## PROSPECTUS

## ADANAC MOLYBDENUM PROJECT

FEBRUARY, 1979

PLACER DEVELOPMENT LIMITED

PROPERTY FILE

104 N 052 (11W) -05



## PLACER DEVELOPMENT LIMITED

February 23rd, 1979

FILE: V-164

Dr. J.T. Fyles
Senior Assistant Deputy Minister
Dept. of Energy, Mines & Petroleum Resources
406 Douglas Building
Victoria, B.C.
V8V-1X4

Dear Dr. Fyles,

In compliance with current regulations we are submitting, for your review, our prospectus on the Adanac Molybdenum Property at Atlin as a first stage in obtaining acceptance of the program.

We would be pleased to receive your comments regarding the proposed development.

Yours truly,

PLACER DEVELOPMENT LIMITED

W.A. Triggs

Manager - Engineering

WAT/cs Attachment

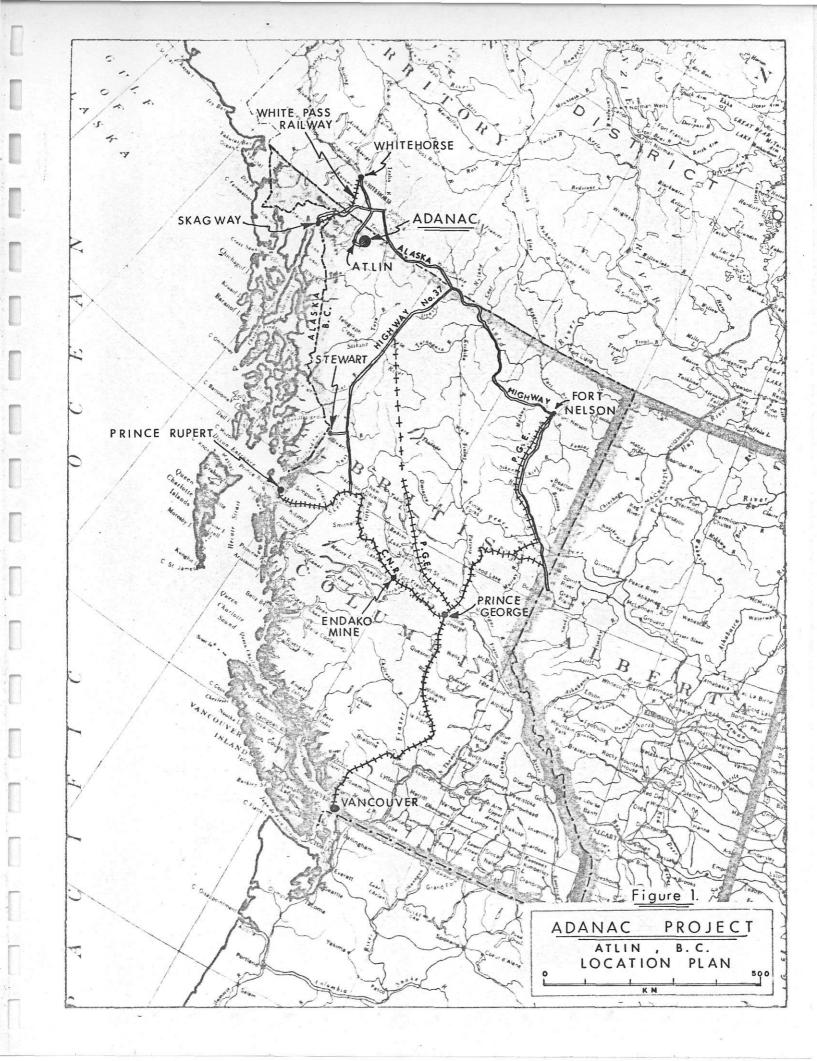
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### SUMMARY

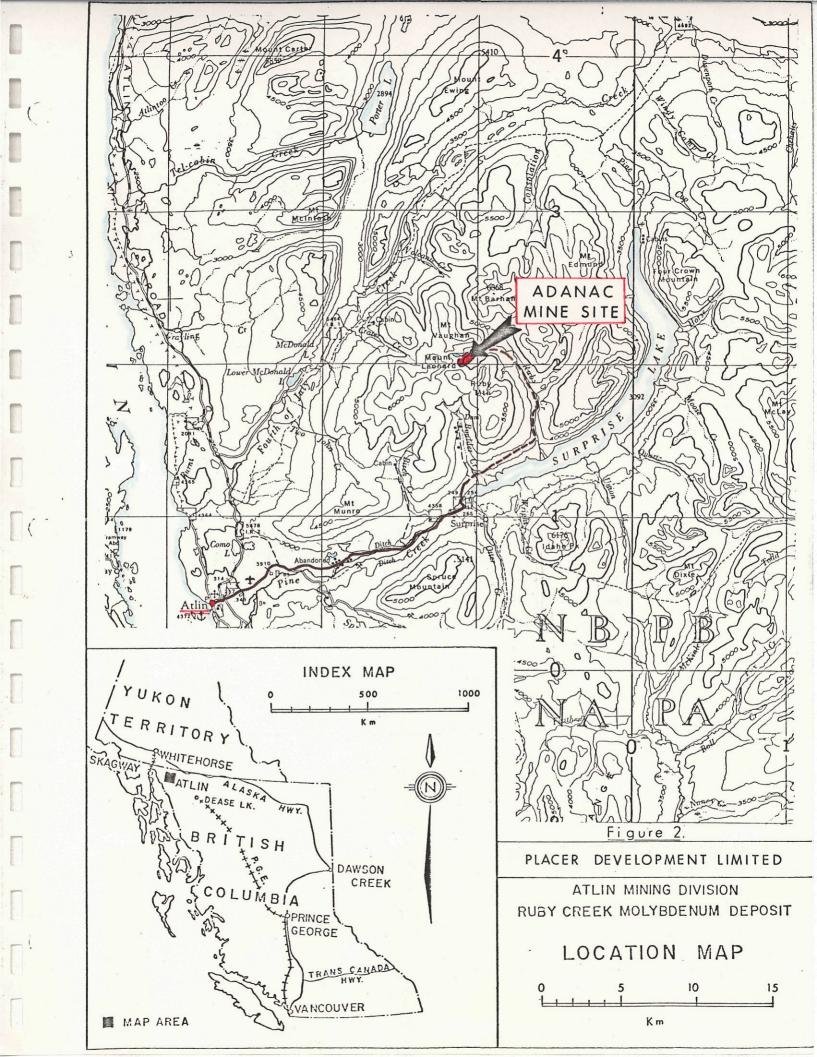
Late in 1978 an agreement was reached between Adanac Mining and Exploration Limited and Placer Development Limited for development of the Ruby Creek molybdenum deposit. Under the agreement, Placer will be the operator and has the right to earn a 70% interest in the project.

The Ruby Creek deposit is located 24 kilometres N.E. of Atlin in the extreme north-western corner of British Columbia and is accessible from Atlin by 39 kilometres of road.

The deposit was explored extensively during the late 1960's and was the subject of a detailed feasibility study by Kerr Addison Mines Limited during 1970. At that time, due in part to depressed marketing conditions for molybdenite, economic projections were not sufficiently encouraging to warrant development.

The Ruby Creek molybdenum occurrence is a bulk low grade type of deposit amenable to extraction by open pit mining methods. The mineable open pit reserves at a .06%  ${\rm MoS}_2$  cut-off grade are estimated to be 68,084,000 metric tons with an average grade of 0.122 percent  ${\rm MoS}_2$  and would supply a 14,000 metric ton per day concentrator for 14 years.

Recent strong demand and significantly improved molybdenum prices have enhanced economic viability. A production decision will depend upon the results of a current feasibility study, which is expected to be completed late in 1979.



Technically the project is at an advanced stage of development. The deposit has been defined by grid pattern diamond drilling and was explored by underground development. Onsite pilot plant operation has confirmed the planned process and produced a saleable product. Engineering work is also generally well advanced. There are, however, several aspects of the project which require substantial work or review before a production decision can be made. They include:

- 1. Carry out environmental requirements.
- 2. Procure licences and permits.
- 3. Develop a housing and community services plan.
- 4. Investigate the feasibility of generating hydroelectric power.
- 5. Update and refine engineering and cost data.
- 6. Negotiate forward molybdenum sales

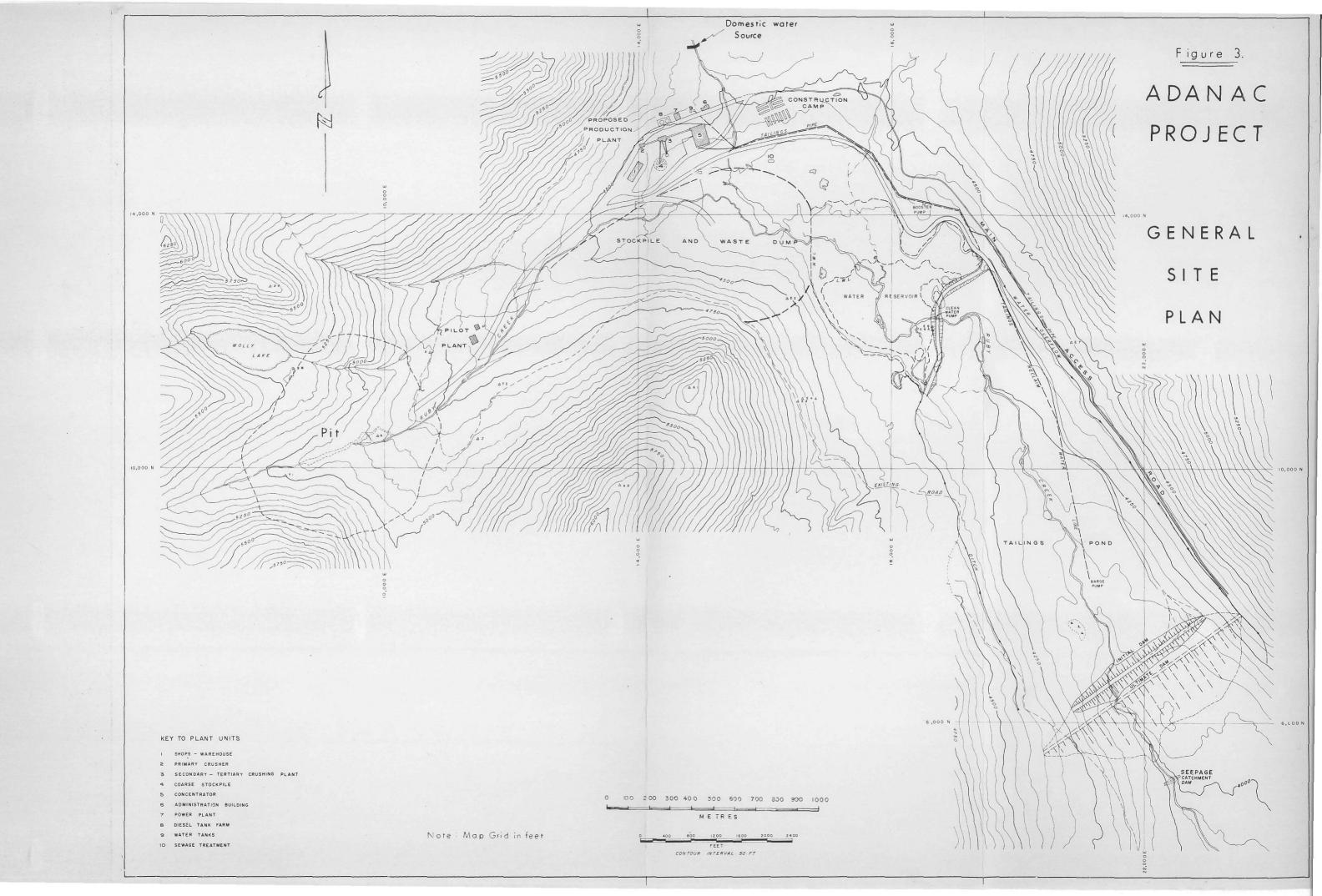
Assuming that no unforeseen delays are experienced and that the feasibility study indicates that production is economically viable, the following schedule is probable.

- 1979 Complete feasibility requirements
- 1980 Commence construction
- 1981 Complete construction and commence production at the end of the year.

The proposed mining and concentrating plans are generally straightforward and comparable to existing British Columbia operations. The ore
will be mined by conventional open pit mining methods utilizing shovels,
trucks and rotary drills. The ore will be processed by primary and secondary
crushing and screening, grinding in a rod mill-ball mill circuit followed
by flotation of a molybdenite concentrate. The production rate will be
14,000 metric tons of ore per day and will require a labour force of approximately
300 people. Concentrate production will be in the order of 20 metric tons
(40,000 lbs.) per day.

The principal support facilities required for a mining project at Ruby Creek include a water reservoir, a tailing disposal and water reclamation system, a power supply, maintenance shops, a warehouse and an administration office. The access road from the village of Atlin requires some upgrading and some relocation. It is assumed that housing for employees will be developed in or near the village of Atlin, the only existing community in this part of B.C. The town currently has a population of less than 300 permanent residents and an economy that is based either directly or indirectly on government, and to a lesser extent on mining or tourism.

The major environmental change resulting from the proposed Ruby Creek project would be the social and economic impact on the town of Atlin. The 1976 census showed a population of 250 and recent estimates are only modestly higher. The size of the construction work force will be in the order of 400 to 450 while the anticipated population increase, on a permanent basis, would exceed 500 people including employee's dependants, related workers



and their dependants. Based on the present schedule the project's permanent employees would arrive in Atlin during 1981.

The deposit is situated in a "U" shaped valley at the head waters of Ruby Creek. The pit area elevation is 1,524 metres and all of the planned facilities will be above timberline in an area characterized by shrubs, grasses, mosses, and lichens in the valley bottom, giving way to talus slopes and rock outcrop along the valley walls. The Ruby Creek property is located in an area of limited land use with mining the most evident possibility for increased utilization.

With the exception of the housing development, no private land will be disturbed. The property is located on Crown Land which is under the jurisdiction of the Land Management Branch. The proposed conventional mining and milling project has the advantages of being close enough to the attractive Atlin residential area that employees may live there and far enough away that it will not adversely affect that community.

A baseline environmental study was carried out by Howard Paish & Associates during the summer of 1970. The initial study was a general assessment of the present and projected values of fish, wildlife, recreational, timber and other resources in the Ruby Creek - Surprise Lake area that could be affected by the development of the Adanac property on Ruby Creek. Later studies included the collection of data during pilot mill operations for comparative evaluation with initial baseline information.

The potential use of the land for mineral production far surpasses its potential for any other use. This is particularly true when it is realized that with proper reclamation most of the area disturbed can be revegitated and returned to its present wild state.

#### GENERAL DESCRIPTIONS

### Introduction

This prospectus has been prepared for submission to the Ministry of Energy, Mines and Petroleum Resources in accordance with the requirements of the Mines Regulation Act. It provides an overview of the proposed development of the Ruby Creek molybdenum deposit in the Atlin area of British Columbia.

The project has been investigated in considerable detail including grid pattern definition drilling, underground bulk sampling, on site pilot plant operation and a related feasibility study by Kerr Addison Mines Limited in 1970. Recent improvement in the demand for molybdenum has resulted in a decision to update the Kerr Addison study and, if warranted, proceed to production.

The proposed project is based on the existence of a molybdenum concentration which is amenable to extraction by open pit mining methods. The principal mineral of economic importance is molybdenite ( $MoS_2$ ) which occurs primarily as fracture fillings in a bulk type, low grade deposit. Mineable open pit reserves are currently estimated at 68,084,000 metric tons with an average grade of 0.122 percent  $MoS_2$ . Potential exists for adding tonnage to the presently known deposit or for locating other zones of economic significance in the immediate area.

## History

Since 1898 prospecting for and the working of placer gold deposits have been the chief source of Atlin's economy. Although the Ruby Creek molybdenum showing was known for some time, no work was done on the deposit until the summer of 1968.

The property was staked for Adanac Mining and Exploration Co. Ltd. in 1967. During the field season of 1968 an access road was extended to the showings, a camp established, a geochemical survey carried out and a diamond drilling program initiated. Twelve diamond drill holes totalling 1,502 metres were completed prior to winter shutdown.

During 1969 Adanac implemented a major grid pattern diamond drilling program totalling 11,273 metres in 68 holes. Bench scale metallurgical test work was begun and preliminary economic studies were undertaken.

In the spring of 1970 an agreement between Adanac and Kerr Addison Mines Limited was finalized and a full scale feasibility program commenced. It continued through to the spring of 1971 and included an extensive grid pattern diamond drilling program, a large underground bulk sampling and pilot milling program, together with the related engineering required for the feasibility study. Due primarily to the then depressed molybdenum market it was concluded that the Ruby Creek deposit could not sustain an operation with adequate profit margins until economic conditions improved.

During the period 1971 to 1978 modest exploration programs and engineering studies were carried out by Adanac Mining and Exploration Co. Ltd., Noranda Mines Ltd. and by Climax Molybdenum Ltd.

Late in 1978 an agreement was reached between Placer Development Limited and Adanac for further work and possible development of the Ruby Creek deposit.

### Location and Access

The Ruby Creek deposit is located within the Atlin Mining Division in the extreme northwestern portion of British Columbia. It is 24 kilometers N.E. of Atlin and approximately 145 air kilometers S.E. of Whitehorse in Yukon Territory. More specifically, the property is located at the headwaters of Ruby Creek, in a broad open valley, at an elevation of approximately 1,525 meters above sea level. The geodetic co-ordinates are 59°43'N 133°24'W.

The property is accessible from Atlin by 39 kilometers of dirt road; the first 19 kilometers to Surprise Lake is a public road which is graded and in fair condition. The town of Atlin is in turn accessible from Whitehorse by 190 kilometers of road. This access includes 93 kilometers along the Alaska Highway between Whitehorse and Jake's Corner which has been recently upgraded and paved while the remainder from Jake's Corner to Atlin is a well maintained gravel road.

## Townsite

Atlin is a small unincorporated settlement presently administered by Provincial Representatives assisted by a local elected committee.

All community services are subsidized by the Province. It is assumed that the most desireable residential site for the mine's employees will be in or adjacent to Atlin.

Placer has, in the past, provided housing in small British Columbia communities through both direct company participation and through forgivable second mortagages. The latter scheme was developed to encourage individual ownership, by bringing the cost of housing within the financial capability of the employees.

The anticipated number of employees and their impact on the community of Atlin is discussed in the Socio-economic Overview section commencing on page 21.

#### PROJECT DESCRIPTION

#### Access Road

Some relocation and upgrading of the present 39-kilometer access road between Atlin and the Ruby Creek deposit will be required. The initial 19 kilometers between Atlin and Surprise Lake is a public road which is generally in fair condition. The next 10 kilometers, to the site of old mine workings in the lower Ruby Creek valley will require some relocation, widening and upgrading.

The final 10 kilometers consists of an exploration access road along the west side of Ruby Creek valley to the site of the molybdenum deposit. The segment of the access road, which is above treeline, requires re-routing to the east side of Ruby Creek valley. Rerouting the road will improve the grade and alignment, while providing greater exposure to the sun and reduced snow hazard conditions.

## Proposed Mining and Milling Operation

It is proposed to mill 14,000 metric tons of molybdenum ore per day (4,900,000 metric tons per year) mined from an open pit mine at the western headwaters of Ruby Creek.

The conventional crushing-grinding-flotation concentrator will be located downstream and  $1\frac{1}{2}$  kilometers east of the pit.

A water reservoir and a tailing pond, in that order, will be located downstream from the concentrator. Process water will be reclaimed from the tailing pond. Make-up water will be drawn from the reservoir and potable water will be drawn from the north branch of Ruby Creek.

## Mineable Reserves

Additional exploration or further investigation of molybdenum selling prices, capital costs and operating costs will affect the eventual mineable ore reserve. The mineable reserve based on a recent pit design is tabulated below.

MINEABL			
(Thousands	of	Metric	Tons)

<u>Pit</u>	Total Tons	Waste Tons	Ore <u>Tons</u>	Grade % MoS <sub>2</sub>	
Initial	50,085	19,943	30,142	.156	
Ultimate	75,103	37,161	37,942	.104	
TOTAL:	125,188	*57,104	68,084	.122	

<sup>\*</sup> Includes overburden and waste rock.

The potential for expanding the reserves at Ruby Creek must be considered good. Molybdenite mineralization is known to occur over a broad area, which to date is essentially unexplored. Onward exploration is planned, as is the investigation of possible by-product production.

## Production Schedule

A mining schedule has been developed to mine 14,000 metric tons of ore per day 350 days per year. During the initial mining stage, ore grading .10%  $MoS_2$  or better would be milled directly and ore grading between .10 and .06%  $MoS_2$  would be stockpiled for later milling.

The mill feed grade is expected to average .18%  $MoS_2$  in production year one, .17%  $MoS_2$  in years two and three and to decrease thereafter during the 14-year life of the operation, based on the currently defined reserves. The stripping ratio will be 2/1 for the first few years and decrease thereafter.

## <u>Open Pit</u>

The oval-shaped pit will eventually be  $765 \text{ m} \times 920 \text{ m}$  in areal extent. The pit will reach a depth of 60 m below the pit rim at the east wall, 210 m at the west wall and 214 m near the southeast wall.

The mine waste dump is located east of the pit on the south side of the western branch of Ruby Creek. This waste dump will ultimately cover an area  $600 \text{ m} \times 1200 \text{ m}$  and have a maximum depth of 125 m. The dumping area is accessible from the main ore and waste haul road at any elevation, facilitating construction of a very stable dump.

Drainage originating west of the pit is diverted around the north side of the pit and will rejoin the natural drainage system.

Mining is carried out using conventional open pit methods and equipment. The equipment is expected to include rotary drills,  $4.25~\text{m}^3$  electric shovels, 110-tonne trucks, large bulldozers, graders and other support equipment.

## Plantsite

A pit access road on the north side of the main western branch of Ruby Creek connects the pit to the plantsite which will occupy 18 hectares.

The proposed construction camp is located at the east end of the plant site.

#### Processing

Metallurgical testing of the Ruby Creek molybdenite ore has been thorough. Britton Research Ltd. of Vancouver provided the technical control for testing and Kerr Addison operated a 100 metric tons per day pilot plant at the property for a period of several weeks. Recoveries in the pilot plant were excellent averaging nearly 97% for sulphide ore and 95% for the overall Mo recovery from the underground workings.

The flow sheet is shown in figure 4 on the following page. 4,900,000 metric tons of ore will be processed each year to produce molybdenite concentrates. Consideration is being given to roasting these concentrates at Endako, B.C. to produce molybdic oxide for shipment to potential customers. The final product form and shipment route are not yet determined. The following paragraphs describe the concentration and support facilities at the Adanac project site.

## Primary Crusher

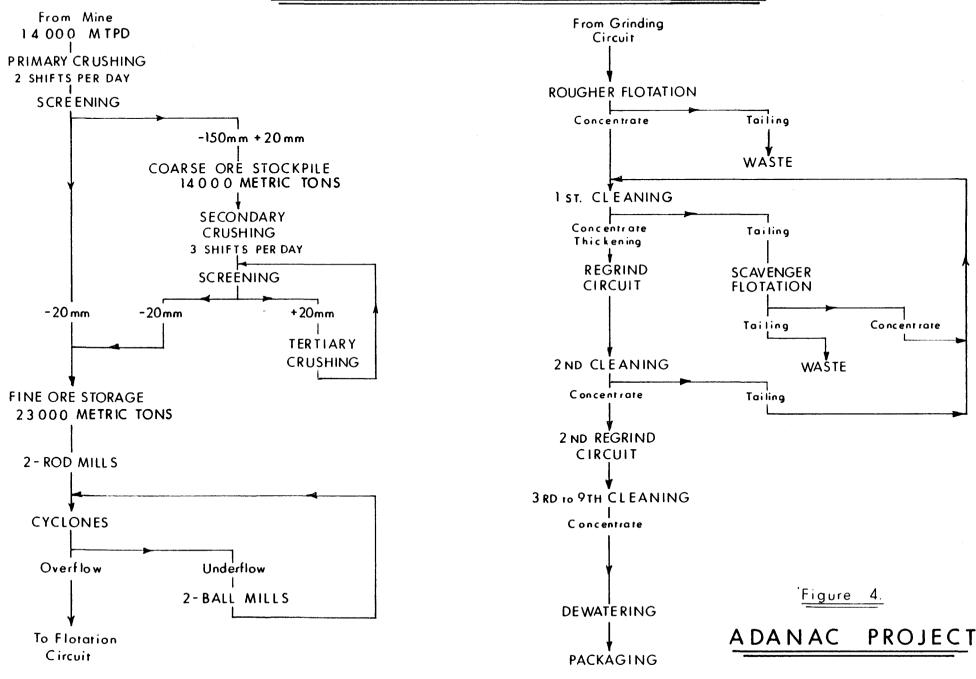
The primary crushing plant is a concrete structure 18.3 m x 12.8 m x 35 m high, housing a 1070 mm x 1650 mm gyatory crusher. All crusher discharge is conveyed to the secondary crushing plant for primary screening.

## Coarse Ore Pile

The oversize discharge from the primary screen is fed to an open stockpile with a live load capacity of 14,000 metric tons.

Ore from the stockpile is fed on to the secondary crushing plant feed conveyor by 3 Syntron vibrating feeders situated in a concrete tunnel below the stockpile.

## PROPOSED FLOWSHEET - 14000 METRIC TPD PLANT



## Secondary Crushing

The secondary crushing plant is housed in a structural steel building and contains  $1-2440~\text{mm} \times 6100~\text{mm}$  double deck primary screen, 1-2130~mm secondary cone crusher feeding 2-2130~mm tertiary core crushers in closed circuit with  $2-2440~\text{mm} \times 6100~\text{mm}$  double deck vibrating screens.

## Fine Ore Storage

The fine ore storage facility is a roofed A-frame building. The roof is 20.7 m high, spans 34.9 m, is 70 m long and is supported on large concrete piers. Skirting is hung from the roof structure to the ore-pile to control dust. Live storage capacity is 23,000 metric tons. A bulldozer may be utilized on the pile to recover an additional 24,000 metric tons.

Concrete tunnels under the pile contain two rod mill feed conveyors each fed by 3 feeder conveyors with 3 tube feeders per feeder - conveyor.

#### Conveying

The conveying system is based on a system similar to the Endako mine, modified to fit the Adanac plant site topography and includes an A-frame type fine ore storage.

## Concentrator

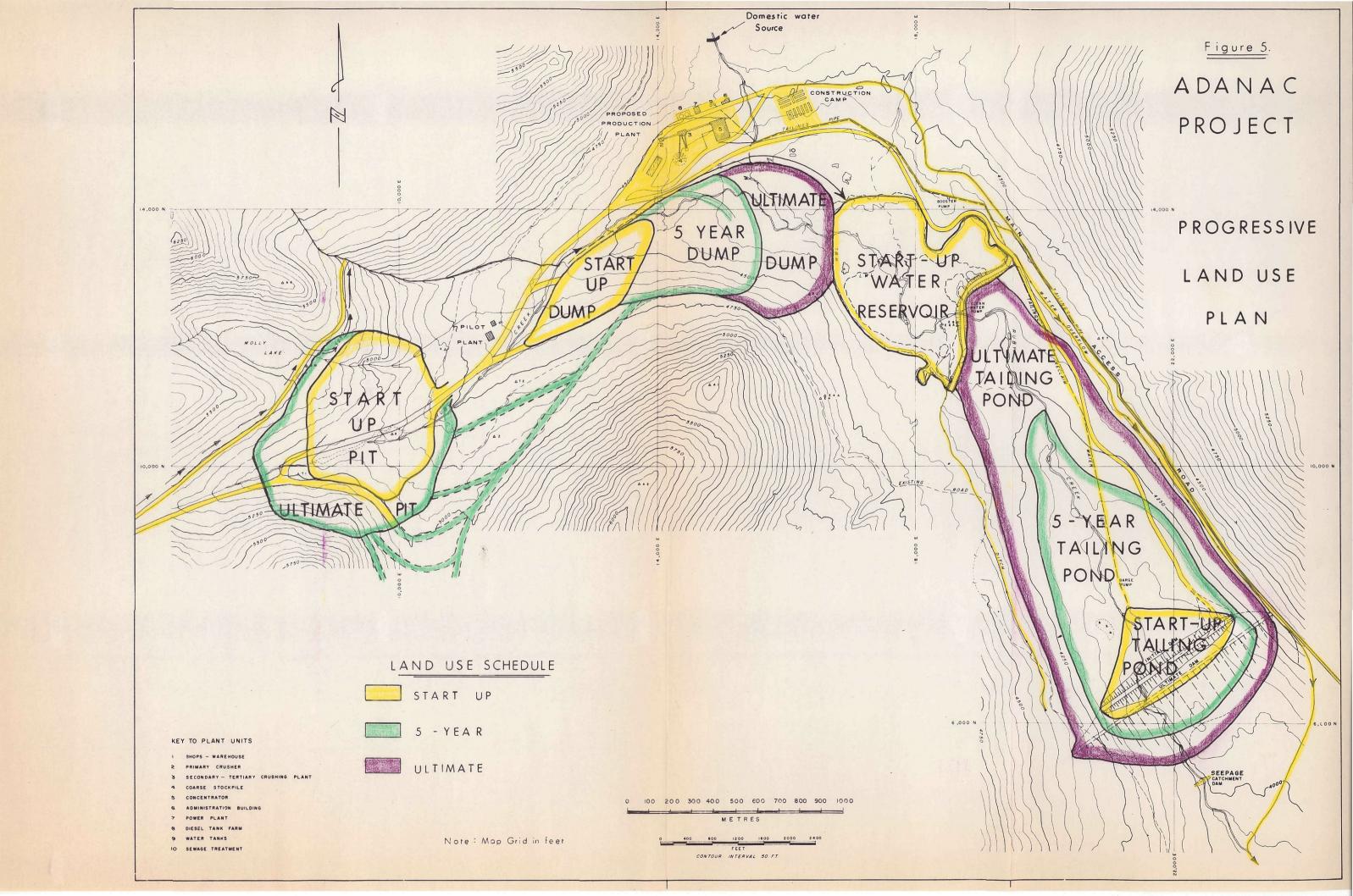
The concentrator is a steel structure 60 m x 70 m in plan. Two 3810 mm x 6100 mm rod mill-ball mill circuits will process a total of 14,000 metric tons of ore per day (4,900,000 metric tons per year). Rougher flotation cells will be of  $11.33\text{m}^3$  capacity. The flotation circuit will include a thickener between the first and second cleaning stages. Two 1830 mm x 3660 mm regrind mills and nine cleaning stages are provided. Concentrate thickening, filtering, drying and packaging of molybdenite concentrate will be done in the concentrator building.

## Tailing Storage

Previous feasibility studies have selected Ruby Creek valley for the tailing storage, and storage in this site is indicated in figures 3, 5, and 8. However, the current feasibility study will consider both this site and an alternative site at the headwaters of Cracker Creek. Both of these sites will be examined in the current environmental study. A well known consulting firm will evaluate dam construction, water diversion, seepage control, reclamation and related matters with respect to the two sites during the next 6 months.

## Water Supply

Water will be recirculated from the tailing pond to the concentrator. Make-up water will be obtained from Ruby Creek. It is proposed to form a water reservoir by daming Ruby Creek between the tailing pond and the plant-site. Potable water is assumed to be obtainable from the north branch of Ruby Creek above the plantsite.



At high water level the reservoir will cover 32 hectares. Water in excess of requirements will be diverted around the tailing pond on the eastern side of Ruby Creek valley.

## Plantsite Services

The location of plantsite facilities and service buildings is shown in Figure 3. These include:

Shop - warehouse - changehouse

Administration building

Diesel power plant (Auxiliary power)

Diesel tank farm

Water tanks

Sewage treatment

## Power Generation

The Adanac project will require approximately 95,000,000 Kwh per year at 0.86 load factor.

It is proposed to produce 87,000,000 Kwh from a 10,000 Kw hydroelectric source, to be constructed at a still to be selected site, operating as a base load station, and the balance from a 3,000 Kw diesel power plant installed at the Adanac plantsite.

More than one site has been considered for hydroelectric power generation. These sites are conceptual only, no detailed field investigations or applications with respect to possible local hydroelectric power generation having been made.

## Operating Labour and Housing

It is anticipated that arrangements can be made to build residential housing adjacent to the village of Atlin. Construction of this housing would be undertaken coincident with plant construction.

The operating labour force will increase to a maximum of about 300 people within a year after commencement of production and after 5 years of production the number of employees will begin declining (along with the stripping ratio) toward an eventual 250 people.

The operating labour force will comprise about 200 families and 100 single people.

Residences will consist of a flexible mix of houses, apartments and a trailer camp, the size of the latter probably decreasing after 5 years of operation.

In summary, the residential development at Atlin will probably include:

100 houses 150 apartments 50 trailer homes Sewer and water system Public service facilities Recreational facilites

No discussions have been held with either local or provincial authorities re this potential development.

## Construction Labour

Figure 6 portrays the potential development schedule for this project. The construction activity scheduled for 1980 and 1981 is dependent upon the feasibility study being carried out this year, particularly with respect to the feasibility of hydroelectric power development and the obtaining of the permits within a reasonable time period in order to take advantage of the currently favourable situation for negotiating molybdenum sales contracts.

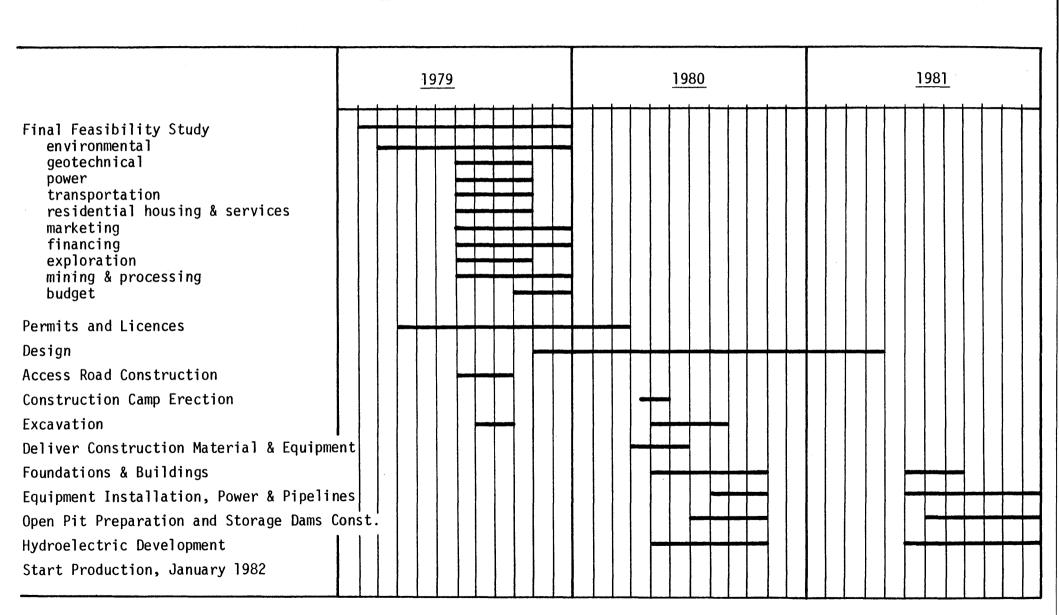
Assuming the above construction schedule is followed the construction labour force will include a maximum of 450 people between May and October of 1980 and 1981.

The main construction crew will be housed in a construction camp at the east end of the plantsite.

Figure 6

ADANAC PROJECT

Potential Development Schedule



The small construction crew required to upgrade the access road from Surprise Lake to the plantsite and the crew required for a possible hydroelectric power development will probably be housed at a construction camp in Pine Creek valley.

## SOCIO-ECONOMIC OVERVIEW

## The Community of Atlin

The establishment of the proposed mining operation at Ruby Creek would principally affect the immediate Atlin area. The access road will lead directly to Atlin and the work force will be encouraged to locate there. Effects on people as far removed as those in Whitehorse would likely be minimal as commuting distances effectively eliminates it from any potential influx of population.

Atlin was born in 1898 when two prospectors struck gold in nearby Pine Creek. In the succeeding year, the town grew and flourished as 10,000 gold seekers flocked to the area. Over the years, total placer-gold production exceeded \$16,000,000 in value, second only in importance to the Cariboo in the history of the Province. Now, the gold fields are essentially idle. As the gold fever passed, Atlin clung to life with a diminished population of hardy, independent people, some retired, some engaged in mining or prospecting and, more recently, in activities associated with tourism. As transportation improves, an increasing number of the more adventurous tourists come to Atlin to enjoy its hunting and fishing, magnificient scenery and fasinating history.

Atlin is well established as the British Columbia administrative centre for the region. The Government Agent and Forest Service are located there as is the Royal Canadian Mounted Police, a Red Cross outpost hospital and an elementary school. British Columbia Telephone has established communication by telephone through Whitehorse and B.C. Hydro recently installed a new diesel-electric generating plant.

Other than being a service and administrative centre for the region,
Atlin's economy is quite rudimentary. Its main sources of income are derived,
either directly or indirectly from government, mining or tourism. Development
of the Adanac project would approximately triple Atlin's permanent population
and financial resources.

The population growth in the immediate Atlin area resulting from the Adanac project will occur in years one, two and three, following a production decision. The anticipated population increase, resulting from the proposed mining operation will be in the order of 500 people including local, secondary jobs generated by the mining operation and its direct employees and their families.

A considerable payroll would be generated by the Adanac project. On the basis of an assumed \$20,000 per man per year, the estimated mine payroll would amount to 6 million dollars a year.

## Environmental Impact

Studies were undertaken by Howard Paish & Associates Ltd., environmental and resource management consultants during 1970 as part of the Kerr Addison feasibility study. They prepared a preliminary assessment of the environmental and ecological implications of the Adanac project.

The major purpose of the study was to obtain baseline information on the physiography, climate, hydrology, vegetation, fisheries and wildlife in the area likely to be affected by the project, prior to the start up of development. Supplementary to this, on-going studies were conducted during the pilot mill operation to determine the environmental implications of waste discharges from the pilot mill. Information is provided on the climate, physiography, vegetation and wildlife of Ruby Creek drainage and on the physical, chemical and biological characteristics of Ruby Creek and Surprise Lake.

The report concludes:

- 1. That if reasonable care is exercised, the actual physical impact of the planned operation can be confined to a very limited area.
- The physiographic and topographic features of the area lend themselves to the planning of a sound waste disposal system.
- 3. Improved access and human pressures will likely have a greater effect on the unique fish and wildlife of the region than the actual physical operation of the mine.

## The report recommends:

- That the information from the studies be borne in mind by the Company and other consultants in planning further physical development, particularly where land disturbance is involved.
- 2. That liaison be maintained between consultants to ensure the upkeep of environmental quality if major development is decided upon.
- 3. That every effort be made to incorporate any townsite development within the existing community of Atlin.
- 4. That the information in the report be used in application for permits to comply with B.C. Mining and Pollution Control regulations.

The proposed mine plant and service facilities would be located along the Ruby Creek valley downstream from the pit area. Topographically the area consists of subrounded mountains cut by broad drainage patterns. The Ruby Creek property lies above timber line in an area of limited rock exposures.

Ruby Creek drains into Surprise Lake which in turn drains into Atlin Lake via Pine Creek. Atlin Lake forms part of the Yukon River system.

Additional environmental studies are being carried out by independent consulting firms.

Progressive land use by the mining project is summarized in figure 8.

As portions of the disturbed area become "inactive", they will be reclaimed.

## Economic Impact

Development of the Adanac project is expected to create local employment for up to 450 people during the peak construction phase and approximately 300 during the operating life of the mine. Additional people would be employed indirectly in British Columbia as a result of the development.

The current reserve estimates would sustain the above mentioned employment for 14 years. As mentioned previously the potential for locating additional ore must be considered good.

The capital cost of the project as currently envisioned will be in the order of \$140 million. The increase in tax revenue will benefit all levels of government, both directly and indirectly, through the operation itself and through the employment created. The total value of metal produced from this area could exceed \$1,000,000,000.

The development and operation of a mine at Ruby Creek would result in an environmental impact of relatively low magnitude, yet offer the possibility of supporting a high yield mineral extraction industry.

FIGURE 8

## ADANAC PROJECT

# PROGRESSIVE LAND USE (Hectares)

<u>Facility</u>	At Production Start Up	After 5 Years Production	After 14 Years Production
Open Pit	45	70	70
Waste Dump	12	33	72
Tailing Storage	12	139	166
Water Reservoir	32	32	32
Plantsite, Construction Camp & Parking Lots	18	18	18
New Roads & Trails	72	84	84
			<del></del>
TOTALS:	191	376	442