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EFFECTIVE UTILIZATION OF HELICOPTERS IN RECONNAISSANCE DRILLING

Paper presented

by:

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INTRODUCTION

This paper discusses exploratory drilling for coal in remote Foothills terrain in which access is difficult and expensive. Information is based on and derived from 3 years of exploration on the Monkman Coal Project in northeastern B.C. (Figure 1). The property is located near the south end of the Peace River Coalfield. Figure 2 indicates the logistics of the property when we commenced work in 1976. This property is 75 kilometres long and stretches from Kinuseo Creek in the north to the Narraway River in the south. The road network at that time consisted of the Wapiti River Road, the Kinuseo Falls Road, the Triad Prairie Creek Road leading southwest off the Wapiti River Road, Denison Mines' Quintette Road in our Five Cabin area and local access of poor quality in the Duke Mountain area. The physiography is typical of the northern foothills and varies from glacial valleys with thick till and heavy forest cover to forested and poorly drained hillsides, to sub-alpine and alpine ridge tops.

EXPLORATION PROGRAM 1976 TO 1978

Objectives

In 1976 when Pacific commenced work our objectives were typical of first-phase exploration:

1. Determine the extent of coal measures on and adjoining the property.
2. Determine the rank, quality and extent of development of the coal seams.
3. Determine those areas most favourable for follow-up work.

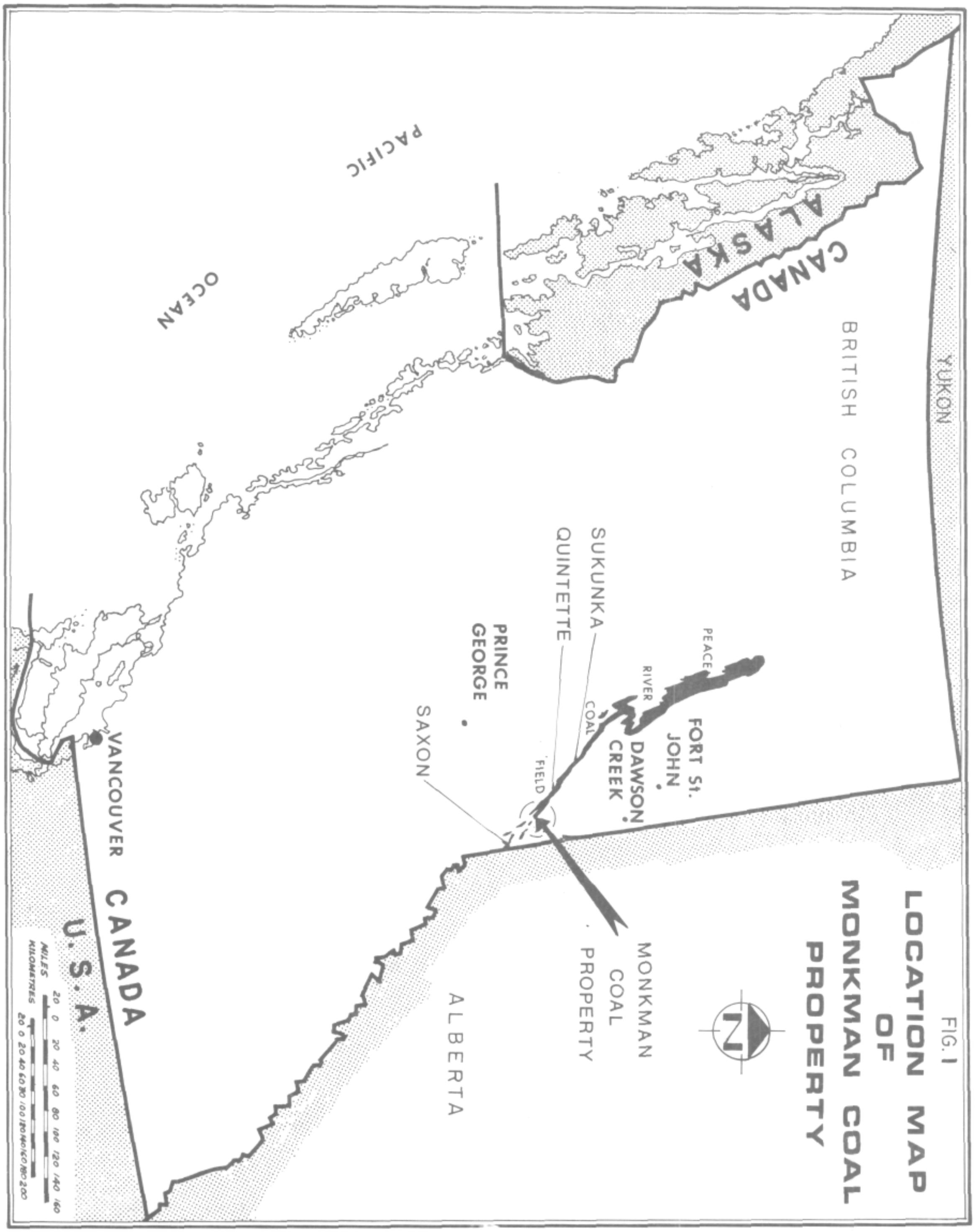

FIG. I
LOCATION MAP OF MONKMAN COAL PROPERTY

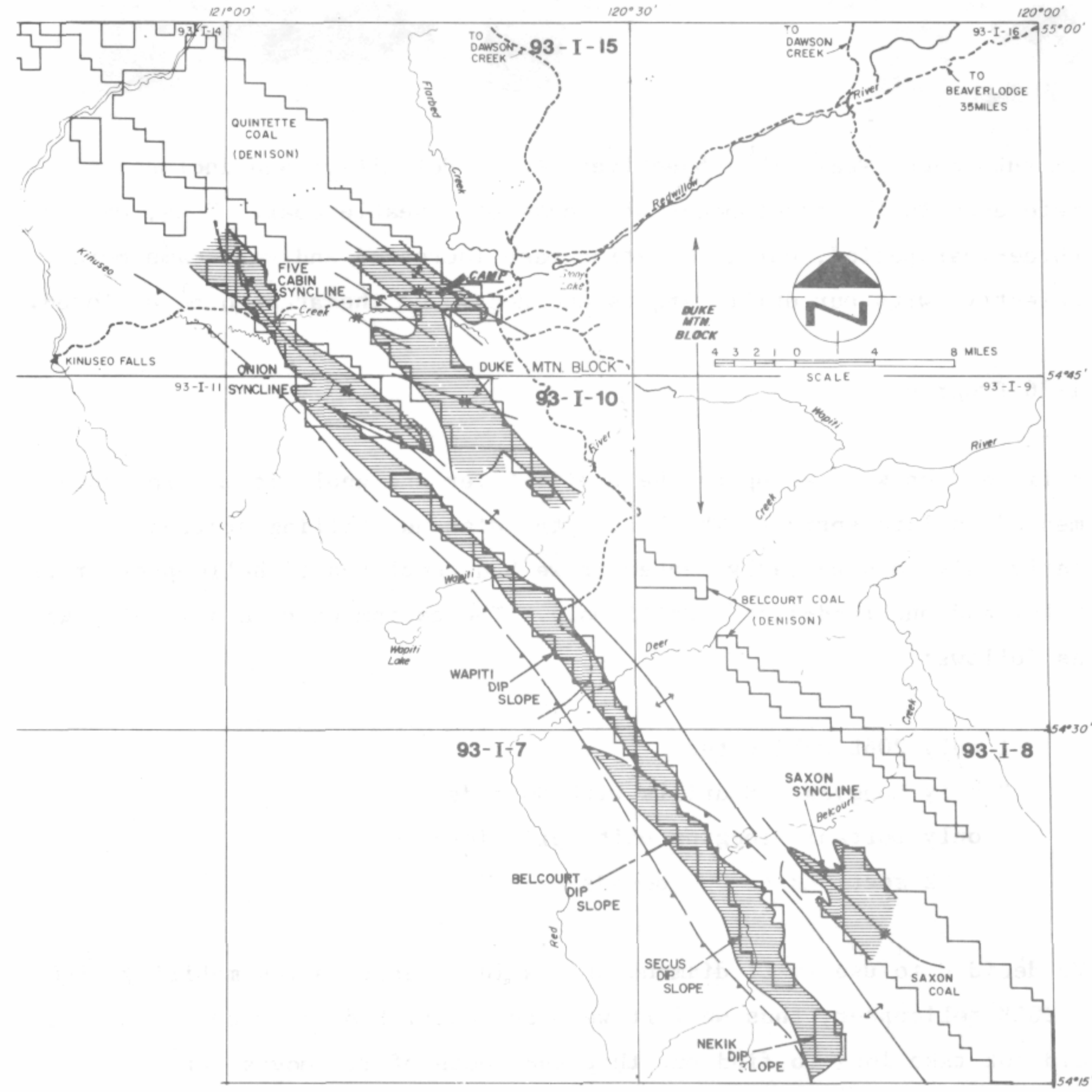

FIGURE 2

PHYSIOGRAPHY OF THE MONKMAN COAL PROJECT

In subsequent years the objectives became definitive and included reference to the development of blocks of mineable coal. Thus, over a three-year period, our information base increased and we became more selective with our drill targets and decreased the area to be explored.

1976 Program

A field camp was set up on the Wapiti River and geologic mapping commenced in late spring. The helicopter diamond drilling started in early July, and by early September we had completed 11 helicopter drill holes and one road-access drill hole. The equipment used initially was as follows:

1 only 206B helicopter
2 only Longyear 38 drills with NQ rods
1 only portable logging unit split into
 2 sections of 900 pounds each

We decided to use small diamond drills in order to allow mobility with a 206B helicopter, thus we felt we were restricted to NQ core size. It did not take long to find out that the costs of rig moves were inordinately high in terms of helicopter and rig time. Therefore medium turbines (205A's and S-58T's) were ferried in for many of the long moves. We found that the ferry costs from Prince George were not a major factor and that the overall cost saving with these larger machines was significant.

The 206B was used to ferry the logging unit from site to site. The large dots labelled 1976 in Figure 3 show the drill holes completed on this program.

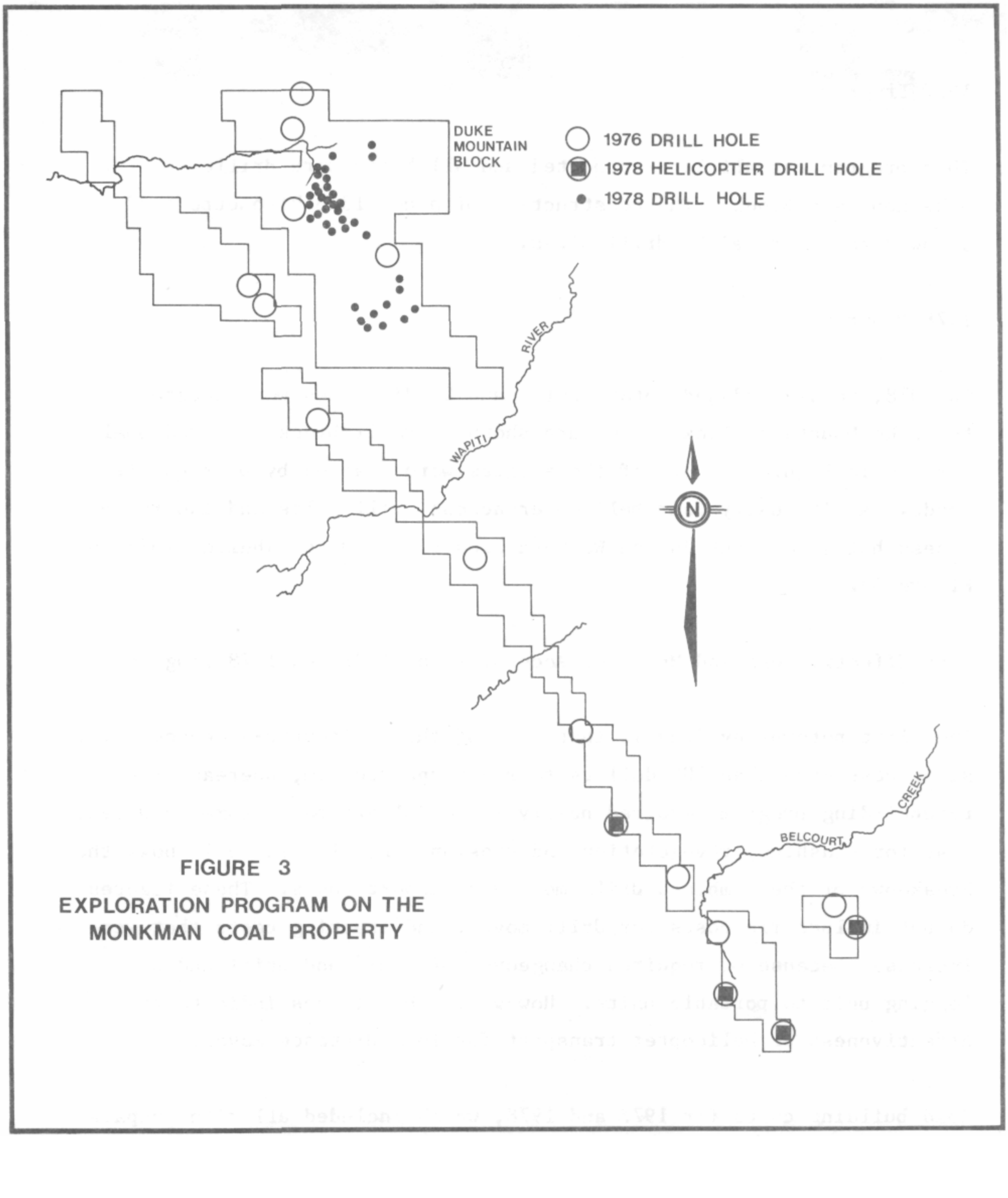

FIGURE 3
EXPLORATION PROGRAM ON THE MONKMAN COAL PROPERTY

1977 Program

This program was all land-supported and all holes were drilled on the Duke Mountain Block. The construction of a new 13.3 kilometre road allowed access to eight drill sites.

1978 Program

In 1978, 46 diamond and rotary holes and 2 adit sites were located on the Duke Mountain Block. They are shown as small black dots and small circles in Figure 3. All of these sites were reached by poor quality roads. Additionally four helicopter-access drill holes and two road-access holes were put in the Western area (large dots labelled 1978 in Figure 3).

Cost Effectiveness and Means of Access, 1976, 1977 and 1978 Programs

The first noteworthy item is that none of the helicopter-accessed drill sites cost more than 500 dollars to slash and reclaim, whereas, the roadbuilding program required nearly 1,500 dollars per kilometre direct cost for slashing, revegetation and erosion control. Table 1 shows the breakdown of the combined drill move and support costs. These figures do not include rig costs for drill moves, and trucking costs that were increased because of required changeover of a diamond drill and a logging unit to portable units. However, Table 1 does indicate the effectiveness of helicopter transport for long distance moves.

Road building costs for 1977 and 1978, which included all site preparation, roadbuilding, road maintenance, cleanup and reclamation costs, averaged 7,440 dollars per kilometre. The reason for this high cost was heavy timber and muddy conditions.

TABLE 1

COST OF HELICOPTER DRILL MOVES

YEAR	NO. HOLES	MOVE COST PER HOLE	SUPPORT COST/HOLE	TOTAL COST PER HOLE	LENGTH OF MOVE (km)	COST ($/km)	SUPPORT COST/ METRE DRILLED
1976	11	3600	6300	9900	12	825	34
1978	4	7600	9400	17,000	26	650	42
AVERAGE	15	4700	7100	11,800		705	37

COST OF ROAD DRILL MOVES

YEAR	NO. HOLES	TOTAL ROAD COSTS	COST PER HOLE	LENGTH OF MOVE (km)	SUPPORT COST/ COST ($/km)	METRE DRILLED
1977	8	66,000	8250	1.7	4850	32.20
1978	48	181,000	3770	0.8	4700	17.50
AVERAGE	56		4410		4740	19.90

Figure 4 consists of two charts which compare the cost of road access versus helicopter access. The left hand chart shows the cost in dollars per kilometre for various moves over varying distances. Three different road costs are presented, which are plotted as horizontal lines. The helicopter costs for the 1976 and the 1978 programs are plotted, and a third point has been calculated for a 1 kilometre move. The helicopter access curve has been developed on this framework. It is immediately obvious that the incremental helicopter costs decrease dramatically with increasing distance to a certain point. The helicopter curve crosses the current Monkman road cost line at the 1.7 kilometre mark. It is noted that, even if we were able to reduce road costs to 3,000 dollars per kilometre, we would only supply 3.5 kilometres of road access before helicopter moves became more economical. At the unrealistically low road cost of 1,000 dollars per kilometre, the breakeven point between road and helicopter access would be 11.2 kilometres.

The righthand chart shows total costs versus distance. The helicopter move curve is obviously shallower than the road access curve. At pre sent Monkman costs, the break-even point is, as we saw on the other chart, 1.7 kilometres.

These figures have been generated for the Monkman property with its own peculiar set of logistics. However, there is no reason to expect that on another property the figures would change by more than 50 percent.

I will now mention a series of constraints that must be considered when evaluating method of access:

1. Weather and climate
2. Physiography of the area to be drilled
3. Local environmental sensitivity
4. Reclamation costs
5. Drilling equipment requirements
6. Availability of equipment

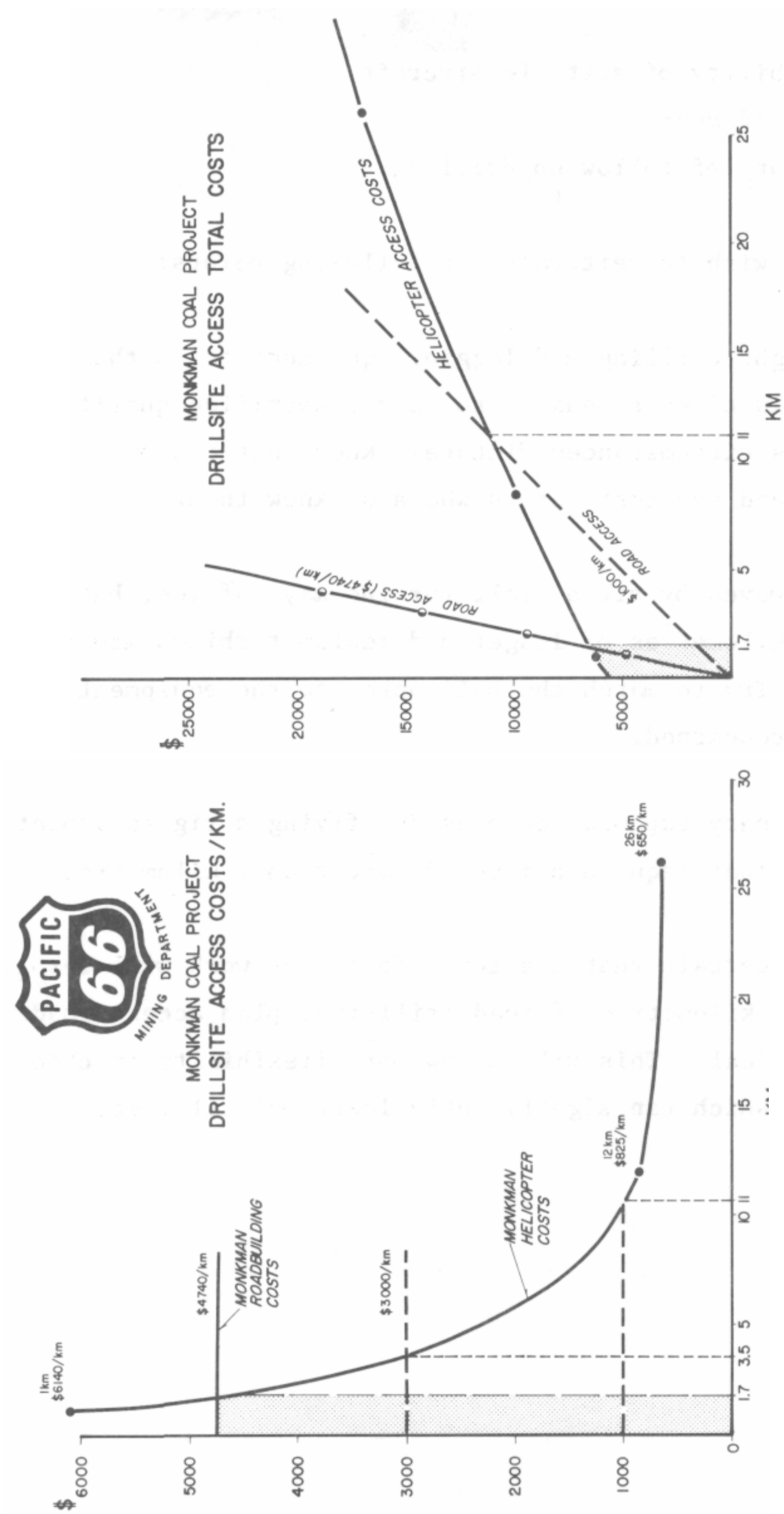

FIGURE 4

COSTS OF ROAD VERSUS HELICOPTER ACCESS

7. Availability of suitable aircraft
8. Length of move
9. Certainty of follow-up drilling

In conclusion I wish to reiterate the following points:

1. Get the right drilling and logging equipment to do the job. Equipment is often expensive so do not sacrifice quality for quantity unless circumstances dictate. Know your equipment weights (Table 2) and use contractors who also know them.

2. For short moves by air a small turbine may suffice, but if distances are 6 kilometres or longer and medium turbines are available, use them. Try to match the helicopter to the equipment and the distances concerned.

3. For preliminary exploration consider flying a rig to isolated drillsites that require a move of more than 2 kilometres.

4. If you are certain that the total follow-up work will result in less than 2 kilometres of road/drillsite, plan access roads as soon as is practical. This will allow more flexibility in choosing equipment, which can significantly lower overall costs.

TABLE 2

SUPER 38 LONGYEAR DIAMOND DRILL

HELICOPTER PORTABLE WEIGHTS

Item	Weight (pounds)
20-foot Aluminum Tower	900
Tabular Skids, fuel tanks and bunks	1200
Folding Drill Shack	700
Super 38 drill with H chuck	3180
353 diesel motor	1230
10-foot HQ rod	77
10-foot HQ casing	113
Portable mud tanks	1000
435 mud pump	1400
Supply pump	820
1000 feet of water line	650
Floor planks	1400
Mud mixer and tank	650
Rod rack and slide	100
Basket	180
Hydraulic cylinder for tower	110
Stiff legs	250
Core barrel with tubes	220
Tidy tank	110
1 HQ core box	12
1 bag mud	50
4 tool boxes	800
100 ft. high pressure hose	100
5 wooden sills	650
Blocks for sills	400

DISCUSSION RELATED TO LES SMITH'S PAPER

Greg Jones, Ministry of Lands, Parks and Housing. You said that you were worried about contractors not knowing the weight of the equipment that they were lifting. Well, previously *I* was involved with helicopter logging on the Island, and the co-pilot would watch a weight gauge. If it indicated over 20,000 pounds, which was the weight limit for the big bird they were using, the co-pilot could just press the kill button and it would drop everything.

ANS. Lovely.

Greg Jones. I was just pointing out that that's an alternative to having to know exactly what your weight should be, if you have no scale handy.

ANS. Yes, some operators use them. We used a 205 for a couple of moves this summer where we had them on. They had to install scales because there were several crashes with the 205 last summer and they had to put the weights on the machines so that they could delift down to 3,000 from 3,500 pounds.

Neil Duncan, Energy Resources Conservation Board. What was the reason for the four-kilometre spacing of the drill holes, which didn't seem to match into the geology of the place. It seemed like a rather strange type of program.

ANS. No comment.

Jim Meyer, Byron Creek Collieries. Did the drill crew travel back and forth in *a* helicopter every night, as well.

ANS. Yes. In 1976 and 1978 we used the light turbines for support of the rig.

Jim Meyer. Basically you're saying that you have few roads and therefore the helicopter drilling is cheaper. What if you plan to do more drilling in there? Your exploration costs will get lower each time, if you have the roads to start with.

ANS. Yes. My seminar paper was designed to discuss preliminary exploration and during this past summer we did build 39 kilometres of road to provide access. Our experience on this road gave me a lot of the cost derivation that I have used here. Once you know that you are going into an area and you are sure you have something, then it's worth building the road. All I am pointing out is that when you have a property with difficult access, don't start planning on building 20 kilometres of road. It can produce some problems for you.

Marv Mitchell, Range Oil Ltd. How many man shifts did you lose on the rigs due to inclement flying weather.

ANS. In 1976 we lost quite a few shifts but in 1978 very few. I would say that helicopter drilling raises your drilling costs, particularly your direct drill contract costs, by 15 to 20 percent. This is mainly due to lost time and to night-time equipment failures in the field when you can't do anything about them.