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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE SOUTHWEST QUARTER OF THE RAWLINS PEAK 15-MINUTE QUADRANGLE, CARBON COUNTY, WYOMING

[Report includes 18 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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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 southwest quarter of the Rawlins Peak 15-minute quadrangle, Carbon County, Wyoming. These reports were compiled to support the land planning work of the Bureau of Land Management to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. This investigation was undertaken by Dames & Moore, Denver, Colorado, at the request of the U.S. Geological Survey under contract number 14-08-0001-17104. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was done, nor was any confidential data used.

Location

The southwest quarter of the Rawlins Peak 15-minute quadrangle is located in west-central Carbon County, Wyoming, approximately 6 mi (10 km) west of the city of Rawlins and 26 mi (42 km) east of Wamsutter, Wyoming. The area is relatively unpopulated except for Daleys Ranch located in the southern portion of the quadrangle.

Accessibility

Interstate Highway 80 passes east-west through the southern half of the quadrangle. The rest of the area is accessible by a few improved light-duty roads near Daleys Ranch, and numerous other unimproved dirt roads and trails.

The main east-west line of the Union Pacific Railroad passes through the southern portion of the quadrangle providing railway service through southern Wyoming. This main line connects Ogden, Utah to the west and Omaha, Nebraska to the east. The loading stations of Hadsell and Daleys Ranch on the Union Pacific Railroad have been abandoned.

Physiography

The southwest quarter of the Rawlins Peak 15-minute quadrangle lies on the southwestern flank of the Rawlins uplift between the Great Divide Basin on the west and the Hanna Basin on the east. The landscape within the quadrangle is characterized by a low-lying, dissected plain on the west, grading upward into a relatively rugged area of ridges or hogbacks on the east.

The elevation in the quadrangle varies between 6,600 ft (2,012 m) and 7,300 ft (2,225 m). Separation Flats, covering the western half of the quadrangle, is a broad area of low relief with a few scattered knolls rising to 100 ft (30.5 m) above the surrounding landscape. There is a gradual increase in elevation from Separation Flats to the eastern border of the quadrangle. The lowest point in elevation occurs in the northwest corner of the quadrangle along Separation Creek. The highest point occurs on a northwest-trending ridge along the east-central edge of the quadrangle.

Separation Creek is the major drainage system for the northwestern portion of the Rawlins uplift, including the quadrangle area. Fillmore

Creek, Indian Spring Creek, Creston Draw, and several other small intermittent streams are tributaries to Separation Creek, which flows into an undrained depression north of the quadrangle. All streams in the quadrangle flow mainly in response to snowmelt in the spring. During the wet season, small lakes form along streams and in scattered, shallow depressions throughout Separation Flats. These lakes are typically alkaline and fluctuate in size with the seasons.

Climate and Vegetation

The climate of south-central Wyoming is semiarid, characterized by low precipitation, rapid evaporation, and large daily temperature variations. Summers are usually dry and mild, and winters are cold. The annual precipitation in the area averages 10.4 in. (26.4 cm). Approximately two-thirds of the precipitation falls in the spring and summer during a seven-month period between April and October.

The average annual temperature of the area is 43°F (6°C). The temperature during January averages 21°F (-6°C) and ranges from 12°F (-11°C) to 31°F (-0.6°C). During July, the average temperature is 68°F (20°C), and the temperature ranges from 51°F (11°C) to 84°F (29°C).

The winds are usually from the southwest and west-southwest with an average wind velocity of 12 miles per hour (19 km per hour).

The principal types of vegetation in the quadrangle include grasses, sagebrush, greasewood, saltbush, rabbitbrush, and other desert shrubs.

Land Status

The southwest quarter of the Rawlins Peak 15-minute quadrangle lies on the northern edge of the Rawlins Known Recoverable Coal Resource Area. Although approximately three-quarters of the quadrangle lies within the KRCRA boundary, the Federal government owns the coal rights for less than one-half of the land, as shown on plate 2 of the Coal Resource Occurrence maps. No outstanding Federal coal leases, prospecting permits, or licenses occur within the quadrangle.

GENERAL GEOLOGY

Previous Work

Veatch (1907) described the Mesaverde Formation coals in his preliminary report on the coal fields in east-central Carbon County. Ball (1909) described the coal-bearing Lance and Fort Union Formations in his study of the western part of the Little Snake River coal field. Smith (1909) covered the entire quadrangle in a portion of his investigation of the eastern part of the Great Divide Basin coal field. In 1952, Barlow published a report on the structure of the Rawlins uplift. A detailed investigation of the geology and groundwater resources of the Rawlins area was made by Berry in 1960. Pipiringos (1961) described the Tertiary Formations covering the quadrangle. Welder and McGreevy (1966) published a report on the geology and groundwater of the Great Divide Basin and adjacent areas. Unpublished data from the Rocky Mountain Energy Company and from recent U.S. Geological Survey reconnaissance mapping and drilling provided coal outcrop and coal thickness information.

Stratigraphy

The formations exposed in the southwest quarter of the Rawlins Peak 15-minute quadrangle range in age from Upper Cretaceous to Recent. The Upper Cretaceous age Niobrara Formation, Steele Shale, Mesaverde Formation, Lewis Shale, Fox Hills Sandstone, and Lance Formation outcrop in a northwest-trending band across the northeastern one-third of the quadrangle. The Paleocene age Fort Union Formation and Eocene age Battle Springs Formation cover the remaining two-thirds of the quadrangle.

The Upper Cretaceous age Niobrara Formation and Steele Shale, mapped as a single unit by Berry (1960), are very similar in color, composition, and weathering characteristics. The formations are composed of dark-gray calcareous shale; fossiliferous, massive gray shale; and argillaceous limestone. They grade upward into gray-brown sandy shale, interbedded with gray to gray-green glauconitic sandstone. The two formations reach a combined thickness of 5,050 ft (1,539 m) where measured just east of the quadrangle boundary. Both formations are non-coal-bearing.

The Niobrara Formation and Steele Shale are conformably overlain by the Upper Cretaceous age Mesaverde Formation. The Mesaverde Formation is composed primarily of light-gray to brown, fine- to medium-grained sandstone with local lenses of carbonaceous sandy shale. The sandstone is massive and bluff-forming. The shale beds are gray to dark-gray, calcareous to noncalcareous, and contain lenses of lignite and coal. Although mapped as a single unit in this quadrangle, the Mesaverde

Formation has been subdivided into three distinct units in the adjacent northwest quarter of the Bridger Pass 15-minute quadrangle. These are, in ascending order, the Haystack Mountains Formation, the Allen Ridge Formation, and the Almond Formation. All are known to be coal-bearing. A fourth unit, the Pine Ridge Sandstone, may be present between the Allen Ridge Formation and the Almond Formation. South of the city of Rawlins, the Pine Ridge Sandstone has lost its characteristic blanketlike form and is probably represented by thick channel-filling sandstones that grade laterally into the rocks of the underlying Allen Ridge Formation (Gill and others, 1970). The Mesaverde Formation is approximately 2,640 ft (805 m) thick where measured in sec. 6, T. 21 N., R. 88 W. (Berry, 1960).

The Upper Cretaceous age Lewis Shale conformably overlies the Mesaverde Formation. It is composed of dark-gray to olive-gray fissile shale which grades into a buff colored sandy shale. The shale contains sporadic lenses of calcareous sandy siltstones that are gray to buff. Thin bentonite beds, brown sandstone concretions, and lenses of dark-gray to brown carbonaceous shale and calcareous sandstone occur throughout the formation. The middle or upper part of the formation often contains a distinctive and widespread unit of interbedded sandstone and sandy shale called the Dad Sandstone Member. The Dad Sandstone Member, a tongue of the overlying Fox Hills Sandstone, averages 725 ft (221 m) thick in the northern portion of the quadrangle. The Lewis Shale ranges in thickness from 2,300 ft (701 m) in secs. 13 and 14, T. 22 N., R. 89 W., on the northern edge of the quadrangle (Gill and others, 1970) where the Dad

Sandstone Member is present; to 1,900 ft (579 m) in sec. 7, T. 21 N., R. 88 W., on the eastern edge of the quadrangle (Berry, 1960) where the Dad Sandstone Member is absent. A 0.1 ft (3 cm) thick bentonite bed present in the shale immediately above the Dad Sandstone Member on the northern edge of the quadrangle thickens to 2 ft (0.6 m) on the eastern edge of the quadrangle. No coals are present in the Lewis Shale.

The sandstones of the Upper Cretaceous age Fox Hills Sandstone intertongue with the underlying marine shales of the Lewis Shale and with the overlying brackish-water and fluvial shales and sandstones of the Lance Formation. The Fox Hills Sandstone is composed of thick units of pale yellowish-gray, very fine to fine-grained, friable sandstone and thin units of olive-gray to dark-gray sandy shale. The sandstone units are thin-bedded to massive, cross-bedded, and ripple marked. They commonly contain fossiliferous sandstone concretions. Thin units of carbonaceous shale, containing brackish-water fossils or thin impure coal beds, also occur in the formation. The sandstone beds are generally nonresistant, but can locally be well-cemented and ridge-forming. The Fox Hills Sandstone is 172 ft (52 m) thick where it outcrops on the northern edge of the quadrangle (Gill and others, 1970).

The Fox Hills Sandstone grades into the overlying Upper Cretaceous age Lance Formation. The Lance Formation is composed of light-brown to dark-gray, sandy carbonaceous shale containing lignite and coal which grades upward into dark-gray fissile carbonaceous shale. The shale is interbedded with brown to light-brown, very fine to fine-grained sandstone. The sandstone may occur in intervals up to 20 ft (6 m) thick throughout the formation. Several fossiliferous zones are present in the upper portion of the formation. The Lance Formation is approximately 4,540 ft (1,384 m) thick where measured in sec. 12, T. 21 N., R. 89 W., on the eastern edge of the quadrangle (Berry, 1960).

Unconformably overlying the Lance Formation, the Paleocene age Fort Union Formation outcrops in the southwestern two-thirds of the quadrangle. Erosion of the formation since deposition has resulted in a wide range in thickness. In the Rawlins area, the Fort Union Formation reaches a maximum thickness of approximately 2,450 ft (747 m) measured approximately 14 mi (22.5 km) north of this quadrangle and no information is available on its thickness within this quadrangle. The Fort Union Formation is composed of dark-gray carbonaceous shale containing beds of lignite and coal interbedded with light-gray to brown, fine- to coarse-grained sandstone. The sandstone beds often contain lenses of light-brown to brown conglomerate composed of well-rounded black, red, and gray chert pebbles, and pink and white quartz in a matrix of coarse- to medium-grained sandstone. Lenses of calcareous material are also present within the formation (Berry, 1960).

Unconformably overlying the Fort Union Formation is a sequence of beds of early and middle Eocene age called the Battle Springs Formation. The Battle Springs Formation consists of coarse-grained to conglomeratic, arkosic, cross-bedded sandstone and green claystone which appears to have been deposited in deltaic sheets. It locally forms low, rounded bluffs. The base of the Battle Springs Formation is exposed in the northwestern part of T. 21 N., R. 89 W. (Pipiringos, 1961). The Battle Springs Formation intertongues with the Wasatch Formation to the south and west.

Recent deposits of gravel and alluvium cover the stream valleys of Fillmore Creek and Separation Creek.

Upper Cretaceous age sediments in the Rawlins area indicate regression and transgression of a widespread Cretaceous sea. The sediments exposed in the quadrangle accumulated near the western edge of the sea and reflect the location of the shoreline.

The lignites, coals, and sandstones of the Mesaverde Formation were deposited in the marsh, brackish-water lagoon and coastal swamp environments present in the Rawlins delta which extended northeastward into the Cretaceous sea (Weimer, 1961).

Deposition of the Lewis Shale marked a landward movement of the sea. The marine sediments of the Lewis Shale were deposited in water depths ranging from a few tens of feet to several hundred feet. Deposition of the Lewis Shale ended in the quadrangle with the regression of the sea.

The sediments of the Fox Hills Sandstone represent a transitional depositional environment between the deeper-water marine environment of the Lewis Shale, and the lagoonal and continental environments of the Lance Formation. Environments of deposition of the Fox Hills sediments include shallow marine, barrier bar, beach, estuarine, and tidal channel.

During the gradual recession of the last Cretaceous sea, marking the close of Cretaceous time in the Rawlins area, the carbonaceous shales, mudstones, and coal beds of the Lance Formation were deposited in broad areas of estuarine, marsh, lagoonal, and coastal swamp environments.

After the final withdrawal of the Cretaceous sea, thick sections of detrital material, eroded from older deposits, were deposited as the coarse conglomerates and sandstones of the Paleocene age Fort Union Formation. The sandstones, shales, and coals of the Fort Union Formation were deposited in stream, lake, and swamp environments.

Structure

The southwest quarter of the Rawlins Peak 15-minute quadrangle is located on the southwestern flank of the Rawlins uplift between the Great Divide Basin on the west and the Hanna Basin on the east. The Rawlins uplift is a large asymmetric anticline with Precambrian age crystalline rocks exposed in the center of the uplift, surrounded by hogbacks formed by the resistant strata of younger formations. The strata on the western flank of the uplift dip steeply in a southwesterly direction.

An asymmetric syncline is located in the southern portion of the quadrangle. It begins near the Dillon mine a few miles east of the quadrangle and plunges in a northwesterly direction across the quadrangle. The folding probably occurred in late Paleocene or early Eocene time.

The stata on the western flanks of the Rawlins uplift are highly faulted and fractured east of the quadrangle near the center of the uplift. One minor normal fault appears in the northeast corner of the quadrangle. This fault is probably related to the subsidence of the Rawlins uplift in post-Miocene time (Barlow, 1955).

COAL GEOLOGY

Coal beds of the Fort Union Formation and of the Lance-Fox Hills Formations were either mapped on the surface or indentified in the subsurface in this quadrangle. The coal beds of the Lance-Fox Hills Zone are stratigraphically below and separated from the Fort Union Coal Zone by about 4,300 ft (1,311 m) of shale, carbonaceous shale, and sandstone. The Fort Union coals occur in the lower part of the formation and are referred to as beds of the Lower Fort Union Coal Zone. The upper portion of the formation has been removed by erosion. A portion of the Mesaverde Formation is exposed in the northeast corner of the quadrangle outside the Known Recoverable Coal Resource Area (KRCRA) boundary and may contain coal.

In general, coals in this quadrangle are subbituminous B in rank and low in sulfur.

Lance-Fox Hills Coal Zone

Throughout the Rawlins KRCRA, it is quite common to encounter coal near the transitional contact of the fluvial deposits of the Lance Formation and the marine beach sands of the Fox Hills Formation. In this quadrangle, the Lance-Fox Hills coals dip 50° to 80° to the west and are not persistant laterally. The coal beds are thin, 2 to more than 6 ft (0.6 to 1.8+ m) thick, unlike the coals of the Lance-Fox Hills to the south (in the northwest quarter of the Bridger Pass 15-minute quadrangle) where three thick beds are found.

Chemical analyses of the Lance-Fox Hills coal zone.--No known chemical analyses of the Lance-Fox Hills coals have been performed; it is assumed, however, that the quality of the coal is similar to coal beds of the Fort Union Formation and is subbituminous B in rank.

Lower Fort Union Coal Zone

Coal beds of the Lower Fort Union Coal Zone crop out in the south-eastern quarter of the quadrangle and are greatly affected by the assy-metrical syncline trending northwest across the southern portion of the quadrangle. Dips taken along the northern limb of the syncline are steep (60° to 85°), while dips along the southern limb average about 14°. Geological data for the north half of the quadrangle is quite limited, whereas data for the south half is more abundant.

Coal beds in the Lower Fort Union Coal Zone often have two names and both are used in this report and on the CRO maps where applicable. Rocky Mountain Energy Company (RMEC) has identified the coal beds by using an alpha-numeric designation (e.g. G), and generic names (e.g. Daleys Ranch) have been used by Edson (1976) to designate the same coal beds.

Chemical analyses of the Lower Fort Union coal zone.--Chemical analyses of samples taken by Smith (1909) and RMEC are listed in Table 1. The RMEC values are more recent and are believed to be more reliable than those taken by Smith. The coals of the Lower Fort Union Coal Zone are subbituminous B in rank.

G (Daleys Ranch) Coal Bed

The G (Daleys Ranch) coal bed is, stratigraphically, the lowest identified bed in the Lower Fort Union Coal Zone in this quadrangle. This coal bed, designated G by RMEC, was named for Daleys Ranch located in sec. 32, T. 21 N., R. 89 W. The G coal bed commonly occurs as two beds, neither being designated as upper or lower. However, for identification purposes in this quadrangle the lower bed has been designated GL, or (Lower) Daleys Ranch on plates 1, 3, 4, 5, and 6. The two coal beds are usually separated by a rock interval approximately 20 ft (6 m) thick. Thickness of the upper bed increases from 5 ft (1.5 m) just south of the syncline axis to 10 ft (3 m) near the southern boundary of the quadrangle. This coal bed extends southward into the northwest quarter of the Bridger Pass 15-minute quadrangle for several miles. The lower bed thickens locally in one isolated area to more than 5 ft (1.5 m) in secs. 26 and 27, T. 21 N., R. 89 W. and pinches out in the adjacent quadrangle to the south. Since the coal beds dip westward at approximately 14°, overburden thicknesses increase rapidly as shown on plate 5.

F2 (Red Rim) Coal Bed

The F2 or Red Rim coal bed is stratigraphically above and separated from the G coal bed by a non-coal interval of approximately 100 ft (30.5 m). The name Red Rim, as used by Edson (1976), refers to a correlatable coal bed which crops out near a ridge of the same name in T. 20 N., R. 90 W. in the northwest quarter of the Bridger Pass 15-minute quadrangle.

A maximum thickness of 13 ft (3.9 m) was obtained in a RMEC drill hole in sec. 35, T. 21 N., R. 89 W. near the southern boundary of the quadrangle. This bed crops out along the southern limb of the syncline and probably crops out to the north, but lack of data prevents confirmation of its presence. However, south of this quadrangle, thickness measurements along the outcrop indicate that the F2 coal bed is persistant and is usually greater than 5 ft (1.5 m) thick. Due to a dip of about 14°, the overburden increases rapidly to the west as shown on plate 8.

Fl Coal Bed

Sixty to 70 ft (18.3 to 21.3 m) above the F2 coal bed lies the Fl coal bed, as named by RMEC. A maximum coal thickness of 28 ft (8.5 m) was measured in a drill hole in sec. 23, T. 21 N., R. 89 W. excluding the non-coal partings which commonly occur in the seam. These partings range in thickness from several inches to 6 ft (1.8 m) and occur randomly throughout the coal bed. The bed crops out along the southern limb of the syncline but pinches out at the quadrangle's southern boundary. Dip and overburden characteristics are similar to those of the other coal beds in the southeastern part of the quadrangle.

E2 Coal Bed

The E2 coal bed occupies a position 35 to 40 ft (10.7 to 12.2 m) above the Fl coal bed. It and the overlying El coal bed are usually split and can contain considerable rock. Thicknesses of only 5 to 6 ft (1.5 to 1.8 m) were measured near the projected axis of the syncline; however, the bed thickens locally to more than 9 ft (2.7 m) south of this quadrangle. Overburden and dip characteristics are similar to those of the other coal beds in the southeastern part of the quadrangle.

El (Olson Draw) Coal Bed

The El or Olson Draw coal bed derives its name from its occurrence near Olson Draw in the southwestern corner of the Fillmore Ranch quadrangle (T. 18 N., R. 91 W.). The bed was penetrated by a RMEC drill hole, showing a cumulative coal thickness of 33 ft (10 m) with 7 ft (2.1 m) of rock partings which occur throughout the coal. No other measurements of the E1 coal bed are known for this quadrangle although its presence has been verified (RMEC) in the northwest quarter of the Bridger Pass 15-minute quadrangle where it thickens locally to more than 18 ft (5.5 m). Due to a lack of data concerning the E1 bed, it has been included with the isolated data points (see below).

Isolated Data Points

In instances where isolated measurements of coal beds thicker than than 5 ft (1.5 m) are encountered, the standard criteria for construction of isopach, structure contour, mining ratio, and overburden isopach maps are not available. The lack of data concerning these beds limits the extent to which they can be reasonably projected in any direction, which usually precludes correlations with other, better known, beds. For this reason, isolated coal data points are included on a separate sheet (in U.S. Geological Survey files) for non-isopachable coal beds. The isolated data points used in this quadrangle are listed below.

Source	Location	Coal Bed or Zone	Thickness
Smith (1909)	sec. 12, T. 21 N., R. 89 W.	Lance-Fox Hills Coal Zone	6.3 ft (1.9 m)
Edson (1977)	sec. 2, T. 21 N., R. 89 W.	Lower Fort Union Coal Zone	9.0 ft (2.7 m)
"	" "	" "	9.5 ft (2.9 m)
RMEC	sec. 13, T. 21 N., R. 89 W.	E2 (Olson Draw) Bed, Lower Fort Union Coal Zone	33.0 ft (10.0 m)

COAL RESOURCES

Data from coal test holes drilled by Rocky Mountain Energy Company and the U.S. Geological Survey, as well as surface mapping by Smith (1909) and Edson (1977), were used to construct outcrop, isopach, and structure-contour maps of the coal beds in the quadrangle.

Coal resources were calculated using data obtained from the coal isopach maps (plates 4, 7 10 and 14). The coal-bed acreage (measured by planimeter) multiplied by the average isopached thickness of the coal bed times a conversion factor of 1,770 short tons of coal per acre-foot (1,204 metric tons per hectare-meter) for subbituminous coal yields the coal resources in short tons of coal for each isopached coal bed. Reserve Base and Reserve values for the GL, G, F2, F1 and E2 beds are shown on plates 6, 9, 13 and 16, and are rounded to the nearest 10,000 short tons (9,072 metric tons). Coal beds thicker than 5.0 ft (1.5 m) that lie less than 3,000 ft (914.4 m) below the ground surface are included although this criteria differs somewhat from that used in calculating Reserve Base and Reserve data as stated in U.S. Geological Survey Bulletin 1450, which calls for a maximum depth of 1,000 ft (304.8 m) for subbituminous coal. Only Reserve Base values (listed as inferred resources) are shown for areas influenced by isolated data points. Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 46 million short tons (42 million metric tons) for the entire quadrangle. Reserve Base tonnages in the various development potential categories for surface and underground mining methods are shown in Tables 2 and 3.

Dames & Moore has not made any determination of economic recoverability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Development Potential for Surface Mining Methods

Areas where the coal beds are overlain by 200 ft (61.0 m) or less of overburden are considered to have potential for strip mining and were assigned a high, moderate, or low development potential based on the mining ratio (cubic yards of overburden per ton of recoverable coal). 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

Note: To convert mining ratio to cubic meters of overburden per metric ton of recoverable coal, multiply MR by 0.8428.

Areas of high, moderate, and low development potential are here defined as areas underlain by coal beds having respective mining ratio values of

0 to 10, 10 to 15, and greater than 15, as shown on plates 5, 8, 12 and 15. These mining ratio values for each development potential category are based on economic and technological criteria and were provided by the U.S. Geological Survey.

Unknown development potentials have been assigned to those areas where coal data is absent or extremely limited. This includes areas influenced by isolated data points only. Even though these areas contain coal thicker than 5 ft (1.5 m), limited knowledge pertaining to the areal distribution of the coal prevents accurate evaluation of development potential.

The coal development potential for surface mining methods (<200 ft or 61.0 m of overburden) is shown on plate 7.

In this quadrangle, high or moderate development potential areas exist only in close proximity to the outcrops of the Fort Union coal beds. Due to the relatively high dip angles, overburden and mining ratios increase rapidly down dip. Low or unknown potentials predominate in all but the southeastern quarter of the quadrangle. High development potential occupies about 56 percent of sec. 24, and about 62 percent of sec. 26, T. 21 N., R. 88 W.

Development Potential for Underground and In-Situ Mining Methods

The coal development potential for underground mining is shown on plate 8. Areas of high, moderate, and low development potential are defined as areas underlain by coal beds of Reserve Base thickness at depths ranging from 200 to 1,000 ft (61.0 to 304.8 m), 1,000 to 2,000 ft (304.8 to 609.6 m), and 2,000 to 3,000 ft (609.6 to 914.4 m), respectively.

Reserve Base tonnages have been calculated for all areas where the coal beds are of Reserve Base thickness or greater. However, underground Reserves have been calculated for only that part of the Reserve Base considered to be suitable for underground mining. An arbitrary dip limit of 15° is assumed to be the maximum dip suitable for conventional underground mining methods, and Reserves have not been calculated for those areas where the dip of the coal beds exceed 15°.

High development potential for underground mining exists in about 44 percent of sec. 24, T. 21 N., R. 88 W., 94 percent of sec. 26, 44 percent of sec. 14, 6 percent of sec. 22, and all of northern part of sec. 34 that is in the quadrangle. Unknown development potentials have been assigned to other Federal lands within the KRCRA because coal-bearing units are present at depths of less than 3,000 ft (914.4 m) but coal data is absent or extremely limited.

All Federal lands within the KRCRA in this quadrangle have been rated as having low in-situ development potential because of the limited areal extent of the coal beds and the low Reserve Base tonnages known to be available for in-situ mining.

Table 1. -- Chemical analyses of coals in the southwest quarter of the Rawlins Peak 15-minute quadrangle, Carbon County, Wyoming

LOCATION	COAL BED NAME	Form of Analysis	Proximate				Ultimate					Heating value	
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Calories	Btu/Lb
SW1/4, SW1/4, sec. 12, T. 21 N., R. 89 W. (after Smith, 1909)	Fort Union, undifferentiated	A	17.24	31.88	49.28	1.60	0.14	5.71	59.08	0.33	33.14	5,719	10,294
		B	12.33	33.77	52.20	1.70	0.15	5.39	62.58	0.35	29.83	6,058	10,905
NE1/4, NW1/4, sec. 35, T. 21 N., R. 89 W. (RMEC, RR-128)	F1	A	15.97	32.57	44.69	6.77	0.15	--	--	--	--	--	9,786
		C	0.0	38.76	53.18	8.06	0.18	--	--	--	--	--	11,646
NW1/4, NW1/4, NW1/4, sec. 25, T. 21 N., R. 89 W. (RMEC, RR-134)	F2	A	16.57	32.79	43.46	7.18	0.24	--	--	--	--	--	9.607
		C	0.0	39.3	52.09	8.61	0.29	--	--	--	--	--	11,515
NW1/4, NE1/4, sec. 35, T. 21 N., R. 89 W. (RMEC, RR-137)	G	A	17.85	32.36	43.01	6.78	0.33	--	--	--	--	--	9,496
		C	0.0	39.39	52.36	8.25	0.40	--	--	--	--	--	11,559

Form of Analysis: A, as received
B, air dried
C, moisture free

Note: To convert BTU/pound to kilojoules/kilogram, multiply by 2.326.

Table 2. -- Strippable coal Reserve Base data for Federal coal lands (in short tons) in the southwest quarter of the Rawlins Peak 15-minute quadrangle, Carbon County, Wyoming

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Total
G	430,000	360,000	1,270,000	2,060,000
F2	1,720,000	900,000	1,320,000	3,940,000
F1	1,090,000	250,000	260,000	1,600,000
E2	540,000	280,000	480,000	1,300,000
Total	3,780,000	1,790,000	3,330,000	8,900,000

Note: To convert short tons to metric tons, multiply by 0.9072.

Table 3. -- Coal Reserve Base data for underground mining methods for Federal coal lands (in short tons) in the southwest quarter of the Rawlins Peak 15-minute quadrangle, Carbon County, Wyoming

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Total
G	8,800,000	50,000	0	8,850,000
F2	10,500,000	50,000	0	10,550,000
F1	17,410,000	140,000	0	17,550,000
E2	440,000	0	0	440,000
Total	37,150,000	240,000	0	37,390,000

Note: To convert short tons to metric tons, multiply by 0.9072.

Table 4. -- Sources of data used on plate 1 (CRO Map)

Plate 1 Index Number	Source	Data Base
1	Rocky Mountain Eneryg Co., (no date), unpublished data	Drill hole No. RR 145
2	↓	Drill hole No. RR 146
3	U.S. Geological Survey, 1977, unpublished data	Drill hole No. RP-D6
4	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. RR 32
5	↓	Drill hole No. RR 147
6	↓	Drill hole No. RR 148
7	↓	Drill hole No. RR 150
8	↓	Drill hole No. RR 132
9	↓	Drill hole No. RR 149
10	↓	Drill hole No. RR 133
11	U.S. Geological Survey, 1977, unpublished data	Drill hole No. RP-D7
12	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. RR 134
13	↓	Drill hole No. RR 152
14	U.S. Geological Survey, 1977, unpublished data	Drill hole RP-D8
15	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. RR 151
16	↓	Drill hole No. RR 127

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Table 4. -- Concluded

Plate 1 Index Number	Source	Data Base
17	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. RR 153
18	U.S. Geological Survey, 1977, unpublished data	Drill hole No. RP-D9
19	↓	Drill hole No. RP-D10
20	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. RR 135
21	↓	Drill hole No. RR 135
22	↓	Drill hole No. RR 137
23	↓	Drill hole No. RR 129
24	↓	Drill hole No. RR 128
25	↓	Drill hole No. RR 138
26	↓	Drill hole No. RR 139
27	↓	Drill hole No. RR 140

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