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COAL RESOURCE OCCURRENCE MAPS AND COAL DEVELOPMENT POTENTIAL OF THE SAND POINT QUADRANGLE, RIO BLANCO AND ROUTT COUNTIES, COLORADO

Prepared for

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GEOLOGICAL SURVEY

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CONTENTS

ILLUSTRATIONS

Page

TABLES

INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence Maps of the Sand Point quadrangle, Rio Blanco and Routt Counties, Colorado. This report was compiled to support the land planning work of the Bureau of Land Management (BLM) and 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 14-08-0001-15789. The resource information gathered for this report is in response to the Federal Coal Leasing Amendments Act of 1976 (P.L. 94-377). Published and unpublished public information available through April, 1978, was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor was any confidential data used.

Location

The Sand Point quadrangle is located in northeastern Rio Blanco County and south-central Routt County in northwestern Colorado, approximately 23 airline miles (37 km) south-southeast of the town of Steamboat Springs and 3.4 miles (5.5 km) southeast of the town of Oak Creek via an improved light-duty road along Oak Creek. With the exception of a few scattered ranches and houses, the quadrangle is unpopulated. The southwestern two thirds of the quadrangle are within the Routt National Forest.

Accessibility

Colorado Highway 131 passes north-south through the town of Oak Creek east of the quadrangle, joining Steamboat Springs to the north with the town of Yampa to the south. Several improved light-duty roads extend westward across the northern half of the Sand Point quadrangle. The remainder of the quadrangle is accessible by several unimproved dirt roads and trails.

Railway service for the Sand Point quadrangle area is provided by the Denver and Rio Grande Western Railroad which follows Colorado Highway 131 approximately 3 miles (5 km) east of the quadrangle. The rail line is the major transportation route for coal shipped east from northwestern Colorado (U.S. Bureau of Land Management, 1977).

Physiography

The Sand Point quadrangle lies in the southern part of the Wyoming Basin physiographic province as defined by Howard and Williams (1972). The quadrangle is approximately 18 miles (29 km) west of the Gore Range, 15 miles (24 km) southeast of the Williams Fork Mountains, and 25 miles (40 km) southwest of the Continental Divide at its closest point.

The landscape within the Sand Point quadrangle is characterized by moderate slopes and valleys. The topography steepens in the northeastern and southwestern parts of the quadrangle. A large plateau, the Little Flat Tops, lies in the southwestern corner of the quadrangle.

Approximately 3,360 feet (1,024 m) of relief is present in the Sand Point quadrangle. Altitudes range from less than 7,720 feet (2,353 m) along Oak Creek in the northeastern corner of the quadrangle to approximately 11,080 feet (3,377 m) on the Little Flat Tops in the southwestern corner.

Hunt Creek and its tributaries drain the southern part of the quadrangle, while Oak Creek and Trout Creek drain the northeastern and northwestern parts, respectively. All are tributaries of the Yampa River to the east and north of the quadrangle boundary. Numerous small lakes, ponds, and reservoirs occur at higher elevations, primarily in the southern half of the quadrangle.

Climate and Vegetation

The climate of northwestern Colorado is semiarid. Clear, sunny days prevail in the Sand Point area, with daily temperatures typically varying from 0° to 35°F (-18° to 2°C) in January and from 42° to 80°F (6° to

27°C) in July. Annual precipitation in the area averages approximately 16 inches (41 cm). Snowfall during the winter months accounts for the major part of the precipitation in the area; however, rainfall from thundershowers during the summer months also contributes to the total. Winds, averaging approximately 3 miles per hour (4.8 km per hour), are generally from the west, but wind directions and velocities vary greatly depending on the local terrain (U.S. Bureau of Land Management, 1977).

Vegetation is varied in the Sand Point quadrangle, and includes sagebrush, aspen, mountain shrub and conifer (U.S. Bureau of Land Management, 1977).

Land Status

The Sand Point quadrangle lies along the southeastern edge of the Yampa Known Recoverable Coal Resource Area (KRCRA). However, only a small part of the northeast corner of the quadrangle is within the KRCRA boundary, and the Federal government owns the coal rights for all of this area as shown in figure 2. (Figures are presented on pages 10 through 13.) No active coal leases occur within the KRCRA in this quadrangle.

GENERAL GEOLOGY

Previous Work

The first geologic description of the general area in which the Sand Point quadrangle is located was reported by Emmons (1877) as part of a Survey of the Fortieth Parallel. The decision to build a railroad into the region stimulated several investigations of coal between 1886 and 1905, including papers by Hewett (1889), Hills (1893), Storrs (1902), and Parsons and Liddell (1903). Fenneman and Gale (1906) conducted geologic studies of the Yampa coal field and included a description of the geology and coal occurrence in the Sand Point quadrangle in their report. The most comprehensive work on the area, including the northeastern part of this quadrangle, was conducted by Bass and others (1955). Tweto (1976) compiled a generalized regional geologic map which included this quadrangle.

Stratigraphy

The sedimentary rock formations exposed in the Sand Point quadrangle range in age from Late Cretaceous to Miocene. These include the Late Cretaceous-age, coal-bearing Iles Formation of the Mesaverde Group; the underlying Late Cretaceous Mancos Shale; and the Browns Park Formation of Miocene age. Only the Iles Formation is known to contain coal in this quadrangle. Since the Browns Park Formation overlies only the Mancos Shale and not the Iles Formation in this quadrangle, it is not shown in the composite columnar section in figure 3.

The Mancos Shale is exposed over much of the quadrangle, except along the north-central edge and in the northeastern and southwestern corners. It is composed of gray to dark-gray marine shale interbedded with light-gray to light-brown fine-grained massive sandstone beds (Kucera, 1962). According to Kucera, the Mancos Shale ranges in thickness from about 2,900 to 3,800 feet (884 to 1,158 m) in the Yampa district, but its total thickness in the Sand Point quadrangle is unknown.

The Iles Formation, which is the lower member of the Mesaverde Group, conformably overlies the Mancos Shale and is exposed in the north-central and northeast parts of the quadrangle. The formation consists of light-gray to light-brown fine- to medium-grained sandstone interbedded with light-gray to dark-gray carbonaceous shale and coals (Kucera, 1959 and 1962). Although the formation is reported by Kucera to be approximately 1,500 feet (457 m) thick in the Yampa district, it is estimated that from 700 to 800 feet (213 to 244 m) of the lower part of the formation is present in this quadrangle. The Tow Creek Sandstone Member is the basal unit of the Iles Formation and consists of light-gray to light-brown, medium-grained sandstone, and is approximately 35 feet (11 m) thick where exposed west of Phippsburg (Kucera, 1962). Coal beds within the Iles Formation are included in the Lower Coal Group of the Mesaverde (Fenneman and Gale, 1906).

The Browns Park Formation lies unconformably on the Mancos Shale in the southwestern part of the quadrangle in the Little Flat Tops area (Tweto, 1976). Near Sand Point it is composed primarily of pebble to boulder conglomerate and very pale orange to white, very fine to medium-grained, massive to cross-bedded sandstone and contains interbedded calcareous concretionary lenses (Kucera, 1962). Kucera indicates that the conglomerate is 100 to 200 feet (30 to 61 m) thick and the sandstone is 510 feet (155 m) thick in the Sand Point-Little Flat Tops area.

A basalt flow caps the Little Flat Tops in the southwestern part of the Sand Point quadrangle and Belly Ache Mountain in the south-central part of the quadrangle (Tweto, 1976). The basalt, probably of Miocene and Pliocene age, unconformably overlies the Mancos Shale. Two small volcanic necks penetrate the Brown Park Formation just northeast of the Little Flat Tops.

Holocene and Pleistocene landslide deposits cover the area surrounding the Little Flat Tops in the southwestern part of the quadrangle, and Holocene deposits of alluvium occur in many of the stream valleys throughout the quadrangle.

The Cretaceous sedimentary rocks in the Sand Point quadrangle accumulated close to the western edge of a Late Cretaceous-age epeirogenic seaway which covered part of the western interior of North America. Several transgressive-regressive cycles caused the deposition of a series of marine, near-shore marine, and non-marine sediments in the Sand Point quadrangle area (Masters, 1959; Ryer, 1977).

The Mancos Shale was deposited in an offshore marine environment which existed east of the shifting strand line. Deposition of the Mancos Shale in the quadrangle area ended with the eastward migration of the shoreline, and the subsequent deposition of the Iles Formation (Kucera, 1959).

The interbedded sandstone, shale, and coal of the Mesaverde Group were deposited as a result of minor changes in the position of the shoreline. Near-shore marine, littoral, brackish tidal, brackish and fresh water supratidal, and fluvial environments existed during the deposition of the Iles Formation. Coal beds of limited areal extent, including those in the Lower Coal Group, were generally deposited in environments associated with fluvial systems, such as back-levee and coastal plain swamps, interchannel basin areas, and abandoned channels (O'Boyle, 1955; Konishi, 1959).

The Miocene-age Browns Park Formation was deposited after a long period of non-deposition and erosion. It is a continental deposit consisting of fluvial and eolian deposits, and much of its thickness has been removed as a result of late Cenozoic erosion.

Structure

The Yampa KRCRA lies in the southern extension of the Washakie/ Sand Wash structural basin of south-central Wyoming. The basin is bordered on the east by the Park Range, approximately 25 miles (40 km) northeast of the Sand Point quadrangle, and on the southwest by the Axial Basin anticline, which is approximately 28 miles (45 km) west-northwest of the quadrangle.

The beds in the Sand Point quadrangle generally dip north-northeast. Three northwest-trending faults cut the Mancos Shale and the Iles Formation in the northeastern part of the quadrangle (Bass and others, 1955). A fourth fault (Tweto, 1976) occurs in the southwestern corner of the quadrangle, but does not cut any coal-bearing beds.

COAL GEOLOGY

Several coal beds in the Lower Coal Group of the Mesaverde Group have been identified in the Sand Point quadrangle. The Lower Coal Group includes all coal beds in the Iles Formation.

Chemical analyses of coal.--Analyses of the coals in this area are listed in table 1. Chemical analyses were not available coal from the

Lower Coal Group in the Sand Point quadrangle, but it is believed that the coal is similar in rank to that mined at the Brazil-Hastings and Gwynn mines in the Yampa quadrangle to the east. Chemical analyses of this coal indicate that it is high-volatile C bituminous in rank on a moist, mineral-matter-free basis according to ASTM Standard Specification D 388-77 (American Society for Testing and Materials, 1977).

Lower Coal Group

Three coal beds in the Lower Coal Group have been identified in two drill holes and a mine-measured section in the northeastern corner of the quadrangle, and one coal bed has been inferred to extend into this quadrangle from the adjacent Yampa quadrangle to the east. Ordinarily, coal beds in this group tend to be thin, lenticular and of limited areal extent in the southeastern part of the Yampa KRCRA, and only the coal bed projected into this quadrangle exceeds Reserve Base thickness (5.0 feet or 1.5 meters). This coal bed has been given a bracketed number for identification purposes in this and the Yampa quadrangle.

The LG[1] (i.e., Lower Coal Group, coal bed [1]) coal bed has not been observed in the Sand Point quadrangle, but it is believed to extend into this quadrangle based on the projection of a coal bed measurement from the Yampa quadrangle where the coal bed was penetrated by a single drill hole and treated as an isolated data point. In instances where an isolated measurement thicker than Reserve Base thickness is encountered, such as the LG[1] coal bed, the standard criteria for construction of isopach, structure contour, overburden isopach, and mining ratio maps are not available. The lack of data concerning this coal bed limits the extent to which it can be reasonably projected in any direction and precludes correlation with any other, better known coal beds. The western edge of this projection lies in the Sand Point quadrangle as shown in figure 4.

COAL RESOURCES

Data from the drill hole in the Yampa quadrangle was used to construct an areal distribution and identified resources map of the non-isopached LG[1] coal bed (figure 4).

Coal resources for Federal land were calculated using data obtained from figure 4. The coal bed acreage (measured by planimeter), multiplied by the average thickness of the coal bed and by a conversion factor of 1,800 short tons of coal per acre-foot (13,238 metric tons per hectare-meter) for bituminous coal, yields the coal resources in short tons. Coal beds thicker than 5 feet (1.5 m) that lie less than 3,000 feet (914 m) below the ground surface are included. These criteria differ somewhat from those stated in U.S. Geological Survey Bulletin 1450-B which call for a minimum thickness of 28 inches (70 cm) and a maximum depth of 1,000 feet (305 m) for bituminous coal.

Only Reserve Base tonnages (designated as inferred resources) are calculated for the LG[1] coal bed. These are shown in figure 4, and are rounded to the nearest 10,000 short tons (9,072 metric tons). Coal Reserve Base tonnages per Federal section are shown in figure 2 and total approximately 0.28 million short tons (0.25 million metric tons) for the entire quadrangle. Reserve Base tonnages in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3. The source of each indexed data point shown in figure 1 is listed in table 4.

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

COAL DEVELOPMENT POTENTIAL

The standard criteria for classifying coal resource development potential by surface and subsurface mining methods were not applied to the Sand Point quadrangle. Unknown development potentials are assigned to those areas where coal data is absent or extremely limited, such as the area influenced by the isolated data point in this quadrangle. Even though this area may contain coal thicker than 5 feet (1.5 m), limited knowledge of the areal distribution, thickness, depth, and attitude of the coal bed prevents accurate evaluation of development potential in the high, moderate, and low categories. Coal tonnages included in the

unknown potential category in this quadrangle total approximately 0.05 million short tons (0.04 million metric tons) for surface mining methods and approximately 0.23 million short tons (0.21 million metric tons) for subsurface mining methods.

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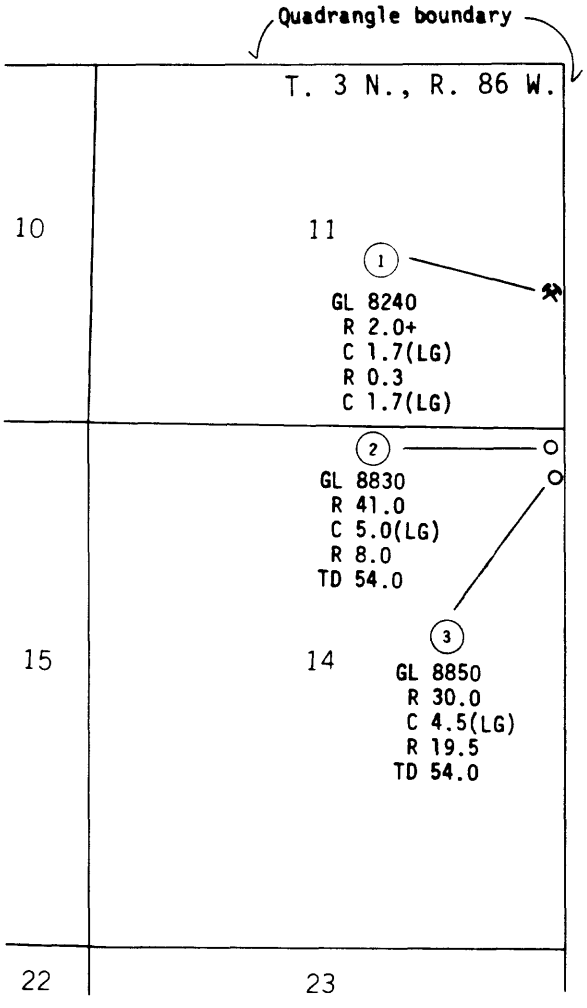

EXPLANATION

○ (2)

GL 8830
R 41.0
C 5.0(LG)
R 8.0
TD 54.0

COAL TEST HOLE - Showing drill-hole data, in feet. Index number refers to hole in figure 3 or in table of text. Letters designate name of coal bed as listed below.

⚒ (1)

GL 8240
R 2.0+
C 1.7(LG)
R 0.3
C 1.7(LG)

MINE MEASURED SECTIONS - Abandoned underground mine, showing rock interval and coal thickness, in feet. Index number refers to section in figure 3 or in table of text. Letters designate name of coal bed as listed below.

GL - Ground level elevation
R - Rock interval
C - Coal interval
TD - Total depth

DRILL HOLE AND MEASURED-SECTION DATA SYMBOLS

LG - Lower Coal Group

COAL BED SYMBOL AND NAME

To convert feet to meters, multiply feet by 0.3048.

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U.S. Geol. Survey, 1957, Inactive Coal Prospecting Permit No. Colorado 013228, Edna Coal Co.

0 .5 1 Miles
0 .5 1 Kilometers

FIGURE 1. — Coal data map.

Table 1. -- Chemical analyses of coals in the Sand Point area, Routt and Rio Blanco Counties, Colorado.

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
Sec. 11, T. 3 N., R. 86 W., Brazil-Hastings Mine (George and others, 1937) from Yampa quadrangle	Iles Formation, Lower Coal Group No. 2	A	8.9	36.5	48.5	6.1	0.7	-	-	-	-	6,667	12,000
		C	-	40.1	53.2	6.7	0.8	-	-	-	-	7,322	13,180
SW¼, SE¼, sec. 12, T. 3 N., R. 86 W., Gwynn Mine (George and others, 1937) from Yampa quadrangle	Iles Formation, Lower Coal Group No. 2	A	9.9	37.6	49.1	3.4	0.6	-	-	-	-	6,739	12,130
		C	-	41.8	54.5	3.7	0.6	-	-	-	-	7,478	13,460

Form of Analysis: A, as received
C, moisture free

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

Table 2. -- Coal Reserve Base data for surface mining methods for Federal coal lands (in short tons) in the Sand Point quadrangle, Rio Blanco and Routt Counties, Colorado.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Isolated Data Point	-	-	-	50,000	50,000
Totals	-	-	-	50,000	50,000

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

Table 3. -- Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the Sand Point quadrangle, Rio Blanco and Routt Counties, Colorado.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Isolated Data Point	-	-	-	230,000	230,000
Totals	-	-	-	230,000	230,000

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

Table 4. -- Sources of data used in figure 1

Plate 1 Index Number	Source	Data Base
1	Bass and others, 1955, U.S. Geological Survey Bulletin 1027-D, pl. 24	Mine Measured Section No. 37
2	U.S. Geological Survey, 1957, Inactive Coal Lease No. C-023207, Edna Coal Co.	Drill hole No. 7
3	↓	Drill hole No. 8

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American Society for Testing and Materials, 1977, Standard specification for classification of coals by rank, in Gaseous fuels; coal and coke; atmospheric analysis: ASTM Standard Specification D 388-77, pt. 26, p. 214-218.

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