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FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS
OF THE PINEHAVEN 7 1/2-MINUTE QUADRANGLE,
McKINLEY COUNTY, NEW MEXICO

[Report includes 8 plates (9 sheets)]

Prepared by Berge Exploration, Inc.

This report was prepared under contract to the U.S. Geological Survey, and has not been edited for conformity with Geological Survey editorial standards or stratigraphic nomenclature. Opinions expressed herein do not necessarily represent those of the Geological Survey.

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INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Pinehaven 7½ minute quadrangle, McKinley County, New Mexico. These maps and report are part of an evaluation of fifty-six 7½ minute quadrangles in northwestern New Mexico, which were completed under U. S. Geological Survey Contract No. 14-08-0001-17459 (see figs. 1 and 2).

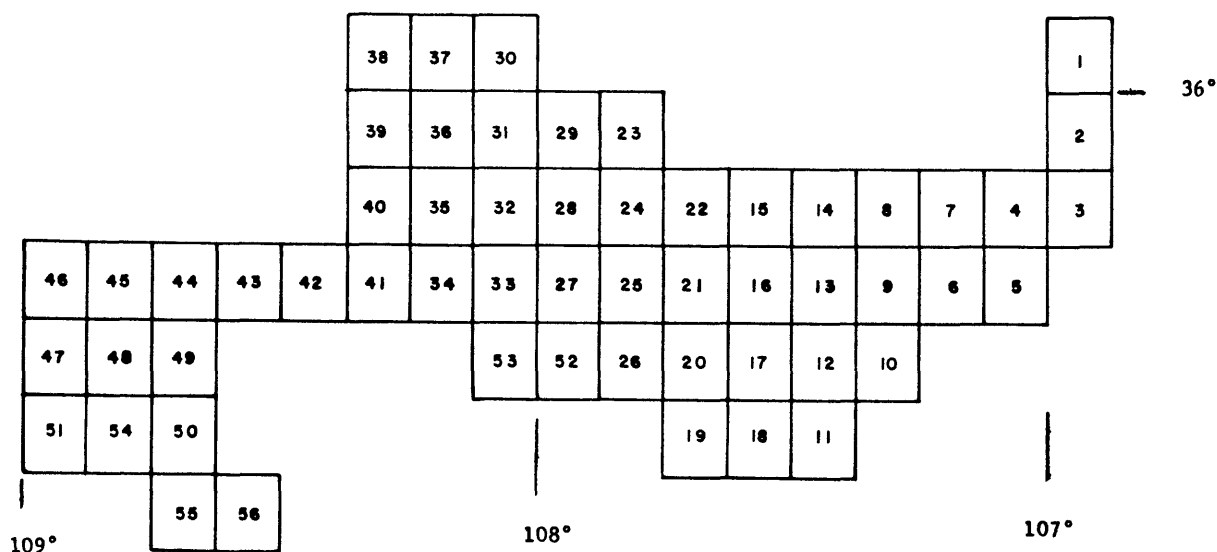
The purpose of this Coal Resource Occurrence-Coal Development Potential program, which was conceived by Congress as part of its Federal Coal Leasing Amendments Act of 1976, is to obtain coal resource information and to determine the geographical extent of Federal coal deposits. In addition, the program is intended to provide information on the amount of coal recoverable by various mining methods and to serve as a guide for land-use planning.

The U. S. Geological Survey initiated the program by identifying areas underlain by coal resources. These areas were designated Known Recoverable Coal Resource Areas based on the presence of minable coal thicknesses, adequate areal extent of these coal deposits, and the potential for developing commercial quantities of coal at minable depths.

This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor were any confidential data used.

FIGURE 2.--Index to USGS 7 1/2-minute quadrangles and coal resource occurrence/
coal development potential maps for the southern San Juan Basin area, New Mexico

Map No.	Quadrangle	Open-file report	Map No.	Quadrangle	Open-file report
1	Cuba	79- 623	31	Nose Rock	79- 641
2	San Pablo	79- 624	32	Becenti Lake	79-1124
3	La Ventana	79-1038	33	Heart Rock	79- 642
4	Headcut Reservoir	79-1043	34	Crownpoint	79-1125
5	San Luis	79-1044	35	Antelope Lookout Mesa	79-1376
6	Arroyo Empedrado	79-1045	36	Milk Lake	79-1377
7	Wolf Stand	79-1046	37	La Vida Mission	79-1378
8	Tinian	79- 625	38	The Pillar 3 SE	79-1379
9	Canada Calladita	79- 626	39	Red Lake Well	79-1380
10	Cerro Parido	79- 627	40	Standing Rock	79-1381
11	El Dado Mesa	79- 628	41	Dalton Pass	80- 026
12	Mesa Cortada	79- 629	42	Oak Spring	80- 027
13	Mesita del Gavilan	79- 630	43	Hard Ground Flats	80- 028
14	Rincon Marquez	79- 631	44	Big Rock Hill	80- 029
15	Whitehorse Rincon	79- 632	45	Twin Lakes	80- 030
16	Mesita Americana	79- 633	46	Tse Bonita School	80- 031
17	El Dado	79- 634	47	Samson Lake	80- 032
18	Cerro Alesna	79- 635	48	Gallup West	80- 033
19	San Lucas Dam	79- 636	49	Gallup East	80- 034
20	Piedra de la Aguila	79-1039	50	Bread Springs	80- 035
21	Hospah	79- 637	51	Manuelito	80- 036
22	Whitehorse	79-1040	52	Borrego Pass	80- 037
23	Seven Lakes NE	79- 638	53	Casamero Lake	80- 038
24	Kin Nahzin Ruins	79- 639	54	Twin Buttes	80- 039
25	Orphan Annie Rock	79-1041	55	Pinehaven	80- 040
26	Mesa de los Toros	79-1122	56	Upper Nutria	80- 041
27	Laguna Castillo	79- 640			
28	Seven Lakes	79-1042			
29	Seven Lakes NW	79-1123			
30	Kin Klizhin Ruins	79-1047			



Location

The Pinehaven 7½ minute quadrangle includes acreage in Tps. 12 and 13 N., Rs. 17 and 18 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

No paved roads pass through the Pinehaven quadrangle. State Route 32 passes within 0.3 mi (0.5 km) west of the quadrangle. A light-duty, maintained road in the northeastern part of the quadrangle provides access to State Route 400, 7 mi (11 km) ENE of the area. Unimproved dirt roads and light-duty maintained roads traverse most parts of the quadrangle. The main line of the Atchison, Topeka, and Santa Fe Railroad passes about 11 mi (18 km) north of the quadrangle.

Physiography

The Pinehaven quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). The topography of the quadrangle is characterized by eroded mesas, alluvial valley floors, and rugged badlands.

No perennial streams are present in the quadrangle. Local drainage is provided by several intermittent arroyos. Elevations within the quadrangle range from less than 6,820 ft (2,079 m) along the southern quadrangle boundary in Coal Mine Canyon to over 7,740 ft (2,359 m) in the northeast.

Climate

The climate of this area is semiarid to arid. The following temperature and precipitation data were reported by the National Oceanic and Atmospheric Administration for the Zuni Station. The Pinehaven quadrangle is about 9 mi (14 km) N of the Zuni Station. Average total annual precipitation for eleven of the previous fifteen years is 13.05 in. (33.15 cm). Intense thunderstorms in July, August, and September account for the majority of precipitation. The area is susceptible to flash flooding associated with these thunderstorms. Mean annual temperature for nine of the previous fifteen years is 50.3°F (10.2°C). The average daily temperatures in January and July are 30.1°F (-1.1°C) and 72.3°F (22.4°C), respectively.

Land status

The Federal Government holds the coal mineral rights to approximately 78 percent of the Pinehaven quadrangle. For the specific coal ownership boundaries, see plate 2. It is not within the scope of this report to provide detailed land-surface ownership. About 22,000 acres (8,903 ha) in the southern, southwestern, central northern, and northeastern parts of the quadrangle are within the Gallup Known Recoverable Coal Resource Area. The Zuni Indian Reservation occupies most of the southeastern part of the area. Federal lands within the Cibola National Forest are present in the northeastern part of the Pinehaven quadrangle. As of October 26, 1978, there were no Federal coal leases, coal preference right lease applications or coal exploration licenses within the Pinehaven quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include surface mapping showing thicknesses from outcrop sections on the Zuni Indian Reservation by Winchester (Sears, 1925). Shomaker, Beaumont, and Kottlowski (1971) reviewed the potential for strippable coal reserves in the area. They reported that the coal beds within the Gallup Sandstone, and Dilco and Gibson Coal Members of the Crevasse Canyon Formation were generally less than 3.0 ft (0.9 m) thick. No strippable reserves were estimated in the area. Tabet (1979), upon request from the U. S. Geological Survey, released coal data of his coal mapping in the Pinehaven quadrangle. He also supplied three coal test hole logs of the New Mexico Bureau of Mines, five coal test hole logs from the Carbon Coal Company, and three coal test hole logs from Utah International, Inc., which are within the Pinehaven quadrangle. His work was not completed at the time of map construction, but all available data were used. B. A. Livingstone of Bokum Corporation (1979) supplied geophysical logs and lithologic descriptions of a uranium test hole drilled under a uranium prospecting permit. This data became available to Berge Exploration, Inc. because the prospecting permit had expired.

Stratigraphy

Within the San Juan Basin, the shoreline positions of the Cretaceous seaways changed innumerable times. The overall regional alignment of the shorelines trended N. 60° W. - S. 60° E. (Sears, Hunt, and Hendricks, 1941). Evidence for the transgressive and regressive shoreline migrations are shown by the intertonguing relationships of continental and marine facies. Rates of trough

(geosynclinal) subsidence and the availability of sediment supplies are the major factors that controlled the transgressive-regressive shoreline sequences.

Exposed rock units in the quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area.

The Gallup Sandstone is a prominent sandstone marker in most of the San Juan Basin which represents nearshore or littoral deposits that formed during a major regression of the Cretaceous seaways. Pink to gray, fine to very coarse-grained, massive sandstone, interbedded gray shales, and coal beds comprise the lithologies of the unit, which ranges from 250 to 315 ft (76 to 96 m) thick locally.

The Dilco Coal Member of the Crevasse Canyon Formation overlies the Gallup Sandstone and represents continental sediments which were deposited inland from the beach area during the deposition of the Gallup Sandstone. Medium to dark gray siltstone with interbedded medium-grained, tan sandstones, and coal beds comprise the lithologies of the Dilco Coal Member which ranges from 220 to 275 ft (67 to 84 m) thick in the area.

About 410 ft (125 m) of the Bartlett Barren Member of the Crevasse Canyon Formation overlies the Dilco Coal Member in this area. Yellowish-brown to olive-gray siltstone, light gray shales, white to brown calcareous sandstones, and thin local coal beds comprise the lithologies of the Bartlett Barren Member which represents flood plain deposits. The Crevasse Canyon Gibson-Menefee Cleary undifferentiated unit overlies the Bartlett Barren Member, and was combined based on similar lithologies and stratigraphic continuity representing essentially continuous continental deposition. Light to medium gray, carbonaceous siltstone with interbedded gray to tan sandstones, gray shales, and coal beds comprise the lithologies of the Crevasse Canyon Gibson-Menefee Cleary unit which averages

350 ft (107 m) thick locally.

The Allison Member of the Menefee Formation is separated from the underlying Crevasse Canyon Gibson-Menefee Cleary undifferentiated coal unit by a massive channel sandstone sequence. The Allison Member represents continued continental deposition and consists of dark gray to brown, carbonaceous to noncarbonaceous shale, light gray sandstones, and thin, lenticular coal beds. Thickness of the eroded Allison Member is about 100 ft (30 m) in the northern part of the quadrangle.

Depositional environments

The Cretaceous System sedimentary units in the quadrangle represent transgressive and regressive depositional conditions. There were innumerable minor cycles of widely varying duration and extent within the major sedimentary sequences. The paucity of data in this quadrangle and the intended scope of this report permit only general interpretations of the depositional environments.

The Cretaceous coal deposits of the San Juan Basin are products of former coastal swamps and marshes. These swamps and marshes were supported by heavy precipitation and a climate conducive to rapid vegetal growth in moderately fresh water. Due to the relatively low sulfur contents of the San Juan Basin coals, Shomaker and Whyte (1977) suggest the coals formed in fresh water environments.

Most of the coal-bearing units were deposited in coastal plain environments. The majority of the peat deposits formed in a transition zone between lower and upper deltaic sediments during periods of relative shoreline stability. Coals also formed in lake margin swamps inland from the coastal area. Shoreline

oscillations and the subsequent influx of continental or marine debris upon the peat accumulations produced the vertical buildup or "stacking" or peat deposits. This sediment debris is represented by variable ash contents, rock partings, and splits within the coal seams.

The peat accumulated in lenses or pods which were generally parallel to the ancient shorelines. The coals in the lower portions of the coal-bearing units represent regressive depositional conditions (Sears, Hunt, and Henricks, 1941). The coals in the upper portions of these units are relatively sporadic in occurrence.

Structure

The Pinehaven quadrangle is in the Gallup Sag structural division in the southwestern portion of the structural depression known as the San Juan Basin (Kelley, 1950). Hackman and Olson (1977) mapped the Allison Syncline in the extreme northeast corner of the Pinehaven quadrangle. No faults have been mapped by any previous workers within the quadrangle. Dips of the rock units range from 2° to 4° E to NE in the area. Hackman and Olson (1977) mapped an anticlinal fold in the southwestern part of the quadrangle.

COAL GEOLOGY

In this quadrangle, the authors identified six coal beds, two coal zones, and local coal beds in coal test holes, a uranium test hole, and surface measured sections by Winchester (Sears, 1925) and Tabet (1979). These coal beds and coal zones are here informally called the Crevasse Canyon Dilco coal zone, Crevasse Canyon Dilco No. 3, No. 5, and No. 7 coal beds, local coal beds, Crevasse Canyon Gibson coal zone, and the Crevasse Canyon Gibson No. 5, No. 6, and No. 7 coal beds.

Stratigraphically, the Crevasse Canyon Dilco coal zone contains the lowest identified coal beds in the Pinehaven quadrangle. Up to twelve individual coal beds that occur from 5 to 230 ft (2 to 70 m) above the top of the Gallup Sandstone comprise the Crevasse Canyon Dilco coal zone. These zone coals, as with all identified zone coals in this quadrangle, may be correlated for limited distances in portions of the area, but they lack sufficient continuity with poorly defined stratigraphic position and cannot be designated as persistent coal beds. The Crevasse Canyon Dilco No. 3, No. 5, and No. 7 coal beds occur from 75 to 135 ft (23 to 41 m), 175 to 240 ft (53 to 73 m), and 250 to 270 ft (76 to 82 m) above the top of the Gallup Sandstone, respectively.

Eight local coal beds that range in thickness from 0.3 to 1.6 ft (0.1 to 0.5 m) occur in the upper part of the Bartlett Barren Member. The Crevasse Canyon Gibson coal zone contains up to four individual coal beds that occur from 2 to 250 ft (1 to 76 m) above the top of the Bartlett Barren Member. The Crevasse Canyon Gibson No. 5, No. 6, and No. 7 coal beds occur from 35 to 55 ft (11 to 17 m), 120 to 135 ft (37 to 41 m), and 140 to 160 ft (43 to 49 m), respectively, above the top of the Bartlett Barren Member. These coal beds, as with all numerically designated coal beds identified in this quadrangle, are inferred to be continuous, although there may be several individual coal beds that are stratigraphically equivalent.

The New Mexico Bureau of Mines (Tabet, 1979) cored coal seams in at least two of the coal test holes, and chemical analyses were to have been performed. However, these data were not available at the time of map construction. No other known published coal quality analyses for coal beds from the Pinehaven quadrangle are available. Several analyses of Gibson Coal Member and Dilco Coal Member beds which were mined north of the quadrangle have been reported by the U. S. Bureau of Mines (1936) and are shown in table 1. Coal beds within

Table 1. - Analyses of coal samples from the Dilco and Gibson Coal Members of the Crevasse Canyon Formation.

[Form of analysis: A, as received; B, moisture free; C, moisture and ash free]

from U. S. Bureau of Mines, 1936

Samples 1 and 2 - Gibson Coal Member

Samples 3 and 4 - Dilco Coal Member

Sample	Type of sample	Location		Form of analysis	Proximate analysis (percent)				Sulfur	Heating value (Btu/lb)
		Sec.	T. N.	R. W.	Moisture	Volatile Matter	Fixed Carbon	Ash		
1	mine sample (Navajo mine)	SE $\frac{1}{4}$ 33	16	18	12.5	38.9	39.4	9.17	0.43	10,800
					--	44.4	45.1	10.49	0.49	12,350
					--	49.7	50.3	--	0.55	13,800
2	mine sample (Weaver mine)	SE $\frac{1}{4}$ 34	16	18	15.8	38.0	43.1	3.14	0.45	11,300
					--	45.1	51.2	3.73	0.53	13,430
					--	46.9	53.1	--	0.55	13,950
3	mine sample (Defiance mine)	SE $\frac{1}{4}$ 16	15	19	10.6	40.9	41.4	7.1	0.79	11,510
					--	45.7	46.4	7.9	0.88	12,880
					--	49.7	50.3	--	0.96	13,990
4	mine sample (Caretto mine)	SW $\frac{1}{4}$ 14	15	18	10.6	40.6	44.4	4.40	0.59	12,100
					--	45.4	49.7	4.92	0.66	13,530
					--	47.7	52.3	--	0.69	14,230

Remarks:

A moist, mineral-matter-free (MMMF) calculation using the Parr formula (American Society for Testing and Materials, 1973) yields heating values of 11,995 Btu/lb (27,900 kJ/kg; sample 1), 11,703 Btu/lb (27,221 kJ/kg; sample 2), 12,482 Btu/lb (29,033 kJ/kg; sample 3), and 12,716 Btu/lb (29,577 kJ/kg; sample 4). No agglomerating characteristics were included with the analyses.

the Gallup Sandstone have been mined south of the Pinehaven quadrangle. The Gibson and Dilco Coal Member beds analyzed are probably similar in quality to the Gibson and Dilco Coal Member beds in this quadrangle. Rank of the Gibson and Dilco Coal Member beds is probably high volatile C bituminous in this area.

Crevasse Canyon Dilco No. 3 coal bed

The Crevasse Canyon Dilco No. 3 coal bed was identified in three coal test holes and one uranium test hole in this quadrangle. Thickness of the bed ranges from 2.0 to 5.5 ft (0.6 to 1.7 m). Because the Crevasse Canyon Dilco No. 3 coal bed is not present in two coal test holes (data points #112 and #113, plates 1 and 3), the bed is inferred to pinch out in the western portion of the mapped area (see plate 4). Existence and character of the Crevasse Canyon Dilco No. 3 coal bed are unknown in most parts of the quadrangle because of insufficient data.

No known chemical analyses are available for the author's Crevasse Canyon Dilco No. 3 coal bed. The Dilco "A" coal bed of Sears (1925) is the same coal bed as the author's Crevasse Canyon Dilco No. 3 coal bed.

COAL RESOURCES

The U. S. Geological Survey requested a resource evaluation of the Crevasse Canyon Dilco No. 3 coal bed, where the bed is 3.0 ft (0.9 m) or more thick. The evaluation is restricted to Federal coal lands.

The following procedures were prescribed by the U. S. Geological Survey for the calculation of reserve base. Criteria established in U. S. Geological Survey Bulletin 1450-B were used to areally divide the bed into measured,

indicated, and inferred reserve base categories. Reserve base was calculated for each category, by section, using data from the isopach and overburden maps (plates 4 and 6). The acreage in each category (measured by planimeter) multiplied by the average coal bed thickness and a bituminous coal conversion factor (1,800 tons of coal per acre-ft) yields the reserve base for that category. Coal beds with 3.0 ft (0.9 m) minimum thickness are included in reserve base and reserve data rather than the 28 in. (71 cm) minimum thickness prescribed in U. S. Geological Survey Bulletin 1450-B. Reserve figures are derived from reserve base totals by applying a recovery factor of 50 percent for coal beds 200 to 3,000 ft (61 to 914 m) deep. All reserve base and reserve values are rounded to the nearest 10,000 short tons (9,072 t).

Total reserve base data for the Crevasse Canyon Dilco No. 3 coal bed, which include all reserve base categories, are shown by section on plate 2. Reserve base and reserve data in the various categories are shown on plate 7.

COAL DEVELOPMENT POTENTIAL

The factors used to determine the development potential are the presence of a potentially coal-bearing formation, and the thickness and overburden of correlative coal beds. The U. S. Geological Survey supplied the criteria to evaluate the coal development potential for Federal lands in this quadrangle. These criteria are based on current industry practice, U. S. Geological Survey Bulletin 1450-B, and anticipated technological advances. All available data were utilized for the coal development potential evaluations.

Any area underlain by a potentially coal-bearing formation with 200 ft (61 m) or less of overburden has potential for surface mining. The U. S. Geological Survey designated the 200 ft (61 m) maximum depth as the stripping limit. Areas where a potentially coal-bearing formation is overlain by more

than 200 ft (61 m) of overburden have no potential for surface mining. Areas with no correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick and overlain by 200 ft (61 m) or less of overburden have unknown surface mining potential.

Any area underlain by a potentially coal-bearing formation with 200 to 3,000 ft (61 to 914 m) of overburden has potential for subsurface mining. Areas where a potentially coal-bearing formation is overlain by more than 3,000 ft (914 m) of overburden have no subsurface mining potential. Development potential for subsurface mining is unknown where a potentially coal-bearing formation within 200 to 3,000 ft (61 to 914 m) of the surface contains no identified correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick. High, moderate, and low development potential areas have respective overburden values of 200 to 1,000 ft (61 to 305 m), 1,000 to 2,000 ft (305 to 610 m), and 2,000 to 3,000 ft (610 to 914 m).

Boundaries of coal development potential areas coincide with the boundaries of the smallest legal land subdivision (40 acres or lot). When a land subdivision contains areas with different development potentials, the potential shown on the map is that of the areally largest component area. When an area is underlain by more than one bed, the potential shown on the map is that of the bed with the highest potential.

Reserve base (in short tons) in the various development potential categories for subsurface mining methods is shown in table 2.

The coal development potential map is subject to revision. Map boundary lines and reserve base values are based on coal resource occurrence map isopachs, overburden isopachs, and coal bed correlations that are interpretive and subject to change as additional coal information becomes available.

Development potential for surface mining methods

The coal development potential for surface mining methods has not been mapped in the Pinehaven quadrangle because based on coal development potential criteria, all Federal coal lands have unknown surface mining potential.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods in the Pinehaven quadrangle is shown on plate 8. Based on coal development potential criteria, all Federal coal lands have high, moderate, or unknown subsurface mining potentials. Refer to table 3 for reserves and planimetered acreage, by section, for Federal coal lands with subsurface mining potential.

In situ gasification of coal has not been done on a commercial scale in the United States and criteria for rating the development potential of this method are unknown.

Table 2. - Reserve base data (in short tons) for subsurface mining methods for Federal coal lands in the Pinehaven quadrangle, McKinley County, New Mexico.

[Development potentials are based on thickness of overburden. To convert short tons to metric tonnes, multiply by 0.9072].

Coal Bed	High Development Potential (200' - 1,000' overburden)	Moderate Development Potential (1,000' - 2,000' overburden)	Low Development Potential (2,000' - 3,000' overburden)	Total
Crevasse Canyon Dilco No. 3	3,790,000	1,940,000	----	5,730,000
Total	3,790,000	1,940,000	----	5,730,000

Table 3. - Reserves and planimetered acreage, by section, for Federal coal lands in the Pinehaven quadrangle with subsurface mining potential.

[To convert acres to hectares, divide acres by 2.471; to convert short tons to metric tonnes, multiply short tons by 0.9072].

Potential category	Coal bed	Sec. T. N.	R. W.	Acres (planimetered)	Reserves (in short tons)
High	Crevasse Canyon Dilco No. 3	25	13	18	530,000
		30	13	17	400,000
		32			70,000
		1	12	18	710,000
		2			170,000
Moderate	Crevasse Canyon Dilco No. 3	25	13	18	20,000
		30	13	17	940,000

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(Pinehaven Quadrangle)

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GLOSSARY

- coal bed--A stratified sequence of coal, composed of relatively homogeneous material, exhibiting some degree of lithologic unity and separated from the rocks above and below by physically rather well defined boundary planes.
- coal bed separation line--A line on a map plate separating areas where different coal beds or zones are mapped.
- coal bench--One of two or more divisions of a coal bed separated by rock.
- coal conversion factor--A factor used to convert acre-feet of coal into short tons of coal; bituminous coal is 1800 tons/acre-ft; subbituminous coal is 1770 tons/acre-ft.
- coal development potential--A subjective determination of the comparative potential of Federal coal lands for development of a commercially viable coal mining operation.
- coal exploration license--An area of Federal coal lands in which the licensee is granted the right, after outlining the area and the probable methods of exploration, to investigate the coal resources. An exploration license has a term not to exceed 2 years and does not confer rights to a lease.
- coal lease--An area of Federal coal lands in which the Federal Government has entered into a contractual agreement for development of the coal deposits.
- coal split--A coal bed resulting from the occurrence of a noncoal parting within the parent coal bed which divides the single coal bed into two or more coal beds.
- coal zone--A distinctive stratigraphic interval containing a sequence of alternating coal and noncoal layers in which the coal beds may so lack lateral persistence that correlating individual beds in the zone is not feasible.
- Federal coal land--Land for which the Federal Government holds title to the coal mineral rights, without regard to surface ownership.
- hypothetical resources--Undiscovered coal resources in beds that may reasonably be expected to exist in known mining districts under known geologic conditions. In general, hypothetical resources are in broad areas of coal fields where points of observation are absent and evidence is from distant outcrops, drill holes or wells. Exploration that confirms their presence and reveals quantity and quality will permit their reclassification as a Reserve or Identified Subeconomic Resource.
- identified resources--Specific bodies of coal whose location, rank, quality, and quantity are known from geologic evidence supported by engineering measurements.
- indicated--Coal for which estimates for the rank, quality, and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections.
- inferred--Coal in unexplored extensions of demonstrated resources for which estimates of the quality and quantity are based on geologic evidence and projections.
- isopach--A line joining points of equal bed thickness.
- Known Recoverable Coal Resource Area (KRCRA)--Formerly called Known Coal Leasing Area (KCLA). Area in which the Federal coal land is classified (1) as subject to the coal leasing provisions of the Mineral Leasing Act of 1920, as amended, and (2) by virtue of the available data being sufficient to permit evaluation as to extent, location, and potential for developing commercial quantities of coal.
- measured--Coal for which estimates for rank, quality, and quantity can be computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well known sample sites.
- mining ratio--A numerical ratio equating the in-place volumes, in cubic yards, of rocks that must be removed in order to recover 1 short ton of coal by surface mining.
- overburden--A stratigraphic interval (composed of noncoal beds and coal beds) lying between the ground surface and the top of a coal bed. For coal zones, overburden is the stratigraphic interval lying between the ground surface and the structural datum used to map the zone.
- parting--A noncoal layer occurring along a bedding plane within a coal bed.
- Preference Right Lease Application (PRLA)--An area of Federal coal lands for which an application for a noncompetitive coal lease has been made as a result of exploration done under a coal prospecting permit. PRLA's are no longer obtainable.
- quality or grade--Refers to measurements such as heat value; fixed carbon; moisture; ash; sulfur; phosphorus; major, minor, and trace elements; coking properties; petrologic properties; and particular organic constituents.
- rank--The classification of coal relative to other coals, according to degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite (Classification of coals by rank, 1973, American Society for Testing and Materials, ASTM Designation D-388-66).
- recovery factor--The percentage of total tons of coal estimated to be recoverable from a given area in relation to the total tonnage estimated to be in the Reserve Base in the ground.
- reserve--That part of identified coal resource that can be economically mined at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the reserve base.
- reserve base--That part of identified coal resource from which Reserves are calculated.
- stripping limit--A vertical depth, in feet, measured from the surface, reflecting the probable maximum, practical depth to which surface mining may be technologically feasible in the foreseeable future. The rock interval, expressed in feet, above the stripping limit is the "strippable interval."
- structure contour--A line joining points of equal elevation on a stratum or bed.