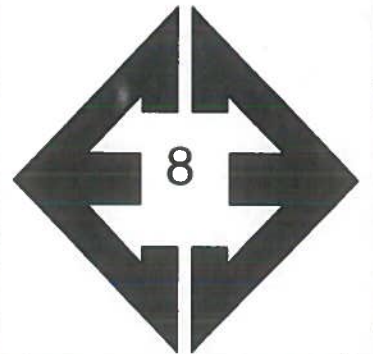
**Looking west from the
south-central portion
of the site.**

August 27, 2019



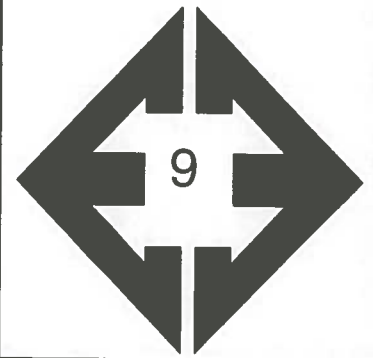
**Looking north from the
west-central portion of
the site.**

August 27, 2019



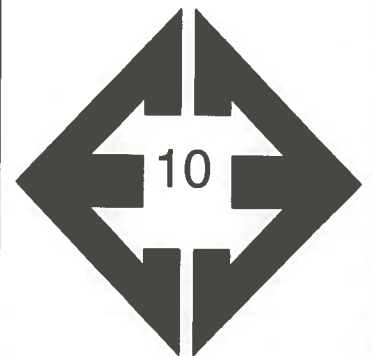
**Looking southwest
from the west-central
portion of the site.**

August 27, 2019



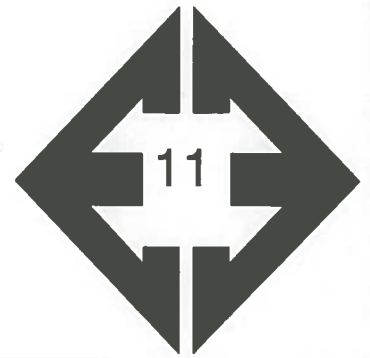
**Looking south from
the west-central
portion of the site.**

August 27, 2019



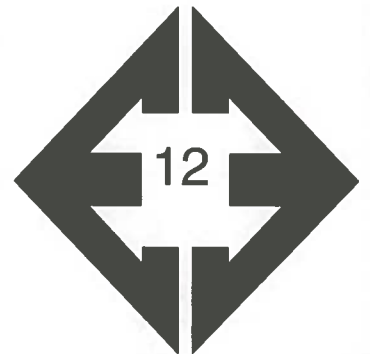
**Looking north at
slopes along Sand
Creek floodplain, west
of the site.**

August 27, 2019



**Looking east from
west of the site.**

August 27, 2019



**Looking south from
west of the site.**

August 27, 2019

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
 DATE DRILLED 7/24/2019
 Job # 191264

TEST BORING NO. 2
 DATE DRILLED 7/24/2019
 CLIENT ELITE PROPERTIES
 LOCATION SPRINGS RANCH

REMARKS						REMARKS					
Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 16', 7/25/19						WATER @ 11', 7/25/16					
0-5	(Symbol)		10	9.3	1	0-5	(Symbol)		9	9.6	1
SAND, CLAYEY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST						SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, LOOSE, MOIST TO WET					
5-10	(Symbol)		14	7.8	1	5-10	(Symbol)		4	13.9	1
SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST											
10-15	(Symbol)		6	9.7	1	10-15	(Symbol)		6	26.7	1
15-20	(Symbol)		50 6"	11.1	3	15-20	(Symbol)		22	28.4	2
SANDSTONE, VERY CLAYEY, FINE TO MEDIUM GRAINED, BROWN, VERY DENSE, MOIST						CLAY, SANDY, TAN, STIFF, MOIST					
20-25	(Symbol)		50 9"	27.1	3	20-25	(Symbol)		44	23.9	3
WEATHERED SANDSTONE, VERY CLAYEY, FINE GRAINED, BROWN, DENSE, MOIST											



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TEST BORING LOG

DRAWN:	DATE:	CHECKED: <i>[Signature]</i>	DATE: 9/5/19
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JOB NO:
 191264

FIG NO:
 B- 1

TEST BORING NO. 3
 DATE DRILLED 7/24/2019
 Job # 191264

TEST BORING NO. 4
 DATE DRILLED 7/24/2019
 CLIENT ELITE PROPERTIES
 LOCATION SPRINGS RANCH

REMARKS

WATER @ 19', 7/25/19
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, TAN, LOOSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			9	6.8	1
5			5	7.7	1
10			4	9.8	1
15			5	9.4	1
20			5	9.7	1



REMARKS

WATER @ 12.5', 7/25/19
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, TAN, LOOSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			9	7.1	1
5			7	4.8	1
10			50 3"	12.8	3
15			50 2"	11.9	3
20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 9/25/19

JOB NO.:
 191264

FIG NO.:
 B- 2

TEST BORING NO. 5
 DATE DRILLED 7/24/2019
 Job # 191264

TEST BORING NO. 6
 DATE DRILLED 7/24/2019
 CLIENT ELITE PROPERTIES
 LOCATION SPRINGS RANCH

REMARKS

WATER @ 20', 7/25/19
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, DARK BROWN, LOOSE,
 MOIST
 SAND, SLIGHTLY SILTY, FINE
 TO COARSE GRAINED, TAN,
 MEDIUM DENSE, MOIST TO WET

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
4			4	6.1	1
5			15	2.8	1
10			13	7.9	1
15			23	3.9	1
20			16	19.3	1



REMARKS

WATER @ 16.5', 7/25/19
 SAND, SLIGHTLY SILTY, FINE TO
 COARSE GRAINED, TAN, LOOSE
 TO DENSE, DRY TO WET

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
12			12	1.9	1
16			16	2.8	1
10			5	7.2	1
15			10	9.1	1
20			31	9.2	1



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

9/25/19

JOB NO.:
 191264

FIG NO.:
 B-3

TEST BORING NO. 7
 DATE DRILLED 7/24/2019
 Job # 191264

TEST BORING NO.
 DATE DRILLED
 CLIENT ELITE PROPERTIES
 LOCATION SPRINGS RANCH

REMARKS

REMARKS

WATER @ 11.5', 7/25/19
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, LOOSE TO DENSE,
 MOIST TO WET

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			14	3.9	1	5					
10			15	4.0	1	10					
15			6	9.3	1	15					
20			35	9.2	1	20					
20			*	17.2	1	20					

*- BULK SAMPLE TAKEN



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TEST BORING LOG

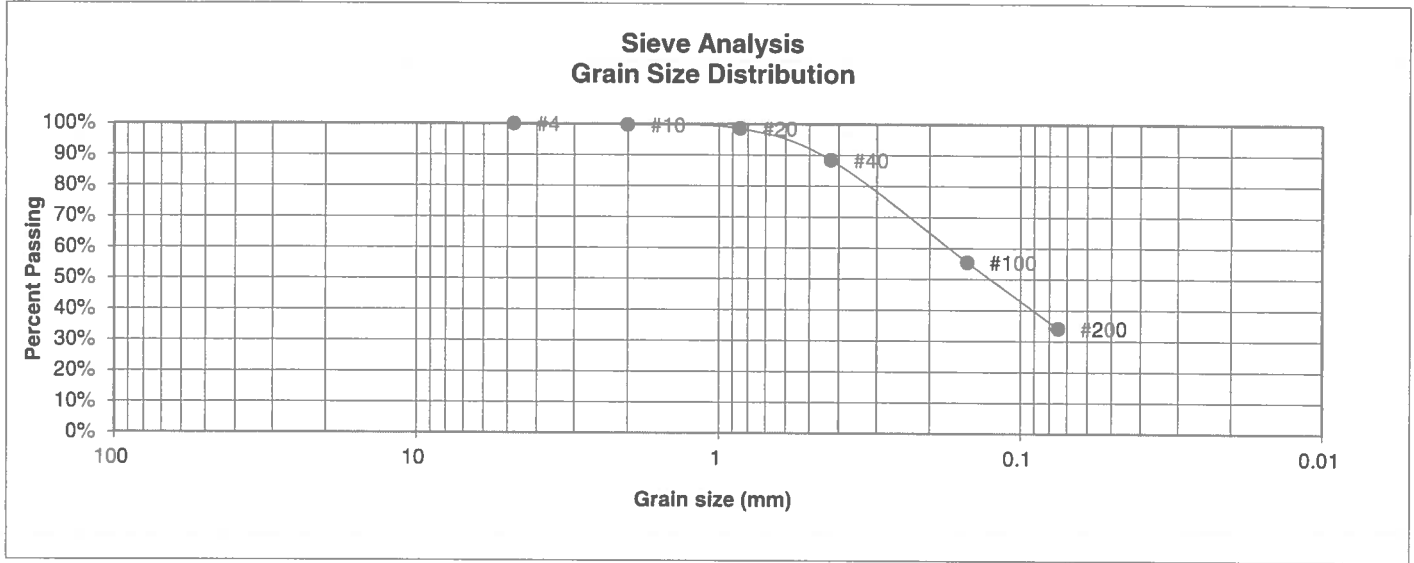
DRAWN: DATE: CHECKED: DATE: 9/5/19

JOB NO.:
 191264

FIG NO.:
 B- 4

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SC	CLIENT	ELITE PROPERTIES
SOIL TYPE #	1	PROJECT	SPRINGS RANCH
TEST BORING #	1	JOB NO.	191264
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	99.7%
20	98.5%
40	88.4%
100	55.5%
200	34.1%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	27
Plastic Index	11

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



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**LABORATORY TEST
RESULTS**

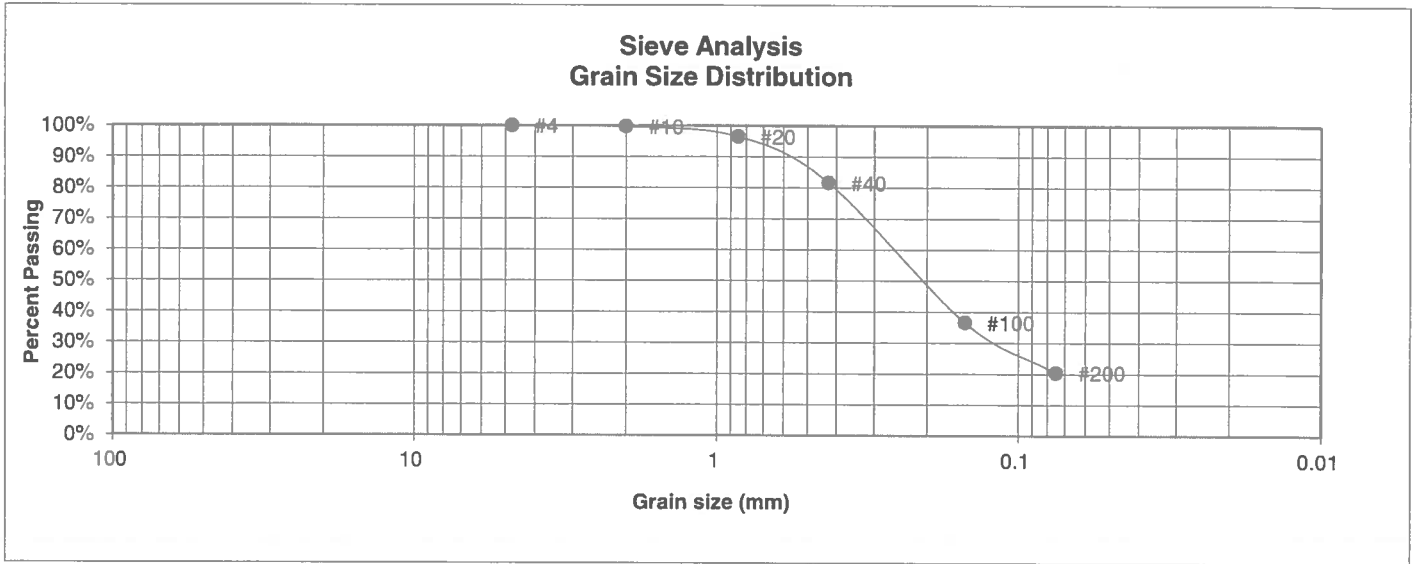
DRAWN:	DATE:	CHECKED:	DATE:
		<i>W</i>	9/5/19

JOB NO.:
191264

FIG NO.:

C-1

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	ELITE PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SPRINGS RANCH
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	191264
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	96.5%
40	81.6%
100	36.6%
200	20.4%

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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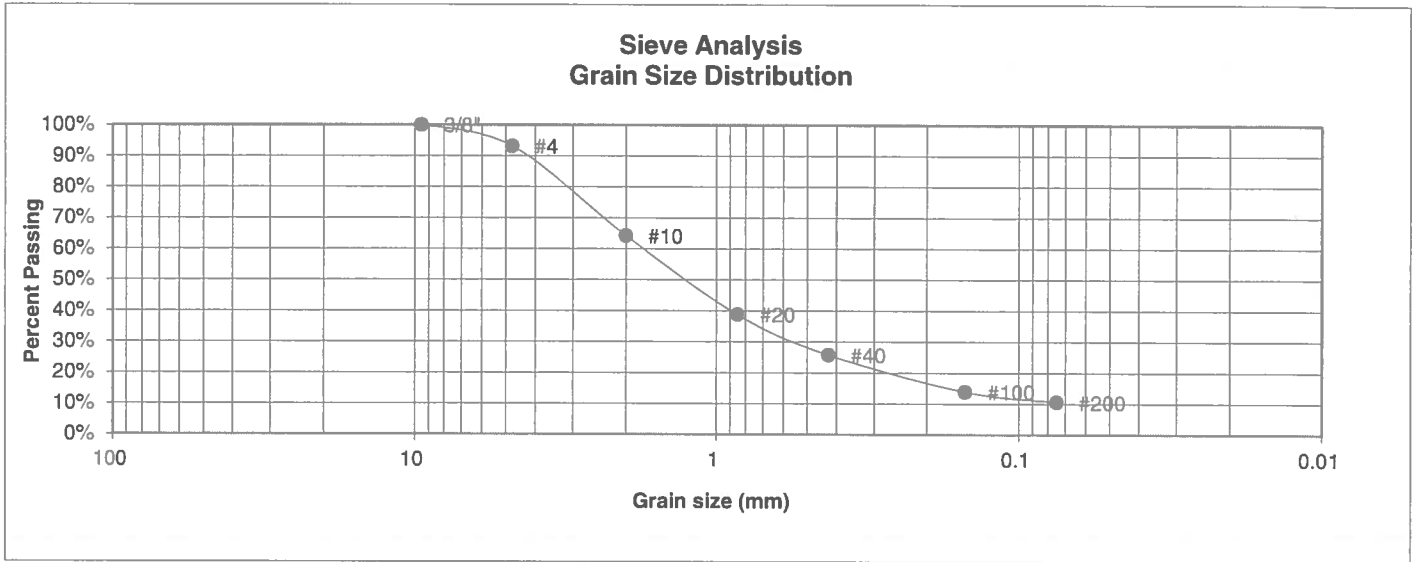
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>h</i>	9/5/10

JOB NO.:
191264

FIG NO.:
C-2

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	ELITE PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SPRINGS RANCH
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	191264
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.2%
10	64.2%
20	38.8%
40	25.7%
100	13.9%
200	10.5%

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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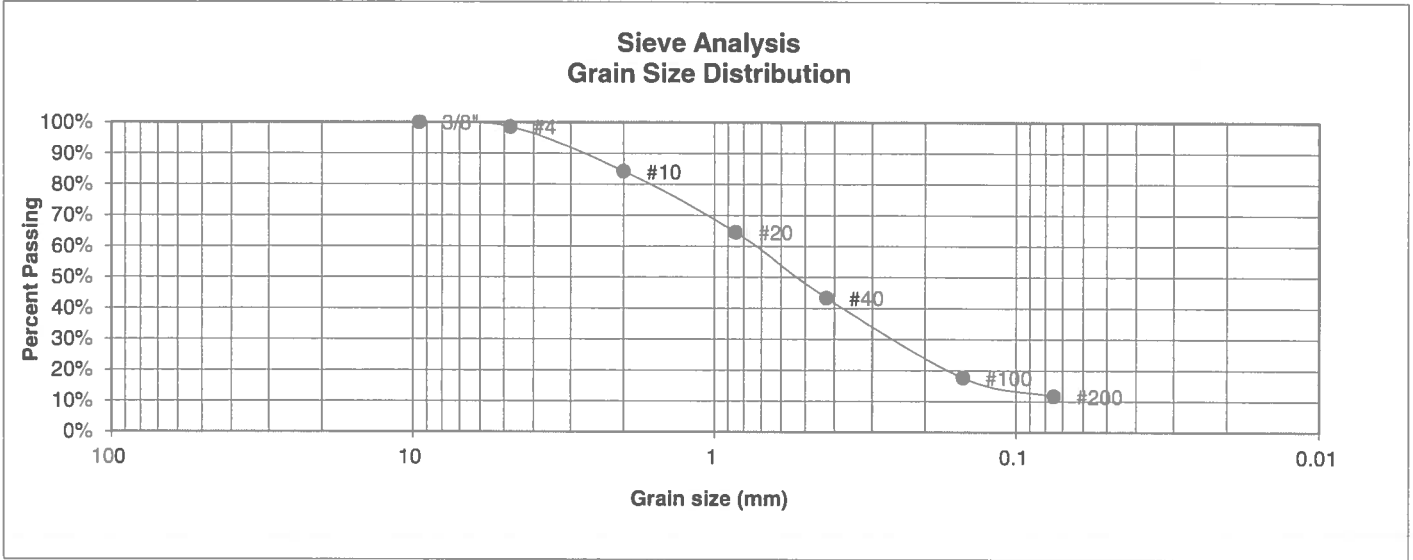
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>BL</i>	9/5/14

JOB NO.:
191264

FIG NO.:
C-3

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	ELITE PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	SPRINGS RANCH
<u>TEST BORING #</u>	7	<u>JOB NO.</u>	191264
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.5%
10	84.3%
20	64.5%
40	43.4%
100	17.6%
200	11.7%

- 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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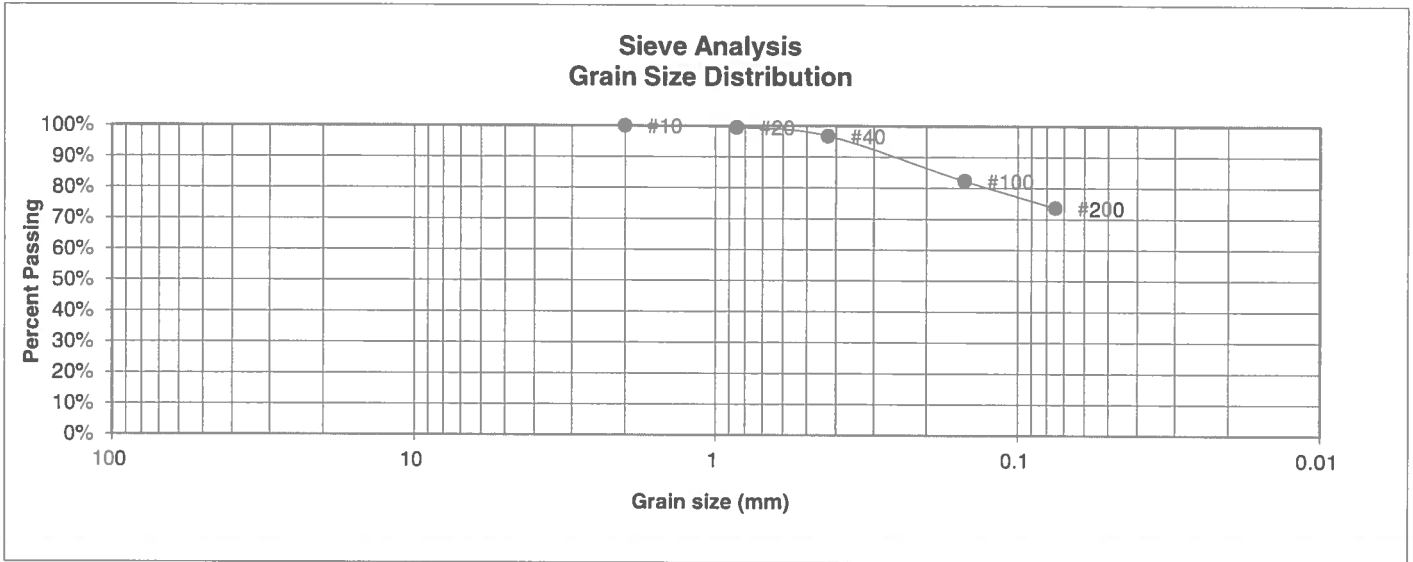
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 9/5/19
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JOB NO.:
191264

FIG NO.:
C-4

UNIFIED CLASSIFICATION	CL	CLIENT	ELITE PROPERTIES
SOIL TYPE #	2	PROJECT	SPRINGS RANCH
TEST BORING #	2	JOB NO.	191264
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.5%
40	96.7%
100	82.3%
200	73.6%

Atterberg Limits	
Plastic Limit	24
Liquid Limit	43
Plastic Index	19

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



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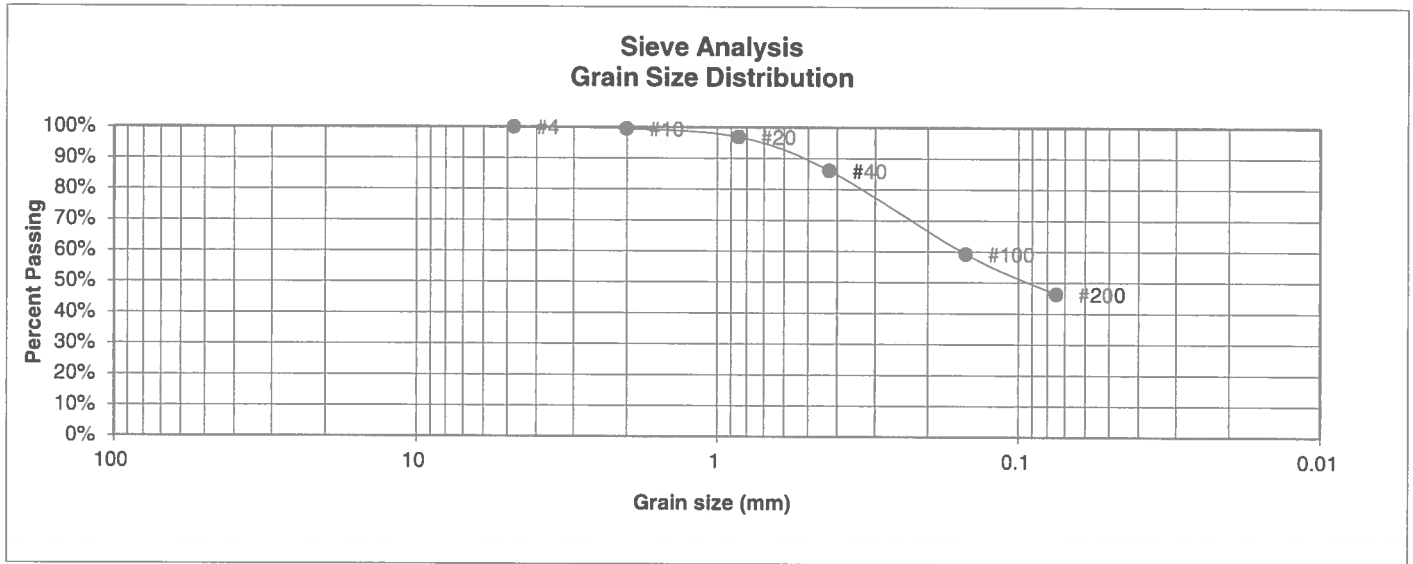
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>L</i>	DATE: <i>9/15/19</i>
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JOB NO.:
191264

FIG NO.:
C-5

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	ELITE PROPERTIES
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	SPRINGS RANCH
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	191264
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	96.9%
40	86.1%
100	59.3%
200	46.3%

<u>Atterberg Limits</u>	
Plastic Limit	26
Liquid Limit	46
Plastic Index	20

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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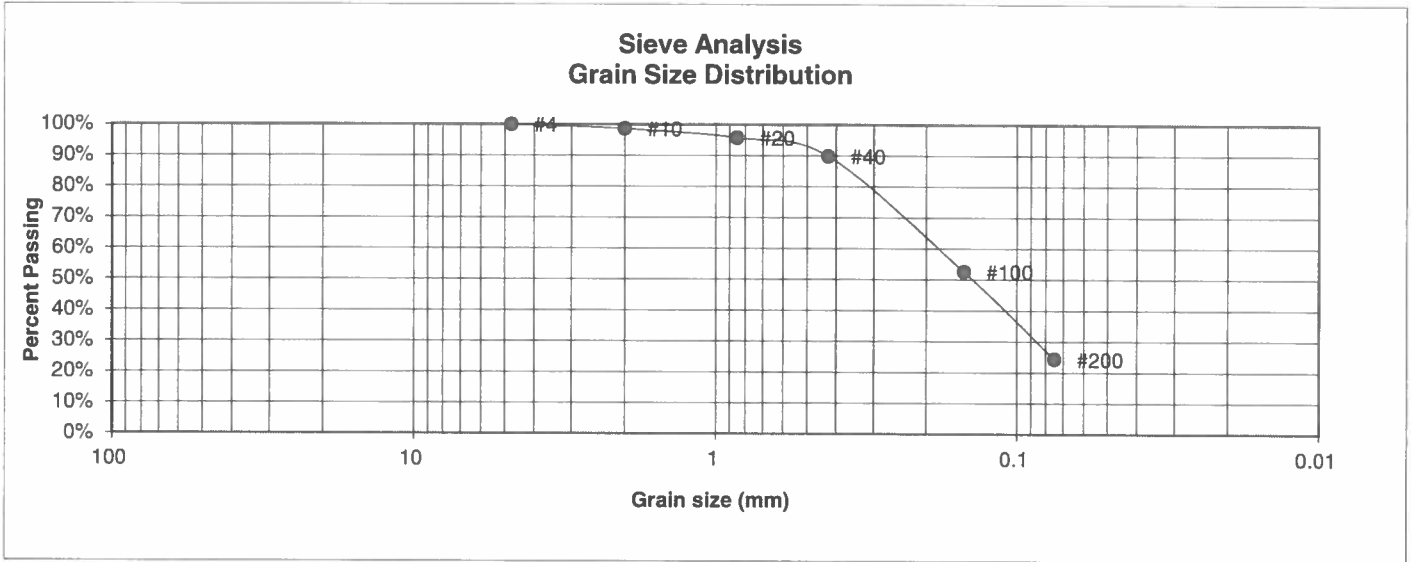
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: <i>9/5/19</i>
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JOB NO.:
191264

FIG NO.:
C-6

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	ELITE PROPERTIES
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	SPRINGS RANCH
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	191264
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.7%
20	95.8%
40	89.8%
100	52.6%
200	24.3%

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

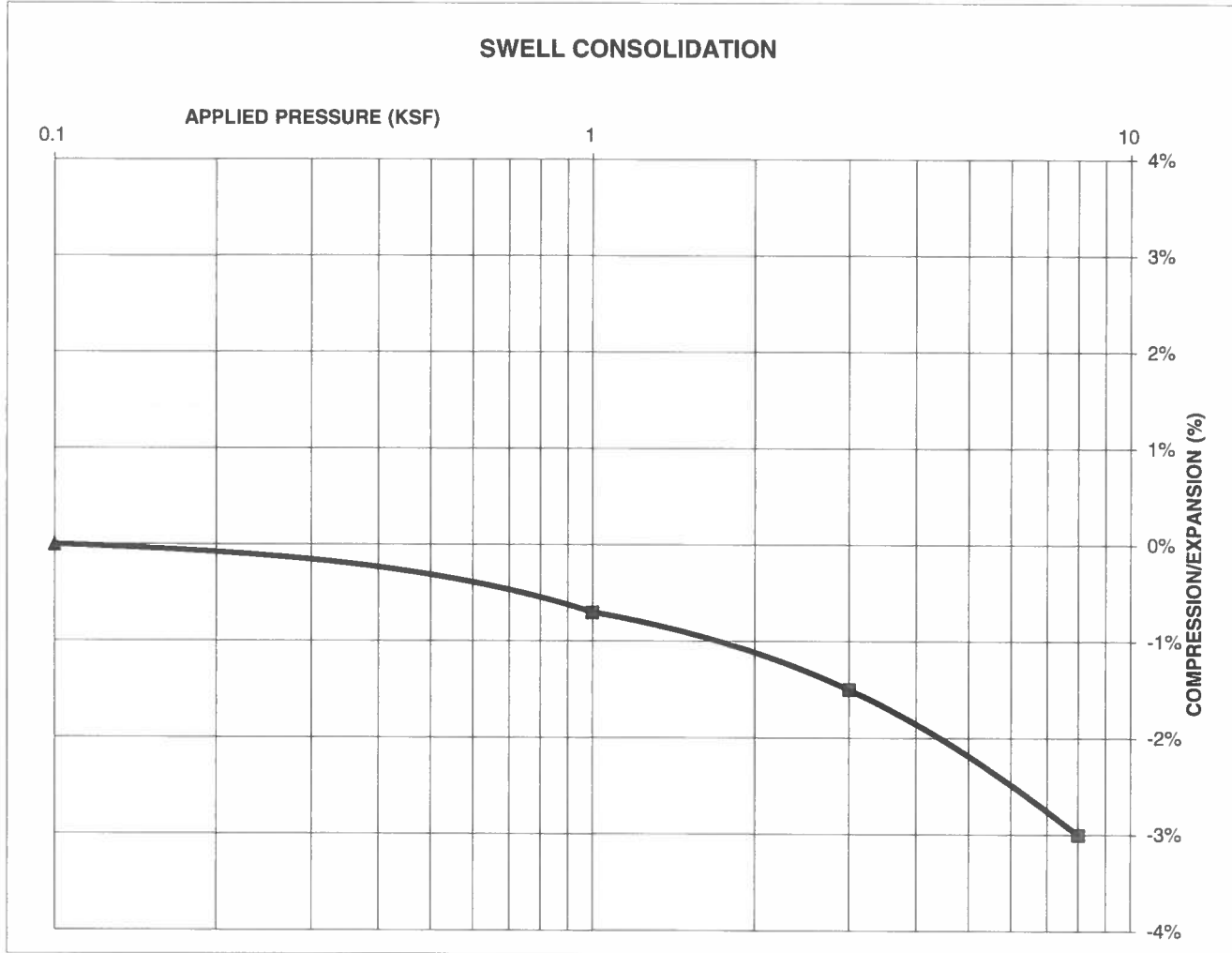
DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 9/5/19
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JOB NO.: 191264
 FIG NO.: C-7

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			101
NATURAL MOISTURE CONTENT			12.7%
SWELL/CONSOLIDATION (%)			0.0%

JOB NO. 191264
CLIENT ELITE PROPERTIES
PROJECT SPRINGS RANCH



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ENGINEERING, INC.

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 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE: 9/5/19

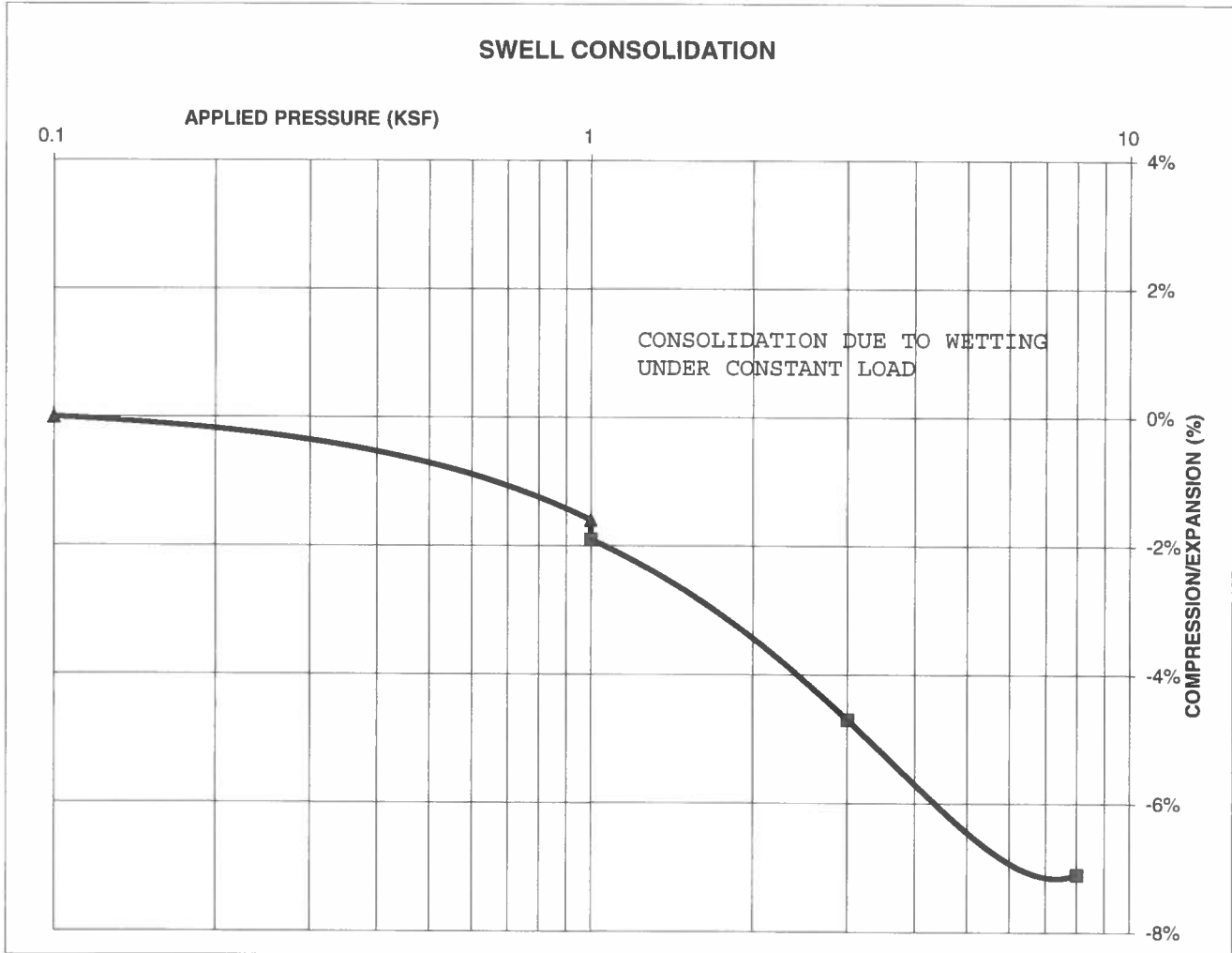
JOB NO.:
 191264

FIG NO.:
 C-8

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	20
DESCRIPTION	SC	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			100
NATURAL MOISTURE CONTENT			10.0%
SWELL/CONSOLIDATION (%)			-0.3%

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**SWELL CONSOLIDATION
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

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JOB NO.:
191264

FIG NO.:

C-9

