Text to accompany:

Open-File Report 78-061
1978

COAL RESOURCE OCCURRENCE MAPS OF THE WILD HORSE MOUNTAIN QUADRANGLE, CARBON COUNTY, WYOMING

(Report includes 3 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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[Plates are in pocket]

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INTRODUCTION

Purpose

This text is to be used along with the accompanying Coal Resource Occurrence (CRO) Maps of the Wild Horse Mountain quadrangle, Carbon County, Wyoming (3 plates; U.S. Geol. Survey Open-File Report 78-061), prepared by Texas Instruments Incorporated under contract to the U.S. Geological Survey. This report was prepared to support the land planning work of the U.S. Bureau of Land Management's Energy Minerals Activities Recommendation System (EMARS) program, and to contribute to a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. The Coal Resource Occurrence maps for this quadrangle cover an area west of the KRCRA of the Hanna coal field. The lack of correlatable coal of Reserve Base thickness in this quadrangle, as indicated on the CRO maps, precluded the construction of Coal Development Potential (CDP) maps which normally accompany this type of report.

Acknowledgment

Texas Instruments Incorporated acknowledges the cooperation of the Rocky Mountain Energy Company, a wholly owned subsidiary of the Union Pacific Railroad Company, in supplying copies of survey sheets, drillers reports, electric logs, and coal analyses from the Union Pacific coal inventory program.

The Hanna and Carbon coal basins were studied as part of the Union Pacific coal inventory program and test drilling was conducted in 1970-1971. More than 650 Union Pacific coal drill holes have been evaluated as part of this contract study of 21 quadrangles in Carbon County, Wyoming, and the results of 230 coal analyses have been incorporated into these reports.

Location

The Wild Horse Mountain 7½-minute quadrangle is in the northwestern part of Carbon County, Wyoming. The center of the quadrangle is approximately 21 miles (34 km) northeast of Rawlins and 24 miles (38 km) northwest of Walcott, Wyoming (Figure 1).

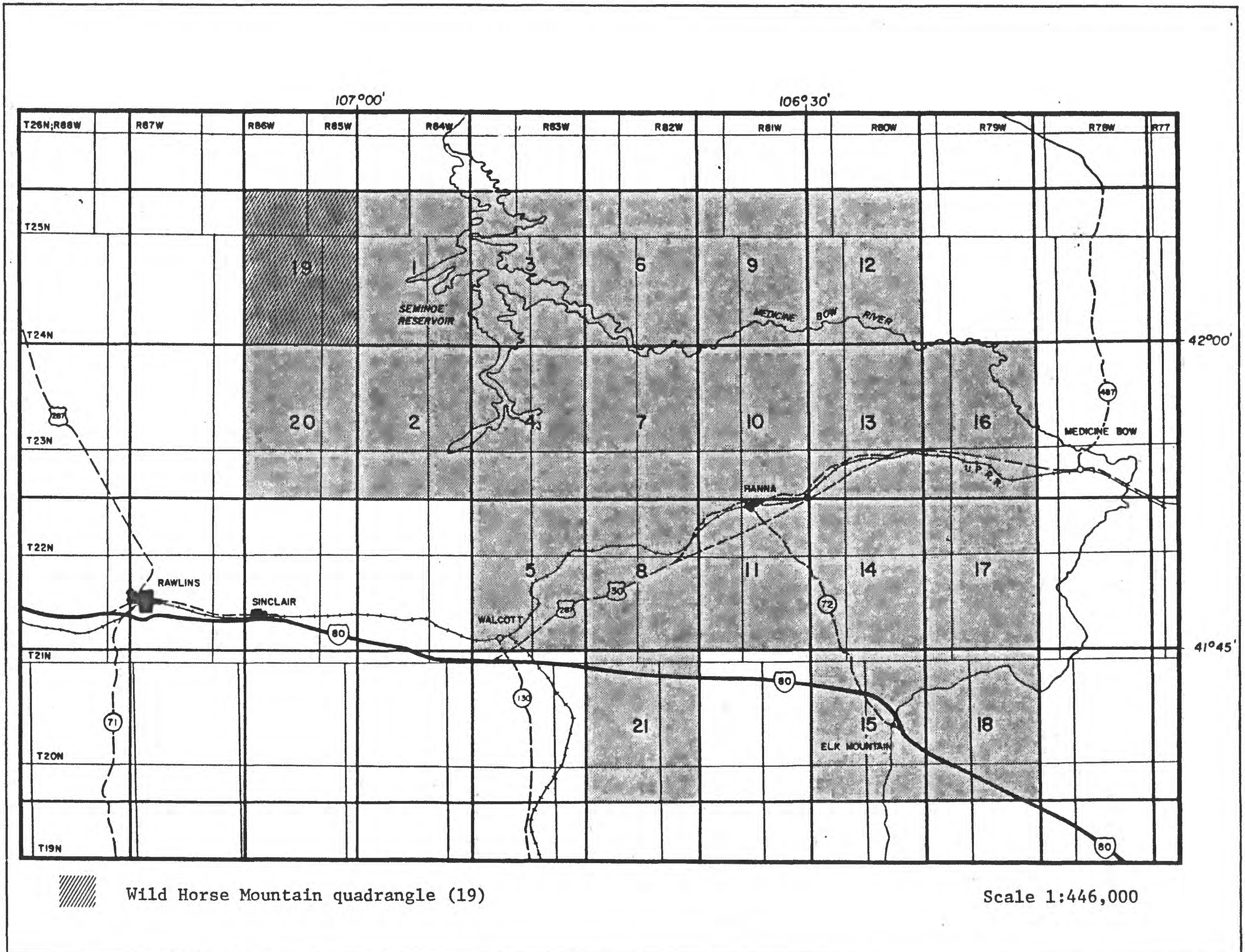

Figure 1. — Map of Hanna and Carbon Basins study area

Accessibility

Seminoe Road is a secondary highway, immediately east of the quadrangle, that connects with State Highway 220 to the north and State Highway 487 to the northeast. To the south, it connects with Interstate Highway 80 at Sinclair, Wyoming. Several local unimproved dirt roads within the quadrangle connect Seminoe Road to local ranches and sources of water; one dirt road extends westerly across the Haystack Mountains for 18 miles (29 km) before connecting with State Highway 287 between Rawlins and Lamont.

The main east-west track of the Union Pacific Railroad is 20 miles (32 km) south of the center of the quadrangle and passes through the towns of Medicine Bow, Hanna, Walcott, Sinclair, and Rawlins.

Physiography

The Wild Horse Mountain quadrangle is located in the extreme northwestern corner of the Hanna structural basin which, in this area, is bounded on the north by the Seminoe Mountains and on the west by the Haystack Mountains. In the northern half of the quadrangle two prominent east-trending ridges, Cheyenne Ridge and Coal Creek Rim, form foothills parallel to the southern flank of the Seminoe Mountains which are less than a mile north of the quadrangle boundary. The two ridges have a maximum relief of 970 feet (296 m). The Haystack Mountains occupy the southwest part of the quadrangle with Wild Horse Mountain forming a prominent cuesta in secs. 22 and 27, T. 24 N., R. 86 W. The topography of the southeast part of the quadrangle is rolling hills typical of the high plains grasslands that form a major part of the Hanna and Carbon coal basins to the east. The quadrangle is dissected by several creeks and many intermittent streams which flow easterly into Seminoe Reservoir. Elevations in the quadrangle range from 6,480 feet (1,975 m) in Coal Creek at the southeast border to 7,924 feet (2,415 m) on Windy Ridge in the northwest corner of the quadrangle.

Climate

The climate is semiarid with a mean annual temperature of 43°F (6°C) and extremes ranging from 98°F to -31°F (37°C to -35°C) as recorded at the Seminoe Dam Weather Substation (U.S. Dept. of Interior, 1975). Average annual precipitation at that location is 12 inches (30 cm). Forty-two percent of the precipitation falls as rain in April, May, and June, with the major portion of the remainder falling as snow in the winter months. High winds commonly occur throughout most of the year. The average growing season is generally 60 to 70 days, from late April to early June. High temperatures and lack of precipitation restrict vegetative growth in late summer and frosts occur from September through April.

Land Status

The Wild Horse Mountain quadrangle is less than one mile (1.6 km) west of the KRCRA of the Hanna coal field. The Federal Government owns approximately 50 percent of the coal rights in the quadrangle; the remaining 50 percent is non federally owned. There are no abandoned coal mines in the quadrangle. There are no known active leases, permits or licenses, and no active mining operations. Plate 2 shows the ownership status of land in the quadrangle.

GENERAL GEOLOGY

Previous Work

Weitz and Love (1952) compiled a geological map of Carbon County, Wyoming, which incorporates available data, published and unpublished, to that date. Gill, Merewether, and Cobban (1970) defined and correlated the upper Cretaceous and lower Tertiary rocks of south-central Wyoming, including the stratigraphic units that are exposed in this quadrangle. Merewether (1971) mapped the geology of the quadrangle from 1965 to 1967. His map is the principle source of data for the following geological summary.

Stratigraphy

Rocks exposed in the quadrangle are Late Cretaceous in age with the exception of widespread, predominantly unconsolidated, Quaternary deposits. Coal beds occur in the nonmarine formations of the Mesaverde Group and in the Fox Hills and Medicine Bow Formations.

The oldest rocks exposed are marine shales assigned to the upper part of the Steele Shale of Late Cretaceous age. Older rocks, found only in the subsurface, include the lower part of the Steele Shale and two underlying formations also of Late Cretaceous age; rocks of Early Cretaceous, Late Jurassic, Triassic, Permian, Carboniferous, and Cambrian age; and Precambrian basement rocks. This succession, 8,100 feet (2,469 m) thick, was intersected in a well drilled in southeast sec. 34, T. 25 N., R. 86 W. The Steele Shale consists of dark-gray shales that contain thin beds of light-gray to gray very fine grained sandstone and siltstone, and occasional layers of gray-weathering limestone concretions. Exposures of the formation are limited to the crest of O'Brien Springs anticline where they are almost entirely mantled by Quaternary sands. Merewether (1971) reports a formation thickness, calculated from well logs, of 2,375 feet (724 m).

Overlying the Steele Shale with a conformable and gradational contact is the marine Haystack Mountains Formation, the basal unit of the Mesaverde Group of Late Cretaceous age. The formation is exposed on the north and south flanks of the east-trending O'Brien Springs anticline, along the southwest border of the quadrangle in the Haystack Mountains, and in the extreme northeast corner of the quadrangle on the northeast flank of the Camp Creek syncline. The formation consists of thick units of marine sandstone, deposited in nearshore and offshore environments, interbedded with thick units of marine shale deposited in a deeper water environment. In this quadrangle three sandstone units have been named and mapped. In ascending order they are the Tapers Ranch Sandstone, the O'Brien Spring Sandstone, and the Hatfield Sandstone. The two intervening shale members and an overlying shale member are unnamed. The marine sandstones are generally pale yellowish gray, very fine to fine grained, laminated to thin bedded, and commonly burrowed. The marine shales are gray to brownish gray and consist mostly of clay and sandy clay with fossiliferous concretions. The shales are interbedded with gray to dark gray siltstones. Gill, Merewether, and Cobban (1970) report a thickness of 2,544 feet (775 m) for the Haystack Mountains Formation at the type locality 15 miles (24 km) south of the center of this quadrangle. Merewether (1971) reports a thickness of 2,120 feet (646 m) for the formation, from measured stratigraphic sections and a well in this quadrangle.

Overlying the Haystack Mountains Formation with a sharp but conformable contact is the dominantly nonmarine Allen Ridge Formation. This formation crops out in the Haystack Mountains in the southwest part of the quadrangle;

on the north and south flanks of the O'Brien Springs anticline; on the northwest slopes of Windy Ridge in the northwest corner of the quadrangle; and on the northeast flank of the Camp Creek syncline in the extreme northeast corner of the quadrangle. The formation is a widespread and distinctive unit that can be recognized throughout much of south-central Wyoming. It is the main ridge-forming part of the Mesaverde Group around the margins of the Hanna and Carbon Basins. Near the type locality at the eastern margin of the Hanna Basin, 39 miles (63 km) east-southeast of the center of this quadrangle, the formation is 1,255 feet (383 m) thick according to Gill, Merewether, and Cobban (1970, p. 27). In a well located five and one-half miles (9 km) east of the center of this quadrangle the formation is 1,240 feet (378 m) thick (Merewether, 1972). In this quadrangle Merewether (1971) measured two stratigraphic sections that show the Allen Ridge Formation is 1,370 feet (418 m) thick. The lower part of the formation is a thick sequence of ridge-forming fluviatile sandstones and shales that weather distinctive shades of brown and rusty brown. The sandstones are gray, fine grained, and silty; the shales are gray to grayish black, silty and carbonaceous. Coal beds occur in this lower part of the formation. Overlying the fluviatile basal unit is a thinner marine sequence of yellowish-gray fine-grained sandstones and dark-gray to dull-olive shales and siltstones. This marine unit grades upwards to brackish-water sediments at the top of the formation which consist of yellowish-gray fine-grained sandstones and brownish-gray carbonaceous shales with minor coal beds.

Overlying the Allen Ridge Formation with apparent unconformity is the nonmarine Pine Ridge Sandstone. The formation is exposed on the eastern slopes of the Haystack Mountains, on both flanks of the O'Brien Springs anticline in the center of the quadrangle, east of Windy Ridge in the northwest, and on the northeast flank of Camp Creek syncline in the northeastern corner of the quadrangle. At a stratigraphic section measured near the type locality on Pine Ridge (Gill and others, 1970, p. 31), 66 miles (106 km) southeast of the center of this quadrangle, the formation is 83 feet (25 m) thick. A well located 6 miles (10 km) southeast of the center of this quadrangle intersected 180 feet (55 m) of Pine Ridge Sandstone (Merewether, 1972) and in this quadrangle Merewether (1971) measured a stratigraphic section in sec. 27, T. 24 N., R. 86 W. where the formation is 175 feet (53 m) thick. The formation consists mainly of pale-yellowish-gray fine-grained sandstones that weather light-gray to white. The unit also includes beds of light-gray carbonaceous siltstone, sandy carbonaceous shale, and thin beds of impure coal.

Conformably overlying the Pine Ridge Sandstone is the Almond Formation, the youngest formation of the Mesaverde Group. This formation is exposed in three areas: as a continuous arcuate outcrop in the south-central and east-central parts of the quadrangle, along the north flank of O'Brien Springs anticline and east of Windy Ridge, and as a narrow outcrop of overturned steeply-dipping sediments on the northeast flank of the Camp Creek syncline. The formation is 440 feet (134 m) thick at the center of this quadrangle (Merewether, 1971) and 608 feet (185 m) thick at a measured stratigraphic section located 11 miles (18 km) to the south (Gill and others, 1970, p. 34). The formation is a sequence of fluviatile, brackish-water, and near-shore marine sediments that intertongue with the overlying Lewis Shale. The unit consists of yellowish-gray to dusky-yellow very fine grained thin-bedded sandstones, gray sandy siltstone, and gray to dark-gray silty carbonaceous shale. In this quadrangle the Almond Formation contains the most abundant coal exposures.

The marine Lewis Shale overlies the Almond Formation with a gradational and conformable contact. Sediments of this formation are generally nonresistant and the outcrops occur (a) in the mantled lowlands and gently sloping hills to the east and south of the Haystack Mountains and Coal Creek Rim, and (b) to the east and north of Windy Ridge and Cheyenne Ridge. Merewether (1971) reports the formation thickness as 2,120 feet (646 m) from two stratigraphic sections measured in this quadrangle. Gill, Merewether, and Cobban (1970, p. 40-41) measured a thickness of 2,310 feet (704 m) at a locality northwest of Rawlins and 23 miles (37 km) southwest of the center of this quadrangle. Merewether (1972) reports a thickness of 2,300 feet (701 m) in the Seminoe Dam SW quadrangle, combining the lower part of the Lewis Shale intersected in a well with the upper part of the formation measured at a stratigraphic section. The well is located 6.5 miles (10.5 km) southeast of the center of the Wild Horse Mountain quadrangle; the measured section is located 8.5 miles (13.7 km) east of the center of this quadrangle.

The Fox Hills Formation conformably overlies the Lewis Shale with a gradational contact. This formation represents a transition from marine deposition to a lagoonal and continental environment as the Cretaceous sea withdrew from southern Wyoming. The formation crops out in the southeast part of the quadrangle where it is about 550 feet (168 m) thick and on both flanks of the Camp Creek syncline in the northeast part of the quadrangle where it is about 520 feet (158 m) thick in the west half of sec. 20, T. 25 N., R. 85 W. The formation consists dominantly of thick units of friable sandstone but includes units of shale. The sandstones are pale yellowish gray, very fine grained, thin bedded to massive, cross bedded and ripple marked; the shales are olive gray to dark gray, mainly sandy, with thin beds of carbonaceous shales and impure coal.

The Medicine Bow Formation conformably overlies the Fox Hills Formation and contains more than 4,800 feet (1,463 m) of continental sediments. The type section of the formation was measured by Bowen (1918) along the banks of North Platte River, near the mouth of Medicine Bow River which is 12 miles (19 km) east of the center of the Wild Horse Mountain quadrangle. The 6,200 feet (1,890 km) of strata measured at the type locality may have included part of the underlying Fox Hills Formation and part of the overlying Ferris Formation. Merewether (1971) measured 1,335 feet (407 m) of lower Medicine Bow sediments in the core of the Camp Creek syncline in the northeast part of this quadrangle; the upper part of the formation has been removed by erosion. The formation consists of light-gray fine-grained partly silty sandstones, gray to grayish-black silty partly carbonaceous shales, and light-gray to grayish-black sandy partly carbonaceous siltstones. Numerous coal beds occur in the lower part of the formation; in this quadrangle eight coal beds crop out in the Camp Creek syncline (Plate 1).

Quaternary alluvium occurs in most of the drainage channels in the quadrangle and Quaternary pediment deposits are common on the low drainage divides. Quaternary unconsolidated sands and sand dunes mantle large areas in the northern half of the quadrangle, principally along the axial trace of the O'Brien Springs anticline.

Structure

The Wild Horse Mountain quadrangle is on the northwestern edge of the intermontane Hanna Basin which is bounded on the north by the Sweetwater Arch and on the west by the Rawlins Uplift. The Haystack Mountains in the southwestern part of the quadrangle are part of the east flank of the Rawlins Uplift. The major east-trending folds in the north half of the quadrangle are structures parallel and close to the south flank of the Seminoe Mountains, part of the Sweetwater Arch.

The Hanna Basin extends about 40 miles (64 km) east-west, 25 miles (40 km) north-south, and in its deepest portion, the eastern half of T. 24 N., R. 82 W., contains 30,000-35,000 feet (9,140-10.670 m) of sediments overlying crystalline basement. The rapid deepening of the basin on its northwestern edge is illustrated in this quadrangle by the following data:

- Precambrian basement rocks crop out less than one-half mile (0.8 km) north of the quadrangle.
- The well drilled in SE sec. 34, T. 25 N., R. 86 W. intersected about 8,000 feet (2,438 m) of sediments before it was completed in Precambrian basement rocks.
- At least 16,000 feet (4,877 m) of sediments occur above the Precambrian basement in the southeast corner of the quadrangle (Knight, 1951, p. 46).

The principle deformation defining the present structural basin occurred during the Laramide Orogeny. The bordering highlands were raised and deformed, and the sediments accumulated rapidly in the basin; consequently, the present Hanna Basin has complexly folded and faulted borders, with mild deformation within the basin expressed by a few broad folds and normal faults. With the retreat of the sea in Late Cretaceous time, depositional environments changed from marine to continental, as exemplified by the three formations exposed in the quadrangle.

The several large folds and steeply dipping beds in the north half of the quadrangle are typical of the borders of the structural basin. The O'Brien Springs anticline, the Table Mountain syncline, the G.P. anticline, and the Camp Creek syncline, are major structures that trend generally east-west across several townships. Dip of the sediments increases northward toward the Seminoe Mountains until northeast of the Camp Creek syncline the beds are overturned. In the south half of the quadrangle the broad arcuate outcrop pattern of the sediments and the easterly component of their dips express the edge of the Hanna Basin. Folding is absent and faulting is minimal in this southern area.

COAL GEOLOGY

Previous Work

The coal deposits of the Hanna and Carbon Basins have been studied by Veatch (1907), Dobbin, Bowen, and Hoots (1929), Berryhill and others (1950), and Glass (1972 and 1975).

Twenty-six coal analyses have been published since 1913 for coal beds of the Mesaverde Group and the Medicine Bow, Ferris, and Hanna Formations within the Hanna and Carbon Basins (Appendices 1 and 2). Samples collected and analyzed prior to 1913 have not been considered in this report (American Society for Testing and Materials, 1977, p. 218). An average analysis of coal beds in each of these four stratigraphic units has also been calculated for the 230 analyses from the Union Pacific coal inventory program (Appendices 1 and 2). An apparent rank has been calculated from the average analysis for coal in each of the four stratigraphic units. A standard rank determination (ASTM, 1977, p. 216, sec. 6.2.2) cannot be made because (a) some of the published analyses are from weathered coal samples, and (b) the procedure and quality of sampling for the Union Pacific coal evaluation program are not known.

Glass (1975) and U.S. Department of Interior (1975) published not only proximate coal analyses for 17 samples collected in the Hanna Basin, but also assays for 10 major and minor oxides, 12 major and minor elements, and up to 32 trace elements. Glass (1975, p. 1) stresses that his assay data are insufficient to characterize the chemical and physical properties of any individual coal bed, but that this will be possible at a later date as the study continues. Assay results of the 17 Hanna Basin samples show that these coals contain no significantly greater amounts of trace elements of environmental concern than are found in the 42 samples collected in six other Wyoming coal fields.

General Features

In this quadrangle, 16 coal beds and 20 or more coal lenses have been mapped by Merewether (1971) or have been identified in the subsurface (Plates 1 and 3). Of these occurrences, eight coal beds are in the Almond Formation in the south half of the quadrangle and eight coal beds are in the

Medicine Bow Formation in the Camp Creek syncline. Merewether (1971) also mapped isolated coal outcrops in the Allen Ridge Formation, Pine Ridge Sandstone, and Fox Hills Formation but no coal beds in these formations were located in the subsurface.

Analyses of two coal samples from Almond Formation coal beds in this quadrangle are shown in Appendix 3. The samples were taken during the Union Pacific coal inventory program.

Mesaverde Coal Beds

The eight beds mapped by Merewether (1971) in the Mesaverde Group are located primarily in the upper half of the Almond Formation. They dip to the east and southeast at angles ranging from 6° to 24°. Thicknesses of the beds range from 1 foot (0.3 m) to 7.3 feet (2.2 m). Analyses of two of the beds, designated WH 5 and WH 6, indicate an apparent rank of subbituminous A.

Medicine Bow Coal Beds

The beds located within the Medicine Bow Formation crop out on the limbs of the Canyon Creek syncline with coal thicknesses ranging from 0.7 feet (0.2 m) to 9.8 feet (2.9 m). On the western flank of the syncline, dip angles vary from 11° to 34°. On the eastern flank, the beds are overturned and dip away from the axis at 45° to 60°. There are no known analyses of these beds.

COAL RESOURCES

Previous Work

Coal reserves of the Hanna and Carbon Basins have been estimated or calculated by Dobbin, Bowen, and Hoots (1929), Berryhill and others (1950), and Glass (1972).

Method of Calculating Resources

Data from Merewether (1971), oil and gas well logs, and coal drill holes (written communication, Rocky Mountain Energy Company, 1977) were used to construct the Coal Data Map (Plate 1) and the Coal Data Sheet (Plate 3) for the Wild Horse Mountain quadrangle. U.S. Geological Survey reviewed these two plates and concluded that no individual coal bed or coal zone on unleased Federal land was thick enough and extensive enough to be selected for coal reserve evaluation. However, the calculation of coal Reserve Base was requested for the isolated or noncorrelatable data points in the quadrangle.

The information on Plates 1 and 3 served as the basis for estimating coal resources in areas of sparse, isolated coal data, insufficient to construct isopach and structure contour maps. The estimates of coal resources were made in accordance with the classification system given in U.S. Geological Survey Bulletin 1450-B and by following methods suggested by the U.S. Geological Survey:

- All outcrop measurements and subsurface measurements are considered as one planar unit.
- All coal deeper than 3,000 feet (914 m) is excluded.
- Coal bed thicknesses from surface mapping are true thicknesses; thicknesses from subsurface data are apparent thicknesses. No corrections were made for coal bed thicknesses to compensate for the dip of the containing rocks.
- Coal resources are calculated for a single coal bed at least 5 feet (1.5 m) thick or for an aggregate thickness of multiple coal beds each at least 5 feet (1.5 m) thick.
- Areal subsurface distribution of coal from outcrop data points is determined by constructing an arc with a radius equal to one-half the length of the outcrop within a five-foot or greater thickness limit, and centered on a point midway on the outcrop.
- Areal subsurface distribution for a subsurface data point with a five-foot or greater thickness of coal is defined by a circle with a radius of 0.5 mile (805 m).
- Coal resources at depths of less than 200 feet (61 m) are tabulated separately from coal resources at depths between 200 and 3,000 feet (61 and 914 m).

When estimating coal resources in areas of sparse, isolated data some data require a unique solution. For example:

- Where a coal bed outcrop has data points with a coal thickness less than 5 feet (1.5 m), a 5-foot (1.5 m) cut-off point is interpolated, and the resulting segments with values greater than 5 feet (1.5 m) are used to generate arcs (radii equal to half the partial outcrop length).

- Where areas within outcrop segment arcs and areas within 0.5 mile (805 m) of a drill hole coincide, the areas are combined, and drill hole coal thickness values are averaged with outcrop coal thickness values.

- When evaluating multiple coal beds of an isolated or noncorrelatable data point, the interburden between subsurface coal beds may be too great to allow the aggregate thickness of coal to be considered as one planar unit. In such instances, a conservative judgment is made and the resources for each bed are calculated separately and then totaled.

Results

The coal resource acreage from isolated or noncorrelatable data points was determined by planimetering the areas which occurred in unleased Federal land. Coal Reserve Base values were obtained by multiplying the coal resource acreage for each section of Federal land by the average thickness of the coal bed, or the average aggregate thickness of multiple coal beds, times a conversion factor of 1,770 short tons (1,606 t) of coal per acre-foot for subbituminous coal. Reserve Base values are shown on Plate 2 and are considered to be in the inferred reliability category of identified coal resources.

The total coal Reserve Base of unleased Federal lands in the Wild Horse Mountain quadrangle is 8.5 million short tons (7.7 million t) of inferred resources with 0-200 feet (0-61 m) overburden; 6.2 million short tons (5.6 million t) of inferred resources with 200 to 3,000-feet (61 to 914-m) overburden. Coal reserves were not calculated and therefore the coal development potential could not be assessed. The coal Reserve Base data are for rough inventory estimates only.

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Appendix 1. — Average analyses of coal samples from the Hanna and Carbon Basins

Source of Data	Number of samples (1)	Total footage		Average analyses — as received basis						Calorific Value, Btu/lb	Apparent rank of coal (3)
				Percent							
		Ft	in	Moisture	Ash	Volatile matter	Fixed carbon	Sulfur	Btu/lb	Moist, mineral-matter-free basis (2)	
Published analyses	26	318	6	12.5	7.1	36.2	44.2	0.6	10,553	11,438	sub A or hvCb
Union Pacific coal inventory program	230	1,605	10	12.48	8.74	35.12	43.68	0.82	10,398	11,494	sub A or hvCb

Notes:

(1) Published data from USBM (1931, p. 40-45, sample nos. 2623, 2624, 22800, 22972, 93486, 93488, 93541, A14123, A14124); Glass (1975, p. 16-19, sample nos. 74-23 to 74-34, inclusive); Dept. of Interior (1975, p. 38, sample nos. D169597-99, D169607-08). Union Pacific coal inventory program data from company files, Rocky Mountain Energy Company (1977).

(2) Moist, mineral-matter-free Btu/lb calculated from average analyses, as received basis, using Parr formula (ASTM, 1977, p. 216, sec. 8.2).

(3) Sub A — subbituminous A; hvCb — high volatile C bituminous (ASTM, 1977, p. 215, sec 4.2, and p. 217).

[To convert feet and inches to meters, multiply feet by 0.3048 and inches by 0.0254. To convert Btu/lb to kilojoule/kilogram, multiply by 2.326].

Appendix 2. — Average analyses of coal grouped by coal-bearing formations in the Hanna and Carbon Basins

Source of data	Formation or Group	Number of samples (1)	Total footage Ft	in	Average analyses — as received basis: Percent Moisture	Ash	Volatile matter	Fixed carbon	Sulfur	Btu/lb	Calorific Value, Btu/lb: Moist, mineral-matter-free basis (2)	Apparent rank of coal (3)
Published analyses	Mesaverde	1	4	0	14.1	7.8	36.5	41.6	1.1	10,290	11,251	sub A <u>or</u> hvCb
	Medicine Bow	2	10	1	12.8	3.8	33.3	50.2	0.8	11,050	11,534	hvCb
	Ferris	10	93	1	13.0	8.3	34.3	44.3	0.4	9,970	10,956	sub A <u>or</u> hvCb
	Hanna	13	211	4	12.0	6.6	38.1	43.3	0.7	11,946	11,797	hvCb
Union Pacific coal inventory program	Mesaverde	13	70	5	9.45	8.41	35.42	46.72	0.77	11,112	12,237	hvCb
	Medicine Bow	16	93	4	13.09	4.03	35.46	47.42	0.80	10,927	11,446	sub A <u>or</u> hvCb
	Ferris	114	863	1	12.69	7.96	34.39	44.97	0.44	10,331	11,309	sub A <u>or</u> hvCb
	Hanna	87	579	0	12.51	10.67	35.96	40.85	1.33	10,280	11,640	hvCb

Notes:

(1) Published data from USBM (1931, p. 40-45, sample nos. 2623, 2624, 22800, 22972, 93486, 93488, 93541, A14123, A14124); Glass (1975, p. 16-19, sample nos. 74-23 to 74-34, inclusive); Dept. of Interior (1975, p. 38, sample nos. D169597-99, D169607-08). Union Pacific coal inventory program data from company files, Rocky Mountain Energy Company (1977).

(2) Moist, mineral-matter-free Btu/lb calculated from average analyses, as received basis, using Parr formula (ASTM, 1977, p. 216, sec. 8.2).

(3) Sub A — subbituminous A; hvCb — high volatile C bituminous (ASTM, 1977, p. 215, sec. 4.2, and p. 217).

[To convert feet and inches to meters, multiply feet by 0.3048 and inches by 0.0254. To convert Btu/lb to kilojoule/kilogram, multiply by 2.326].

Appendix 3. — Coal analyses, Wild Horse Mountain quadrangle

Drill hole	Location			Coal bed	Sample interval				Sample width		Analyses — as received basis					
					From		To				Percent					
	Sec.	Twp.	Rge.		Ft	in	Ft	in	Ft	in	Moisture	Ash	Volatile matter	Fixed carbon	Sulfur	Btu/lb
21	9	24N	85W	WH6	72	7	73	10	1	3	10.69	5.01	34.06	50.24	0.51	11,310
21	9	24N	85W	WH5	153	11	162	0	8	1	8.89	9.75	36.18	45.18	0.36	10,979

Data from Rocky Mountain Energy Company (1977).

[To convert feet and inches to meters (m), multiply feet by 0.3048 and inches by 0.0254. To convert Btu/lb to kilojoules/kilogram (kJ/kg), multiply by 2.326].