UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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1985

FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE CANADA CALLADITA 7 1/2-MINUTE QUADRANGLE, McKINLEY AND SANDOVAL COUNTIES, NEW MEXICO

[Report includes 19 plates]

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CANADA CALLADITA QUADRANGLE

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INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Cañada Calladita 7½ minute quadrangle, McKinley and Sandoval Counties, 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 Published and unpublished public information was used as the data base for this study.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.

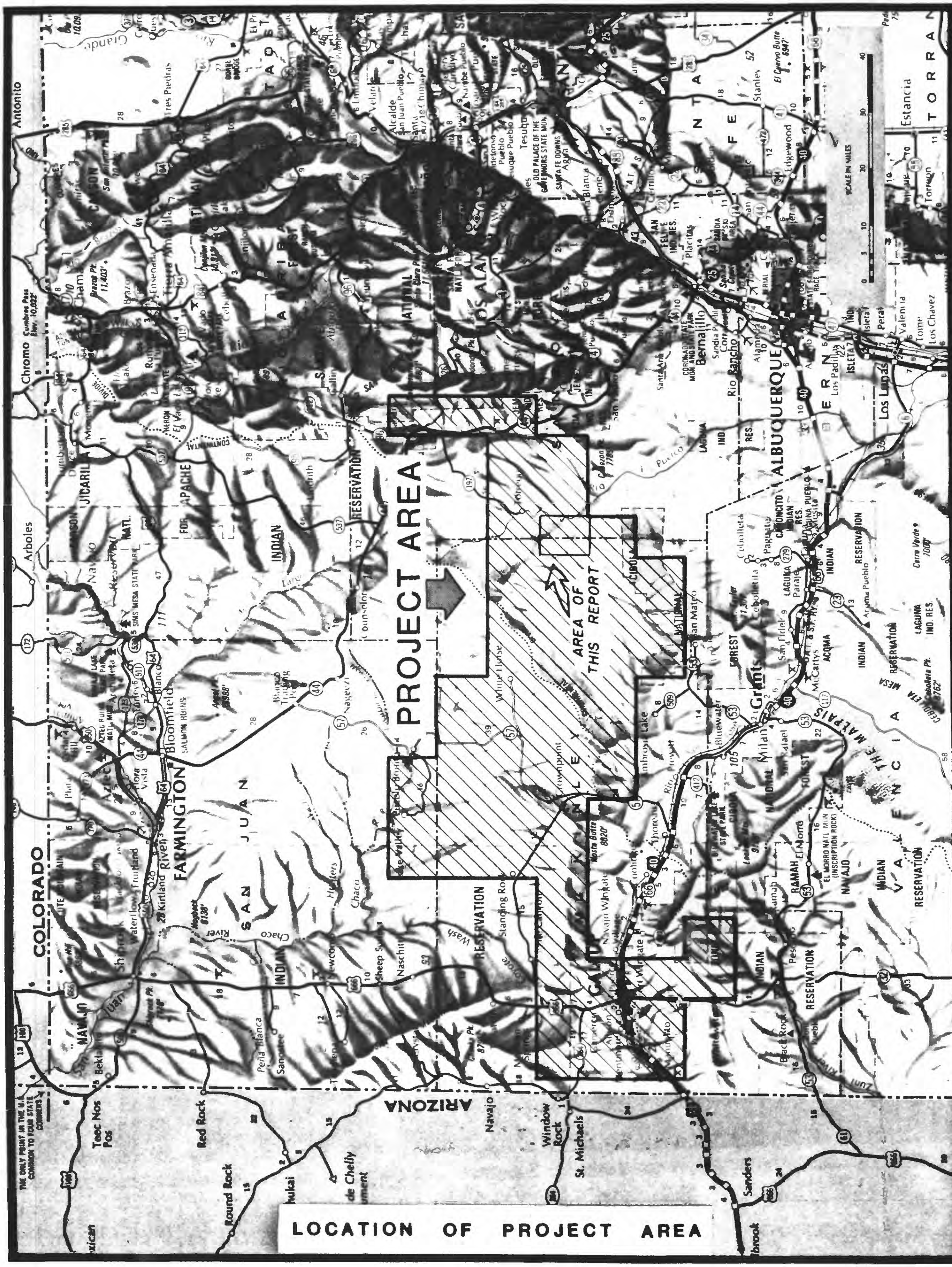
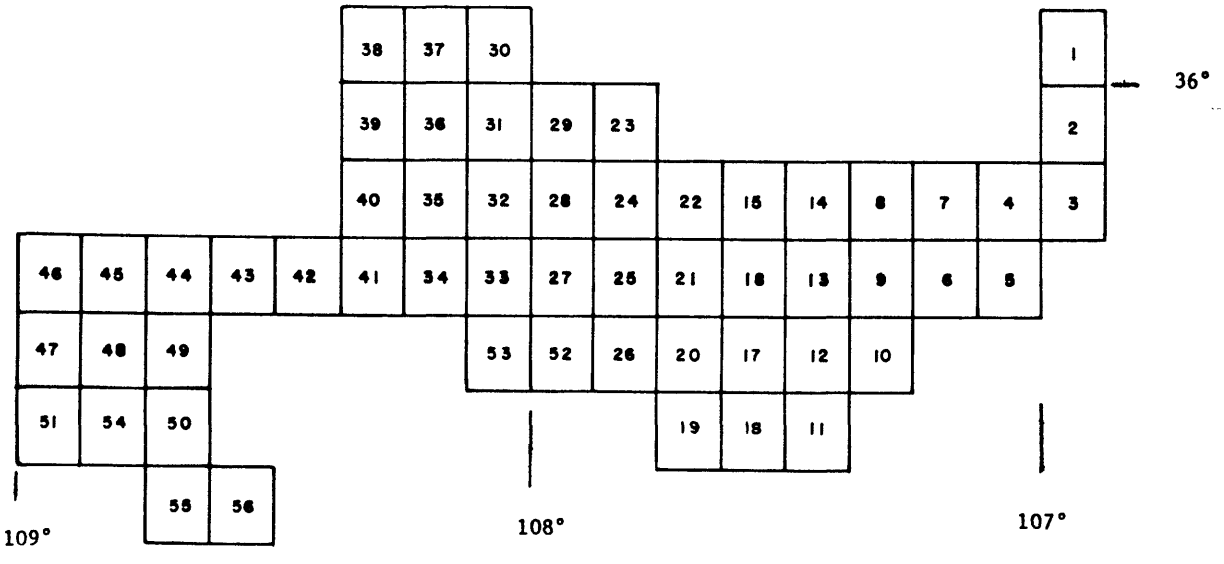

LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
Grants
Gallup

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 Cañada Calladita 7½ minute quadrangle includes acreage in Tps. 16, 17, and 18 N., Rs. 4 and 5 W. of the New Mexico Principal Meridian, McKinley and Sandoval Counties, northwestern New Mexico (see figs. 1 and 2).

Accessibility

No paved roads pass through the Cañada Calladita quadrangle. Unimproved dirt roads traverse most parts of the area. The Atchison, Topeka, and Santa Fe Railroad line passes about 40 mi (64 km) due south of the quadrangle (see fig. 1).

Physiography

The Cañada Calladita 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 mesa-and-canyon.

No perennial streams are present in the quadrangle. Local drainage is provided by intermittent arroyos which include: Arroyo Chico, Torreon Wash, and Cañada Calladita. Elevations within the quadrangle range from 6,000 ft (1,829 m) in the southeastern corner of the quadrangle along Arroyo Chico to 7,120 ft (2,170 m) in the northwestern corner.

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 Torreon Navajo Mission Station. The Cañada Calladita quadrangle is about 2 mi (3.2 km) SW. of the Torreon Navajo Mission Station. Average total annual precipitation for thirteen of the previous fifteen years is 9.94 in. (25.25 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 49.4°F (9.7°C). The average daily temperatures in January and July are 27.4°F (-2.5°C) and 72.7°F (22.6°C), respectively.

Land status

The Federal Government holds coal rights to approximately 90 percent of the Cañada Calladita 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. Most of the quadrangle is within the La Ventana Known Recoverable Coal Resource Area. About 2,260 acres (915 ha) in the northwestern part of the quadrangle are 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 Cañada Calladita quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Gardner (1910) who measured several coal outcrops, including one bed 3.1 ft (1.0 m) thick within the quadrangle. Both Dane (1936) and Hunt (1936) investigated outcrops in the area and reported no coal beds exceeding 2.5 ft (0.8 m) in thickness. Shomaker, Beaumont, and Kottlowski (1971) assessed the potential for strippable coal resources in the area and noted that the mesa-and-canyon topography would limit mining feasibility. Tabet and Frost (1979) mapped the surface geology including coal outcrops and conducted exploration drilling in the area. Their study was completed after the compilation of these maps and should be consulted for additional coal data in this area.

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

The Satan Tongue of the Mancos Shale is stratigraphically the lowest rock unit exposed in the quadrangle. It was formed from marine sands, silts, and muds during a transgression of the Cretaceous seaways, and is composed of light to dark gray silty shale with interbedded tan to buff sandstone. The unit is 205 to 300 ft (62 to 91 m) thick, and crops out in the southeastern corner of the quadrangle.

The Point Lookout Sandstone overlies the Satan 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). It is composed of light gray to reddish-brown, fine-to medium-grained sandstone with interbedded shales, and is 85 to 105 ft (26 to 32 m) thick in the quadrangle. 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 the upper Allison Member. A massive channel sandstone sequence which caps mesas in the central part of the quadrangle defines the boundary between the two members. The Cleary Coal Member averages 450 ft (137 m) thick locally. The Allison Member is about 850 ft (259 m) thick at the northern quadrangle boundary, but thins southward. The Allison Member is partially eroded throughout the area.

The Cretaceous seaways advanced soutwestward during the final transgression in the San Juan Basin. The Cliff House Sandstone was deposited in a nearshore marine environment during this transgressive episode. Light gray, medium-grained calcareous sandstone with interbedded shales, and local coal beds comprise the lithologies of the Cliff House Sandstone. The unit crops out along the northern quadrangle boundary, where it is about 100 ft (30 m) thick. The Crevasse Canyon Formation which contains coals in areas nearby was not mapped in the Cañada Calladita quadrangle because of insufficient data.

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 represents 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 Cañada Calladita quadrangle is in the Chaco Slope structural division in the southeastern portion of the structural depression known as the San Juan Basin (Kelley, 1950). The rock units dip from 1° to 2° N. to NE. The San Miguel Creek Dome which is southwest of the quadrangle has little structural influence other than causing minor dip variations. Local folding and several low displacement faults mapped by Hunt and Dane (1936) are present in the quadrangle.

COAL GEOLOGY

In this quadrangle, the authors identified three coal beds and two coal zones in Tabet and Frost's (1979) coal test holes, oil and gas well logs, and Hunt and Dane's (1936) surface mapping. All of these coals are within the Cleary Coal Member and Allison Member of the Menefee Formation.

The beds and zones are here informally called the Menefee Cleary No. 1, No. 2, and No. 3 coal beds, the Menefee Cleary coal zone, and the Menefee Allison coal zone.

The Menefee Cleary No. 1 bed is the first persistent coal bed above the Point Lookout Sandstone. It occurs 1 to 11 ft (0.3 to 3.3 m) above the Point Lookout Sandstone in this quadrangle, but is known to occur as much as 15 ft (5 m) above the point Lookout Sandstone in areas nearby

The Menefee Cleary No. 2 coal bed was identified in only one coal test hole, and does not crop out in the quadrangle. The bed is 3.2 ft (1.0 m) thick and about 28 ft (9 m) above the Point Lookout Sandstone in this quadrangle.

The Menefee Cleary No. 3 coal bed is persistent in outcrops and drill holes within the quadrangle. The bed ranges from 1.2 to 4.0 ft (0.4 to 1.2 m) thick and is about 35 ft (11 m) above the Menefee Cleary No. 2 coal bed. These coal beds are inferred to be continuous, although they may be several individual beds that are stratigraphically equivalent.

The Menefee Cleary coal zone contains one to eight coal beds. The total zone coal thickness ranges from 1.0 to 20.5 ft (0.3 to 6.2 m). Menefee Cleary zone coal beds occur 92 to 421 ft (28 to 128 m) above the Point Lookout Sandstone.

The Menefee Allison coal zone contains the only identified coal beds in the Allison Member, and crops out in the extreme northern part of the quadrangle. The total zone coal thickness ranges from 1.3 to 2.9 ft (0.4 to 0.9 m) and contains one to three beds. The top of the Menefee Allison coal zone is from 65 to 175 ft (20 to 53 m) below the Cliff House Sandstone. 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 Cañada Calladita quadrangle. Analyses of three Allison Member coal core samples (from one drill hole) taken about 3 mi (5 km) north of the quadrangle have been reported by Shomaker and Whyte (1977) and are shown in table 1. The Allison Member beds analyzed are probably similar in quality to the Allison and Cleary Coal Member beds in this quadrangle. Rank of these coal beds is probably high volatile C bituminous in this area.

Menefee Allison coal zone

Dane (1936) mapped and measured Menefee Allison coal zone outcrops along the northern boundary of the Cañada Calladita quadrangle. Isopachs, structure contours, and overburden isopachs of the coal zone shown on plates 4, 5, and 6 are based primarily on information from the northern adjacent Tinian quadrangle. The 10 ft (3 m) isopach (plate 4) is inferred, and is larger than the coal thickness shown in the nearby outcrop measurements because there is the possibility of additional Allison zone coals in the subsurface south of the outcrops. Existence and character of the zone are unknown in the southern four-fifths of the quadrangle because of insufficient data.

Menefee Cleary coal zone

The Menefee Cleary coal zone was identified in four drill holes and in several outcrop measurements in this quadrangle. The zone is shown to

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

(Core sample from NE¼ NE¼ NE¼ sec. 11, T. 18 N., R. 5 W.)

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

from Shomaker and Whyte, 1977

Sample	Form of Analysis	Proximate analysis (percent) Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Heating Value (Btu/lb)
1	A	12.0	34.1	39.9	14.0	0.3	10,410
	B	----	38.7	45.4	15.9	0.4	11,830
	C	----	46.1	53.9	----	0.5	14,070
2	A	13.0	34.7	33.8	18.5	0.3	9,550
	B	----	39.8	39.0	21.2	0.4	10,980
	C	----	50.6	49.4	----	0.5	13,940
3	A	11.0	34.4	35.1	19.5	0.4	9,800
	B	----	38.7	39.4	21.9	0.5	11,020
	C	----	49.5	50.5	----	0.6	14,100

Remarks:

A moist, mineral-matter-free (MMMF) calculation, using the Parr formula (American Society for Testing and Materials, 1973), yields heating values of 12,270 Btu/lb (28,540 kJ/kg; sample 1), 11,940 Btu/lb (27,772 kJ/kg; sample 2) and 12,432 Btu/lb (28,917 kJ/kg; sample 3). No agglomerating characteristics are available for these analyses.

have a total coal thickness of up to 20.5 ft (6.2 m) in the extreme northeastern portion of the quadrangle (see plate 7). Existence and character of the zone are unknown in certain portions of the quadrangle because of insufficient data.

Menefee Cleary No. 3 coal bed

The Menefee Cleary No. 3 coal bed crops out in the southern and southeastern parts of the quadrangle. The bed is shown on plate 10 to pinch out in the southern part of the quadrangle where Hunt (1936) did not map an outcrop of the bed in areas that structurally have potential for outcrop. The bed is also shown to pinch out in the extreme northwestern part of the quadrangle based on data from the adjacent Tinian and Rincon Marquez quadrangles. Existence and character of the bed are unknown in the western part of the quadrangle because of insufficient data.

Menefee Cleary No. 1 coal bed

The Menefee Cleary No. 1 crops out in the southeastern part of the quadrangle. Hunt (1936) reported no coal bed measurements in this quadrangle, although oil and gas well logs indicate the Menefee Cleary No. 1 bed to be 2.0 to 4.0 ft (0.6 to 1.2 m) thick. The bed pinches out to the south where the bed was not mapped in areas that structurally have potential for outcrop. Existence and character of the bed are unknown in the western part 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 and hypothetical resource 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 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 recovery factors of 85 and 50 percent for coal beds 0 to 200 ft (0 to 61 m) and 200 to 3,000 ft (61 to 914 m) deep, respectively. 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, 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 plates 16 and 17.

Total identified resources for the Menefee Cleary coal zone, where the total zone coal thickness is 5.0 ft (1.5 m) or greater, are 292.7 million

short tons (265.5 million t). Total identified Menefee Allison coal resources are 33.8 million short tons (30.7 million t).

COAL DEVELOPMENT POTENTIAL

The factors used to determine the development potential are the presence of a potentially coal-bearing formation, and 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 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 within 200 ft (61 m) of the surface and contains no identified correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick have unknown surface mining potential. Areas which have a correlative coal bed 3.0 ft (0.9 m) or more thick with surface mining potential are assigned a high, moderate or low development potential based on the mining ratio (cubic yards of overburden per short ton of recoverable coal). The formula used to calculate mining ratios is:

$$MR = \frac{t_o\ (C)}{t_c\ (Rf)}$$

Where MR = Mining ratio

t_o = Thickness of overburden in feet

t_c = Thickness of coal in feet

Rf = Recovery factor

C = Volume-weight conversion factor

(.896 yd^3/short tons for bituminous coal)

(.911 yd^3/short ton for subbituminous coal)

High, moderate, and low development potential areas have respective surface mining ratio values of 0 to 10, 10 to 15, and greater than 15.

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. The no and unknown boundaries for surface and subsurface development potential (plates 18 and 19), are defined at the contact of the coal-bearing Menefee Formation and the underlying non-coal-bearing Point Lookout Sandstone. These contacts are approximated due to the inaccurracies of adjusting old geologic maps to modern topographic bases.

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) in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3, respectively. Total hypothetical resources are tabulated separately from the reserve base data on table 3.

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

The coal development potential for surface mining methods in the Cañada Calladita quadrangle is shown on plate 18. Based on coal development potential criteria, Federal coal lands have high, moderate, low, no or unknown development potentials for surface mining methods. Refer to table 4 for reserves and planimetered acreage, by section, for Federal coal lands with surface mining potential.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods in the Cañada Calladita quadrangle is shown on plate 19. Based on coal development potential criteria, all Federal coal lands have high, moderate or unknown development potentials for subsurface mining methods. Refer to table 5 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 surface mining methods for Federal coal lands in the Cañada Calladita quadrangle, McKinley and Sandoval Counties, New Mexico. New Mexico.

[Development potentials are based on mining ratios (cubic yards of overburden per ton of underlying coal). To convert short tons to metric tonnes, multiply by 0.9072; to convert mining ratios in yds^3/ton, to m^3/ton, multiply by 0.842].

Coal Bed	High Development Potential (0-10 mining ratio)	Moderate Development Potential (10-15 mining ratio)	Low Development Potential (greater than 15 mining ratio)	Total
Menefee Cleary No. 1	---------	---------	10,260,000	10,260,000
Menefee Cleary No. 3	700,000	870,000	3,940,000	5,510,000
Total	700,000	870,000	14,200,000	15,770,000

Table 3. - Reserve base data and hypothetical resources (in short tons) for subsurface mining methods for Federal coal lands in the Cañada Calladita quadrangle, McKinley and Sandoval Counties, 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	47,370,000	3,700,000	---------	51,070,000
Menefee Cleary No. 3	9,430,000	3,810,000	---------	13,240,000
Total	56,800,000	7,510,000	---------	64,310,000
Hypothetical Resources				
Menefee Cleary No. 1	990,000	4,940,000	---------	5,930,000
Total	990,000	4,940,000	---------	5,930,000

Table 4. - Reserves and planimetered acreage, by section, for Federal coal lands in the Cañada Calladita quadrangle with surface 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.	Total Acres (planimetered)	Reserves (in short tons)
High	Menefee Cleary No. 3	11	16		5		68.8	410,000
		12					27.2	140,000
		1					6.8	30,000
Moderate	Menefee Cleary No. 3	11	16		5		52.7	310,000
		12					45.9	220,000
		1					36.4	190,000
		2					2.7	10,000
Low	Menefee Cleary No. 3	11	16		5		98.6	640,000
		12					6.8	30,000
		1					121.5	690,000
		2					210.7	1,280,000
		35	17		5		20.3	120,000
		31	17		4		116.1	590,000
	Menefee Cleary No. 1	28	17		4		47.1	240,000
		21					41.0	220,000
		27					97.2	520,000
		22					63.8	410,000
		6	16		4		273.6	1,290,000
		1	16		5		588.3	2,790,000
		2					266.0	1,240,000
		34	17		5		9.1	40,000
		35					282.8	1,340,000
		31	17		4		128.3	610,000

Table 5. - Reserves and planimetered acreage, by section, for Federal coal lands in the Cañada Calladita quadrangle with subsurface mining potential.

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

Potential category	Coal bed	Sec.	T. N.	R. W.	Total Acres (planimetered)	Reserves (in short tons)
High	Menefee Cleary No. 3	31	17	4	263.3	860,000
		30			41.9	120,000
		25	17	5	9.5	20,000
		33	18	4	36.5	110,000
		3	17	4	68.8	190,000
		4			607.6	1,920,000
		5			426.2	1,350,000
		9			43.2	120,000
		8			3.0	10,000
	Menefee Cleary No. 1	28	17	4	10.6	30,000
		21			357.3	1,210,000
		15			153.9	690,000
		22			94.3	370,000
		10			168.8	820,000
		17			41.9	110,000
		8			113.4	320,000
		9			638.6	2,470,000
		4			559.0	2,020,000
		5			20.2	50,000
		34	18	4	87.8	350,000
		3	17	4	145.8	700,000
		33	18	4	58.0	170,000
		6	16	4	17.5	40,000
		1	16	5	14.8	40,000
		2			77.0	210,000
		34	17	5	136.8	390,000
		35			367.9	1,060,000
		31	17	4	498.3	1,380,000
		30			638.6	1,770,000
		25	17	5	640.0	1,840,000
		26			625.1	1,850,000

Table 5. - Reserves and planimetered acreage, by section, for Federal coal lands in the Cañada Calladita quadrangle with subsurface mining potential (continued).

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

Potential category	Coal bed	Sec.	T. N.	R. W.	Total Acres (planimetered)	Reserves (in short tons)
High	Menefee Cleary No. 1	27	17	5	304.0	900,000
		23			402.3	1,190,000
		24			640.0	1,840,000
		19	17	4	287.6	770,000
		13	17	5	324.0	900,000
		14			27.0	less than 10,000
Moderate	Menefee Cleary No. 3	31	18	4	263.0	800,000
		32			121.8	440,000
		33			90.5	260,000
		3	17	4	16.2	40,000
		4			17.6	50,000
		5			60.8	180,000
		6			40.5	110,000
	Menefee Cleary No. 1	4	17	4	25.6	100,000
		34	18	4	5.4	20,000
		3	17	4	22.9	100,000
		33	18	5	121.5	410,000
		33	18	4	118.8	350,000
		34	18	5	164.7	630,000
		31	18	4	22.9	60,000
		1	17	5	2.7	less than 10,000
		29	17	4	58.0	150,000

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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.