<u>McIVOR LAKE COAL PROJECT</u>

<u>VOLUME III</u> (1)

"CONSIDERATION OF THE
UNDERGROUND MINING POTENTIAL"

FEBRUARY 1989

CONFIDENTIAL

747

CANADIAN OCCIDENTAL PETROLEUM LTD.

McIVOR LAKE COAL PROJECT

VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

(BASED ON PRELIMINARY EXPLORATION DATA)
COMPLETED IN NOVEMBER 1988.

REPORT BY

R.G. BARFOOT AND ASSOCIATES

and

STEFFEN, ROBERTSON AND KIRSTEN
CONSULTING MINING AND GEOTECHNICAL ENGINEERS

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R.G. BARFOOT and ASSOCIATES

#6, 903 - 49th Ave. S.W.
Calgary, Alberta
Canada T2S 1H1

Telephone: (403) 243-9701
Fax: (403) 264-1262
Telex: 03-825570

STEFFEN, ROBERTSON and KIRSTEN

Ste. 801, The Burrard Bldg.
1030 West Georgia Street
Vancouver, B.C.
Canada V6E 2Y3

Telephone: (604) 681-4196
Fax: (604) 687-5532
Telex: 04-352578

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VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

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McIVOR LAKE COAL PROJECT

VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

SECTION I - INTRODUCTION

1.1 GENERAL STATEMENT

This report forms part of an evaluation of the McIvor Lake Coal Property by Canadian Occidental Petroleum Ltd. of Calgary, Alberta. The exploration history, geological interpretation, maps, sections, and bore hole data are contained and illustrated in Volumes I and II, prepared and presented by Mr. R. (Ron) SWAREN, MANAGER - Coal for Canadian Occidental.

This Volume III "A Consideration of the Mining Potential", has been prepared by R.G. BARFOOT and ASSOCIATES, now amalgamated with Steffen, Robertson, and Kirsten, Consulting Engineers, located in Vancouver, Denver, and Cardiff (United Kingdom).

1.2 PROPERTY LOCATION

The property is located on Vancouver Island in the Province of British Columbia, approximately six kilometers inland from the town of Campbell River. The exploration licence area is illustrated on the Canadian Occidental map (reference 4001. T 542) and included in this report as Figure 1-1. The details of land ownership, acreage, environment and infrastructure are contained in Volume I.

1.3 SCOPE OF WORK

1.3.1 GENERAL STATEMENT

Canadian Occidental Petroleum Ltd. believe that the McIvor Lake Coal Property may contain sufficient coal resources to sustain a small/medium level of production from an underground mining project. This judgement is based on data from previous exploration (36 drill holes) completed on and adjacent to the property, the data revealed the presence of two seams, the lower seam (#1 seam) being likely to be the most attractive to mine at an assumed average seam thickness of 1.5 metres.

In October/November 1988 a further exploration program of eight bore holes was completed. This program was commissioned to;

(i) confirm the presence of the #1 and #2 seams;

(ii) to provide sufficient site specific data to identify the probable geology, seam continuity, initial hydrogeology, and general geotechnical data;

(iii) to enable a broad conceptual mining strategy to be prepared which would indicate the mining potential of the property.

MINING POTENTIAL

1.3.2 PROPOSED SCOPE OF WORK

The following Scope of work was proposed in December 1988 and confirmed in January 1989.

(i) To prepare a conceptual mining extraction strategy suitable for the lower seam (#1 seam), and for the #2 seam where recoverable reserves are located.

(ii) To select a method of mining best suited for the seam thickness, seam dip and spatial distribution of the reserves.

(iii) To forecast the most realistic annual production objective that can be sustained over a number of years from the (as yet) inferred or probable reserves.

(iv) To identify the mining blocks within the property and recommend the acquisition of additional mining blocks which would compliment the reserves currently under review.

(v) To identify two or more suitable alternative sites for the location of the mine surface and the access to the underground reserves.

(vi) To prepare a conceptual site layout for the surface facilities of the proposed mine.

(vii) To identify any concerns or restraints to the mining plan which may arise from the data originating from the 1988 exploration program.

(viii) To recommend areas where further exploration would add confidence to the proposed mine plan/mining strategy.

SECTION 2 - THE MINING BLOCKS AND RECOVERABLE RESERVES

The 1988 exploration licence/mining area is bisected by the Quinsam River, this bisection conveniently defines two mining blocks. Block D which is located west of the river and Block C east of the river. Figure 1-1 illustrates these locations and also defines an area "A-B" recommended for acquisition to increase the potential reserves of the property.

2.1 MINING BLOCK D

The western boundary of Block D is formed by the assumed position of the #1 and #2 seam sub-crops. This boundary is very approximate and will require further drilling to prove its more exact location. The eastern licence boundary of the block is formed by a north to south line adjacent to the Quinsam River.

Two of the 1988 drill holes (88-10 and 88-01) intersected the #1 and #2 seams proving a seam thickness range of 1.5 metres to 4 metres at a depth of approximately 145 metres.

The in-situ reserves of this mining block calculated on an overall average seam thickness of 1.5 metres in one seam only, are approximately 4.578 million tonnes.

2.2 WITHHELD AREAS

The 1988 drilling program was restricted by the withholding of coal licences in two areas located at the northern portion of Block D. This restriction affected an area of approximately 276 hectares, representing substantial tonnage of in-situ resources of mining Block D.

The areas withheld from exploration are illustrated by cross-hatching on the mine map reference 400.T 542 (Figure 1-1).

It is understood coal licences were withheld for environmental concerns, particularly regarding the possible pollution of water feeding into the Quinsam Fish Hatchery. However, the 1988 exploration program was conducted with great care and we believe that the concerns regarding pollution have now been considerably lessened and that the coal licences for the withheld areas should be granted in 1989.

If the governing authority continue to withhold these coal licences and hence reduce the area of potential reserves; then, consequently there is every likelihood that the remaining reserves will not support a viable mine.

2.3 MINING BLOCK C

This block is located adjacent to the southern boundary of the exploration area on the eastern side of the Quinsam River. The boundaries of the block are the seam sub-crops to the west and to the east, north and south by the coal licence area limits. Prior to the interpretation of the 1988 exploration program, it was thought that a fault having a down-throw on the southern side of 183 metres (600 feet) would form the southern boundary. However, the latest geological assessment indicates that this fault may not now occur within the licence area.

The in-situ reserves of mining Block C calculated on an assumed overall average seam thickness of 1.5 metres in a single seam are 5.04 million tonnes.

2.4. THE RESERVES OF MINING BLOCKS D & C

Blocks D and C are at present the only two mineable areas of coal contained within the boundaries of the coal licence area. They have been calculated to contain mineable reserves totalling 9.618 million tonnes contained in one seam.

This assessment of the "inferred reserves" for the two blocks is affected by two deductions of area:-

(i) a deduction for coal not to be mined lying in a 500 metres wide strip adjacent and running parallel to the assumed line of the sub-crop. This strip must remain unworked in order to provide a coal barrier between the proposed underground workings and the potentially water-bearing overburden of glacial till.

It will be necessary in future exploration programs to obtain further data on the location of the sub-crop and on the overall ground water regime, and to assess the hydrological characteristics of the glacial till, gravel beds and the coal seams. Also, some means (perhaps seismic) of assessing the presence of pre-glacial buried channels must be established. This additional data is necessary in order to prepare mine designs which will ensure that mining induced roof fractures will not penetrate any significant water bearing strata and result in the inflow of water into the mine workings. This data will also be required to more accurately design the barrier of coal required to remain unworked adjacent to the seam sub-crop.

(ii) In this first very broad assessment of inferred reserves, we believe it would be conservative to leave a pillar of coal unworked beneath the Quinsam River. Hence, we have provisionally omitted from the reserve calculations that coal lying approximately 100 metres on either side of the river.

The effect of the above two deductions of area has been to reduce the in-situ resources for mining Blocks D and C to 9.618 million tonnes, of mineable reserves.

Clearly, an inferred total reserve of 9.618 million tonnes is hardly sufficient to support a mine of reasonable size for many years; and the current situation of withholding coal licences affecting 276 hectares in the locality of mining Block D could further jeopardize this mining project.

2.5 POSSIBLE ADDITIONAL MINING BLOCKS A AND B

To the north of Block C, but outside the present licence area, there are two areas of land (illustrated as A and B on Map Ref. 4001 T 542 Figure 1-1). These areas are ideally located for increasing the reserves and hence, the viability of this conceptual mining project.

Mining Block A is located on crown land and mining Block B is on land privately owned. The two areas contain a combined total of 5.423 million tonnes of in-situ reserves, assuming an average single seam thickness of 1.5 metres.

The blocks are not affected by sub-crop location, or any barriers required against faulting; hence, the in-situ resources may be classified as inferred reserves. A further advantage is that the spatial distribution or geometrical shape of the blocks is very well suited for the development of mini-longwall panel extraction and could support an annual production level of 300,000 to 400,000 tonnes for a period of eight to ten years at an overall extraction of 60%.

We believe that the addition of these two areas would considerably enhance the prospects of this conceptual mining project.

2.6 SUMMARY OF MINEABLE RESERVES, PROBABLE EXTRACTION RATIOS AND COAL RECOVERABLE

Table I of this report indicates a summary of the reserves and probable recoverable coal from the aforementioned four mining Blocks, A-B-C and D. Although mining Block D contains an area of withheld exploration and Blocks A and B are not yet within the exploration area, we have assumed a successful outcome of land and licence negotiations and have therefore included the reserves contained in all four blocks when assessing the potential of the McIvor Lake Coal Project.

TABLE 1

RESERVES IN DESIGNATED MINING BLOCKS

Coal Thickness - (Assumed 1.5m in a single seam only S.G.1.4)

MINING BLOCKS	MINEABLE RESERVES (INFERRED) 000'S TONNES	EXTRACTION RATIO %	RECOVERABLE COAL TONNES 000'S
1) East of the Quinsam River			
Block A-B	5423	[illegible]&P [illegible]	3254
Block C	5040	[illegible]%	3024
Sub-Total East of the River	[illegible]046[illegible]	60%	6278
2) West of the Quinsam River			
Block D	4578	P&P and R&P 50%	2289
Total Area	15041	Resultant 57%	8567

Note: P & P = Panel and Pillar Method

R & P = Room and Pillar Method

747 (4)

SECTION 3 - SEAM STRUCTURE

3.1 GENERAL STATEMENT

There are two seams of mineable thickness in the property, #1 seam the lower of the two and an upper #2 seam. Both seams have been estimated to have an average thickness of 1.5 metres, but seam continuity has not been proven throughout the property.

The regional dip of the measures is approximately 7^{o} in a south westerly direction; local anticline and syncline structures cause minor variation in dip and direction.

Little further is known of the structure, and additional exploration is required in order to provide data on:

(i) isopachs of seam thickness

(ii) intervals between #1 and #2 seam

(iii) seam contours (confirmation)

(iv) degree of faulting and thrusting

(v) strata conditions of the immediate floor and roof of #1 and #2 seams.

(vi) top of bed rock contours (confirmation)

(vii) ground water regime and hydrology.

THE CURRENT GEOLOGICAL DATA IS INSUFFICIENT TO PREPARE A DETAILED MINE DESIGN AND WE CAN ONLY THEREFORE CONSIDER THE APPLICATION OF GENERAL MINING CONCEPTS ASSUMED TO BE APPLICABLE TO THE McIVOR LAKE PROPERTY.

However, this preliminary examination will usefully reveal the most likely mining method suitable for the size and distribution of the resource and will also identify the level of annual production which may be sustained to support a viable mine.

In addition, the study will assist in identifying target areas for further exploration which it is expected will enable the seam structure to be better defined.

SECTION 4 - MINING METHODS

4.1 GENERAL STATEMENT

When considering alternative underground mining methods, the selection may be from two main groups:

(i) Room and Pillar or Bord and Pillar Extraction

(ii) Longwall or mini-longwall extraction (with total caving of the roof).

The following Figures illustrate the general mining layout for:

Room and Pillar Mining	- Figure 4-1
Longwall Mining	- Figure 4-2
Shortwall Mining (Australia)	- Figure 4-3
Mini-Longwall or Single Entry Short Longwall Mining	- Figure 4-4

Each of the above groups has unique variations in the method of application and selection of equipment.

The most appropriate mining method depends on a number of factors, the most important being:

(a) seam depth

(b) seam dip

(c) seam thickness

(d) total reserves and spatial distribution or geometry of the property

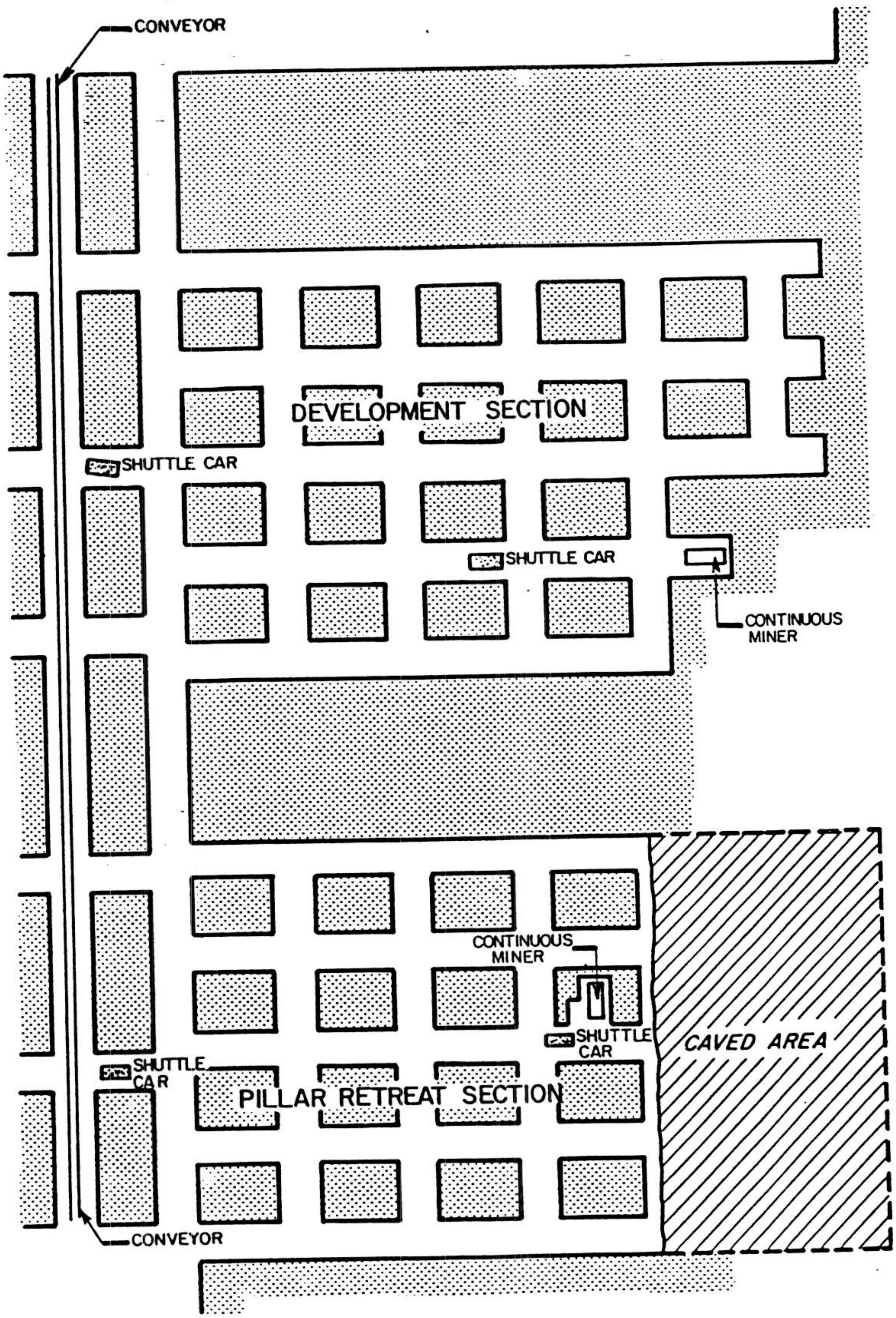
(e) desired annual production

(f) the likelihood or desirability of training the workforce to the required degree of advanced technology and mining mechanisation

(g) limitation of extraction due to the need or desirability to support the surface or limit the tensile strain at or near to the mine surface

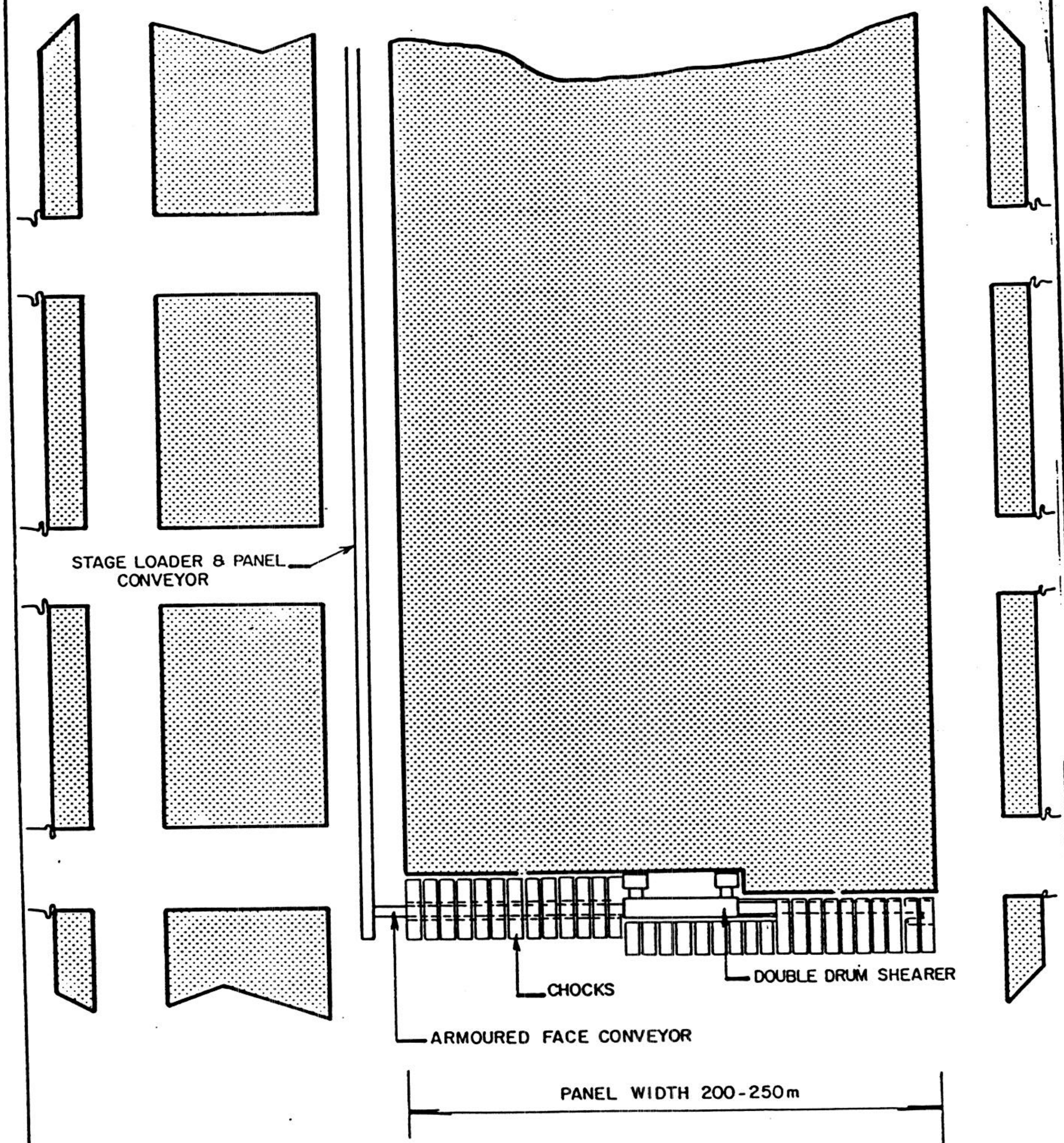
(h) degree of geological uncertainty and the location and effects of known geological and hydrogeological hazards

(i) provincial and local environmental concerns, controls and conditions.



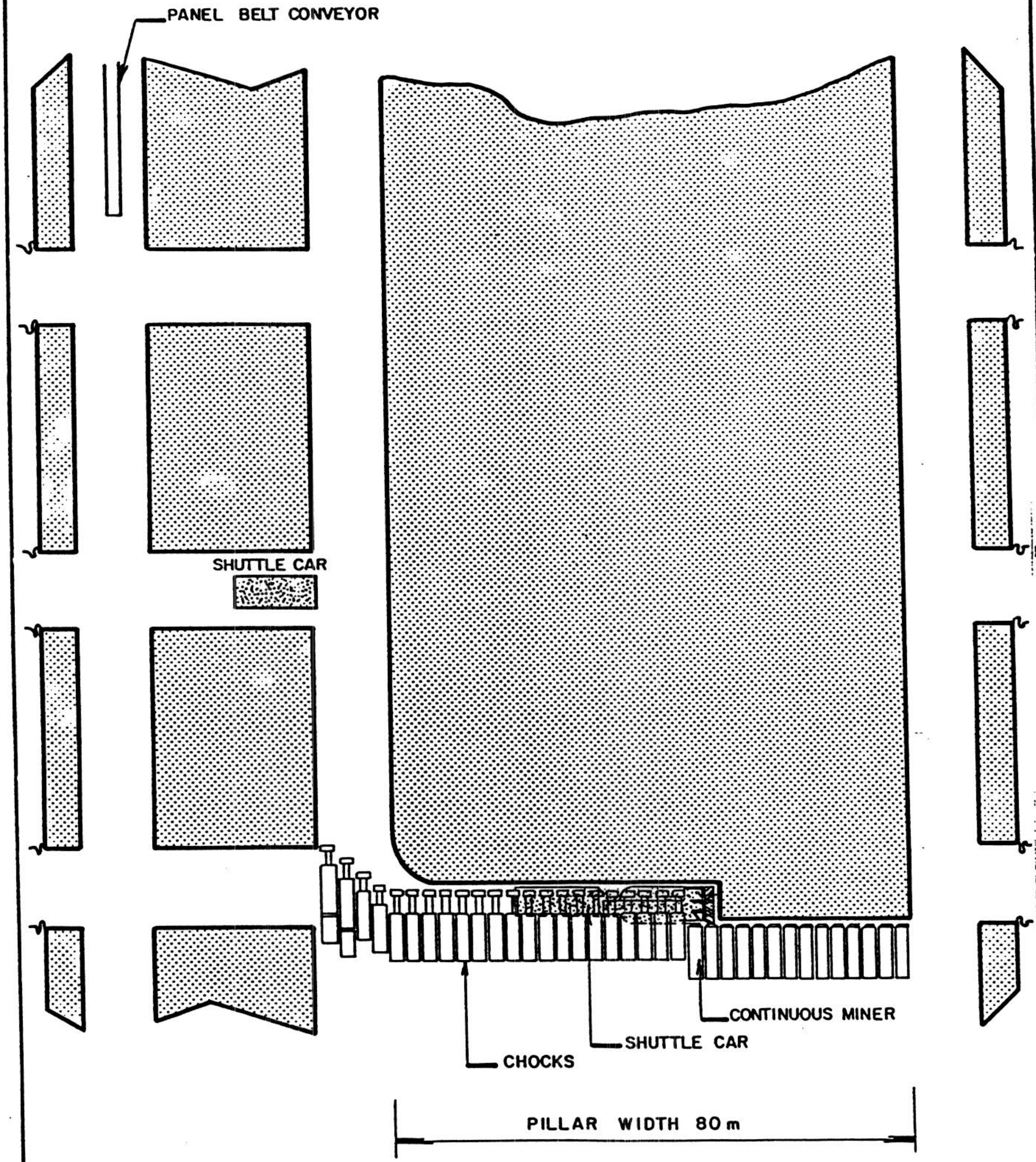
ROOM & PILLAR MINING METHOD

FIGURE 4-1



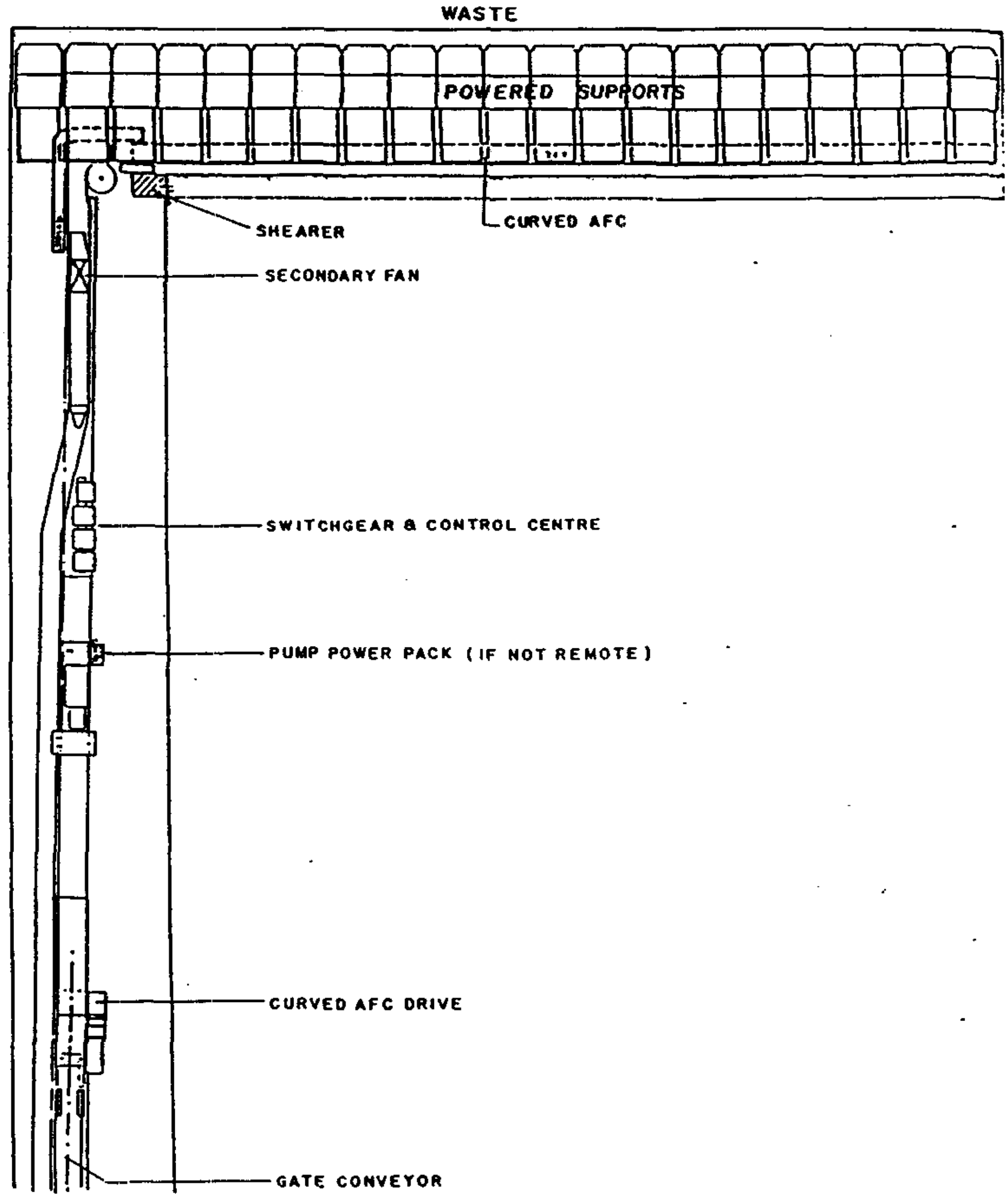
LONGWALL MINING METHOD

FIGURE 4-2



SHORTWALL MINING METHOD.

FIGURE 4-3



SINGLE ENTRY FACE - BASIC LAYOUT

FIGURE 4-4

Those factors likely to have a major influence at McIvor Lake on the selection of an appropriate mining method are:

(i) The geometry of the property to the west of the Quinsam River. This is affected by the variation in the location of the sub-crop, which consequently will most likely affect the direction of extraction of the longwalls or mini-longwalls and may limit the length or life of each panel in mining Block D.

(ii) The current uncertainty on the hydrology of the area and the thickness and proximity of the glacial till to the seam. This must signal a cautious approach in the selection and design of the mining method.

(iii) The direction and density of geological faulting which has yet to be determined. The degree of geological uncertainty particularly the number and size of seam "pinch outs" or depositional impoverishment has also yet to be established and quantified, also the seam continuity in both #1 and #2 has yet to be proven.

(iv) Underground environmental operating conditions; water, methane, spontaneous combustion, roof support etc.

4.2 ALTERNATIVE RECOMMENDED MINING METHODS

4.2.1 ROOM AND PILLAR

Room and Pillar mining will certainly be required to extract the reserves where a flexible method is desirable and where the geometry of the reserves is not suitable for the application of mini-longwall mining. This method is generally not as productive as longwall and we would therefore recommend that it be applied in conjunction with a mini-longwall method.

The selection of equipment for room and pillar mining cannot at this time be considered. Much will depend upon the expected variation in seam thickness, the nature and hardness of the seam floor and roof, the seam structure, and the anticipated direction and degree of faulting.

We believe that the room and pillar method should be regarded as the secondary or "back-up" mining method and be supportive to the primary mining method of mini-longwalls.

4.2.2 MINI-LONGWALL METHOD

The mini-longwall method, is, as its name implies, a short (in width) longwall, but is not to be confused with the shortwall method originating in Australia. A mini-longwall panel would be selected from a range of panel widths from approximately 10 metres to 60 metres.

The general principle of this method is to extract the whole width of the panel in successive shears by means of a coal shearing machine mounted upon a flexible armoured face conveyor. The roof of the excavation is allowed to collapse or cave in a controlled manner, and the immediate support to the face is provided by hydraulic supports.

The mini-longwall has the following advantages:

(i) By virtue of its' limited width, the system is more flexible than the long (up to 250 metres) conventional longwall.

(ii) The flexibility enables the system to conveniently operate in-between geological faults and in restricted areas of reserves.

(iii) The short length panel is ideally suitable for use in the "panel and pillar" extraction method which is one of the methods used when mining below water-bearing strata or bodies of water such as inland lakes and the ocean.

(iv) The mini-longwall may be applied as a retreating system.

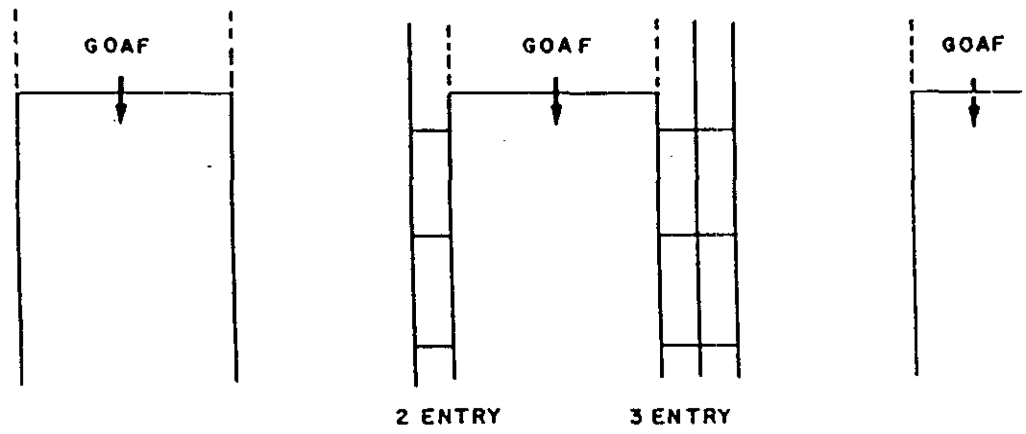
(v) The mini-longwall may be applied as a single entry system. This recently developed mining system requires the use of only one entry instead of two or sometimes three or four entries, thus increasing the ratio between production and development. The mining legislation or some Provinces/Countries may not allow this system, however, we understand that in some Canadian Provinces there does not exist any preventative legislation to the operation of a mini-longwall retreat system.

The two main disadvantages are:

(i) The system, may, in some circumstances be unable to produce the same bulk tonnage as that possible from a 250 metres longwall panel.

(ii) The speed of retreat of the mini-longwall requires a high degree of efficiency in the development methods for replacement panels.

Figures 4-5 to 4-12 illustrate alternative design configuration, equipment application and ventilation circuits which are currently practiced with mini-longwall mining. The illustrations originate from a report "Single Entry Short Longwall Retreating Systems" commissioned by the Department of Energy, Mine and Resources dated March 1988 (Report No. 03SQ. 23440-7-9022) which was prepared for the use of the Cape Breton Development Corporation.



(a)

CONVENTIONAL LONGWALL FACE (EUROPE & CANADA)

(b)

CONVENTIONAL LONGWALL FACE (USA, S.AFRICA & AUSTRALIA)

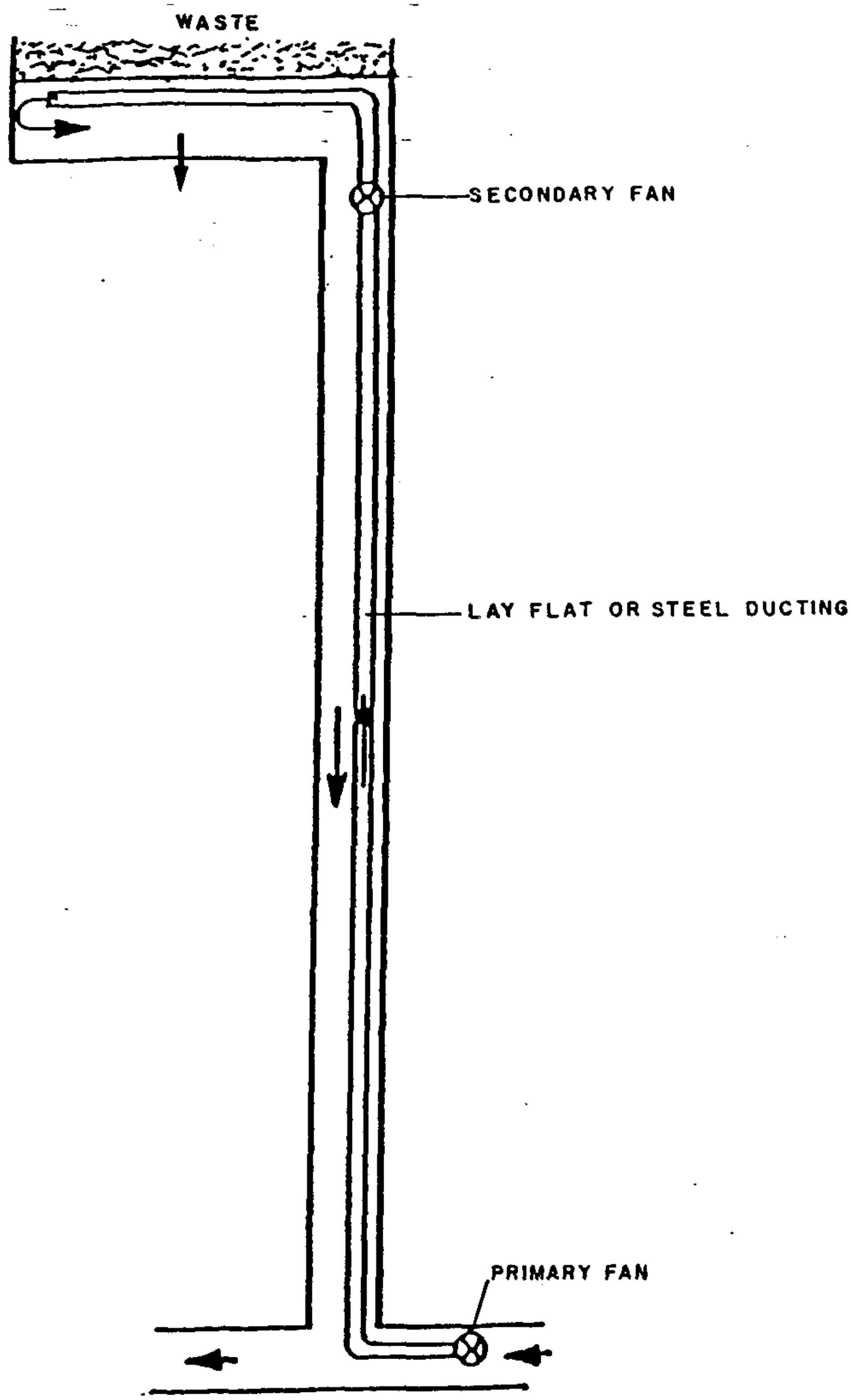
(c)

SINGLE ENTRY LONGWALL FACE (EUROPE & CANADA)

DEFINITION OF SINGLE ENTRY FACE

(Source: Monenco)

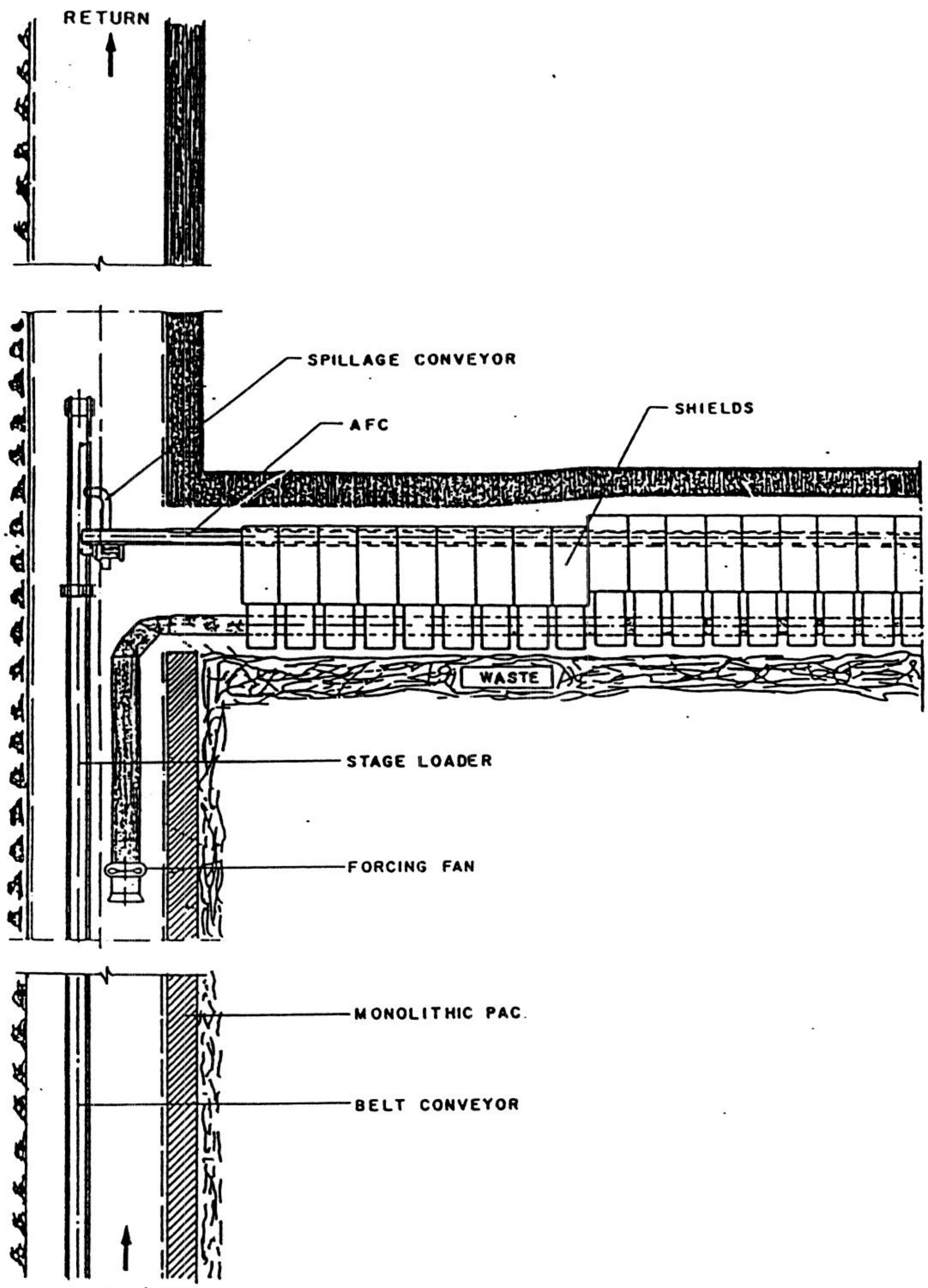
FIGURE 4-5



VENTILATION SYSTEMS - SINGLE ROADWAY DUCT

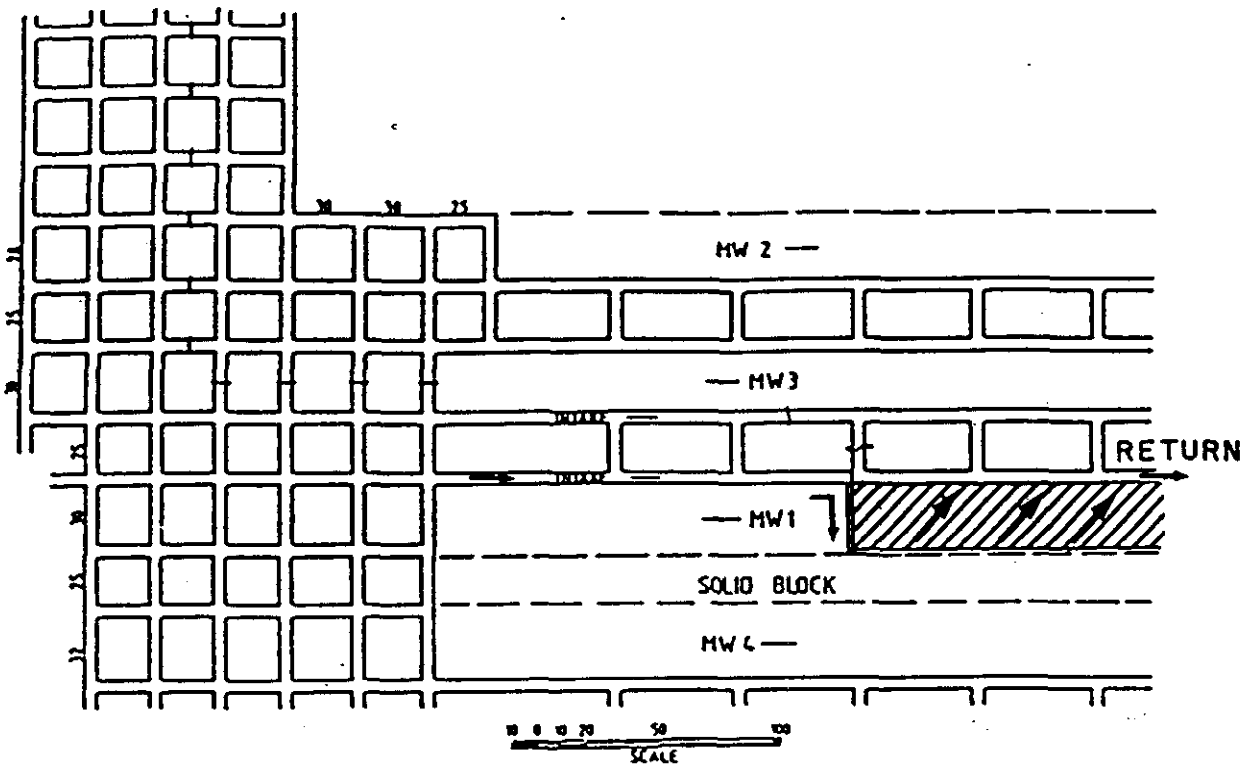
(Source: Monenco)

FIGURE 4-6



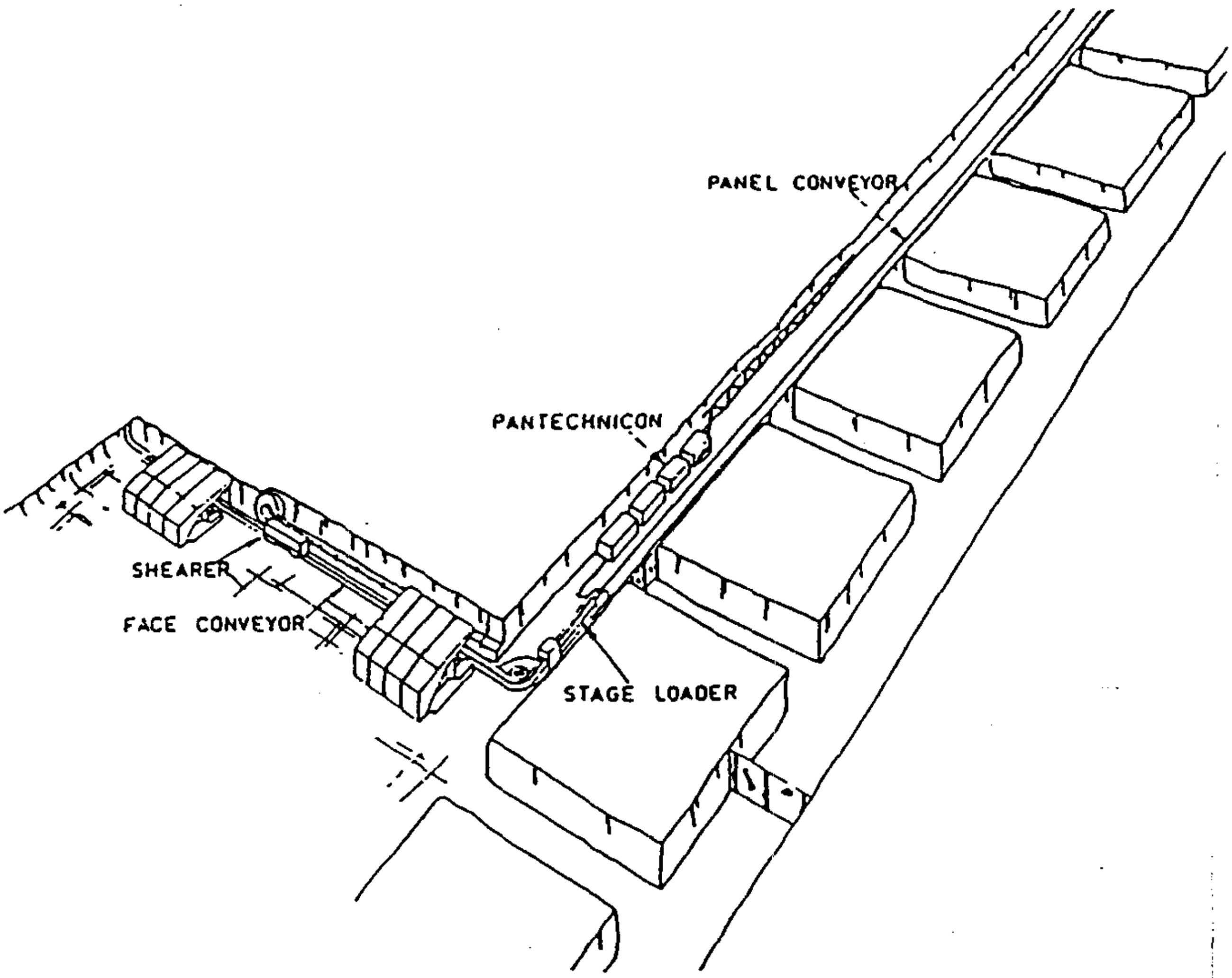
SINGLE ENTRY FACE - ALTERNATIVE # 1

FIGURE 4-7



MODIFIED PANEL LAYOUT MINIWALL 1 EXTRACTION

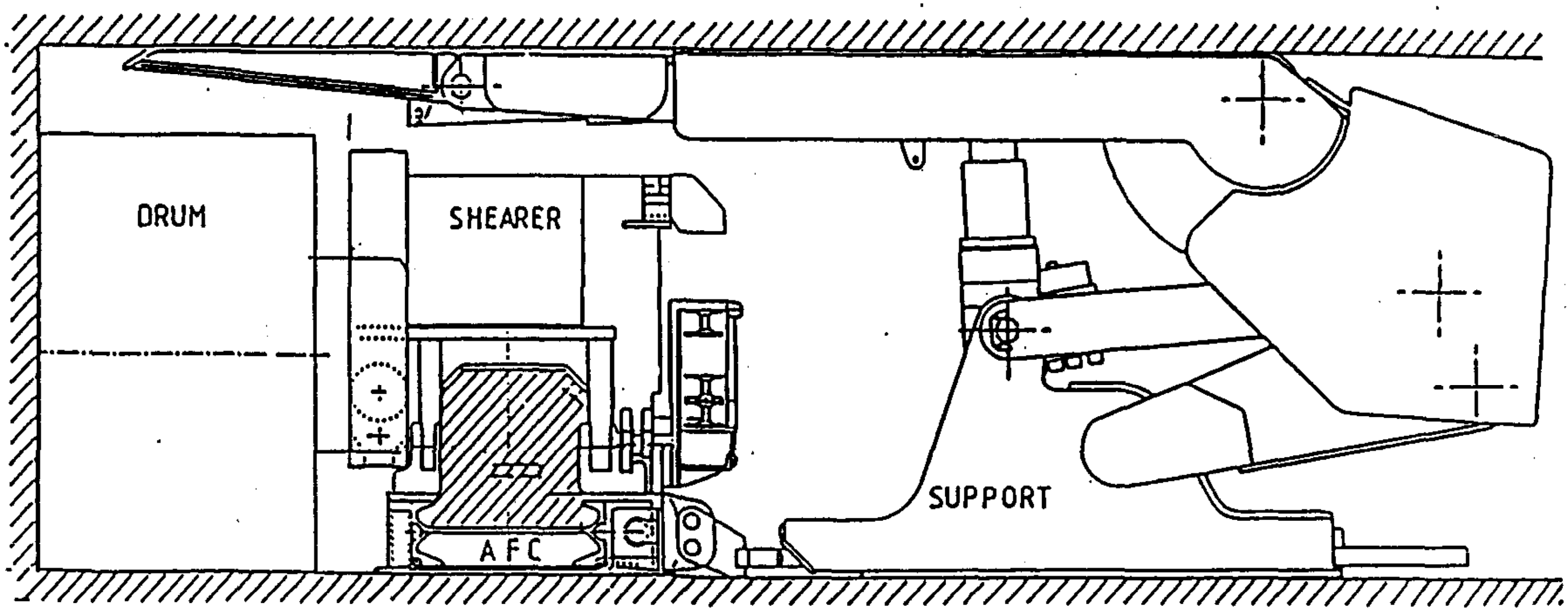
SINGLE ENTRY FACE - ALTERNATIVE # 2



MINIWALL MINING SYSTEM

GRETLEY MINE - MINIWALL SCHEMATIC

FIGURE 4-9



GRETLEY MINE - FACE CROSS SECTION

FIGURE 4-10

WISTOW MINE - SOUTH WEST SIDE

PLAN SHOWING PROPOSED WORKINGS

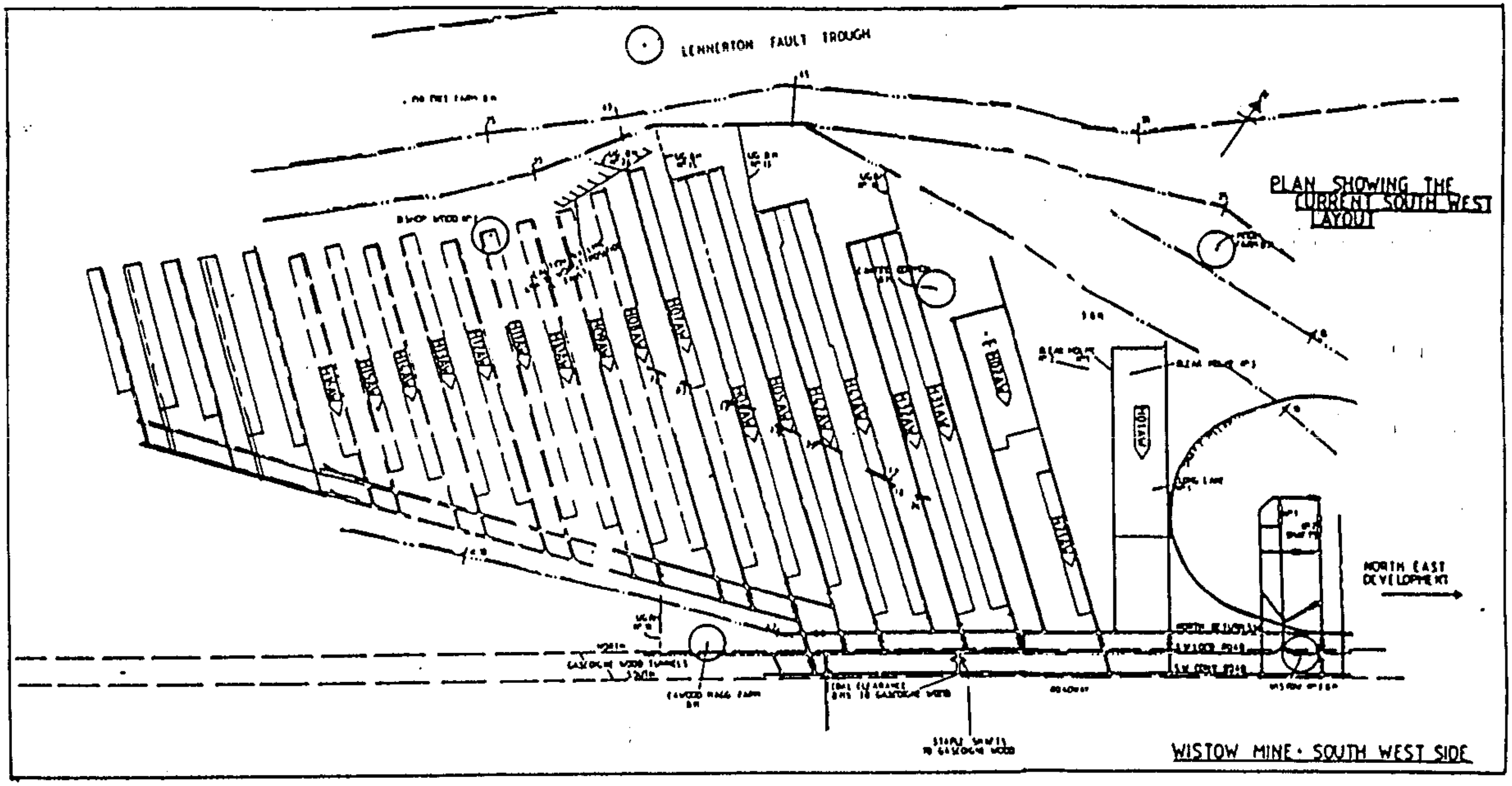
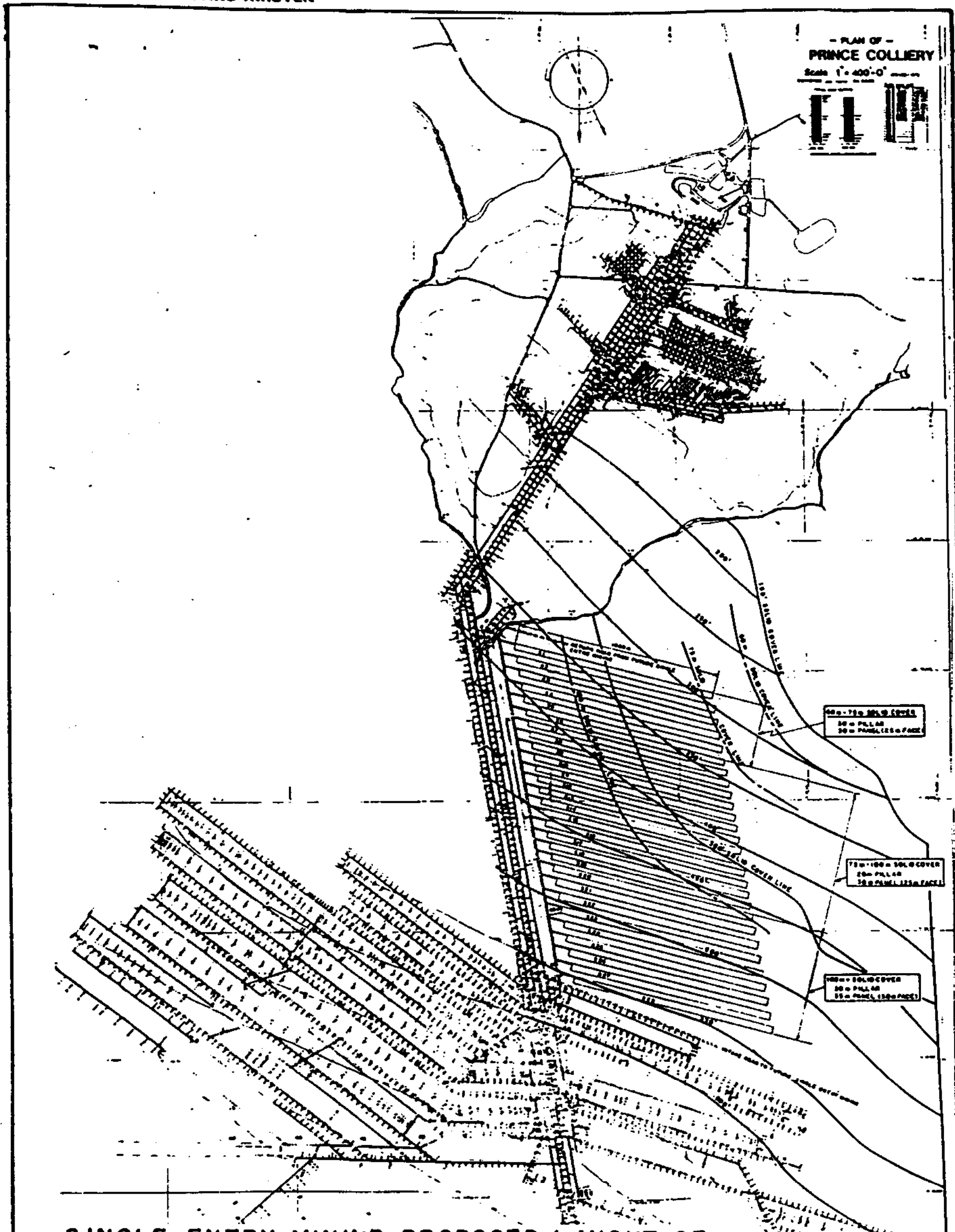


FIGURE 4-11

STEFFEN ROBERTSON AND KIRSTEN



SINGLE ENTRY MINING PROPOSED LAYOUT OF INITAL MINING AREA (Source: Monenco)

FIGURE 4-12

SECTION 5 - MINING STRATEGY

5.1 GENERAL STATEMENT ON PARTICULAR PARAMETERS OF DESIGN

Mining Blocks - The larger part (10.4 million tonnes) of the reserves of the McIvor Lake Property are contained in mining Blocks A/B and C. These areas do not appear to be constrained by the location of sub-crops and subsequent close proximity to the unconsolidated gravel beds and to-date there is no evidence of an easterly trend to seam "pinch-outs" or depositional impoverishment. Therefore, the mining development strategy may well consider that these areas should support production at an early stage in the mine life. Mining Block C, at its N.E. corner is located close to a local housing development, which although would be protected from damage by mining subsidence, may become an environmentally sensitive issue. Hence, it may be desirable to consider leaving a limited, unworked pillar of coal in this location.

Seam Dip - The dip of #1 and #2 seams in all areas does not unduly constrain the mining transport strategy. A trackless transport system is a desirable feature of mine design and we believe that a mining development strategy can be selected which will provide this advantage in a large portion of the mine roadways.

Similarly, the control of mine water may also be planned for efficient natural drainage and pumping.

Spatial Distribution of the Seams - The mining blocks are of such dimensions, that for the efficient design of panel mining the areas may have to be split or divided.

At this stage of conceptual design, we believe that the maximum panel length (life) should not be greater than 1500 metres and preferably not less than 1000 metres. Also, it is most likely that if a single-entry system is preferred, then the Mines Inspectorate will require certain limitations in panel length.

The reason for panel length being of some importance is, the rate of retreating panels is now so great that the shorter panel lengths lead to two and sometimes three equipment moves in one year, which is non productive.

Mine Development Roadways - Those mine development roadways which are constructed as a direct extension of the access-slopes are named "MAINS", subsequent mine development roadways constructed off the "mains" are nominated "SUB-MAINS". The roadways which service and ventilate the production panels are of short life duration and are named "panel roadways".

The lineal amount of mains and sub-mains in the case of the McIVOR LAKE PROPERTY is critical. This is because the seams may only average 1.5 metres in thickness and these roadways require to be 3 metres high and 4.25 to 5 metres wide; hence, requiring the excavation of 7.5 cubic metres of rock for every metre of roadway drivage (15 to 18 tonnes). This event is costly to mine and transport and costly to dump at the mine surface.

It is therefore important to consider the amount of development roadways when selecting the mining strategy.

5.2 ALTERNATIVE MINING STRATEGIES

Figures 5-1, 5-2 and 5-3 illustrate limited initial conceptional strategies for the location of the "mains" and "sub-mains" designed with reference to the parameters discussed above.

The three alternatives are of course directly influenced by the location of the mine access, although in Figures 5-1 and 5-3 the sub-main roadway development is identical.

At a later stage in the planning of the mine, the local seam dips in each block must bear considerable influence on methane migration, water flow, and conveying efficiency. This consideration will mainly effect the direction of the panel retreat.

5.3 PANEL MINING

The Figures 5-1 to 5-3 also indicate that we have assumed that a panel mining system will predominate. At this time we cannot predict the panel width, the selection we believe will be from 200 metres to 40 metres! Much depends on strata conditions, location of aquifiers, fault patterns and geotechnical constraints.

However, at this time we foresee that a shorter or more flexible and hence, lower risk panel width is conservatively desirable.

More data and time is required to prepare a detailed quantitative and qualitative analyses of mining strategy and panel widths.

5.4 CONCLUSION ON MINING STRATEGY

This section, although brief, indicates some of the design work which will be required to be addressed on the completion of the next round of exploration.

From the limited time allowed for this study and the limited data we do however, consider that the signs are encouraging for designing a well balanced and economic mining strategy and that potential exists for further exploration targeted at a conceptual underground mine of some 300/400,000 tonnes annual production.

ALTERNATE MINING STRATEGY No.1

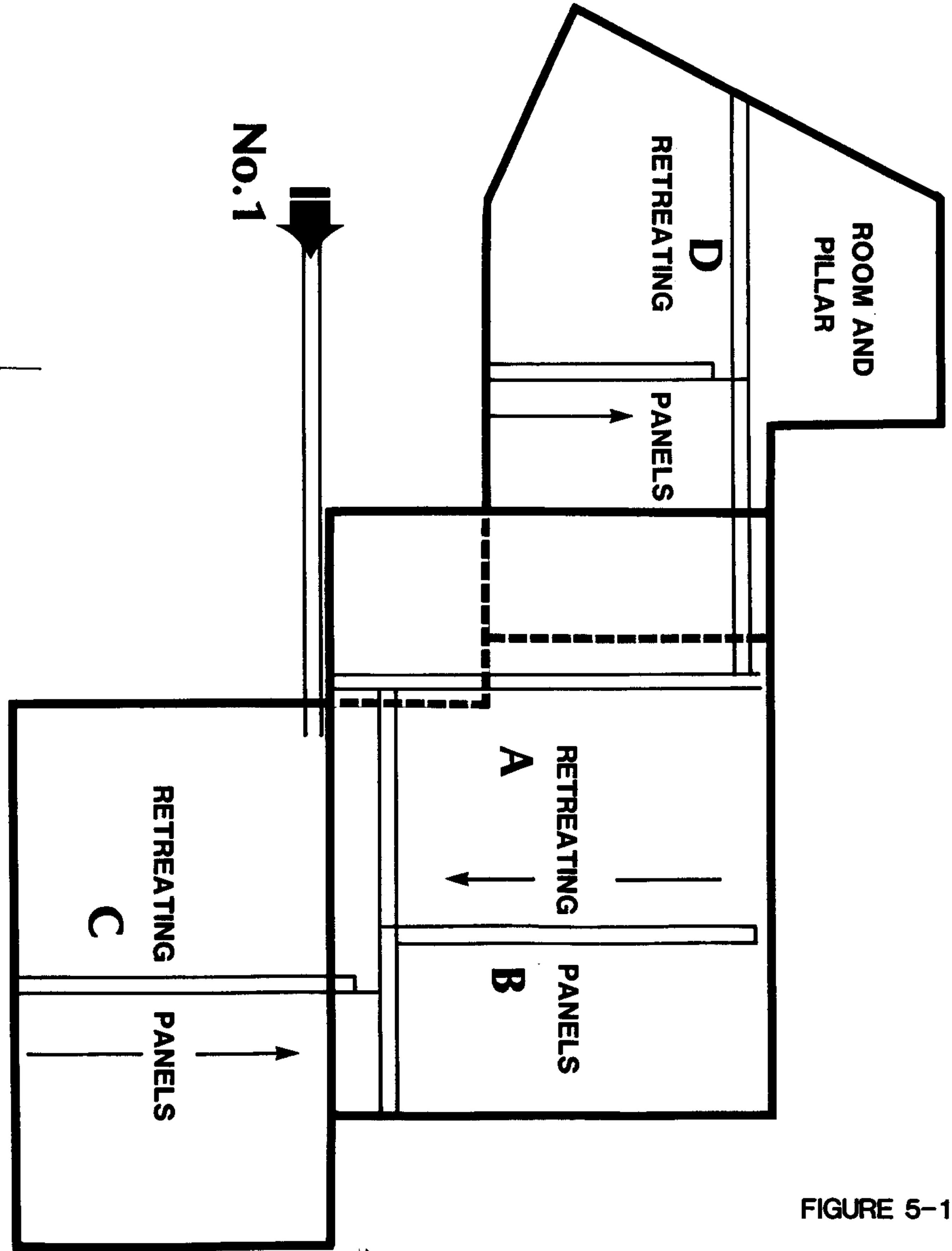


FIGURE 5-1

ALTERNATE MINING STRATEGY No.2

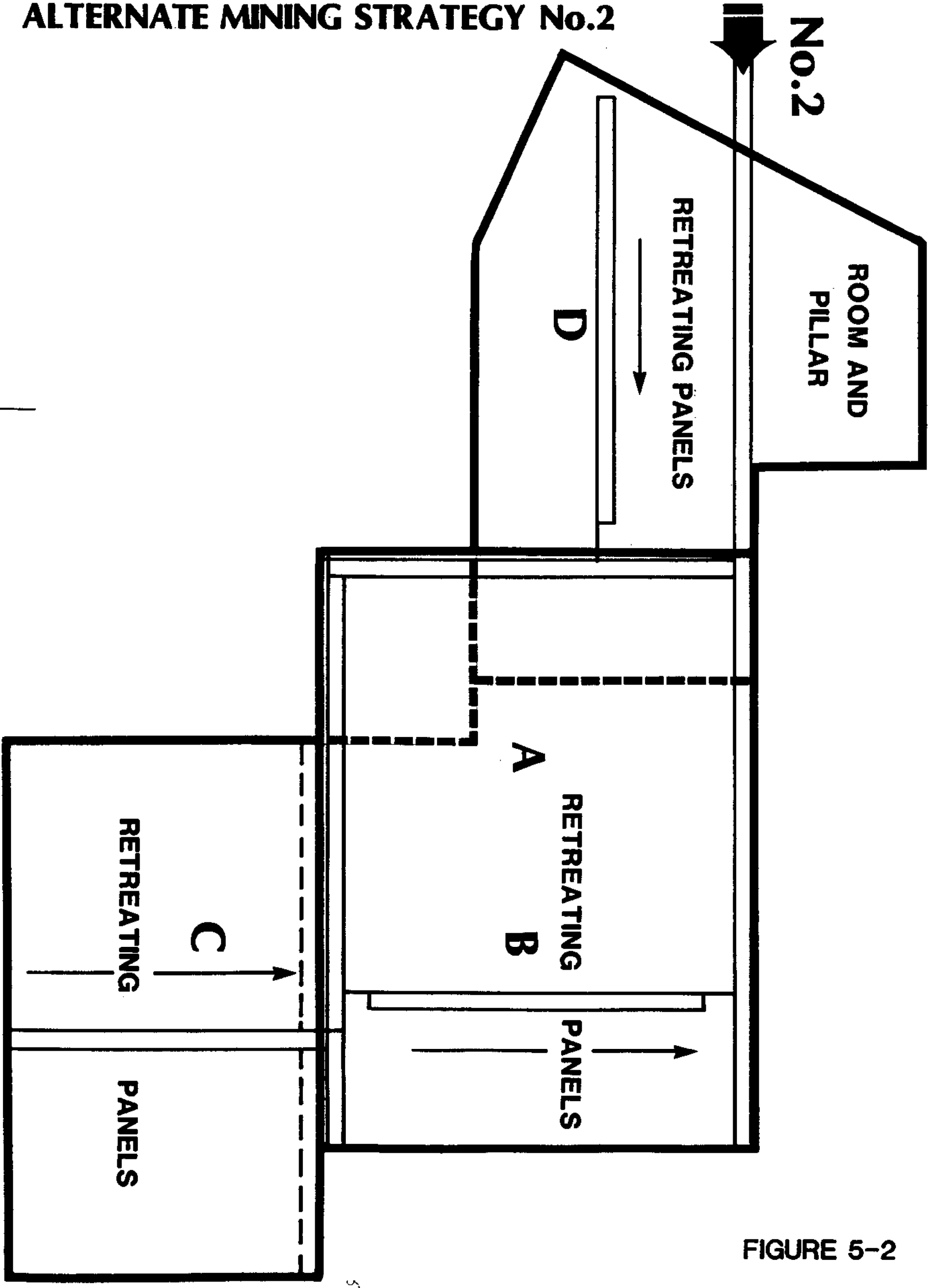


FIGURE 5-2

ALTERNATE MINING STRATEGY No.3

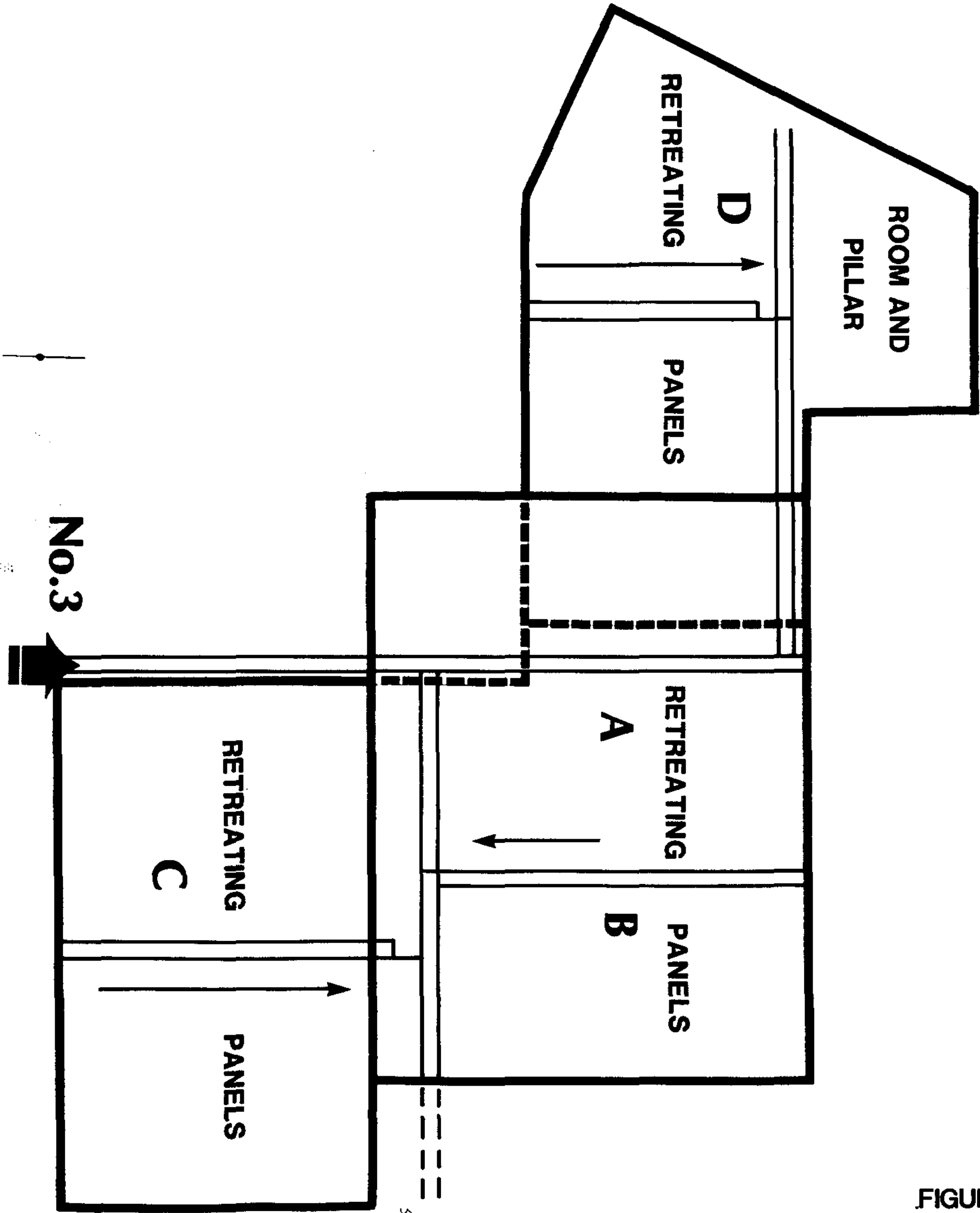


FIGURE 5-3

SECTION 6 - FORECAST OF ANNUAL PRODUCTION

6.1 GENERAL STATEMENT

When considering conceptual mine designs, an initial and by necessity, conservative forecast of annual production is normally prepared, which may then be tested against site specific mine design parametres and quantified in a financial analysis over the expected life of the mine.

The selected annual production and hence, the expected mine life should be such as is sufficient to repay the capital investment and over the life of the mine, produce a satisfactory return on investment.

For the McIvor Lake Property with its' limited reserves, it is apparent at the outset that the range of annual production must be approximately 250,000 tonnes to 500,000 tonnes and not under any circumstances be considered in a higher range i.e. 750,000 tonnes to 2 million tonnes.

This judgement is based upon the current geological data and the assumption that a high target annual production rate would not be acceptable in terms of the possible environmental impact in an area of scenic beauty and conservation.

6.2 POTENTIAL ANNUAL PRODUCTION

The table of reserves (Table I) indicates that the property may contain 15 million tonnes of in-situ or inferred reserves and that approximately 8.6 million tonnes (57%) will be recoverable. These first broad reserve estimates must be viewed with caution, as, although the calculations of recoverable coal have been conservative, the seam thickness and consistency of thickness has not yet been proved, and as discussed earlier, will require further exploration.

However, based upon a recoverable reserve of 8.6 million tonnes and an assumed required mine life of 20 years, then an annual production in the order of 350,000 tonnes would appear to be a reasonable initial forecast.

This figure is well within the technical performance of a 50 metres in width mini-longwall panel operating in a 1.5 metres seam thickness. In fact with good machine performance, reasonable mining/geological conditions, further proving of the reserves and the inclusion of the coal produced by panel development, an annual target of 400,000 tonnes should be a realistic achievable production forecast.

SECTION 7 - THE MINE SURFACE AND ACCESS TO THE RESERVES

7.1 GENERAL STATEMENT

This section has been included in order to advise on the amount of land that most likely will be required for accommodating the mine buildings, services and access tunnels to the reserves. A typical conceptual mine surface design is illustrated on Figure 6-1 which represents a standard design suitable for a mine utilizing inclined tunnels or drifts to access the underground reserves.

The precise location of access roads into the mine surface site and details on the routes to truck the mine production overland to the coast, cannot at this time be considered, nor indeed are these details required at this stage of project consideration.

7.2 ACCESS TO THE RESERVES BY INCLINED TUNNELS

The underground reserves are at a relatively shallow depth and as such are therefore easily intersected by inclined tunnels from the alternative mine surface locations. An alternative means of access to the reserves by vertical shafts is considered to be operationally uneconomical and environmentally unsuitable, the latter in view of headframe requirements.

Three alternative locations for access to the reserves have been identified and illustrated on the mine map ref (4001 T 542) - Figure 1-1.

Access #1 is within reach of numerous disused gravel pits which may be suitable for the disposal of mine waste. However, this location would require that the access tunnels may need to pass below the Quinsam River. Therefore, until data is available to consider the engineering constraints of tunnel construction, it is not possible to judge whether this location is a viable proposition.

The alternative access location #3 would suit the intersection of the seams and provide a convenient access into mining Blocks A, B and C.

However, the approach to the trucking routes to the coast may prove to be environmentally unsuitable, and access from this location to the gravel pits would require crossing the Quinsam River. Therefore, alternative locations should be considered.

Finally, there is the alternative access location #2 which is located close to the gravel pits and is adjacent to the highway leading to the coast.

This location is suitable for access to the large area of reserves in mining Blocks A, B and C and would also be suitable for the simultaneous development of mining Block D which may prove to be desirable. Production from Block D could be achieved early into the life of the project and would enhance the discounted cash flow results.

At this time, we consider that the alternative locations #1 or #3 may prove to be the preferred locations, but considerably more data will be required to confirm this preference. Land ownership and environmental considerations will considerably influence the selection.

7.3 THE MINE SURFACE (10 Hectares Approximately)

A typical surface layout suitable for a medium sized mine using access by inclined tunnels is illustrated on Figure 7-1.

The services that require to be provided are as follows:

(i) Incoming electrical supply into a main electrical sub-station leading into the distribution switchboards for the surface and underground distribution of electrical power.

(ii) An incoming supply of fresh and industrial water for the purposes of fire-fighting, the baths and mine dry, and for drinking water. Also, water will be required for the suppression of dust both on the surface and underground.

(iii) Sewage disposal arrangements to meet the conditions specified by local regulations.

(iv) Mine water settling ponds to receive all water pumped out of the mine. Two or three ponds or lagoons will be required where the water will be treated to remove all suspended sediment and neutralize any acidity or alkalinity prior to disposal arrangements to be agreed with the local government authorities.

(v) A mine waste disposal scheme which will dispose of the mine waste in local gravel pits, or in areas of low lying ground or in a an agreed manner in alternative locations.

(vi) Mine service buildings

- (i) Office and administration centre
- (ii) Mine Dry and bathing facilities
- (iii) Workshops
- (iv) Warehouse
- (v) Stockyard for mine materials
- (vi) First Aid Rooms, lamp room, hauling or hoist engine houses and mine fan building.

(vii) Areas for coal loading and stocking.
Coal loadout facilities.
Car park area.

The above listed facilities, may for the needs of the McIvor Lake Project be accommodated in an area of 10 hectares, with dimensions approaching 250 metres x 400 metres, this area does not include the land required for the disposal of mine waste.

7.4 ENVIRONMENTAL IMPACT

7.4.1 GENERAL STATEMENT

Concern on the environmental impact by mine owners/operators throughout the world has been reflected by the improved architectural design approach and landscaping of the majority of mines recently constructed in the progressive and environmentally conscious countries.

We believe that the McIvor Lake mine surface can be designed to produce a minimum of environmental disturbance to the surrounding locality. There will be no need for mine hoist head frames and all service buildings can be of a low profile and constructed in material which will blend with the surrounding countryside.

The very natural concerns regarding pollution of the Quinsam River and water feedstock to the Quinsam Fish Hatchery are well understood by the mining consultant, author of this study. For 25 years R. Barfoot was responsible for the design and operation of new mines in the South Wales area of the United Kingdom where the prolific salmon rivers of that area were in many cases near to the construction sites for new coal mines, i.e., The River Tawe and its tributaries adjacent to Ammanford in Carmarthenshire.

From this practical construction experience, we believe that the anti-pollution measures that can be proposed and built into the construction and operation of the mine will safeguard the highly prestigious salmon industry of Campbell River.

7.4.2 MINING SUBSIDENCE

Although the seam to be mined is at a relatively shallow depth, there need be no concern regarding damage to surface structures due to the effects of subsidence caused by mining excavations.

The extraction system of "panel and pillar" mining which results in minimal surface tensile strain and minimal ground subsidence has been proven in many applications throughout the world.

Figure 7-2 illustrates just one example of the application of this system. The parameters of design for McIvor Lake would not necessarily be as illustrated, but the principals of limited panel width and strength of inter-panel pillars would still apply.

This panel and pillar method may also prove to be the only safe and satisfactory alternative method to Room and Pillar mining, if it is proven or assumed that the gravel beds above the seam contain or may contain considerable quantities of water.

SECTION 8 - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. RESERVES - there are indications that either the #1 seam or the #2 seam may be of a mineable thickness over the exploration area, commencing from the western location of the seam sub-crop. Further exploration will be required to classify the reserves as "recoverable reserves".

2. The reserves in mining Block D will be limited by a coal barrier located to prevent mining excavation taking place at a distance too close to the shales and glacial till which may contain significant quantities of groundwater.

3. Additional areas of reserves need to be acquired, notably those contained in Blocks A, B and D (withheld acreage).

4. There is insufficient data on the hydrogeology of the area. The presence of glacial till and gravel beds leads us to be concerned regarding the likelihood of sub-surface aquifers being intersected by mining induced breaks to the bed rock.

5. ON THE ASSUMPTION THAT A MINERABLE SEAM IS PRESENT OVER THE WHOLE AREA AT AN AVERAGE THICKNESS OF 1.5 METRES, THEN THE McIVOR LAKE COAL PROPERTY WITH THE ADDITION OF MINING BLOCKS A AND B WILL PROBABLY SUPPORT A MINE OF 350,000/400,000 TONNES PER YEAR FOR A PERIOD OF 20 YEARS.

6. The McIVOR LAKE COAL PROPERTY has the advantage of being located in close proximity to the deep water coal loading terminal at Roberts Bank. Hence, the costs of transport from the mine site to the deep water terminal may be in the comparative low range of $10 to $14 Canadian per tonne.

   In addition, the coal quality is expected to be such as to not require benefication; therefore, with these two considerable monetary advantages, the proposed project has an economic lead over coal located in Alberta and elsewhere in Canada.

   Although the current data is sparse, we believe that there are indications to provide sufficient confidence to continue with a further `round' of geological and hydrogeological exploration and to extend the mining potential study into more detailed consideration of design, equipment selection, capital costs, manpower and operating costs.

EXAMPLE OF PANEL AND PILLAR MINING

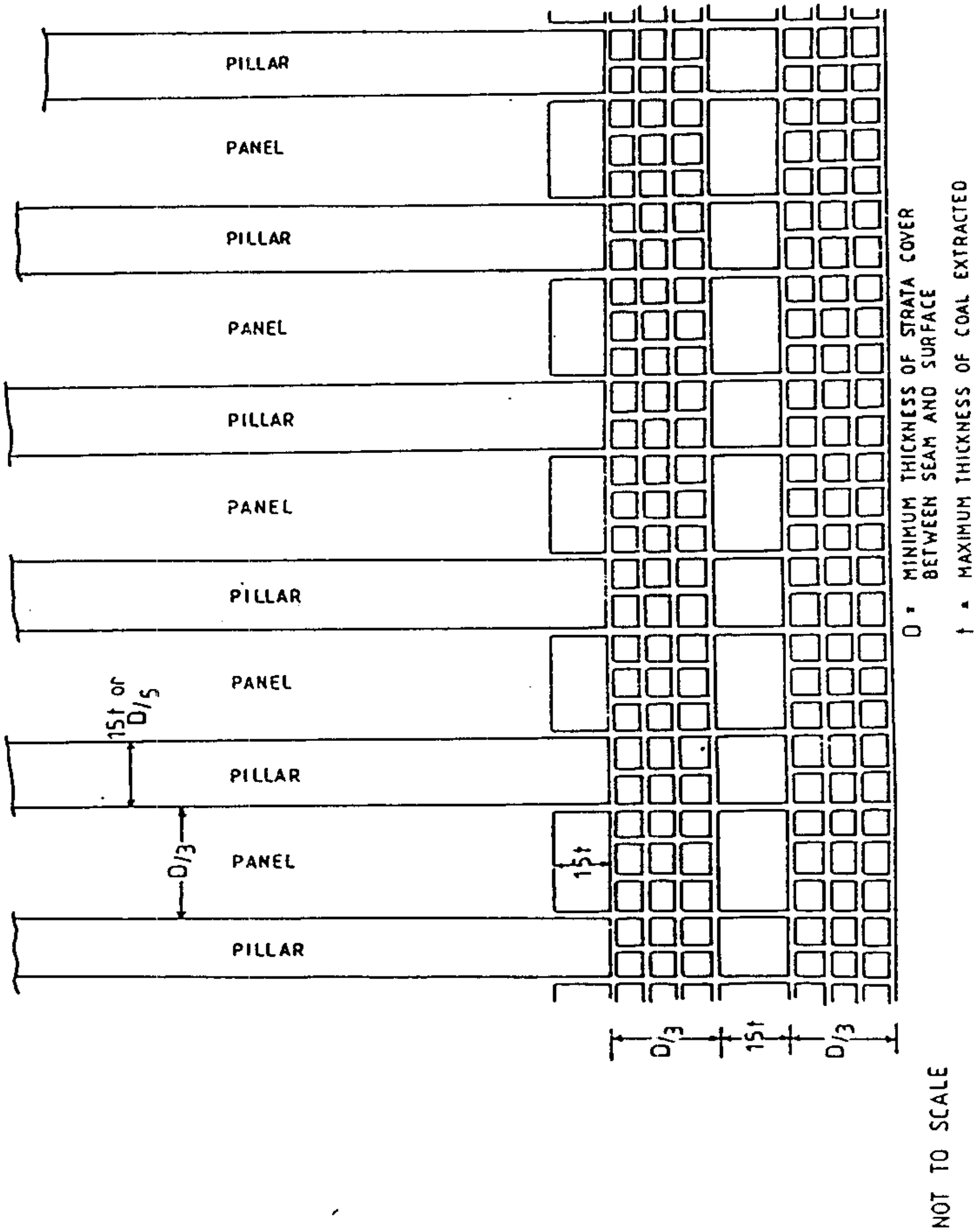


FIGURE 7-2

RECOMMENDATIONS

1. A program for additional drill holes should be prepared for implementation during 1989.

2. The exploration should contain drill wells which provide data for an assessment of the hydrogeology of the area, as soon as practical following the 1989 program.

3. Negotiation for acquiring exploration/mining rights on land applicable to mining Blocks A and B should be commenced as soon as possible.

4. Drill hole data located in close proximity to the preferred access slopes, would be useful to arrive at cost estimates for the construction of access tunnels.

5. A cored bore hole in mining Block A/B would provide core for geotechnical observation and testing. Geotechnical data will be required on:

   (a) the immediate seam roof and floor
   (b) strata ten metres above the seam and five metres below the seam.
   (c) geotechnical data necessary to design mine roadway supports and to consider the selection of panel supports.

6. Enquiries should be made into the quality and reliability of a seismic survey designed specifically for determining the profiles of the base of the gravel beds.

7. Until more information is available on the geology and hydrogeology of the property, only two methods of mining should be entertained;

   (1) Room and Pillar
   (2) Panel and Pillar

   Both methods to be applied with limited extraction designed to produce a safe and acceptable tensile strain below the horizon of the gravel beds.

8. We recommend that during the design of future exploration programs, it would be desirable to obtain <u>mining engineering input</u> into the purpose and location of some of the proposed holes.

   We believe that after the next "round" of exploration, a more specific pre-feasibility report will be expected to be prepared, which, must by necessity not be curtailed by lack of data. Particularly that data relating specifically to safety and production risks.

APPENDIX A

Extract from Technical Paper by Ian Rozier, - 1983.

"Prediction of Ground Control Problems for Underground Coal Mining in Southern Alberta."

Ground Water

The prediction of ground control problems is complicated by the ground water regime. Hydrological data from the Lethbridge area indicates that the overall permeability of the glacial overburden will be very low, in the order of 1×10^{-10} m/s. Isolated gravel bands may have higher permeability, but the water in them will generally be confined by almost impermeable materials. Above extracted longwall panels, mining will result in caving and fracturing of the roof strata. The height of the induced 'fracture zone' above mined out longwall panels may vary between 25 and 40 times the extracted seam thickness. Although there is a large degree of ambiguity in this calculation, it is reasonable to assume that the induced 'fracture zone' over longwall panels will penetrate the bedrock/overburden contact across parts of the Lethbridge Coalfield. However, even if the fractures induced by mining penetrate the bedrock/glacial overburden contact, it is anticipated that inflows will not pose serious problems because of the clayey/silty nature of the till and its expected very low permeability.

Pumping tests over the full section of the overburden would enable a more detailed assessment of potential inflows, and confirm whether or not ground water in the overlying glacial material should be considered as a constraint to mining in areas of thin rock cover, or during shaft sinking operations.

It is probable that the Galt Seam, with its well-defined cleat system, has a higher permeability than the enclosing strata. However, there are no records of excessive inflows in the Galt #8 Mine, and high water pressures within the coal have not been encountered during exploration drilling. It is reasonable to assume, therefore that the overall ground water regime and the hydrological characteristics of the Galt Seam will be similar across the area. The extremely low permeability of the Bearpaw Shale Formation, and the strata enclosing the Galt Seam, indicate that ground water flow from these strata into mine openings should not be a problem. Also, the lack of ground water flow through the coal seam, or from the overlying strata in the Kipp test mine, is significant in that it is consistent with conditions experienced in the old mines in the area. However, pre-glacial buried channels with associated highly permeable Saskatchewan gravel and sand deposits are known to exist in this area and, in some cases, have cut right down to seam horizon. Mining induced roof fractures above extracted longwall panels that penetrate the base of these channels could result in significant mine inflows. The location of these channels could impact on mine layout and development (Figure 5).

NOTE!

If detailed hydrogeological studies indicate that ground water inflows would be a serious constraint to mining at any particular property as a result of buried channels or thin cover, the most favourable longwall extraction direction would be to the east (up-dip), allowing water to drain off into gob areas. In the longwall retreat method of mining, this would involve the development of gate roads in a down-dip direction. Bed separation and induced ground fracturing above roadways would not be as severe as above working longwall faces, and it is anticipated that water problems would not be encountered at the face during development of roadways.

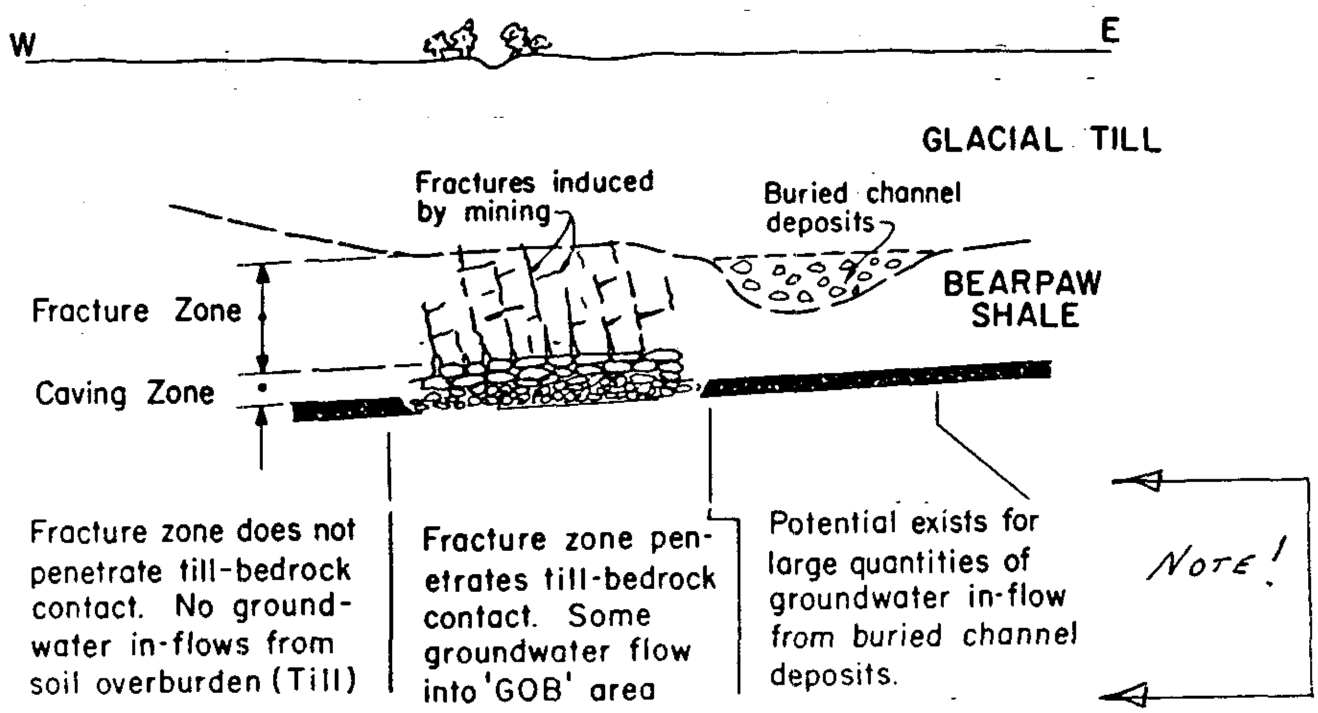


Figure 5

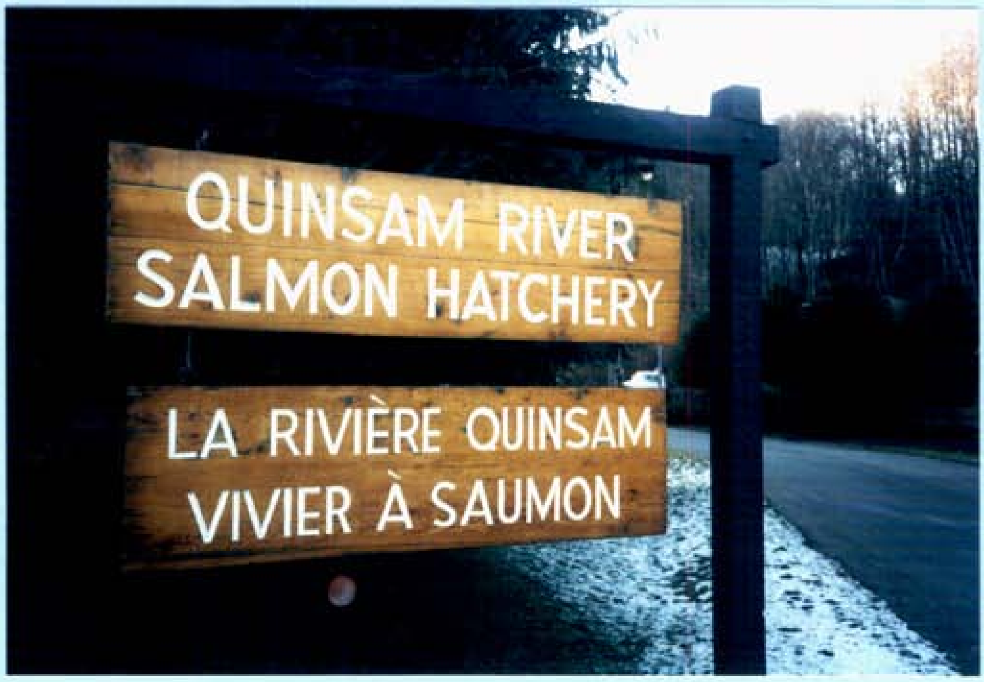
INFLUENCE OF MINING INDUCED FRACTURES ABOVE LONGWALL PANEL ON GROUNDWATER IN-FLOW

APPENDIX B

ROAD ADJACENT TO ALTERNATIVE ACCESS #3

DRILL HOLE 88-08 AT NORTHERN BOUNDARY - BLOCK C

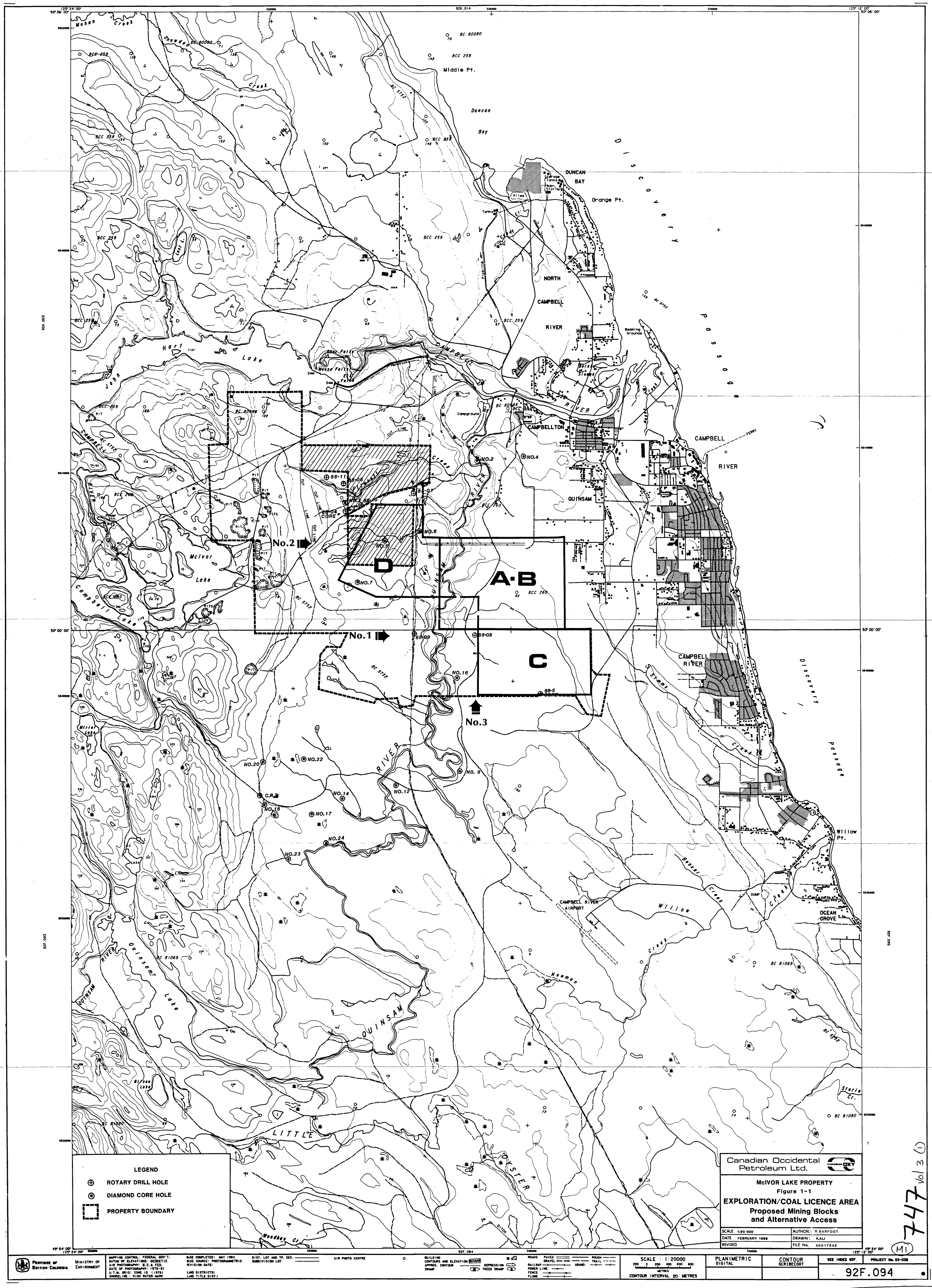
DRILL HOLE 88-09 ADJACENT TO CENTRE LINE
OF ACCESS ALTERNATIVE #1



SALMON HATCHERY NORTH OF MINING BLOCK A-B
AND NOT AFFECTED BY MINING ACTIVITY.

TYPICAL DISUSED GRAVEL PITS.
POSSIBLE SITES FOR MINE ROCK WASTE DISPOSAL.

APPENDIX C


Canadian Occidental Petroleum Ltd.
McIVOR LAKE PROPERTY
Figure 1-1
EXPLORATION/COAL LICENCE AREA
Proposed Mining Blocks and Alternative Access
SCALE 1:20 000
DATE FEBRUARY 1989
REVISED
AUTHOR: R.BARFOOT
DRAWN: A.ALI
FILE No. 4001T542
LEGEND
ROTARY DRILL HOLE
DIAMOND CORE HOLE
PROPERTY BOUNDARY
D
A·B
C
No.1
No.2
No.3
Campbell River
Campbellton
Quinsam
North Campbell River
Duncan Bay
Orange Pt.
Middle Pt.
Discovery Passage
McIvor Lake
John Hart Lake
Campbell Lake
Mirror Lake
Quinsam Lake
Quinsam River
Little Oyster
Campbell River Airport
Ocean Grove
Willow Pt.
Willow Creek
Newman
Beaver Creek
Simms Creek
Elk Falls
Stories Cr.
Woodhus Cr.
PLANIMETRIC DIGITAL
CONTOUR SCRIBECOAT
SEE INDEX 92F.
PROJECT No. 83-035
SCALE 1:20000
CONTOUR INTERVAL 20 METRES
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT
92F.094
747 Vol 3 (1)
M1

McIVOR LAKE COAL PROJECT
MINE SURFACE
PROPOSED LAYOUT OF SURFACE BUILDINGS
FIGURE No. 7-1 (M2)

(Area Approximately 10 Hectares)

DATE :	PLAT No. :
FEB. 17, 1989	C260.BOR

797

McIVOR LAKE COAL PROJECT

VOLUME III (2)

"CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL"

FEBRUARY 1989

CANADIAN OCCIDENTAL PETROLEUM LTD.

McIVOR LAKE COAL PROJECT

VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

(BASED ON PRELIMINARY EXPLORATION DATA)
COMPLETED IN NOVEMBER 1988.

REPORT BY

R.G. BARFOOT AND ASSOCIATES

and

STEFFEN, ROBERTSON AND KIRSTEN
CONSULTING MINING AND GEOTECHNICAL ENGINEERS

FEBRUARY 1989

REPORT # JV 002 CGY

R.G. BARFOOT and ASSOCIATES

#6, 903 - 49th Ave. S.W.
Calgary, Alberta
Canada T2S 1H1

Telephone: (403) 243-9701
Fax: (403) 264-1262
Telex: 03-825570

STEFFEN, ROBERTSON and KIRSTEN

Ste. 801, The Burrard Bldg.
1030 West Georgia Street
Vancouver, B.C.
Canada V6E 2Y3

Telephone: (604) 681-4196
Fax: (604) 687-5532
Telex: 04-352578

CANADIAN OCCIDENTAL PETROLEUM LTD.

McIVOR LAKE COAL PROJECT

VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

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By: Ian Rozier
September 1983

APPENDIX B

Selection of Photographs ...

McIvor Lake Property
February 1989

APPENDIX C

Figures 1-1 and 7-1

CANADIAN OCCIDENTAL PETROLEUM LTD.

McIVOR LAKE COAL PROJECT

VOLUME III CONSIDERATION OF THE UNDERGROUND MINING POTENTIAL

SECTION I - INTRODUCTION

1.1 GENERAL STATEMENT

This report forms part of an evaluation of the McIvor Lake Coal Property by Canadian Occidental Petroleum Ltd. of Calgary, Alberta. The exploration history, geological interpretation, maps, sections, and bore hole data are contained and illustrated in Volumes I and II, prepared and presented by Mr. R. (Ron) SWAREN, MANAGER - Coal for Canadian Occidental.

This Volume III "A Consideration of the Mining Potential", has been prepared by R.G. BARFOOT and ASSOCIATES, now amalgamated with Steffen, Robertson, and Kirsten, Consulting Engineers, located in Vancouver, Denver, and Cardiff (United Kingdom).

1.2 PROPERTY LOCATION

The property is located on Vancouver Island in the Province of British Columbia, approximately six kilometers inland from the town of Campbell River. The exploration licence area is illustrated on the Canadian Occidental map (reference 4001. T 542) and included in this report as Figure 1-1. The details of land ownership, acreage, environment and infrastructure are contained in Volume I.

1.3 SCOPE OF WORK

1.3.1 GENERAL STATEMENT

Canadian Occidental Petroleum Ltd. believe that the McIvor Lake Coal Property may contain sufficient coal resources to sustain a small/medium level of production from an underground mining project. This judgement is based on data from previous exploration (36 drill holes) completed on and adjacent to the property, the data revealed the presence of two seams, the lower seam (#1 seam) being likely to be the most attractive to mine at an assumed average seam thickness of 1.5 metres.

In October/November 1988 a further exploration program of eight bore holes was completed. This program was commissioned to;

(i) confirm the presence of the #1 and #2 seams;

(ii) to provide sufficient site specific data to identify the probable geology, seam continuity, initial hydrogeology, and general geotechnical data;

(iii) to enable a broad conceptual mining strategy to be prepared which would indicate the mining potential of the property.

MINING POTENTIAL

1.3.2 PROPOSED SCOPE OF WORK

The following Scope of work was proposed in December 1988 and confirmed in January 1989.

(i) To prepare a conceptual mining extraction strategy suitable for the lower seam (#1 seam), and for the #2 seam where recoverable reserves are located.

(ii) To select a method of mining best suited for the seam thickness, seam dip and spatial distribution of the reserves.

(iii) To forecast the most realistic annual production objective that can be sustained over a number of years from the (as yet) inferred or probable reserves.

(iv) To identify the mining blocks within the property and recommend the acquisition of additional mining blocks which would compliment the reserves currently under review.

(v) To identify two or more suitable alternative sites for the location of the mine surface and the access to the underground reserves.

(vi) To prepare a conceptual site layout for the surface facilities of the proposed mine.

(vii) To identify any concerns or restraints to the mining plan which may arise from the data originating from the 1988 exploration program.

(viii) To recommend areas where further exploration would add confidence to the proposed mine plan/mining strategy.

SECTION 2 - THE MINING BLOCKS AND RECOVERABLE RESERVES

The 1988 exploration licence/mining area is bisected by the Quinsam River, this bisection conveniently defines two mining blocks. Block D which is located west of the river and Block C east of the river. Figure 1-1 illustrates these locations and also defines an area "A-B" recommended for acquisition to increase the potential reserves of the property.

2.1 MINING BLOCK D

The western boundary of Block D is formed by the assumed position of the #1 and #2 seam sub-crops. This boundary is very approximate and will require further drilling to prove its more exact location. The eastern licence boundary of the block is formed by a north to south line adjacent to the Quinsam River.

Two of the 1988 drill holes (88-10 and 88-01) intersected the #1 and #2 seams proving a seam thickness range of 1.5 metres to 4 metres at a depth of approximately 145 metres.

The in-situ reserves of this mining block calculated on an overall average seam thickness of 1.5 metres in one seam only, are approximately 4.578 million tonnes.

2.2 WITHHELD AREAS

The 1988 drilling program was restricted by the withholding of coal licences in two areas located at the northern portion of Block D. This restriction affected an area of approximately 276 hectares, representing substantial tonnage of in-situ resources of mining Block D.

The areas withheld from exploration are illustrated by cross-hatching on the mine map reference 400.T 542 (Figure 1-1).

It is understood coal licences were withheld for environmental concerns, particularly regarding the possible pollution of water feeding into the Quinsam Fish Hatchery. However, the 1988 exploration program was conducted with great care and we believe that the concerns regarding pollution have now been considerably lessened and that the coal licences for the withheld areas should be granted in 1989.

If the governing authority continue to withhold these coal licences and hence reduce the area of potential reserves; then, consequently there is every likelihood that the remaining reserves will not support a viable mine.

2.3 MINING BLOCK C

This block is located adjacent to the southern boundary of the exploration area on the eastern side of the Quinsam River. The boundaries of the block are the seam sub-crops to the west and to the east, north and south by the coal licence area limits. Prior to the interpretation of the 1988 exploration program, it was thought that a fault having a down-throw on the southern side of 183 metres (600 feet) would form the southern boundary. However, the latest geological assessment indicates that this fault may not now occur within the licence area.

The in-situ reserves of mining Block C calculated on an assumed overall average seam thickness of 1.5 metres in a single seam are 5.04 million tonnes.

2.4. THE RESERVES OF MINING BLOCKS D & C

Blocks D and C are at present the only two mineable areas of coal contained within the boundaries of the coal licence area. They have been calculated to contain mineable reserves totalling 9.618 million tonnes contained in one seam.

This assessment of the "inferred reserves" for the two blocks is affected by two deductions of area:-

(i) a deduction for coal not to be mined lying in a 500 metres wide strip adjacent and running parallel to the assumed line of the sub-crop. This strip must remain unworked in order to provide a coal barrier between the proposed underground workings and the potentially water-bearing overburden of glacial till.

It will be necessary in future exploration programs to obtain further data on the location of the sub-crop and on the overall ground water regime, and to assess the hydrological characteristics of the glacial till, gravel beds and the coal seams. Also, some means (perhaps seismic) of assessing the presence of pre-glacial buried channels must be established. This additional data is necessary in order to prepare mine designs which will ensure that mining induced roof fractures will not penetrate any significant water bearing strata and result in the inflow of water into the mine workings. This data will also be required to more accurately design the barrier of coal required to remain unworked adjacent to the seam sub-crop.

(ii) In this first very broad assessment of inferred reserves, we believe it would be conservative to leave a pillar of coal unworked beneath the Quinsam River. Hence, we have provisionally omitted from the reserve calculations that coal lying approximately 100 metres on either side of the river.

The effect of the above two deductions of area has been to reduce the in-situ resources for mining Blocks D and C to 9.618 million tonnes, of mineable reserves.

Clearly, an inferred total reserve of 9.618 million tonnes is hardly sufficient to support a mine of reasonable size for many years; and the current situation of withholding coal licences affecting 276 hectares in the locality of mining Block D could further jeopardize this mining project.

2.5 POSSIBLE ADDITIONAL MINING BLOCKS A AND B

To the north of Block C, but outside the present licence area, there are two areas of land (illustrated as A and B on Map Ref. 4001 T 542 Figure 1-1). These areas are ideally located for increasing the reserves and hence, the viability of this conceptual mining project.

Mining Block A is located on crown land and mining Block B is on land privately owned. The two areas contain a combined total of 5.423 million tonnes of in-situ reserves, assuming an average single seam thickness of 1.5 metres.

The blocks are not affected by sub-crop location, or any barriers required against faulting; hence, the in-situ resources may be classified as inferred reserves. A further advantage is that the spatial distribution or geometrical shape of the blocks is very well suited for the development of mini-longwall panel extraction and could support an annual production level of 300,000 to 400,000 tonnes for a period of eight to ten years at an overall extraction of 60%.

We believe that the addition of these two areas would considerably enhance the prospects of this conceptual mining project.

TABLE 1

RESERVES IN DESIGNATED MINING BLOCKS

Coal Thickness - (Assumed 1.5m in a single seam only S.G.1.4)

MINING BLOCKS	MINEABLE RESERVES (INFERRED) 000'S TONNES	EXTRACTION RATIO %	RECOVERABLE COAL TONNES 000'S
1) East of the Quinsam River			
Block A-B	5423	P&P 60%	3254
Block C	5040	P&P 60%	3024
Sub-Total East of the River	10463	60%	6278
2) West of the Quinsam River			
Block D	4578	P&P and R&P 50%	2289
Total Area	15041	Resultant 57%	8567

Note: P & P = Panel and Pillar Method

R & P = Room and Pillar Method

SECTION 3 - SEAM STRUCTURE

3.1 GENERAL STATEMENT

There are two seams of mineable thickness in the property, #1 seam the lower of the two and an upper #2 seam. Both seams have been estimated to have an average thickness of 1.5 metres, but seam continuity has not been proven throughout the property.

The regional dip of the measures is approximately 7° in a south westerly direction; local anticline and syncline structures cause minor variation in dip and direction.

Little further is known of the structure, and additional exploration is required in order to provide data on:

(i) isopachs of seam thickness

(ii) intervals between #1 and #2 seam

(iii) seam contours (confirmation)

(iv) degree of faulting and thrusting

(v) strata conditions of the immediate floor and roof of #1 and #2 seams.

(vi) top of bed rock contours (confirmation)

(vii) ground water regime and hydrology.

THE CURRENT GEOLOGICAL DATA IS INSUFFICIENT TO PREPARE A DETAILED MINE DESIGN AND WE CAN ONLY THEREFORE CONSIDER THE APPLICATION OF GENERAL MINING CONCEPTS ASSUMED TO BE APPLICABLE TO THE McIVOR LAKE PROPERTY.

However, this preliminary examination will usefully reveal the most likely mining method suitable for the size and distribution of the resource and will also identify the level of annual production which may be sustained to support a viable mine.

In addition, the study will assist in identifying target areas for further exploration which it is expected will enable the seam structure to be better defined.

SECTION 4 - MINING METHODS

4.1 GENERAL STATEMENT

When considering alternative underground mining methods, the selection may be from two main groups:

(i) Room and Pillar or Bord and Pillar Extraction

(ii) Longwall or mini-longwall extraction (with total caving of the roof).

The following Figures illustrate the general mining layout for:

Room and Pillar Mining	- Figure 4-1
Longwall Mining	- Figure 4-2
Shortwall Mining (Australia)	- Figure 4-3
Mini-Longwall or Single Entry Short Longwall Mining	- Figure 4-4

Each of the above groups has unique variations in the method of application and selection of equipment.

The most appropriate mining method depends on a number of factors, the most important being:

(a) seam depth

(b) seam dip

(c) seam thickness

(d) total reserves and spatial distribution or geometry of the property

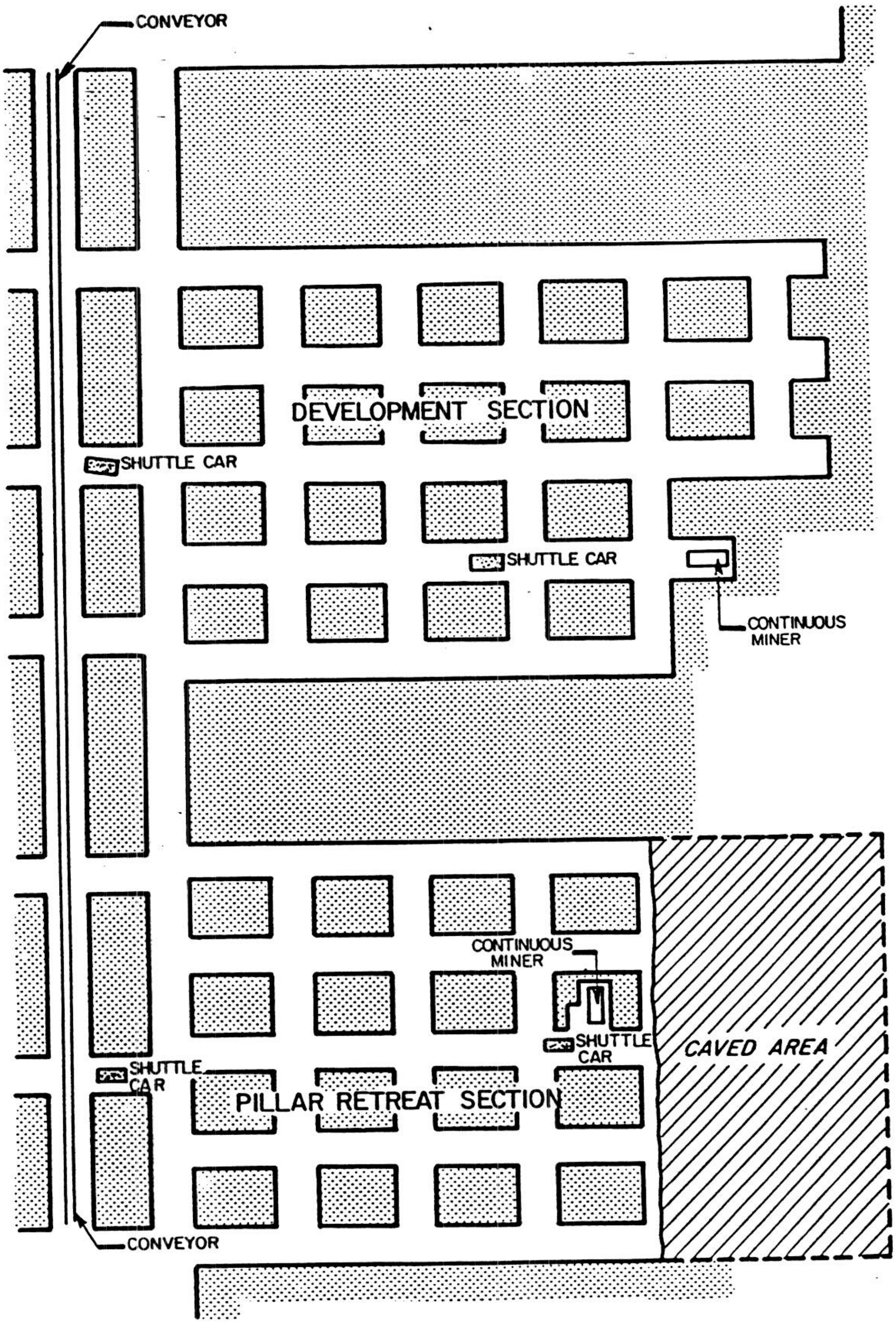
(e) desired annual production

(f) the likelihood or desirability of training the workforce to the required degree of advanced technology and mining mechanisation

(g) limitation of extraction due to the need or desirability to support the surface or limit the tensile strain at or near to the mine surface

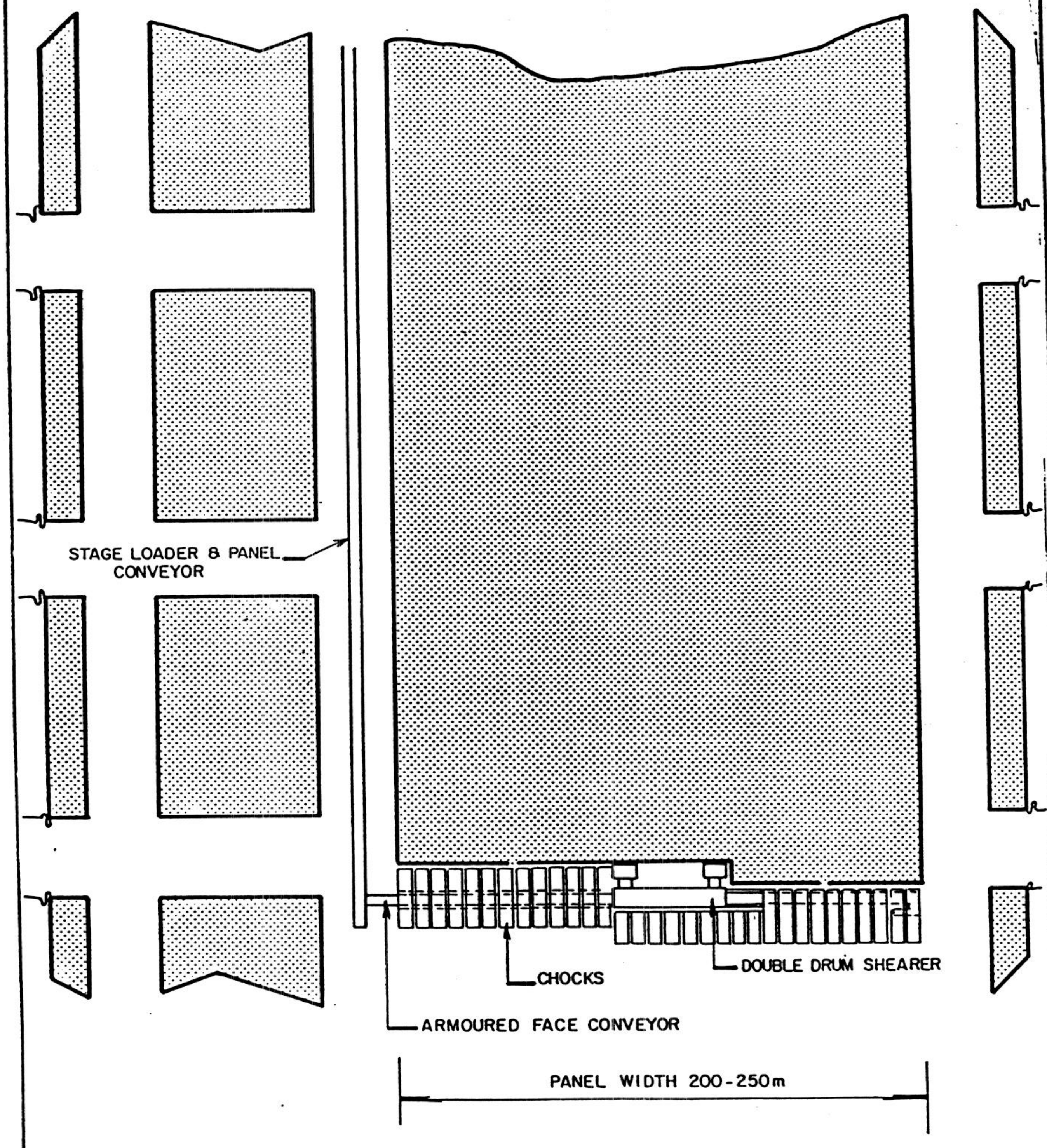
(h) degree of geological uncertainty and the location and effects of known geological and hydrogeological hazards

(i) provincial and local environmental concerns, controls and conditions.



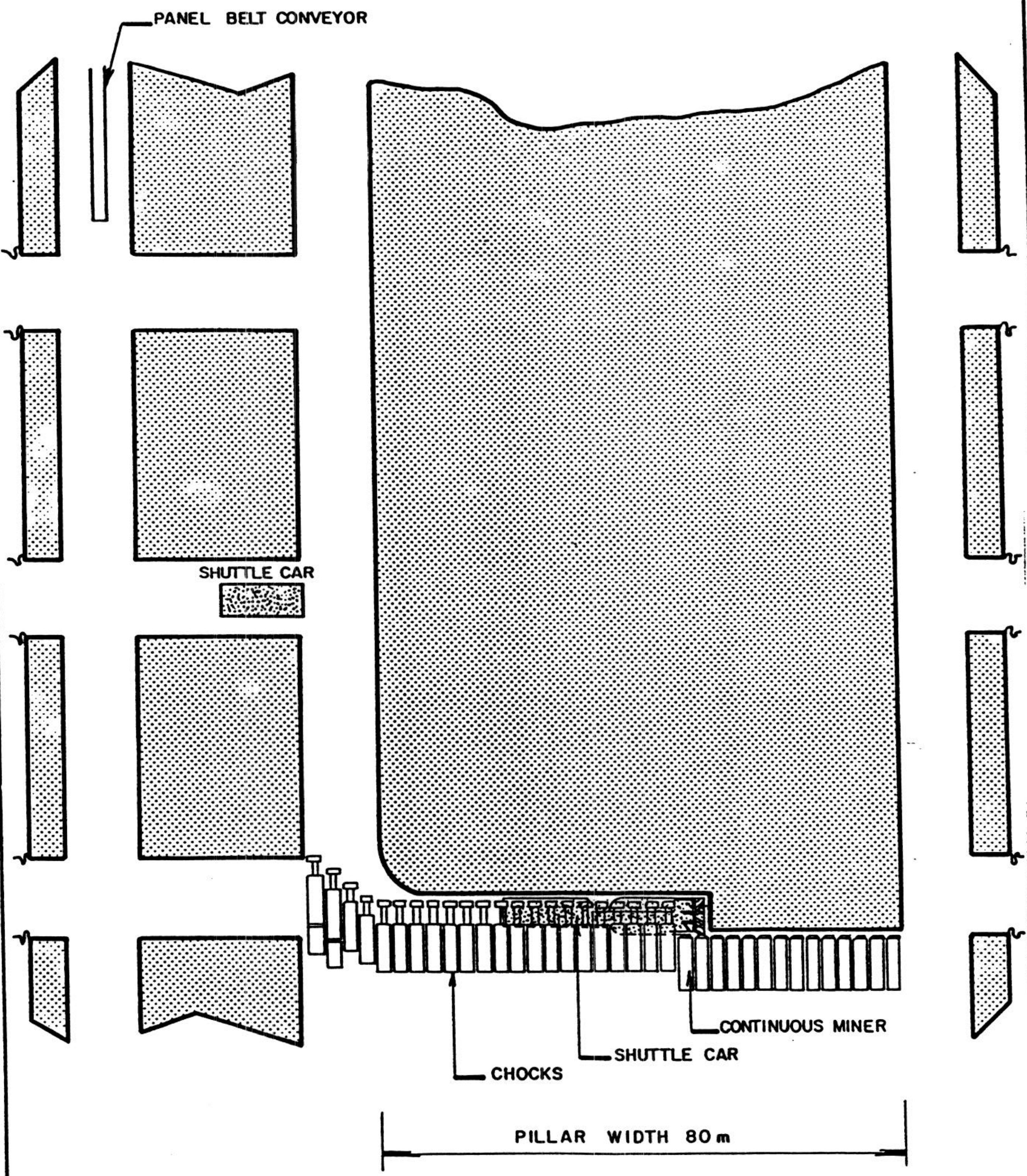
ROOM & PILLAR MINING METHOD

FIGURE 4-1



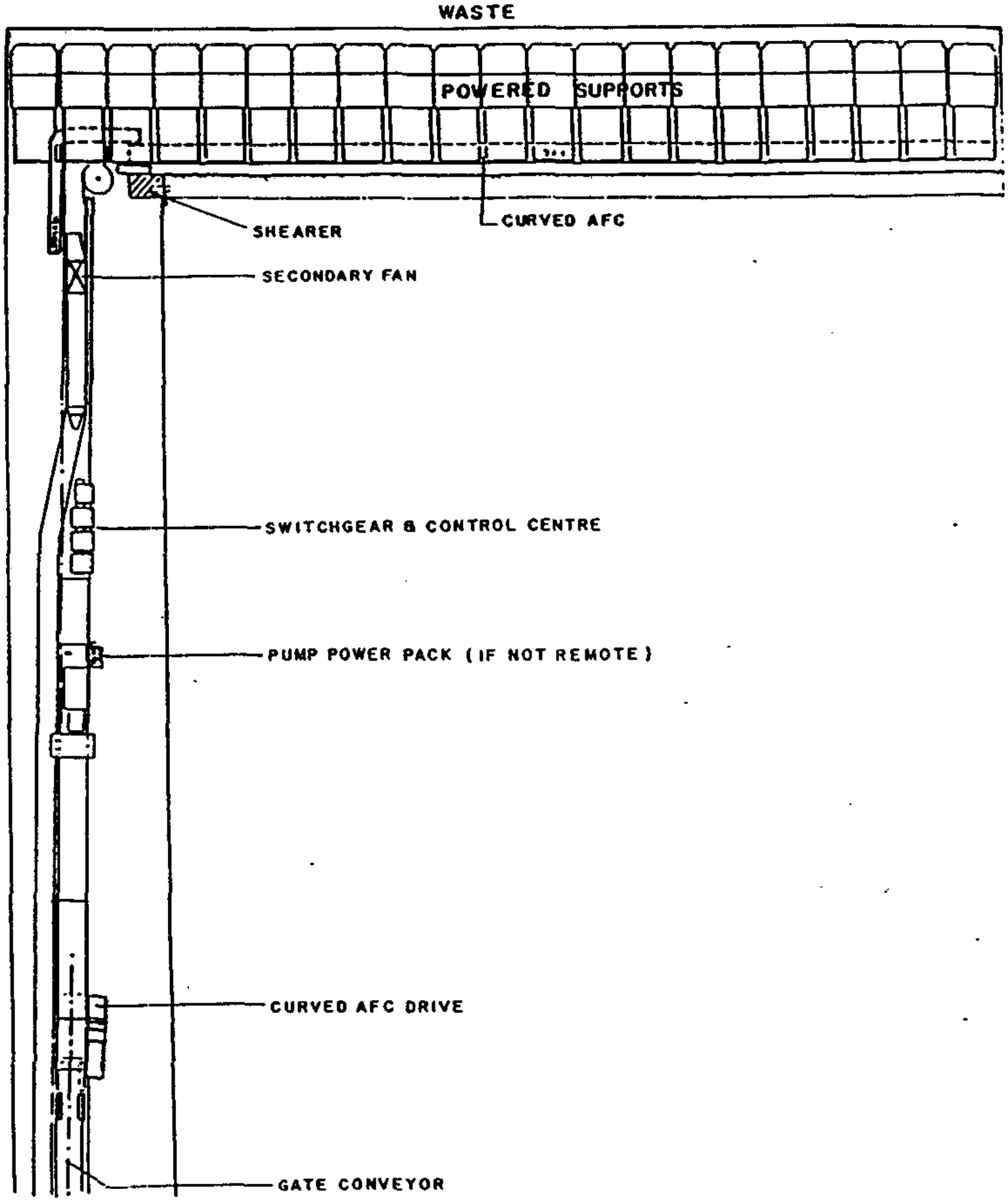
LONGWALL MINING METHOD

FIGURE 4-2



SHORTWALL MINING METHOD.

FIGURE 4-3



SINGLE ENTRY FACE - BASIC LAYOUT

FIGURE 4-4

Those factors likely to have a major influence at McIvor Lake on the selection of an appropriate mining method are:

(i) The geometry of the property to the west of the Quinsam River. This is affected by the variation in the location of the sub-crop, which consequently will most likely affect the direction of extraction of the longwalls or mini-longwalls and may limit the length or life of each panel in mining Block D.

(ii) The current uncertainty on the hydrology of the area and the thickness and proximity of the glacial till to the seam. This must signal a cautious approach in the selection and design of the mining method.

(iii) The direction and density of geological faulting which has yet to be determined. The degree of geological uncertainty particularly the number and size of seam "pinch outs" or depositional impoverishment has also yet to be established and quantified, also the seam continuity in both #1 and #2 has yet to be proven.

(iv) Underground environmental operating conditions; water, methane, spontaneous combustion, roof support etc.

4.2 ALTERNATIVE RECOMMENDED MINING METHODS

4.2.1 ROOM AND PILLAR

Room and Pillar mining will certainly be required to extract the reserves where a flexible method is desirable and where the geometry of the reserves is not suitable for the application of mini-longwall mining. This method is generally not as productive as longwall and we would therefore recommend that it be applied in conjunction with a mini-longwall method.

The selection of equipment for room and pillar mining cannot at this time be considered. Much will depend upon the expected variation in seam thickness, the nature and hardness of the seam floor and roof, the seam structure, and the anticipated direction and degree of faulting.

We believe that the room and pillar method should be regarded as the secondary or "back-up" mining method and be supportive to the primary mining method of mini-longwalls.

4.2.2 MINI-LONGWALL METHOD

The mini-longwall method, is, as its name implies, a short (in width) longwall, but is not to be confused with the shortwall method originating in Australia. A mini-longwall panel would be selected from a range of panel widths from approximately 10 metres to 60 metres.

The general principle of this method is to extract the whole width of the panel in successive shears by means of a coal shearing machine mounted upon a flexible armoured face conveyor. The roof of the excavation is allowed to collapse or cave in a controlled manner, and the immediate support to the face is provided by hydraulic supports.

The mini-longwall has the following advantages:

(i) By virtue of its' limited width, the system is more flexible than the long (up to 250 metres) conventional longwall.

(ii) The flexibility enables the system to conveniently operate in-between geological faults and in restricted areas of reserves.

(iii) The short length panel is ideally suitable for use in the "panel and pillar" extraction method which is one of the methods used when mining below water-bearing strata or bodies of water such as inland lakes and the ocean.

(iv) The mini-longwall may be applied as a retreating system.

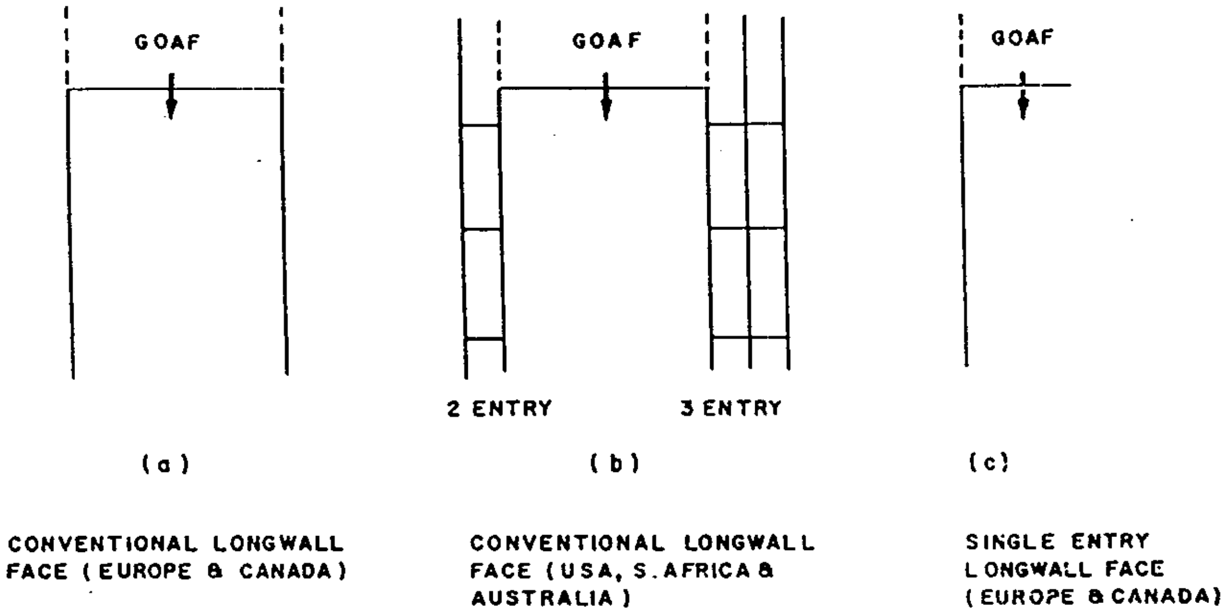
(v) The mini-longwall may be applied as a single entry system. This recently developed mining system requires the use of only one entry instead of two or sometimes three or four entries, thus increasing the ratio between production and development. The mining legislation or some Provinces/Countries may not allow this system, however, we understand that in some Canadian Provinces there does not exist any preventative legislation to the operation of a mini-longwall retreat system.

The two main disadvantages are:

(i) The system, may, in some circumstances be unable to produce the same bulk tonnage as that possible from a 250 metres longwall panel.

(ii) The speed of retreat of the mini-longwall requires a high degree of efficiency in the development methods for replacement panels.

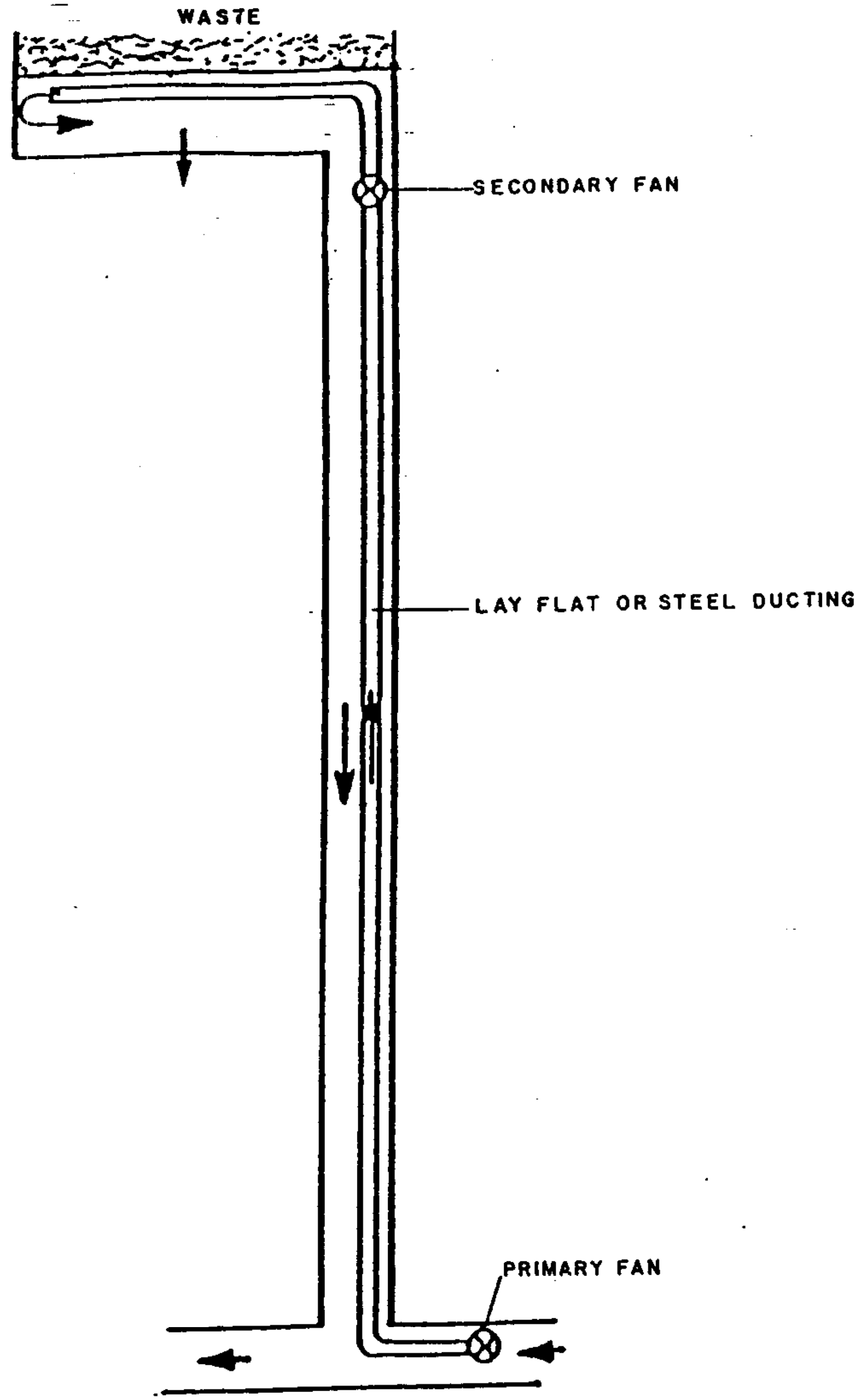
Figures 4-5 to 4-12 illustrate alternative design configuration, equipment application and ventilation circuits which are currently practiced with mini-longwall mining. The illustrations originate from a report "Single Entry Short Longwall Retreating Systems" commissioned by the Department of Energy, Mine and Resources dated March 1988 (Report No. 03SQ. 23440-7-9022) which was prepared for the use of the Cape Breton Development Corporation.



DEFINITION OF SINGLE ENTRY FACE

(Source: Monenco)

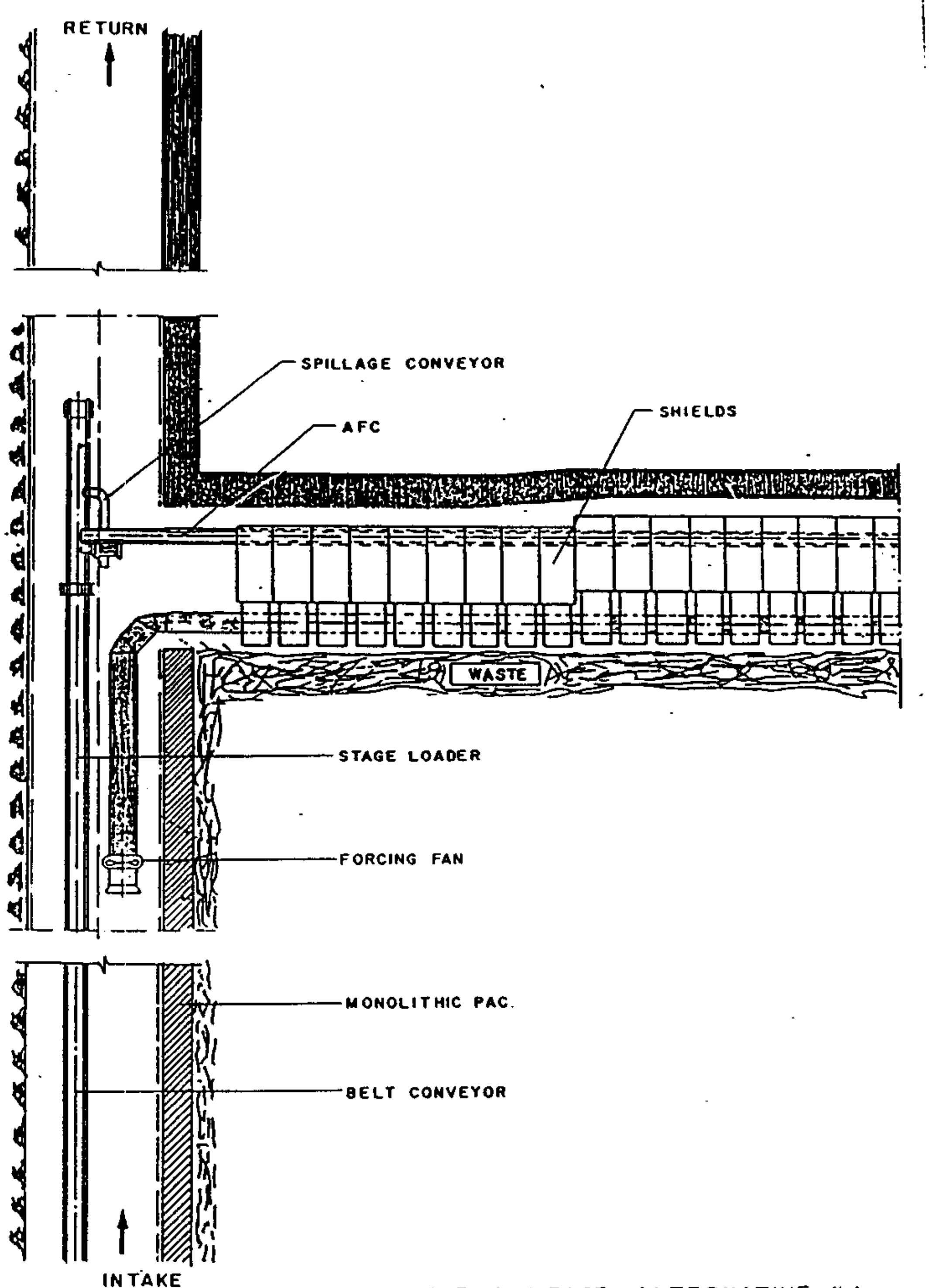
FIGURE 4-5



VENTILATION SYSTEMS - SINGLE ROADWAY DUCT

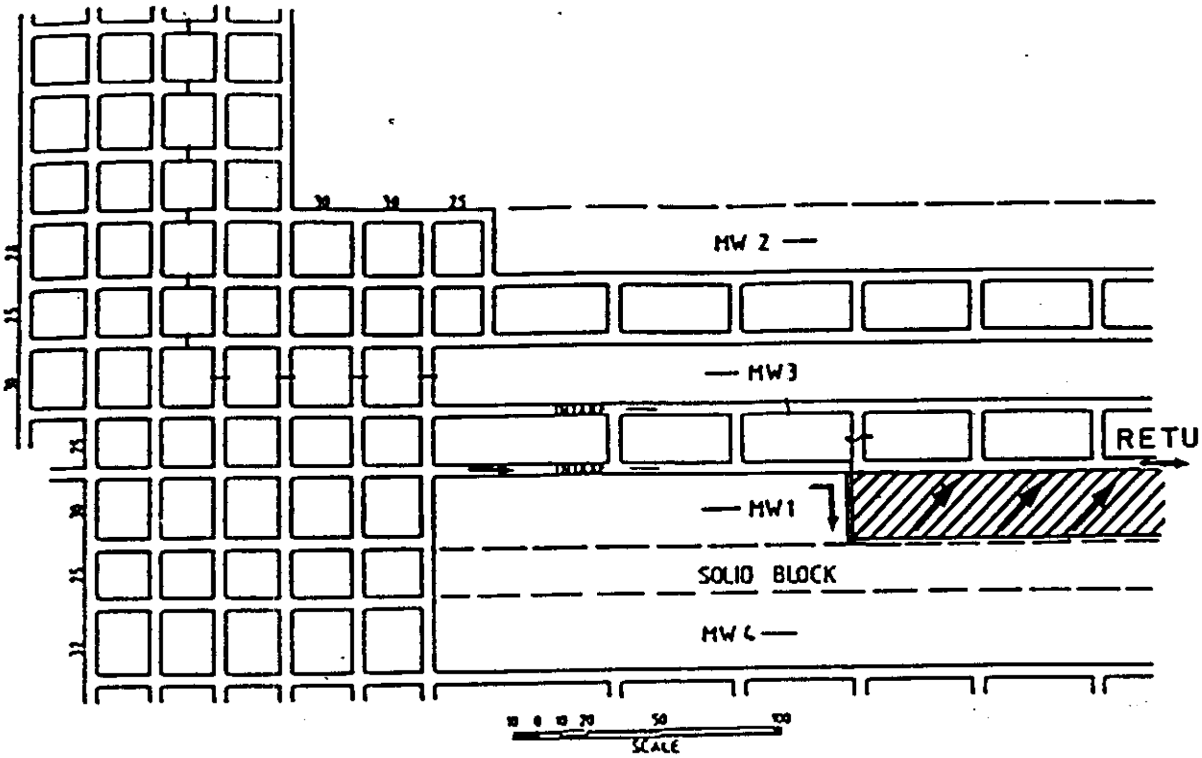
(Source: Monenco)

FIGURE 4-6



SINGLE ENTRY FACE - ALTERNATIVE # 1

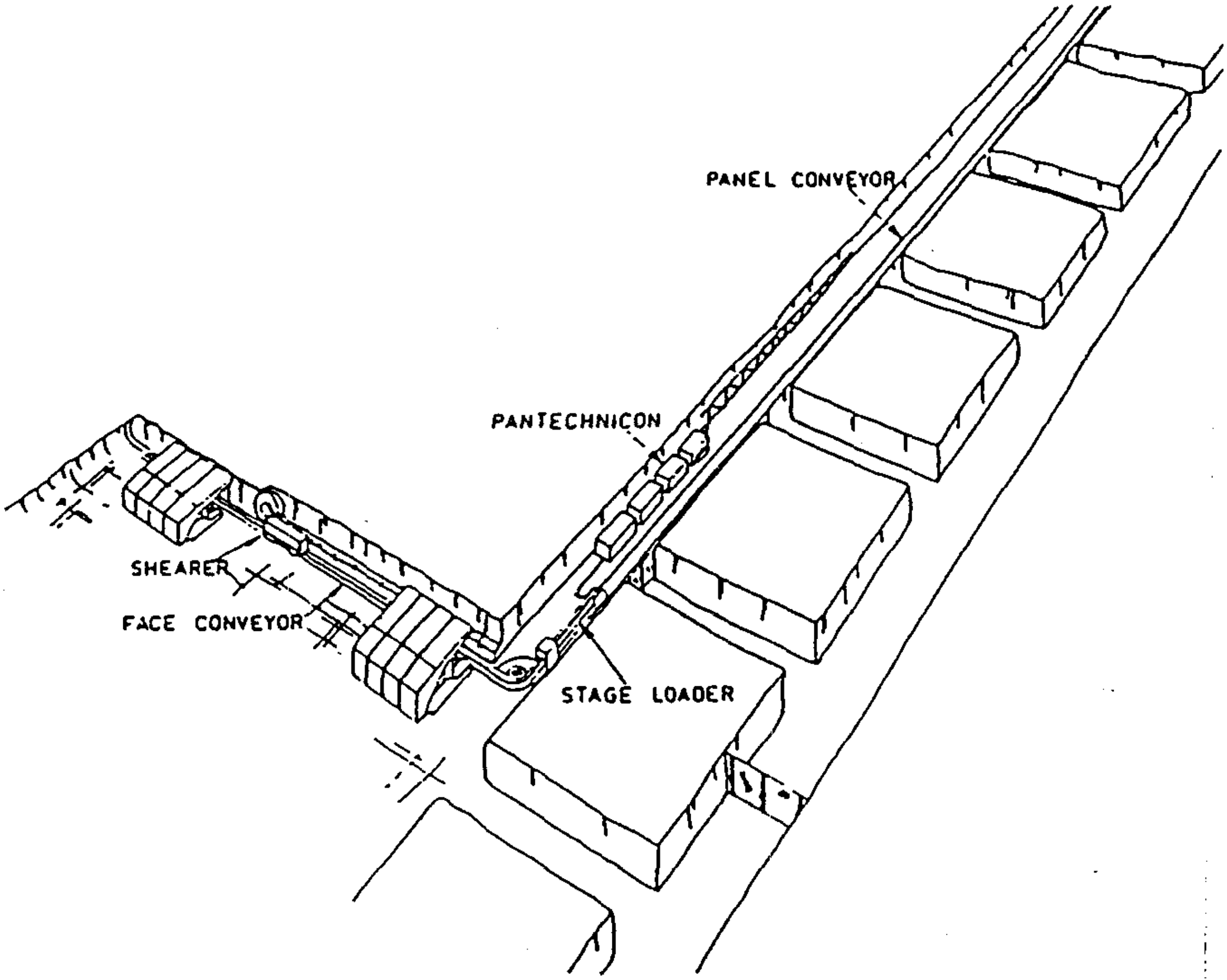
FIGURE 4-7



MODIFIED PANEL LAYOUT MINIWALL 1 EXTRACTION

SINGLE ENTRY FACE - ALTERNATIVE # 2

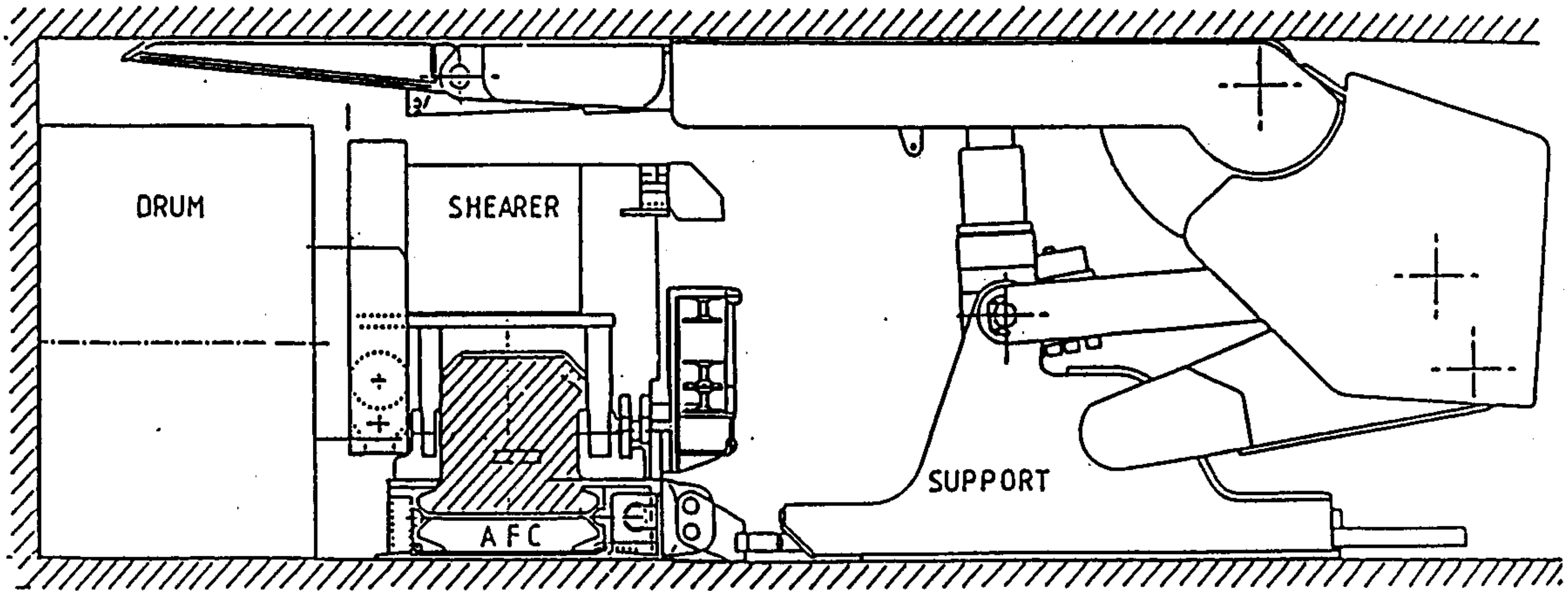
FIGURE 4-8



MINIWALL MINING SYSTEM

GRETLEY MINE - MINIWALL SCHEMATIC

FIGURE 4-9



GRETLEY MINE - FACE CROSS SECTION

FIGURE 4-10

WISTOW MINE - SOUTH WEST SIDE

PLAN SHOWING PROPOSED WORKINGS

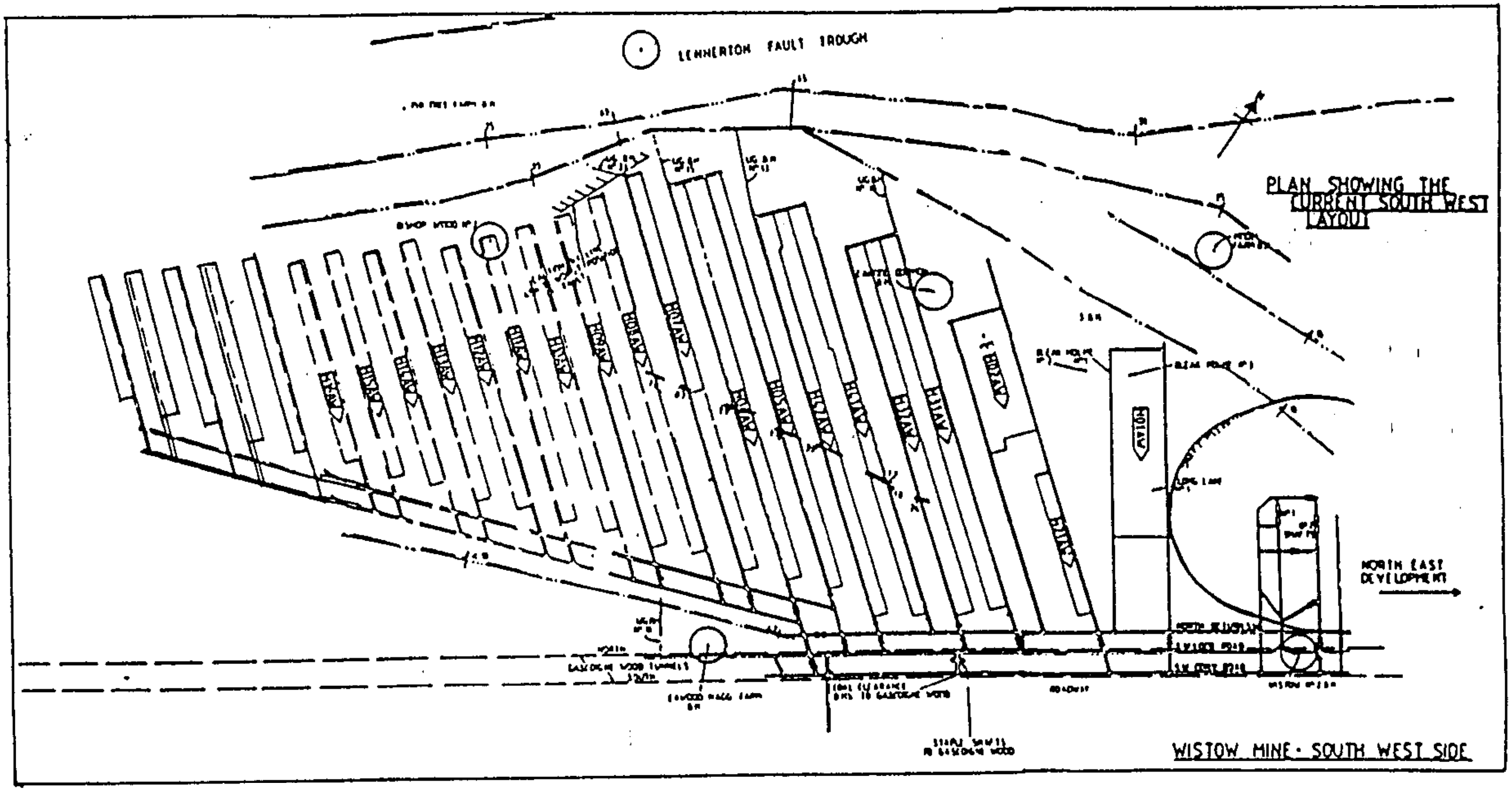
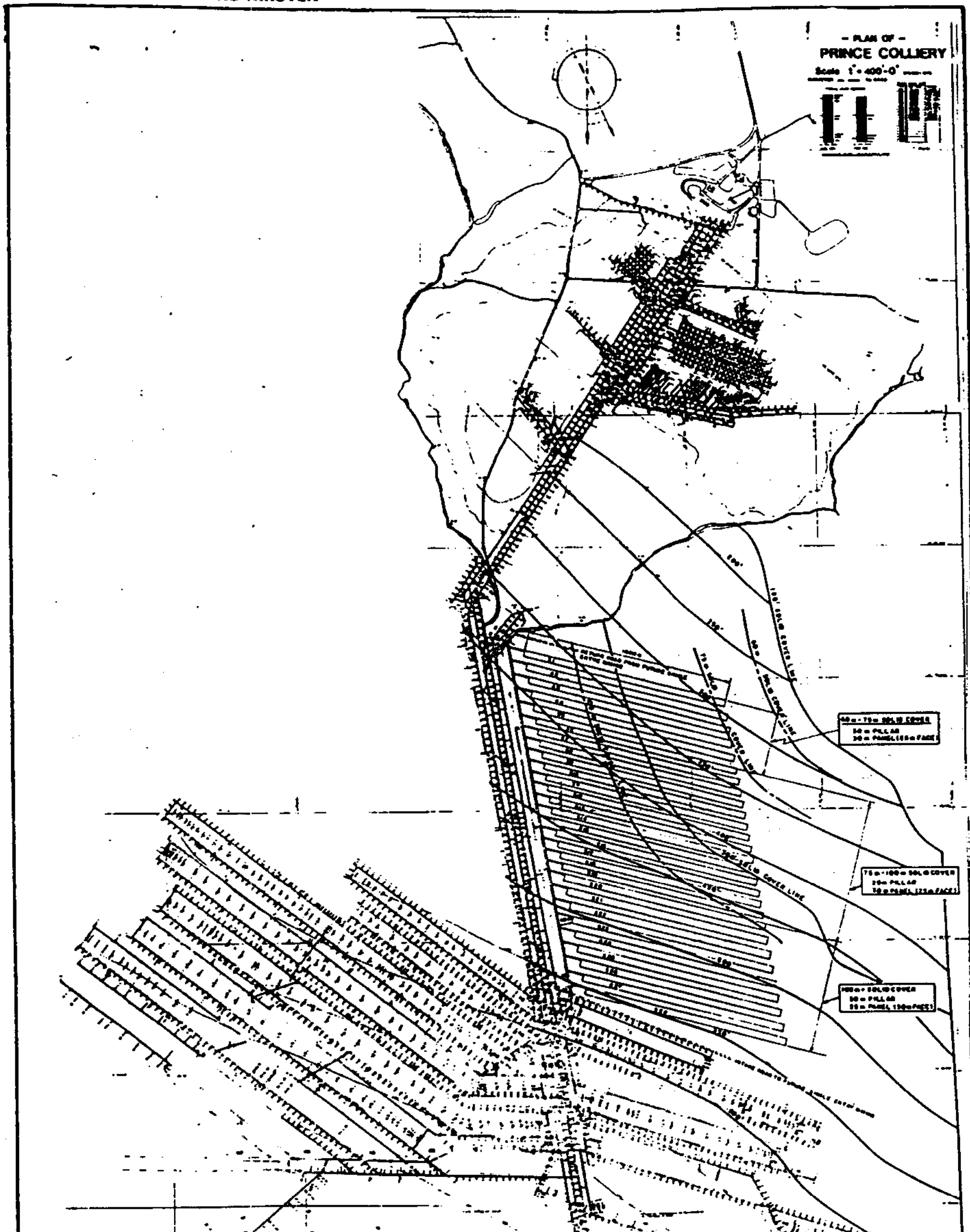


FIGURE 4-11

STEFFEN ROBERTSON AND KIRSTEN



SINGLE ENTRY MINING PROPOSED LAYOUT OF
INITAL MINING AREA (Source: Monenco)

FIGURE 4-12

SECTION 5 - MINING STRATEGY

5.1 GENERAL STATEMENT ON PARTICULAR PARAMETERS OF DESIGN

Mining Blocks - The larger part (10.4 million tonnes) of the reserves of the McIvor Lake Property are contained in mining Blocks A/B and C. These areas do not appear to be constrained by the location of sub-crops and subsequent close proximity to the unconsolidated gravel beds and to-date there is no evidence of an easterly trend to seam "pinch-outs" or depositional impoverishment. Therefore, the mining development strategy may well consider that these areas should support production at an early stage in the mine life. Mining Block C, at its N.E. corner is located close to a local housing development, which although would be protected from damage by mining subsidence, may become an environmentally sensitive issue. Hence, it may be desirable to consider leaving a limited, unworked pillar of coal in this location.

Seam Dip - The dip of #1 and #2 seams in all areas does not unduly constrain the mining transport strategy. A trackless transport system is a desirable feature of mine design and we believe that a mining development strategy can be selected which will provide this advantage in a large portion of the mine roadways.

Similarly, the control of mine water may also be planned for efficient natural drainage and pumping.

Spatial Distribution of the Seams - The mining blocks are of such dimensions, that for the efficient design of panel mining the areas may have to be split or divided.

At this stage of conceptual design, we believe that the maximum panel length (life) should not be greater than 1500 metres and preferably not less than 1000 metres. Also, it is most likely that if a single-entry system is preferred, then the Mines Inspectorate will require certain limitations in panel length.

The reason for panel length being of some importance is, the rate of retreating panels is now so great that the shorter panel lengths lead to two and sometimes three equipment moves in one year, which is non productive.

Mine Development Roadways - Those mine development roadways which are constructed as a direct extension of the access-slopes are named "MAINS", subsequent mine development roadways constructed off the "mains" are nominated "SUB-MAINS". The roadways which service and ventilate the production panels are of short life duration and are named "panel roadways".

The lineal amount of mains and sub-mains in the case of the McIVOR LAKE PROPERTY is critical. This is because the seams may only average 1.5 metres in thickness and these roadways require to be 3 metres high and 4.25 to 5 metres wide; hence, requiring the excavation of 7.5 cubic metres of rock for every metre of roadway drivage (15 to 18 tonnes). This event is costly to mine and transport and costly to dump at the mine surface.

It is therefore important to consider the amount of development roadways when selecting the mining strategy.

5.2 ALTERNATIVE MINING STRATEGIES

Figures 5-1, 5-2 and 5-3 illustrate limited initial conceptional strategies for the location of the "mains" and "sub-mains" designed with reference to the parameters discussed above.

The three alternatives are of course directly influenced by the location of the mine access, although in Figures 5-1 and 5-3 the sub-main roadway development is identical.

At a later stage in the planning of the mine, the local seam dips in each block must bear considerable influence on methane migration, water flow, and conveying efficiency. This consideration will mainly effect the direction of the panel retreat.

5.3 PANEL MINING

The Figures 5-1 to 5-3 also indicate that we have assumed that a panel mining system will predominate. At this time we cannot predict the panel width, the selection we believe will be from 200 metres to 40 metres! Much depends on strata conditions, location of aquifiers, fault patterns and geotechnical constraints.

However, at this time we foresee that a shorter or more flexible and hence, lower risk panel width is conservatively desirable.

More data and time is required to prepare a detailed quantitative and qualitative analyses of mining strategy and panel widths.

5.4 CONCLUSION ON MINING STRATEGY

This section, although brief, indicates some of the design work which will be required to be addressed on the completion of the next round of exploration.

From the limited time allowed for this study and the limited data we do however, consider that the signs are encouraging for designing a well balanced and economic mining strategy and that potential exists for further exploration targeted at a conceptual underground mine of some 300/400,000 tonnes annual production.

ALTERNATE MINING STRATEGY No.1

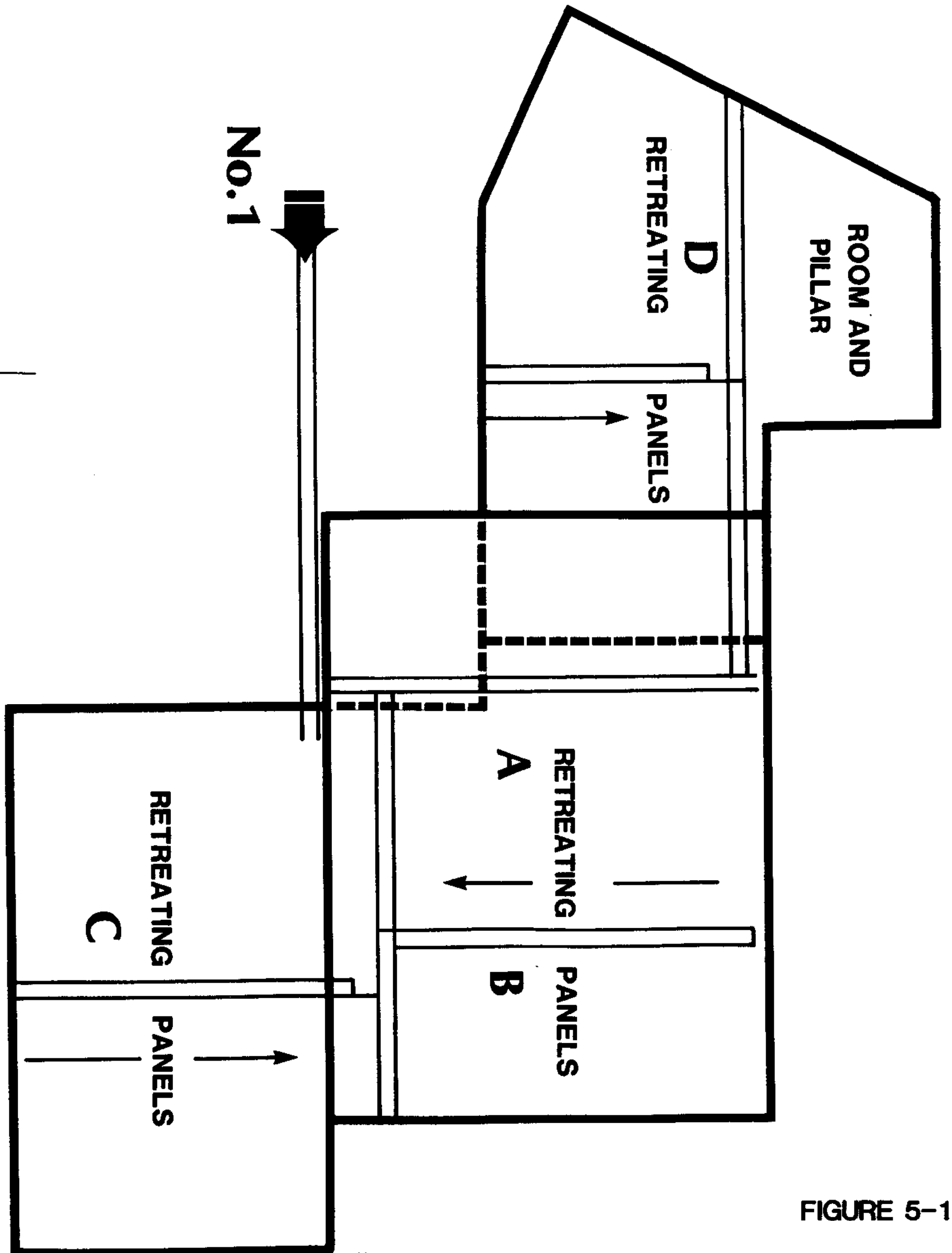
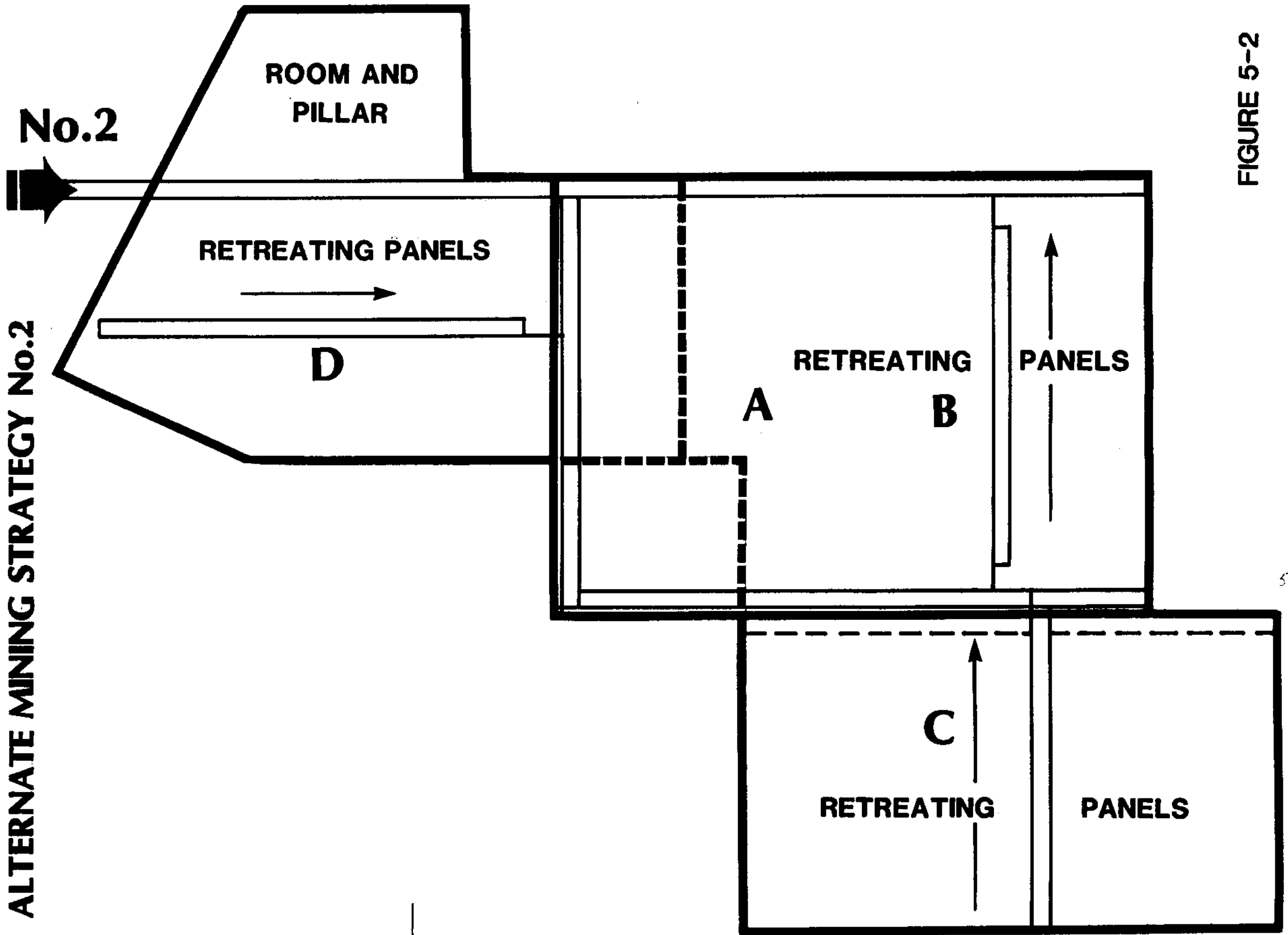


FIGURE 5-1

FIGURE 5-2

ALTERNATE MINING STRATEGY No.2



ALTERNATE MINING STRATEGY No.3

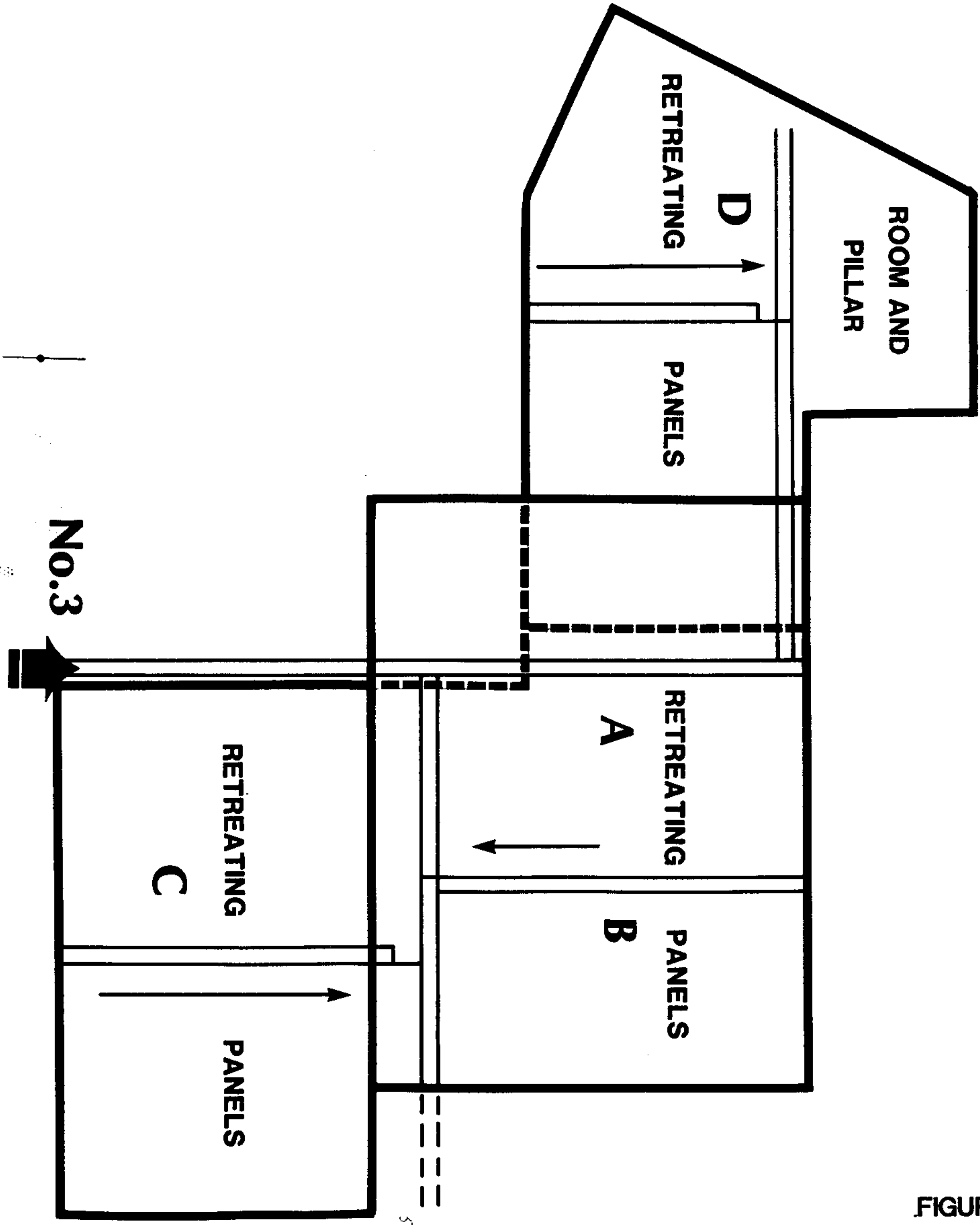


FIGURE 5-3

SECTION 6 - FORECAST OF ANNUAL PRODUCTION

6.1 GENERAL STATEMENT

When considering conceptual mine designs, an initial and by necessity, conservative forecast of annual production is normally prepared, which may then be tested against site specific mine design parametres and quantified in a financial analysis over the expected life of the mine.

The selected annual production and hence, the expected mine life should be such as is sufficient to repay the capital investment and over the life of the mine, produce a satisfactory return on investment.

For the McIvor Lake Property with its' limited reserves, it is apparent at the outset that the range of annual production must be approximately 250,000 tonnes to 500,000 tonnes and not under any circumstances be considered in a higher range i.e. 750,000 tonnes to 2 million tonnes.

This judgement is based upon the current geological data and the assumption that a high target annual production rate would not be acceptable in terms of the possible environmental impact in an area of scenic beauty and conservation.

6.2 POTENTIAL ANNUAL PRODUCTION

The table of reserves (Table I) indicates that the property may contain 15 million tonnes of in-situ or inferred reserves and that approximately 8.6 million tonnes (57%) will be recoverable. These first broad reserve estimates must be viewed with caution, as, although the calculations of recoverable coal have been conservative, the seam thickness and consistency of thickness has not yet been proved, and as discussed earlier, will require further exploration.

However, based upon a recoverable reserve of 8.6 million tonnes and an assumed required mine life of 20 years, then an annual production in the order of 350,000 tonnes would appear to be a reasonable initial forecast.

This figure is well within the technical performance of a 50 metres in width mini-longwall panel operating in a 1.5 metres seam thickness. In fact with good machine performance, reasonable mining/geological conditions, further proving of the reserves and the inclusion of the coal produced by panel development, an annual target of 400,000 tonnes should be a realistic achievable production forecast.

SECTION 7 - THE MINE SURFACE AND ACCESS TO THE RESERVES

7.1 GENERAL STATEMENT

This section has been included in order to advise on the amount of land that most likely will be required for accommodating the mine buildings, services and access tunnels to the reserves. A typical conceptual mine surface design is illustrated on Figure 6-1 which represents a standard design suitable for a mine utilizing inclined tunnels or drifts to access the underground reserves.

The precise location of access roads into the mine surface site and details on the routes to truck the mine production overland to the coast, cannot at this time be considered, nor indeed are these details required at this stage of project consideration.

7.2 ACCESS TO THE RESERVES BY INCLINED TUNNELS

The underground reserves are at a relatively shallow depth and as such are therefore easily intersected by inclined tunnels from the alternative mine surface locations. An alternative means of access to the reserves by vertical shafts is considered to be operationally uneconomical and environmentally unsuitable, the latter in view of headframe requirements.

Three alternative locations for access to the reserves have been identified and illustrated on the mine map ref (4001 T 542) - Figure 1-1.

Access #1 is within reach of numerous disused gravel pits which may be suitable for the disposal of mine waste. However, this location would require that the access tunnels may need to pass below the Quinsam River. Therefore, until data is available to consider the engineering constraints of tunnel construction, it is not possible to judge whether this location is a viable proposition.

The alternative access location #3 would suit the intersection of the seams and provide a convenient access into mining Blocks A, B and C.

However, the approach to the trucking routes to the coast may prove to be environmentally unsuitable, and access from this location to the gravel pits would require crossing the Quinsam River. Therefore, alternative locations should be considered.

Finally, there is the alternative access location #2 which is located close to the gravel pits and is adjacent to the highway leading to the coast.

This location is suitable for access to the large area of reserves in mining Blocks A, B and C and would also be suitable for the simultaneous development of mining Block D which may prove to be desirable. Production from Block D could be achieved early into the life of the project and would enhance the discounted cash flow results.

At this time, we consider that the alternative locations #1 or #3 may prove to be the preferred locations, but considerably more data will be required to confirm this preference. Land ownership and environmental considerations will considerably influence the selection.

7.3 THE MINE SURFACE (10 Hectares Approximately)

A typical surface layout suitable for a medium sized mine using access by inclined tunnels is illustrated on Figure 7-1.

The services that require to be provided are as follows:

(i) Incoming electrical supply into a main electrical sub-station leading into the distribution switchboards for the surface and underground distribution of electrical power.

(ii) An incoming supply of fresh and industrial water for the purposes of fire-fighting, the baths and mine dry, and for drinking water. Also, water will be required for the suppression of dust both on the surface and underground.

(iii) Sewage disposal arrangements to meet the conditions specified by local regulations.

(iv) Mine water settling ponds to receive all water pumped out of the mine. Two or three ponds or lagoons will be required where the water will be treated to remove all suspended sediment and neutralize any acidity or alkalinity prior to disposal arrangements to be agreed with the local government authorities.

(v) A mine waste disposal scheme which will dispose of the mine waste in local gravel pits, or in areas of low lying ground or in a an agreed manner in alternative locations.

(vi) Mine service buildings

- (i) Office and administration centre
- (ii) Mine Dry and bathing facilities
- (iii) Workshops
- (iv) Warehouse
- (v) Stockyard for mine materials
- (vi) First Aid Rooms, lamp room, hauling or hoist engine houses and mine fan building.

(vii) Areas for coal loading and stocking.
Coal loadout facilities.
Car park area.

The above listed facilities, may for the needs of the McIvor Lake Project be accommodated in an area of 10 hectares, with dimensions approaching 250 metres x 400 metres, this area does not include the land required for the disposal of mine waste.

7.4 ENVIRONMENTAL IMPACT

7.4.1 GENERAL STATEMENT

Concern on the environmental impact by mine owners/operators throughout the world has been reflected by the improved architectural design approach and landscaping of the majority of mines recently constructed in the progressive and environmentally conscious countries.

We believe that the McIvor Lake mine surface can be designed to produce a minimum of environmental disturbance to the surrounding locality. There will be no need for mine hoist head frames and all service buildings can be of a low profile and constructed in material which will blend with the surrounding countryside.

The very natural concerns regarding pollution of the Quinsam River and water feedstock to the Quinsam Fish Hatchery are well understood by the mining consultant, author of this study. For 25 years R. Barfoot was responsible for the design and operation of new mines in the South Wales area of the United Kingdom where the prolific salmon rivers of that area were in many cases near to the construction sites for new coal mines, i.e., The River Tawe and its tributaries adjacent to Ammanford in Carmarthenshire.

From this practical construction experience, we believe that the anti-pollution measures that can be proposed and built into the construction and operation of the mine will safeguard the highly prestigious salmon industry of Campbell River.

7.4.2 MINING SUBSIDENCE

Although the seam to be mined is at a relatively shallow depth, there need be no concern regarding damage to surface structures due to the effects of subsidence caused by mining excavations.

The extraction system of "panel and pillar" mining which results in minimal surface tensile strain and minimal ground subsidence has been proven in many applications throughout the world.

Figure 7-2 illustrates just one example of the application of this system. The parameters of design for McIvor Lake would not necessarily be as illustrated, but the principals of limited panel width and strength of inter-panel pillars would still apply.

This panel and pillar method may also prove to be the only safe and satisfactory alternative method to Room and Pillar mining, if it is proven or assumed that the gravel beds above the seam contain or may contain considerable quantities of water.

SECTION 8 - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. RESERVES - there are indications that either the #1 seam or the #2 seam may be of a mineable thickness over the exploration area, commencing from the western location of the seam sub-crop. Further exploration will be required to classify the reserves as "recoverable reserves".

2. The reserves in mining Block D will be limited by a coal barrier located to prevent mining excavation taking place at a distance too close to the shales and glacial till which may contain significant quantities of groundwater.

3. Additional areas of reserves need to be acquired, notably those contained in Blocks A, B and D (withheld acreage).

4. There is insufficient data on the hydrogeology of the area. The presence of glacial till and gravel beds leads us to be concerned regarding the likelihood of sub-surface aquifers being intersected by mining induced breaks to the bed rock.

5. ON THE ASSUMPTION THAT A MINERABLE SEAM IS PRESENT OVER THE WHOLE AREA AT AN AVERAGE THICKNESS OF 1.5 METRES, THEN THE McIVOR LAKE COAL PROPERTY WITH THE ADDITION OF MINING BLOCKS A AND B WILL PROBABLY SUPPORT A MINE OF 350,000/400,000 TONNES PER YEAR FOR A PERIOD OF 20 YEARS.

6. The McIVOR LAKE COAL PROPERTY has the advantage of being located in close proximity to the deep water coal loading terminal at Roberts Bank. Hence, the costs of transport from the mine site to the deep water terminal may be in the comparative low range of $10 to $14 Canadian per tonne.

   In addition, the coal quality is expected to be such as to not require benefication; therefore, with these two considerable monetary advantages, the proposed project has an economic lead over coal located in Alberta and elsewhere in Canada.

   Although the current data is sparse, we believe that there are indications to provide sufficient confidence to continue with a further `round' of geological and hydrogeological exploration and to extend the mining potential study into more detailed consideration of design, equipment selection, capital costs, manpower and operating costs.

EXAMPLE OF PANEL AND PILLAR MINING

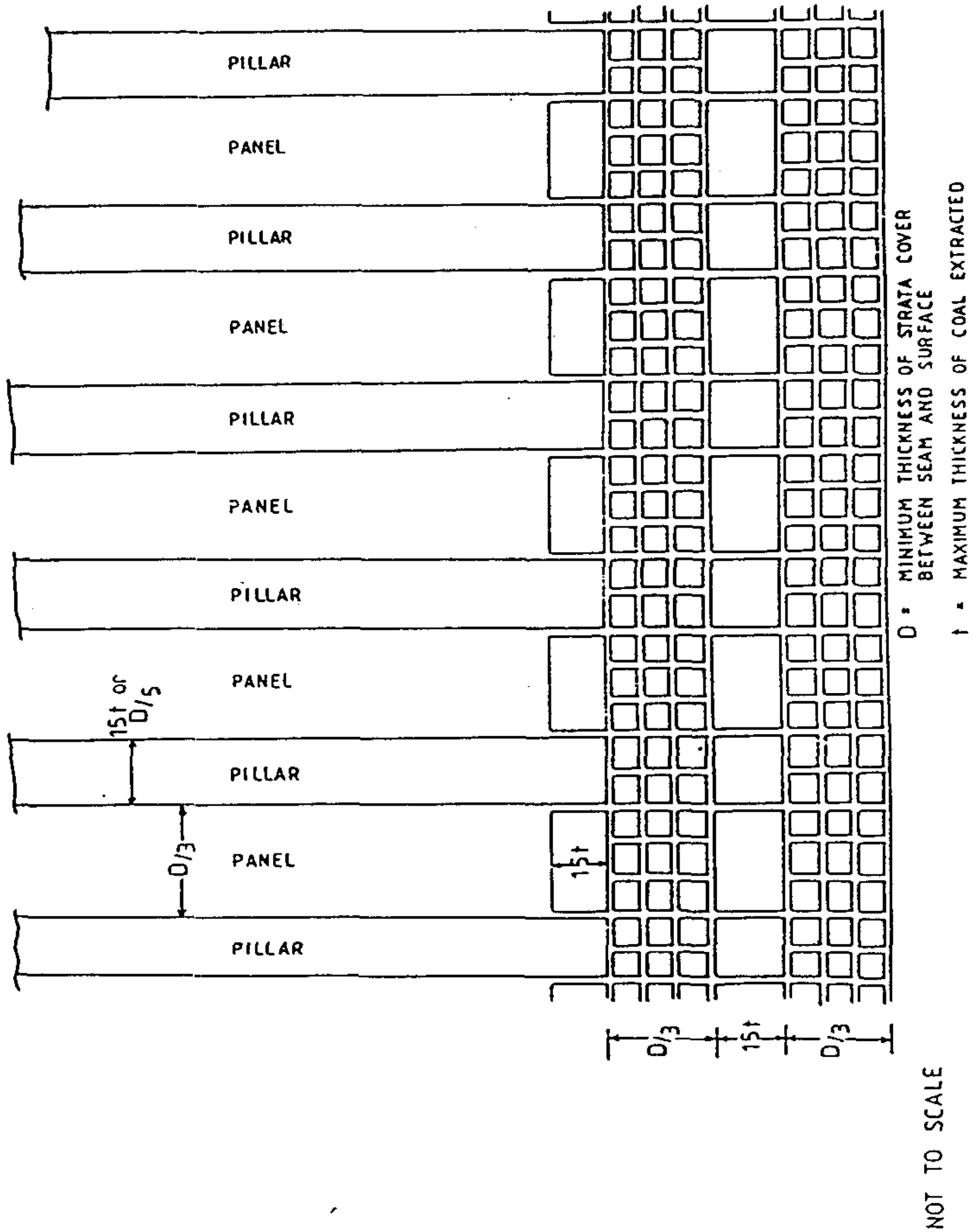


FIGURE 7-2

RECOMMENDATIONS

1. A program for additional drill holes should be prepared for implementation during 1989.

2. The exploration should contain drill wells which provide data for an assessment of the hydrogeology of the area, as soon as practical following the 1989 program.

3. Negotiation for acquiring exploration/mining rights on land applicable to mining Blocks A and B should be commenced as soon as possible.

4. Drill hole data located in close proximity to the preferred access slopes, would be useful to arrive at cost estimates for the construction of access tunnels.

5. A cored bore hole in mining Block A/B would provide core for geotechnical observation and testing. Geotechnical data will be required on:

   (a) the immediate seam roof and floor
   (b) strata ten metres above the seam and five metres below the seam.
   (c) geotechnical data necessary to design mine roadway supports and to consider the selection of panel supports.

6. Enquiries should be made into the quality and reliability of a seismic survey designed specifically for determining the profiles of the base of the gravel beds.

7. Until more information is available on the geology and hydrogeology of the property, only two methods of mining should be entertained;

   (1) Room and Pillar
   (2) Panel and Pillar

   Both methods to be applied with limited extraction designed to produce a safe and acceptable tensile strain below the horizon of the gravel beds.

8. We recommend that during the design of future exploration programs, it would be desirable to obtain <u>mining engineering input</u> into the purpose and location of some of the proposed holes.

   We believe that after the next "round" of exploration, a more specific pre-feasibility report will be expected to be prepared, which, must by necessity not be curtailed by lack of data. Particularly that data relating specifically to safety and production risks.

APPENDIX A

APPENDIX A

Extract from Technical Paper by Ian Rozier, - 1983.

"Prediction of Ground Control Problems for Underground Coal Mining in Southern Alberta."

Ground Water

The prediction of ground control problems is complicated by the ground water regime. Hydrological data from the Lethbridge area indicates that the overall permeability of the glacial overburden will be very low, in the order of 1×10^{-10} m/s. Isolated gravel bands may have higher permeability, but the water in them will generally be confined by almost impermeable materials. Above extracted longwall panels, mining will result in caving and fracturing of the roof strata. The height of the induced 'fracture zone' above mined out longwall panels may vary between 25 and 40 times the extracted seam thickness. Although there is a large degree of ambiguity in this calculation, it is reasonable to assume that the induced 'fracture zone' over longwall panels will penetrate the bedrock/overburden contact across parts of the Lethbridge Coalfield. However, even if the fractures induced by mining penetrate the bedrock/glacial overburden contact, it is anticipated that inflows will not pose serious problems because of the clayey/silty nature of the till and its expected very low permeability.

Pumping tests over the full section of the overburden would enable a more detailed assessment of potential inflows, and confirm whether or not ground water in the overlying glacial material should be considered as a constraint to mining in areas of thin rock cover, or during shaft sinking operations.

It is probable that the Galt Seam, with its well-defined cleat system, has a higher permeability than the enclosing strata. However, there are no records of excessive inflows in the Galt #8 Mine, and high water pressures within the coal have not been encountered during exploration drilling. It is reasonable to assume, therefore that the overall ground water regime and the hydrological characteristics of the Galt Seam will be similar across the area. The extremely low permeability of the Bearpaw Shale Formation, and the strata enclosing the Galt Seam, indicate that ground water flow from these strata into mine openings should not be a problem. Also, the lack of ground water flow through the coal seam, or from the overlying strata in the Kipp test mine, is significant in that it is consistent with conditions experienced in the old mines in the area. However, pre-glacial buried channels with associated highly permeable Saskatchewan gravel and sand deposits are known to exist in this area and, in some cases, have cut right down to seam horizon. Mining induced roof fractures above extracted longwall panels that penetrate the base of these channels could result in significant mine inflows. The location of these channels could impact on mine layout and development (Figure 5).

NOTE!

If detailed hydrogeological studies indicate that ground water inflows would be a serious constraint to mining at any particular property as a result of buried channels or thin cover, the most favourable longwall extraction direction would be to the east (up-dip), allowing water to drain off into gob areas. In the longwall retreat method of mining, this would involve the development of gate roads in a down-dip direction. Bed separation and induced ground fracturing above roadways would not be as severe as above working longwall faces, and it is anticipated that water problems would not be encountered at the face during development of roadways.

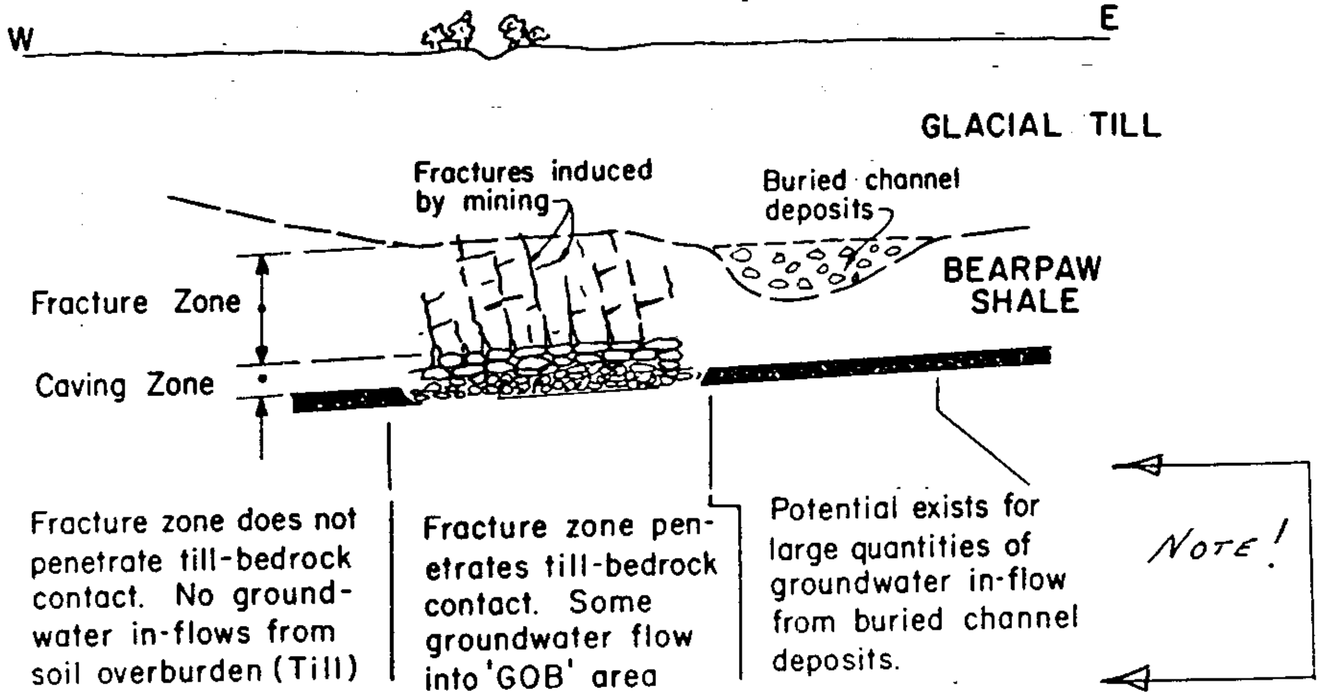


Figure 5

INFLUENCE OF MINING INDUCED FRACTURES ABOVE LONGWALL PANEL ON GROUNDWATER IN-FLOW

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

July 28, 1989

Mr. Ron Swaren
Manager-Coal
Canadian Occidental Petroleum Ltd.
1500, 635-8th Avenue, S.W.
Calgary, Alberta
T2P 3Z1

Dear Mr. Swaren:

RE: McIvor Lake 1988 Exploration Report

The above mentioned report has been reviewed, however before final approval can be granted the report must be amended to conform with the following Sections of the Coal Act Regulations:

Section 7(2) - there is no bibliography
Section 8(5) - the coal licences are not shown on figure 1-1
- figure 4 does not show the entire exploration area
Section 9(3) - there is no geological compilation map
Section 13 - the forms in Appendix 1 cannot be reproduced

If you have any questions concerning the above, please contact Alex Matheson at (604)356-2275.

Yours truly

(Mrs.) Kim Stone
Deputy Coal Administrator

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

To: Paul Hagen
Coal Administrator

April 18, 1989

RE: MCIVOR LAKE 1988 EXPLORATION

There are some deficiencies in this report. It does not conform to the following sections of the Coal Act Regulations:

7 (2) there is no bibliography,

8 (5) the coal licences are not shown on Fig 1-1, Fig 4 does not show the entire exploration area,

9 (3) there is no geological compilation map

13 the forms in Appendix I cannot be reproduced.

The more minor deficiencies have been rectified.

Alex Matheson
Coal Geologist

AM:ra

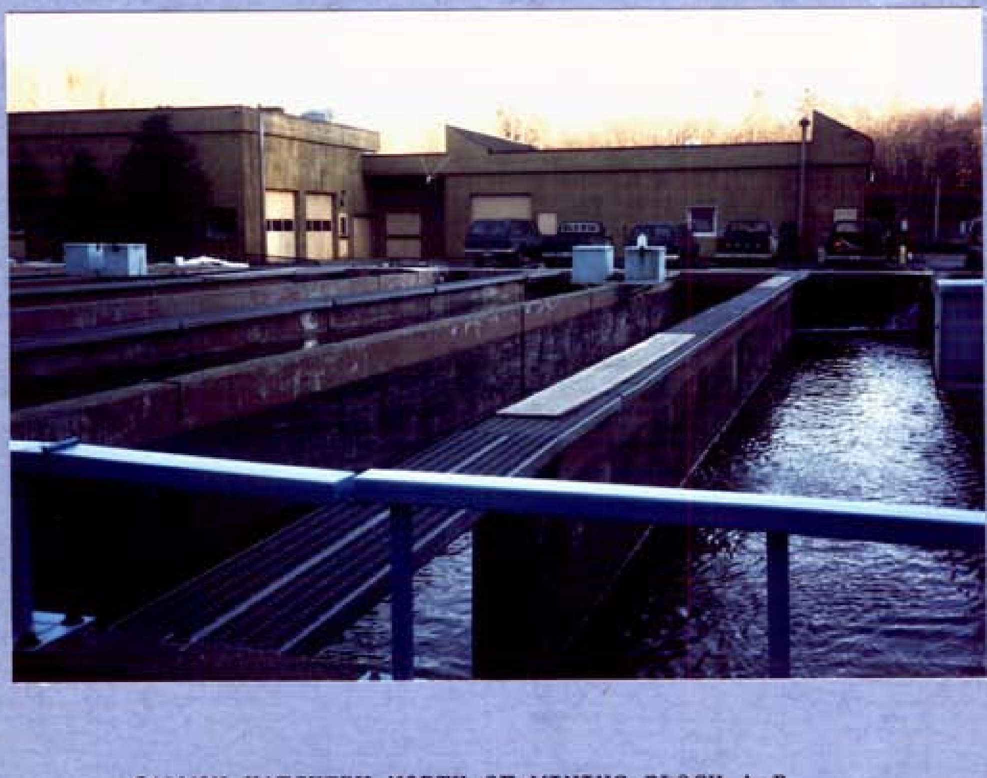
W-984

APPENDIX B

ROAD ADJACENT TO ALTERNATIVE ACCESS #3

DRILL HOLE 88-08 AT NORTHERN BOUNDARY - BLOCK C

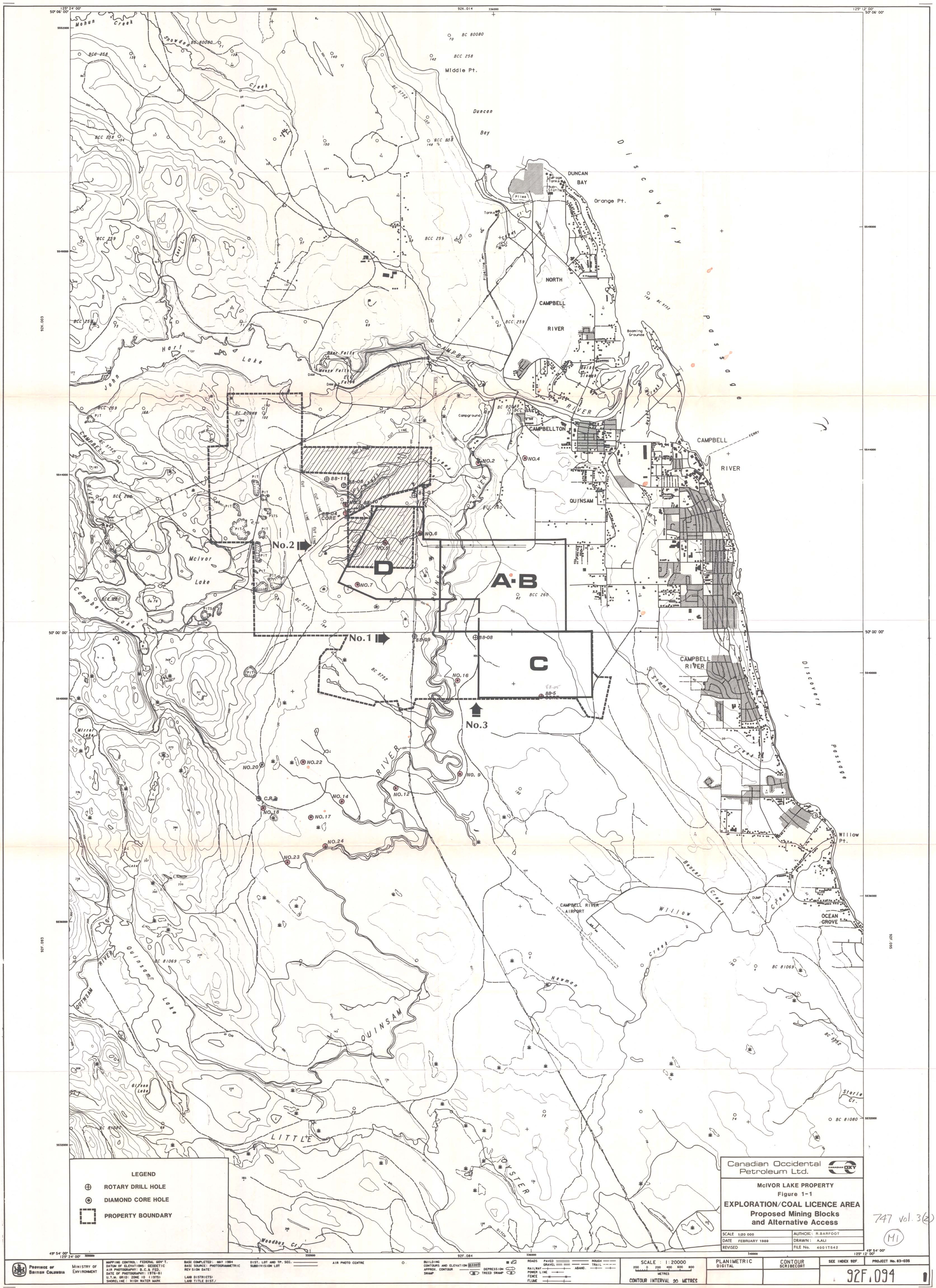
DRILL HOLE 88-09 ADJACENT TO CENTRE LINE
OF ACCESS ALTERNATIVE #1



SALMON HATCHERY NORTH OF MINING BLOCK A-B
AND NOT AFFECTED BY MINING ACTIVITY.

TYPICAL DISUSED GRAVEL PITS.
POSSIBLE SITES FOR MINE ROCK WASTE DISPOSAL.

APPENDIX C


Canadian Occidental Petroleum Ltd.
CANADIAN OXY
McIVOR LAKE PROPERTY
Figure 1-1
EXPLORATION/COAL LICENCE AREA
Proposed Mining Blocks and Alternative Access
SCALE 1:20 000
DATE FEBRUARY 1989
REVISED
AUTHOR: R.BARFOOT
DRAWN: A.ALI
FILE No. 4001T542
LEGEND
ROTARY DRILL HOLE
DIAMOND CORE HOLE
PROPERTY BOUNDARY
D
A·B
C
No.1
No.2
No.3
Discovery Passage
DUNCAN BAY
Orange Pt.
Middle Pt.
Duncan Bay
NORTH CAMPBELL RIVER
CAMPBELLTON
CAMPBELL RIVER
QUINSAM
Campbell River
McIvor Lake
John Hart Lake
Campbell Lake
Quinsam Lake
Mohun Creek
Willow Pt.
OCEAN GROVE
CAMPBELL RIVER AIRPORT
Willow Creek
Newman
Simms Creek
Storie Cr.
Woodhus Cr.
Mirror Lake
Gilson Lake
LITTLE OYSTER
QUINSAM RIVER
RIVER
NO.2
NO.4
NO.5
NO.6
NO.7
NO.9
NO.12
NO.14
NO.16
NO.17
NO.18
NO.20
NO.22
NO.23
NO.24
88-01
88-04 CORE
88-05
88-06
88-08
88-09
88-10
88-11
88-5 CORE
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT
MAPPING CONTROL: FEDERAL GOV'T.
DATUM OF ELEVATIONS: GEODETIC
AIR PHOTOGRAPHY: B.C.& FED.
DATE OF PHOTOGRAPHY: 1976-81
U.T.M. GRID: ZONE 10 (1975)
SHORELINE: HIGH WATER MARK
BASE COMPLETED: MAY 1984
BASE SOURCE: PHOTOGRAMMETRIC
REVISION DATE:
LAND DISTRICTS:
LAND TITLE DIST.:
DIST. LOT AND TP. SEC.
SUBDIVISION LOT
AIR PHOTO CENTRE
BUILDING
CONTOURS AND ELEVATION
APPROX. CONTOUR
SWAMP
DEPRESSION
TREED SWAMP
ROADS PAVED
GRAVEL
ROUGH
TRAIL
RAILWAY
ABAND.
POWER LINE
FENCE
FLUME
SCALE : 1:20000
METRES
CONTOUR INTERVAL 20 METRES
PLANIMETRIC DIGITAL
CONTOUR SCRIBECOAT
SEE INDEX 92F.
PROJECT No. 83-035
92F.094
747 Vol. 3(2)
(M1)

McIVOR LAKE COAL PROJECT
MINE SURFACE
PROPOSED LAYOUT OF SURFACE BUILDINGS
FIGURE No. 7-1

(Area Approximately 10 Hectares)

DATE :	PLAT No. :
FEB. 17, 1989	C260.DGN