UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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1985

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

[Report includes 17 plates]

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SEVEN LAKES NE QUADRANGLE
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INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Seven Lakes NE 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.

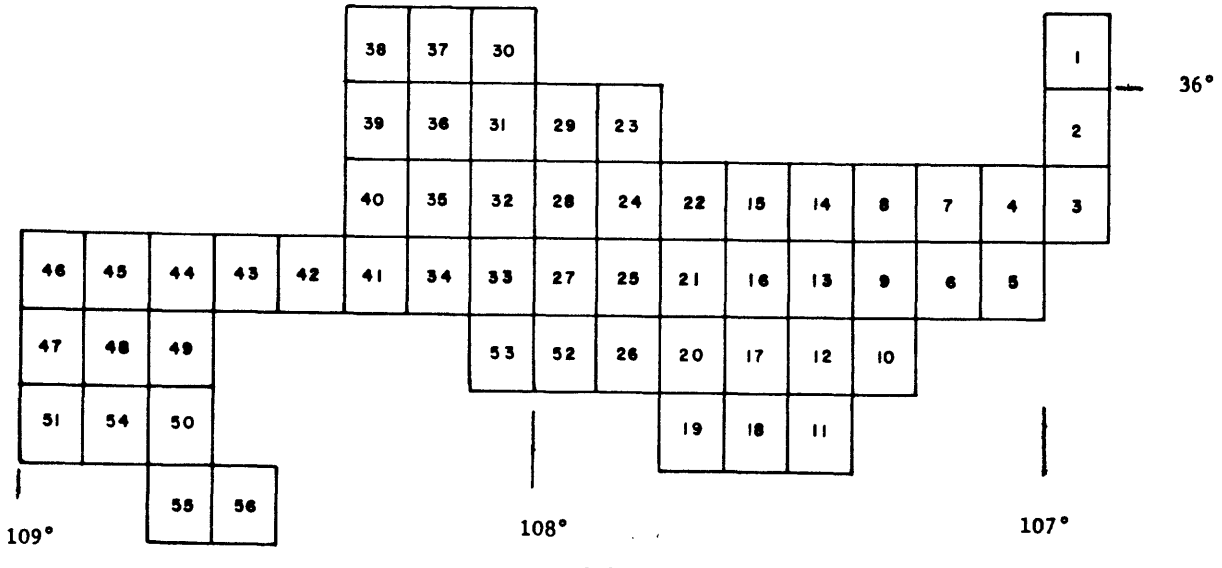
This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor were any confidential data used.


LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
Grants
Bloomfield
Aztec
Bernalillo
Gallup
Milan
Thoreau
Crownpoint
Estancia
Window Rock
St. Michaels
Sanders
Shiprock
Chaco
Counselor
White Horse
Standing Rock
Navajo
Teec Nos Pos
Red Rock
Round Rock
Chromo
Arboles
Antonito
Tres Piedras
Cuba
Los Lunas
Laguna
San Mateo
Bluewater
Prewitt
Ramah
El Morro
Zuni
Acoma
INDIAN RESERVATION
SAN JUAN
SCALE IN MILES

FIGURE 1

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 Seven Lakes NE 7 1/2 minute quadrangle includes acreage in Tps. 19 and 20 N., Rs. 9 and 10 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

No paved roads pass through the Seven Lakes NE quadrangle. An unimproved dirt road connects to State Highway 57, 5 mi (8 km) west of the quadrangle. Dirt roads and jeep trails traverse most parts of the area. The Atchison, Topeka, and Santa Fe Railroad line passes about 50 mi (80 km) due south of the quadrangle (see fig. 1).

Physiography

The Seven Lakes NE quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). Mesa-and-canyon topography characterizes the northern part of the quadrangle, with eroded flatlands typical of the remainder. Chaco Mesa is a prominent landform in the northern part of the quadrangle.

No perennial streams are present in the quadrangle. Local drainage is provided by Chaco Wash and Fajada Wash. Elevations within the quadrangle range from less than 6,260 ft (1,908 m) along Fajada Wash in the northwest to over 7,080 ft (2,158 m) on Chaco Mesa along the eastern quadrangle boundary.

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 Chaco Canyon National Monument Station. The Seven Lakes NE quadrangle is about 7 mi (11 km) SE. of the Chaco Canyon National Monument Station. Average total annual precipitation for thirteen of the previous fifteen years is 8.75 in. (22.23 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 eleven of the previous fifteen years is 48.4°F (9.1°C). The average daily temperatures in January and July are 26.3°F (-3.2°C) and 72.5° F (22.5° C), respectively.

Land status

The Federal Government holds coal rights to about 25 percent of the Seven Lakes NE 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. All of the Seven Lakes NE quadrangle is within the Hospah Known Recoverable Coal Resource Area. As of October 26, 1978, there were no Federal coal leases, coal preference right lease applications or coal exploration licenses within the Seven Lakes NE quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Dobbin (1932) who mapped the western portion of the Seven Lakes NE quadrangle but did not identify any coal. Dane (1936) mapped the eastern portion of the area, and reported coals in the Allison Member of the Menefee Formation near the Allison Member-Cliff House Sandstone contact on Chaco Mesa. Shomaker, Beaumont, and Kottlowski (1971) report Allison Member coals ranging in thickness from a few inches to 6.5 ft (2.0 m) in the area. They note that due to the limited extent of coal bed thickening and excessive overburden, surface mining would be unfavorable in this area. Shomaker and Whyte (1977) estimate Menefee Formation coal resources overlain by 500 ft (152 m) or less of overburden for areas within the Seven Lakes NE quadrangle.

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). The transgressive and regressive shoreline migrations are evidenced by the intertonguing relationships of the 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 Seven Lakes NE quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area.

The Point Lookout Sandstone is a prominent sandstone marker in most of the San Juan Basin and represents nearshore or littoral deposits which formed during the most extensive northeastward retreat prior to the final withdrawal of the Cretaceous seaways in the San Juan Basin (Sears, Hunt, and Hendricks, 1941). Light gray to reddish-brown, fine-to medium-grained sandstone with interbedded shales comprise the lithologies of the unit which ranges from 100 to 115 ft (30 to 35 m) thick locally. The continental sediments deposited inland from the beach area during deposition of the Point Lookout Sandstone compose the overlying Menefee Formation.

The Menefee Formation consists of dark gray to brown, carbonaceous to noncarbonaceous shales, light gray sandstones, and coal beds, and is divisible into the basal Cleary Coal Member and upper Allison Member. A massive channel sandstone sequence defines the boundary between the two members. The Cleary Coal Member contains the most important coal beds in this area, and ranges from 400 to 495 ft (122 to 151 m) thick locally. The Allison Member represents continued continental sedimentation. Erosion has reduced the Allison Member to about 870 ft (265 m) thick in some areas, although the full thickness of the member is about 1,250 ft (380 m) locally. Intertonguing of the Allison Member with the overlying Cliff House Sandstone indicates the instability of the Cretaceous shorelines during transition from regressive to transgressive depositional conditions in this area.

The Cliff House Sandstone formed in a nearshore marine environment as the Cretaceous seaways advanced southwestward during the final transgression

in the San Juan Basin. Chaco Mesa and Red Mountain represent the approximate maximum southwestern development of the Cliff House Sandstone in this area. Light gray, medium-grained, locally calcareous sandstone with interbedded shales, and local coal beds comprise the lithologies of the Cliff House Sandstone, which ranges from 280 to 360 ft (85 to 110 m) thick locally.

As the transgressing seaways deepened, the Lewis Shale formed from the marine sands, silts, and muds. The Lewis Shale overlies the Cliff House Sandstone and is composed of gray to black silty shale with interbedded light gray to buff, very fine to fine-grained calcareous sandstones, and bentonite marker beds. A partial section of the Lewis Shale is present along the northern boundary of the Seven Lakes NE 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 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" of 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 Hendricks, 1941). The coals in the upper portions of these units are relatively sporadic in occurrence.

Structure

The Seven Lakes NE quadrangle is in the Chaco Slope and Central Basin structural divisions in the southern portion of the structural depression known as the San Juan Basin (Kelley, 1950). No major structural features are present in the area. Dane (1936) mapped two major faults which form a graben and locally affect structure in the central part of the quadrangle. The rock units dip from 1° to 3° N. to NE.

COAL GEOLOGY

In this quadrangle, the authors identified two coal beds and three coal zones in oil and gas well logs and Dane's (1936) surface mapping. These coals occur in the Cleary Coal and Allison Members of the Menefee Formation and in the Cliff House Sandstone. These beds and zones are here informally called the Menefee Cleary No. 1 and No. 3 coal beds, Menefee Cleary coal zone, Menefee Allison coal zone, and the Cliff House coal zone.

The Menefee Cleary No. 1 coal bed is the first persistent bed above the Point Lookout Sandstone. It is, stratigraphically, the lowest identified bed and occurs as much as 13 ft (4 m) above the Point Lookout Sandstone in this quadrangle. The Menefee Cleary No. 3 coal bed was identified in four of the ten drill holes (plate 3) and occurs from 73 to 84 ft (22 to 26 m) above the Point Lookout Sandstone in this quadrangle. The beds are inferred to be continuous, although they may be several individual beds that are stratigraphically equivalent.

Several thin coal beds that occur as much as 430 ft (131 m) above the Point Lookout Sandstone were identified in nine drill holes and comprise the Menefee Cleary coal zone. Several other higher coal beds identified in seven drill holes and outcrop measurements by Dane (1936) comprise the Menefee Allison coal zone. The Cliff House coal zone is represented by a coal outcrop of unknown thickness mapped by Dane (1936) near the top of Red Mountain in the central part of the quadrangle.

There are no published coal quality analyses of Menefee Formation coals from the Seven Lakes NE quadrangle. Analyses of an Allison Member sample from the abandoned Pueblo Bonito mine, taken about 8.5 mi (13.7 km)

NW. of the quadrangle has been reported by the U. S. Bureau of Mines (1936) and is shown in table 1. The Allison Member mine sample analyzed is probably similar in quality to the Allison Member and Cleary Coal Member beds in this quadrangle. Rank of the Allison Member and Cleary Coal Member seams is probably subbituminous A or high volatile C bituminous in this area.

Menefee Allison coal zone

The Menefee Allison coal zone was identified by Dane (1936) in surface exposures along the northern cliffs of Chaco Mesa and in the Red Mountain area, and in oil and gas well logs. The coals of this zone are generally less than 3.0 ft (0.9 m) thick and very limited in areal extent.

The isopach map for the Menefee Allison coal zone (plate 4) is based on the total coal thickness measured at each data point. Structure contours, except in the Red Mountain area and north of the Chaco Mesa outcrop, are drawn on the projected top of the partially eroded Allison Member of the Menefee Formation.

Interburden for each data point is the total rock thickness, excluding coal thicknesses, from the surface to the top of the lowest identified Menefee Allison zone bed. No Allison Member coals were identified in data points #6 and #13 (see plate 3), so the stratigraphic position of the lowest Menefee Allison coal in data point #10 was projected to data points #6 and #13 to approximate the interburden thickness.

Table 1.- Analysis of a coal sample from the Allison Member of the Menefee Formation.

(Mine sample from sec. 14, T. 21 N., R. 10 W.)

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

from U. S. Bureau of Mines, 1936

Form of analysis	Proximate analysis (percent)				Sulfur	Heating Value (Btu/lb)
	Moisture	Volatile Matter	Fixed Carbon	Ash		
A	14.4	34.8	42.3	7.5	1.5	10,220
B	----	40.7	50.5	8.8	1.8	11,940

Remarks:

A moist, mineral-matter-free (MMMF) calculation, using the Parr formula (American Society for Testing and Materials, 1973) yields a heating value of 11,139 Btu/lb (25,909 kJ/kg).

No agglomerating characteristics are available for this analysis.

Menefee Cleary coal zone

The Menefee Cleary coal zone was identified only in the subsurface in the quadrangle and contains several lenticular beds, although none of the individual coals are greater than 4.5 ft (1.4 m) thick. The Menefee Cleary coal zone interburden map (plate 9) was constructed utilizing similar criteria to that used for the construction of the Menefee Allison coal zone map.

Menefee Cleary No. 3 coal bed

The Menefee Cleary No. 3 coal bed was identified in four drill hole logs that are located in the southwest part of the quadrangle. The bed thickens to 3.5 ft (1.1 m) in data point #13 (see plate 3). Because the Menefee Cleary No. 3 coal bed was not identified in other parts of the quadrangle, it is inferred to pinch out. Existence and character of the bed are unknown in the southeast corner of the quadrangle because of insufficient data.

Menefee Cleary No. 1 coal bed

The Menefee Cleary No. 1 coal bed was identified in all of the oil and gas well logs in the Seven Lakes NE quadrangle. The bed is widespread throughout most of the area, and is up to 6.0 ft (1.8 m) thick. Rock partings are present in data points #7, #11, #12, and #14 (see plate 3). The procedure prescribed by the U. S. Geological Survey regarding rock partings in coal beds overlain by 200 ft (61 m) or more of overburden is

the rock parting must be thicker than one coal bench to discount the thinner bench from the isopached thickness. Following these guidelines, the Menefee Cleary No. 1 bed was isopached as 4.0 ft (1.2 m) in data point #7, 4.0 ft (1.2 m) in data point #11, and 3.0 ft (0.9 m) in data point #12. The bed was isopached as 6.0 ft (1.8 m) in data point #14 because the rock parting was equal in thickness to both coal benches. Existence and character of the Menefee Cleary No. 1 coal bed are unknown in the southeast corner of the quadrangle because of insufficient data.

COAL RESOURCES

The U. S. Geological Survey requested resource evaluations of the Menefee Cleary No. 1 and No. 3 coal beds, where the beds are 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 10, 12, 13, and 15). 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 a 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 Menefee Cleary No. 1 and No. 3 coal beds, which include all reserve base categories, are shown by section on plate 2. Reserve base and reserve data in the various categories for the Menefee Cleary No. 1 bed are shown on plate 16. Because the Menefee Cleary No. 3 has reserves only in sec. 30, T. 20 N., R. 9 W., the areal distribution and identified resources map is included in this text as a page-sized map (fig. 3).

The U. S. Geological Survey also requested resource evaluations of the Menefee Allison and Menefee Cleary coal zones. Total identifed resources were calculated only where the total coal thickness is 5.0 ft (1.5 m) or greater. The Menefee Allison and Menefee Cleary coal zones have total identified resources in the Seven Lakes NE quadrangle of 18.50 and 19.89 million short tons (16.78 and 18.04 million t), respectively.

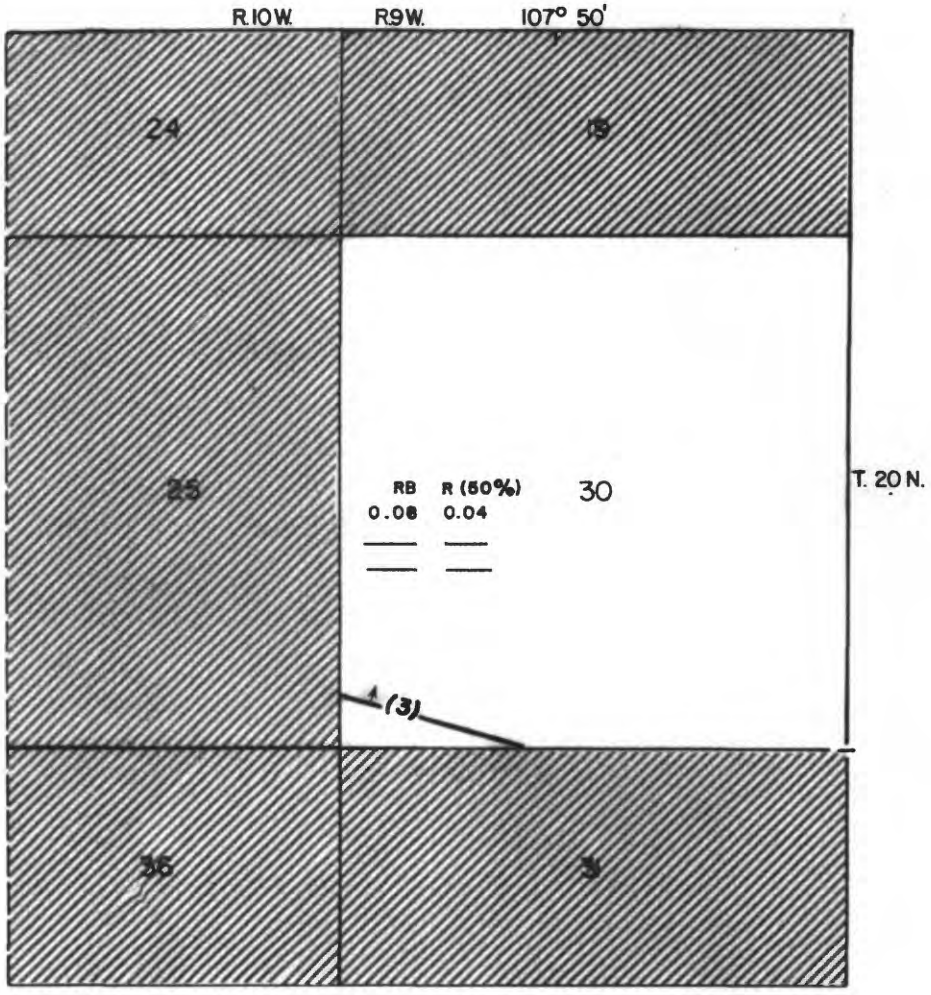
COAL DEVELOPMENT POTENTIAL

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 surface and subsurface

Figure 3

AREAL DISTRIBUTION AND IDENTIFIED RESOURCES OF THE MENEFEE CLEARY NO. 3 COAL BED

(See explanation p. 17)



SCALE 1:24,000

Figure 3

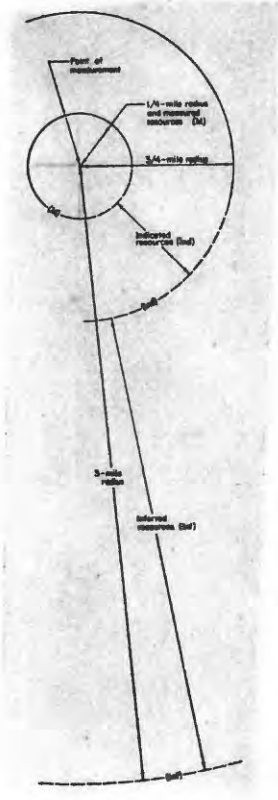
EXPLANATION

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

BOUNDARY OF IDENTIFIED RESERVE BASE COAL-Drawn along the 3 foot (0.9 meter) isopach (3). Arrow points toward are of identified Reserve Base coal.

RB	R (50%)	
0.08	0.04	(Measured resources)
——	——	(Indicated resources)
——	——	(Inferred resources)

IDENTIFIED COAL RESOURCES OF THE MENEFEE CLEARY NO. 3 BED-Showing totals for Reserve Base (RB) and Reserves (R) in millions of short tons, for each section of Federal coal land outside the stripping limit line. Dash indicates no resources in that category. Reserve Base (RB) x the Recovery Factor (50 percent) = Reserves (R).



BOUNDARY LINES-Enclosed areas of measured (M), indicated (Ind) and inferred (Inf) coal resources.

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

To convert miles to kilometers, multiply miles by 1.609.

NOTE: BLM coal ownership data current as of Oct. 26, 1978.

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) in thickness 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 acre 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) for the moderate development potential category 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

Based on coal development potential criteria, all Federal coal land in the Seven Lakes NE quadrangle has unknown development potential for surface mining methods.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods in the Seven Lakes NE quadrangle is shown on plate 17. Based on coal development criteria, all Federal coal lands in the Seven Lakes NE quadrangle have subsurface mining potentials of moderate or unknown. 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 Seven Lakes NE 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
Menefee Cleary No. 1	---	7,180,000	---	7,180,000
Menefee Cleary No. 3	---	80,000	---	80,000
Total	---	7,260,000	---	7,260,000

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

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

Potential category	Coal bed	Sec.	T. N.	R. W.	Acres (planimetered)	Reserves (in short tons)
Moderate	Menefee Cleary No. 3	30	20	9	14.9	40,000
	Menefee Cleary No. 1	7	20	9	9.5	20,000
		17			16.3	40,000
		18			137.0	460,000
		30			638.5	3,040,000

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(SEVEN LAKES NE 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 forseeable 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.