IR - SUKUNKA - 76(7)A

222

BRAMEDA RESOURCES LIMITED

'PROSPECTUS'
FOR
DEVELOPMENT OF THE SUKUNKA MINE

OCTOBER 1976

TABLE OF CONTENTS

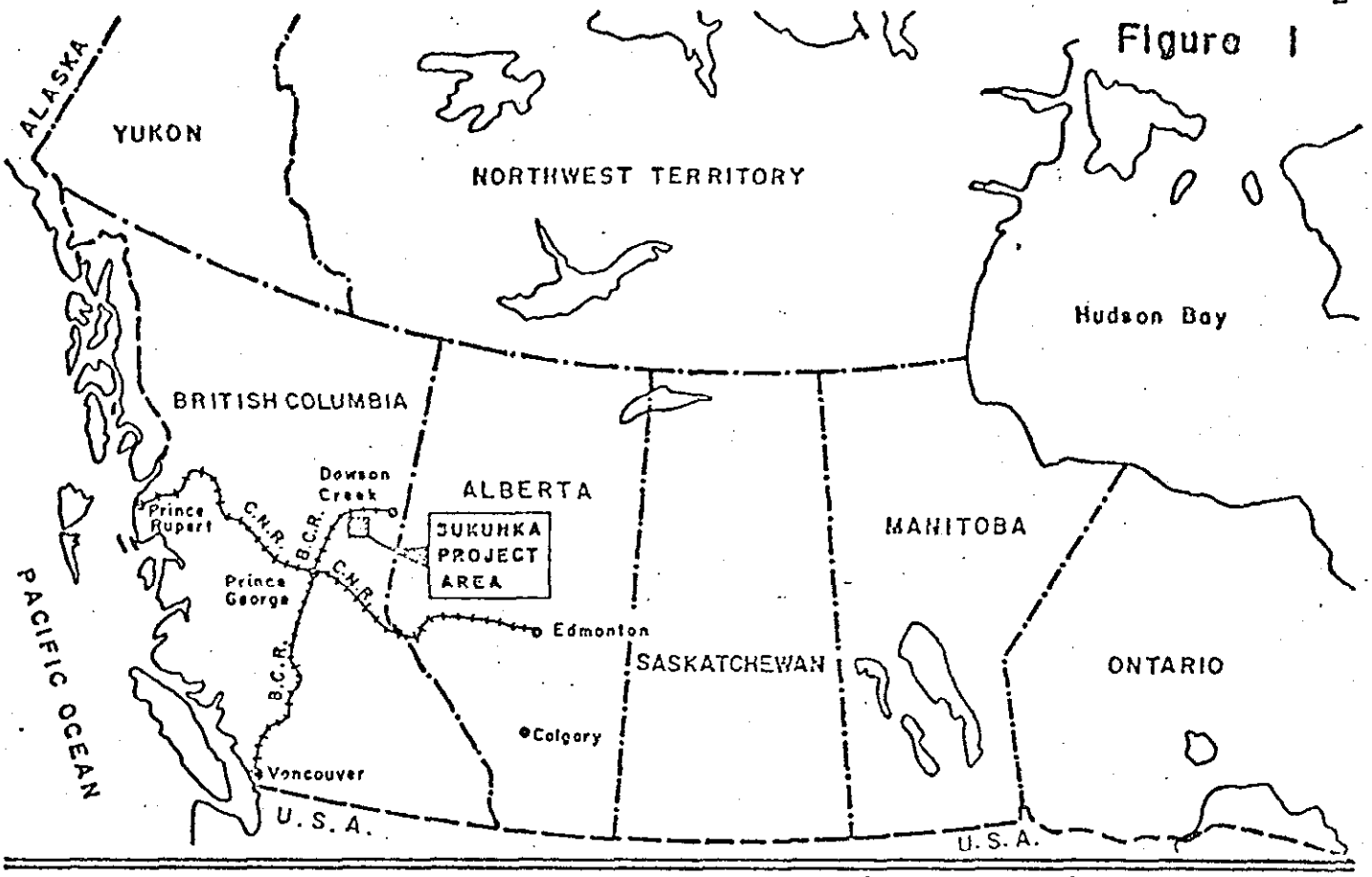
INTRODUCTION

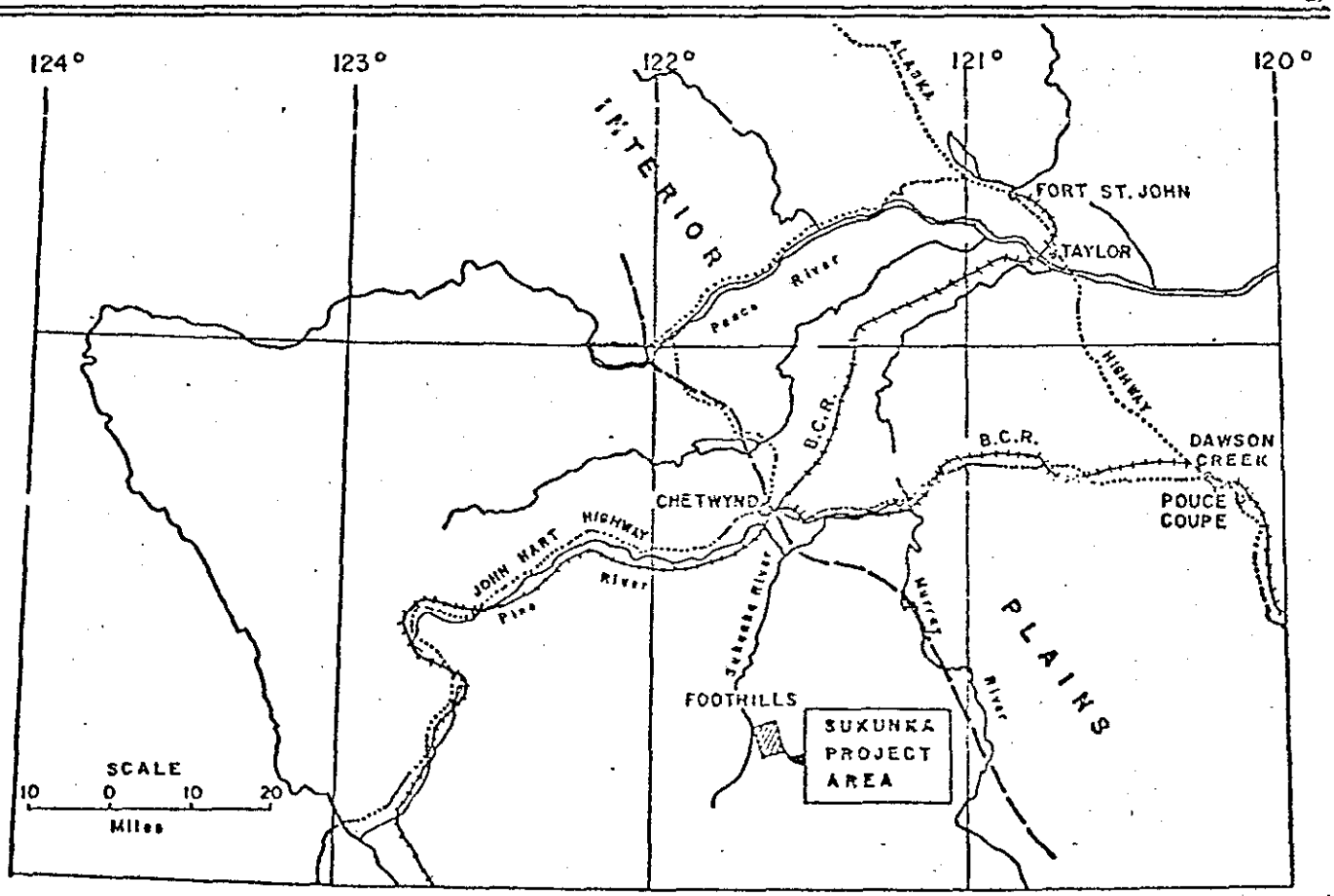
Brameda Resources owns 41 licenses in the Sukunka valley area 38 miles south of Chetwynd, B. C. (Fig. 1).

Exploration for coal on this area has been continuous since 1969 when Brameda Resources outlined the resource through a programme of diamond drilling, followed during the Brascan Resources Ltd. 1971-76 option period by further drilling. In addition, an extensive underground programme was carried out on the Chamberlain and Skeeter Seams. In the course of the underground development 134,000 tons of coal was produced proving both the quality and mineability of the Chamberlain and Skeeter coal seams.

Brameda Resources Ltd. proposes to place the Sukunka properties into production at an initial output of 1,000,000 tons per year increasing to 2,000,000 tons over a period of three to four years.

Figure 1





BRAMEDA RESOURCES LIMITED
SUKUNKA RIVER COAL PROJECT
GENERAL LOCATION MAP After Clifford McElroy & Associates

COAL PROPERTY

Forty-one coal licences, numbers 3089 to 3129 inclusive, currently comprise the Sukunka property. The total area is 26,996.28 acres. (figure 2).

These licences were acquired by Brameda Resources Ltd. in 1970. The licences subsequently were optioned to Coalition Mining Ltd., a subsidiary of Brascan Resources Ltd. until the option expired on June 30, 1976. Brascan currently holds an interest of 12.5 per cent in the Sukunka licences.

GEOLOGY AND COAL OCCURRENCES

The coal deposits of the Sukunka River area occur within Lower Cretaceous sedimentary rocks of the Bullhead group and Fort St. John Group. The local section has a thickness in excess of 3,000 feet.

TABLE OF FORMATIONS

Fort St. John

- Commotion formation
  - Boulder Creek member
  - Hullcross member
  - Gates member*
  - Sukunka member
- Moosebar formation

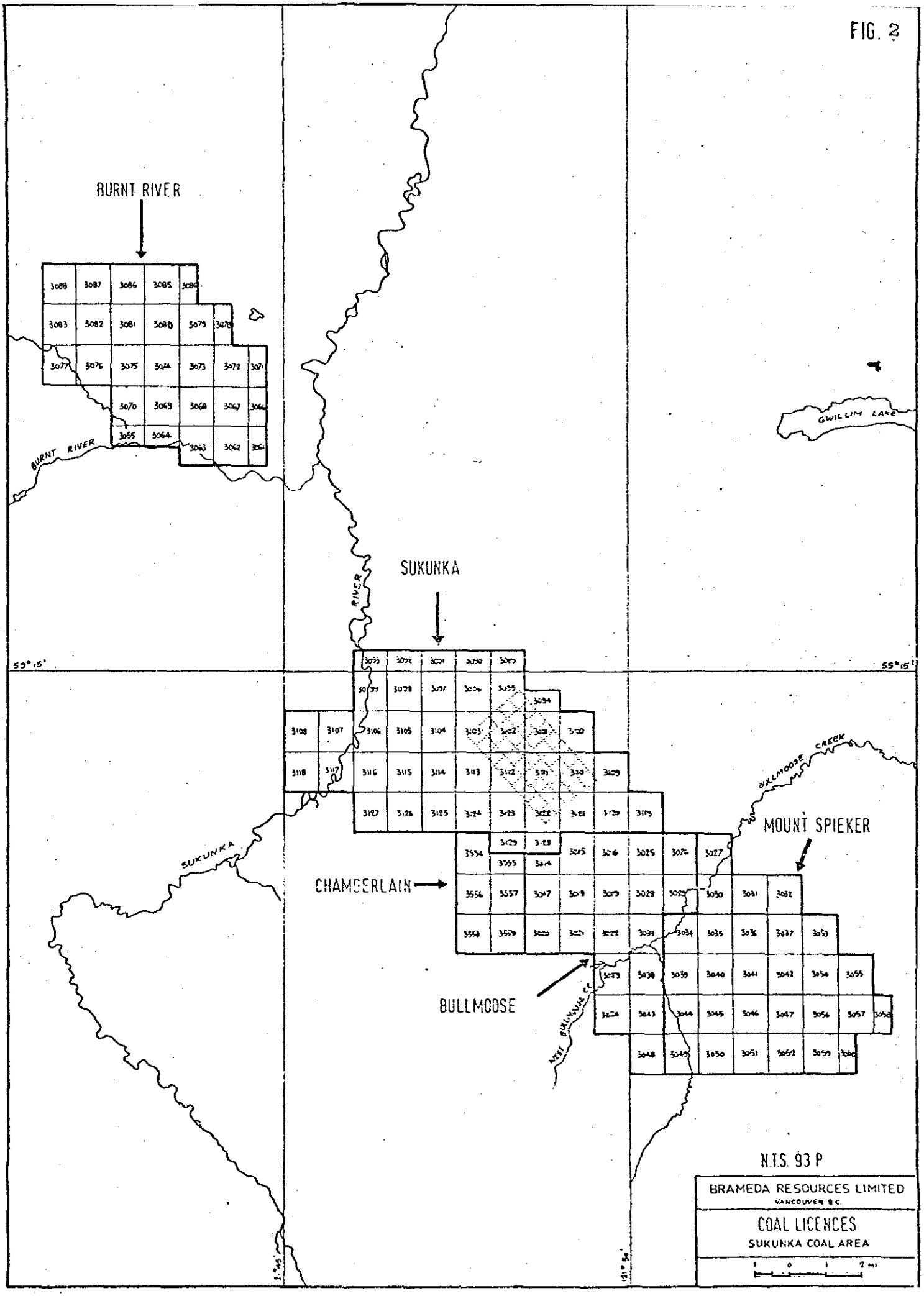
Bullhead Group

- Gething formation*
- Cadomin formation

Minnes Group

*denotes unit containing coal of economic interest.

FIG. 2


BURNT RIVER
BURNT RIVER
SUKUNKA
RIVER
GWILLIM LAKE
55°15'
55°15'
SUKUNKA
CHAMBERLAIN
BULLMOOSE
BULLMOOSE CREEK
MOUNT SPIEKER
N.T.S. 93 P
BRAMEDA RESOURCES LIMITED
VANCOUVER B.C.
COAL LICENCES
SUKUNKA COAL AREA
0 1 2 mi

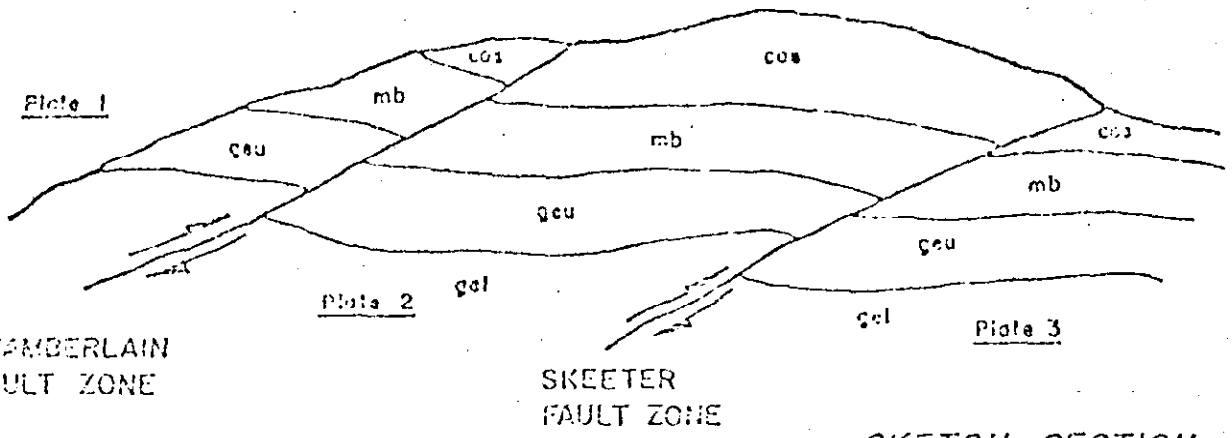
The coal measures in the upper part of the Gething formation, have undergone intensive exploration since 1969. Potentially important, but largely untested coals also occur in the lower part of the Gething formation. The coal seams in the Gates member of the Commotion formation occur approximately 1,000 feet stratigraphically above the important upper Gething seams. The Gates coals have their maximum local development in the southern portion of the Bullmoose property south of the Sukunka property, where they currently are undergoing intensive exploration.

Most of the previous work on the Sukunka property has been directed toward the testing and evaluation of the Chamberlain seam, an unexcelled metallurgical coal, and the Skeeter seam which lies a few feet higher in the section. The Skeeter seam is similar in quality to the Chamberlain but reaches economic thickness over a rather restricted area. The Chamberlain on the Sukunka property has an average thickness of about 9 feet; it occurs about 150 feet below the top of the Gething formation.

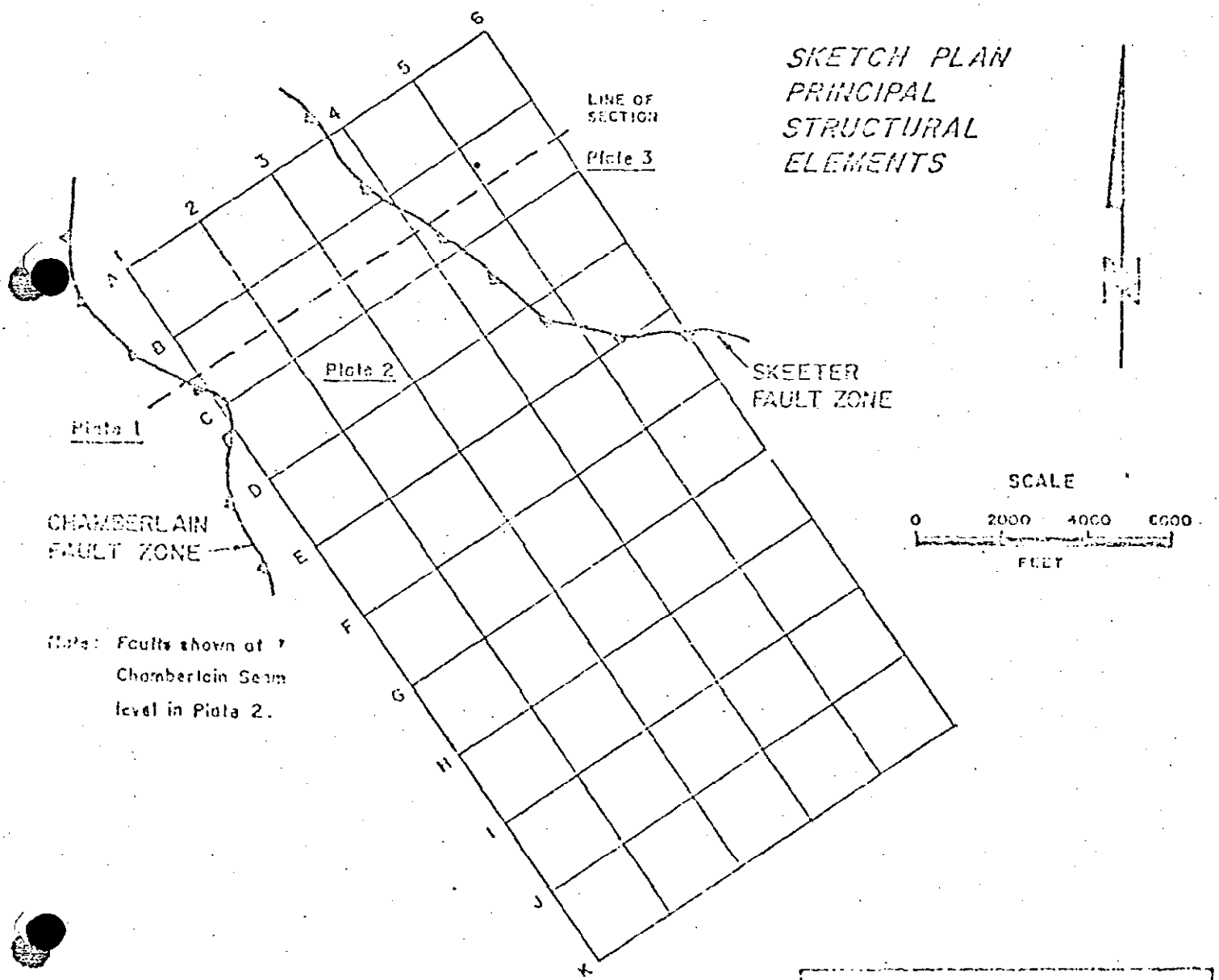
Most of the exploration work was carried out within a broad synclinal area flanked to the northeast and southwest by strongly faulted and steeply inclined structural units. Dips within the grid area on the Sukunka property are generally less than 10 degrees.

Several southwesterly-dipping thrust faults have disrupted the coal seams within the grid area on the Sukunka property. Three main fault blocks have been designated as Plates 1 to 3 numbering from the west. Plate 2 lies between the Chamberlain fault on the west and Skeeter fault on the east. In the northern part of the area this plate in turn has been divided into Plates 2a, 2b, and by the Pond and Rim faults. (see figures 3 and 4.)

Figure 3



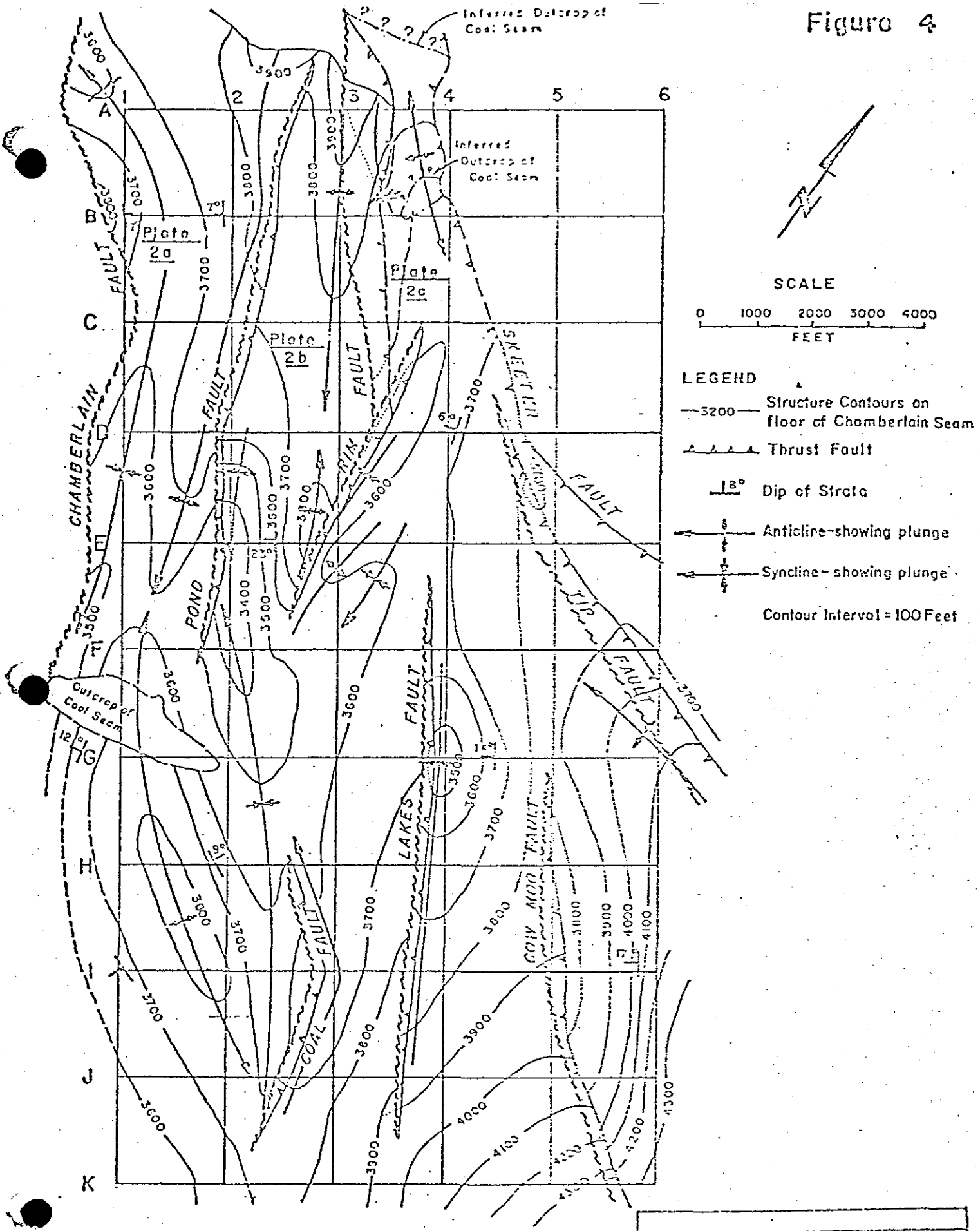
SKETCH SECTION
(looking North-West)



Note: Faults shown at Chamberlain Seam level in Plate 2.

SKETCH PLAN AND SECTION OF PRINCIPAL STRUCTURAL ELEMENTS
After Clifford Nelson & Associates

Figure 4



SURUNKA RIVER COAL PROJECT

STRUCTURE CONTOUR MAP OF CHAMBERLAIN SEAM

After Clifford McElroy & Associates

COAL RESERVES AND QUALITY

The intensive exploration work carried out by Brameda Resources and Coalition Mining on the Sukunka property has permitted an estimate of measured reserves for the Chamberlain and Skeeter seams within the grid area (ca. 7 square miles). In addition there are large indicated reserves of Chamberlain on both the Sukunka and Bullmoose properties. Large amounts of Gething coal occur on untested protions of the property and are not included in any of the reserve categories. However structural complications and depth of cover may limit the utilization of these resources.

Table 1 shows the breakdown of these reserves by category, seam and area.

TABLE I

SUMMARY OF IN-PLACE COAL RESERVES-SUKUNKA PROPERTY
(Millions of long tons in place)

CATEGORY	SEAM	PLATE 1	PLATE 2	PLATE 3	TOTAL
Measured	Chamberlain	3.6	57.2	7.0	67.8
	Skeeter	2.5	9.1	2.8	14.4
	TOTAL	6.1	66.3	9.8	82.2
Indicated	Chamberlain				22.0
Inferred	Chamberlain				16.0
TOTAL MEASURED INDICATED & INFERRED					120.2

A relatively small amount of the coal reserve is accessible to surface mining methods. Previous work indicated approximately 1.5 million tons of coal recoverable by surface methods at a maximum overburden: Coal ratio of 10:1. Exploration is in progress to increase the reserve of surface-mineable coal.

The underground recoverable coal reserve depends to a large extent on the mining methods utilized. The August 1973, report of the Japan Overseas Coking Coal Development Co. Ltd. suggests that, by the use of longwall mining methods, the recoverable coal reserves within the grid area are 58.4 million tons in the Chamberlain seam and 10.9 million tons for the Skeeter seam.

Extensive testing of the Chamberlain and Skeeter coals has demonstrated that both are low-medium volatile, heavy coking coals. Both coals can be washed, at high yields, to very low ash contents. In each case sulphur and phosphorus contents are low and fluidities above average for Western Canadian coals. Carbonization tests have clearly identified the superior coking characteristics of the coals.

The predicted clean-coal specifications after heavy-media, froth-flotation treatment are shown on Table 2.

TABLE 2

PREDICTED CLEAN-COAL SPECIFICATIONS

	Chamberlain Seam		Skeeter Seam
	Adit #2	Adit #4	Adit #5
Yield %	74.0	78.0	75.0
Air dried moisture %	1.0	1.0	1.0
Ash %	2.8	5.4	4.5
Volatile matter %	22.8	22.2	22.7
Fixed carbon %	73.4	71.4	71.8
Sulphur %	0.50	0.48	0.50
FSI	8½	8½	8½
Calorific value (BTU/lb.)	14,800	14,400	14,600
Phosphorus %	0.020	0.034	0.035

DESCRIPTION OF PROPOSED COAL MINING OPERATION

EXPLORATION PHASE

Exploration work has been carried out continuously on the Sukunka property since 1970. During 1970 and 1971 Brameda Resources Ltd. completed 49,000 feet of diamond drilling and drove three short adits. From 1971 until June 1976, when its option expired, Coalition Mining completed more than 80,000 feet of drilling and carried out extensive development at two sites including nearly 20,000 feet of underground workings.

During 1976 an exploration program consisting of short diamond drill holes was undertaken in order to test several potential open pits. It is anticipated that this type of program will continue into 1977. No additional surface drilling is planned to increase or upgrade the known underground reserves. It is believed that these reserves have been sufficiently well defined by the previous six years of serious exploration.

The main access roads on the property have been defined and have been upgraded on the basis of environmental factors. All other roads, as well as trenches, drill sites and other disturbed areas, have ben reclaimed in accordance with existing environmental regulations.

CONSTRUCTION STAGE

Construction of the mine complex will be mounted from a construction camp at the Sukunka mine site employing a peak of 250 construction workers in year 2 and 3 of the construction programme for the first of the 1,000,000 ton capacity plant. After the initial plant is complete and in operation the second phase to produce 2,000,000 tons will be undertaken for completion in year 8 of the mine operation. The second phase will reach a peak of 150 construction personnel by the year 7 of the programme.

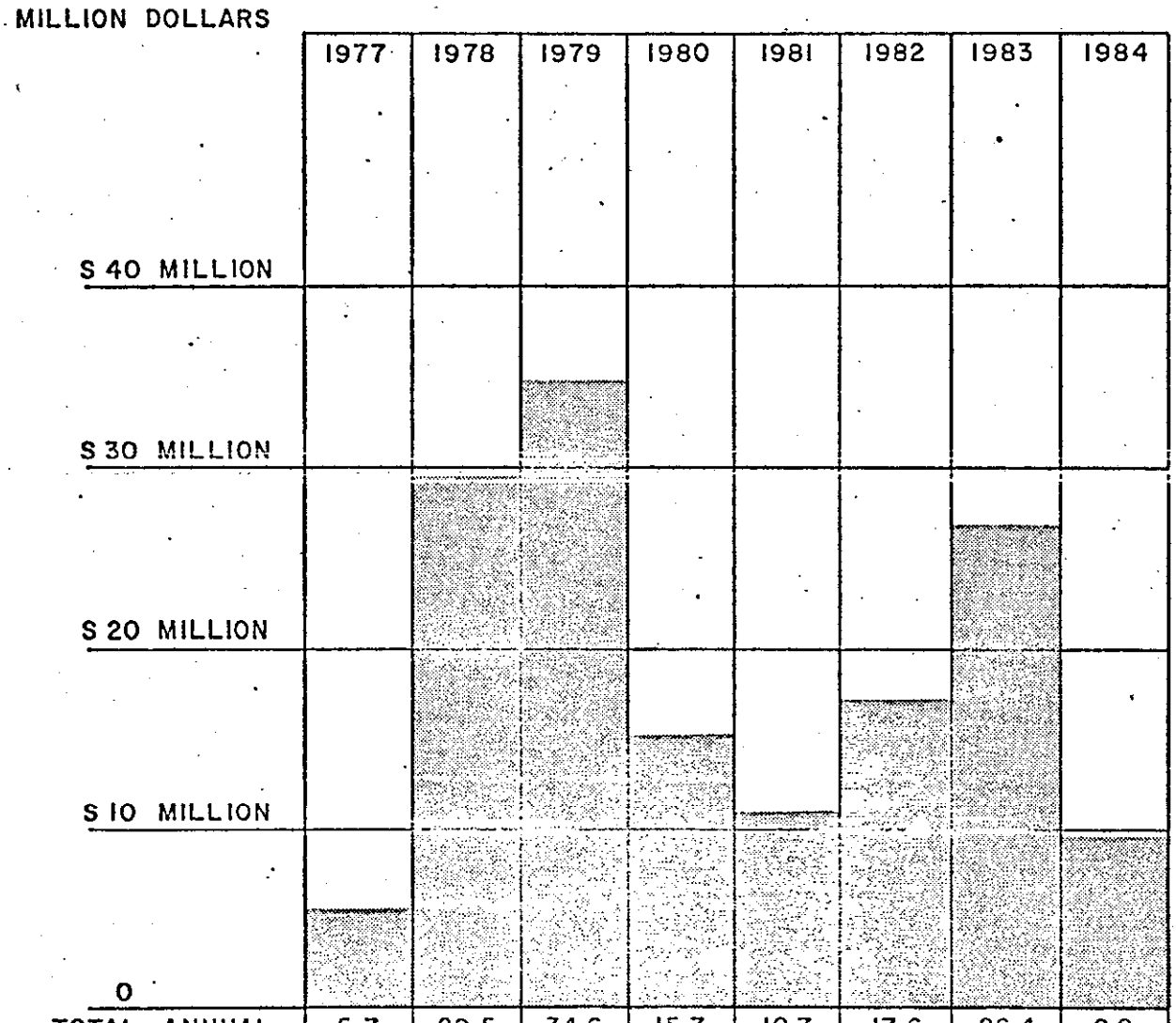
It is anticipated that the mining function will recruit personnel from the construction stage. It is virtually impossible to quantify this transfer, however, as the construction stage proceeds, recruiting and training of mine personnel with the objective of employing approximately 500 miners and salary staff to meet the production level of 2,000,000 long tons by 1984, or year 8 of the development, will be undertaken.

The preparation plant and other surface buildings will be constructed on a comparatively level area at approximately 2,450 feet between the Skeeter and Chamberlain Creeks and served by the present Sukunka Valley road. The project cost is estimated to be 150 million dollars which provides for all underground, surface and outside service construction. The sum includes an estimate for inflation during the development period. The programme of annual expenditure is shown in figure 5.

FIGURE 5

CAPITAL EXPENDITURE PROGRAMME FOR SUKUNKA MINE DEVELOPMENT 1977 — 1984

INCLUDING EMPLOYEES FOR CONSTRUCTION AND MINE OPERATION



	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL ANNUAL	5.7	29.5	34.6	15.7	10.7	17.6	26.4	9.8
PROJECT TOTAL	150.0 MILLION							
EMPLOYEES								
CONSTRUCTION	100	250	200	20	—	20	150	20
MINING	51	109	109	292	365	438	511	584
TONNAGE MILLIONS				1.0	1.25	1.50	1.75	2.0

PROPOSED COAL MINE OPERATION

It is proposed that the underground mining operations will be mainly concentrated in the explored section of the property, (see figure 2), in which both the Chamberlain and Skeeter seams are present. These seams have widths and depths suitable for most conventional mining methods.

A number of different mining methods have been examined including:

1. Room and pillar, without pillar extraction.
2. Room and pillar, with pillar extraction using power supports (i.e. "short wall").
3. Room and pillar, with pillar extraction and not using power supports.
4. Retreating long wall.
5. Advancing long wall.

In systems 1, 2 and 3, a combination of continuous miners and shuttle cars would be used both for the initial drives and in the extraction of the pillars. In the long wall method (systems 4 and 5) the main production would come from the use of coal shearers in conjunction with power supports feeding on to a system of belts. The run of mine coal will be fed through a breaker onto a continuous belt conveyor for transfer from the mine to the preparation plant.

Underground coal will be supplemented by surface mining during the training up period of the underground crews.

Both mine and plant power will be provided by B. C. Hydro through overland line transmitting 138 KV from the Chetwynd sub-station.

COAL PROCESSING

The run of mine coal from the Skeeter and Chamberlain seams will be processed in a central washing plant. The processing facility will be located 36 miles south from the John Hart Highway (B. C. Highway 97) on an existing logging road. The plant site will be of an elevation of 2,450 feet in the Sukunka River Valley between Skeeter and Chamberlain Creek.

The washing plant will be designed to produce 1 million long tons of clean coal per year with provisions for future expansion to 2 million long tons per year. The clean coal will be a high quality metallurgical coal with consistent low ash and low sulfur contents. The following objectives have been set based on available washing data.

1.	Clean Coal Ash	4.0 - 4.5%
2.	Sulfur	0.4 - 015% S
3.	Overall Yield	75%

The flow chart of the washing plant is shown in figure 6. The run of mine coal will be stored at the plant site in an outside stock pile of 5,000 ton live capacity and in a 1,000 ton coal silo.

The coal preparation will be carried out in three size ranges:

1.	Coarse coal	(-5" x +3/8")
2.	Medium coal	(-3/8 x +35 mesh)
3.	Fine coal	(-35 mesh x 0)

IV. DEVELOPMENT HISTORY AND SOCIAL ENVIRONMENT

Chetwynd's original development was centered around the forest industry, and was typical of northern communities in that there was a lack of long range planning. Residential, industrial and commercial areas have been allowed to grow at random without restriction and thus the village has an unplanned mixture of land utilization.

The community was built around an already existing native settlement. As is common in most northern communities, the native population lives in obviously segregated sectors of the village. In effect the community is divided into two; the larger, better equipped white sector, and the smaller, more dilapidated Indian sectors. Relations between the two communities are impersonalized and restricted to specifics.

Not enough industry has been attracted to, and maintained in, Chetwynd to provide adequate financial support for the community. The present recessionary trend in the forest industry has had a marked effect on local business and thus attitudes toward expansion and development of business.

The Hudson Hope dam project, located 49 miles north of Chetwynd, which is now entering Phase II of construction, has exposed the community to detrimental transient and spin-off trends. The dam project draws people because of high salaries, but no economic benefits filter back into Chetwynd. Chetwynd and Hudson Hope are geographically distant

enough to make daily transit of workers living in Chetwynd to the damsite impractical. Consequently, the economic advantages accruing to the region generally, tend to by-pass Chetwynd. The fact that Chetwynd industries cannot compete with the lucrative labour attractions characteristic of the dam project has also had a negative effect on the development of the community. The detrimental transient trend results in Chetwynd being used as a temporary stop-over point by labourers on their way further north to better paying development areas.

In this situation a variety of behavioral disorders and stress reactions exist, apparently resulting from the unsettled and frequently changing social structure. There is an air of impermanence in the community which makes long-term social planning, and thereby economic planning, difficult.

In new developments attention is often exclusively economic and machinery is lacking for citizen participation in decision making and planning.

The company towns and communities redeveloped by new industry, of which Chetwynd is a specific example, are essentially displaced southern communities attempting to emulate their counterparts "outside", but under handicaps of remoteness, isolation, severe climate, transportation and communication problems and a transient population. In both the town and the mining camp, the expectation is that one will

not be there long. The constant development and breakdown of social and emotional ties has an important influence on the attitude of permanent and transient members of the community to their "quality of life" and its desirability over an extended period of time.

"Quality of life" refers to a person's psychological and physical well-being, as he perceives it, in different contexts such as work, family, community and recreation. The quality of living in communities such as Chetwynd influences and is influenced by the amassing of people in the settlement. Men are attracted to a new mining area, for example, because of the prospects of better job opportunities, high wages, and lower expenditures than are common in more heavily populated, diversified, and multi-industry areas. The isolated mining community can also have some positive, aesthetic attractions for those who move to such an area. The outdoor, spatial freedom and uncluttered visual aspects are also attraction features.

The attitude of the individual to the community has significant repercussions on his attitude and behavior as an employee. Mining communities, or one industry communities, of which Chetwynd is a primary example, have a high incidence of worker mobility. This factor is a reflection and a parallel of the situation that exists within the industry serving as the economic base of the community; that is, the industry is characterized by a high incidence of worker turnover.

What factors affect turnover? Workers seeking only money do not stay long. For those seeking adventure on the frontier, there is too little excitement; for those seeking the comforts of suburbia, isolation is too great. Many become discontent with the cold, the mosquitoes and black flies, the lack of amenities, the absence of opportunities, and the limited scope of a small population.

Employment and family problems are also reasons for leaving:

> Workers come to a new community hoping for better wages and improved working conditions - so many come expecting it to be the "promised land" - and are disillusioned to find they must work just as hard here as elsewhere. Discontent with employment is perhaps a major factor for a few, but .. the majority that leave do so because of discontent in the home which causes the breadwinner to look elsewhere for work. The wife is unhappy, she has difficulty making friends, she feels she is not accepted into the social structure created, or she finds the climate not to her liking.

The factor of "wife dissatisfaction" is decidedly crucial. On the other hand, a man that is dissatisfied with his job may use the excuse of a discontented wife, even though the wife may be content. There now is, however, considerable evidence to support the theory of wife dissatisfaction and its influences. Prolonged confinement during the winter months, especially if there are several small children in the family, brings about a condition variously labelled

"cabin fever", "housewife psychosis", and "crowding". Another important factor that should be noted is that the husband being away from home much of the time because of his job has a significant influence on the existence of the "wife dissatisfaction" syndrome. The longer the husband stays away from the home for reasons of employment requirements, the more dissatisfied the wife becomes.

The cumulative effects of high turnover rates have a significant economic impact. A 1972 study done by the University of Manitoba, Centre for Settlement Studies, indicates that it costs $1,000 per employee to hire a new employee and place him in work at some of the northern mines. The annual rate of turnover at mines is about 200%. A 200% turnover with a hiring cost of $1,200* per employee implies an extra cost per employee year of $2,400.

Unquestionably this amount would be better spent in minimizing turnover by providing some of those amenities which the community members perceive as contributing to a desirable quality of life.

The types of improvements that the workers themselves perceive as most necessary are: income in relation to cost of living; housing accommodation; access to cities; local government; retail facilities; educational facilities and opportunities; working conditions; and entertainment and recreation.

* This figure was adjusted by 20% to reflect 1974-5 prices. It does not include additional costs of off-shore recruitment.

However, these are not the only necessities involved in the quality of life. A "needs" study conducted by the University of Manitoba, Centre for Settlement Studies, with mine workers indicated that the workers found satisfaction of the following basic needs necessary:

1. Physiological needs: health, food, living quarters.
2. Security needs: job safety, permanent employment, company welfare program.
3. Social needs: getting along with others, making friends, feeling of belonging.
4. Esteem needs: credit for work done, value of job to company, respectability of job to others.
5. Autonomy needs: decision as to what to work on, decision as to how to work, decision as to time off.
6. Self-actualization needs: self-improvement on the job, feeling that the job is worthwhile, using all skills and abilities.

Esteem and self-actualization needs represent the greatest source of perceived dissatisfaction. This attitude, together with other lower rated needs, would seem to imply then that northern jobs should provide the worker not only with good living conditions and a safe job setting, but also with the realization that he has a job worth his efforts, that his value to the job is recognized, that he is fulfilling himself by being on the job, and that he is using his full capabilities while on the job.

However, the approach of some managements, and even of some unions, has been that men work only for money, food, safety and a "good time". Jobs and communities, therefore, have often been structured to serve only these needs. Cognizance of this problem, and the resulting high labour turnover and its effect on economic development has gradually been increasing at governmental, management and layman levels. Economic development is closely associated with social and cultural development. Therefore it is advisable to base economic development on human needs for self-respect, self-improvement and challenge. On the basis of long-term projection calculations, recognition of "human needs" can be turned into economic advantage for the company in terms of minimizing losses incurred by employee turnover and also in terms of increased production resulting from employee satisfaction.

V. ACCESS TO MINESITE FROM CHETWYND

The existing road which gives access to the minesite is primarily a logging road, 40 miles in length, and is privately maintained. The present condition of the road is such that, using a bus transport facility, 1-1/2 hours are required to complete a one way trip from Chetwynd to the Sukunka site.

The provincial government estimate for reconstruction, whereby the road would be improved to a secondary highway standard, is approximately $8,000,000. Due to the deterioration of watershed and drainage

capacities, caused by deforestation of areas proximal to the access road, it is anticipated that the present road could be closed for up to six weeks at one time, specifically during the spring thaw period. Existing elevations, bridges, and general drainage conditions would substantially increase travel time, if not make transit impossible, during severe snow storms - which are characteristic of the winter climate in this area - and during periods of heavy rainfall.

Taking into consideration the logistic problems surrounding development of the Sukunka mine, coupled with the socioeconomic problems that currently exist and that will be precipitated by the sudden injection of 160 to over 300 workers into Chetwynd's socioeconomic milieu, we have considered various alternates as possible solutions and make our recommendations accordingly.

VI. ECONOMIC EVALUATION OF ALTERNATIVE APPROACHES

The following discussion has been predicated on the basis of a 750,000 tons per year operation with a work force requirement which reaches 162 by July 1977 and 312 by July 1980. Allowing for an estimated 12 percent absenteeism, housing requirements, for 181 employees by July 1977, and 349 employees by July 1980, will have to be satisfied.

The alternatives considered are:

a. All employees would be accommodated in a camp at the mine site.

b. Married employees would live in Chetwynd and single-status employees would be accommodated in a camp at the mine-site.

and

c. All employees would live in Chetwynd.

We have evaluated the operating economics of the three approaches based on the following assumptions:

1. Alternative #1 Assumptions

   a. Camp costs of $15.46 per regular manshift worked.

   b. Travel allowance of $14.00 paid once each week (five working days) i.e. a cost of $2.80 per regular manshift worked.

   c. Bus subsidy of $3.00 paid once per week (five working days) i.e. a cost of $0.60 per regular manshift worked.

2. Alternative #2 Assumptions

   a. Forty (40) percent of the work force would be single status and would live in the camp.

   b. These men would incur the same costs per regular manshift worked as shown in Alternative #1.

   c. Sixty (60) percent of the work force would be married status and live in Chetwynd, in subsidized accommodation.

   d. Each married status man would receive a $14.00 travel

allowance for every regular manshift worked.

e. A bus subsidy of $3.00 would be required for each regular manshift worked by these married-status men.

f. A housing subsidy of $180 per month would be allowed to each married status man living in Chetwynd, i.e. $9.00 per regular manshift worked.

3. Alternative #3 Assumptions

a. All employees would live in Chetwynd.

b. All employees would receive the $14.00 travel allowance and $3.00 bus subsidy per regular manshift worked.

c. All married status employees (assumed to be 80 percent of the work force) would receive the housing subsidy of $9.00 per regular manshift worked.

A. ALTERNATIVE #1 ANNUAL COSTS

At full production, and allowing for a 12 percent rate of absenteeism, the work force would consist of 349 employees on the payroll.

The annual accommodation and travel costs would be:

Camp Accommodation:

349 x 240 days at $15.46/day $1,294,930

Travel Allowances:

349 x (240 ÷ 5) x $14.00 234,528

Bus Subsidy:

349 x (240 ÷ 5) x $3.00 ..... $ 50,256

Total Annual Cost $1,579,714

B. ALTERNATIVE #2 ANNUAL COSTS

Of the required work force of 349, 209 would be married status and live in Chetwynd. The remaining 140 would be single status and live in camp.

Single Status Costs:

Camp Accommodation:

140 x 240 days at $15.46/day ..... $ 519,456

Travel Allowance and Bus Subsidy:

140 x (240 ÷ 5) x $17.00 114,240

Total Single Status Costs ..... $ 633,696

Married Status Costs:

Travel Allowance and Bus Subsidy:

187 x 240 x $17.00 ..... $ 762,960

(Note: No travel costs for absentees)

Housing Subsidy:

209 x 240 x $9.00/day 451,440

Total Married Status Costs $1,214,400

Total Alternative #2 Costs Per Year $1,848,096

C. ALTERNATIVE #3 ANNUAL COSTS

The work force would comprise of 349 personnel, of whom 279 would be married status, and 70 would be single status. All would live in Chetwynd and 312 people would travel to the minesite each day.

Travel Allowance and Bus Subsidy:

312 x 240 days x $17.00/day	$1,272,960

Housing Subsidy:

279 x 240 x $9.00	602,640
Total Annual Costs of Alternative #3	$1,875,600

D. COMPARISON OF THE THREE ALTERNATIVES

Alternative #1 shows annual savings in operating costs of $268,382 when compared against alternative #2, and $295,886 when compared against alternative #3. In addition, this approach would result in a very significant decrease in Brascan's direct capital costs and contingent liabilities, since the capital component of providing housing in Chetwynd for married status employees would be eliminated. This reduction would depend on the type of accommodation provided in Chetwynd.

E. COMMENTS ON THE THREE ALTERNATIVES

Despite it's apparent economic advantages we do not believe that alternative #1 offers a realistic approach to the accommodation requirements of the proposed operation. We feel that it would be

very difficult - if not impossible - to obtain a stable, satisfied work force with a camp operation. Such an approach will not be satisfactory to the stable, married employee which the operation will need. If we accept the cost figure, previously quoted, of $1,200 per new employee hired (recruitment and training costs), the apparent operating savings of $295,886 per year, would be quickly dissipated.

Experience suggests that turnover rates in a camp environment can easily attain 15 percent per month. With a work force of 349 men on payroll, this would mean 628 new hirings per year. If the turnover rate under alternative #3 could be maintained at 8 percent per month (and this seems reasonable to expect) the new hirings per year would be reduced to 335. At $1,200 direct cost, of recruitment and training, per hire, this would mean a savings of $351,600 per year. However, more important than the apparent direct savings potential would be the greatly increased operational efficiency - and correspondingly decreased costs - of the proposed mine. We do not believe that alternative #2 offers any advantages over alternative #3. Although a small operational cost savings might be effected, and some reduction in capital expenditures achieved, the problems of having a camp at the minesite would not, in our opinion, be justified.

VII. RECOMMENDED APPROACH

We believe for the reasons outlined in the preceding section, that the operation should be based on a high percentage of stable, married employees living with their families. Ideally this would mean the development of a new townsite within 5 to 20 miles of the minesite. Unfortunately, this alternative appears to be precluded by the attitude of the provincial government. In any event the size of work force contemplated would appear to be too small to justify the infra-structure costs required to develop an attractive and economically viable new community.

Therefore, it seems that the only realistic alternative, which can be considered at this time, is to use Chetwynd as the domicile community and bear the costs - and other problems - associated with the very long personnel transportation to the minesite.

Accepting this premise, the problem then becomes one of selecting the optimum method of providing accommodation in Chetwynd. Basically the options available fall into two categories:

a. Provide permanent housing

or

b. Provide an attractive mobile-home park.

In either case, it is assumed that the 20 percent (70 men) single-status portion of the work force would find suitable accommodation in

Chetwynd without direct assistance from the company. It may, however, be necessary for Brascan to provide a private developer some form of occupancy guarantee for bachelor-type accommodation built to service the needs of these single-status employees.

A. PERMANENT HOUSING

We have assumed that, under this approach, the company would have 273 homes built and that these homes would be sold to the married-status employees. The estimated cost of these homes has been assumed to be $38,000 per unit. Since it is unlikely that the employees would have enough money for down payments, we have presumed that the company would provide a forgiveable second mortgage of $8,000 to each home purchaser. The equity in this mortgage could be transferred to the employee over a period of, say, 10 years beginning after the fifth year of employment. The employee would not make any repayments on this loan and the company, therefore would have to consider the $2,176,000 as a capital, non-recoverable expenditure.

The remaining $30,000 of each home's cost would be covered by a 25 year duration CMHC mortgage at an interest rate of 11 percent. The company would probably have to assume a ten year contingent liability for the $8,160,000 involved.

The principal and interest payment on the $30,000 first mortgage

would cost the employee $294 per month. Taxes would probably increase the total monthly cost to $344. If we surmize that the company will pay each home-purchasing employee a monthly subsidy of $180, and that this subsidy is taxable in the hands of the employee, at an average rate of 25 percent, the net monthly cost of home ownership to the employee would be $209 plus maintenance.

In addition to the above 273 homes, the company would have an additional seven (7) homes built for senior staff. These homes would have an average cost of $50,000 each and the company would provide a forgiveable second mortgage of $20,000 on each house. The remaining $30,000 would be covered by a CMHC mortgage which the company would have to guarantee for a period of ten (10) years.

Thus the total cost to the company under this approach would be:

- Forgiveable second mortgages $2,316,000
- Contingent (10 year) liabilities $8,370,000

B. MOBILE HOME PARK

In this case, we have assumed that the company would purchase approximately 35 acres of raw land, in Chetwynd, and develop an attractive mobile-home park. This park would be fully serviced, landscaped and would have playgrounds and a recreational complex. The recreational complex would be an aesthetically pleasing

Pan-a-Bode-type structure and would include activities rooms, a large room suitable for dances, or similar activities, and an indoor swimming pool.

We have estimated the capital cost of developing this mobile-home park as follows:

Land purchase - 35 acres @ $3,000	$ 105,000
Site Preparation	35,000
Servicing	280,000
Fencing	50,000
Sidewalks	34,000
Landscaping	70,000
Perimeter road and parking	75,000
Playgrounds	30,000
Service buildings (2)	80,000
Recreational complex	240,000
Contingencies	100,000
Total Cost	$1,099,000

The basic development, including servicing and the recreational complex, would be completed in the initial instance. Fencing, landscaping and the second service building would be added as the number of mobile homes was built-up.

The company would then arrange, with a manufacturer, the phased acquisition of 272 mobile homes. These would be 60 foot by 12 foot units with an attached 24 foot by 12 foot porch. This porch would be factory-built and fully insulated and floored.

Thus each unit would provide 1008 square feet of usable space, with the insulated porch being capable of use as a family room or for development into an extra bedroom, etc. We have estimated the cost of these units, fully furnished, as $13,500. The company would lease these units on a 7-year lease purchase option. We have calculated the monthly leasing cost as approximately $237 per unit.

Allowing $30.00 per month for municipal taxes, and $33.00 per month for full maintenance (including park and recreational complex), the total cost per month for each unit would be $300.00. Thus, if the company subsidized each unit to the extent of $180 per month, the units could be rented to the employees at a monthly cost of $120. There would be no tax component to the employee since he would not directly receive the $180 per month subsidy.

In addition, the company would provide houses for the seven senior staff personnel as detailed under the permanent housing approach.

The total cost to the company of this approach would be as follows:

Development of mobile home park	$1,099,000
Transport and set-up 272 units at $1100 each ..	299,200
Senior staff houses - forgiveable second mortgages	140,000
Total out-of-pocket cost	$1,538,200

The company's contingent liabilities would be:

Ten Year liability on senior staff home
CMHC mortgages ..... $ 210,000

Leasing liabilities on mobile homes
84 months @ $237/month on 272 units $5,414,976

In practice this latter liability would be restricted to the "buy-out" costs of the 272 units, i.e. a maximum of $3,672,000.

C. RECOMMENDATIONS

After careful consideration of the two alternative methods of providing accommodation in Chetwynd, we believe that the mobile home park development is the preferable approach. It has the following advantages:

1. Cost to the Company

The out-of-pocket cost (initial capital) to the company would be $777,800 less than the permanet housing alternative. The contingent liability would be $4,488,000 less than the alternative approach and would be for a shorter time period.

2. Cost to the Employee

The employee, assuming similar monthly subsidies from the company, would be able to rent a fully-furnished mobile home, with full maintenance, for $120 per month. The

permanent housing approach would cost him an estimated $209 per month, plus maintenance.

3. Recreational Facilities

The mobile home park development would provide the company's employees with private recreational facilities which would not otherwise be available in Chetwynd.

4. Flexibility

The use of Chetwynd as a domicile community for the proposed operation is not an attractive proposition in the long-term. It imposes an onerous cost burden on the company - in the form of very costly travel allowances. Furthermore, it forces the employees to accept long "working" days away from home.

If, and when, the Sukunka River operation is expanded to a size which would justify a new community to be developed closer to the minesite, it would be in the interests of both the company and it's employees to have such a development take place. However, if permanent residences are built in Chetwynd, this would mitigate against the practicality of eventually developing a new townsite.

5. Other Advantages

a. Furnishings

The mobile homes would be fully furnished. Since many of the employees of the proposed operation will be relocating over long distances - perhaps off-shore - the provision of fully-furnished accommodation could be of great advantage to them.

b. Community Spirit

The proposed mobile home park would, in effect, become a community within a community. This might well have beneficial effects on the morale of the company; work force and their families. It must be remembered that, assuming an average family of four, the mobile home park would have over a thousand residents. This compares to the existing Chetwynd population of 1405 people.

In recommending the mobile home park approach, we recognize the two principal problems which may be encountered. These are:

a. The local municipality may tend to oppose the approach. We believe that this can be overcome by a frank discussion with the local council members about the economics involved. It would seem reasonable to expect that Chetwynd would prefer the mobile home park development to no development at all,

and,

b. There could be some aversion, on the part of some employees, to mobile home living. However the many advantages - parti-

cularly of this type of mobile home development - should overcome any initial reluctance. Our experience with mobile homes in Grande Cache - in a much less sophisticated type of development - suggests that this problem may be considerably less than might be expected.

VIII. CONCLUSIONS

The contradictory influences of the distance of the proposed minesite from Chetwynd, and the relatively modest size of the proposed operation, pose a difficult problem in terms of selection of the optimum method of providing accommodation for the required work force. In the preceding sections of this report, we have examined the problems, analysed the possible alternatives and made our recommendations.

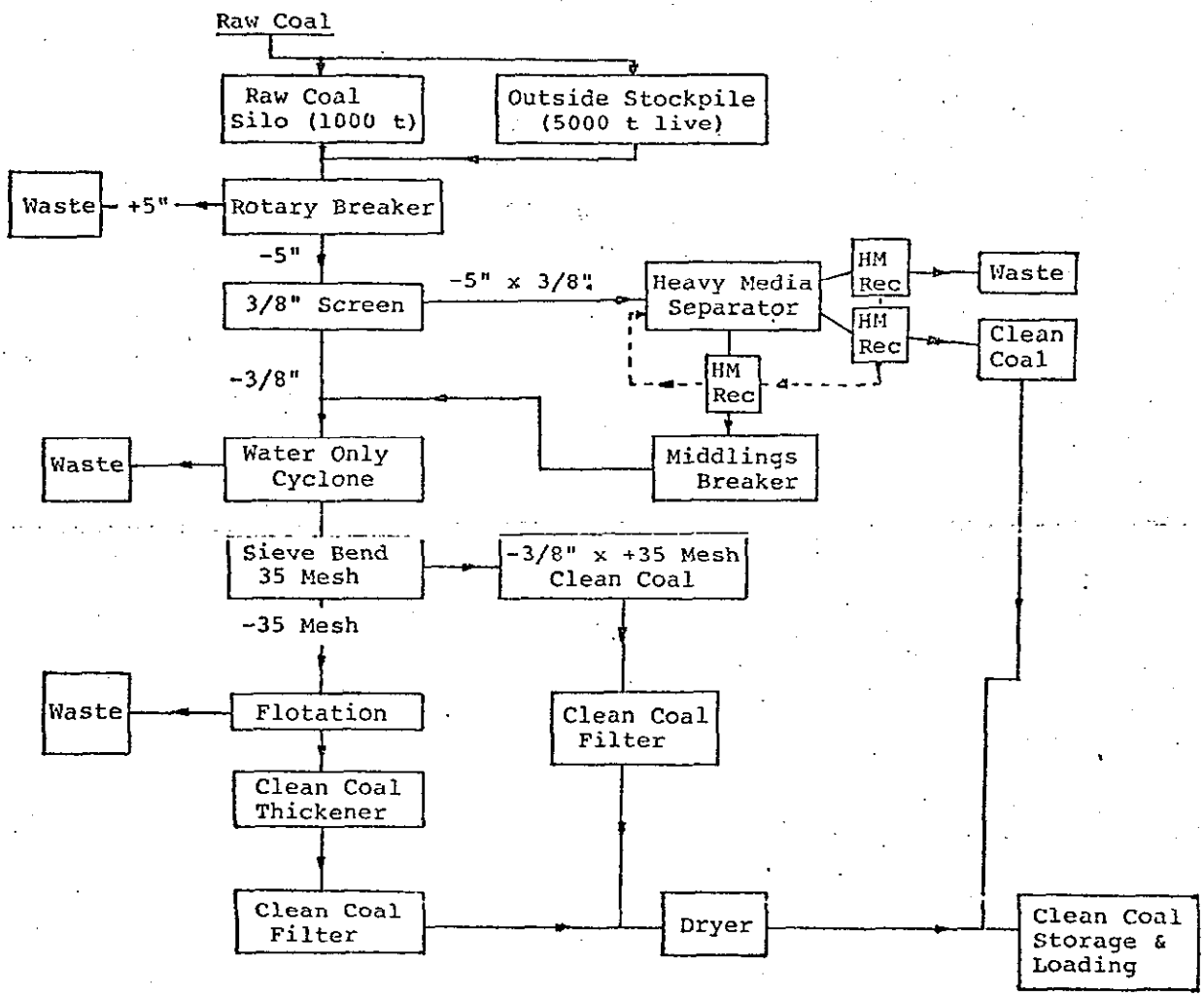
It is our belief that a mobile home park in Chetwynd offers the best solution to the problem. This approach still does not eliminate the difficulties inherent in transporting men forty miles to, and from, their place of work. It does, however, provide the necessary flexibility to allow relocation in the event that a new townsite, closer to the mine, is eventually developed.

We have predicated our thinking on the mobile home park being developed for initial occupancy by July 1977. This presumes that the work force to that date will be accommodated at the existing campsite. If this proves to be unacceptable from the viewpoint of maintaining a

stable work force, it would be relatively easy to accelerate development of the mobile home park. In fact, one of the great advantages of the approach is its flexibility in terms of phased development.

FIGURE 6

COAL PROCESSING FLOWCHART



The plant feed will be drawn from the silo and crushed in rotary breakers to -5". Oversize rejects from the breakers will be delivered to the waste dump. The crushed raw coal is separated into two size fractions on a 3/8" vibrating screen.

(a) Coarse Coal

The coarse coal (-5 x +3/8") will be washed in a heavy media separator to yield three products. The waste is delivered to the refuse stock pile while the middlings are recrushed and combined with the -3/8" raw coal product. The clean coal is dewatered and crushed to pass 2".

(b) Medium Coal

The -3/8" raw coal is treated in a water-only cyclone with a two product discharge. The waste is discarded and the overflow fraction is passed over a 35 mesh sieve bend to yield -3/8" x +35 mesh clean coal.

(c) Fine Coal

The -35 mesh x 0 fraction from the sieve bend will be de-watered in a thickener and fed the flotation section. The flotation tailings will be dewatered and pumped to the tailings pond. The clean coal from the flotation section will be de-watered, filtered and combined with the -3/8" x +35 mesh clean coal. The combined fine and medium size clean coal is fed to a dryer and dried to 3 - 4% moisture.

The dry clean coal is delivered by truck to the 15,000 ton capacity railway storage silo for loading into unit trains.

TRANSPORTATION

The initial 1,000,000 ton production will be hauled over a high vehicle capacity (100 ton-plus) industrial road to a point, in the vicinity of Martin and Dickebush Creeks, at which a storage and rail car loading plant will be constructed.

Cars will be loaded about 14 miles south of Chetwynd on tracks which could be extended beyond this point to provide the main service artery to the Bullmoose, Wolverine, Babcock coal zones.

Until such time as the terminal at Prince Rupert becomes operative the production from Sukunka will be transported by B. C. Railway to Neptune Terminals in North Vancouver. The volume through Neptune Terminals Ltd. cannot exceed 1,000,000 annual tons or 13 trains of 78 cars each month.

It is recognized that the completion of the terminal at Prince Rupert will remove a major constraint in our development programme to achieve the 2,000,000 ton production level. The construction of the terminal will be contingent upon a coal traffic growth to 10,000,000 long tons annaully within ten years of a commitment to construct.

SOCIO ECONOMIC CONSIDERATIONS

The 38 mile distance from Chetwynd to the Sukunka mine represents a major constraint in the development of a stable work force. It will be somewhat aleviated with the emergence of alternate residence areas providing a choice rather than a compulsion to living in Chetwynd.

The immediate programme will be to mount the early development of the mine from a campsite at the Sukunka mine. During this period the planned development of permanent residences in the township of Chetwynd or any other convenient residential area that may emerge will be undertaken.

During the full development period of eight years the mine work force will grow from 51 to 584. (see figure 5).

The examination of the many alternatives will be documented in the phase 1 and 2 stage studies outlined in the Guidelines for Coal Development.

We recognize the geographic importance of Chetwynd and can forsee a considerable growth as mine service industries occupy the town. We are not concerned that alternative communities will detract from the township's capacity to grow as a service community.

ENVIRONMENTAL STUDY

A preliminary environmental study has been conducted by B. C. Research Council in which three major conclusions were reached.

"The impact of the mine development as outlined indicates that most of the effects of mining will occur outside the most environmentally sensitive areas, alpine and bottom valley communities. However, future plans may call for development in sensitive zones.

A preliminary assessment of potential waste material using drill cores indicated no major chemical barriers to plant growth, although high pH values must be considered when choosing reclamation species. Weathering rates were adequate and should be of minor importance in waste rock placement.

There are no known sites of historical or archeological value in the immediate area of the proposed mine operation."

EMPLOYEE HOUSING STUDY FOR BRASCAN RESOURCES LIMITED

SUKUNKA RIVER PROJECT

by

Infracon Developments Limited

R. A. Hislop

May, 1975

TABLE OF CONTENTS

I. OBJECTIVE

To establish a solid base of residences and provide the normal amenities - such as education facilities, retail facilities, and recreational facilities, - with a view towards attracting and maintaining a stable work force for normal operation of the proposed coal mine situated 40 miles south of the village of Chetwynd, B. C.

II. STUDY GUIDELINES

It has been previously established by joint meetings between the B.C. government departments and senior people of Brascan Resources Limited that the townsite base must be the village of Chetwynd. This governmental decree was obviously reached in order to help the government avoid the related capital costs and operational problems that might result from a one industry townsite being built adjacent to the mine.

At the present time there exists a fully operational 200 man trailer camp at the minesite. Development of this camp was originally intended to house the development mining crews and the construction crews for on site construction of preparation plant, shop facilities, offices, etc.

As the utilization of Chetwynd as a townsite for the initial start-up programme of about 160 miners by 1977 - rising to over 300 by 1980 - will be incumbered by various logistical factors, this report will attempt to provide various alternates as solutions to the requirements, for a 1976 mine start-up.

III. EXISTING CONDITIONS

Chetwynd is a village incorporated September 1972 under the jurisdiction of a locally elected mayor and aldermen. The town straddles Highway 97, 65 miles west of Dawson Creek, 192 miles north east of Prince George, and is serviced by the British Columbia Railway. A 5,000 foot airport facility exists which requires gravel surfacing for completion.

The population is 1,405, which includes a 25% native population. The community is fully serviced by municipal water and sewer, natural gas, hydro, telephone, radio and television. The existing tax rate is 56.62 mills.

Business and professional services, by categories, are as follows:

Architects	1	Medical Clinics	1
Apartment Rentals	5	Motel Operators	4
Banks (Cr. Union Non Lic.)	2	Weekly Newspapers	1
Billiard Halls	1	Plumb. Heating & Electrical Supply	1
Bulk Whsl. Oil Stns.	2	Propane Services	2
Clothing Stores	2	Radio & T.V. Repair	1
Groc. & Confectionary	3	Restaurants & Cafe	
Contractors (General - Electrical - Painting - Heating & Plumbing)	22	General Sales & Services (Transient Traders, Mag. Sales, Developers, Itinerant Salesmen)	24
Department Stores	1		
Drug Stores	1	Saw Sales & Repairs	1
Garages, S. Stns. & Repair Shops	9	School of Baton	1
General & Grocery	2	Taxi	1
Hardware	2	Theatre	1

Hotel	1	Trailer Sales	2
Insurance Agents	2	Trailer Parks	3
Laundromats	1	Trucking Business	2
Lumber & Bldg. Supply	1	Variety Stores	1
Lumber Manufacturing	1	Veterinary Clinic	1

The existing school facilities include one primary school and one junior-secondary school. These facilities can accommodate an additional 200 students.

Recreational facilities include a recently constructed indoor hockey arena with a club house facility; limited curling facilities; common fraternal orders; the usual outdoor recreational facilities such as game playing fields, a ski hill, and a government camp ground located 20 miles north of the village.

Chetwynd has some health services provided by a newly constructed 30-bed hospital and 3 resident doctors. There is, however, no resident dentist.

Dawson Creek is the nearest city offering a full range of shopping and related services.

There exists within the current village boundaries suitable vacant residential land. With proper lead time, additional facilities for water, sewer and serviced lots could be provided. This is broken down on the following basis:

151 existing lots partially serviced
365 proposed lots to be serviced
516 Total

The climate of Chetwynd is typical of northern British Columbia areas. Heavy winter conditions exist for seven months of the year, with an average snowfall of 80 inches. Annual rainfall is 9.96 inches. Short duration but heavy intensity spring and fall storms are common. The mean yearly temperature is 34.1°F. (1.2°C), with a recorded low of -55°F (-48.3°C) and a recorded high of 90°F (32.2°C). Annual sunshine is 2100 hours with the larger proportion of sunny days occurring during the winter months.

The physical aspect of the area is characterized by high, rolling hills which are heavily timbered. The area is ideally suited for hunting, fishing, hiking and general outdoor winter activities.

Chetwynd's soil conditions and topography have influenced its urban development pattern to a great extent. The village is situated in a narrow river valley, the low lying areas of which drain poorly and are swampy. The valley has dominant slopes rising into high, contiguous hills. Urban development has followed a scattered pattern to use suitable pieces of available land.

Deforestation has upset the watershed in some places adjacent to Chetwynd and also along the Sukunka mine access road. Consequently, during periods of heavy precipitation or rapid spring thaw, drainage problems might occur which could greatly hamper road utilization.