Geologic Hazard Plan

Rule 304.c.(21)

Coyote Fed 0397-14

Section 14 T3N R97W 6th P.M.

Moffat County, Colorado

November 2022

September 2, 2022

Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, CO 80203

RE: Geological Hazards Map and Geological Hazards Plan
COGCC Rule 304.b.(7).l and Rule 304.c.(21)
Coyote Federal Well Pad Site, Moffat County, Colorado

Dear COGCC Representative,

Attached you will find Geological Hazard Maps and a Geological Hazards Plan for the Coyote Federal Well Pad location. Anschutz Exploration Corporation (Anschutz) retained Entrada Consulting Group, Inc. (Entrada) to assess geologic hazards within one mile of the Working Pad Surface (WPS) of the Coyote Federal Well Pad.

The Coyote Federal Well Pad Geologic Hazards Assessment Plan addresses "Geologic Hazards" as outlined by COGCC's Rules and Regulations and Colorado Revised Statutes (C.R.S.) § 24-65.1-103(8):

> "*Geologic hazard" means a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property. The term includes but is not limited to:*
> *(a) Avalanches, landslides, rock falls, mudflows, and unstable or potentially unstable slopes;*
> *(b) Seismic effects;*
> *(c) Radioactivity; and*
> *(d) Ground subsidence.*

The Coyote Federal Well Pad Geologic Hazards Map was prepared in accordance with COGCC Rule 304.b.(7).l.:

> *Geologic Hazard Map. A map identifying any Geologic Hazards within a 1 mile radius of the proposed Working Pad Surface. For any identified Geologic Hazard that extends beyond the 1 mile radius, a second map scaled to show the extent of that hazard in relation to the proposed Oil and Gas Location.*

Based on the definition of the geologic hazards stated above, the Geologic Hazard Map, and the references below, a geologic hazard was identified within one mile of the WPS. Per COGCC Rule 304.c.(21), a Geologic Hazards Plan is required.

I certify that I am a Professional Geologist, having met the educational requirements and professional work experience required by C.R.S. § 23-41-208(b). I have reviewed information pertaining to this Oil and Gas location and the surrounding area, and have identified the following Geologic Hazards: ***Soils with high corrosiveness for steel.***

Please see the attached Geological Hazard Maps and Geological Hazard Plan for additional details.

Sincerely,

S. Reed Johnson
Senior Project Geologist
Entrada Consulting Group
Date: August 2, 2022
Wyoming Licensed Professional Geologist #4165

Geological Hazards Map and Plan References:

Hail, Jr., W.J., 1973, Geologic Map of the Smizer Gulch Quadrangle, Rio Blanco and Moffat Counties, Colorado, 1 map sheet.

Nelson-Moore, J.L., Bishop C.D., and Hornbaker, A.L., 2005, Colorado Geologic Survey, Bulletin 40, *Radioactive Mineral Occurrences of Colorado*, 1054 p.

Pipiringos, G.N., and Rosenlund, G.C., 1977, Preliminary Geologic Map of the Indian Valley Quadrangle, Rio Blanco and Moffat Counties, Colorado, 1 map sheet.

White, J. L., and Greenman, C., 2008, *EG-14 Collapsible Soils in Colorado*, ColoradoGeological Survey, Department of Natural Resources, 108p, 1 map sheet

Online References:
American Geosciences Institute/Colorado Division of Reclamation Mining and Safety. Interactive Map of Mines in Colorado.
https://www.americangeosciences.org/critical-issues/maps/interactive-map-mines-colorado

American Institute for Avalanche Research and Education
https://avtraining.org/

Colorado Abandoned Mine Land Map
https://erams.com/aml/

Colorado Department of Public Health and Environment – Radon
https://cdphe.colorado.gov/understanding-radon

COGCC Online Interactive Map
https://cogccmap.state.co.us/cogcc_gis_online/

Colorado Geological Survey Statewide Landslide Inventory Map ON-006-01
https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=9dd73db7fbc34139abe51599396e2648

Radioactive Mineral Occurrence in Colorado
https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=c5381e1335284d63bfa5d4b018b3372f

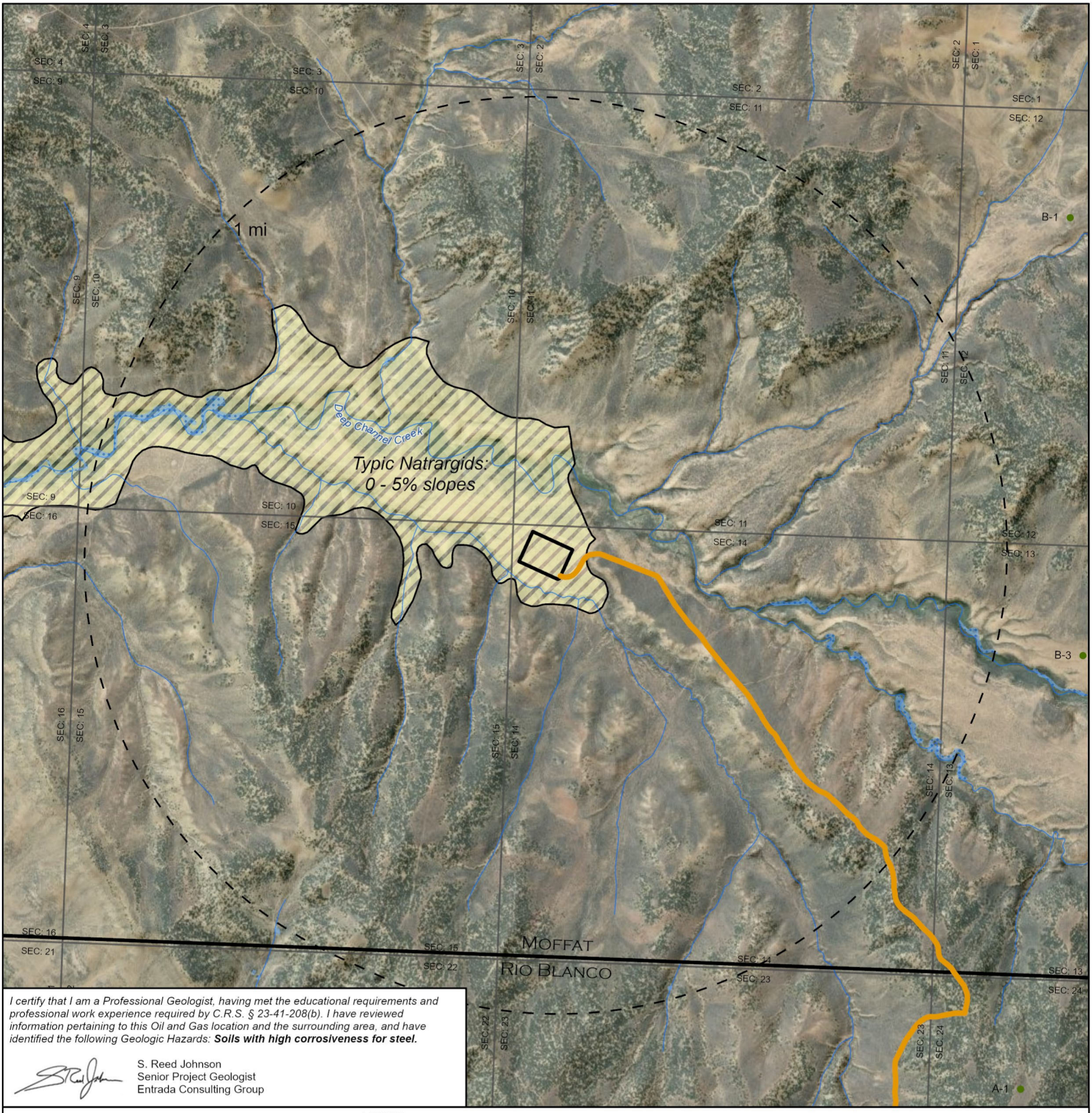
Oregon State University - Prism Climate Group
https://prism.oregonstate.edu/

USDA Natural Resources Conservation Service, Web Soil Survey
https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

USGS Earthquake Hazards Program
https://earthquake.usgs.gov/

USGS Quaternary Faults Database
https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf

USGS Mine Related Features
https://mrdata.usgs.gov/usmin/map-us.html



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S. Reed Johnson
Senior Project Geologist
Entrada Consulting Group

LEGEND

- Access Road
- Well Pad
- Well Location
- Coal Mines 2009 (None)
- CGS Radioactive Minerals B40 (None)
- Intermittent Streams
- Perennial Creeks/Rivers
- Wetland
- Lake/Pond
- 100-Year Floodplain (COGCC, None)
- Updated Statewide Undermined Areas (None)
- Typic Natrargids: 0 - 5% slopes

US Landslide (USGS)

- High confidence in extent or nature of landslide (None)
- Confident consequential landslide at this location (None)
- Likely landslide at or near this location (None)
- Probable landslide in the area (None)
- Possible landslide in the area (None)

N W E S

0 1,000 2,000 ft

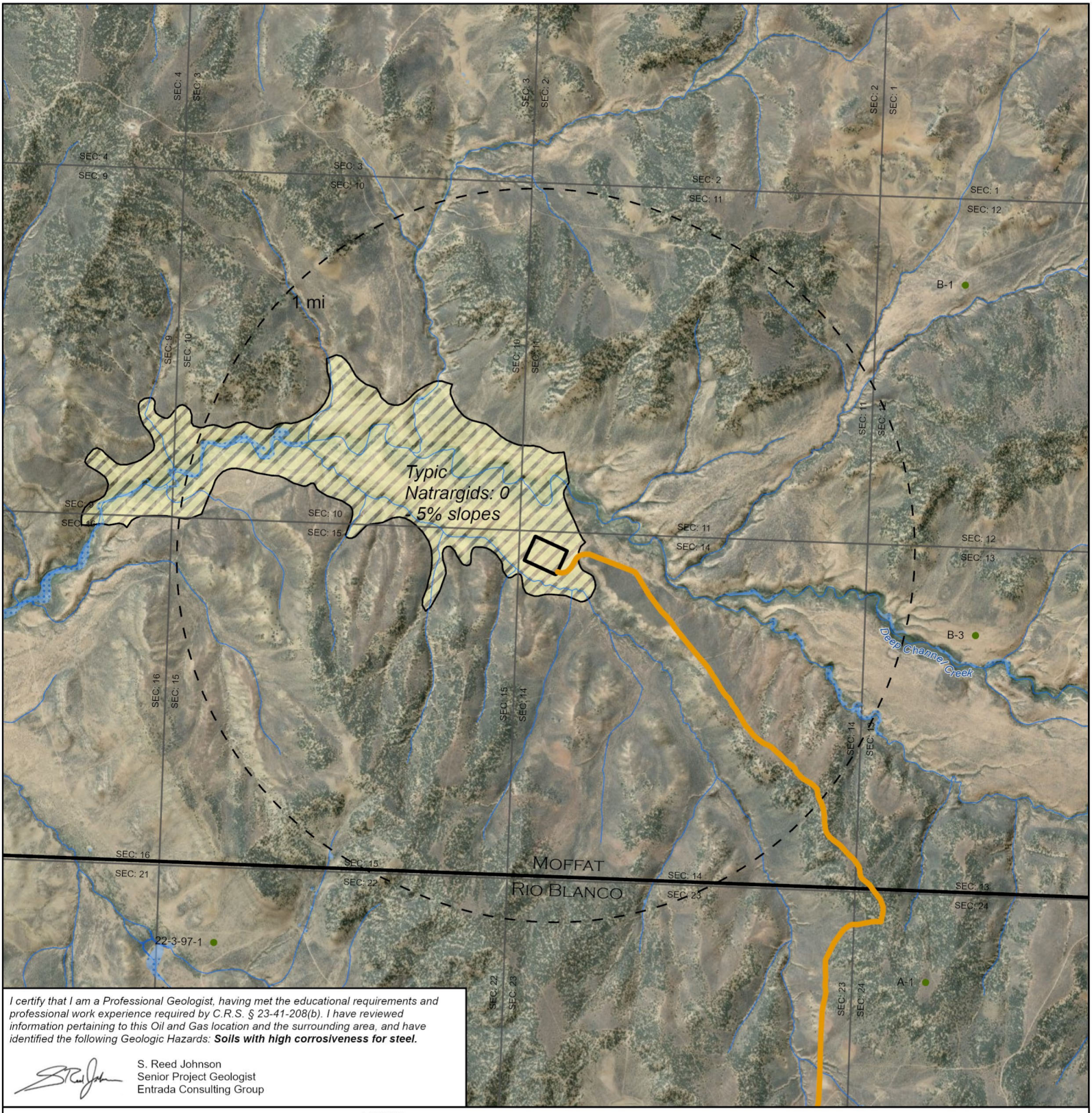
Anschutz Exploration Company
555 17th Street, Suite 2400,
Denver, CO 80202

Figure 1

Coyote Federal Pad
Geologic Hazard Map
NWNW, Section 14, T3N R97W, 6th P.M.
Moffat County, Colorado

ENTRADA
330 Grand Avenue, Unit C
Grand Junction, CO 81501
970-549-1015

Survey Date:	
Date Drawn:	8/26/2022
Drawn By:	Nathan Baier
Scale:	1 inch = 1,600 ft



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N W E S

0 1,000 2,000 ft

Anschutz Exploration Company
555 17th Street, Suite 2400,
Denver, CO 80202

Figure 2

Coyote Federal Pad
Geologic Hazard Map - Scaled to Include Soil Extents
NWNW, Section 14, T3N R97W, 6th P.M.
Moffat County, Colorado

ENTRADA
330 Grand Avenue, Unit C
Grand Junction, CO 81501
970-549-1015

Survey Date:	
Date Drawn:	8/26/2022
Drawn By:	Nathan Baier
Scale:	1 inch = 2,000 ft

Geologic Hazard Plan

Anschutz Exploration Corporation

Coyote Federal Well Site

ENTRADA
CONSULTING GROUP

Project Number 022-076

September 2, 2022

Table of Contents

1.0 INTRODUCTION

Anschutz Exploration Corporation (Anschutz) retained Entrada Consulting Group, Inc. (Entrada) to develop a Limited Desktop Geological Hazard Plan for submittal to the Colorado Oil and Gas Conservation Commission(COGCC) for the proposed Coyote Federal Well Pad (the Site). This report was developed using publicly available information and did not include sample collection, analyses, or site visits.

2.0 SITE OVERVIEW

The Site is located in the northern Piceance Basin, approximately 6 miles north of the White River Dome Oil Field in Moffat County, Colorado. Elevation for the site is approximately 5,897 feet above mean sea level (famsl). The Site is located in the NWNW of section 14, range 97W, township 3N and Latitude and Longitude for the Site are 40.235179°, -108.253494° respectively.

The topography of the area consists of rolling hills, arroyos, mesas, and cuestas. Major topographic features nearby include the Citadel Plateau to the northeast, Pinyon Ridge to the west, and Colorow Mountain to the southeast. The Site is located between Rim Rock Gulch and Deep Channel Creek, both ephemeral drainages. Bedrock across the area is comprised of the sandstones, siltstones, and mudstones of the Eocene Wasatch Formation.

The Site will be developed on undisturbed ground. The proposed area of disturbances is approximately 6.8 acres.

3.0 GEOLOGIC HAZARDS

A geologic hazard assessment was conducted within a one-mile radius of the proposed site location.
In accordance with COGCC Rule 304.b.(7).I., **Geological Hazard Maps (Figure 1 and Figure 2)** were developed for the Form 2A Location Assessment. This Geologic Hazard Plan addresses "Geologic Hazards" as outlined by COGCC's Rules and Regulations and Colorado Revised Statutes § 24-65.1-103(8).

3.1 AVALANCHES

According to the American Institute for Avalanche Research and Education (AIARE) most avalanches occur on slopes from 30 to 45 degrees. Slope angles in the Site vicinity do not exceed 30 degrees. Furthermore, the Site is not within the higher precipitation and mountainous areas of Colorado where avalanches tend to occur. **Avalanches are not a significant geological hazard at this Site.**

3.2 LANDSLIDES

The Site is not located in a known Landslide Hazard area. The closest landslide deposits that have been mapped are along McAndrews gulch 6.8 miles southwest of the Site. **Landslides are not a significant geological hazard at this Site.**

3.3 ROCKFALLS

The Site is not located in a known Rockfall Hazard area**.** All outcrops capable of producing damaging rockfalls are sufficient distance from the site as to not pose a hazard. **Rockfalls are not a significant geological hazard at this Site.**

3.4 MUDFLOWS OR DEBRIS FLOWS

Debris flows are common in Colorado and can occur in many locations following heavy precipitation events. However, the Site is not located in a known Mudflow or Debris Flow Hazard area. Furthermore, the site is not located on or near debris-fan type deposits. **Mudflows and Debris Flows are not significant geological hazards at this Site.**

3.5 UNSTABLE OR POTENTAILLY UNSTABLE SLOPES

The Site will be constructed between two drainages in a broad, relatively flat-bottomed, valley where slopes rarely exceed 15%. **Unstable slopes are not a significant geological hazard at this Site.**

3.6 SEISMIC EFFECTS

The Site is not located above any known mapped faults. The closest faults known to have shown surface deformation due to large earthquakes in the last 2.58 million years are the Pot Creek and Diamond Gulch faults, 55 miles away in the eastern Uintah Mountains, Utah.

The United States Geological Survey (USGS) Earthquake Hazards Program online records were researched for seismic activity greater than magnitude 2.5 in this area dating back to 1973. The closest recorded earthquake in this dataset was a magnitude 3.4 that occurred on November 3rd 1994 and was located 13.5 miles south of the Site. There were no additional earthquakes within a 25 mile radius of the Site in this dataset. Moffat County was the site of two Modified Mercalli Scale VI earthquakes in 1871 and 1891 according to the Colorado Geological Survey. While significant, properly constructed facilities should suffer no damage in an earthquake of this size. **Earthquakes and seismic effects are not a significant geological hazard at this Site.**

3.7 RADIOACTIVITY

Review of the Colorado Department of Public Health and Environment website for Radon information indicates that Moffat County has high radon potential. It is anticipated that based on the proposed project for the Site, that limited structures and buildings will be developed, and workers will predominantly be outside during the normal work shifts; therefore, radon is not expected to represent a significant geologic or worker exposure health hazard.

Naturally occurring radioactive minerals are common Moffat County. However, they typically occur in Miocene and Jurassic strata and are therefore not anticipated in the geologic section exposed at this Site. **Radioactivity is not a significant geological hazard at this Site.**

3.8 GROUND SUBSIDENCE

The Site is not located in an area that is known to have been impacted by mining operations, karst dissolution, groundwater related subsidence, or known collapsible soils. Ground Subsidence is not a

significant geological hazard at this Site.

3.9 CORROSIVE SOILS

A soils report from the Natural Resource Conservation Service (NRCS) indicates that the proposed Oil and Gas Location will be located on Typic Natragrids (0-5% slopes). This soil type is typically found on stream terraces and alluvial fans and is derived from sandstone, siltstone, and shale. Typic Natragrids has high corrosiveness ratings for uncoated steel and concrete per the NRCS. As limited structures will be constructed the high corrosiveness to concrete rating does not constitute a geological hazard. **Steel corrosion due to corrosive soils is a geological hazard at this Site.** The risk associated with this hazard is **low**.

4.0 MEASURES TO AVOID, MINIMIZE, OR MITIGATE IMPACTS OF GEOLOGIC HAZARDS

4.1 CORROSIVE SOILS

Anschutz will use coatings on subsurface pipe, sacrificial anodes, and cathodic protection to mitigate the risk of steel pipe failure due to corrosive soils.

5.0 CONCLUSIONS AND SUMMARY

Based on this Geological Hazards review of publicly available information, it is Entrada's opinion that the Site can be safely developed. To safely develop, the operator should follow the measures described in section four of this report.

6.0 REFERENCES

Please see the cover letter for a reference list for the Geological Hazard Map and this report.

Sincerely,

S. Reed Johnson
Senior Project Geologist
Entrada Consulting Group
Phone: 720-253-2940
Email: rjohnson@entradainc.com

C.R.S. § 23-41-208(b) Professional Geologist Qualifications:

S. Reed Johnson

Environmental Geologist | Petroleum Geologist
Entrada Consulting Group, 330 Grand Ave., Grand Junction, CO 81501
720-253-2940 | rjohnson@entradainc.com

Relevant Employment History:

Entrada Consulting Group, Denver, CO and Grand Junction, CO:
Senior Project Geologist. *July 2019 - Present*

Vermilion Energy USA Inc., Denver, CO:
Senior Geologist. *February 2015 - October 2018*

Resolute Energy, Denver, CO:
Geologist. *December 2013 - February 2015*

Comet Ridge Resources LLC, Denver CO:
Geologist. *August 2011 - November 2013*

Encana Oil and Gas Inc., Denver, CO:
Geologist. *January 2007 - August 2011*

Cabot Oil and Gas Corporation, Denver, CO:
Geology Intern. *May 2006 - August 2006*

Education:

West Virginia University, Morgantown, WV, Master of Science, Geology — May 2007
Western Carolina University, Cullowhee, NC, Bachelor of Science, Geology — December 2003