ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
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April 2, 2019

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

Attn: Jim Boulton

Re: Soil, Geology and Geologic Hazards Report and Site Review
Midtown at Hannah Ridge – Tracts AA & BB
El Paso County, Colorado

Ref: Entech Engineering, Inc., revised June 13, 2005
Soil, Geology and Geologic Hazard Study,
Hannah Ridge Filing 1, Constitution and Akers Drive
El Paso County, Colorado, Entech Job No. 35044

Entech Engineering, Inc., February 28, 2019
Subsurface Soil Investigation – Midtown at Hannah Ridge, Tracts AA & BB
El Paso County, Colorado, Entech Job No. 181769

Dear Mr. Boulton:

As requested, personnel of Entech Engineering, Inc. have reviewed the above referenced Soil, Geology and Geologic Hazard Study by Entech Engineering, Inc. with respect to the above referenced site. Additionally, a Subsurface Soil Investigation was prepared by Entech Engineering, Inc. for the site, as referenced above. Elite Properties of America is planning the construction of single-family residential lots and storm quality/detention ponds at the above referenced site. The proposed site plan is shown on Figure 1.

A recent site visit indicated current site conditions are similar to the site conditions in the area of the proposed development and are consistent with what is described in the above referenced Geologic Hazard Study. Recent site grading conducted on the site includes filling of a central drainage that previously bisected the site, and the construction of the proposed storm quality/detention ponds as shown on Figure 1.

This area was previously mapped in an area of "Qaf: Artificial fill of Quaternary Age". Soils encountered in the Subsurface Soil Investigation by Entech, referenced above, consisted of 3 to 9 feet of clayey sand fill and sandy clay fill overlying native sands and clays. Bedrock was not encountered in the test borings, which were drilled to depths ranging from 5 to 20 feet. The Bedrock underlying the site consists of the Dawson Formation of Tertiary to Cretaceous Age. The Dawson typically consists of sandstone with interbedded lenses of claystone or siltstone. The geology of the site is shown on the Geology Map, Figure 1. Test Boring Logs from the above referenced Subsurface Soil Investigation are included in Appendix A. The Laboratory Test Results are summarized in Table 1.

Artificial fill has been mapped and encountered over the entire site in the above referenced reports. Fill was observed on the site during our recent site visit. The fill is considered uncontrolled for construction purposes and will require mitigation. Recommendations for the site have been included in the above referenced Subsurface Soil Investigation and in the Soil, Geology and Geologic Hazard Study. It is our opinion the conclusions and recommendations in the above referenced reports remain valid and the reports may be used for the proposed development. The Soil, Geology, and Geologic Hazard Study is included in Appendix B.

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

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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

KAH/am

Entech Job No.181769
AAprojects/2018/181769 geologic site review

Reviewed by:

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

TABLE

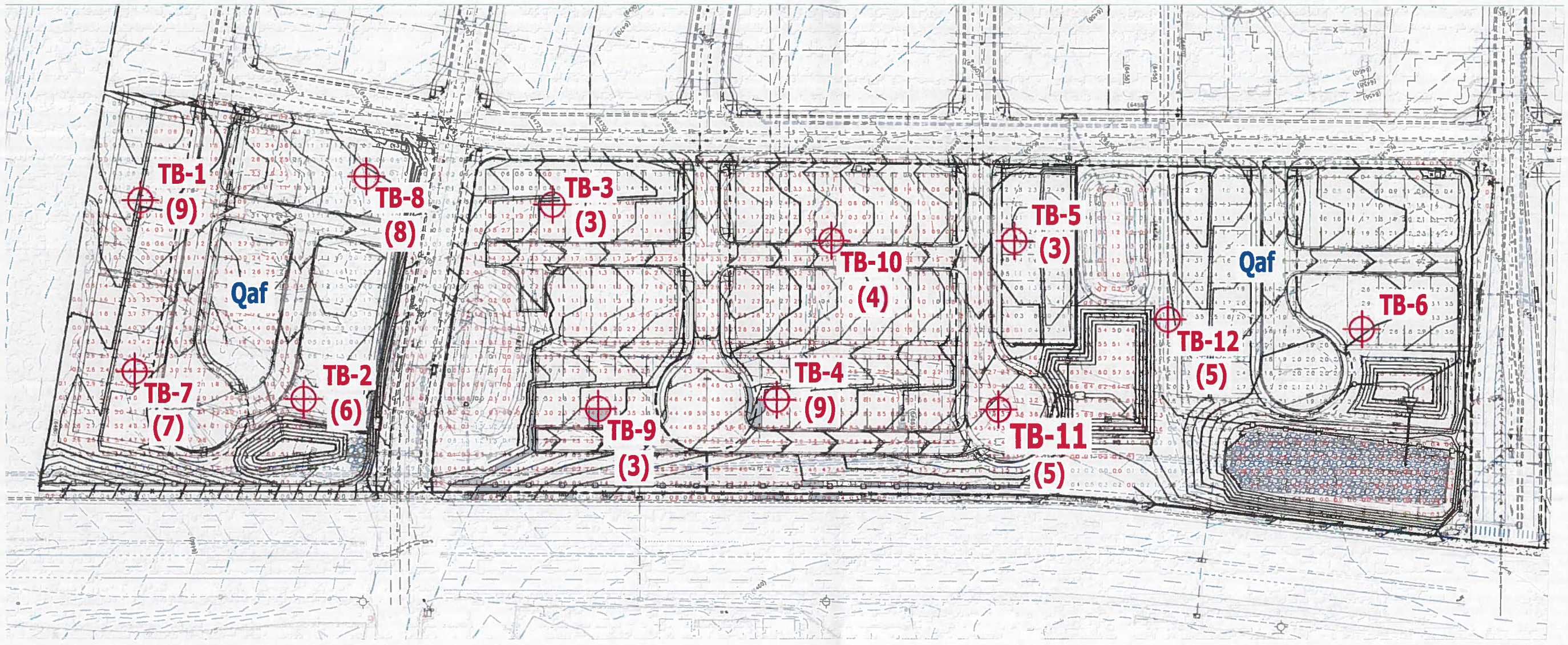
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT ELITE PROPERTIES
PROJECT HANNAH RIDGE
JOB NO. 181769

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	5			47.4			<0.01			SC	FILL, SAND, VERY CLAYEY
1	4	2-3			36.6	38	15				SC	FILL, SAND, CLAYEY
1	5	2-3			41.3	31	14	0.00			SC	FILL, SAND, VERY CLAYEY
1	9	2-3			17.3				330		SM	FILL, SAND, SILTY
1	11	5	10.2	106.1	29.4			<0.01		-1.0	SC	FILL, SAND, CLAYEY
2	3	2-3			55.5				1390		CL	FILL, CLAY, VERY SANDY
2	7	5	22.3	93.7	72.0			<0.01		0.2	CL	FILL, CLAY, SANDY
3	2	15			39.9	30	15				SC	SAND, VERY CLAYEY
3	6	5			49.4				560		SC	SAND, VERY CLAYEY
4	3	5	17.2	103.7	61.0					0.6	CL	CLAY, VERY SANDY

FIGURES



TB-2- APPROXIMATE TEST BORING LOCATION AND NUMBER

( ) - APPROXIMATE DEPTH OF FILL (FEET)

Qaf - ARTIFICIAL FILL of QUATERNARY AGE

REVISION	BY

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GEOLOGY MAP
MIDTOWN AT HANNAH RIDGE
EL PASO COUNTY, COLORADO
FOR: ELITE PROPERTIES OF AMERICA

DRAWN	JAC
CHECKED	
DATE	04/2/19
SCALE	NTS
JOB NO.	181769
FIGURE No.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 11/14/2018
Job # 181769

REMARKS

DRY TO 20', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	FILL 0-9', SAND, VERY CLAYEY, FINE GRAINED, BROWN, LOOSE TO MEDIUM DENSE, MOIST		9	7.4	1
5			10	11.3	1
10	SAND, CLAYEY TO SILTY, FINE GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST		10	5.1	3
15			14	6.4	3
20			14	8.1	3

TEST BORING NO. 2
DATE DRILLED 11/14/2018
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS

DRY TO 20', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	FILL 0-6', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, LOOSE TO MEDIUM DENSE, MOIST		9	14.7	1
5			12	17.7	1
10	SAND, CLAYEY TO VERY CLAYEY, FINE GRAINED, BROWN, MEDIUM DENSE, MOIST		22	8.8	3
15			22	7.4	3
20			12	8.8	3

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		u	12/10/18

JOB NO.: 181769
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 11/14/2018
Job # 181769

REMARKS

DRY TO 18', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			17	21.6	2	FILL 0-3', CLAY, VERY SANDY, BROWN, STIFF, MOIST
5			12	18.3	4	CLAY, VERY SANDY, BROWN, FIRM, MOIST
						SAND, CLAYEY, FINE GRAINED, BROWN, MEDIUM DENSE, MOIST
10			16	11.9	3	
15			12	9.8	3	SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST
20			17	11.9	3	

TEST BORING NO. 4
DATE DRILLED 11/14/2018
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS

DRY TO 19', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			8	15.8	1	FILL 0-9', SAND, CLAYEY, FINE GRAINED, BROWN, LOOSE, MOIST
5			9	14.5	1	
10			24	19.5	3	SAND, VERY CLAYEY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST
15			12	9.2	3	SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST
20			12	7.2	3	

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			12/10/18

JOB NO.: 181769
FIG NO.: A- 2

TEST BORING NO. 5
DATE DRILLED 11/14/2018
Job # 181769

REMARKS

DRY TO 20', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			23	12.4	1	FILL 0-3', SAND, VERY CLAYEY, FINE GRAINED, BROWN, MEDIUM DENSE, MOIST
5			29	13.5	3	SAND, CLAYEY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST
10			12	13.2	3	
15			19	9.4	3	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST
20			21	9.3	3	

TEST BORING NO. 6
DATE DRILLED 11/14/2018
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS

DRY TO 19', 11/26/18

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			15	8.8	3	SAND, CLAYEY TO VERY CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST
5			19	11.6	3	
10			19	2.4	3	SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST
15			26	4.8	3	COARSE GRAINED LENSES
20			25	12.1	3	

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		SCC	1/25/19

JOB NO. 181769
FIG NO. A-3

TEST BORING NO. 7
DATE DRILLED 1/14/2019
Job # 181769

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 7', 1/14/19						
FILL 0-7', SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST				22	14.1	1
FILL, CLAY, SANDY, BROWN, VERY STIFF, MOIST	5			34	24.1	2
CLAY, SANDY, DARK BROWN, FIRM, MOIST				14	12.0	4
	10					
	15					
	20					

TEST BORING NO. 8
DATE DRILLED 1/14/2019
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 7', 1/14/19						
FILL 0-7', CLAY, SANDY, BROWN, STIFF TO VERY STIFF, MOIST				24	10.4	2
	5			39	10.7	2
SAND, CLAYEY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE, MOIST				21	9.2	3
	10					
	15					
	20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		SLC	1/25/19

JOB NO.: 181769
FIG NO.: A- 4

TEST BORING NO. 9
DATE DRILLED 1/14/2019
Job # 181769

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 4', 1/14/19						
FILL 0-3', POSS. FILL 3-5', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST				15	9.4	1
POSS. FILL, SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	5			24	17.8	1
	10					
	15					
	20					

TEST BORING NO. 10
DATE DRILLED 1/14/2019
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 4', 1/14/19						
FILL 0-4', SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST				23	13.9	1
CLAY, SANDY, BROWN, STIFF, MOIST	5			23	13.8	4
	10					
	15					
	20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		SCC	1/25/19

JOB NO.: 181769
FIG NO.: A- 5

TEST BORING NO. 11
DATE DRILLED 1/14/2019
Job # 181769

REMARKS

DRY TO 9', 1/14/19

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			22	10.6	2	FILL 0-5', CLAY, SANDY, BROWN, STIFF, MOIST
5			24	11.3	1	FILL, SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST
			22	9.4	3	SAND, CLAYEY, FINE TO
			18	9.7	3	MEDIUM GRAINED, BROWN,
10						MEDIUM DENSE, MOIST
15						
20						

TEST BORING NO. 12
DATE DRILLED 1/14/2019
CLIENT ELITE PROPERTIES
LOCATION HANNAH RIDGE

REMARKS

DRY TO 4', 1/14/19

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			19	12.6	2	FILL 0-5', CLAY, SANDY, BROWN MOIST
5			18	15.8	2	
10						
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED: SLL	DATE: 1/25/19

JOB NO.: 181769
FIG NO.: A- 6

APPENDIX B: Soil, Geology and Geologic Hazard Study, revised June 13, 2005, Entech Job No. 35044

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SOIL, GEOLOGY AND GEOLOGIC HAZARD STUDY HANNAH RIDGE FILING NO. 1 CONSTITUTION AVENUE AND SHAWNEE DRIVE EL PASO COUNTY, COLORADO

Prepared for

Sand Creek Investments North, LLC
90 South Cascade Avenue, Suite 1500
Colorado Springs, Colorado 80903

Attn: Danny Mientka

January 13, 2005
Revised June 13, 2005

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Kristen A. Andrew-Hoeser
Professional Engineering Geologist

KAH/ek

Encl.

Entech Job No. 35044
2MSW/rep/2004/35044sg&ghs

Reviewed by:

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

REGISTERED JOSEPH COLLIN GOODE JR. 23725 2-14-05 PROFESSIONAL ENGINEER

TABLE OF CONTENTS

1.0 SUMMARY

Project Location

The project lies in a portion of S½ of Section 32, Township 13 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. The site is located west of Marksheffel Road and north of Constitution Avenue. The property lies just east of the Colorado Springs city limits.

Project Description

Total acreage involved in this investigation is approximately 47 acres. This includes 31 acres of Filing 1 of the proposed subdivision. The proposed site development consists of single-family residential development. Sewer and water will be provided by Cherokee Metropolitan District.

Scope of Report

This report presents the results of our geologic investigation and treatment of engineering geologic hazard for the proposed development.

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 seasonal shallow groundwater areas, hydrocompaction, expansive soils, unstable slopes and fill. Based on the development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

In general, it is our opinion that the proposed type of development is suitable with the observed geologic conditions. Development of the site can be achieved if the geologic conditions are mitigated in the design/construction phases of the project. All recommendations are subject to the limitations discussed in the report.

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the S½ of Section 32, Township 13 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. The site is located west of Marksheffel Road and north of Constitution Avenue just east of the Colorado Springs city limits. The location of the site is shown on the Vicinity Map, Figure 1.

The topography of the site is gently sloping with some steeper slopes along some fill slopes and a drainage gully in the southern portion of the site. The approximate site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included open space with some stockpiling of fill in the southwestern portion of the site. The abandoned Rock Island Railroad exists along the western boundary of the site. This line is to become the Rock Island Trail. Existing industrial development lies east of the site and existing single-family residential development lies to the west of the site. The site contains primarily field grasses, weeds and yucca. Site photographs are included in Appendix A. The location and direction of the photographs are shown on Figure 3.

Total acreage involved in this investigation is approximately 47 acres. The proposed development consists of the southern 30 acres of the area investigation. The proposed development consists of single-family residential lots. The proposed concept plan is shown on Figure 3. The area will be serviced by Cherokee Metropolitan District.

3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data and subsurface soil information. 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.

- Identification of geologic hazards and mitigation recommendations for the proposed development.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of bedrock features and significant surficial deposits. The field mapping was conducted by personnel of Entech Engineering, Inc. on December 17, 2004. The Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The positions of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identifies pertinent geologic conditions affecting development.

As a part of the investigation, a Subsurface Soil Investigation was performed by Entech Engineering, Inc. This investigation consisted of drilling 9 test borings on the site. The borings were drilled with a power driven continuous flight auger drill rig to 20 feet. Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a 2-inch O.D. Split Barrel Sampler and a California Sampler. Results of the penetration tests are shown on the drilling logs to the right of the sampling portion. The location of the test borings is included on the Test Boring Location Plan, Figure 3, and the Geology Map, Figure 8. The drilling logs are included in Appendix B.

Laboratory testing was performed to classify and determine the soils engineering characteristics. Laboratory tests included moisture content, ASTM D-2216, grain size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell tests included FHA Testing and Denver Swell/Consolidation Testing. A Summary of Laboratory Test Results is presented in Table 1. Results of the laboratory testing are also included in Appendix C.

Studies performed in the vicinity of the site include a Soil, Geology and Geologic Hazard Study by Entech Engineering, Inc. for the property south of the site (Referenced 1). Information from this report was used in evaluating the site.

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 10 miles to the west 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 end of a large structural feature known as the Denver Basin. Bedrock in the area tends to be gently dipping in a northeasterly direction. The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site itself is the Dawson Formation. Overlying the Dawson Formation are unconsolidated deposits of eolian, alluvial, and artificial soils of Quaternary Age. The eolian sands were deposited as windblown sand dune deposits. The alluvial soils were deposited as stream deposits. The artificial soils are associated with areas of man-made fill placed on-site. The site's stratigraphy will be discussed in more detail in the following section.

5.2 Soil Conservation Service

The Soil Conservation Service has mapped one soil type on the site (Figure 4)(Reference 2). In general, the soils consist of loamy sand. Soils are described as follows:

Type	Description
8	Blakeland loamy sand, 1-9% slopes

Complete descriptions of the soils are presented in Figure 5. The soils have been described to have rapid permeabilities. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate to severe erosion hazards.

5.3 Site Stratigraphy

The Colorado Springs Geology Map showing the site is presented in Figure 6 (Reference 3) and the Elsmere Quadrangle Geology Map is presented in Figure 7 (Reference 4). The Geology

Map prepared for the site is presented in Figure 8. Three mappable units were identified on this site which are identified as follows:

- **Qaf** **Artificial Fill of Quaternary Age: These** are man-made fill deposits associated fill piles on-site. Most of these fill piles are uncontrolled with soil and debris. Fill may be encountered in other areas of the site. Unless records can be obtained, the fill on-site will be considered uncontrolled for construction purposes.
- **Qal** **Recent Alluvium of Quaternary Age:** These are recent stream deposits associated with a minor drainage area in the central portion of the site. The materials consist of silty sands and may contain lenses of clay or silt.
- **Qes** **Eolian Sand of Quaternary Age: These** are windblown sand deposits that typically occur as ridges or dunes deposited by the prevailing winds from the northwest. The material consists of well sorted sands and silty sands that typically have high permeability and low density.

The bedrock underlying the site is the Dawson Formation of Tertiary to Cretaceous Age. The Dawson consists of arkosic sandstone with interbedded siltstone, claystone and shale. Typically the claystones and shales are expansive.

The soils listed above were mapped from the *Reconnaissance Geologic Map of Colorado Springs* distributed by the USGS in 1973 (Figure 6, Reference 3) and the *Elsmere Quadrangle Geology Map* the Colorado Geological Survey in 2003 (Figure 7, Reference 4). The Elsmere Quadrangle Geology Map by Charles Robinson and Associates, 1977 (Reference 5), *The Geologic Map of the Colorado Springs-Castle Rock area*, distributed by the USGS, 1979 (Reference 6) and the test borings drilled by Entech Engineering, Inc. were also used in evaluating the site. The Geology Map prepared for the site is presented in Figure 8.

5.4 Soil Conditions

The soils encountered in the test borings consisted of silty sand fill (SM), sandy clay fill (CL), sandy silty fill (ML) and native silty sands (SM), sandy clays (CL) and sandy silts (ML) overlying silty sandstone (SM). The upper soils were encountered at loose to medium dense states and at moist conditions. The fill on-site is slightly to moderately expansive. An FHA Swell pressure of 1210 psf was measured on the sandy clay fill. A swell of 0.6% was measured on the sandy

silt fill in the Denver Swell/ Consolidation Test. The native soils on-site are also slightly to moderately expansive. An FHA Swell pressure of 939 psf and a Denver Swell of 0.3% were measured on the silty sands. An FHA Swell pressure of 1970 psf was measured on the sandy silts. A swell of 0.6% was measured on the clays in the Denver Swell/ Consolidation Test. Bedrock was encountered at 17 feet in Test Boring No. 9. Bedrock was not encountered in any of the other test borings which were drilled to 20 feet. The bedrock encountered is non-plastic. A Summary of Laboratory Test Results is presented in Table 1. Laboratory Test Results are included in Appendix C.

5.5 Groundwater

Groundwater was not encountered in any of the test borings during or subsequent to drilling which were drilled to 20 feet. Groundwater is not expected to be at depths that should affect shallow foundations on much of the site. Areas of seasonal shallow groundwater have been identified on the site and are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

It should be noted that in the sandy materials on-site, some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock or clays. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with each individual problem as necessary at the time of construction.

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

As mentioned previously, detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 8). This map shows the location of various geologic conditions of which the developers and planners should be cognizant during the planning,

design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

Expansive Soils

Some areas of expansive soils were encountered in the upper soils in the test borings. These occurrences are too sporadic to be mapped, however, expansive clays may be encountered in the subsurface on the site. These clays can cause differential movement in the structure foundation. These occurrences should be identified and dealt with on an individual basis.

Mitigation: Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at 90% of Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Drilled piers are another option that is used in areas where highly expansive soils are encountered. Typical minimum pier depths are on the order of 20 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. Final recommendations should be determined after additional investigation of each building site.

Seasonal Shallow Groundwater Area

Areas mapped with this hazard may be subject to high groundwater conditions on a seasonal basis. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and possible frost heave potential, depending on the soil conditions.

Mitigation: We would anticipate these areas to be filled, during site grading raising foundation levels further above the groundwater level. Foundations in areas close to the water table are subject to severe frost heave potential and should penetrate sufficient depth so as to discourage the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 2.5 feet is recommended. In areas where high subsurface moisture conditions are anticipated periodically, drains may be necessary to help prevent the intrusion of water into areas located below grade. Typical Perimeter Drain Details are presented in Figure 9. During periods of high moisture, the water table may be shallower. It is anticipated that the site grading may mitigate areas of seasonally shallow groundwater. No areas of the site are

located within the FEMA floodplain (Figure 10, Reference 7). Exact floodplain location and drainage studies are beyond the scope of this report.

Hydrocompaction

Areas in which this hazard has been identified are acceptable as building sites. However, in areas identified for this hazard classification, we anticipate a potential for settlement movements upon saturation of these surficial soils. The low density, uniform grain sized, windblown sand deposits are particularly susceptible to this type of phenomenon.

Mitigation: The potential for settlement movement is directly related to saturation of the soils below the foundation areas. Therefore, good surface and subsurface drainage is extremely critical in these areas in order to minimize the potential for saturation of these soils. The ground surface around all permanent structures should be positively sloped away from the structure to all points, and water must not be allowed to stand or pond anywhere on the site. We recommend that the ground surface within 10 feet of the structures be sloped away with a minimum gradient of five percent. If this is not possible on the upslope side of the structures, then a well-defined swale should be created to intercept the surface water and carry it quickly and safely around and away from the structures. Roof drains should be made to discharge well away from the structures and into areas of positive drainage. Where several structures are involved, the overall drainage design should be such that water directed away from one structure is not directed against an adjacent building. Planting and watering in the immediate vicinity of the structures, as well as general lawn irrigation, should be minimized.

Areas of loose soils may also be encountered on this site. Should loose soils be encountered beneath foundations, recompaction of the upper 2 feet of soil at 90% of its maximum Modified Proctor Dry Density, ASTM D-1557 may be required. Proofrolling may also be necessary where roadways cross loose soils.

Artificial Fill

These are areas of man-made fill associated with filling and fill piles. Other areas of fill may be encountered on the site that were not mapped.

Mitigation: Unless records can be obtained, the fill is considered uncontrolled for construction purposes. Any uncontrolled fill encountered beneath foundations will

require removal and recompaction at 90% of its maximum Modified Proctor Dry Density, ASTM D-1557. Large areas of soil/ debris fill must be removed prior to development. An alternative mitigation in areas of deeper fill is the use of drilled pier foundation systems, as discussed under *Expansive Soils*.

Unstable Slopes

Some steeper slopes exist along a gully and some fill slopes in the central and southern portions of the site. These have been identified as unstable on the Geology Map, Figure 8. It is anticipated this area will be regraded during site grading. Slopes on-site should be graded to no steeper than 3:1 and fill should be properly compacted and benched into native soils. Some drainage improvements will be necessary prior to construction in this area of the site to allow for surface drainage. Drainage studies are beyond the scope of this report.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, the development will consist of single-family residential development. In our opinion, the existing geologic and engineering geologic conditions impose some constraints on the proposed development and construction. The most significant problems affecting development will be that of the hazards associated with hydrocompaction and existing uncontrolled fill. These and other hazards encountered on-site may be satisfactorily mitigated through proper engineering design and construction.

The upper native soils are suitable to support foundations. Foundations anticipated for the site consist of standard spread footings possibly in combination with overexcavation in areas of expansive soils, loose soils, or uncontrolled fill. Investigation on each lot is recommended prior to construction. Areas of fill will require removal and recompaction at 90% of its maximum Modified Proctor Dry Density, ASTM D-1557. Any concrete or debris encountered in the fill material would require removal prior to recompaction.

Areas in the central portion of the site along a drainage have been mapped with potentially seasonal shallow groundwater areas. In these areas we would anticipate some regrading that would mitigate the hazards by filling. All organic soils should be removed prior to site grading and filling.

Unstable slopes were identified in the central and southern portions of the site. It is anticipated that these areas will be regraded during site construction. All slopes should be no steeper than 3:1 and any fill should be properly compacted and benched into stabilized native slopes.

Areas of hydrocompaction potential have been mapped on the site. Grading should be done in a manner that directs surface flow away from structures and does not create areas of ponded water. Planting and watering near structures should be minimized. Areas of loose soils, if encountered, may require recompaction. Proofrolling may also be necessary for roadways that cross loose soils.

In summary, constraints on land use development and construction may be satisfactorily mitigated through proper engineering design and construction practices or through avoidance.

7.0 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), the site is mapped as eolian sand deposits. The majority of the site has been excluded from resource value on Map 3 due to development. An inactive mine, probably a sand quarry, was identified south of the site on the Resource Maps (Reference 8). 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 mapped as E4 – wind deposited sand: probable aggregate resource. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), tracts in the area of the site have been mapped as "Fair" to "Good" for industrial minerals. Quarries exist in the area of the site for sand and gravel, particularly in the Eolian Sand and Verdos Alluvium deposits. No gravel quarries are known to have existed on the site itself. Considering the close proximity to development, and abundance of similar materials through the region, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 10), the tracts in the area of the site have been mapped as "Moderate" for coal resources. The site lies within the Denver coal region and 3 miles east of

formerly productive coalmines. Due to the close proximity to development, it is anticipated that coal would not be a resource considered for extraction on this site. The area of the site is considered to have "Little to no potential" for metallic compounds (Reference 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No known oil or gas wells have been drilled within 2 miles of the site. The sedimentary rocks in the area have the essential elements for oil or gas, but may not contain the geologic structure for traps or reservoirs.

8.0 EROSION CONTROL

The soil types observed on the site are moderately susceptible to wind erosion, and moderately 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 reestablished, 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 re-vegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

9.0 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. Geologic conditions on-site may be satisfactorily mitigated through proper engineering design and construction practices.

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 building sites 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 Sand Creek Investments North, LLC 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.

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TABLES

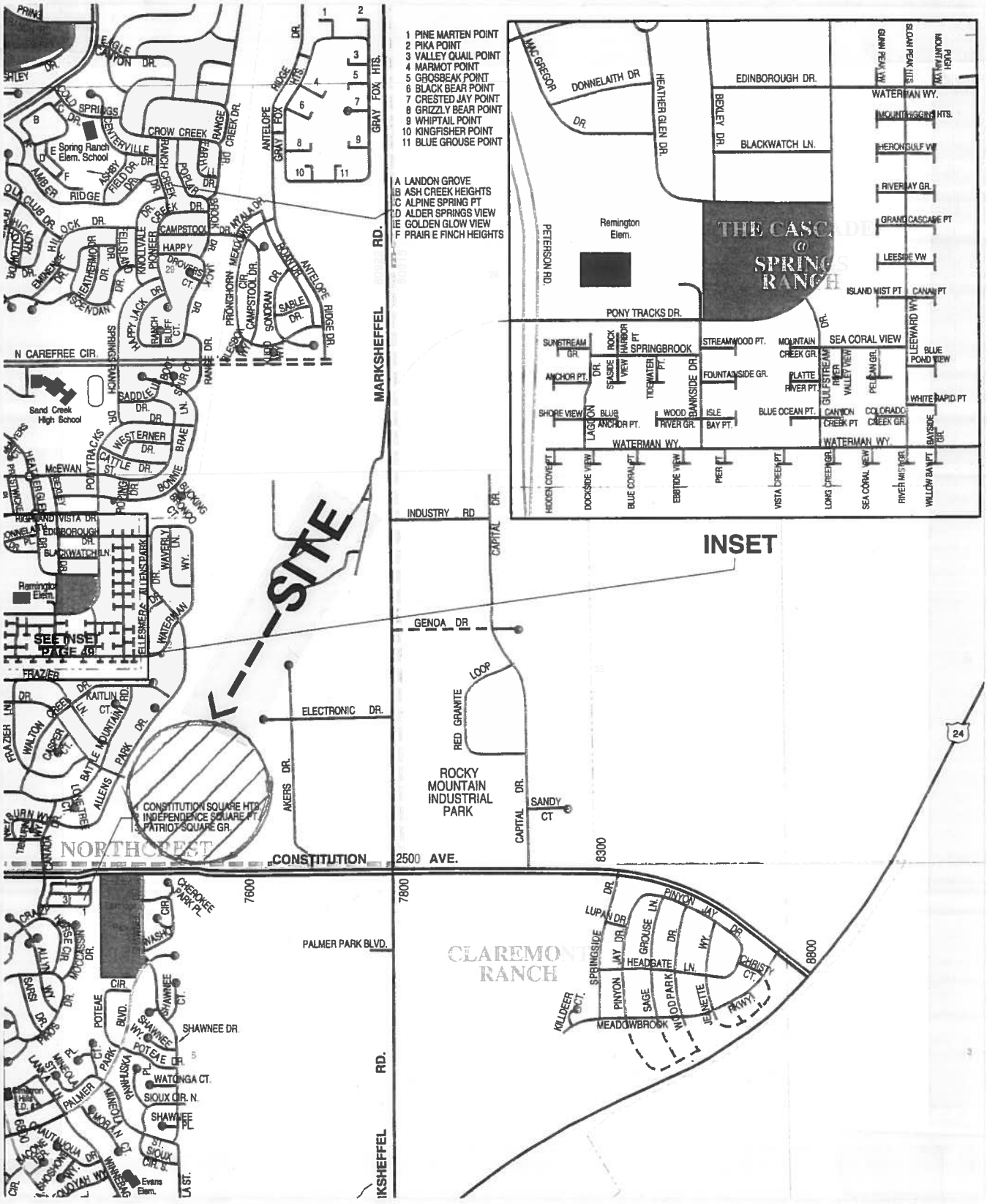
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT SAND CREEK INVESTMENT
PROJECT SAND CREEK COMMUNITIES
JOB NO. 35044

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	TB-3	5'				1210		CL	FILL, CLAY, SANDY
1	TB-4	2-3'	53.4%	38	9			ML	FILL, SILT, VERY SANDY
1	TB-4	2-3'					0.6%	ML	FILL, SILT, VERY SANDY
2	TB-1	10'	39.7%	29	3	939		SM	SAND, SILTY
2	TB-2	5-10'	23.4%	25	3			SM	SAND, SILTY
2	TB-1	10'					0.3%	SM	SAND, SILTY
3	TB-7	3'					0.6%	CL	CLAY, SANDY
4	TB-4	5'	73.1%	37	11	1970		ML	SILT, SANDY
5	TB-9	20'	29.1%	NV	NP			SM	SANDSTONE, SILTY

FIGURES



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

VICINITY MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN:	DATE:	CHECKED:	DATE:
RJO	28DEC04		

JOB NO.: 35044

FIG NO.: 1

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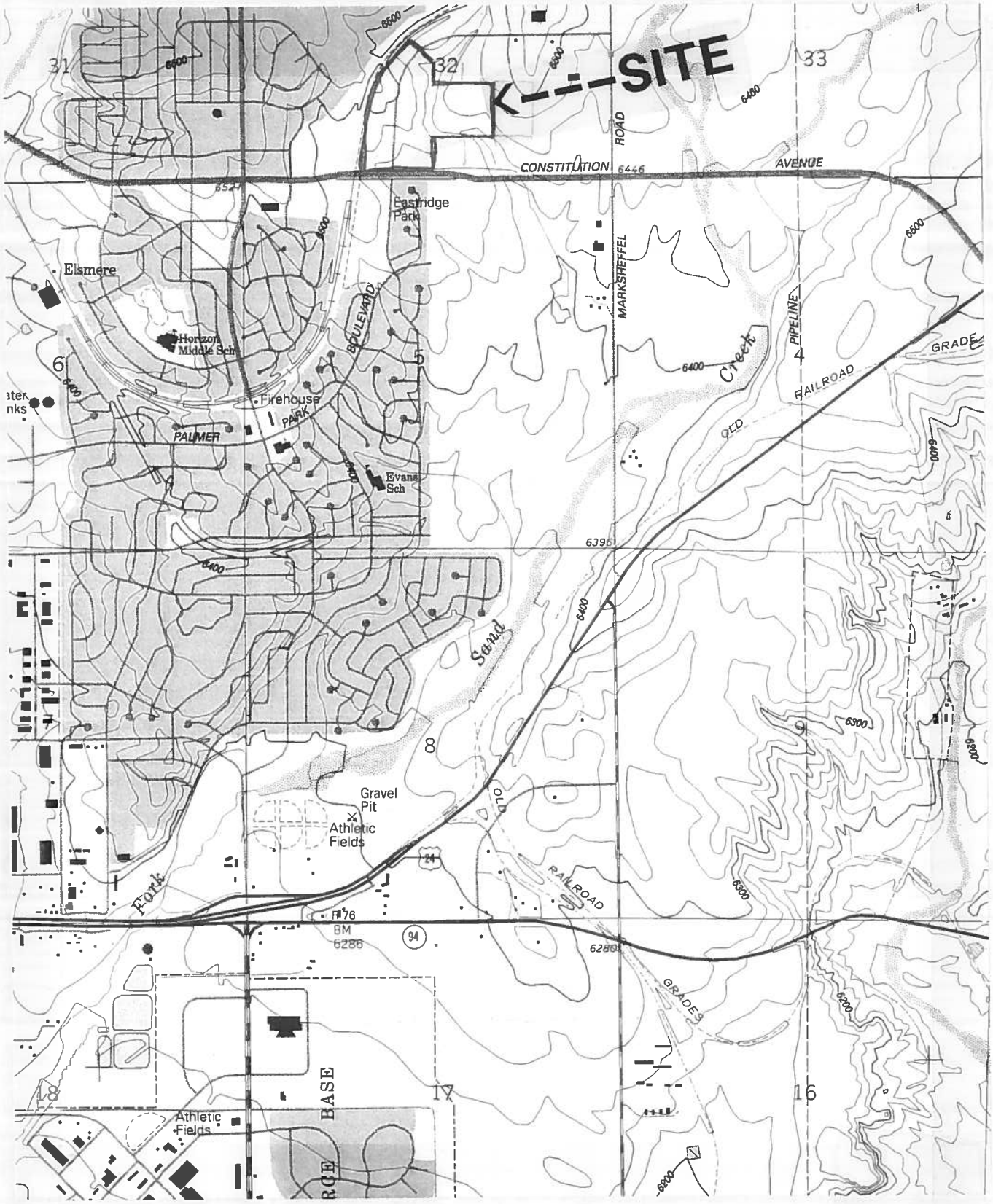

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USGS MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN:	DATE:	CHECKED:	DATE:
RJO	28DEC04		

JOB NO.: 35044

FIG NO.: 2

TB – INDICATES APPROXIMATE TEST BORING LOCATION AND NUMBER

REVISION	BY:
REVISED PER NEW DEVELOPMENT PLAN 13JUN05	RJO

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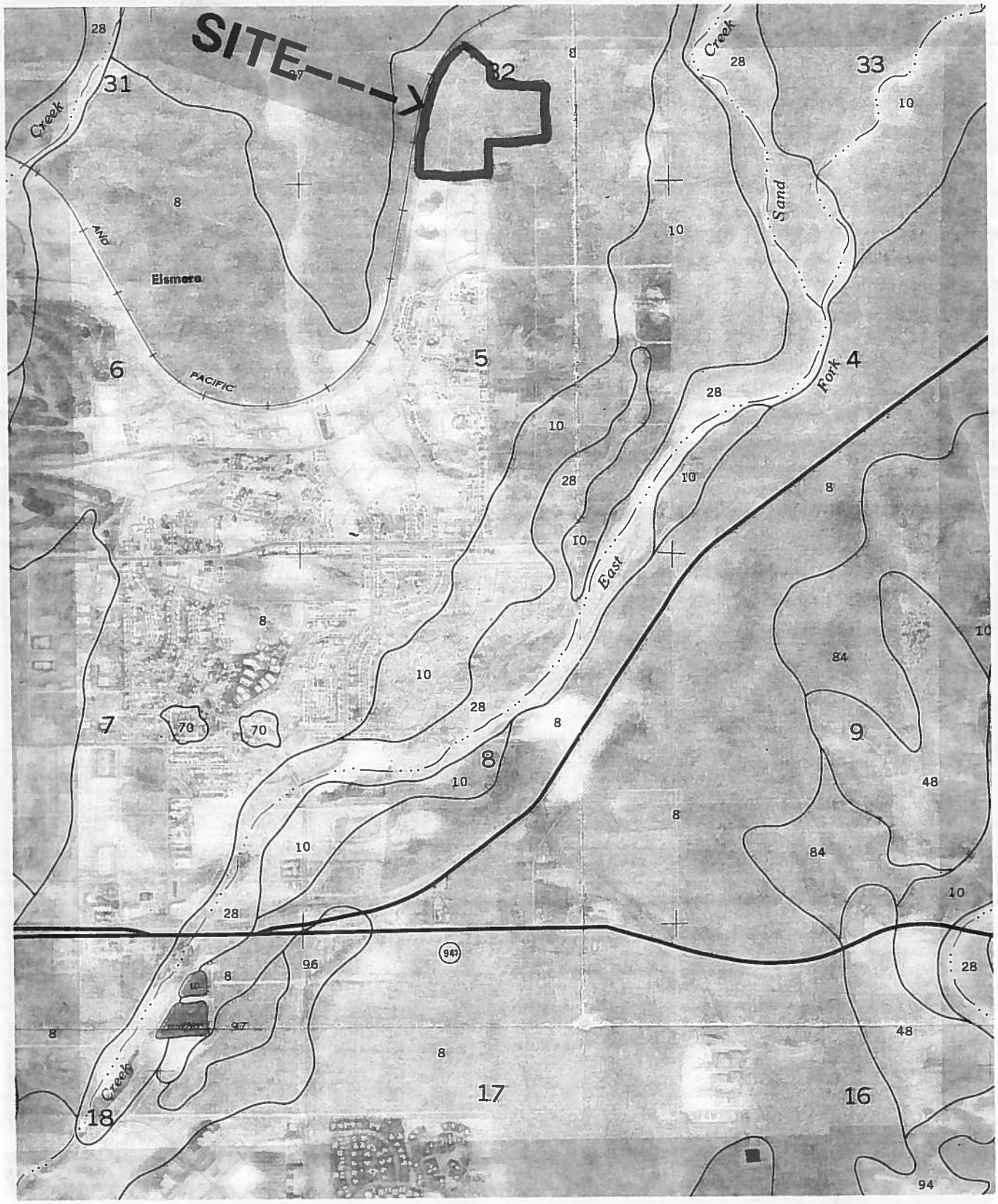
COLORADO SPRINGS, CO. 80907
(719) 531-5599

TEST BORING LOCATION PLAN
SAND CREEK COMMUNITIES
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN BY:	R.J. OLSON
DESIGNED BY:	KAH
CHECKED BY:	
DATE:	13JAN05
SCALE:	1" = 125'
JOB NO.:	35044
FIGURE NO.:	3



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SCS MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN:	DATE:	CHECKED:	DATE:
RJO	28DEC04		

JOB NO.: 35044

FIG NO.: 4

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8—**Blakeland loamy sand, 1 to 9 percent slopes.** This deep, somewhat excessively drained soil formed in alluvial and eolian material derived from arkosic sedimentary rock on uplands. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The substratum, to a depth of 27 inches, is brown loamy sand; it grades to pale brown sand that extends to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; Truckton sandy loam, 0 to 3 percent slopes; Truckton sandy loam, 3 to 9 percent slopes; and Stapleton sandy loam, 3 to 8 percent slopes. In some areas, mainly north of Colorado Springs in the Cottonwood Creek area, arkosic beds of sandstone and shale are at a depth of 0 to 40 inches.

Permeability of this Blakeland soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Organic matter content of the surface layer is medium. Surface runoff is slow, the hazard of erosion is moderate, and the hazard of soil blowing is severe.

Most areas of this soil are used for range, homesites, and wildlife habitat.

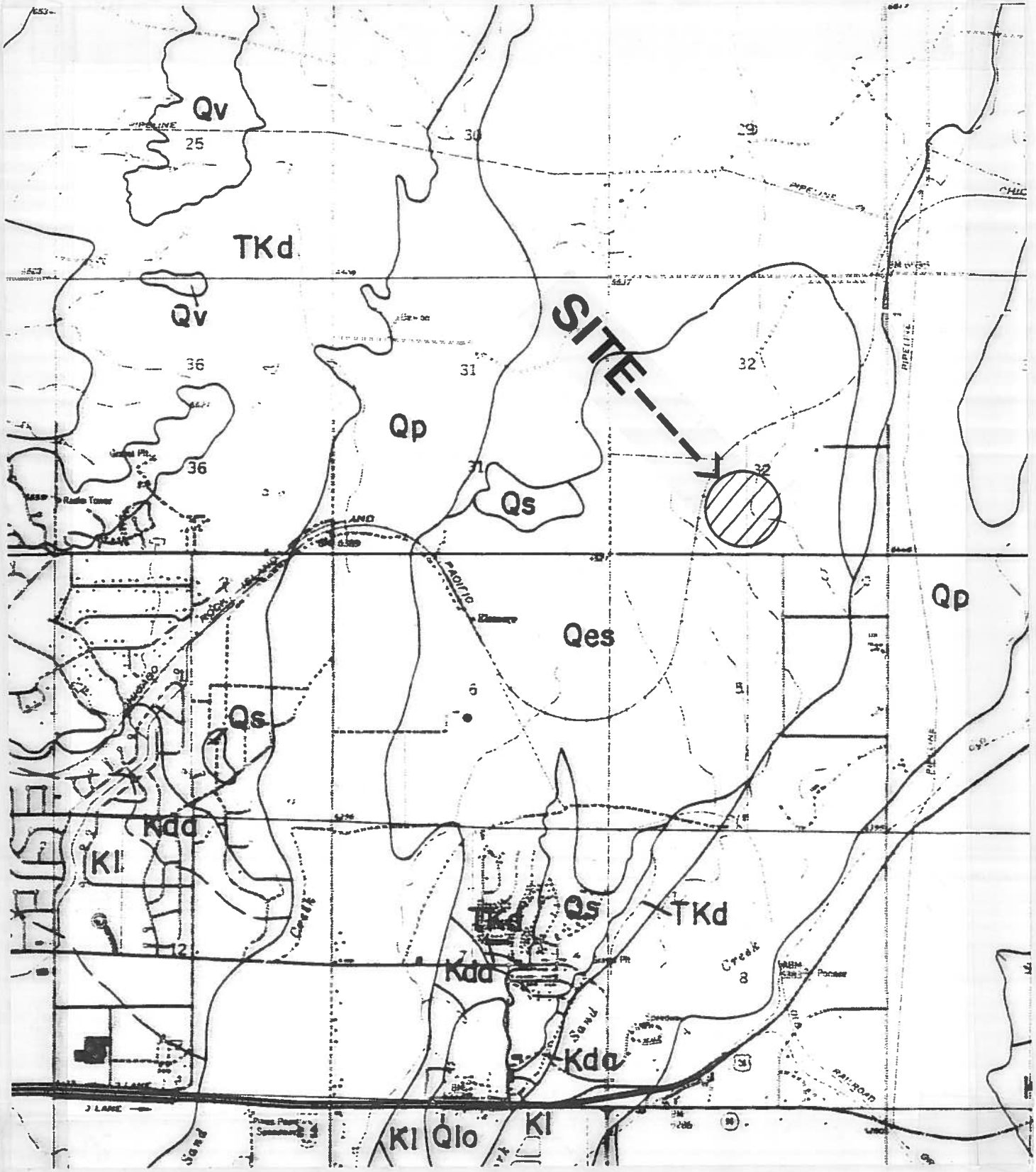
Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread. This soil is best suited to deep-rooted grasses.

Proper range management is necessary to prevent excessive removal of plant cover from the soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for urban development. Soil blowing is a hazard if protective vegetation is removed. Special erosion control practices must be provided to minimize soil losses. Capability subclass VIe.



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COLORADO SPRINGS GEOLOGY MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN:	DATE:	CHECKED:	DATE:
RJO	28DEC04		

JOB NO.: 35044

FIG NO.: 6

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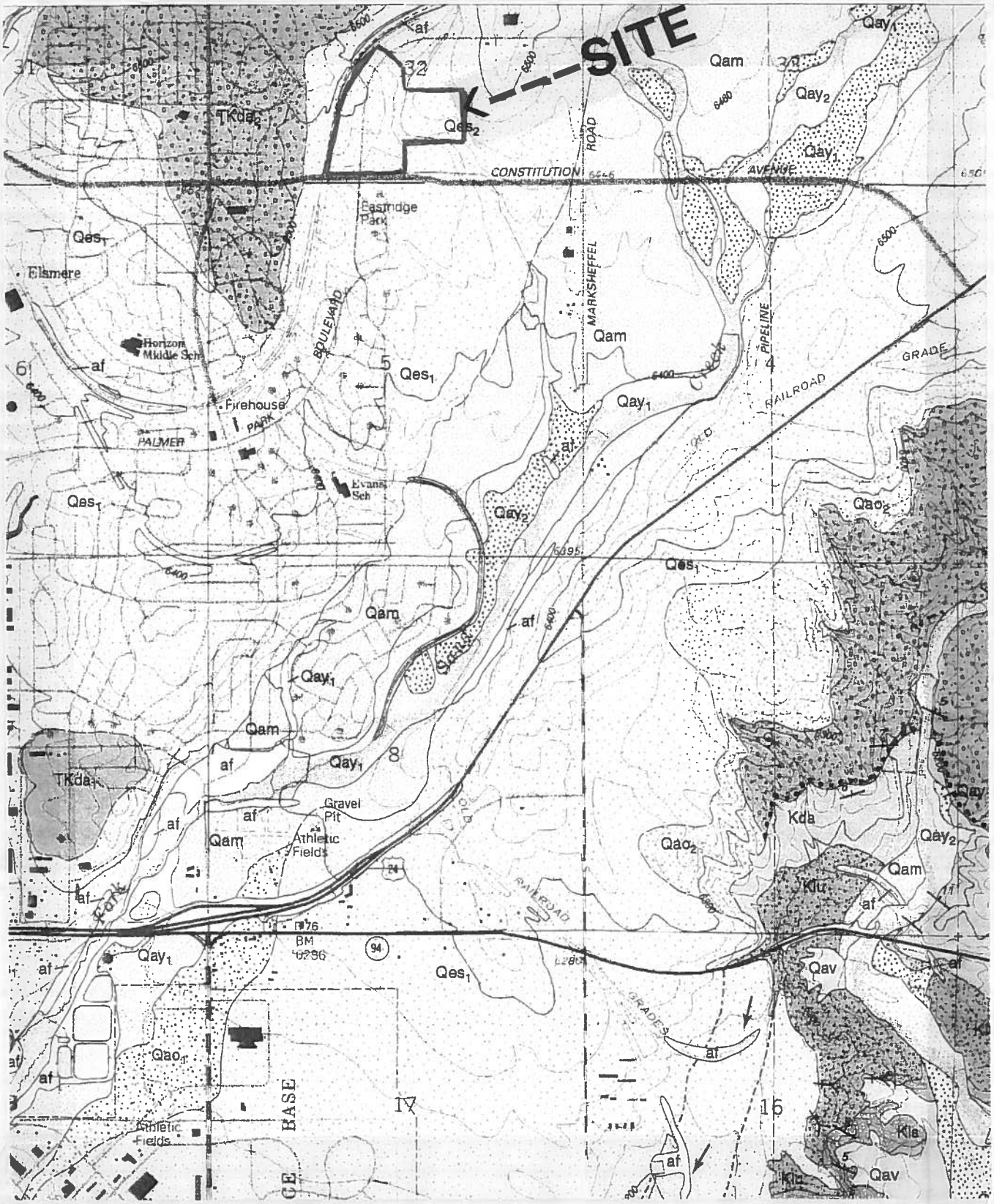

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ELSMERE QUADRANGLE GEOLOGY MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN:	DATE:	CHECKED:	DATE:
RJO	28DEC04		

JOB NO.: 35044

FIG NO.: 7

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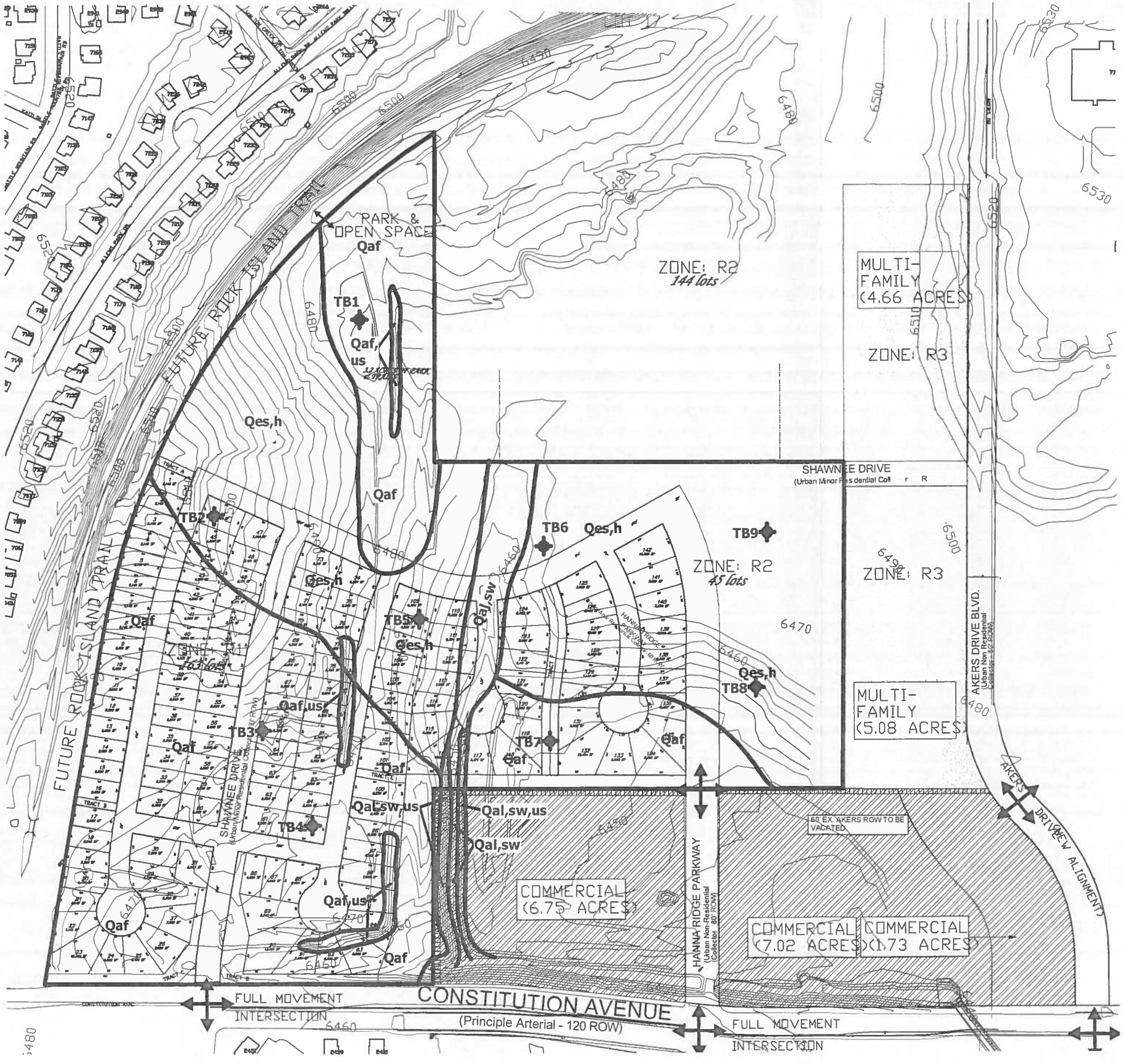

LEGEND

Qaf -*Artificial Fill of Quaternary Age :*
Man-made fill deposits.

Qal -*Recent Alluvium of Quaternary Age :*
Stream deposits.

Qes - *Eolian Sand Deposits of Quaternary Age :*
Windblown sands

sw - Seasonal high groundwater area.

h - Hydrocompaction.

us - Unstable slopes.

TB - Approximate location of Test Borings.

REVISION	BY:
REVISED PER NEW DEVELOPMENT PLAN 13JUN05	RJO

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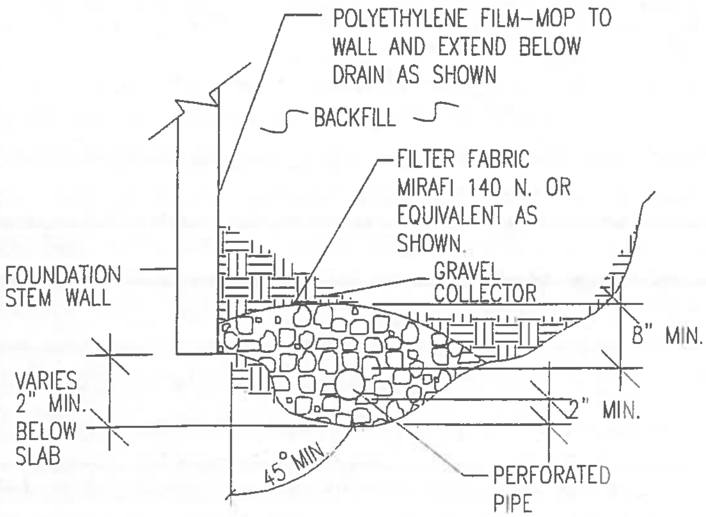
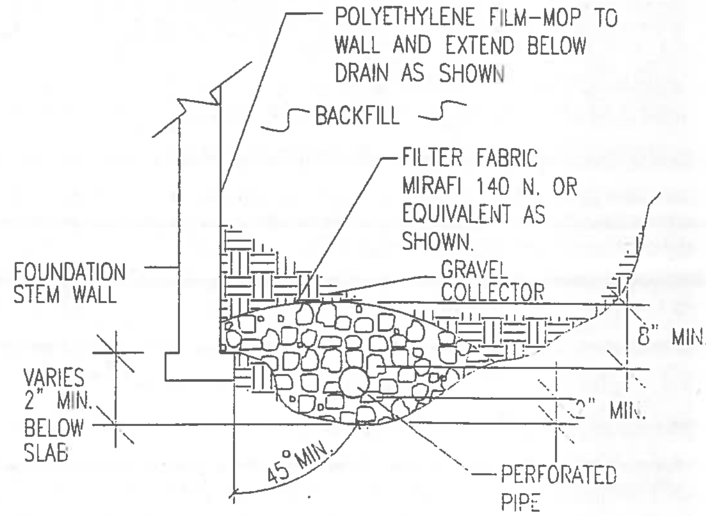
GOELOGY/ ENGINEERING GEOLOGY MAP
SAND CREEK COMMUNITIES
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN BY:	R.J. OLSON
DESIGNED BY:	KAH
CHECKED BY:	
DATE:	13JAN05
SCALE:	1" = 125'
JOB NO.:	35044
FIGURE NO.:	8





NOTES:

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

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

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

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

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

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

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PERIMETER DRAIN DETAIL

DRAWN	DATE	DESIGNED	CHECKED
R.J. OLSON			

JOB NO.: 35044

FIG NO.: 9

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

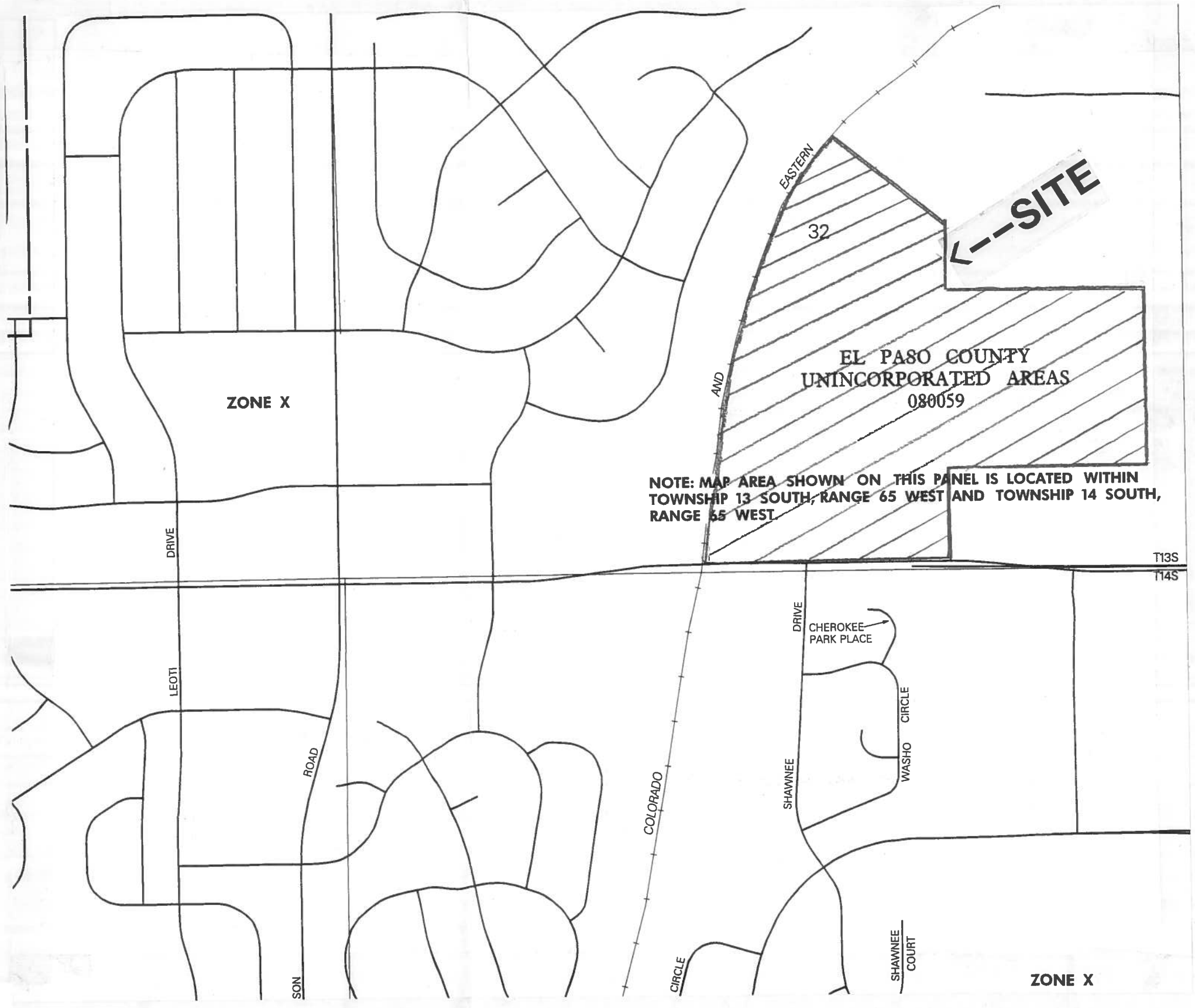
- **ZONE X** — Areas determined to be outside 500-year floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.
- D — D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.
- RM7 × — Elevation Reference Mark
- ● M2 — River Mile
- 97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

REVISION	BY

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

FLOODPLAIN MAP
SAND CREEK COMMUNITY PROPERTY
EL PASO COUNTY, CO.
FOR: SAND CREEK INVESTMENTS NORTH, LLC.

DRAWN	R.J.OLSON
CHECKED	
DATE	28DEC04
SCALE	AS SHOWN
JOB NO.	35044
FIGURE No.	10

APPENDIX A: Site Photographs

1

Looking northeast from southeast corner of site.

2

Looking northeast from west-central portion of site.

3

Looking east from west-central portion of site.

4

Looking south from west-central portion of site.

5

Looking east from central portion of site.

6

Looking west from southern portion of site.

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 12/17/04
Job # 35044

REMARKS

DRY TO 20',
12/17/04
CAVED TO 18',
12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			11	5.2	2
5			18	8.4	2
10			28	11.2	2
15			30	13.4	2
20			28	17.4	3

SAND, SILTY, FINE GRAINED, DARK BROWN, MEDIUM DENSE, MOIST

SAND, SILTY, FINE GRAINED, LIGHT BROWN, MEDIUM DENSE TO DENSE, MOIST

CLAY, SANDY, BROWN, STIFF, MOIST

TEST BORING NO. 2
DATE DRILLED 12/17/04
CLIENT SAND CREEK INVESTMENTS
LOCATION SAND CREEK COMMUNITIES

REMARKS

DRY TO 20', 12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			7	9.5	2
5			8	7.9	2
10			9	8.6	2
15			12	5.7	2
20			14	4.3	2

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

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

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 12/17/04
Job # 35044

REMARKS

DRY TO 20', 12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			18	11.3	1
5			7	17.0	1
10			8	10.8	2
15			8	10.8	2
20			7	9.7	2

FILL 0-9', SAND, SILTY WITH SANDSTONE FRAGMENTS, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST

FILL, CLAY, SANDY, BROWN, SOFT, MOIST

SAND, SILTY, FINE TO MEDIUM GRAINED, LOOSE, MOIST

TEST BORING NO. 4
DATE DRILLED 12/17/04
CLIENT SAND CREEK INVESTMENTS
LOCATION SAND CREEK COMMUNITIES

REMARKS

DRY TO 20',
12/17/04
CAVED TO 17.5',
12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			22	12.0	1
5			12	14.0	4
10			26	17.0	4
15			26	3.5	2
20			22	8.8	2

FILL 0-3', SILT, VERY SANDY, LIGHT BROWN, STIFF, MOIST

SILT, VERY SANDY, DARK BROWN TO LIGHT BROWN, FIRM TO STIFF, MOIST

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

ENTECH
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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KMH	12/28/04

JOB NO.: 35044
FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 12/17/04
Job # 35044

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 12/19/04						
SAND, SILTY, FINE GRAINED, BROWN, LOOSE TO MEDIUM DENSE, MOIST				8	5.5	2
	5			13	6.5	2
SAND, CLAYEY, FINE GRAINED, BROWN						2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	10			27	4.7	2
CLAY, VERY SANDY, BROWN, STIFF, MOIST	15			22	13.3	3
SAND, SILTY, FINE GRAINED, LIGHT BROWN, MEDIUM DENSE, MOIST	20			22	9.6	2

TEST BORING NO. 6
DATE DRILLED 12/17/04
CLIENT SAND CREEK INVESTMENTS
LOCATION SAND CREEK COMMUNITIES

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 12/19/04						
SAND, SILTY, FINE GRAINED, BROWN TO LIGHT BROWN, MEDIUM DENSE, MOIST				19	9.9	2
	5			29	9.9	2
	10			18	10.1	2
CLAY, SANDY, TAN, STIFF, MOIST	15			23	16.2	2
SAND, SILTY, FINE TO MEDIUM GRAINED, LIGHT BROWN, MEDIUM DENSE, MOIST	20			18	18.1	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: B-3

TEST BORING NO. 7
DATE DRILLED 12/17/04
Job # 35044

REMARKS

DRY TO 20', 12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			10	16.4	3
5			6	6.7	2
10			15	6.0	2
15			16	8.5	2
20			16	12.6	2

CLAY, SANDY, DARK BROWN, FIRM, MOIST

SAND, SILTY, FINE TO MEDIUM GRAINED, LIGHT BROWN LOOSE TO MEDIUM DENSE, MOIST

TEST BORING NO. 8
DATE DRILLED 12/17/04
CLIENT SAND CREEK INVESTMENTS
LOCATION SAND CREEK COMMUNITIES

REMARKS

DRY TO 20', 12/19/04

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					3
			11	6.9	2
5			10	6.1	2
10			19	11.3	2
15			9	11.4	2
			*	13.1	4
20			24	13.3	4

CLAY, SANDY, DARK BROWN

SAND, SILTY, FINE TO COARSE GRAINED, LIGHT BROWN, MEDIUM DENSE, MOIST

SAND, CLAYEY, FINE GRAINED, LIGHT BROWN, MEDIUM DENSE, MOIST

SAND, SILTY, FINE GRAINED, LIGHT BROWN, LOOSE, MOIST

SILT, VERY SANDY, BROWN, STIFF, MOIST

* - BULK SAMPLE TAKEN

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: B-4

TEST BORING NO.	9
DATE DRILLED	12/17/04
Job #	35044

TEST BORING NO.	
DATE DRILLED	
CLIENT	SAND CREEK INVESTMENTS
LOCATION	SAND CREEK COMMUNITIES

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 12/19/04						
CLAY, SAND, DARK BROWN						3
SAND, SILTY, FINE TO MEDIUM GRAINED, LIGHT BROWN, LOOSE TO MEDIUM DENSE, MOIST	5			9	6.9	2
				23	7.4	2
SAND, SILTY, FINE TO MEDIUM GAINED, TAN, MEDIUM DENSE, MOIST	10			18	4.3	2
	15			16	5.8	2
CLAYEY LENSES SANDSTONE, SILTY, FINE TO MEDIUM GRAINED, LIGHT BROWN, VERY DENSE, MOIST	20			50/9"	12.2	5

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	5					
	10					
	15					
	20					

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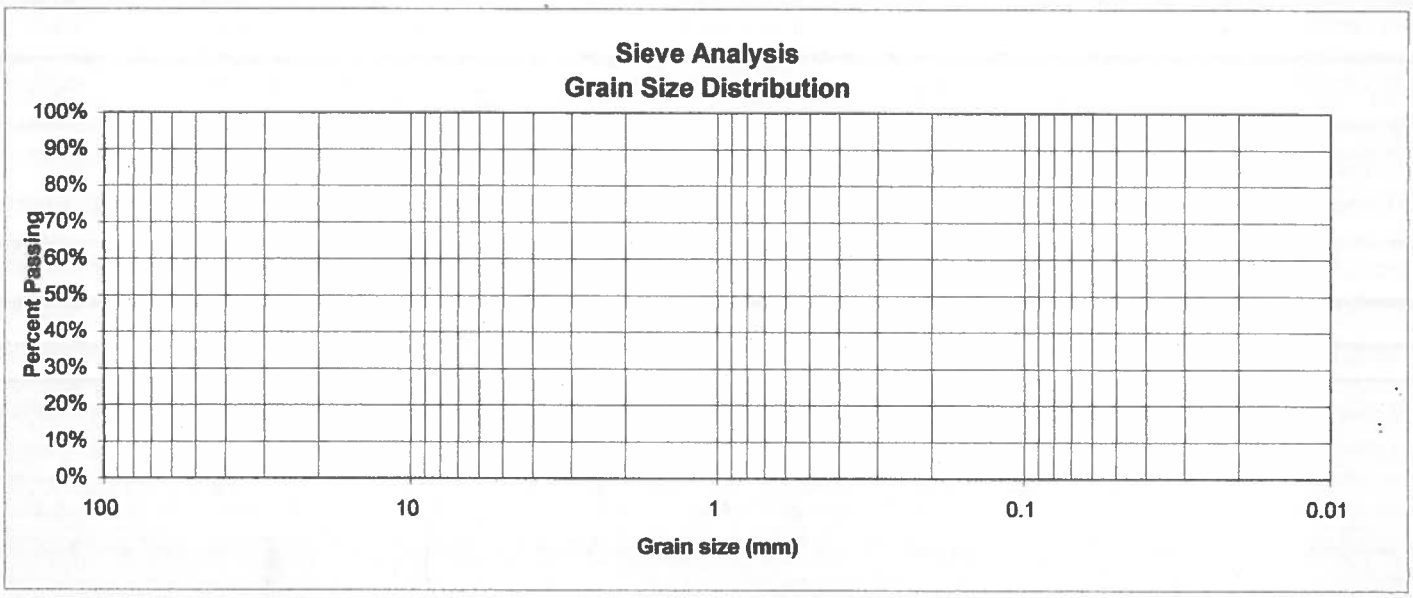
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: B-5

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	CL	CLIENT	SAND CREEK INVESTMENT
SOIL TYPE #	1	PROJECT	SAND CREEK COMMUNITIES
TEST BORING #	TB-3	JOB NO.	35044
DEPTH	5'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	
100	
200	

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	
Swell	
Moisture at start	13.4%
Moisture at finish	19.3%
Moisture increase	5.9%
Initial dry density (pcf)	105
Swell (psf)	1210

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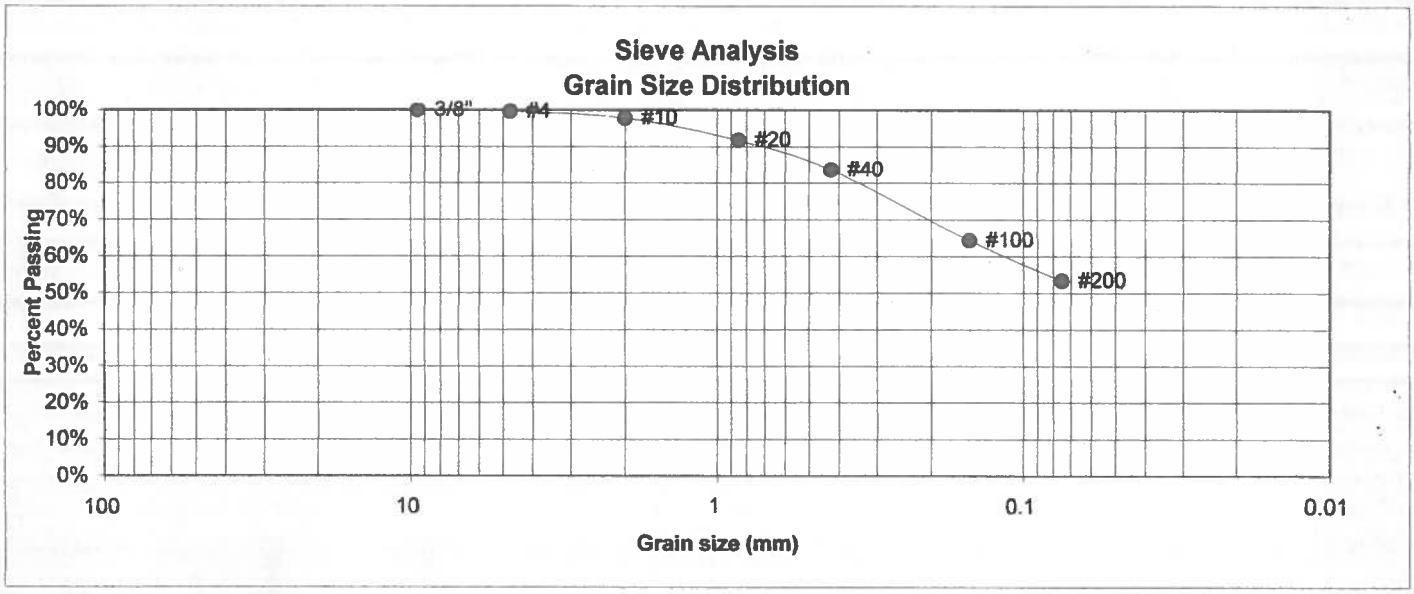
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: C-1

UNIFIED CLASSIFICATION	ML	CLIENT	SAND CREEK INVESTMENT
SOIL TYPE #	1	PROJECT	SAND CREEK COMMUNITIES
TEST BORING #	TB-4	JOB NO.	35044
DEPTH	2-3'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	97.8%
20	91.8%
40	83.7%
100	64.4%
200	53.4%

Atterberg Limits

Plastic Limit	29
Liquid Limit	38
Plastic Index	9

Swell

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

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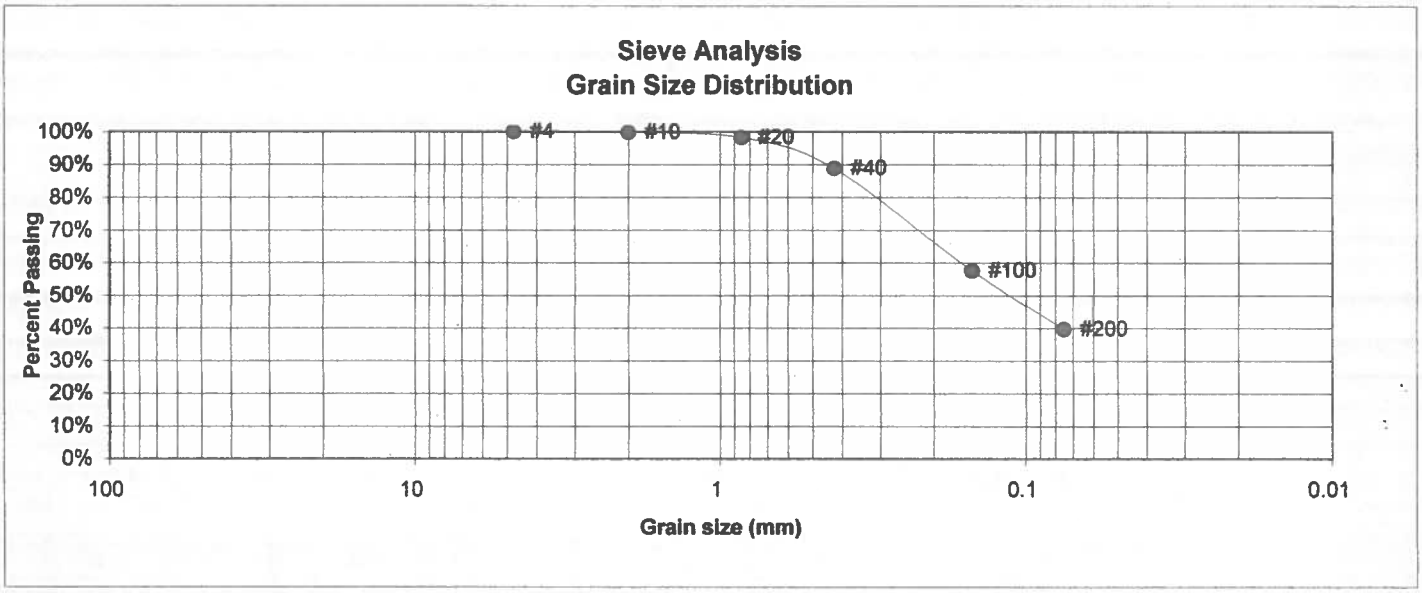
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAA	12/28/04

JOB NO.: 35044

FIG NO.: C-2

UNIFIED CLASSIFICATION	SM	CLIENT	SAND CREEK INVEST.
SOIL TYPE #	2	PROJECT	SAND CREEK COMM.
TEST BORING #	TB-1	JOB NO.	35044
DEPTH	10'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	98.2%
40	88.9%
100	57.5%
200	39.7%

Atterberg Limits	
Plastic Limit	26
Liquid Limit	29
Plastic Index	3

Swell	
Moisture at start	11.9%
Moisture at finish	22.8%
Moisture increase	10.9%
Initial dry density (pcf)	101
Swell (psf)	939

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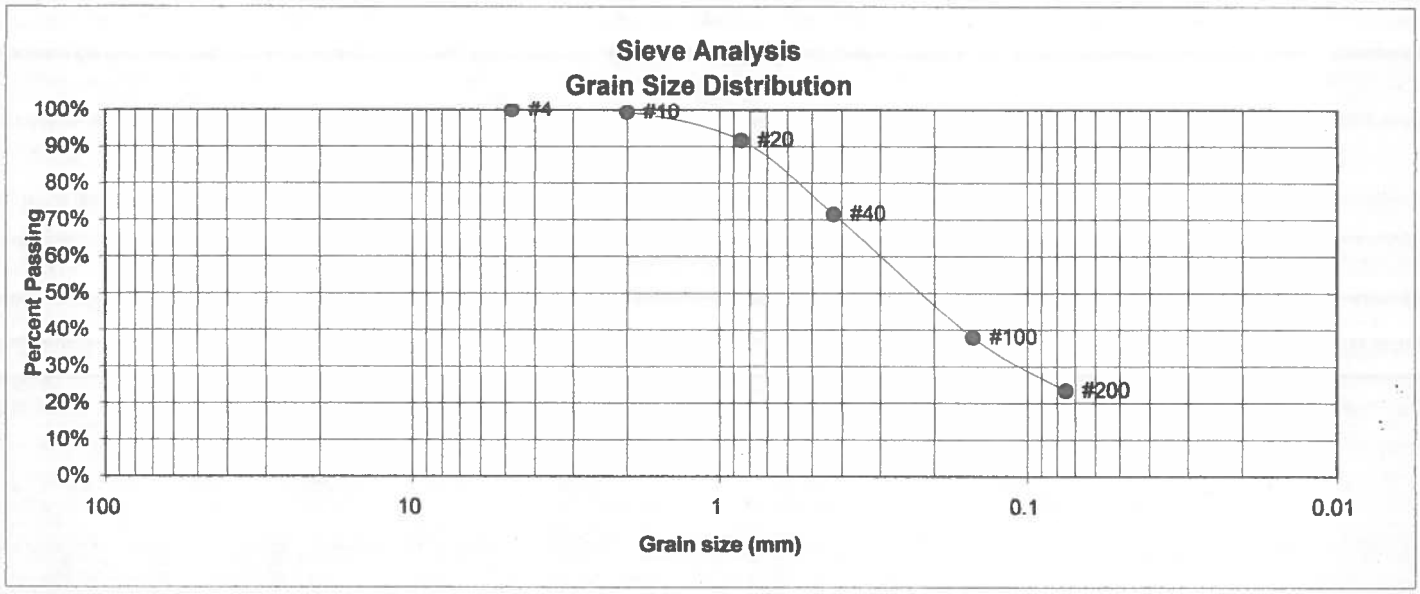
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: C-3

UNIFIED CLASSIFICATION	SM	CLIENT	SAND CREEK INVEST.
SOIL TYPE #	2	PROJECT	SAND CREEK COMM.
TEST BORING #	TB-2	JOB NO.	35044
DEPTH	5-10'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	91.6%
40	71.5%
100	37.9%
200	23.4%

Atterberg Limits	
Plastic Limit	22
Liquid Limit	25
Plastic Index	3

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

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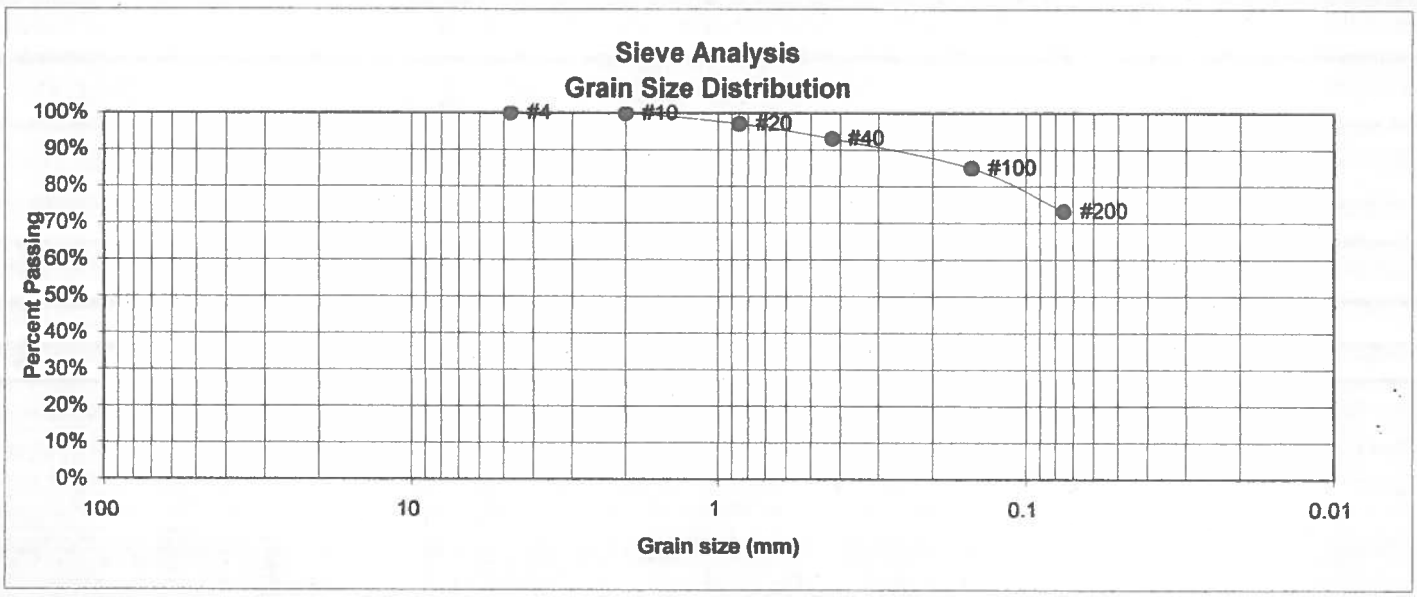
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LA-H	12/28/04

JOB NO.: 35044
FIG NO.: C-4

UNIFIED CLASSIFICATION	ML	CLIENT	SAND CREEK INVESTMENT
SOIL TYPE #	4	PROJECT	SAND CREEK COMMUNITIES
TEST BORING #	TB-4	JOB NO.	35044
DEPTH	5'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.9%
20	97.1%
40	93.1%
100	85.1%
200	73.1%

Atterberg Limits	
Plastic Limit	26
Liquid Limit	37
Plastic Index	11

Swell	
Moisture at start	15.7%
Moisture at finish	21.7%
Moisture increase	6.1%
Initial dry density (pcf)	102
Swell (psf)	1970

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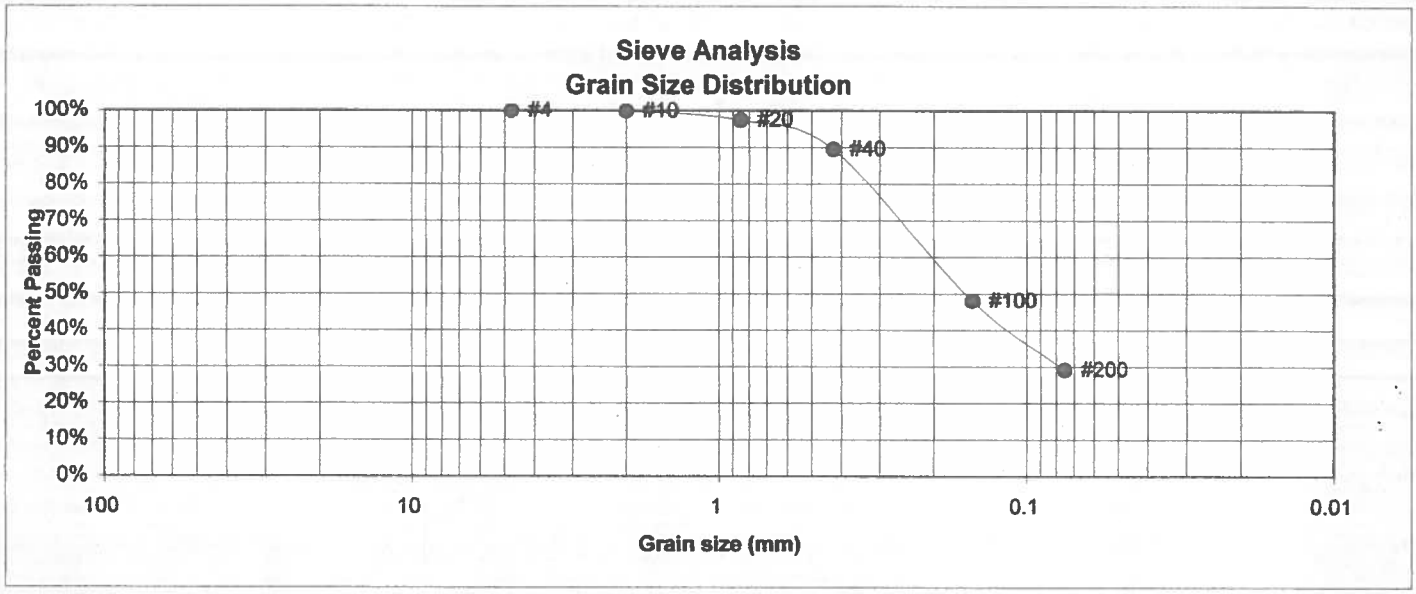
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: C-5

UNIFIED CLASSIFICATION	SM	CLIENT	SAND CREEK INVESTMENT
SOIL TYPE #	5	PROJECT	SAND CREEK COMMUNITIES
TEST BORING #	TB-9	JOB NO.	35044
DEPTH	20'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.9%
20	97.5%
40	89.4%
100	48.0%
200	29.1%

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

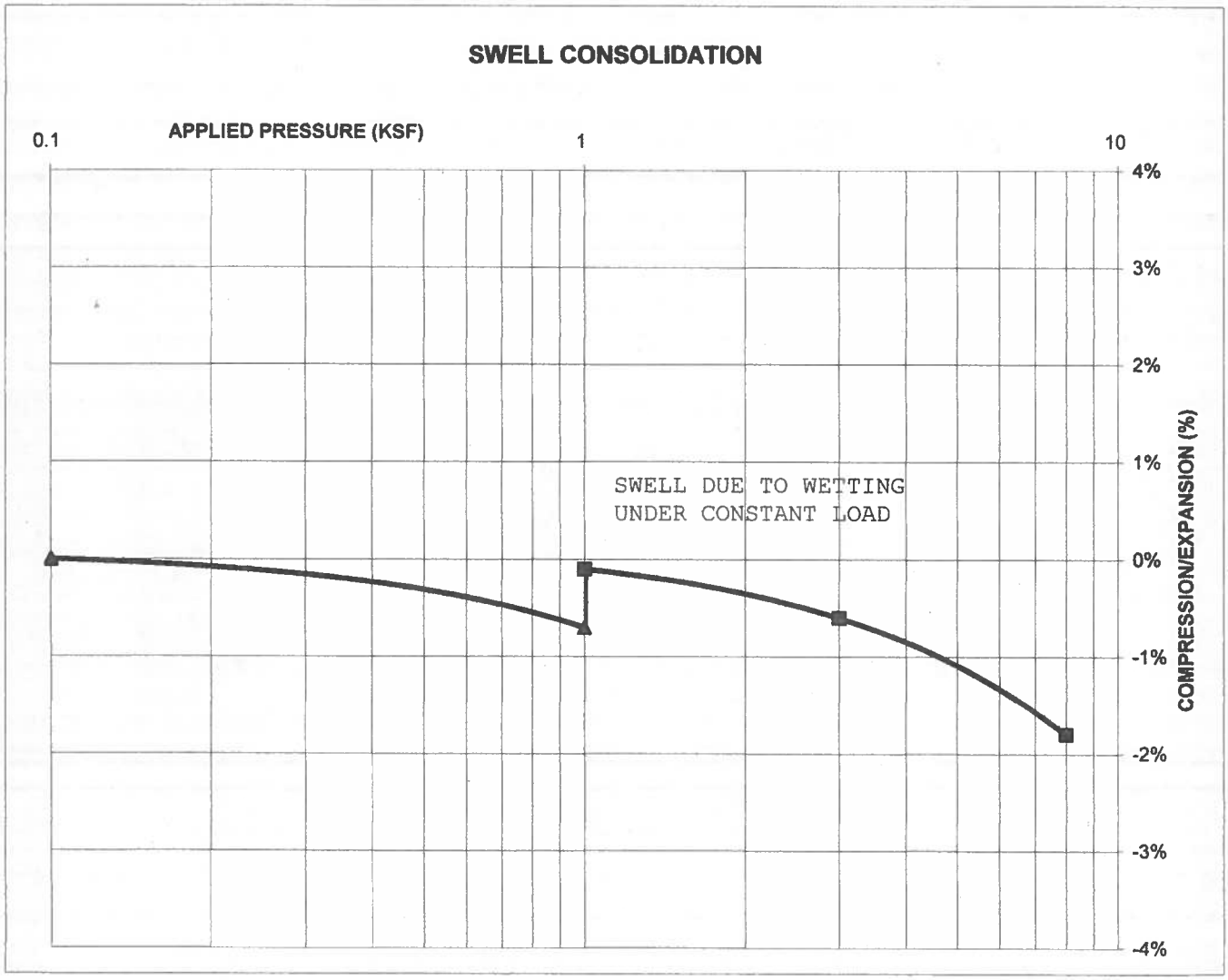
DRAWN:	DATE:	CHECKED:	DATE:
		GAH	12/28/04

JOB NO.: 35044
FIG NO.: C-6

CONSOLIDATION TEST RESULTS

SAMPLE FROM:	TB-4	AT DEPTH	2-3'
DESCRIPTION	ML	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			96
NATURAL MOISTURE CONTENT			21.3%
SWELL/CONSOLIDATION (%)			0.6%

JOB NO. 35044
CLIENT SAND CREEK INVESTMENT
PROJECT SAND CREEK COMMUNITIES



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SWELL CONSOLIDATION TEST RESULTS

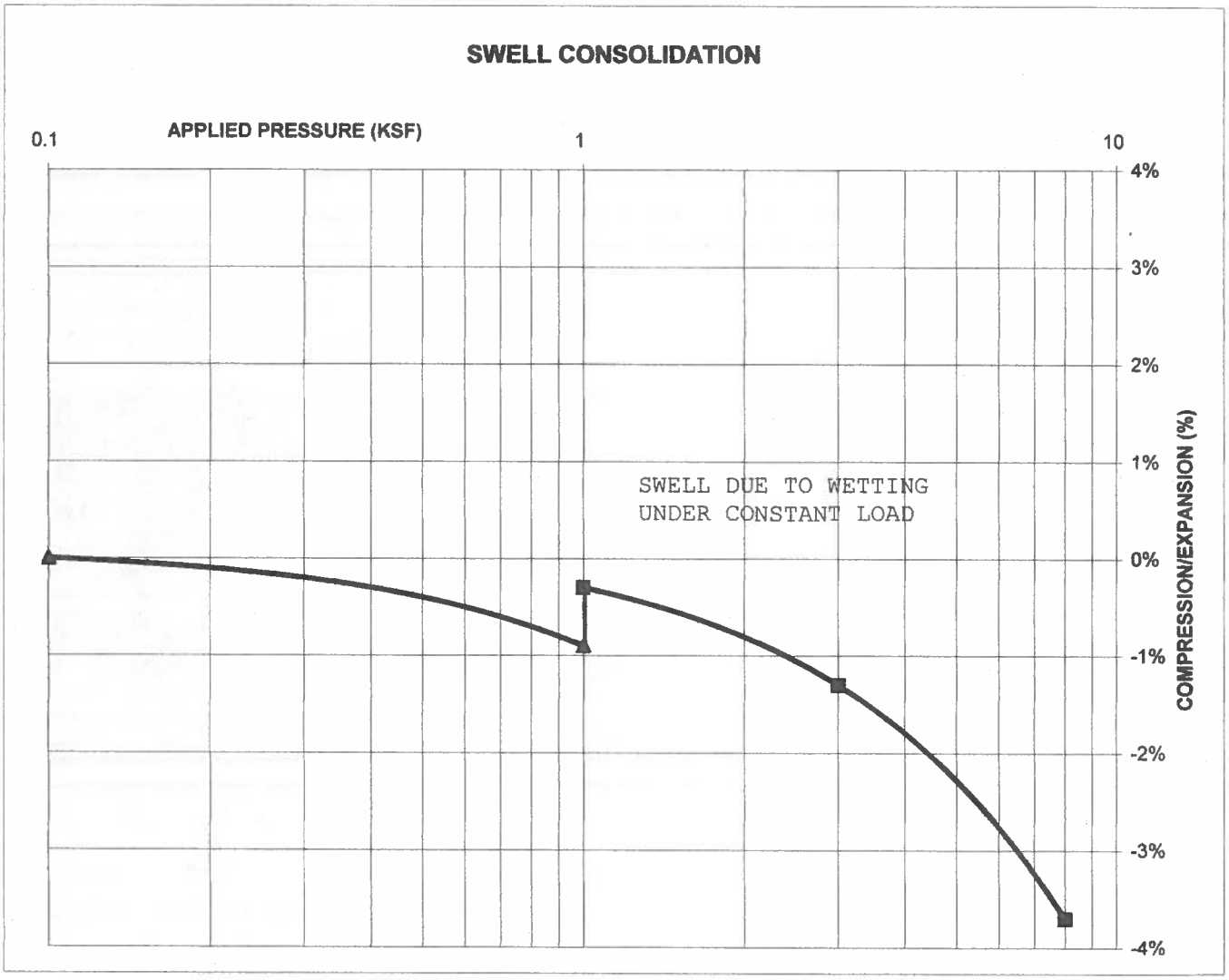
DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/04

JOB NO.: 35044
FIG NO.: C-7

CONSOLIDATION TEST RESULTS

SAMPLE FROM:	TB-7	AT DEPTH	3'
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			107
NATURAL MOISTURE CONTENT			16.7%
SWELL/CONSOLIDATION (%)			0.6%

JOB NO. 35044
CLIENT SAND CREEK INVESTMENT
PROJECT SAND CREEK COMMUNITIES



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SWELL CONSOLIDATION
TEST RESULTS

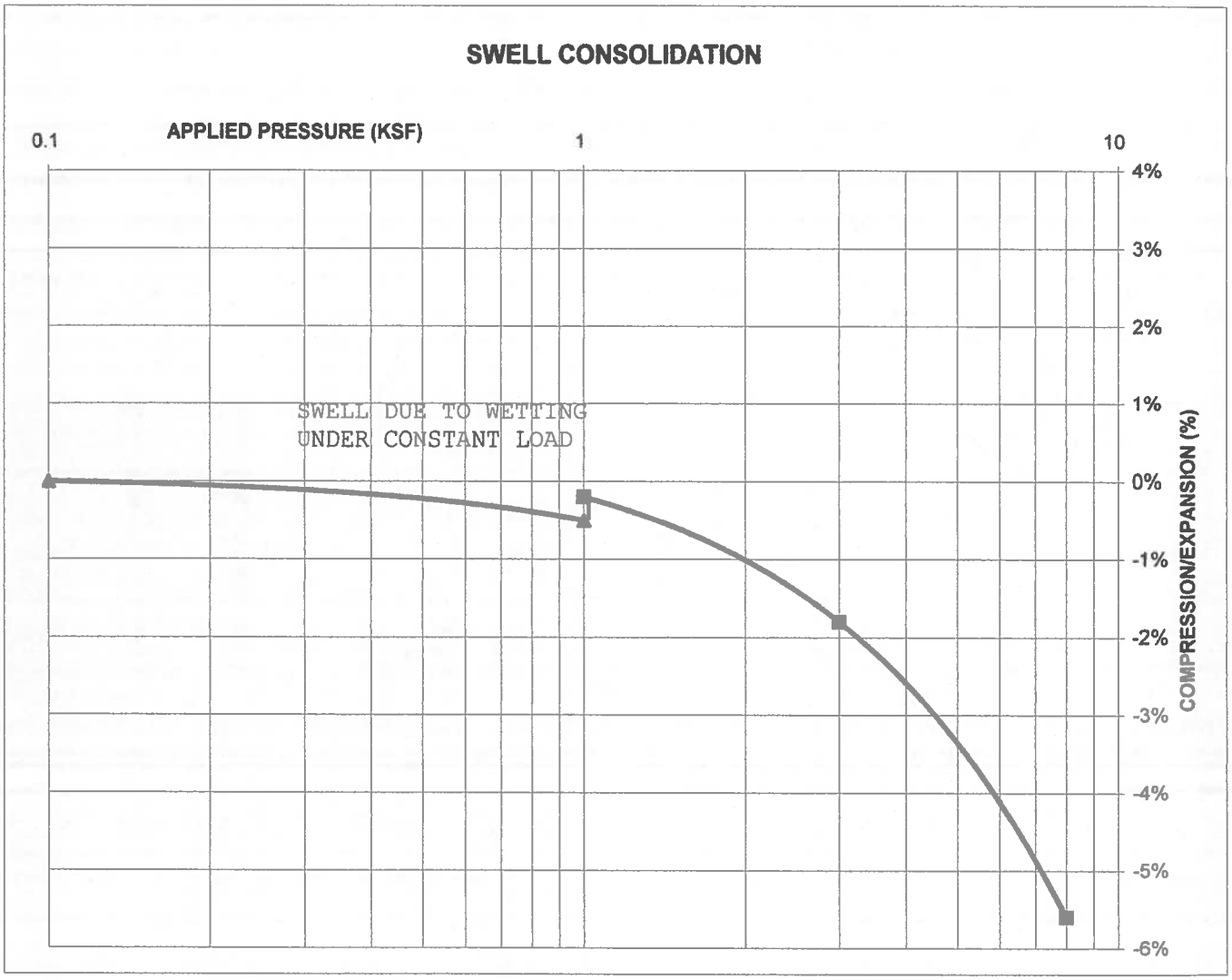
DRAWN:	DATE:	CHECKED:	DATE:
		KAH	12/28/01

JOB NO.: 35044
FIG NO.: C-9

CONSOLIDATION TEST RESULTS

SAMPLE FROM:	TB-1	AT DEPTH	10'
DESCRIPTION	SM	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			97
NATURAL MOISTURE CONTENT			13.5%
SWELL/CONSOLIDATION (%)			0.3%

JOB NO. 35044
CLIENT SAND CREEK INVESTMENT
PROJECT SAND CREEK COMMUNITIES



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	1/14/05

JOB NO.: 35044
FIG NO.: C-8