UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE SAN PABLO 7 1/2-MINUTE QUADRANGLE, SANDOVAL AND RIO ARRIBA COUNTIES, NEW MEXICO

[Report includes 9 plates]

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INTRODUCTION

Purpose

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 Published and unpublished public information was used as the data base for this study.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

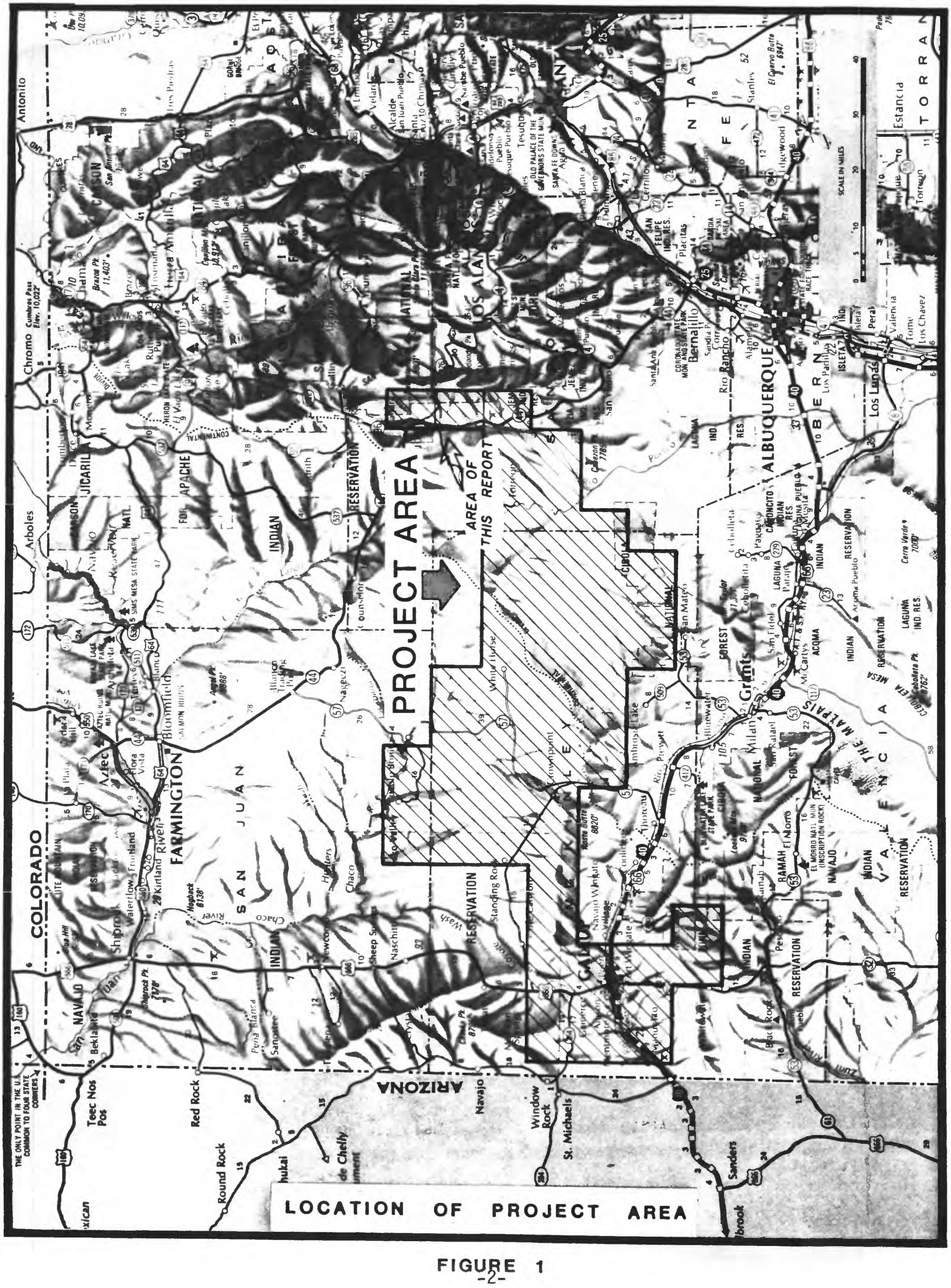
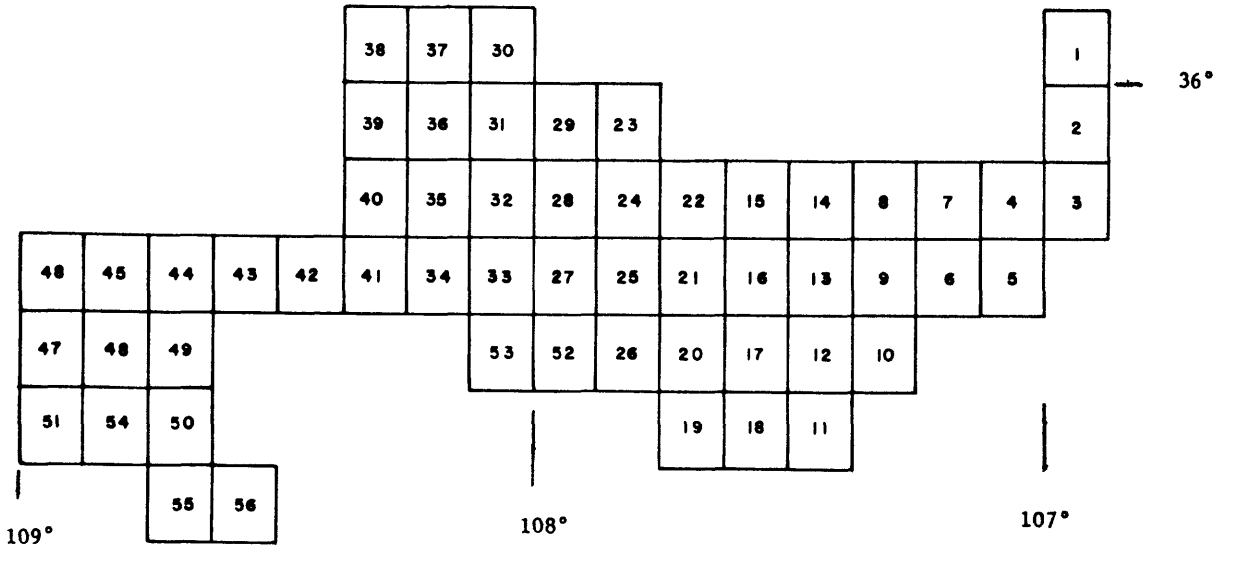

LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
Grants
Gallup
SAN JUAN
SCALE IN MILES

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 San Pablo 7½ minute quadrangle includes acreage in Tps. 19, 20, and 21 N., Rs. 1 E., 1 W., and 2 W. of the New Mexico Principal Meridian, Sandoval and Rio Arriba Counties, northwestern New Mexico (see figs. 1 and 2). The town of San Pablo is in the northeastern part of the quadrangle.

Accessibility

Access to the San Pablo quadrangle is by two-lane paved State Highways 126 from the north, 44 from the north and south, and 197 from the west and north. Dirt roads and jeep trails traverse most parts of the area. The Atchison, Topeka, and Santa Fe Railroad line passes about 38 mi (61 km) southeast of the quadrangle (see fig. 1).

Physiography

The San Pablo quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). Mountainous terrains characterize the eastern one-fourth of the area, and alluvial valley floors and mesas characterize the remainder.

The Rio Puerco and several intermittent arroyos provide drainage in the area. Elevations within the quadrangle range from 6,580 ft (2,006 m) along the Rio Puerco in the southwestern part of the quadrangle to 8,980 ft (2,737 m) at Cerro Castrado in the eastern 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 Cuba Station. The San Pablo quadrangle is about 2 mi (3 km) south of the Cuba Station. Average total annual precipitation for thirteen of the previous fifteen years is 13.57 in. (34.47 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 seven of the previous fifteen years is 46.2°F (7.9°C). The average daily temperatures in January and July are 25.5°F (-3.6°C) and 68.8°F (20.4°C), respectively.

Land status

The Federal Government holds coal rights to approximately 50 percent of the San Pablo 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 western two-thirds of the quadrangle is within the La Ventana Known Recoverable Coal Resource Area. The eastern one-third of the quadrangle is Federal land in the Santa Fe National Forest. As of October 26, 1978, several Federal coal leases held by the Consolidation Coal Company are in the southwestern part of the quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Gardner (1910), who mapped portions of the San Pablo quadrangle and noted coal outcrops. Dane (1936) measured several Menefee Formation coal outcrops in the area. Woodward, and others (1973), mapped the geology without noting coal occurrences. Shomaker, Beaumont, and Kottlowski (1971) dealt with potential strippable coal resources and reported the steep dips and irregular nature of the coal beds would discourage surface mining in the 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^{o} W.-S. 60^{o} 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 San Pablo quadrangle range in age from Precambrian to Quaternary. Precambrian rocks are exposed along the Nacimiento fault zone in the eastern part of the quadrangle. Quaternary deposits include alluvium and terrace gravels of the Rio Puerco and its tributaries. Various Tertiary and Upper Cretaceous formations are exposed in the area. All known

coal occurrences in the quadrangle are confined to the Menefee Formation of the MesaVerde Group. The Point Lookout Sandstone is a persistent sandstone unit occurring immediately below the Menefee Formation.

The Point Lookout Sandstone 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). The Point Lookout Sandstone is composed of light gray to reddish-brown, fine-to medium-grained sandstone with interbedded shales, and averages 155 ft (47 m) thick locally. The unit thickens southward to as much as 275 ft (84 m) near the southern boundary of the San Pablo quadrangle. 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 the upper Allison Member. A massive channel sandstone sequence defines the boundary between the two members. The Coal Member averages 140 ft (43 m) thick locally. Thickness of the Allison Member averages 395 ft (120 m) in the area. The Allison Member was defined as the Allison Barren Member (Sears, 1925), containing only thin, noncommercial coal beds. However, the upper part of the Allison Member contains important coal beds in this area. The Fruitland Formation and Dakota Sandstone are coal-bearing in nearby areas, but no coals within these formations have been identified or mapped in the San Pablo quadrangle.

Depositional environments

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

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

Most of the coal-bearing units were deposited in coastal plain environments. The majority of the peat deposits formed in a transition zone between lower and upper deltaic sediments during periods of relative shoreline stability. Coals also formed in lake margin swamps inland from the coastal area. Shoreline oscillations and the subsequent influx of continental or marine debris upon the peat accumulations produced the vertical buildup or "stacking" 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.

Because coal beds of the Cleary Coal Member in the San Pablo quadrangle are fewer and less extensive than in other parts of the basin, it can be concluded that generally poor environments of peat accumulations prevailed when the Cleary Coal Member was deposited. Allison Member coal beds, however, possess significant lateral extent and thickness in the area, which indicates favorable environments for peat deposition and accumulation.

Structure

The San Pablo quadrangle is in the Central Basin, Chaco Slope, and Nacimiento Uplift structural divisions in the extreme eastern portion of the structural depression known as the San Juan Basin (Kelley, 1950). The major structural feature in the quadrangle is the Nacimiento Uplift and associated thrust faults. The complex fault system brought Precambrian crystalline rocks into contact with basinal strata. Northwest-plunging en echelon folds associated with the uplift are present west of the fault zone (Woodward, and others, 1973). Coal bed dips at outcrop are 10^{o} to 15^{o} W. near the southern quadrangle boundary, and 65^{o} to 85^{o} E. with vertical to overturned beds near the northern boundary.

COAL GEOLOGY

In this quadrangle, the authors identified two coal beds and two coal zones from surface mapping by Dane (1936). The beds and zones are here informally called the Menefee Allison No. 1 coal bed, Menefee Cleary No. 1 coal bed, Menefee Allison coal zone, and Menefee Cleary coal zone.

The Menefee Allison No. 1 coal bed is correlative throughout the quadrangle. The bed is mapped as one continuous outcrop, but may be several individual beds that are stratigraphically equivalent. The Menefee Allison coal zone is represented by as many as four coal beds that occur 10 to 182 ft (3 to 55 m) below the Menefee Allison No. 1 coal bed. These zone coals may be correlated for limited distances, but they lack sufficient continuity with poorly defined stratigraphic position and cannot be designated as persistent coal beds.

The Menefee Cleary No. 1 coal bed and Menefee Cleary coal zone were identified by Dane (1936) at outcrop in the south-central part of the quadrangle. Because the Cleary Coal Member beds were identified in one measured section, continuity of the beds is unknown in this quadrangle.

There are several coal quality analyses for the Cleary Coal Member and Allison Member beds within and 1.8 to 3.5 mi (2.9 to 5.6 km) south to southeast of the San Pablo quadrangle. These analyses were reported by the U. S. Bureau of Mines (1936) and are shown in table 1. Rank of the Cleary Coal Member and Allison Member coals is subbituminous A to high volatile C bituminous in this area.

Menefee Allison No. 1 coal bed

The Menefee Allison No. 1 coal bed is a persistent coal bed which occurs at the top of the Allison Member. The bed is 1.0 to 11.2 ft (0.3 to 3.4 m) thick and commonly contains rock partings. The coal bed dips 10^{o} to 15^{o} W. at outcrop in the southern part of the quadrangle, near vertical in the center of the quadrangle, and along the northern quadrangle boundary, the bed

Table 1. - Analyses of coal samples from the Allison and Cleary Coal Members of the Menefee Formation.

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

from U. S. Bureau of Mines, 1936

Sample	Type of sample	Sec. T. N. R. W.	Form of analysis	Proximate analysis (percent) Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Heating value (Btu/lb)
1 Allison Member	mine sample (Rio Puerco mine)	SE¼ 19 19 1	A	12.1	35.8	44.5	7.6	2.8	10,940
			B	----	40.7	50.6	8.7	3.2	12,460
			C	----	44.6	55.4	---	3.5	13,640
2 Allison Member	mine sample (Anderson mine)	NE¼NW¼ SE¼ 35 19 2	A	20.0	32.5	42.6	4.9	0.7	10,240
			B	----	40.7	53.2	6.1	0.8	12,790
			C	----	43.3	56.7	---	0.9	13,630
3 Cleary Coal Member	mine sample (San Juan mine)	NE¼NW¼ SW¼ 31 19 1	A	15.7	32.0	45.1	7.2	0.6	10,790
			B	----	38.0	53.5	8.5	0.7	12,800
			C	----	41.5	58.5	---	0.8	13,990
4 Allison Member	prospect pit (McDonald prospect)	NE¼ 4 19 1	A	17.7	35.0	42.5	4.8	2.1	10,310
			B	----	42.5	51.7	5.8	2.5	12,530
			C	----	45.1	54.9	---	2.6	13,300
5 Cleary Coal Member	prospect pit (Wilkins No. 2 prospect)	SW¼SW¼ SW¼ 26 19 1	A	18.2	34.4	40.8	6.6	0.9	10,280
			B	----	42.0	49.9	8.1	1.0	12,570

Remarks:

A moist, mineral-matter-free calculation, using the Parr formula (American Society for Testing and Materials, 1973), yields heating values of 11,966 Btu/lb (27,833 kJ/kg; sample 1), 10,819 Btu/lb (25,165 kJ/kg; sample 2), 11,709 Btu/lb (27,235 kJ/kg; sample 3), 10,896 Btu/lb (25,344 kJ/kg; sample 4), and 11,080 Btu/lb (25,772 kJ/kg; sample 5). No agglomerating characteristics were included with these analyses.

is overturned and dips 65° to 85° E. (plate 5). Existence and character of the bed are unknown in the western and northwestern portions of the quadrangle because of insufficient data. There is also insufficient data where the coal bed outcrop is covered by alluvium.

The Menefee Allison No. 1 coal bed was mined during the 1920's and 1930's in the San Pablo quadrangle. Abandoned low tonnage mines and prospect pits are present along and east of the outcrop. The Menefee Allison No. 1 coal bed was locally named "Kaseman" (U. S. Bureau of Mines, 1936).

COAL RESOURCES

The U. S. Geological Survey requested a resource evaluation of the Menefee Allison 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 reserve base categories. Reserve base was calculated for each category, by section, using data from the isopach and overburden maps (plates 4 and 6). The acreage in each category (measured by planimeter) multiplied by the average coal bed thickness and a bituminous coal conversion factor (1,800 tons of coal per acre/ft) yields the reserve base for that category. Coal beds with 3.0 ft (0.9 m) minimum thickness are included in reserve base and reserve data rather than the 28 in. (71 cm) minimum thickness prescribed in U. S. Geological Survey Bulletin 1450-B.

Reserve figures are derived from reserve base totals by applying recovery factors of 85 percent 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 Allison 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 are shown on plate 7.

COAL DEVELOPMENT POTENTIAL

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

The no and unknown boundaries for surface development potential (plate 8) are defined at the contacts of the coal-bearing Menefee and Fruitland Formations with the noncoal-bearing Point Lookout Sandstone, La Ventana Tongue of the Cliff House Sandstone, Pictured Cliffs Sandstone, and Ojo Alamo Sandstone. The no and unknown boundaries for subsurface development potential (plate 9) are defined at the formation contact between the Menefee Formation and the Point Lookout Sandstone. These contacts are approximated due to the inaccuracies 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.

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 San Pablo quadrangle is shown on plate 8. Based on development potential criteria, Federal coal lands have high, moderate, low, unknown or no 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. Reserves were not computed north of sec. 14, T. 20 N., R. 1 W., because the vertical to overturned beds make conventional mining methods impractical and recovery factors unknown.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods in the San Pablo quadrangle is shown on plate 9. Based on development potential criteria, Federal coal lands have high, unknown or no 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 San Pablo quadrangle, Sandoval and Rio Arriba Counties, New Mexico.

[Development potentials are based on mining ratios (cubic yards of overburden/ton of underlying coal). To convert short tons to metric tonnes, multiply by 0.9072; to convert mining ratios in yds^3/ton coal to m^3/t, 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 Allison No. 1	730,000	480,000	2,920,000	4,130,000
Total	730,000	480,000	2,920,000	4,130,000

Table 3. - Reserve base data (in short tons) for subsurface mining methods for Federal coal lands in the San Pablo quadrangle, Sandoval and Rio Arriba 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 Allison No. 1	4,750,000	---	---	4,750,000
Total	4,750,000	---	---	4,750,000

Table 4. - Reserves and planimetered acreage, by section, for Federal coal lands in the San Pablo 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.	Acres (planimetered)	Reserves (in short tons)
High	Menefee	23	20	1	4.5	40,000
	Allison No. 1	26			16.6	130,000
		27			18.1	100,000
		33			10.6	80,000
		34			10.6	80,000
		4	19	1	9.1	80,000
		9			6.5	30,000
Moderate	Menefee	23	20	1	4.5	40,000
	Allison No. 1	26			10.5	90,000
		27			16.6	90,000
		33			4.5	30,000
		34			7.5	60,000
		4	19	1	3.0	30,000
		17			6.1	30,000
Low	Menefee	23	20	1	5.0	50,000
	Allison No. 1	26			45.3	360,000
		27			116.2	630,000
		28			27.2	170,000
		33			52.9	400,000
		34			10.6	80,000
		4	19	1	4.5	40,000
		17			117.0	710,000

Table 5. - Reserves and planimetered acreage, by section, for Federal coal lands in the San Pablo 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 Allison No. 1	22	20	1	132.2	540,000
		23			12.7	80,000
		26			18.1	60,000
		27			389.4	1,300,000
		28			86.0	250,000
		17	19	1	38.0	120,000

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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.