October 09, 2024

Jason Davidson
Remediation Advisor
Chevron Rockies Business Unit
PDC Energy, Inc.
2115 117th Avenue
Greeley, CO 80631

Re: **Phelps 11-32CHZ**
Reclamation Plan
SENE, Section 32, Township 1 N, Range 66 W
Weld County, Colorado

Mr. Davidson:

Tasman, Inc. (Tasman) has prepared this Reclamation Plan (Plan) on behalf of PDC Energy, Inc. (PDC) for the Phelps 11-32CHZ in Weld County, Colorado (Site). The Colorado Energy and Carbon Management Commission (ECMC) has assigned this project Remediation Project No. 33237. Surface areas disturbed by remediation activities shall be reclaimed per ECMC Rules 1003 *Interim Reclamation* and 1004 *Final Reclamation of Well Sites and Associated Production Facilities*. Additional remedial activities and assessment results associated with this project were presented to and approved by the ECMC in previously submitted Form 27 reports. In anticipation of reclamation activities, Tasman completed a Site inspection on October 3, 2024; the associated field notes and photo logs are included as Attachment A.

Site Description

The Site is located in Weld County in northeastern Colorado, in the SENE Quarter-Quarter of Section 32, Township 1 North, Range 66 West near the intersection of County Road (CR) 4 and CR 31, approximately 2 miles northeast of the town of Brighton (Figure 1). There are four mapped Fish and Wildlife Service (FWS) Wetland (PSS1A: Freshwater Forested/Shrub; Wetland, Rp2SS: Forested/Shrub Wetland; R4SBCx: Riverine; and PABGh: Freshwater Pond) located within 500 feet of the Site (Figure 2). The current landowner is Vincent C. Phelps Trust.

Site Background

An unintentional release from the Phelps 11-32CHZ separator occurred in August 2023 from a broken sight glass. Following ECMC approval of the Initial Form 27 (Document No. 403575609), an initial remediation investigation was conducted by Fremont Environmental, Inc. (Fremont) in August 2023. During initial remediation activities, six confirmation soil samples (Waste Char, N-2, E-2, W-2, S-2, and F2-5) were collected and submitted to Summit Scientific Laboratory (Summit) for analysis of ECMC Table 915-1 Organic Compounds in Soils, total petroleum hydrocarbons (TPH) as total volatile hydrocarbons (C_6-C_{10}), total extractable hydrocarbons (C_{10}-C_{36}), Table 915-1 Metals, and Soil Suitability for Reclamation constituents. In January 2024, five background soil samples (BG N-W, BG N-C, BG N-E, BG SE, and BG SW) were collected and submitted to Summit for analysis of ECMC Table 915-1 Soil Suitability for Reclamation constituents and Table 915-1 Metals. Analytical results indicated that the sodium adsorption ratio (SAR) values in one confirmation soil sample (Waste Char) was above the applicable ECMC Table 915-1 regulatory standards. In addition, electrical conductivity (EC) and SAR values in one confirmation soil

sample (E-2) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. The remaining soil samples (N-2, W-2, S-2, and F2-5) were in full compliance with ECMC standards and Site-specific background concentrations. The SAR exceedance observed in soil sample Waste Char was removed through the excavation of impacted material in September 2023. Confirmation soil sample locations are illustrated on Figure 3-A and background sample locations are illustrated on Figure 3-B. Analytical results are presented in Table 1.

Following ECMC approval of Supplemental Form 27 Document No. 403668926, a supplemental Site investigation was conducted by Fremont in January 2024 to delineate the horizontal groundwater impacts encountered during the remediation excavation and delineate the extents of the EC and SAR exceedances observed in soil sample E-2, which was left in place. Five confirmation soil samples (MW-1 2 Ft, MW-2 2 Ft, MW-3 2 Ft, MW-4 2 Ft, and MW-5 2 Ft) were collected via hand auger during the installation of the groundwater monitoring wells and were submitted to Summit for the analysis of ECMC Table 915-1 Soil Suitability for Reclamation constituents. In addition, five background soil samples (BG N-W, BG N-C, BG N-E, BG SE, and BG SW) were collected and submitted to Summit for the analysis of ECMC Table 915-1 Soil Suitability for EC and SAR, as well as Table 915-1 Metals for arsenic, barium, and selenium. Analytical results indicated that pH values in three confirmation soil samples (MW-1 2 Ft, MW-3 2 Ft, and MW-4 2 Ft) were above the applicable ECMC Table 915-1 regulatory standards and Site-specific background concentrations. The remaining confirmation soil samples were in full compliance with ECMC Table 915-1 standards and Site-specific background concentrations.

Following ECMC approval of Supplemental Form 27 Document No. 403770398, Fremont conducted a supplemental Site investigation from April 2024 through July 2024, to delineate the horizontal and vertical extents of the pH exceedances observed in samples MW-1 2 Ft, MW-3 2 Ft, and MW-4 2 Ft. Two delineation soil samples (HA-S and HA-E) were collected and submitted to Summit for the analysis of ECMC Table 915-1 Soil Suitability for pH. Analytical results indicated that pH in sample HA-S was above the applicable ECMC Table 915-1 regulatory standards. Two additional soil samples (SS-SS and SS-SSS) were collected as delineation and background samples, respectively, to address the pH exceedance observed in HA-S. Analytical results indicated that HA-S was above the applicable Table 915-1 standards, but within Site-specific background concentrations.

Soils and Vegetation Information

The primary soil type at Site is Olney Fine Sandy Loam with a 1-3% slope (Attachment B). Olney Fine Sandy Loam soils consist of very deep, well drained soils that formed in eolian deposits. Olney soils are found on plains, hills, and ridges. Native vegetation in such soils are blue gramma, prairie sandreed, sideoats gramma, needle and thread, threeawn, sand dropseed, and sagebrush. Such soils are used as irrigated and dryland crop production and native rangeland.

Tasman completed a Site inspection on October 3, 2024, to evaluate general soil and vegetive conditions. Current land use surrounding the Site is active oil and gas production associated with the Phelps 12-32NHZ Facility. There is no existing vegetation on-Site and the Site is actively managed to prevent vegetation; therefore, background reference vegetation was collected along the northeastern boundary of the Site. Species observed include alkali saltgrass, slender wheatgrass, needle and thread, *kochia* and Russian thistle. Salt-crusted soils were observed in the background reference vegetation area located northeast of the Site.

Reclamation Operations and Erosion Control

As the Site and surrounding area is an active oil and gas facility, reclamation seeding will not be completed. Excavation of the contaminated road base was completed in September 2023. Following excavation of the contaminated soils and road base, clean fill soil and new road base were emplaced to match pre-existing conditions.

Stormwater compliance to prevent soil erosion shall be maintained by a combination of earthwork practices and placement of non-erodible surfaces. No stormwater inspections related to remediation or reclamation activities will be required. If stormwater management is required, it will be implemented.

Annual Final Reclamation Monitoring

The Site will continue to operate as an active oil and gas facility; therefore, Final Reclamation annual inspections and/or monitoring will not be completed at this time.

Conclusion

Analytical results collected during the supplemental Site investigations completed from January to July of 2024 indicated that the SAR and EC exceedances recorded during the initial unintentional release investigation were horizontally and vertically delineated and were either removed during the excavation or could not be duplicated. The pH exceedances recorded during the installation of the groundwater monitoring wells were horizontally and vertically delineated and located within the rooting zone. Understanding that groundwater was encountered at a depth of three feet below ground surface (bgs) and the native Olney Fine Sandy Loams soils means pH variability occurs throughout the calendar year as ground water levels fluctuate. Based on the analytical results collected during the supplemental Site investigations collected between January and July of 2024, native soil characteristics, and an understanding that the Site will remain an active oil and gas facility, there will be no long-term impacts to soil suitability at the Site and surrounding land.

If you have any questions about this Reclamation Plan, do not hesitate to contact Jason Davidson at 970-939-1925 or jason.davidson@chevron.com, Philip Porter at 303-597-6847 or philip.porter@chevron.com, or myself at 303-726-9642 or acook@tasman-geo.com.

Sincerely,

Alex Cook, TECS, QSM

Environmental Scientist

Figures:

1. Site Location Map
2. Site Overview Map
3. Soil Sampling and Boring Location Maps
    A. Site Map
    B. Soil Chemistry Map
    C. pH Soil Chemistry Map

Table:

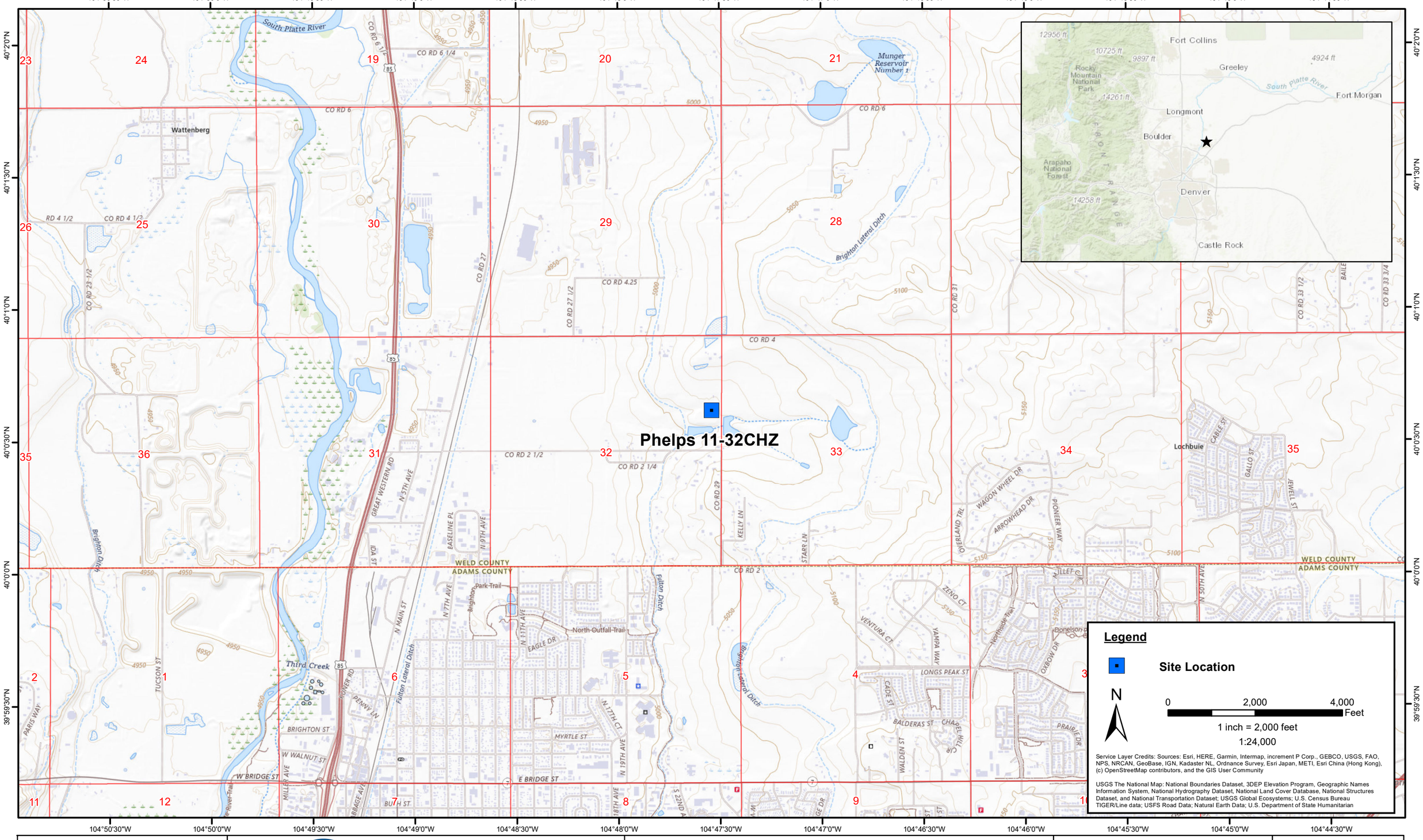
1. Summary of Soil Suitability for Reclamation (Fremont)

Attachments:

A. Vegetation Monitoring Report
B. United States Department of Agriculture (USDA) Custom Soil Resource Report
C. USDA Official Series Description – Olney Series

FIGURE 1

Site Location Map



DATE: October 2024 DESIGNED BY: B. Nelson DRAWN BY: J. Woffinden	**Tasman, Inc.** **6855 W. 119th Ave** **Broomfield, CO 80020**	**PDC Energy Inc. - 69175 - DJ Basin** **Phelps 11-32CHZ** SENE, Section 32, Township 1 North, Range 66 West Weld County, Colorado	Site Location Map	Figure 1

FIGURE 2

Site Overview Map

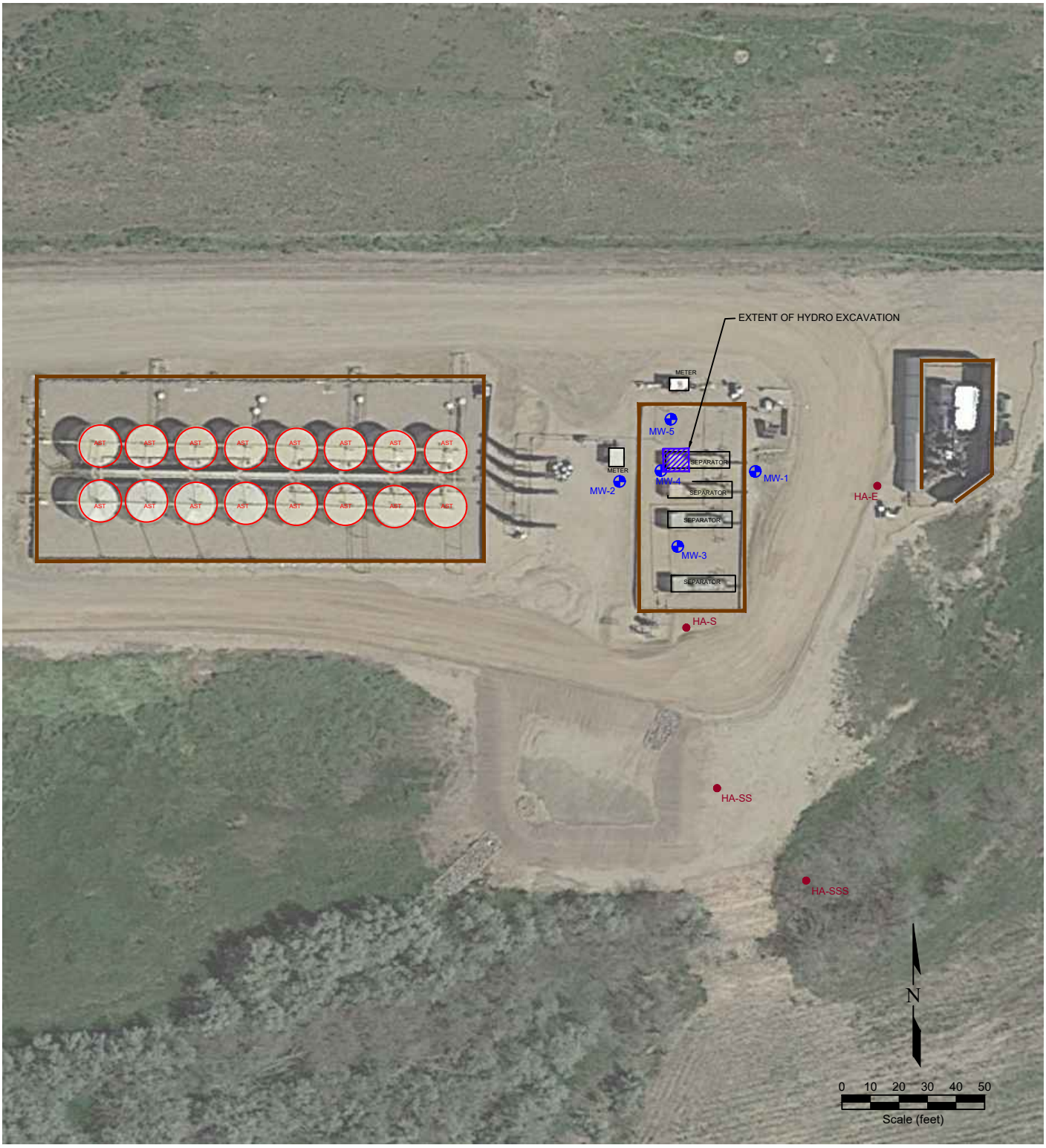
DATE: October 2024 DESIGNED BY: A. Cook DRAWN BY: J. Woffinden	**Tasman, Inc.** **6855 W. 119th Ave** **Broomfield, CO 80020**	**PDC Energy, Inc. - 69175 - DJ Basin** **Phelps 11-32CHZ** SENE, Section 32, Township 1 North, Range 66 West Weld County, Colorado	Site Overview Map	Figure 2

FIGURE 3

Figure 3-A, Site Map

Figure 3-B, Soil Chemistry Map

Figure 3-C, pH Soil Chemistry Map



LEGEND

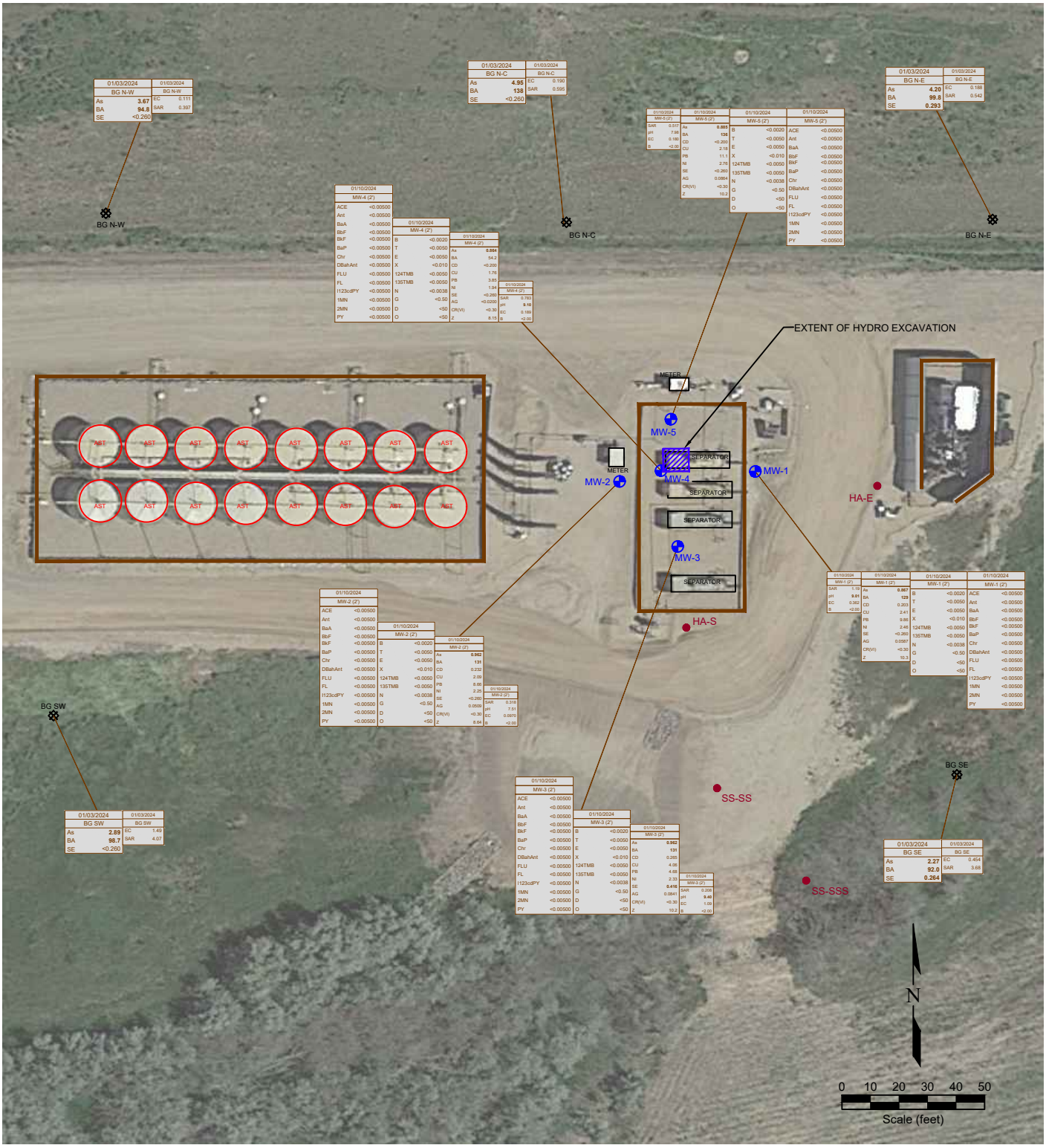
HAND AUGURED SOIL BORING
MONITORING WELL LOCATION
HYDROEXCAVATION
ABOVE GROUND STORAGE TANK
FORMER
FORMER FACILITY
BUILDING
CONTAINMENT BERM
CONTAINMENT WALL
EXTENT OF EXCAVATION
FENCE LINE

Figure 3-A
SITE MAP

PDC ENERGY, INC. ~ PHELPS 11-32CHZ
SENE Section 32, T1N, R66W, 6th PM
Weld County, Colorado
40.01110°, -104.79257°

Project No.	API #	Facility #
C023-233		**433548**
Date	Remediation #	Filename
7/15/24		**23233Q**

FREMONT ENVIRONMENTAL



LEGEND

- HAND AUGURED SOIL BORING
- MONITORING WELL LOCATION
- SOIL SAMPLE LOCATION
- HYDROEXCAVATION
- ABOVE GROUND STORAGE TANK
- FORMER FACILITY
- BUILDING
- CONTAINMENT BERM
- CONTAINMENT WALL
- EXTENT OF EXCAVATION
- FENCE LINE

DATE SAMPLED	
SAMPLE ID and DEPTH (ft)	
ACENAPHTHENE (mg/kg)	
ANTHRACENE (mg/kg)	
BENZO (A) ANTHRACENE (mg/kg)	
BENZO (B) FLUORANTHENE (mg/kg)	
BENZO (K) FLUORANTHENE(mg/kg)	
BENZO (A) PYRENE (mg/kg)	
CHRYSENE (mg/kg)	
DIBENZ (A,H) ANTHRACENE (mg/kg)	
FLUORANTHENE (mg/kg)	
FLUORENE (mg/kg)	
INDENO (1,2,3-CD) PYRENE(mg/kg)	
1-METHYLNAPHTHALENE (mg/kg)	
2-METHYLNAPHTHALENE (mg/kg)	
PYRENE (mg/kg)	
DATE SAMPLED	
SAMPLE ID & DEPTH (ft)	
pH (pH units)	
DATE SAMPLED	
SAMPLE ID and DEPTH (ft)	
BENZENE (mg/kg)	
TOLUENE (mg/kg)	
ETHYLBENZENE (mg/kg)	
TOTAL XYLENES (mg/kg)	
1,2,4-TRIMETHYLBENZENE (mg/kg)	
1,3,5-TRIMETHYLBENZENE (mg/kg)	
NAPHTHALENE (mg/kg)	
TPH-GRO (mg/kg)	
TPH-DRO (mg/kg)	
TPH-ORO (mg/kg)	
DATE SAMPLED	
SAMPLE ID & DEPTH (ft)	
ARSENIC (mg/kg)	
BARIUM (mg/kg)	
SELENIUM (mg/kg)	
DATE SAMPLED	
SAMPLE ID & DEPTH (ft)	
EC (mmhos/cm)	
SAR (units)	
DATE SAMPLED	
SAMPLE ID & DEPTH (ft)	
SAR (units)	
pH (pH units)	
EC (mmhos/cm)	
BORON (mg/L)	
DATE SAMPLED	
SAMPLE ID & DEPTH (ft)	
ARSENIC (mg/kg)	
BARIUM (mg/kg)	
CADMIUM (mg/kg)	
COPPER (mg/kg)	
LEAD (mg/kg)	
NICKEL (mg/kg)	
SELENIUM (mg/kg)	
SILVER (mg/kg)	
HEXAVALENT CHROMIUM (mg/kg)	
ZINC (mg/kg)	

Figure 3-B

SOIL CHEMISTRY MAP

PDC ENERGY, INC. ~ PHELPS 11-32CHZ

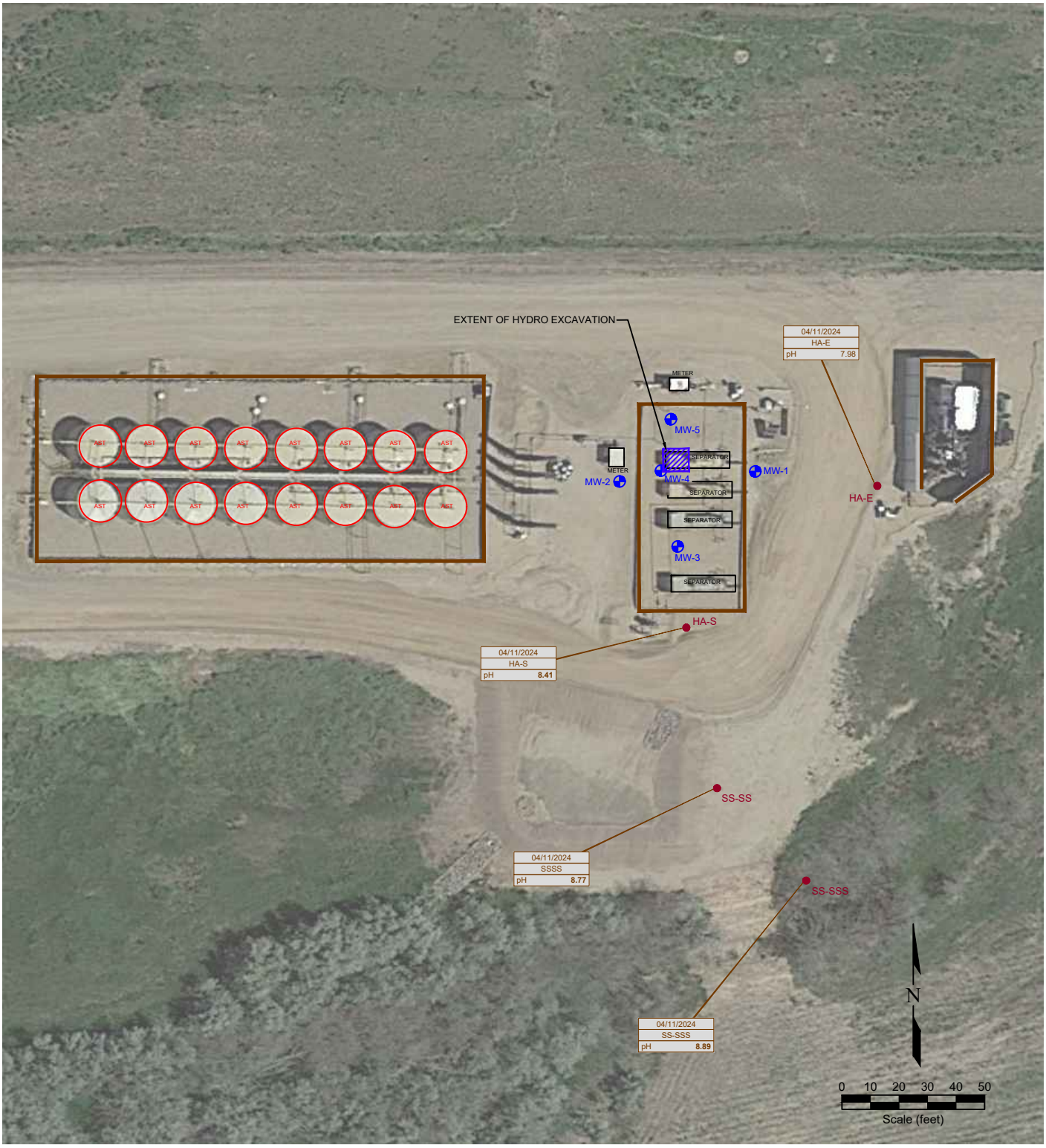
SENE Section 32, T1N, R66W, 6th PM

Weld County, Colorado

40.01110°, -104.79257°

Project No.	API #	Facility #
C023-233		**433548**
Date	**Remediation #**	**Filename**
7/15/24		**23233Q**

FREMONT ENVIRONMENTAL



LEGEND

- HAND AUGURED SOIL BORING
- MONITORING WELL LOCATION
- HYDROEXCAVATION
- ABOVE GROUND STORAGE TANK
- FORMER FACILITY
- BUILDING
- CONTAINMENT BERM
- CONTAINMENT WALL
- EXTENT OF EXCAVATION
- FENCE LINE

04/11/2024 — DATE SAMPLED
HA-S — SAMPLE ID & DEPTH (ft)
pH 8.41 — pH (pH units)

Figure 3-C
pH SOIL CHEMISTRY MAP

PDC ENERGY, INC. ~ PHELPS 11-32CHZ
SENE Section 32, T1N, R66W, 6th PM
Weld County, Colorado
40.01110°, -104.79257°

Project No.	API #	Facility #
C023-233		**433548**
Date	Remediation #	Filename
7/15/24		**23233Q**

FREMONT ENVIRONMENTAL

Table 1

Summary of Soil Suitability for Reclamation (Fremont)

TABLE 1
SUMMARY OF SOIL SUITABILITY FOR RECLAMATION
PDC ENERGY INC.
PHELPS 11-32 CHZ, WELD COUNTY, COLORADO
FREMONT PROJECT NO. C023-233

Sample ID	Sample Date	Depth (ft)	pH	EC (mmhos/cm)	SAR	Boron (mg/L)
ECMC Table 915-1 Soil Suitability Limits			6 - 8.3	<4	<6	2
Waste Char	8/22/2023	0.2	6.58	0.0119	**12.6**	0.146
N-2	8/23/2023	2	8.06	0.815	3.60	<0.0100
E-2	8/23/2023	2	6.45	**9.78**	**7.78**	0.0524
W-2	8/23/2023	2	7.73	1.13	3.97	*<0.0100*
S-2	8/23/2023	2	8.21	0.156	0.654	*<0.0100*
F2-5	8/23/2023	5	7.70	0.514	2.27	*<0.0100*
MW-1 2 Ft	1/10/2024	2	**9.01**	0.362	1.19	*<2.00*
MW-2 2 Ft	1/10/2024	2	7.51	0.097	0.318	*<2.00*
MW-3 2 Ft	1/10/2024	2	**9.40**	1.09	0.208	*<2.00*
MW-4 2 Ft	1/10/2024	2	**9.10**	0.189	0.783	*<2.00*
MW-5 2 Ft	1/10/2024	2	7.98	0.18	0.517	*<2.00*
BG N-W	1/3/2024	2	*NA*	0.111	0.397	*NA*
BG N-C	1/3/2024	2	*NA*	0.190	0.595	*NA*
BG N-E	1/3/2024	2	*NA*	0.188	0.542	*NA*
BG SE	1/3/2024	2	*NA*	0.454	3.68	*NA*
BG SW	1/3/2024	2	*NA*	1.49	4.07	*NA*
HA-S	4/11/2024	2	**8.41**	*NA*	*NA*	*NA*
HA-E	4/11/2024	2	7.98	*NA*	*NA*	*NA*
SS-SS	6/11/2024	2	**8.77**	*NA*	*NA*	*NA*
SS-SSS	7/3/2024	2	**8.89**	*NA*	*NA*	*NA*

Bold faced values exceed the ECMC Table 915-1 concentrations

Yellow highlighted 915-1 Limits indicate the referenced soil screening level (SSL)

NA - Not analyzed

Green shaded samples indicate this soil was removed during subsequent excavation

ATTACHMENT A

Vegetation Monitoring Report

Vegetation Monitoring Report

Project: Phelps 11-32CHZ

Date & Time: 10/3/2024 11:47

Tasman Personnel: Alex Cook

Weather: Sunny, Windy (5-15 mph), 67F

Client: PDC Energy, Inc.

Stormwater Issues: None Observed

Debris/Trash On-Site: None Observed

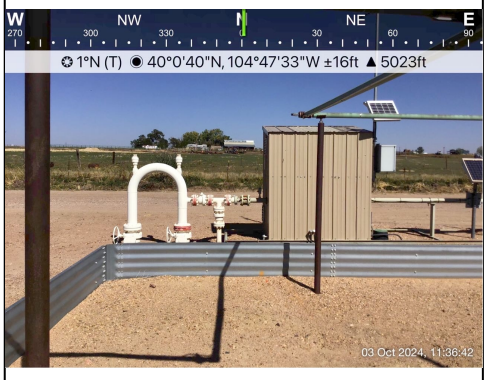
Equipment On-Site: Yes active facility.

Observations:

The Site has returned to active production. The Site has clean road base placed and contoured to match the existing conditions.
Monitoring wells observed in place around the Site. Background reference vegetation collect northeast of the Site. Vegetation species
observed include alkali salt grass, slender wheatgrass, needle and thread, kochia, and Russian thistle.

	Site Status	Comments
Vegetation Present?	Yes	See observations section.
Noxious or invasive weeds present?	Yes	See observations section.
Have weeds been managed according to the narrative?	No	No initial site visit.

Photo Log (descriptions below)



P1 - Looking north from the center of the Site, clean backfill was emplaced following the excavation.

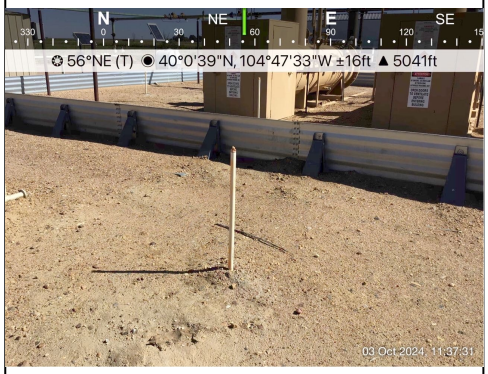
P2 - Looking east from the center of the Site, the equipment has been replaced and returned to active production.

P3 - Looking south from the center of the Site, clean backfill was emplaced following the excavation.

Photo Log Continued (descriptions below)

P4 - Looking west from the center of the Site, the equipment has been replaced and returned to active production.

P5 - Looking east ground water monitoring well in place. The separator has returned to active production.



P6 - Looking northeast, groundwater monitoring well to remain in place at the Site.

P7- Looking south toward the separator, backfill has been emplaced and the equipment has returned to production.

P8 - Background reference vegetation, looking north at slender wheatgrass and needle and thread grass.

P9 - Background reference vegetation, looking east at slender wheatgrass and needle and thread grass.

P10 - Background reference vegetation, looking south at slender wheatgrass, kochia, and Russian thistle.

P11 - Background reference vegetation, looking west at slender wheatgrass and needle and thread grass.

P12 - Background reference vegetation, slender wheatgrass, kochia and needle and thread grass.

Legend

Site Visit Footprint

Excavation Extent

Photo Location

Notes

1) All locations are approximate unless otherwise noted.

GPS – Global Positioning System

0 ft. 50 ft. 100 ft.

N

Image Source: Google Earth; 2023 Google
Projection: WGS 84 UTM Zone 13 North

DATE:	October 7, 2024
DESIGNED BY:	A. Cook
DRAWN BY:	A. Cook

Tasman, Inc.
6855 W. 119th Ave.
Broomfield, CO 80020

PDC Energy Inc. - 69175 - DJ Basin
Phelps 11-32CHZ
SENE, Section 32, Township 1 North, Range 66 West
Weld County, Colorado

Reclamation Plan Map

FIGURE
1

ATTACHMENT B

UDSA Custom Soil Resources Map and Report

United States Department of Agriculture

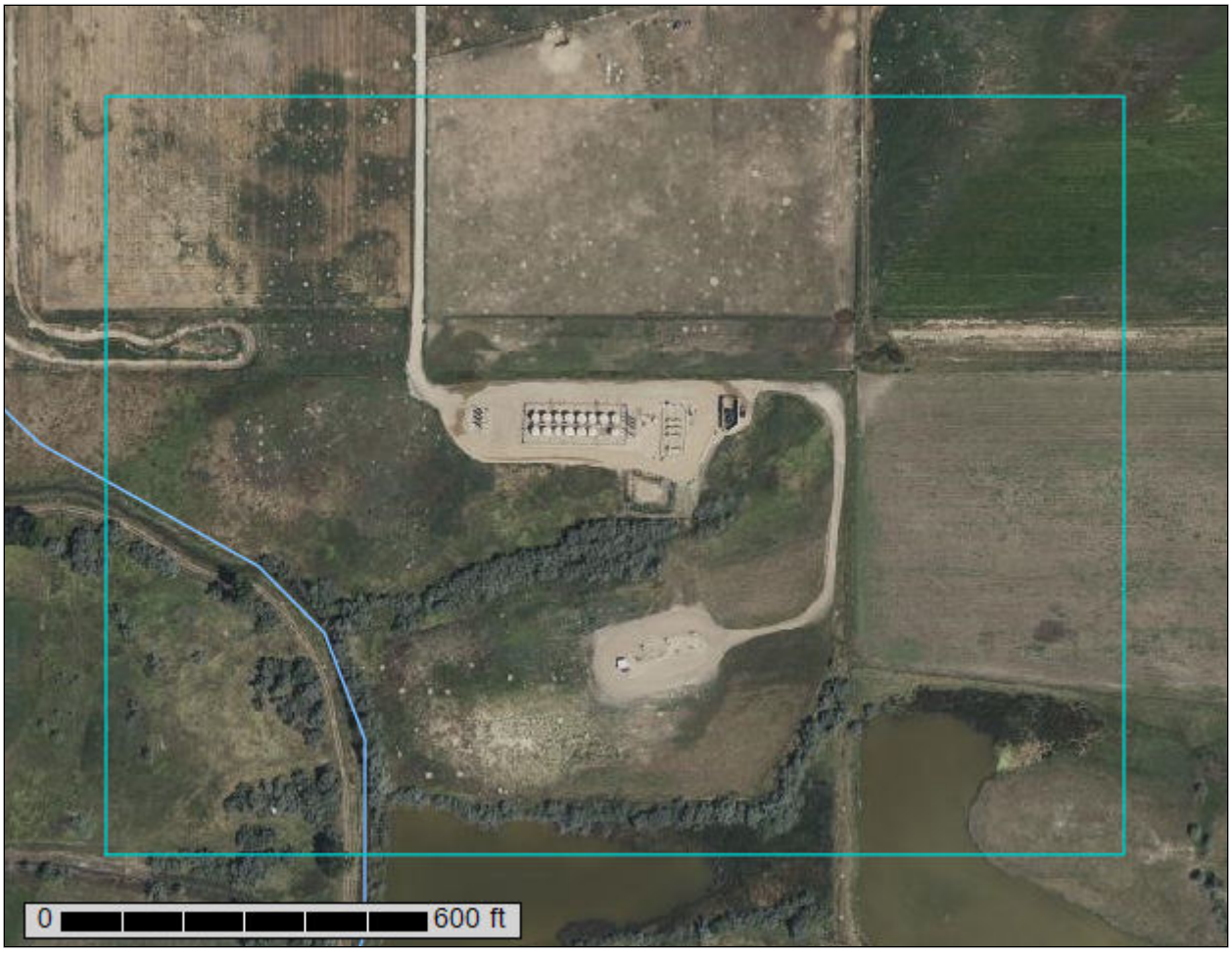
NRCS

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 Weld County, Colorado, Southern Part

Phelps 11-32CHZ



October 2, 2024

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

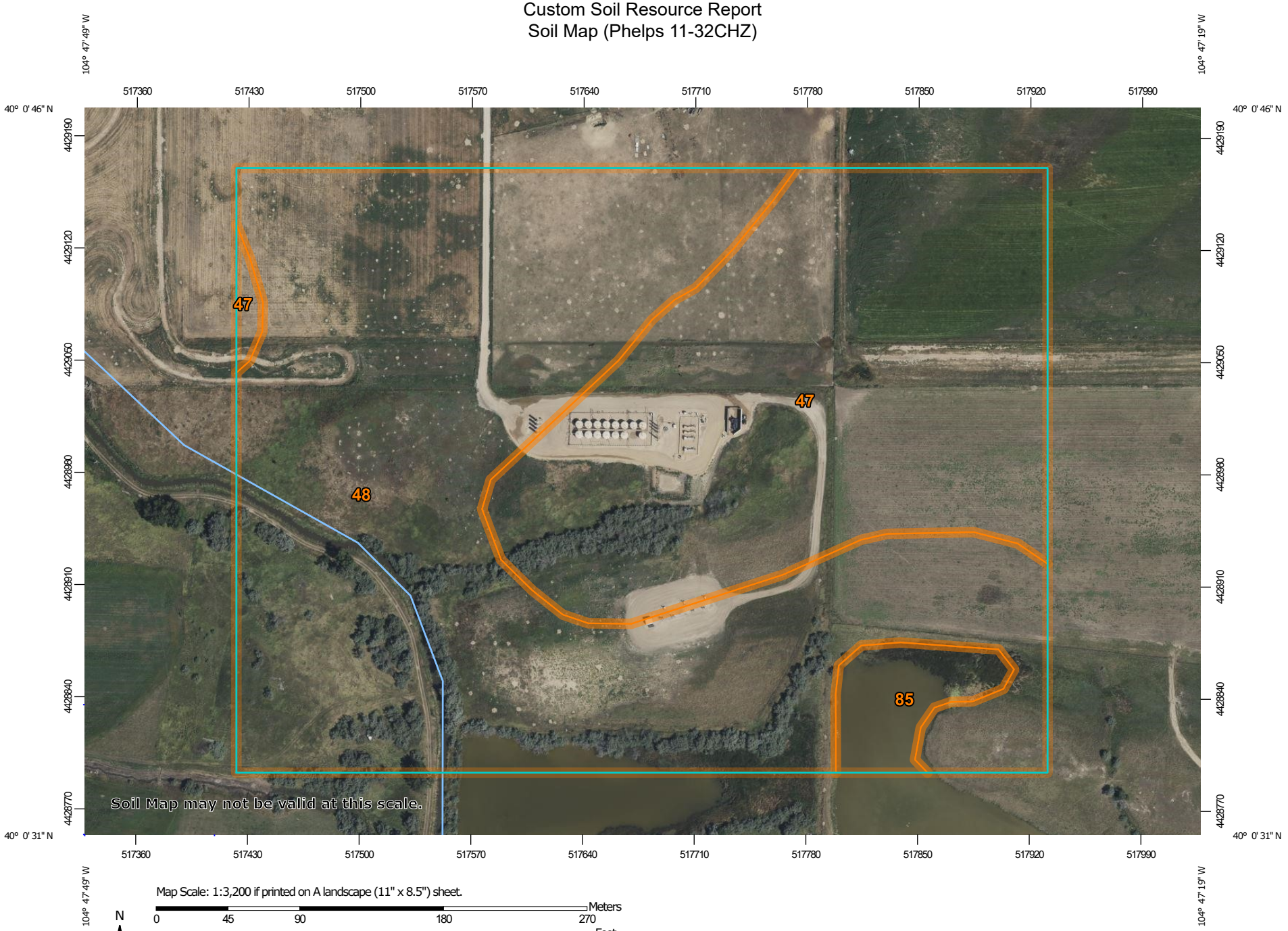
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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: 1:3,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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: Weld County, Colorado, Southern Part
Survey Area Data: Version 23, Aug 29, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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 (Phelps 11-32CHZ)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
47	Olney fine sandy loam, 1 to 3 percent slopes	17.3	36.3%
48	Olney fine sandy loam, 3 to 5 percent slopes	28.8	60.5%
85	Water	1.5	3.1%
Totals for Area of Interest		**47.6**	**100.0%**

Map Unit Descriptions (Phelps 11-32CHZ)

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, 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 and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils 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. Other minor components, however, have properties and behavioral 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*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one 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.

Weld County, Colorado, Southern Part

47—Olney fine sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 362v
Elevation: 4,600 to 5,200 feet
Mean annual precipitation: 11 to 15 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 125 to 175 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Olney and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olney

Setting

Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed deposit outwash

Typical profile

H1 - 0 to 10 inches: fine sandy loam
H2 - 10 to 20 inches: sandy clay loam
H3 - 20 to 25 inches: sandy clay loam
H4 - 25 to 60 inches: fine sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Zigweid
Percent of map unit: 10 percent
Hydric soil rating: No

Vona
Percent of map unit: 5 percent
Hydric soil rating: No

48—Olney fine sandy loam, 3 to 5 percent slopes

Map Unit Setting
National map unit symbol: 362w
Elevation: 4,600 to 5,200 feet
Mean annual precipitation: 11 to 15 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 125 to 175 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Olney and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olney

Setting
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed deposit outwash

Typical profile
H1 - 0 to 10 inches: fine sandy loam
H2 - 10 to 20 inches: sandy clay loam
H3 - 20 to 25 inches: sandy clay loam
H4 - 25 to 60 inches: fine sandy loam

Properties and qualities
Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Zigweid

Percent of map unit: 9 percent
Hydric soil rating: No

Vona

Percent of map unit: 6 percent
Hydric soil rating: No

85—Water

Map Unit Composition

Water: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Aquolls

Percent of map unit: 5 percent
Landform: Marshes
Hydric soil rating: Yes

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Attachment C

USDA Official Series Description – Olney Series

LOCATION OLNEY CO+MT NE WY

Established Series
Rev. RHM-GB
04/2012

OLNEY SERIES

The Olney series consists of very deep, well drained soils that formed in eolian deposits. Olney soils are on plains, hills, and ridges in the Upper Arkansas Valley Rolling Plains MLRA 69. Slopes range from 0 to 15 percent. The mean annual precipitation is 13 inches (330 mm) and the mean annual air temperature is 52 degrees F. (11 degrees C.)

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Ustic Haplargids

TYPICAL PEDON: Olney loamy sand, rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 13 cm (0 to 5 inches); pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; neutral (pH 7.2); clear smooth boundary. (4 to 6 inches thick)

Bt1--13 to 30 cm (5 to 8 inches); brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; few faint clay films on faces of peds; neutral (pH 7.2); clear smooth boundary. (2 to 6 inches thick)

Bt2--30 to 41 cm (8 to 16 inches); brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, common faint clay films on faces of peds; slightly alkaline (pH 7.4); clear smooth boundary. (8 to 24 inches thick)

Btk--41 to 56 cm (16 to 22 inches); pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist, weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; few faint clay films on faces of peds; 3 percent gravel; common fine distinct threads of carbonate masses and carbonate coatings on the sand and pebble fragments in matrix; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary. (2 to 10 inches thick)

Bk1--56 to 61 cm (22 to 24 inches); very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; common fine distinct threads of carbonate masses in matrix; strongly effervescent; moderately alkaline (pH 8.2); gradual irregular boundary. (10 to 16 inches thick)

Bk2--61 to 200 cm (24 to 79 inches); pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few fine distinct carbonate masses in matrix; strongly effervescent; moderately alkaline (pH 8.2). (Several feet thick)

TYPE LOCATION: Crowley County, Colorado; approximately 300 feet west and 100 feet north of the SE corner of Sec. 18, T. 21 S., R. 59 W.; latitude 38 degrees, 12 minutes, 52.4 seconds north and longitude 104 degrees, 2 minutes, 40.7 seconds west; USGS Fowler topographical quadrangle, NAD 83.

RANGE IN CHARACTERISTICS:
Mean soil temperature: 9 to 12 degrees C. (49 to 54 degrees F.)
Soil moisture control section: moist March through May, intermittently moist June through August. The soil is driest December through February.

Soil moisture regime: aridic bordering on ustic
Depth to secondary calcium carbonate: 25 to 71 cm (10 to 28 inches)
Depth to the base of the Bt horizon: 36 to 100 cm (14 to 40 inches)
Organic carbon in the upper 15 inches averages about .7 to .8 percent and ranges from .3 to 2.0 percent.

Particle size distribution (weighted average)
Clay: 20 to 30 percent
Sand: 50 to 65 percent, dominantly fine sand and coarser
Silt: 10 to 20 percent

The A horizon:
Hue: 2.5Y through 7.5YR
Value: 4 through 6 dry, 3 through 5 moist
Chroma: 2 through 4
Clay content: 8 to 25 percent
Texture: loamy sand, sandy loam, or sandy clay loam
Rock fragment content: typically 0 but can range up to 5 percent fine gravel
Reaction: neutral or slightly alkaline

Bt horizon:
Hue: 2.5Y through 7.5YR
Value: 4 through 7 dry, 4 or 5 moist
Chroma: 2 through 4
Texture: sandy clay loam, clay loam, loam or sandy loam
Clay content: 18 to 35 percent
Sand content: 40 to 75 percent sand, with more than 35 percent fine sand or coarser.
Rock fragment content: 0 to 5 percent, dominantly fine gravel.
Reaction: neutral or slightly alkaline

Btk horizon:
Hue: 2.5Y through 7.5YR
Value: 5 through 7 dry, 5 or 6 moist
Chroma: 2 through 4
Texture: sandy loam, fine sandy loam, clay loam or sandy clay loam
Clay content: 15 to 35 percent
Sand content: 40 to 75 percent sand, with more than 35 percent fine sand or coarser.
Calcium Carbonate content: 1 to 5 percent
Rock fragment content: 0 to 10 percent, dominantly fine gravel.
Reaction: slightly alkaline or moderately alkaline

Bk horizons:
Hue: 10YR or 2.5Y
Value: 6 or 7 dry, 5 or 6 moist
Chroma: 3 or 4
Texture: sandy loam, loamy sand, fine sandy loam, sandy clay loam, or loam
Clay content: 3 to 25 percent
Rock fragment content: 0 to 15 percent, dominantly fine gravel
Reaction: moderately alkaline or strongly alkaline
Calcium carbonate content: 1 to 14 percent.

COMPETING SERIES: These include the Balon (AZ), Blancot (NM), Bowbac (WY), Buckle (NM), Cambria (WY), Cerropelon (NM), Chilerojo (NM), Chilojo (NM), Cumacho (NM), Cushman (WY), Decolney (WY), Doakum (NM), Forkwood (WY), Fort (CO), Gaddes (AZ), Gapmesa (CO), Hagerman (NM), Hagerwest (NM), Hiland (WY), Mentmore (NM), Oelop (NM), Palacid (NM), Penistaja (NM), Pokeman (WY), Potts (WY),

Pugsley (WY), Quagwa (AZ), Redpen (T)(NM), Spangler (WY), Sundance (CO), Tamarindo (NM), Teckla (WY), and Yenlo (CO) series.
Balon soils: average more than 15 percent rock fragments in the PSCS
Blancot soils: are dry in the moisture control section April to July.
Bowbac, Cerropelon, and Cushman soils: have a paralithic contact at depths of 20 to 40 inches.
Buckle soils: have less than 40 percent fine or coarser sand.
Cambria and Hiland soils: are dry in the moisture control section July through October.
Chilerojo and Chilojo soils: have a densic contact from 60 to 79 inches.
Cumacho soils: have a paralithic contact at depths of 40 to 60 inches.
Decolney soils: depth to carbonates is greater than 40 inches.
Doakum, Mentmore, and Penistaja soils: have a moisture control section that is driest May and June.
Forkwood and Fort soils: have less than 35 percent fine sand or coarser.
Gaddes and Pugsley soils: have a paralithic contact at depths of 20 to 40 inches and is leached of carbonates.
Gapmesa, Hagerman, and Hagerwest soils: have a lithic contact at depths of 20 to 40 inches.
Oelop soils: have less than 15 percent fine or coarser sand.
Palacid soils: the PSCS averages 30 to 40 percent sand.
Pokeman soils: have a paralithic contact at depths of 20 to 40 inches and accumulations of gypsum.
Potts and Tamarindo soils: have hues of 2.5YR or 5YR in the control section.
Quagwa soils: depth to the base of the Bt horizons is greater than 40 inches.
Redpen soils: are calcareous throughout.
Spangler soils: have a paralithic contact at depths of 20 to 40 inches and average less than 35 percent fine and coarser sand.
Sundance soils: have buried horizons at depths of 10 to 30 inches.
Teckla soils: have a fragmental discontinuity at depths of 20 to 40 inches.
Yenlo soils: have moisture control section that is dry from May 15 to July 15.

GEOGRAPHIC SETTING:
Landform: hills, ridges, and plains
Slopes: 0 to 15 percent
Parent material: eolian deposits and Ogallala or similar sediments.
Elevatation: 1219 to 1829 m (4,000 to 6,200 feet)
Mean annual precipitation: 254 mm to 356 mm (10 to 14 inches), of which 203 to 229 mm falls (8 to 9 inches) falls during the months of April through August.
Mean annual temperature: 8 to 12 degrees C. (47 to 54 degrees F.)
Frost-free season: 125 to 170 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Oterodry, Vonid, Haxtun and Valent soils. Oterodry and Vonid soils have a coarse-loamy control section. Haxtun soils have a mollic epipedon. Valent soils have a sandy control section.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained; low to medium runoff; moderately high or moderately low hydraulic conductivity.

USE AND VEGETATION: These soils are used primarily as nonirrigated or irrigated cropland, and as rangeland. Native vegetation is mainly blue grama, prairie sandreed, sidoats grama, needleandthread, threeawn, sand dropseed, and sand sagebrush. It is correlated to the Sandy Ecological Site Description R069SY026CO.

DISTRIBUTION AND EXTENT: Eastern Colorado and adjacent parts of Nebraska and Wyoming. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Denver, Colorado

SERIES ESTABLISHED: Big Horn County, Montana, 1971.

REMARKS: Diagnostic features recognized in this pedon include:
Argillic horizon: from 13 to 56 cm (5 to 22 inches).
Ochric epipedon: 0 to 13 cm (0 to 5 inches).
Secondary calcium carbonate: 41 to 200 cm (16 to 79 inches).

Remarks: Last updated by the state 12/1999. This update reflects the current format for official series descriptions.
LAN 2/2012 Update and changes of horizon nomenclature and range in characteristics is based on re-examination of correlation samples from the type location and extensive field work in MLRA 69. Also updated the competing series section.
The competing soils Blancot, Buckle, Doakum, Mentomre, and Penistala are primarily in Land Resource Region (LRR) D.
The competing Yenlo soils are in LRR E.

Taxonomic Version: Eleventh Edition, 2010

National Cooperative Soil Survey
U.S.A.