

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

Open-File Report 79-151

1979

COAL RESOURCES OF THE MATTS SUMMIT QUADRANGLE  
CARBON, DUCHESNE, AND UTAH COUNTIES, UTAH

By

AAA Engineering and Drafting, Inc.

This report has not been edited for conformity with U.S. Geological Survey editorial standards or stratigraphic nomenclature.

## CONTENTS

|   | Page |
|---|------|
| Introduction-----   | 1    |
| Purpose-----  | 1    |
| Location-----   | 1    |
| Accessibility-----  | 2    |
| Physiography-----   | 2    |
| Climate-----  | 3    |
| Land Status-----  | 3    |
| General Geology-----  | 5    |
| Previous Work-----  | 5    |
| Stratigraphy-----   | 5    |
| Structure-----  | 7    |
| Coal Geology-----   | 7    |
| Spring Canyon Group of Coal Beds-----   | 9    |
| Castlegate "A" Coal Bed-----  | 10   |
| Castlegate "B" Coal Bed-----  | 10   |
| Royal Blue Coal Bed-----  | 10   |
| Castlegate "C" Coal Bed-----  | 10   |
| Kenilworth Coal Bed-----  | 10   |
| Other Coal Beds-----  | 11   |
| Chemical Analyses of the Coal-----  | 11   |
| Mining Operations-----  | 12   |
| Coal Resources and Coal Development Potential-----  | 12   |
| Development Potential for Surface Mining Methods-----                                     | 12   |
| Development Potential for Subsurface Mining and<br>In Situ Coal Gasification Methods----- | 13   |
| References-----   | 14   |

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## ILLUSTRATIONS

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|   | Page |
|---|------|
| Plate 1. Boundary and coal data map for the Matts Summit<br>quadrangle, Carbon, Duchesne, and Utah Counties,<br>Utah----- | 4    |
| 2. Composite columnar section, Matts Summit quadrangle,<br>Carbon, Duchesne, and Utah Counties, Utah-----                 | 8    |

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## TABLES

---

|   |    |
|---|----|
| Table 1. Approximate distribution of coal lands within the<br>the KRCRA in the Matts Summit quadrangle, Carbon,<br>Duchesne, and Utah Counties, Utah----- | 5  |
| 2. Average proximate analysis of coal mined in the Helper<br>quadrangle, Carbon County, Utah-----   | 12 |

## INTRODUCTION

### 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 Matts Summit 7½-minute quadrangle is located in east-central Utah and includes the common boundary of the north side of Carbon County, the southwestern corner of Duchesne County and the southeastern corner of Utah County. The city of Helper lies 4.0 miles (6.4 km) south of the southwest corner of quadrangle. The city of Price, the county seat of Carbon County, is 10 miles (16 km) south of the quadrangle. The county seat of Duchesne County is the city of Duchesne, approximately 27 miles (43 km) northeast of the quadrangle. The city of Provo is the county seat of Utah County and is 48 miles (77 km) northwest of the Matts Summit quadrangle.

### Accessibility

Utah Highway 33 crosses the quadrangle in a north-south direction along Willow Creek. This highway continues southwestward 2.6 miles (4.2 km) to its junction with U.S. Highway 6-50. Utah Highway 33 runs northeastward from the quadrangle 29 miles (47 km) to the city of Duchesne.

A light-duty gravel road crosses the central part of the quadrangle in an east-west direction and runs westward from its junction with Utah Highway 33 to its intersection with U.S. Highway 6-50 approximately 4.5 miles (7.2 km) west of the quadrangle. Several dirt roads and jeep trails provide access to some of the canyons and ridges in the mountainous areas.

The nearest railhead is at the city of Helper, 4.0 miles (6.4 km) south of the quadrangle. A main line of the Denver and Rio Grande Western Railroad passes through Helper and provides connections to Salt Lake City, Utah and Denver, Colorado.

### Physiography

The Book Cliffs form a bold southward-facing irregular escarpment of barren sandstone cliffs from 1,000 to 2,000 ft (305 to 610 m) high. The main escarpment front of the Book Cliffs lies approximately 4 miles (6.4 km) south of the Matts Summit quadrangle in the adjoining Helper quadrangle. The steep-sided Willow Creek Canyon in the south part of the Matts Summit quadrangle is a tributary of Price Canyon, a major re-entrant canyon into the Book Cliffs.

The sedimentary strata dip gently northward and an upland east-west trending strike valley called Emma Park lies across the central area of the quadrangle. A rim of cliffs on the north side of Emma Park is called the Roan Cliffs. The gently sloping south side of Emma Park is a dip slope developed on resistant beds of the Flagstaff Limestone.

The total relief in the quadrangle area is 3,280 ft (1,000 m). Surface elevations range from 6,560 ft (1,999 m) where Willow Creek leaves the quadrangle on the south side to 9,840 ft (2,999 m) on a peak in the northwest corner of the quadrangle.

Nearly all of the quadrangle area drains into Willow Creek, a tributary of Price River. A small area on the north side of the drainage divide at the north edge of the quadrangle is part of the Dugesne River drainage system. Both the Price River and the Dugesne River drain into the Green River.

#### Climate

The Book Cliffs coal field is located in a mid-latitude steppe climate and semi-arid conditions prevail at the lower elevations. The normal annual precipitation for the Matts Summit quadrangle ranges from 14 inches (36 cm) on the south side to approximately 22 inches (56 cm) on the north side (U.S. Department of Commerce, (1964)).

Air temperatures in the quadrangle area are expected to range from a summertime high of 90 degrees F (32 degrees C) to a wintertime low of -30 degrees F (-34 degrees C).

#### Land Status

The Book Cliffs Known Recoverable Coal Resource Area (KRCRA) covers approximately 5,300 acres (2,144 ha) in the Matts Summit quadrangle. This area includes non-Federal, leased-Federal, and unleased-Federal coal lands as shown on plate 1 and in table 1.

EXPLANATION

KRCRA

KNOWN RECOVERABLE COAL RE-SOURCES AREA 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.

FEDERAL COAL LEASE BOUNDARY - Lease number within boundary  
CL U0148779

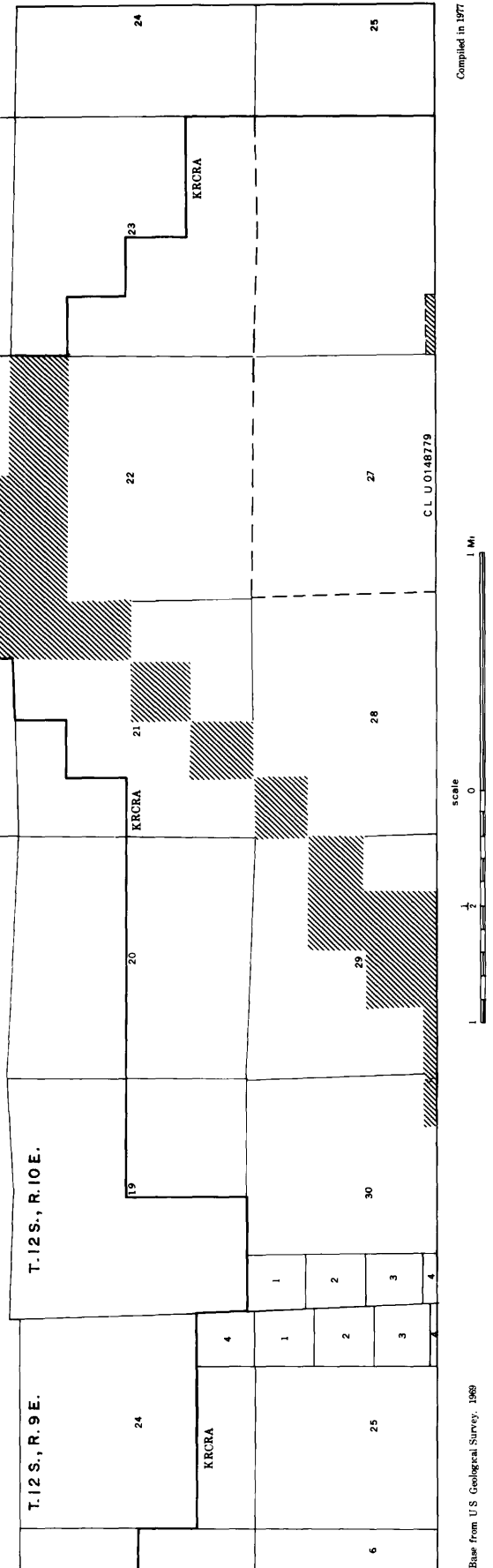
|   |    |
|---|----|
| 1 | 30 |
| 2 |    |
| 3 |    |
| 4 |    |

SECTION OF LAND - Showing lots and lot numbers

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

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. 1460-B, 7p.



Base from U.S. Geological Survey, 1969

Compiled in 1977

PLATE I. Boundary and coal data map for the Matts Summit Quadrangle, Carbon, Duchesne, and Utah Counties, Utah.

Table 1. Approximate distribution of coal lands within the KRCRA in the Matts Summit quadrangle, Carbon, Duchesne, and Utah Counties, Utah.

| Category                   | Approximate Area (acres)* | Percent of KRCRA (%) |
|----------------------------|---------------------------|----------------------|
| Non-Federal land           | 700                       | 13                   |
| Leased Federal coal land   | 1,000                     | 19                   |
| Unleased Federal coal land | 3,600                     | 68                   |
| Total                      | 5,300                     | 100                  |

\*To convert acres to hectares, multiply acres by 0.4047

## GENERAL GEOLOGY

### Previous Work

Clark (1928) mapped the geology and coal outcrops of the western part of the Book Cliffs coal field, and his maps represent the most detailed original work presently available. The stratigraphy of the area is further described in Abbott and Liscomb (1956), Fisher, Erdmann, and Reeside (1960), and Young (1955, 1957, and 1966). Doelling (1972) summarized the geology and updated the coal data described by the earlier workers. AAA Engineering and Drafting, Inc. (1979, 1979a) has prepared coal resource occurrence and coal development potential maps for the adjoining Standardville and Helper quadrangles.

### Stratigraphy

The coal beds of economic importance in the Book Cliffs field are Upper Cretaceous in age and are confined to the Blackhawk Formation of the Mesaverde Group. This group includes, in ascending order, the Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and Price River Formation. The Upper Cretaceous Mancos Shale underlies the Mesaverde Group and consists of a gray marine shale with interfingering sandstone members in the upper part.



The Tertiary strata overlying the Mesaverde Group include the North Horn Formation (Upper Cretaceous and Tertiary) which is successively overlain by the Flagstaff Limestone, the Colton Formation, and the Green River Formation.

The oldest formation exposed in the Matts Summit quadrangle is the Castlegate Sandstone which crops out in the bottom of Willow Creek Canyon at the extreme south edge of the quadrangle. The Castlegate Sandstone disconformably overlies the Blackhawk Formation and consists of a single bed of massive sandstone which forms a near-vertical cliff 250 to 300 ft (76 to 91 m) high. It is medium- to coarse-grained, gray to yellowish-gray in color, and weathers brown. The Blackhawk Formation which contains the coal beds of the Book Cliffs Coal field underlies the Castlegate Sandstone and crops out in Willow Creek Canyon a short distance south of the Matts Summit quadrangle boundary.

The Castlegate Sandstone is overlain by the Price River Formation which is composed of alternating beds of sandstone, shale, and sandy shale. The sandstones and shales have eroded to a rugged topography of cliffs and ledges. The formation is about 900 ft (274 m) thick.

The North Horn Formation overlies the Price River Formation and ranges from 700 to 800 ft (213 to 244 m) in thickness. It consists of variegated shale, impure limestone, and subordinate amounts of sandstone and conglomerate. The Flagstaff Limestone overlies the North Horn Formation and consists of some 500 ft (152 m) of thin-bedded limestone, shale, and sandstone. The limestone is resistant and yellowish-gray in color; the shale is variegated, and the sandstone is reddish-brown. The Flagstaff Limestone underlies the dip slope on the south side of Emma Park and is overlain by variegated shales, irregular beds of gray, brown, and buff sandstone, and thin-bedded limestones of the Colton Formation.

The Green River Formation overlies the Colton Formation and consists of argillaceous-, ostracodal-, and oolitic-limestone, light-gray claystone, brown carbonaceous- and micaceous-shale, and micaceous- and chloritic-sandstone.

### Structure

The Book Cliffs of east central Utah lie on the gentle north-dipping south flank of the Uinta Basin. The Upper Cretaceous and Tertiary strata in the Matts Summit quadrangle display this regional north to northeastward dip of from 4 to 6 degrees. No faults have been mapped in the quadrangle, but if any do occur they are expected to have very small displacements.

### COAL GEOLOGY

The only available non-proprietary information on the coal resources of the Matts Summit quadrangle is a laterlog of an oil and gas test well, the Government Dial No. 1, drilled by the Carter Oil Company in 1956 in the NW $\frac{1}{4}$  NE $\frac{1}{4}$  Section 27, Township 12 South, Range 10 East. The spontaneous potential curve of the log is non-definitive for coal, but the resistivity (conductivity) trace suggests the presence of some coal beds in the Blackhawk Formation. However, without additional diagnostic logs, the identification of the coal beds encountered in this well is unreliable. Tentative formation tops in this well have been picked at depths of 1,900 feet (579 m) for the top of the Blackhawk Formation and 2,780 ft (847 m) for the top of the Star Point sandstone. No other logs of non-proprietary drill holes were available to the present authors.

The coal beds underlying the Matts Summit quadrangle are expected to be similar in character and thickness to those that occur in the north part of the adjoining Helper quadrangle where extensive coal mining has taken place (AAA Engineering and Drafting, Inc., 1979a).

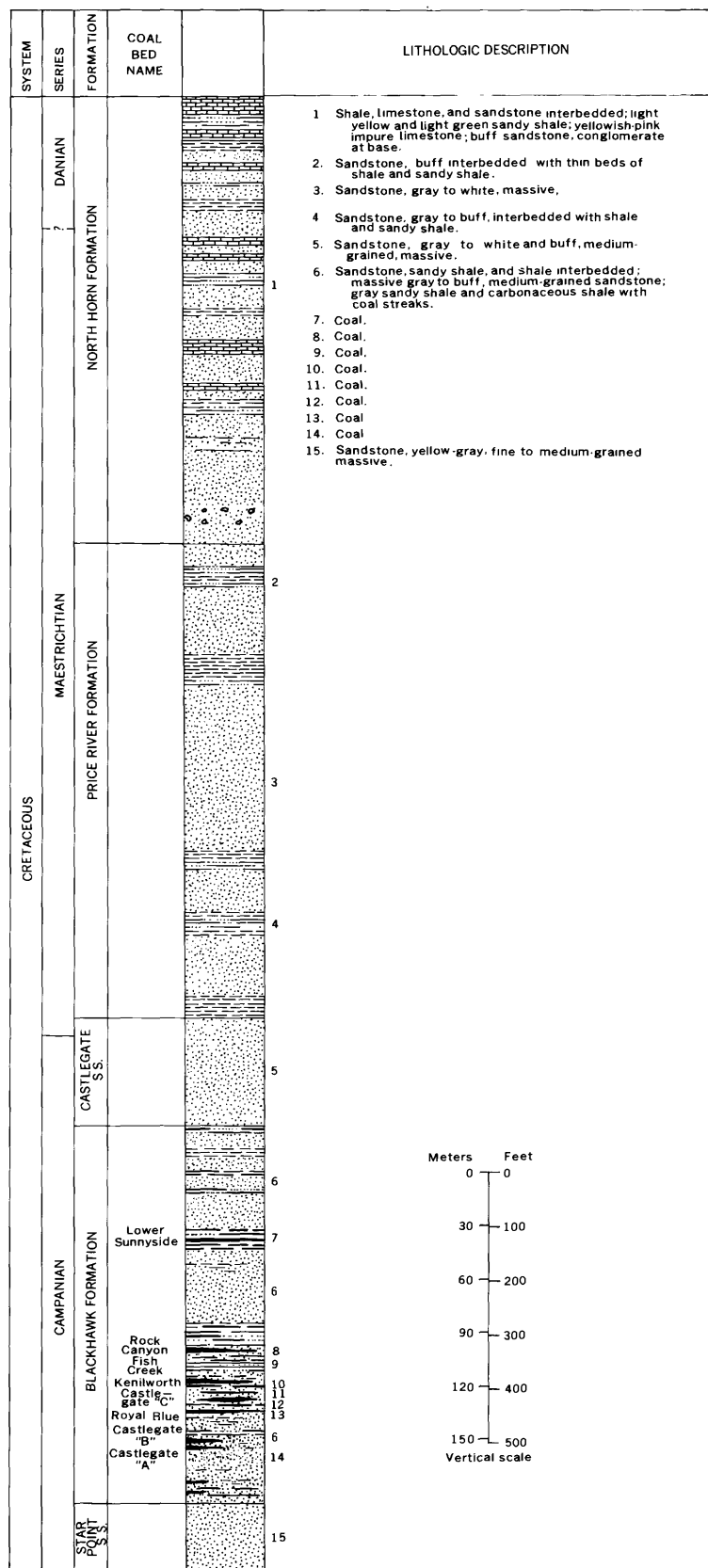


PLATE 2. Composite columnar section, Matts Summit Quadrangle, Carbon, Duchesne, and Utah Counties, Utah.

The following generalized section after Doelling (1972) shows the thicknesses of the coal beds and rock intervals, in descending order, for the Matts Summit and Helper quadrangles.

|   | <u>Thicknesses</u> |               |
|---|--------------------|---------------|
|   | <u>Feet</u>        | <u>Meters</u> |
| Lower Sunnyside coal bed  | 0-5                | 0-1.5         |
| Coal beds in the 325-foot (99.1 m)<br>interval between the Lower Sunnyside<br>and Kenilworth beds | 0-8                | 0-2.4         |
| Kenilworth coal bed   | 1-20               | 0.3-6.1       |
| Rock interval (Kenilworth Sandstone)  | 35-55              | 10.7-16.8     |
| Castlegate "C" coal bed   | 0-13               | 0-4.0         |
| Rock interval   | 45-60              | 13.7-18.3     |
| Royal Blue coal bed   | 0-9                | 0-2.7         |
| Rock interval   | 25                 | 7.6           |
| Castlegate "B" coal bed   | 1-13               | 0.3-4.0       |
| Rock interval   | 40                 | 12.2          |
| Castlegate "A" coal bed   | 1-20               | 1.3-6.1       |
| Rock interval (Aberdeen Sandstone)  | 100-210            | 30.5-64.0     |
| Spring Canyon Group (several coal beds) ea. bed   | 0-4                | 0-1.2         |
| Star Point Sandstone  |                    |               |

#### Spring Canyon Group of Coal Beds

The Spring Canyon Group constitutes the principal coal beds in the Standardville quadrangle on the southwest side of the Matts Summit quadrangle. However, these beds thin eastward into the Helper quadrangle where they pinch-out. It is expected that these coal beds will also be thin or nonexistent in the Matts Summit quadrangle.

### Castlegate "A" Coal Bed

The Castlegate "A" coal bed is one of the more important beds in the Book Cliffs and Wasatch Plateau coal fields, but the bed thins eastward in the Helper quadrangle and finally pinches out in the Deadman Canyon quadrangle. The bed is expected to occur in the Matts Summit quadrangle, but will probably be thin and pinching out toward the east side.

### Castlegate "B" Coal Bed

The Castlegate "B" coal bed is generally thin but reaches an observed thickness of 6.8 ft (2.1 m) in the Helper quadrangle. Thickness measurements in that quadrangle, however, suggest a possible thickening of the bed to the north in the Matts Summit quadrangle (AAA Engineering and Drafting Inc., 1979a).

### Royal Blue Coal Bed

The Royal Blue coal bed is very lenticular in the Helper quadrangle and is important only in a small area near the town of Kenilworth where it reaches a thickness of 8.8 ft (2.7 m). At all other localities in that quadrangle where measurements have been made, the bed is below Reserve Base thickness. This bed is expected to underlie parts of the Matts Summit quadrangle.

### Castlegate "C" Coal Bed

The Castlegate "C" coal bed is lenticular in the Helper quadrangle and is Reserve Base thickness in a small area in the northwest corner of that quadrangle. If the bed is present in the Matts Summit quadrangle it will probably be thin with isolated areas of thickening.

### Kenilworth Coal Bed

The Kenilworth, also called the Castlegate "D", coal bed is the most important coal bed in the Helper quadrangle where it has been extensively

mined. In that quadrangle the bed generally thickens northward from its outcrop. Although there is insufficient drilling data along the north side of the Helper quadrangle to predict coal thickness, it is reasonable that the Kenilworth bed continues northward into the Matts Summit quadrangle. The Kenilworth coal contains some bony and shaly partings which may indicate the possibility of the bed splitting in directions away from the Helper quadrangle.

#### Other Coal Beds

Several coal beds found in the Helper quadrangle occur in a 325-ft (99.1-m) interval above the Kenilworth bed. These beds have been called in ascending order, the Gilson, Fish Creek, Rock Canyon, Castlegate "E", Castlegate "F", and Lower Sunnyside coal beds (Doelling, 1972). These beds are generally less than 5 ft (1.5 m) thick in the Helper quadrangle, although the Castlegate "F" is over 7 ft (2.1 m) thick in the northwest corner of that quadrangle. Most of these higher coal beds thicken eastward and reach mineable thickness in other areas of the Book Cliffs coal field. It is probable that these beds will have similar thicknesses and characteristics in the southern part of the Matts Summit quadrangle as they do in the Helper quadrangle.

#### Chemical Analyses of the Coal

Doelling (1972) reported over 300 analyses of coal samples of the Kenilworth and Castlegate group of coal beds taken mostly from the Castlegate and Kenilworth mines in the Helper quadrangle. Doelling (1972) showed the range and average of the analyses in the following table. It is expected that the coal beds underlying the Matts Summit quadrangle will be chemically similar to those mined in the adjoining quadrangle to the south.

Table 2. Average proximate analysis of coal mined in the Helper quadrangle, Carbon County, Utah.

|                 | No.<br>Analyses | Average | Percent (as received)<br>Range |
|-----------------|-----------------|---------|--------------------------------|
| Moisture        | 312             | 4.7     | 2.5-10.4                       |
| Volatile matter | 306             | 41.7    | 25.7-64.3                      |
| Fixed carbon    | 306             | 47.2    | 28.3-52.1                      |
| Ash             | 311             | 6.3     | 3.8-12.7                       |
| Sulfur          | 295             | 0.44    | 0.1-0.8                        |
| Btu/lb          | 303             | 12,755  | 11,840-13,370                  |

(To convert Btu/lb to Kj/Kg multiply by 2.326.)

Based on the ASTM system of classification and the average coal analysis shown in table 2, the average coal represented is ranked as high volatile bituminous B (American Society for Testing and Materials, 1977).

#### Mining Operations

The earliest coal mining in the Helper quadrangle to the south began in 1889. The coal was used to produce a low-grade coke until 1907. Several mines produced coal from four coal beds including the Castlegate, Kenilworth, and Royal Blue beds. There were no active mines in the quadrangle in 1979. Doelling (1972) estimated that the total coal production from mines in the Helper quadrangle through 1969 was about 65 million short tons (59 million metric tons).

The available mine maps show that mining in the Helper quadrangle proceeded northward to about 1,000 ft (304.8 m) from the Matts Summit quadrangle boundary (Doelling, 1972).

#### COAL RESOURCES AND COAL DEVELOPMENT POTENTIAL

##### Development Potential for Surface Mining Methods

No development potential for surface mining methods exist in the KRCRA 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

No coal beds are known to crop out in the Matts Summit quadrangle and no non-proprietary drilling data were available to the present authors except the laterolog of the oil and gas test well referred to above. Evidence of formation tops from this well indicate that the coal beds in the Blackhawk Formation will occur at depths between 2,000 ft (609.6 m) and 3,000 ft (914.4 m) in the KRCRA area in the Matts Summit quadrangle. Inasmuch as there are no data points of coal measurements, the entire unleased Federal coal land in the Matts Summit quadrangle KRCRA (approximately 3,600 acres (1,457 ha)) is classified as having an "unknown" coal development potential for subsurface mining.

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 5.0 ft (1.5 m). There are two development potential classifications--moderate and low. The criteria are based on 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 generally dip less than 15 degrees in the Matts Summit quadrangle, the criteria for the classification of in-situ coal gasification methods of development potential do not apply.

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



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