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UNDERGROUND MINING
AND RECLAMATION PLAN
CARBON COUNTY MINES
CARBON COUNTY, UTAH
APPENDIX F
SOIL SURVEY STUDY

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SOIL SURVEY STUDY

FOR

HELPER, UTAH COAL PROPERTY

INTRODUCTION

This Soil Survey Study has been made as required by the Surface Coal Mining and Reclamation Operations Program, March 1979. The new regulations require that a soil survey of permit areas be made.

Thirteen backhoe pits were dug in five designated areas. The location of the pits is shown on Figure 1. The soils in Crandall Canyon and on the mountainsides surrounding the study areas were in their normal conditions--hence could be described as soils. The other areas consisting of mostly fill material are classified as a miscellaneous land type or made land.

CRANDALL CANYON

Pits 1, 2, and 3 were taken in Crandall Canyon. A proposed mine shaft is to be located in this area. The soils are a mixture of two kinds. Pits 1 and 3 are Kornman (like) being in a coarse-loamy, mixed, mesic family of Ustic Torrefluvents. The other soil is similar except that it has about 35 percent coarse fragments (by volume), mainly boulders, throughout the profile. This soil is in a loamy-skeletal, mixed, calcareous, mesic family of Ustic Torrefluvents.

These soils are only moderately errosive and are designated as K1. Soils in this area should be compatible with locating a mine shaft.

Descriptions of the soils in the three (3) pits follows:

Pit 1. Lower part of the shaft site in Crandall Canyon area (Figure 2). Vegetation is grasses with some big sagebrush. The soil is formed in alluvium derived from mixed sedimentary rocks, mainly sandstone, shale and limestone. The soil is well drained, has no appreciable amount of soluble salt but has occasional boulders on the surface.

Soil Profile:

A1 horizon, 0 to 4 inches - light brownish gray (10 YR 6/2) loam having about 20 percent clay, dark grayish brown (10 YR 4/2) when moist; moderate medium platy structure; soft, friable, slightly sticky, slightly plastic; moderate effervescence with acid, mildly alkaline (pH 7.5); abrupt smooth lower boundary. No coarse fragments other than occasional boulders.

C1 horizon, 4 to 9 inches - light brownish gray (10 YR 6/2) gravelly fine sand, having about 5 percent clay, dark grayish brown (10 YR 4/2) when moist; single grain, loose, nonsticky, nonplastic; moderate effervescence with acid; mildly alkaline (pH 7.5); abrupt smooth lower boundary. Soil has about 20 percent gravel.

C2 horizon, 9 to 27 inches - light brownish gray (10 YR 6/2) sandy loam having about 110 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; soft, very friable, slightly sticky, nonplastic; strong effervescence with acid; mildly alkaline (pH 7.5); abrupt smooth lower boundary. Soil has no coarse fragments.

C3 horizon, 27 to 35 inches - light brownish gray (10 YR 6/2) clay loam having about 29 percent clay, dark grayish brown (10 YR 4/2) when

moist; massive; hard, firm, sticky and plastic; strong effervescence; mildly alkaline (pH 7.5); clear smooth lower boundary. No coarse fragments.

C4 horizon, 35 to 37 inches - light brownish gray (10 YR 6/2) sandy loam having about 9 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; soft, very friable, slightly sticky, nonplastic; strong effervescence; mildly alkaline (pH 7.5); abrupt smooth lower boundary. No coarse fragments.

C5 horizon, 37 to 40 inches - light brownish gray (10 YR 6/2) gravelly loamy sand having about 5 percent clay, dark grayish brown (10 YR 4/2) when moist; single grain; loose, nonsticky, nonplastic; strong effervescence; abrupt smooth lower boundary. Soil has about 20 percent coarse fragments.

C6 horizon, 40 to 50 inches - light brownish gray (10 YR 6/2) loamy sand having about 5 percent clay, dark grayish brown (10 YR 4/2) when moist; massive, loose, nonsticky, nonplastic; strong effervescence; abrupt smooth lower boundary. No coarse fragments.

A1b horizon, 50 to 53 inches - very dark gray (2.5 Y 3/1) loam, having about 25 percent clay, black (2.5 Y 2/1) when moist; massive; slightly hard, friable, slightly sticky, slightly plastic; strong effervescence; abrupt smooth lower boundary. No coarse fragments.

C7b horizon, 53 to 58 inches - light brownish gray (10 YR 6/2) sand having about 5 percent clay, dark grayish brown (10 YR 4/2) when moist; single grain; loose, nonsticky, nonplastic; violent effercescence; abrupt smooth lower boundary. No coarse fragments.

IIA1b horizon, 58 to 67 inches - very dark gray (2.5 Y 3/1) loam having about 25 percent clay, black (2.5 Y 2/1) when moist; massive, soft, friable, slightly sticky, slightly plastic, moderate effervescence.

Pit 2. Upper end of the propsed shaft site in Crandall Canyon (Figure 2). Native vegetation is big sagebrush, cottonwood, yellowbrush and grasses. Climate is semidesert, soil forming in alluvium derived from mixed sedimentary rocks (sandstone, shale and limestone) in a stream bottom. It is well drained on east facing 3 percent slope. Roots penetrate to 5 feet. Erosion is slight and permeability moderate.

Soil Profile:

A1 horizon, 0 to 5 inches - light brownish gray (10 YR 6/2) sandy loam having about 15 percent clay, dark grayish brown (10 YR 4/2) when moist; moderate medium platy structure; soft, very friable, slightly sticky, nonplastic; strong effervescense with acid; mildly alkaline (pH 7.5); abrupt smooth lower boundary. About 15 percent coarse fragments, mostly boulders.

C1 horizon, 5 to 17 inches - light brownish gray (10 YR 6/2) loam having about 22 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; hard, friable, slightly sticky, slightly plastic, violent effervescence; abrupt smooth lower boundary. About 15 percent boulders.

C2 horizon, 17 to 26 inches - light brownish gray (10 YR 6/2) very gravelly sandy loam with about 17 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; hard, very friable, nonsticky, nonplastic; violent effervescence; clear wavy lower boundary. Soil contains about 60% coarse fragments of which about 15 percent is boulders.

C3 horizon, 26 to 32 inches - light brownish gray (10 YR 6/2) light sandy loam with about 12 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; soft, very friable, nonsticky, nonplastic; violent effervescence; abrupt smooth. lower boundary. Soil contains about 15 percent boulders.

A1b horizon, 32 to 46 inches - dark gray (2.5 Y 4/1) sandy loam with about 10 percent clay, very dark gray (2.5 Y 3/1) when moist; massive, slightly hard, friable, slightly sticky, slightly plastic; strong effervescence; gradual wavy lower boundary. Horizon has about 30 percent stones and boulders.

C4b horizon, 46 to 89+ inches - light brownish gray (10 YR 6/2) very stony sandy loam with about 15 percent clay, dark grayish brown (10 YR 4/2) when moist; massive; hard, friable, slightly sticky, nonplastic coarse fragments make up 80 percent of horizon and consist of stones and boulders.

Pit 3. 200 feet west of Pit 2, on an alluvial fan in Crandall Canyon, (Figure 2). Vegetation consists of big sagebrush, stipa, houndstongue, and snowberry. Climate is semi-desert. Slope is about 6 percent. Roots penetrate to 6 feet.

01 horizon, 0 to 3 inches - litter.

A1 horizon, 0 to 7 inches - light brownish gray (10 YR 6/2) loam, with about 22 percent clay, dark grayish brown (10 YR 4/2) when moist; moderate, medium platy structure; slightly hard, friable, slightly sticky, slightly plastic; strong effervescence with acid; mildly alkaline (pH 7.5); clear wavy lower boundary. Horizon has 5 percent coarse fragments.

C1 horizon, 7 to 13 inches - light brownish gray (10 YR 6/2) sandy loam, having about 15 percent clay, dark grayish brown (10 YR 4/2) when moist; weak platy structure; soft friable, slightly sticky, nonplastic; strong effervescence; mildly alkaline (pH 7.5); gradual wavy lower boundary.

C2 horizon, 13 to 80+ inches - this consists of stratified layers of sandy loam and light loam textures each ranging from 2 to 4 inches thick. Colors are the same as the C1 horizon. The sandy loam layers are massive; loose, very friable, nonsticky, nonplastic; violent effervescence. They have about 10 percent stones. The light loam layers are massive; slightly hard, very friable, slightly sticky, slightly plastic; moderate effervescence. They have about 15 percent stones. There is evidence of a buired A1 horizon at 72 inches.

WILLOW CREEK

Pits 4 and 5 at the proposed Mine #6 location (Figure 3). This area has been leveled by cutting into the mountain on the north side and filling the valley side on the south. Pit No. 4 represents the cut area and Pit No. 5 represents the fill area of the leveling project. Pit 4 was cut into bedrock of interlayered sandstone, limestone, siltstone and shale. The shale rock has weathered somewhat. The backhoe was able to dig 40 inches into the bedrock. This area is shown on Figure 3 as M1 (made land #1).

The following is the description of the materials from Pit No. 5.

Pit 5. Outer edge of flat area in fill material. Area is essentially barren of vegetation.

0 to 12 inches - consists of light brownish gray (10 YR 6/2) very stony sandy loam, dark grayish brown (10 YR 4/2) when moist. There is no structure (massive). This layer is extremely hard when dry and contains about 60 percent stones.

12 to 33 inches - consists of very pale brown (10 YR 7/3) very gravelly heavy sandy loam having about 17 percent clay, brown (10 YR 5/3) when moist. This layer has about 50 percent gravel and stones.

23 to 35 inches - consists of dark gray (2.5 Y 4/1) very cobbly loam mixed with coal dust. It is extremely hard when dry and has an estimated 20 percent clay and 70 percent cobble and other coarse fragments.

35 to 96+ inches - consists of light reddish brown (5 YR 6/3) very bouldery clay, reddish gray (5 YR 5/3) when moist. It has an estimated 60 percent boulders.

The lower boundaries are abrupt and smooth.

The mountainside to the north has a slope of about 60 percent and consists of shallow soil (less than 20 inches over bedrock) with juniper, big sagebrush, rabbitbrush and grasses. The soil in Castle Valley is extremely rocky very fine sandy loam. It is shown on the maps as C. This soil has an A1 horizon about 2 inches thick of extremely rocky very fine sandy loam. It has a B2t horizon from 2 to 5 inches of gravelly very fine sandy loam; a B2ca horizon from 5 to 10 inches of gravelly very fine sandy loam over sandstone bedrock at 10 inches. A profile description follows:

A1 horizon, 0 to 2 inches - brown (10 YR 5/3) loamy very fine sand, dark yellowish brown (10 YR 4/4) when moist; weak, thick, platy structure; soft, very friable, nonsticky, and nonplastic; few fine and few medium alkaline (pH 7.6); clear, smooth boundary.

B2t horizon, 2 to 5 inches - brown (10 YR 5/3) gravelly very fine sandy loam, dark brown (10 YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few medium and few fine roots; few fine pores; few thin, patchy clay films; noncalcareous; mildly alkaline (pH 7.5); clear, smooth boundary.

B2ca horizon, 5 to 10 inches - brown (10 YR 5/3) gravelly very fine sandy loam, dark yellowish brown (10 YR 4/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few medium and few fine roots and pores; many sandstone fragments; moderately calcareous; mildly alkaline (pH 7.6); abrupt, wavy boundary.

R horizon, 10 inches + - sandstone, bedrock.

CASTLE GATE PREPARATION PLANT AREA

This area consists of made land called made land #2 and shown on the maps as M2. It is mainly filled with materials high in coarse fragments and is represented by Pits 6 through 10.

Pit 6 is about 400 feet east of power substation in a canyon area that has been filled (Figure 4). The outer edge has been filled with trash. The pit in the south part showed the fill consisted of about 60 percent cobble and stones with loam, soil, bottles, wire and other trash. The mountain north of pit 6 is Castle Valley, extremely rocky, very fine sandy loam soil as previously described. It is designated as the letter C. The mountain to the south is Kennilworth very strong sandy loam on the colluvial cones and Castle Valley extremely rocky very fine sandy loam soil in areas where rock outcrops are visable. These soils are shown on maps as K2.

Kennilworth soils are described as follows:

Al horizon, 0 to 7 inches - pale brown (10 YR 6/3) very stony sandy loam, dark brown (10 YR 4/3) when moist; moderately fine, granular structure; soft, very friable, slightly sticky and slightly plastic; few large, plentiful medium and fine roots; no pores; strongly calcareous, mildly alkaline (pH 7.7); clear, smooth boundary.

Clca horizon, 7 to 13 inches - very pale brown (10 Yr 7/3) stony sandy loam, pale brown (10 YR 6/3) when moist; weak, medium to coarse, angular blocky structure. Slightly hard, very friable, slightly sticky and slightly plastic; few medium and fine roots; few medium and fine pores; very strongly calcareous, moderately alkaline (pH 8.0), wavy, gradual boundary.

C2 horizon, 13 to 21 inches - pale brown (10 YR 6/3) stony sandy loam, brown (10 YR 5/3) when moist; weak, medium to coarse, angular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few medium and fine roots; common fine and a few medium pores; strongly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.

C3 horizon, 21 to 34 inches - pale brown (10 YR 6/3) stony sandy loam, brown (10 YR 5/3) when moist; massive, hard, very friable, slightly sticky and slightly plastic; few medium and fine roots; few fine pores, strongly calcareous; strongly alkaline (pH 8.5).

Stones and cobblestones occupy from 0.1 to 3.0 percent of the surface, and they range from 3 inches to 4 feet in diameter. Limey horizons are within 3 to 9 inches of the surface.

Pit 7. North end of preparation plant area. Made land. A barren fill area of made land (Figure 4).

0 to 23 inches - filled material consisting of light brownish gray (2.5 Y 6/2) sandy loam, dark grayish brown (2.5 Y 4/2) when moist mixed with about 50 percent stones. The stones consist of sandstone, siltstone, and coal.

23 to 52 inches - fill material, mainly coal dust, shale, sandstone and quartzite rocks with about 30 percent soil, 30 percent rocks and 40 percent coal.

52 to 80 inches - light brown (10 YR 6/3) gravelly clay, brown (10 YR 4/3) when moist. This layer has about 40 percent clay in the soil material and appears to be part of the undisturbed.

Pit 8. North end of preparation plant about 100 feet south of open water storage reservoir (Figure 4). It is a barren coal storage area.

0 to 58 inches - consists of fill material made up of 50 percent stones and boulders mixed with loam textured soil. Trash such as concrete pieces, wire and cable are in this layer.

58 to 78 inches - consists of loamy sand with no coarse fragments.

78 to 88 inches - consists of very cobbly loamy sand (about 60 percent cobble).

Pit 9. 150 feet south of stockpile silo (prep. plant - Figure 4). This is made land -- mostly fill.

0 to 15 inches - dark grayish brown (10 YR 4/2) very gravelly sandy loam mixed with coal dust (50 percent gravel).

15 to 55 inches - pinkish gray (7.5 YR 6/2) clay loam, brown (7.5 YR 4/2) when moist, interlayered stony loam, black (10 YR 2/1) when moist. Stones make up about 30 percent of the volume.

55 to 95 inches - consists of coal dust and clinkers mixed with a little loam soil and cobble. About 40 percent is cobble. Steep slopes to the east are Castle Valley soils (C) with inclusions of Kennilworth soils as described previously.

Pit 10. East of road. (Preparation plant area - Figure 4). Vegetation consists of annual weeds. This small area has been filled and consists of the following:

0 to 7 inches - light brownish gray (10 YR 6/2) loamy sand with about 5 percent clay.

7 to 55 inches - interlayered soil, coal and sand with 50 percent cobble and lumps of coal. The soil is sandy loam.

55 to 90 inches - consists of loamy sand with about 4 percent clay and no coarse fragments.

SOWBELLY AREA

This area consists of made land, high in coarse fragments and shown on Figure 5 as made land #3 (M3).

Pit 11. As shown on Figure 5, Pit 11 is located at the upper end of the Sowbelly area. This area consists mainly of fill material and is the planned location of a bath house and office facilities.

0 to 8 inches - light brownish gray (10 YR 6/2) very stony loam, very dark grayish brown (10 YR 3/2) when moist; weak coarse platy structure; very hard, friable, slightly sticky, slightly plastic; about 50 percent stones and cobble.

8 to 95 inches - light brownish gray (10 YR 6/2) very stony loam, dark grayish brown (10 YR 4/2) when moist, massive; extremely hard, friable, slightly sticky, slightly plastic, violent effervescence. This layer

is about 50 percent stones and boulders. This material would be good for foundations for low buildings and would be good for septic tanks and filter fields.

Pit 12. Sowbelly - 50 feet south of west end of trailers, made land, and parking lot.

0 to 8 inches - light gray (2.5 Y 7/2) very gravelly sandy loam. Sandy loam soil has about 15 percent clay and is very hard. This layer has about 50 percent gravel.

8 to 88 inches - light brownish gray (10 YR 6/2) very cobbly loam (loam soil has about 25 percent clay) dark grayish brown (10 YR 4/2) when moist; very hard, friable, slightly sticky, slightly plastic. This layer has about 50 percent coarse fragments mainly cobble and stones. M3 material would be good foundation material and would be suitable for septic tanks and filter fields with proper field drains.

HARDSCRABBLE AREA

Pit 13. This pit is located near the old loadout facilities in the Hardscrabble area (Figure 6). It is a fill area consisting of made land #4 (M4).

0 to 3 inches - coal mixed with a small amount of soil

3 to 55 inches - light reddish brown (5 YR 6/3) very cobbly sandy loam, reddish brown (5 YR 5/4) when moist; extremely hard, very friable, slightly sticky, nonplastic. This layer has about 65 percent cobble, stone and boulders, 25 percent gravel, and 10 percent sandy loam soil.

55 to 64 inches - this buried A1 horizon is brown (10 YR 4/3) loam, very dark grayish brown (10 YR 3/2) when moist; massive; hard, friable, slightly sticky, slightly plastic and is about 10 percent gravel.

C1b horizon - 64 to 80 inches - brown (7.5 YR 5/4) very gravelly loam; brown (7.5 YR 4/4) when moist; massive, hard, friable, slightly sticky, slightly plastic. This layer is 50 percent gravel and cobble.

The upper 55 inches of this made land would be difficult to reclaim or restore because of the high amount (90 percent) of coarse fragments and only about 10 percent soil. It would be much easier to restore if 6 to 12 inches of top soil were added. The surface of the area would need to be loosened up, as with a ripper, before top soil was added. This area could be seeded to crested wheatgrass.

The soils on the mountain slopes on each side of the canyon are Castle Valley (C).

PRESENT AND POTENTIAL PRODUCTION

C - Castle Valley soil produces 327 pounds air dry herbage per acre, 29 percent from bullgrass, 55 percent from pinyon-juniper, 16 percent from dryland sedge, bluebunch wheatgrass, penstemon, mat buckwheat, hairy golden aster, rock goldenrod, woody phlox and shadescale. The potential plant cover is about 57 percent pinyon-juniper, and 40 percent Indian ricegrass, bluegrama, galletagrass, perennial mustard, senecio, milkweed, birchleaf mahogany, prickly pear, Mormon-tea and winterfat with total potential production of 450 pounds of forage in favorable years and 100 pounds in less favorable years per acre. This soil is in a semi-desert stony hills range site.

K-1 - Kornman like soil. This soil has a total potential production of 950 pounds per acre of air dry forage in favorable years and of 550 pounds per acre in unfavorable years. Vegetation consists of

needle-and-thread, squirreltail, winterfat, bud sagebrush, and big sagebrush. In its present condition it produces about 60 percent of its potential. This soil is in a semi-desert loam, bench range site.

K-2 - Kennilworth - Castle Valley soils. The Castle Valley soils produce essentially the same as that described above. The Kennilworth soils in potential condition have an overstory of pinyon and juniper. The understory consists of 85 percent Indian ricegrass. The remainder is squirreltail, needle-and-thread, bullgrass, and sand dropseed 5 percent; birchleaf mahogany, bitterbrush, cliffrose, Morman-tea and mockarange 5 percent; phlox, scarlet globemallow, pinstemon, locoweed, and aster 5 percent.

It produces 1,250 pounds of forage per acre in good years and 900 pounds in less favorable years. The potential production would be about 50 percent higher.

M1, M2 and M3. This made land will produce about the same amount of forage as the Kornman soil if a cover can get established. Getting a cover established would probably consist of seeding to crested wheatgrass and may require some irrigation.

M4. This made land will produce about 60 percent as much forage as the other made land. These yields are estimated from those of similar soils in Carbon County, Utah.

Legend

C = Castle Valley extremely rocky very fine sandy loam.

K1 = Kornman like loam and Kornman like sandy loam with bouldary profile - Pits 1, 2, and 3.

K2 = Kennilworth - Castle Valley soils.

M1 = Made land #1 at proposed mine #6 in Willow Creek, Pits 4 and 5.

M2 = Made land #2 in Castle Gate preparation plant area, Pits 6 to 10.

M3 = Made land #3 Sowbelly, Pits 11 and 12.

M4 = Made land #4 in Hardscrabber, Pit 13.