

**REPORT
PRELIMINARY
GEOTECHNICAL INVESTIGATION
PARCELS PP-46-A AND PP-46-C
2854 AND 2952 WEST RASMUSSEN ROAD
SUMMIT COUNTY, UTAH**

July 5, 2016

Job No. 278-004-16

Prepared for:

Summit County

% NV5

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Murray, Utah 84107

Prepared by:

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July 5, 2016
Job No. 278-004-16

Summit County
% NV5
5217 South State Street, Suite 200
Murray, Utah 84107

Attention: Ms. Mindy Low

Ladies and Gentlemen:

Re: Report
Preliminary Geotechnical Investigation
Parcels PP-46-A and PP-46-C
2854 and 2952 West Rasmussen Road
Summit County, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our preliminary geotechnical investigation performed at Parcels PP-46-A and PP-46-C which is located at 2854 and 2952 West Rasmussen Road in Summit County, Utah. The general location of the site with respect to major topographic features and existing facilities, as of 1998, is presented on Figure 1, Vicinity Map. A detailed location of the site showing existing roadways and surrounding facilities, on an air photograph base, is presented on Figure 2, Area Map. A more detailed layout of the site showing the proposed structures and roadways is presented on Figure 3, Site Plan. The locations of the borings drilled in conjunction with this study are also presented on Figure 3.

1.2 OBJECTIVES AND SCOPE

The objective and scope of our study were planned in discussions between Ms. Mindy Low and Mr. Richard Miller with NV5 and Mr. Patrick Emery of Gordon Geotechnical Engineering, Inc. (G²).

In general, the objective of this study was to define and evaluate the subsurface soil and groundwater conditions across the site.

In accomplishing this objective, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of eight borings.
2. A laboratory testing program.
3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of the NV5 Professional Services Subconsultant Agreement dated July 1, 2016.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, G² must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

2. PROPOSED CONSTRUCTION

At this time, it is not known what type of development is planned for the two parcels totaling 29.6 acres. We anticipate that the development will likely consist of a mixture of small commercial retail structures and multi-family residential units. When development plans are finalized G² must be contacted so that we can review the plans and perform site-specific geotechnical studies.

3. INVESTIGATIONS

3.1 FIELD PROGRAM

In order to define and evaluate the subsurface soil and groundwater conditions at the site, 8 borings were explored to depths of 9 to 21 feet below existing grade. The borings were drilled using a truck-mounted drill rig equipped with hollow-stem augers. Locations of the borings are presented on Figure 3.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figures 4A through 4H, Log of Borings. Soils were classified in accordance with the nomenclature described on Figure 5, Unified Soil Classification System.

A 3.25-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) was utilized in the subsurface sampling at the site. The blow counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Following completion of drilling operations, one and one-quarter-inch diameter slotted PVC pipe was installed in some of the borings in order to provide a means of monitoring the groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was completed. The program included moisture, density, partial gradation, Atterberg limits, consolidation, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected samples. The results of these tests are presented on the boring logs, Figures 4A through 4H.

3.2.3 Partial Gradation Tests

To aid in classifying the granular soils, partial gradation tests were performed. Results of the tests are tabulated below:

Boring No.	Depth (feet)	Percent Passing No. 4 Sieve	Percent Passing No. 200 Sieve	Soil Classification
B-1	2.5	42.4	14.9	GM/SM
B-5	2.5	49.0	18.9	GM/SM
B-6	5.0	51.9	22.4	GM/SM
B-7	4.5	54.9	12.3	GM/SM

3.2.4 Atterberg Limit Tests

To aid in classifying the soils, an Atterberg limit test was performed on a sample of the fine-grained cohesive soils. Results of the test are tabulated below:

Boring No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
B-2	4.0	*	*	*	CL
B-6	2.5	*	*	*	CL

* Not available within the timeframe of this report. Results will be transmitted when they become available.

3.2.5 Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on a representative sample of the fine-grained cohesive soils encountered in the exploration borings. Due to the granular nature of the majority of the soils encountered, we were unable to obtain additional samples for consolidation testing. The results of the test indicate that the clay is moderately over-consolidated, non-moisture sensitive, and will exhibit moderate compressibility characteristics when loaded below the preconsolidation pressure. Detailed results of the tests are maintained within our files and can be transmitted to you, upon your request.

3.2.6 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the soils encountered at the site. The results of the chemical tests are tabulated below:

Boring No.	Depth (feet)	Soil Classification	pH	Total Water Soluble Sulfate (mg/kg-dry)
B-2	4.0	CL	*	*

* Not available within the timeframe of this report. Results will be transmitted when they become available.

4. SITE CONDITIONS

4.1 SURFACE

The site consists of two irregular-shaped parcels containing a total of 29.6-acres of vacant/undeveloped land. A gravel roadway was observed extending from east-west across the northern portion of the site. This gravel driveway serves as access for a warehouse structure beyond the northern boundary in the central portion of the site. East Canyon Creek extends from north-to-south across the eastern portion of the site. Vegetation at the site consists of ankle- to waist-high weeds, grasses, and sagebrush.

The site is bordered by Jeremy Ranch Elementary School and a water treatment plant to the north; vacant/undeveloped land to the east; a commercial development to the south; and Rasmussen Road followed by Interstate 80 to the west.

The topography of the site is undulating with several small hills and drainages. Overall the topography slopes down to the east with a total relief of approximately 20 to 30 feet across the site. A drainage with heavy vegetation suggesting a shallow water table extends from west-to-east across the central portion of the site.

Representative photographs of the site area are shown on Figure 6, Photographs.

4.2 SUBSURFACE SOIL

Subsurface conditions encountered at the boring locations were relatively sporadic. In each of the borings, varying layers of clay, sand, and gravel were encountered. At the surface in each of the borings approximately four to six inches of loose/disturbed soil was encountered. The upper two to three inches contains major roots and has been classified as topsoil.

Underlying the topsoil and extending to the maximum explored depths of 9 to 21 feet, natural soils consisting of layers of clay, sand, and gravel ranging from 1 to 15 feet in thickness were encountered.

In general, the clay layers consist of silty clay with trace fine sand which is very stiff to hard, moist to saturated, reddish-brown to brown, and is projected to exhibit moderate strength and compressibility characteristics under the anticipated loading range.

The sand/gravel layers contain varying amounts of silt and are loose to very dense, moist to saturated, brown, and will exhibit high strength and low compressibility characteristics under the anticipated loading range. It should be noted that drilling refusal was encountered at depths of 9 and 12 feet in Borings B-4 and B-6, respectively.

In general, the soils were more dense/stiff and difficult to penetrate in the areas of the site with a higher elevation. The soils were less difficult to penetrate in the low-lying areas. We anticipate that the soils in the low-lying areas have been more susceptible to erosion.

The lines designating the interface between soil types on the boring logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

4.3 GROUNDWATER

Immediately following drilling operations, the groundwater was measured in each boring. On July 1, 2016 we returned to the site and measured the groundwater within the piezometers placed in the borings. Groundwater measurements are tabulated below:

Boring No.	Groundwater Depth (feet)	
	June 16, 2016	July 1, 2016
B-1	9.0*	15.0
B-2	8.0*	No PVC
B-3	10.0*	7.8
B-4	NGWE at 9.0*	No PVC
B-5	NGWE at 13.0*	No PVC
B-6	NGWE at 12.0*	No PVC
B-7	14.0	No PVC
B-8	10.0	17.2

* During drilling; not stabilized.

NGWE No groundwater encountered.

Seasonal and longer-term groundwater fluctuations on the order of one to one and one-half feet are projected, with the highest seasonal levels generally occurring during the late spring and early summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The most significant geotechnical aspects of the site are:

1. Varying depth to the groundwater table.
2. The moderately low compressibility and relatively high preconsolidation pressure characteristics exhibited by the natural clay soils encountered.

During drilling operations, groundwater was encountered at depths ranging from 7.8 to 17.2 feet below grade. Subdrains may be required in order to construct buildings with below-grade levels in the low-lying areas.

The natural soils encountered ranged from silty clay to sand and gravel. The silty clay is moderately over-consolidated and will experience settlements within the elastic range for lightly loaded structures. Very tall buildings or unusual foundation loading could potentially exceed the preconsolidation pressure of the clay. No moisture sensitive (collapsible/expansive) soils were encountered.

When development plans are available, G² must be contacted so that we can review them and perform site-specific geotechnical studies where necessary and provide appropriate bearing pressures for foundation design.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

Gordon Geotechnical Engineering, Inc.

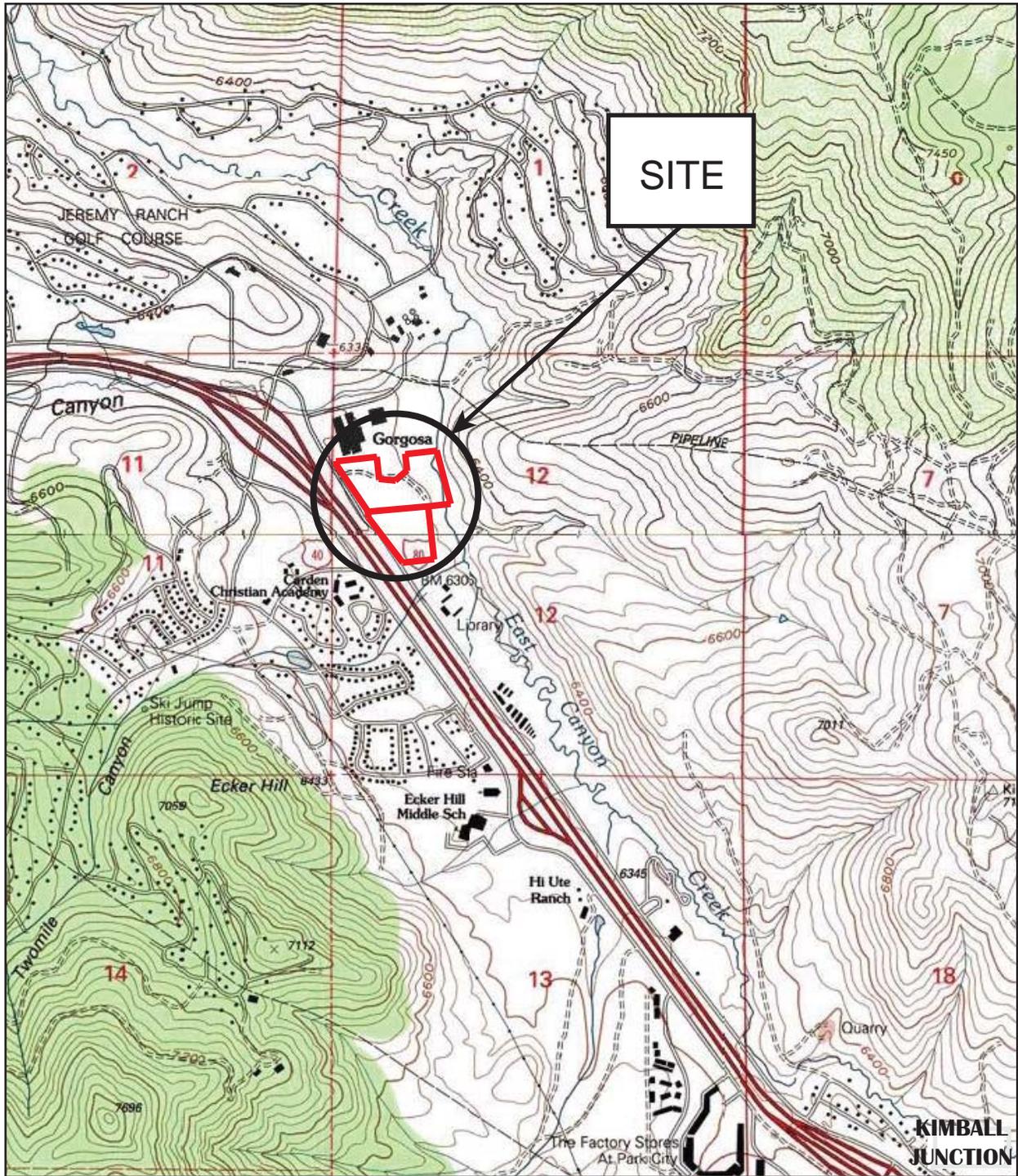


Patrick R. Emery, State of Utah No. 7941710
Senior Engineer

PRE:sn

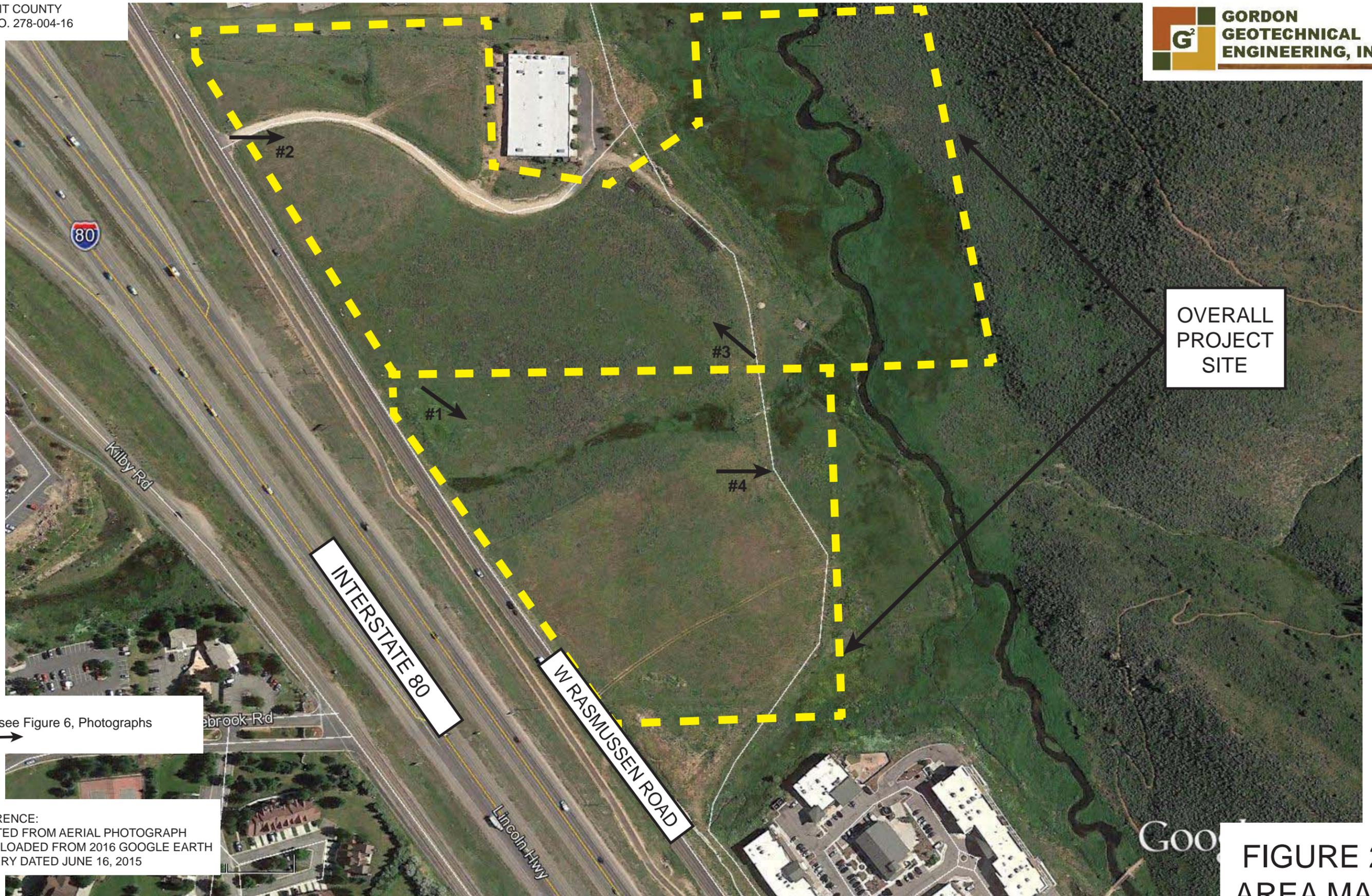
- Encl. Figure 1, Vicinity Map
- Figure 2, Area Map
- Figure 3, Site Plan
- Figures 4A through 4H, Log of Borings
- Figure 5, Unified Soil Classification System
- Figure 6, Photographs

Addressee (3 + email)



REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAPS
TITLED "PARK CITY WEST, UTAH", AND
"BIG DUTCH HOLLOW, UTAH," BOTH DATED 1998

FIGURE 1 
VICINITY MAP



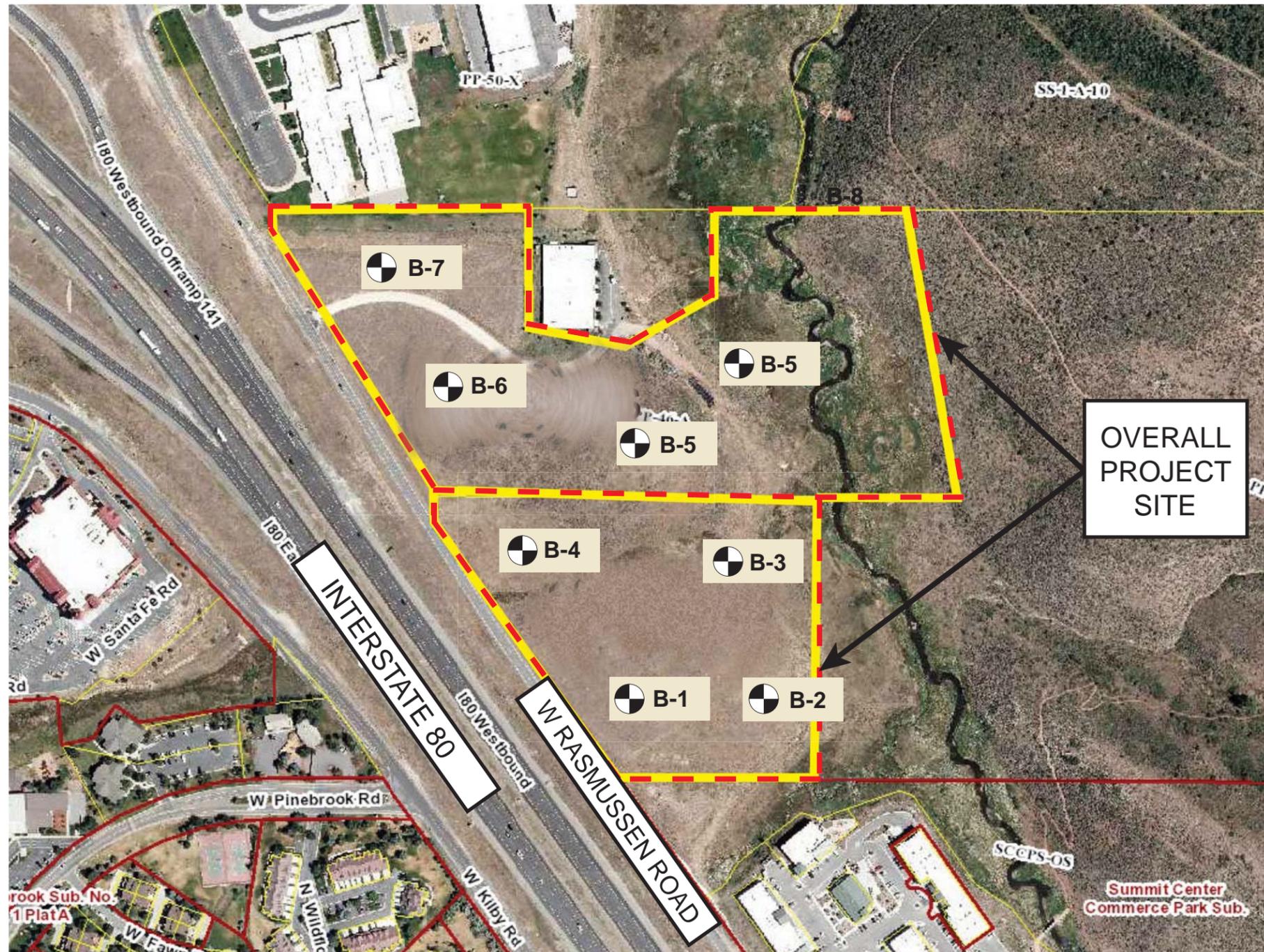
↑ ## see Figure 6, Photographs
→

REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH
DOWNLOADED FROM 2016 GOOGLE EARTH
IMAGERY DATED JUNE 16, 2015

SCALE: feet
meters



FIGURE 2
AREA MAP



REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"CLINE DAHLE PROPERTY: 29.6 TOTAL ACRES"
PROVIDED BY CLIENT, NOT DATED

NOT TO SCALE

↑
FIGURE 3
SITE PLAN

Project Name: Parcels PP-46-A and PP-46-C
 Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT
 Drilling Method: 3.75" ID Hollow-Stem Auger
 Elevation: ---
 Remarks: _____

Project No.: 278-004-16
 Client: Summit County
 Date Drilled: 06-16-16
 Water Level: 9.0' (06-16-16), 15.0' (07-01-16)

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									moist medium dense
SILTY FINE GRAVEL/SAND with occasional large cobbles; grass; major roots (topsoil) to 2"; reddish-brown (GM/SM)				D		35	12.3		14.9			
SILTY CLAY with trace fine sand; grayish-brown (CL)												moist stiff
FINE TO MEDIUM SAND with trace silt and some fine gravel; reddish-brown (SP)			5	D		38						moist medium dense
grades with gravelly and cobbly layers												
SILTY CLAY with some fine sand; reddish-brown (CL)			10	D		47						saturated stiff
SILTY FINE TO COARSE SAND/GRAVEL reddish-brown (SM/GM)												saturated medium dense
			15	D		45						
Stopped drilling at 14.5'. Stopped sampling at 16.0'. Installed slotted PVC pipe to 16.0'.												
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A

Project Name: Parcels PP-46-A and PP-46-C
 Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT
 Drilling Method: 3.75" ID Hollow-Stem Auger
 Elevation: ---
 Remarks: _____

Project No.: 278-004-16
 Client: Summit County
 Date Drilled: 06-16-16
 Water Level: 8.0' (06-16-16)

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									
SILTY FINE SAND/GRAVEL with occasional large cobbles; grass; major roots (topsoil) to 2"; reddish-brown (SM/GM)				D		46						moist medium dense
SILTY CLAY with trace fine sand and occasional layers to 1/2" thick of medium sand; reddish-brown (CL)				D		16	29.3					moist stiff
SILTY FINE AND COARSE GRAVEL with some fine to coarse sand; reddish-brown (GM)			5									moist very dense
				D		114						saturated
SILTY CLAY with trace fine sand and frequent layers to 6" thick of silty fine sand; reddish-brown (CL)			10									saturated very stiff
				D		24						
Stopped drilling at 12.5'. Stopped sampling at 14.0'.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B

Project Name: Parcels PP-46-A and PP-46-C

Project No.: 278-004-16

Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT

Client: Summit County

Drilling Method: 3.75" ID Hollow-Stem Auger

Date Drilled: 06-16-16

Elevation: ---

Water Level: 10.0' (06-16-16), 7.8' (07-01-16)

Remarks: _____

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									slightly moist medium dense
SILTY FINE TO COARSE SAND/GRAVEL light vegetation; surficial gravels; reddish-brown (SM/GM)												
SILTY CLAY with some fine sand; sandy layers; reddish-brown (CL) grades with frequent layers of silty fine sand and gravelly sand		▼		D		20						moist stiff
			5	D		10	24.1	99				
			10	D		21						saturated
			15	D		55						
SILTY FINE TO COARSE SAND/GRAVEL reddish-brown (SM/GM)												saturated dense
			20	D		75						
Stopped drilling at 19.5'. Stopped sampling at 21.0'. Installed slotted PVC pipe to 21.0'.			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

Project Name: Parcels PP-46-A and PP-46-C

Project No.: 278-004-16

Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT

Client: Summit County

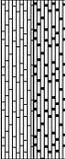
Drilling Method: 3.75" ID Hollow-Stem Auger

Date Drilled: 06-16-16

Elevation: ---

Water Level: Groundwater not encountered.

Remarks: _____

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									moist hard
FINE SANDY CLAY weeds; major roots (topsoil) to 3"; reddish-brown (CL)				D		56	13.7	114				
SILTY FINE TO COARSE SAND/GRAVEL reddish-brown (SM/GM)			5	D		65 5"						moist very dense
				D		50 2" ↓						
Drilling refusal at 9.0' on very dense gravel. Stopped sampling at 9.0'. No groundwater encountered at time of drilling.			10									
			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4D

Project Name: Parcels PP-46-A and PP-46-C
 Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT
 Drilling Method: 3.75" ID Hollow-Stem Auger
 Elevation: ---
 Remarks: _____

Project No.: 278-004-16
 Client: Summit County
 Date Drilled: 06-16-16
 Water Level: Groundwater not encountered.

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS	
Ground Surface			0									moist dense	
CLAYEY FINE AND COARSE GRAVEL grass; major roots (topsoil) to 3"; reddish-brown (GC)				D	▲▼	82	9.5		18.9				
				D	▲▼	50 3"							very dense
FINE SAND with trace silt; light brown (SP)				D	▲▼	31						moist medium dense	
				D	▲▼	56							moist medium dense
FINE TO COARSE SAND/GRAVEL with trace silt; brown (SP/GP)													
Drilling refusal at 13.0'. Very tight, slow drilling. Stopped sampling at 13.0'. No groundwater encountered at time of drilling.			15										
			20										
			25										

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4E

Project Name: Parcels PP-46-A and PP-46-C

Project No.: 278-004-16

Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT

Client: Summit County

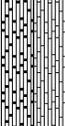
Drilling Method: 3.75" ID Hollow-Stem Auger

Date Drilled: 06-16-16

Elevation: ---

Water Level: Groundwater not encountered.

Remarks: _____

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									
FINE AND COARSE GRAVELLY CLAY vegetation; major roots (topsoil) to 2"; brown (CL/GC)				D		25	16.8	105				moist very stiff
SILTY FINE AND COARSE GRAVEL/SAND reddish-brown (GM/SM)			5	D		61	13.2		22.4			moist medium dense
grades with cobbles			10	D		60						
Drilling and sampler refusal at 12.0'. No groundwater encountered at time of drilling.			15			50 0"						
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F

Project Name: Parcels PP-46-A and PP-46-C

Project No.: 278-004-16

Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT

Client: Summit County

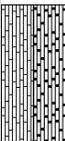
Drilling Method: 3.75" ID Hollow-Stem Auger

Date Drilled: 06-16-16

Elevation: ---

Water Level: 14.0' (06-16-16)

Remarks: _____

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									moist very stiff
CLAYEY FINE AND COARSE GRAVEL with some sand; light vegetation; brown (CL/GC)				D		53						
SILTY FINE AND COARSE GRAVEL/SAND reddish-brown (GM/SM)			5	D		106	9.7	12.3				moist very dense
			10	D		84						dense
			15	D		104						saturated very dense
Stopped drilling at 14.0'. Stopped sampling at 15.5'.			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G

Project Name: Parcels PP-46-A and PP-46-C

Project No.: 278-004-16

Location: 2854 & 2952 West Rasmussen Rd, Summit County, UT

Client: Summit County

Drilling Method: 3.75" ID Hollow-Stem Auger

Date Drilled: 06-16-16

Elevation: ---

Water Level: 10.0' (06-16-16), 17.2' (07-01-16)

Remarks: _____

DESCRIPTION	GRAPHIC LOG	Water Level	DEPTH FT.	SAMPLE TYPE	SAMPLE SYMBOL	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
Ground Surface			0									moist loose
SILTY FINE TO COARSE SAND/GRAVEL grasses; weeds; major roots (topsoil) to 2"; reddish-brown (SM/GM) grades with layers to 6" thick of fine to medium sand				D	▲▼	15						
				D	▲▼	20						
SILTY CLAY with some fine to coarse sand; brown (CL)			10	D	▲▼	3						moist soft saturated
			15	D	▲▼	9						
CLAYEY FINE AND COARSE GRAVEL with some sand; reddish-brown (GC)												saturated very dense
			20	D	▲▼							
Stopped drilling at 19.5'. Stopped sampling at 20.5'. Installed slotted PVC pipe to 20.0'.			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4H

UNIFIED SOIL CLASSIFICATION SYSTEM				GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS		
FIELD IDENTIFICATION PROCEDURES								
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	Well graded gravels, gravel-sand mixtures, little or no fines.		
			Predominantly one size or a range of sizes with some intermediate sizes missing.		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.		
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		GM	Silty gravels, poorly graded gravel-sand-silt mixtures.		
			Plastic fines (for identification procedures see CL below).		GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.		
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		SW	Well graded sands, gravelly sands, little or no fines.		
			Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	Poorly graded sands, gravelly sands, little or no fines.		
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	Silty sands, poorly graded sand-silt mixtures.		
			Plastic fines (for identification procedures see CL below).		SC	Clayey sands, poorly graded sand-clay mixtures.		
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE							
	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.	
			Medium to high	None to very slow	Medium		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			Slight to medium	Slow	Slight		OL	Organic silts and organic silt-clays of low plasticity.
		SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			High to very high	None	High		CH	Inorganic clays of high plasticity, fat clays.
			Medium to high	None to very slow	Slight to medium		OH	Organic clays of medium to high plasticity.
	HIGHLY ORGANIC SOILS			Readily identified by color, odor, spongy feel and frequently by fibrous texture.		Pt	Peat and other highly organic soils.	

1. Boundary classifications - Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.
 2. All sieve sizes on this chart are U.S. standard.

GENERAL NOTES

- In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There fore, actual designations (based on laboratory testing) may differ.
- Lines separating strata on the logs represent approximate boundaries only Actual transitions may be gradual.
- Logs represent general soil conditions observed at the point of exploration on the date indicated.
- No warranty is provided as to the continuity of soil conditions between individual sample locations.

LOG KEY SYMBOLS

	Thin Wall
	No Recovery
	3-3/4" ID D&M Sampler
	3" ID D&M Sampler
	California Sampler

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakly	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FINE - GRAINED SOIL TORVANE POCKET PENETROMETER

CONSISTENCY	SPT (blows/ft)	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1" by Thumb. Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2" by Thumb with moderate effort. Molded by strong finger pressure.
	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2" by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

COARSE - GRAINDE SOIL

APPARENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2" reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2" reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2" reinforcing rod driven with 5-lb hammer
	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2" reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2" reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2"
LAYER	1/2 - 12"
DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thickness

FIGURE 5



#1 Facing southeast across the southern parcel.



#2 Facing east across the northern parcel, along the water plant access road.



#3 Facing northwest toward the water plant.



#4 Facing east toward the creek.