Quintette Coal Limited

QUINTETTE PROJECT

PRELIMINARY

FEASIBILITY

REPORT

1975

Volume IV

Kilborn

QUINTETTE COAL LIMITED

VOLUME IV

PARTNERS FEASIBILITY STUDY

FOR

5,000,000 M.T.P.Y. COAL DEVELOPMENT

NOVEMBER 1975

KILBORN LIMITED

CONSULTING ENGINEERS

VOLUME IV

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1.0 INTRODUCTION

This volume contains the Operating and Capital Cost Summaries for three alternate plant configurations with their respective operational schedules.

Alternate No. 1 is the basic 4,500,000 MTPY configuration at the Babcock and Wolverine areas, on which the original investigation was carried out.

Alternate No. 2 is an adjustment to the original mining program and increases the Wolverine production to 2,000,000 MTPY to bring the total output to 5,000,000 MTPY.

Alternate No. 3 maintains the total output at 5,000,000 MTPY but modifies the start-up dates to bring the Wolverine area into production ahead of the Babcock area.

Included in this volume are some observations and comparisons of the three alternates, and recommendations for ongoing studies for the project development.

SEC. 2

2.0 CRITERIA

The following paragraphs give a summary of the criteria used in the investigation to develop the cost estimates.

2.1 PRODUCTION REQUIREMENTS

The individual mine production schedules were developed from data given for each alternate by Quintette Coal Limited, and are indicated numerically and graphically in this volume, parts 3, 4 and 5 respectively.

2.2 PLANT AND EQUIPMENT SIZING

The flowsheets and equipment sizing were developed in co-operation with Quintette Coal Limited, Mitsui Mining Co. Ltd. and World Resources Co. Ltd. The criteria were reviewed with respect to the experience of current mining operations in similar areas and refined where necessary with data supplied by major equipment suppliers currently active in this field.

Details of the criteria are provided in the appropriate sections of the report.

2.3 LABOUR FORCE

The basic organization chart for the work force was supplied by Quintette Coal Limited, and expanded to conform with data supplied by Mitsui Mining Co. Ltd. and the known labour requirements of similar currently operating organizations.

The labour rates are comparable to existing Union agreements valid as of October 31, 1975, for a similar coal operation in the area.

2.4 CORPORATE COSTS

Corporate costs were given by Quintette Coal Limited, and include such items as licensing fees, marketing fees, royalties, etc.

2.5 TAXES

Allowances have been made in the cost estimates as follows:

Federal Sales Tax - 5% on non-production material, supplies and equipment.
- Production equipment tax exempt.

B.C. Provincial Tax - 5% on all items.

2.6 FINANCE AND INTEREST CHARGES

Allowances have been made for interest and finance charges on 75% of the project cost at the rate of 12% per annum.

No interest or finance charges were applied to the 25% Equity portion of the project cost.

2.7 CONTINGENCY

A contingency allowance of 10% was applied to the installed costs.

2.8 ESCALATION

All costs were generated using the basis of 1975 dollar values. Escalation allowances at 10% per annum were included on each yearly expenditure, as follows:

1976	-	10%
1977	-	20%
1978	-	30%
1979	-	40%
1980	-	50%
1981	-	60%

2.9 TOWNSITE

Estimated costs for the townsite were developed on the basis of approximately 1250 direct employees. A lower unit cost was applied for incremental increase in labour force after the establishment of the primary townsite.

Allowances were included for all utilities and services, construction camp construction and operation, and temporary construction facilities.

2.10 PORT FACILITIES

Cost estimates included in this report for the Port construction and operation were prepared by Swan Wooster, Consulting Engineers, Vancouver, and submitted as a separate report (refer to Volume III).

2.11 POWER SUPPLY

Estimated costs for the power supply lines were given by British Columbia Hydro and Power Authority (refer to Volume III).

2.12 RAILWAY

Estimated costs for the railway line construction and transportation equipment were prepared by the British Columbia Railway (refer to Volume III).

3.0 ALTERNATE NO. 1

3.1 CAPITAL COST SUMMARY

Pre-Production Capital Cost

The estimated total capital cost for the development of the Quintette Project at a rated capacity of 4.5 million MTPY to December 31, 1981, is as follows:

Description	Amount	Total
BABCOCK MINE		
Open Pits - Windy Area	$22,010,000	
Underground Mine No.1 (Flat)	73,449,000	
Surface Plant	76,148,000	$171,607,000
WOLVERINE MINE		
Open Pits	20,396,000	
Surface Plant	35,700,000	56,096,000
TOWNSITE		65,000,000
OFF-SITE FACILITIES		
Access Roads	8,600,000	
Power Supply	8,550,000	
Railroad - Construction	62,125,000	
- Equipment	45,890,000	
Port Facilities - Prince Rupert	42,600,000	167,765,000
PROJECT OVERHEADS		28,891,000
Sub-Total		$489,359,000
CONTINGENCY		48,941,000
ESCALATION		206,100,000
Sub-Total		$744,400,000
NET CREDIT FOR COAL SALES		143,750,000
Total		600,650,000
ALLOWANCE - INTEREST AND FINANCING		133,433,000
TOTAL		$734,083,000

The forecast annual expenditure during the preproduction period is indicated on Table 3-1.

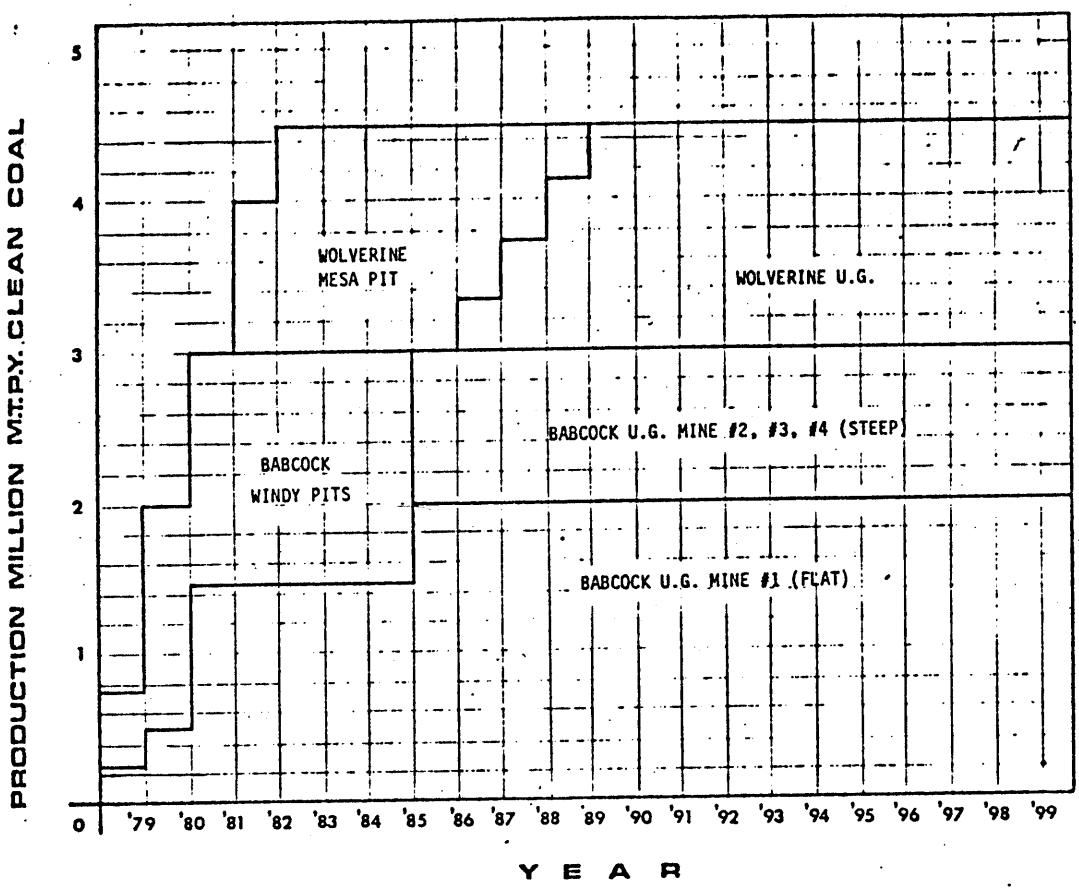
The estimate of cost is complete and includes the related mining costs to develop the Babcock Plant at a rated capacity of 3.0 million MTPY by October 1, 1979 and the Wolverine Plant at 1.5 million MTPY by December 1981. The mine development required to sustain the plant operation is indicated in Fig. 3-1.

The summary details of the capital cost estimate are in Appendix A of Volume II.

The criteria on which the estimate is based are as follows:

- 1975 - 3rd quarter prices with escalation at 10% per annum.
- Complete cost for all infrastructures including
  - . access roads
  - . power supply line
  - . railway construction
  - . railway equipment
  - . port facilities at Prince Rupert.
- Net allowance of $25/tonne for coal produced and shipped during the period.
- Allowance for Owner's overhead costs including the following:

Inventory and spare parts	$3,000,000
Working Capital, plant start-up	$2,000,000
Staff Recruitment	$2,000,000



PRODUCTION - CLEAN COAL (THOUSAND METRIC TONS)

BABCOCK MINES	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
WINDY PITS	500	1500	1500	——	——	——	1500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,500
U.G.MINE #1	250	500	1500	——	——	——	1500	2000	——	——	——	——	——	——	——	——	——	——	——	——	2000	36,250
U.G.MINE #2, #3, #4(STEEP)								1000	——	——	——	——	——	——	——	——	——	——	——	——	1000	14,000
SUB-TOTAL	750	2000	3000	3000	3000	3000	3000	3000	——	——	——	——	——	——	——	——	——	——	——	——	3000	59,750
WOLVERINE MINES																						
MESA PIT				1000	1500	——	——	1500	1125	750	375	-	-	-	-	-	-	-	-	-	-	9,250
UNDERGROUND									375	750	1125	1500	——	——	——	——	——	——	——	——	1500	17,250
TOTAL	750	2000	3000	4000	4500	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	4500	86,250

ASSUMPTIONS:

Babcock Plant - 3.0 MTPY - Start-up October 1, 1979

Wolverine Plant - 1.5 MTPY - Start-up January 1, 1982

Construction Authorization - January 1, 1977

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QUINTETTE PROJECT
MINE PRODUCTION
ALTERNATE 1
FIGURE 3.1

TABLE 3-1

QUINTETTE COAL LIMITED

ALTERNATE NO. 1

FORECAST OF EXPENDITURES PRE-PRODUCTION

Description	Total	1976	1977	1978	1979	1980	1981
BABCOCK MINE							
Open Pits - Windy Area	22,010		6,551	6,551	8,908		
U/G Mine No. 1 (Flat)	73,449		9,650	17,091	19,895	19,013	7,800
Surface Plant	76,148	1,000	20,000	30,000	25,148		
Sub-Total	171,607	1,000	36,201	53,642	53,951	19,013	7,800
WOLVERINE MINE							
Open Pits	20,396				4,000	6,000	10,396
Surface Plant	35,700					15,000	20,700
Sub-Total	56,096				4,000	21,000	31,096
TOWNSITE	65,000		5,000	10,000	13,000	21,000	16,000
OFF-SITE FACILITIES							
Access Roads	8,600	500	4,100	2,000	1,000	1,000	
Power Supply	8,550		2,250	4,150	1,150	500	500
Railroad - Const.	62,125	2,000	10,000	20,000	24,000	3,000	3,125
- Equip.	45,890		5,000	11,000	14,600	3,500	11,790
Port Facilities	42,600	600	8,000	16,000	18,000		
Sub-Total	167,765	3,100	29,350	53,150	58,750	8,000	15,415
PROJECT OVERHEADS (1)	28,891	7,600	2,000	3,000	12,291	1,500	2,500
Total	489,359	11,700	72,551	119,792	141,992	70,513	72,811
CONTINGENCY	48,941	1,200	7,200	12,000	14,200	7,100	7,241
Total	538,300	12,900	79,751	131,792	156,192	77,613	80,052
ESCALATION	206,100	1,300	16,000	39,500	62,500	38,800	48,000
Total	744,100	14,200	95,751	171,292	218,692	116,413	128,052
NET CREDIT FOR COAL SALES	143,750				18,750	50,000	75,000
Total	600,650	14,200	95,751	171,292	199,942	66,413	53,052
INTEREST AND FINANCE	133,433	-	-	3,426	25,472	45,590	58,945
TOTAL (YEARLY)	734,083	14,200	95,751	174,718	225,414	112,003	111,997
TOTAL (CUMULATIVE)			109,951	284,669	510,083	622,086	734,083

(1) Includes allowance of $2,000,000 for working capital.

Post-Production Capital Cost

Indicated in Table 3-2 is the estimated on-going capital expenditure required to sustain a clean coal output of 4.5 million MTPY to 1999. In the case of the Babcock development, the production from the Underground Mines 2, 3 and 4 is to commence in 1984 at which time the production from the open pit is assumed to be complete.

In the case of the Wolverine development, the production from the underground mines is to commence in 1987 when production from the open pit mines is assumed to decrease.

Included in the estimate of post start-up capital expenditures is a nominal annual allowance for capital expenditures for the surface plant.

The forecast total capital expenditure from 1982 to 1999 is

Babcock Development	$ 91,805,000
Wolverine Development	$ 69,600,000
Total	$156,905,000

TABLE 3-2

ALTERNATE NO. 1

ESTIMATE OF POST PRODUCTION CAPITAL EXPENDITURE ($'000)

	BABCOCK MINES				WOLVERINE			TOTAL
Year	Open Pits	U/G #1 (Flat)	U/G #2 (Steep)	Surface Plant	Open Pits	Under-ground	Surface Plant	
1982	-	7,705	-	1,000			500	9,205
83	-	500	15,900	500			300	17,200
84	-	500	15,800	1,000			300	17,600
85	-	500	11,000	500			300	12,300
86	-	500	11,000	500		5,000	300	17,300
87	(5,000)	500	9,600	500		10,000	300	15,900
88	-	500	2,400	500		15,000	300	18,700
89	-	500	500	1,000	(5,000)	15,000	300	12,300
1990	-	500	700	500		15,000	300	17,000
91	-	500	300	500		500	300	2,100
92	-	500	300	500		500	300	2,100
93	-	500	300	500		500	300	2,100
94	-	500	300	1,000		500	300	2,600
95	-	500	300	500		500	300	2,100
96	-	500	300	500		500	300	2,100
97	-	500	300	500		500	300	2,100
98	-	500	300	500		500	300	2,100
99	-	500	300	500		500	300	2,100
TOTAL	(5,000)	16,205	69,600	11,000	(5,000)	64,500	5,600	156,905

3.2 OPERATING COST SUMMARY

The estimated operating cost for the project, based on production of 4.5 million MTPY of clean coal, is as follows:

		Annual Cost	Cost/Tonne
Corporate Overhead		$ 2,186,000	$ 0.486
Plant Administration			
Babcock	$2,171,260)		
Wolverine	$ 483,200)	2,800,000	0.622
Preparation Plant			
Babcock	$8,876,000)		
Wolverine	$4,554,000)	13,430,000	2.99
		$18,416,000	
Mining			
Estimated average		49,500,000	11.000
Transportation		65,160,000	14.480
Port Operating		2,250,000	0.500
TOTAL		$135,326,000	$30.08/tonne

OPERATING COST SUMMARY - BABCOCK OPERATIONS

Description	Annual Cost		3 MMTPY
Quintette Corporate Cost	$ 1,375,000		$0.46
Plant Administration	2,171,800		0.72
Preparation Plant	$ 8,876,000		$2.96
		1.5 M-MTPY	
U/G Mining	$15,541,000	$10.36	
Open Pit Mining	$16,335,000	10.89	
Sub-Total Mining	$31,875,000		$10.63
Transportation	$43,434,000		14.48
Port Operating	$ 1,500,000		0.50
TOTAL	$89,232,800		$29.75

The above figures were developed during the course of the preliminary study, and are substantiated in the details accompanying the report.

These figures were used as the basis for proportioning all values included in the preceding overall summary for the Wolverine operations.

The estimate is based on 1975 costs.

The allowance for corporate overhead has been provided by Quintette Coal Limited.

The estimate for transportation cost has been assumed as $0.019 per tonne mile.

Other costs have been developed by principals with a background knowledge and experience of current coal mining operations in Western Canada.

The mining costs per ton of clean coal are dependent on the production of the respective mines. The average estimated costs are as follows:

Babcock	
Windy Pits	$10.89
Underground Mine No.1 (Flat Area)	$10.36
Underground Mines Nos.2, 3 & 4 (allowance)	$14.58
Wolverine	
Sheriff Open Pit	$10.89
Underground	$10.36

SEC. 4

4.0 ALTERNATE NO. 2

4.1 CAPITAL COST SUMMARY

Pre-Production Capital Cost

The estimated total capital cost for the development of the Quintette Project at a rated capacity of 5.0 million MTPY to December 31, 1981, is as follows:

Description	Amount	Total
BABCOCK MINE		
Open Pits - Windy	$16,300,000	
- Roman Mountain	18,400,000	
Underground Mine No.1	9,600,000	
Nos.2 & 3	17,590,000	
Surface Plant	76,148,000	$138,088,000
WOLVERINE MINE		
Open Pits	30,664,000	
Surface Plant	50,000,000	80,664,000
TOWNSITE		68,400,000
OFF-SITE FACILITIES		
Access Roads	8,600,000	
Power Supply	8,550,000	
Railroad - Construction	62,125,000	
- Equipment	51,000,000	
Port Facilities - Prince Rupert	42,600,000	172,875,000
PROJECT OVERHEADS		30,000,000
Sub-Total		$490,027,000
CONTINGENCY		49,000,000
ESCALATION		213,800,000
Sub-Total		$752,827,000
NET CREDIT FOR COAL SALES		143,750,000
Total		609,077,000
ALLOWANCE - INTEREST AND FINANCING		123,340,000
TOTAL		$732,417,000

The forecast annual expenditure during the preproduction period is indicated on Table 4-1.

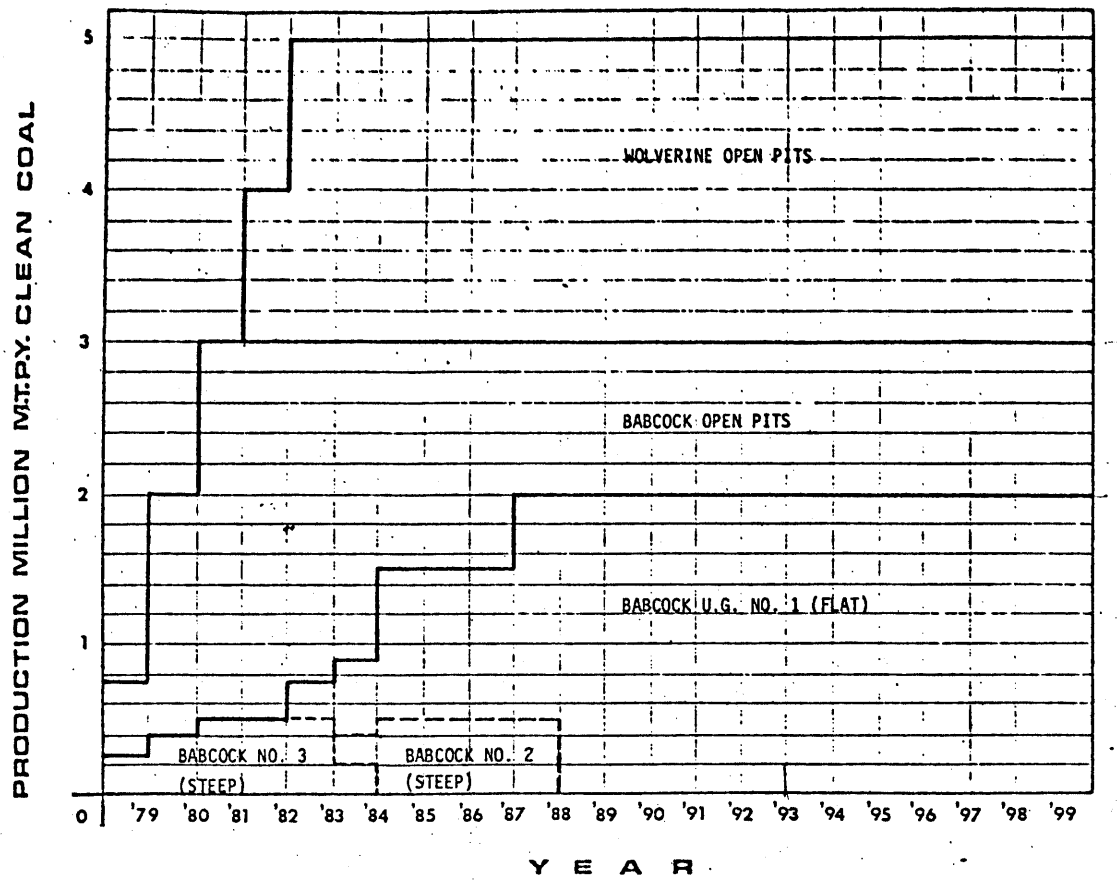
The estimate of cost is complete and includes the related mining costs to develop the Babcock Plant at a rated capacity of 3.0 million MTPY by October 1, 1979 and the Wolverine Plant at 2.0 million MTPY by December 1981. The mine development required to sustain the plant operation is indicated in Fig. 4-1.

The summary details of the capital cost estimate are proportioned from Alternate No. 1 given in Appendix A of Volume II.

The criteria on which the estimate is based are as follows:

- 1975 - 3rd quarter prices with escalation at 10% per annum.
- Complete cost for all infrastructures including
  - . access roads
  - . power supply line
  - . railway construction
  - . railway equipment
  - . port facilities at Prince Rupert.
- Net allowance of $25/tonne for coal produced and shipped during the period.
- Allowance for Owner's overhead costs including the following:

Inventory and spare parts	$3,000,000
Working Capital, plant start-up	$2,000,000
Staff Recruitment	$2,000,000



PRODUCTION

BABCOCK MINES	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
U.G.NO. 1					250	500	1000	1000	1000	1500	2000										200	27,250
U.G.NO. 3	250	400	500	500	500	200																2,350
U.G.NO. 2						200	500	500	500	500												2,200
O.P.WINDY	500	800	1500	1200	700	700	700	700	700	200												7,700
O.P.ROMAN	-	800	1000	1300	1550	1400	800	800	800	800	1000										1000	20,250
WOLVERINE MINES																						
O.P.SHERIFF				1000	2000																2000	35,000
TOTAL	750	2000	3000	4000	5000																5000	94,750

ASSUMPTIONS:

Babcock Plant - 3,000,000 MTPY - Start-up October 1, 1979
Wolverine Plant - 2,000,000 MTPY - Start-up January 1, 1982
Construction Authorization - January 1st, 1977

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QUINTETTE PROJECT
MINE PRODUCTION
ALTERNATE 2
FIGURE 4.1

TABLE 4-1

QUINTETTE COAL LIMITED

ALTERNATE NO. 2

FORECAST OF EXPENDITURES PRE-PRODUCTION ($'000)

Description	Total	1976	1977	1978	1979	1980	1981
BABCOCK MINE							
Open Pits - Windy Area	16,300		4,890	4,890	6,520		
- Roman Mtn.	18,400			5,520	5,520	7,360	
U/G Mine No. 1 (Flat)	9,650						9,650
Nos.2 & 3	17,590			4,000	10,250	3,340	
Surface Plant	76,148	1,000	20,000	30,000	25,148		
Sub-Total	138,088	1,000	24,890	44,410	47,438	10,700	9,650
WOLVERINE MINE							
Open Pits	30,664			2,656	6,170	11,018	10,820
Surface Plant	50,000					21,000	29,000
Sub-Total	80,664			2,656	6,170	32,018	39,820
TOWNSITE	68,400		5,000	10,000	13,000	26,000	14,400
OFF-SITE FACILITIES							
Access Roads	8,600	500	4,100	2,000	1,000	1,000	
Power Supply	8,550		2,250	4,150	1,150	500	500
Railroad - Const.	62,125	2,000	10,000	20,000	24,000	3,000	3,125
- Equip.	51,000		5,000	11,000	14,600	3,525	16,875
Port Facilities	42,600	600	8,000	16,000	18,000		
Sub-Total	172,875	3,100	29,350	53,150	58,750	8,025	20,500
PROJECT OVERHEADS (1)	30,000	7,600	2,000	3,000	12,000	3,000	2,400
Total	490,027	11,700	61,240	113,216	137,358	79,743	86,770
CONTINGENCY	49,000	1,200	6,100	11,300	13,700	8,800	8,700
Total	539,027	12,900	67,340	124,516	151,058	87,743	95,470
ESCALATION	213,800	1,300	13,500	37,400	60,400	43,900	57,300
Total	752,827	14,200	80,840	161,916	211,458	131,643	152,770
NET CREDIT FOR COAL SALES	143,750				18,750	50,000	75,000
Total	609,077	14,200	80,840	161,916	192,708	81,643	77,770
INTEREST AND FINANCE	123,340	-	-	2,067	21,838	42,591	57,434
TOTAL (YEARLY)	732,417	14,200	80,840	163,983	214,546	123,644	135,204
TOTAL (CUMULATIVE)			95,040	259,023	473,569	591,213	732,417

(1) Includes allowance of $2,000,000 for working capital.

Post-Production Capital Cost

Indicated in Table 4-2 is the estimated on-going capital expenditure required to sustain a clean coal output of 5.0 million MTPY to 1999. In the case of the Babcock development, the production from the Underground Mines 2 and 3 is to commence in 1979.

In the case of the Wolverine development, the production from the open pit mines is to commence at 1,000,000 tonnes in 1982 and increase to 2,000,000 tonnes in 1983.

Included in the estimate of post start-up capital expenditures is a nominal annual allowance for capital expenditures for the surface plants.

The forecast total capital expenditure from 1982 to 1999 is

Babcock Development	$115,860,000
Wolverine Development	$ 51,696,000
Total	$167,556,000

TABLE 4-2

ALTERNATE NO. 2

ESTIMATE OF POST PRODUCTION CAPITAL EXPENDITURE ($'000)

	BABCOCK MINES					WOLVERINE		TOTAL
	Open Pits		Underground		Surface	Open	Surface	
Year	Windy	Roman	No.1	No.2 & 3	Plant	Pit	Plant	
1982	-	-	16,591	4,000	500	8,396	500	29,987
83	-	-	19,495	6,000	500		400	26,395
84	-	2,000	19,013	1,060	500		400	22,973
85	-	2,000	7,800		500		400	10,700
86	-	2,000	5,401		500	3,000	400	11,301
87	-	-	500		500	4,000	400	5,400
88	-	-	500		500	4,000	400	5,400
89	-	3,000	500		500		400	4,400
1990	-	3,000	500		500		400	4,400
91	-	3,000	500		500	4,000	400	8,400
92	-		500		500	5,000	400	6,400
93	-		500		500	5,000	400	6,400
94	-	2,000	500		500		400	3,400
95	-	2,000	500		500		400	3,400
96	-	2,000	500		500	3,000	400	6,400
97	-		500		500	4,000	400	5,400
98	-		500		500	4,000	400	5,400
99	-		500		500		400	1,400
TOTAL	-	21,000	74,800	11,060	9,000	44,396	7,300	167,556

4.2 OPERATING COST SUMMARY

The operating costs for Alternate No. 2 are assumed to be similar to Alternate No. 1 on a unit cost basis. Details of Alternate No. 1 operating costs are given in Appendix A of this volume.

To allow for the increase in Townsite requirements for the Wolverine employees, due to the increase in plant capacity, the following assumptions were made:

a) The Surface Plant employees remain the same as Alternate No. 1.

b) All supervisory staff will remain the same as Alternate No. 1.

c) The Open Pit hourly workers will increase in proportion to the increase in mine output

$$\text{i.e. } \frac{500{,}000}{1{,}500{,}000} \times 210 = 70 \text{ additional employees.}$$

The estimated operating cost for the project, based on production of 5.0 million MTPY of clean coal, is as follows:

		Annual Cost	Cost/Tonne
Corporate Overhead		$ 2,430,000	$ 0.486
Plant Administration			
Babcock	$2,171,260)		
Wolverine	$ 938,740)	3,110,000	0.622
Preparation Plant			
Babcock	$8,876,000)		
Wolverine	$6,092,000)	14,918,000	2.980
		$20,508,000	
Mining			
Estimated average		55,000,000	11.000
Transportation		72,400,000	14.480
Port Operating		2,500,000	0.500
TOTAL		$150,408,000	$30.08/tonne

4.3 OBSERVATIONS ON CAPITAL AND OPERATING COSTS

Open Pit Mining

The capital and operating costs for open pit mining were developed based on the assumed strip ratio included in the Dames and Moore report dated October 1975. This report was prepared based on preliminary geological information available for the Windy and Roman Mountain Pits and assumptions on the extent of oxidized coal agreed to with Denison Mines (B.C.) Ltd. prior to completion of the 1975 drilling program.

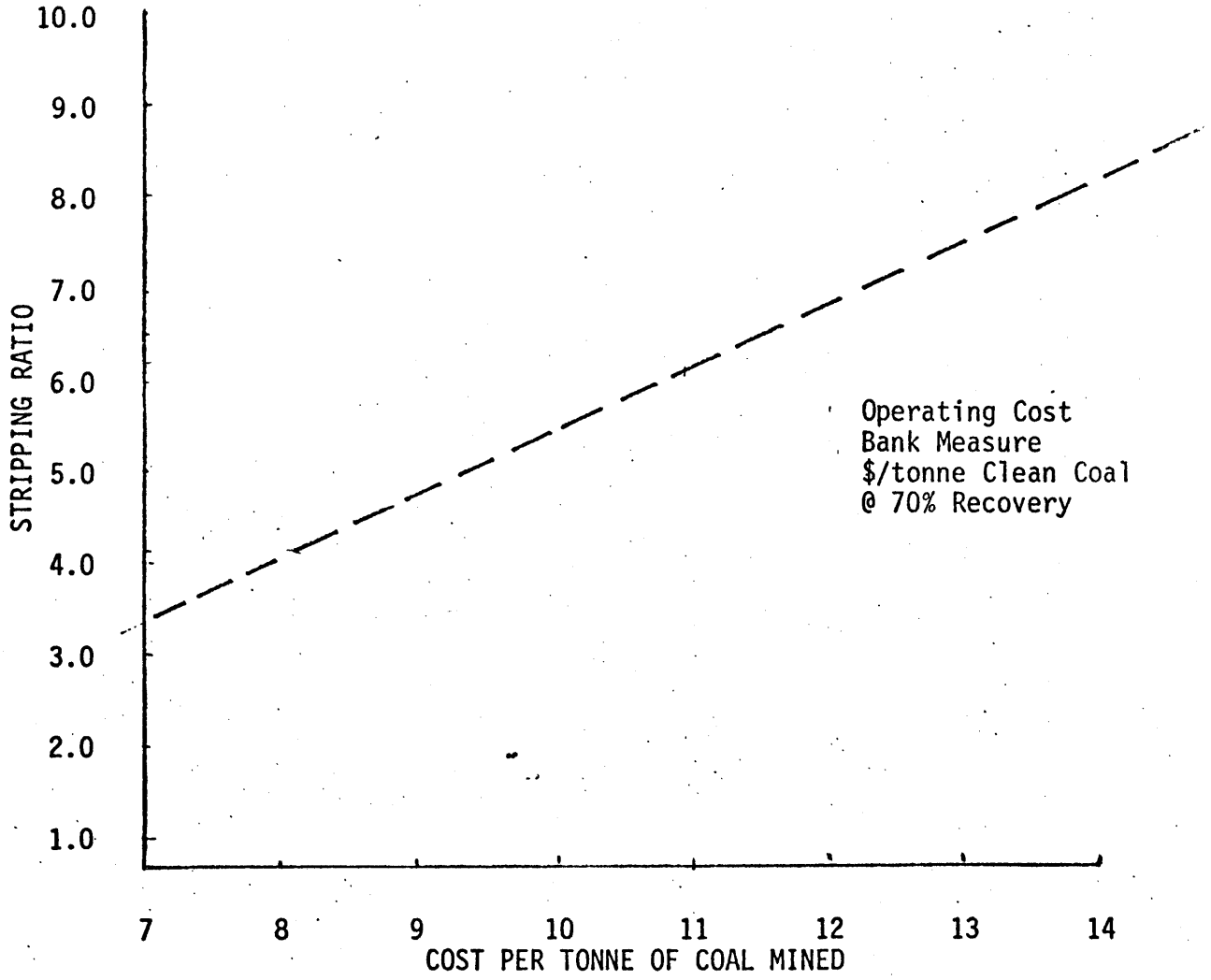
The final geological report on the 1975 exploration program is to be completed shortly. The information on coal reserves, stripping ratios and related information included in Section 1.0 of Volume II was submitted immediately prior to issuing this report. Some preliminary comments on the effect of this additional geological information on mine planning and capital and operating costs are included in this section.

Indicated in Fig. 4-2 is the estimated cost per tonne of clean coal derived for various stripping ratios based on the study for Windy Pit. The operating costs assumed for each pit were as follows:

	Strip Ratio[1] cu.m/tonne	Operating Cost Clean Coal
Windy Pit	6.2 6.14	$10.89/tonne
Roman Mountain Pit	4.0 5.91	8.00/tonne
Sheriff Pit	6.2 4.15	10.89/tonne

(1) Stripping Ratio is based on "bank" measure.

FIG. 4-2



Direct Cost $8.20/tonne Clean Coal for Stripping 6.2:1 (bank measure)
$1.13/tonne Clean Coal 70% recovery
$1.56/tonne General

Indicated in Table 4-3 attached is the estimated strip ratio for the various pits based on the 1975 exploration program.

The estimated coal reserves and mine operating cost based on Table 4-3 are as follows:

Location	Mineable Reserves ('000 tonnes) Coal	Dilution	Total	Strip Ratio (Note 1)	Operating Cost/tonne Clean Coal
Windy Pit	9,177	2,429	11,606	7.81	$12.30
Roman Mtn. Pit	18,634	2,523	21,157	5.62	9.50
Sheriff Pit	17,372	6,151	23,523	3.07	7.70
Frame Pit	26,307	4,155	30,462	9.71	14.70

(1) Strip ratio is "bank" measure

The estimate of capital cost for open pits in the Wolverine area was based on the study for the Windy Pit. Based on the above it is apparent that to develop 2.0 million MTPY operation in the Wolverine area both the Sheriff and Frame pits should be developed. The combined stripping ratio of the two pits is 6.8 to 1, which is very close to the 7.2 to 1 ratio assumed for the Windy Pit. In consideration of the preliminary nature of this study, no adjustment in capital expenditure for pit development has been made at this time.

TABLE 4-3

QUINTETTE PROJECT

ORE RESERVES AND STRIPPING RATIO

Pit Location	Total Volume	Volume			Volume Stripping	Coal - Mined Tonnes			Stripping Ratio		Estimated Clean Coal	Ratio of Coal
		Coal cu.m	Dilution cu.m	Total cu.m	(1)-(4)	Weight	Dilution	Total (6)+(7)	cu.m/ M.T.	cu.m(loose) M.T.	Res.90%(6)	Yield
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BABCOCK - Windy Pit	98,510	6,555	1,278	7,833	90,677	9,177	2,429	11,606	7.81	10.15	8,259	79%
- Roman Mtn.	133,578	13,317	1,335	14,652	118,926	18,644	2,537	21,181	5.62	7.31	16,771	88%
WOLVERINE - Sheriff	88,006	12,404	3,238	15,646	72,360	17,367	6,151	23,518	3.07	3.99	15,635	74%
- Frame	316,634	18,797	2,184	20,981	295,653	26,315	4,150	30,465	9.71	12.62	23,676	86%

NOTE: Based on preliminary information provided by Denison Mines (B.C) Ltd., November 1975.

5.0 ALTERNATE NO. 3

5.1 CAPITAL COST SUMMARY

Pre-Production Capital Cost

The estimated total capital cost for the development of the Quintette Project at a rated capacity of 5.0 million MTPY to December 31, 1980, is as follows:

Description	Amount	Total
BABCOCK MINE		
Open Pits - Windy	$16,300,000	
- Roman Mountain	11,040,000	
Underground Mine No.1	-	
Nos.2 & 3	14,250,000	
Surface Plant	76,148,000	$117,738,000
WOLVERINE MINE		
Open Pits	30,664,000	
Surface Plant	50,000,000	80,664,000
TOWNSITE		68,400,000
OFF-SITE FACILITIES		
Access Roads	8,600,000	
Power Supply	8,550,000	
Railroad - Construction	62,125,000	
- Equipment	51,000,000	
Port Facilities - Prince Rupert	42,600,000	172,875,000
PROJECT OVERHEADS		30,000,000
Sub-Total		$469,677,000
CONTINGENCY		47,000,000
ESCALATION		188,271,000
Sub-Total		$704,948,000
NET CREDIT FOR COAL SALES		68,750,000
Total		636,198,000
ALLOWANCE - INTEREST AND FINANCING		85,141,000
TOTAL		$721,339,000

The forecast annual expenditure during the preproduction period is indicated on Table 5-1.

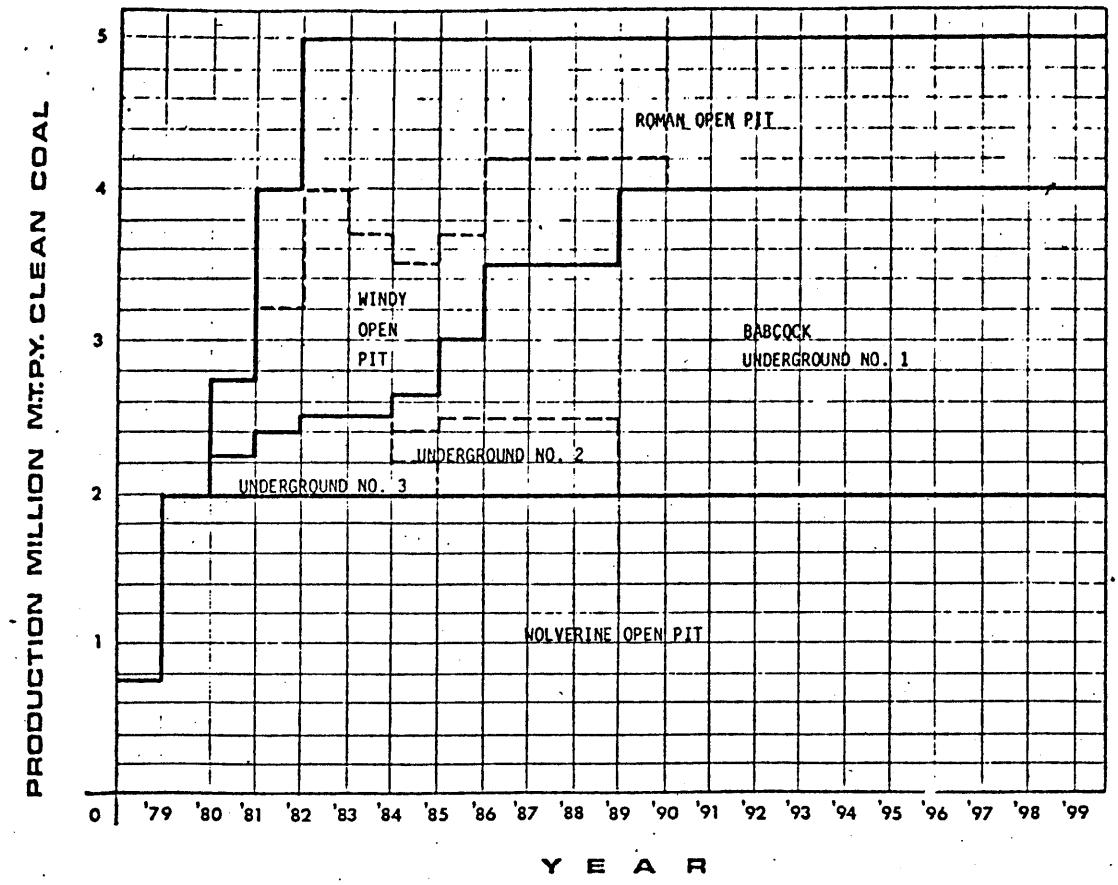
The estimate of cost is complete and includes the related mining costs to develop the Babcock Plant at a rated capacity of 3.0 million MTPY by December 31, 1980 and the Wolverine Plant at 2.0 million MTPY by October 1979. The mine development required to sustain the plant operation is indicated in Fig. 5-1.

The summary details of the capital cost estimate are proportioned from Alternate No. 1 given in Appendix A of Volume II.

The criteria on which the estimate is based are as follows:

- 1975 - 3rd quarter prices with escalation at 10% per annum.
- Complete cost for all infrastructures including
  - . access roads
  - . power supply line
  - . railway construction
  - . railway equipment
  - . port facilities at Prince Rupert.
- Net allowance of $25/tonne for coal produced and shipped during the period.
- Allowance for Owner's overhead costs including the following:

Inventory and spare parts	$3,000,000
Working Capital, plant start-up	$2,000,000
Staff Recruitment	$2,000,000



PRODUCTION

BABCOCK MINES	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
U.G. No. 1							250	500	1000	1000	1000	2000	2000									23,750
U.G. No. 3			250	400	500	500	200															1,850
U.G. No. 2							200	500	500	500	500											2,200
O.P. Windy			500	800	1500	1200	800	700	700	700	700	200										7,800
O.P. Roman				800	1000	1300	1550	1300	800	800	800	800	1000									18,150
Sub-Total			750	2000	3000	3000	3000	3000	3000	3000	3000	3000	3000									53,750
WOLVERINE MINES																						
O.P. Sheriff	750	2000	2000																			40,750
TOTAL	750	2000	2750	4000	5000																	94,500

Assumptions

Babcock Plant - 3,000,000 MTPY - Start-up October 1980
Wolverine Plant - 2,000,000 MTPY - Start-up October 1979
Construction Authorization - January 1st, 1977

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QUINTETTE PROJECT
MINE PRODUCTION
ALTERNATE 3
FIGURE 5.1

TABLE 5-1

QUINTETTE COAL LIMITED

ALTERNATE NO. 3

FORECAST OF EXPENDITURES PRE-PRODUCTION ($'000)

Description	Total	1976	1977	1978	1979	1980
BABCOCK MINE						
Open Pits - Windy Area	16,300			4,890	4,890	6,520
- Roman Mtn.	11,040				5,520	5,520
U/G Mine No. 1 (Flat)	-					
Nos.2 & 3	14,250				4,000	10,250
Surface Plant	76,148		1,000	20,000	30,000	25,148
Sub-Total	117,738		1,000	24,890	44,410	47,438
WOLVERINE MINE						
Open Pits	30,664	2,656	6,170	11,018	10,820	
Surface Plant	50,000			21,000	29,000	
Sub-Total	80,664	2,656	6,170	32,018	39,820	
TOWNSITE	68,400		5,000	23,000	26,000	14,400
OFF-SITE FACILITIES						
Access Roads	8,600	500	4,100	2,000	1,000	1,000
Power Supply	8,550		2,250	4,150	1,150	1,000
Railroad - Const.	62,125	2,000	10,000	20,000	24,000	6,125
- Equip.	51,000		5,000	11,000	14,600	20,400
Port Facilities	42,600	600	8,000	16,000	18,000	
Sub-Total	172,875	3,100	29,350	53,150	58,750	28,525
PROJECT OVERHEADS (1)	30,000	7,600	2,000	3,000	12,000	5,400
Total	469,677	13,356	43,520	136,058	180,980	95,763
CONTINGENCY	47,000	1,300	4,300	13,700	18,100	9,600
Total	516,677	14,656	47,820	149,758	199,080	105,363
ESCALATION	188,271	1,466	9,564	44,927	79,632	52,682
Total	704,948	16,122	57,384	194,685	278,712	158,045
NET CREDIT FOR COAL SALES	68,750				18,750	50,000
Total	636,198	16,122	57,384	194,685	259,962	108,045
INTEREST AND FINANCE	85,141			2,427	27,921	54,793
TOTAL (YEARLY)	721,339	16,122	57,384	197,122	287,883	162,838
TOTAL (CUMULATIVE)			73,506	270,618	558,501	721,330

(1) Includes allowance of $2,000,000 for working capital.

Post-Production Capital Cost

Indicated in Table 5-2 is the estimated on-going capital expenditure required to sustain a clean coal output of 5.0 million MTPY to 1999. In the case of the Babcock development, the production from the Underground Mines 2 and 3 is to commence in 1981.

In the case of the Wolverine development, the production from the open pit mines is to commence at 1,000,000 tonnes in 1979 and increase to 2,000,000 tonnes by January 1980.

Included in the estimate of post start-up capital expenditures is a nominal annual allowance for capital expenditures for the surface plants.

The forecast total capital expenditure from 1982 to 1999 is

Babcock Development	$135,310,000
Wolverine Development	$ 43,600,000
Total	$178,910,000

TABLE 5-2

ALTERNATE NO. 3

ESTIMATE OF POST PRODUCTION CAPITAL EXPENDITURE ($'000)

	BABCOCK MINES					WOLVERINE		TOTAL
	Open Pits		Underground		Surface	Open	Surface	
Year	Windy	Roman	No.1	No.2 & 3	Plant	Pit	Plant	
1981	-	7,360		3,340			400	11,100
82	-		9,650				400	10,050
83	-		16,591	4,000	500		400	21,491
84	-		19,495	6,000	500	3,000	400	29,395
85	-	2,000	19,013	1,060	500	4,000	400	26,973
86	-	2,000	7,800		500	4,000	400	14,700
87	-	2,000	5,501		500		400	8,401
88	-		500		500		400	1,400
89	-		500		500	4,000	400	5,400
1990	-	3,000	500		500	5,000	400	9,400
91	-	3,000	500		500	5,000	400	9,400
92	-	3,000	500		500		400	4,400
93	-		500		500		400	1,400
94	-		500		500	3,000	400	4,400
95	-	2,000	500		500	4,000	400	7,400
96	-	2,000	500		500	4,000	400	7,400
97	-	2,000	500		500		400	3,400
98	-		500		500		400	1,400
99	-		500		500		400	1,400
TOTAL	-	28,360	84,050	14,400	8,500	36,000	7,600	178,910

CAPITAL COST DETAILS

Babcock Surface Plant

The capital cost details for the Babcock Surface Plant are the same as for Alternate No. 1. Refer to Volume II, Appendix A, for details.

Wolverine Surface Plant

The capital cost details for the Wolverine Surface Plant have been adjusted from the Alternate No. 1 figures to $50,000,000. This adjustment allows for the increase in plant capacity from 1,500,000 tonnes per year to 2,000,000 tonnes per year clean coal output.

Mining

Adjustments for the capital costs for the Babcock No. 1, 2 and 3, and the Windy and Roman Mountain pits are the same as in Alternate No. 2, ref. 4.1 this volume. Other costs are the same as Alternate No. 1 (refer to Volume II, Appendix A, for details).

Wolverine capital cost details are the same as Alternate No. 2 (refer to part 4.1 this volume).

5.2 OPERATING COST SUMMARY

The operating costs for Alternate No. 3 are assumed to be similar to Alternate No. 1 on a unit cost basis. Details of Alternate No. 1 operating costs are given in Appendix A of this volume.

To allow for the increase in Townsite requirements for the Wolverine employees, due to the increase in plant capacity, the following assumptions were made:

a) The Surface Plant employees remain the same as Alternate No. 1.

b) All supervisory staff will remain the same as Alternate No. 1.

c) The Open Pit hourly workers will increase in proportion to the increase in mine output

$$\text{i.e. } \frac{500{,}000}{1{,}500{,}000} \times 210 = 70 \text{ additional employees.}$$

The estimated operating cost for the project, based on production of 5.0 million MTPY of clean coal, is as follows:

		Annual Cost	Cost/Tonne
Corporate Overhead		$ 2,430,000	$ 0.486
Plant Administration			
Babcock Wolverine	$2,171,260) $ 938,740)	3,110,000	0.622
Preparation Plant			
Babcock Wolverine	$8,876,000) $6,092,000)	14,918,000	2.980
		$20,508,000	
Mining			
Estimated average		55,000,000	11.000
Transportation		72,400,000	14.480
Port Operating		2,500,000	0.500
TOTAL		$150,408,000	$30.08/tonne

6.0 OBSERVATIONS AND RECOMMENDATIONS

6.1 OBSERVATIONS

The following observations are submitted based on our preliminary study of the project and are subject to review pending receipt of the final report on the 1975 drilling program at the site and reports not received to date from B.C. Research, British Columbia Railway, and Price Waterhouse.

1. The forecast reserves for open pit coal are in excess of those assumed for Alternative No. 1.

2. The capital expenditure to develop open pit coal is less and the operating cost approximately equal as compared with coal obtained from underground mines.

3. The Babcock underground mines #2 and #3 (steep) have limited coal reserves, and have relatively high capital and operating cost. However, they require the shortest lead time to bring into production.

4. Based on information provided by Mitsui, the Babcock underground mine #1 can sustain an annual production of 2.0 million MTPY. Its development for hydraulic mining should be integrated with coal produced from open pits to maintain a 3.0 million MTPY output from the Babcock plant.

5. With the high capital cost of the project, investigations should continue to obtain all possible assistance and subsidy for the construction of the work, especially for the townsite and off-site facilities which have major secondary benefits.

6. Discussions should continue with British Columbia Railway and Canadian National Railways to obtain economical long term rate charges for coal transportation to Prince Rupert.

7. The present environmental studies in progress should be accelerated and expanded to include the related studies for the townsite, railway and port facilities.

8. The reserves of open pit coal from the Sheriff and Frame pits are sufficient to sustain an annual production of 2.0 million MTPY for the Wolverine Plant.

9. The routing of rail access to the Babcock plant should be verified with B.C.Rail to ensure acceptable grades.

10. On-going studies should be implemented to determine possible use and market for oxidized coal.

11. On-going studies should continue on possible use of coal, natural gas and other fuels for heating and power.

12. Other organizations have indicated a willingness to develop the port facilities at Prince Rupert with payment as an increased port operating cost. The alternative plans for port development should be actively pursued.

13. The development of the underground mines is predicated on an adequate supply of skilled manpower for the work. At present there is a shortage of skilled personnel for underground work, and it is difficult to obtain trainees for this class of work. Consequently, an extended program for the development of the Babcock underground mine No. 1 is advisable.

14. At present there are available personnel for open pit operations and in addition trainees are usually readily available.

15. The time allocated to complete financing and to apply for and to receive permits for the construction work to commence January 1, 1977, is one year.

16. Based on present information, a detailed drilling program should be implemented immediately to confirm the quality and extent of the coal in the Sheriff and Frame pits, and to provide information for specific pit design.

17. It is apparent from the exploration to date that the mineable reserves in the area will exceed the 20 year life assumed in the study.

18. The coal projects developed to date in Western Canada have encountered major problems in achieving scheduled production. A careful analysis is required of the experience to date on these projects to ensure that possible similar problems on the Quintette project are minimized and are allowed for in establishing production schedules for the work.

19. The climatic information available for the area is limited. Steps should be taken immediately with the Atmospheric Environment Service of the Department of the Environment to ascertain data for the specific area.

20. Prior to the final decision on the use of hydraulic mining for the Babcock Underground Mine No. 1, a careful assessment is required of the following:

- the problems and related costs in installing and maintaining the flumes at the desired slope
- the problems in ensuring the "flow" of coal produced by the monitors to the flumes.

6.2 RECOMMENDATIONS

1. That the drilling programs be expanded immediately to confirm the estimated open pit reserves, coal quality and quality, and to permit detailed open pit planning to proceed.

2. That a study proceed to assess the comparative economic cost for development of a single plant in the Murray River valley.

3. That the assistance of the government and other parties be obtained in financing and development of the townsite and off-site facilities.

4. That the parameters for the detailed capital cost study be established after a careful assessment of the observations and costs included in this report.

5. That the on-going schedule for the 1976 work be carefully reviewed to determine if the scheduled start date of construction of January 1, 1977 is obtainable.

APPENDIX A

APPENDIX A

OPERATING COSTS - ALTERNATE NO. 1

The following operating costs were developed for Alternate No. 1 and are used as the basis for estimating operating costs for Alternates Nos. 2 and 3.

OPERATING COST - DETAILS

PREPARATION PLANT - 3,000,000 MTPY CLEAN COAL

		Annual Cost
Labour - Salaried		$ 1,158,640
- Hourly		2,192,200
Supplies:		
Operating Materials	$ 620,000	
Maintenance Materials	2,100,000	
Shops	60,000	
Vehicle	15,000	
Laboratory	12,000	
Flocculant	200,000	
Fuel (Heating)	300,000	3,307,000
Services:		
Equipment Rental	$ 25,000	
Outside Services	500,000	
Reject Haulage	500,000	
Extra Coal Movement	500,000	1,525,000
Power:		693,000
TOTAL		$ 8,875,840
	Use	$ 8,876,000

OPERATING COSTS

UNDERGROUND MINING - 1,500,000 MTPY CLEAN COAL

	Annual Cost
Labour - Salaried	$ 1,121,500
- Hourly	5,905,500
Operating and Maintenance Supplies	6,870,000
Power	1,194,000
Royalties (0.30/ton)	450,000
TOTAL	$15,541,000

OPEN PIT MINING - 1,500,000 MTPY CLEAN COAL

Raw Coal Production = 2,140,000 MTPY

Strip Ratio = 6.2 cu.m/tonne

Total Strip Bank = 6.2 x 2,140,000 = 13,268,000 cu.m

Direct Costs

Stripping	= $12,282,000	= $ 0.95/cu.m
Coal Handling	= 1,700,000	= $ 0.79/tonne
General	= 2,353,000	
Total	= $16,335,000	= $10.89/tonne Clean Coal

OPEN PIT MINING - 1,500,000 MTPY CLEAN COAL

DIRECT COSTS

		Labour & Materials	
Stripping	Clearing	200	
	Drilling & Blasting	3,200	
	Loading	2,100	
	Hauling	2,800	
	Roads & Dumps	950	
	Support Equipment	1,500	
	Dev. Pit Drilling	450	
	Reclamation	500	
	Miscellaneous	582	12,282
Coal Handling	Loading & Hauling	1,450	
	Roads	150	
	Support Equipment	25	
	Miscellaneous	75	1,700
General	Power, Supervision, Engineering, Safety, etc.		2,353
			16,335

OPERATING COSTS

TRANSPORTATION	Annual Cost
Railway (Plant Site to Prince Rupert, 762 miles @ 1.9¢/ton/mile)	$43,434,000

PORT OPERATING	
3,000,000 tonnes @ $0.50/tonne	$ 1,500,000

PAYROLL COST SUMMARY

BABCOCK FACILITIES

Notes (1) Payroll Burden assumed @ 40% of pay rates.

(2) Hourly rates taken from existing Union Agreement applicable as of October 1, 1975.

(3) Allowances for overtime premiums are included in the 40% Burden.

(4) Hourly totals based on 2080 hrs/year.

(5) Manpower for Underground as 1st Year operation.

Department	Number	Annual Cost
Administration	95	$ 2,171,260
Preparation Plant		
Salaried	54	1,158,640
Hourly	117	2,192,130
Underground Mine		
Salaried	47	1,121,400
Hourly	299	5,905,022
Open Pit		
Salaried	29	754,320
Hourly	202	3,880,038
TOTAL	843	$17,180,810

OPERATING COST DETAILS

The Payroll Burden of 40% used in the estimate of payroll costs, includes allowances for the following items:-

Description	Hourly	Salaried
Unemployment Insurance Canada Pension Company Pension Group Insurance Medical Plan	11.0%	4.5%
Workmen's Compensation	7.5%	1.0%
Vacation & Holiday Pay	12.5%	-
Travelling & Miscellaneous	1.0%	4.0%
Sub-Total	32.0%	9.5%
Allowance for Absenteeism and Overtime	9.0%	9.0%
Allowance for Personnel Turnover	5.0%	5.0%
TOTAL	46.0%	23.5%

The ratio of Salaried to Hourly personnel is approximately 1:3, giving an average Burden of 40%.

PAYROLL COSTS

ADMINISTRATION DEPARTMENT

SUMMARY	No.of Persons	Annual Cost
	95	$ 1,550,900
Payroll Burden (40%)		620,360
	TOTAL	$ 2,171,260

DETAILS

Description	No.	Salary	Total
General Manager	1	$40,000	$ 40,000
Manager - Administration	1	30,000	30,000
Manager - Construction	1	30,000	30,000
Manager - Processing	1	35,000	35,000
Manager - Plant Services	1	30,000	30,000
Manager - Mining	1	35,000	35,000
Chief Explorations Geologist	1	28,000	28,000
Environmental Engineer	1	20,000	20,000
Industrial Engineer	1	20,000	20,000
Designer/Technicians	3	12,000	36,000
Controller	1	21,600	21,600
Accounting Supervisor	1	19,800	19,800
Cost Accountant	1	14,400	14,400
Financial Accountant	1	14,400	14,400
Payroll Clerks	3	10,800	32,400
D.P. Supervisor	1	16,800	16,800
Computer Operators	2	13,200	26,400
Computer Programmers	2	13,200	26,400
Industrial Relations Super.	1	19,800	19,800
Personnel Supervisor	1	18,000	18,000
Clerk	1	8,400	8,400
Employee Development Super.	1	19,800	19,800
Training Foreman - Open Pit	1	18,000	18,000
Instructors	2	12,000	24,000
Training Foreman - U/G	1	18,000	18,000
Instructors	2	12,000	24,000
Training Foreman - Prep.Plant	1	18,000	18,000
Instructors	2	12,000	24,000
Safety Superintendent	1	22,300	22,300
First Aid	8	12,000	96,000
Safety Inspectors	3	15,600	46,800

Description	No.	Salary	Total
Security Services (Contracted)	8	$ 12,000	$ 96,000
Fire Protection Superv./Trainer	1	15,600	15,600
Townsite Manager	1	17,400	17,400
Clerk/Secretary	1	8,400	8,400
Town Maintenance Foreman	1	14,400	14,400
Cost Control Engineers	2	16,800	33,600
Planners and Schedulers	3	12,000	36,000
Purchasing Agents	2	18,000	36,000
Expediters	2	12,000	24,000
Site Accountant	1	14,400	14,400
Inspectors	2	15,600	31,200
Stenos/Secretarial	8	8,400	67,200
Traffic Superintendent	1	18,000	18,000
Prep.Plant Superintendent	1	25,000	25,000
Process Metallurgist	1	24,000	24,000
Mechanical Superintendent	1	24,000	24,000
Chief Maintenance Engineer	1	24,000	24,000
Electrical Superintendent	1	24,000	24,000
General Services Superintendent	1	24,000	24,000
Materials Superintendent	1	24,000	24,000
U/G Mine Superintendent	1	24,000	24,000
Open Pit Superintendent	1	24,000	24,000
Chief Mine Geologist	1	24,000	24,000
Chief Mine Engineer	1	24,000	24,000
Chief Stationary Engineer	1	20,000	20,000
Terminal Foreman	1	20,400	20,400

PAYROLL COSTS

PREPARATION PLANT

SUMMARY	No.of Persons	Annual Cost
Salaried	54	$ 827,600
Payroll Burden (40%)		331,040
SALARIED TOTAL		$ 1,158,640
Hourly	117	$ 1,565,807
Payroll Burden (40%)		626,323
HOURLY TOTAL		$ 2,192,130

DETAILS - SALARIED

Description	No.	Salary	Total
Instrument Engineer	1	$ 18,000	$ 18,000
Electrical Foreman	4	20,400	81,600
General Utilities Foreman	1	20,400	20,400
Surface Maintenance Foreman	1	20,400	20,400
Purchasing Agent	1	18,000	18,000
Buyers and Expediters	4	16,800	67,200
Stenos	2	8,400	16,800
Warehouse Superintendent	1	18,000	18,000
Warehousemen	4	12,000	48,000
Clerks	2	8,400	16,800
Loadout Foreman	1	20,400	20,400
Senior Plant Foreman	1	22,200	22,200
Plant Foremen	4	20,400	81,600
Clerk	1	8,400	8,400
Process Metallurgist	1	19,200	19,200
Lab. Technicians	4	13,200	52,800
Assistants	8	10,800	86,400
Mech. Foremen	4	20,400	81,600
M/C Shop Foreman	1	20,400	20,400
Mtn. Plan. Engineer	1	23,000	23,000
Planners	1	15,000	15,000
Coordinators	2	12,000	24,000
Design Eq. Engineer	1	15,000	15,000
Technicians	2	12,000	24,000
Clerk	1	8,400	8,400

DETAILS - HOURLY

Description		No.	Rate	Total
Mechanics (Convr.)	Cat.6	2	$6.53	$ 27,165
Lub. Man	Cat.6	1	6.53	13,582
Helper	Cat.4	1	6.28	13,062
Millwrights	Cat.10	4	7.14	59,405
Welders	Cat.10	2	7.14	29,702
Pipefitter	Cat.8	1	6.77	14,082
Electricians	Cat.8	3	6.77	42,245
Electricians	Cat.10	3	7.14	44,554
Helpers	Cat.2	4	6.03	50,170
Tradesman	Cat.8	1	6.77	14,082
Helpers	Cat.2	3	6.03	37,627
Equipment Operators	Cat.6	2	6.53	27,165
Tradesmen	Cat.8	4	6.77	56,326
Helpers	Cat.2	4	6.03	50,170
Stationary Engineers		4	7.00	58,240
Warehouse Helpers	Cat.1	12	5.66	141,274
Town Tradesmen	Cat.6	6	6.77	84,490
Loadout Operators	Cat.2	2	6.03	25,085
Breaker Station	Cat.3	4	6.15	51,168
Control Room	Cat.8	4	6.77	56,327
Jig Operators	Cat.6	4	6.53	54,330
Flotation Operators	Cat.6	4	6.53	54,330
Table Operators	Cat.6	4	6.53	54,330
Dryer Operators	Cat.3	4	6.15	51,168
Dryer Helpers	Cat.2	4	6.03	50,170
Convr/Thickener Op's	Cat.2	4	6.03	50,170
Machinists	Cat.8	2	6.77	28,163
Mechanics	Cat.8	6	6.77	84,490
Welders	Cat.10	6	7.14	89,107
Helpers	Cat.4	6	6.28	78,374
Laborers	Cat.2	6	6.03	75,254

PAYROLL COSTS

UNDERGROUND MINING

SUMMARY	No.of Persons	Annual Cost
Salaried	47	$ 801,000
Payroll Burden (40%)		320,400
SALARIED TOTAL		$ 1,121,400
Hourly	299	$ 4,217,873
Payroll Burden (40%)		1,687,149
HOURLY TOTAL		$ 5,905,022

DETAILS - SALARIED

Description	No.	Salary	Total
U/G Mechanical Foremen	3	$ 20,400	$ 61,200
U/G Electrical Foremen	3	20,400	61,200
Shift Foremen	3	20,400	61,200
Fire Bosses	24	18,000	432,000
Clerk	1	8,400	8,400
Geologist	1	14,400	14,400
Sen. U/G Engineer	1	22,200	22,200
Surveyors	6	12,000	72,000
Designer/Tech.	2	12,000	24,000
Planning Engineer	1	18,000	18,000
Planners/Tech.	2	13,200	26,400

DETAILS - HOURLY

Description		No.	Rate	Total
Mechanics	Cat.10	12	$7.49	$ 186,950
Mechanics	Cat.6	12	6.83	171,725
Electricians	Cat.10	3	7.49	46,738
Electricians	Cat.11	3	7.63	47,611
Electrican Helpers	Cat.6	6	6.88	85,863
Monitor Operators	Cat.9	12	7.40	184,704
Monitor Retreating	Cat.7	24	7.01	349,939
Cont. Miner Op's	Cat.9	24	7.40	369,408
Helpers	Cat.7	24	7.01	349,939
Facemen	Cat.7	24	7.01	349,939
Roof Bolters	Cat.9	6	7.40	92,327
Roof Bolter Helpers	Cat.7	6	7.01	87,485
Supplymen	Cat.2	20	6.38	265,408
Timbermen	Cat.2	24	6.38	318,489
Pipe & Flume	Cat.2	20	6.30	265,408
Bratitemen	Cat.2	12	6.38	159,245
Flume Patrol	Cat.2	9	6.38	119,436
Convr. Patrol	Cat.6	3	6.88	42,931
Dewatering	Cat.6	3	6.88	42,931
Pump Op's U/G	Cat.2	6	6.38	95,862
Pump Op's Surf.	Cat.2	6	6.03	75,254
Rock Dusting	Cat.2	16	6.38	212,326
Lamp men	Cat.2	3	6.03	37,627
Pit men	Cat.1	3	5.66	35,318
Utility Clean-up	Cat.1	18	6.01	225,014

PAYROLL COSTS

OPEN-PIT

SUMMARY	No.of Persons	Annual Cost
Salaried	29	$ 538,800
Payroll Burden (40%)		215,520
SALARIED TOTAL		$ 754,320
Hourly	202	$ 2,771,456
Payroll Burden (40%)		1,108,582
HOURLY TOTAL		$ 3,880,038

DETAILS - SALARIED

Description	No.	Salary	Total
Open Pit Mech. Foremen	4	$ 20,400	$ 81,600
Open Pit Elec. Foreman	1	20,400	20,400
General Foremen	4	22,200	88,800
Coal Foremen	4	20,400	81,600
Garage Foremen	4	20,400	81,600
Rock Foremen	4	20,400	81,600
Clerk	1	8,400	8,400
Geologist	1	14,400	14,400
Planners	2	13,200	26,400
Sen. Open Pit Engineer	1	18,000	18,000
Surveyors	2	12,000	24,000
Designer/Tech.	1	12,000	12,000

DETAILS - HOURLY

Description		No.	Rate	Total
Shovel Operators	Cat.10	12	$7.14	$ 178,214
Rock Truck Drivers	Cat.7	40	6.66	554,112
Coal Truck Drivers	Cat.6	24	6.53	325,978
Service Drivers	Cat.4	16	6.23	209,000
Coal Loaders	Cat.8	4	6.77	56,326
Tractor Operators	Cat.6	10	6.53	135,824
Drillers	Cat.8	8	6.77	112,653
Drillers Helpers	Cat.4	8	6.28	104,499
Grader Operators	Cat.6	2	6.53	27,165
Loader/Blasters	Cat.8	4	6.77	56,326
Mechanics	Cat.10	4	7.14	59,405
Welders	Cat.10	8	7.14	118,810
Electricians	Cat.10	2	7.14	29,702
Electrician Helpers	Cat.4	2	6.28	26,125
Motor Mechanics	Cat.10	9	7.14	133,661
Motor Mechanics	Cat.8	9	6.77	126,734
Helpers	Cat.4	18	6.28	235,123
Repairmen	Cat.5	8	6.41	106,662
Helpers	Cat.4	8	6.28	104,500
Laborers	Cat.1	6	5.66	70,637

OPERATING MANPOWER

ALTERNATE NO. 1

The operating manpower has been estimated for the original base case dated June 1975 covering the period of increasing production from September 1979 through 1983. (4,500,000 MTPY of clean coal).

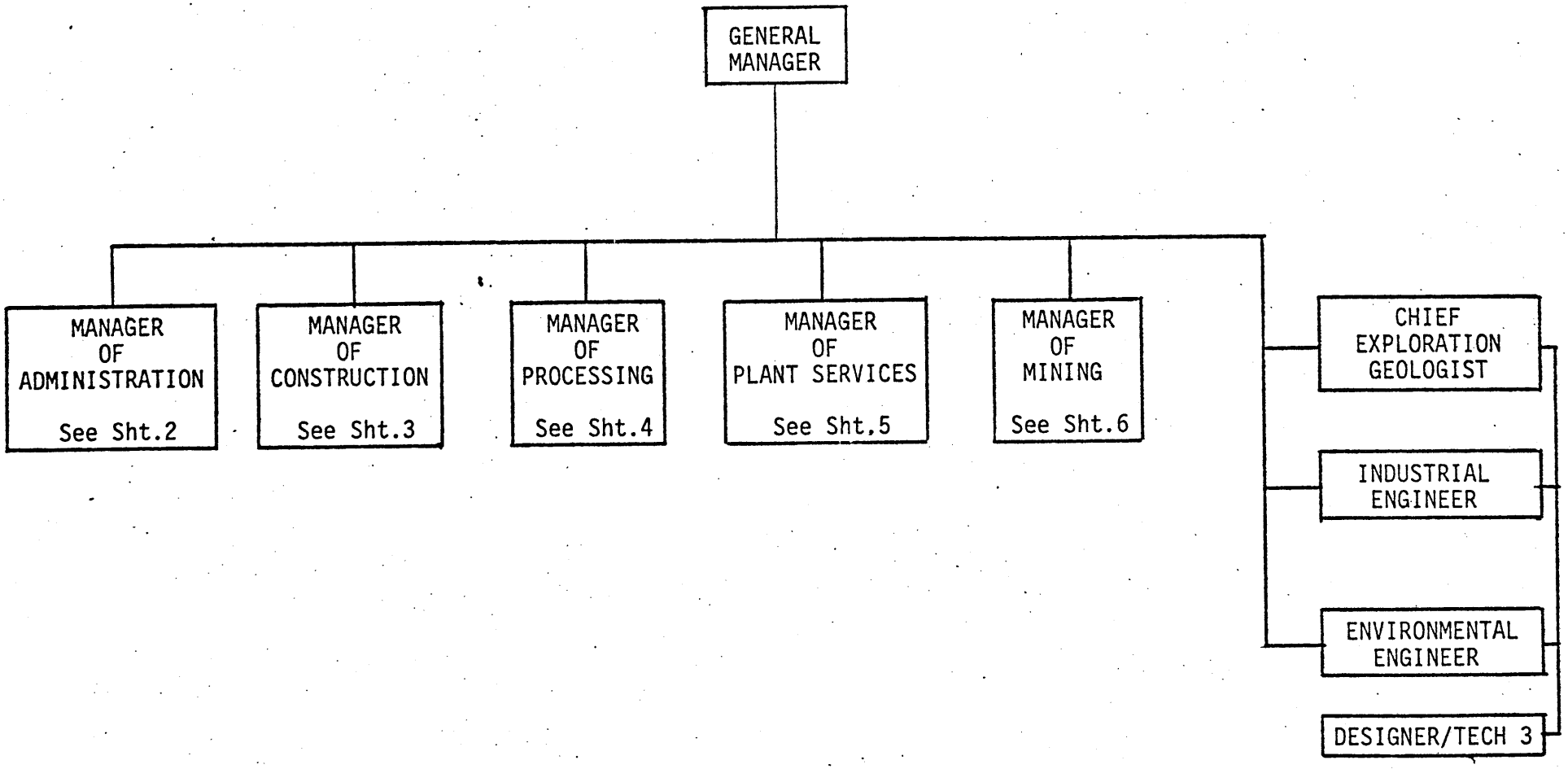
The following figures are for the direct plant employees, and do not include the secondary labour force needed for the operation of the Townsite.

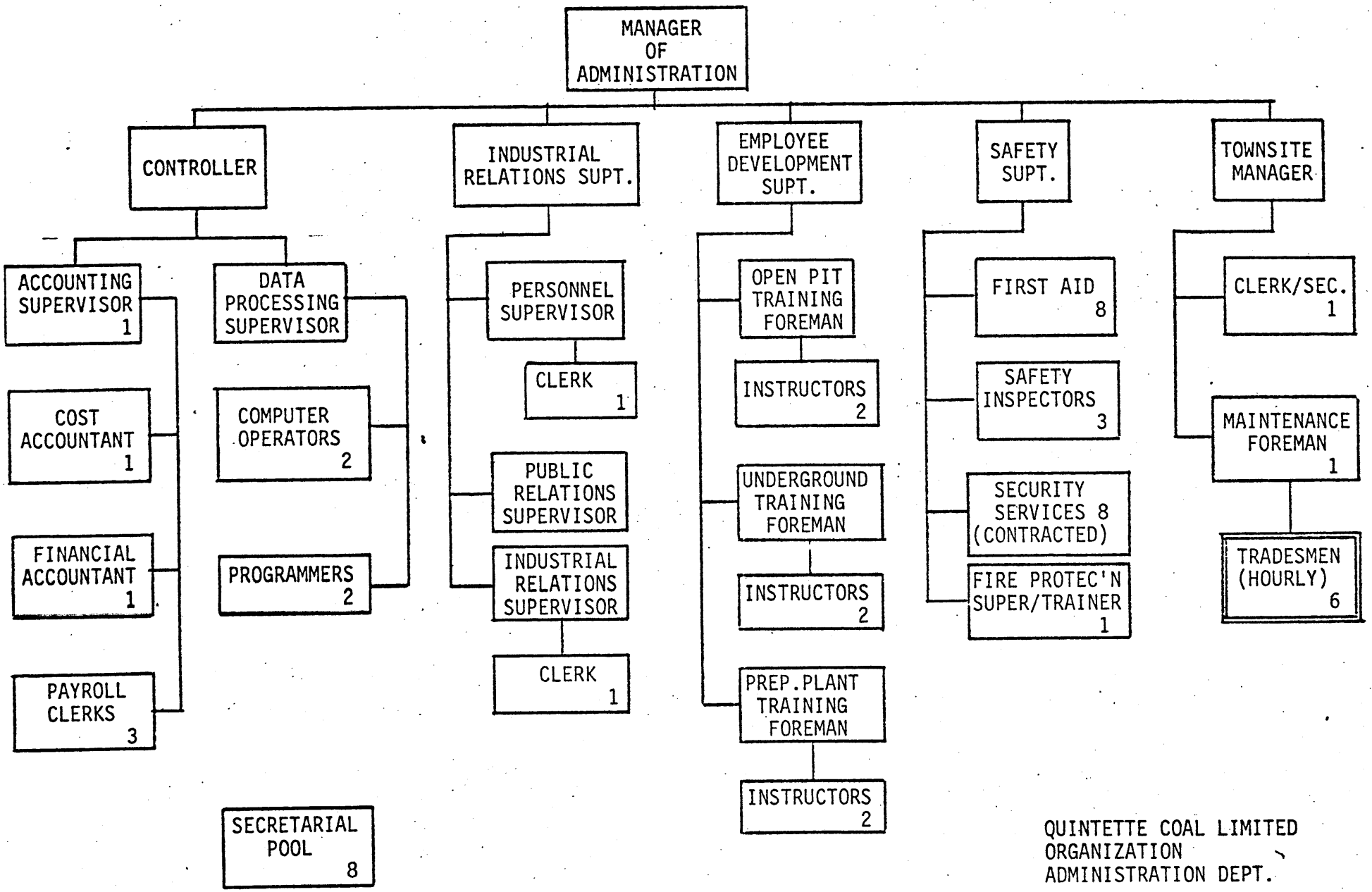
	YEAR				
	* 1979	1980	1981	1982	1983
Administration - Babcock	95	95	95	95	95
Preparation Plant - Babcock	171	171	171	171	171
U/G Mining - Babcock	-	346	346	346	346
Open Pit Mining - Babcock	231	231	231	231	231
Sub-Total Babcock (3,000,000 MTPY)	497	843	843	843	843
Administration - Wolverine	-	-	-	28	28
Preparation Plant - Wolverine	-	-	-	142	142
Open Pit - Wolverine	-	-	-	231	231
Sub-Total Wolverine (1,500,000 MTPY)	-	-	-	401	401
TOTAL WORK FORCE (4,500,000 MTPY)	497	843	843	1244	1244

* Part Year

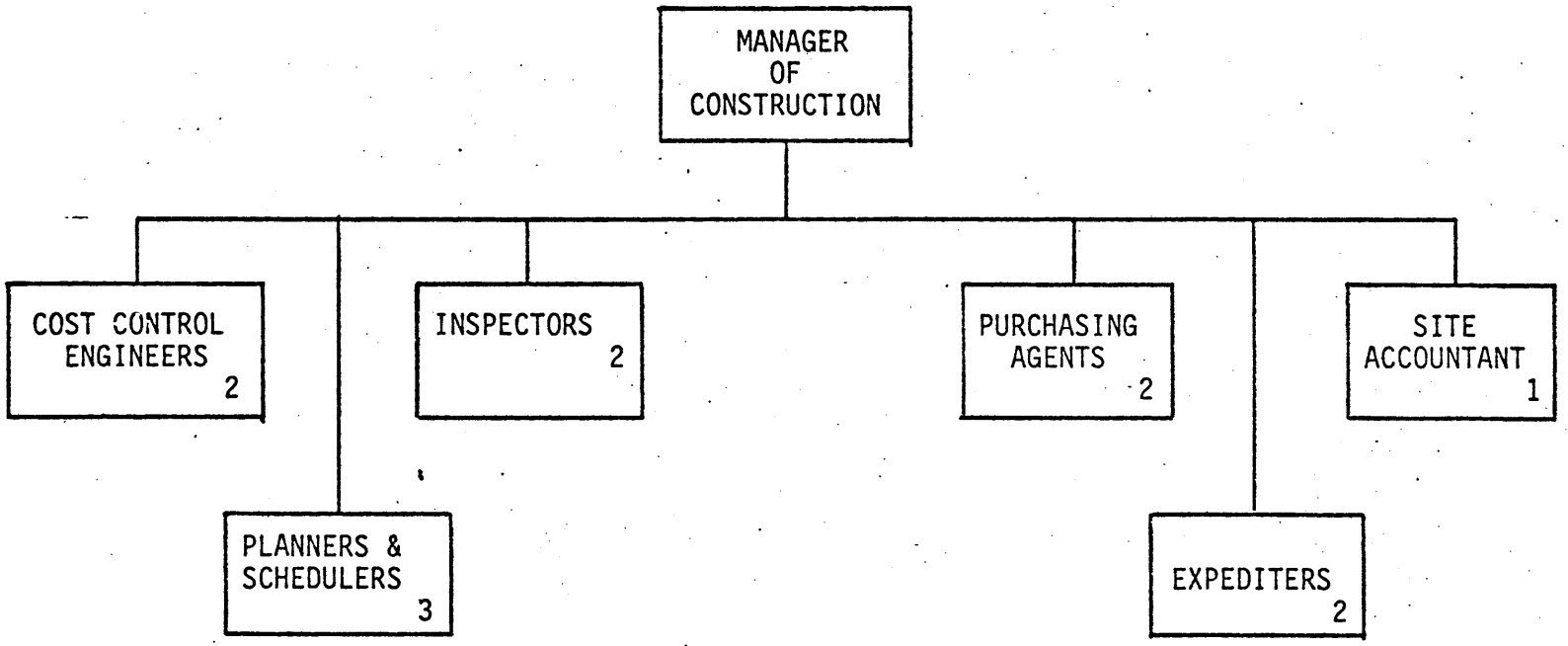
QUINTETTE COAL LIMITED - ORGANIZATION CHART

BABCOCK OPERATIONS - 3,000,000 MTPY CLEAN COAL





QUINTETTE COAL LIMITED
ORGANIZATION
ADMINISTRATION DEPT.



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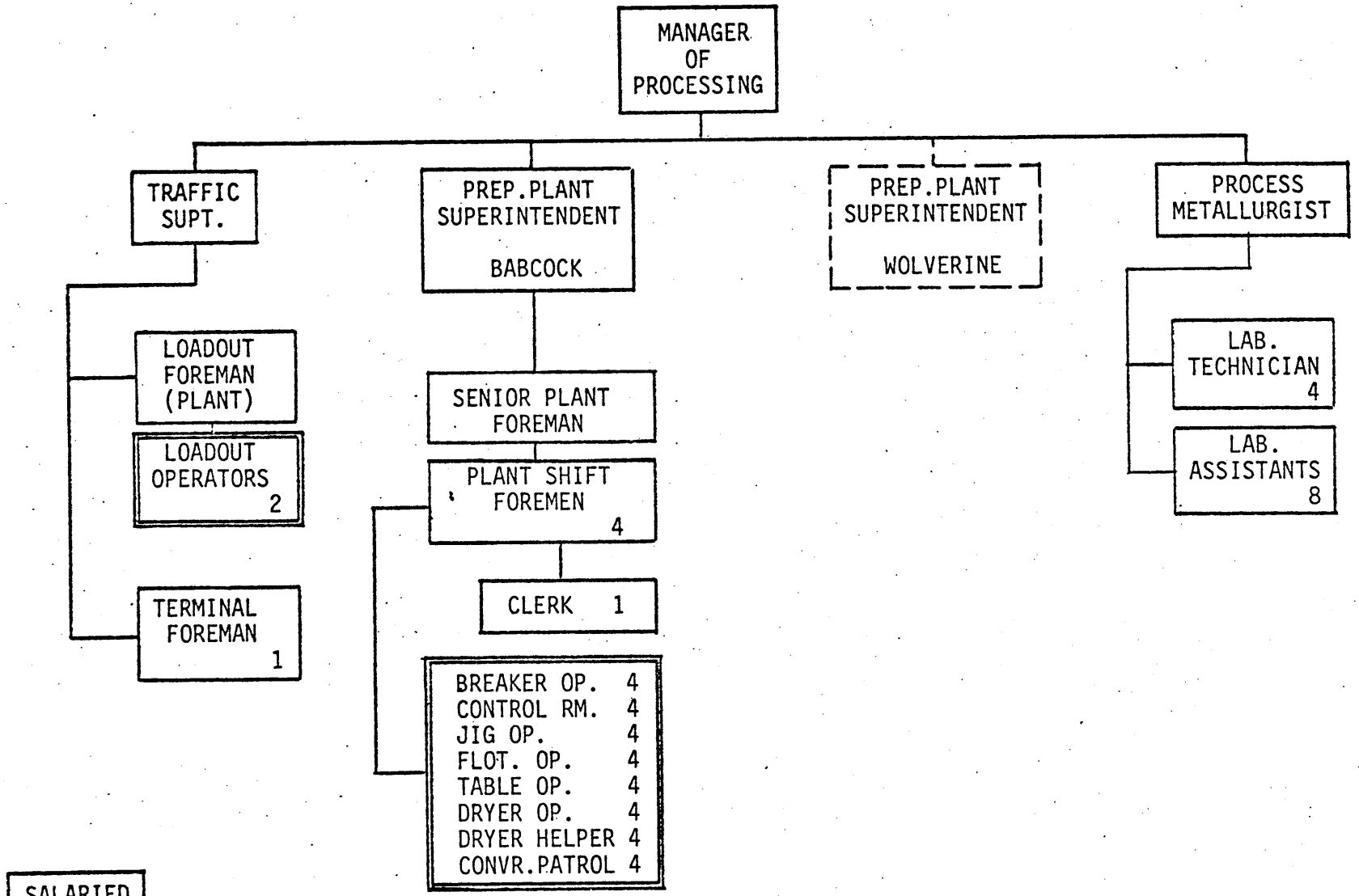

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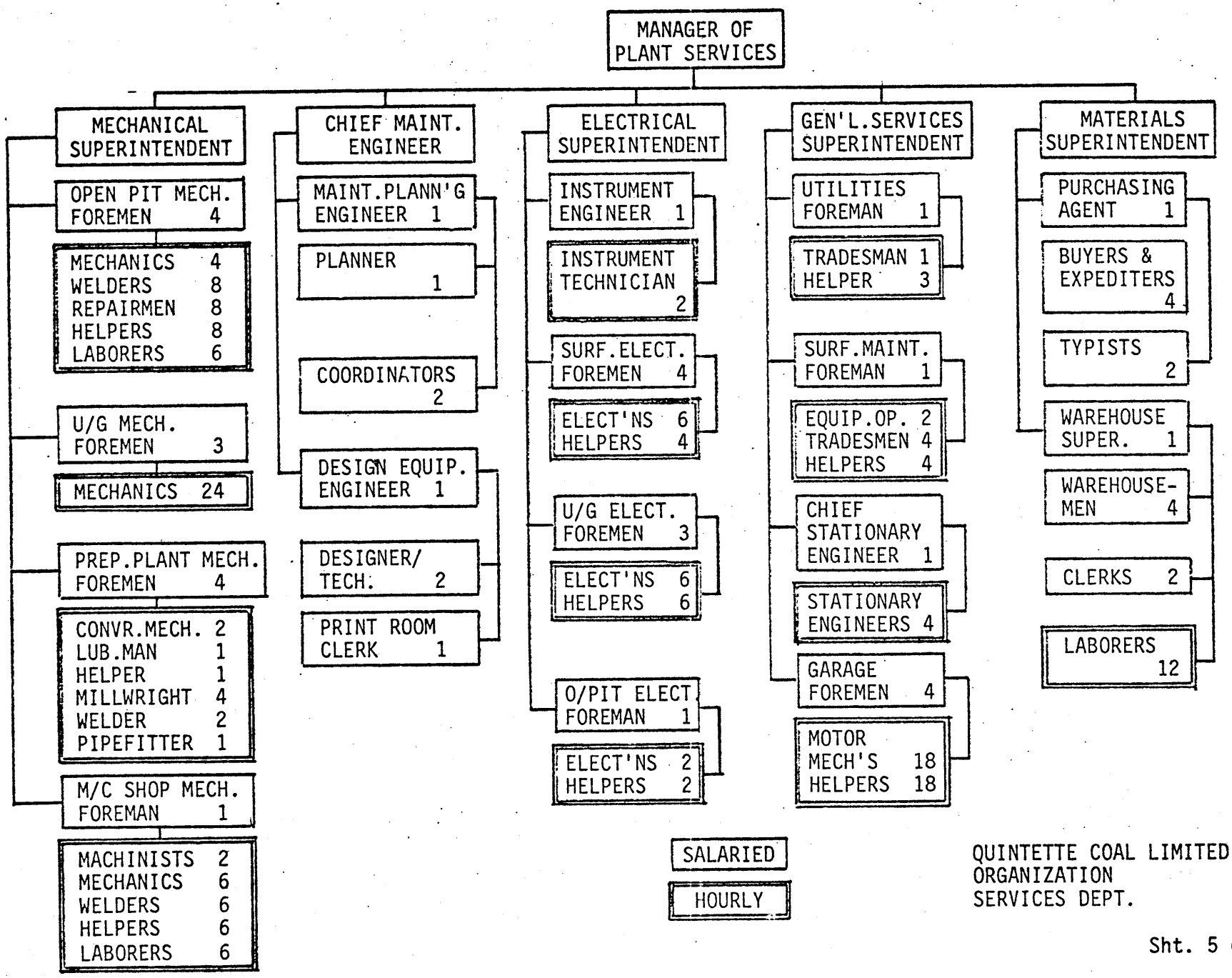
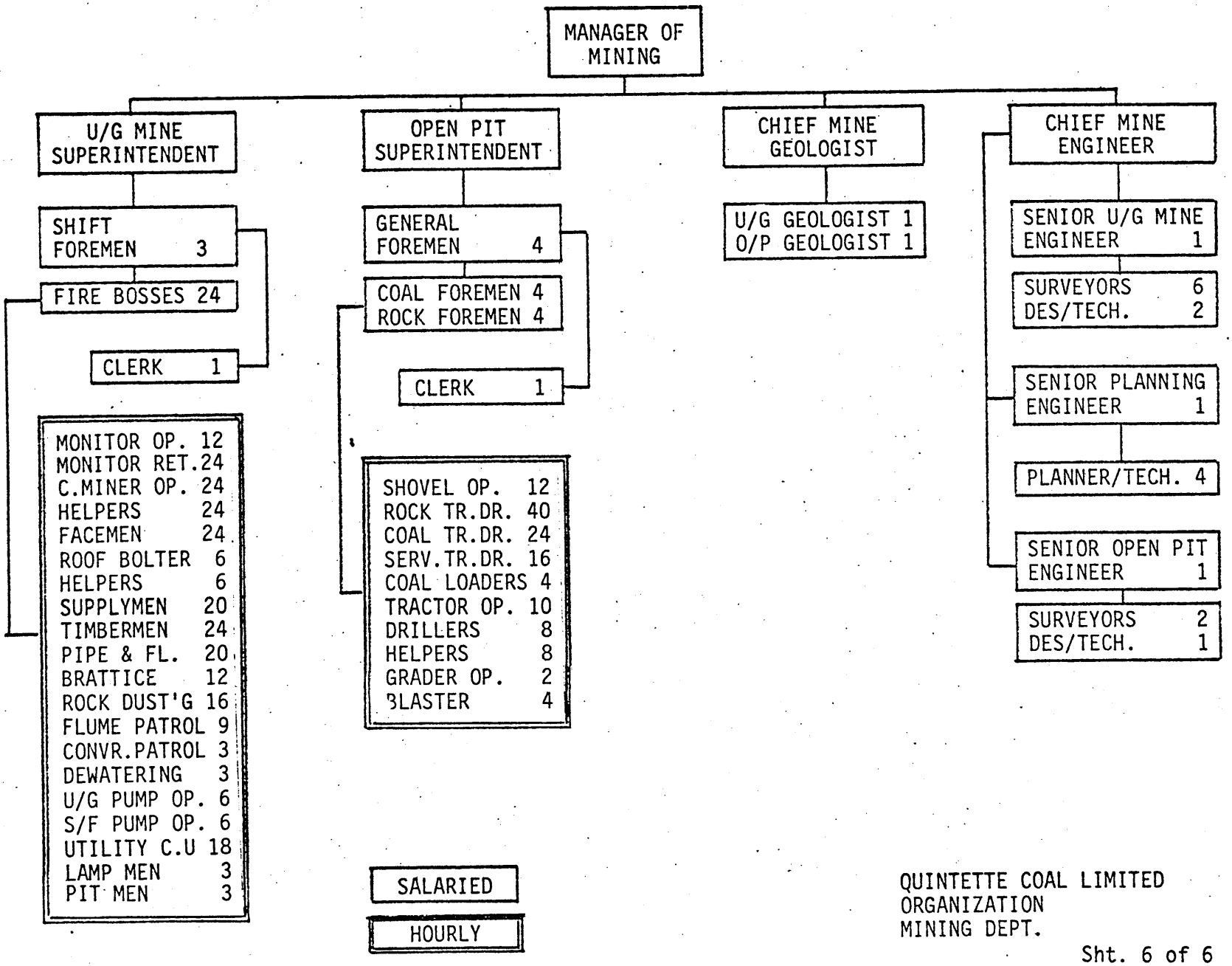


QUINTETTE COAL LIMITED
ORGANIZATION
SERVICES DEPT.



QUINTETTE COAL LIMITED
ORGANIZATION
MINING DEPT.

APPENDIX B

APPENDIX B

CAPITAL COSTS - ALTERNATE NO. 2

Babcock Surface Plant

The capital cost details for the Babcock Surface Plant are the same as for Alternate No. 1. Refer to Volume II, Appendix A, for details.

Wolverine Surface Plant

The capital cost details for the Wolverine Surface Plant have been adjusted from the Alternate No. 1 figures to $50,000,000. This adjustment allows for the increase in plant capacity from 1,500,000 tonnes per year to 2,000,000 tonnes per year clean coal output.

Mining

Adjustments for the capital costs for the Babcock No. 1, 2 and 3, and the Windy and Roman Mountain pits, are given on the following pages. Other costs are the same as Alternate No. 1. Refer to Volume II, Appendix A, for details.

ALTERNATE NO. 2

CAPITAL COST DETAILS

NO. 1 UNDERGROUND MINE

Year	Tonnage (Metric Tons)	Expenditures
1981	-	$ 9,650,000
1982	-	16,591,000
1983	250,000	19,495,000
1984	500,000	19,013,000
1985	1,000,000	7,800,000
1986	1,000,000	5,501,000
1987	1,000,000	-
1988	1,500,000	-
1989	2,000,000	-
TOTAL		$78,050,000

The development of this mine is delayed until 1981-1985, at which time the permanent power supply to the site is available and construction of the Townsite is complete.

The capital cost for the development of the mine in 1975 dollars is adjusted as follows:

Total Cost Alternate No. 1		$81,150,000
Less Construction Cost & Op. -	$2,600,000	
Less Adjustment for Power	500,000	3,100,000
TOTAL		$78,050,000

ALTERNATE NO. 2

CAPITAL COST DETAILS

SUMMARY - UNDERGROUND MINES NOS. 2 & 3

	Mine No.3	Mine No.2	Total
Surface Facilities	$ 4,104,000	$ 535,000	$ 4,639,000
Underground Facilities	8,532,000	6,820,000	15,372,000
Underground Development	3,705,000	3,705,000	7,410,000
Construction Overheads	1,250,000	-	1,250,000
	$17,590,000	$11,060,000	$30,670,000

ALTERNATE NO. 2

CAPITAL COST DETAILS

SURFACE FACILITIES FOR MINES NOS. 2 & 3

(in thousand dollars)

	Mine No.3	Mine No.2	General	Total
Access Road	75	169	119	363
Site Preparation	30	30	95	155
Mine Ventilation	70	70	-	140
General Office	-	-	10	10
Mine Site Plant & Buildings (Portals included with Underground Development)	-	-	240	240
Clean Water System	-	-	110	110
Mine Heating System Distribution (Propane)	-	-	30	30
Power Substation & Dist.	240	266	130	636
Portal Pump Equipment				
Water Lift Pump	310	-	-	310
Water Lift Pipe	325	-	-	325
Fluming Water Pump	420	-	-	420
Monitor Feed Pump	810	-	-	810
Surface Dewatering and Slurry Pump	580	-	-	580
Slurry Pump Line	510	-	-	510
TOTAL	3370	535	734	4639

UNDERGROUND FACILITIES

	Mine No.3	Mine No.2	Total
High Pressure Pipe	1500	1383	2,883
Low Pressure Pipe	352	350	702
Sluicing Flume	1900	1922	3,822
Power Distribution	900	765	1,665
Face Equipment	1980	1000	2,980
Monorails	500	-	500
Roof Supports	1400	1400	2,800
TOTAL	8532	6820	15,352

UNDERGROUND DEVELOPMENT

Portals	300	300	600
Intake Airways	500	500	1,000
Dev. Intake Airway	55	55	110
Main Entry	1700	1700	3,400
Airway	650	650	1,300
Sub-level	500	500	1,000
TOTAL	3705	3705	7,410

CONSTRUCTION OVERHEADS

Camp Operation - allowance	400
Engineering, Procurement & Management	500
Exploration and Testing	50
Insurance and Taxes	300
TOTAL	1,250

TOTAL COST	28,651

ALTERNATE NO. 2

CAPITAL COST DETAILS

BABCOCK MINE - ROMAN MOUNTAIN PIT

Item	Description			Amount	Total
1.	Production Equipment				
	Rotary Drills	(2) x $	416,000	832,000	
	Sec'y Drills	(2)		116,000	
	Shovels	(2) x	1,321,000	2,642,000	
	F.E. Loaders	(3) x	386,000	1,158,000	
	Trucks - coal & rock	(12) x	508,000	6,096,000	
	Horizontal Drill			250,000	
	Dozers	(5)		1,012,000	
	Graders	(2)		308,000	
	Service Units incl. flatbed			198,000	
	Mine Vehicles			56,000	
	Communications- allowance			50,000	$12,718,000
2.	Haulroad Construction				183,000
3.	Electrical				
	Power Line			150,000	
	Transformation and distribution			400,000	550,000
4.	Miscellaneous Structures				300,000
5.	Preproduction Stripping (allowance)				2,000,000
6.	Construction Overheads				
	Camp Operation			150,000	
	Engineering, Procurement & Construction Management			900,000	
	Exploration			100,000	
	Insurance			200,000	
	Taxes			1,300,000	2,650,000
	TOTAL				$18,401,000
				Assume	$18,400,000

ALTERNATE NO. 2

CAPITAL COST DETAILS

BABCOCK MINE - WINDY PIT

Item	Description		Amount	Total
1.	Production Equipment			
	Rotary Drills	(2) x $ 416,000	832,000	
	Sec'y Drills	(2)	116,000	
	Shovels	(2) x 1,321,000	2,642,000	
	F.E. Loaders	(3)	1,158,000	
	Trucks	(9) x 508,000	4,572,000	
	Dozers	(5)	1,012,000	
	Graders	(2)	308,000	
	Service Units - allowance		123,000	
	Communications- allowance		60,000	$10,823,000
2.	Haulroad Construction (6.8km)			411,000
3.	Electrical			
	Power Line		150,000	
	Transformation and distribution		400,000	550,000
4.	Miscellaneous Structures			200,000
5.	Preproduction Stripping (3 million cu.m)			2,000,000
6.	Construction Overheads			
	Camp Operation		150,000	
	Engineering, Procurement & Construction Management		800,000	
	Exploration		100,000	
	Insurance		170,000	
	Taxes		1,100,000	2,320,000
	TOTAL			$16,304,000
			Assume	$16,300,000

WOLVERINE MINE

SHERIFF OPEN PIT

($'000)

		ALTERNATE NO.1 1,500,000 MTPY Windy Pit		ALTERNATE NO.2 2,000,000 MTPY Sheriff Pit	
1.	Production Equipment				
	Drills	(2)	832	(3)	1,248
	Shovels	(3)	3,963	(4)	5,284
	Loaders	(2)	772	(3)	1,158
	Trucks	(15)	7,620	(19)	9,577
	Dozers	(7)	1,485	(9)	1,837
	Graders	(3)	462	(3)	462
	Other		385		400
	Sub-Total		15,519		19,966
2.	Road Construction		411		700
3.	Electrical		550		900
4.	Miscellaneous Structures		200		325
5.	Pit Preparation		2,500		5,000
6.	Construction Overheads		2,830		3,773
	TOTAL		22,010		30,664

ALTERNATE NO. 2

EQUIPMENT SIZING AND SELECTION

	Windy Pit	Roman Mt. Pit
Total Tonnes Coal:		
Clean	7,700,000	20,250,000
Raw	11,000,000	29,000,000
Effective Strip Ratio m^3/tonne raw coal	6.2:1	4:1
Total Waste Disposal	68,200,000m^3	115,700,000m^3
Years of Operation	9(1)	20
Annual Average Waste Stripping	7,600,000m^3	5,800,000m^3
Equipment Required		
Rotary Drills	Two	Two
Crawler Mounted Drills	Two	Two
Shovels	Two	Two
F.E. Loaders	Two	Two
Trucks(2)	Nine	Twelve
Dozers	Five	Five

(1) First and tenth year are combined as one production year.

(2) Twenty-one trucks are required for pit preparation and production from both pits.

Waste Rock Drilling

Drills - Alternate 2

	Windy Pit	Roman Mt. Pit
Annual Requirements (Bank m^3)	7,600,000	5,800,000
Hole Spacing	8m x 8m	8m x 8m
Volume per metre of hole drilled (Bank m^3)	$64m^3$	$64m^3$
Annual drilling required	118,750m	90,625m
Average hourly penetration	15m	15m
Annual drilling time - hours	7,900	6,042
Annual theoretical hours 7 hrs. x 3 shifts x 7 days x 52 wks.	7,644	7,644
Holidays 216		
Sched. maintenance 832		
Weather 336		
Vacations 336		
Total hours discounted	1,720	1,720
Annual operating hours scheduled (.77)	5,924	5,924
Drills required - Rotary	Two	One
Crawler-mounted	Two	One

Overburden and Interval Material Loading

Shovels - Alternate 2

Dipper Size	$13m^3$
Dipper Factor	0.65
Average load loose	$8.45m^3$
Rated Truck Capacity	$70m^3$ loose
Cycles to fill truck:	
Calculated	8.3
Actual	9
Minutes to load truck	5
Trucks loaded per 50m hour	10
Hourly production	
loose m^3	700
bank m^3	538
Annual operating hours scheduled (from drill calculation)	5,924
Available annual production	$3,200,000m^3$ in place

	Windy	Roman
Annual requirements m^3 in place	7,600,000	5,800,000
Equipment required	3	2
Production available with calculated fleet	$9,600,000m^3$	$6,400,000m^3$

Coal Loading

Front End Loaders - Alternate 2

Bucket Size	$11.5m^3$
Bucket Factor	0.7
Average Load/Bucket	$8m^3$
Truck capacity	$70m^3$
Bucket cycles to fill truck	approx. 9
Minutes to load truck	10
Loads per 45 minute hour	4.5
Truck/loader production, m^3 per hour tonnes per hour	315 285
Annual Operating Hours (see Drilling Schedule)	5924
Annual Capacity/F.E. Loader	1,690,000 tonnes
Annual raw coal required (see Plate 4.1)	3,570,000 tonnes
Total Loaders Required	Two

Because of distance and availability requirements, allow three loaders per pit.

Overburden and Interval Material

Hauling - Alternate 2

Average length of haul	1.6km
Capacity of truck	$70m^3$ loose
Average truck cycle time	10 min.
Trips per 45 min. hour	4.5
Production/hour per truck	$315m^3$ loose
Shovel production/hour	$700m^3$
Trucks required per shovel:	
Calculated	2.2
Actual	2

	Windy	Roman
Annual requirements:		
m_3 in place	7,600,000	5,800,000
m^3 loose	9,883,000	7,550,000
Shovels required	3	2
Trucks required	6	4
Trucks for both pits	10	
Standby	3	
Total trucks required	13	

Note that the truck fleet distribution varies between Windy and Roman Mountain according to the requirements of the production schedule.

Coal Hauling

Average Length of Haul	7.5km (both pits)
Average Load/Truck m^3	70

Average Truck Cycle Time Minutes:

Loads	7.0
Haul	20.0
Turn & Dump	1.0
Return	20.0
Spot	1.0
	49.0

Trips per 50 minute hour	1
Production/Hour m^3	70
Metric Tons/Hour (70 x 1.36)	95
Scheduled Operating Hours	5924
Annual Tons per Truck	563,000
Annual coal hauled (See Production Schedule Alternate 2) (raw coal)	3,570,000
Trucks required	6.3, say 7

Note that haul capacity must be adequate to carry weekends at 670 TPH raw coal feed.