

March 28, 2018



**ENTECH**  
ENGINEERING, INC.

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

Hammers Construction  
1411 Woolsey Heights  
Colorado Springs, CO 80915

Attn: Zack Crabtree

Re: Soil, Geology and Geologic Hazard Evaluation  
Big O Tires  
6985 Meridian Road  
Falcon, Colorado

**PCD File No. SF-18-003**

Dear Mr. Butler:

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 subsurface soil conditions were previously investigated by Entech Engineering, Inc. in a Subsurface Soil Investigation, October 20, 2017 (Reference 1). This investigation is not intended to be a complete Soil and Geology Study that satisfies the El Paso County Land Development Code.

The project consists of commercial development on a 1.2-acre site. The site lies in El Paso County, Colorado, in the southern portion of Falcon, Colorado. The approximate location of the site is shown on the Vicinity Location Map, Figure 1.

The topography of the site is generally flat. No major drainages exist on the site. The site lies in portions of Sections 7 and 12, Township 13 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. Currently several commercial buildings exist on the site with a gravel parking area. It is our understanding the existing structures are to be removed and a new 4,710 square-foot auto service building with a 1,120 square-foot retail/sales building will be constructed. The Site Plan is presented in Figure 2.

Two test borings were drilled on the site to evaluate the subsurface soil conditions. The Test Boring logs are included in Appendix A. Laboratory Test Results are summarized in Table 1 and included in Appendix B. Information from this report was used evaluating the site.

The scope of this report will include a geologic analysis evaluation of the site utilizing published geologic data, available subsurface soils information and site-specific mapping of major geologic features, and identification of geologic hazards with respect to the development with recommended mitigation techniques. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) Survey was also reviewed to evaluate the site.

## **SOIL AND GEOLOGIC CONDITIONS**

### Soil Survey

The Natural Resource Conservation Service (NRCS) (Reference 2, Figure 3), previously the Soil Conservation Service (Reference 3) has mapped one soil type on the site. Complete

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Falcon, Colorado

description of the soils is presented in Appendix C. In general, the soils consist of gravelly sandy, loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
19	Columbine gravelly sand loam, 0-3% slopes

### Soils

The soils encountered in the test borings from Subsurface Soil Investigation (Reference 1) consisted of three feet of silty sand fill and slightly to silty native sand overlying silty sandstone. The upper soils were encountered as very loose to loose states and moist conditions. The soils are considered to have low expansion potential.

### Groundwater

Groundwater was encountered at 10 to 10.5 feet the test borings drilled on this site (Reference 1). It is anticipated groundwater will not affect shallow foundations on site with no basement construction. Fluctuations in groundwater conditions may occur due to variations in rainfall or other factors not readily apparent at this time. Isolated sand layers within the soil profile can carry water in the subsurface. Contractors should be cognizant of the potential for the occurrence of subsurface water features during construction.

### Geology

Approximately 16 miles west of the site is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northwesterly direction. The bedrock underlying the site consists of the Black Squirrel Formation of Cretaceous Age. The Black Squirrel Formation typically consists of coarse-grained arkosic sandstone with interbedded layers of fine-grained sandstone, siltstone or claystone.

The geology of the site was evaluated using the *Geologic Map of the Falcon Quadrangle*, by Morgan and White in 2012, (Reference 4, Figure 4). The Geology for the site is indicated in Figure 2. One mappable unit was identified on this site which, is as follows:

**Tbs**      **Black Squirrel Formation of Tertiary Age:** The Black Squirrel Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty sands and may contain layers of sandy clays.

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## **ENGINEERING GEOLOGIC HAZARDS**

Mapping has been performed on this site to identify areas where various geologic conditions exist of which developers should be cognizant during the planning, design and construction stages should new construction be proposed. The engineering geologic hazards identified on this site include artificial fill and loose soils. These hazards and recommended mitigation techniques are discussed as follows:

### **Artificial Fill**

Up to three feet of fill was encountered in one of the borings test drilled on site. Fill likely exists associated with the existing buildings, as well.

Mitigation: It is anticipated the fill will be removed during site grading. The old fill and debris from the existing buildings should be completely removed. All old formation remnants and utilities should be completely removed. Any uncontrolled fill encountered beneath new foundations should be removed and recompact at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

### **Loose Soils**

Loose to very loose soils were encountered in borings drilled on site (Reference 1). Loose soils encountered beneath the foundation or floor slabs will require mitigation.

Mitigation: Should loose soils be encountered beneath any new foundations or floor slabs, mitigation will be necessary. Overexcavation and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. An overexcavation depth of 2 to 3 feet is anticipated.

## **RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING**

As mentioned, the proposed development will be commercial. The existing buildings on the site are to be removed. The existing geologic and engineering geologic conditions will impose minor constraints on development and construction. The geologic conditions on the site include artificial fill and the loose soils, which can be satisfactorily mitigated through proper engineering design and construction practices. The site Subsurface Soil Investigation (Reference 1), was reviewed by the Colorado Geological Survey (CGS) February 19, 2018 (Reference 5). The CGS review letter is presented in Appendix D.

The upper granular soils encountered in the borings drilled on the site were encountered at loose to very loose states. Loose or collapsible soils, if encountered beneath foundation or floor slabs, will require recompactation. Expansive layers may also be encountered in the soil on this site. Expansive soils, if encountered, will require special foundation design. These soils will not prohibit development.

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Big O Tires  
6985 Meridian Road  
Falcon, Colorado

Fill exists on this site that is likely associated with the existing buildings. All fill, debris, foundation remnants and utilities should be completely removed and prior to construction. Any uncontrolled fill encountered beneath new foundations and floor slabs will require removal and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Groundwater was encountered at 10 to 10.5 feet in the test borings. It is anticipated groundwater will not affect a shallow foundation with slab-on-grade construction and no basement construction. According to the Drainage Report by JPS Engineering, January 18, 2018, (Reference 6) the site should not be affected by any delineated 100-year FEMA floodplains.

In summary, the recompacted granular soils will likely provide suitable support for shallow foundations. The geologic conditions encountered on site can be mitigated with proper engineering and construction practices. Specific recommendations have been made in the Subsurface Soil Investigation (Reference 1).

## **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. Any new construction considered on this site will require additional investigation. Construction and design personnel should be made familiar with the contents of this report. Specific construction and foundation recommendations will be provided when investigations are completed for any new construction.

This report has been prepared for Hammers Construction for application to the proposed development in accordance with generally accepted geologic, soil and engineering practices. No other warranty expresses or implied is made.

Hammers Construction  
Soil, Geology and Geologic Hazard Evaluation  
Big O Tires  
6985 Meridian Road  
Falcon, Colorado

We trust that this report has provided you with all the information that you required. Should you have any questions or require additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

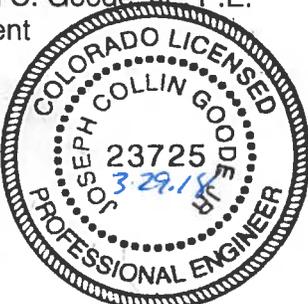
  
Kristen A. Andrew-Hoeser, P. G.  
Engineering Geologist

KAH/kc

Encl.

Entech Job No. 171206  
2MSW/tr/2017/171206sg&ghs

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



Hammers Construction  
Soil, Geology and Geologic Hazard Evaluation  
Big O Tires  
6985 Meridian Road  
Falcon, Colorado

## BIBLIOGRAPHY

1. Entech Engineering, Inc. October 20, 2017. *Subsurface Soil Investigation, Big O Tires, 6985 Meridian Road, Falcon, Colorado*. Entech Job No. C5.12.019.
- 7-2. Natural Resources Conservation Service. September 23, 2016. *Web Soil Survey*. United States Department of Agriculture. <http://websoilsurvey.sc.egov.usda.gov>.
- 8-3. United States Department of Agriculture Soil Conservation Service. June, 1981. *Soil Survey of El Paso County Area, Colorado*.
4. Morgan, Matthew L. and White, Jonathan L. 2012. *Falcon Quadrangle Geologic Map, El Paso County, Colorado*. Colorado Geological Survey. Open-File Report 12-05.
- 11-5. Colorado Geological Survey. February 19, 2018. *Largent Subdivision, File Number SF 183: El Paso County, CO: CGS Unique No. EP-18-0043*.
- 12-6. JPS Engineering. January 18, 2018. *Final Drainage Report, Largent Subdivision, 6895 meridian Road*. JPS Project No. 091701.

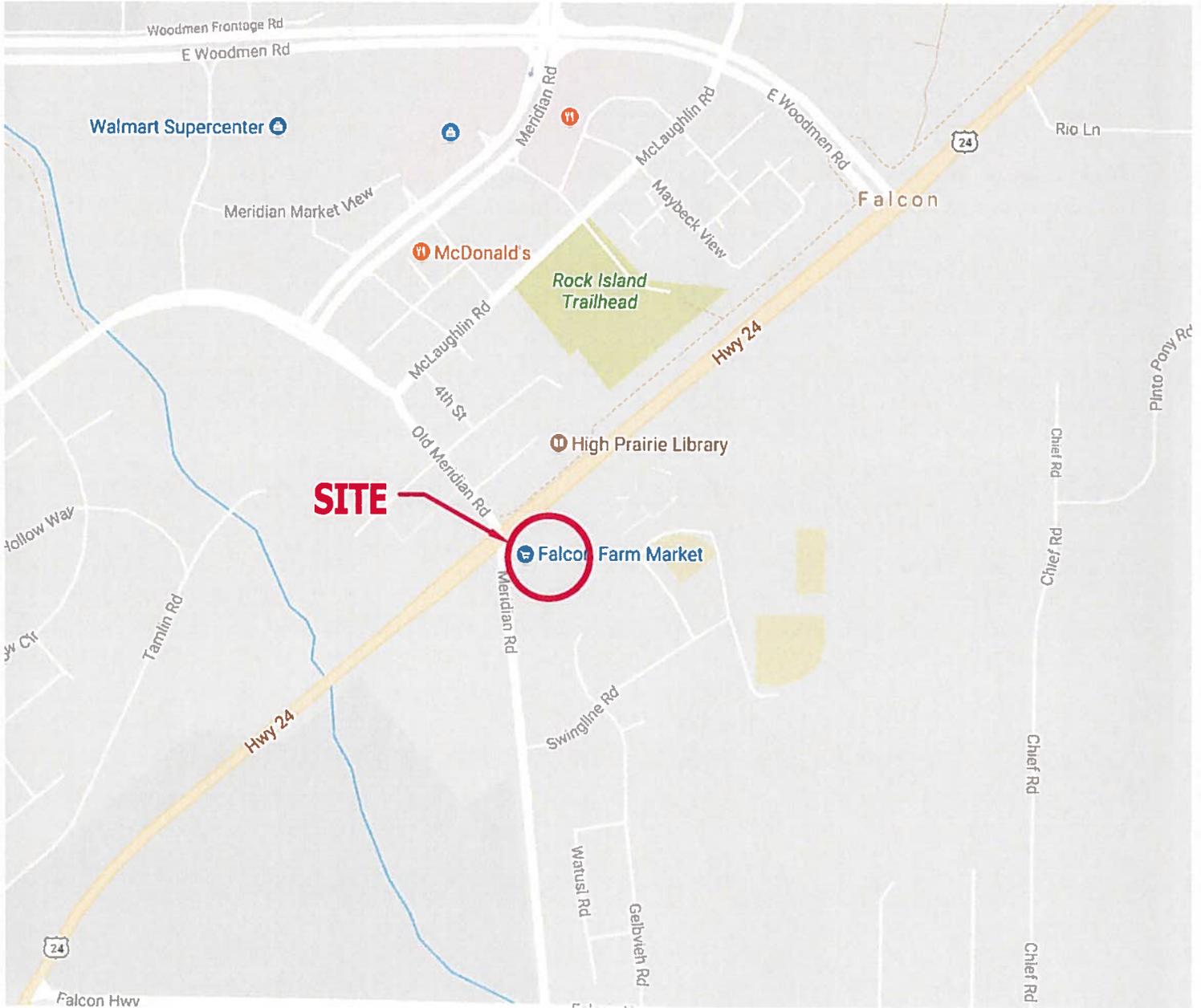
## TABLE

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT HAMMERS CONSTRUCTION  
 PROJECT 6985 MERIDIAN ROAD  
 JOB NO. 171206

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			12.3	NV	NP	<0.01			SM	SAND, SILTY
1	2	5			6.2						SM-SW	SAND, SLIGHTLY SILTY
1	2	15			12.8						SM	SAND, SILTY
2	1	20			18.7						SM	SANDSTONE, SILTY
1	2	20			18.2	24	2	<0.01			SM	SAND, SILTY

## FIGURES

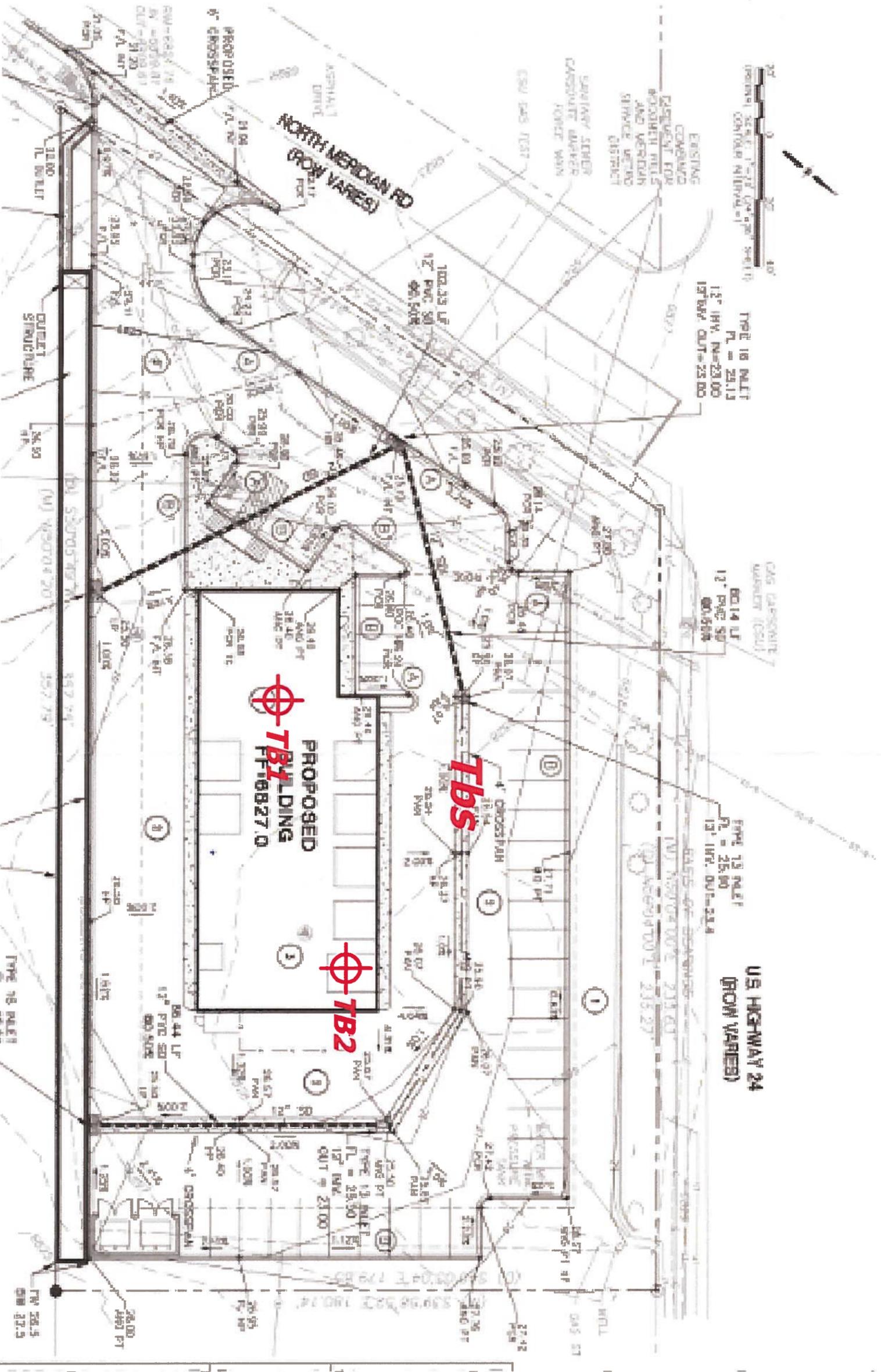


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*VICINITY LOCATION MAP*  
**6985 MERIDIAN ROAD**  
**FALCON, CO**  
**FOR: HAMMERS CONSTRUCTION**

<b>DRAWN BY:</b> BWV	<b>DATE DRAWN:</b> 09/29/17	<b>DESIGNED BY:</b> DS	<b>CHECKED:</b> <i>hw</i>
-------------------------	--------------------------------	---------------------------	------------------------------

**JOB NO.:**  
171206  
**FIG. NO.:**  
1



LEGEND:

- Tbs- Black Squirrel Formation of Cretaceous Age:
- Residual silty sands overlying arkosic sandstone with claystone lenses
- TB1 Approximate location of test boring

DRAWN	KAH
CHECKED	
DATE	3/26/16
SCALE	AS SHOWN
JOB NO.	1712006
REVISION	2

Site/Test Boring Location Map  
 6985 Meridian Road  
 Colorado Springs, CO.  
 For: Hammers Construction

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REVISION	BY



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Soil Survey Map  
 6985 Meridian Road  
 Falcon, CO.  
 For: Hammers Construction

JOB NO:  
 171206

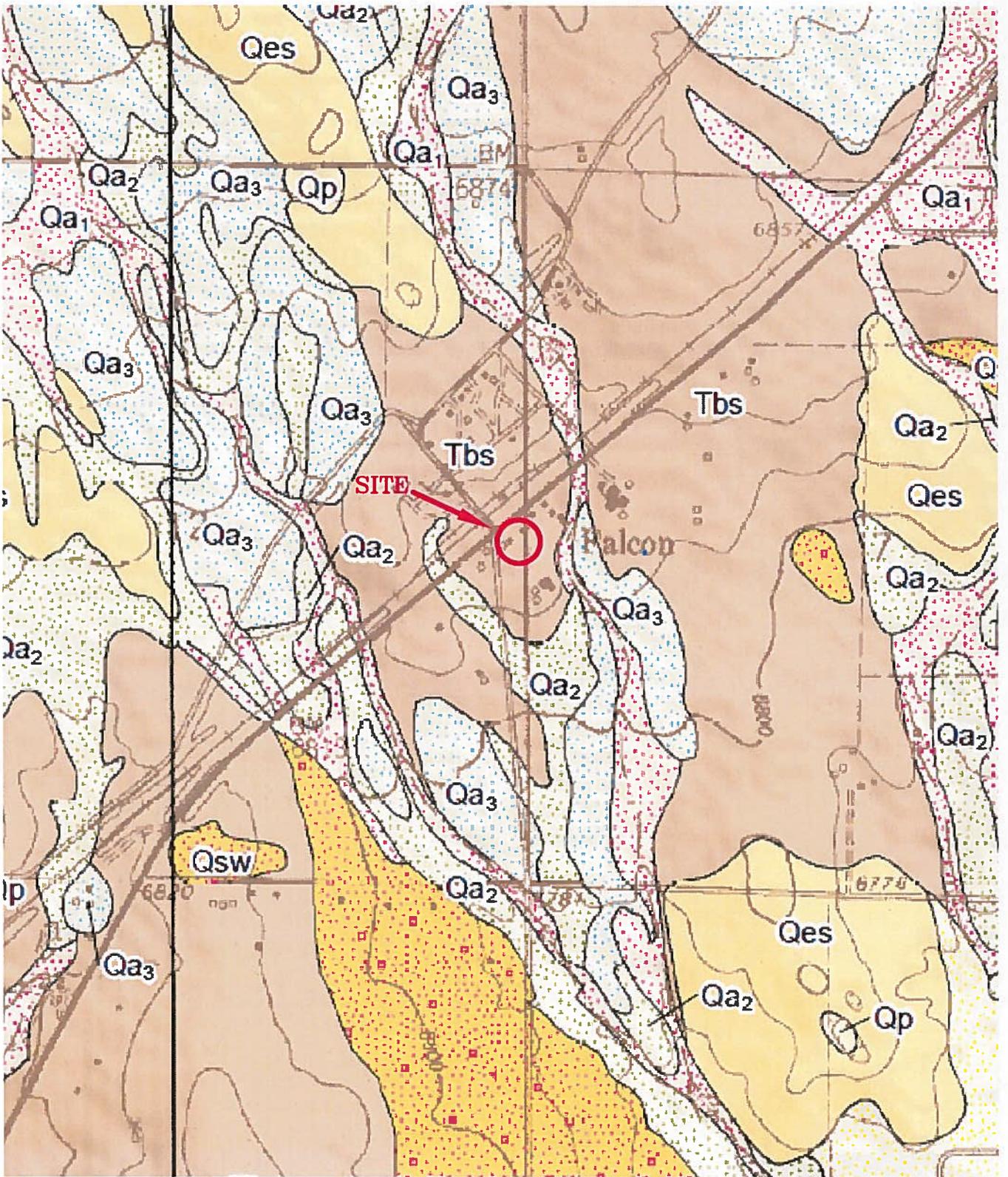
FIG NO:  
 3

DRAWN:  
 KAH

DATE:  
 3/28/18

CHECKED:  
*[Signature]*

DATE:  
 3/29/18



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Falcon Quadrangle Geology Map  
6985 Meridian Road  
Falcon, CO.  
For: Hammers Construction

DRAWN:  
KAH

DATE:  
3/28/18

CHECKED:

*h*

DATE:

3/29/18

JOB NO.:  
171206

FIG NO.:  
4

## **APPENDIX A: Test Boring Logs**

TEST BORING NO. 1  
 DATE DRILLED 9/14/2017  
 Job # 171206

TEST BORING NO. 2  
 DATE DRILLED 9/14/2017  
 CLIENT HAMMERS CONSTRUCTION  
 LOCATION 6985 MERIDIAN ROAD

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 10', 9/14/17 CAVED TO 6', 9/26/17, DRY							WATER @ 10.5', 9/26/17						
FILL 0-3', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, LOOSE, MOIST				6	8.1	1A	SAND, SLIGHTLY SILTY, FINE GRAINED, TAN, LOOSE MOIST				8	2.2	1
SAND, SILTY, FINE TO COARSE GRAINED, BROWN, VERY LOOSE, MOIST	5			3	8.0	1		5			6	2.4	1
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, VERY MOIST TO WET	10			21	7.6	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN TO GRAY, MEDIUM DENSE TO DENSE, VERY MOIST TO WET	10			12	5.0	1
	15			18	9.6	1		15			30	9.9	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	20			50 9"	9.8	2		20			25	14.8	1



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TEST BORING LOG

DRAWN:

DATE:

CHECKED: *W*

DATE:

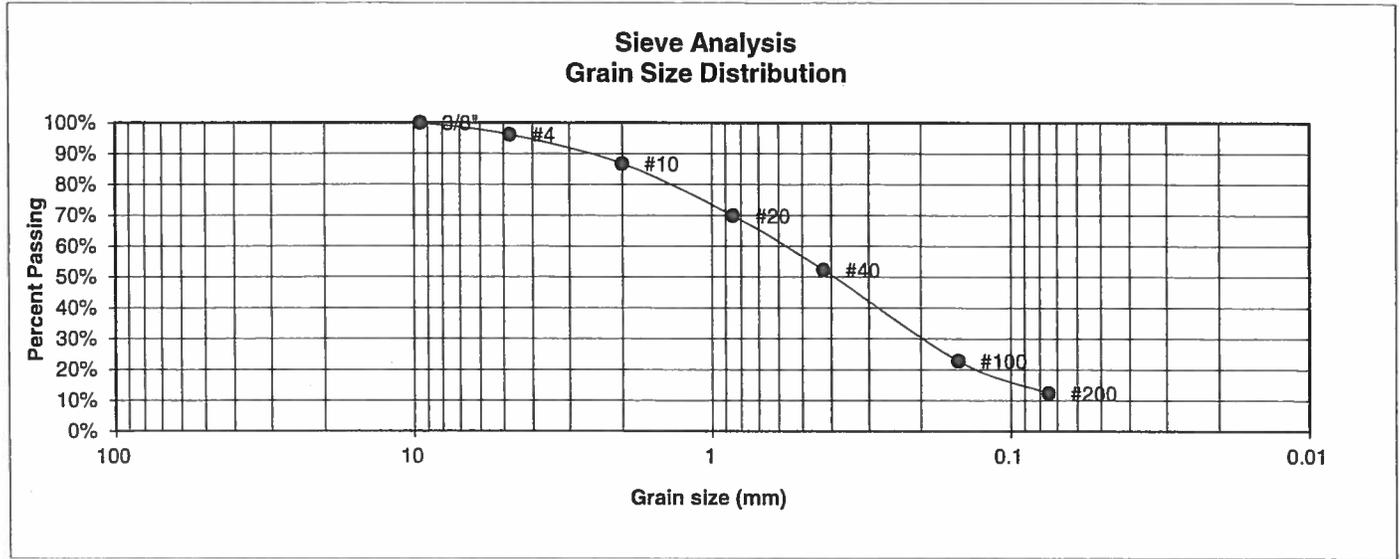
10/17/17

JOB NO.:  
171206

FIG NO.:  
A-1

## **APPENDIX B: Laboratory Testing Results**

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	HAMMERS CONSTRUCTION
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	6985 MERIDIAN ROAD
<b>TEST BORING #</b>	1	<b>JOB NO.</b>	171206
<b>DEPTH (FT)</b>	5	<b>TEST BY</b>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.2%
10	86.7%
20	69.9%
40	52.3%
100	22.8%
200	12.3%

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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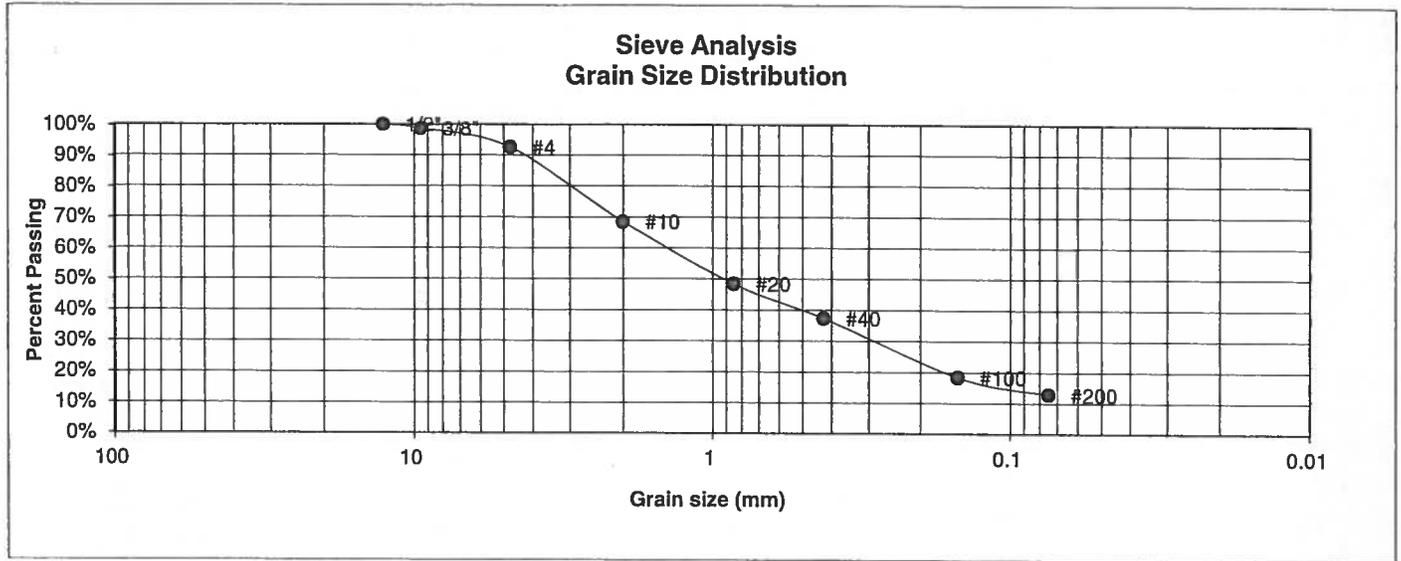
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>BLV</i>	DATE: <i>9/24/17</i>
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JOB NO.:  
171206

FIG NO.:  
*B-1*

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	HAMMERS CONSTRUCTION
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	6985 MERIDIAN ROAD
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	171206
<u>DEPTH (FT)</u>	15	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.7%
4	92.5%
10	68.5%
20	48.4%
40	37.3%
100	18.4%
200	12.8%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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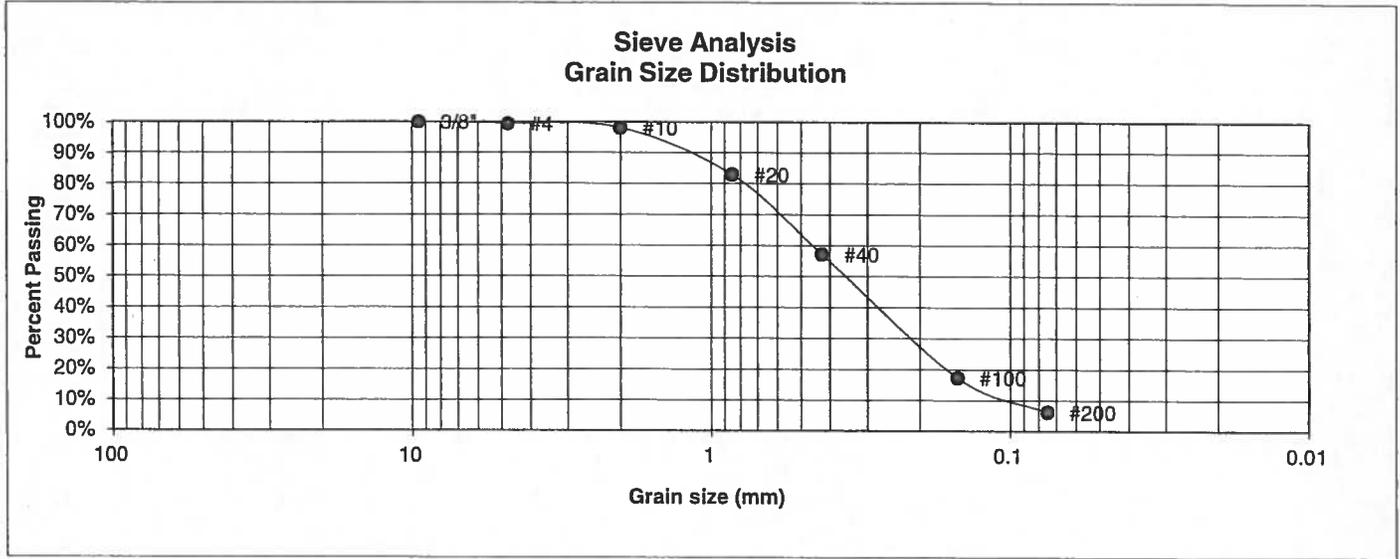
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> BV	<u>DATE:</u> 9/29/17
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JOB NO.:  
171206

FIG NO.:  
B-2

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	HAMMERS CONSTRUCTION
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	6985 MERIDIAN ROAD
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	171206
<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	99.4%
10	98.1%
20	82.9%
40	57.1%
100	17.3%
200	6.2%

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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COLORADO SPRINGS, COLORADO 80907

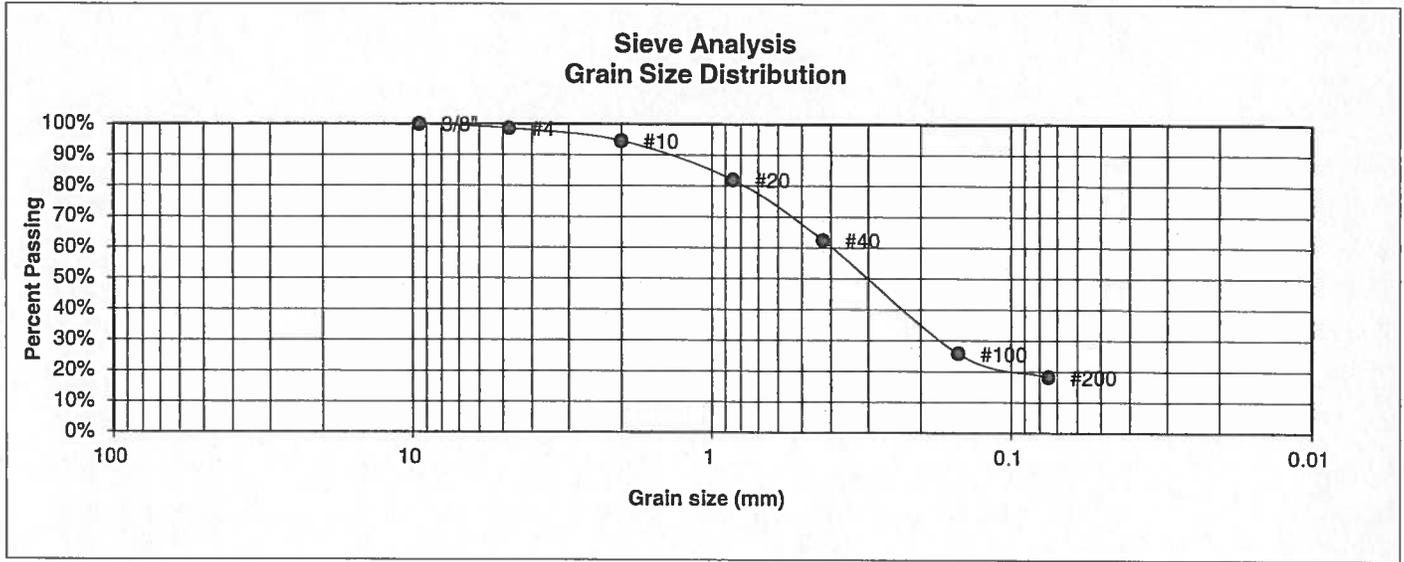
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		BV	9/29/17

JOB NO.:  
171206

FIG NO.:  
B-3

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	HAMMERS CONSTRUCTION
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	6985 MERIDIAN ROAD
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	171206
<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	98.6%
10	94.6%
20	81.9%
40	62.5%
100	25.8%
200	18.2%

<u>Atterberg Limits</u>	
Plastic Limit	22
Liquid Limit	24
Plastic Index	2

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



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COLORADO SPRINGS, COLORADO 80907

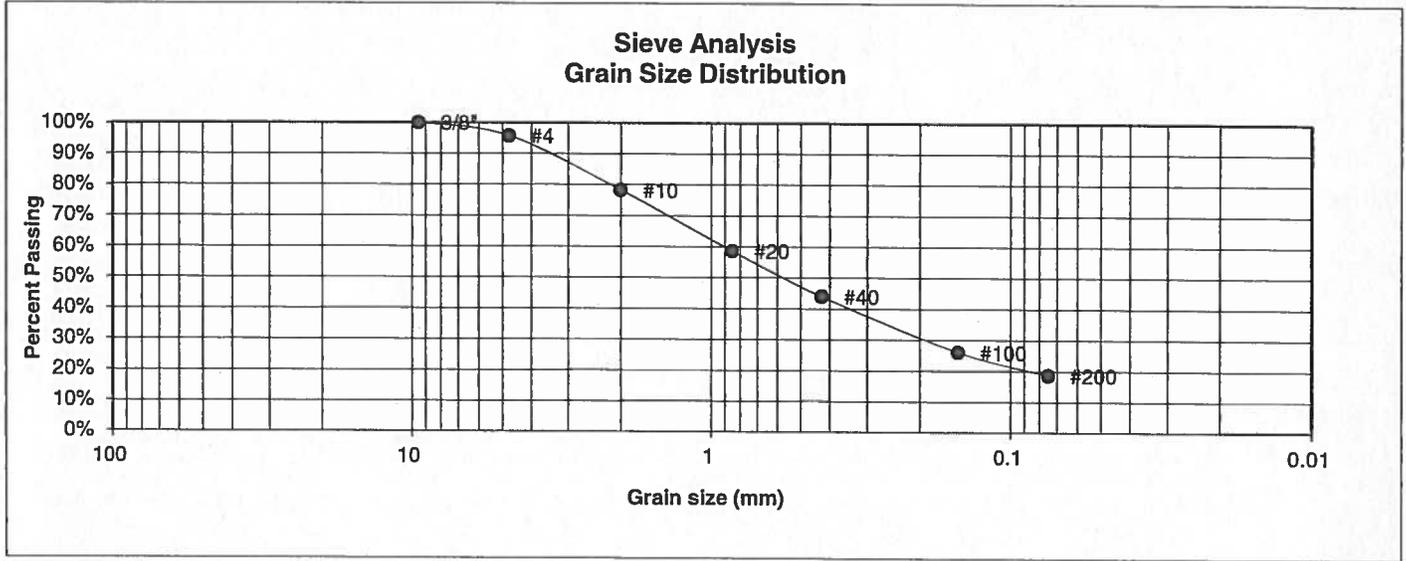
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>[Signature]</i>	10/17/17

JOB NO.:  
171206

FIG NO.:  
*B-4*

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	HAMMERS CONSTRUCTION
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	6985 MERIDIAN ROAD
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	171206
<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	95.8%
10	78.3%
20	58.6%
40	44.0%
100	26.1%
200	18.7%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



**ENTECH  
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COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>[Signature]</i>	10/17/17

JOB NO.:  
171206

FIG NO.:

*B-5*



## **APPENDIX C: Soil Survey Description**

19—Columbine gravelly sandy loam, 0 to 3 percent slopes. This deep, well drained to excessively drained soil formed in coarse textured material on alluvial terraces and fans and on flood plains. Elevation ranges from 6,500 to 7,300 feet. 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 grayish brown gravelly sandy loam about 14 inches thick. The underlying material is light yellowish brown very gravelly loamy sand.

Included with this soil in mapping are small areas of Stapleton sandy loam, 3 to 8 percent slopes; Blendon sandy loam, 0 to 3 percent slopes; Louviers silty clay loam, 3 to 18 percent slopes; and Fluvaquentic Haplaquolls, nearly level. In places the parent arkose beds of sandstone or shale are at a depth of 0 to 40 inches.

Permeability of this Columbine soil is very rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is slight to moderate.

This soil is used mainly for grazing livestock and for wildlife habitat. It is also used for homesites.

Native vegetation is mainly western wheatgrass, side-oats grama, needleandthread, and little bluestem. The main shrub is true mountainmahogany.

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 principal limitations to the establishment of trees and shrubs. The soil is so loose that trees need to be planted in 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.

Rangeland wildlife, such as pronghorn antelope, cottontail, coyote, and scaled quail, is best adapted to life on this droughty soil. Forage production is typically loam, and proper livestock grazing management is necessary if wildlife and livestock share the range. Livestock watering developments are also important and are used by various wildlife species.

The main limitation of this soil for urban development is a hazard of flooding in some areas. Care must be taken when locating septic tank absorption fields because of possible pollution as a result of the very rapid permeability of this soil. Capability subclass VIe.



**ENTECH**  
ENGINEERING, INC.

SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>W</i>	3/29/10

Job No.

171206

Fig. No.

C-1

**APPENDIX D: Colorado Geological Survey Review Letter**

# COLORADO GEOLOGICAL SURVEY

1801 19<sup>th</sup> Street  
Golden, Colorado 80401  
303.384.2655



February 19, 2018

Karen Berry  
State Geologist

Kari Parsons  
El Paso County Development Services Dept.  
2880 International Circle, Suite 110  
Colorado Springs, CO 80910

**Location:**  
Portions of Lot 2 and 3 of Sec 7 and  
SE NE and NE SE of Sec 12  
T13S, R64W of the 6<sup>th</sup> PM  
38.933°, -104.608°

**Subject: Largent Subdivision**  
**File Number SF183; El Paso County, CO; CGS Unique No. EP-18-0043**

Dear Kari:

Colorado Geological Survey has reviewed the subject referral. For this review we received: Application (1.23.18), Letter of Intent (Hammers Construction, Undated), Plat (Ridgeline Land Surveying, 10.25.17), Final Drainage Report (JPS Engineering, 1.18.18), Erosion Control Plan and Map (JPS Engineering, 1.18.18), Subsurface Soil Investigation (Entech, 10.20.17), and various other documents.

**Geologic Hazards:** The subsurface soils investigation submitted, while providing useful information for the project, is not a geology hazard report. There are several geologic hazards that CGS identifies within this site. However, our review is not a substitute for a lot-specific geologic hazard report with mapping of site geology and areas of identified geologic hazards. The hazards identified by CGS review include collapsible and/or loose soils, erosion, undocumented fill, and the potential for shallow groundwater and expansive clays. All of these identified geologic hazards can be mitigated with specific engineering as outlined in the soils and erosion reports.

Per El Paso County Land Development Code 8.4.2 (B) "*Lots or tracts subject to natural hazards which may be eliminated through specialized engineering shall be identified on the plat.*" The plat should include the listing of these identified geologic hazards. The soils report includes engineering mitigation for loose soils, undocumented fill, and potential expansive clay and provides surface and subsurface drain recommendations for shallow groundwater. The erosion control plan and map includes design to control erosion.

**Shallow groundwater:** Entech reports groundwater levels in their borings of 10 and 10.5 feet below the ground surface. One of the borings caved at 6 feet below ground surface between times of measurements. Caving is typical at groundwater level. The groundwater levels reported were measured in September, a typically dry time of year. This location is in an area generally known for shallow groundwater issues. Groundwater levels typically fluctuate throughout the year and are generally highest in the spring and summer months. Without specific groundwater monitoring throughout the year it cannot be determined what groundwater levels may be over the engineered life of the planned structures. However, groundwater should be expected to be shallower than 6 to 10 feet below existing ground level on a seasonal basis. Entech's recommendations on perimeter drains must be strictly adhered to.

**Geotechnical observation:** As stated on page 5 of Entech's report, observation by the geotechnical engineer of overall foundation excavation and any overexcavated subgrade is critical to determine specific engineering requirements that may be necessary for the long-term performance of the foundation system.

Kari Parsons  
February 19, 2018  
Page 2 of 2

**Provided the recommendations of this letter and those of the geotechnical engineer are followed, CGS has no objections to this plat request.**

Thank you for the opportunity to review and comment on this project. If you have questions or need additional review, please call at (303) 384-2643, or e-mail [jlovekin@mines.edu](mailto:jlovekin@mines.edu).

Sincerely,



Jonathan R. Lovekin, P.G.  
Senior Engineering Geologist