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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE CRESTON QUADRANGLE, CARBON AND SWEETWATER COUNTIES, WYOMING

[Report includes 26 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.

CONTENTS

ILLUSTRATIONS

Illustrations--Continued

INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) Maps of the Creston quadrangle, Carbon and Sweetwater Counties, Wyoming. This report was compiled to support the land planning work of the Bureau of Land Management (BLM) 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. 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 Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed, nor was any confidential data used.

Location

The Creston quadrangle is located in south-central Wyoming on the county line between western Carbon and eastern Sweetwater Counties, approximately 26 miles (42 km) west of Rawlins and 6 miles (10 km) east of Wamsutter, Wyoming. The area is unpopulated. Creston and Latham, former loading stations for the Union Pacific Railroad, have been abandoned.

Accessibility

The main east-west line of the Union Pacific Railroad passes through the northern half of the quadrangle providing railway service across southern Wyoming. This railway connects Ogden, Utah to the west and Omaha, Nebraska to the east.

Interstate Highway 80 passes east-west across the northern half of the quadrangle. The abandoned station of Creston, on the Union Pacific Railroad, is accessible by an improved light-duty road from Interstate Highway 80. Wyoming Highway 789, connecting Baggs and Creston Junction, cuts across the southeastern corner of the quadrangle. The remainder of the quadrangle is served by numerous unimproved dirt roads and trails.

Physiography

The Creston quadrangle is located in the Red Desert region on the southern edge of the Great Divide Basin. The landscape within the quadrangle is characterized by gravel-capped terraces, shallow dry washes, badlands and dunes. Altitudes in the quadrangle vary from 6,770 feet (2,064 m) in the southwestern corner of the quadrangle to 7,230 feet (2,204 m) on the northern edge of the quadrangle.

Latham Draw, cutting across the northwestern portion of the quadrangle, and Hansen Draw, cutting across the southern portion of the quadrangle, empty into a large undrained depression or playa approximately 8 miles (13 km) west of the quadrangle. Streams in the quadrangle are intermittent, flowing mainly in response to snowmelt in the spring. Several terminate locally in a large playa on the eastern edge of the quadrangle forming a shallow alkaline lake which fluctuates 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 inches (26.4 cm). Approximately two thirds of the precipitation falls in the spring and summer during a seven-month period from April through October.

The average annual temperature in 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) (Wyoming Natural Resources Board, 1966).

Winds are usually from the southwest and the west-southwest with an average velocity of 12 miles per hour (19 km per hr) (U.S. Bureau of Land Management, 1978).

Principal types of vegetation in the quadrangle include grasses, sagebrush, greasewood, saltbush, rabbitbrush, and other desert shrubs (U.S. Bureau of Land Management, 1978).

Land Status

The Creston quadrangle lies on the northwestern edge of the Rawlins Known Recoverable Coal Resource Area and on the southeastern edge of the Red Desert Known Recoverable Coal Resource Area. The southeastern portion of the quadrangle, approximately one third of the quadrangle's total area, lies within the Rawlins KRCRA boundary and the northern half of the quadrangle lies within the Red Desert KRCRA boundary. The Federal government owns the coal rights for approximately half of the land in the KRCRA's. One active coal lease is present within the Rawlins KRCRA boundary as shown on plate 2.

GENERAL GEOLOGY

Previous Work

Ball (1909) described the coals of the Fort Union and Wasatch Formations present in the Creston quadrangle in his study of the western part of the Little Snake River coal field. Smith (1909) covered a small area in the northern portion of the quadrangle in an investigation of the eastern part of the Great Divide Basin coal field. Masursky and Pipiringos (1959) described the Wasatch coals present in the northern portion of the Creston quadrangle in their study of uranium-bearing coal in the Red Desert area. Masursky (1962) also described the stratigraphy of the Tertiary-age formations present in the quadrangle. Welder and McGreevy (1966) included the Creston quadrangle in a report published in the geology and ground-water resources of the Great Divide Basin. Smith and others (1972) described the strippable coals and the coal reserves present in the Cherokee deposit in the eastern portion of the quadrangle. Sanders made a detailed investigation of the geology and coal resources of the Riner quadrangle in 1974 and of the adjacent Creston Junction quadrangle in 1975. Recent unpublished data from the Rocky Mountain Energy Company (RMEC) and from the U.S. Geological Survey provided the location of coal outcrops and coal thickness information.

Stratigraphy

The formations exposed in the Creston quadrangle range in age from Paleocene to Recent. The Paleocene-age Fort Union Formation and the Eocene-age Wasatch Formation contain coal.

No information is available on the thickness of the Fort Union Formation which crops out in the southeastern corner of the Creston quadrangle. However, it is approximately 3,400 feet (1,036 m) thick in the adjacent Creston Junction quadrangle. Present in the subsurface at the base of the formation are approximately 500 feet (152 m) of light-gray, thick-bedded to massive, medium- to coarse-grained sandstones. This is overlain by approximately 1,500 feet (457 m) of alternating beds of light-brown to orange argillaceous siltstone, light-gray fine- to medium-grained sandstone, light- to dark-gray shale, and thin lenticular coal beds. Above this are approximately 700 feet (213 m) of arenaceous siltstone and carbonaceous shale. The upper 600 to 700 feet (183 to 213 m) of the Fort Union Formation, which crops out in the quadrangle, consist of gray-brown argillaceous siltstone, brown micaceous sandstone, shale, thick coals, and lignite (Sanders, 1974 and 1975).

Unconformably overlying the Fort Union Formation, and cropping out throughout the remainder of the quadrangle, are Wasatch Formation sediments. No information is available on their thickness in the Creston quadrangle. These consist of intertonguing white to yellowish-white massive beds of arkose or brown ferruginous lenses of coarse-grained to granulitic arkose, and dark-gray, gray-green, or black shale which locally contains numerous plant fragments. These sediments are lithologically equivalent to the Battle Springs Formation occurring north of the quadrangle. These grade into the coal-bearing main body of the Wasatch Formation which consists of cream-colored to gray siltstone, organic shale, fossiliferous fine-grained sandstone, sandy limestone, carbonaceous shale, and thick coals, some of which are uraniferous (Masursky, 1962, and Sanders, 1974 and 1975).

Recent deposits of alluvium cover the stream valleys of Latham Draw and Hansen Draw. Pleistocene-age terrace remnants of unconsolidated gravel cap the northeastern portion of the quadrangle. A large area of playa-lake clays is present on the east-central border of the quadrangle.

Thick sections of detrital material, eroded from older deposits, were deposited as the coarse sandstones of the Fort Union Formation. The sandstones, shales, and coals were deposited in stream, lake, and swamp environments.

The coarse-grained arkose of the Wasatch Formation is probably a fluvial facies of the main Wasatch Formation which formed in a piedmont environment adjacent to the sediment source. The beds of the Wasatch Formation grade into the fine-grained, thin-bedded, coal-shale-sandstone facies deposited in alternating lake, swamp, and stream environments (Masursky, 1962).

Structure

The Creston quadrangle lies on the southern edge of the Wamsutter Arch, a broad low structure separating the Great Divide and Washakie structural basins. Beds in the quadrangle strike northeasterly and dip gently to the northwest.

Masursky (1962) mapped two sets of normal faults, with displacements of up to 70 feet (21.3 m), in the eastern part of the Red Desert area. Two faults, included in the first set, trend approximately N 70° E., and are located in the northeastern corner of the Creston quadrangle. One fault, included in the second set, trends approximately N. 45° W. and is located in the northwestern corner of the quadrangle.

COAL GEOLOGY

The Wasatch and Fort Union Formations both contain significant amounts of coal, as shown on plate 1. The Fort Union Formation consists of two coal zones, separated by approximately 1,500 feet (457 m) of of siltstone and shale. The Wasatch Formation lies unconformably above the Fort Union Formation, and contains a zone of coal approximately 620 feet (189 m) above the base of the formation. Data collection has been expanded beyond the Rawlins KRCRA to include the coal beds of the Wasatch Formation. Therefore, the entire quadrangle will be considered for the purposes of this report.

Chemical analyses of coal.--Analyses of the coals in this area are listed in table 1.

No information on coal quality was found for the Lower Fort Union Formation coal beds; however, analyzed samples of the Upper Fort Union Formation coal beds were obtained from the adjacent High Point and Creston Junction quadrangles (Sanders, 1974). Analyses from four coal beds of the Wasatch Formation are also included in the table (Pike and others, 1977).

Rocky Mountain Energy Company (oral communication, 1978) has indicated that the coals in this quadrangle are high in uranium and sulfur content, and rank from lignitic to subbituminous B. In general, the Fort Union Formation coals are subbituminous B or C and the Wasatch Formation coals range from lignite to subbituminous B or C in rank. The coals were ranked on a moist, mineral-matter-free basis according to ASTM Standard Specification D 388-77 (ASTM, 1977).

Fort Union Coal Zones

The Fort Union Formation contains two coal zones, the upper and lower. The Lower Fort Union Coal Zone is represented in one oil well, located in sec. 4, T. 19 N., R. 92 W., at a depth of more than 2,200 feet (671 m). Because of insufficient data, correlation of Lower Fort Union Coal Zone beds present in this hole with the better known Lower Fort Union Coal Zone beds to the east is not possible. One bed, FU[3], is of Reserve Base thickness (greater than 5 feet or 1.5 meters) and, therefore, isopach and structure contour maps were prepared. The dotted line shown on plate 4 represents the limit of confidence of the data, but it is quite likely that the FU[3] bed is of Reserve Base thickness beyond this line. The bracketed number is used for identification purposes in this quadrangle only.

The Upper Fort Union Coal Zone is 320 feet (98 m) thick and contains four identified coal beds. None of the beds crop out in the Creston quadrangle, but they do occur at depth in drill holes in the southeastern corner of the quadrangle. No strike and dip measurements were available in this quadrangle, but data from surrounding quadrangles indicate that the beds dip 2° or less in a northwesterly direction. Overburden thickness increases in the same direction.

Horse Butte Coal Bed

The Horse Butte coal bed is, stratigraphically, the lowest identified coal bed in the Upper Fort Union Coal Zone. The bed is named for Horse Butte located in sec. 5, T. 19 N., R. 91 W. (Edson, in press, a). The Horse Butte coal bed is found in only one drill hole in sec. 3, T. 19 N., R. 92 W., and it is 10.5 feet (3.2 m) thick at that location. To the east, in the Creston Junction quadrangle, the Horse Butte bed attains a maximum thickness of 11 feet (3.4 m) in sec. 12, T. 19 N., R. 92 W. It is not continuous throughout the Creston Junction quadrangle, but occurs only in the southwest corner. The Horse Butte coal bed dips 3° or less in a northwesterly direction as shown on plate 8.

Cow Butte Coal Bed

The Cow Butte coal bed is 45 feet (13.7 m) above the Horse Butte coal bed. The bed is named for Cow Butte in sec. 5, T. 19 N., R. 91 W. (Back, 1976). In this quadrangle, the maximum bed thickness is 23.5 feet (7.2 m) with a 12-foot (3.7-m) shale parting. In sec. 1, T. 19 N., R. 92 W., in the Creston Junction quadrangle, the Cow Butte coal bed reaches a thickness of 26.6 feet (8.1 m) excluding 12.7 feet (3.9 m) of shale partings. To the south in sec. 3, T. 18 N., R. 92 W. (in the High Point quadrangle), the bed is 15.2 feet (4.6 m) thick. This bed generally contains significant amounts of shale partings, and in some areas of the Creston Junction quadrangle to the east the bed is split by as much as 100 feet (30.5 m) of shale and sandstone. On plate 15 the bed is shown dipping northwest to west at 3° or less.

Cherokee Coal Bed

The Cherokee coal bed is split in a small portion of the Creston quadrangle as shown on plate 18. It lies approximately 135 feet (41 m) above the Cow Butte bed when split into the Upper and Lower Cherokee beds, and about 180 feet (55 m) above the Cow Butte bed when not split. The bed is named for the abandoned Cherokee loading station on the Union Pacific Railroad in sec. 10, T. 20 N., R. 91 W. The Lower Cherokee bed is 19.1 feet (5.8 m) thick and the Upper Cherokee bed is 18.5 feet (5.6 m) thick in sec. 3, T. 19 N., R. 92 W., where the interburden reaches a maximum thickness of 58.5 feet (17.8 m). To the west of the split line shown on plate 18, the upper and lower beds combine and attain a thickness of 47 feet (14.3 m) in sec. 3, T. 19 N., R. 92 W. To the east in the Creston Junction quadrangle, where the bed remains split, the Lower Cherokee bed attains a maximum thickness of 30.5 feet (9.3 m) in sec. 35, T. 20 N., R. 92 W. In sec. 11, T. 19 N., R. 92 W., the Upper Cherokee bed is 19.6 feet (6.0 m) thick with a 1.1-foot (0.3-m) thick parting of carbonaceous shale. Interburden between the Cherokee splits in the Creston Junction quadrangle increases to more than 100 feet (30.5 m) in sec. 9, T. 20 N., R. 91 W., but thins to 1 foot (0.3 m) to the southwest. In the High Point quadrangle to the south, the Cherokee bed is 38.6 feet (11.8 m) thick in sec. 21, T. 19 N., R. 92 W., and contains 2.9 feet (0.9 m) of carbonaceous shale partings. The dip, calculated from plate 19, is 3° to the west-northwest.

High Point Coal Bed

The High Point coal bed is, stratigraphically, the highest bed identified in the Upper Fort Union Coal Zone, lying 6 to 60 feet (1.8 to 18.3 m) above the Cherokee bed. The bed is named for the High Point ridge found in sec. 17, T. 19 N., R. 92 W. (Back, 1976). The High Point bed is 5 feet (1.5 m) thick in secs. 9 and 15, T. 19 N., R. 92 W., but thins to the north. To the east in the adjacent Creston Junction quadrangle, the bed measures 12.5 feet (3.8 m) thick in sec. 17, T. 20 N., R. 91 W., but it is discontinuous and occurs only in the southwest and northeast corners of the quadrangle. To the south in the High Point quadrangle, the bed attains a thickness of 5.6 feet (1.7 m) in sec. 21,

T. 19 N., R. 92 W. The dip of the bed, as derived from plate 23, is less than 2° to the west-northwest.

Wasatch Coal Zone

The coal beds of the Wasatch Formation crop out in the northern half of the Creston quadrangle, and have not been found in any other quadrangle within the Rawlins KRCRA. A total of seven beds in the Wasatch Coal Zone were identified, four of which are thick enough to warrant detailed descriptions. Strike and dip measurements were not available from the literature for any of the formations in this quadrangle. However, drill hole data and information from adjacent quadrangles indicate that dips in the Wasatch Formation average 1° to 2° in a west-northwest direction.

Latham No. 3 Coal Bed

The Latham No. 3 coal bed is the lowermost bed of the Wasatch Coal Zone described in this report. The bed was named for the abandoned loading station of Latham on the Union Pacific Railroad in sec. 24, T. 20 N., R. 93 W. (Masursky, 1962). This bed measures 12.2 feet (3.7 m) thick in sec. 13, T. 20 N., R. 93 W., with 8 feet (2.4 m) of shale partings. It thins to less than 5 feet (1.5 m) to the north and south of this point.

Latham No. 4 Coal Bed

The Latham No. 4 coal bed is, stratigraphically, above and separated from the Latham No. 3 coal bed by approximately 30 feet (9.1 m) of carbonaceous shale. This bed reaches a maximum thickness of 17 feet (5.2 m) in sec. 11, T. 20 N., R. 92 W.

Creston No. 2 Coal Bed

The Creston No. 2 coal bed lies approximately 35 feet (10.7 m) above the Latham No. 4 coal bed. The bed was named for the abandoned Creston loading station on the Union Pacific Railroad in sec. 15, T. 20 N., R. 92 W., (Masursky, 1962). This bed measures 9.9 feet (3.0 m) thick in sec. 15, T. 20 N., R. 93 W. It thins to less than 5 feet (1.5

m) to the east of this point. To the west, lack of information prevents accurate description of this coal bed.

Creston No. 3 Coal Bed

The Creston No. 3 coal bed lies approximately 20 feet (6.1 m) above the Creston No. 2 coal bed. The Creston No. 3 bed is the thickest Wasatch Formation coal bed in this quadrangle, reaching a maximum recorded thickness of 44.5 feet (13.6 m) with a 2-foot (0.6-m) carbonaceous shale parting in sec. 6, T. 20 N., R. 92 W. The bed appears to remain thick to the north and west, but thins to the east.

Isolated Data Points

In instances where isolated measurements of coal beds thicker than 5 feet (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 they can be reasonably projected in any direction and usually precludes correlations with other, better known beds. For this reason, isolated data points are included on a separate sheet (in U.S. Geological Survey files) for non-isopached coal beds. The isolated data point used in this quadrangle is shown below. The coal bed identified by a bracketed number is not formally named, but is numbered for identification purposes in this quadrangle only.

Source	Location	Coal Bed or Zone	Thickness
Amoco Production Co.	sec. 1, T. 19 N., R. 93 W.	FU[2]	10.0 ft (3.1 m)

COAL RESOURCES

Information from coal test holes drilled by RMEC, as well as oil well information and drill hole data from Smith (1909), Masursky and Pipiringos (1959), Masursky (1962), Smith and others (1972), and Edson (in press, b, and 1977), was used to construct outcrop, isopach, and structure contour maps of the coal beds in this quadrangle. The source of each indexed data point shown on plate 1 is listed in table 4. At the request of RMEC, coal-rock data for some of their drill holes have not been shown on plate 1 or on the derivative maps. Data from these drill holes have, however, been used to prepare the derivative maps. These data may be obtained by contacting RMEC.

Coal resources were calculated using data obtained from the coal isopach maps (plates 4, 7, 11, 14, 18 and 23). The coal bed acreage (measured by planimeter) multiplied by the average isopached thickness of the coal bed, and by a conversion factor of 1,770 short tons of coal per acre-foot (13,018 metric tons per hectare-meter) for subbituminous coal, yields the coal resources in short tons for each isopached coal bed. Reserve Base and Reserve tonnages for the FU[3], Latham No. 3, Cherokee, Lower Cherokee, Latham No. 4, Cow Butte, Creston No. 3, Creston No. 2, and Horse Butte beds are shown on plates 6, 10, 13, 17, 21 and 22, and are rounded to the nearest 10,000 short tons (9,072 metric 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 that used in calculating Reserve Base and Reserve tonnages as stated in U.S. Geological Survey Bulletin 1450-B which calls for a maximum depth of 1,000 feet (305 m) for subbituminous coal. Only Reserve Base tonnages (designated as inferred resources) are calculated for areas influenced by the isolated data point in this quadrangle. Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 290.01 million short tons (263.10 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.

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

COAL DEVELOPMENT POTENTIAL

Coal development potential areas are drawn so as to coincide with the boundaries of the smallest legal land subdivisions shown on plate 2. In sections or portions of sections where no land subdivisions have been surveyed by the BLM, approximate 40-acre (16-ha) parcels have been used to show the limits of the high, moderate, or low development potentials. A constraint imposed by the BLM specifies that the highest development potential affecting any portion of a 40-acre (16-ha) lot, tract, or parcel be applied to that entire lot, tract, or parcel. For example, if 5 acres (2 ha) within a parcel meet criteria for a high development potential, 25 acres (10 ha) a moderate development potential, and 10 acres (4 ha) a low development potential, then the entire 40 acres (16 ha) are assigned a high development potential.

Development Potential for Surface Mining Methods

Areas where the coal beds are overlain by 200 feet (61 m) or less of overburden are considered to have potential for surface 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 for surface mining methods are 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 9, 12, 16, 20 and 24. 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, including areas influenced by isolated data points. Even though these areas contain coal thicker than 5 feet (1.5 m), limited knowledge of the areal distribution of the coal prevents accurate evaluation of development potential.

The coal development potential for surface mining methods (less than 200 feet or 61 meters of overburden) is shown on plate 25.

Federal lands within this quadrangle are classified as having high or unknown development potential for surface mining methods. The Federal land classified as having unknown development potential has no known coal beds 5 feet (1.5 m) or more thick occurring within 200 feet (61 m) of the ground surface but coal-bearing units are present.

Development Potential for Subsurface and In-Situ Mining Methods

The coal development potential for subsurface mining is shown on plate 26. 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 feet (61 to 305 m), 1,000 to 2,000 feet (305 to 610 m), and 2,000 to 3,000 feet (610 to 914 m), respectively.

All of those Federal land areas having known development potential for conventional subsurface mining methods have high potential. Unknown potential is assigned to the remaining Federal land within the KRCRA, implying that no known coal beds 5 feet (1.5 m) or more thick, not including the isolated data point, occur between 200 and 3,000 feet (61 m and 914 m) below the ground surface but that coal-bearing units are present. Tonnages for the unknown (subsurface) development potential for isolated data points total 3,010,000 short tons (2,730,000 metric tons).

None of the Federal land areas in this quadrangle have been rated for in-situ development because all of the coal beds dip less than 15°.

Table 1 -- Chemical analyses of coals in the Creston quadrangle, Carbon and Sweetwater Counties, 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
sec. 5, T. 20 N., R. 93 W. (Pike and others, 1977)	Creston No. 3	A	31.7	26.8	24.8	16.7	4.5	--	--	--	--	--	6,630
sec. 6, T. 20 N., R. 92 W. (Pike and others, 1977)	Creston No. 2	A	21.6	33.9	32.3	12.3	2.6	--	--	--	--	--	8,225
sec. 7, T. 20 N., R. 92 W. (Pike and others, 1977)	Latham No. 4	A	23.2	27.3	27.4	22.2	2.6	--	--	--	--	--	6,875
sec. 17, T. 20 N., R. 92 W. (Pike and others, 1977)	Latham No. 3	A	25.2	30.4	33.2	11.2	3.0	--	--	--	--	--	8,210
sec. 27, T. 19 N., R. 92 W. (Sanders, 1974)	High Point	A	15.9	34.8	29.0	20.4	3.3	--	--	--	--	--	7,782
T. 19 N., R. 92 W., Cherokee mines area (Sanders, 1974)	Upper Cherokee	A	22.7	31.6	30.3	14.6	1.8	--	--	--	--	--	7,714
T. 19 N., R. 92 W., Cherokee mines area (Sanders, 1974)	Lower Cherokee	A	22.4	34.9	30.4	12.8	1.7	--	--	--	--	--	8,293
T. 19 N., R. 92 W., Cherokee mines area (Sanders, 1974)	Cow Butte	A	17.6	35.0	25.8	21.3	3.3	--	--	--	--	--	7,417
T. 19 N., R. 92 W., Cherokee mines area (Sanders, 1974)	Horse Butte	A	18.9	33.1	28.3	19.8	2.3	--	--	--	--	--	7,613

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 Creston quadrangle, Carbon and Sweetwater Counties, Wyoming

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Creston No. 3	109,410,000	4,350,000	1,790,000	115,550,000
Creston No. 2	1,760,000	3,440,000	7,190,000	12,390,000
Latham No. 4	12,360,000	7,870,000	16,320,000	36,550,000
Latham No. 3	15,200,000	3,880,000	5,810,000	24,890,000
Cherokee (Upper)	1,590,000	0	0	1,590,000
Cherokee (Lower)	1,510,000	0	0	1,510,000
Cherokee	14,870,000	1,290,000	220,000	16,380,000
Cow Butte	0	0	0	0
Horse Butte	0	0	0	0
Fu {3}	0	0	0	0
TOTAL	156,700,000	20,830,000	31,330,000	208,860,000

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

Table 3 -- Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the Creston quadrangle, Carbon and Sweetwater Counties, Wyoming

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Creston No. 3	24,730,000	0	0	24,730,000
Creston No. 2	0	0	0	0
Latham No. 4	7,800,000	0	0	7,800,000
Latham No. 3	0	0	0	0
Cherokee (Upper)	0	0	0	0
Cherokee (Lower)	0	0	0	0
Cherokee	19,360,000	0	0	19,360,000
Cow Butte	12,110,000	0	0	12,110,000
Horse Butte	7,490,000	0	0	7,490,000
Fu {3}	0	0	6,670,000	6,670,000
TOTAL	71,490,000		6,670,000	78,160,000

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

Table 4. -- Sources of data used on plate 1

Plate 1 Index Number	Source	Data Base
1	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
2	Edson, 1977, U.S. Geological Survey, unpublished data	Drill hole No. 83 (PP & L)
3		Drill hole No. 82 (PP & L)
4	El Paso Natural Gas Co.	Oil/gas well No. 1 Government - Davidson
5	Edson, 1977, U.S. Geological Survey, unpublished data	Drill hole No. 80 (PP & L)
6		Drill hole No. 8 (PP & L)
7		Drill hole No. 79 (PP& L)
8		Drill hole No. 78 (PP & L)
9		Drill hole No. 77 (PP & L)
10	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
11	Smith, 1972, U.S. Bureau of Mines Information Circular 8538, fig. 12, and Edson, 1977, U.S. Geological Survey, unpublished data	Drill hole No. 76 (PP & L)
12	Edson, 1977, U.S. Geological Survey, unpublished data	Drill hole No. 66 (PP & L)
13	Amoco Production Co.	Oil/gas well No. Champlin 242 Amoco "A"

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
14	Marathon Oil Co.	Oil/gas well No. 1-2 Marathon - Federal
15	Sun Oil Co.	Oil/gas well Echo Springs Federal No. 1-12
16	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 5	Drill hole No. 65
17		Drill hole No. 64
18		Drill hole No. 62
19	Smith, 1909, U.S. Geological Survey Bulletin 341-B, p. 236	Surface prospect
20	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 202
21	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 204
22		Coal Auger hole No. 217
23	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 205
24		Coal Auger hole No. 216
25		Coal Auger hole No. 206
26		Coal Auger hole No. 218

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
27	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 212
28		Coal Auger hole No. 213
29		Coal Auger hole No. 207
30		Coal Auger hole No. 209
31		Coal Auger hole No. 208
32		Coal Auger hole No. 210
33		Coal Auger hole No. 201
34		Coal Auger hole No. 214
35		Coal Auger hole No. 215
36	U.S. Geological Survey, 1965, Inactive Coal Lease No. Wyoming 0252675	Drill hole No. 3
37	Smith, 1972, U.S. Bureau of Mines Information Circular 8538, fig. 12	Coal test hole
38	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 197
39	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2AS

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
40	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
41		Drill hole No. 3AS
42		Drill hole No. 2AS
43		Drill hole No. 1AS
44	Masursky and Pipiringos, 1959, U.S. Geological Survey Bulletin 1055, pl. 36 and 44	Measured Section No. 227
45	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
46		Drill hole No. 3AS
47		Drill hole No. 1AS
48		Drill hole No. 2AS
49	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 195
50	Masursky, 1962, U.S. Geological Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 198
51		Coal Auger hole No. 199
52	Masursky and Pipiringos, 1959, U.S. Geological Survey Bulletin 1055, pl. 36 and 44	Coal Auger hole No. 231
53	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
54	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 200

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
55	Masursky and Pipiringos, 1959, U.S. Geological Survey Bulletin 1055, pl. 36 and 44	Coal Auger hole No. 233
56	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2AS
57	Masursky and Pipiringos, 1959, U.S. Geological Survey Bulletin 1055, pl. 36 and 44	Measured Section No. 194
58	↓	Coal Auger hole No. 193
59	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Measured Section No. 192
60	Smith, 1909, U.S. Geological Survey Bulletin 341-B, p. 236	Surface prospect
61	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 3AS
62	↓	Drill hole No. 1AS
63	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 5	Drill hole No. 70
64	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2AS
65	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 10	Coal Auger hole No. 191
66	↓	Coal Auger hole No. 188
67	↓	Drill hole No. 71

Table 4. -- Concluded

Plate 1 Index Number	Source	Data Base
68	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
69		Drill hole No. 2AS
70	Masursky, 1962, U.S. Geological Survey Bulletin 1099-B, pl. 1 and 5	Drill hole No. 60
71	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS

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