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**WASTEWATER STUDY  
THE RESERVE AT CORRAL BLUFFS  
EL PASO COUNTY, COLORADO**

Prepared for

**Corral Ranches Development Company**  
1830 Coyote Point Drive  
Colorado Springs, Colorado 80904

Attn: Howard Kunstle

December 12, 2019  
Revised June 18, 2020

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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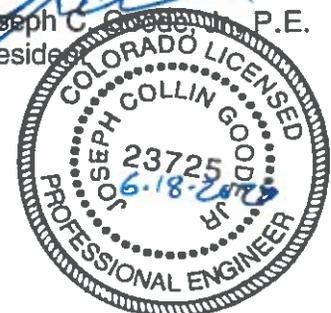
KAH/III

Encl.

Entech Job No. 192142 (previously 83691)  
AAProjects/2019/192142 county soil geo-revised

Reviewed by:

Joseph C. Gollin, P.E.  
President



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## **1.0 SUMMARY**

### ***Project Location***

The project lies in portions of Sections 31 and 32, Township 13 South, Range 64 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 5 miles east of Colorado Springs, Colorado.

### ***Project Description***

Total acreage involved in the project is approximately 186 acres. The proposed development consists of 31 single-family rural residential lots. The development will utilize individual wells and on-site wastewater treatment systems.

### ***Scope of Report***

This report presents the results of our geologic evaluation and wastewater study for individual on site wastewater treatment systems.

### ***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 wastewater treatment systems and land use. These include areas of potentially seasonal shallow groundwater areas, areas of ponded water, and potentially unstable slopes. Soils with slow percolation rates may also be encountered. Based on the proposed 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 development can be achieved if the observed geologic conditions on site are either avoided or properly mitigated. All recommendations are subject to the limitations discussed in the report.

## **2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION**

The site is located in portions of Sections 31 and 32, Township 13 South, Range 64 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 5 miles east of Colorado Springs, Colorado, south of Blaney Road South and east of Meridian Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the north with steeper slopes in the southern portions of the site that slope to the south. Minor drainages on site flow north on the main portion of the property. No water was observed flowing in any of these drainages at the time of this investigation however, minor areas of ponded water were observed behind an earthen dam in the northern central portion of the site. The site boundaries are indicated on the USGS Map, Figure 2. An aerial photograph of the area of the site is presented in Figure 3. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds with areas of yucca. Site photographs, taken December 19, 2011, are included in Appendix A.

Total acreage involved in the proposed development is approximately 183 acres. Thirty-one single-family rural residential lots are proposed with areas of open space in the southern portion of the site. Lot sizes range from 5.0 acres to 6.1 acres. The area will be serviced by individual wells and on-site wastewater treatment systems. The proposed Development Plan by Land Resource Associates, revised May 1, 2012, is presented in Figure 4. It is our understanding no significant changes have been made to the development plan.

## **3.0 SCOPE OF THE REPORT**

The scope of the report includes the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.
- The site will be evaluated for individual on site wastewater treatment systems. This evaluation is based on percolation testing completed prior to the new OWTS regulations. Tactile test pits will be required for each site after construction is performed.

## **4.0 FIELD INVESTIGATION**

Our field investigation on this site consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on December 19, 2011. The site was revisited by personnel of Entech Engineering, Inc. on December 4, 2019. The conditions observed on the site are not significantly changed from the original mapping.

### ***4.1 Previous Investigations***

The site was previously investigated by Entech Engineering, Inc. as a part of a Soil, Geology, Geologic Hazard and Wastewater Study, January 30, 2012 (Reference 1). Nine (9) percolation tests were performed on the site to determine general suitability of the site for the use of individual wastewater treatment systems. The locations of these percolation tests are indicated on the Development Plan/Percolation Test Location Map, Figure 4. The Test Boring Logs from the Profile Holes are presented in Appendix B. Results of this testing will be discussed later in this report.

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

Additional Test Borings and Percolation Testing were performed by Entech Engineering, Inc., August 30, 2012 (Reference 2). The additional testing consisted of drilling an additional 6 test

borings and performing an additional 3 percolation tests. The locations of the additional tests are indicated on Figure 4. The test boring logs and laboratory test results from the additional testing are included in Appendix D and summarized in Table 1.

An On-site Wastewater Report was prepared by Entech Engineering, Inc., April 9, 2013 (Reference 3). This previous report was completed prior to the new OWTS regulations using percolation testing. The new regulations require tactical test pits. In our opinion the percolation tests can be used for evaluation the site for septic systems. This report summarized the findings in the previous wastewater studies (References 1 and 2).

## **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 14 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 southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northerly direction (Reference 4). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual, colluvial, man-made, eolian and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. Some colluvial soils exist which are deposited by gravity and sheetwash. The alluvial soils were deposited by water in the minor drainage areas on site and as stream deposits. The eolian materials were deposited by wind. Fill material exist as earthen dams and erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

## 5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 5), previously the Soil Conservation Service (Reference 6) has mapped four soil types on the site. In general, they vary from sandy loam and clay loam to areas of sandstone. The soils are described as follows:

<u>Type</u>	<u>Description</u>
3	Ascalon Sandy Loam, 3-9% Slopes
4	Badland
13	Bresser Sandy loam, 5-9% Slopes
85	Stapleton – Bernal Sandy Loams, 3-20% Slopes

Complete descriptions of each soil type are presented in Appendix E. The soils have generally been described to have rapid to moderate permeabilities. Soil Type 4 (Badland) exists on the steeper slopes in the southern portion of the site where no development is proposed. Soil Types 3 and 13 have been described as having good potential for home sites. Limitations on soil Type 85 include steep slopes, and depth to bedrock. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate erosion hazards with high erosion hazards on Soil Type 4 (Badland) due to the potential for gullying.

## 5.3 Site Stratigraphy

The Colorado Geology Map showing the site is presented in Figure 6 (Reference 7). The Corral Bluff/Falcon Geology Map, showing the site, is presented in Figure 7 (References 8 and 9). The Geology Map prepared for the site is presented in Figure 8. Five mappable units were identified on this site which are described as follows:

**Artificial Fill of Holocene Age:** These are man-made fill deposits associated with erosion berms and earthen dams on-site.

**Recent Alluvium of Holocene Age:** These are recent stream deposits associated with the drainages on-site. These materials generally consist of silty to clayey sands and may contain clay lenses.

**Piney Creek Alluvium of Holocene Age:** This material is a water-deposited terrace alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density. The Piney Creek Alluvium can sometimes be very highly stratified containing thin layers of very silty and clayey soil.

**Eolian Sand of Quaternary Age:** These deposits are fine to medium grained soil deposited on the site by the action of the prevailing winds from the west and northwest. They typically occur as large dune deposits or narrow ridges. These soil types are typically tan to brown in color and tend to have very uniform or well-sorted gradation. These materials tend to have a relatively high permeability and low density.

**Colluvium of Quaternary Age overlying Dawson Arkose of Tertiary to Cretaceous Age:** These materials consist of silty to clayey sands and sandy clays, deposited by the action of sheetwash and gravity. Some areas contain residual soils derived from the in-situ weathering of the bedrock materials. These soils are overlying the Dawson Formation. The Dawson Formation typically consists of coarse-grained, arkosic sandstone with interbedded lenses of fine-grained sandstone, siltstone and claystone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Pueblo 1°x 2° Quadrangle* distributed by the US Geological Survey in 1978 (Reference 7), the *Geologic Map of the Falcon Quadrangle* distributed by the Colorado Geologic Survey in 2012 (Reference 8), the *Geologic Map of the Corral Bluff Quadrangle* distributed by the US Geological Survey in 1968 (Reference 9), and the *Geologic Map of the Corral Bluffs and Falcon Quadrangles* by Charles S. Robinson and Associates, Inc. in 1977 (Reference 10). The Test Borings from the previous investigations (References 1 and 2) were also used in evaluating the site and are included in Appendices B and D. The Geology Map prepared for the site is presented in Figure 8.

#### **5.4 Soil Conditions**

The soils encountered in the Profile Holes and Test Borings (References 1 and 2) can be grouped into four general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a silty to very silty sand (SM), encountered in the upper soil profile in all but one of the profile holes. These soils were encountered at medium dense to dense states and at moist conditions. Samples tested had 27 to 49 percent passing the No. 200 Sieve. A consolidation of 0.6% was measured in the Swell/Consolidation Test. This consolidation is in the low range.

Soil Type 2 consists of sandy to very sandy clay and clay-silt (CL, CL-ML). The clays were encountered in two of the profile holes at depths ranging from the surface to 9 feet below the surface. These soils were encountered at stiff to very stiff consistencies and moist conditions. Samples tested had 57 to 74 percent passing the No. 200 sieve. A swell of 3.3 percent was measured on the clays in the Swell/Consolidation Test. This swell is in the moderate to high expansion range. A consolidation of 0.2 percent was measured on the soils in the Swell/Consolidation Test indicating low potential for consolidation.

Soil Type 3 consists of sandy to very sandy silt (ML). This material was encountered in two of the test borings at the surface and extending to the depths explored. The silt was encountered at stiff to very stiff consistencies and at moist conditions. The samples tested had 52 to 64 percent passing the No. 200 sieve. A swell pressure of 850 psf was measured in the FHA Swell Test. This swell is in the low expansion range.

Soil Type 4 consists of very clayey to silty sandstone bedrock (SM, SC, SC-SM). This material was encountered in 4 of the test borings at 7 to 13 feet below the surface. The sandstone was encountered at very dense states and moist conditions. The samples tested had 40 to 44 percent passing the No. 200 sieve. A FHA swell pressure of 1330 psf was measured on the very clayey sandstone. This swell is in the moderate expansion range.

The Test Boring Logs are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1 (References 1 and 2).

### ***5.5 Groundwater and Drainage Areas***

Groundwater was not encountered in any of the profile holes which were drilled to 10 and 15 feet. Minor drainages on site flow north on the main portion of the property. No water was observed flowing in any of these drainages at the time of this investigation however, minor areas of ponded water were observed behind an earthen dam in the northern central portion of the site. Areas of potentially seasonal shallow groundwater and ponded water have been mapped in the drainages on-site (Figure 8). These areas are discussed below. 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.

#### **Potentially Seasonal Shallow Groundwater Area**

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within minor drainage areas which can be avoided by the proposed development. Due to the potential for seasonal high groundwater conditions, on site wastewater treatment systems are not recommended in these areas. Due to lot sizes, it is anticipated these areas can be avoided by systems. The site does not lie within any floodplain zones according to the FEMA Map Nos. 08041CO563G, 08041CO564G, and 08041CO780G dated December 7, 2018 (Figure 9, Reference 11). Exact locations of floodplain and specific drainage studies are beyond the scope of this report. Individual wastewater treatment systems must be located a minimum of 25 feet from dry gulches and 50 feet from water courses or floodplains.

#### **Areas of Ponded Water**

These are areas of standing water behind an earth dam on site. We would not expect development in this area. Individual wastewater treatment systems must be located a minimum of 50 feet from ponded areas.

## **6.0 ON-SITE WASTEWATER TREATMENT**

The site was evaluated for individual on-site wastewater treatment systems. Nine (9) percolation tests were initially performed on the property (Reference 1). An additional six (6) test borings with three (3) additional percolation tests were performed on the southern portions of the site (Reference 2). Percolation tests may not be located in the exact areas of proposed systems. The approximate locations of the percolation tests are indicated on Figure 4, the Geology Map, Figure 8 and the Septic Suitability Map Figure 10. Table 2 shows the results of the percolation tests. The specific test results are presented in Appendix F.

The results of this investigation are based on percolation testing that was performed prior to changes made in the El Paso County OWTS regulations. Individual tactile test pits will be required on each lot prior to construction in accordance with El Paso County guidelines.

The Natural Resource Conservation Service (Reference 5), previously the Soil Conservation Service (Reference 6) has been mapped with 4 soil descriptions. The Soil Survey Map (Reference 5) is presented in Figure 5, and the Soil Survey Descriptions are presented in Appendix E. Soil Type 4 (Badland) is mapped in the southern portion of the site where steep slopes exist. No development is proposed in this area and it has been designated as a non-build zone. The majority of the soils are described as having rapid to moderate percolation rates.

The individual percolation test results ranged from 14 minutes per inch to 134 minutes per inch. The soils will generally be classified as Type 2 to 3A soils. Occasionally type 5 soils were encountered. Most of the percolation rates are suitable for conventional individual sewage treatment systems. Three of the percolation rates are slower than 60 minutes per inch which will require designed systems.

Standard penetration testing, ASTM D-1586, was performed in each profile hole to evaluate the density of the soil and the presence of bedrock. Bedrock was encountered in Profile Hole Nos. 4 through 7 at 7 to 13 feet. Bedrock was not encountered of the other profile holes which were drilled to 10 to 15 feet. Designed systems are generally required in areas of shallow bedrock (less than 6 feet).

Leach fields must be maintained a minimum of 4 feet above groundwater. Groundwater was not encountered in any of the profile holes, which were drilled to depths of 10 to 15 feet. Should groundwater be encountered within 6 feet of the surface, shallow leaching fields will be recommended. In areas where groundwater is less than 4 feet, designed systems will be required.

Potentially unstable slopes have been mapped on the southern portions of the site. Development is not proposed in this area. A 50-foot building setback is recommended from the crest of the potentially unstable slopes. A 100-foot setback is recommended for Lots 24 and 25. These setbacks also apply to individual wastewater treatment systems. The recommended 50-foot and 100-foot setbacks are indicated on the Geology Map, Figure 8 and the Septic Suitability Map, Figure 10. It is anticipated the lots are of sufficient size to avoid the potentially unstable slopes and maintain the minimum setbacks.

The percolation rates in nine of the locations are suitable for conventional systems. (References 1 and 2). Three tests had rates of slower than 60 minutes per inch. Additional drilling may reveal other areas where more suitable rates can be found. El Paso County guidelines require designed systems for percolation rates exceeding 60 minutes per inch. Bedrock was not encountered in any of the profile holes at a depth that would affect conventional systems, however, some areas may contain shallow bedrock. Where bedrock is encountered less than 6 feet, designed systems may be required. A Septic Suitability Map is presented in Figure 10. A possible house location, two potential on site wastewater treatment system (OWTS) locations and a possible well site for each lot are indicated on Figure 10. Due to the size of the building lots, it is anticipated that suitable areas will be available where conventional systems may be utilized on most lots. In areas where suitable percolation rates cannot be found, shallow groundwater exists or shallow bedrock exists, designed systems will be required.

In summary, it is our opinion the site is suitable for individual onsite wastewater treatment systems (OWTS) and that contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated, installed according to El Paso County and State Guidelines and properly maintained. Individual tactile test pits and testing according to current El Paso County guidelines will be required on each lot prior to construction. Septic systems must be located a minimum of 100 feet from any well, including those on adjacent properties. Septic

systems must also be located a minimum of 50 feet from any water courses, floodplains or ponded areas, 50 feet from the potentially unstable slopes, and 25 feet from dry gulches.

## **7.0 CLOSURE**

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these conditions can be avoided by construction. Others can be mitigated through proper engineering design and construction practices. The proposed development and use is consistent with anticipated geologic and engineering geologic conditions. Individual tactile test pits will be required on each lot prior to construction.

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 and septic systems will be required prior to construction. Construction and design personnel should be made familiar with the contents of this report. Discrepancies should be reported to Entech Engineering, Inc. soon after they are discovered so that the evaluation and recommendations presented can be reviewed and revised if necessary. Additional investigation for the building sites is recommended prior to site grading or construction. Planning and design personnel should be made familiar with the contents of this report.

This report has been prepared for Corral Ranches Development Company 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.

**BIBLIOGRAPHY**

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## TABLES

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

CLIENT: CORRAL RANCH DEVELOPMENT  
PROJECT: RESERVE AT CORRAL BLUFFS  
JOB NO.: 83891

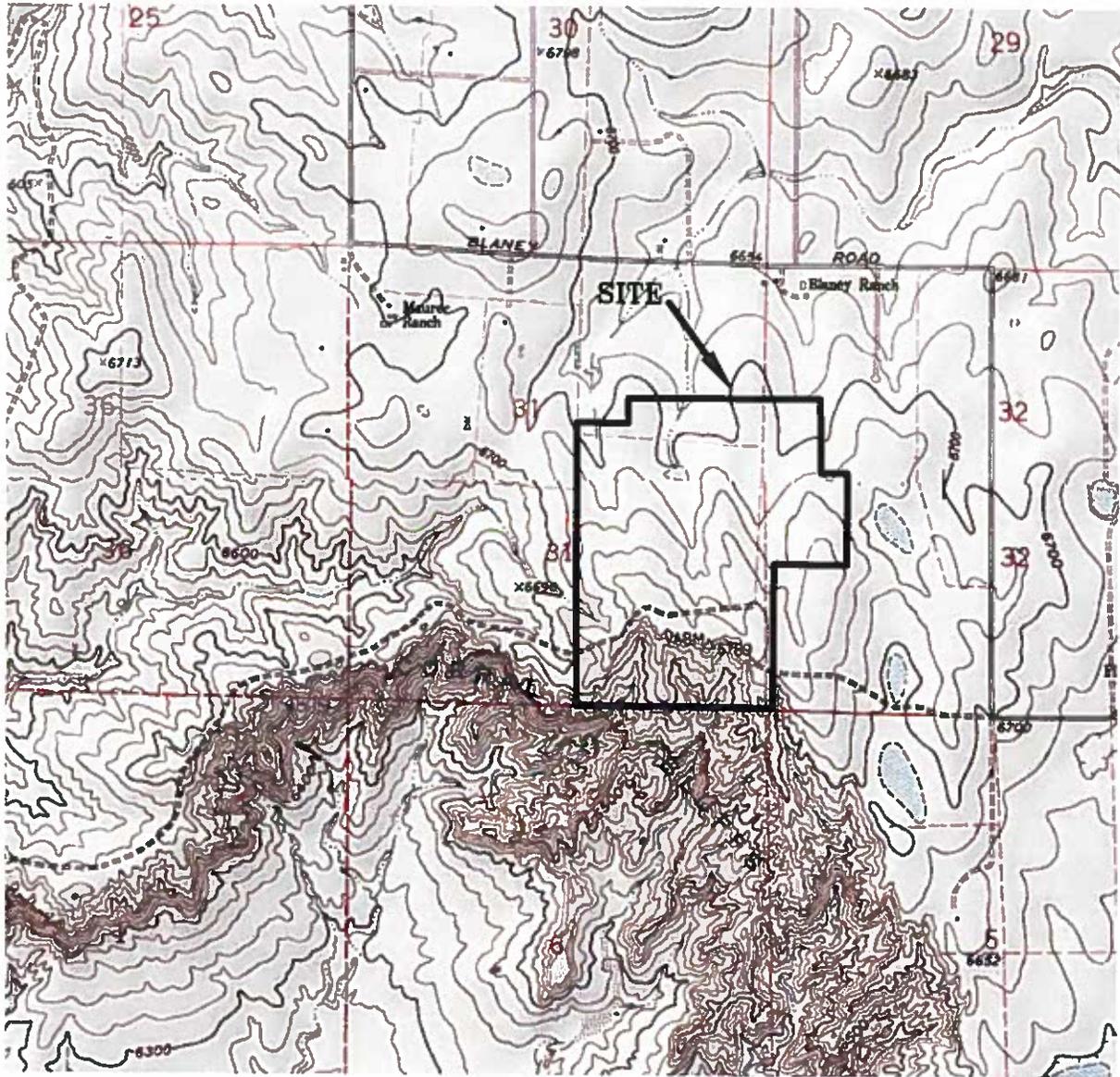
SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3	6.3	106.5	45.3					-0.6	SM	SAND, VERY SILTY
1	5	2-3			26.9						SM	SAND, SILTY
1	6	2-3			41.7						SM	SAND, VERY SILTY
1	7	2-3			45.5						SM	SAND, VERY SILTY
1	8	2-3			49.0						SM	SAND, VERY SILTY
1	9	2-3			28.0						SM	SAND, SILTY
1	11	5			40.0						SM	SAND, VERY SILTY
1	12	5			30.5						SM	SAND, SILTY
1	15	5			38.3						SM	SAND, VERY SILTY
2	1	10			57.0	18	7				CL-ML	CLAY-SILT, VERY SANDY
2	4	2-3	16.7	109.3	73.2	21	8			-0.2	CL	CLAY, SANDY
2	4	5	11.0	109.5	74.3	20	6			3.3	CL-ML	CLAY-SILT, SANDY
3	2	2-3			52.7						ML	SILT, VERY SANDY
3	2	10							850		ML	SILT, VERY SANDY
3	3	2-3			64.4						ML	SILT, SANDY
4	4	15			39.6	17	6				SC-SM	SANDSTONE, VERY CLAYEY, SILTY
4	6	10			43.8	28	16		1330		SC	SANDSTONE, VERY CLAYEY

**Table 2: Summary of Percolation Test Results**

Test Boring No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	80	>15	>15
2	14	>15	>15
3	20	>15	>15
4	134	13	>15
5	45	7	>10
6	18	7	>10
7	44	10	>15
8	12	>10	>10
9	67	>10	>10
10	N/A	>10	>10
11	25	>10	>10
12	16	>10	>10
13	N/A	>10	>10
14	N/A	>10	>10
15	15	>10	>10

## FIGURES





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USGS Map  
The Reserve at Corral Bluffs  
El Paso County, CO.  
For: Corral Ranch Development Co.

DRAWN:  
KAH

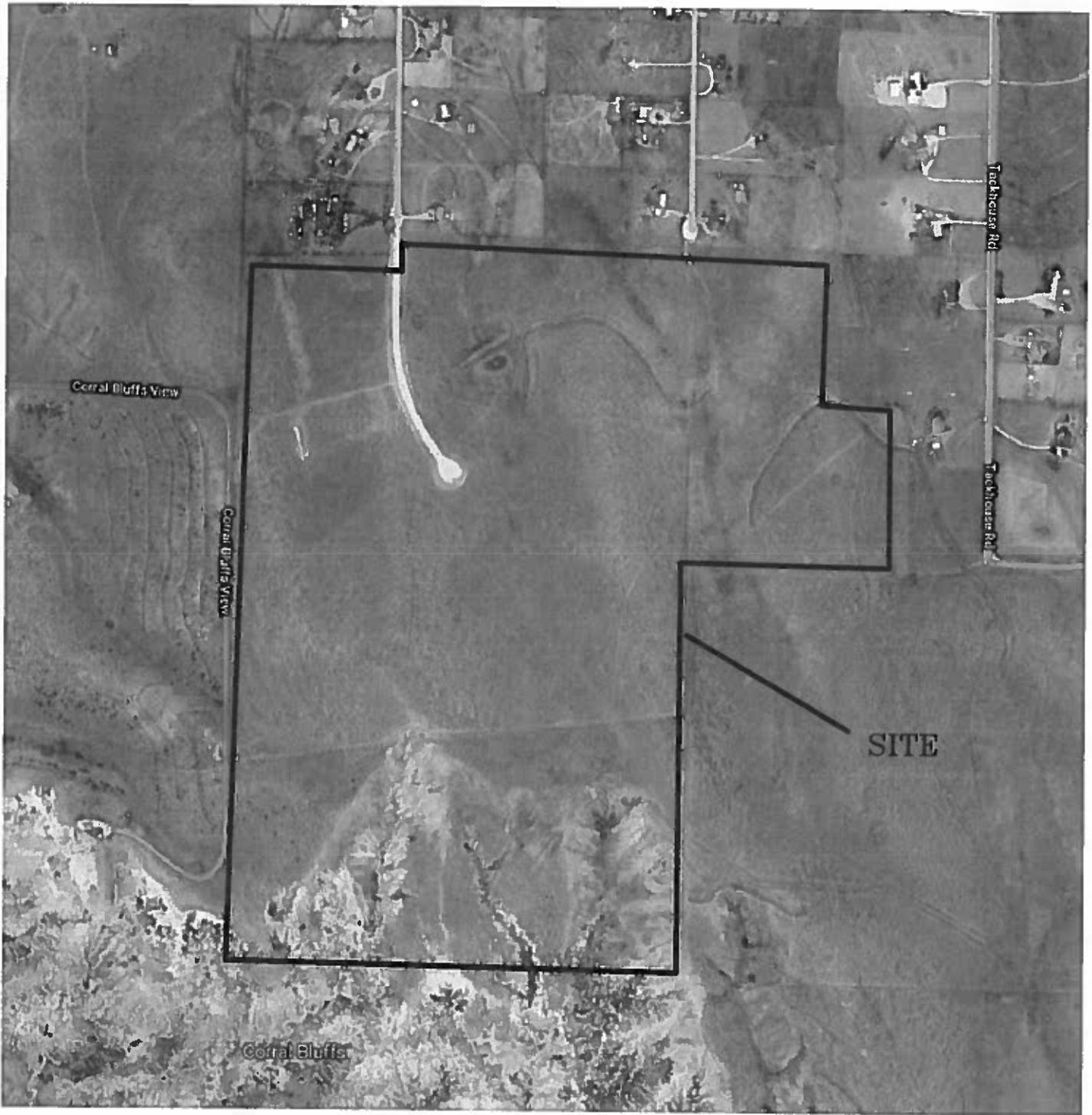
DATE:  
12/2/19

CHECKED:

DATE:

JOB NO.:  
192142

FIG NO.:  
2



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**Aerial Photograph**  
**The Reserve at Corral Bluffs**  
**El Paso County, CO.**  
**For: Corral Ranch Development Co.**

DRAWN:  
KAH

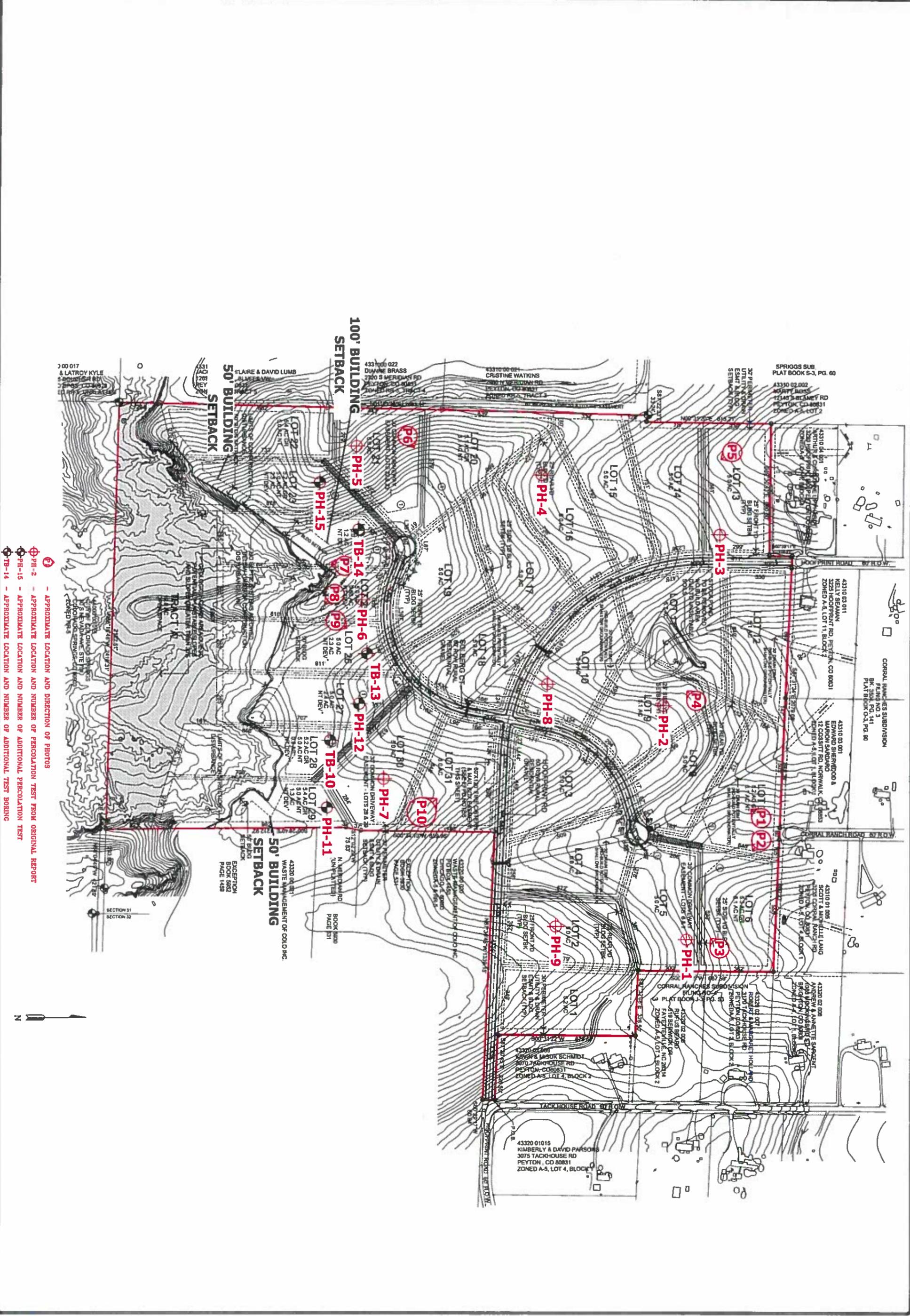
DATE:  
12/2/19

CHECKED:

DATE:

JOB NO.:  
192142

FIG NO.:  
3



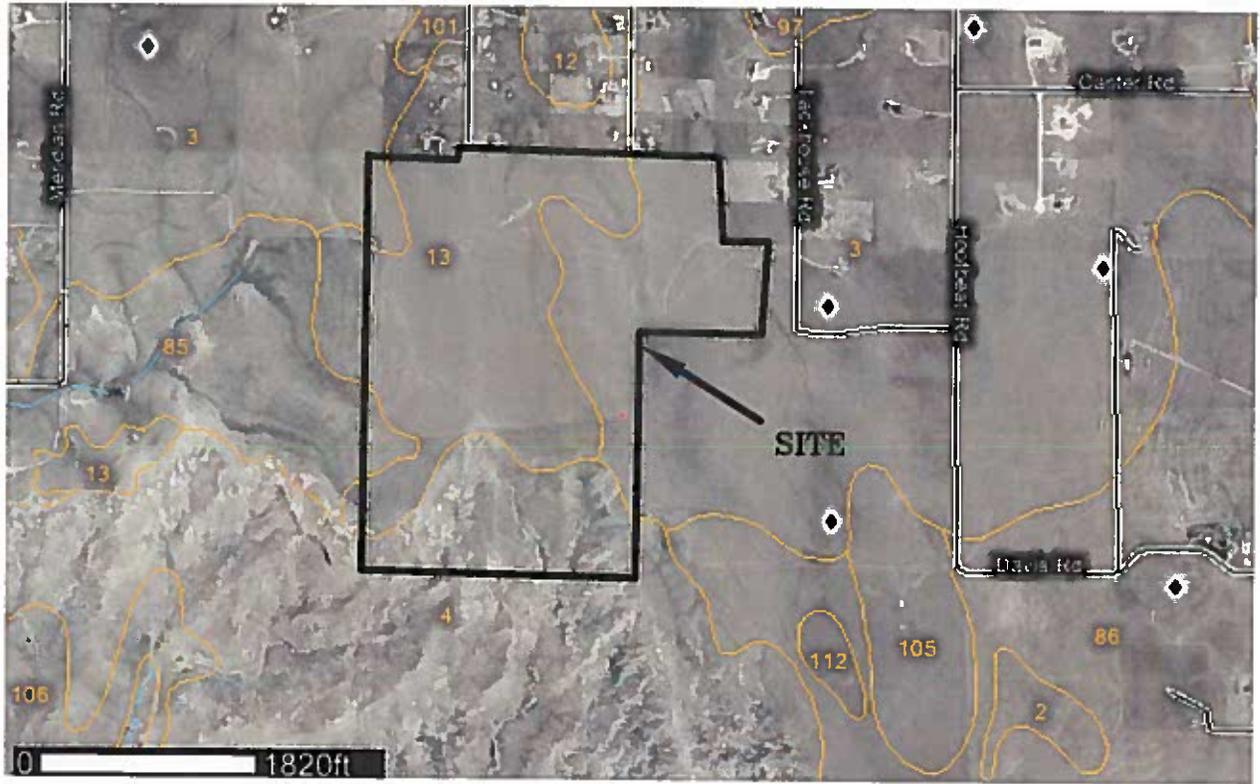
- ② - APPROXIMATE LOCATION AND DIRECTION OF PHOTOS
- ⊕PH-2 - APPROXIMATE LOCATION AND NUMBER OF PERCOLATION TEST FROM ORIGINAL REPORT
- ⊕PH-15 - APPROXIMATE LOCATION AND NUMBER OF ADDITIONAL PERCOLATION TEST
- ⊕TB-14 - APPROXIMATE LOCATION AND NUMBER OF ADDITIONAL TEST BORING

DEVELOPMENT PLAN / PERCOLATION TEST LOCATION MAP  
 THE RESERVE AT CORRAL BLUFFS  
 EL PASO COUNTY, CO  
 FOR: CORRAL RANCH DEVELOPMENT

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DRAWN BY: JAC  
 DESIGNED BY: KAH  
 CHECKED BY:  
 DATE: 12/04/19  
 SCALE: 1:200  
 JOB NO.: 192142  
 FIGURE NO.: 4

REVISIONS BY:



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Soil Survey Map  
The Reserve at Corral Bluffs  
El Paso County, CO.  
For: Corral Ranch Development Co.

DRAWN:  
KAH

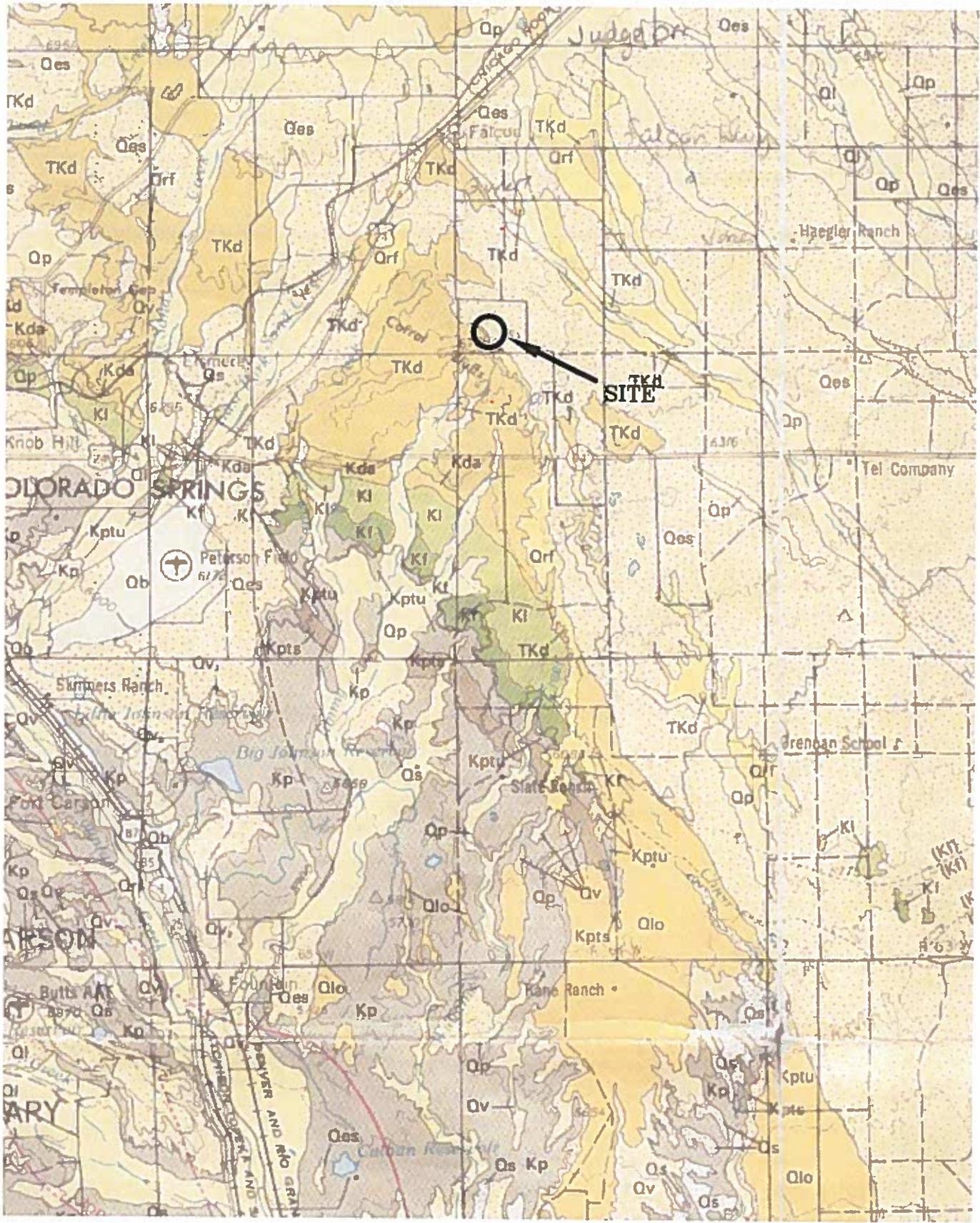
DATE:  
12/2/19

CHECKED:

DATE:

JOB NO.:  
192142

FIG NO.:  
5



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Colorado Geology Map  
The Reserve at Corral Bluffs  
El Paso County, CO.  
For: Corral Ranch Development Co.

DRAWN:  
KAH

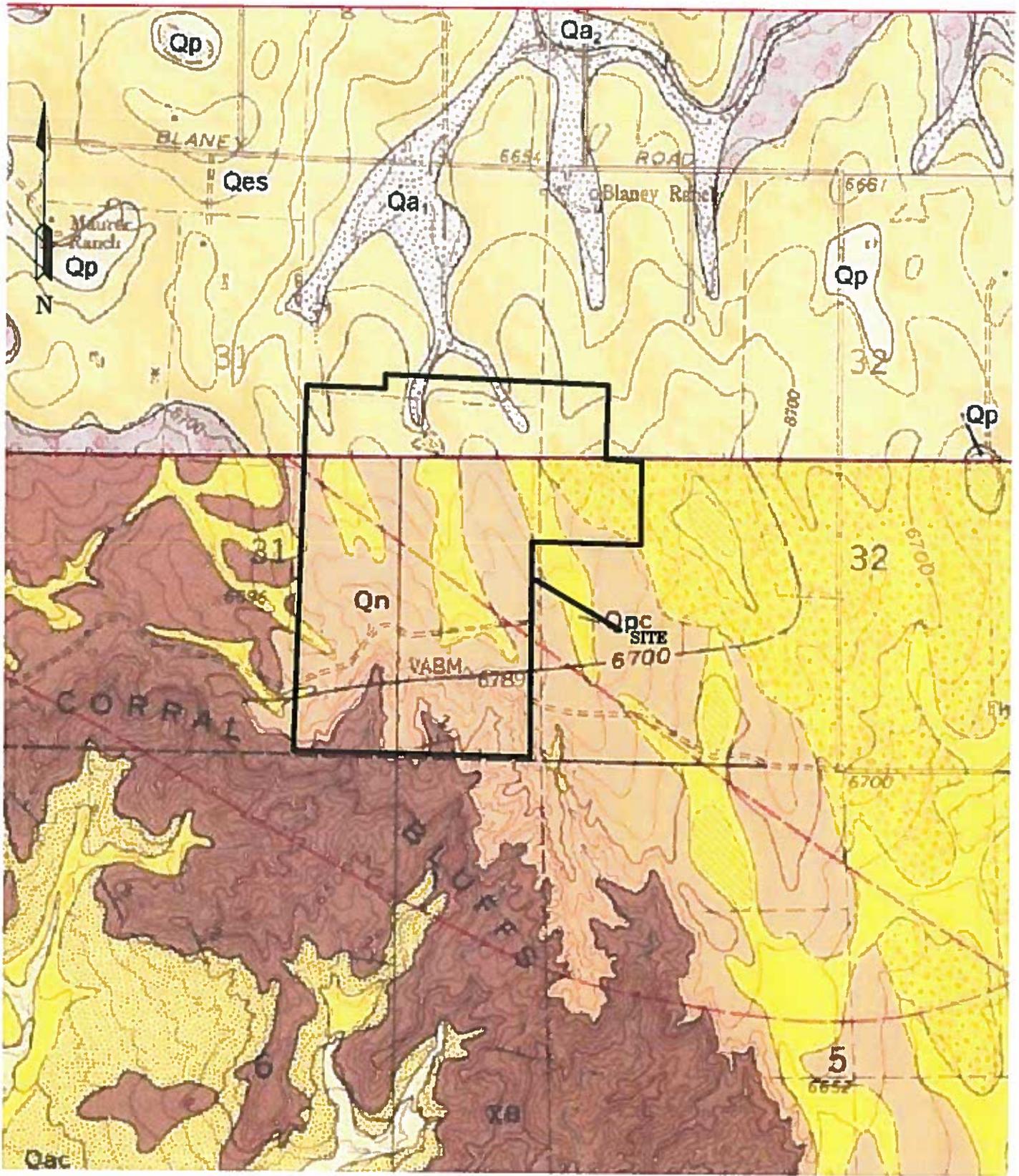
DATE:  
12/2/19

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DATE:

JOB NO.:  
192142

FIG NO.:  
6



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Corral Bluffs/Falcon Geology Map  
 The Reserve at Corral Bluffs  
 El Paso County, CO.  
 For: Corral Ranch Development Co.

JOB NO.:  
 192142

FIG NO.:  
 7

DRAWN:  
 KAH

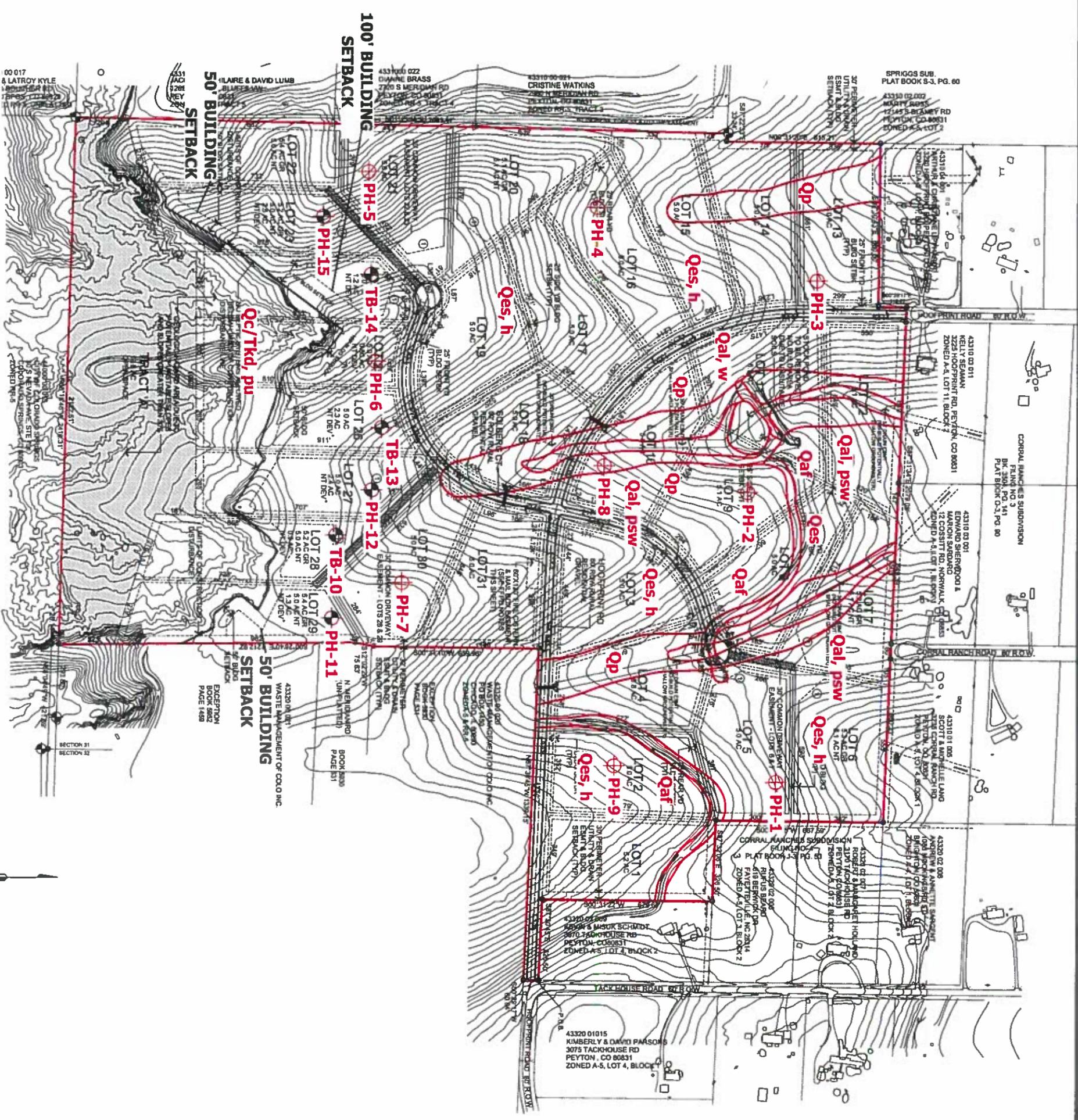
DATE:  
 12/2/19

CHECKED:

DATE:

**LEGEND**

- Qaf** - Artificial Fill of Holocene Age:  
Man-made fill deposits.
- Qal** - Recent Alluvium of Holocene Age:  
Recent water deposited materials
- Qp** - Piney Creek Alluvium of Holocene Age:  
Water deposited sands and clays
- Qes** - Eolian Sand of Quaternary Age:  
Wind blown sand deposits
- Qc/Tkd** - Colluvium of Quaternary Age Overlying  
the Dawson Formation of Tertiary to  
Cretaceous Age:  
Sheetwash and residual soil deposits  
overlying arkosic sandstone with  
interbedded siltstone and claystone.
- w** - areas of ponded water
- psw** - potentially seasonal shallow groundwater
- h** - hydrocompaction
- pu** - potentially unstable slope



PH-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

DRAWN BY: JAC
DESIGNED BY: KAH
CHECKED BY:
DATE: 12/04/19
SCALE: 1:200
JOB NO.: 192142
FIGURE NO.: 8

**GEOLOGY/ENGINEERING GEOLOGY MAP**  
**THE RESERVE AT CORRAL BLUFFS**  
**EL PASO COUNTY, CO**  
**FOR: CORRAL RANCH DEVELOPMENT**

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

REVISIONS BY:	

# LEGEND

**SPECIAL FLOOD HAZARD AREAS INUNDATE**  
**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  
Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.



Identified  
1990  
Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.



Otherwise  
Protected 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.

Base Flood Elevation Line: Elevation in Feet See Map Index for Elevation Datum.

Cross Section Line

Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

Elevation Reference Mark

● M2

RM7 X

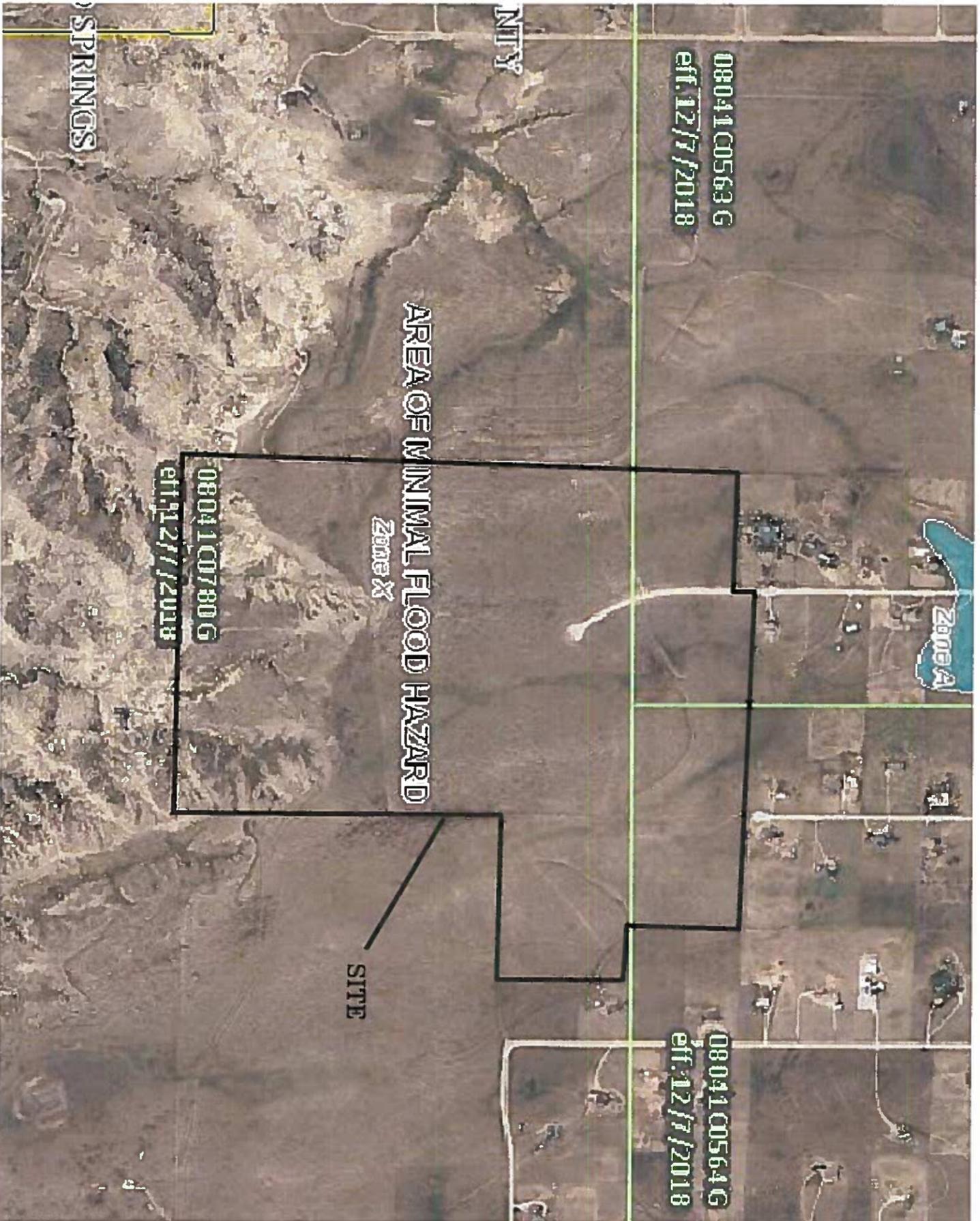
(EL. 987)



513

97°07'30", 32°22'30"

Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.



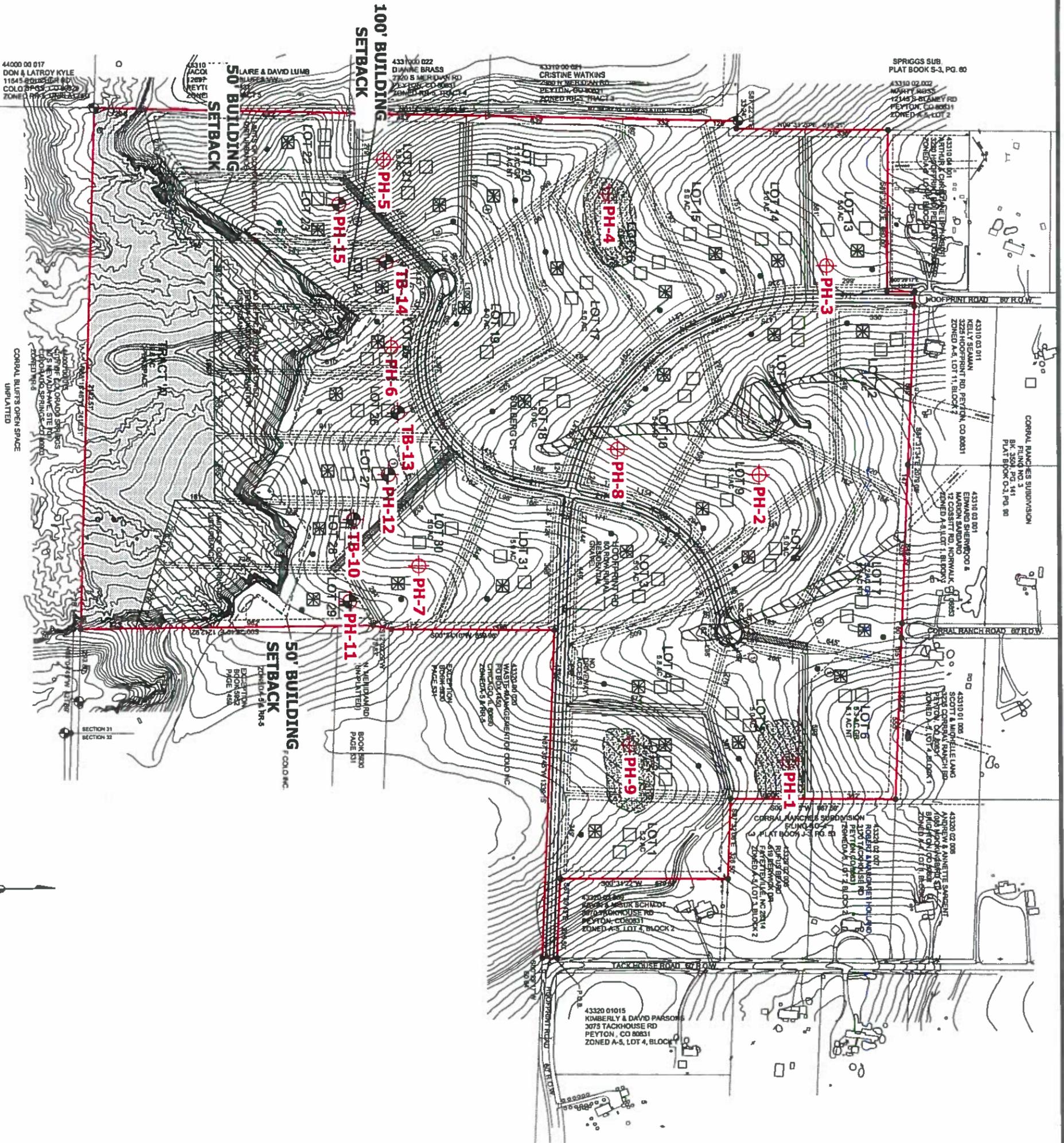
REVISION	BY

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Floodplain Map  
The Reserve at Corral Bluffs  
El Paso County, CO.  
For: Corral Ranch Development Co.

DATE	BY	REVISION
12/2/19 <td>AS SEBOWN <td>9</td> </td>	AS SEBOWN <td>9</td>	9
10/21/12 <td>JOE MA <td> </td> </td>	JOE MA <td> </td>	
1/20/12 <td>JOE MA <td> </td> </td>	JOE MA <td> </td>	

- LEGEND**
-  AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED DUE TO DRAINAGE AREA OR POTENTIALLY UNSTABLE SLOPES
  -  AREAS WHERE DESIGNED SYSTEMS MAY BE REQUIRED DUE TO SLOW PERCOLATION RATES
  -  AREAS WHERE CONVENTIONAL SYSTEMS MAY BE USED UNLESS SLOW PERCOLATION RATES, SHALLOW GROUNDWATER, OR SHALLOW BEDROCK IS ENCOUNTERED REQUIRING DESIGNED SYSTEMS
  -  POSSIBLE HOUSE LOCATION
  -  TWO POSSIBLE SEPTIC FIELD SITES
  -  POSSIBLE WELL LOCATION



PH-2 APPROXIMATE TEST BORING LOCATION AND NUMBER

SEPTIC SUITABILITY MAP  
 THE RESERVE AT CORRAL BLUFFS  
 EL PASO COUNTY, CO  
 FOR: CORRAL RANCH DEVELOPMENT



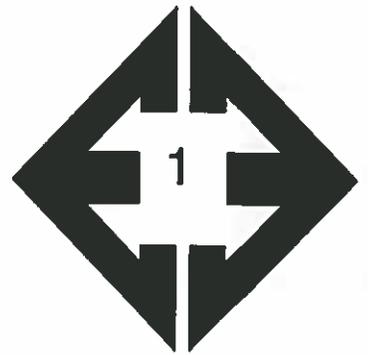
**ENTECH**  
 ENGINEERING, INC.  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-5599

REVISIONS BY:

NO.	DATE	BY	DESCRIPTION

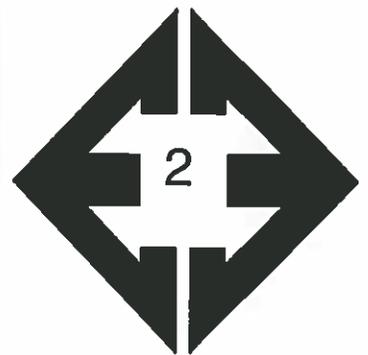
DRAWN BY: JAC  
 DESIGNED BY: KAH  
 CHECKED BY:  
 DATE: 12/04/19  
 SCALE: 1:200  
 JOB NO.: 192142  
 FIGURE NO.: 10

## **APPENDIX A: Site Photographs**



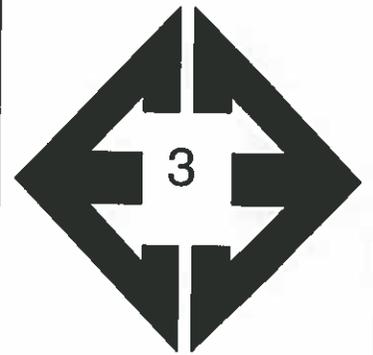
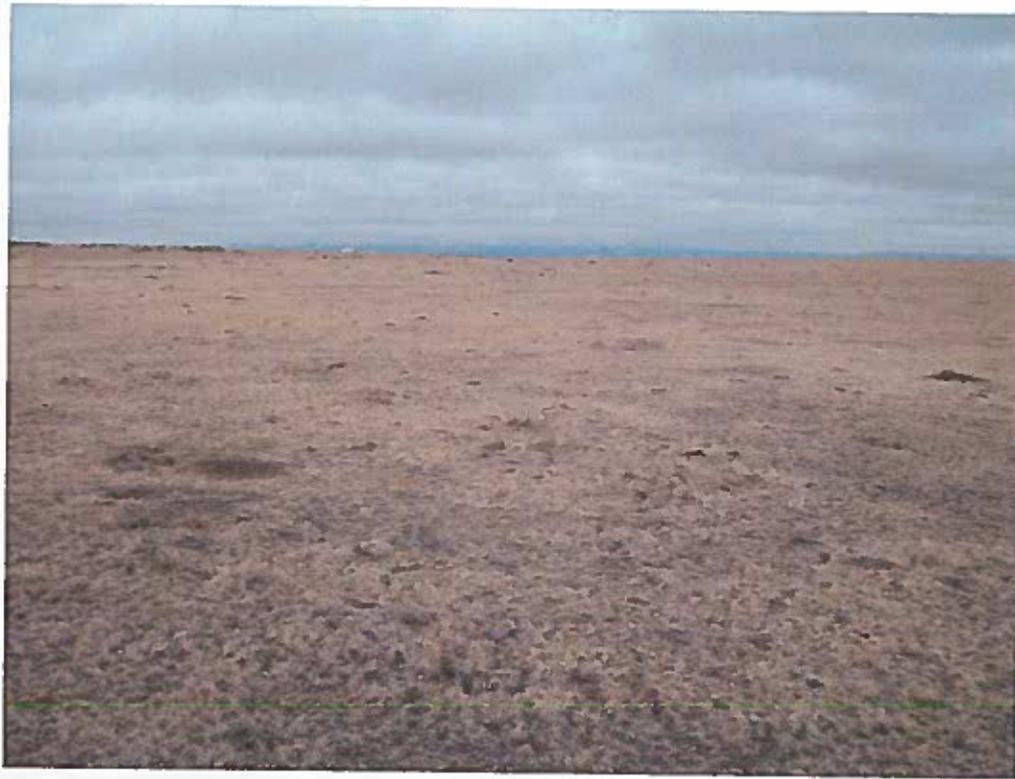
**Looking southwest  
from the north central  
portion of the site.**

December 19, 2011



**Looking southeast  
from the north central  
portion of the site.**

December 19, 2011



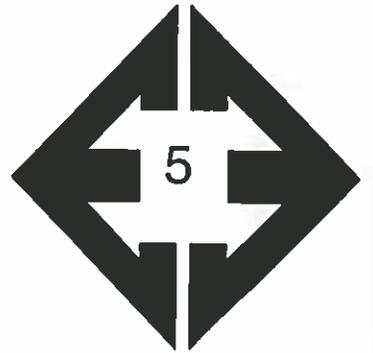
**Looking southwest  
from the southeast  
portion of the site.**

December 19, 2011



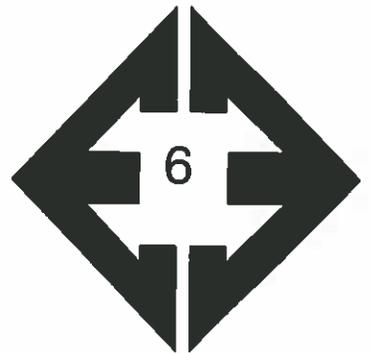
**Looking at dam and  
pond in central portion  
of the site.**

December 19, 2011



**Looking southeast  
from the northwest  
portion of the site.**

December 19, 2011



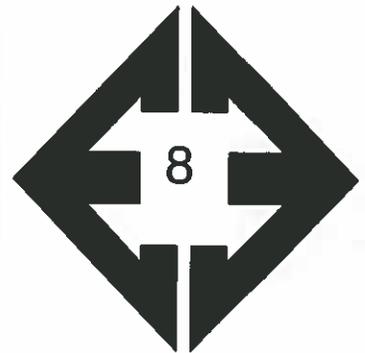
**Looking northeast  
from the southwest  
portion of the site.**

December 19, 2011



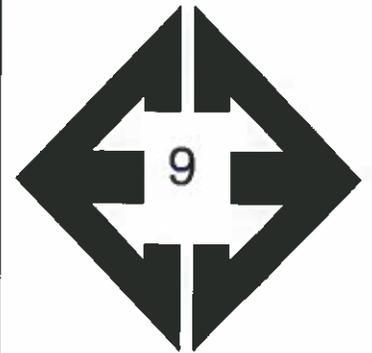
**Looking south at potentially unstable slopes in south central portion of the site.**

December 19, 2011



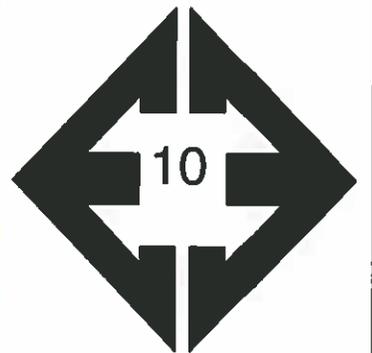
**Looking southeast at potentially unstable slopes in south central portion of the site.**

December 19, 2011



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

December 19, 2011



**Looking northwest  
from the southeast  
portion of the site.**

December 19, 2011

**APPENDIX B: Test Boring Logs from Profile Holes  
(Reference 1)**

PROFILE HOLE NO 1  
 DATE DRILLED 12/28/2011  
 Job # 83691

PROFILE HOLE NO 2  
 DATE DRILLED 12/28/2011  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 14', 12/29/11 SAND, VERY SILTY, FINE GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST	5			21	6.1	1	DRY TO 15', 12/29/11 SILT, VERY SANDY, TAN TO BROWN, STIFF TO VERY STIFF, MOIST	5			21	10.1	3
	5			12	8.2	1		5			19	12.0	3
CLAY-SILT, VERY SANDY, TAN, VERY STIFF, MOIST	10			35	9.0	2		10			21	11.9	3
	15			35		2		15			32	20.7	3
	20							20					



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505 ELKTON DRIVE  
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PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>th</i>	1/17/12

JOB NO.:  
 83691  
 FIG NO.:  
 B-1

PROFILE HOLE NO 3  
 DATE DRILLED 12/28/2011  
 Job # 83691

PROFILE HOLE NO 4  
 DATE DRILLED 1/4/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 15', 12/29/11  
 SILT, SANDY, TAN TO BROWN,  
 STIFF TO VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			17	13.9	3
5			27	12.6	3
10			21	13.7	3
15			41	7.9	3

DRY TO 14', 1/5/12  
 CLAY, SANDY, DARK BROWN,  
 STIFF, MOIST

CLAY-SILT, SANDY, TAN,  
 VERY STIFF TO STIFF, MOIST

SANDSTONE, VERY CLAYEY,  
 VERY SILTY, FINE GRAINED,  
 TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			19	16.4	2
5			30	10.9	2
10			24	5.8	2
15			50	6.0	4
			10"		



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 COLORADO SPRINGS, COLORADO 80907

PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/17/12

JOB NO:  
 83691  
 FIG NO:  
 B-2

PROFILE HOLE NO 5  
 DATE DRILLED 1/4/2012  
 Job # 83691

PROFILE HOLE NO 6  
 DATE DRILLED 1/4/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 7', 1/5/12

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		28	7.4	1
5	[Symbol]		24	8.9	1
10	[Symbol]		50 9"	6.1	4

DRY TO 9', 1/5/12

SAND, VERY SILTY, FINE  
 GRAINED, DENSE, TAN, MOIST

SANDSTONE, VERY CLAYEY,  
 FINE GRAINED, TAN, VERY  
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		32	10.4	1
5	[Symbol]		40	6.9	1
10	[Symbol]		50 11"	7.6	4



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

PROFILE HOLE LOG

DRAWN: DATE CHECKED: DATE  
 1/17/12

JOB NO:

83691

FIG NO:

B-3

PROFILE HOLE NO 7  
 DATE DRILLED 1/4/2012  
 Job # 83691

PROFILE HOLE NO 8  
 DATE DRILLED 1/4/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 14', 1/5/12

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

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					
5			21	10.8	1
5			40	8.0	1
10			38	4.5	1
15			50	8.1	4
			11"		
20					

DRY TO 10', 1/5/12

SAND, VERY SILTY, FINE  
 GRAINED, TAN, DENSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					
5			30	7.5	1
5			47	6.7	1
10			40	5.0	1
15					
20					



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 COLORADO SPRINGS, COLORADO 80907

PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/17/12

JOB NO.:

83691

FIG NO.:

B-4

POFILE HOLE NO. 9  
 DATE DRILLED 1/4/2012  
 Job # 83691

POFILE HOLE NO.  
 DATE DRILLED  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 10', 1/5/12

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			26	8.6	1	5					
5			33	7.4	1	5					
10			45	6.4	1	10					
15						15					
20						20					



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 COLORADO SPRINGS, COLORADO 80907

PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *ar*

DATE:

1/17/12

JOB NO.:

83691

FIG NO.:

B-5

**APPENDIX C: Laboratory Test Results  
(Reference 1)**

UNIFIED CLASSIFICATION SM

CLIENT

CORRAL RANCH DEV.

SOIL TYPE #

1

PROJECT

RESERVE AT CORRAL BLUFFS

TEST BORING #

1

JOB NO.

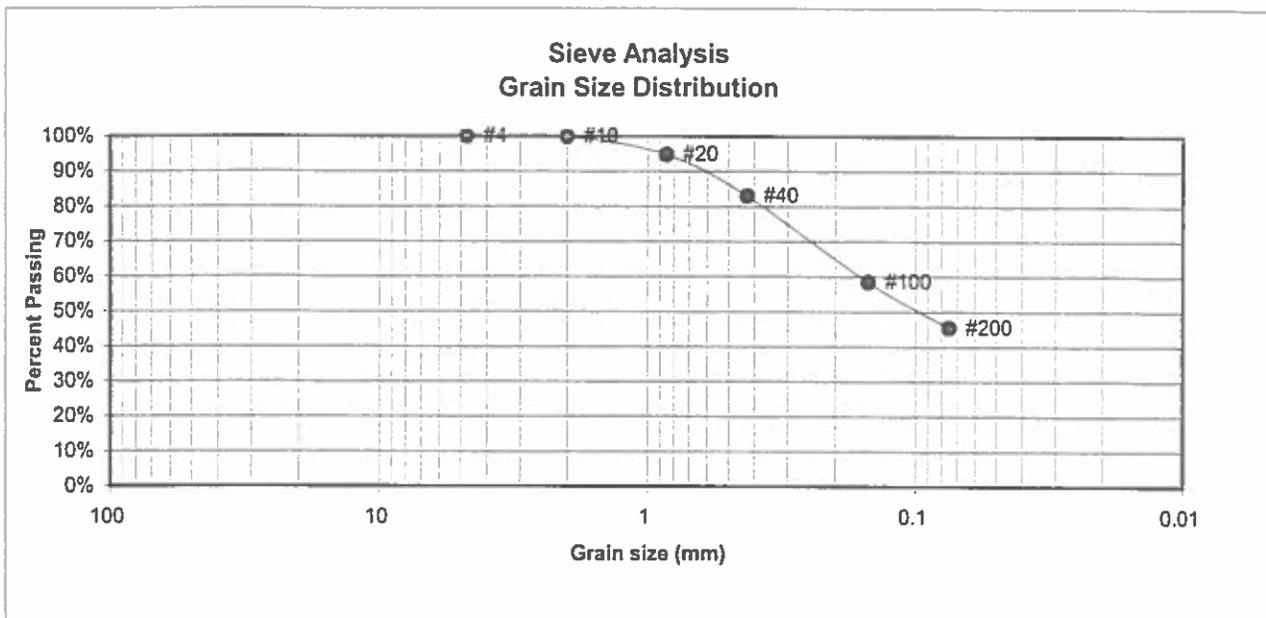
83691

DEPTH (FT)

2-3

TEST BY

BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.9%
20	94.8%
40	83.0%
100	58.5%
200	45.3%

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST  
RESULTS

DRAWN

DATE

CHECKED *W*

DATE

1/17/12

JOB NO.

83691

FIG NO.

C-1

UNIFIED CLASSIFICATION SM

SOIL TYPE # 1

TEST BORING # 5

DEPTH (FT) 2-3

CLIENT

PROJECT

JOB NO.

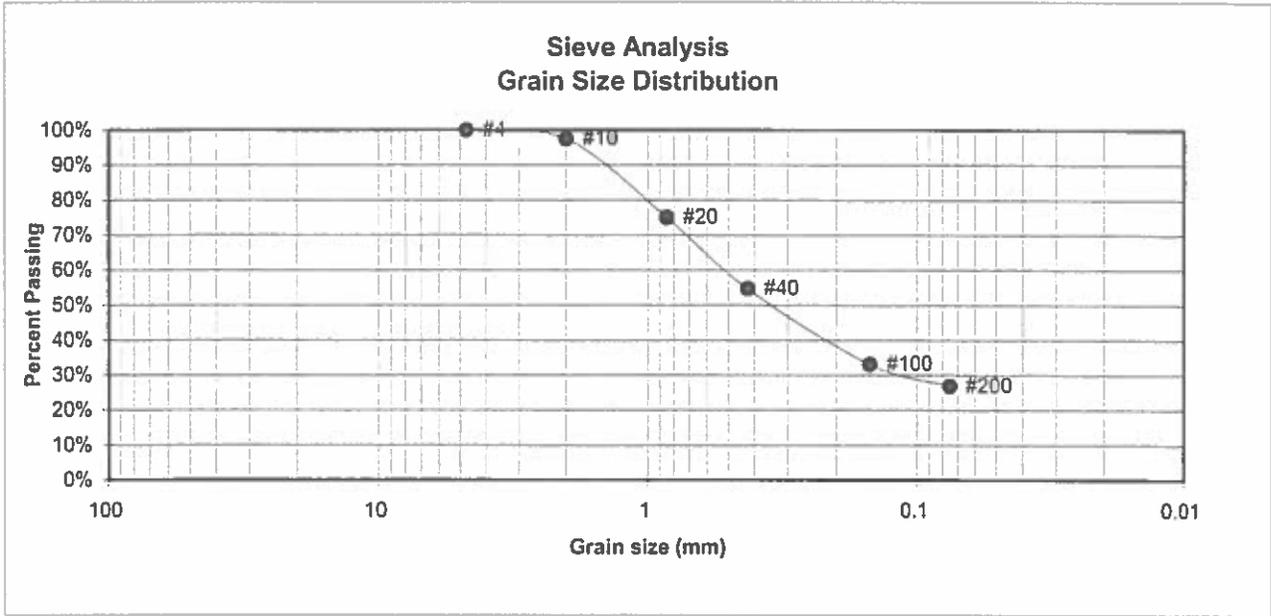
TEST BY

CORRAL RANCH DEV.

RESERVE AT CORRAL BLUFFS

83691

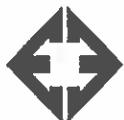
BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.5%
20	75.0%
40	54.7%
100	33.2%
200	26.9%

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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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

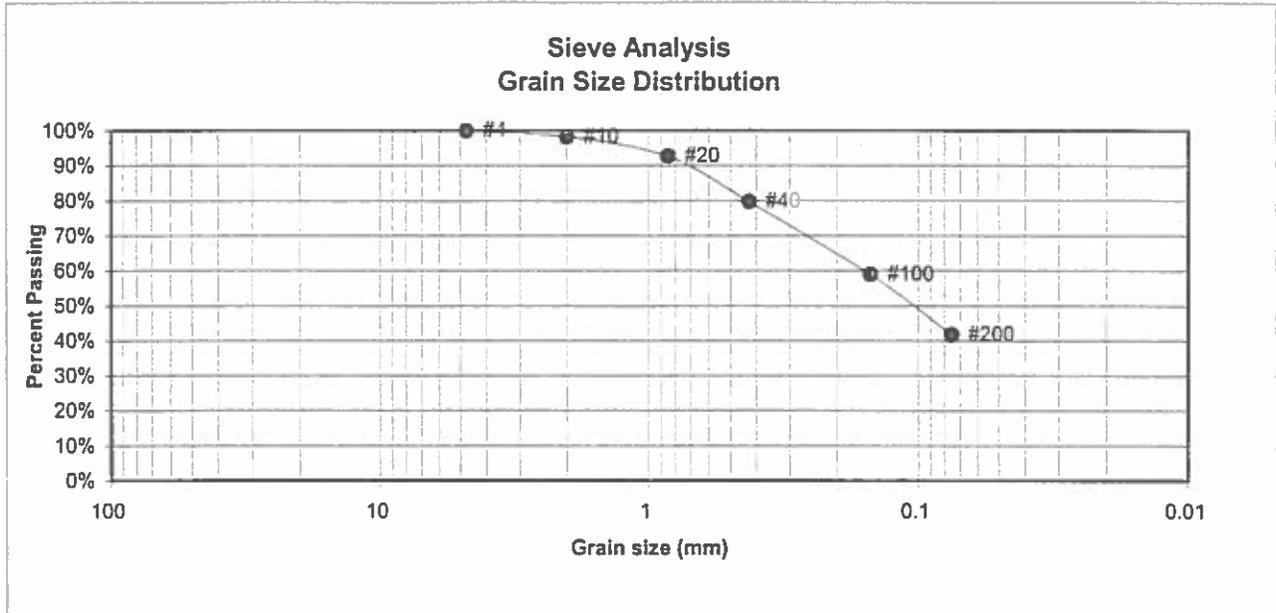
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	11/17/12

JOB NO.:  
 83691  
 FIG NO.:  
 C-2

UNIFIED CLASSIFICATION SM  
 SOIL TYPE # 1  
 TEST BORING # 6  
 DEPTH (FT) 2-3

CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS  
 JOB NO. 83691  
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.2%
20	92.7%
40	79.7%
100	58.9%
200	41.7%

Atterberg  
 Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST  
 RESULTS

DRAWN

DATE

CHECKED: *W*

DATE: 1/27/12

JOB NO:

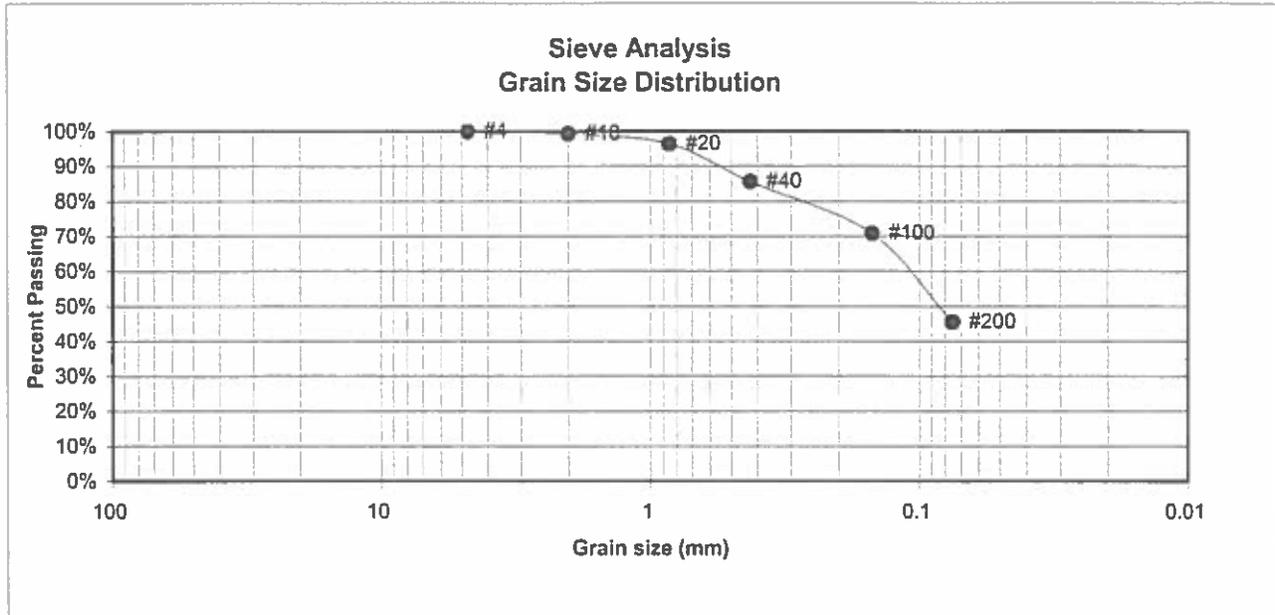
83691

FIG NO:

C-3

UNIFIED CLASSIFICATION SM  
 SOIL TYPE # 1  
 TEST BORING # 7  
 DEPTH (FT) 2-3

CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS  
 JOB NO. 83691  
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.3%
20	96.4%
40	85.7%
100	70.8%
200	45.5%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:

DATE:

CHECKED *BL*

DATE *11/17/12*

JOB NO:

*83691*

FIG NO:

*C-4*

UNIFIED CLASSIFICATION SM

SOIL TYPE # 1

TEST BORING # 8

DEPTH (FT) 2-3

CLIENT

PROJECT

JOB NO.

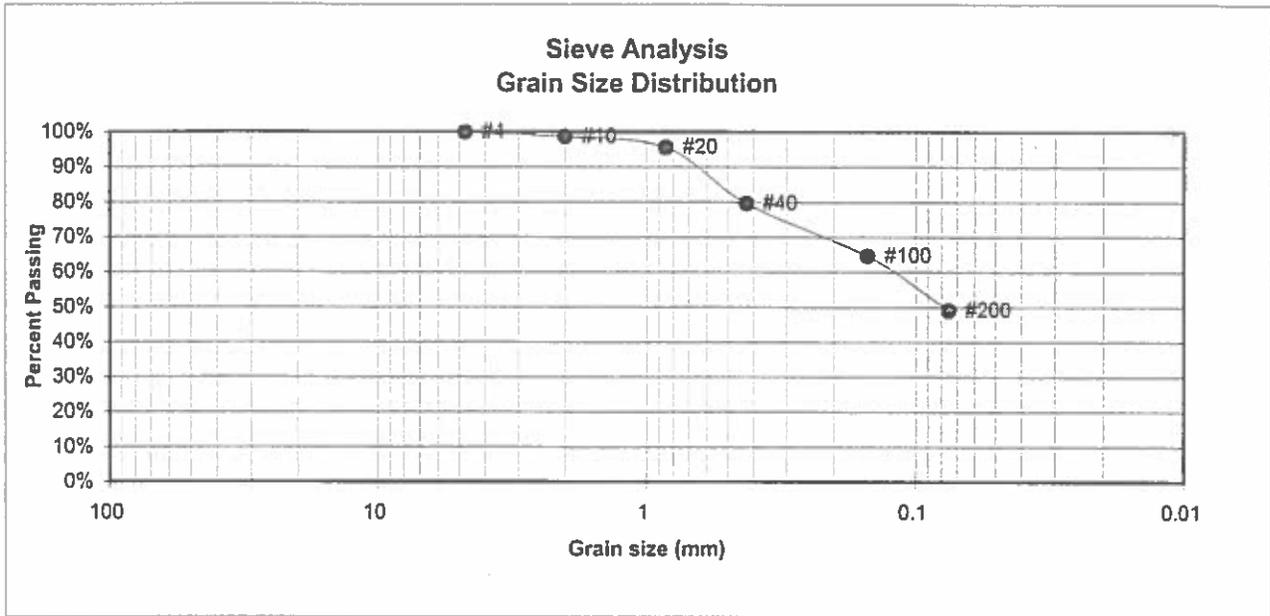
TEST BY

CORRAL RANCH DEV.

RESERVE AT CORRAL BLUFFS

83691

BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.7%
20	95.6%
40	79.6%
100	64.6%
200	49.0%

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

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



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST  
RESULTS

DRAWN

DATE

CHECKED

DATE

*Handwritten initials and date: 1/17/12*

JOB NO.:

*83691*

FIG NO.:

*C-5*

UNIFIED CLASSIFICATION SM

SOIL TYPE # 1

TEST BORING # 9

DEPTH (FT) 2-3

CLIENT

PROJECT

JOB NO.

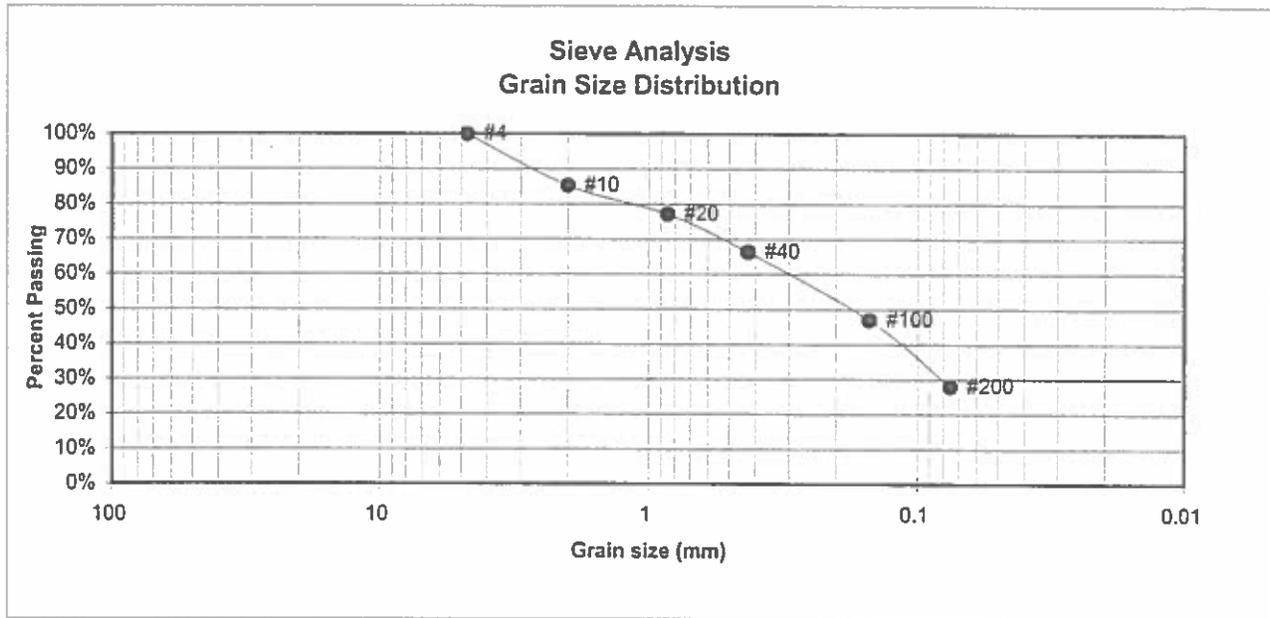
TEST BY

CORRAL RANCH DEV.

RESERVE AT CORRAL BLUFFS

83691

BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	85.3%
20	77.1%
40	66.3%
100	47.0%
200	28.0%

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

DRAWN

DATE

CHECKED

DATE

*[Signature]*

1/17/12

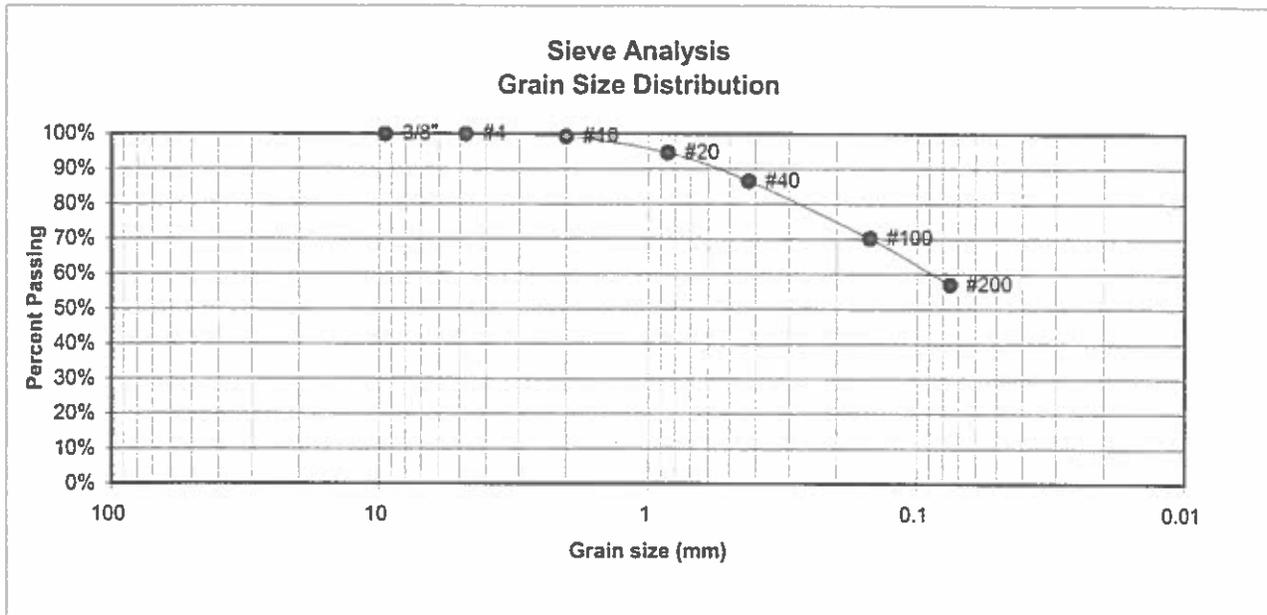
JOB NO:

83691

FIG NO:

C-6

<u>UNIFIED CLASSIFICATION</u>	CL-ML	<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	100.0%
10	99.3%
20	94.6%
40	86.5%
100	70.2%
200	57.0%

<u>Atterberg Limits</u>	
Plastic Limit	12
Liquid Limit	18
Plastic Index	7

<u>Swell</u>	
Moisture at start	#DIV/0!
Moisture at finish	#DIV/0!
Moisture increase	#DIV/0!
Initial dry density (pcf)	0
Swell (psf)	0



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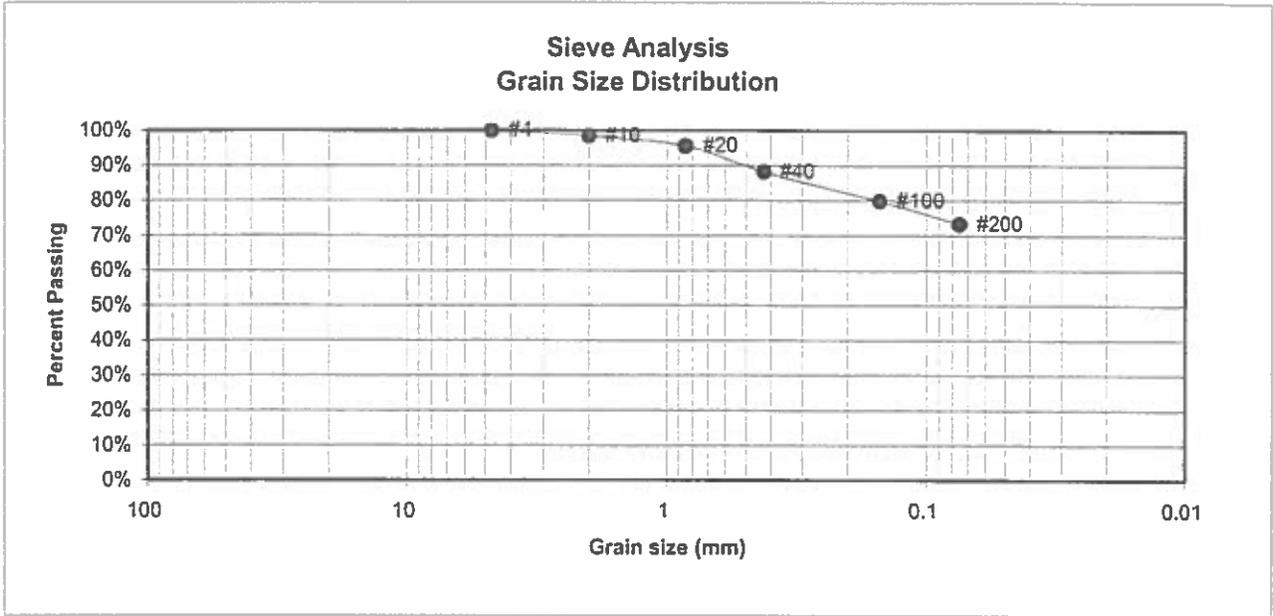
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>W</i>	1/17/12

JOB NO:  
83691  
FIG NO:  
C-7

UNIFIED CLASSIFICATION CL  
 SOIL TYPE # 2  
 TEST BORING # 4  
 DEPTH (FT) 2-3

CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS  
 JOB NO. 83691  
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.4%
20	95.6%
40	88.2%
100	79.9%
200	73.2%

Atterberg Limits	
Plastic Limit	13
Liquid Limit	21
Plastic Index	8

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



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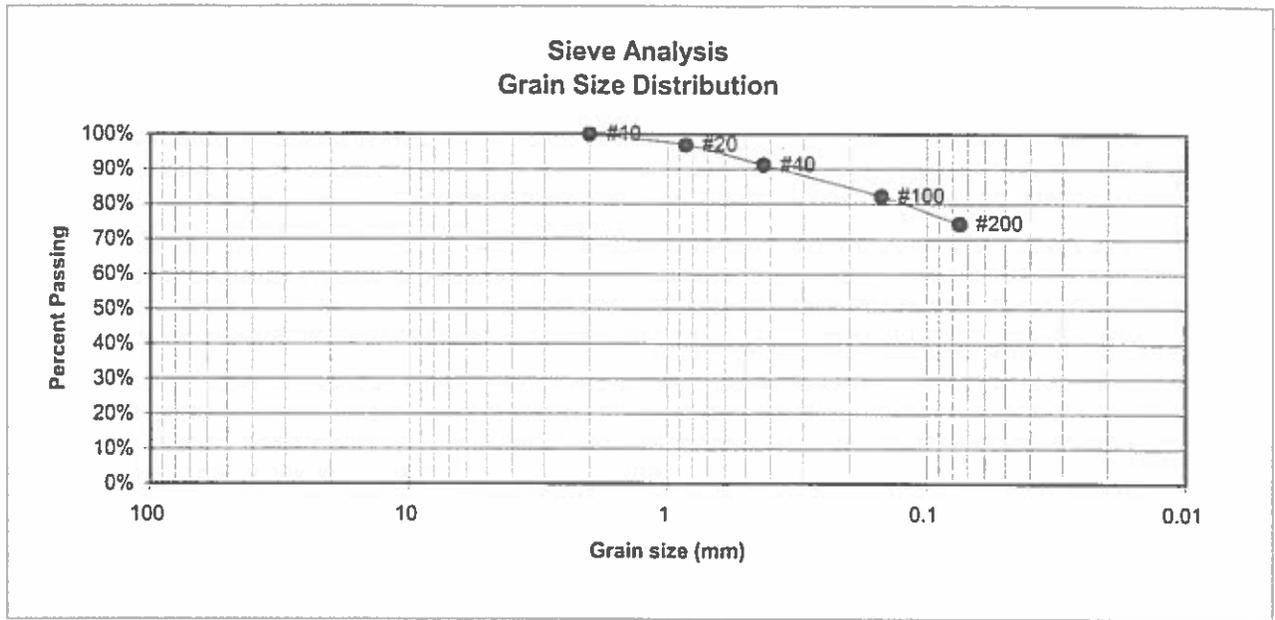
505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 1/17/12
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JOB NO.: 83691  
 FIG NO.: C-8

<u>UNIFIED CLASSIFICATION</u>	CL-ML	<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	14
1 1/2"		Liquid Limit	20
3/4"		Plastic Index	6
1/2"		<u>Swell</u>	
3/8"		Moisture at start	
4		Moisture at finish	
10	100.0%	Moisture increase	
20	97.0%	Initial dry density (pcf)	
40	91.2%	Swell (psf)	
100	82.2%		
200	74.3%		



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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>m</i>	DATE: 1/17/12
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JOB NO:  
**83691**  
FIG NO:  
**C-9**

UNIFIED CLASSIFICATION ML

SOIL TYPE # 3

TEST BORING # 2

DEPTH (FT) 2-3

CLIENT

PROJECT

JOB NO.

TEST BY

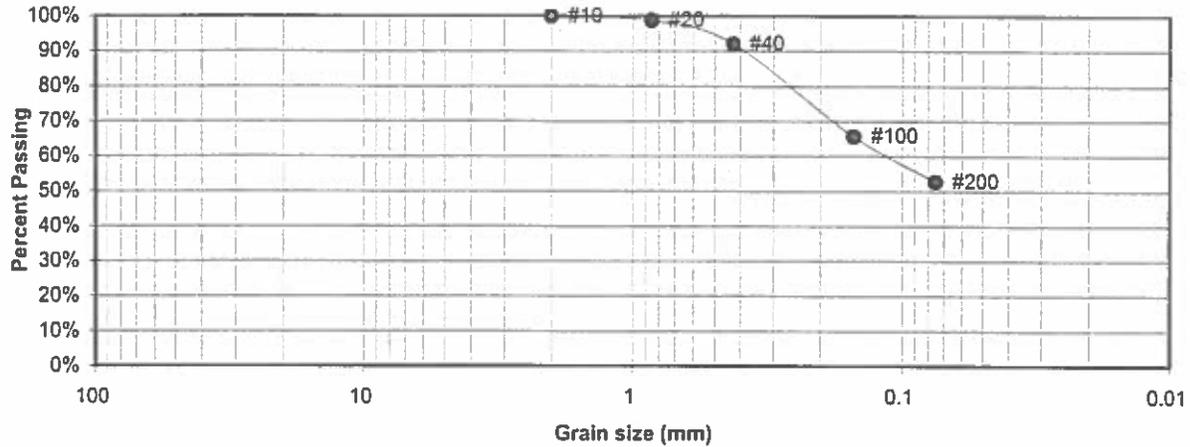
CORRAL RANCH DEV.

RESERVE AT CORRAL BLUFFS

83691

BL

### Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	98.8%
40	92.0%
100	65.7%
200	52.7%

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

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



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### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED: *h*

DATE: 1/17/12

JOB NO.:

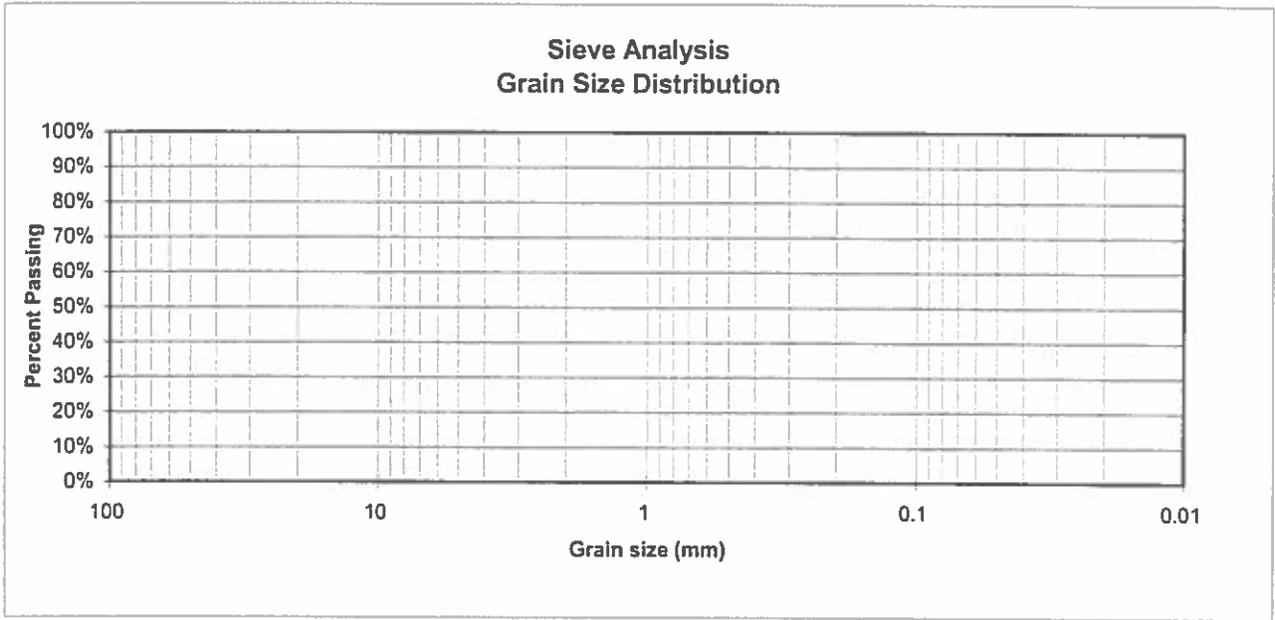
83691

FIG NO.:

C-10

UNIFIED CLASSIFICATION ML  
SOIL TYPE # 3  
TEST BORING # 2  
DEPTH (FT) 10

CLIENT CORRAL RANCH DEV.  
PROJECT RESERVE AT CORRAL BLUFFS  
JOB NO. 83691  
TEST BY BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	
1 1/2"		Liquid Limit	
3/4"		Plastic Index	
1/2"			
3/8"			
4		<u>Swell</u>	
10		Moisture at start	9.4%
20		Moisture at finish	15.3%
40		Moisture increase	5.9%
100		Initial dry density (pcf)	103
200		Swell (psf)	850



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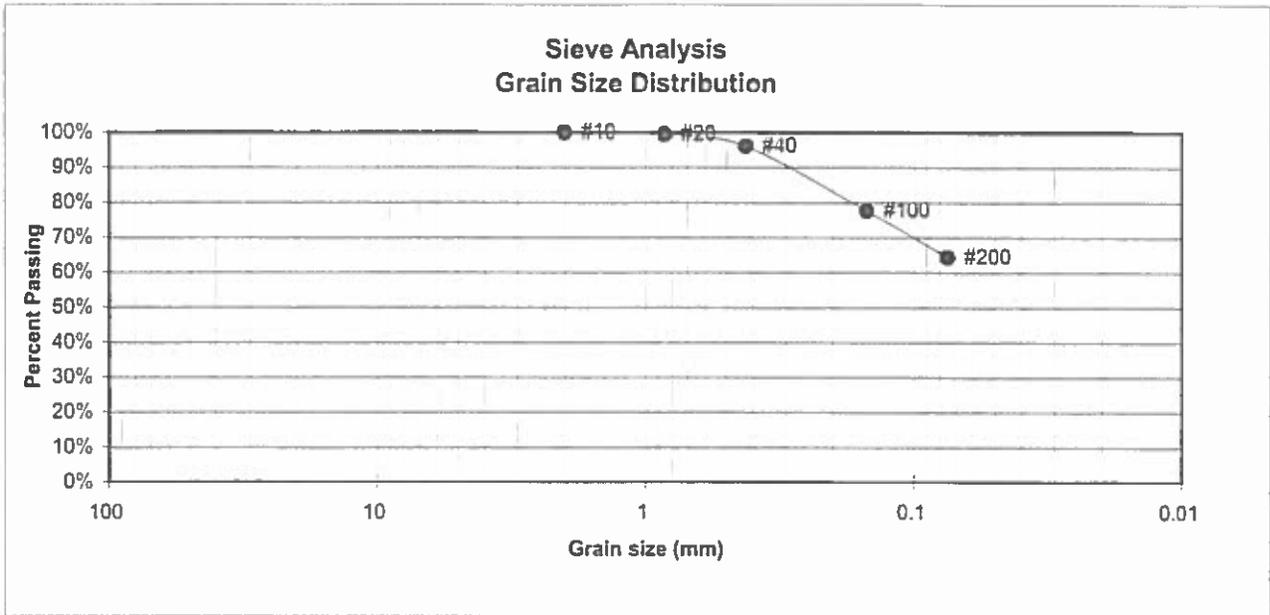
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>BL</i>	DATE: 11/17/10
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JOB NO.:  
83691  
FIG NO.:  
C-11

UNIFIED CLASSIFICATION ML  
 SOIL TYPE # 3  
 TEST BORING # 3  
 DEPTH (FT) 2-3

CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS  
 JOB NO. 83691  
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.4%
40	96.2%
100	77.7%
200	64.4%

Atterberg  
 Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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LABORATORY TEST  
 RESULTS

DRAWN

DATE

CHECKED: *h*

DATE: 1/17/12

JOB NO

83691

FIG NO

C-12

**UNIFIED CLASSIFICATION** SC-SM

**SOIL TYPE #** 4

**TEST BORING #** 4

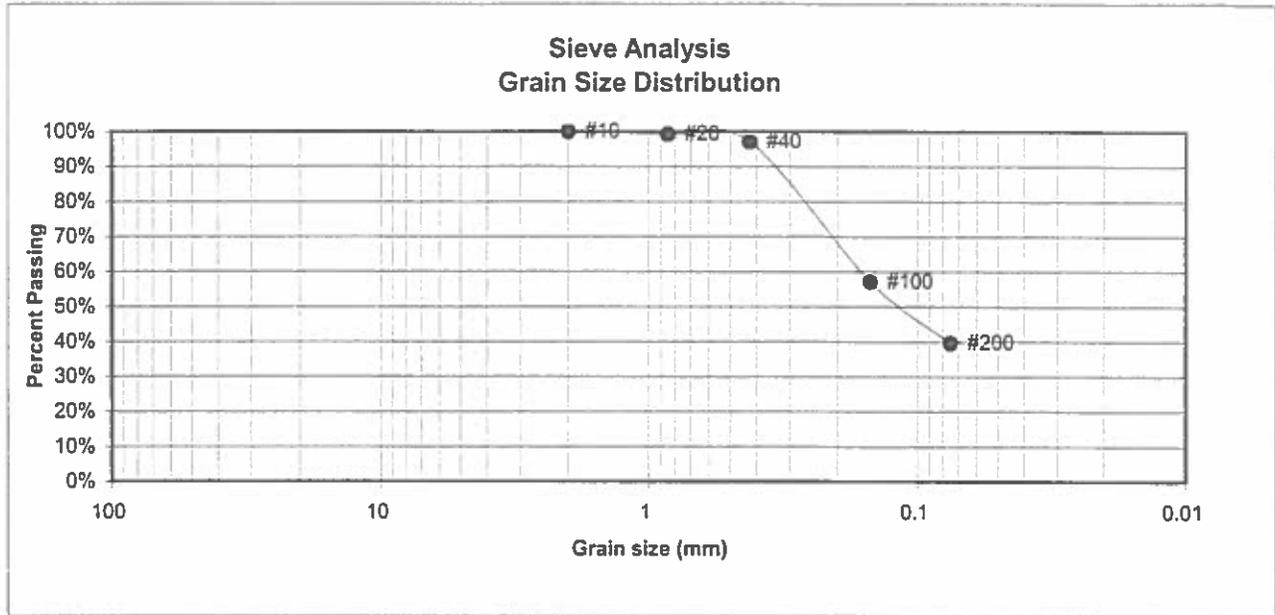
**DEPTH (FT)** 15

**CLIENT** CORRAL RANCH DEV.

**PROJECT** RESERVE AT CORRAL BLUFFS

**JOB NO.** 83691

**TEST BY** BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.3%
40	97.0%
100	57.1%
200	39.6%

Atterberg Limits	
Plastic Limit	10
Liquid Limit	17
Plastic Index	6

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



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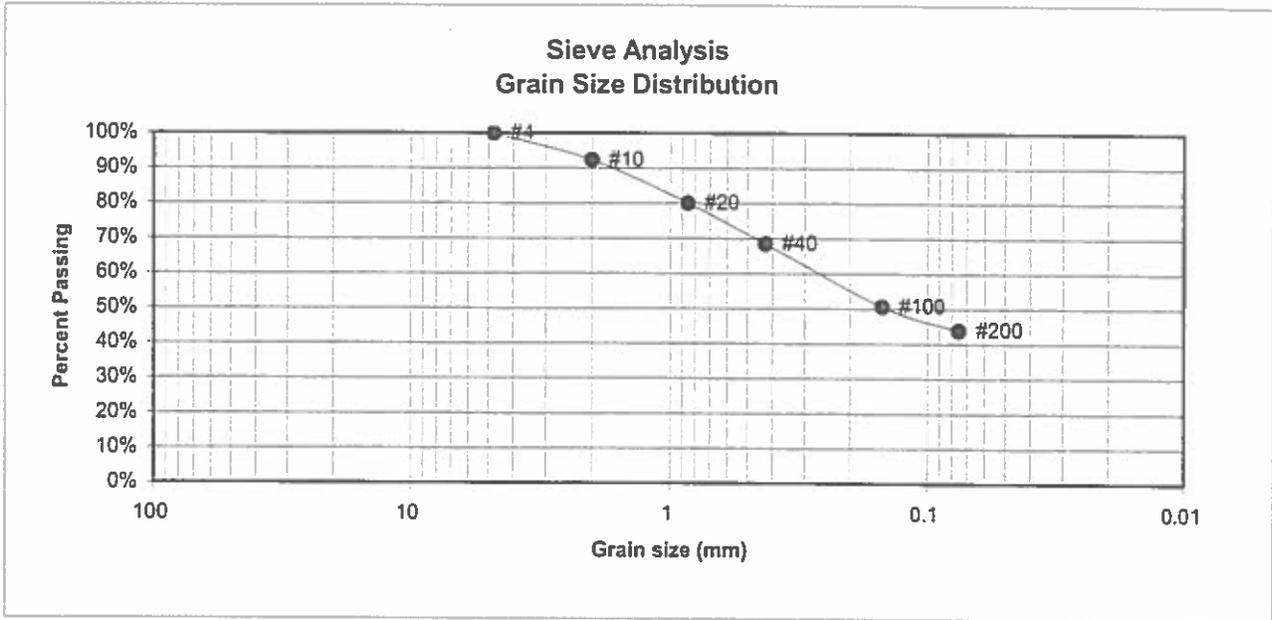
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 1/17/12
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JOB NO.:  
83691  
FIG NO.:  
C-13

UNIFIED CLASSIFICATION SC  
 SOIL TYPE # 4  
 TEST BORING # 6  
 DEPTH (FT) 10

CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS  
 JOB NO. 83691  
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	92.3%
20	80.0%
40	68.5%
100	50.6%
200	43.8%

Atterberg Limits	
Plastic Limit	12
Liquid Limit	28
Plastic Index	16

Swell	
Moisture at start	14.2%
Moisture at finish	23.6%
Moisture increase	9.4%
Initial dry density (pcf)	103
Swell (psf)	1330



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST  
 RESULTS

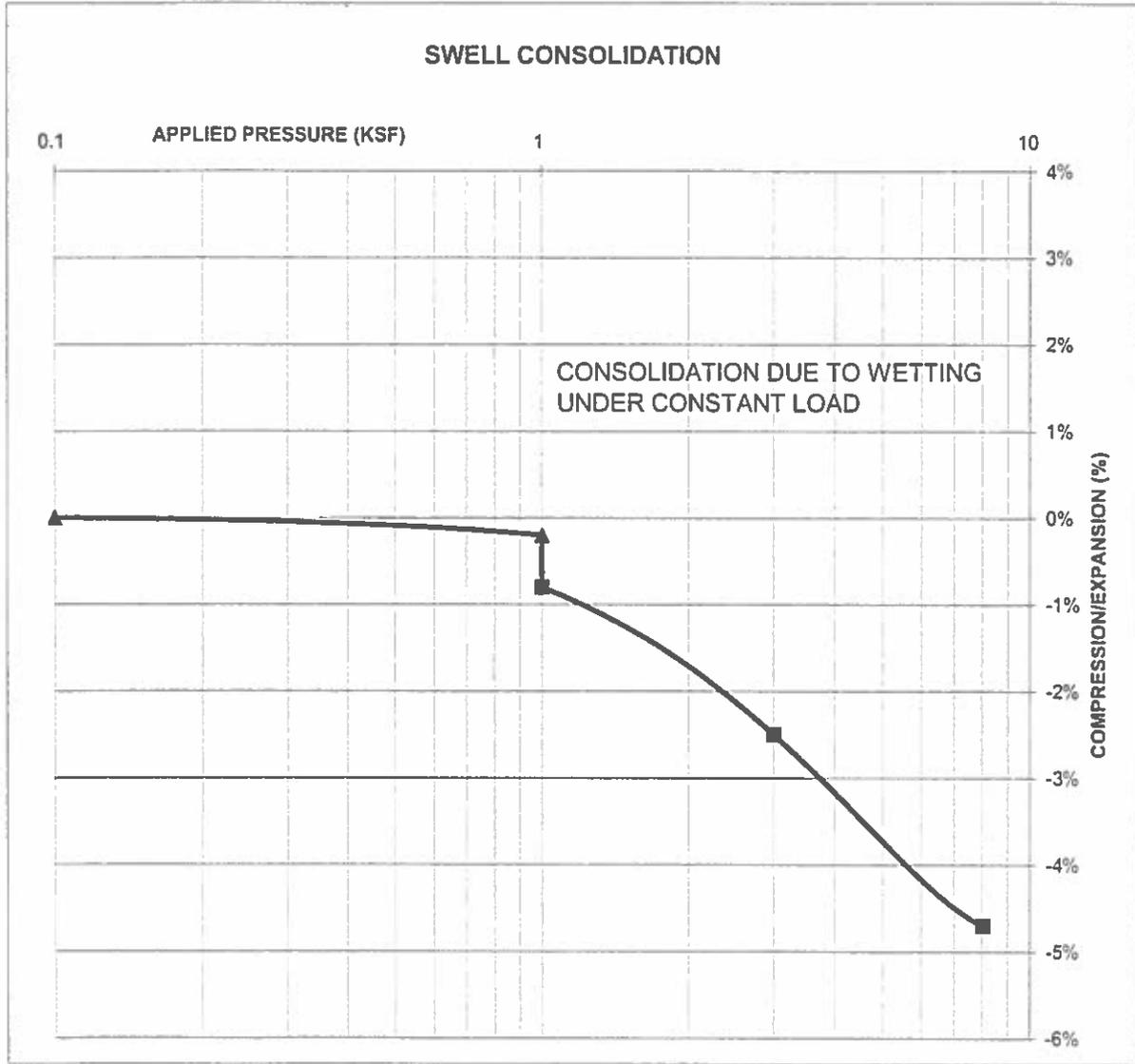
DRAWN	DATE	CHECKED	DATE
		<i>Kar</i>	1/23/12

JOB NO:  
 83691  
 FIG NO:  
 C-14

**CONSOLIDATION TEST RESULTS**

TEST BORING #	1	DEPTH(ft)	2-3
DESCRIPTION	SM	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			107
NATURAL MOISTURE CONTENT			6.3%
SWELL/CONSOLIDATION (%)			-0.6%

JOB NO. 83691  
CLIENT CORRAL RANCH DEV.  
PROJECT RESERVE AT CORRAL BLUFFS



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE

CHECKED: *hr*

DATE

*1/17/12*

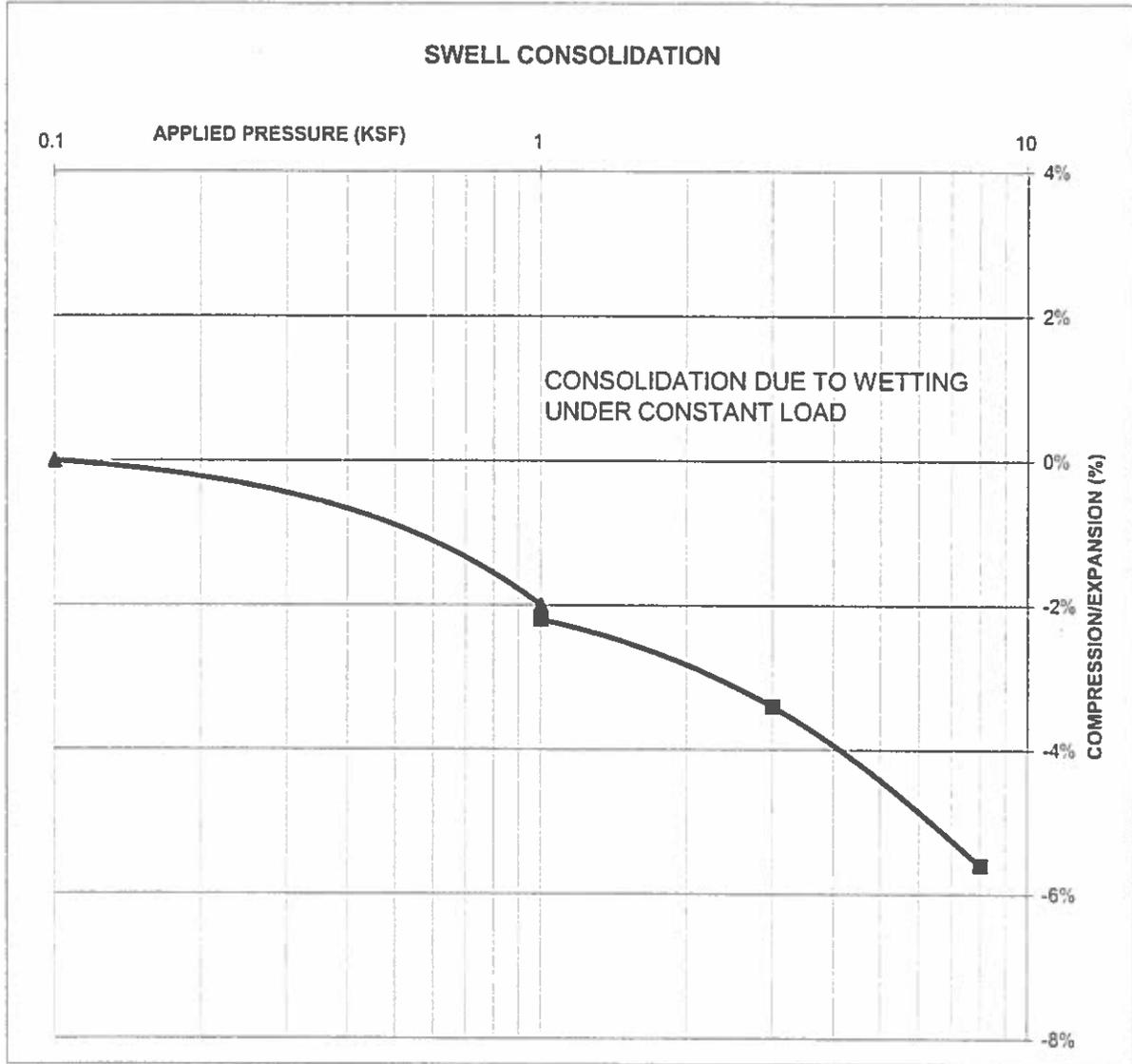
JOB NO:  
*83691*

FIG NO:  
*C-15*

**CONSOLIDATION TEST RESULTS**

TEST BORING #	4	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	109		
NATURAL MOISTURE CONTENT	16.7%		
SWELL/CONSOLIDATION (%)	-0.2%		

JOB NO. 83691  
 CLIENT CORRAL RANCH DEV.  
 PROJECT RESERVE AT CORRAL BLUFFS



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE

CHECKED:

DATE

*[Signature]* 1/17/12

JOB NO.:

83691

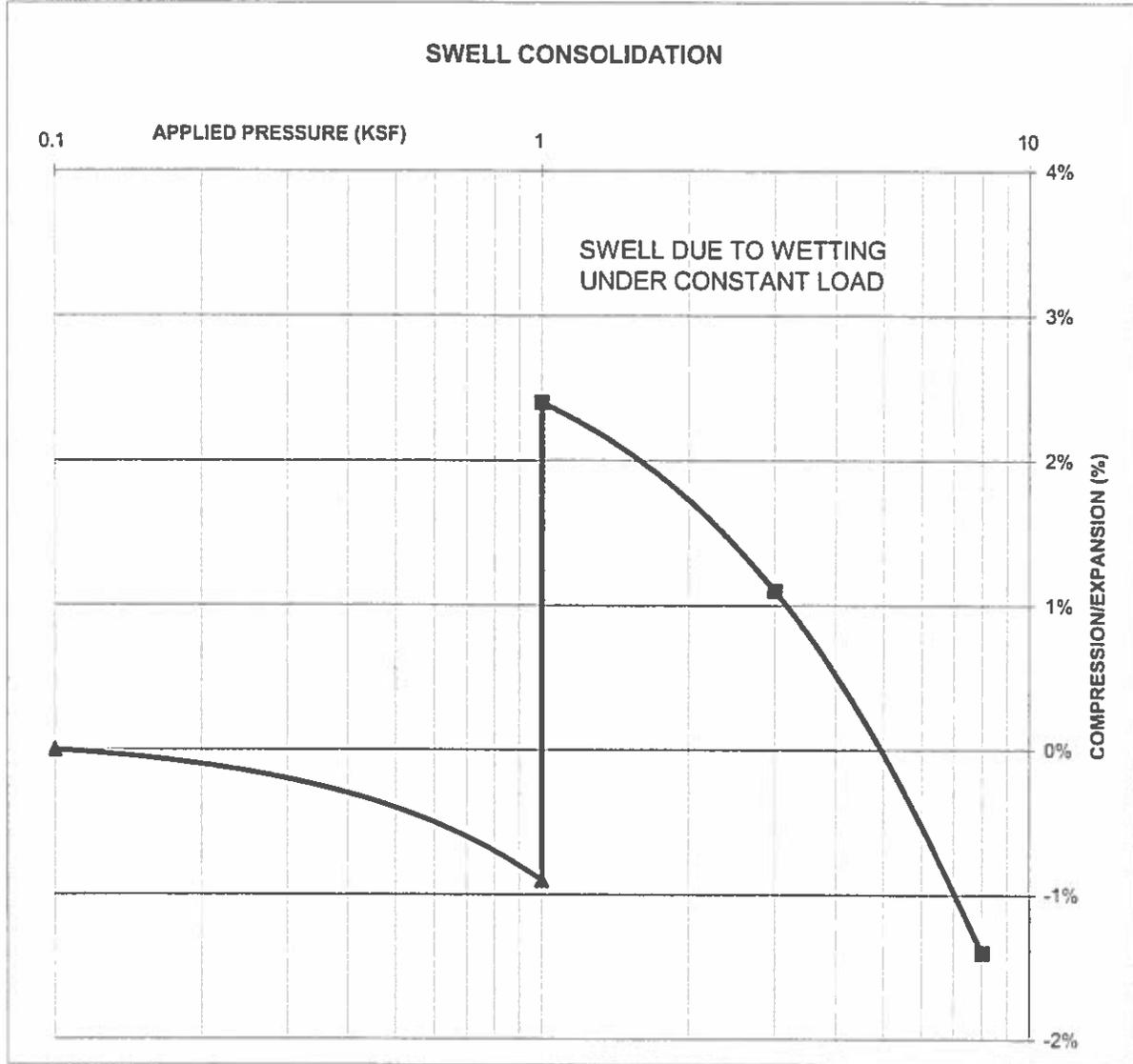
FIG NO.:

C-16

**CONSOLIDATION TEST RESULTS**

TEST BORING #	4	DEPTH(ft)	5
DESCRIPTION	CL-M	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	110		
NATURAL MOISTURE CONTENT	11.0%		
SWELL/CONSOLIDATION (%)	3.3%		

JOB NO. 83691  
CLIENT CORRAL RANCH DEV.  
PROJECT RESERVE AT CORRAL BLUFFS



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED *[Signature]*

DATE:

1/17/12

JOB NO:

83691

FIG NO:

C-17

**APPENDIX D: Test Boring Logs and Laboratory Test Results  
From Additional Testing  
(Reference 2)**

TEST BORING NO. 10  
 DATE DRILLED 8/13/2012  
 Job # 83691

PROFILE HOLE NO. 11  
 DATE DRILLED 8/13/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 28 DRY TO 10', 8/14/12 SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST	5			15	10.3	1	LOT 29 DRY TO 10', 8/14/12 SAND, VERY SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST	5			10	9.9	1
	10			28	4.3	1		10			18	8.2	1
	15							15					
	20							20					



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TEST BORING / PROFILE HOLE LOG

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *L* DATE: *8/30/12*

JOB NO.: 83691  
 FIG NO.: A-1

PROFILE HOLE NO. 12  
 DATE DRILLED 8/13/2012  
 Job # 83691

TEST BORING NO. 13  
 DATE DRILLED 8/13/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

LOT 27

DRY TO 10', 8/14/12  
 SAND, SILTY, FINE TO MEDIUM  
 GRAINED, TAN, DENSE TO  
 MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			30	7.7	1
10			23	10.2	1
15					
20					

REMARKS

LOT 26

DRY TO 10', 8/14/12  
 SAND, SILTY, FINE GRAINED,  
 BROWN TO TAN, MEDIUM  
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			10	7.4	1
10			16	9.2	1
15					
20					



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TEST BORING / PROFILE HOLE LOG

DRAWN: DATE: CHECKED: *L* DATE: 8/30/12

JOB NO:  
 83691

FIG NO.:

A-2

TEST BORING NO. 14  
 DATE DRILLED 8/13/2012  
 Job # 83691

PROFILE HOLE NO. 15  
 DATE DRILLED 8/13/2012  
 CLIENT CORRAL RANCH DEVELOPMENT  
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 24 DRY TO 10', 8/14/12 SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST	5			21	9.7	1	LOT 23 DRY TO 10', 8/14/12 SAND, VERY SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST	5			17	6.2	1
	10			29	6.8	1		10			20	4.6	1
	15							15					
	20							20					



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TEST BORING / PROFILE HOLE LOG

DRAWN	DATE	CHECKED	DATE
		<i>[Signature]</i>	8/30/12

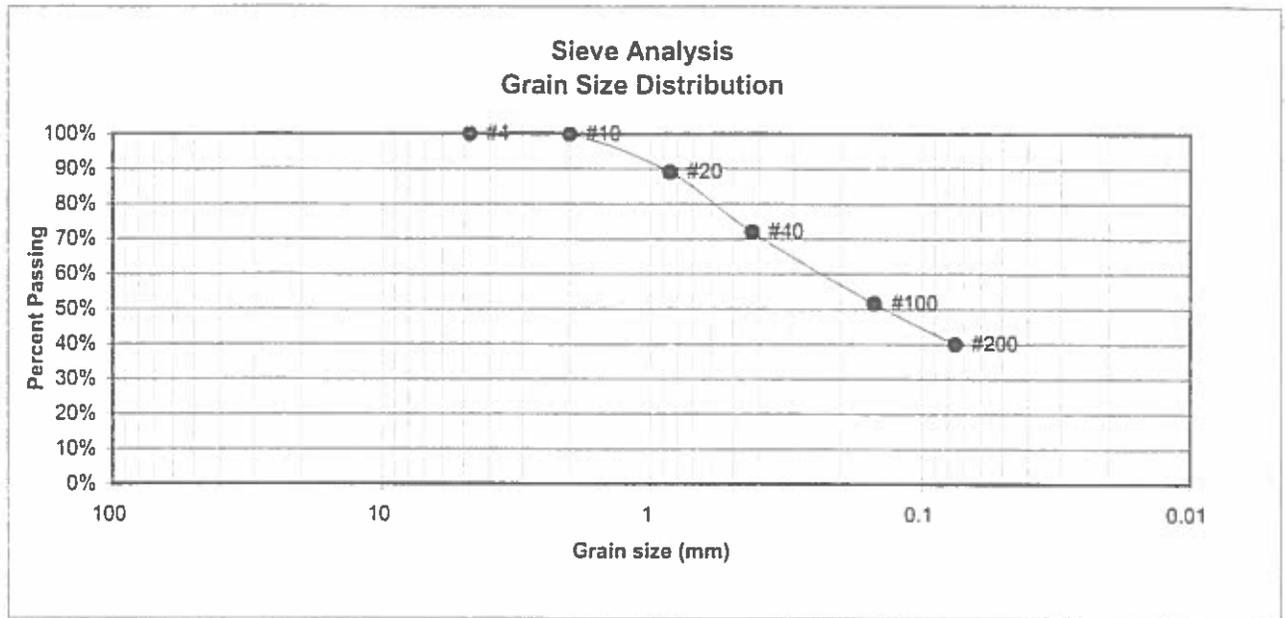
JOB NO:

83691

FIG NO:

A-3

UNIFIED CLASSIFICATION	SM	CLIENT	CORRAL RANCH DEV.
SOIL TYPE #	1	PROJECT	RESERVE AT CORRAL BLUFFS
TEST BORING #	11	JOB NO.	83691
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer	Atterberg Limits
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	99.9%	Moisture at start
20	89.1%	Moisture at finish
40	72.0%	Moisture increase
100	51.6%	Initial dry density (pcf)
200	40.0%	Swell (psf)



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**LABORATORY TEST  
RESULTS**

DRAWN	DATE	CHECKED <i>h</i>	DATE 8/21/12
-------	------	------------------	--------------

JOB NO.:  
**83691**  
FIG NO.:  
**B-1**

UNIFIED CLASSIFICATION SM

SOIL TYPE # 1

TEST BORING # 12

DEPTH (FT) 5

CLIENT

CORRAL RANCH DEV.

PROJECT

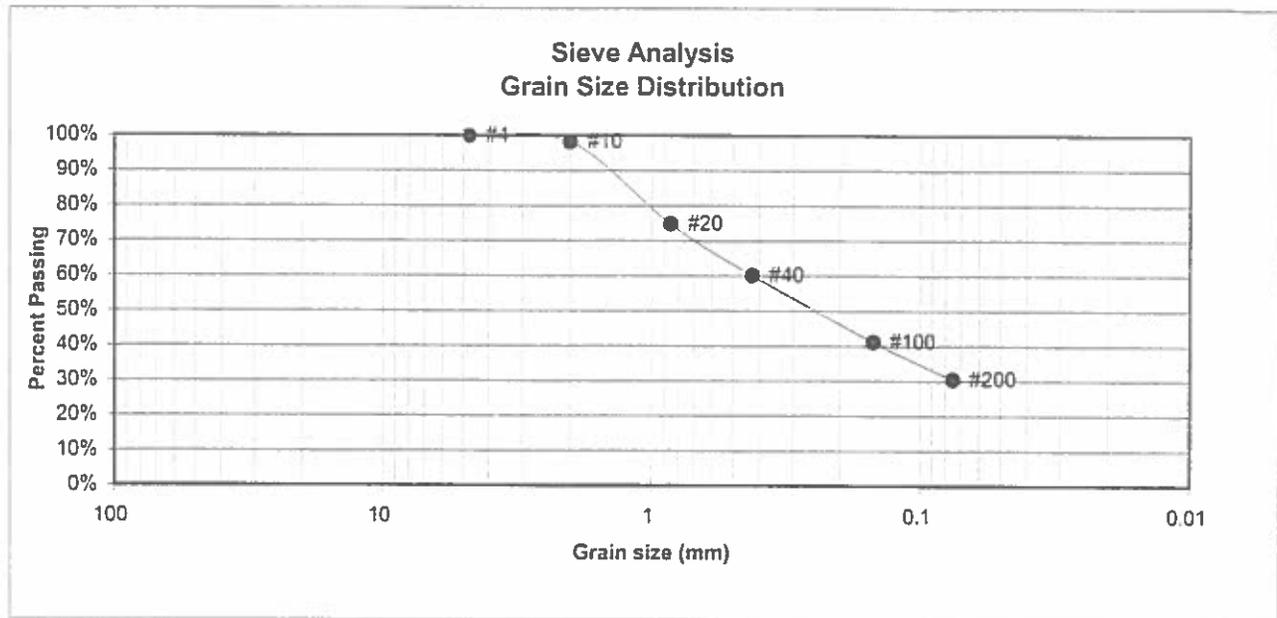
RESERVE AT CORRAL BLUFFS

JOB NO.

83691

TEST BY

BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.3%
20	74.8%
40	60.1%
100	41.2%
200	30.5%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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 COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN

DATE

CHECKED

DATE

*le* 8/21/12

JOB NO:  
 83691

FIG NO:  
 B-2

UNIFIED CLASSIFICATION SM

SOIL TYPE # 1

TEST BORING # 15

DEPTH (FT) 5

CLIENT

CORRAL RANCH DEV.

PROJECT

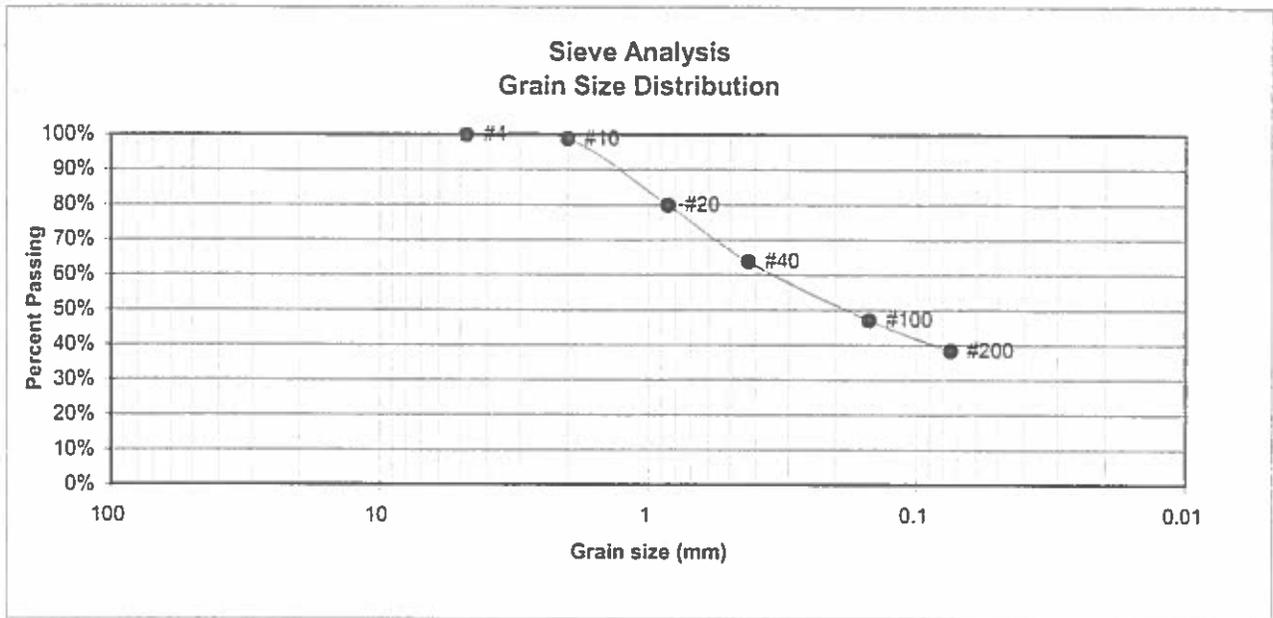
RESERVE AT CORRAL BLUFFS

JOB NO.

83691

TEST BY

BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.8%
20	79.9%
40	63.7%
100	47.2%
200	38.3%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>u</i>	8/21/12

JOB NO:  
 83691  
 FIG NO:  
 B-3

## **APPENDIX E: Soil Survey Descriptions**

3—Ascalon sandy loam, 3 to 9 percent slopes. This deep, well drained soil formed in mixed alluvium and wind-laid materials on uplands. Elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typically, the surface layer is brown sandy loam about 8 inches thick. The subsoil is brown, yellowish brown, and pale brown sandy clay loam about 22 inches thick. The substratum is calcareous, very pale brown sandy loam and loamy sand.

Included with this soil in mapping are small areas of Bresser sandy loam, 3 to 5 percent slopes; Olney sandy loam, 3 to 5 percent slopes; Vona sandy loam, 3 to 9 percent slopes; and Fort Collins loam, 3 to 8 percent slopes.

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

Most areas of this soil are used as range, but some areas on the more gentle slopes are cultivated. Wheat is the main crop, but some sorghum is also grown.

Native vegetation is dominantly blue grama, needle-andthread, side-oats grama, sand dropseed, and buckwheat. Western wheatgrass, junegrass, and mountain muhly are also present, predominantly where this soil occurs in the northern part of the survey area.

Seeding is a good practice if the range has deteriorated. Native grasses should be used. If the range is severely eroded and blowouts have developed, fertilizing the new seeding is a good practice. Brush control and grazing management may be needed to improve the depleted range. Grazing of animals should be managed so that enough forage is left standing to protect the soil from blowing, to increase infiltration of water, and to catch and hold snow.

Windbreaks and environmental plantings are generally suited to this soil. Soil blowing is the principal limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be necessary at the time of planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. 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. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. 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 use as homesites. Its main limitation for foundations, roads, and streets is moderate shrink-swell potential. Special design of roads is also necessary because of potential frost action. Capability subclasses IVe, nonirrigated, and IIIe, irrigated.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>R</i>	12/5/19

Job No.

192142

Fig. No.

E-1

4—Badland. Badland occupies steep, rough, eroding areas. Slopes range from 0 to more than 100 percent. Depending on the location, Badland formed from material derived from shale, sandstone, siltstone, and gold ore mill tailings. Areas of Badland are in the vicinity of the town of Calhan; the Corral Bluffs, east of Colorado Springs; the southwestern part of the survey area on Fort Carson; and the old Golden Cycle gold ore processing mill in the western part of Colorado Springs.

Runoff is very rapid, and the hazard of erosion is high. The reaction of the tailings material is slightly acid to extremely acid. Little or no soil development has taken place. Gullying is severe in most areas of Badland.

Vegetation grows only in small patches of soil material in drainageways and in some of the less eroded areas. The sloping part of Badland is extremely gullied and lacks vegetation.

Most areas of Badland are used for wildlife habitat. In the mill tailings area in the western part of Colorado Springs, some urban development has taken place in level areas that have had a layer of topsoil applied to the surface. Capability subclass VIIIs.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>W</i>	12/5/19

Job No.

192142

Fig. No.

E-2

13--Bresser sandy loam, 5 to 9 percent slopes. This deep, well drained soil formed in arkosic alluvium and residuum on terraces and uplands. Elevation ranges from 6,000 to 6,800 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 sandy loam about 5 inches thick. The subsoil is brown sandy clay loam about 31 inches thick. The substratum is light yellowish brown loamy coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser soils that have a loam surface layer, mostly along the western side of the survey area; Truckton sandy loam, 3 to 9 percent slopes; Yoder gravelly sandy loam, 1 to 8 percent slopes; Kutch clay loam, 3 to 5 percent slopes; and Kutch clay loam, 5 to 20 percent slopes. Some areas of Ustic Torrifuvents, loamy, are along narrow drainageways. In some areas, arkose beds are at a depth of 0 to 40 inches. These beds occur as sandstone or shale.

Permeability of this Bresser soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies are present.

Most areas of this soil are used for range. A small acreage is used for dryland crops, mostly wheat.

This soil is suited to limited cultivation. It is better suited to use as rangeland or pastureland because these uses protect the soil by providing permanent cover. Basin terraces may be needed before seeding this soil back to grass.

Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed 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 generally suited to this soil. Soil blowing is the main limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. 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. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. 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 homesites. Practices are needed to control surface runoff and keep soil losses to a minimum. Limiting the disturbance of the soil and the removal of existing plant cover during construction helps to control erosion. Capability subclass IVe.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>[Signature]</i>	12/5/19

Job No.

192142

Fig. No.

E-3

85--Stapleton-Bernal sandy loams, 3 to 20 percent slopes. These gently sloping to moderately steep soils are on upland ridges and hills. Elevation ranges from about 6,500 to 6,800 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.

The Stapleton soil makes up about 40 percent of the complex, the Bernal soil about 30 percent, and included soils about 30 percent.

Included with these soils in mapping are areas of Blakeland loamy sand, 1 to 9 percent slopes; Louviers silty clay loam, 3 to 18 percent slopes; Travessilla-Rock outcrop complex, 8 to 90 percent slopes; Truckton sandy loam, 3 to 9 percent slopes; and small outcrops of arkose sandstone and shale.

The Stapleton soil is commonly on the lower part of slopes. It is deep and well drained. It formed in sandy alluvium derived from arkosic bedrock. Typically, the surface layer is grayish brown sandy loam about 11 inches thick. The subsoil is grayish brown gravelly sandy loam about 6 inches thick. The substratum extends to a depth of 60 inches or more. It is pale brown gravelly sandy loam in the upper part and grades to gravelly loamy sand in the lower part.

Permeability of the Stapleton soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Bernal soil is commonly on ridges and hills. It is shallow and well drained. It formed in material weathered from sandstone and modified by eolian sediment. Typically, the surface layer is dark grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam about 7 inches thick. The substratum is brown sandy loam about 2 inches thick. Hard, light colored sandstone is at a depth of about 13 inches.

Permeability of the Bernal soil is moderate. Effective rooting depth is 8 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this complex are used for grazing livestock, for wildlife habitat, and as homesites.

The native vegetation on the Stapleton soil is mainly western wheatgrass, side-oats grama, needleandthread, and little bluestem. The dominant shrub on this soil is true mountainmahogany. Yucca is present in some places.

The native vegetation on the Bernal soil is mainly blue grama, side-oats grama, western wheatgrass, Scribner needlegrass, and needleandthread. The dominant shrubs and trees are mountainmahogany, skunkbush sumac, and one-seeded juniper. There are lesser amounts of pinyon pine.

Deferred grazing late in summer and early in fall improves the condition of the range on the Stapleton soil. Careful management of plant cover is essential because of the difficulty of vegetating the Bernal soil. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are suited to the Stapleton soil. Soil blowing is the main limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

Windbreaks and environmental plantings generally are not suited to the Bernal soil. Onsite investigation is needed to determine if plantings are feasible.

Rangeland wildlife, such as antelope, cottontail, coyote, and scaled quail, is best adapted for life on the soils in this complex. Proper livestock grazing management is necessary if wildlife and livestock share the range. Livestock watering developments are also important, and they are used by various wildlife species.

The main limitations of the Stapleton soil for urban use are frost-action potential and slope. The main limitations of the Bernal soil are depth to bedrock, frost-action potential, and slope. Special designs for sites, buildings, and roads and streets are needed to control soil blowing and water erosion on construction sites where vegetation has been removed. Capability subclass VIe.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>[Signature]</i>	12/5/19

Job No.

192142

Fig. No.

E-4

**APPENDIX F: Percolation Test Results  
(References 1 and 2)**

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 1**

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1  
 Depth: 32"

Hole No. 2  
 Depth: 23"

Hole No. 3  
 Depth: 30"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/4		1	10	1/4		1	10	1/16	
2	10	1/4		2	10	1/4		2	10	1/16	
3	10	1/4		3	10	1/4		3	10	1/16	

Perc Rate (min./in.): 40

Perc Rate (min./in.): 40

Perc Rate (min./in.): 160

Average Perc Rate (min./in.) 80

**PROFILE HOLE**

Date Profile Hole Completed: 12/28/2011

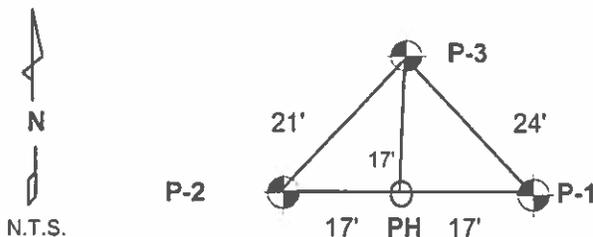
Depth	Visual Classification	Remarks
0-9'	Sand, very silty, fine grained, brown to tan	
9-15'	Clay-silt, very sandy, tan	No Bedrock No Groundwater

- 21 Blows / ft. @ 2'
- 12 Blows / ft. @ 4'
- 35 Blows / ft. @ 9'
- 35 Blows / ft. @ 14'

Required Area of Absorption Field: 1.79 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 402 Sq. Ft./bedroom  
 Required Area of Absorption Field: 644 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 34.0" N, 104° 35' 24.1" W

Observer: Joey Goode By:



**ENTECH**  
**ENGINEERING, INC**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN DATE *h* CHECKED 1/19/12 DATE

JOB NO.: 83691  
 FIG NO.: E-1

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 2**

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1  
 Depth: 31"

Hole No. 2  
 Depth: 31"

Hole No. 3  
 Depth: 30"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/2	1	10	9	1	10	1
2	10	1/2	2	10	7	2	10	1
3	10	1/2	3	10	6	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 2

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 14

**PROFILE HOLE**

Date Profile Hole Completed: 12/28/2011

Depth 0-15'      Visual Classification Silt, very sandy, tan to brown

Remarks

No Bedrock  
 No Groundwater

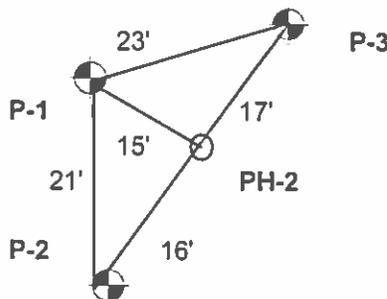
- 21 Blows / ft. @ 2'
- 19 Blows / ft. @ 4'
- 21 Blows / ft. @ 9'
- 32 Blows / ft. @ 14'

Required Area of Absorption Field: 0.75 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 168 Sq. Ft./bedroom  
 Required Area of Absorption Field: 269 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 32.4" N, 104° 35' 38.0" W

Observer: Joey Goode

By:



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *m* DATE: 1/19/12

JOB NO:

83691

FIG NO:

E-2

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 3**

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1  
 Depth: 29"

Hole No. 2  
 Depth: 27"

Hole No. 3  
 Depth: 28"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1		1	10	1		1	10	1	
2	10	3/4		2	10	1/2		2	10	1/2	
3	10	1/2		3	10	1/2		3	10	1/2	

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 20

**PROFILE HOLE**

Date Profile Hole Completed: 12/28/2011

Depth: 0-15'  
 Visual Classification: Silt, sandy, tan to brown

Remarks

No Bedrock  
 No Groundwater

- 17 Blows / ft. @ 2'
- 27 Blows / ft. @ 4'
- 21 Blows / ft. @ 9'
- 41 Blows / ft. @ 14'

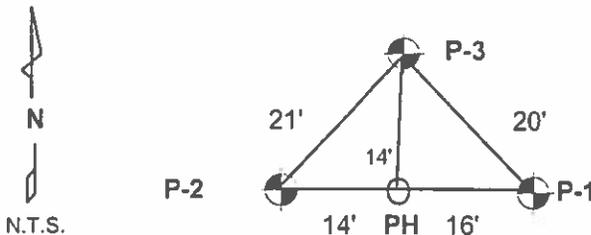
Required Area of Absorption Field: 0.89 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 201 Sq. Ft./bedroom  
 Required Area of Absorption Field: 322 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 33.4" N, 104° 35' 47.9" W

Observer: Joey Goode

By:



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *h* DATE: 1/19/12

JOB NO.

83691

FIG NO.

E-3

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 4**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 39"

Hole No. 2  
 Depth: 27"

Hole No. 3  
 Depth: 29"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10		1/16	1	10		1/16	1	10		1/8
2	10		1/16	2	10		1/16	2	10		1/8
3	10		1/16	3	10		1/16	3	10		1/8

Perc Rate (min./in.): 160

Perc Rate (min./in.): 160

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 134

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

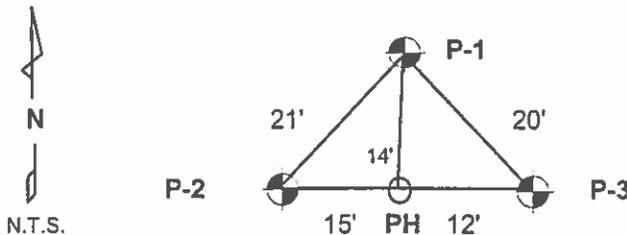
Depth	Visual Classification	Remarks
0-9'	Clay, sandy, dark brown	
9-13'	Clay-silt, sandy, tan	Sandstone Bedrock at 13'
13-15'	Sandstone, very clayey, very silty, fine grained, tan	No Groundwater

- 19 Blows / ft. @ 2'
- 30 Blows / ft. @ 4'
- 24 Blows / ft. @ 9'
- 50 Blows / 10" @ 14'

Required Area of Absorption Field: 2.32 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 521 Sq. Ft./bedroom  
 Required Area of Absorption Field: 833 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 25.9" N, 104° 35' 50.5" W

Observer: Blake Leonard By:



**ENTECH**  
**ENGINEERING, INC**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: DATE: *W* CHECKED: *W* DATE: *1/19/12*

JOB NO:  
**83691**

FIG NO:  
**E-4**

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 5**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 36"

Hole No. 2  
 Depth: 33"

Hole No. 3  
 Depth: 35"

Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/8	1	10	1/2	1	10	7/8
2	10	1/8	2	10	1/2	2	10	3/4
3	10	1/8	3	10	3/8	3	10	1/2

Perc Rate (min./in.): 80

Perc Rate (min./in.): 27

Perc Rate (min./in.): 27

Average Perc Rate (min./in.) 45

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

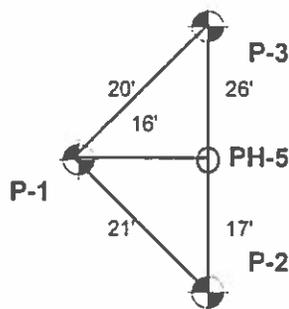
Depth	Visual Classification	Remarks
0-7'	Sand, silty, fine to medium grained, tan to brown	
7-10'	Sandstone, silty, fine to medium grained, tan	Sandstone Bedrock at 7'
	28 Blows / ft. @ 2'	No Groundwater
	24 Blows / ft. @ 4'	
	50 Blows / 9" @ 9'	

Required Area of Absorption Field: 1.34 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 302 Sq. Ft./bedroom  
 Required Area of Absorption Field: 483 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 17.8" N, 104° .35' 53.6" W

Observer: Blake Leonard

By:



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.: 83691  
 FIG NO.: E-5

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 6**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 29"

Hole No. 2  
 Depth: 34"

Hole No. 3  
 Depth: 33"

Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/2	1	10	3/4	1	10	2 3/8
2	10	3/8	2	10	5/8	2	10	2 3/8
3	10	3/8	3	10	1/2	3	10	1 5/8

Perc Rate (min./in.): 27

Perc Rate (min./in.): 20

Perc Rate (min./in.): 6

Average Perc Rate (min./in.) 18

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-7'	Sand, silty, fine grained, tan	
7-10'	Sandstone, very clayey, fine grained, tan	Sandstone Bedrock at 7' No Groundwater

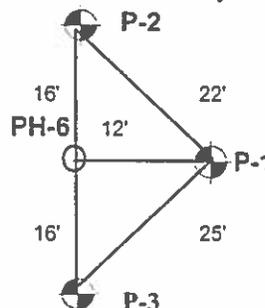
32 Blows / ft. @ 2'  
 40 Blows / ft. @ 4'  
 50 Blows / ft. @ 9'

Required Area of Absorption Field: 0.85 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 191 Sq. Ft./bedroom  
 Required Area of Absorption Field: 305 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 16.5" N, 104° 35' 42.5" W

Observer: Blake Leonard

By:



**ENTECH**  
**ENGINEERING, INC**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: DATE: *W* CHECKED: DATE: 1/19/12

JOB NO.:  
 83691  
 FIG NO.:

E-6

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 7**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 31"

Hole No. 2  
 Depth: 32"

Hole No. 3  
 Depth: 31"

Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	2	1	10	5/8	1	10	1/4
2	10	1 1/8	2	10	3/8	2	10	1/4
3	10	1	3	10	1/4	3	10	1/8

Perc Rate (min./in.): 10

Perc Rate (min./in.): 40

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 44

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-7'	Sand, very silty, fine grained, tan	
7-10'	Sand, silty, fine to medium grained, brown	Sandstone Bedrock at 10'
10-15'	Sandstone, silty, fine to medium grained, tan	No Groundwater

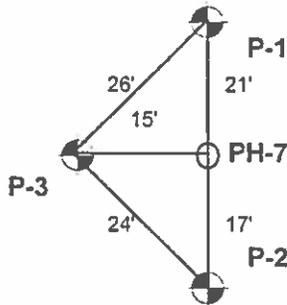
- 21 Blows / ft. @ 2'
- 40 Blows / ft. @ 4'
- 38 Blows / ft. @ 9'
- 50 Blows / 11" @ 14'

Required Area of Absorption Field: 1.33 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 298 Sq. Ft./bedroom  
 Required Area of Absorption Field: 478 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 16.2" N, 104° 35' 31.2" W

Observer: Blake Leonard

By:



**ENTECH**  
**ENGINEERING, INC**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *W* DATE: 1/19/12

JOB NO.

83691

FIG NO.

E-7

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 8**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 35"

Hole No. 2  
 Depth: 37"

Hole No. 3  
 Depth: 32"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	4	1	10	5/8	1	10	2 1/2
2	10	2 1/4	2	10	5/8	2	10	2 3/8
3	10	1 1/8	3	10	5/8	3	10	1

Perc Rate (min./in.): 9

Perc Rate (min./in.): 16

Perc Rate (min./in.): 10

Average Perc Rate (min./in.) 12

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

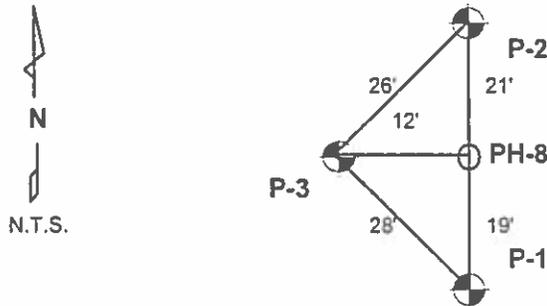
Depth	Visual Classification	Remarks
0-3'	Sand, very silty, fine grained, tan	
3-10'	Sand, silty, fine to medium grained, brown	No Bedrock No Groundwater

30 Blows / ft. @ 2'  
 47 Blows / ft. @ 4'  
 40 Blows / ft. @ 9'

Required Area of Absorption Field: 0.69 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 156 Sq. Ft./bedroom  
 Required Area of Absorption Field: 249 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 23.4" N, 104° 35' 34.0" W

Observer: Blake Leonard By:



**ENTECH**  
**ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: DATE: *h* CHECKED: *h* DATE: 1/19/12

JOB NO.: 83691  
 FIG NO.: E-8

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 9**

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1  
 Depth: 28"

Hole No. 2  
 Depth: 29"

Hole No. 3  
 Depth: 32"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/2		1	10	3/8		1	10	1	
2	10	1/8		2	10	1/4		2	10	7/8	
3	10	1/8		3	10	1/8		3	10	1/4	

Perc Rate (min./in.): 80

Perc Rate (min./in.): 80

Perc Rate (min./in.): 40

Average Perc Rate (min./in.) 67

**PROFILE HOLE**

Date Profile Hole Completed: 1/4/2012

Depth 0-10'      Visual Classification Sand, silty, fine to medium grained, tan

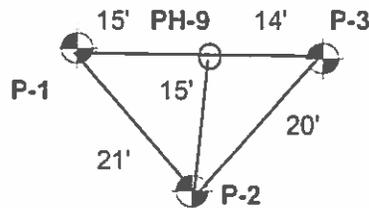
Remarks  
 No Bedrock  
 No Groundwater

26 Blows / ft. @ 2'  
 33 Blows / ft. @ 4'  
 45 Blows / ft. @ 9'

Required Area of Absorption Field: 1.64 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 368 Sq. Ft./bedroom  
 Required Area of Absorption Field: 589 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

GPS Coordinates: 38° 52' 25.0" N, 104° 35' 23.5" W

Observer: Blake Leonard      By:



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 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN:      DATE:      CHECKED: *[Signature]* 1/19/12      DATE:

JOB NO.: 83691  
 FIG NO.: E-9

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 11**

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1  
 Depth: 31"

Hole No. 2  
 Depth: 38"

Hole No. 3  
 Depth: 38"

Trial	Time (min.)	Water Level	Trial	Time (min.)	Water Level	Trial	Time (min.)	Water Level
		Change (in.)			Change (in.)			Change (in.)
1	10	0	1	10	3/4	1	10	1/2
2	10	1/2	2	10	1/2	2	10	1/2
3	10	1/4	3	10	1/2	3	10	3/4

Perc Rate (min./in.): 40

Perc Rate (min./in.): 20

Perc Rate (min./in.): 13

Average Perc Rate (min./in.) 25

**PROFILE HOLE**

Date Profile Hole Completed: 8/13/2012

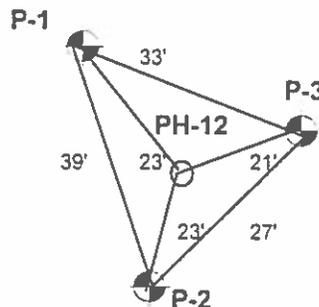
Depth	Visual Classification	Remarks
0-10'	Sand, clayey, fine grained, tan	No Bedrock No Groundwater

10 Blows / ft. @ 4'  
 18 Blows / ft. @ 9'

Required Area of Absorption Field: 1.00 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 225 Sq. Ft./bedroom  
 Required Area of Absorption Field: 360 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

Observer: Hansel Bjork

By:



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**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: 8/21/12 CHECKED: \_\_\_\_\_ DATE: \_\_\_\_\_

JOB NO.:

83691

FIG NO.:

C-1

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 12**

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1  
 Depth: 42"

Hole No. 2  
 Depth: 39"

Hole No. 3  
 Depth: 39"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1 1/2	1	10	2 1/8	1	10	1
2	10	2	2	10	2 7/8	2	10	1/2
3	10	1/2	3	10	1 7/8	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 5

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 16

**PROFILE HOLE**

Date Profile Hole Completed: 8/13/2012

Depth 0-10'      Visual Classification Sand, silty, fine to medium grained, tan

Remarks

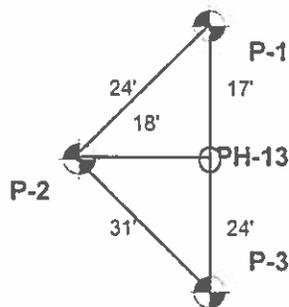
No Bedrock  
 No Groundwater

30 Blows / ft. @ 4'  
 23 Blows / ft. @ 9'

Required Area of Absorption Field: 0.80 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 180 Sq. Ft./bedroom  
 Required Area of Absorption Field: 288 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

Observer: Hansel Bjork

By:



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**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: ce DATE: 8/21/12

JOB NO.: 83691  
 FIG NO.: C-2

Client: Corral Ranch Development  
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

**PERCOLATION HOLES-TEST NO. 15**

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1  
 Depth: 34"

Hole No. 2  
 Depth: 37"

Hole No. 3  
 Depth: 31"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1	1	10	3/4	1	10	7/8
2	10	1/2	2	10	3 1/2	2	10	1/8
3	10	1/2	3	10	2 1/4	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 4

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 15

**PROFILE HOLE**

Date Profile Hole Completed: 8/13/2012

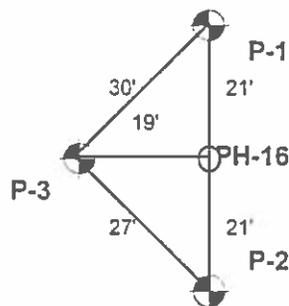
Depth	Visual Classification	Remarks
0-10'	Sand, clayey to silty, fine to medium grained, brown	No Bedrock No Groundwater

17 Blows / ft. @ 4'  
 20 Blows / ft. @ 9'

Required Area of Absorption Field: 0.77 Sq. Ft./gpd sewage volume  
 Required Area of Absorption Field: 174 Sq. Ft./bedroom  
 Required Area of Absorption Field: 279 Sq. Ft./bedroom with garbage disposal and washing machine  
 Remarks:

Observer: Hansel Bjork

By:



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 COLORADO SPRINGS, COLORADO 80907

**PERCOLATION TEST RESULTS**

DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_ CHECKED: *W* DATE: 8/21/12

JOB NO.: 83691  
 FIG NO.: C-3