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Quintette Coal Limited

QUINTETTE PROJECT

PRELIMINARY

FEASIBILITY

REPORT

1975

Volume 1

Summary

Kilborn

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November 24, 1975

Mr. R. C. Hermann
Vice-President, Coal
1500, 444 - 5th Avenue S.W.
Calgary, Alberta
T2P 2T8

Re: Quintette Project
Preliminary Feasibility Study

Dear Mr. Hermann:

In compliance with your request, we submit this preliminary feasibility study for a fully integrated mine development to produce 4,500,000 tonnes per year of metallurgical grade coal. This report is in three volumes as follows:-

Volume I	-	Summary
Volume II	-	Engineering
Volume III	-	References

The estimated capital cost for the project, including mine development, surface plants, townsite, power, railway and port facilities for a fully integrated operation is \$734,083,000. The estimate is based on construction commencing early in 1977, first case production in late 1979, and project completion late 1980. The estimate includes an allowance for escalation during this period.

The coal production is to be obtained from both open pit and underground mines. In accordance with the criteria, two preparation plants are to be built, namely:-

Babcock Plant	-	3,000,000 tonnes per year
Wolverine Plant	-	1,500,000 tonnes per year

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The assistance of the following consultants and organizations in completing this study is gratefully acknowledged:-

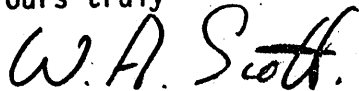
Port Facilities, Prince Rupert	-	Swan Wooster Engineering Co. Ltd.
Railway	-	British Columbia Railway
Power	-	British Columbia Hydro and Power Authority
Environmental	-	B.C. Research
Open Pit Mining	-	Dames and Moore
Hydraulic Mining	-	Mitsui Mining Co. Ltd.

The direction and guidance of you and your staff, and of your associates, World Resources, Mitsui Mining, and Tokyo Boeki Ltd., is very much appreciated. The assistance of Messrs. C. H. Frame, R. C. Hermann, A. A. Johnson, E. P. Sheriff and A. L. Wenturine is specifically acknowledged.

The on-going plans for development of this project should be carefully reviewed when the final results of your 1975 drilling program are available.

We trust that the above reports fulfill your requirements and are looking forward to working with you on the continuing studies required for the development of this exciting project.

Yours truly



W. A. Scott, P.Eng.
Vice-President, Metallurgical Projects

WAS:jh
Encls.

QUINTETTE COAL LIMITED

PROJECT INVESTIGATION RE QUINTETTE
4.5 MILLION M.T.P.Y. COAL DEVELOPMENT

VOLUME I - SUMMARY

OCTOBER 1975

KILBORN LIMITED
CONSULTING ENGINEERS

VOLUME I - SUMMARY REPORT

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A. DRAWINGS

LIST OF ABBREVIATIONS

Ft, ft	Feet
ft ² , sq.ft	Square Feet
ft ³ , cu.ft	Cubic Feet
m	Metre
m ³ , cu.m	Cubic Metre
M	Mesh (Tyler)
M.T.	Metric Tons
MTPY	Metric Tons per Year
MTPH	Metric Tons per Hour
USGPM	US Gallons per Minute
cfm	Cubic Feet per Minute
KV	Kilovolts - 1000 volts
KW	Kilowatts - 1000 watts
H.P.	Horsepower
R.C.	Raw Coal
C.C.	Clean Coal
U/G	Underground
O'size	Oversize
U'size	Undersize
H.P.	High Pressure
L.P.	Low Pressure
O'flow	Overflow
U'flow	Underflow
S.D.	Single Deck
D.D.	Double Deck
S.G.	Specific Gravity

1.0 INTRODUCTION

1.1 HISTORICAL DATA

The coal licences referred to as the Quintette licences were originally acquired by Denison Mines Limited in 1969 and 1970, and the first coal exploration on the property was carried out by Denison in 1971. A significant exploration program has been completed each year since that time and, as a result of participation in the work that was carried out, World Resources Company (a Division of Alco Standard Corporation), Mitsui Mining Co. Ltd., and Tokyo Boeki Ltd. have each earned an interest in the property. The coal licences are now held by Quintette Coal Limited, the shares of which are owned by Denison, World Resources, Mitsui Mining, and Tokyo Boeki in proportion to their earned interest in the property.

In the spring of 1975, based on encouraging results of exploration and preliminary studies completed up until that time, the Board of Directors of Quintette Coal Limited decided that a further major program of field exploration should be carried out during 1975, and that a preliminary study should be undertaken to test the feasibility of developing the property at a production level of 4.5 million tonnes per year. Provided that the results of the 1975 exploration program and this feasibility study are satisfactory to the Board of Directors of Quintette Coal Limited, it is the intent that more definitive exploration work and a detailed feasibility study will be carried out during 1976, with the objective of being prepared by the end of 1976 to make a decision as to whether or not to proceed with the project.

Denison Mines (B.C.) Limited was nominated by Quintette Coal Limited to manage the program of exploration and the feasibility study, and Kilborn Limited were in turn commissioned by Denison to carry out the preliminary feasibility study. This report presents the results of the preliminary feasibility study.

1.2 LOCATION AND DESCRIPTION OF PROJECT

The project is located in the foothills of the Rocky Mountains, approximately 65 miles south of Chetwynd and 60 miles southwest of Dawson Creek, B.C. For the purposes of this report the project has been subdivided into four main components or areas as follows:

- 1) The Babcock Plant
- 2) The Wolverine Plant
- 3) The Townsite
- 4) Off-site Facilities

The Babcock Plant is located near the headwaters of Babcock Creek. The plant is approximately 4350 feet above sea level in an area presently tree covered and accessible only by helicopter or four-wheel drive vehicle.

The Wolverine Plant is located in the valley of the Wolverine River and approximately 10 miles west of the confluence of the Wolverine and Murray Rivers. The plant is approximately 2700 feet above sea level in an area presently tree covered and accessible only by helicopter.

The Townsite is located east of the confluence of the Wolverine and Murray Rivers, and immediately north of Flatbed Creek. The Townsite is approximately 2700 feet above sea level in a tree covered area which is only accessible by helicopter. The travelling distance from the townsite to the Babcock Plant is approximately 21 miles to the south. The distance to the Wolverine Plant is approximately 10 miles to the west.

The Babcock Plant will have a capacity of 3,000,000 tonnes of clean coal per year, and is to be operational by October 1, 1979. This plant, complete with all the necessary support facilities and infrastructure is the subject of the basic investigation. The facilities will include:

- Washing and Preparation Plant
- Underground Mining, by Hydraulic Methods
- Open Pit Mining
- Power Transmission from Chetwynd, B.C.
- Railway Transportation to Prince Rupert, B.C.
- Road Construction to Dawson Creek, B.C.
- Plant Administration, Changehouse and Maintenance Buildings
- Water Supply, Sanitary and Tailings Disposal Systems.

The Wolverine Plant will have a capacity of 1,500,000 tonnes of clean coal per year, and is to be operational by the end of 1981. This plant will also be complete with the necessary support facilities for plant operation, but will be incremental to the Babcock Plant with regard to Railway, Power, Roads and Townsite accommodation. The Wolverine facilities will include:

- Washing and Preparation Plant
- Underground Mining, by Hydraulic Methods
- Open Pit Mining
- Power Transmission from the Townsite area
- Railway to the Townsite area
- Road construction to the Townsite area
- Administration, Changehouse and Maintenance Buildings
- Water Supply, Sanitary and Tailings Disposal Systems.

The Townsite will be developed in two stages to meet the anticipated workforce requirements from each plant. The first stage will include the requirements for a fully integrated municipality including the following:

- Personnel accommodation
- Utilities and Services
- Recreational Facilities
- Schools and Institutional Facilities
- Medical and Dental Facilities
- Commercial Facilities
- Security and Fire Protection Services
- Radio, T.V. and Telephone Communications
- Air Strip for Unscheduled Air Service

The second stage is an expansion of the first phase to accommodate the expanded work force for the second phase.

The Off-site Facilities include the following:

a) Power Supply

Power to the plants and townsite is to be supplied from the existing B.C. Hydro grid system. This requires a new transmission line from Chetwynd, B.C. to be constructed, a distance of approximately 80 miles to the Babcock Plant. The route of the new line includes the Townsite, but a 10 mile addition is required for the Wolverine Plant.

b) Railway Transportation

Product transportation will utilize an open car unit train system operated by B.C. Railway. This necessitates a new rail line from the Babcock Plant to the existing B.C. Railway track at Chetwynd, B.C., a distance of approximately 80 miles. The railway route also services the Townsite, but an additional 10 mile spur is required to the Wolverine Plant. The unit trains could have a maximum of 100 cars each of 90 tonne capacity, and will require a four day turnaround cycle. The distance to the proposed terminal at Prince Rupert is approximately 762 miles.

c) Shiploading Terminal

It is proposed that a new coal storage and ship loading terminal be constructed on Ridley Island, adjacent to Prince Rupert, B.C. A short railway spur is necessary to connect to the existing C.N.R. rail line. The terminal will be capable of handling vessels of 150,000 D.W.T. and will contain storage facilities for in excess of 500,000 tonnes of coal. The unit car unloading system will be capable of unloading a 100 car train in approximately six hours. The shiploading system will have a coal loading capacity of 4,500 tonnes per hour. The terminal will be complete with car wash equipment, pollution control, trackage for two unit trains, and the necessary utilities and services.

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2.0 PLAN OF DEVELOPMENT

2.1 PROJECT DEVELOPMENT SCHEDULE

The scheduled start-up date for the Babcock Plant is October 1979 at the design rate of 3.0 million MTPY based on project authorization late 1976. Initially the supply of raw coal to the plant is from the Windy and Roman Mountain open pits and from the stockpile of development coal (approximately 250,000 tonnes) from the underground operations at the Babcock Mine.

The plant output in the initial year is restricted by the output from the mines. The start-up of the Babcock Mine (hydraulic mining) is scheduled for September 1980 with an estimated production in the first year of 500,000 tonnes. The production from the Babcock Mine as proposed by Mitsui Mining Co. Ltd. is approximately 2.0 million MTPY of clean coal. This capacity is to be achieved by 1986 with mining operation in D, F and J seams.

The construction of the townsite is to proceed simultaneously with process plant construction with the housing facilities completed in stages to conform to the build up of operating personnel. The installation of all services must be completed by early 1978 to permit a sustained program for completion of the housing and other facilities.

The schedule for construction of the power line has been reviewed with the British Columbia Hydro and Power Authority and for the rail line with British Columbia Railway. To ensure completion on schedule it is necessary that clearing of the right-of-way be essentially completed in 1977 - 1st quarter.

The schedule for construction of the port facilities at Prince Rupert is based on completion of foundation studies and certain hydraulic and marine investigations in 1976.

In order to ensure completion of the work on schedule, planning for the project must proceed in 1976 to permit placement of orders for major items of open pit and port equipment early in 1977. No problems are envisaged in obtaining delivery of major items of process equipment.

The estimated camp facilities required for mining and construction activities at the Babcock development are:-

Mining	200
Surface Plant	300
Townsite	<u>250</u>
TOTAL	750

including additional personnel for railway and power facilities. The estimated peak work force is 1000 men. As planned, separate construction camps are to be established at the Babcock plant site and the townsite for the work.

The method of mining in the Babcock Mine is to be determined late in 1978 after completion of development headings in D seam. However, certain commitments may have to be made for equipment for hydraulic mining prior to this date to ensure delivery in time for start-up of fluming coal in October 1979 and hydraulic mining coal in October 1980.

The Wolverine Plant is to commence operation in January 1982 with raw coal supplied from the Sheriff and Frame open pits. Initial plant construction is to commence in 1980 with the access road completed to the site in the summer of 1979 or earlier to assist in site development work.

The summary schedule for the project is indicated on Drawing No. 100-26-1.

2.2 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 British Columbia Railway and Price Waterhouse.

1. The forecast reserves for open pit coal in the Babcock area are in excess of those assumed in this study.
2. The capital expenditure to develop open pit coal is less than coal obtained from underground mines.
3. The Babcock underground mines #2, #3 and #4 (steep) have limited coal reserves, and have relatively high capital 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. The rate charges should preferably include complete write-off of the capital expenditures for the work.
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. The development of the project will require skilled manpower for construction and skilled manpower for operation, especially hydraulic mining. The Government should be encouraged to establish and sponsor training programs to provide the manpower required for the work.

13. 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.
14. 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.
15. 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.
16. 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.
17. 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.

2.3 RECOMMENDATIONS

1. That the drilling programs be expanded immediately to confirm the estimated open pit reserves, coal quantity 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.

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3.0 CAPITAL COST SUMMARY3.1 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:

<u>Description</u>	<u>Amount</u>	<u>Total</u>
BABCOCK MINE		
Open Pits - Windy Area	\$22,010,000	
Underground Mine No.1 (Flat)	73,449,000	
Surface Plant	<u>76,148,000</u>	\$171,607,000
WOLVERINE MINE		
Open Pits	20,396,000	
Surface Plant	<u>35,700,000</u>	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	<u>42,600,000</u>	167,765,000
PROJECT OVERHEADS		<u>28,891,000</u>
Sub-Total		\$489,359,000
CONTINGENCY		48,941,000
ESCALATION		<u>206,100,000</u>
Sub-Total		\$744,400,000
Net Credit for Coal Sales		<u>143,750,000</u>
Total		600,650,000
Allowance - Interest and Financing		<u>133,433,000</u>
TOTAL		<u><u>\$734,083,000</u></u>

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. I.

The summary details of the capital cost estimate are in Appendix A, 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 to December 1981.
- Allowance for Owner's overhead costs including the following:

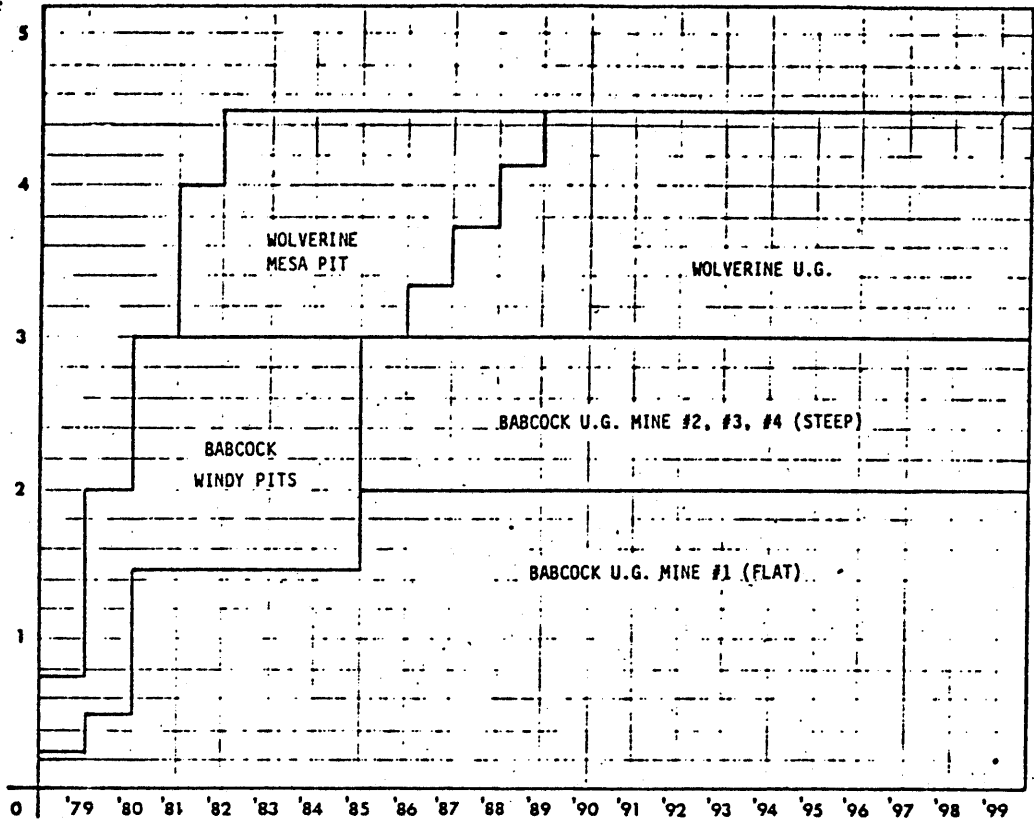
Inventory and spare parts	\$3,000,000
Working Capital, plant start-up	\$2,000,000
Staff Recruitment	\$2,000,000

TABLE 3-1
QUINTETTE COAL LIMITED
FORECAST OF EXPENDITURES PRE-PRODUCTION

<u>Description</u>	<u>Total</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
<u>BABCOCK MINE</u>							
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
<u>WOLVERINE MINE</u>							
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
<u>TOWNSITE</u>	65,000		5,000	10,000	13,000	21,000	16,000
<u>OFF-SITE FACILITIES</u>							
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
<u>PROJECT OVERHEADS (1)</u>	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
<u>CONTINGENCY</u>	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
<u>ESCALATION</u>	206,100	1,300	16,000	39,500	62,500	38,800	48,000
Total	744,400	14,200	95,751	171,292	218,692	116,413	128,052
<u>NET CREDIT FOR COAL SALES</u>	143,750				18,750	50,000	75,000
Total	600,650	14,200	95,751	171,292	199,942	66,413	53,052
<u>INTEREST AND FINANCE</u>	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.

PRODUCTION MILLION MTPY. CLEAN COAL



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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 1**

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3.2 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	<u>\$156,905,000</u>

There is no allowance for escalation of post-production expenditures.

TABLE 3-2

ESTIMATE OF POST PRODUCTION CAPITAL EXPENDITURE (\$'000)

Year	BABCOCK MINES				WOLVERINE			TOTAL
	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

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4.0 SCOPE OF STUDY

4.1 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of the investigation is to develop the preliminary engineering, design and cost estimate data, in sufficient depth to determine the scope of work for a future detailed Feasibility Study. The investigation will develop known criteria and isolate areas where additional data is required in order to proceed with the next phase.

The scope of the investigation includes the following:

- 1) Plant requirements to treat 3,000,000 MTPY of clean coal from the Babcock area.
- 2) Underground mining by Hydraulic methods for the Babcock area.
- 3) Open pit mining by conventional methods for the Babcock area.
- 4) Utilities and Services for the Babcock Mines and Surface Plant.
- 5) Coal Transportation and Shiploading facilities.
- 6) Townsite development for the work-force.
- 7) Environmental and Social Impact of the development.

- 8) Plant requirements to treat 1,500,000 MTPY of clean coal from the Wolverine area.
- 9) Underground mining by Hydraulic methods for the Wolverine area.
- 10) Open pit mining by conventional methods for the Wolverine area.
- 11) Incremental additions for Utilities, Services, and infrastructure for the Wolverine area.
- 12) Estimated Capital costs and distribution of expenditures for the total project.
- 13) Estimated Operating costs for the total project.
- 14) Estimated Cash Flows and related financial data.

4.2 GEOLOGY

The geological information, reserve calculations, and estimates of productive capacity presented in this report are based to some extent on preliminary evaluations of information recently received from the field and on sometimes incomplete re-evaluations of previously reported information.

The summary of the indicated reserves in each of the mining areas is given in the table accompanying this report.

Detailed geological descriptions and tabulations, complete with sections and drawings, will be found in Volume II, Part 1, of this report.

QUINETTE PROPERTY
SUMMARY OF INDICATED RESERVES AND PRODUCTIVE CAPACITY

UNDERGROUND MINING RESERVES

<u>Proposed Mine Site</u>	<u>Indicated Reserves In Place Within Mining Area</u> M.T.x10 ⁶	<u>Estimated Raw Coal Productive Capacity* - First 20 Years</u> M.T.x10 ⁶	<u>Preparation Plant Yield</u> %	<u>Estimated Clean Coal Productive Capacity -First 20 Years</u> M.T.x10 ⁶
Babcock No.1	122.0	54.0	69	37.3
Babcock No.2,3 & 4****	41.4	22.9	73	16.7
Wolverine				
- Perry Creek Anticline	94.47	22.0**	70	15.4
- Five Cabin Syncline	104.3	44.0	-not estimated-	

OPEN PIT MINING RESERVES

<u>Proposed Mine Site</u>	<u>Strip Ratio Cubic Metres Per Metric Ton</u> Ton	<u>Indicated Reserves In Place</u> M.T.x10 ⁶	<u>Estimated Preparation Plant Recovery ***</u> %	<u>Estimated Clean Coal Productive Capacity At Stated Strip Ratio</u> M.T.x 10 ⁶
Babcock Area				
- Windy Pit	7.8	11.6	71	8.2
- Roman Mountain Pit	5.6	21.2	79	16.7
				24.9
Wolverine Area				
- Sheriff Pit	3.1	23.5	67	15.7
- Frame Pit	9.7	30.5	78	23.8
- Sheriff & Frame Pits combined	6.8			39.5

* Productive capacities estimated from preliminary data in previous reports by Denison Mines Limited and Mitsui Mining Company, extended to 20 years.

** Underground production from the Wolverine area is expected to come primarily from the Gates Member during the first stage of production.

*** Preparation plant recovery (yields) for open pit reserves are estimated by assuming that 90% of the coal only portion of the total raw coal mined will be recovered.

**** The productive capacity of No.2 and No.3 Mines together is estimated at 3.7 million tonnes per year over a period of 5 to 6 years.

4.3 CRITERIA FOR STUDY

The design criteria have been established on the requirements given in the Quintette Coal Company's Alternate 1 dated June 23, 1975. These criteria indicate that the plant will be designed to process 50% of the throughput from open pit sources and 50% from underground using hydraulic mining methods. The Babcock plant will be designed to ultimately utilize 100% of raw coal from underground.

The design criteria for the Wolverine area has not been established for the individual coal seams, due to the preliminary nature of the test data so far available. For the purpose of this study, it has been assumed that the data developed for the Babcock area can be used for estimating purposes.

<u>Criteria</u>	<u>Babcock Plant</u>	<u>Wolverine Plant</u>
Annual Production (Clean Coal)	3,000,000 MTPY	1,500,000 MTPY
Ash Content	7.5%	7.5%
Raw Coal Treated	4,631,000 MTPY	2,315,000 MTPY
Operating Days	320	320
Hours per Day	24	24
Shifts per Day	3	3
Days per Week	7	7
Availability	90%	90%
Plant Feed Rate	670 MTPH	335 MTPH
Clean Coal Produced	436 MTPH	218 MTPH
Refuse	234 MTPH	117 MTPH
Raw Coal Storage (Silos)	30,000 MT	15,000 MT
Raw Coal Storage (Slurry)	15,000 MT	7,500 MT
Clean Coal (Silos)	30,000 MT	15,000 MT

4.4 MINING

4.4.1 Scope of Mining Study

This study investigates the engineering problems associated with organizing a surface and underground mine program capable of an ultimate capacity of 4.5 million tonnes annually. The initial production of 3.0 million tonnes per year is mined from the Babcock area. Within three years of Babcock Plant start-up, production is expanded to 4.5 million tonnes per year by the addition of the Wolverine area mines and preparation plant.

The "Feasibility Report on the Babcock Project of Quintette Coal Company" by Mitsui Mining Company is the basic reference for the underground phase of this study. The following items are significant departures from the Mitsui Report.

- a) Redesign of mine entries to exclude hoists and provide access for mobile equipment, and to include an elevator shaft for man travel to the seams.
- b) Addition of a seam exploration program in the Flat Area Development Schedule.
- c) Adjustment of the Mitsui schedule to initiate hydraulic mining in D and F Seams, prior to J Seam.
- d) Surface mined coal is included.

Dames & Moore, Consultants, provided design and operating data in their study which incorporated Windy and Roman Pits as simultaneous operations. Their report indicated that development of two pits required unacceptable initial capital costs. For this study, pertinent information has been extracted from the Dames & Moore report for capital and operating costs for Windy Pit.

4.4.2 Surface Mining

Reserve estimates have been provided by Denison Mines Limited for Babcock and Wolverine areas. This information is included in Section 1 of this Volume, and is the basic reference for any continuing studies of surface mining.

A preliminary but reasonably detailed study of Windy and Roman Mountain Pits was made by Dames & Moore, Consultants. The information supplied by Dames & Moore has been modified and incorporated in the proposed operation of Windy Pit to produce 1.5 million clean tonnes (2.143 million raw) coal.

4.4.3 Underground Mining

The proposed development program incorporates a geological investigation of D seam to confirm its suitability for hydraulic mining methods. The development schedule requires 3.75 years to bring hydraulic mining areas into production, one year after start-up of the coal preparation plant.

Capital and operating cost estimates for this study are based on hydraulic mining. Should the initial development and geological investigation phase indicate that hydraulic mining is not practical in D and F seams, then these seams can be developed and mined with continuous miners while J seam is developed for hydro-cutting. No cost estimates are included for mining conventionally.

4.4.4 Production Schedule

Development of surface and underground mines is integrated to ensure adequate coal production during the complex and difficult underground development phase. Project authorization is required in December 1976 to mobilize forces and equipment for surface mine preparation if the production start-up in 1979 is to be met. Preproduction work at Windy is restricted to haulroad construction and limited waste removal. Sufficient time has been allocated for equipment deliveries, but site erection will be subject to rail and access road construction schedules.

Contractors' forces are proposed for both surface and underground development, and it is possible that these forces will assist in the initial production years.

4.5 SITE DEVELOPMENT - BABCOCK AREA

The location of the Babcock surface facilities is determined primarily by its compatibility with the underground mining of the Babcock No. 1 Mine (Flat). The plant site is located near the headwaters of Babcock Creek in an area which is tree covered and having a natural gradient of 10 to 15 degrees. The preliminary plant layouts have attempted to make use of the natural contours wherever possible.

The main construction camp facilities will be developed adjacent to the existing drill camp, which will give a central location for mining and surface construction operations. This location also enables the camp to remain without disturbance for the entire development and construction period. The initial development of the site will require the early construction of the access road from the Quality Lake region to achieve a good supply route from Dawson Creek for construction materials and equipment.

The site development will begin as early as is practical in 1977. It is anticipated that surface construction will be restricted during the winter season of 1977-1978. No interruption will be necessary to underground development. By the fall of 1978, the supply roads should be well established and some of the major building structures closed in. This will allow construction to proceed throughout the following winter season.

Access roads to the open pit and townsite areas will be constructed during the summer of 1977. A construction camp will be established at the townsite, and construction commenced on the utilities and services.

The summer of 1978 will also see the start of work on the site services for the permanent plant facilities. This work will be interrupted by the winter of 1978-79, but will continue to completion during the summer of 1979.

All site development and construction for the Babcock surface facilities will be complete by September 1979.

Construction camp facilities will continue to be used for the underground development until the end of 1981. Portions of these facilities will be relocated at the Wolverine site after the peak requirements have been met.

4.6 SITE DEVELOPMENT - WOLVERINE AREA

Site development in the Wolverine area is scheduled to begin in the summer of 1979. This work will be comprised of access roads to the area, site clearing, and construction of camp facilities. Major construction of the surface plant and services will commence in the summer of 1980 and continue to completion by September of 1981.

Due to the limited knowledge of the Wolverine area, site development has been assumed to follow a similar pattern to Babcock. From available mapping it appears that the terrain is more favourable to construction needs, and consequently no major difficulties are anticipated at this time.

4.7 TOWNSITE

The Townsite is located east of the confluence of the Murray River and Flatbed Creek. The site was chosen for the central location for the two proposed plant sites, and the suitable terrain for economic construction.

The site is approximately 60 miles south of Chetwynd, B.C., and approximately 90 miles southwest of Dawson Creek. The travelling distances to the proposed plants will be 21 miles south to Babcock and 10 miles west to Wolverine.

The site chosen has adequate area for future expansion, in accordance with the B.C. Government's proposed development for the area, and is ideally located for road and rail access, power and other services.

The capital cost for the Townsite is sufficient for the growth of the project labour force. Construction is scheduled to complete approximately 850 units in time for the Babcock plant start-up, and increase to approximately 1300 units some two years later.

The development of the residential areas will progress in modular groupings as the project expands, with green belt separations to provide an attractive appearance from the early stages.

The initial development will include all the utilities and services, institutional and recreational facilities required for the completed Townsite.

Construction work and camp areas are located so as to utilize the cleared areas for commercial and recreational use after the Townsite is completed, wherever practical.

The residential requirements have been based on a ratio of 70% married status and 30% single status persons.

For estimating purposes, it has been assumed that the married personnel will require a range of one to five-bedroom detached houses, and single personnel can be accommodated in one-bedroom apartments or communal type housing. The family units will be complete with all the usual facilities, but not furnishings or domestic appliances. The single status units will be furnished, with some common domestic facilities.

In addition to the residential requirements, the Townsite will also include:

- a) Schools - to Grade 12
- b) Municipal Buildings - including Provincial and Federal
- c) Recreational Facilities - Indoor and Outdoor
- d) Institutional Buildings
- e) Commercial Buildings
- f) Industrial Buildings

Services and Utilities for the Townsite have been based on a total of 3500 residents. These services include:

- a) Water Supply
- b) Sewage Treatment
- c) Storm Sewers
- d) Power Supply
- e) Radio, T.V. and Telephone distribution.

Adjacent to the Townsite it is proposed to construct a gravel airstrip. The airstrip will be suitable for non-scheduled air line service. The nearest airport for scheduled air line service is at Dawson Creek.

4.8 RAIL TRANSPORT

The transportation of the clean coal to the Terminal at Ridley Island, B.C. will involve unit trains travelling a distance of approximately 762 miles. The selected route is by C.N.R. to Prince George, B.C. and by British Columbia Railway to Chetwynd. A new line is to be constructed from Chetwynd to the site.

The route and grade selected by British Columbia Railway from "in office" data for the new line is to be confirmed as more detail becomes available.

The length of new track required is 93 miles at the Babcock-Wolverine area and approximately 4 miles at Ridley Island.

Negotiations between British Columbia Railway and the C.N.R. have not been finalized, but the indications are that no major difficulties are anticipated.

Construction of the new trackage is tentatively scheduled to require two years to completion, which is within the project requirements.

Locomotive and unit cars are required and will be permanently assigned to the Quintette project.

It is anticipated that the round trip, including loading and unloading, will require a four-day cycle. The plant facilities and Terminal will be designed to accommodate two complete unit trains to ease transportation delays.

Details of weight-control and accounting procedures have not been determined, and will require clarification as the project develops.

4.9 RECEIVING, STORING AND LOADING FACILITIES - PRINCE RUPERT

Negotiations are in progress for the construction of a new Bulk Loading Terminal at Prince Rupert, B.C. For the purposes of this investigation it has been assumed that the outcome will be favourable to the project requirements.

The proposed terminal will be located on Ridley Island and will have an initial capacity to handle 6,000,000 tonnes per year of coal, with storage for 500,000 tonnes. The Terminal is to be designed to handle vessels up to 150,000 DWT, and to load the cargo without moving the vessel.

The Terminal will be equipped with a unit train rotary car dumper, and a stacker-wheel reclaimer with a peak coal loading capacity of 4500 TPH. Dust control and car washing facilities will be included.

The port facilities will occupy an area of approximately 70 acres, and will have the capacity to expand up to 10,000,000 tonnes annually. The storage area will be designed with a loop track system that will enable two complete unit trains to be on the property simultaneously.

Rail access to the Terminal will require a short extension to the existing CNR track on Kaien Island, a distance of approximately 2000 feet.

Road access to the Terminal is considerably longer, and will connect into Highway 16 to Port Edward.

VOLUME I -. APPENDIX A

DRAWINGS

The following drawings are included as part of this volume:

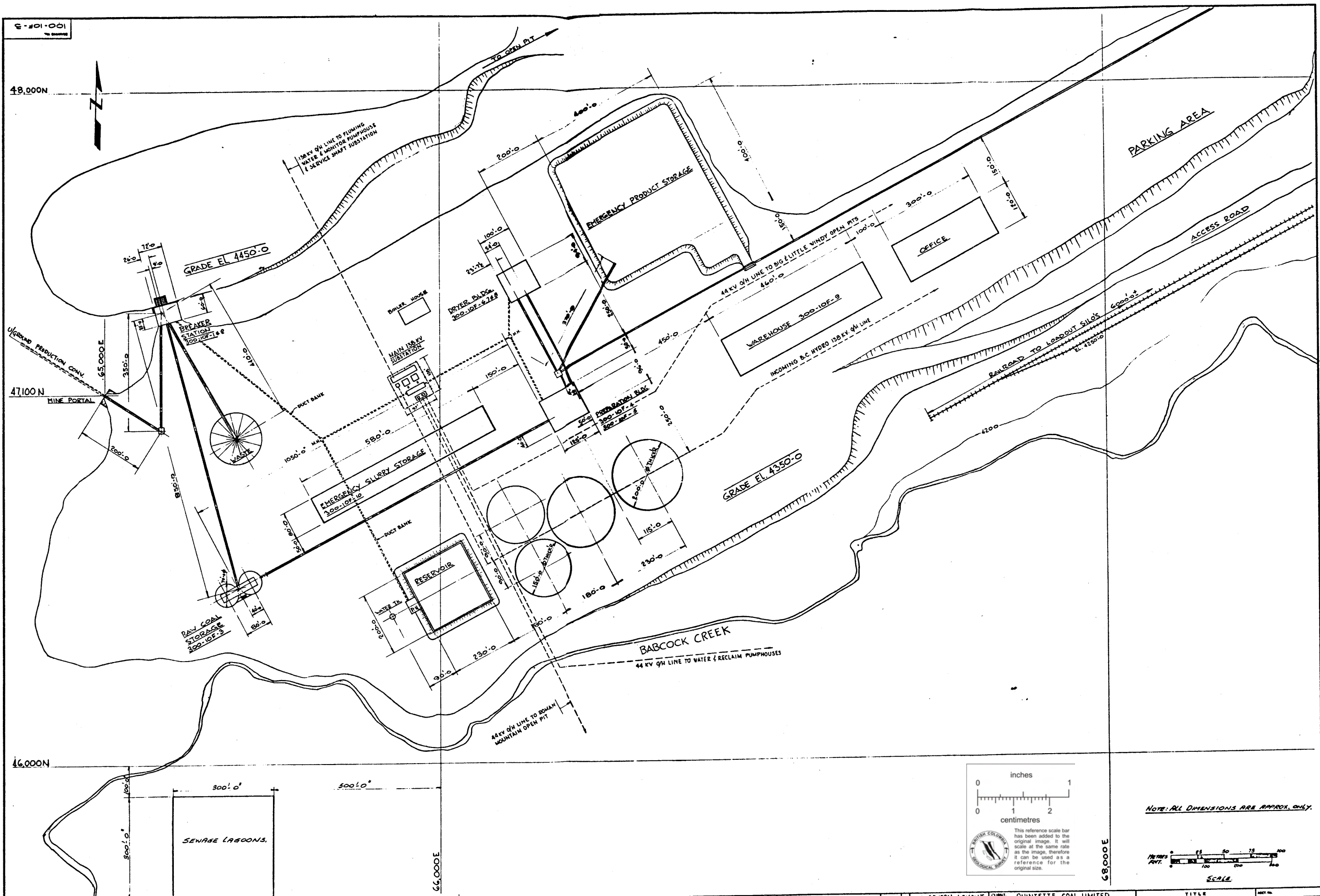
Area Plan	100-10F-1
Babcock Area - Plot Plan	100-10F-2
Babcock Area - Site Plan	100-10F-3
Wolverine Area - Site Plan	100-10F-4
Townsite - Plot Plan	100-11F-1
Project Summary Schedule	100-26-1

E-101-001

48,000N

47,100N

46,000N



PARKING AREA

ACCESS ROAD

OFFICE

WAREHOUSE 300-10F-9

EMERGENCY SLURRY STORAGE

RESERVOIR

RAW COAL STORAGE 300-10F-3

BREAKER STATION 300-10F-4

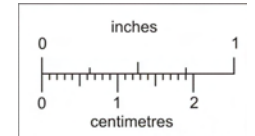
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PREPARATION BLDG. 300-10F-4

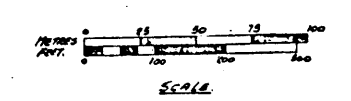
BABCOCK CREEK

GRADE EL 4450.0

GRADE EL 4350.0

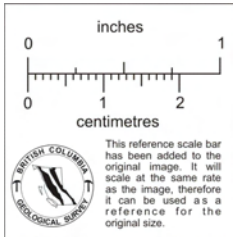
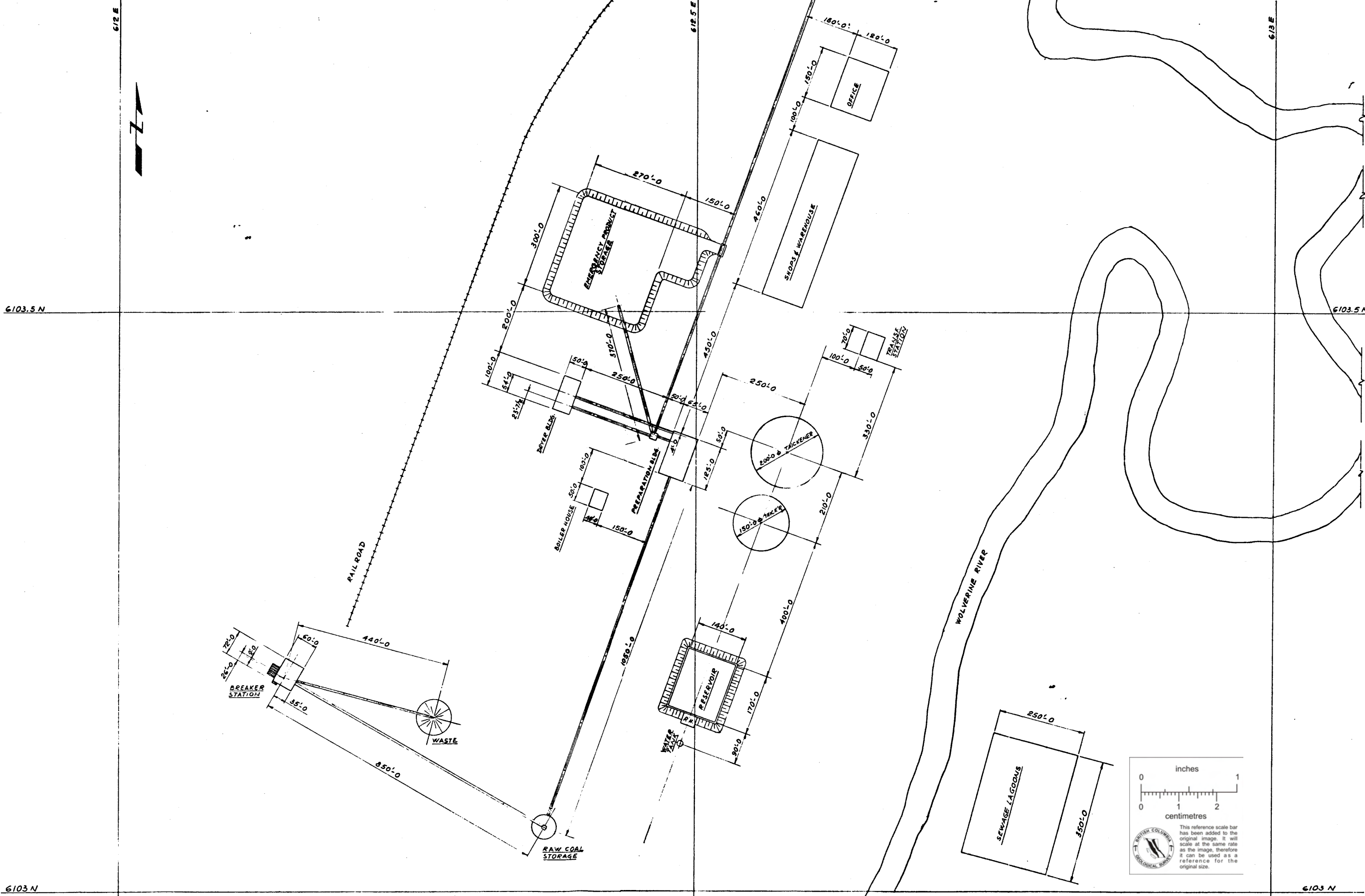


NOTE: ALL DIMENSIONS ARE APPROX. ONLY.

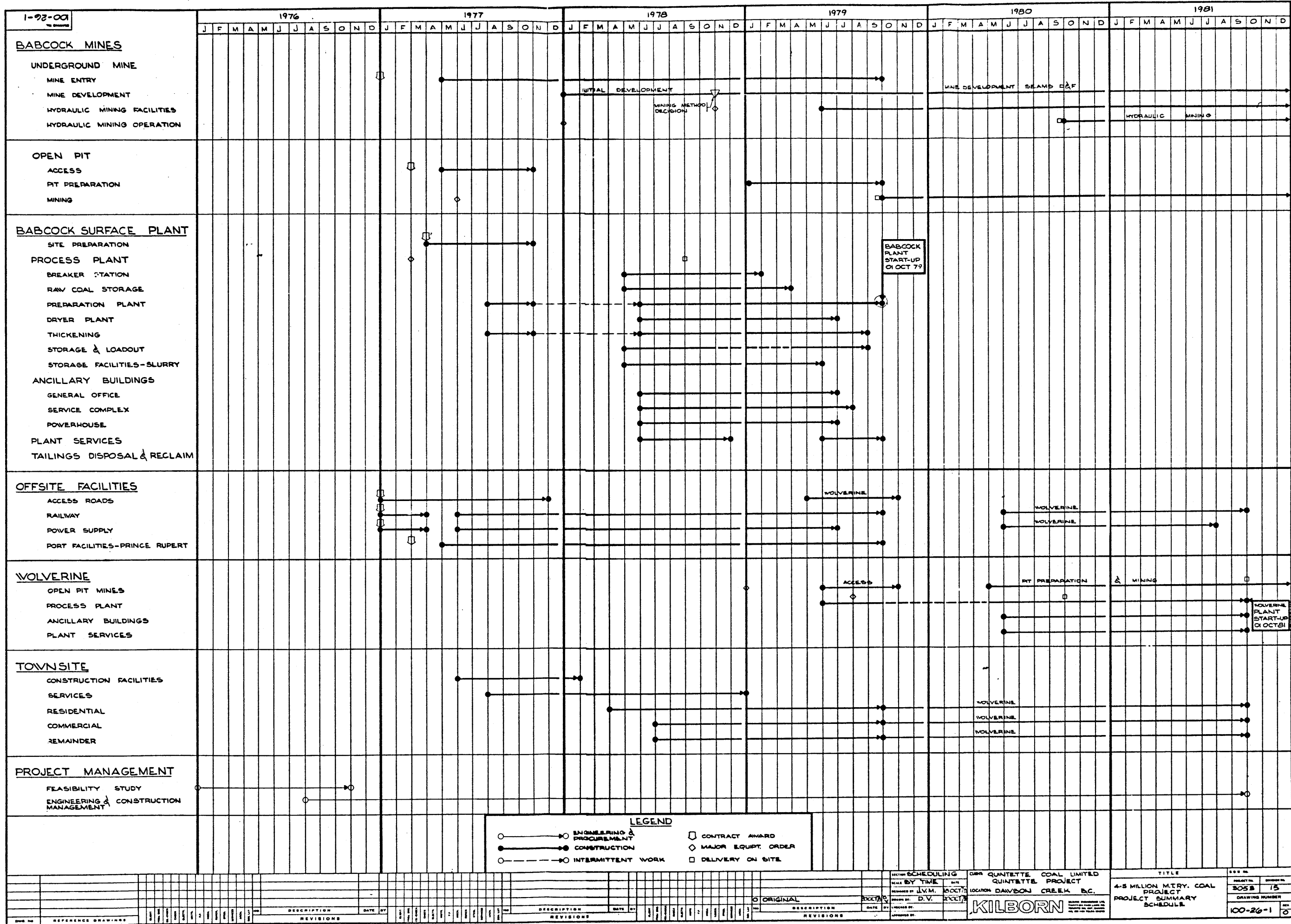


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DESIGNED BY: D. SCOTT		CHECKED BY:	KILBORN		
APPROVED BY:		This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.			
REVISIONS		REVISIONS DESCRIPTION DATE BY			
REFERENCE DRAWINGS		REFERENCE DRAWINGS DESCRIPTION DATE BY			

100-10F-4



SECTION: GENERAL LAYOUT		CLIENT: QUINTETTE COAL LIMITED QUINTETTE PROJECT		TITLE		PROJECT NO.		DRAWING NO.	
SCALE: 1" = 100'-0"		LOCATION: DAWSON CREEK, B.C.		4.5 MILLION MTPY COAL PROJECT WOLVERINE AREA 1.5 MILLION MTPY COAL PREPARATION PLANT SITE PLAN		3053		15	
DRAWN BY: R.K.		DATE: 1988		DRAWING NUMBER		100-10F-4		REV. NO.	
APPROVED BY:				KILBORN				0	



1-22-001

BABCOCK MINES
 UNDERGROUND MINE
 MINE ENTRY
 MINE DEVELOPMENT
 HYDRAULIC MINING FACILITIES
 HYDRAULIC MINING OPERATION

OPEN PIT
 ACCESS
 PIT PREPARATION
 MINING

BABCOCK SURFACE PLANT
 SITE PREPARATION
 PROCESS PLANT
 BREAKER STATION
 RAW COAL STORAGE
 PREPARATION PLANT
 DRYER PLANT
 THICKENING
 STORAGE & LOADOUT
 STORAGE FACILITIES-SLURRY
 ANCILLARY BUILDINGS
 GENERAL OFFICE
 SERVICE COMPLEX
 POWERHOUSE
 PLANT SERVICES
 TAILINGS DISPOSAL & RECLAIM

OFFSITE FACILITIES
 ACCESS ROADS
 RAILWAY
 POWER SUPPLY
 PORT FACILITIES-PRINCE RUPERT

WOLVERINE
 OPEN PIT MINES
 PROCESS PLANT
 ANCILLARY BUILDINGS
 PLANT SERVICES

TOWNSITE
 CONSTRUCTION FACILITIES
 SERVICES
 RESIDENTIAL
 COMMERCIAL
 REMAINDER

PROJECT MANAGEMENT
 FEASIBILITY STUDY
 ENGINEERING & CONSTRUCTION MANAGEMENT

LEGEND
 ○ ——— ○ ENGINEERING & PROCUREMENT
 ● ——— ● CONSTRUCTION
 ○ — - - ○ INTERMITTENT WORK
 □ CONTRACT AWARD
 ◇ MAJOR EQUIPT. ORDER
 □ DELIVERY ON SITE

SECTION SCHEDULING
 DRAWN BY TIME DATE
 CHECKED BY J.V.M. 10/27/79
 DESIGNED BY D.V. 10/27/79
 DRAWN BY
 CHECKED BY
 APPROVED BY

QUINTEtte COAL LIMITED
 QUINTEtte PROJECT
 LOCATION DAIBON CREEK B.C.

TITLE
 4-5 MILLION M.TRY. COAL PROJECT
 PROJECT SUMMARY SCHEDULE

PROJECT NO. 305B
 DRAWING NUMBER 15
 100-26-1

NO.	DESCRIPTION	DATE	BY