001598

PROSPECTUS

CRYSTAL PEAK GARNET PROJECT

NEAR HEDLEY, B.C.

SUBMITTED

BY

POLESTAR EXPLORATION INC.

VANCOUVER, B.C.

SEPTEMBER, 1989

~~CONFIDENTIAL~~

PROPERTY FILE

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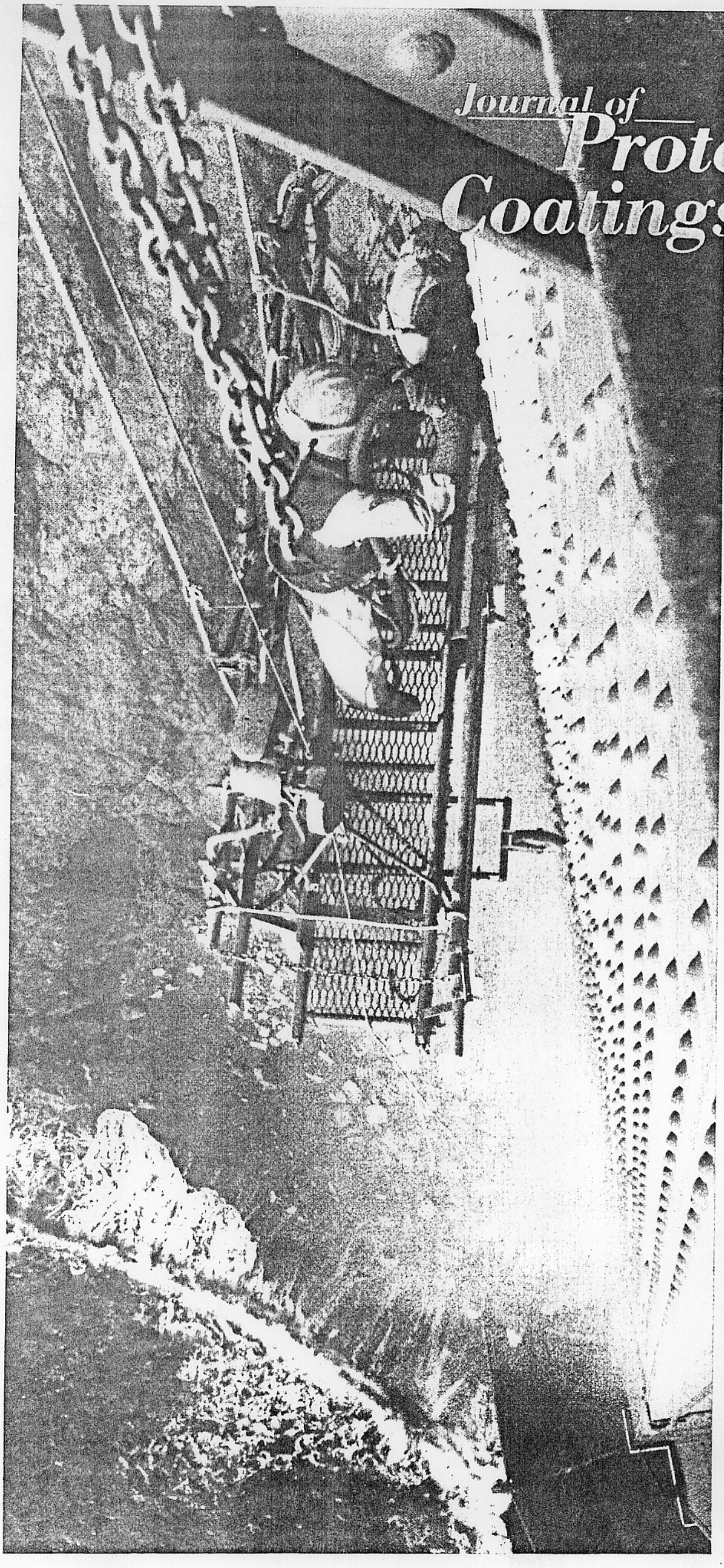

ABRASIVE BLAST CLEANING THE GOLDEN GATE BRIDGE

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FACT SHEET

CORPORATE DATA:

PROJECT NAME:	Crystal Peak Garnet
COMPANY NAME AND ADDRESS:	Polestar Exploration Inc. 701 - 675 West Hastings Street Vancouver, BC V6B 1N2 (604) 684-6287
CONTACT/TITLE:	Robert Wolfe, P.Eng. Vice President

PROJECT DETAILS:

PROJECT LOCATION:	Between Hedley, Penticton, and Keremeos, B.C. 7 km east of the Nickel Plate Mine
ESTIMATED CAPITAL COST:	$2,100,000
MINERALS:	Garnet
MINE SYSTEM:	Quarry (Negligible overburden or waste)
ESTIMATED PRODUCTION:	100 -200 tpd
PROCESS PLANT/MILL:	Gravity, Magnetic and Electrostatic separation- no chemicals
PROPOSED MINE LIFE:	20 years plus

MINERAL RESOURCES:

GEOLOGICAL RESERVES:	Probable 3.6 million tons
AVERAGE GRADE OF MATERIAL:	80% Garnet
CUT-OFF GRADE:	N.A.
POTENTIAL FOR ADDITIONAL GEOLOGICAL RESERVES:	Excellent

ACCESS/TRANSPORTATION:

ROAD:	Mostly paved Hwy. from Penticton or Keremeos
RAIL:	Kelowna, B.C. or Oroville, Wash.
AIR ACCESS:	Penticton Airport (40 min by car)
SHIPPING:	Vancouver, B.C., Seattle, WA.

POWER SUPPLY:

REQUIREMENTS:	250 KW
SUPPLY ALTERNATIVES:	B.C. Hydro Powerline within 600m.

WORKFORCE INFORMATION:

TOTAL OPERATIONAL WORKFORCE:	6 workers/day
HOUSING OPTIONS:	Apex Village (5 min.), Penticton (40 min)
CONSTRUCTION WORKFORCE:	4 man-years (12 men, 3 mons.)
CONSTRUCTION CAMP:	Accommodation in Apex village
WORKFORCE ROTATION:	One 8-hour shift
INDIRECT/INDUCED EMPLOYMENT:	Minor

DEVELOPMENT SCHEDULE:

PROSPECTUS:	September 1989
SITE CONSTRUCTION STARTUP:	2nd quarter 1990 (on completion of permitting etc)
PRODUCTION STARTUP:	3rd quarter 1990

1.0 CONCEPT SUMMARY

1.1 A supply crisis is developing in the Abrasive Blasting Industry. Abrasive blasting or "Sandblasting" is used to strip steel surfaces of millscale, old paint and/or rust.

1.2 The dust from Silica Sand, the "cheap" material of choice for generations can cause silicosis and is known to be a serious health risk (often fatal) to the human respiratory system. Silica is banned from use in many countries, in California and by the U.S. Military. All silica sand used for blasting in British Columbia is imported from the United States and sells in Vancouver for $130/ton.

1.3 The major alternative abrasives, metal or coal slags, are by-products of copper and nickel smelters or boiler operations. These materials usually contain numerous heavy metals, often toxic elements and frequently corrosive chlorides. Serious environmental concerns are being raised regarding the use of slags. Slags kill fish. The department of Fisheries and oceans published guidelines for bridge maintenance operations in June 1989. Slags sell for about $100/ton in Vancouver. Fifty percent of consumed slags in B.C. and Alberta are imported from the U.S.. Some slags are so contaminated that disposal costs can be as high as $1200/ton.

1.4 One mineral stands out as truly superior in all aspects as a blasting abrasive and that is garnet. Garnet is considerably heavier than silica and slags, is extremely hard, contains no free silica and is chemically totally safe.

1.5 Even though garnet is recognized as a superior abrasive throughout the industry, very little is produced for the blast cleaning market since historically its cost has been prohibitive.

There is no garnet production in Canada. There are three producers in the Eastern U.S. and only one in the Western United States(Idaho). Garnet from Idaho sells in Vancouver for $39.60 per 100 lb bag or almost $800/ton. What the industry needs is a consistent, reliable supply of garnet abrasive at a competitive price (in the $100-$140/ton

2.0 INTRODUCTION

2.1 Transmittal Statement

The Prospectus has been prepared and submitted by Polestar Exploration Inc. in support of their request to proceed with development of the Crystal Peak Garnet Project.

2.2 Proponent

Polestar Exploration Inc. was incorporated in 1983 and listed on the Vancouver Stock Exchange in November 1986, about 5 million shares are outstanding. The principals are: J.H. Montgomery, Ph.D., P.Eng., President, Robert Wolfe, P.Eng., Vice President, D.R. Cochrane, P.Eng., Director and G. Magel, Director.

2.3 Responsiblity

Corporate responsiblity for the Prospectus was assumed by Polestar Exploration Inc., who co-ordinated the activities of the contributors to the Prospectus.

Technical responsiblity for the preparation of the Prospectus are as follows:

Polestar Exploration Inc.

- Project Description
- Geology and Resources
- Processing
- Socio - Economics

Steffan Robertson & Kirsten (B.C.) Inc. Consulting Engineers

- Site Selection
- Waste, Water and Reclamation Plans
- Mine Plan

Merit Consultants Ltd.

- Plant Construction

3.0 THE CRYSTAL PEAK GARNET DEPOSIT

3.1 Location

The property is located at Latitude: 49° 24', Longitude: 119° 55', (N.T.S. 82E/5W) just west of the Apex Ski Village and 7 km. east of the Nickel Plate Gold Mine, some 190 air miles due east of Vancouver, British Columbia.

3.2 Access

Access is excellent by all weather road (Hwy #3A) north from Keremeos for 10 km, then north from Hwy 3A for 12 km and west for 8 km into Apex village.

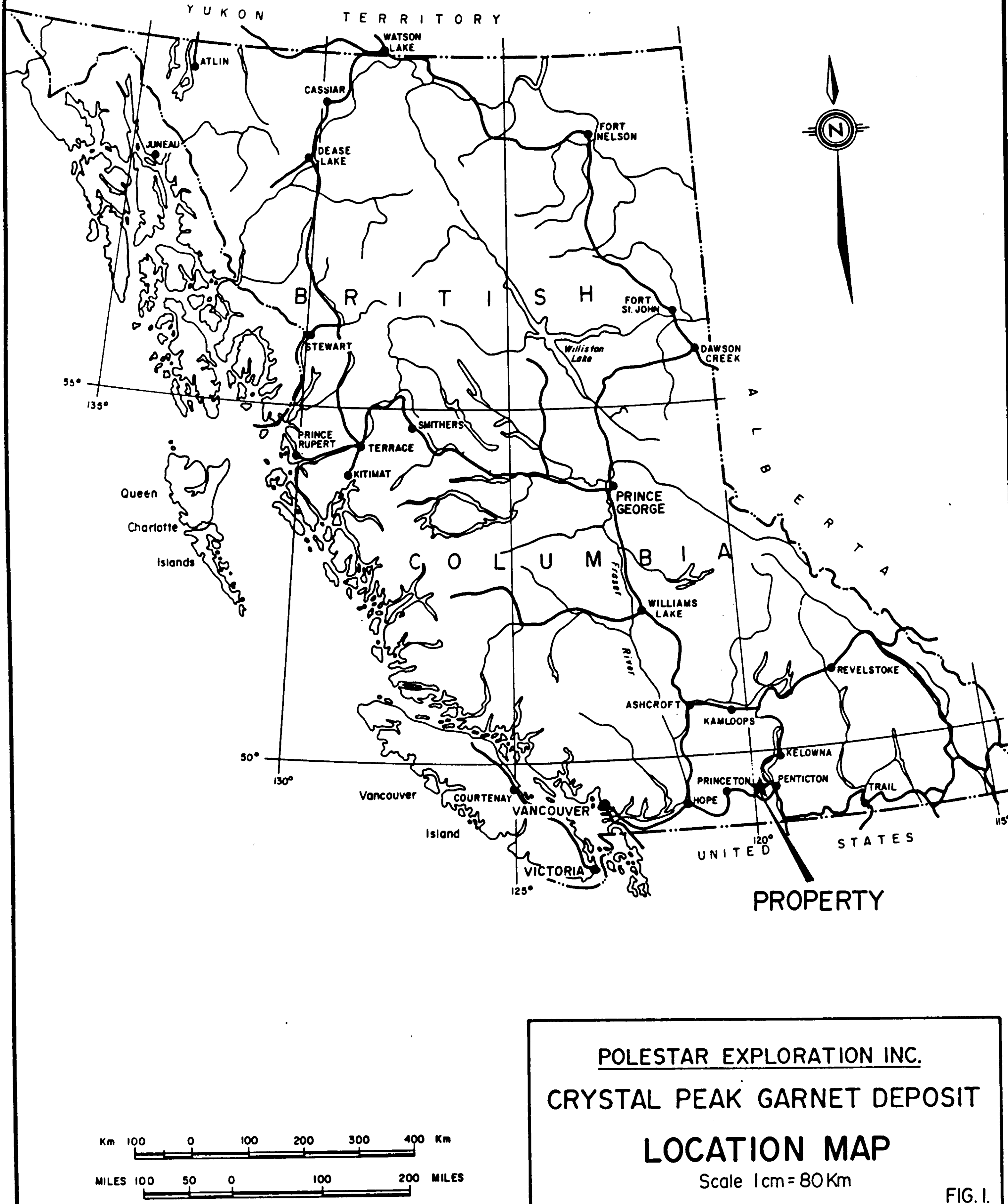
From Penticton airport southwest for 20 km and west for 8 km (see Figure 2).

Also, there is a narrow, winding gravel road through Nickel Plae Mine to Hedley, B.C.

3.3 Claims

TYPE	NAME	No. of Units or Acreage	Recording Date
Located	KE8674	24 units	April 18/89
Crown Granted	Billy Goat (L3122)	34.62 Ac	Sept. 15, 1898

The property is part of the Apex Recreation area which includes Mt. Riordan and was opened to mineral exploration on April 17, 1989. Viable mineral deposits are allowed to be developed with full security of tenure for claim holders.



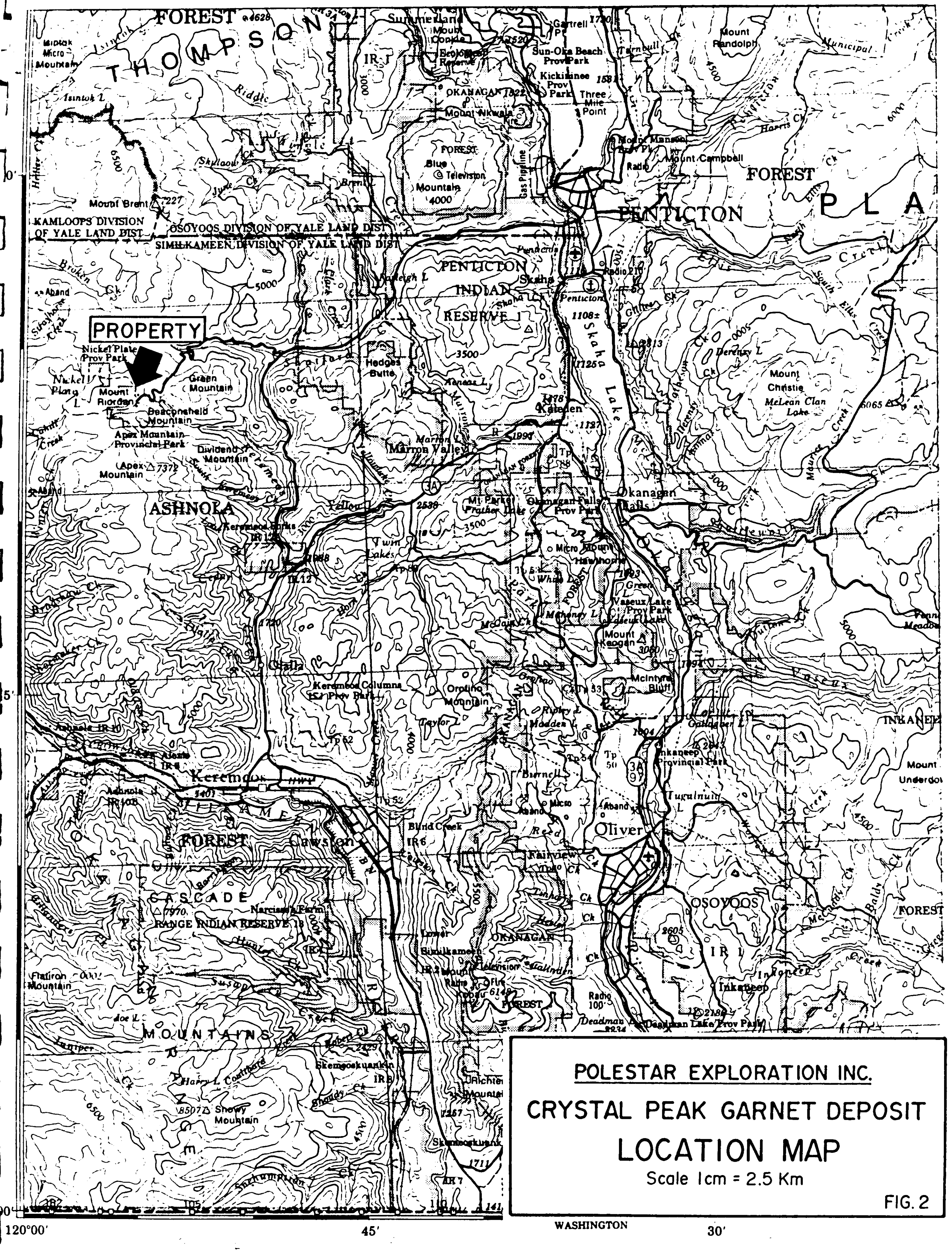
POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

LOCATION MAP

Scale 1cm = 80Km

FIG. 1.



POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

LOCATION MAP

Scale 1cm = 2.5 Km

FIG. 2

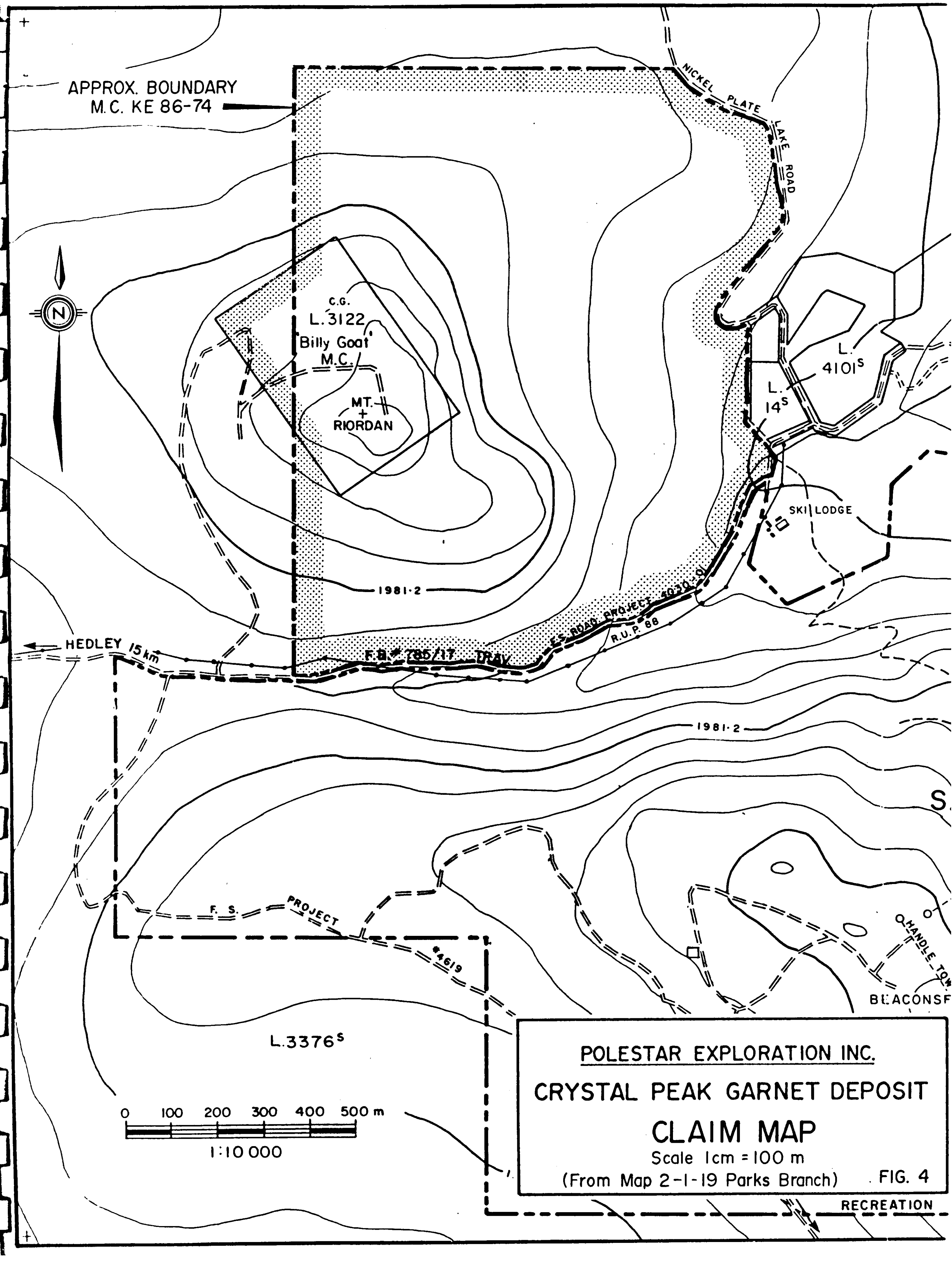
POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

LOCATION MAP

Scale 1 cm = 0.5 Km

FIG. 3

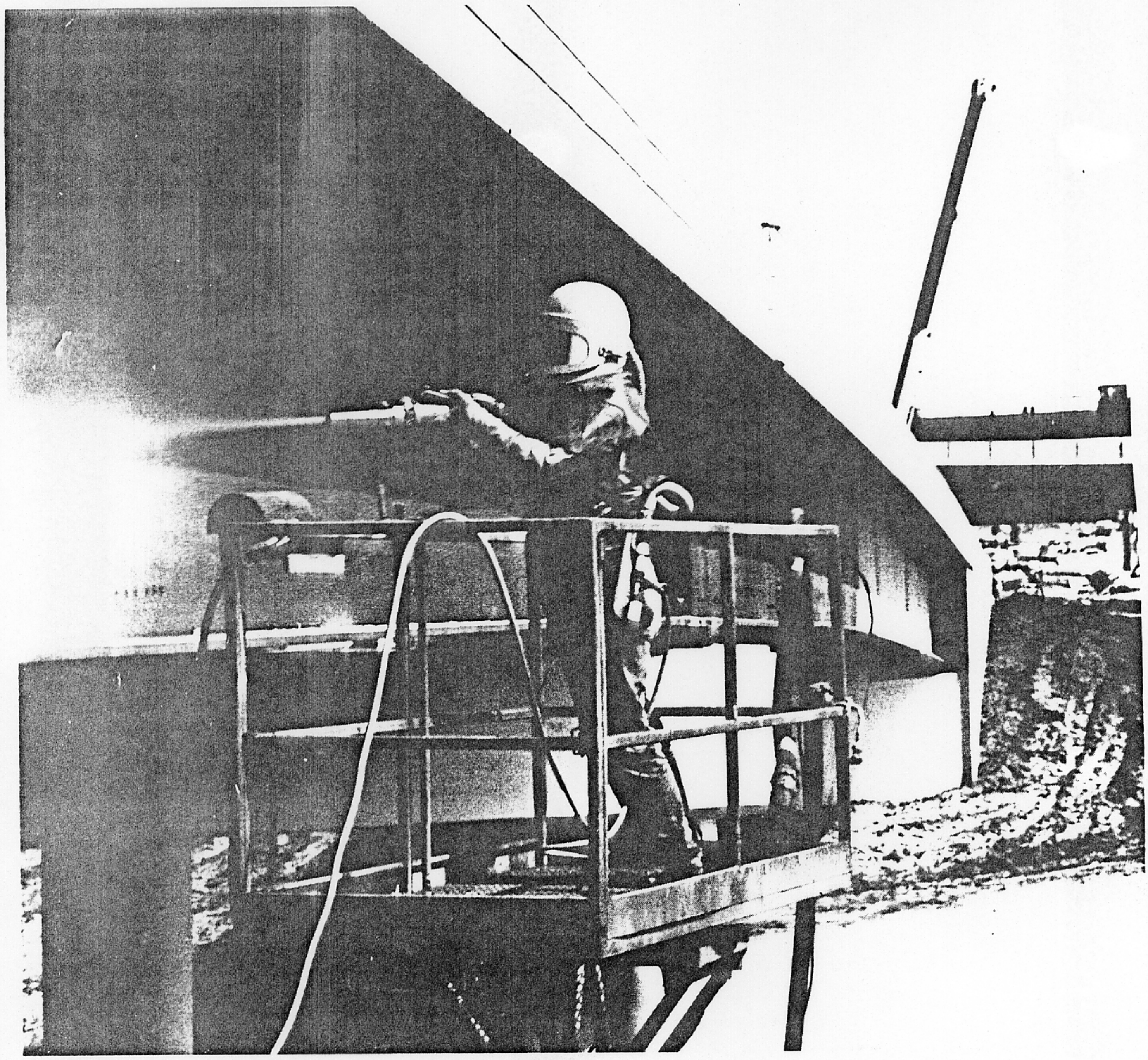

APPROX. BOUNDARY
M.C. KE 86-74
NICKEL PLATE LAKE ROAD
C.G.
L.3122
Billy Goat
M.C.
MT. RIORDAN
L. 4101S
L. 14S
SKI LODGE
1981·2
HEDLEY 15 km
F.S. ROAD PROJECT 4030-01
R.U.P. 88
F.S. #786/17 TRAV.
1981·2
F. S. PROJECT
#4619
L.3376S
0 100 200 300 400 500 m
1:10 000
BEACONSF
RECREATION
POLESTAR EXPLORATION INC.
CRYSTAL PEAK GARNET DEPOSIT
CLAIM MAP
Scale 1cm = 100 m
(From Map 2-1-19 Parks Branch)
FIG. 4

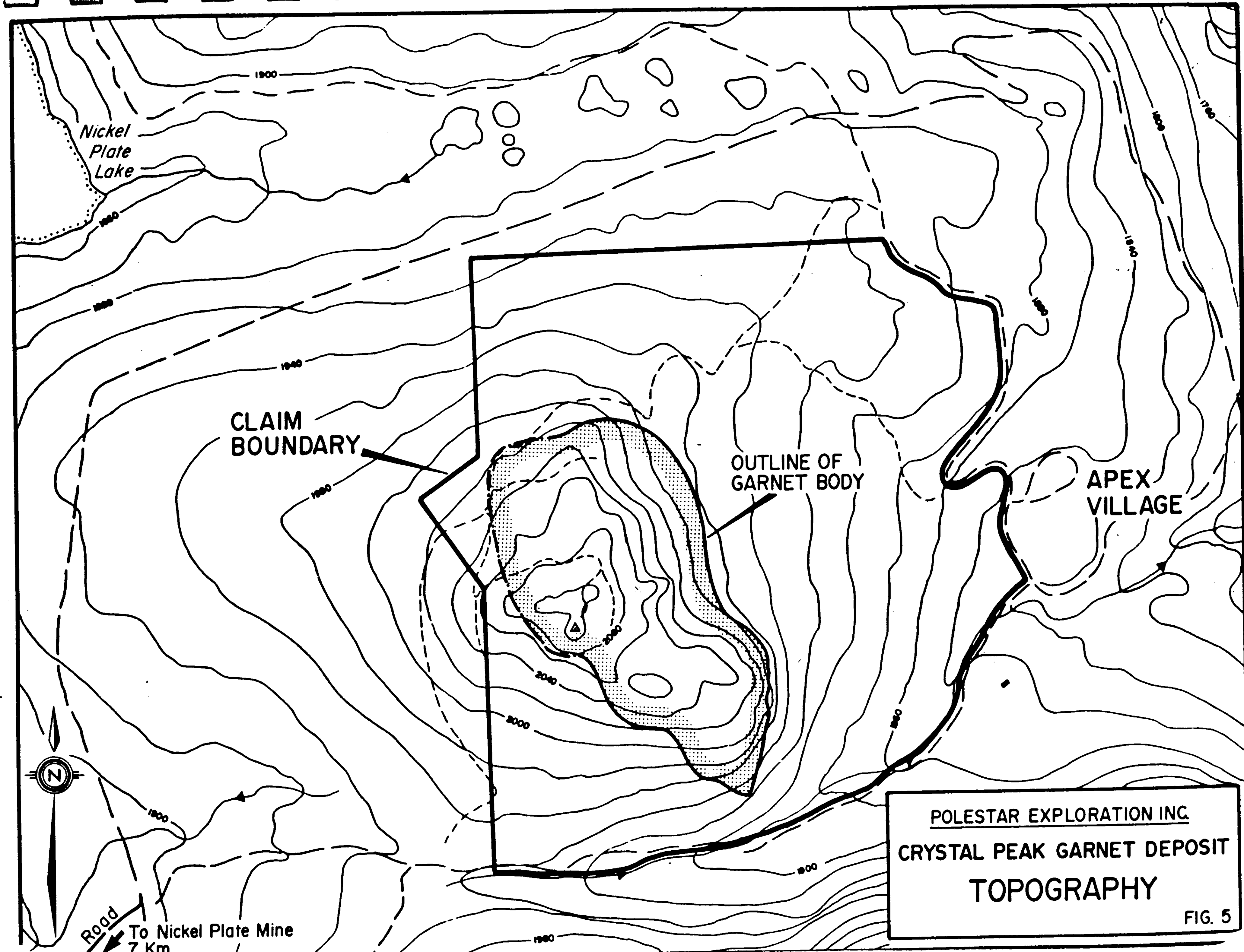
3.4 History

The Hedley area has had a long history of gold mining. The largest mine was the Nickel Plate, which was recently reopened and is now operated by Corona Resources.

Exploration started in the area of the claims just prior to the turn of the century and continued intermittently on a small scale for some time. A series of small gossans have been explored by trenches, pits, and two short adits.

There is no evidence of any exploration activity in the last 10 years.





POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

TOPOGRAPHY

FIG. 5

4.0 GEOLOGY

4.1 Regional Geology

The area was mapped and described in detail by Dr. G. E. Ray et. al. from the B. C. Ministry of Energy Mines and Petroleum Resources (Paper 1988-1).

The Mt. Riordan skarn deposit is the most easterly of a series of skarns which includes the presently operating Nickel Plate Mine and the old French and Goodhope mines.

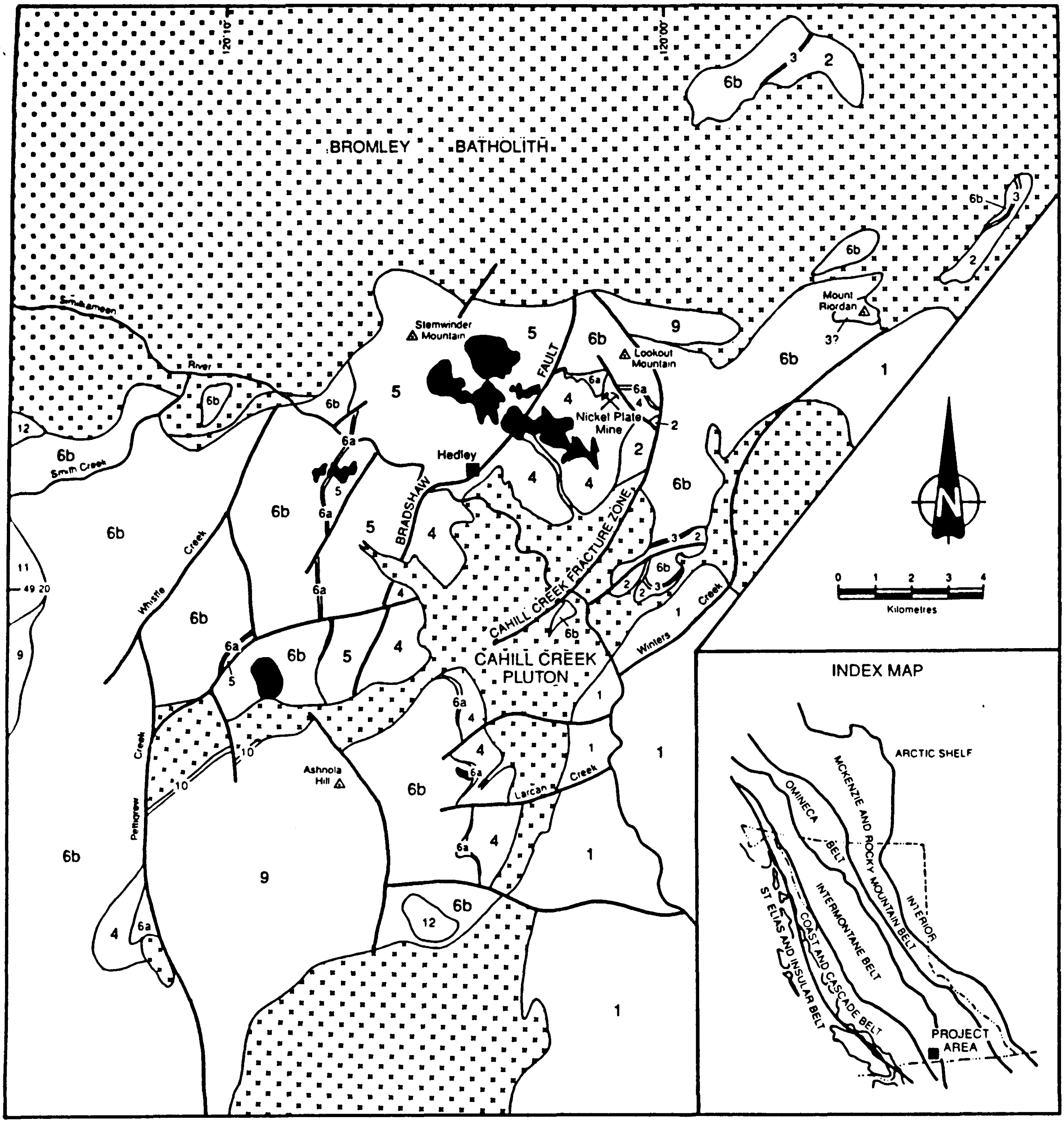
Early Jurassic granitic plutons have intruded late Triassic Nicola group sediments and volcanics.

The composition of the skarns varies from high arsenic and gold-low garnet in the west to high garnet-low gold-no arsenic in the east (Mt. Riordan) (see Table 1).

4.2 Property Geology

The Mt. Riordan garnet skarn is most unusual in several ways. The "skarnification" or replacement of limestone to garnet is almost complete. No limestone is found on the property and none of the original sedimentary structures have been preserved. Diopsite (clinopyroxene) is the most common accessory silicate. Quartz, epidote, and actinolite occur in relatively low quantities. Calcite content is also relatively low, occurring in small veins near the top of the mountain and occasionally as interstitial blebs 1-3 mm across. Unlike the gold bearing skarns to the west, no mineralogical zoning or biotite hornfels rocks have been observed.

Garnet occurs either as massive garnetite or coarsely crystalline, often showing growth zonations. Brown and green are the most common colors although pale, black, and red brown varieties have been noted.



LEGEND

TERTIARY

| 12 | Basaltic flows |

EROSIONAL UNCONFORMITY

EARLY CRETACEOUS

| 11 | VERDE CREEK INTRUSION – *granite and microgranite* |

| 10 | RHYOLITE INTRUSION – *quartz porphyry* |

| 9 | SPENCES BRIDGE GROUP – *andesitic to dacitic pyroclastics and flows with minor sediments* |

CONTACT UNCERTAIN

EARLY JURASSIC

| 8 | BROMLEY BATHOLITH AND CAHILL CREEK PLUTON – *granodiorite to quartz monzodiorite* |

| 7 | HEDLEY INTRUSION – *quartz diorite, diorite, and gabbro* |

NICOLA GROUP

LATE TRIASSIC

| 6b | WHISTLE CREEK FORMATION – *bedded to massive ash and lapilli tuff, minor tuffaceous siltstone* |

| 6a | Copperfield Conglomerate – *limestone boulder conglomerate* |

| 5 | STEMWINDER MOUNTAIN FORMATION (WESTERN FACIES) – *thinly bedded argillite and limestone* |

| 4 | HEDLEY FORMATION (CENTRAL FACIES) – *thinly bedded siltstone, thick limestone beds and minor tuffs* |

| 3 | FRENCH MINE FORMATION (EASTERN FACIES) – *limestone, limestone breccia and pebble conglomerate* |

| 2 | PEACHLAND CREEK FORMATION – *basaltic ash tuffs and flows with minor limestone and chert-pebble conglomerate* |

CONTACT OCCUPIED BY CAHILL CREEK PLUTON

PALEOZOIC

| 1 | APEX MOUNTAIN COMPLEX – *ophiolite sequence of cherts, greenstones, siltstones, argillites and minor limestones* |

POLESTAR EXPLORATION INC.

Crystal Peak Garnet Deposit

Regional Geology

(by Ray et al)

FIG. 6

Microprobe analyses by Ray (1988) show the garnet to be about 90% Andradite (Ca_3 Fe_2 Si_3 O_{12}) and 10% Grossularite (Ca_3 Al_2 Si_3 0_{12}). An interesting phenomenon is that the cores of the garnet crystals tend to be high in Andradite, whereas the margins are higher in Grossularite. Andradite and Grossularite usually form a solid solution series with Fe and Al being interchangeable. To a lesser extent Mg or Mn can substitute for Ca (see Figure 8).

The magnetometer survey shows a strong east-west linear structure just north of 1600N along which several gossans occur, explored by the "old timers" by trenching and pitting.

The gossans contain pyrite, some scheelite, magnetite, quartz, calcite, and minor pyrrhotite and chalcopyrite (now mostly altered to limonite/jarosite/malachite).

Several other small gossans, two of which have short (less than 10 m) adits, have been mapped.

The granodiorite contact at the eastern edge of the skarn is well exposed. In addition, small diorite remnants are scattered in a broad zone through the center of the skarn. These range in size from a few meters to 30 m across (see Figure 7). Ray (1988) considers these intrusions to predate the skarn, but it is difficult to determine what, if any, influence they had on skarn formation.

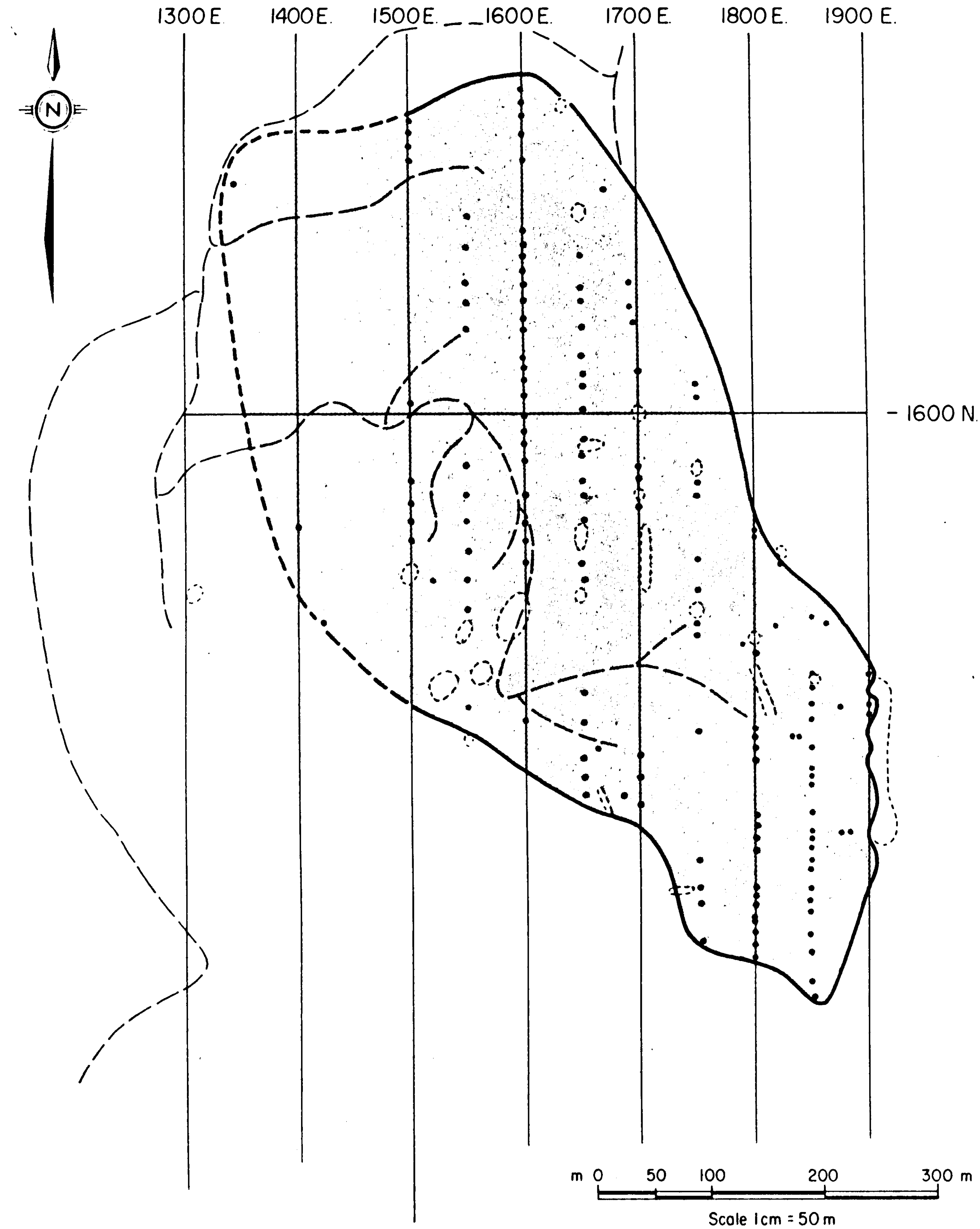
The most westerly skarn outcrop described by Ray occurs over 1 km west of the top of the mountain. The gently sloping west flank is mostly covered with till but the few outcrops indicate that garnet content diminishes to the west and various other skarn minerals such as quartz, diopside and even scapolite are on the increase.

From a geological viewpoint the garnet skarn appears very large. Garnet-rich outcrop occurs intermittently over an area 800 m x 300 m. Outcrop exposed over this area of interest is high, some 25%. In areas of almost continuous outcrop, three major high grade zones (60%-100% garnet) cover a total area of about 33,500 m^2 (360,000 ft^2). Since the garnet body is exposed on two sides, ie. cliff faces on the northeast and south sides and regular outcrops elsewhere, geological reserves fall into the "probable" category. Assuming a conservative depth of only a 100 feet and a density of 10 ft^3/ton, 3.6 million tons are probable and immediately accessible.

There is no doubt that the possible reserves of this garnet skarn are many time greater than the above figure.

TABLE 1
CHARACTERISTICS OF EAST–WEST SKARN VARIATION ACROSS THE HEDLEY DISTRICT

FEATURES	WEST NICKEL PLATE MINE	FRENCH AND GOODHOPE MINES	EAST MOUNT RIORDAN
Skarn mineralogy	Banded, clinopyroxene-dominant skarn. Garnets – generally noncrystalline and brown	Locally clinopyroxene or garnet-dominant skarn. Crystalline and noncrystalline garnet	Massive, garnet-dominant skarn. Crystalline garnet with highly variable colour
Degree of skarn overprinting	Sedimentary structures often preserved in skarn	Sedimentary structures locally preserved	No sedimentary structures preserved
Skarn metallogeny	Au, As, Cu, Co, Bi, Te, Ag, Ni	Au, Cu, W, Co, Mo, Bi, As, Ag	W, Cu, Ag
Skarn-related intrusions	Associated with I-type dioritic Hedley intrusions	Associated with I-type dioritic Hedley intrusions	Associated with I-type granodiorites that do not resemble the Hedley intrusions
District hostrock geology	Siltstones and limestones of the Hedley formation	Limestone breccia and limy sediments of the French Mine formation	Probably massive limestone of the French Mine formation



LEGEND

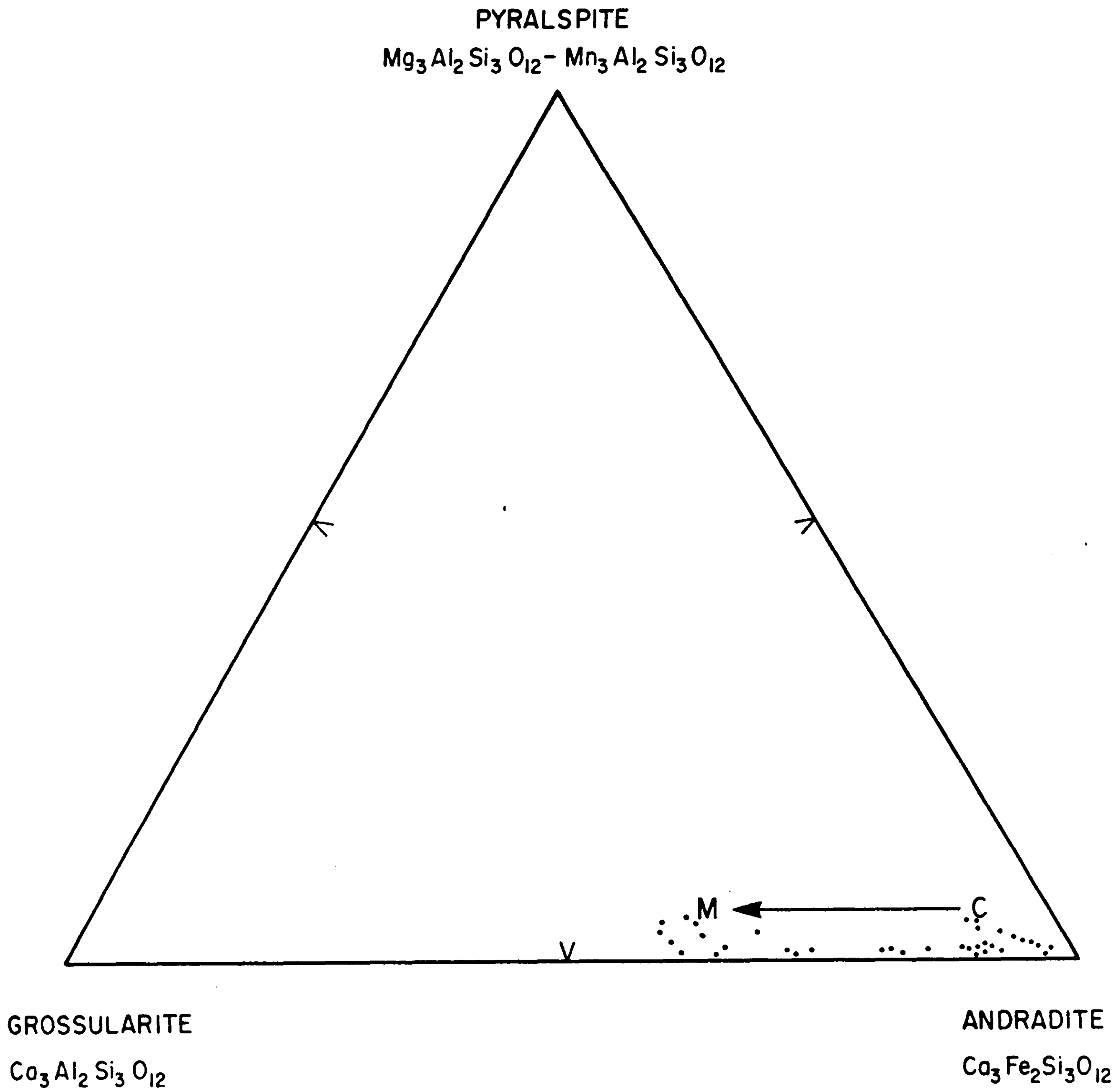
- GARNET OUTCROP / SAMPLE SITE
- DIORITE / GRANODIORITE OUTCROP
- OUTLINE OF GARNET BODY
- ROAD

POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

PROPERTY GEOLOGY

FIG. 7



35 MICROPROBE ANALYSES BY RAY (1988).
ARROW INDICATES CHANGE OF COMPOSITION FROM CRYSTAL CORES (C) TO MARGINS (M)

POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

MICROPROBE ANALYSIS

(BY RAY 1988)

FIG. 8

5.0 QUARRY PLANNING AND OPERATION

5.1 Quarry Plan

Ideally a deposit such as the Crystal peak Garnet deposit would be quarried beginning at or near the top of Mt. Riordan. Since the size of the deposit is so large compared to the planned production of 60,000 tonnes per year, quarrying should begin in the area where the better quality is and as close to the plant location as possible.

The recommended quarry location is shown on Figure 11. This will quarry an area where sampling has indicated good quality garnet. It is also reasonably close to the plant. The potential reserves of this quarry design are summarized as follows:

TABLE 5.1

LEVEL (m)	VOLUME (m^3)	TONNES	TONS
2080	15,200	48,600	53,500
2060	194,400	622,100	685,700
2040	350,600	1,121,900	1,236,700
2020	357,500	1,144,000	1,261,000
2000	335,600	1,073,900	1,183,800
	1,253,300	4,010,500	4,420,800

* assumes A 3.2 S.G.

At a production level of 60,000 tons per year it would take over 10 years to mine to the 2060 level and over 70 years to complete the quarry. It is not practical to make the quarry smaller due to the minimum working widths that would be safe and efficient.

Two haul roads are shown on Figure 11, one for the upper levels, and one for the lower levels. During the initial phases there would also be access roads to the 2080 level, shown in dashed lines. The upper haul road can be extended for mining of the south-east section when required, and could also be used to mine the top of Mt. Riordan.

Haul roads were designed 15 m wide and at a maximum grade of 10%. It is assumed that the maximum downhill haul will be -10%. Initially existing roads may be used assumed that the maximum downhill haul will be -10%. Initially existing roads may be used although the grades would be a concern for hauling downhill.

Quarrying will be done during the summer and the material stockpiled. This will improve a contractors efficiency and decrease the average cost. The annual requirement is 60,000 tons or 17,000 cubic meters of rock. Using from three to four 35 tonne trucks and a front-end loader, a contractor could move the material to the stockpile area in about three weeks, at most one month. About a week would be required for preparation and drilling of a blast.

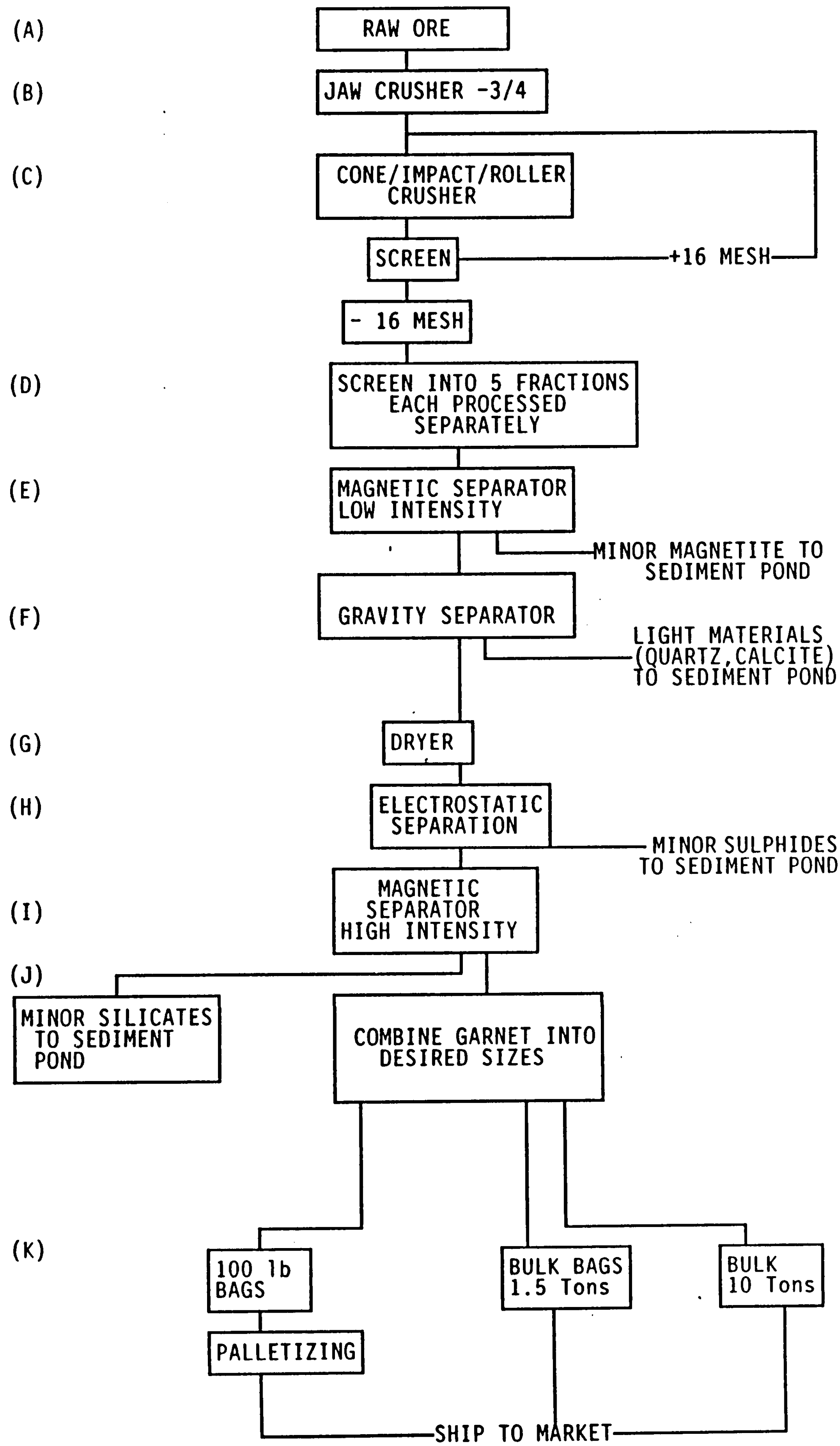
Contractor costs are expected to be in the range of $4.00 to $6.00 per tonne, or between $218,000 and $327,000 per year. There may also be mobilization and demobilization costs due to the short season, although these could be negotiated.

5.2 Processing

Research to date shows that simple physical techniques using gravity and magnetic separation will be effective in producing a marketable garnet grit.

Although continuing research will refine the details, the following preliminary flow sheet has been developed (Table 2).

TABLE 2: MINERAL PROCESSING - FLOWSHEET



A) The actual mining of the material is subcontracted. This will simplify the operation and reduce the capital requirements significantly. Initial production is estimated at 100 tons/day.

B) Jaw crushing to -3/4"

C) Closed circuit crushing to -16 mesh. The +16 mesh material is recirculated and the -16 mesh fraction is continuously removed in order to keep the amount of fines to a minimum. The most popular size blasting grit is -16 +40 mesh (about 0.5 -1.0 mm). Sizes vary for each end product, roofing granules for instance are coarser.

D) The material is screened into 5 closely sized fractions to facilitate subsequent separation. Tentatively: 16-24, 24-32, 32-40, 40-60 and -60. Separation is easier for the finer fractions. Each fraction is now processed separately.

E) Low intensity magnetic separation takes out the magnetite, present indications are that magnetite content is very low.

F) Gravity separation using spirals, jigs, tables or combinations thereof. All water is settled and recirculated. Consumption should be minimal. All light materials with S.G. less than 3.0 are removed (Quartz, Calcite, Chlorite etc.) to sediment pond. The volume of waste to the sediment pond is estimated at 5-15% for 100 tpd or 30,000 tpy operation. This would amount to only 1500-4500 tons per year.

G) Drying

H) Electrostatic separation. Curiously, garnet is one of the least conductive materials found in nature, whereas sulphides are conductive. Most skarn deposits have moderate concentrations of sulphides. The Crystal Peak deposit, however, contains very low concentrations except in the small gossan zones (these will not be disturbed). The small amount of sulphides will go to the sediment pond, where the more abundant calcite will maintain a basic environment.

I) High intensity magnetic separation to remove other silicates such as actinolite. Andradite is paramagnetic (very slightly magnetic).

J) The garnet is combined into several size mixtures depending on market demand.

K) The various fractions of garnet are combined into several end products and packaged into 3 different containers. 100 lb double wall paper (or plastic) bags, 1.5 ton bulk bags or large bulk containers. The 100 lb bags are placed on pallets and wrapped in plastic for shipment and water proof storage.

5.3 Proposed Production Levels

Initial production is projected at 100 tpd or 30,000 tpy in one shift per day. Industrial minerals production levels are a function of sales in the market place. In the case of garnet, which has to replace silica and slags, market penetration is projected as follows:

YEAR	TPD	TPY
1	100	30,000
2	150	45,000
3	200	60,000

5.4 Power and Water Supplies

Site operations are within one km of Apex village, where power is available. Also, a power line is located along the southern border of the property.

Water is available from some small ponds just north of the Nickel Plate Mine Road. However, it is anticipated that drilling a well near the operational site will be the preferred supply option. The present estimate of water requirement is 20 to 50 gpm for a processing rate of 100 tpd.

5.5 Site Selection

In addition to a large and expandable area for the sedimentation pond, an area of about 0.1 hectares would be required for the plant and 1.5 to 2 hectares for a coarse ore stockpile.

There are three general areas where the plant and related facilities could be located:

- on the northern flank of Mt. Riordan;
- on the western flank of Mt. Riordan; and,
- at a location remote from the mine site.

Locations on the southern and eastern flanks of Mt. Riordan are unsuitable because of area limitations for development and proximity to the ski resort.

A site remote from the mine would require trucking all material including waste from the quarry to the processing area. Sites are available with adequate space along the access road to Penticton, but these would be in competition with other forms of land use including agricultural use.

The topography of the western flank of Mt. Riordan would be suitable for development of the plant site and related facilities. Sufficient area for the needs of the project is available, and the base of Mt. Riordan would provide a screen between the operations and the ski resort. However, most of the suitable ground on the western flank lies beyond the limits of the mineral claims.

Of the available sites within the mineral claims, the site on the north flank of Mt. Riordan provides the best combination of features. The slope of the ground allows for the elevation sequential development of stockpile, crusher, plant and sediment pond. A low ridge with tree cover would provide a buffer between the plant and the recreational facilities. All operations would be outside the catchment of the water supply of the ski resort. Traffic would be limited to haulage of the finished product because the impurities removed during processing would be stored on site.

The tentative layout of the facilities is shown on Figure 9. The layout of structures has been selected to utilize topography in the flow of materials.

At the upper end of the site, the ore stockpile would be located. The stockpile must have capacity to store sufficient material quarried during the summer to supply the plant for an entire year's operation. Consequently, it is planned to maintain 50,000 to 70,000 tons in storage, which would require about a 3 metre high stockpile over 1.5 ha.

The tentative crusher location would be at the southeast corner of the stockpile. During detailed design studies, the crusher may be moved within the main plant building.

The plant would be located on the bench below the stockpile. The bench at this location is about 200 m wide, and the initial sediment pond would be developed on about 2 ha of the lower part of the bench.

5.6 Transportation Analysis

The nearest Canadian rail spur is located in Kelowna. Until recently CP was operating in Okanagon Falls and Princeton, however this section will be abandoned. Freight quotes in box cars by CP and CN were received as follows:

RAIL

FROM	TO	PRICE
Kelowna	Lloydminster, Alberta	$40/ton
Kelowna	Vancouver	$30/ton

TRUCK

Mine site to Vancouver $20/ton
(40 ton lots - B-Train)

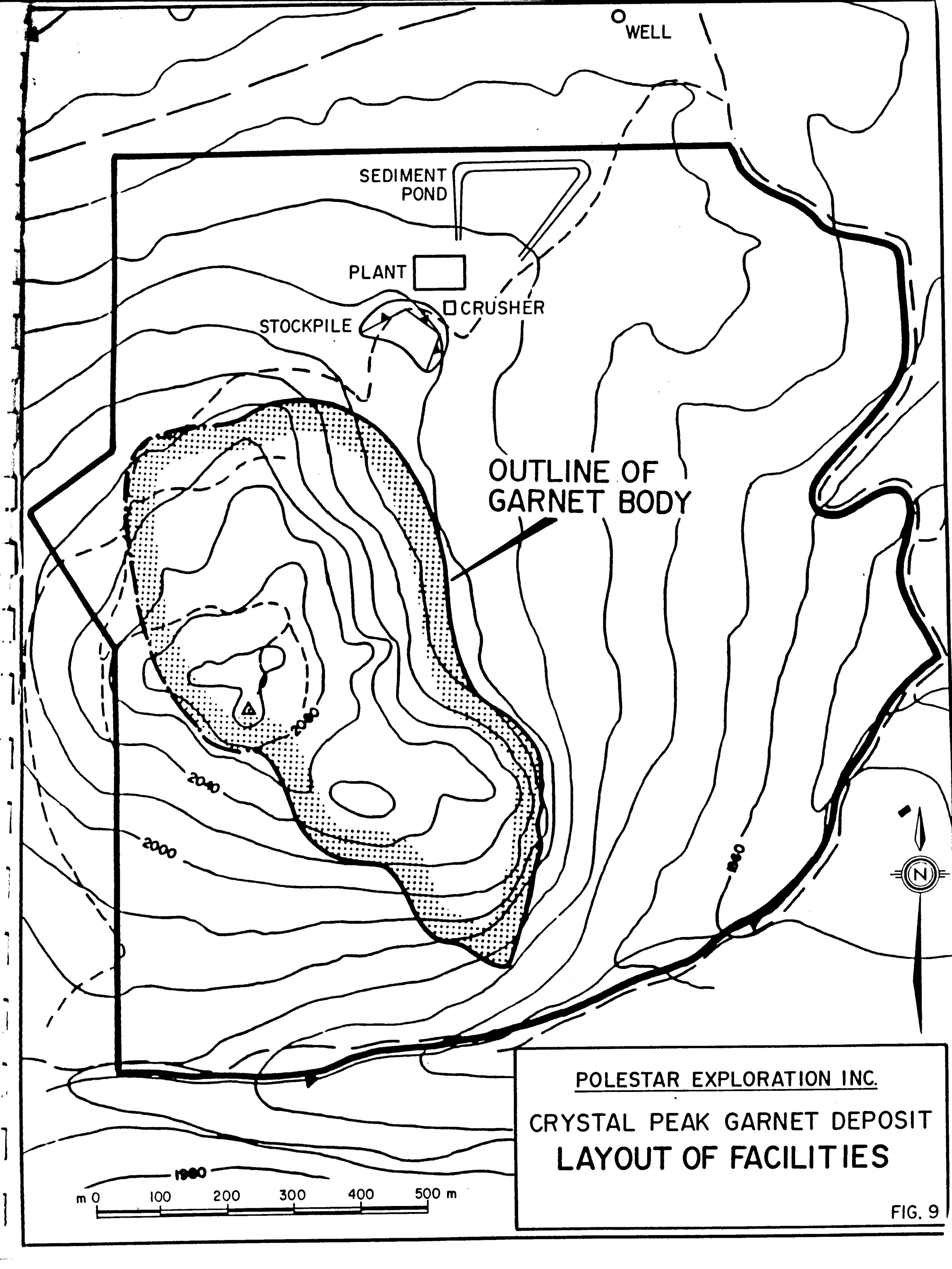
OCEAN

A quote was received from the East Asiatic Company for ocean shipments of 10,000 MT.

Vancouver to Rotterdam: US$36.00/ton
Vancouver to Tokyo: US$28.00/ton

WEST COAST BARGE

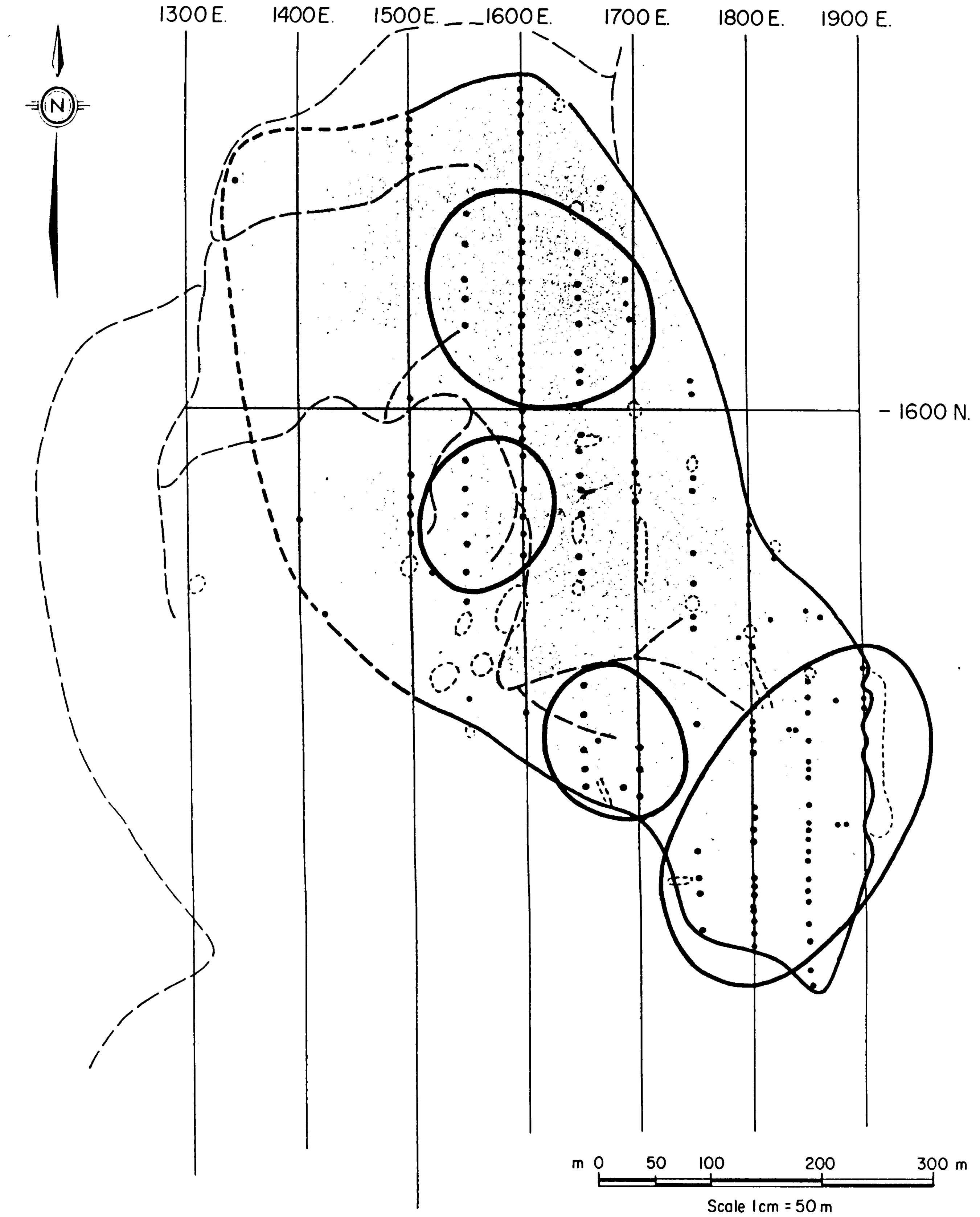
Vancouver to San Diego based on 22,000 S.T. load:
US$19.50 plus unloading charges (UNIMAR)



POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT
LAYOUT OF FACILITIES

FIG. 9



LEGEND

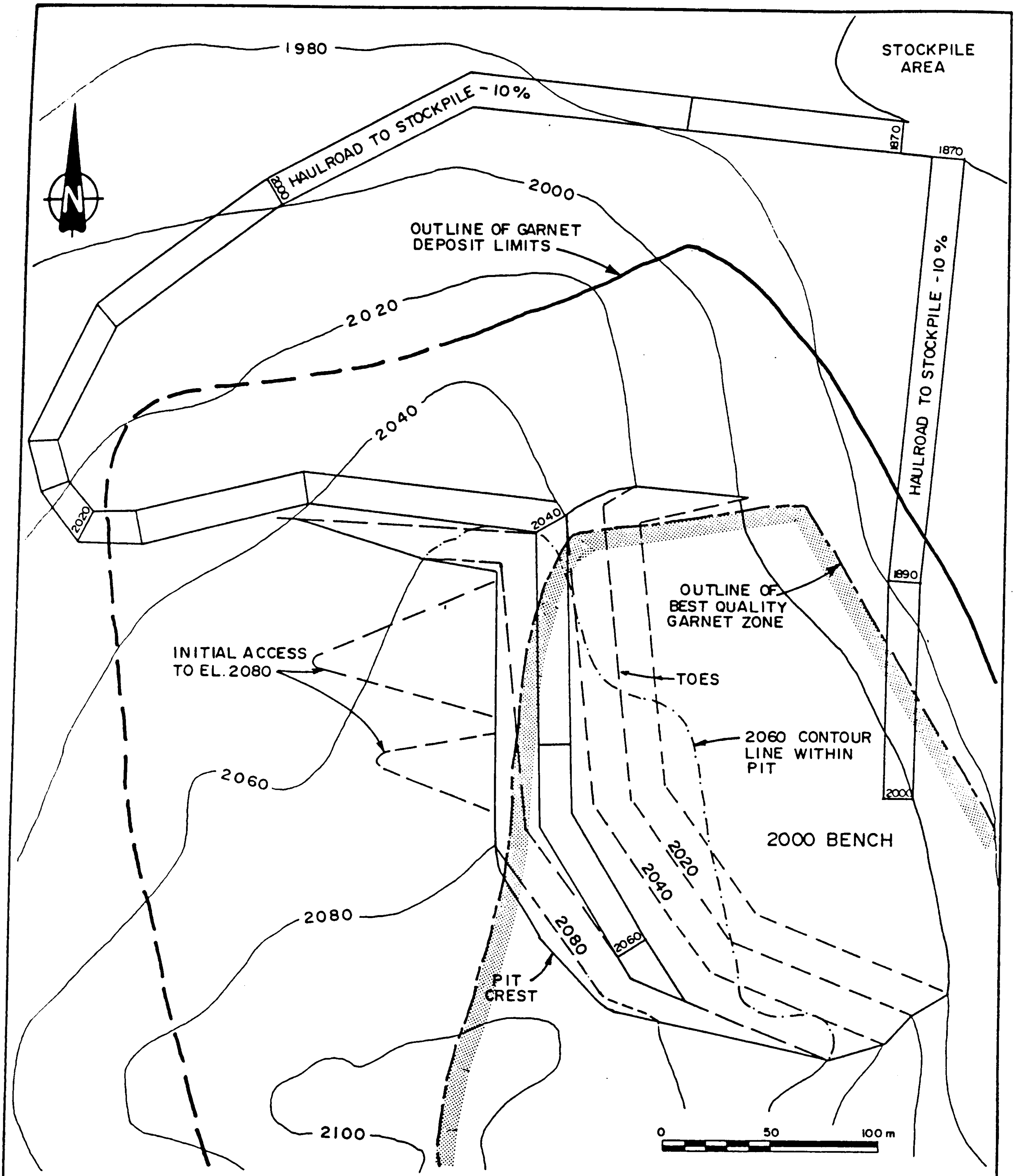
- GARNET OUTCROP/SAMPLE SITE
- DIORITE/GRANODIORITE OUTCROP
- OUTLINE OF GARNET BODY
- ROAD

POLESTAR EXPLORATION INC.

CRYSTAL PEAK GARNET DEPOSIT

POTENTIAL QUARRY SITES

FIG. 10



POLESTAR EXPLORATION INC.	DATE SEPT. 1989
CRYSTAL PEAK GARNET PROJECT QUARRY DESIGN AND HAUL ROADS	PROJ. NO. 70501 APPROVED FIG. 1.1
STEFFEN ROBERTSON & KIRSTEN, Consulting Engineers	

Costs to San Francisco 65% of cost to San Diego.

If a return cargo can be arranged, prices will be reduced.

5.7 Workforce

Only one shift per day is planned for the first year. Personnel will consist of:

1 - Manager (Mineral Processing Engineer)

3 - Machine and Equipment operators.

1 - Bookkeeper/Secretary/Purchase Agent

1 - Mechanic/Electrician

Housing is readily available in Apex village or workers can commute from Penticton (about 40 minutes by car) or Keremeos.

Employment opportunities in the Okanagon region are limited and obtaining skilled workers should present no problem.

5.8 Machinery and Capital Cost Estimate

(costs obtained from Mining Cost Service (8) in 1987 Cd dollars).

PROCESSING EQUIPMENT

Crusher (jaw) 3/4	92,000
Crusher (double Roll)	69,000
Screens (vibrating) 5 @ $16,000	80,000
Gravity Separators	100,000
Magnetic Separator Low Intensity	30,000
Magnetic Separator High Intensity	50,000
Electrostatic Separators, 3 @ $70,000	210,000
Dryer	27,000
Bagging Machine	12,000
Palletizing Machine	75,000
Motors, Controls	50,000
Miscellaneous Equipment Feeders, Hoppers, Bins, Purifiers	105,000
	$900,000

OTHER CAPITAL COSTS

Buildings (Plant, Offices, Warehouse)	350,000
Water Supply	25,000
Power Supply (Transmission lines, transformers)	90,000
Pre Production Development	20,000
Site Preparation (clearing, stripping, drainage, site grading, etc. for stockpile, plant and sediment pond)	35,000
Sediment Pond	125,000
Haul Roads	100,000
Engineering Management	150,000
Working Capital	150,000
Contingencies (approx. 8%)	160,000
TOTAL	$2,100,000

5.9 Development Timetable

The rate of development is mainly determined by how long the permitting process will take.

Tentatively the following schedule is proposed:

Submission Prospectus:	September 1989
Site Construction Start-up:	2nd quarter 1990
Production Start-up:	3rd quarter 1990

6.0 ENVIRONMENTAL SUMMARY

6.1 Physiography

The Crystal Mountain Project is located in the southern part of the Thompson Plateau, which is a rolling upland with generally low relief. The plateau in the vicinity of the project site consists of a chain of prominences dissected by the headwaters of the Keremeos Creek on the east and south sides and the tributaries of the Similkameen River on the west and northern sides.

The site is located on Mt. Riordan at the northern end of a chain of peaks including Beaconsfield Mountain and Apex Mountain. Relief from the peak of Mt. Riordan to the lower flanks is about 650 feet (200 metres).

The Apex Alpine Ski Resort is developed at the base of the eastern flank of Mt. Riordan, within about 1 km of the proposed development.

6.2 Climate

The area is characterised by warm, dry summers and cool winters.

Based on extrapolation of data from weather stations in the area, the mean annual daily temperature in the vicinity of the proposed plant site would be about 1.5° C, with a range of mean daily temperatures from -4 to 7°C. The extreme minimum and maximum temperatures are likely to be -39 and 32°C.

The mean annual precipitation would be about 600 mm, consisting of 200 mm of rainfall and 400 mm (water equivalent) of snowfall. The 200-year, 24-hour maximum rainfall is presently estimated to be 62 mm.

For purposes of the pre-engineering studies, the annual water surface evaporation rate has been taken as 875 mm. The corresponding maximum potential evapo-transpiration rate over land surfaces has been taken as 400 mm.

Information on air quality for the area is sparse. Pre-development measurements at the Nickel Plate Project indicated soluble and insoluble particulate levels at 0.3 and 2.7 $mg/cm^2/day$, respectively.

6.3 Hydrology

The site is located at a watershed divide between the Keremeos Creek and Similkameen River systems. The northern and western flanks of Mt. Riordan drain toward Nickel Plate Lake. The eastern and southern flanks drain toward the Keremeos Creek.

Except for limited clearing for earlier ski runs, the catchment areas are covered with dense vegetation. Beneath the topsoil and ground litter, the soils and bedrock appear to have moderate to high infiltration rates.

Regional analysis of the streams to the west indicate a mean annual watershed yield of about 6.3 $l/sec/km^2$. The corresponding yield for the eastern flowing Keremeos Creek is about 4.1 $l/sec/km^2$. Based on the observed conditions at the Crystal Mountain site, the watershed yield in the upper part of the catchment is likely to be one-third to one-half of the values computed for the gauging station records.

A 200-year storm would result in a rainfall intensity of about 12.5 mm/hr. The peak instantaneous discharge at the plant site for the 200-year storm would therefore be calculated by the Rational Method to be about 100 l/sec (1500 gpm). With snowmelt superimposed on the flood discharge, the peak instantaneous discharge is estimated to be in the order of 250 l/sec.

At the time of preparation of this Prospectus, no background measurements of water quality were available. Water samples were taken on September 8, 1989 from 4 locations around the flanks of Mt. Riordan. The analytical results are expected by the beginning of October.

No signs of groundwater discharge were observed on the northern flank of Mt. Riordan during the site reconnaissance. Marshy ground and springs were observed on the lower, western and southern flanks. The observations were inadequate to describe groundwater conditions in detail, other than to suggest that groundwater flow occurs at the interface between the bedrock and overlying glacial drift.

During the forthcoming exploratory program, standpipe observation wells will be installed in the quarry and plant site areas to provide information on groundwater conditions.

6.4 Soils and Surficial Geology

The soils encountered at the site consist of glacial drift - a random assortment of glacial till and glacial outwash. The soils, which originated from mountain glaciation, are typically sandy with gravel and cobbles, and are deficient in the very fine sizes. Glacial erratics varying from 1 to 5 m in diameter are strewn over the entire site.

Above about Elevation 2000 m, soil overburden is sparse to absent. The thickness of soil overburden on the lower flanks of Mt. Riordan is expected to vary from 3 to 8 m in thickness.

The glacial drift and bedrock occurring at the site would provide adequate foundation materials for plant site structures and embankments. Site-specific testing of foundation materials is required before finalization of foundation design. The soils are expected to be moderately pervious and water retention structures may require lining with imported clayey soils or synthetic liners.

6.5 Vegetation

The vegetation associations belong to the Subalpine Englemann Spruce-Subalpine Fir biogeoclimatic zone below about Elevation 2050 m and the Alpine Tundra zone at higher levels. The zone classifications are as proposed by Krajina in 1969. Generally canopy coverage in the proposed plant site area consists of Englemann Spruce, Subalpine fir and some Lodgepole pine. Second-storey vegetation includes seedlings of the canopy species as well as mixed shrubs and grasses.

6.6 Fish and Wildlife

The streams in the immediate vicinity of Mt. Riordan are too small to sustain fisheries resources. However, Nickel Plate Lake and the lower reaches of Keremeos Creek would likely provide habitat for rainbow trout, longnose dace and sculpin.

Generally, bird species are not present in exceptional abundance or species diversity. Habitat for waterfowl is limited to Nickel Plate Lake and bordering wetlands. The topography of the project site precludes development of wetland habitat.

The smaller mammal population is represented by squirrels and chipmunks based on sightings during field reconnaissance.

Land capability in the site area has moderate limitations for ungulate production. The limitations are due to land characteristics affecting habitat and climatic factors affecting mobility and food availability. The site is in the range of mule deer and mountain goat.

There are no known threatened or endangered species within the project area.

6.7 Land Capability and Use

The project site occurs in an area characterized by soils, which for agricultural purposes, are typically capable of sustaining only perennial forage crops. The terrain and soil limitations are such that improvement techniques would be impractical. Cattle grazing occurs in the area. The extent and ownership of grazing leases are presently unknown.

Land in the vicinity of the project exhibits moderately severe to severe limitations for growth of commercial forests. No known regular harvesting occurs in the area, although merchantable timber from road clearing and site development is hauled to Penticton.

The site has high capability for outdoor recreation. The Apex Alpine Ski Resort is located 1 km east of the site. A ski run - now abandoned - was developed on the eastern flank of Mt. Riordan and numerous cross-country ski trails traverse the area. Recreational hunting for mule deer also takes place in the area.

6.8 Historical and Archaeological Sites

Although the area has been prospected since the early part of the century and there are a number of shallow exploratory excavations on Mt. Riordan, there are no structures or facilities of historical note in the vicinity of the site.

There are no known archaeological sites.

7.0 WATER MANAGEMENT PLAN

7.1 There were no signs of surface water, springs or streams on the summit and northern flank of Mt. Riordan. The soil mantle appears to be pervious and the bedrock is highly fractured. Except for isolated occurrences of heavy rainfall when sheet runoff might take place, precipitation infiltrates into the ground.

7.2 Rainfall and snowmelt in the quarry would continue to percolate into bedrock fractures, and only minor surface drainage is anticipated from the quarry.

7.3 After periods of intense rainfall, some surface discharge would accumulate on and adjacent to the haul roads.

7.4 Surface drainage from the catchment above the plant would be diverted into the sediment pond. If it is practical, a small runoff catch basin could be considered to augment the supply of process water.

7.5 There would be no effluent discharged from the sediment pond. Water slurried with the dust collected from screening and impurities removed by the separators would be contained in the sediment pond until the water is either recycled as process water or evaporates/seeps from the sediment pond.

7.6 For a production rate of 100 tpd, the following average water balance has been estimated:

Inflow	
Net Precipitation Runoff[1]	10 gpm
Waste Slurry (35% solids)	8 gpm
Total Inflow	18 gpm
Outflow	
Entrained with Waste	5 gpm
Seepage Loss[2]	8 gpm
Pond Evaporation	2 gpm
Total Outflow	15 gpm
Balance for Reclaim	3 gpm

Notes: 1. Based on 600 mm total precipitation, 300 mm evapo-transpiration and 200 mm infiltration.

2. Based on basin permeability of 2×10^{-5} cm/sec and water area of 2,500 m^2.

7.7 As production rate increases, slurry inflow and entrainment with waste would increase, resulting in a net increase in the balance available for reclaim.

7.8 The initial estimate for process water is in the range of 20 to 50 gpm. The balance after reclaim from the sediment pond would be made up with fresh water.

7.9 The fresh water supply would be provided as groundwater from one or more water wells developed in the plant site area and along the slope down gradient from the sediment pond.

7.10 Where haul roads cross topographic lows, culverts would be provided to prevent accumulation of ponded water against road embankments.

8.0 WASTE MANAGEMENT PLAN

8.1 Because the garnet deposit is almost entirely exposed as outcrop, there would be no waste from overburden stripping, and therefore, no waste dumps associated with quarrying. Topsoil stripped from the plant site and embankment foundation areas would be stockpiled for reuse during site reclamation.

8.2 Waste materials would consist of dust collected from screening, undersize from screening and impurities removed through the various gravity, magnetic and electrostatic separations. There would be no toxic materials in liquid or solid form included with the wastes. No reagents would be used in processing.

8.3 Impurities would consist mainly of inert silicates, calcite and a minor amount of sulphides. The ratio of calcite to sulphide is sufficient to preclude acid generation.

8.4 Based on current information, the impurities comprise 5 to 15 percent of the tonnage of the deposit.

8.5 At the proposed processing rates, between 3,000 and 4,500 tons of waste per year would be generated initially.

8.6 Wastes from processing the garnet would be stored in a sedimentation pond constructed on the slopes below the plant. The initial pond would have a surface area of about 2 hectares and would provide storage for about 70,000 tons of material (at least 10 years of production). As required, more storage would be developed by constructing additional ponds east and west of the first.

8.7 The sedimentation pond would be constructed by cut-and-fill techniques - material for the perimeter embankment would be scooped out of the basin. The average height of the embankment would be about 10 feet, but the excavated depression would add the equivalent of about 4 feet of extra storage. The sideslopes of the embankment would be 2.5:1 and 1.75:1 (horizontal:vertical) for the upstream and downstream slopes, respectively.

8.8 A single stream of waste slurry would be discharged from the plant to the upslope end of the sediment basins. For the anticipated coarseness of the waste materials, sedimentation is expected to be rapid. There are no clay minerals reported associated with the impurities. Retention time for clarification of water prior to reclaim would be minimal.

8.9 A single pond system is considered to be sufficient to achieve the required clarification, and no polishing pond is provided at this time in the layout of facilities. Should operational experience indicate the need, a secondary clarification pond could be added at a later stage.

8.10 Sewage would be accommodated by a septic tank and drain tile field. For the proposed work force, a daily volume of septic effluent of less than 500 gallons is estimated. The septic tank and drain tile field would be located in the catchment area of the sediment pond.

8.11 Refuse would be disposed of in the landfill used by the Apex Alpine Ski Resort. As required, empty containers of lubricants and other materials consumed by the operation that cannot be placed in the landfill would be hauled to Penticton for disposal.

9.0 RECLAMATION PLAN

9.1 The quarry site will require minimal reclamation on abandonment. As proposed, the quarry would be excavated by removing the top of Mt. Riordan. The final surface is expected to be a level, mesa-like feature.

9.2 There will be no waste dumps to reclaim.

9.3 The plant will be demolished and removed.

9.4 Areas disturbed by mine-related activities such as the plant site, haul roads and stockpile will be scarified and revegetated.

9.5 The sediment pond will be graded, contoured and covered with topsoil from the stripping stockpile. The surface will then be revegetated.

9.6 At this time, measures for constructing or rehabilitating surface damage are not foreseen because there is no significant existing surface drainage in the area to be developed. The need for surface drainage channels and appropriate lining systems would be reassessed during operation and prior to abandonment of the site.

10.0 ENVIRONMENTAL ISSUES

10.1 Air Quality

The major impacts on air quality would be due to dust emanating from quarrying, haulage and processing.

Quarrying will be seasonal and the dust related to blasting is not expected to be severe because the nature of the rock is more amenable to shattering rather than pulverizing. Winds through the Alpine Tundra zone in which the quarry would be located would result in rapid dispersion of blast-related dust.

Road traffic will contribute dust. Use of the haul roads from the quarry would be seasonal and dust suppression by sprinkling would be implemented. Delivery of supplies and transport of the finished product would take place over the existing road system. Dust suppression on gravel-surfaced roads may be required.

Emissions from processing would be limited to dust from screening. A collector system is proposed to collect and slurry particulates to the sediment pond.

10.2 Noise

The proposed project would result in elevated levels of noise, including blasting, traffic and processing.

Blasting in the quarry is planned for the summer season. During this season, recreational use of the area is at a minimum so that inconvenience to other users of the area would be limited. Further, the short duration of blasting would minimize the impact on wildlife disturbance.

Some noise from processing is unavoidable. Measures involving maintaining a greenbelt between the plant site and the Apex Alpine resort will reduce noise pollution.

The increase in traffic will not be significant. Therefore traffic-related noise would not increase noticeably.

10.3 Aquatic Environment

There are no toxic components associated with quarrying or processing the garnet. Further there is no planned effluent discharge from the sediment pond because as much water as can be obtained will be recycled for process purposes.

Sediment from surface drainage from disturbed areas of the property and from the processing would be stored in the sediment pond and would not affect surface water quality below the property.

The stream that is used for the water supply of the Apex Alpine resort flows along the southern flank of Mt. Riordan. Apart from seasonal quarrying in some areas of the quarry, there would be no mine-related activities in the watershed of the water supply.

No impact is foreseen on surface water flow or quality.

Seepage will occur from the sediment pond. This will result in a local increase in hydraulic head in the immediate area. No down-gradient impacts are foreseen due to locally increased groundwater flow.

The septic tank and tile field system for sewage disposal will require approval from the Ministry of Health.

No detrimental effects on local groundwater quality would occur due to a properly operated septic system.

10.4 Vegetation and Soils

During project development, vegetation communities and surficial soils within the quarry, along haul roads, and in the plant site and sediment pond areas will be cleared and stripped. The disturbance would last for the duration of the life of the project.

The significance of vegetation loss is minimal considering the size of the area of development in relation to the size of the overall habitat in the surrounding area.

Any sediment resulting from erosion of cleared or stripped areas would be contained in the sediment pond.

Topsoil from stripping would be stockpiled for use in post-abandonment reclamation.

10.5 Fish and Wildlife

There is no fisheries resource within the boundaries of the project and the nearest streams and lakes that would provide fish habitat are beyond the area of influence of the proposed activities.

The proposed project may result in impacts on the wildlife populations due to temporary loss of habitat, disturbance by quarrying and processing activities, and a nominal increase in traffic.

The loss of wildlife habitat would be temporary. Further, the area of development is small relative to surrounding, available habitat.

Machine and human activity may cause disturbance to wildlife in the immediate vicinity of the operations. While quarrying would be limited to the summer months, the plant will operate year-round. Experience elsewhere indicates that wildlife are adaptable, and, following a temporary reduction in wildlife activity, normal wildlife population levels are expected to quickly re-establish.

The projected increase in traffic on the existing road network is not anticipated to be significant compared to current use. Haul roads on the property are not expected to deter migration patterns.

10.6 Agriculture and Grazing

The plant site, infrastructure, and sediment pond would alienate tracts of land from current usage. It will be necessary to negotiate a reasonable arrangement with grazing lease holders for potential loss of use.

A fence will be built around the sediment pond to exclude cattle.

The agricultural use of the land is of no consequence because of low capability of the land, and the proposed project would therefore have no impact.

10.7 Forest Resources

The impact on forest resources will be negligible.

It will be necessary to obtain a Licence to Cut and a burning permit for site clearing. Merchantable timber from clearing will be sold. Burning will be completed in accordance with the appropriate schedules and regulations.

During operations, the prevailing fire protection regulations will be complied with.

10.8 Recreation

The major impact of the proposed project will be the alienation of recreational areas and potential disturbance to users of adjacent recreational facilities. The impacts include the visual impact of the quarry and potential noise associated with the plant.

New ski trails have been developed, and additional trails can be constructed, on the flanks of Mt. Riordan around the area of development.

Operation of the quarry is planned for the summer months. Quarry activities would take place when recreational use of the area is at a minimum. During the peak-use winter season, the harsher visual appearance of the quarry would be snow-covered.

The plant site and sediment pond will be operated on a year round basis. A greenbelt of vegetation will be maintained between the resort area and the plant site area to reduce noise levels and screen the operations from view.

APPENDIX 1

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