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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS
OF THE MUD SPRINGS RANCH QUADRANGLE
SWEETWATER COUNTY, WYOMING

(Report includes 35 plates)

By

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This report has not been edited for
conformity with U.S. Geological Survey
editorial standards or stratigraphic
nomenclature.

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INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) Maps of the Mud Springs Ranch quadrangle, Sweetwater County, Wyoming (35 plates). This report was compiled to support the land planning work of the Bureau of Land Management to provide a systematic coal resource inventory of federally owned coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States.

Location

The Mud Springs Ranch 7 1/2-minute quadrangle is in southern Sweetwater County, southeast of the city of Rock Springs.

Accessibility

Wyoming Highway 430, the primary highway in the area, enters the north part of the quadrangle 23 mi (37 km) southeast of the city of Rock Springs, Wyoming, and crosses the east-central part of the quadrangle. Most areas in the quadrangle are accessible by unimproved gravel roads, trails, and a light-duty road which crosses the central and southwestern parts of the quadrangle.

Physiography

The Mud Springs Ranch quadrangle is situated in the southern part of the Rock Springs coal field in the southern part of the Rock Springs uplift. The desert landscape in the area consists of barren rock ridges and alluvium-filled valleys. The vegetation is mostly sparse grass and patches of sage at lower elevations and groves of juniper trees along high ridges. Topographic elevations range from 7,682 ft (2,341 m) along the west-central part of the quadrangle to 6,700 ft (2,042 m) along Salt Wells Creek in the northern part of the quadrangle. The major drainage is Salt Wells Creek and its intermittent tributaries, Pretty Water Creek, Dans Creek, Gap Creek, Joyce Creek, and Big Flat Draw.

Industries in the quadrangle are sheep and cattle ranching.

Climate

The climate in the Mud Springs Ranch quadrangle is arid and windy. Mean annual precipitation, mostly in the form of snow, is about 9 in. (23 cm) (Root and others, 1973). Temperatures annually range between -30°F (-34°C) and 100°F (38°C). Strong westerly winds occur almost daily.

Land Status

The Mud Springs Ranch quadrangle is 8.6 mi (13.8 km) long, 6.5 mi (10.5 km) wide, and encompasses 56.3 mi² (145 km²). The Federal Government owns coal rights to some lands where the coal beds are known to be more than 5 ft (1.5 m) thick and under less than 1,000 ft (305 m) of overburden.

GENERAL GEOLOGY

Previous Work

The southern part of the Rock Springs coal field, including the quadrangle area, was mapped in 1908, by A. R. Schultz. A geologic map showing coal outcrops at the scale of 1:250,000, on a planimetric base, was published 2 years later (Schultz, 1910, pl. 14). A geologic map of the quadrangle, on a topographic base, was published in 1977, as an open-file report by Henry W. Roehler.

There is no drill-hole data in the quadrangle to supplement the outcrop data published by Roehler. However, there are drill holes in the adjacent Burley Draw quadrangle which confirm the underground areal extent of the coals, and whose data has been used to draw structure contours on the coal beds. The outcrop information was the principle source for the evaluation of the isopach maps and resources.

Stratigraphy

Rocks exposed in the quadrangle are of Quaternary, Tertiary, and Cretaceous age. They are assigned to surficial deposits of alluvium that occupy narrow stream valleys, and to the Green River, Wasatch, Fort Union, Lewis Shale, and Almond Formations (Roehler, 1973).

Beds of coal more than 5 ft (1.5 m) thick and under less than 1,000 ft (305 m) overburden are restricted to the Fort Union and Almond Formations in the eastern part of the quadrangle. The Fort Union Formation is about 610 ft (186 m) thick and is composed of very fine grained, gray sandstone; gray siltstone; gray shale; brown, black carbonaceous shale; coal; conglomerate lenses; gray dolomite; and gray mudstone. The Almond Formation is about 700 ft (213 m) thick and is composed of gray shale, siltstone, sandstone, carbonaceous shale, and coal (pl. 3).

The Almond coal beds were deposited in a tropical climate in brackish water lagoons that formed on landward sides of barrier bars that developed along the western coastlines of the Late Cretaceous Lewis Sea (Roehler, 1976). During early stages of development the lagoons had large areas of open water; in late stages they were choked with thick mats of vegetation. The erratic lenticular-shaped characteristics of the Almond coal beds reflect their deposition along the length of the back-barrier areas, which was in a north-south direction.

Coal beds in the Fort Union Formation were deposited in extensive fresh-water swamps of the intermontane Green River Basin area. The fresh-water peat swamps were developed in delta plain environments (Romeo Flores, oral commun.). In contrast to the Almond coal beds, the Fort Union coal beds are laterally extensive, typical of peat deposits formed in deltaic environments.

Structure

The quadrangle is on the southeast flank of the Rock Springs uplift, a few miles east of the southward plunge of the major axis of the uplift. The Pine Butte Syncline trends east to west and plunges to the southeast in the southern part of the quadrangle. A minor normal fault occurs in sec. 28, T. 15 N., R. 102 W., but does not offset any of the potentially economic coals.

COAL GEOLOGY

Numerous coal outcrops have been mapped in the Mud Springs Ranch quadrangle. Fourteen coal beds identified in this report, the Upper Little Valley, Robin, Golden Eye, Falcon, Mallard, Pintail, Starling, Upper Sparrow, Lower Little Valley, Lower Mourning Dove, Gull, Lower Gull, Upper Mourning Dove, and Finch, are locally more than 5 ft (1.5 m) thick and lie beneath less than 1,000 ft (305 m) of overburden.

The Magpie (pl. 1) and Upper Gull and Mourning Dove (pl. 3) coal beds are not discussed because they do not occur in Reserve Base thickness 5 ft (1.5 m) on Federal coal lands beneath less than 1,000 ft (305 m) of overburden.

The coal beds have not been stratigraphically arranged in the text, because the grouping of certain beds on the maps did not allow stratigraphic order, however, the coal beds are depicted in their proper stratigraphic order on the columnar section and measured sections on plate 3.

The Upper Little Valley coal bed of this report is equivalent to the Deadman seam recently named at the Jim Bridger Strip Mine 25 mi (40 km) north of the Mud Springs Ranch quadrangle (Roehler, 1977).

Coal beds in the Mud Springs Ranch quadrangle usually crop out as weathered small dark-gray or black bands in drab gray predominantly shale valleys, or on slopes below sandstone escarpments. The coal is usually covered by a veneer of alluvium at least 12 in. (30 cm) thick. The best exposures are in drainage cuts and on crests or ridges between drainages (Roehler, 1977).

Beds of minable coal in the Fort Union Formation are the Upper Little Valley and Lower Little Valley coal beds. Beds of minable coal in the Almond Formation are the Robin, Golden Eye, Falcon, Mallard, Pintail, Starling, Upper Sparrow, Lower Mourning Dove, Gull, Lower Gull, Upper Mourning Dove, and Finch. Beds of underground minable coal are the Upper Little Valley, Pintail, Lower Little Valley, Lower Mourning Dove, Lower Gull, Upper Mourning Dove, and Finch.

There are no chemical analyses of coal beds in the quadrangle. However, analyses from other places in the Rock Springs coal field indicate that the Almond coal beds are subbituminous C to subbituminous A in rank. They contain less than 1 percent sulfur and average about 50 percent fixed carbon and 4 percent ash. The heating values range from 8,800 to 10,850 Btu/lb (20,469 to 25,237 kJ/kg) on a moist, mineral-matter-free basis (Schultz, 1910, p. 243).

Upper Little Valley Coal Bed

The Upper Little Valley coal bed is quite extensive areally and is located in sec. 27, T. 16 N., R. 102 W., and sec 34, 3, 4, 9, 8, 17, 16, 21, and 27, T. 15 N., R. 102 W., where the coal bed is over 5 ft (1.5 m) thick.

Overburden on the Upper Little Valley varies from less than 100 ft (30 m) to more than 1,000 ft (305 m), where the coal bed is of minable thickness (pl. 6).

Robin Coal Bed

The Robin coal bed outcrops in sec. 16, T. 16 N., R. 102 W., where it is 4.2 ft (1.3 m) thick. The coal bed thickens rapidly toward the north in the Camel Rock quadrangle in sec. 10, T. 16 N., R. 102 W., where it is 14.6 ft (4.5 m) thick.

Overburden on the Robin coal bed varies from less than 100 ft (30 m) to more than 300 ft (91 m), where the coal bed is of minable thickness (pl. 11).

Golden Eye Coal Bed

The thickest part of the Golden Eye coal bed occurs in sec. 8, T. 15 N., R. 102 W., where it is 6.1 ft (1.9 m) thick in the south part of the section and 5.1 ft (1.6 m) thick in the north part of the section. It then thins rapidly north and south of sec. 8.

Overburden on the Golden Eye coal bed is less than 200 ft (61 m), where the coal bed is of minable thickness (pl. 11).

Falcon Coal Bed

The Falcon coal bed is thick enough in only one place to meet criteria for mining. It is 5.9 ft (1.8 m) thick in the northeastern part of sec. 33, T. 16 N., R. 102 W. and thins rapidly north and south of this point.

Overburden on the Falcon coal bed is less than 100 ft (30 m) where the coal bed is of minable thickness (pl. 11).

Mallard Coal Bed

The Mallard coal bed is 7.2 ft (2.2 m) thick in sec. 15, T. 16 N., R. 102 W., and is burned on outcrop toward the northwestern part of the section. It thins rapidly towards the southwest where on outcrop it is 3.25 ft (1 m) thick in sec. 16, T. 16 N., R. 102 W.

Overburden on the Mallard coal bed ranges from less than 100 ft (30 m) to more than 300 ft (91 m), where the coal bed is of minable thickness (pl. 16).

Pintail Coal Bed

The Pintail coal bed outcrops in sec. 4, T. 15 N., R. 102 W., and sec. 8 and 17 where it is up to 6.5 ft (2 m) thick and thins toward the south where it is 4.6 ft (1.4 m) thick. In sec. 4 the Pintail is the minimum of 5 ft (1.5 m) thick.

Overburden on the Pintail coal bed ranges from less than 100 ft (30 m) to more than 600 ft (183 m), where the coal bed is of minable thickness (pl. 16).

Starling Coal Bed

The Starling coal bed is thickest in sec. 21, T. 16 N., R. 102 W., where it is 8.9 ft (2.7 m) thick. It splits into two beds toward the southwest part of the section. It then merges into one bed, 6.3 ft (1.9 m) thick, and thins again rapidly to 3.9 ft (1.1 m) thick in sec. 29, T. 16 N., R. 102 W.

Overburden on the Starling coal bed ranges from less than 100 ft (30 m) to more than 200 ft (61 m), where the coal bed is of minable thickness (pl. 16).

Upper Sparrow Coal Bed

The Upper Sparrow coal bed is 5.4 ft (1.6 m) thick in sec. 20, T. 15 N., R. 102 W.

Overburden on the Upper Sparrow coal bed is less than 200 ft (61 m), where the coal bed is of minable thickness (pl. 21).

Lower Little Valley Coal Bed

The Lower Little Valley coal bed is widespread, but its thickness reaches the minable minimum of 5 ft (1.5 m) only in sec. 8, T. 15 N., R. 102 W., and 6.7 ft (2.0 m) in sec 9, T. 15 N., R. 102 W.

Overburden on the Lower Little Valley coal bed varies from less than 100 ft (30 m) to more than 400 ft (122 m), where the coal bed is of minable thickness (pl. 21).

Lower Mourning Dove Coal Bed

The Lower Mourning Dove coal bed is thickest in sec. 32, T. 16 N., R. 102 W., where it is 6.1 ft (1.9 m) thick. It thins rapidly toward the south where it is only 3.3 ft (1.0 m) thick. The Lower Mourning Dove thickens and thins erratically toward the north where it is 6 ft (1.8 m) thick in sec. 21, T. 16 N., R. 102 W., and thins rapidly to 3.8 ft (1.2 m) thick.

Overburden on the Lower Mourning Dove varies from less than 100 ft (30 m) to more than 600 ft (183 m), where the coal bed is of minable thickness (pl. 21).

Gull Coal Bed

The Gull coal bed is 5.5 ft (1.7 m) thick in sec. 20, T. 15 N., R. 102 W., but its areal extent is very limited because it thins out rapidly toward the northwest and southeast.

Overburden on the Gull coal bed is less than 100 ft (30 m), where the coal bed is of minable thickness (pl. 26).

Lower Gull Coal Bed

The Lower Gull coal bed is 7.1 ft (2.2 m) thick in sec. 28, T. 15 N., R. 102 W., and thins out rapidly toward the northwest.

Overburden on the Lower Gull coal bed varies from less than 100 ft (30 m) to more than 300 ft (91 m), where the coal bed is of minable thickness (pl. 26).

Upper Mourning Dove Coal Bed

The Upper Mourning Dove coal bed is 6 ft (1.8 m) thick in sec. 32, T. 16 N., R. 102 W., and thins to the northeast where it is 2.4 ft (0.7 m) thick in sec. 28, T. 16 N., R. 102 W. It is 7.1 ft (2.2 m) thick in sec. 33, T. 16 N., R. 102 W., and thins out toward the south.

Overburden on the Upper Mourning Dove varies from less than 100 ft (30 m) to more than 400 ft (122 m), where the coal bed is of minable thickness (pl. 26).

Finch Coal Bed

The Finch coal bed is 8.6 ft (2.7 m) thick in sec. 8, T. 15 N., R. 102 W. It splits into two beds in sec. 17, T. 15 N., R. 102 W., and thins toward the southeast. It again becomes 6 ft (1.8 m) thick in sec. 28, T. 15 N., R. 102 W., but its lateral extent is very limited.

Overburden on the Finch coal bed varies from less than 100 ft (30 m) to more than 200 ft (61 m), where the coal bed is of minable thickness (pl. 31).

COAL RESOURCES AND RESERVES

Coal resources and reserves were calculated from data obtained from isopach maps (pl. 4, 9, 14, 19, 24, and 29), mining ratio and overburden maps (pl. 6, 11, 16, 21, 26, and 31), areal distribution maps (pl. 7, 12, 17, 22, 27, and 32), and identified resource maps (pl. 8, 13, 18, 23, 28, and 33). The data were calculated for all coal beds that are more than 5 ft (1.5 m) thick, that dip less than 15°, and that are under less than 1,000 ft (305 m) of overburden. The coal-bed tonnages were measured by a computing planimeter which is programmed to measure acreage, multiply it by the average isopached thickness of the coal bed and multiply by 1,770 (short tons of coal per acre-foot - 13,018 metric tons per hectare-meter)

for subbituminous coal. This yielded the Reserve Base for each coal bed in each reporting category (measured, indicated, and inferred, less than 200 ft (61 m) overburden; measured, indicated, and inferred, more than 200 ft (61 m) overburden). Recovery factors applied were 0.85 for surface mining methods (outcrop to 200 ft (61 m) of overburden), and 0.50 for underground mining methods (200 to 1,000 ft (61 to 305 m) of overburden). Reserves were determined for each reporting category by multiplying the Reserve Base times the recovery factor.

COAL DEVELOPMENT POTENTIAL FOR SURFACE MINING

Areas where the coal beds are overlain by 200 ft (61 m) or less of overburden are considered to have potential for strip mining and were assigned to high, moderate, or low development potential based on the mining ratio—cubic yards of overburden per ton of recoverable coal (to convert to cubic meters per metric ton of overburden multiply by 0.842). The formula used to calculate mining ratios is as follows:

$$MR = \frac{t_o (0.911)}{t_c (rf)}$$

where MR = Mining ratio

t_o = Thickness of overburden

t_c = Thickness of coal

rf = Recovery factor

0.911 = Factor for subbituminous coal

Areas of high, moderate, and low development potential for surface mining have mining-ratio values of 0 to 10:1, 10:1 to 15:1, and >15:1, respectively, as shown on CDP map plate 34. The areas of high, moderate, and low development potential are based on present-day economic and technological criteria and are applicable only to this quadrangle. They were derived in consultation with J. Paul Storrs, Area Mining Supervisor, U. S. Geological Survey.

The Upper Little Valley coal bed has high potential for surface mining in secs. 27 and 34, T. 16 N., R. 102 W., secs. 4, 9, 17, 21, and 27, T. 15 N., R. 102 W. The coal bed is 5.3 ft (1.6 m) to 9 ft (2.7 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Robin coal bed has high potential for surface mining in sec. 10, T. 16 N., R. 102 W. The coal bed is 4.2 ft (1.3 m) to 14.6 ft (4.5 m) thick in the Camel Rock quadrangle, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Golden Eye coal bed has high potential for surface mining in secs. 8 and 17, T. 15 N., R. 102 W. The coal bed is 5.1 ft (1.6 m) to 6.1 ft (1.9 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Falcon coal bed has high potential for surface mining in sec. 34, T. 16 N., R. 102 W. The coal bed is 5.2 ft (1.6 m) to 5.9 ft (1.8 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Mallard coal bed has high potential for surface mining in sec. 10, T. 16 N., R. 102 W. The coal bed is 3.5 ft (1.4 m) thick in the Camel Rock quadrangle to 7.2 ft (2.2 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Pintail coal bed has high potential for surface mining in secs. 4, 8, and 17, T. 15 N., R. 102 W. The coal bed is 5 ft (1.5 m) to 6.5 ft (2 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Starling coal bed has high potential for surface mining in secs. 20 and 28, T. 16 N., R. 102 W. The coal bed is 6.3 ft (1.9 m) to 8.9 ft (2.7 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Upper Sparrow coal bed has high potential for surface mining in secs. 20, 21, 28, and 29, T. 15 N., R. 102 W. The coal bed is 5.4 ft (1.6 m) to 6.9 ft (2.1 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Lower Little Valley coal bed has high potential for surface mining in secs. 8, 9, and 17, T. 15 N., R. 102 W. The coal bed is 5.7 ft (1.7 m) to 6.7 ft (2 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Lower Mourning Dove coal bed has high potential for surface mining in secs. 28 and 32, T. 16 N., R. 102 W., sec. 4, T. 15 N., R. 102 W. The coal bed is 5 ft (1.5 m) to 6.1 ft (1.9 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Gull coal bed has high development potential for surface mining in sec. 20, T. 15 N., R. 102 W. The coal bed is 5.5 ft (1.7 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Lower Gull coal bed has high development potential for surface mining in sec. 28, T. 15 N., R. 102 W. The coal bed is 7.1 ft (2.2 m) thick, and thins to 4.2 ft (1.3 m) in the Potter Mountain quadrangle. The coal bed has less than 200 ft (61 m) of overburden, and dips 3° to 12°.

The Upper Mourning Dove coal bed has high development potential for surface mining in sec. 4, T. 15 N., R. 102 W. The coal bed is 5 ft (1.5 m) to 7.1 ft (2.2 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

The Finch coal bed has high potential for surface mining in secs. 8 and 17, T. 15 N., R. 102 W. The coal bed is 5.4 ft (1.6 m) to 8.7 ft (2.7 m) thick, and has less than 200 ft (61 m) of overburden. The bed dips 3° to 12°.

COAL DEVELOPMENT POTENTIAL FOR UNDERGROUND MINING

The Finch, Lower Gull, Upper Mourning Dove, Lower Mourning Dove, Upper Little Valley, Lower Little Valley, and Pintail coal beds, where they are 5 ft (1.5 m) thick and are underlain by 200 to 1,000 ft (61 to 305 m) of overburden, are considered to have high potential for underground mining (pl. 35). These coal beds are probably everywhere less than 10 ft (3 m) thick and dip in southeasterly and northeasterly directions from 3° to 15°.

Table 1.--Strippable-coal Reserve Base data (in short tons) for Federal coal lands in the
Mud Springs Ranch quadrangle, Sweetwater County, Wyoming

(Development potentials are based on mining ratios (cubic yards of overburden/ton of underlying coal). To convert tons to metric tons, multiply by 0.9072; to convert mining ratios from yd³/ton to m³/metric ton multiply by 0.842)

Coal bed	High development potential (0 to 10:1 mining ratio)	Moderate development potential (10:1 to 15:1 mining ratio)	Low development potential (>15:1 mining ratio)	Total
Upper Little Valley	2,300,000	1,500,000	4,700,000	8,500,000
Robin	100,000	100,000	300,000	500,000
Golden Eye	700,000	400,000	400,000	1,500,000
Falcon	100,000	100,000	300,000	500,000
Mallard	40,000	20,000	40,000	100,000
Pintail	900,000	400,000	2,200,000	3,500,000
Starling	90,000	100,000	900,000	1,090,000
Upper Sparrow	500,000	200,000	200,000	900,000
Lower Little Valley	900,000	200,000	1,200,000	2,300,000
Lower Mourning Dove	500,000	300,000	1,300,000	2,100,000
Gull	100,000	100,000	100,000	300,000
Lower Gull	200,000	100,000	200,000	500,000
Upper Mourning Dove	40,000	20,000	100,000	160,000
Finch	800,000	600,000	2,000,000	3,400,000
TOTAL	7,270,000	4,140,000	13,940,000	25,350,000

(To convert short tons to metric tons, multiply by 0.9072)

Coal bed name	High development potential (200 to 1,000 ft)
Finch	2,300,000
Lower Gull	100,000
Upper Mourning Dove	1,600,000
Lower Mourning Dove	4,300,000
Upper Little Valley	10,800,000
Lower Little Valley	3,300,000
Pintail	3,800,000
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TOTAL	26,200,000

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