May 4, 2023

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915.b. RECLAMATION PLAN	
Operator Location Name	Apache Canyon 06-09V
COGCC Location Name (ID)	APACHE CANYON / 06-09V (312120)
Legal Description	NESE Sec. 6 T34S-R67W
Coordinates (Lat/Long)	37.112225 / -104.924301
County (Number)	Las Animas (071)

Introduction

At your request, this reclamation plan (Plan) was prepared to meet the requirements of Colorado Oil & Gas Conservation Commission (COGCC) Rule 915.b (Soil Suitability for Reclamation) for the Apache Canyon 06-09V well site referenced above (Location). The Location and site-specific conditions discussed in the Plan are illustrated in the attached figures. This Plan was developed to address potential impacts to revegetation efforts and final reclamation success resulting from burial and final onsite disposition of soil with elevated concentrations of designated inorganic constituents of concern that could affect soil suitability for reclamation. The constituents specific to this project are discussed in detail later in the Plan.

The Location has been decommissioned and final reclamation will commence subsequent to the approval of this Plan. This Plan provides recommendations for data collection and site characterization, analysis and interpretation of characterization results, and reclamation procedures and best practices, which if followed during final reclamation, will prevent negative impacts to initial revegetation efforts or long-term impacts to climax vegetation communities or the desired final ecological condition.

In accordance with COGCC Rule 915.b for requesting remediation project closure based on restored agronomic conditions for the reclamation-based constituents in Table 915-1, this Plan includes:

- Description of the location, source, and nature of contaminants and site characterization, including reference and background information.
- Soil property information for both reference and disturbed/affected areas, including descriptions, depths, qualitative and quantitative information, other soil quality influences.
- Details of planned site preparation, grading, decompaction, and seeding/stabilization.
- Successional analysis for the associated climax community and/or desired ecological site condition.
- Existing stormwater and erosion management control measures and planned measures for final reclamation.

- Weed management plans.
- Fencing details.
- Reclamation monitoring procedures.
- Conclusions, Recommendations, and Justification

Location

Remediation Project Background and Characterization

In preparation for final decommissioning and reclamation of the Location, XTO prepared and submitted Initial Form 27 (Document 402979959) proposing investigation activities associated with P&A activities and closure of the historical pit, opening Remediation Project Number 22832. When the presence of inorganic constituents of concern were identified in the former pit footprint at the base of a significant cut slope, preparation of a 915.b reclamation plan was recommended to support closure of the remediation project and to ensure implementation of best practices for successful final reclamation.

Remaining onsite impacts are documented in the attached Current Site Contours and Location Map Figure. Analytical results of soil samples collected from the sidewalls and base of the historical pit indicate levels of SAR and pH exceeding COGCC Table 915-1 Residential Soil Screening Levels remain in-situ.

- Pit base at 13.5 feet (220906_Apache_Bottom_CS2(1030)@13.5'): 8.57 pH
- Pit base at 13.5 feet (220906_APACHE_BOTTOM-HOLE_CS1(1015)13.5'): 8.09 SAR and 9.12 pH
- East sidewall of pit at 7 feet (220906_APACHE_SIDE-WALL_CS6(1115)7.0'): 8.86 pH
- Pit base at 14.5 feet (221006_Apache_Bottom-Hole_CS1(1100)14.5'): 17.2 SAR and 9.18 pH
- Adjacent to the former well, impacts were identified three and a half to four and a half feet BGS. Subsequent sampling around the former well head did not return exceedances of Table 915-1 Constituents of Concern.

For further information on the remediation project, please see Subsequent Form 27 (Document 403186127) providing results of the initial site investigation and produced water characterization data.

Timing

- July 7, 2022: Confluence collected background soil samples to characterize native levels of inorganic constituents of concern at the Location.
- September 6, 2022: Confluence collected initial investigation samples at the Location in support of facility decommissioning and historical pit closure.
- On October 6, 2022: Confluence returned to the Location to collect an additional pit characterization sample.
- December 1, 2022: Confluence collected background soil samples to further characterize native levels of inorganic constituents of concern at the Location.
- March 14, 2023: Confluence returned to the location to collect additional wellhead and flowline characterization samples to delineate the horizontal extents of elevated pH to the north, east, and west of the wellhead and associated flowline.

Site Description

The Apache Canyon 06-09V well site and pit are in the Purgatoire River Field 4.3 miles southwest of Weston, Colorado in Las Animas County. The Location is situated in an unnamed canyon 0.6 miles north of the Alamosito Canyon on the slopes of the Ute Hills on land owned and operated by the Colorado Division of Wildlife within the Bosque Del Oso State Wildlife Area.

The Location elevation is 7,660 feet above sea level with a predominately north-facing slope/aspect. National Oceanic and Atmospheric Administration (NOAA) climate data collected from 2001 through 2022 in Las Animas County indicates that the Location receives an average of 12.23 inches of annual precipitation [1]. The site resides on a canyon floor with steep slopes along the northern and southern edges of the Location. The general area houses three main Ecological sites, as defined by the Natural Resources Conservation Service (NRCS): mixed conifer (F048AY908CO), ponderosa pine forest (F048AY925CO), and Shrubby Foothill (R049XE223CO) [3], [5] overstory with moderate shrub coverage and moderate to low coverage of low-lying perennial grasses, forbs, and shrubs in the understory. Surrounding land use includes wildlife habitat and natural gas development.

The Location disturbance includes the well site and pipeline rights-of-way (ROW). The road that provides access to the well site predates oil and gas operations on the pad and has therefore been excluded from total surface disturbance estimates. Total surface disturbance for construction to support drilling, completions, and operations was 2.7 acres. During interim reclamation operations 1.7 acres were reclaimed, leaving 1.0 acres of active working surface for well pad operations.

The working surface of the Location is shared with Ogris Operating LLC (Operator #: 10758) (Ogris). Ogris owns and operated the plugged and abandoned Apache Canyon 6-10 well (API: 05-071-06136) and associated pipeline infrastructure and metering on the western portion of the pad. XTO Energy Inc. (Operator #: 100264) (XTO) owns and operated the plugged and abandoned Apache Canyon 06-09 well (API: 05-071-06188), the plugged and abandoned Apache Canyon 06-09V well (API: 05-071-09126), the Apache Canyon 06-09V Pit (Facility ID: 292612), and associated pipeline infrastructure and metering on the eastern portion of the pad. The Current Site Contours and Location Map Figure attached to this Plan provides an overview of the site.

Soil Properties

USDA Soil Description

According to the United States Department of Agriculture (USDA) Web Soil Survey, the Soil Map Units (SMU) present at this location include Fuera-Dargol-Vamer complex (DFV) and the Saruche-Rombo-Rock outcrop complex (SR) [3]. These SMU are typical of Major Land Use Resource Area (MLRA) 048A, the Southern Rocky Mountains, which are characterized by high elevation, steep rugged mountains, with both linear ranges and complex masses of peaks. Middle to high elevations have been glaciated [2].

The complex geologic mix of Precambrian metasedimentary, metavolcanic, and intrusive rocks, Tertiary and Cretaceous sedimentary rocks, and Tertiary volcanic rocks do not produce fertile soils suitable for farmland [2]. These SMU are non-saline to very slightly saline, with poorly

defined topsoil and bedrock or restrictive layers in the shallow subsurface [3]. Northern and eastern slopes with greater moisture availability may support growth of relatively thick forests and woodlands, as do the canyon bottoms where perennial and intermittent streams are present. Southern and western slopes support low to moderate density communities of grasses and forbs of low to moderate height [3]. These conditions are observable in the attached aerial imagery and Custom Soil Resource Report.

Topsoil

Topsoil depths and qualities vary within the reference area, with thin to no topsoil on the steep slopes of the canyon, and topsoil depths of approximately five to eight inches within the canyon bottom [3]. Topsoil texture ranges from channery silty clay loam to cobbly loam [3]. During final reclamation operations, all topsoil will be stripped from the current interim reclamation area and stored along the Location perimeter for reapplication following recontouring.

Subsoil

B horizon subsoils within the project area have channery silty clay loam and parachannery silty clay loam to cobbly clay texture and depths of zero to 27 inches [3]. C horizon subsoils have cobbly clay texture to depths of 25 feet, with bedrock at greater depths [3]. These soils are anticipated to be well drained through the loam textured layers, and moderate to poorly drained through the silt textured layers. Depth to lithic bedrock is greater than 37 feet below ground surface (BGS) [3].

Affected Soil Analysis/Soil Suitability for Reclamation

The impacted soils within the Location are confined to the immediate area around the plugged and abandoned Apache Canyon 06-09V well and contained within the former pit. Impacted soil within the former pit footprint are present between seven to 14.5 feet BGS resulting in an impacted area of 4,000 ft^2. Based on drilling operations to assess impact depths following initial excavation and removal of impacted soils, SAR and pH levels above Allowable Concentrations remain in subsoils from seven feet to a maximum of 14.5 feet BGS. The maximum volume of soils with SAR above Table 915-1 Allowable Concentrations is estimated to be 37.9 cubic yards (CY). During Location recontouring during final reclamation, and with approval of this plan, impacted subsoils will remain in-situ at a minimum depth of 37 ft BGS.

Reclamation Procedure

Road Base and Gravel Removal

Gravel/road base will be removed from the well pad and access road working surface. Areas where the Location borders vegetated surfaces will receive extra attention to ensure material is removed up to the edge. Removed material will be hauled away or utilized for maintenance of nearby access roads and well pads, as specified by XTO personnel.

Recontouring and Subsoil Preparation

After gravel and road base removal from the Location, compaction alleviation will be completed by cross-ripping the sub-soils to a depth of 18 inches, with the second pass perpendicular to

existing slopes. Cut and fill slopes will be recontoured: existing fill material in the northern disturbance area will be moved south to fill the historical cut slope and achieve pre-disturbance contour and topography. Stormwater riprap slope armoring on the eastern perimeter will be removed and recontoured and preexisting drainages will be reestablished. Recontouring will include all edges of the disturbance to ensure the recontoured surface matches the grade of the surrounding reference.

Seedbed Preparation

Topsoil will be redistributed to pre-disturbance depths. Seedbed preparation will proceed to ensure that proper grade, soil texture and bulk density is achieved to support seeding, amendment, and mulching objectives.

Broadcast Seeding and Soil Amendments

The seed mix and amendments specified below were selected based on vegetative community composition data, ocular assessment of adjacent reference area vegetative community, and refined using climate and soils data [1], [2], [3], [5]. Seed and amendments will either be broadcast onto the soil surface or applied using a hydroseeder machine. Broadcast seed will be covered to a maximum depth of 0.5 inch by harrowing, drag bar, or roller. Seed and soil amendments will not be tilled into the soil profile.

Table 1: Apache Canyon 06-09V – Custom Seed Mix

Common Name	Scientific Name	Variety	% of Seeds/square foot	lb. PLS/Acre
Western Wheatgrass	*Pascopyrum smithii*	Arriba	18%	2.4
Mountain muhly	*Muhlenbergia montana*	Colorado origin if possible	18%	2.4
Prairie junegrass	*Koeleria macrantha*	Colorado origin if possible	18%	2.4
Nodding brome	*Bromus anomalus*	Colorado origin if possible	11%	1.7
Sideoats grama	*Bouteloua curtipendula*	Vaughn	11%	1.7
Needleandthread Grass	*Hesperostipa comata*	Colorado origin if possible	10%	1.85
Scarlet globemallow	*Sphaeralcea coccinea*	Colorado origin if possible	7%	1
Fourwing saltbush	*Atriplex canescens*	Colorado origin if possible	7%	1
Total			**100%**	**14.45**

Note: The seed mix may be adjusted based on seed availability, seeding dates, or other variables.

The seed mix will be applied at the specified rate at least 5 feet into the adjacent landscape using broadcast equipment with the following amendments:

- 500 lbs. per acre of sulfur flakes.
- 1000 lbs. per acre of Mesa Verde brand humates.
- 500 lbs. per acre of Richlawn 3-6-3 organic fertilizer with mycorrhizae and humates.
- Soil biotic treatment of 30 gallons per acre of Lot 125 Biotics applied with any free-flowing equipment ensuring even application.

Drill Seeding and Mulching

Seed application will be completed within 24 hours of seedbed preparation, weather permitting. The disturbance area will be drill seeded via two passes with the second pass at a 60° angle to

the first. Each pass will be completed with a seeding rate of one-half the specified seed rate to a minimum seed depth of 0.25-inches and maximum depth of 0.5-inches. Seeding will occur at least 5 feet into the adjacent landscape with final orientation on contour of the slope. Multiple passes will be completed along the narrow linear disturbance of the access road to reduce drill spacing and promote density. All seed will be certified weed free and pure live seed (PLS) rated per federal, state, county, and municipal standards.

Straw mulch, or another suitable mulch alternative, will be uniformly applied to cover 100% of the seed bed. If utilized, straw mulch will be secured to the soil surface using a commercial straw crimper with a final orientation on contour of the slope. Hydraulically applied tackifier will be used to sufficiently secure mulch and increase water retention.

Site Stabilization Methods

Land forming and revegetation will be employed as the primary best management practice to achieve long-term site stabilization to prevent erosion during final reclamation. The reclaimed area will be recontoured to blend with surrounding topography and prevent channelized flow of stormwater runoff. To slow stormwater runoff and increase infiltration, the soil surface will be left rough during final seedbed preparation. Following seeding, certified weed-free straw mulch will be applied at a rate of 3,000 lbs./acre and secured with a commercial crimper. Crimping will be completed on contour. Hydromulch will be applied at 3,000 lbs./acre for temporary stabilization in areas with slopes greater than 3:1.

Stormwater Controls

Existing stormwater control measures on the Location include vegetation establishment throughout the interim reclamation area. During the final reclamation phase, sediment control logs (SCL) will be installed around the disturbance perimeter prior to surface disturbance operations. The SCL will remain in place until site stabilization is achieved through vegetation establishment. Control measures will be inspected during routine stormwater inspections and repairs or replacement will be completed as soon as practicable to ensure they remain in proper functioning condition. Once the Location is stabilized, SCL will be removed.

Weed Management for Vegetation Establishment

Weed germination or establishment will be evaluated during routine monitoring. Weeds will be mitigated on an as-needed basis via mechanical methods or herbicide application prior to seed development. Mechanical weed mitigation typically includes line trimming or manual removal but may include mowing if weeds are widespread. Herbicide applications will be spot specific to prevent damage to desirable vegetation and only broadleaf herbicides will be applied. Soil sterilant and non-selective herbicides will not be used within the reclaimed area.

Noxious Weed Management

Weed treatment timing at the Location includes spring (May) to treat germinating weeds, mid to late summer (late July and August) to treat establishing weeds, and late summer (late August through September) to remove weeds prior to seed dispersal and treat late germinating rosettes of biennial weeds such as noxious thistles (bull and plumeless) and houndstongue. These species, along with cheatgrass, are the state and county-listed noxious weeds known to exist near the project area. Thistles and houndstongue are typically treated with spot-specific herbicide applications and are manually removed during inspections. Based on field

observations, cheatgrass in this area is typically in low concentrations that are outcompeted by seeded species and encroachment of native species. If cheatgrass establishment is identified in the reclaimed surface disturbance, additional measures are taken which typically include additional seeding but may include specialized herbicide and amendment applications.

Fencing

Fencing will not be deployed to exclude wildlife once the Location is reclaimed.

Monitoring

State regulations and XTO best management practices require routine site visits and active management over construction activities, along with annual reclamation reporting requirements. For compliance with Colorado Department of Public Health and Environment (CDPHE) Stormwater rules, the location will be visited for stormwater inspections every 14 days during active construction and within 24 hours of an erosive storm event. Following final reclamation operations and seeding, stormwater inspections are completed monthly until the reclaimed area is stable and vegetation has reached 70% cover of pre-disturbance levels, with the focus on stabilizing exposed soils. The reclaimed area is monitored for invasive and noxious weed establishment during these stormwater inspections as well as routine inspections completed by weed management contractors. Annual inspections (at a minimum) are completed by an environmental specialist until the reclaimed disturbance achieves Rule 1004 final reclamation requirements. The reclamation focus for these inspections and any associated maintenance is to ensure site stability, prevent erosion and site degradation, and to monitor for invasive weeds.

Once it is determined that the reclaimed surface has reached 80% vegetative cover of reference areas and the location shows visible signs of sustainability, trending towards overall success criteria (multi-species diversity with a self-sustaining plant community), additional quantitative monitoring will be completed to qualify the site for bond release.

Vegetation Analysis

Seeded and Pioneer Species

Native grasses and forbs within the provided seed mix have varying root depths, typically between 16 and 36 inches BGS [4], [5]. During periods of drought, grass taproots may reach depths of 65 inches or more [4], [5]. The selected grass species have moderate to high salinity and calcium carbonate tolerance and can establish in soils with a pH of 7.3 to 9.0 [6], [7]. Roots of Fourwing saltbush (*Atriplex canescens*) within the provided seed mix can reach depths of 20 feet BGS when mature and without the presence of restrictive layers, though most roots are within the upper 6 feet of soils [8]. The species has very high salinity and calcium carbonate tolerance and can establish in soils with a pH of 9.1.

Secondary Succession Species

Following initial revegetation, secondary succession will result in additional shrub establishment within the disturbance area. Shrub encroachment and early establishment in the region typically occurs three to five years following initial revegetation efforts, with shrub maturity occurring over

a period of 5 to 10 years. Common shrubs within the surrounding area include Fourwing saltbush, Gambel's oak (*Quercus gambelii*), Rocky Mountain juniper (*Juniperus scopulorum* Sarg.), Common juniper (*Juniperus communis* L.), and Mountain mahogany (*Cercocarpus* spp.) [3], [5]. These species have moderate tolerance to salts and root depths of 6 to 12 feet with taproots extending over 25 feet in dry climates without the presence of restrictive layers in the soil profile [3], [5].

Climax Species and Final Desired Ecological Condition

The climax community of nearby reference areas with similar soils, slope, and aspect within the canyon includes grasses, shrubs, Ponderosa Pine (*Pinus ponderosa*), Twoneedle pinyon (*Pinus edulis* Engelm.), Rocky Mountain juniper (*Juniperus scopulorum*), and Common juniper (*Juniperus communis*) [3]. Coniferous tree species present within the reference climax community have root depths that can extend over 25 feet without the presence of restrictive layers in the soil profile [9]. The species have moderate salt tolerance and can establish in soils with pH of up to 8.

Conclusions and Recommendations

While contemplating COGCC Rule 915.b and the presence of soil with elevated levels of the reclamation-based constituents of concern at this Location, Confluence Compliance Companies, LLC (Confluence) considered the following criteria in evaluating whether leaving known soil impacts in place would negatively affect revegetation efforts.

- Contours of the surrounding landscape.
- Depth of identified soil impacts and elevation of the current working surface.
- Finished grade following final reclamation.
- Moisture regime and climate.
- Climax species likely to occupy the location or final desired ecological condition.
- Vegetation rooting behaviors and tolerance to soil conditions.
- Time before final reclamation efforts and species succession.
- Local subsurface geology.

Based on these evaluation criteria and observed conditions at the Location, Confluence is comfortable recommending no additional remedial activities or characterization of the identified reclamation-based constituents of concern.

A drone assessment using ground control points was completed at the Location to create a sub-centimeter accurate digital elevation model (DEM) and orthomosaic. Based on these data, impacted soil remaining at the site and is contained within the former pit and will be covered with between 14.5 and 37 feet of native fill material and topsoil during recontouring of existing cut and fill slopes. This coverage depth was estimated using undisturbed reference area contours illustrated in the attached Current Site Contours and Location Map Figure and visually assessing current and past aerial imagery and elevation data. With the shallowest identified soil impacts at 7 feet BGS, following final reclamation impacted soils will be a minimum of 37 feet below finished grade at the former pit location. See Table 2 for a summary of elevations and impact depths.

Table 2: Apache Canyon 06-09V - Elevations and Depths Table	
Depth of Impacts (Current) [feet (ft) below ground surface (bgs)]	**7**
Working Surface Elevation (Current) [ft-ASL]	**7,650**
Reclaimed Surface Elevation (Required*) [ft-ASL]	**7,680**
Depth of Fill [ft]	**30**
Depth of Reclaimed Impacts (ft-bgs)	**37**

** Minimum elevation needed to meet requirement for matching pre-construction landscape contours during final reclamation. This is an estimation based on available elevation data and analysis of current and pre-disturbance contours.*

Of primary concern when considering possible impacts of burying saline soil is the potential for evapotranspiration to pull salts up into the soil profile. However, the average annual precipitation at this site is 12.23 inches per year, and classification of the soil as well drained, precipitation within the region is predicted to exceed evapotranspiration, allowing salts to move vertically through the subsurface profile, where they will disperse and dilute levels past the point of potential harm to vegetation.

With a finished grade of at least 37 feet above identified soil impacts, none of the identified secondary or climax species are likely to encounter the soils of concern until their rooting structures and function are well established. In the unlikely event that remaining reclamation-based constituents are encountered by rooting vegetation, the resulting impacts to vegetation are more likely to cause stunted growth than mortality of the plant, which over such a small area (4,000 square feet) of impacts would be undiscernible in a visual assessment of onsite vegetation in the reclaim area.

In conclusion, based on the depth of potentially impacted soils, moisture regime, and temporal and background conditions at the Location, the presence of these constituents is not likely to pose a greater concern than naturally occurring challenges to revegetation efforts at the Location.

The information presented here was acquired from publicly available records and field observations. Analysis and interpretation were completed by Confluence Reclamation Specialists. If you have any questions about the scope of the Plan or associated analysis and conclusions, please do not hesitate to contact me.

Sincerely,

Chris Jones

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Attachments

- Topographic Map: Current Site Contours
- Location Map Figure: Delineation Samples
- NRCS – Custom Soil Resource Report

References

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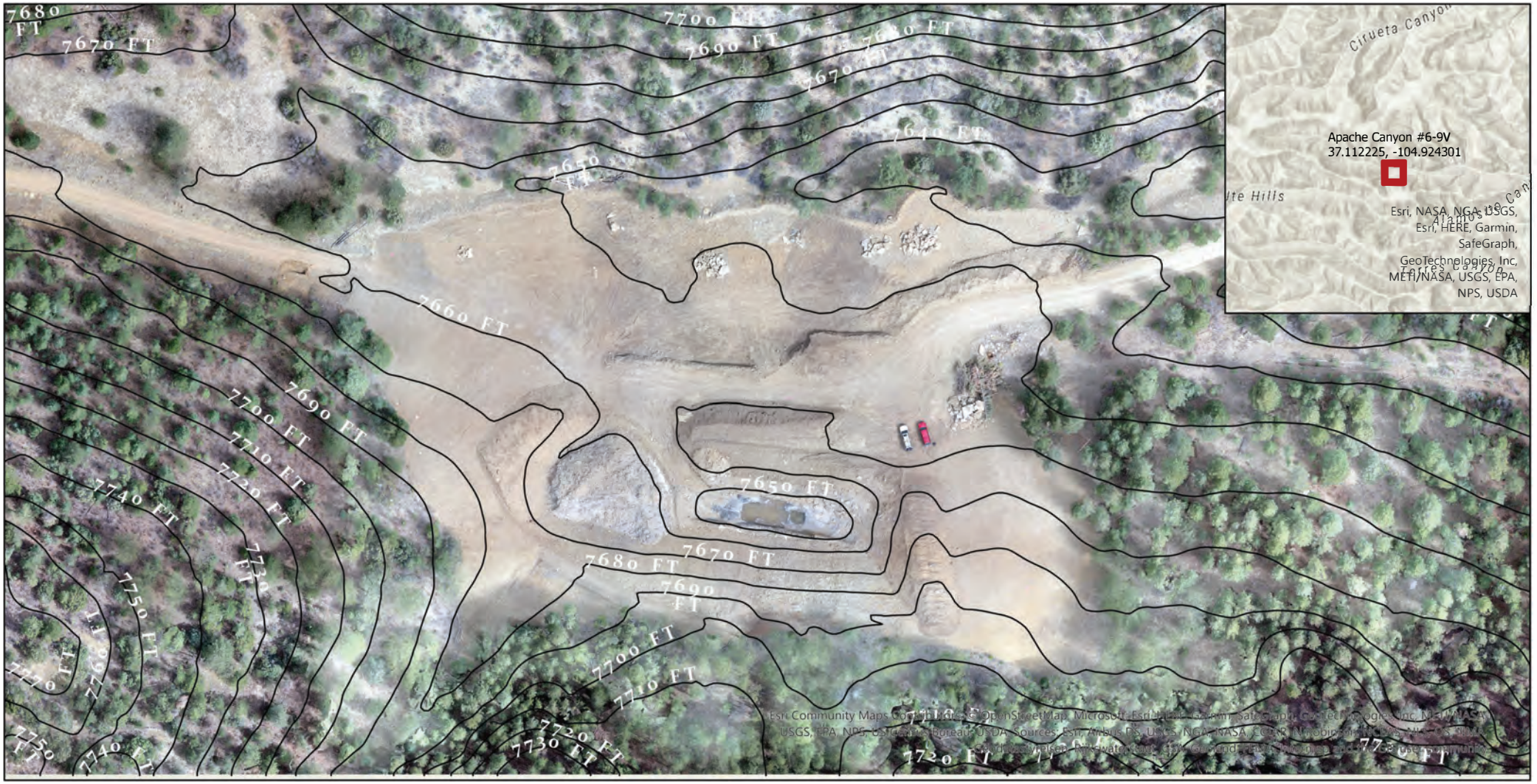

N
W E
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0 50 100 200 Feet

Topographic Map

Apache Canyon #6-9V
XTO Energy Inc.
COGCC Location ID: 312120
Las Animas County
NESE, Sec. 6, T34S - R67W

CONFLUENCE
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N
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Soil Sample Location

Final Excavation Extent

Red Text Undelineated Inorganic Exceedance

0 50 100 200 Feet

Delineation Samples

Apache Canyon #6-9V
XTO Energy Inc.
COGCC Location ID: 312120
Las Animas County
NESE, Sec. 6, T34S - R67W

CONFLUENCE
COMPLIANCE COMPANIES

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Las Animas County Area, Colorado

April 27, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

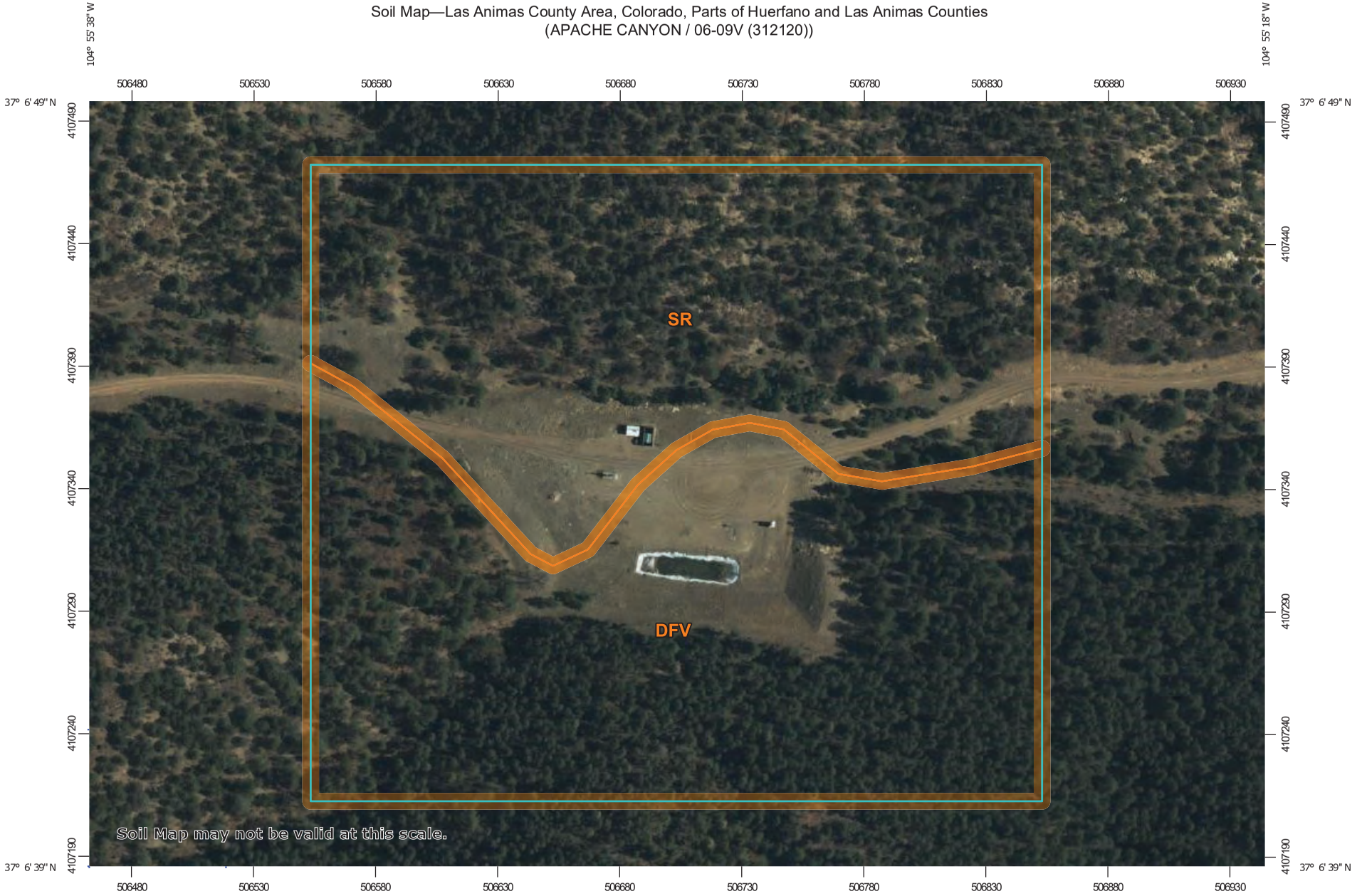
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:2,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Las Animas County Area, Colorado, Parts of Huerfano and Las Animas Counties
Survey Area Data: Version 25, Sep 7, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 31, 2020—May 18, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DFV	Fuera-Dargol-Vamer complex, 10 to 45 percent slopes	10.2	52.7%
SR	Saruche-Rombo-Rock outcrop complex, 25 to 50 percent slopes	9.1	47.3%
Totals for Area of Interest		**19.3**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Las Animas County Area, Colorado, Parts of Huerfano and Las Animas Counties

SR—Saruche-Rombo-Rock outcrop complex, 25 to 50 percent slopes

Map Unit Setting

National map unit symbol: hw1d
Elevation: 6,800 to 8,500 feet

Mean annual precipitation: 16 to 22 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 70 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Saruche and similar soils: 40 percent
Rombo and similar soils: 35 percent
Rock outcrop: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saruche

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium and residuum weathered from shale

Typical profile

A - 0 to 4 inches: channery silty clay loam
Bw - 4 to 16 inches: parachannery silty clay loam
Cr1 - 16 to 20 inches: bedrock
Cr2 - 20 to 30 inches: bedrock

Properties and qualities

Slope: 25 to 50 percent
Surface area covered with cobbles, stones or boulders: 2.0 percent
Depth to restrictive feature: 8 to 20 inches to paralithic bedrock; 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R049XE223CO - Shrubby Foothill
Hydric soil rating: No

Description of Rombo

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Slope alluvium and residuum weathered from shale and siltstone

Typical profile

A - 0 to 4 inches: channery silty clay loam
Bw - 4 to 22 inches: channery silty clay loam
Bk - 22 to 34 inches: parachannery silty clay loam
Cr - 34 to 44 inches: bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R049XE223CO - Shrubby Foothill
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Scarps
Parent material: Sandstone

Typical profile

R - 0 to 60 inches: bedrock

Properties and qualities

Slope: 35 to 50 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Bandarito

Percent of map unit: 5 percent
Landform: Fan remnants, valley sides
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R049XB208CO - Clayey Foothill
Other vegetative classification: Clayey (G049XW001CO), Clayey Foothills #208 (049XY208CO_3)
Hydric soil rating: No

Stout

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F048AY925CO - Ponderosa Pine Forest
Other vegetative classification: ponderosa pine/mountain muhly (Pipo/Mumo)
Hydric soil rating: No

Dargol

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F048AY925CO - Ponderosa Pine Forest
Other vegetative classification: Douglas fir (048AY903CO)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Las Animas County Area, Colorado, Parts of Huerfano and Las Animas Counties
Survey Area Data: Version 25, Sep 7, 2022

Las Animas County Area, Colorado, Parts of Huerfano and Las Animas Counties

DFV—Fuera-Dargol-Vamer complex, 10 to 45 percent slopes

Map Unit Setting

National map unit symbol: hw0f
Elevation: 7,500 to 9,000 feet
Mean annual precipitation: 17 to 22 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 70 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Fuera and similar soils: 35 percent
Dargol and similar soils: 30 percent
Vamer and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fuera

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from shale and siltstone

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 7 inches: cobbly loam
E and Bt - 7 to 10 inches: cobbly loam
E and Bt - 10 to 11 inches: cobbly clay loam
Bt1 - 11 to 27 inches: cobbly clay
Bt2 - 27 to 47 inches: cobbly clay
C - 47 to 60 inches: cobbly clay

Properties and qualities

Slope: 10 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: F048AY908CO - Mixed Conifer
Other vegetative classification: Rocky Mountain Douglas fir/ ponderosa pine/mountain muhly (Pmeg-Pipo)
Hydric soil rating: No

Description of Dargol

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium and residuum weathered from shale and siltstone

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 6 inches: loam
Bt1 - 6 to 10 inches: clay
Bt2 - 10 to 29 inches: clay
R - 29 to 60 inches: bedrock

Properties and qualities

Slope: 10 to 45 percent
Surface area covered with cobbles, stones or boulders: 1.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F048AY908CO - Mixed Conifer
Other vegetative classification: Rocky Mountain Douglas fir/ ponderosa pine/mountain muhly (Pmeg-Pipo)

Hydric soil rating: No

Description of Vamer

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium and residuum weathered from siltstone over sandstone

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: fine sandy loam
E - 3 to 7 inches: fine sandy loam
Bt - 7 to 16 inches: clay
R - 16 to 60 inches: bedrock

Properties and qualities

Slope: 10 to 40 percent
Surface area covered with cobbles, stones or boulders: 1.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: F048AY925CO - Ponderosa Pine Forest
Other vegetative classification: ponderosa pine/mountain muhly (Pipo/Mumo)
Hydric soil rating: No

Minor Components

Saruche

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R049XE223CO - Shrubby Foothill

Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Scarps
Hydric soil rating: No

Stout

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F048AY925CO - Ponderosa Pine Forest
Other vegetative classification: ponderosa pine/mountain muhly (Pipo/Mumo)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Las Animas County Area, Colorado, Parts of Huerfano and Las Animas Counties
Survey Area Data: Version 25, Sep 7, 2022

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