CHAPTER 5

COAL RECOVERY AND PROTECTION PLAN

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CHAPTER 5

COAL RECOVERY AND PROTECTION PLAN

Engineering Methods

Throughout the mine planning process, from exploration to coal production, proper engineering control and methodologies are employed. Various engineering disciplines such as geological, chemical, civil, mining, mechanical, and electrical engineering are involved in developing and scheduling the tasks necessary to acquire, interpret, analyze, and utilize various coal resource and mining engineering data and develop an economically and physically feasible mine plan.

Topographic mapping is essential for mine plan development. United States Geological Survey products are often used. However, where greater detail or updated maps are required, a technically competent mapping service is used to produce the needed products in accordance with national mapping standards. Engineering surveys provide control for map development.

Quality assurance drilling to refine coal location, quantity, and quality information is also supported by engineering surveys. Geologists and mining engineers interpret, analyze, and correlate the physical and chemical properties of the coal and overburden to define economically recoverable reserves. Accepted standard laboratory and field procedures are employed.

The computer is heavily relied upon as a mine-planning tool. The basic mine plan development process involves entering drill hole information into a data base, correlating coal seams, creating a surface topography data base, modeling the coal reserve, and validating the model. Stratagraphic, lithologic, and quality data are obtained and stored for each drill hole. This drill hole data base enables the geologist and mine planner to identify and correlate the various seams. This process is particularly complex for the Black Mesa coal field because of the large number of seams and the tendency of seams to split and rejoin. A graphic display of the drill holes in cross section is one of several useful tools to assist in this process.

The collection of drill holes with seam codes properly assigned to the coal intervals forms the basis for generating a mathematical model of each coal resource area. In the early computer modeling years, Peabody Western Coal Company (PWCC) used a Control Data Corporation gridded seam model called SEAM SYSTEM (SEAMSYS). Today software developed in-house to create the model called (SLIC) is used. Once the model is created, its accuracy is verified. Once calibrated, the model produces volumetric and coal seam quality data from composited and interpolated surface topography and drill hole data. The model also outputs the mining sequence when information such as direction of mining, equipment characteristics, and target production values are supplied.

Aerial photogrammetric techniques, Global Positioning Survey (GPS) equipment and computer software are used to develop production statistics such as overburden and parting removed, coal produced, coal in pits, and coal in stockpiles. Surveyed ground control panels provide ground truthing capabilities. Production and volume reports are computer generated using the digital data from the various surveying sources.

Mining Methods and Equipment

The Black Mesa and Kayenta Mines practice a conventional form of strip mining called area mining wherein the overburden above the coal is removed in parallel strips across the coal field until the area is mined. Draglines excavate the overburden by creating wide trenches or cuts and piling the spoil along the side of the cut. When mining in a coalfield begins, the first cut is called a box cut and the dirt and rock material from the cut is called box cut spoil. This spoil differs from other spoil in that it is placed outside and adjacent to the cut being mined onto lands that have not been mined. The other spoil, internal spoil, results from cuts created after the initial box cut and is placed directly into the adjacent, previously mined cut (Figure 1).

Draglines are the primary excavators for overburden material. They will also remove partings as parting thickness and field conditions indicate. Equipment such as trucks and shovels or loaders and scrapers may also be used to assist with overburden or parting removal. When trucks and shovels or scrapers are utilized, excavated material remains in the cut or pit area. A bulldozer is continually assigned to each dragline to perform bench leveling, access road preparation, trailing cable relocation and miscellaneous duties. The major equipment utilized at each mine is shown in Tables 1 and 2. Specific information for draglines and shovels may be found in Figures 2, 3, 4, 5, 6 and 8.

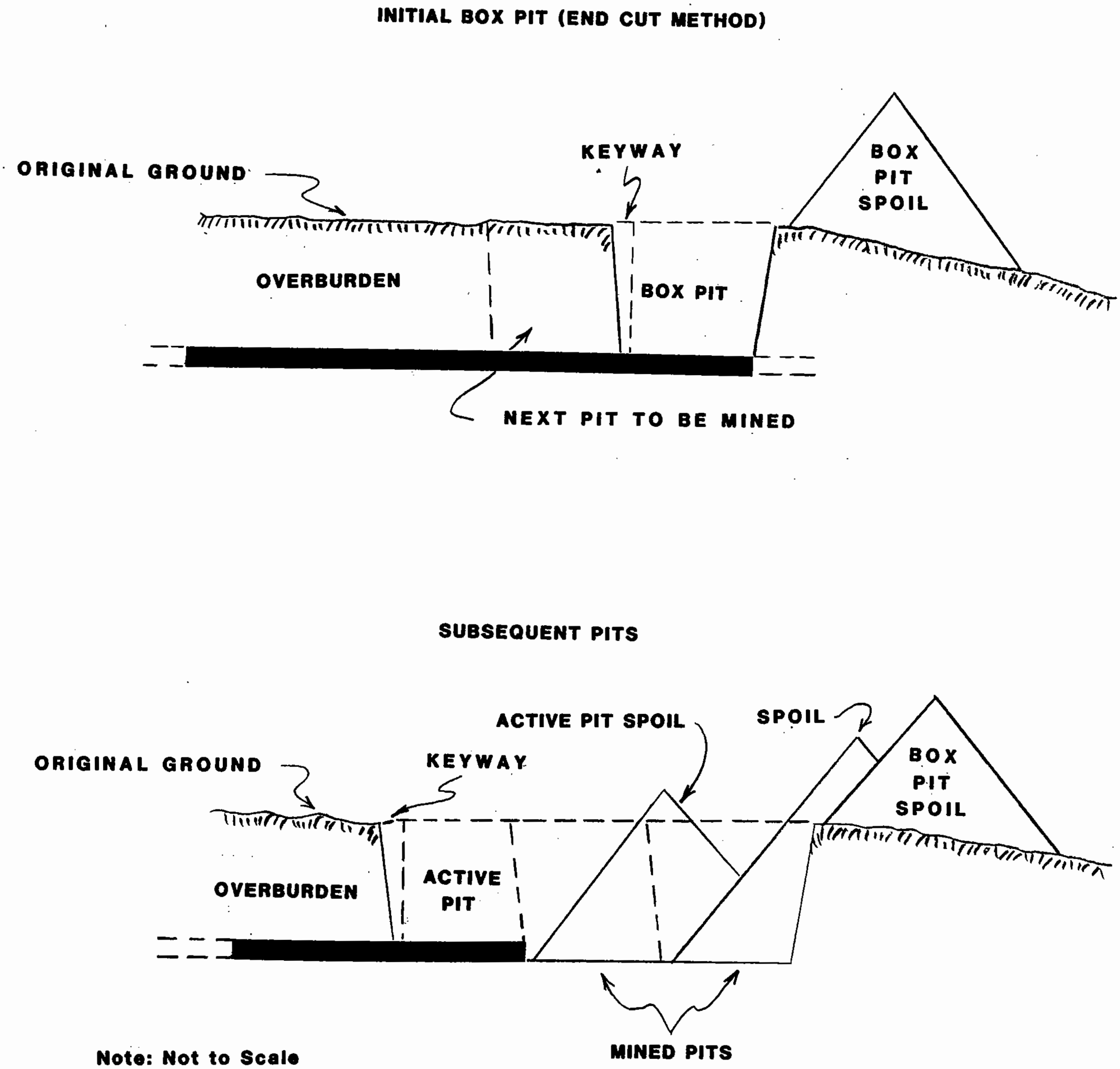
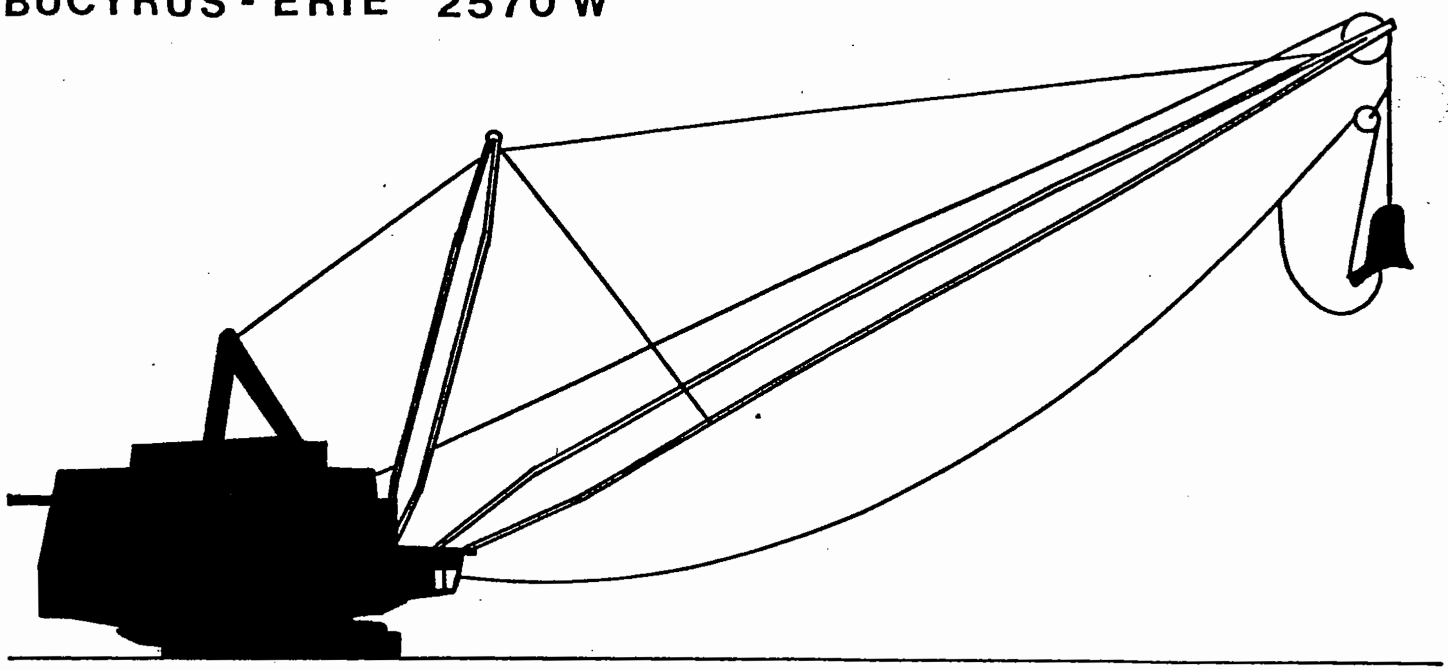


FIGURE 1
TYPICAL PIT CROSS SECTIONS

BUCYRUS - ERIE 2570 W



2570 WALKING DRAGLINE
SPECIFICATIONS

WEIGHTS:

NET WEIGHT*, DOMESTIC, APPROX. (WITH BUCKET + 80' BASE) LBS.........	10,430,000
WORKING WEIGHT, APPROX. (WITH BUCKET) LBS...........................	11,180,000
BALLAST WEIGHT (FURNISHED BY PURCHASER) LBS.........................	750,000

* ADD 90,000 LBS. FOR BLOCKING ON CARS WHEN ESTIMATING DOMESTIC FREIGHT.

ELECTRICAL EQUIPMENT:

HOIST MOTORS (BLOWN)..................	EIGHT 500 HP
DRAG MOTORS (BLOWN)...................	SIX 500 HP
SWING MOTORS (BLOWN)..................	FOUR 625/1250 HP
WALKING MOTORS (BLOWN)................	FOUR 500/1000 HP

ALL ABOVE MOTORS RATED AT 75° CONTINUOUS AND AT 230/460V.
MT SET DRIVES: FOUR 2,500 HP SYNCHRONOUS MOTORS

WORKING DIMENSIONS

A	CLEARANCE RADIUS, FT.-IN..........................	80-0
B	OPERATING RADIUS, FT..............................	329
C	BOOM FOOT RADIUS, FT.-IN..........................	30-0
D	CLEARANCE HEIGHT, FT.-IN..........................	14-0
E	BOOM FOOT HEIGHT, FT.-IN..........................	16-0
F	DUMPING CLEARANCE, FT.-IN.........................	72
G	BOOM POINT HEIGHT, FT.............................	204
H	DIGGING DEPTH, FT.................................	160
J	POINT SHEAVE PITCH DIAMETER, IN...................	144
	BUCKET SIZE.......................................	90 C.Y.
	BOOM LENGTH, FT...................................	366'
	BOOM ANGLE..	35°
	MAX. SUSPENDED LOAD (TONS)........................	225

BASE:

OUTSIDE DIAMETER, FT.-IN....................	80-0
BEARING AREA, SQ. FT........................	5026
CIRCLE RAIL DIAMETER, FT.-IN................	54-0

WALKING MOUNTING:

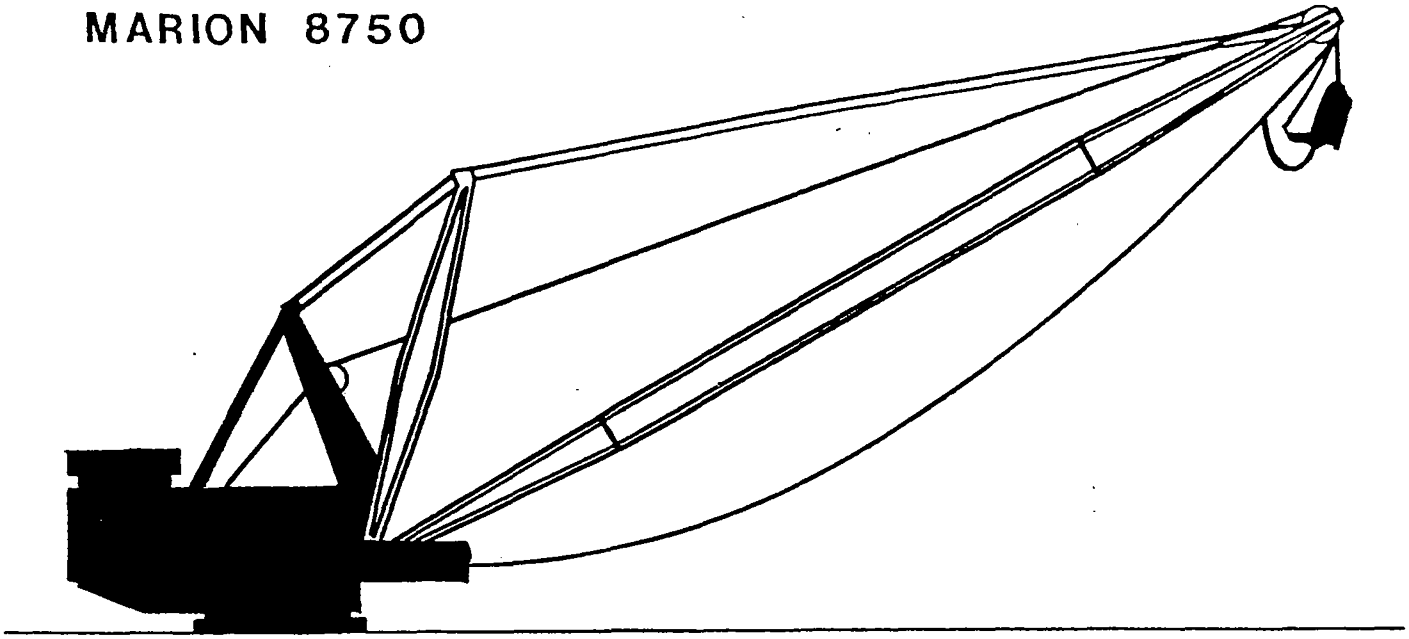
SHOE WIDTH AND LENGTH, FT...................	14X72
COMBINED BEARING AREA, SQ. FT............	2016
OVERALL WIDTH OVER SHOES, FT.-IN............	110-6
LENGTH OF STEP, APPROX. FT.-IN..............	8-6
WALKING SPEED, APPROX. MPH..................	0.15

FIGURE 2

BUCYRUS-ERIE 2570 W

Revised 7/01/97

MARION 8750



8750 WALKING DRAGLINE
SPECIFICATIONS

WEIGHTS

DOMESTIC SHIPPING WEIGHT (INC. BUCKET) LBS.......	9,200,000
WORKING WEIGHTS, LBS.............................	9,800,000
BALLAST (FURNISHED BY PURCHASER), LBS............	600,000

DIMENSIONS

BOOM LENGTH......................................	301'-0"
A - BOOM ANGLE, APPROX...........................	36-1/2°
B - DUMPING RADIUS...............................	265'-4"
C - DUMPING HEIGHT...............................	107'-0"
D - DEPTH..	150'-0"
MAXIMUM ALLOWABLE LOAD, LBS..................	427,000
BUCKET SIZE..................................	84 CU. YD.

BASE

E - OUTSIDE DIAMETER - NOMINAL...................	70'-0"
BEARING AREA - EFFECTIVE, SQ. FT.............	3,848
RAIL CIRCLE - MEAN DIA.......................	55'-0"

ELECTRICAL EQUIPMENT

HOIST MOTORS, EIGHT, 1000 HP EACH @ 460 V, TOTAL HP....	8,000
DRAG MOTORS, SIX, 1000 HP EACH @ 460 V. , TOTAL HP.....	6,000
SWING MOTORS, FOUR, 1000 HP EACH @ 460 V., TOTAL HP....	4,000
PROPEL MOTORS, FOUR, 600 HP EACH @ 460 V., TOTAL HP....	2,400
AC DRIVING MOTORS, TOTAL HP............................	10,250

ROTATING FRAME

J - WIDTH @ REAR END...................................	80'-0"
K - LENGTH...	109'-0"
L - CLEARANCE RADIUS - REAR END........................	77'-0"
M - CLEARANCE UNDER FRAME..............................	15'-10"
N - CENTER ROTATION TO BOOM FOOT.......................	24'-0"
P - GROUND TO BOOM FOOT................................	21'-4"

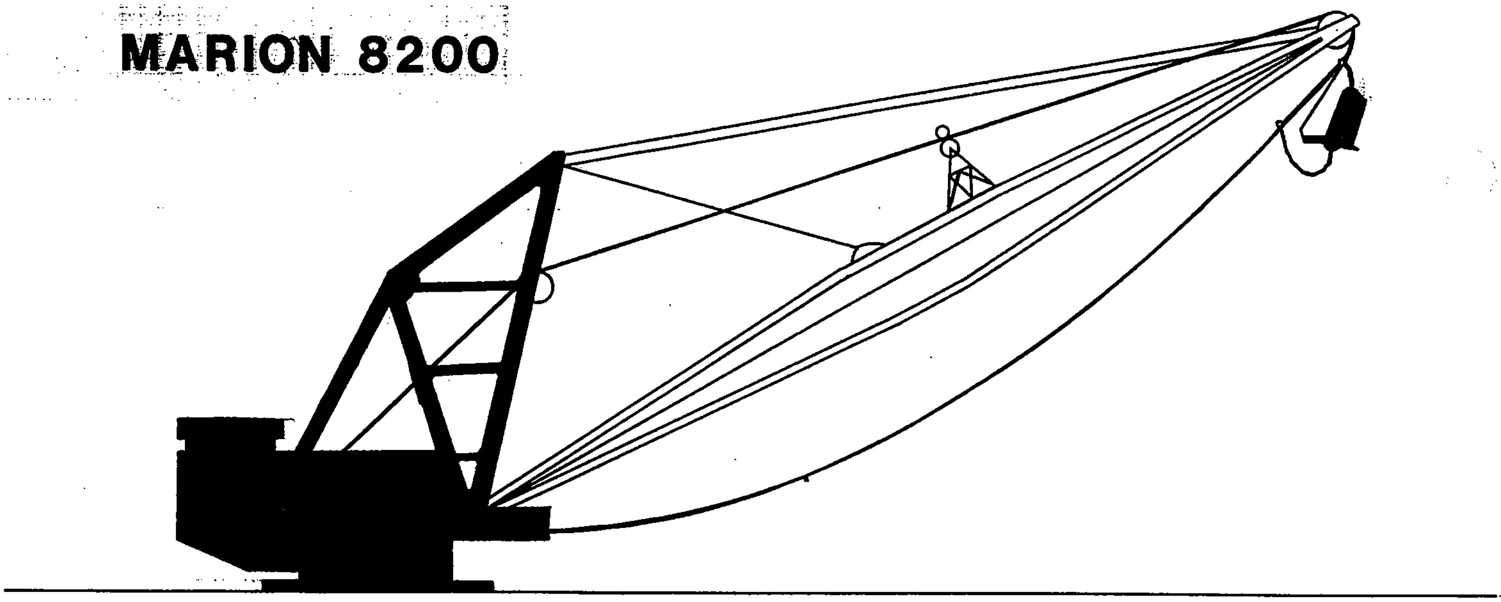
WALKING TRACTION

F - WIDTH OF SHOE......................................	13'-6"
G - LENGTH OF SHOE.....................................	65'-0"
H - WIDTH OVER BOTH SHOES..............................	101'-0"
BEARING AREA OF BOTH SHOES, SQ. FT.................	1,750
LENGTH OF STEP - APPROX............................	7'-0"
WALKING SPEED - APPROX.,MPH........................	0.14

FIGURE 3

MARION 8750

MARION 8200



8200 WALKLING DRAGLINE SPECIFICATIONS

DIMENSIONS

Boom Length.............................. 331'-0"
Boom Point Sheave, Pitch Diameter.......... 120"
Boom Angle, Approx...................... 34°
Dumping Radius.......................... 296'-0"
Dumping Height.......................... 126'-0"
Depth.................................. 160'-0"
Maximum Allowable Load, lbs............. 360,000

BASE

Outside Diameter - Nominal................. 68'-0"
Bearing Area - Effective, sq. ft........... 3630
Bearing Pressure, psi...................... 15.9
Rail Circle - Mean Diameter................ 46'-6"

WALKING TRACTION

Width of Shoe.............................. 13'-6"
Length of Shoe............................. 68'-0"
Width Over Both Shoes...................... 98'-0"
Bearing Area of Both Shoes, sq. ft......... 1690
Length of Step - Approx.................... 6'-0"

ROTATING FRAME

Width @ Rear End.. 67'-4"
Length.. 91'-0"
Clearance Radius - Rear End............................... 68'-0"
Clearance Under Frame..................................... 11'-0"
Center Rotation to Boom Foot.............................. 21'-6"
Ground to Boom Foot....................................... 15'-1"

ELECTRICAL EQUIPMENT

Hoist Motors, Four, 1300 hp each @ 475 V. Total hp.......... 5200
Drag Motors, Four, 1300 hp each @ 475 V. Total hp........... 5200
Swing Motors, Standard, Four, 800 hp each @ 475 V. Total hp. 3200
Propel Motors, Two, 1045 hp each @ 475 V. Total hp.......... 2090
AC Driving Motors, Total hp................................. 7000

WEIGHTS

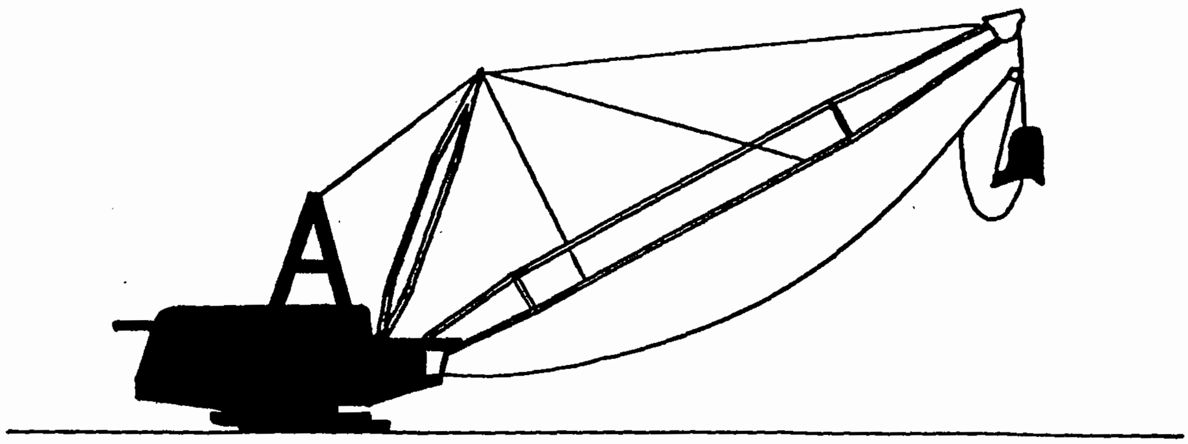
Domestic Shipping Weight, (inc. Bucket), lbs.......... 6,600,000
Working Weight, lbs................................... 7,750,000
Ballast (Furnished by Purchaser), lbs................. 1,150,000

FIGURE 4

MARION 8200

Revised 7/01/97

BUCYRUS - ERIE 1260 W



1260 WALKING DRAGLINE
SPECIFICATIONS

WEIGHTS:

NET WEIGHT*, DOMESTIC, APPROX. (WITH BUCKET + 50' BASE) LBS...........	2,805,000
WORKING WEIGHT, APPROX. (WITH BUCKET) LBS..............................	3,265,000
BALLAST WEIGHT (FURNISHED BY PURCHASER) LBS............................	460,000

* ADD 200,000 LBS. FOR 55' TUB. ADD 12,500 LBS. FOR BLOCKING ON CARS WHEN ESTIMATING DOMESTIC FREIGHT.

ELECTRICAL EQUIPMENT:

HOIST MOTORS (BLOWN)...............	TWO 500/1000 HP
DRAG MOTORS (BLOWN)................	TWO 500/1000 HP
SWING MOTORS (BLOWN)...............	FOUR 175/350 HP
WALKING MOTORS (UNBLOWN)...........	TWO 150/300 HP

ALL ABOVE MOTORS RATED AT 75° CONTINUOUS AND AT 230/460V.

MG SET DRIVES: ONE 1750 HP SYNCHRONOUS MOTOR
ONE 700 HP INDUCTION MOTOR

BASE:

OUTSIDE DIAMETER, FT.-IN..................	50-0	55-0
BEARING AREA. SQ. FT.......................	1,965	2,375
CIRCLE RAIL DIAMETER, FT.-IN..............	34-0	

WALKING MOUNTING:

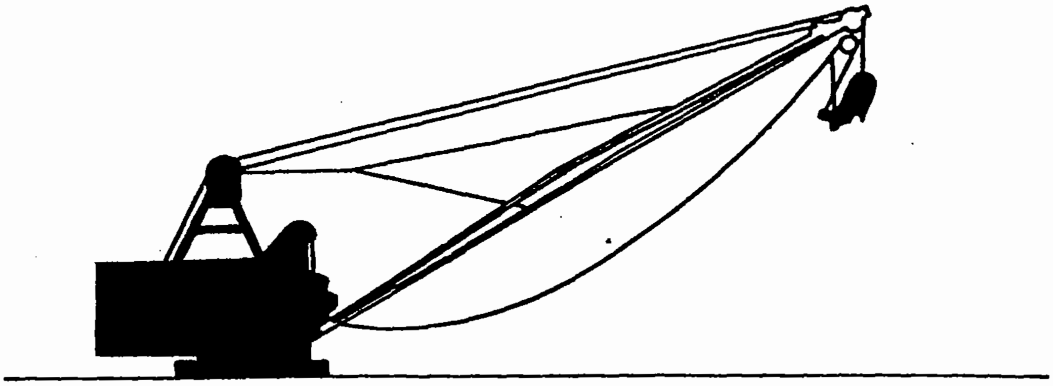
SHOE, WIDTH AND LENGTH, FT..............	9X54	10X56
COMBINED BEARING AREA, SQ. FT.....	972	1,120
OVERALL WIDTH OVER SHOES, FT............	70	77
LENGTH OF STEP, APPROX. FT.-IN..........	7-4	
WALKING SPEED, APPROX. MPH..............	0.17	

WORKING DIMENSIONS:

A	CLEARANCE RADIUS, FT.-IN...............	52-0
B	OPERATING RADIUS, FT...................	218
C	BOOM FOOT RADIUS, FT.-IN...............	17- 2-1/2
D	CLEARANCE HEIGHT, FT.-IN...............	9-0
E	BOOM FOOT HEIGHT, FT.-IN...............	17-2
F	DUMPING CLEARANCE, FT.-IN..............	42-0
G	BOOM POINT HEIGHT, FT..................	134
H	DIGGING DEPTH, FT......................	157
J	POINT SHEAVE PITCH DIAMETER, IN........	85-1/4
	BUCKET SIZE............................	36 C.Y.
	BOOM LENGTH, FT........................	234'
	BOOM ANGLE.............................	31°
	MAX. SUSPENDED LOAD (TONS).............	90

FIGURE 5
BUCYRUS-ERIE 1260

MARION 7800



7800 WALKING DRAGLINE
SPECIFICATIONS

WEIGHTS:

DOMESTIC SHIP. WT - LESS BAL. APPROX	2,400,000 LBS.
EXPORT SHIP. WT. - LESS BAL. APPROX	2,525,000 LBS.
BALLAST (FURNISHED BY PURCHASER)	275,000 LBS.
WORKING WEIGHT - WITH BALLAST	2,675,000 LBS.

FOR ACTUAL DOMESTIC SHIPPING WEIGHT, ADD 25,000 LBS. FOR BLOCKING.

ELECTRICAL:

A.C. MOTORS DRIVING MOTOR GENERATOR SETS ....TOTAL	1400 HP
GENERATOR CAPACITY	TO SUIT MOTORS
HOISTING MOTORS - TWO, EACH 425 HP WITH BLOWER	850 HP
DRAGGING MOTORS - TWO, EACH 425 HP WITH BLOWER	850 HP
ROTATING MOTORS - THREE, EACH 125 HP WITH BLOWER	375 HP
BOOM HOIST MOTOR	15 HP

BASE:

OUTSIDE DIAMETER	46'-0"
BEARING AREA	1662 SQ. FT.
DIAMETER OF RAIL CIRCLE	32'-9"
WALKING TRACTION SHOE - WIDTH	8'-0"
LENGTH	44'-0"
AREA OF BOTH SHOES	704 SQ.FT.
LENGTH OF STEP	6'-8"
OVERALL WIDTH OF SHOES	64'-0"
WALKING SPEED	0.15 MPH

DIMENSIONS:

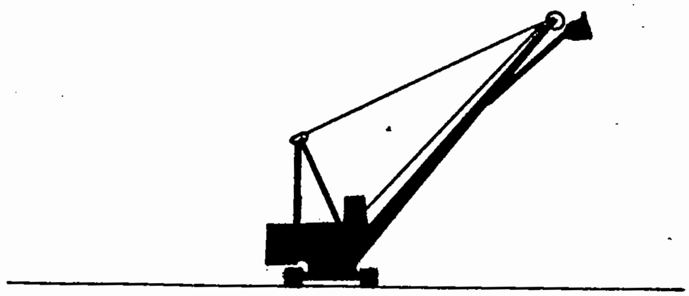
BUCKET SIZE - HEAVY DUTY	30 CU.YD.
BOOM LENGTH	184'-0"
BOOM ANGLE - APPROX	31°
DUMPING RADIUS - MAX	174'-0"
DUMPING HEIGHT - MAX	53'-0"
DIGGING DEPTH - STANDARD CABLES	100'-0"
DIGGING DEPTH - NO OVERWIND	167'-0"
MAXIMUM ALLOWABLE LOAD - LBS	165,000
CLEARANCE RADIUS - REAR END	48'-0"
CLEARANCE UNDER UPPER FRAME	5'-4"
CLEARANCE HEIGHT OF A-FRAME	69'-4"
DISTANCE FROM GROUND TO TOP OF HOUSE	34'-6"

~~FIGURE 6~~

MARION 7800

Revised 7/01/97

BUCYRUS - ERIE 295 B



295-B SHOVEL
SPECIFICATIONS

COAL/ROCK DIVIDER SHOVEL

WEIGHTS:

NET WEIGHT, WITHOUT BALLAST AND WITHOUT DIPPER, LBS	1,068,000
BALLAST, FURNISHED BY PURCHASER, LBS	310,000
COAL/ROCK DIPPER (19 CUBIC YARD) LBS	47,000
WORKING WEIGHT, WITH DIPPER, LBS	1,425,000

ELECTRICAL EQUIPMENT: WARD LEONARD DRIVE
CONTROL - SIMPLIFIED STATIC (SPEED REGULATED)
POWER - 3 PHASE, 60 CYCLE, 7200 VOLTS
INDUCTION MOTOR HP 800 CONTINUOUS
2000 INTERMITTENT

DC MOTORS:

HOIST - BLOWN 1 (800 HP AT 475 V.) 75°C
SWING - BLOWN 2 (195 HP AT 475 V.) RISE
CROWD - BLOWN 1 (195 HP AT 475 V.) CONT.
PROPEL - BLOWN 1 (500 HP AT 475 V.)
(IN LOWER WORKS)

CRAWLER TRUCK MOUNTING:

WIDTH OF TREADS	60"
OVERALL WIDTH OF MOUNTING	24'-6"
OVERALL LENGTH OF MOUNTING	28'-4"
TOTAL EFFECTIVE BEARING AREA, SQ. FT.	242
BEARING PRESSURE, P.S.I.	40.9

WORKING RANGE:

COAL/ROCK DIPPER CAPACITY, CUBIC YARDS		19
LENGTH OF BOOM		85'-0"
EFFECTIVE LENGTH OF DIPPER HANDLE		47'-6"
ANGLE OF BOOM		47-1/2°
DUMPING HEIGHT - MAXIMUM	A	57"-3"
DUMPING HEIGHT AT MAXIMUM RADIUS		35"-0"
DUMPING RADIUS AT MAXIMUM HEIGHT - A	B	77"-6"
DUMPING RADIUS - MAXIMUM		84'-0"
DUMPING RADIUS AT 16'-0" DUMPING HEIGHT	B_2	79'-9"
CUTTING HEIGHT, MAXIMUM	D	75'-6"
CUTTING RADIUS - MAXIMUM	E	92'-6"
RADIUS OF LEVEL FLOOR	G	57'-9"
DIGGING DEPTH BELOW GROUND LEVEL, MAXIMUM	H	5'-0"
CLEARANCE HEIGHT, BOOM POINT SHEAVES	I	77'-9"
CLEARANCE RADIUS, BOOM POINT SHEAVES	J	68'-9"
CLEARANCE RADIUS, REVOLVING FRAME	K	28'-1"
CLEARANCE UNDER FRAME, TO GROUND	L	8'-6"
CLEARANCE HEIGHT OF OPERATOR'S CAB	M	27'-8"
HEIGHT OF A-FRAME	M_1	49'-10"
HEIGHT OF BOOM FOOT ABOVE GROUND LEVEL	N	12'-2"
DISTANCE - BOOM FOOT TO CENTER OF ROTATION	P	8'-5"
OPERATOR'S EYE LEVEL	U	24'-0"

FIGURE 8

BUCYRUS-ERIE 295B

TABLE 1

Major Equipment List for Kayenta Mine*

Primary Excavation Equipment

Draglines:	Bucyrus-Erie, (1) Model 2570-W, (1) Model 1260-W
	Marion, (1) Model 8750, (1) Model 8200
Shovels:	Bucyrus-Erie, (1) Model 295B

Major Support Equipment

Blasthole Drills:	(1) Ingersoll-Rand DM252SP, (1) Ingersoll-Rand 270SPC
	(2) Ingersoll-Rand DML, (1) Drill Tech D245S
	(2) Drill Tech D55SP
Haulage Trucks:	Caterpillar 789, (8) 250-tons, bottom-dump
	Caterpillar 785, (4) 150-ton end-dump
Dozers:	Caterpillar, (2) Model 690, Caterpillar (2) Model D6
	Caterpillar (8) Model D10, Caterpillar (9) Model D11
Scrapers:	Caterpillar, (3) Model 631
Loaders:	Caterpillar, (6) Model 992, (3) Model 910
Motor Graders:	Caterpillar, (3) Model 16
Water Trucks:	(3) Off-Highway Water Trucks

* As of November 21, 2003

TABLE 2

Major Equipment List For Black Mesa Mine*

Primary Excavation Equipment

Draglines:	Marion, (1) Model 8750, (1) Model 7800

Major Support Equipment

Blasthole Drills:	Drilltech, (1) Model D55SP2L, (1) Model D245S
	Ingersoll-Rand, (1) Model DMM3, (1) Model DM35SP,
	(1) Model DM30
Haulage Trucks:	(6) 150-ton, bottom-dump
	Caterpillar 789, (3) 250-tons, bottom-dump
	Caterpillar 785, (3) 150-tons, end-dump
	Rimpull, (2) 250-ton, bottom-dump
Dozers:	Caterpillar, (6) Model D-10, (6) Model D-11
	Caterpillar, (2) Model 690
Scrapers:	Caterpillar, (2) Model 631
	Caterpillar, (2) Model 637
Loaders:	Caterpillar, (1) Model 916, (5) Model 992
Motor Graders:	Caterpillar, (4) Model 16
Water Trucks:	(3) Off-Highway Water Trucks

*As of November 21, 2003

The overburden excavation process begins with the digging of a narrow slot, or key cut, down to the coal seam to establish the highwall (Figure 10). The location of the key cut and the spoil establishes the width of the pit. The dragline positions itself above the area to be excavated and in line with the direction the cut is progressing. The dragline bucket is lowered to the material to be excavated, drawn toward the dragline, lifted, and swung to the side, at which point it dumps or spoils the excavated material into a previously mined cut or along the side of the cut onto unmined ground. This process is repeated until the entire area in front of the dragline has been excavated. The dragline then repositions itself and begins another key cut and starts the process again. This procedure is followed until the operational limits of the machine are achieved or pit boundaries are reached. At this point, the dragline walks, or deadheads, to where the next cut is to begin. The entire process starts again with each successive cut being excavated parallel to the previously mined cut and continues until excavation activities are complete within the pit.

An alternative to the highwall-side overburden excavation process is to level a bench on the spoil-side and position the dragline on the spoil-side to excavate the overburden and pull back the spoil over the coal seam (Figures 11 and 12). The main advantage of this method is to enable a dragline which has a limited operating radius to handle overburden covers of greater depth than would normally be contemplated. Other advantages of this overburden excavation process include better coal recovery in deeper overburden, reduced auxiliary equipment required for overburden excavation, increased spoil stability, reduced material rehandle, and maintaining an adequate pit width. The disadvantages include the need to prepare a spoil side bench, sequencing the spoil-side benching operation with the pit operations, and increased dragline cycle times.

Typically, at the Black Mesa Complex in deeper overburden, the upper coal seams may be uncovered on the highwall side and the lower seams uncovered on the spoil side. The positioning of the overburden removal equipment will be determined on a pit by pit basis to allow the most efficient coal recovery.

Partings at the Black Mesa mining complex vary radically due to the Deltaic deposition process that formed the coal beds. The partings may vary in thickness from six inches to more than fifty feet in the length of one cut (pit). Therefore, parting removal must be accomplished with a variety of equipment, which includes draglines, shovels, bulldozers, and sometimes truck and shovel operations. The selection of parting removal equipment is dependent upon the operational requirements within each pit. A dragline will generally remove partings in excess of 15 feet; however, it may occasionally remove partings as thin as 5 feet. Shovels and front-end loaders are utilized to remove partings that range in thickness from 3 to 15 feet. Occasionally, end dump trucks are used in conjunction with a shovel or front-end loader to remove partings within a pit. Bulldozers may remove partings that are less than three feet thick by first ripping the parting and afterwards pushing it off the coal seam to be removed.

Once the overburden or parting has been removed from above the coal seam, any remaining overburden material is cleared from the top of the coal seam utilizing rubber-tired or track-type dozers.

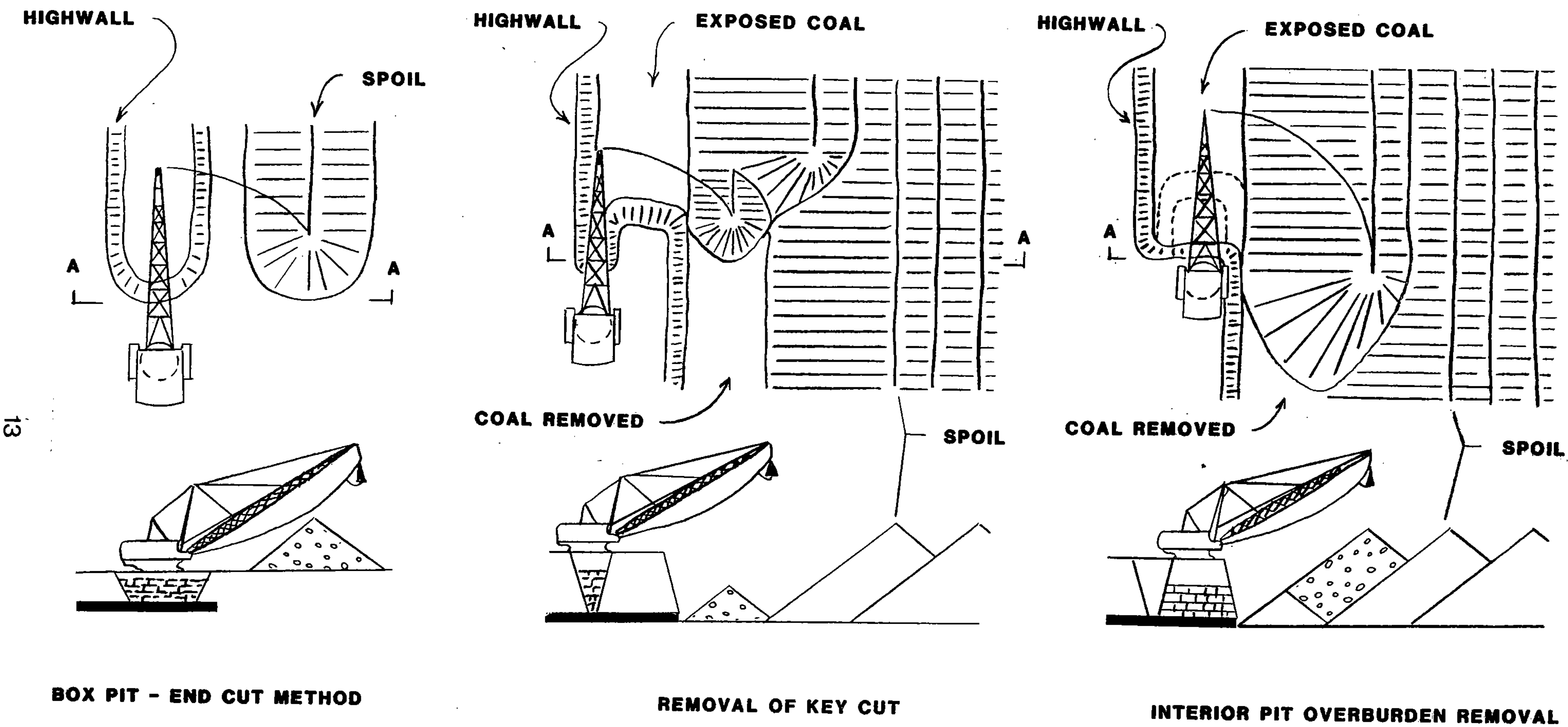
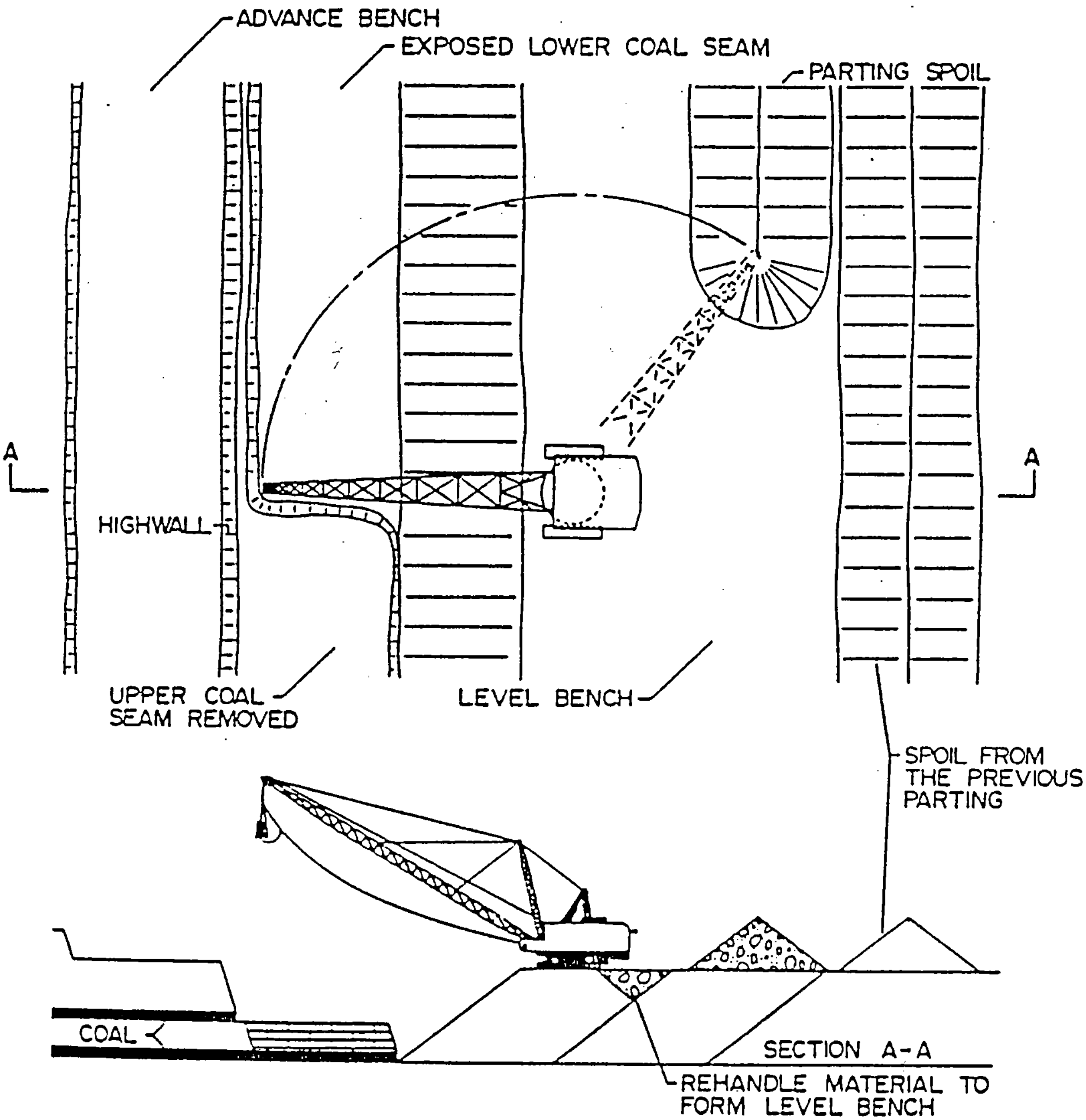


FIGURE 10

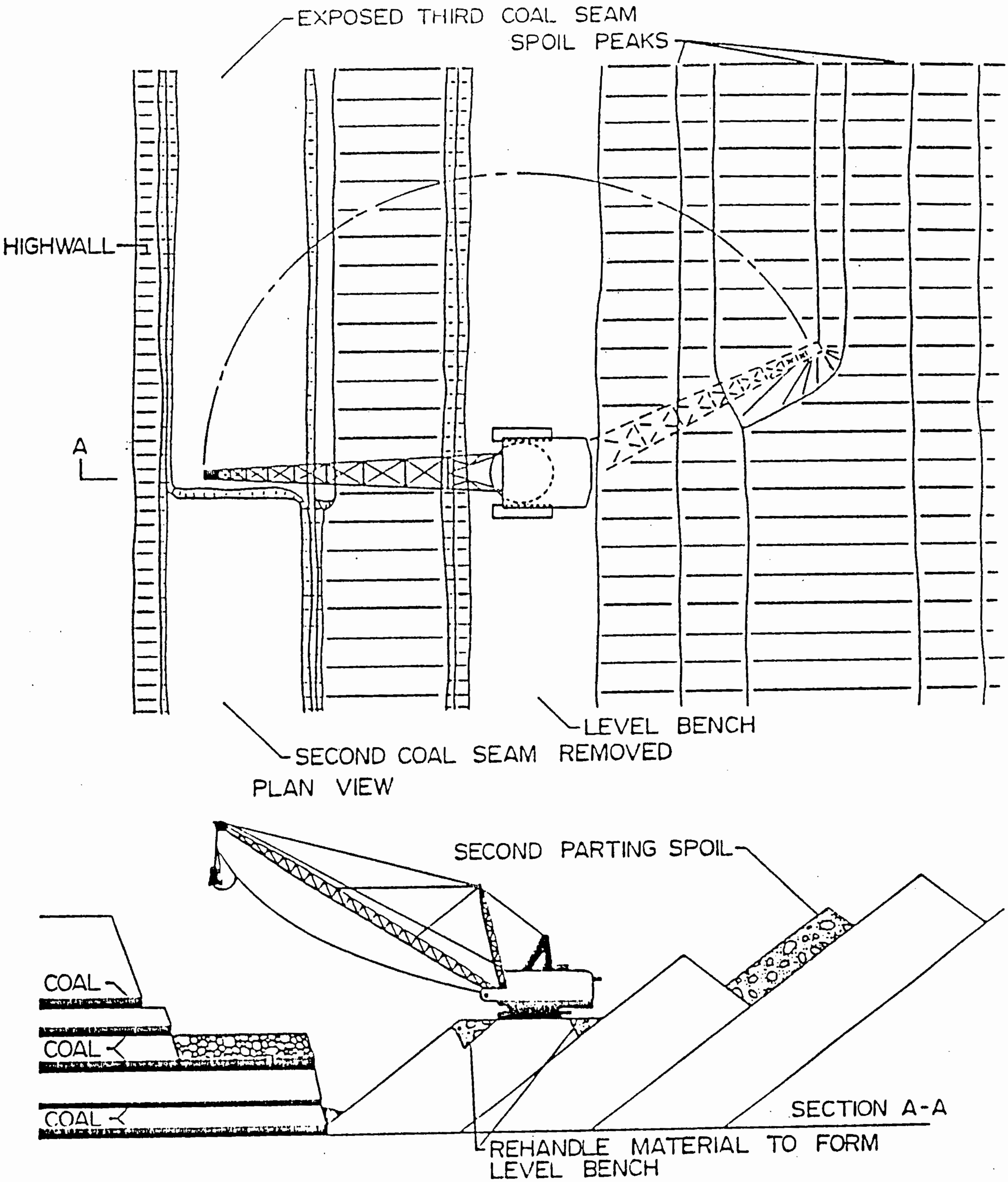
TYPICAL PIT CROSS SECTION SHOWING INITIAL BOX PIT AND SUBSEQUENT PITS

FIGURE 11



PLAN AND CROSS SECTIONAL VIEW
SPOIL-SIDE OVERBURDEN STRIPPING

FIGURE 12



PLAN AND CROSS SECTIONAL VIEW
SPOIL-SIDE OVERBURDEN STRIPPING

Revised 05/19/95

The coal seam is then drilled and blasted using the same procedures that are followed to fragment overburden parting (see Chapter 7). Rubber-tired front-end loaders and electric shovels are primarily used to load the coal into haulage trucks for transportation to preparation areas. Shovels are used in areas where a large amount of coal is to be loaded and mobility of the loader is not a prime consideration. Rubber-tired front-end loaders are used to load coal on thinner seams and in areas where mobility of the loader is required.

Haulage from the pits to preparation areas is accomplished by bottom dump trucks ranging in capacity from 150 to 250 tons. Occasionally, 150-ton end dumps or smaller equipment may also be used. Haulage trucks are routed to pits as necessary to meet production and coal quality requirements.

Coal Leases

The mining leases, which PWCC has signed with the Navajo and Hopi Tribes, are described in Chapter 3. The leases, shown in Figure 18, provide that PWCC may produce up to 290 million tons from the exclusive Navajo Lease Area (Contract 14-20-0603-8580) and up to 380 million tons from the Hopi and Navajo Joint Mineral Ownership Lease Area (Contracts 14-20-0603-9910 and 14-20-0450-5743) for a combined total of 670 million tons.

Coal Supply Agreements

PWCC has signed coal supply agreements and is presently negotiating extensions to supply coal to the Mohave and Navajo Generating Stations. The participants and operating agents for each of these generating stations are shown in Table 3. The forecasted mine plan reserve areas within the leased lands are shown in Figure 19. Approximately 803 million tons of potentially economical coal reserves are available within the existing coal leases and proposed permit boundary. As of January 1, 2003 approximately 345 million of the 670 million tons, currently under lease, has been mined.

Historical Coal Production

Peabody Coal Company began mining operations on the Black Mesa at the Black Mesa Mine in 1970. Coal resource areas that have been completely mined since that time include J-1, J-3, and J-27. The J-7 and N-6 coal resource areas are currently being mined. As of January 1, 2003, approximately 136,134,000 tons of coal was produced at Black Mesa Mine and approximately 6,870 acres of land was disturbed by mining activities. Tables 4 and 5 summarize the coal production at the Black Mesa Mine. Figure 20 shows annual coal production at the Black Mesa Mine and at the Black Mesa mining complex.

Mining operations began at the Kayenta Mine in 1973. Since then, the N-1, N-2, N-7/8, J-16, and N-14 resource areas have been completely mined. Active mining operations are currently ongoing in the N-11, J-19, and J-21 coal resource areas. Mining in the N-10 coal area began in 1979. The pit was temporarily closed in 1981 due to poor coal quality. As of January 1, 2003, approximately 206,831,800 tons of coal was produced at Kayenta Mine and approximately 13,843 acres of land has been disturbed by mining activities. Tables 4 and 10 summarize the coal production at the Kayenta Mine. Figure 20 shows annual coal production at the Kayenta Mine and at the Black Mesa mining complex.

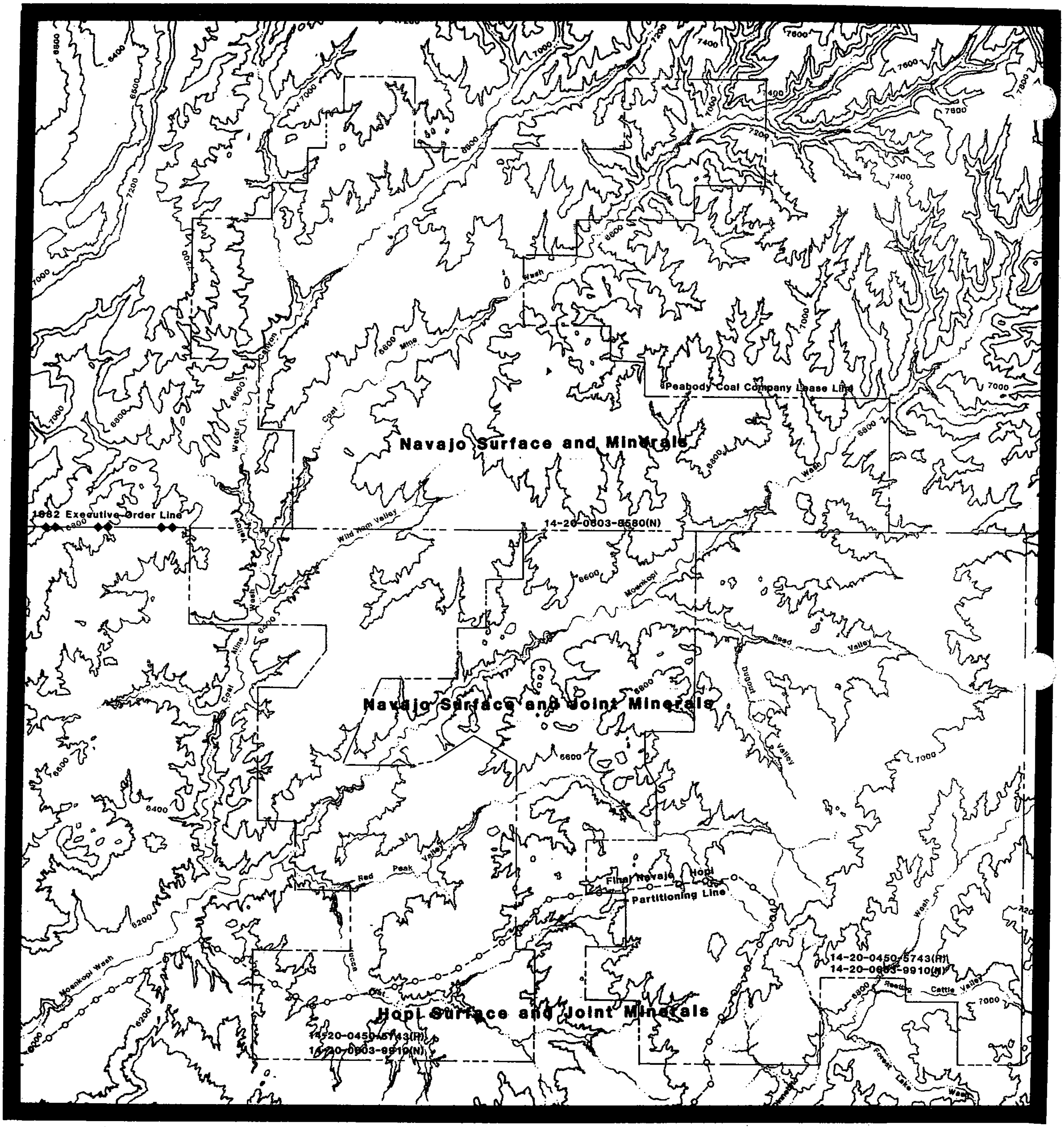


FIGURE 18

BLACK MESA LEASES
PEABODY COAL COMPANY

TABLE 3

Participants in the Mohave and Navajo Generating Stations

Mohave Generating Station Participants

56%	Southern California Edison Company (The Operating Agent)
20%	Salt River Project Agricultural Improvement and Power District
14%	Nevada Power Company
10%	Department of Water and Power of the City of Los Angeles

Navajo Generating Station Participants

24.3%	United States Bureau of Reclamation
21.7%	Salt River Project Agricultural Improvement and Power District (The Operating Agent)
21.2%	Department of Water and Power of the City of Los Angeles
14.0%	Arizona Public Service Company
11.3%	Nevada Power Company
7.5%	Tucson Gas and Electric Company

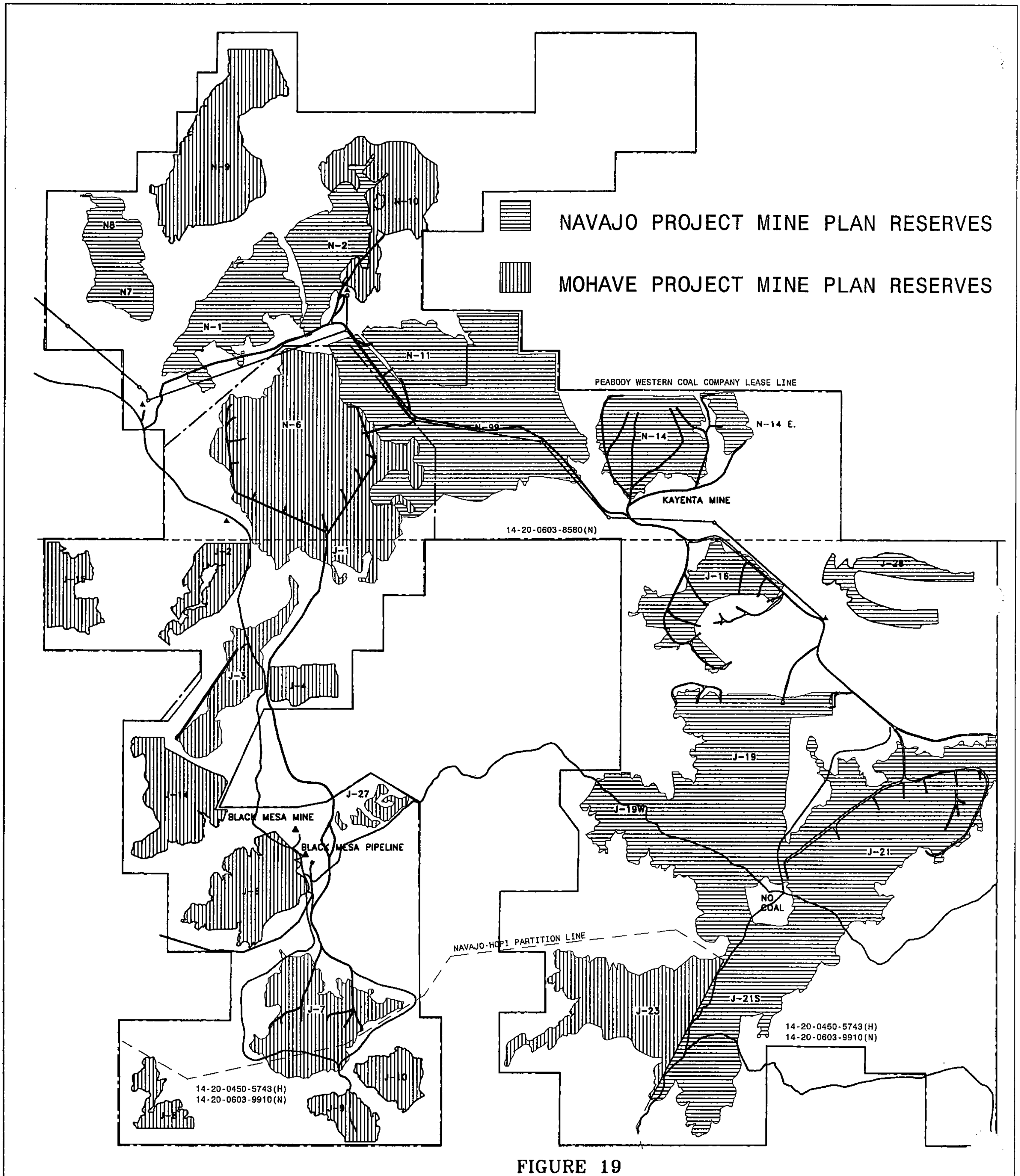


FIGURE 19
RESERVES OF THE BLACK MESA LEASES
PEABODY WESTERN COAL COMPANY

REVISED 01/23/2004

FIGURE 20
PRODUCTION SUMMARY
BLACK MESA AND KAYENTA MINE

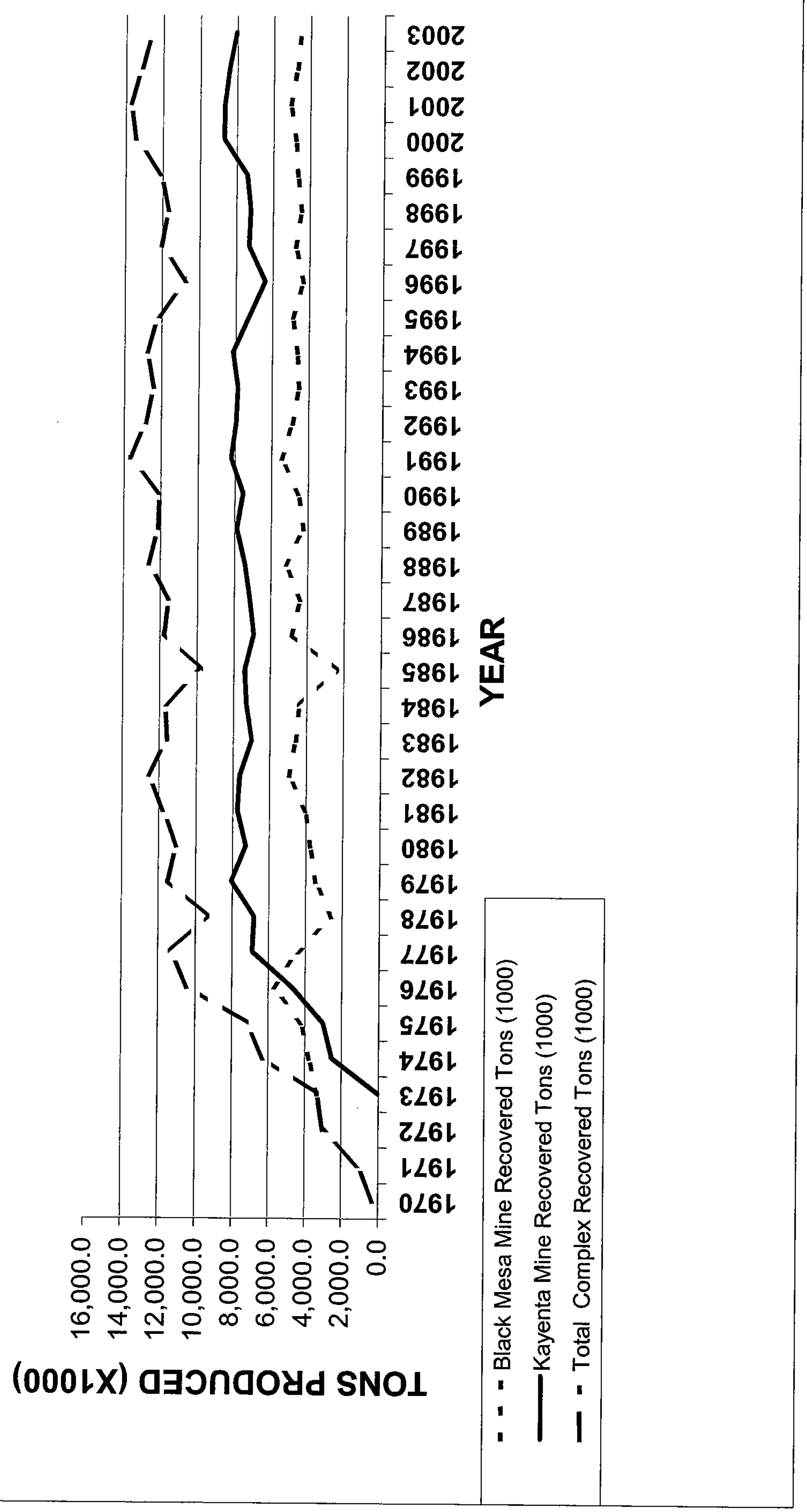


TABLE 4
PRODUCTION SUMMARY
BLACK MESA AND KAYENTA MINES

LEASE	PERIOD	BLACK MESA MINE (MOHAVE STATION)	KAYENTA MINE (NAVAJO STATION)	TOTAL
NAVAJO	1970-2000	67,139,700	91,257,900	158,397,600
NAVAJO	2001-END	66,574,600	90,619,100	157,193,700
NAVAJO	1970-END	133,714,300	181,877,000	315,591,300
JOINT	1970-2000	59,237,100	98,487,800	157,724,900
JOINT	2001-END	124,356,600	204,932,100	329,288,700
JOINT	1970-END	183,593,700	303,419,900	487,013,600
BOTH*	1970-END	317,308,000	485,296,900	802,604,900

NOTE: *The total coal reserves leased by Peabody is 670,000,000 tons.
An additional 132,745,800 tons is available within the lease boundaries.
Current coal supply agreements are curenntly being renogtiated.
As of 1/1/2004 approximately 95,000,000 tons is needed to meet existing coal supply agreements.

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TABLE 5
PRODUCTION SUMMARY
BLACK MESA MINE TOTAL

Year	Coal * Acres (Mined)	Recovered Tons (1000)	Virgin Yardage (1000)	Virgin Ratio
1986	366.6	4,846.7	14,973	3.1
1987	352.9	4,375.7	13,912	3.2
1988	430.4	5,207.1	20,829	4.0
1989	357.2	4,235.8	16,858	4.0
1990	385.1	4,514.6	16,836	3.7
1991	406.7	5,464.2	16,679	3.1
1992	376.0	4,871.1	18,596	3.8
1993	352.1	4,529.2	14,349	3.2
1994	363.8	4,617.7	16,804	3.6
1995	375.4	4,901.4	17,331	3.5
1996	364.5	4,299.3	17,192	4.0
1997	376.3	4,748.6	22,096	4.7
1998	356.8	4,436.2	21,605	4.9
1999	346.3	4,651.7	18,889	4.1
2000	351.2	4,754.2	21,194	4.5
1986-2000	5,561.3	70,453.5	268,143	3.8
2001	384.1	5,056.9	22,878	4.5
2002	362.3	4,700.3	21,983	4.7
2003	332.3	4,504.6	21,187	4.7
2004	349.5	4,606.5	23,671	5.1
2005	396.1	4,619.8	24,341	5.3
2001-2005	1,824.3	23,488.1	114,060	4.9
2006-2010	2,991.3	27,794.9	131,146	4.7
2011-End	14,255.7	139,648.4	827,363	5.9
Grand Total	24,632.6	261,384.9	1,340,712	5.1

NOTE: * Coal acres is the traditional industry standard for calculating the aerial extent of each coal seam. In multi-seam coal operations with multi-benches, surface acres have overlap from seam mined. For surface acres, see Drawing No. 85210.

Future Coal Production

PWCC is proposing a life-of-mine (LOM) mining plan for the Black Mesa and Kayenta Mines, which includes producing approximately 670 million tons between 1970, and the end of the life-of-mine (LOM) mining plan. The LOM Mining Plan has been prepared so as to show the planned sequence of mining by year through the present permit term (beginning in 2000) and thereafter in approximate five-year increments through 2010. Mining reserve areas beyond 2010 have been identified on Drawing 85210.

If both electric generating stations serviced by the Black Mesa complex complete coal supply renegotiations it is anticipated the combined fuel supply requirements will equal approximately 670 million tons. This leaves approximately 133 million tons of additional coal reserves within the lease boundary that may be leased at some future date (Table 4). In 1987, a total of 670 million tons of coal reserves were leased from the tribes and these coal reserves are sufficient to supply the anticipated coal supply agreements. The current permit assumption is that cessation of mining activities will occur when the 670 million tons of coal reserves have been produced. Given these assumptions, coal production at the Black Mesa and Kayenta Mine will continue through 2025.

The mining sequence is shown in Drawings 85210. Coal production is summarized by mine in Tables 5 and 10. Similar data for each mine area is given in Tables 6 through 9 and 11 through 17. The dragline utilization sequence for each mine through 2010 is shown in Figure 21. The quality, strike, and dip of each coal seam to be mined is given in Table 18. A summary of coal production by coal seam and mining area is given in Table 19. Coal reserve and recovery information may be found in Table 20. Typical cross sections of mining areas may be found in Chapter 25. The location of the cross sections may be found on the Mine Plan Map, Drawing 85210. Following are discussions briefly outlining anticipated mining operations in each coal resource area.

Black Mesa Mine. The J-7 coal resource area is located approximately two miles south of the Black Mesa Mine office in the west tract of the Joint Mineral Ownership Lease Area. Mining began in this pit in 1975, and at the current production rate, mining will continue until approximately the year 2005. The area will continue to be mined to the south with the Blue and Red coal seams being removed. Primary overburden excavation will be performed by the Marion 7800 dragline. In order to extend the life-of-pit to approximately the year 2005 and to maximize coal recovery, the entire J-7 coal reserve shown on Drawing No. 85210 will be mined.

TABLE 6
PRODUCTION SUMMARY
J7 Coal Resource Area
Black Mesa Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Average Burden Depth	Virgin Ratio
1986	98.2	1,220.6	8.6	3,508	22.1	2.9
1987	95.5	1,072.9	6.8	3,843	24.9	3.6
1988	116.5	1,348.9	7.1	4,717	25.1	3.5
1989	93.9	1,082.9	7.3	3,812	25.2	3.5
1990	90.2	1,065.2	7.5	3,727	25.6	3.5
1991	96.0	1,381.0	9.1	3,511	22.7	2.5
1992	89.2	1,186.0	8.4	4,327	30.1	3.6
1993	72.9	938.0	8.1	2,706	23.0	2.9
1994	90.0	1,173.3	8.2	4,674	32.2	4.0
1995	95.2	1,292.6	8.6	4,818	31.4	3.7
1996	109.9	1,445.8	8.3	5,302	29.9	3.7
1997	103.8	1,500.9	9.6	4,919	29.4	3.3
1998	70.0	1,140.3	10.9	4,372	38.7	3.8
1999	64.3	1,064.7	11.0	4,742	45.7	4.5
2000	56.2	1,127.6	12.9	4,161	45.9	3.7
1986-2000	1,341.8	18,040.7	8.8	63,139	30.1	3.5
2001	51.3	900.0	11.2	4,628	55.9	5.1
2002	44.4	798.4	11.6	4,188	58.5	5.2
2003	35.4	706.3	12.7	4,244	74.3	6.0
2004	48.8	872.6	11.7	5,875	74.6	6.7
2005*	18.0	380.3	13.8	1,864	64.2	4.9
2001-2005	197.9	3,657.6	12.2	20,799.0	65.5	5.7
Grand Total	1,539.7	21,698.3	9.7	83,938	39.0	3.9

*J7 reserve mined out in 2005

TABLE 7
PRODUCTION SUMMARY
N6 Coal Resource Area
Black Mesa Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Average Burden Depth	Virgin Ratio
1986	268.4	3,626.1	8.4	11,465	26.5	3.2
1987	257.4	3,302.8	8.3	10,069	24.2	3.0
1988	313.9	3,858.2	8.1	16,112	31.8	4.2
1989	263.3	3,152.9	7.6	13,046	30.7	4.1
1990	294.9	3,449.4	7.4	13,109	27.6	3.8
1991	310.7	4,083.2	8.3	13,168	26.3	3.2
1992	286.8	3,685.1	8.1	14,269	30.8	3.9
1993	279.2	3,591.2	8.1	11,643	25.8	3.2
1994	273.8	3,444.4	7.9	12,130	27.5	3.5
1995	280.2	3,608.8	8.1	12,513	27.7	3.5
1996	254.6	2,853.5	7.1	11,890	28.9	4.2
1997	272.5	3,247.7	7.9	17,177	39.1	5.3
1998	286.8	3,295.9	7.7	17,233	37.2	5.2
1999	282.0	3,587.0	8.5	14,147	31.1	3.9
2000	295.0	3,626.6	7.9	17,033	35.8	4.7
1986-2000	4,219.5	52,412.8	7.5	205,004	30.1	3.9
2001	332.8	4,156.9	8.0	18,250	34.0	4.4
2002	317.8	3,901.9	7.9	17,795	34.7	4.6
2003	296.9	3,798.3	8.2	16,943	35.4	4.5
2004	300.7	3,733.9	8.1	17,796	36.7	4.8
2005	378.1	4,239.5	7.3	22,477	36.8	5.3
2001-2005	1,626.3	19,830.5	7.9	93,261	35.5	4.7
2006-2007*	659.8	7,408.4	7.3	37,344	28.9	5.0
Grand Total	6,505.6	79,651.7	7.9	335,609	31.2	4.2

*N6 reserve mined out in 2007

TABLE 8
PRODUCTION SUMMARY
J2, J4, J6, J8, J9, J10, J14, J15, J23 Coal Resource Areas
Black Mesa Mine

Area	Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
J-23	2006-2010	1,011.2	10,591.4	6.9	39,874	24.4	3.8
J-23	2011- End	4,681.7	44,581.6	6.4	188,743	25.0	4.2
J-23	Total	5,692.9	55,173.0	6.7	228,616	24.9	4.1

Area	Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
J-2	2011- End	894.6	7,428.9	5.4	44,972	31.2	6.1
J-4	2011- End	401.9	4,203.1	6.6	24,718	38.1	5.9
J-6	2011- End	1,221.1	14,808.5	7.9	128,287	65.1	8.7
J-8	2011- End	471.3	5,474.4	8.0	19,856	26.1	3.6
J-9	2011- End	546.4	6,325.9	7.7	32,715	37.1	5.2
J-10	2011- End	695.9	5,232.3	4.9	34,509	30.7	6.6
J-14	2011- End	1,246.9	12,032.2	6.3	76,237	37.9	6.3
J-15	2011- End	1,297.5	10,020.9	4.9	53,022	25.3	5.3
	Grand Total	6,775.6	65,526.2	6.5	414,315	37.9	6.3
Grand Total with J-23		12,469	120,699	6.5	642,932	32.0	5.3

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TABLE 9
PRODUCTION SUMMARY
N9 and N10 Coal Resource Areas
Black Mesa Mine

Area	Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
N-9	2006-2010	1,320.3	9,795.1	4.8	53,928	25.3	5.5
N-9	2011 - END	562.6	6,380.3	7.7	32,746	36.1	5.1
N-9	Total	1,882.9	16,175.4	6.3	86,673	28.5	5.4

Area	Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
N-10	2011 - END	2,235.8	23,160.3	6.7	191,559	53.1	8.3
N-10	Total	2,235.8	23,160.3	6.7	191,559	53.1	8.3
N-9/N10	Grand Total	4,118.7	39,335.7	6.5	278,232	41.9	7.1

TABLE 10
PRODUCTION SUMMARY
KAYENTA MINE TOTAL

Year	Coal * Acres (Mined)	Recovered Tons (1000)	Virgin Yardage (1000)	Virgin Ratio
1986	648.4	6,872.2	38,140	5.5
1987	691.7	7,146.9	34,059	4.8
1988	742.7	7,426.1	35,586	4.8
1989	869.7	7,882.5	39,176	5.0
1990	780.0	7,547.0	37,004	4.9
1991	880.6	8,206.8	39,716	4.8
1992	822.9	7,946.0	40,443	5.1
1993	788.8	7,869.3	39,576	5.0
1994	849.4	8,131.3	49,916	6.1
1995	751.0	7,277.1	52,391	7.2
1996	683.8	6,405.6	50,808	7.9
1997	753.1	7,304.7	51,461	7.0
1998	799.9	7,224.2	49,072	6.8
1999	845.4	7,427.6	42,611	5.7
2000	912.8	8,687.9	48,424	5.6
1986-2000	11,820.2	113,355.2	648,383	5.7
2001	915.1	8,665.7	47,771	5.5
2002	846.3	8,420.4	44,029	5.2
2003	735.3	7,874.9	44,426	5.6
2004	800.5	8,000.5	49,426	6.2
2005	778.7	8,002.1	55,031	6.9
2001-2005	4,075.8	40,963.6	240,682	5.9
2006-2010	4,171.2	40,997.7	278,957.8	6.8
2011-End	23,293.2	213,589.9	1,286,792	6.0
Grand Total	43,360.4	408,906.4	2,454,815	6.0

NOTE: * Coal acres is the traditional industry standard for calculating the aerial extent of each coal seam. In multi-seam coal operations with multi-benches, surface acres have overlap from seam mined. For surface acres, see Drawing No. 85210.

TABLE 11
PRODUCTION SUMMARY
J16 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Ovb. Depth	Virgin Ratio
1986	171.7	1,895.8	7.0	10,791	40.0	5.7
1987	175.3	2,215.5	8.0	9,701	34.3	4.4
1988	151.2	1,980.8	8.3	9,360	38.3	4.7
1989	214.9	2,040.0	6.0	11,208	32.3	5.5
1990	175.0	1,769.2	6.4	9,714	34.3	5.5
1991	188.7	1,737.0	5.8	10,077	33.1	5.8
1992	158.8	1,403.7	5.6	8,933	34.9	6.4
1993	173.9	1,537.9	5.6	10,326	36.8	6.7
1994	154.2	1,596.6	6.5	14,253	57.3	8.9
1995	63.8	773.3	7.6	7,895	76.6	10.2
1996	1.2	10.5	5.5	33	32.3	3.1
1997	1.0	7.5	4.7	2	1.2	0.3
1998	2.0	13.2	4.2	401	124.3	30.4
1999	14.8	120.5	5.1	1,158	48.5	9.6
1986-1999	1,646.5	17101.5	6.6	103,852	39.1	6.1
2000-2005	0	0	0	0	0	0
2006-2011	0	0	0	0	0	0
2012-End	0	0	0	0	0	0
Grand Total	1,646.5	17,101.5	6.6	103,852	39.1	6.1

TABLE 12
PRODUCTION SUMMARY
J19 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
1986-1992	0.00	0.0	0.0	0	0.0	0.0
1993	41.00	384.2	5.9	3,928	59.4	10.2
1994	237.80	2,136.6	5.7	16,665	37.2	7.8
1995	241.10	2,308.2	6.0	20,438	52.5	8.9
1996	221.40	2,017.8	5.8	18,187	50.9	9.0
1997	264.70	2,400.6	6.1	17,823	44.1	7.7
1998	299.92	2,699.4	5.7	20,919	43.2	7.7
1999	286.07	2,623.1	5.8	17,127	37.1	6.5
2000	317.65	3,013.9	6.0	21,714	36.8	7.2
1986-2000	1,909.64	17,583.8	6.1	136,801	40.1	7.8
2001	283.90	2,689.3	6.2	17,642	38.3	6.6
2002	223.50	2,198.6	6.4	14,494	41.3	6.6
2003	223.00	2,272.3	6.6	12,953.1	36.3	5.7
2004	372.53	3,527.2	6.2	22,161.4	36.0	6.3
2005	473.50	4,456.0	6.11	25,055.6	31.6	5.6
2001-2005	1,576.43	15,143.4	5.9	92,306	36.7	6.1
2006-2010	1,946.40	18,993.9	6.34	94,401.9	23.1	5.0
2011-End	4,853.10	53,453.7	7.2	262,088	34.1	4.9
Grand Total	10,285.57	105,174.8	6.4	585,597	35.3	5.6

TABLE 13
PRODUCTION SUMMARY
J21 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
1986	301.00	3,065.5	6.4	12,269	25.3	4.0
1987	378.30	3,509.8	5.9	12,268	20.2	3.5
1988	395.60	3,436.0	5.5	11,625	18.2	3.4
1989	453.60	3,699.4	5.1	12,862	17.6	3.5
1990	424.10	3,729.6	5.6	13,590	19.9	3.6
1991	482.90	4,275.4	5.6	15,715	20.2	3.7
1992	450.70	4,123.6	5.8	15,634	21.5	3.8
1993	410.40	3,845.8	5.9	15,410	23.3	4.0
1994	447.30	4,230.1	6.0	18,998	26.3	4.5
1995	394.30	3,610.3	5.8	17,699	27.8	4.9
1996	367.90	3,338.7	5.7	19,899	33.5	6.0
1997	310.00	3,139.4	6.4	18,782	37.6	6.0
1998	286.00	2,632.9	5.8	15,441	33.5	5.9
1999	392.40	3,282.5	5.3	14,746	23.3	4.5
2000	402.31	3,765.8	5.9	19,736	27.2	5.2
1986-2000	5,896.81	53,684.8	5.8	234,674	25.0	4.4
2001	447.22	4,273.0	6.2	18,845	26.7	4.4
2002	424.52	4,405.4	6.8	18,839	26.8	4.3
2003	314.69	3,711.3	7.7	20,164	36.0	5.4
2004	312.05	3,439.6	7.2	21,725	43.4	6.3
2005	245.15	3,118.9	8.3	20,125	48.0	6.5
2001-2005	1,743.63	18,948.2	6.7	99,698	36.2	5.3
2006-2010	522.73	4,660.5	5.8	27,259	32.3	5.8
2011-End	9,356.02	83,670.0	5.8	396,697	26.4	4.7
Grand Total	17,519.19	160,963.5	6.0	758,328	30.0	4.7

TABLE 14
PRODUCTION SUMMARY
J28 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
2011- End	1,094.93	10,062.4	6.0	61,111	34.60	6.07
Grand Total	1,094.93	10,062.4	6.0	61,111	34.60	6.07

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TABLE 15
PRODUCTION SUMMARY
N11 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
1986-1994	0.00	0.0	0.0	0	0.0	0.0
1995	51.80	574.0	7.0	6,359	76.1	11.1
1996	93.30	1,038.6	7.0	12,722	84.6	12.2
1997	177.50	1,757.1	6.2	14,855	51.9	8.5
1998	211.90	1,878.7	5.6	12,311	36.0	6.6
1999	152.20	1,401.5	5.8	9,579	39.0	6.8
2000	192.86	1,908.2	6.3	12,897	41.6	6.8
1995-2000	879.56	8,558.1	6.1	68,723	54.9	8.0
2001	183.98	1,703.4	6.0	11,284	37.0	6.6
2002	198.32	1,816.4	5.9	10,696	32.4	5.9
2003	197.59	1,891.3	6.2	11,309	37.4	6.0
2004	115.88	1,033.7	5.8	5,539	29.4	5.4
2005	0.00	0.0	0.0	0	0.0	0.0
2001-2005	695.77	6,444.8	5.8	38,828	34.1	6.0
2006-2010	0.00	0.0	0.0	0	0.0	0.0
Grand Total	1,575.33	15,002.9	5.4	107,551	46.5	7.2

TABLE 16
PRODUCTION SUMMARY
N-14 COAL RESOURCE AREA
KAYENTA MINE

YEAR	COAL ACRES MINED	RECOVERED TONS (X1000)	AVG. SEAM THICKNESS FT.	VIRGIN YARDAGE (X1000)	AVERAGE OVB. DEPTH FT.	VIRGIN RATIO YDS / TONS
1986	158.2	1,679.5	6.7	14,738	57.8	8.8
1987	138.1	1,421.6	6.5	12,090	54.3	8.5
1988	195.9	2,009.3	6.5	14,601	46.2	7.3
1989	201.2	2,143.1	6.7	15,106	46.5	7.0
1990	180.9	2,048.2	7.1	13,700	46.9	6.7
1991	209.0	2,194.4	6.6	13,924	41.3	6.3
1992	213.4	2,418.7	7.2	15,876	46.1	6.6
1993	163.5	2,101.4	8.1	9,912	37.6	4.7
1994	10.1	168.0	10.5			
1995		11.3				
1996						
1997						
1986-1997	1,470.3	16,195.5	6.9	109,947	46.4	6.8

TABLE 17
PRODUCTION SUMMARY
N99 Coal Resource Area
Kayenta Mine

Year	Coal Acres	Tons (1000)	Coal Thk	Yards (1000)	Avg. Thk. Ovb. / Int.	Virgin Ratio
2001						
2002						
2003						
2004						
2005	60.01	427.2	4.62	9,850.5	73.8	23.1
2001-2005	60.01	427.2	0.0	9,851	73.8	23.1
2006-2010	1,702.07	17,343.3	6.62	157,296.5	52.0	9.1
2011-End	7,647.56	63,163.0	5.4	553,838	45.0	8.8
Grand Total	9,409.64	80,933.5	6.0	720,985	48.5	8.9

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TABLE 18
SUMMARY OF COAL QUALITY, STRIKE, AND DIP BY COAL RESOURCE AREA AND SEAM

AREA	HORIZON	% ASH	% SULFUR	BTU	pH	STRIKE (DEGREES)	DIP (DEGREES)
J-07	Violet	9.73	0.49	11,162	5.6	N39W	2.4W
	Green	8.84	0.43	11,968	6.8	N40W	1.5W
	Blue	7.09	0.61	12,626	7.6	N31W	2.4W
	Red	9.66	0.42	12,328	8.0	N42W	1.8W
N-06	Violet	10.31	0.62	12,128	7.7	N38W	4.2W
	Green	8.91	0.51	12,375	7.9	N29E	1.8W
	Blue	6.78	0.50	12,703	8.0	N22W	2.0W
	Red	5.59	0.55	12,914	8.1	N15W	2.1W
J-19	Violet	10.12	0.51	11,889	6.5	N50W	2.5W
	Green	5.04	0.60	12,866	7.4	N22W	2.2W
	Blue	6.77	0.56	12,592	7.4	N17W	2.0W
	Red	5.01	0.57	12,961	7.5	N27E	2.1W
	Yellow	7.73	0.85	12,596	7.4	N59E	1.3E
	Brown	9.35	0.78	12,407	7.8	N57W	1.8W
	Orange	7.06	0.48	12,823	8.0	N40E	1.6E
J-21	Violet	8.72	0.59	12,336	7.4	N35E	2.9W
	Green	10.94	0.48	12,030	7.8	N71W	2.1W
	Blue	6.72	0.62	12,728	8.0	N21W	2.0W
	Red	6.14	0.49	12,807	7.9	N27E	2.1W
	Yellow	9.71	1.00	12,404	8.0	N59E	1.3E
	Brown	9.14	0.66	12,458	8.0	N57W	1.8W
	Orange	4.96	0.42	13,066	7.8	N48W	2.2W
N-11	Red	5.52	1.14	12,729	6.4	N34W	2.0W
	Brown	7.67	0.55	12,704	8.2	N34W	1.8W
	Orange	6.33	0.50	12,964	8.1	N33W	2.1W
N-10	Brown	10.94	1.06	12,164	7.4	N9E	4.4W
	Orange	8.28	0.79	12,614	7.6	N4E	5.2W
N-99	Red	5.45	1.00	12,851	8.0	N19W	1.5W
	Brown	7.50	0.67	12,705	8.1	N28W	0.8W
	Yellow	9.77	1.69	12,262	7.4	N20W	1.1W
	Orange	6.79	0.48	12,883	8.1	N32W	1.2W
J-23	Green	9.21	0.66	12,279	6.8	N63E	1.4W
	Blue	8.97	0.55	12,362	7.6	N83E	0.6W
	Red	6.8	0.62	12,724	7.7	N82E	0.5W
	Yellow	8.8	0.74	12,483	7.7	N40W	0.3W
	Brown	9.79	0.59	12,364	8.0	N66W	0.2E

TABLE 18 (Cont.)
SUMMARY OF COAL QUALITY, STRIKE, AND DIP BY COAL RESOURCE AREA AND SEAM

AREA	HORIZON	% ASH	% SULFUR	BTU	pH	STRIKE (DEGREES)	DIP (DEGREES)
J-28	Brown	6.48	1.05	12,867	7.7	N30W	1.0W
	Orange	6.77	0.62	12,805	7.6	N9W	1.0W
N-9	Red	7.53	0.85	11879	4.7	N88W	1.4W
	Yellow	5.91	0.89	12797	7.5	N76E	1.6E
	Brown	9.41	0.95	12397	8.2	N74E	1.8E
	Orange	6.21	0.52	12887	8.4	N72E	1.8E
J-2	Yellow	5.26	0.66	12914	7.3	N46E	0.1W
	Brown	10.15	0.61	12272	8.1	N59W	0.1E
	Orange	6.95	0.53	12790	8.2	N65E	0.5E
J-4	Yellow	6.66	0.65	12825	8.0	N28W	0.9W
	Brown	7.14	0.84	12517	8.0	N27W	0.8W
	Orange	11.74	0.70	12029	8.0	N17W	0.6W
J-6	Yellow	8.71	0.74	12278	7.3	N81E	0.8E
	Brown	7.77	0.51	12248	7.4	N73W	0.4W
	Orange	8.14	0.45	12659	8.0	N82E	0.4E
J-8	Red	7.64	0.82	12426	4.2	N44W	1.6E
	Yellow	11.67	0.50	11883	6.9	N51W	1.2E
	Brown	13.79	0.47	11628	7.7	N52W	0.8E
J-9	Red	6.20	0.50	12256	4.5	N24W	1.5W
	Yellow	12.22	0.58	12000	8.0	N14W	1.3W
	Brown	10.76	0.54	12065	8.0	N10W	0.6W
J-10	Red	7.29	1.08	11555	2.9	N24W	2.2W
	Yellow	12.13	0.75	12103	8.1	N24W	1.7W
	Brown	11.63	0.48	12121	8.1	N30W	1.8W
J-14	Red	10.12	0.88	12316	7.2	N54E	0.9W
	Yellow	9.43	0.69	12370	7.9	N57E	0.3W
	Brown	6.90	0.83	12850	8.0	N77E	0.2E
	Orange	7.61	0.42	12706	8.1	N27W	0.3E
J-15	Red	5.81	0.58	12361	8.0	N47E	0.8E
	Yellow	13.13	0.67	11786	8.0	N55E	0.8E
	Brown	9.24	0.60	12508	8.0	N64E	0.7E

TABLE 16 REPLACE WITH NEW TABLE 19

COAL PRODUCTION BY SEAM MINED (2001-2005)

Kayenta & Black Mesa Mining Complex

	J-07		N-06		J-19		J-21		N-11		
COAL SEAM	COAL ACRES	TONS	COAL ACRES	TONS	COAL ACRES	TONS	COAL ACRES	TONS	COAL ACRES	TONS	TOTAL TONS
Violet	0.0	0.0	161.1	854.9	11.3	71.5	175.7	1,257.7			2,184.1
Green	0.0	0.0	457.4	5,837.4	2.0	7.9	251.8	2,999.8			8,845.1
Blue	124.0	944.3	409.3	6,213.7	70.2	454.2	591.2	2,847.1			10,459.3
Red	211.0	4,552.9	795.8	9,256.0	347.3	3,525.3	617.8	9,676.6	59.7	323.5	27,334.3
Yellow					308.1	1,996.5					1,996.5
Brown					436.0	4,552.0			185.7	2,478.1	7,030.1
Orange					624.0	6,437.1			478.7	3,662.6	10,099.7
TOTALS	335.0	5,497.2	1,823.6	22,162.0	1,798.9	17,044.5	1,636.4	16,781.2	724.1	6,464.2	67,949.1

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TABLE 17 REPLACE WITH NEW TABLE 20

COAL RECOVERY STATISTICS (2001-END)

	MINING AREA					
	J-07	N-06	J-19	J-21	N-11	N-10
TONS PRODUCED	5,497.2	34,894.0	89,652.7	61,357.8	6,464.2	9,511.2
COAL LOSS DURING MINING (1)	549.7	3,489.4	11,821.8	8,051.5	852.4	1,254.2
BURIAL/CULTURAL SITE AVOIDANCE(2)	0.0	0.0	353.1	312.2	0.0	0.0
TOTAL IN PLACE GEOLOGIC RESERVES (3)	6,046.9	38,383.4	101,827.6	69,721.5	7,316.6	10,765.4

NOTES: (1) Coal lost during mining operations, e.g., during coal loading.

(2) Estimated in-place reserves under burial sites and surrounding areas that will be by-passed from mining at this time.

(3) In-place reserves are calculated from the surface to lowest surface mineable seam.

FIGURE 21
Dragline Sequencing

YEAR

	1986 1990 1995 2000 2005 2010 2011+	
BLACK MESA MINE		<u>LIFE OF PIT</u>
J-7	1986---------(7800DL)------------------------------------2005	19.0 Years
N-6	1986---------(7400DL)--------1995	10 Years
	1986-----------------------(8750DL)-------------------------2007	21 Years
J-23	2007-----(8750DL)--Beyond 2011	5+ Years
N-9	2006-----(8200DL)--Beyond 2011	5+ Years
KAYENTA MINE		
J-16	1986-(8200DL)-1995--(Highwall Mining Eval)—1998—(1260DL)—1999	9.75 Years
J-19	1993 --------------------(2570DL) -------2006	13 Years
	2004-2005 (8200DL)	1.5 Years
	2006--(8750DL)--Beyond 2011	5+ Years
J-21	1985-----------------------(8750DL)-------------------------------Beyond 2011	27+ Years
J-21	1986------------(1260DL) 1995-2000—(1260DL)—2005	15 Years
N-99	2005--(2570DL)---Beyond 2011	5+ Years
N-11	1995--(8200DL)---2004	9 Years
N14	1986-------(2570DL)---1993--(Highwall Mining)—1995	7.75 Years

The N-6 coal resource area is located on the exclusive Navajo lease area approximately four miles north of the Black Mesa preparation facilities. Mining began in this pit in 1973, and at the current production rate, mining will continue until approximately the year 2008. Mining will advance on both the east and west sides of this pit until a U-shape is achieved. The Violet, Green, Blue, and Red coal seams will be extracted. Primary overburden removal will be performed by the Marion 8750 dragline throughout the life of the pit.

The J-23 coal resource area is located approximately four miles southeast of the Black Mesa preparation facilities on the east tract of the Joint Mineral Ownership Leases. Mining is planned to begin in this pit as early as 2006. Mining will advance to the south of this pit with the Green, Blue, Red, Yellow, Brown and Orange coal seams being extracted. Primary overburden removal will be performed by the Marion 8750 dragline throughout the life of the pit. At the forecasted production rate, mining will continue in the J-23 coal resource area until approximately the year 2018.

The N-9 Coal resource area is located approximately 9 miles north of the Black Mesa Mine preparation facilities on the Navajo lease area. Mining is planned to begin in this pit as early as 2006. Mining will advance on both the east and west sides of this pit until a U-shape is achieved. The Yellow, Brown, and Orange coal seams will be extracted. Primary overburden removal will be performed by the Marion 8200 dragline throughout the life of the pit. At the forecasted production rate, mining will continue in the N-9 coal resource area until approximately the year 2016.

Kayenta Mine. The J-16 coal resource area is located approximately two miles west of Kayenta Mine on the east tract of the Joint Mineral Ownership Leases. Mining began in J-16 in 1982, and the Marion 8200 dragline completed overburden removal in 1995. This dragline was moved to the N-11 area in 1995. The Yellow, Brown, and Orange coal seams were removed. Final reclamation and coal removal activities on the final highwall with the 1260 dragline continued through 1999.

Mining in the J-21 coal resource area began in 1985. This area is located approximately two miles southeast of the Kayenta Mine preparation facilities on the east tract of the Joint Mineral Ownership Leases. The mining began along the north coal cropline and continued to the south with cuts extending to the southwest along the north and east sides until a U-shaped pit were achieved. A short north-south pit was opened on the west end of J-21 in 1996 to accommodate short-term market conditions. This pit was extended in 1997 to connect with the "L" shaped J-19 pit. The Violet, Green, Blue, Red, Yellow, Brown, and Orange coal seams will be removed. Primary overburden removal will be performed by the Marion 8750 dragline. Secondary overburden removal will be performed by the Bucyrus Erie 1260 dragline.

By the year 2012, at the current production rate, J-21 will still have approximately 21.8 million tons of recoverable coal available to market. A burial site whose centered coordinate location is approximately E65825, N-40446, has been identified and mining plans have been altered to excavate and protect around this site (Mine Plan – Drawing No.85210) and (Attachment A).

The J-19 coal resource area is located approximately two miles southwest of the Kayenta Mine preparation facilities on the east tract of the Joint Mineral Ownership Leases. Mining began in 1993 on the northern side of the resource area and progressed southward until 1997 when there was an "L" shape pit in the east-west and north-south direction. This pit configuration has minimized disturbance, increased the pit length, and improved mining efficiency, and haulage access. The north-south pit eventually extended southward along the western side of the previously mined J-21 coal resource area and in 1997 joined the existing short north-south pit on the west end of J-21. This J-19 pit extension formed a U-shaped pit junction with the west end of the existing J-21 pit. Subsequently, the J-19 and J-21 pits will butt up against the "no coal void area" at approximately N-40,000 and E60,000 area between the two pits (Drawing 85210, Sheet 4 of 4). This mine plan will provide a better opportunity for mining equipment to be used more efficiently and economically between these two pits based on pit conditions, production rates, market conditions, and economics. Merging the J-19 and J-21 pits will not have any adverse impacts to future coal recovery. The Violet, Green, Blue, Red, Yellow, Brown, and Orange coal seams will be extracted. The affected lands are shown on the Jurisdictional Permit and Affected Lands Map, Drawing No. 85360. The primary overburden excavator in J-19 has been the Bucyrus-Erie 2570 dragline. In early 2004, the Marion 8200 dragline will mine out of the N-11 resource area and deadhead to J-19 to commence mining in the western most portion of the J-19 resource area. The pit configuration for the west extension of J-19 will be U-shaped (inverted) as pit development continues along the crop extents to the north, west and south (Mine Plan – Drawing No.85210 Sheet SE). The mine plan was developed using the Marion 8200 dragline in this area from 2004 to mid-2005. Afterward, the B.E. 2570 dragline will assume mining responsibilities for the entire J-19 area and by mid-2005 the B.E. 2570 will be the primary overburden excavator in J-19. By the end of year 2011, at the current production rate, J-19 will still have approximately forty-eight million tons of recoverable coal available to market. As in the case with J-21, there also exists a burial site in the J19 coal resource area that will be bypassed. A burial site whose centered coordinate location is approximately E58937, N-39379, has been identified and mining plans have been altered to excavate and protect around this site (Mine Plan – Drawing No.85210) and (Attachment A).

The N-11 coal resource area is located approximately six miles northwest of the Kayenta Mine preparation facilities on the Navajo Lease. Mining began in 1995 and will continue until the year 2004. The Red, Brown, and Orange coal seams will be mined. Primary overburden removal will be performed by the Marion 8200 dragline. Upon completion of mining in this area, the dragline will be moved to the J-19 area.

The N-99 coal resource area is adjacent to the N-11 coal resource area. Coal reserves in the N-99 area are an extension of the N-11 reserve. The Brown and Orange seams will be mined in the N-99 area beginning in 2005. Primary overburden removal will initially be performed by the Marion 8200 dragline.

Coal Resource Protection

Mining on the Black Mesa involves extraction of nonconcentrated, multiple coal seams having varying overburden depths and innerburden thicknesses. This situation is clearly discernable by examining the cross sections found in Chapter 25. Coal seams split, change to burned coal, and pinch out in very short distances. The initial choice of mining equipment type and size was based upon the type of mining conditions (i.e., area mining in an area with highly changing surface elevations), production requirements, the life of the mining operation, types and thicknesses of overburden and parting, local and regional dip, and thickness of coal seams. Experience in mining on the Black Mesa has resulted in the current mix of major excavators and support equipment and in highly efficient and effective coal removal. Auxiliary equipment has been carefully matched to primary excavators and their capabilities. Mining activities are conducted to maximize the recovery of coal while maintaining environmental integrity. Based upon geological conditions and the mix of excavation equipment on Black Mesa, PWCC has defined the maximum recovery depth to be 180 feet. In some conditions, it may be economical to extend the maximum recovery depth to approximately 220 feet; however, this is evaluated by PWCC's engineering department on a site-by-site basis.

During reserve development, all the coal encountered during bore hole drilling is recorded. The correlatable and estimated mineable seams are cored and analyzed regardless of seam thickness. These data are utilized to finally determine mineable reserves. The quality of thin seams as well as their occurrence in the geologic column is considered when determining whether the seam is mineable or nonmineable. Because of the varying conditions encountered on the Black Mesa, it is impossible to specify precise criteria relating to coal recovery in all mining areas. The Bureau of Land Management (BLM) receives copies of PWCC's new drilling data after the drilling is completed. In addition, BLM receives an Annual Mining Activities Report each year, summarizing the mining activities for each mine.

Experience in mining the Black Mesa coal seams has allowed PWCC to formulate certain general guidelines regarding coal recovery. In general, when a single thin seam is first to occur below the surface, the guideline PWCC uses is that the seam must average at least three feet in thickness to be considered mineable. If a thin seam occurs lower in the mining zone, then the seam must average at least two feet in thickness and have a maximum innerburden to coal ratio of 3:1 to be considered mineable. Thin seams, which have high ash or sulfur content, may be considered nonmineable due to contract quality constraints. Due to the above constraints and conditions encountered during coal loading operations, the amount of coal not being recovered is shown in Table 20. The outermost mineable limit is shown on the Mine Plan Map (Drawing No. 85210, Sheets 1, 2, 3, and 4 of 4). PWCC will utilize surface mining methods to maximize the utilization and conservation of the coal, while utilizing the best appropriate technology currently available to maintain environmental integrity so that reaffecting the land in the future through surface coal mining operations is minimized.

As PWCC's mining professionals receive and evaluate exploration drilling and geological data, they determine the geologic limit of the coal reserves. Once the geologic limit of the coal resources area is determined, they must develop a mine plan that applies the economical, market, operational, environmental, and regulatory constraints to the geologic limits to obtain the mineable limits. In some areas, the geologic limit may match the mineable limits, in other areas, the mineable limit may be inside the geologic limit of the coal resource area. The mining professionals continually evaluate the above constraints as they receive new information and they evaluate the coal recovery guidelines to determine the current mineable limits for each coal resource area. Following are some examples of conditions, which may cause a revision to the mining limits of a coal resource area:

- More exploration drilling has been completed and geological data has been reviewed since the previous mine plan and PWCC has better defined the mineable coal reserves.
- PWCC has refined the mineable limits giving consideration to environmental constraints such as sediment control, buffer zones, topsoil stockpiles, and support facility locations.
- PWCC has reconfigured some of the pits for operational reasons (i.e., greater pit length, balanced ratios and haulage distances, and/or a revised equipment mix or mining technique, etc.).
- The coal market has changed due to the Clean Air Act, electrical deregulation, competition from other sources of electrical generation, and other market and regulatory conditions, causing re-evaluation of what is marketable coal.

In conclusion, none of these changes has isolated coal from future recovery as economics and/or technology may continue to change and the coal recovery is maximized. The resulting outermost mineable limit is shown on the Mine Plan Map, Drawing No. 85210. The mineable limits may be revised on Drawing No. 85210 with the submittal and approval of a PWCC permit revision by the appropriate federal and tribal agencies.

During overburden removal, the width of the pits is designed based upon the machine performing the excavation. This prevents pits from becoming too wide resulting in spoil material being placed on uncovered coal. Sloughing of spoil material onto uncovered coal occurs infrequently because of the nature of the overburden and parting material and lack of moisture on Black Mesa. If sloughing does occur, auxiliary equipment is utilized to remove the spoil material so that the coal can be removed and coal fenders are minimized. Negligible amounts of coal are lost during the Black Mesa operations because of either of these two conditions. Further, it is in the operators best interest to recover the maximum amount of coal possible one the overburden has been removed and the coal seam exposed.

The number of tons of coal produced per acre-foot (TPAF) can measure the efficiency of the mining operations. Based on drill hole data regarding seam thickness and extent and laboratory analysis of specific gravity (1.30), in place reserves are estimated to be 1,743 tons per acre foot. Actual production is calculated monthly using scale measurements and stockpile fluctuations. This production is applied through the use of monthly aerial and GPS surveys to the area where coal was actually removed to produce the TPAF recovered for each month. The historical average recovery for the Black Mesa and Kayenta Mines is approximately 86.0 and 87.0 percent, respectively, for surface mining methods. Mined tonnage is, therefore, estimated at 1,520, and 1,530 TPAF, respectively. These recoveries are well within industry standards (Wood, 1983). For estimating purposes, the mine plan assumed an optimistic 87.8 percent average coal recovery (see Table 20).

The "Coal Loss During Mining" given in Table 20 was estimated using the historical average recovery factors discussed above. Coal loss can occur due to a dragline or auxiliary equipment removing some coal while uncovering the seams, removal of some coal during coal cleaning prior to coal loading, sloughing of spoil, mining inside curves, and placement of spoil on coal during mining which form ribs or fenders. Each of these losses are factored into the recovery factors. These losses appear more significant in multi-seam operations due to the fact that there are several coal seams to uncover and clean before loading. Peabody will continue to minimize such loss through efficient stripping and loading operations.

The “Burial/Cultural Site Avoidance” listed in Table 20 was estimated using the historical average recovery factors discussed above. The tonnage listed is included in the sum of the “Total In-Place Geologic Reserves” category.

In accordance with the requirements of 816.57 and 816.59, PWCC will obtain approval to recover coal to the coal cropline in the J-19 coal reserve area in the Red Peak Valley Wash stream buffer zone area and to allow surface mining activities in the Red Peak Valley Wash to the limits shown on Drawing 85360, (SE Sheet), and Drawing 85642A, (SE Sheet). This will allow the maximum recovery of coal as required in 816.59 while obtaining the specific approval required in 816.57. The thin alluvium in this section of Red Peak Valley Wash is normally dry except during a precipitation-induced runoff event based on 20 years of hydrologic monitoring. The scoured channel bottom with little perennial vegetation displays characteristics associated with high intensity-short duration thunderstorms or runoff from significant snowfall events. There are no sections within this reach wherein steam baseflow occurs. Vegetation in the channel is characteristic of upland sagebrush and pinyon-juniper habitats that predominate adjacent to either side of the wash. Threatened and endangered (T & E) species for the J-19 West area including Red Peak Valley Wash were addressed in an attachment to the February 19, 2002 transmittal letter. A site-specific reconnaissance of Red Peak Valley Wash on July 25, 2002 confirmed the earlier results that no T & E species were found nor was suitable habitat present. The J7-Jr MSHA Dam captures, contains, and controls all surface water runoff, including entrained sediment, from upper Red Peak Valley Wash.

Therefore, this surface mining activity will not cause or contribute to the violations of applicable Federal water quality standards, and will not adversely affect the water quantity and quality or other environmental resources of this section of Red Peak Valley Wash.

Chapter 22, Minesoil Reconstruction, presented in Volume 11, provides for the placement of plant growth media over material determined to be unsuitable for the establishment of vegetation. This process will also protect coal seams exposed in the upper portion of reclaimed highwalls and assure all acid-forming, toxic-forming, and combustible materials exposed, used, or produced during mining will be adequately covered. All non-coal mine waste material will be disposed of in accordance with the Solid Waste Disposal Plan in Chapter 6.

When exposed coal seams occur in the lower portion of the final highwall, backfill material at the seam locations will be of noncombustible material placed in a manner to provide at least four feet of covering. Reclaimed highwalls shall be monitored visually on a quarterly basis to identify any evidence of burning coal. Should evidence indicate coal seams are burning, PWCC shall excavate, extinguish, and backfill to the extent practicable, the burning portion of the coal seam.

Coal fires may also occur in the mined cut and adjacent spoil, and at coal handling facilities. It is in PWCC's best interest to control fires and prevent loss of the coal resource. Burning coal in these areas will be extinguished under the supervision of a qualified and certified MSHA "Green Card" Surface Certified Supervisor in accordance with 30 CFR, 816.87, by removing and mixing the burning material with noncombustible material to the extent practicable or burial with at least four feet of noncombustible material, if appropriate. Water may be utilized to extinguish coal fires near coal handling facilities where the burning coal can be isolated. Fires, which occur in nonrecoverable coal seams, which are exposed in the highwall, will be extinguished as described above if the seam is reachable by support equipment in the pit. If not reachable, the fire will be extinguished in the overburden removal process.

Within 48 hours of its discovery, PWCC shall commence efforts to extinguish any coal-related fire that could affect the amount of recoverable coal. If the fire is not extinguished within 96 hours after its discovery, PWCC shall notify BLM of that fact by telephone within that period. Within 48 hours of such telephone notice, PWCC shall submit to BLM a written report describing the extent of the fire, its exact location, the amount of recoverable coal affected, and any other relevant information.

Within 48 hours of any extraordinary or unusual event other than those specified in the preceding paragraph that causes a loss of recoverable coal (e.g., highwall failure), PWCC shall notify BLM of that event by telephone. Within 48 hours of such telephone notice, PWCC shall submit to BLM a written report describing the event, its exact location, the amount of recoverable coal affected, and any other relevant information.

Literature Cited

Wood, G.H., et al. "Coal Resource Classification System of the U.S. Geological Survey". U.S. Geological Survey Circular 891, pp. 28-29. 1983.

Workman, J.L. and Calder, P.N. 1994. "Effective Operation of Mines Using Draglines". Calder & Workman, Inc. Washburn, North Dakota.

CHAPTER 6

FACILITIES

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