CHAPTER 2
SOILS

2.10 Introduction

This chapter contains pertinent information relating to identification, management, and reclamation activities associated with the soil resources present in the disturbed area of the Wellington Dry-Coal Cleaning Facility.

2.20 Environmental Description

The Wellington Dry-Coal Cleaning Facility lies in central Utah in the lowlands south of the Book Cliffs and north of the San Rafael Swell. Topography is dominated by broad plains and pediment surfaces dissected by small drainages. The dominant surficial geologic formation at the site is the Mancos Shale, of which the Blue Gate member is present at the surface in this location. The Blue Gate member is dominated by shales with some siltstones and minor sandstone bedding. The drainages are often filled with alluvial and slope wash deposits (Weiss et al, 1990). Surface elevations at the site range from about 5,530 to about 5,500 feet above sea level. Due to thin soils and shortage of irrigation water, most areas near the facility are not used to grow crops. Photographs taken of the area prior to facility construction are provided in Appendix 2-1.

Soils in the area have formed from residual shale particles that mixed as they migrated down slope. Soils are usually shallow to very shallow, and consist predominantly of silty clay loams. The inherent erosion hazard from water is moderate (Jensen and Borchert, 1988).

2.2.1 Prime Farmland Investigation

No prime farmland soils are located within the Wellington Dry-Coal Cleaning Facility disturbed area (Jensen and Borchert, 1988). In surrounding undisturbed areas, native vegetation is very sparse. Furthermore, the disturbed area has been zoned for general industrial use by Carbon County, which allows for coal-cleaning activities at this site.
2.2.2 Soil Survey

In accordance with the agreement between DOGM and the prior owner, soils data for the Wellington Dry-Coal Cleaning Facility disturbed area have been taken from previously published information (Jensen and Borchert, 1988). Soil survey data are presented in Appendix 2-2, and are herein summarized in Sections 2.2.2.1 and 2.2.2.2. Survey data include the following information: taxonomic classification, typical pedon, ranges of mineral and particle size characteristics, competing series, and geographic setting (Appendix 2-2). Prior to any future disturbance of currently-undisturbed areas of the site, soil samples will be collected from the area to be affected. These samples will be analyzed according to DOGM guidelines then in affect.

2.2.2.1 Soils Map

Figure 2-1 delineates the soil types present in the disturbed and adjacent areas.

2.2.2.2 Soil Identification

According to the Soil Survey of Carbon Area, Utah (Jensen and Borchert, 1988), the Wellington Dry-Coal Cleaning Facility disturbed area is located largely on soils classified as the Persayo-Chipeta Complex with some soils classified as the Killpack Clay Loam on its eastern edge. The Persayo-Chipeta Complex (Map Unit 80) consists of light brownish-grey, shallow, well-drained soils that formed in shale. Permeability is slow to moderately slow and the soil is slightly to moderately alkaline. The potential for water erosion is moderate to high, and the potential for blowing soil is moderate. Large-scale agricultural use or revegetation of the Persayo-Chipeta Complex is not considered practical due to its fine texture and the low amount of precipitation that it receives (Jensen and Borchert, 1988). Additional information for the Persayo and Chipeta soils is included in Appendix 2-2.

The Killpack Clay Loam (Map Unit 59) consists of grayish-brown, moderately deep, well-drained soils that have formed as residuum from shale. Permeability is slow and the soil is mildly alkaline. The potentials for water erosion and blowing soil are moderate. Like the Persayo-Chipeta Complex, revegetation of the Killpack Clay Loam is not considered practical due to its fine texture...
and the low amount of precipitation that it receives (Jensen and Borchert, 1988). Additional information for the Killpack Clay Loam is included in Appendix 2-2.

2.2.2.3 Soil Description

In accordance with the agreement between the prior owner and DOGM, no site-specific soil survey was performed. Thus, no further descriptions of soils are included.

2.2.2.4 Soil Productivity

Under favorable conditions, Jensen and Borchert (1988) indicate that Killpack soils can produce 700 lb/acre (dry weight) of rangeland vegetation. They report that production rates of 500 and 300 lb/acre can be expected under normal and unfavorable conditions. The Persayo-Chipeta Complex has a rangeland vegetation productivity of 300 to 400 lb/acre under favorable conditions, dropping to 100 to 150 lb/acre under unfavorable conditions.

2.2.3 Prime Farmland Soil Characterization

The published soil survey indicates that soil within the disturbed area does not qualify as prime farmland (Jensen and Borchert, 1988).

2.2.4 Substitute Topsoil

The Applicant segregated topsoil from the site prior to disturbance and, therefore, does not propose to use substitute topsoil during reclamation. Since the use of substitute topsoil is not anticipated, no field trials or other tests of suitability are anticipated.
2.30 Operation Plan

2.3.1 General Requirements

2.3.1.1 Removing and Storing Soil Methods

The Wellington Dry-Coal Cleaning Facility has been operating periodically since January 2006. At the time the facilities were constructed, topsoil was segregated and stored in stockpiles located within the main yard of the facility. Due to the thin nature (less than 6 inches thick) and relatively poor quality of the soil, it was not segregated by soil horizon. All of the segregated soil will be treated as topsoil in compliance with R614-201-234.300.

2.3.1.2 Suitability of Topsoil Substitutes/Supplements

No topsoil substitutes or supplements are planned to be used at the facility.

2.3.1.3 Testing of Topsoil Handling and Reclamation Procedures

The facility is located in an area zoned for general industrial purposes, and is expected to be used for other industrial activities after the dry-coal cleaning operation is shut down. Hence, total site reclamation is not anticipated.

For those areas of the site where reclamation will occur, BRC Wellington will exercise care to guard against erosion during and after application of topsoil and will employ the necessary measures to ensure the stability of topsoil on graded slopes. Erosion control measures will include surface roughening and erosion mat placement on slope areas thought to be unstable. The Applicant will fill, regrade, or otherwise stabilize any rills or gullies deeper than 9 inches which form in areas which have been regraded and topsoiled. The areas adjacent to any rills or gullies which have been filled, regraded or otherwise stabilized will be reseeded or stabilized appropriately.
2.3.1.4 Construction, Modification, Use, and Maintenance of Topsoil Stockpiles

The two topsoil storage piles at the facility were constructed in August 2005 and consist of 1,302 cubic yards of soil that was removed from the ground surface during site grading prior to constructing the facility. Since the topsoil averaged less than six inches thick, it was not segregated before it was stockpiled. The stockpiled materials were initially placed on a stable surface in the southeast portion of the permit area but were then moved in October 2010 to the location indicated on Plate 5-1 to accommodate site activities. The west stockpile contains 302 yd$^3$ of topsoil and the southwest stockpile contains 1,000 yd$^3$ of topsoil. The stockpiles were protected from wind and water erosion by being revegetated on November 18, 2010 with the seed mix contained in Table 3-1 (minus *Eriogonum inflatum*, *Oenothera caespitosa*, and *Stipa hymenoides* due to a lack of availability at the time) and by installing silt fencing below the stockpiles to help trap sediment coming off the stockpiles. A marker has been placed on the piles to indicate that they contain topsoil. It is not anticipated that this topsoil will be moved or disturbed again until required for redistribution during final reclamation.

2.3.2 Topsoil and Subsoil Removal

2.3.2.1 Topsoil Removal and Segregation

It is not anticipated that additional soil disturbances will occur at the site. However, if such disturbances do occur, all topsoil thicker than 6 inches will be removed prior to disturbance as a separate layer from the subsoil, segregated, and stockpiled separately. Topsoil less than 6 inches thick will be removed according to Section 2.3.2.3.

2.3.2.2 Poor Topsoil

Topsoil that is of an insufficient quantity or of poor quality (for sustaining vegetation) will be removed as a separate layer and segregated. Such operations will be done with approval of DOGM and in compliance with R614-301-233.100.

2.3.2.3 Thin Topsoil

Topsoil to be removed that is less than 6 inches thick will be removed with the immediately underlying unconsolidated materials. This material mixture will be treated as topsoil.
2.3.2.4 Minor Disturbances Not Requiring Topsoil Removal

**Small Structures.** Topsoil will not be removed prior to construction resulting in only minor disturbances. Such construction activities include work on small structures such as power poles, signs, fence lines, and other small structures.

**Vegetation.** BRC Wellington will not remove topsoil for minor disturbances where such activity will not destroy vegetation or cause erosion.

2.3.2.5 Subsoil Segregation

Due to the poor quality of the subsoil, the B and C soil horizons will not be individually segregated and stockpiled.

2.3.2.6 Timing

Soil removal will take place after all vegetation has been removed that could interfere with soil salvage. Surface disturbance activities will take place after the soil has been removed.

2.3.2.7 Topsoil and Subsoil Removal Under Adverse Conditions

In areas of surface disturbance where sufficient topsoil is present, topsoil and subsoil will be removed separately and segregated, except where natural conditions render such operations hazardous.

**Conventional Machines.** In localities where steep grades, adverse terrains, severe rockiness, limited depth of soils, or other adverse conditions exist that render soil removal and segregation activities using conventional machines hazardous, soils will not be salvaged and stockpiled.

**Substitute Topsoil.** Importing of substitute topsoil will not be required.
2.3.3 Topsoil Substitutes and Supplements

2.3.3.1 Overburden Materials Supplementing and/or Replacing Topsoil

No overburden materials will be used in site reclamation.

2.3.3.2 Suitability of Topsoil Substitutes and Supplements

No topsoil substitutes or supplements are planned for use at the facility.

2.3.3.3 Physical and Chemical Analyses

No topsoil substitutes or supplements are planned for use at the facility. Hence, no physical or chemical analyses of substitute material are anticipated.

2.3.3.4 Testing of Substitute Topsoil

Since it will not be used at the site, no testing of substitute topsoil is anticipated.

2.3.4 Topsoil Storage

2.3.4.1 Topsoil Stockpiling

Topsoil that was removed from the area during site grading is stored in two on-site stockpiles (Section 2.3.1.4). Any topsoil removed from the site in the future will be stockpiled for later use in reclamation operations when it is impractical to promptly redistribute the topsoil on regraded areas.

2.3.4.2 Stockpiled Topsoil

Stable Stockpile Site. The topsoil removed from the site is stored in two small stockpiles (approximately 5,500 square feet each), located in a stable area in the southern portion of the permit area.
Protection from Contaminants and Compaction. Stockpiled topsoil will be located in areas away from traffic that might introduce contaminants and unnecessary compaction.

Wind and Water Erosion Protection. The topsoil stockpile will be protected from wind and water erosion by prompt establishment and maintenance of a vegetative cover. Silt fencing or a soil berm with a minimum height of 1 foot will be installed below the stockpile to help trap sediment runoff from the stockpile.

Topsoil Redistribution. No stockpiled topsoil will be moved until redistributed during reclamation operations unless approved by DOGM.

2.3.4.3 Topsoil Stockpile Relocation

Stockpiled topsoil in jeopardy of being detrimentally affected in terms of its quantity and quality by facility operations may be temporarily redistributed.

Host Site. Topsoil relocation may occur provided that such action does not permanently adversely affect topsoil of the host site.

Topsoil Suitability. Topsoil relocation may occur provided the topsoil is retained in a condition more suitable for redistribution than if stockpiled.

2.40 Reclamation Plan

2.4.1 General Requirements

Topsoil redistribution, amendments, and stabilization are discussed below.

2.4.2 Soil Redistribution

2.4.2.1 Soil Redistribution Practices

Under the industrial post-operation land-use scenario, the extent of the future redistribution of soil resources following facility shutdown is not currently known. However, for the sake of
developing a reclamation cost estimate, it is assumed in this permit application that the 9.7-acre area south of the facility loop road will be reclaimed, with the runoff- and sediment-control structures being retained for use by the future landowner. For areas of the site that may be reclaimed, the topsoil will be redistributed following removal of all structures not part of the post-operation land use and regrading of the site. Due to the high clay content and sodicity of the soils, no reclamation grading or redistribution of topsoil will occur when the soil is too wet to adequately handle. As described in 2.4.2.3, roads, storm water impoundments, and their appurtenant drainage channels will be left in place to support the post-operation land use.

2.4.2.2 Regrading

Since the facility is essentially level, extensive site regrading will not be performed following its closure. The topographic configuration of the plant area will be left essentially unchanged for the subsequent landowner.

2.4.2.3 Topsoil Redistribution on Impoundments and Roads

On-site storm water impoundments and roads will be left in place to support the post-operation land use.

2.4.3 Soil Nutrients and Amendments

No soil nutrients or amendments will be applied.

2.4.4 Soil Stabilization

2.4.4.1 Protection and Stabilization of Surface Areas

The site has no unstable grades. Since there will be no substantial regrading of the site upon closure, no protection or stabilization of surface areas will be required.
2.4.4.2 Mulch Application

In support of the post-operation land use, no substantial regrading or redistribution of topsoil is anticipated upon site closure. If topsoil is redistributed over an area, revegetation of this soil will be promoted via surface roughening and (potentially) the application of erosion mats, rather than through the application of mulch.

2.4.4.3 Rills and Gullies

Low slope angles and drainage diversions retained on the site will minimize the potential for rills and gullies to form following closure.

2.50 Performance Standards

2.5.1 Topsoil, Subsoil, and Topsoil Supplements Management

All topsoil, subsoil, and topsoil supplements shall be managed as outlined in Sections 2.30 and 2.40.

2.5.2 Stockpiled Topsoil and Subsoil

All stockpiled topsoil and subsoil will be managed according to plans outlined in Sections 2.30 and 2.40.
REFERENCES


APPENDIX 2-1

Pre-Disturbance Photographs
Photo 1 - North Property Boundary Facing West, Ridge Road on Right

Photo 2 - Overview of Property Facing Southwest

Job #0484-001- 1865 West Ridge Road, Wellington, Utah
Photo 3- East Property Boundary Facing South

Photo 4- Southwest Property Boundary Facing North

Job #0484-001- 1865 West Ridge Road, Wellington, Utah
Photo 5- Overview of Property

Photo 6- Septic Tank
APPENDIX 2-2

Published Soil Survey Information
**Official Series Description - CHIPETA Series**

**CHIPETA SERIES**

The Chipeta series consists of very shallow and shallow, well drained, slowly permeable soils that formed in residuum and colluvium from shale. Chipeta soils are on upland pediments and hills and have slopes of 0 to 35 percent. The average annual precipitation is about 7 inches and the mean annual temperature is about 50 degrees F.

**TAXONOMIC CLASS:** Clayey, mixed, active, calcareous, mesic, shallow Typic Torriorthents

**TYPICAL PEDON:** Chipeta silty clay loam -cultivated. (Colors are for air-dry soil unless otherwise noted.)

- Ap--0 to 5 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine ubangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few fine discontinuous pores; violently effervescent; slightly alkaline (pH 7.7); clear smooth boundary. (1 to 5 inches thick)

- C--5 to 13 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; hard, very firm, sticky and plastic; few fine and medium roots; few large continuous pores, few fine discontinuous pores; violently effervescent; slightly alkaline (pH 7.6); clear wavy boundary. (6 to 10 inches thick)

- Cy--13 to 17 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, moderately thick platy structure parting to weak medium blocky; hard, very firm, sticky and plastic; few fine and medium roots; many fine crystals and mycelia-like veins of gypsum; 20 percent unweathered shale fragments; violently effervescent; slightly alkaline (pH 7.4); gradual irregular boundary. (3 to 5 inches thick)

- Cr--17 inches; weathered marine shale.

**TYPE LOCATION:** Emery County, Utah; 1 mile south and 1-1/2 miles east of Castle Dale, 1,000 feet south and 20 feet east of the northwest corner, sec. 11, T. 19 S., R. 8 E.

**RANGE IN CHARACTERISTICS:**
- Soil moisture regime: Typic Aridic.
- Soil temperature regime: Mesic.
- Depth to shale: 5 to 20 inches.
- Salinity: moderate to strong.
- Particle-size control section: 35 to 50 percent clay.
- Mean annual soil temperatures: 49 to 57 degrees F.
- Reaction: slightly alkaline to strongly alkaline.

**A horizon:**
- Hue: 10YR to 5Y
- Value: 5 to 8 dry, 3 to 6 moist
- Chroma: 2 to 4
- Texture: loam or silty clay loam

**C horizon:**
- Hue: 10YR to 5Y
- Value: 4 to 6 dry, 3 to 5 moist
- Chroma: 1 to 4
- Textures: silty clay loam or silty clay
- Gypsum: 0.5 to 10 percent and gypsum crystal ranges from few to many.

**COMPETING SERIES:** This is the Chipenhill series. Chipenhill soils have more than 10 percent gypsum.

**GEOGRAPHIC SETTING:** These soils are on gently sloping to steep upland pediments and hills. Slopes are complex and range from 0 to 35 percent. These soils formed in residuum from alkaline marine shales containing gypsum. The climate is semiarid. The mean annual temperature is 45 to 55 degrees F. The freeze-free period ranges from 90 to 160 days. Mean annual precipitation ranges from 5 to 11 inches.
GEOGRAPHICALLY ASSOCIATED SOILS: These are the Killpack, Persayo, and Libbings soils. Killpack soils: have fine-silty particle-size control sections. Persayo soils: have loamy particle-size control sections. Libbings soils: have a salic horizon.

DRAINAGE AND PERMEABILITY: Well drained; medium to very high runoff; slow permeability.

USE AND VEGETATION: A few of the smoother areas of deeper soil are irrigated and used for growing grain and hay crops. Potential vegetation is mat saltbush and galleta.

DISTRIBUTION AND EXTENT: Western Colorado, Wyoming, eastern Utah, and New Mexico. LRR D, MLRA 34. The series is extensive.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado


REMARKS:
All pH values given are of soil paste.
Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon-the zone from the surface to 5 inches (Ap horizon)
Shallow feature-weathered shale at 17 inches (Cr horizon)

National Cooperative Soil Survey
U.S.A.
Official Series Description - KILLPACK Series

KILLPACK SERIES

The Killpack series consists of moderately deep, well drained, slowly permeable soils that formed in alluvium and residuum from saline marine shale. Killpack soils are on sideslopes and toeslopes of rolling shale hills. Slopes are 1 to 25 percent. Average annual precipitation is about 7 inches and mean annual temperature is about 52 degrees F.

TAXONOMIC CLASS: Fine-silty, mixed, active, calcareous, mesic Typic Torriorthents

TYPICAL PEDON: Killpack clay loam, cropland. (Colors are for air-dry soil unless otherwise noted.)
Ap--0 to 9 inches; brownish gray (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and fine granular structure; hard, firm, slightly sticky and slightly plastic; common fine roots; common fine pores; strongly calcareous; mildly alkaline (pH 7.8); clear smooth boundary. (6 to 9 inches thick)
C--9 to 23 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; moderate coarse subangular blocky parting to weak fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine pores; strongly calcareous; mildly alkaline (pH 7.7); gradual wavy boundary. (8 to 21 inches thick)
Cy--23 to 29 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, very firm, sticky and plastic; few fine roots; strongly calcareous; mildly alkaline (pH 7.7); many gypsum crystals 5 to 15mm in diameter; gradual wavy boundary. (6 to 10 inches thick)
Cr--29 inches; light brownish gray weathered shale.

TYPE LOCATION: Emery County, Utah; 2 miles northwest of Elmo, northeast of the Elmo road and the Cleveland-Price road; 2,450 feet north and 300 feet east of the SW corner of sec. 30, T. 16 S., R. 10 E.

RANGE IN CHARACTERISTICS: Soil temperatures are more than 47 degrees F. Depth to shale bedrock ranges from 20 to 40 inches. There is a few to common gypsum crystals accumulated immediately above the shale. Clay minerals are mixed but dominantly illite and kaolinite. The particle-size control section ranges from silty clay loam to silt loam with 18 to 35 percent clay.
The A horizon has hue of 10YR through 5Y, dry value of 5 or 6, moist value of 4 or 5, and chroma of 2 through 4. The C horizon has hue of 10YR through 5Y, value of 5 through 7 dry, 3 through 7 moist, and chroma of 2 through 4. The Cy horizon has the same color as the C horizon and contains 5 to 15 percent shale channers.

COMPETING SERIES: These are the Rosney, Sagers and Swingler series. Rosney, Sagers and Swingler soils are deeper than 40 inches to bedrock.

GEOGRAPHIC SETTING: These soils are on the gentle sideslopes of rolling shale hills. Slope gradients range from 1 to 25 percent. Killpack soils formed in alluvium and residuum from saline marine shale. The climate is semiarid with mean annual temperature of 47 to 55 degrees F. Mean annual precipitation ranges from 5 to 11 inches.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Chipeta, Persayo, Billings and Libbings soils. Chipeta and Persayo soils are less than 20 inches deep over shale. Billings soils are very deep and developed in alluvium. Libbings soils have salic horizons above a depth of 20 inches.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; slow permeability.
USE AND VEGETATION: Cultivated areas are used for grain, alfalfa hay, and irrigated pasture. The remaining areas are used for rangeland. Potential vegetation is shadscale, greasewood, galleta grass, and gardner saltbush.

DISTRIBUTION AND EXTENT: Eastern Utah and western Colorado. The series is moderately extensive.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES ESTABLISHED: Emery County, Utah, 1972.

REMARKS: The pH values were determined of soil paste.

National Cooperative Soil Survey
U.S.A.
Official Series Description - PERSAYO Series

PERSAYO SERIES

The Persayo series consists of shallow, well drained soils on hills, terraces, and ridges. These soils formed in thin sediments weathered from underlying soft sedimentary bedrock. Slopes are 1 to 45 percent. The mean annual precipitation is about 9 inches and the mean annual temperature is about 51 degrees F.

TAXONOMIC CLASS: Loamy, mixed, active, calcareous, mesic, shallow Typic Torriorthents

TYPICAL PEDON: Persayo silty clay loam - grassland. (Colors are for dry soil unless otherwise noted.)
A--0 to 4 inches; light yellowish brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) moist; moderate fine granular structure, weak platy in the upper 1/2 inch; soft, very friable; calcareous; moderately alkaline (pH 8.2); gradual smooth boundary. (3 to 7 inches thick)
C--4 to 14 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure parting to moderate fine granules; hard, very friable; few small calcium sulfate crystals; calcareous; moderately alkaline (pH 8.2) gradual smooth boundary. (7 to 14 inches thick)
Cr--14 inches; calcareous; gray and yellow shale and siltstone.

TYPE LOCATION: Montrose County, Colorado; 0.1 mile north of the southeast corner of Sec. 22, T. 51 N., R. 10 W.

RANGE IN CHARACTERISTICS:
These soils are dry in all parts of the moisture control section for more than three-fourths of the time that the soil temperature is above 41 degrees F.
Moisture regime: Typic Aridic.
Mean annual soil temperature: 47 to 58 degrees F.
Mean summer soil temperature: 60 to 75 degrees F.
Depth to paralithic contact: 4 to 20 inches.
Organic carbon: approximately .4 percent.
The sand/clay ratio: less than 1 to about 3.
Exchangeable sodium: typically less than 3 percent, but tends to increase as depth increases and differs among pedons.
Calcium carbonate equivalent: 5 to 14 percent. Calcium sulfate: less than 1 to about 10 percent.
Particle-size control section (weighted average): Texture: silt loam, loam, clay loam, or silty clay loam.
Clay content: 18 to 35 percent.
Silt content: 30 to 65 percent.
Sand content: 5 to 45 percent.
Coarse fragments: usually less than 5 percent and range from 0 to 15 percent.

A horizon
Hue: 10YR to 5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 through 4
Reaction: slightly to strongly alkaline
Consistence: soft to slightly hard.

C horizon
Hue: 10YR through 5Y
Value: 5 or 6 dry, 4 or 5 moist
Chroma: 2 to 4
Reaction: slightly alkaline to strongly alkaline. It contains some visible calcium carbonate and gypsum which are not concentrated into a definite horizon of secondary accumulation and are considered to be characteristics of the parent sediments rather than pedogenic.
COMPETING SERIES: This is the Shalet series. Shalet soils have hues redder than 7.5YR.

GEOGRAPHIC SETTING: These soils are on upland hills, terraces, and ridges. Slopes range from 1 to 45 percent. The soil formed in thin sediments weathered from underlying soft sedimentary bedrock. Elevation ranges from 5,000 to 6,800 feet. At the type location mean annual precipitation is 7 to 11 inches with peak periods of precipitation occurring during the late summer. Mean annual temperature ranges from 47 to 53 degrees F., and mean summer temperature is about 66 to 70 degrees F. Frost-free period ranges from 95 to 150 days. In Utah this soil has a mean annual precipitation of 6 to 8 inches, mean annual temperature of 48 to 50 degrees, and a frost-free season of 115 to 140 days at an elevation of 5,300 to 6,200 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Chipeta and Menoken soils. Chipeta soils have more than 35 percent clay in the series control section. Menoken soils lack bedrock above a depth of 20 inches and have cambic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderate or moderately slow permeability.

USE AND VEGETATION: These soils are used almost exclusively for native pastureland. Native vegetation is salt sage, greasewood, shadscale, and scattered grasses.

DISTRIBUTION AND EXTENT: Western Colorado and Wyoming, northwestern New Mexico, and eastern Utah. The series is of large extent. MLRA 35.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES ESTABLISHED: Western Colorado Reconnaissance, W95, 1939.

REMARKS: Diagnostic horizons and features recognized in this pedon are: Paralithic contact - at about 14 inches. Classified according to Keys to Soil Taxonomy Ninth Edition, 2003

National Cooperative Soil Survey
U.S.A.