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COAL RESOURCES OF THE NORTHWEST QUARTER OF THE WOODSIDE 15-MINUTE QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH

By

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Purpose

This report was compiled to support the land planning work of the Bureau of Land Management 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. It supplements the land planning requirements of the Federal Coal Leasing Amendments Act of 1976 (Public Law 94-377) sec. (3)(B) which states, in part, that "Each land-use plan prepared by the Secretary [of the Interior] (or in the case of lands within the National Forest System, the Secretary of Agriculture pursuant to subparagraph (A)(i)) shall include an assessment of the amount of coal deposits in such land, identifying the amount of such coal which is recoverable by deep mining operations and the amount of such coal which is recoverable by surface mining operations."

Published and unpublished public information were used as data sources for this study. No new drilling nor field mapping were done to supplement this study. No confidential nor proprietary data were used.

Location

The Northwest Quarter of the Woodside 15-minute quadrangle is located in the northeast part of Emery County and the southeast part of Carbon County in east-central Utah. The towns of Sunnyside and East Carbon City are 3 miles (5 km) north of the quadrangle. The city of Price, the county seat of Carbon County, is 18 miles (29 km) west-northwest of the quadrangle and Castle Dale, the county seat of Emery County, is 30 miles (48 km) to the west. The town of Green River is approximately 29 miles (47 km) south-southeast of the quadrangle.

Accessibility

U.S. Highway 6 crosses the central part of the quadrangle diagonally in a northwest to southeast direction. This highway continues southeastward to the town of Green River and northward to the city of Price.

Utah Highway 124 crosses the northeast quarter of the quadrangle and connects the Geneva coal mine in Horse Canyon in the adjoining quadrangle to East Carbon City to the north. A gravel road extends from the center of the east side of the quadrangle southwestward to its junction with U.S. Highway 6. Several unimproved dirt roads cross the alluvial plain below the mountainous area in the northwest corner of the quadrangle.

A main line of the Denver and Rio Grande Western Railroad crosses the southwest quarter of the quadrangle. This railroad makes connections to Salt Lake City, Utah and Denver, Colorado. A short line called the Carbon County Railroad crosses the northeast corner of the quadrangle and provides rail accessibility from the Geneva mine in Horse Canyon to a branch line of the Denver and Rio Grande Western Railroad at East Carbon City. The branch line continues westward 7 miles (11 km) and then southward 5 miles where it joins the main line of the Denver and Rio Grande Western Railroad at the Mounds station.

Physiography

The Northwest Quarter of the Woodside 15-minute quadrangle lies near the central part of the Book Cliffs, a long bold arcuate escarpment of barren sandstone cliffs from 1,000 to 2,000 ft (305 to 610 m) high. The cliff front crosses into the northwest corner of the quadrangle. The area east of the cliffs in the adjoining quadrangle is rugged and mountainous.

Approximately 99 percent of the quadrangle is lowland area below the cliffs and consists of gently sloping alluvial plains of gravel-covered benches, soft shale exposures, and shallow washes.

The total relief in the quadrangle area is approximately 2,450 ft (747 m) between the highest point on the cliffs in the northeast corner where the elevation is over 7,400 ft (2,256 m) and the lowest point of 4,950 ft (1,509 m) where Grassy Trail Creek leaves the quadrangle in the southwest corner. The drainage system in the quadrangle consists of shallow washes that drain westward, southwestward, and southward into Grassy Trail Creek and the Price River in the adjoining quadrangle on the south.

Climate

The quadrangle is located in the mid-latitude steppe climate with semi-arid conditions prevailing over most of the quadrangle area. The normal annual precipitation in the quadrangle ranges from about 7 inches (18 cm) in the southwest part to approximately 10 inches (25 cm) on the mountainous area in the northeast corner of the quadrangle (U.S. Department of Commerce, (1964)).

Temperatures in most of the quadrangle area are expected to range from a summertime high of over 100 degrees F (38 degrees C) to a wintertime low of about -20 degrees F (-29 degrees C). The temperatures in the higher mountainous areas in the northeast corner of the quadrangle will be somewhat below those at the lowest elevations.

Land Status

The Northwest Quarter of the Woodside 15-minute quadrangle includes a small part of the Book Cliffs Known Recoverable Coal Resource Area

(KRCRA) in the northeast corner of the quadrangle (see plate 1). The KRCRA covers approximately 160 acres (65 ha) of the quadrangle. This area is divided into about 25 acres (10 ha) of non-Federal land and about 135 acres (55 ha) of unleased Federal coal land.

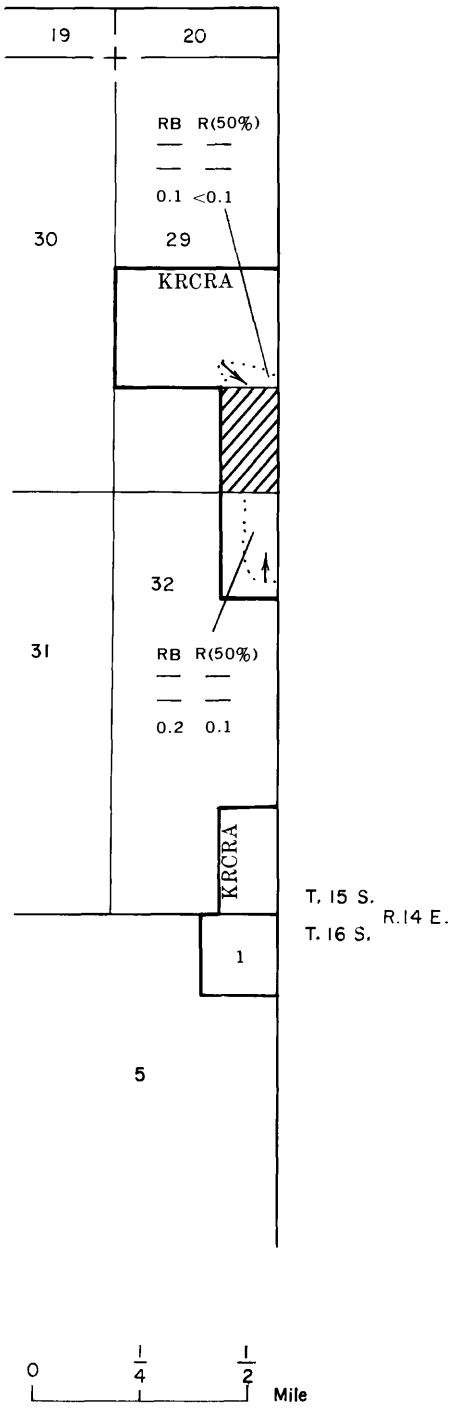
GENERAL GEOLOGY

Previous Work

Clark (1928) mapped the geology and coal outcrops in the western part of the Book Cliffs coal field from the Standardville 7½-minute quadrangle on the west to the Patmos Head quadrangle on the east. The Patmos Head quadrangle joins the northeast corner of the Northwest Quarter of the Woodside 15-minute quadrangle. Fisher (1936) mapped the area south and east of Clark's map along the Book Cliffs to the Utah-Colorado state line. The geology and coal deposits in the area have also been described by Abbott and Liscomb (1956), Fisher, Erdmann, and Reeside (1960), Hayes and others (1977), Brodsky (1960), and Young (1955, 1957, and 1966). Doelling (1972) has summarized and updated the geology and coal information reported in earlier writings. AAA Engineering and Drafting, Inc., (1979a-c) prepared coal resource occurrence and coal development potential maps for the adjoining Sunnyside, Patmos Head, and Northeast Quarter of the Woodside 15-minute quadrangles.

Stratigraphy

The coal beds of economic importance in the Book Cliffs coal field are Upper Cretaceous in age and are confined to the Blackhawk Formation of the Mesaverde Group (see plate 2). In the area on the eastside of the quadrangle the Mesaverde Group consists of the following three formations in ascending order: the Blackhawk Formation, Castlegate Sandstone, and the



EXPLANATION

KRCRA

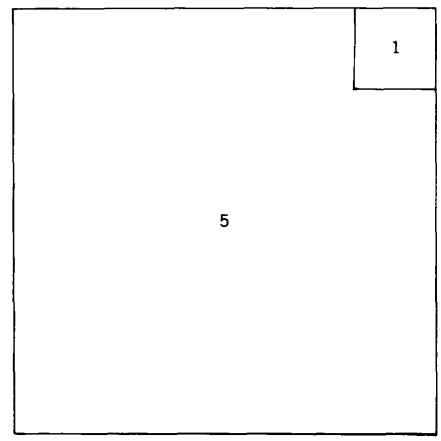
KRCRA BOUNDARY – Label within KRCRA boundary.

NON-FEDERAL COAL LAND – Land within the KRCRA boundary for which the Federal Government does not own the coal rights.

BURNED AND CLINKERED COAL BOUNDARY – Dotted line indicates inferred limit of burning. Arrow points toward coal-bearing area.

RB R(50%)
— — (Measured)
-- — (Indicated)
0.1 <0.1 (Inferred)

IDENTIFIED COAL RESOURCES–Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part of section of non-leased Federal coal land within the KRCRA. Reserve (R) tonnage is calculated by multiplying the Reserve Base (RB) tonnage by the appropriate recovery factor. Dash indicates no resource in that category.



SECTION OF LAND – Showing lots and lot numbers.

NOTE: BLM Coal Ownership Data current as of September 22, 1977.

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

To convert feet to meters, multiply feet by 0.3048

REFERENCE

U.S. Bureau of Mines and U.S. Geological Survey 1976, Coal resource classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geol. Survey Bull. 1450-B, 7p.

PLATE I. Boundary data and areal distribution and identified resources map of the Lower Sunnyside coal bed in the KRCRA of the Northwest Quarter of the Woodside 15-minute Quadrangle, Emery and Carbon Counties, Utah.

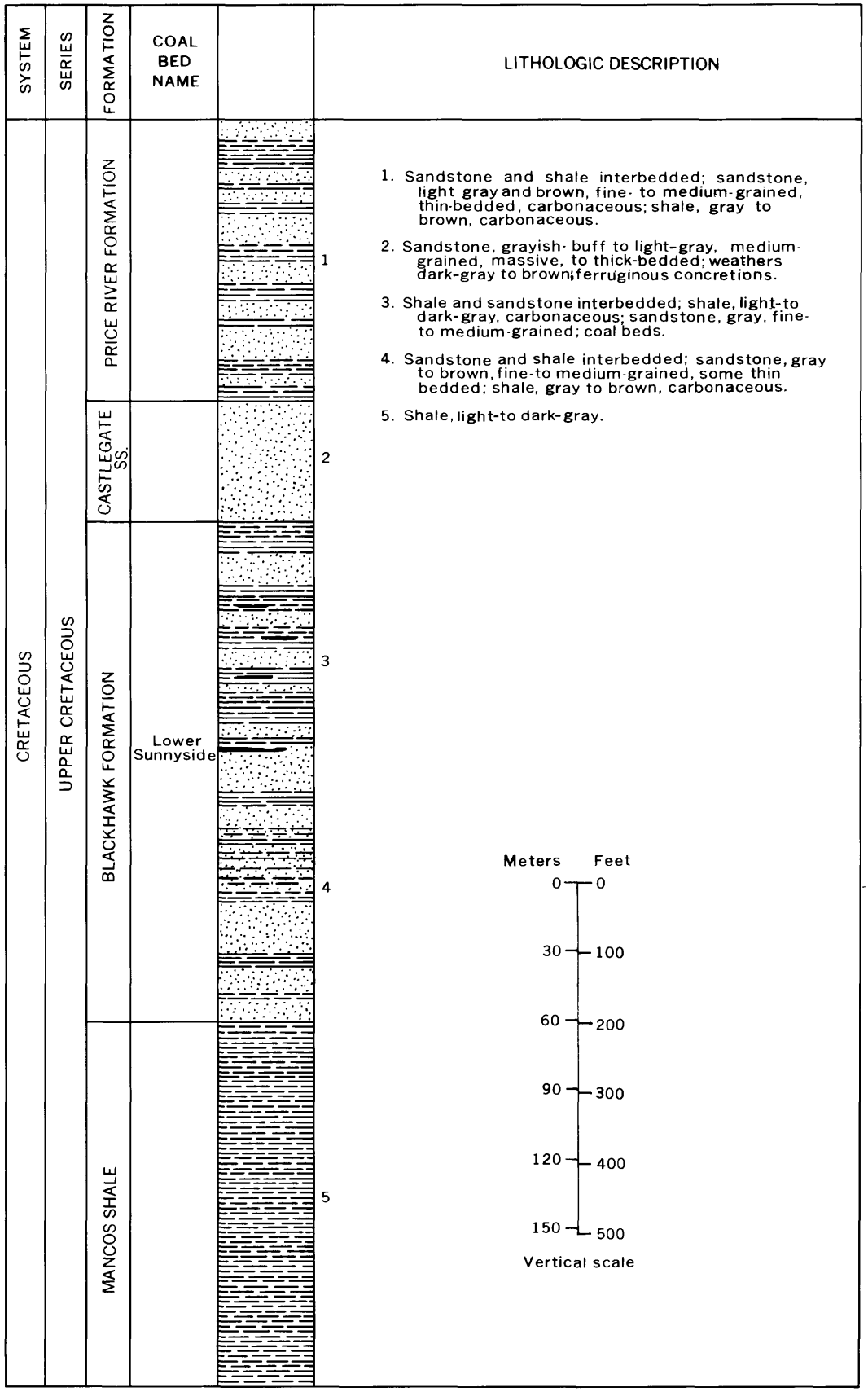


PLATE 2. Composite columnar section, Northwest Quarter of the Woodside 15-minute Quadrangle, Emery and Carbon Counties, Utah.

Price River Formation. The Upper Cretaceous Mancos Shale underlies and intertongues with the Blackhawk Formation. The Mancos was deposited in an offshore marine environment. The Castlegate Sandstone and the Price River Formation were formed in a continental environment.

The bluish-gray shale of the Mancos Shale crops out at the base of the cliffs in the northeast corner of the quadrangle and is exposed in washes and low hills throughout the quadrangle. The formation underlies the gravel-covered benches and alluvial plains and fans below the Book Cliffs. Sandstone beds of the Blackhawk Formation and Castlegate Sandstone crop out in steep cliffs in the northeast corner of the quadrangle. The cliffs are capped by the Price River Formation.

Fisher (1936) divided the Blackhawk Formation into the following four members in ascending order: the Lower Sandstone Member 150 to 170 ft (46 to 52 m) thick; the Middle Shale Member 100 to 190 ft (30 to 58 m) thick; the Middle Sandstone Member 100 to 160 ft (30 to 49 m) thick; and the Upper Member 70 to 230 ft (31 to 70 m) thick.

The Lower Sandstone Member thins eastward and cannot be traced east of Green River. The Middle Shale Member is apparently a tongue of the Mancos Shale and cannot be distinguished from the Mancos east of Green River. The Sunnyside coal beds lie in the upper part of the Middle Sandstone Member. The Upper Member consists of sandstone, shale, and lenticular coal beds.

The Castlegate Sandstone thins eastward from 500 ft (152 m) of conglomeratic sandstone in the northern part of the Wasatch Plateau to a feather edge of siltstone near the Utah-Colorado state line (Fisher, 1936). In this quadrangle the Castlegate is approximately 170 ft (52 m) thick. Fisher (1936) refers to the Castlegate as a member of the Price River Formation.

The Castlegate is overlain by the Buck Tongue of the Mancos Shale which is poorly developed in the quadrangle area, but which thickens eastward toward the Utah-Colorado state line where it is 350 ft (107 m) thick. The Price River Formation lies above the Castlegate Sandstone where the Buck Tongue is not present. Fisher (1936) delineates three members of the Price River Formation above the Buck Tongue in the eastern part of the Book Cliffs, but which are not recognized northwest of the Beckwith Plateau southeast of the Woodside 15-minute quadrangle. Only the lower part of the Price River Formation is exposed on top of the cliffs in the northeast corner of the quadrangle.

Structure

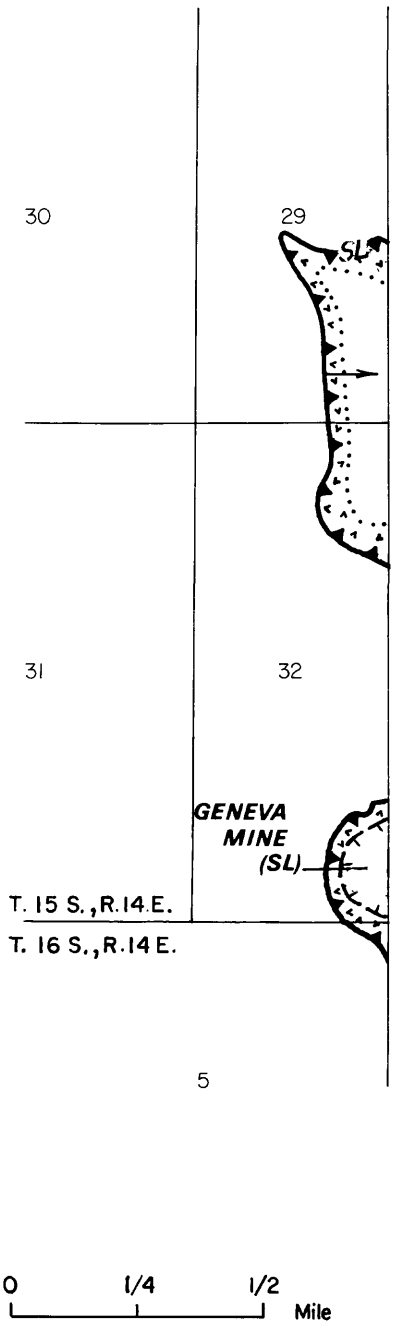
The strata in the Book Cliffs on the east side of the quadrangle generally dip eastward from less than 4 degrees to 7 degrees. No faults have been mapped in the Book Cliffs area of the quadrangle.

COAL GEOLOGY

Lower Sunnyside Coal Bed

The main coal bed with commercial significance in the quadrangle is the Lower Sunnyside bed. It lies about 75 ft (23 m) below the top of the Middle Sandstone Member of the Blackhawk Formation, between 200 and 250 ft (61 and 76 m) above the lower sandstone member. The outcrop of the bed in this quadrangle is extensively burned and no outcrop measurements are available (see plate 3).

The coal isopach map for the Lower Sunnyside coal bed in the adjoining quadrangle to the east shows the bed is continuous but variable in thickness (AAA Engineering and Drafting, Inc., 1979c). The bed appears to be thickest in the northwest and central parts of that quadrangle with a maximum measured



EXPLANATION

SL

TRACE OF COAL BED OUTCROP – Letters designate the name of the coal bed as listed above. Arrow points toward the coal bearing area.

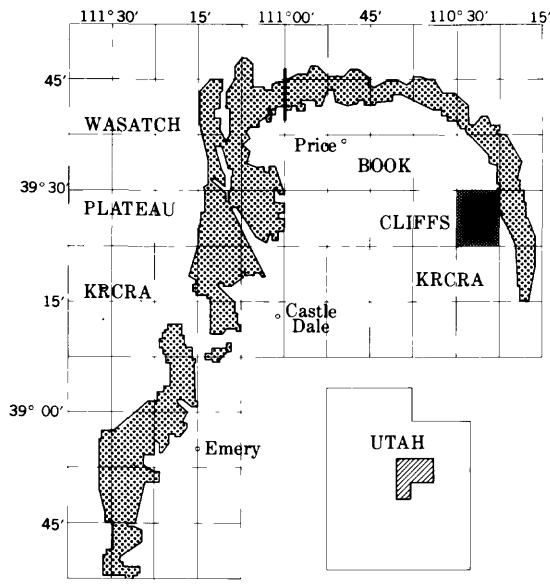
BURNED AND CLINKERED COAL BED– Showing area of baked and fused rock (v symbol). Dotted line indicates the inferred limit of burning.

SL – Lower Sunnyside

COAL BED SYMBOL AND NAME

GENEVA MINE (SL)

Subsurface coal mine showing name of mine and beds removed. Hachures point to mined-out areas. Dashed where approximately located.



MAP SHOWING LOCATION OF THE NORTHWEST QUARTER OF THE WOODSIDE 15-MINUTE QUADRANGLE (SHADED) AND THE BOOK CLIFFS AND WASATCH PLATEAU KNOWN RECOVERABLE COAL RESOURCE AREAS (STIPPLED), UTAH.

PLATE 3. Coal data map of the Northwest Quarter of the Woodside 15-Minute Quadrangle, Emery and Carbon Counties, Utah.

thickness of 18.2 ft (5.5 m). Projections of the isopach lines from the adjoining quadrangle indicate that the coal bed may range from 7 to 12 ft (2 to 4 m) thick in this quadrangle. The bed has been mined-out under much of the northwestern part of the adjoining quadrangle in the Geneva Mine.

Chemical Analyses of the Coal

Doelling (1972) lists 110 analyses of coal samples from the Lower Sunnyside bed in the adjoining quadrangle. The proximate analyses are summarized in the following table.

Table 1. Average proximate analysis of coal, Northeast Quarter of the Woodside 15-minute quadrangle, Emery and Carbon Counties, Utah.*

	No. Analyses	Percent Average	Range
Moisture	110	5.5	1.9 - 9.8
Volatile matter	96	37.5	16.4 - 44.7
Fixed carbon	96	50.1	41.6 - 74.3
Ash	99	6.7	3.8 - 10.7
Sulfur	91	0.70	0.5 - 1.1
Btu/lb.**	105	12,664	10,860 - 14,220

*Doelling, 1972, p. 406
**To convert Btu/lb to Kj/kg multiply by 2.326

Based on the ASTM system of classification, coal having the average analysis of the Lower Sunnyside coal shown in table 1 is ranked as high volatile B bituminous (American Society for Testing and Materials, 1977).

The Coal in the Geneva mine area is coking grade but is not considered as good as that in the Sunnyside area (Doelling, 1972).

Mining Operations

A large area of the Lower Sunnyside coal bed has been mined in the adjoining quadrangles to the east and north. The coal was mined westward to the burned area in this quadrangle shown on plate 3. The portal of the Columbia mine of U.S. Steel Corporation is in the adjoining quadrangle to the north (Sunnyside) and the portal of the Geneva mine, also called the Horse Canyon mine, is located in the adjoining quadrangle to the east (Northeast Quarter of the Woodside 15-minute quadrangle).

The Geneva mine was opened in 1943 and is operating at this writing (1979). The mine provides coking coal for U.S. Steel Corporation's Geneva steel plant at Provo, Utah. Doelling (1972, p. 407) reported the mine produced 23,425,000 short tons (21,251,160 metric tons) of coal through 1969. Production since that time is unknown. Several other smaller mines in the adjoining quadrangles have operated in the past but are now inactive or abandoned.

COAL RESOURCES

Coal resource tonnages are normally calculated for measured, indicated, and inferred categories based on the distance from points of coal bed measurements. Inasmuch as there are no available coal thickness measurements in this quadrangle, coal isopach lines for the Lower Sunnyside coal bed were projected from the adjoining quadrangle on the east (AAA Engineering and Drafting, Inc., 1979c).

The small amount of unleased Federal coal land within the KRCRA of this quadrangle is approximately 1.1 miles (1.8 km) from the nearest point of measurement east of the quadrangle boundary. The calculated tonnages for the coal bed in this quadrangle therefore fall into the "inferred" resources category based on the criteria established by the U.S. Geological Survey as follows:

"Inferred quantitative estimates are based largely on broad knowledge of the geologic character of the bed or region and where a few measurements of bed thickness are available. The estimates are based primarily on an assumed continuation from Demonstrated coal for which there is geologic evidence. The points of observation are 1 1/2 (2.4 km) to 6 miles (9.6 km) apart. Inferred coal is projected to extend as a 2 1/4-mile (3.6 km) wide belt that lies more than 3/4 mile (1.2 km) from the outcrop or points of observation or measurement." (U.S. Bureau of Mines and U.S. Geological Survey, 1976).

Coal Reserve Base tonnages per Federal section are shown on plate 1 and total approximately 300,000 short tons (272,160 metric tons) for the unleased Federal coal lands within the KRCRA boundary in the Northwest Quarter of the Woodside 15-minute quadrangle.

AAA Engineering and Drafting, Inc. has not made any determination of economic mineability for any coal bed described in this report.

COAL DEVELOPMENT POTENTIAL

Development Potential for Surface Mining Methods

No development potential for surface mining methods exists in the area of this quadrangle because of the rugged topography, steep-sided canyons, extreme relief, and thick overburden.

Development Potential for Subsurface Mining and In-Situ Coal Gasification Methods

The coal development potential for the subsurface mining of coal is determined by the thickness of overburden under which the coal bed lies. In this quadrangle the areas where coal beds 5 ft (1.5 m) or more in thickness are overlain by less than 1,000 ft (305 m) of overburden are considered

to have a high development potential for subsurface mining.

Areas where such beds are overlain by 1,000 to 2,000 ft (305 to 610 m) and 2,000 to 3,000 ft (610 to 914 m) of overburden are rated as having a moderate and a low development potential respectively. Areas that contain no known coal in beds 5 ft (1.5 m) or more thick, but coal-bearing units are present at depths of less than 3,000 ft (914 m) are classified as areas of unknown coal development potential. Areas where no coal beds are known to occur or where coal beds are present at depths greater than 3,000 ft (914 m) have no coal development potential. The areas of unleased Federal coal land within the KRCRA in the Northwest Quarter of the Woodside 15-minute quadrangle fall within the "high" and "no" development potential classifications.

The following areas have a high development potential:

T. 15 S., R. 14 E.

Sec. 29: W½ NE¼ SW¼
Sec. 32: W½ NE¼ NW¼

The unleased Federal lands in the KRCRA that have no coal development potential are:

T. 15 S., R. 14 E.

Sec. 29: NW¼ SW¼
Sec. 32: W½ SE¼ SW¼

T. 16 S., R. 14 E.

Sec. 5: Lot 1

In the area of "no" development potential, the coal has apparently been mined-out to the burned area (Doelling, 1972) and no other coal is present.

The designation of a coal development potential classification is based on the occurrence of the highest-rated coal-bearing area that may occur within any fractional part of a 40-acre (16 ha) BLM land grid area or lot

area of unleased Federal coal land. For example, a certain 40-acre (16 ha) area is totally underlain by a coal bed with a "moderate" development potential. If a small corner of the same 40-acre (16 ha) area is also underlain by another coal bed with a "high" development potential, the entire 40-acre (16 ha) is given a "high" development potential rating even though most of the area is rated "moderate" by the lower coal bed. Another possibility is a 40-acre (16 ha) area devoid of any coal except a small corner where a 5-ft (1.5 m) coal bed crops out. In this case the 40-acre (16 ha) area will have a "high" development potential rating.

The in situ coal gasification methods of development potential classification are based on the dip and depth of coal beds having a minimum thickness of 5 ft (1.5 m). There are two development potential classifications--moderate and low. The criteria for in situ classification include coal bed dips of 15 to 90 degrees and coal bed depths of 200 to 3,000 ft (61 to 914 m).

Inasmuch as the coal beds dip less than 15 degrees in the Northwest Quarter of the Woodside 15-minute quadrangle, the in situ coal gasification methods of development potential classification do not apply.

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