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

[Report includes 11 plates]

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MILK LAKE QUADRANGLE
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INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Milk Lake 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.

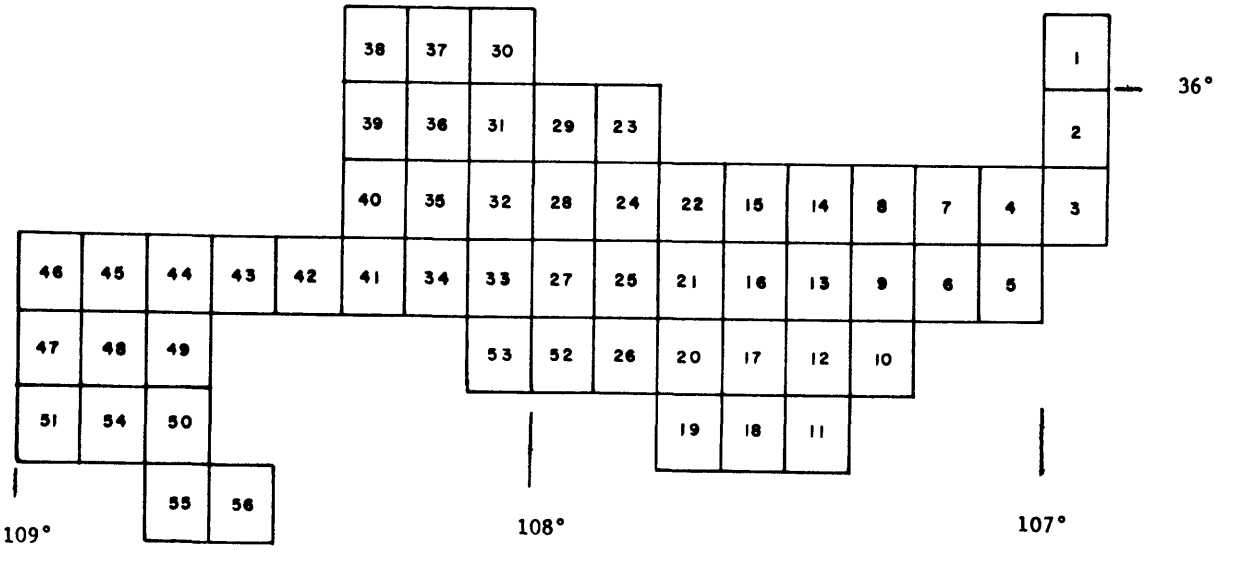
This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling of field mapping was performed as part of this study, nor were any confidential data used.

LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
SAN JUAN

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 Milk Lake 7½ minute quadrangle includes acreage in Tps. 19 and 20 N., Rs. 12 and 13 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

State Highway 371 passes through the quadrangle and provides access to the towns of Crownpoint, 14 mi (23 km) south, and White Rock, 8 mi (13 km) northeast of the quadrangle. Unimproved dirt roads traverse most parts of the area. The Atchison, Topeka, and Santa Fe Railroad line passes about 32 mi (51 km) south of the quadrangle (see fig. 1).

Physiography

The Milk Lake quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). Gently sloping flat lands characterize the topography of the area.

No perennial streams are present in the quadrangle. Local drainage is provided by several intermittent arroyos including Indian Creek and Kim-me-ni-oli Wash. Elevations within the quadrangle range from less than 6,040 ft (1,841 m) along Kim-me-ni-oli Wash in the northeast to 6,450 ft (1,966 m) on an isolated hill in the central part of the quadrangle.

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 Milk Lake quadrangle is about 9.5 mi (15.3 km) SW 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 approximately 50 percent of the Milk Lake 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. No areas in the Milk Lake quadrangle are within any 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 Milk Lake quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Dobbin (1932) who mapped the area but did not report any coal occurrences within the Milk Lake quadrangle. Shomaker and Whyte (1977) estimated Menefee Formation coal resources overlain by 500 ft (152 m) or less of overburden as 18.0 million short tons (16.3 million t) for T. 20 N., R. 12 W., and 10.8 million short tons (9.8 million t) for T. 20 N., R. 13 W. Portions of these townships-ranges are within the Milk Lake 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 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 Milk Lake quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area. Coal beds have been identified in the Dilco Coal Member of the Crevasse Canyon Formation and Cleary Coal Member of the

Menefee Formation in this quadrangle. The Gallup Sandstone is a prominent sandstone marker in most of the southern San Juan Basin.

A major northeastward regression of the Cretaceous seaways resulted in deposition of the Gallup Sandstone in a beach or littoral environment. The Gallup Sandstone is composed of pink to gray, fine-to medium-grained, massive sandstone with interbedded gray shales, and ranges from 110 to 160 ft (34 to 49 m) thick locally. The Dilco Coal Member of the Crevasse Canyon Formation overlies the Gallup Sandstone and represents the 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 80 to 100 ft (24 to 30 m) thick in the area.

Increased rates of trough subsidence caused the regressive sequence to gradually slow, and finally stop. The seaways deepened and the shorelines advanced southwestward during the succeeding transgressive phase. The Mulatto Tongue of the Mancos Shale was deposited over the Dilco Coal Member, and is composed of light gray to tan, silty shale with interbedded reddish-tan, very fine-grained sandstone. Thickness of the unit ranges from 500 to 1,020 ft (152 to 311 m) in this area.

South of the Milk Lake quadrangle, the Dalton Sandstone Member of the Crevasse Canyon Formation overlies the Mulatto Tongue. Other units were deposited over the Dalton Sandstone Member and, in ascending order, include the Gibson Coal Member of the Crevasse Canyon Formation and the Hosta Tongue of the Point Lookout Sandstone. These units were not deposited in this area. The Satan Tongue of the Mancos Shale was deposited in this area, although it is essentially inseparable from the thick marine sequence of the Mulatto Tongue.

The Point Lookout Sandstone was deposited over the Mulatto Tongue, 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 120 to 150 ft (37 to 46 m) thick locally. The continental sediments deposited inland from the beach area during the 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 quadrangle and ranges from 460 to 560 ft (140 to 171 m) thick locally. The Allison Member has been partially eroded locally, and only the basal 400 to 500 ft (122 to 152 m) of the member is present in the Milk Lake quadrangle. No Allison Member coal beds have been identified in this area.

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" 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 Milk Lake quadrangle is in the Chaco Slope structural division in the southern part of the structural depression known as the San Juan Basin (Kelley, 1950). The rock units dip from $\frac{1}{2}^{o}$ to 1^{o} north, with minor, localized folding present in the area. No faults have been mapped in the quadrangle (Dobbin, 1932).

COAL GEOLOGY

In this quadrangle, the authors identified two coal beds and two coal zones in oil and gas well logs. These coal beds and coal zones are here informally called the Crevasse Canyon Dilco coal zone, Menefee Cleary No. 1 and No. 3 coal beds, and the Menefee Cleary coal zone.

The Crevasse Canyon Dilco coal zone was identified in three of the four oil and gas logs in this quadrangle, and consists of up to three individual coal beds. These zone coals occur from 11 to 95 ft (3 to 29 m) above the Gallup Sandstone and range in thickness from 2.0 to 2.5 ft (0.6 to 0.8 m).

The remainder of the identified coal beds in this quadrangle occur within the Cleary Coal Member of the Menefee Formation. The Menefee Cleary No. 1 bed is the first persistent coal bed above the Point Lookout Sandstone. It occurs up to 9 ft (3 m) above the Point Lookout Sandstone in this area, although it occurs up to 15 ft (5 m) above the Point Lookout Sandstone in nearby areas. The Menefee Cleary No. 3 coal bed was identified in only one oil and gas well log in this area, occurring 82 ft (25 m) above the Point Lookout Sandstone. These coal beds are inferred to be continuous, although they may be several individual beds that are stratigraphically equivalent.

Several other beds that occur from 20 to 550 ft (6 to 168 m) above the Point Lookout Sandstone comprise the Menefee Cleary coal zone. These zone coals 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.

There are no published coal quality analyses for coal beds from the Milk Lake quadrangle. Analyses of five coal samples from two core test holes of Cleary Coal Member beds that have been reported by Shomaker, Beaumont, and Kottlowski (1971) are shown in table 1. Core test hole No. 3A is about 7.3 mi (11.7 km) SW of the quadrangle and core test hole No. 3B is about 6.9 mi (11.1 km) SW of the Milk Lake quadrangle. The Cleary Coal Member beds analyzed are probably similar in quality to the Cleary Coal Member beds in this quadrangle. Rank of the Cleary Coal Member beds is probably subbituminous A in this area.

Menefee Cleary coal zone

The Menefee Cleary coal zone was identified in all four oil and gas well logs in the Milk Lake quadrangle, and contains up to four beds with a maximum total thickness of 11.5 ft (3.5 m). Individual zone coal thicknesses range from 2.0 to 4.0 ft (0.6 to 1.2 m). The zone is inferred to thicken to 30 ft (9.1 m) based on data from the western adjacent Red Lake Well quadrangle, and is inferred to pinch out in the northcentral part of the quadrangle (see plate 4). Existence and character of the Menefee Cleary coal zone are unknown along the eastern edge and southwestern corner of the quadrangle because of insufficient data.

Table 1. - Analyses of coal samples from the Cleary Coal Member of the Menefee Formation.

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

from Shomaker, Beaumont, and Kottlowski, 1971

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	core test hole No. 3A	NW¼SW¼ NE¼ 16	18	14		A	15.3	36.9	40.7	7.1	0.5	10,620
						B	----	43.6	48.0	8.4	0.5	12,540
						C	----	47.6	52.4	----	0.6	13,690
2	core test hole No. 3A	NW¼SW¼ NE¼ 16	18	14		A	17.3	34.5	43.3	4.9	0.5	10,810
						B	----	41.7	52.4	5.9	0.6	13,070
						C	----	44.3	55.7	----	0.7	13,900
3	core test hole No. 3A	NW¼SW¼ NE¼ 16	18	14		A	16.4	31.8	37.7	14.1	1.0	9,520
						B	----	38.1	45.0	16.9	1.2	11,390
						C	----	45.8	54.2	----	1.4	13,710
4	core test hole No. 3B	NW¼NE¼ NE¼ 8	18	14		A	16.0	31.1	34.5	18.4	0.5	8,870
						B	----	37.1	41.5	21.9	0.6	10,570
						C	----	47.5	52.5	----	0.7	13,530
5	core test hole No. 3B	NW¼NE¼ NE¼ 8	18	14		A	15.4	33.2	37.5	13.9	0.8	9,480
						B	----	39.2	44.4	16.4	1.0	11,200
						C	----	46.9	53.1	----	1.2	13,390

Remarks: A moist, mineral-matter-free (MMMF) calculation, using the Parr formula (American Society for Testing and Materials, 1973) yields heating values of 11,509 Btu/lb (26,770 kJ/kg, sample 1), 11,421 Btu/lb (26,565 kJ/kg, sample 2), 11,244 Btu/lb (26,153 kJ/kg, sample 3), 11,077 Btu/lb (25,765 kJ/kg, sample 4), and 11,035 Btu/lb (25,667 kJ/kg, sample 5). The free-swelling index of each sample indicates all of the above samples are nonagglomerating.

Menefee Cleary No. 1 coal bed

The Menefee Cleary No. 1 coal bed was identified in all four oil and gas well logs. The bed is inferred to thicken to 6.0 ft (1.8 m) based on data from the western adjacent Red Lake Well quadrangle and is inferred to pinch out along the southern edge of the quadrangle (see plate 7). Existence and character of the bed are unknown along the eastern edge and in the southwestern corner of the quadrangle because of insufficient data.

COAL RESOURCES

The U. S. Geological Survey requested a resource evaluation of the Menefee Cleary No. 1 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 base categories. Reserve base was calculated for each category, by section, using data from the isopach and overburden maps (plates 7 and 9). The acreage in each category (measured by planimeter) multiplied by the average coal bed thickness and a subbituminous coal conversion factor (1,770 tons of coal per acre-ft) yields the reserve base for that category. Coal beds with a 3.0 ft (0.9 m) mininum 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 coal bed, 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 coal bed are shown on plate 10.

The U. S. Geological Survey also requested a resource evaluation of the Menefee Cleary coal zone. Total identified resources were calculated only where the total coal thickness is 5.0 ft (1.5 m) or greater. The Menefee Cleary coal zone has total identified resources of 321.05 million short tons (291.26 million t) in the Milk Lake quadrangle.

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 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 identified 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 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) for the high and moderate development potential categories for subsurface mining methods is shown in table 2.

The coal development potential maps are 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 has unknown development potential for surface mining methods in the Milk Lake quadrangle.

Development potential for subsurface mining methods and in situ gasification.

The coal development potential for subsurface mining methods in the Milk Lake quadrangle is shown on plate 11. Based on coal development criteria, all Federal coal lands have subsurface mining potentials of high, 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 Milk Lake 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	43,060,000	11,960,000	----------	55,020,000
Total	43,060,000	11,960,000	----------	55,020,000

Table 3. - Reserves and planimetered acreage, by section, for Federal coal lands in the Milk Lake 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	Menefee Cleary No. 1	6	19	12	307.1	900,000
		1	19	13	650.6	2,100,000
		2			664.4	2,340,000
		3			662.8	2,390,000
		4			530.5	1,790,000
		10			51.7	140,000
		11			109.5	310,000
		12			63.8	180,000
		18	20	12	8.0	20,000
		30			258.4	750,000
		8	20	13	26.8	80,000
		14			31.9	90,000
		20			513.8	2,660,000
		22			61.5	280,000
		24			364.8	1,220,000
		26			439.3	1,760,000
		28			640.0	3,170,000
		32			261.5	1,200,000
		34			667.4	2,940,000
Moderate	Menefee Cleary No. 1	8	20	13	45.6	140,000
		14			465.2	1,470,000
		22			592.9	2,400,000
		24			296.4	1,090,000
		26			214.4	860,000

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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.