PRELIMINARY ENGINEERING STUDY

KERR ADDISON MINES LIMITED

HARRISON LAKE GOLD PROJECT

BEAR MOUNTAIN, B. C.

DECEMBER 1987

L. J. MANNING & ASSOCIATES LTD.
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December 22,1987.

Mr. R. Dujardin,
Manager Western Division,
Kerr Addison Mines Limited,
703 Fidelity Life Building,
1112 West Pender Street,
Vancouver, B.C. V6E 2S1

Dear Mr. Dujardin:

We are pleased to submit the report entitled Preliminary Engineering Study, Kerr Addison Mines Limited, Harrison Lake Gold Project, Bear Mountain, B.C.

The report contains layouts for both Sub-level Caving and Block Caving mining methods with their respective Capital and Operating Costs. The basic metallurgical flow-sheet with Capital and Operating Costs were prepared by G. Hawthorn, P.Eng. Mineral Processing Engineer. It is understood that Kerr Addison personnel will develop the pertinent cash flows when the necessary information becomes available.

Both Capital and Operating Costs are considered to be within plus or minus thirty percent (30%) limits.

We are pleased to have been afforded the opportunity to collaborate with your organization in preparation of the study. Should you have any question with regard to the contents, we would be pleased to meet with you at your convenience.

Yours truly,

L. J. Manning & Associates Ltd.,

N. C. Croome, P.Eng.

NCC/hmc

# TABLE OF CONTENTS

| SECTION | Page |
|---|---|

| SECTION | Page |
|---|---|

# 1.0 SUMMARY

## 1.1 Project Summary

The Harrison Lake Bear Mountain Project is designed to mine and mill 350,000 ~~tons~~ tonnes per year. The mine will operate on a 2-shift 5 day week and the mill on a 3-shift 7-day week.

The geological ore reserves within the mineralized stock from surface down to the 47 Level total 3,929,940 tonnes. The mineable ore reserves in the same area total 3,550,660 tonnes.

The geological reserves within the selected area of the mineralized stock from surface to the 47 Level total 2,407,650 tonnes and the mineable ore reserves in the same area total 2,178,350 tonnes.

Dilution of the ore due to inclusions of waste in mining has not been included and for the mining methods, as described in this report, could average in the range of twenty percent (20%). The net effect would be to raise the tonnage of ore and dilute the grade.

An ore grade was not available for the reserves.

Total capital costs for mining, milling and ancillaries were calculated for two mining systems:

Sub-level Caving

| | Total Mining Area | Selected Mining Area |
|---|---|---|
| Capital Costs | $ 22,703,166 | $ 21,158,830 |
| Operating Costs | $ 24.98 per tonne treated | $ 24.98 per tonne treated |

Block Caving

| | Total Mining Area | Selected Mining Area |
|---|---|---|
| Capital Costs | $ 22,583,597 | $ 21,428,572 |
| Operating Costs | $ 23.97 per tonne treated | $ 23.97 per tonne treated |

Because of the mine's location in a highly sensitive area, an estimated cost of environmental studies is $450,000.

Surface rights to land necessary for mining and milling facilities must be acquired, therefore, a sum of $1,000,000 should be included for that purpose.

An inventory of spare parts and reagents at an estimated cost of $300,000 should be included.

A minimum of three months operating capital should be included at the time of start-up to allow for delays in liquidation of products, or a total of $2,250,000. This sum will be recovered at the termination of the project.

The sum of these items, or $4,000,000, should be added to the capital costs for financial requirements.

Recommendations:

At this preliminary stage, it is our opinion that the operation of a mine and concentrator, as proposed, is technically feasible.

However, the prior use of Harrison Lake for recreational purposes, and its significant salmon population, will result in considerable political resistance to the proposed use of the lake for tailing disposal. The fact that the ideal technical site for the tailing is in Harrison Lake may not alter this position.

The prior use of Kootenay Lake for the disposal of mine tailing would normally provide sufficient data to rationalize a similar use for Harrison Lake. However, it may be that no politician will be prepared to risk his political future for the benefit of industry.

An assessment of the political potential should be made early in future investigations, since it may be pointless to pursue a technically attractive option which may not be politically feasible.

If permission is obtained to use Harrison Lake, it will require a Federal Order-In-Council. The cost of the investigations and presentations will be costly and protracted.

The possible use of a land area north of Sasquatch Park makes much less technical sense than that of the lake, but it may be politically more attractive, and therefore may be viewed by Kerr Addison as a more pragmatic approach.

## 1.2 Capital Cost Summary

### 1.2.1 Capital Cost Summary ( for total mining)

| | Sub-level Caving | Block Caving |
|---|---|---|
| Upper Mine Development | $ 5,775,350 | $ 5,060,744 |
| Lower Mine Development | 2,524,500 | 3,382,800 |
| Equipment | 2,044,830 | 1,804,989 |
| Sub Total | 10,344,680 | 10,248,533 |
| Underground Crushing | 1,739,654 | 1,739,654 |
| Sub Total | 12,084,334 | 11,988,187 |
| Contingency 15% | 1,812,650 | 1,789,228 |
| Estimated Total Cost | $ 13,896,984 | $ 13,777,415 |

Mining Capital Cost Summary (selective mining)

| | Sub-level Caving | Block Caving |
|---|---|---|
| Upper Mine Development | $ 4,432,000 | $ 4,296,209 |
| Lower Mine Development | 2,524,500 | 3,135,159 |
| Equipment | 2,044,830 | 1,804,989 |
| Sub Total | 9,001,330 | 9,236,357 |
| Underground Crushing | 1,739,634 | 1,739,634 |
| Sub Total | 10,740,964 | 10,975,991 |
| Contingency 15% | 1,611,155 | 1,646,399 |
| Estimated Total Cost | $ 12,352,119 | $ 12,622,390 |

1.2.1 Capital Cost Summary (Cont'd)

Milling Capital Cost Summary

| | |
|---|---|
| Processing | $ 4,686,300 |
| Overheads | 940,000 |
| Sub total | 5,626,300 |
| Contingency 15% | 843,945 |
| Estimated Total Cost | $ 6,470,245 |

Ancillaries Capital Cost Summary

| | |
|---|---|
| General ancillaries | $ 2,031,250 |
| Contingency 15% | 304,687 |
| Estimated Total Cost | $ 2,335,937 |

1.2.2 Capital Cost Summary - Sub-level Caving mining total ore zone, underground crushing

| | |
|---|---|
| Mining | $ 13,896,984 |
| Milling | 6,470,245 |
| Ancillaries | 2,335,937 |
| Total Capital Cost | $ 22,703,166 |

1.2.3 Capital Cost Summary - Sub-level Caving selective mining, underground crushing

| | |
|---|---|
| Mining | $ 12,352,119 |
| Milling | 6,470,245 |
| Ancillaries | 2,335,937 |
| Total Capital Cost | $ 21,158,830 |

1.2.4 Capital Cost Summary - Block Caving, mining total ore zone, underground crushing

| | |
|---|---|
| Mining | $ 13,777,415 |
| Milling | 6,470,245 |
| Ancillaries | 2,335,937 |
| Total Capital Cost | $ 22,583,597 |

1.2.5 Capital Cost Summary - Block Caving, selective mining, underground crushing

| | |
|---|---|
| Mining | $ 12,622,390 |
| Milling | 6,470,245 |
| Ancillaries | 2,335,937 |
| Total Capital Cost | $ 21,428,572 |

## 1.3 Operating Cost Summary

1.3.1 Operating Cost Summary - Sub-level Caving underground crushing

| | Annual Cost | Cost per Tonne |
|---|---|---|
| Mining | $ 4,173,240 | $ 11.92 |
| Milling | 2,682,900 | 7.67 |
| Administration | 746,054 | 2.13 |
| Sub total | 7,602,194 | 21.72 |
| Contingency 15 % | 1,140,329 | 3.26 |
| Total Annual Operating Cost | $ 8,742,523 | $ 24.98 |

## 1.3.2 Operating Cost Summary - Block Caving

| | Annual Cost | Cost per Tonne |
|---|---|---|
| Mining | $ 3,866,419 | $ 11.04 |
| Milling | 2,682,900 | 7.67 |
| Administration | 746,054 | 2.13 |
| Sub total | $ 7,295,373 | $ 20.84 |
| Contingency 15% | 1,094,306 | 3.13 |
| Total Annual Operating Cost | $ 8,389,679 | $ 23.97 |

## 2.0 ORE RESERVES

Using data available, the ore reserves can only be considered as "reasonably assured" and "drill indicated". For the purposes of the study, the outline shown on geological plans and sections as provided by Kerr Addison were used.

### 2.1 Geological Reserves

2.1.1 Selected Mining Area - between 140 meter Level and surface.
Specific Gravity of ore 2.88, average area of selected mining 3981 square meters.
Tonnes per vertical meter 3981 x 2.88 = 11,465
Total tonnage 11,465 x 110 = 1,261,150 tonnes

Selected Mining Area between 47 Level and 140 Level.
Specific Gravity 2.88, average area of selected mining area 3,981 square meters.
Tonnes per vertical meter 3,981 x 2.88 = 11,465
Total tonnage 11,465 x 100 = 1,146,500 tonnes

Total Geological Reserves, selected mining area 2,407,650 tonnes.

2.1.2 Total Area Mining - between 140 meter Level and surface
Specific Gravity of ore 2.88, average area of total mining 6,498 square meters.
Tonnes per vertical meter 6,498 x 2.88 = 18,714 tonnes
Total tonnage 18,714 x 110 = 2,058,540 tonnes.

Total Area Mining between 47 Level and 140 Level
Specific Gravity 2.88, average area of total mining 6,498 square meters.
Tonnes per vertical meter 6,498 x 2.88 = 18,714 tonnes
Total tonnage 18,714 x 100 = 1,871,400 tonnes

Total Geological Reserves above 47 Level, total mining area 3,929,940 tonnes.

## 2.2 Mineable Reserves

2.2.1 Selected Mining Area, between 140 Level and surface, Specific Gravity 2.88, average area of selected mining 3,981 square meters.

Tonnes per vertical meter 3,981 x 2.88 = 11,465

Total tonnage 11,465 x 100 = 1,146,500 tonnes

Selected Mining Area between 47 Level and 140 Level, Specific Gravity 2.88, average area of selected mining 3,981 square meters.

Tonnes per vertical meter 3,981 x 2.88 = 11,465 tonnes

Total tonnage 11,465 x 90 = 1,031,850 tonnes

Total Mineable Reserves, selected mining area 2,178,350 tonnes

2.2.2 Total Area Mining, between 140 Level and surface, Specific Gravity 2.88, average area of total mining 6,498 square meters.

Tonnes per vertical meter 6,498 x 2.88 = 18,714 tonnes

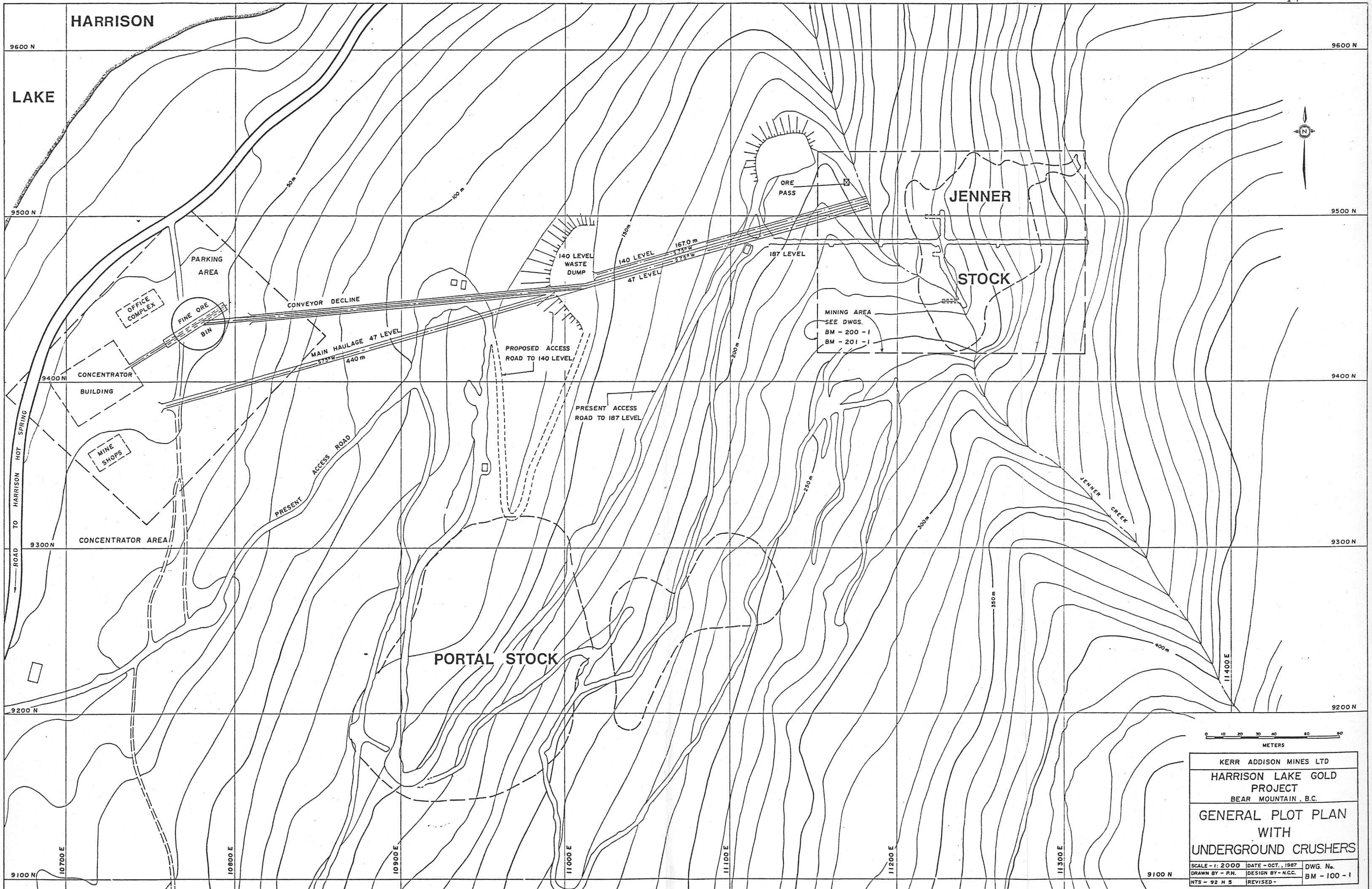
Total tonnage 18,714 x 100 = 1,871,400 tonnes

Total Area Mining between 47 Level and 140 Level Specific Gravity 2.88, average area of total mining 6,498 square meters.

Tonnes per vertical meter 6,498 x 2.88 = 18,714 tonnes

Total tonnage 18,714 x 90 = 1,684,260 tonnes.

Total Mineable Reserves, total area mining 3,555,660 tonnes.


HARRISON
LAKE
9600 N
9500 N
9400 N
9300 N
9200 N
9100 N
10700 E
10800 E
10900 E
11000 E
11100 E
11200 E
11300 E
11400 E
ROAD TO HARRISON HOT SPRING
PARKING AREA
OFFICE COMPLEX
FINE ORE BIN
CONCENTRATOR BUILDING
MINE SHOPS
CONCENTRATOR AREA
CONVEYOR DECLINE
MAIN HAULAGE 47 LEVEL
440 m
140 LEVEL WASTE DUMP
140 LEVEL
47 LEVEL
167.0 m
187 LEVEL
ORE PASS
PROPOSED ACCESS ROAD TO 140 LEVEL
PRESENT ACCESS ROAD TO 187 LEVEL
PRESENT ACCESS ROAD
JENNER STOCK
MINING AREA SEE DWGS. BM - 200 - I BM - 201 - I
PORTAL STOCK
JENNER CREEK
50 m
100 m
150 m
200 m
250 m
300 m
350 m
400 m
N
METERS
KERR ADDISON MINES LTD
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B.C.
GENERAL PLOT PLAN WITH UNDERGROUND CRUSHERS
SCALE - 1: 2000
DATE - OCT., 1987
DRAWN BY - P.H.
DESIGN BY - N.C.C.
NTS - 92 H 5
REVISED -
DWG. No. BM - 100 - I

## 3.0 MINING

The ore body above the Harrison Lake Level can be divided into two almost equal tonnages, the upper being from surface down to the 140 Level and the lower from the 140 Level down to the 47 Level. The levels are approximately 95 meters apart, a distance adequate to allow economical mechanized mining methods for production of ore.

The upper section of the mine, above the 140 Level, would be mined first. Access to this area is through the 140 Level crosscut, a distance of approximately 167 meters to the ore body. The ore body would be developed for mining by either the Sub-level Caving Method or the Block Caving Method. The development waste would be placed in the waste dump near the 140 Level adit. Ore would be dumped into an ore pass connecting the 140 Level to the 47 Level. From that point the coarse ore would be transferred to underground trucks for transportation either directly along the 47 Level to an ore bin at surface, a distance of 440 meters, or into an underground coarse ore storage bin, from which it would be fed to a jaw crusher, gyratory crusher and transported 140 meters up an incline by conveyor belt to a fine ore bin adjacent to the millsite.

The lower section of the ore body, that section between Level 140 and Level 47, would be developed and brought into production as mining in the upper section was being terminated.

## 3.1 General Description of Mining Method

3.1.1 Sub-level Caving - The increased application of the sub-level caving mining system may be traced to many new technological developments, increasing labor costs and a better understanding of the mechanics of this method. Sub-level caving has found application in both weak and strong ore bodies and may be summarized as a high production method, combining a minimum of labor and a high degree of mechanization. It is well suited to selective mining which may be deemed necessary due to the inclusions of hornfels and other low grade materials within the ore mass. It is considered as a safe mining method and this factor is important due to the blocky nature of the ground in the Jenner Stock.

Because a relatively large number of drifts and crosscuts are kept open, the technique is very flexible and reliable. If local stoppages or difficulties occur, mining can be shifted to other sections of the mine. The planning is uncomplicated, being based on three principal operations, development for drilling, blasting and ore loading.

The method can be best summarized by examining drawing BM-201.1. Basically, the stoping procedure consists of driving a series of sub-levels commencing at the top of the ore body. A starting vertical slot and then a series of ring patterns drilled and blasted, and the broken ore being drawn after each blast.

A modified sub-level caving system, as being used at the Kiruna property in Sweden, was designed to reduce the contact area between the ore and waste assuming the ore draw is properly controlled. The ore is developed in the normal sequence of sub-level caving, but only "swell" ore is mucked and transported to the ore pass, until all the ore in the block is broken and ready for pulling, thus minimizing the potential for dilution, normally inherent in sub-level caving.

3.1.2 Block Caving - This method, where applicable, gives a lower mining cost. It requires a relatively large capital expenditure for preliminary development and basically is for large scale work. Block Caving is not a selective method as underground sorting is not feasible, therefore, a fairly uniform distribution of values in the ore body is necessary. Large massive deposits meet these requirements. Outlines of the ore body should be fairly regular. Small extensions of the ore body into the walls are not recovered and low grade inclusions in the ore cannot be left unmined. Physical characteristics of ore which will break up under block caving have not been exactly defined. Usually ore mined by block caving contains numerous small veinlets or other planes of weakness. Behaviour of a given ore is determined by trial.

Advantages of Block Caving -

(a) safety

(b) cheap mining, since but little drilling, blasting and drilling per ton of ore and amount of development is relatively small

(c) centralized production, permitting efficient supervision

(d) good natural ventilation as compared to other caving methods.

Disadvantages of Block Caving -

(a) preparing the blocks for caving requires time and large expense

(b) cost of maintaining drifts in drawing area can be high and interferes with production

(c) varying the rate of production to meet changes in demand for product is difficult, stoppage of drawing for a considerable time may result in the complete loss of the development openings in the area involved if it is subject to weight concentrations

(d) recovery is sometimes low and there is constant danger of losing large amounts of ore if good draw control is not practiced

(e) this method is inflexible, once started a change to another underground method is difficult.

Block Caving method of mining can be successfully used where the rock mass has a sufficient number of fractures or planes of weakness so that the mass will break up if the support of an area of sufficient size is removed by some method of undercutting. The material "caves" from the bottom of the block. Broken material is drawn off and the caving of the mass progresses upward through the ore. There is a limit to the rate that this caving progresses, which is relative to the structure of the material being caved. If the rock is being drawn faster than the ore caves, a void will be created which could result in a dangerous situtation. It is also possible to form a stable arch if the rock is mass is strong enough so that it is difficult to promote further caving. On the other hand, the material should be drawn rapidly enough to avoid packing in the new undercut and to permit the caving to proceed upward through the rock mass. The rate of draw may vary from one-half to four feet per day.

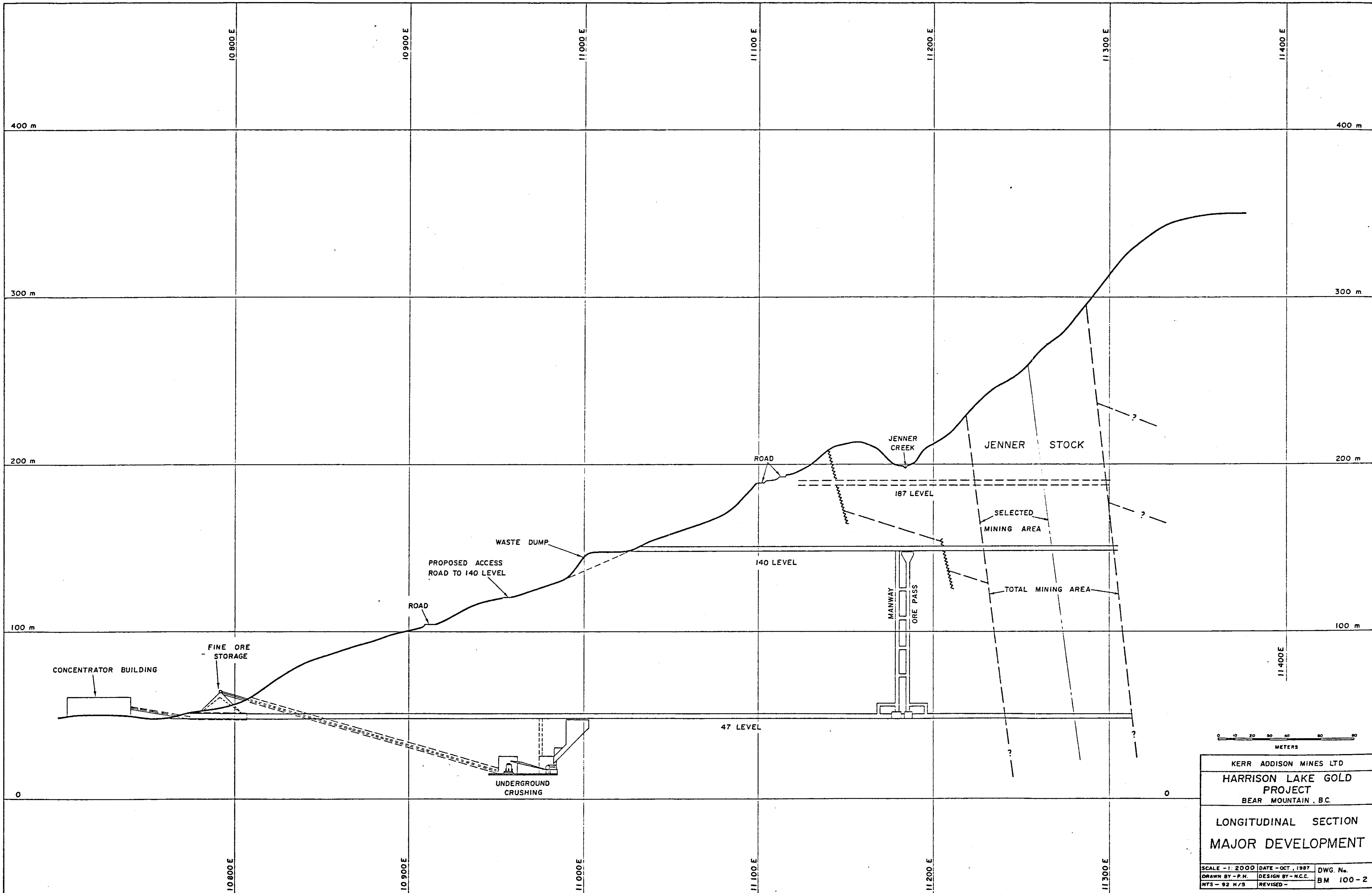
Newly blasted undercut pillars should be pulled empty immediately following an undercut blast to be sure no small parts of pillar remain as support between the roof and the undercut floor. If not removed at the time of undercutting, these can support the back of the undercut and interfere with proper caving and transmit damaging weight to the extraction openings below the undercut level. Ore caves and crushes by its own weight and that of any overlying capping into pieces suitable for handling.

## 3.2 Mine Design Criteria

The major considerations for the development of the mining method and mining plan for the Bear Mountain ore deposit are as follows;

- Mining method which will give selectivity, minimal dilution and high recovery of the resource available.
- Equipment and facilities will be selected on simplicity of operation, ease of maintenance, dependability and versatility.
- Plant facilities will be designed with consideration of ease of on site erection and salvage value.
- Capital and operating costs will be kept to a minimum due to grade and tonnage projected for the ore body.

3.2.1 Comparison Sub-level vs. Block Caving - Sub-level Caving is possible in softer ore and smaller ore bodies but should be considered where gravity caving may be questionable


10 800 E
10 900 E
11 000 E
11 100 E
11 200 E
11 300 E
11 400 E
400 m
300 m
200 m
100 m
0
JENNER STOCK
JENNER CREEK
ROAD
187 LEVEL
SELECTED MINING AREA
WASTE DUMP
140 LEVEL
PROPOSED ACCESS ROAD TO 140 LEVEL
TOTAL MINING AREA
ROAD
MANWAY
ORE PASS
FINE ORE STORAGE
CONCENTRATOR BUILDING
47 LEVEL
UNDERGROUND CRUSHING
METERS
KERR ADDISON MINES LTD
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B.C.
LONGITUDINAL SECTION
MAJOR DEVELOPMENT
SCALE - 1: 2000
DATE - OCT, 1987
DRAWN BY - P.H.
DESIGN BY - N.C.C.
NTS - 92 H/5
REVISED -
DWG. No. BM 100-2

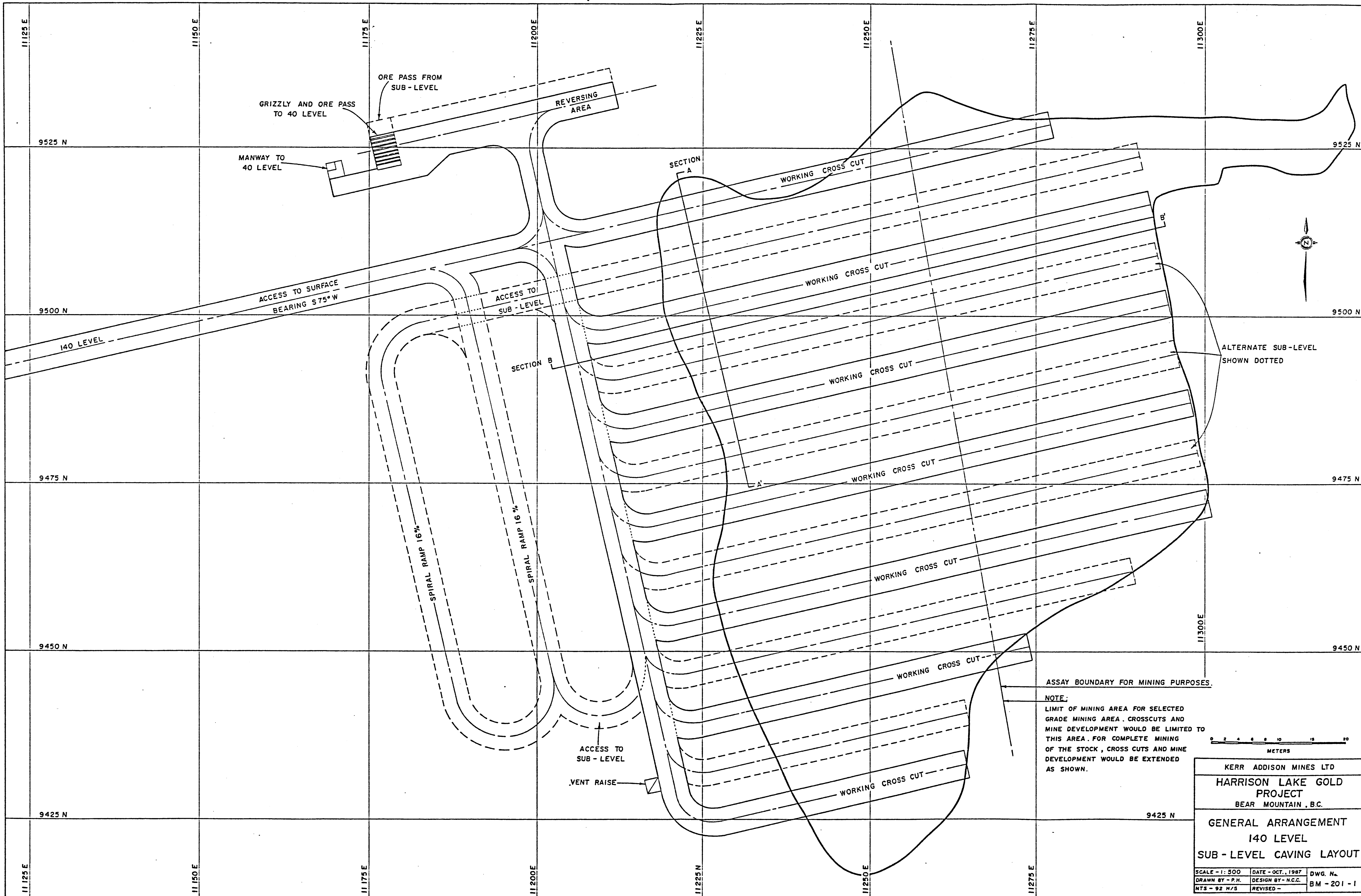
because of sparse fracturing or where large pieces may result in high secondary blasting costs. The relative advantages of block caving include the following - it is traditionally cheaper, gives larger daily output from a given area, requires less development per ton ore, and ventilation is better.

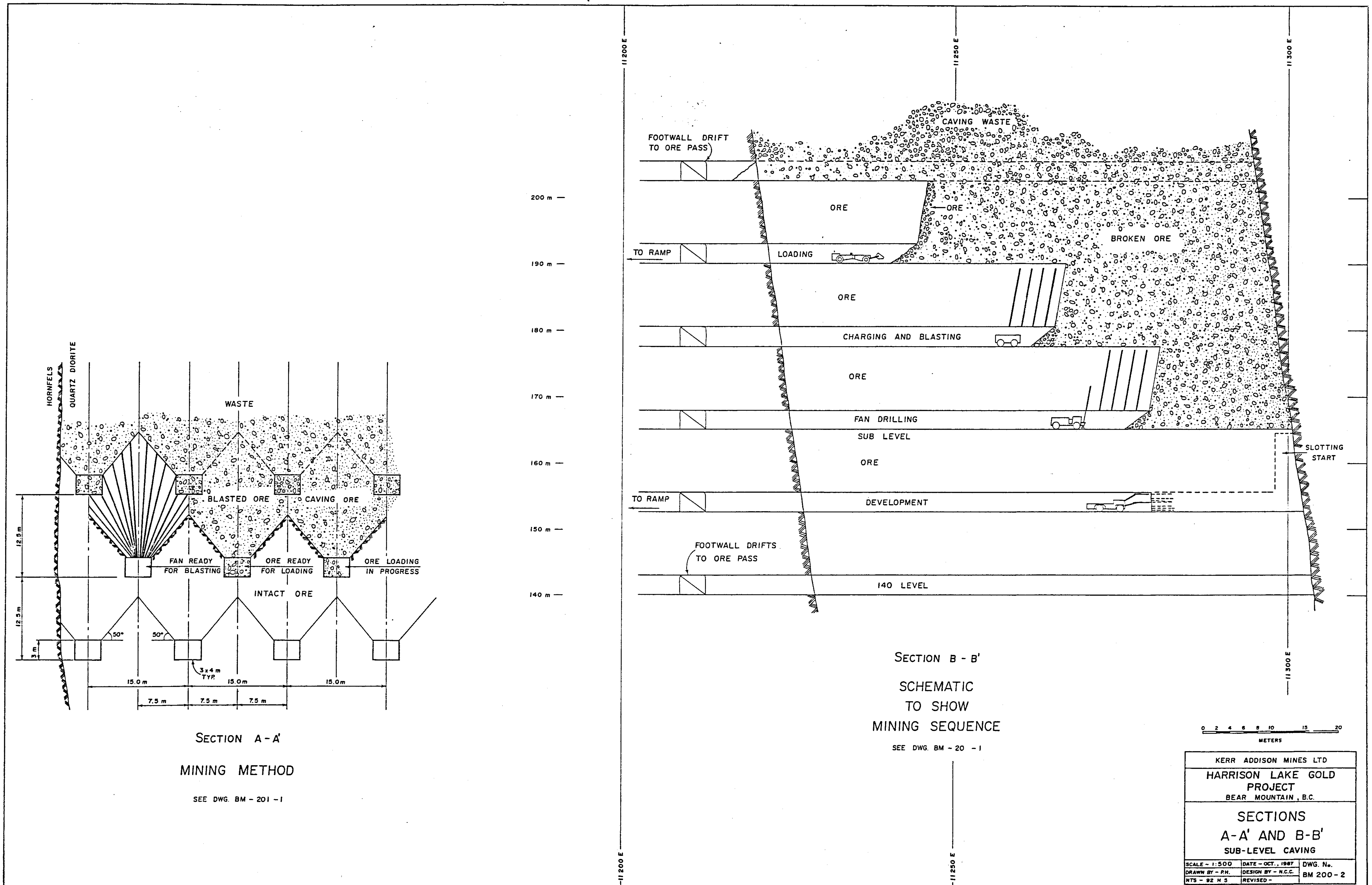
### 3.3 Development Plan

3.3.1 Sub-level Caving Method, see drawing BM-200-1. The 140 Level and the 47 Level is developed simultaneously. Both levels are driven by trackless methods with dimensions of 4.0m wide and 3.0m high. Grade is plus one half of one percent. At this stage, the 47 Level is driven to a point approximately 440 meters which is adequate from which to drive two raises from the 47 Level to the 140 Level, a distance of 93 meters. One raise is used for an ore-pass and the other for manway and ventilation purposes. The raises are 4 meters apart with short crosscuts to allow access from the manway to the ore-pass when necessary. The raises are driven using Alimak equipment. An air operated chute gate on the ore-pass allows minimum spillage when mine truck loading.

The 140 Level is driven 167 meters to the footwall area of the Jenner Stock. A drift 4.0 x 3.0 is driven in the footwall on a bearing generally parallel to the strike of the mineralization. From this drift a series of crosscuts is driven across the ore body at 14 meter intervals. These crosscuts extend to the limits of the mineralizationl.

A ramp starts from the main crosscut parallel to the access drift at a slope of 16 percent. This allows an increase in elevation of 12.5 meters for each length of the ramp, from


11 125 E
11 150 E
11 175 E
11 200 E
11 225 E
11 250 E
11 275 E
11 300 E
9525 N
9500 N
9475 N
9450 N
9425 N
ORE PASS FROM SUB-LEVEL
GRIZZLY AND ORE PASS TO 40 LEVEL
MANWAY TO 40 LEVEL
REVERSING AREA
SECTION A
A'
SECTION B
B'
WORKING CROSS CUT
ACCESS TO SURFACE
BEARING S75° W
140 LEVEL
ACCESS TO SUB-LEVEL
SPIRAL RAMP 16%
SPIRAL RAMP 16%
ALTERNATE SUB-LEVEL SHOWN DOTTED
ACCESS TO SUB-LEVEL
VENT RAISE
ASSAY BOUNDARY FOR MINING PURPOSES.
NOTE:
LIMIT OF MINING AREA FOR SELECTED GRADE MINING AREA. CROSSCUTS AND MINE DEVELOPMENT WOULD BE LIMITED TO THIS AREA. FOR COMPLETE MINING OF THE STOCK, CROSS CUTS AND MINE DEVELOPMENT WOULD BE EXTENDED AS SHOWN.
METERS
KERR ADDISON MINES LTD
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B.C.
GENERAL ARRANGEMENT
140 LEVEL
SUB-LEVEL CAVING LAYOUT
SCALE - 1:500
DATE - OCT., 1987
DRAWN BY - P.H.
DESIGN BY - N.C.C.
NTS - 92 H/5
REVISED -
DWG. No.
BM - 201 - 1

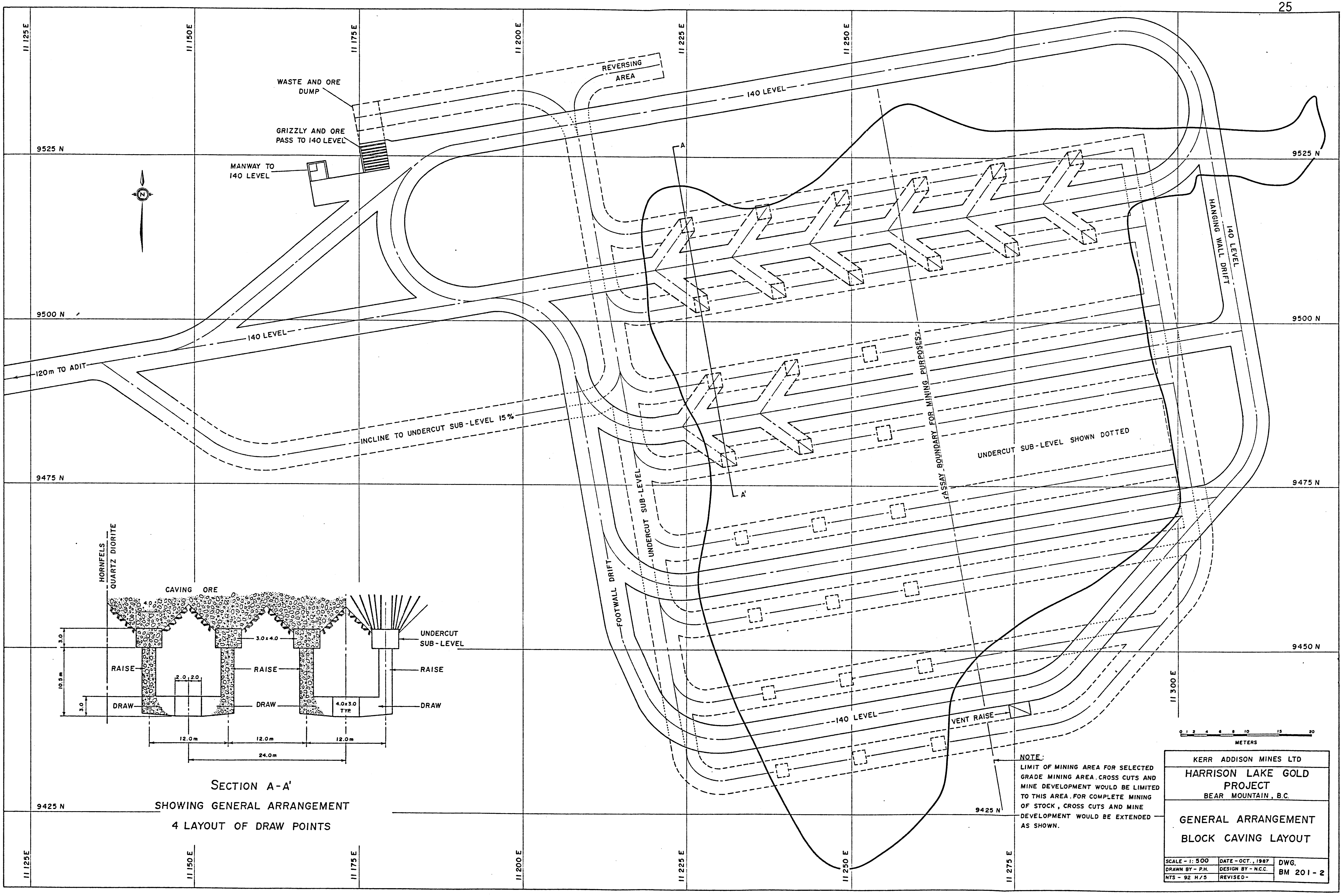


HORNFELS
QUARTZ DIORITE
WASTE
BLASTED ORE
CAVING ORE
FAN READY FOR BLASTING
ORE READY FOR LOADING
ORE LOADING IN PROGRESS
INTACT ORE
12.5 m
12.5 m
3 m
50°
50°
3 x 4 m TYP.
15.0 m
15.0 m
15.0 m
7.5 m
7.5 m
7.5 m
SECTION A - A'
MINING METHOD
SEE DWG. BM - 201 - 1
200 m
190 m
180 m
170 m
160 m
150 m
140 m
11 200 E
11 250 E
11 300 E
CAVING WASTE
FOOTWALL DRIFT TO ORE PASS
ORE
ORE
BROKEN ORE
TO RAMP
LOADING
ORE
CHARGING AND BLASTING
ORE
FAN DRILLING
SUB LEVEL
ORE
SLOTTING START
TO RAMP
DEVELOPMENT
FOOTWALL DRIFTS TO ORE PASS
140 LEVEL
SECTION B - B'
SCHEMATIC
TO SHOW
MINING SEQUENCE
SEE DWG. BM - 20 - 1
0 2 4 6 8 10 15 20
METERS
KERR ADDISON MINES LTD
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B.C.
SECTIONS
A-A' AND B-B'
SUB-LEVEL CAVING
SCALE - 1:500
DATE - OCT., 1987
DWG. No.
DRAWN BY - P.H.
DESIGN BY - N.C.C.
BM 200-2
NTS - 92 H 5
REVISED -

which entries to the mining area sub-levels are made. On each sub-level a similar footwall drift parallel to the strike of the ore body from which working crosscuts are driven across the ore body to the limits of the mineralization. An ore pass 2.0 x 2.0 is constructed to allow passing of development and production ore from each sub-level down to the main ore pass on the 140 Level. A 12" grizzly is located on that level to reduce any oversize entering the main ore pass to the 47 Level. A 2.0 x 2.0 vent raise is driven through to surface to assist in provision of adequate ventilation in the mining area.

The ramp continues to provide access to the uppermost, near surface, sub-levels. In this upper area, some minor variations in the generalized layout are required.

3.3.2 Block Caving Method - The basic development plan for the 140 Level and 47 Level haulages is basically similar to that described for the Sub-level Caving system. The arrangement of manway and ore-pass is similar. The main haulage 140 Level is continued to a point near the footwall of the ore body from which a footwall drift is driven parallel to the general strike of the ore body, from which crosscuts are driven to traverse the designated mineralized zone to intercept the hanging wall drift. The footwall drift continues along the southern perimeter of the ore zone to become the hangingwall drift continuing along the northern perimeter of the ore zone to connect with the ore-pass. A connection is made from the ore-pass back to the footwall drift and to connect with the main 140 Level crosscut. These connections will facilitate movement of scooptrams when hauling ore to the main ore pass,


11 125 E
11 150 E
11 175 E
11 200 E
11 225 E
11 250 E
11 275 E
11 300 E
9525 N
9500 N
9475 N
9450 N
9425 N
WASTE AND ORE DUMP
GRIZZLY AND ORE PASS TO 140 LEVEL
MANWAY TO 140 LEVEL
REVERSING AREA
140 LEVEL
120m TO ADIT
INCLINE TO UNDERCUT SUB-LEVEL 15%
A
A'
ASSAY BOUNDARY FOR MINING PURPOSES
UNDERCUT SUB-LEVEL SHOWN DOTTED
HANGING WALL DRIFT
FOOTWALL DRIFT
UNDERCUT SUB-LEVEL
VENT RAISE
HORNFELS
QUARTZ DIORITE
CAVING ORE
UNDERCUT SUB-LEVEL
RAISE
DRAW
3.0 x 4.0
4.0 x 3.0 TYP.
2.0
10.5m
3.0
12.0m
24.0m
SECTION A-A'
SHOWING GENERAL ARRANGEMENT
4 LAYOUT OF DRAW POINTS
NOTE:
LIMIT OF MINING AREA FOR SELECTED GRADE MINING AREA. CROSS CUTS AND MINE DEVELOPMENT WOULD BE LIMITED TO THIS AREA. FOR COMPLETE MINING OF STOCK, CROSS CUTS AND MINE DEVELOPMENT WOULD BE EXTENDED AS SHOWN.
METERS
0 1 2 4 6 8 10 15 20
KERR ADDISON MINES LTD
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B.C.
GENERAL ARRANGEMENT
BLOCK CAVING LAYOUT
SCALE - 1:500
DATE - OCT., 1987
DRAWN BY - P.H.
DESIGN BY - N.C.C.
NTS - 92 H/5
REVISED -
DWG. BM 201-2

or waste to the waste dump on surface near the 140 Level adit.

The crosscuts from the footwall drift to the hanging wall drift are on 24 meter centres. From these crosscut, short stub drifts 3.0 x 3.0 meters are driven a distance up to the undercut sub-level, a vertical distance of 10.5 meters. These drawpoints are reinforced and strengthened by a pattern of rock bolting and shot creting to avoid deterioration due to large tonnages passing through and secondary blasting of large pieces of ore. Access to the undercut sub-level is maintained from a 15 percent incline driven from the 140 Level crosscut. A footwall sub-level drift is located adjacent to the mineralized zone and runs parallel to the general strike of the ore body. A series of crosscuts on 12 meter centres traverse the mineralization. These are connected at each end to facilitate access and ventilation during the development period.

## 3.4 Mining Plan

3.4.1 Sub-level Caving - On completion of the development program for a minimum of 4 sub-levels, fan hole drilling is commenced on a vertical basis from the starting slot. Drilling is done with an Atlas Copco electric-hydraulic drill using 2" bits, the fan angle is approximately 80 degrees from the horizontal. Double fan blasts were conducted at Craigmont using a 1 meter burden, however, practice in most mines indicates a burden 1.8 meters. Good fragmentation and recovery are achieved in those circumstance, although powder factors may be high. Blasting is normally done one fan at a time. Blasting is done with ANFO. Only the "swell" or 40 percent of the broken ore is mucked at this time, leaving the remaining 60 percent as a fill material until all the ore in the block is broken and at that time the remaining ore is extracted, thus minimizing any potential dilution. The ore is trammed using ST4 scooptrams, the diesel engines de-rated to 105 hp to minimize ventilation requirements, to the ore pass on each sub-level. The ore is passed through to the 140 Level where the oversize material is reduced to a minus 30 centimeter dimension on a grizzly on the 140 Level. The ore continues down the orepass to the 47 Level.

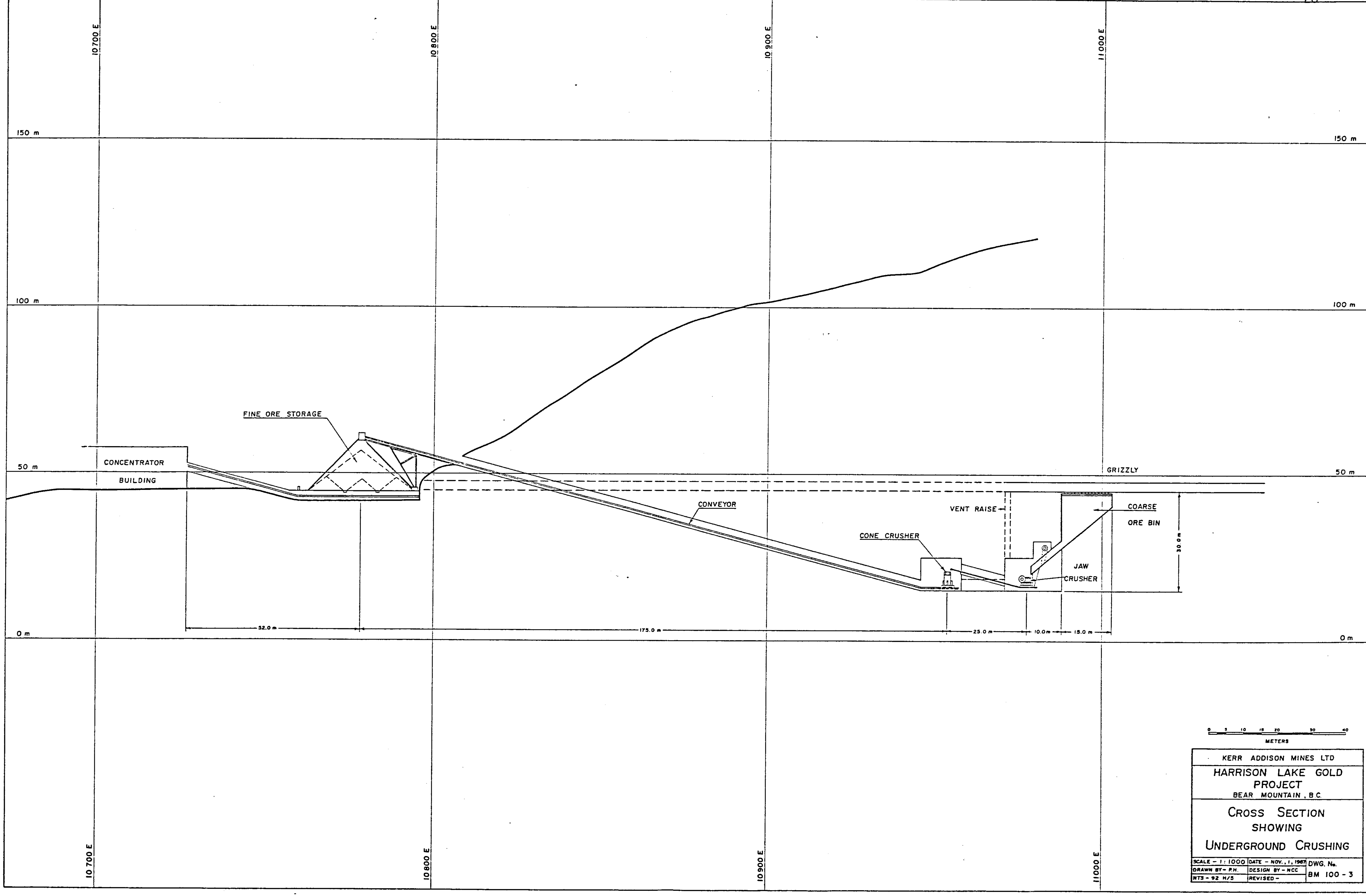
3.4.2 Block Caving - On completion of the development previously outlined, drilling from the sub-level to prepare cones over the draw raises is commenced, using an electric hydraulic drill, drilling 2 inch diameter holes and blasted with ANFO explosives. The direction of vertical is diagonally across the ore body, once started the undercutting proceeding rapidly as possible. Drawing of the ore from the finger raises usually requires some secondary blasting due to possible large sized ore material from the caved area. The ore is transported by ST4 scooptrams from the draw points to the ore pass on the sub-level. The ore is reduced in size to minus 30 centimeters one direction and passed through to the main ore pass to the 47 Level.

### 3.5 Ore Transportation

* 3.5.1 Surface Crushing - The ore would be loaded from an air operated chute on the main ore pass on the 47 Level and transferred by diesel mine truck to the 200 tonne capacity coarse ore bin on surface, a haul distance of 440 meters.

Daily tonnage ore hauled - 1400 tonnes

Tonnes per shift $\frac{1400}{2}$ = 700 tonnes.


10700 E
10800 E
10900 E
11000 E
150 m
100 m
50 m
0 m
FINE ORE STORAGE
CONCENTRATOR
BUILDING
GRIZZLY
CONVEYOR
VENT RAISE
COARSE
ORE BIN
CONE CRUSHER
JAW
CRUSHER
30.0 m
52.0 m
175.0 m
25.0 m
10.0 m
15.0 m
METERS
KERR ADDISON MINES LTD
HARRISON LAKE GOLD
PROJECT
BEAR MOUNTAIN, B.C.
CROSS SECTION
SHOWING
UNDERGROUND CRUSHING
SCALE – 1 : 1000
DATE – NOV., 1, 1987
DRAWN BY – P.H.
DESIGN BY – NCC
NTS – 92 H/5
REVISED –
DWG. No.
BM 100 - 3

Cycle Time: load — 2.0 minutes

haul average speed 5 mph

440 feet per minute

travel time $\frac{440 \times 3.28}{440}$ = 3.3 minutes

dump — 1.0 minutes

using 2 vehicles, time lost in passing at mid point — 2.0 minutes

return trip average speed 6 mph
528 feet per minute
travel time $\frac{440 \times 3.28}{528}$ = 2.7 minutes

Total cycle time — 9.0 minutes

Availability 80% = 48 minutes

Cycles per hour $\frac{48}{9}$ = 5.3 trips per hour

Recommended vehicle - Jarvis Clark JDT413, 13 ton end dump, capacity = 11.80 tonnes

Tonnes per vehicle per shift: 11.8 x 5.3 x 7.0 hrs. = 438 tonnes

Total tonnage per day: 2 vehicles, 2 shifts = 1752 tonnes
use 2 trucks per shift

* Due to environmental considerations, air and noise pollution, surface crushing is not being recommended at this time.

3.5.2 Underground Crushing - The ore is transferred from the orepass through an air operated chute gate on the main orepass on 47 Level. The ore is trammed in a diesel powered rear dump mine truck similar to the Jarvis Clark JDT413, to the coarse ore bin, a distance of 200 meters.

Daily tonnage per shift $\frac{1500}{2}$ = 750 tonnes

Cycle Time: Load — 2.0 minutes

haul average speed 5 mph

440 feet per minute

travel time $\frac{200 \times 3.28}{440}$ = 1.5 minutes

dump — 1.0 minutes

return trip average speed 6 mph
528 feet per minute
travel time $\frac{200 \times 3.28}{528}$ = 1.3 minutes

Total cycle time — 5.8 minutes
(say 6.0 minutes)

Availability 80% = 48 minutes

Cycles per hour $\frac{48}{6}$ = 8 trips per hour

Recommended vehicle Jarvis Clark JDT413, 13 ton end dump

capacity = 11.8 tonnes

Tonnes per shift 11.8 x 8 x 7.5= 755 tonnes per shift
use one truck per shift

The ore is dumped into a 1500 tonne capacity coarse ore storage bin. The ore is fed from the coarse ore storage bin by a Ross chain feeder into a 30" x 42" jaw crusher. The ore is crushed to minus 4", and fed to a 32 conveyor belt, length 27 meters. Conveyor No. 1 is 27 meters long and discharges into a 4½ foot short head cone crusher. The ore is reduced to minus ½" and fed onto a 30 inch conveyor. Conveyor No. 2 transports the fine ore up a 17 degree incline and discharges into the fine ore bin. The fine ore bin has 10,000 capacity of which 3,000 tonnes are in live storage.

## 3.6 Mine Ventilation

3.6.1 Sub-level Caving - In the sub-level caving method, ventilation is relatively simple. Primary mine ventilation is provided by 75,000 cfm vane axial fan exhausting from the decline where it connects through to surface. Ventilation in the various sub-level working area is maintained by fans and vent pipes to the working faces and blasting areas. A vent raise is located on the 140 Level which continues through to surface, a 25,000 cfm fan located on Level 140 will provide additional ventilation to the working areas. The main haulage will thus be incast and contaminated air removed from the workings as expeditiously as possible.

3.6.2 Block Caving - In the block caving mining method, the adequate ventilation becomes more difficult as all operations, blasting and tramming, takes place on the 140 Level and the undercut sub-level. Primary mine ventilation is provided by a 75,000 cfm axial vane fan located at the portal of the 140 Level which is closed by doors forcing the air into the draw point areas where secondary blasting of oversize muck is taking place. Contaminated air is discharged through to surface through a vent raise equipped with a 75,000 cfm axial vane fan located on surface.

3.6.3 Underground Crushers - The underground crushers are equipped with dust collectors with contaminated air passing being forced out the conveyor decline by an axial vane fan located on the 47 Level at the access raise from the primary crushing chamber.

## 3.7 Manpower Requirements Mine

### 3.7.1 Sub-level Caving

| | |
|---|---|
| **Staff** | |
| Mine Superintendent | 1 |
| Shift Boss | 2 |
| Maintenance Foreman | 1 |
| Chief Mine Engineer | 1 |
| Mine Surveyor | 1 |
| Technician | 2 |
| Chief Geologist | 1 |
| Sampler | 1 |
| Mine Clerk | 1 |
| Sub Total | 11 |
| **Mine Operating Labor, hourly rate** | |
| Development miners | 8 |
| Long Hole Drillers & Blasters | 4 |
| Mucking Crew | 8 |
| Tramming Crew | 2 |
| Sub Total | 22 |
| **Mine Maintenance & Service Labor** | |
| Electricians | 2 |
| Diesel Mechanics | 2 |
| Welder | 1 |
| Timber men | 2 |
| Changehouse & Lamproom | 1 |
| Sub Total | 8 |
| **Crushing** | |
| Operators | 4 |
| Sub Total | 4 |
| Total Underground Manpower Requirement Sub-level Caving | 45 |

3.7.2 Block Caving

Staff

| | |
|---|---|
| Mine Superintendent | 1 |
| Shift Boss | 2 |
| Maintenance Foreman | 1 |
| Chief Mine Engineer | 1 |
| Mine Surveyor | 1 |
| Technician | 2 |
| Chief Geologist | 1 |
| Sampler | 1 |
| Mine Clerk | 1 |
| Sub Total | 11 |

Mine Operating Labor, hourly rate

| | |
|---|---|
| Development miners | 4 |
| Blasters draw hole | 8 |
| Mucking Crew | 6 |
| Tramming Crew | 2 |
| Sub Total | 20 |

Mine Maintenance & Service Labor

| | |
|---|---|
| Electricians | 2 |
| Diesel Mechanics | 2 |
| Welder | 1 |
| Timber men | 6 |
| Changehouse & Lamproom | 1 |
| Sub Total | 12 |

Crushing

| | |
|---|---|
| Crushermen | 4 |
| Sub Total | 4 |

| | |
|---|---|
| Total Underground Manpower Requirement Block Caving | 47 |

# 4.0 MILLING

## 4.1 Review of Metallurgical Information

During 1986, laboratory metallurgical testing was performed on diamond drill core.

This investigation, conducted by Coastech Research, of North Vancouver, determined that material from the deposit is amenable to processing using conventional technology consisting of gravity and flotation concentration, as well as cyanidation.

The testing indicated three technical options, as follows:

(1) gravity concentration followed by cyanidation
(2) gravity concentration followed by flotation concentration and sale of the flotation concentrate
(3) gravity concentration followed by flotation concentration followed by cyanidation of the flotation concentrate.

This work determined that Au recovery in the high 80's to low 90's is attainable, and there did not appear to be any technical deterents to the processing of this material.

Part of this study included a 50 kg table gravity concentration test performed at Sando Research, Delta, B.C., under the direction of Kerr Addison and results reviewed by Coastech.

The testing consistently indicated that a gravity recovery of +50% was achievable, although the ratios of concentration were quite low, as tested.

During the period, August to November, 1987, approximately 1,000 tonnes of "ore" from the underground development was processed through a gravity + flotation pilot mill. This plant, owned and operated by Coastech Research, consisted of crushing, grinding, and recovery circuits which utilized gravity and flotation concentration.

Piloting was performed in an attempt to derive a correlation between the grade established by underground sampling based upon diamond drill, face, and muck samples and a grade determined by calculation from metallurgical products. The exclusion of cyanidation was based upon environmental permitting pragmation rather than any apparent superiority of the other unit operation. The pilot plant, which operated at 700 kg/hr, was sampled regularly, and metallurgical statements were prepared for each of the 9 test samples.

Surprisingly, although the overall gravity + flotation recovery was consistent with the results predicted from the bench scale testing, the distribution in recovery was significantly different, as follows:

| Unit Operation | Bench Scale | Piloting |
|---|---|---|
| Gravity recovery | 55 | 20 |
| Flotation | 37 | 72 |
| Total | 92 ** | 92 |

** - Based upon an estimated 3.0 g/t feed grade.

In summary, the plant operating metallurgy is anticipated to be as follows:

| Product | Wt % | Au g/t | Au Distribution |
|---|---|---|---|
| Gravity concentrate | | | 20 |
| Cyanidation Bullion | | | 68.2 (1) |
| Total Saleable | | | 88.2 |
| Tailing - cyanidation | 2.0 | 5.4 | 3.6 |
| Tailing - flotation | 98.0 | .25 | 8.2 |
| Feed | 100.0 | 3.0 | 100.0 |

Samples of the pilot plant flotation concentrate have been leached by the Hawthorn Laboratory. This investigation determined that the material responded well to cyanidation, with recoveries of 95%.

As expected, the flotation concentrate which is predominantly pyrrhotite, oxidizes readily. The plant will need to be operated in a manner so that the flotation concentrate is not exposed to air, since there is a significant risk of spontaneous combustion. Even minor oxidation will increase both the lime and cyanide consumption several fold.

## 4.2 Process Design Criteria

### 4.2.1 Production Criteria

| | | |
|---|---|---|
| Annual processing rate | 350,000 | mt |
| Average daily tonnage | 1,000 | mt |
| Annual operating time | 350 | days |
| Plant availability | 96 | % |
| Average head grade (assumed) | 3.0 | g/t Au |
| Recovery | | |
| Gravity | 20 | % |
| Flotation + Cyanidation | 68.2 | % |
| Total | 88.2 | % |
| Production | | |
| Daily | 2.6 | kg Au |
| | 85.2 | oz Au |
| Annualy | 927.5 | kg Au |
| | 29,800 | oz Au |
| Plant tailing grade | | |
| Flotation tailing | .25 | g/t Au |
| Leach tailing | 5.4 | g/t Au |
| Flotation concentrate grade | 107 | g/t Au |

### 4.2.4 Crushing

| | | |
|---|---|---|
| Mine ore passing size | 600 | mm |
| | 24 | mm |
| Ore moisture | 5 | % |
| Ore specific gravity | 2.8 | |
| Ore bulk density | 1.9 | mt/ cu m |
| | 100 | #/cu ft |
| Coarse ore storage | 1,500 | mt |
| Crushing rate | 250 | mth |
| Crushing schedule | 1 shift / day / 5 days / week | |
| Crushing product size 80% passing | 12 | mm |
| | 0.5 | mm |

4.2.3 Fine Ore Storage

| | |
|---|---|
| Capacity - live | 3,000 mt |
| Capacity - Total | 10,000 mt |

4.2.4 Grinding

| | |
|---|---|
| Work Index - rod mill *** | 25 kwh/mt |
| Work Index - ball mill *** | 25 kwh/mt |
| *** subject to confirmation | |
| Product size - rod mill | 1,500 micron |
| Product size - cyclone overflow | 75 micron |

4.2.5 Gravity Circuit

| | |
|---|---|
| Au recovery | 20 % |
| Au production - daily | .6 kg |
| | 19.3 oz |
| - annual | 210 kg |
| | 6,800 oz |
| Concentrate grade | 30,000 g/t Au |
| Concentrate production | 20 kg/day |

4.2.6 Flotation

| | |
|---|---|
| Feed density | 40 % solids |
| Retention time | 20 minutes |
| Cleaner stages | 1 |
| Reagent requirements | |
| Potassium amyl xanthate (PAX) | 15 g/t |
| Methyl isobutyl carinol (MIBC) | 100 g/t |
| Ratio of concentation | 50:1 |
| Concentrate production - daily | 20 mt |
| - annual | 7,300 mt |
| Concentrate grade | 107 g/t Au |
| Concentrate SG | 4.5 |

4.2.7 Cyanidation

| | |
|---|---|
| Schedule 7 days/ week: 52 wk/year | |
| Au recovery | 95 % |
| Au production - daily | 2.05kg |
| | 65.8 oz |
| - annual | 716 kg |
| | 23,000 oz |
| Reagent requirements | |
| Sodium cyanide (NaCN) | 10 kg/t conc |
| | .2 kg/t ore |

| | |
|---|---|
| Lime ($CaOH_2$) | 10 kg/t conc |
| | .2 kg/t ore |
| Retention time | 36 hr |
| Stages | 6 |
| Carbon loading - Au | 7,000 g/t |
| | 200 oz/t |
| - Ag | g/t |
| | oz/t |
| Screen type - | launder |

4.2.8 Carbon Stripping

| | |
|---|---|
| Type | pressure |
| Schedule | 5 days/wk |
| Au removal | 2.05 kg |
| | 65.8 oz |
| Batch size | .41 mt |
| Cycle time allowance | 24 hr |
| Stripped carbon | 240 g/t Au |
| | 7 oz/t Au |

4.2.9 Electrowinning

| | |
|---|---|
| Cell type | Rectangular/Zadra |
| Cathodes | +12 |
| Solution retention time | 60 minutes |
| Schedule | To suit stripping |

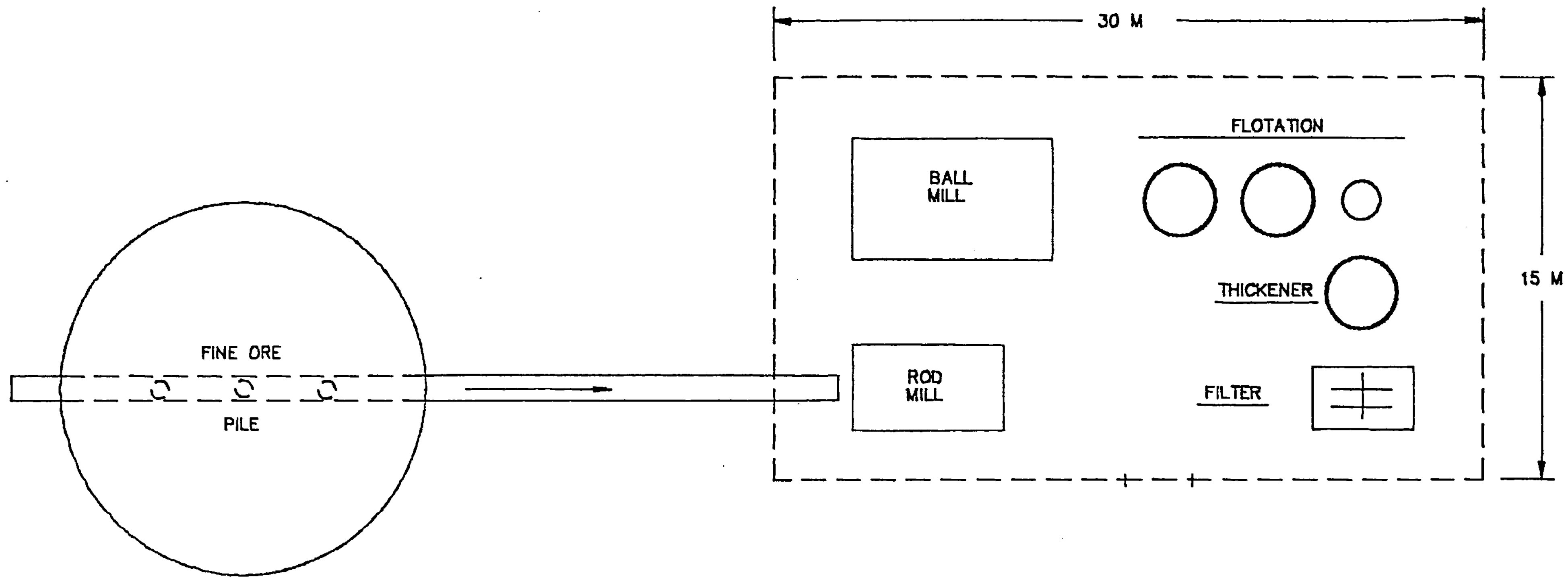
4.2.10 Carbon Regeneration

| | |
|---|---|
| Furnace type | vertical/tube/electric |
| Capacity | 25 kg/hr |
| Temperature | 600-700 deg C |
| Schedule | As required |

4.2.11 Tailing Disposal

| | |
|---|---|
| Terminal density | 75% solids |

10062




| | |
|---|---|
| G. Hawthorn – P. Eng.<br>Mineral Processing Engineer | KERR ADDISON<br>HARRISON LAKE<br>CONCENTRATOR GENERAL ARRANGEMENT |
| Date: 87–11–19 | |
| Drawn: Nick LeForte | |
| Scale: None | PAGE 4 OF 4 — BM 401 - I — Rev. |
| Approved: | |

## 4.3 Process Description

Because of the preliminary nature of this investigation, it is premature to suggest only a single flowsheet option.

The environmental and recreational sensitivity of the minesite, almost certainly will necessitate some compromises in both costs and gold recovery.

If the site was somewhat more remotely located, and had the availability of an ideal tailing disposal site, the optimum process flowsheet would consist of gravity concentration and straight cyanidation.

Although this circuit would maximize gold recovery, at an acceptable capital and operating cost it would do so only by ignoring several mineralogical and site constraints, as follows:

(1) The ore contains pyrrhotite, a readily oxidized iron sulphide mineral, which is poorly viewed from the perspective of acid generation potential.

(2) The installation of a cyanidation plant on the edge of Harrison Lake, although technically feasible, will likely meet with considerable political and social opposition.

(3) The use of Harrison Lake for tailing disposal is likely to be technically feasible. However, from a pragmatic viewpoint, it will be much easier to obtain permitting for the disposal of tailing from a flotation concentrator than from a straight cyanidation plant no matter how many assurances can be offered to the public and the government.

The alternative of using a tailing site other than Harrison Lake is neither technically attractive nor inexpensive. The only suitable land sites would involve either surface ore haulage or tailing pumping through a designated park.

Therefore, the recommended process flowsheet consists of gravity and flotation concentration at the minesite followed by concentrate cyanidation at a second site in the Aggasiz area in a location which provides a higher level of environmental protection than does the proposed millsite adjacent to Harrison Lake.

It is our opinion that this proposal, although somewhat more costly from a capital and operating perspective than the preferred gravity + straight cyanidation, gives due recognition to the site conditions. It is anticipated that the proposed flowsheet will result in a loss in gold recovery of approximately 5% ($2.80/tonne), but a significant portion of this will be recovered in decreased operating costs associated with the supply of NaCN, and the operation of the inevitable cyanide destruction circuit.

From a comminution perspective, although the ore can be readily processed in a grinding circuit consisting of a rod mill and a ball mill, the ore appears to have physical characteristics which may make semi-autogenous grinding (SAG mill + ball mill) an attractive alternative. At this point, the proposal recommends the installation of a rod mill-ball mill grinding circuit. However, as the project advances, the option of SAG mill-ball mill grinding must be considered, since this option can potentiall reduce the capital cost and may reduce operating costs somewhat.

The proposed process flowsheet, therefore, is as follows:

The as-mined ore will be crushed underground to -12mm (½"), and belt conveyed to a covered conical fine ore stockpile located on surface. Although the climate does not indicate a need for covering the pile, its use is recommended to reduce dusting.

Fine ore will be withdrawn from the pile using tube feeders onto a belt conveyor which will feed the grinding circuit. The rod mill-ball mill circuit will operate with the rod mill in open circuit and the ball mill closed circuited with hydrocyclones.

A mineral jig will be installed at the discharge end of the ball mill for primary gravity gold recovery. A Wilfley table will be used for upgrading the jig concentrates into either a saleable product or one which can be smelted on-site into bullion.

The cyclone overflow discharges to a flotation circuit which will consist of a rougher and single cleaner stage. Since the concentrate will be cyanided nearby, the emphasis on the flotation circuit will be to maximize gold recovery rather than maximum concentrate grade.

The daily 20 tonnes of flotation concentrate will be dewatered in a thickening + filtration circuit and trucked to a second site for cyanidation. It is anticipated that the cyanidation plant will be located within 10 km of the minesite.

Particular attention must be paid to maintain the pyrrhotite concentrate in an alkaline state to avoid oxidation and possible spontaneous combustion, either of which will substantially increase the consumption of NaCN and lime, and the cost of cyanide destruction.

The cyanide circuit will utilize carbon-in-leach (CIL) cyanidation to produce bullion. Although the daily production of flotation concentrate is sufficiently small that the circuit could be operated for only 5 days per week, the need for security indicates that continuous coverage be provided at the site. It is, therefore, suggested that the cyanidation plant be operated continuously, and that considerable attention be given to plant security. This would likely consist of both a secure compound, and camera surveillance to the minesite.

The proposed flowsheet is as follows:

The dewatered flotation concentrate will be discharged to a 50 ton surge hopper, from which the concentrate can be continuously drawn and fed to a preaeration tank immediately ahead of the first leaching tank. The 6 CIL tanks installed in series will provide a total of 36 hr. of contact time. This is anticipated to be sufficient for both gold leaching and carbon adsorption.

The leached residue will be continuously filtered on a disk filter so that the barren solution can be recycled, and the dewatered leached tailing be passed through a cyanide destruction circuit.

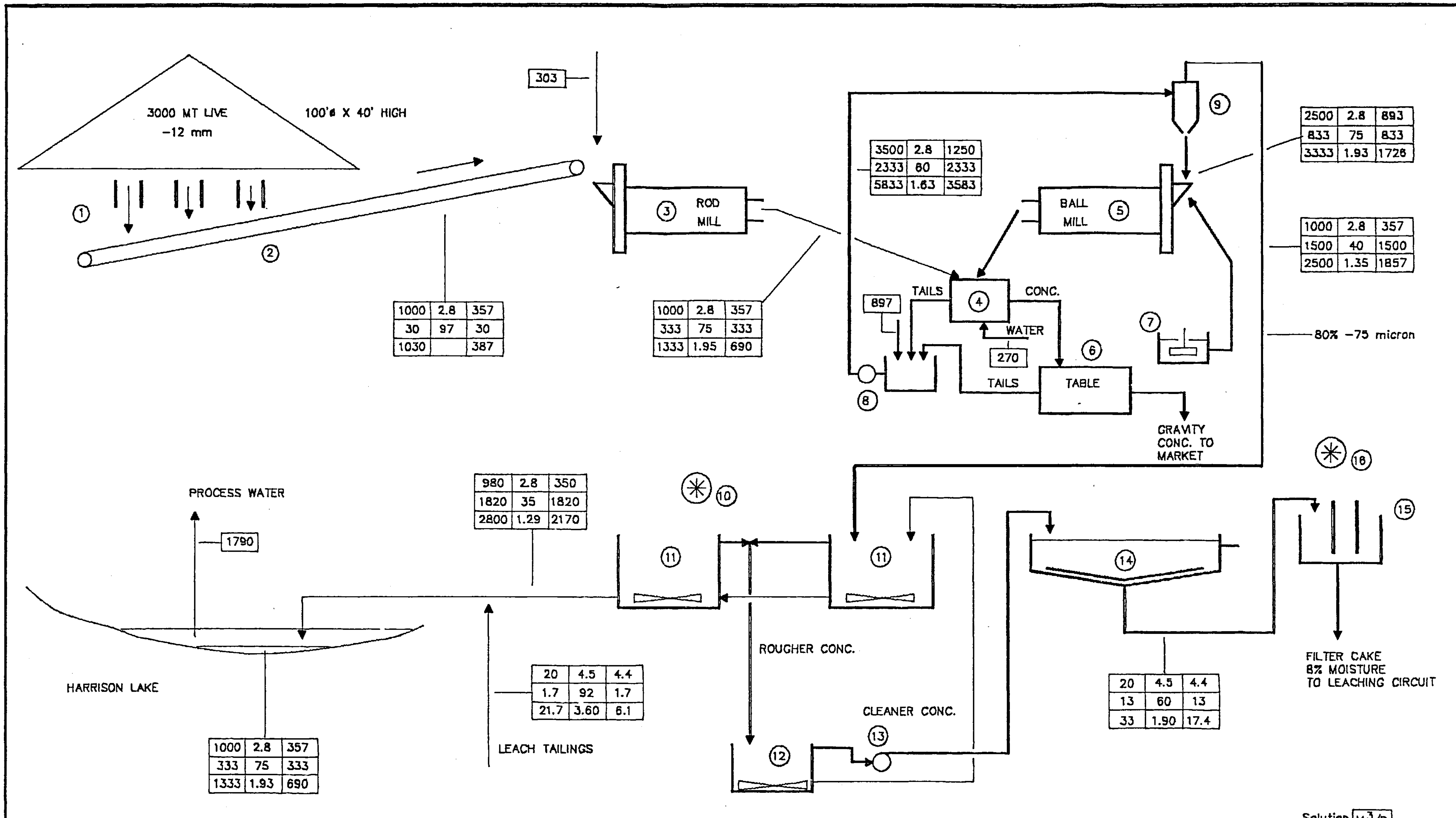
After cyanide destruction, the filter cake will be back-hauled to the millsite using the concentrate haulage truck. At the millsite, the leached tailing will be discharged to a bin from which it will be belt conveyor fed into the flotation tailing line for discharge into Harrison Lake below the 50 m. elevation.

The laboratory testing has indicated that providing, the concentrate is kept from oxidizing in storage, and is preaerated prior to cyanidation, the dissolution of iron can be controlled.

It is anticipated that by avoiding the oxidation of pyrrhotite, the dissolution of Fe can be kept under control, in which case there will be no need to discharge solutions from the plant. The only chemical bleed will be in the form of leached tailing cake moisture. If this does not occur, the possibility of needing to discharge a further 7% on the solution daily will be provided by the installation of an evaporator with a capacity of 2 mt/day.

Eventually, it may be possible to demonstrate to the satisfaction of the environmentalists that this plant can be operated without any significant environmental risk, in which case it may be possible to transfer the plant and equipment to the millsite, to reduce operating costs.

The process flowsheets are illustrated in detail in drawings BM-400-1 and BM-400-2 by G. Hawthorn, P.Eng., Mineral Processing Engineer, Kerr Addison Harrison Lake Gold Project, Bear Mountain, B.C.




| Item | Qty. | Description | HP | Item | Qty. | Description | HP | Item | Qty. | Description | HP | Item | Qty. | Description | HP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | TUBE FEEDER | – | 14 | 1 | 10' DIA. THICKENER | 2 | 27 | | | | 40 | | | |
| 2 | 1 | 24"X CONVEYOR | 5 | 15 | 1 | 6' DIA.X2 DISK FILTER | 3 | 28 | | | | 41 | | | |
| 3 | 1 | 7'X10' ROD MILL | 200 | 16 | 1 | 500 CFM VAC. PUMP | 25 | 29 | | | | 42 | | | |
| 4 | 1 | 24"X36" DUPLEX JIG | 2 | 17 | | | | 30 | | | | 43 | | | |
| 5 | 1 | 12' X15' BALL MILL | 1000 | 18 | | | | 31 | | | | 44 | | | |
| 6 | 1 | 4'X8' SHAKING TABLE | 1 | 19 | | | | 32 | | | | 45 | | | |
| 7 | 1 | 2.5"GAL.SUMP PUMP | 5 | 20 | | | | 33 | | | | 46 | | | |
| 8 | 2 | 8 X 6 SLURRY PUMP | 2\|25 | 21 | | | | 34 | | | | 47 | | | |
| 9 | 2 | 18" CYCLONES | | 22 | | | | 35 | | | | 48 | | | |
| 10 | 1 | BLOWER (FLOT. AIR) | 50 | 23 | | | | 36 | | | | 49 | | | |
| 11 | 2 | MX10 MAX.FLOT MACH | 2\|10 | 24 | | | | 37 | | | | 50 | | | |
| 12 | 1 | MX6 MAX.FLOT MACH. | 5 | 25 | | | | 38 | | | | 51 | | | |
| 13 | 1 | 1.5" VERTICAL PUMP | 2 | 26 | | | | 39 | | | | 52 | | | |

Solution M3/D

| | MTD | | M3/D |
|---|---|---|---|
| Solids | | S.G | |
| Solution | | %S | |
| Slurry | | S.G. | |

G. Hawthorn – P. Eng.
Mineral Processing Engineer

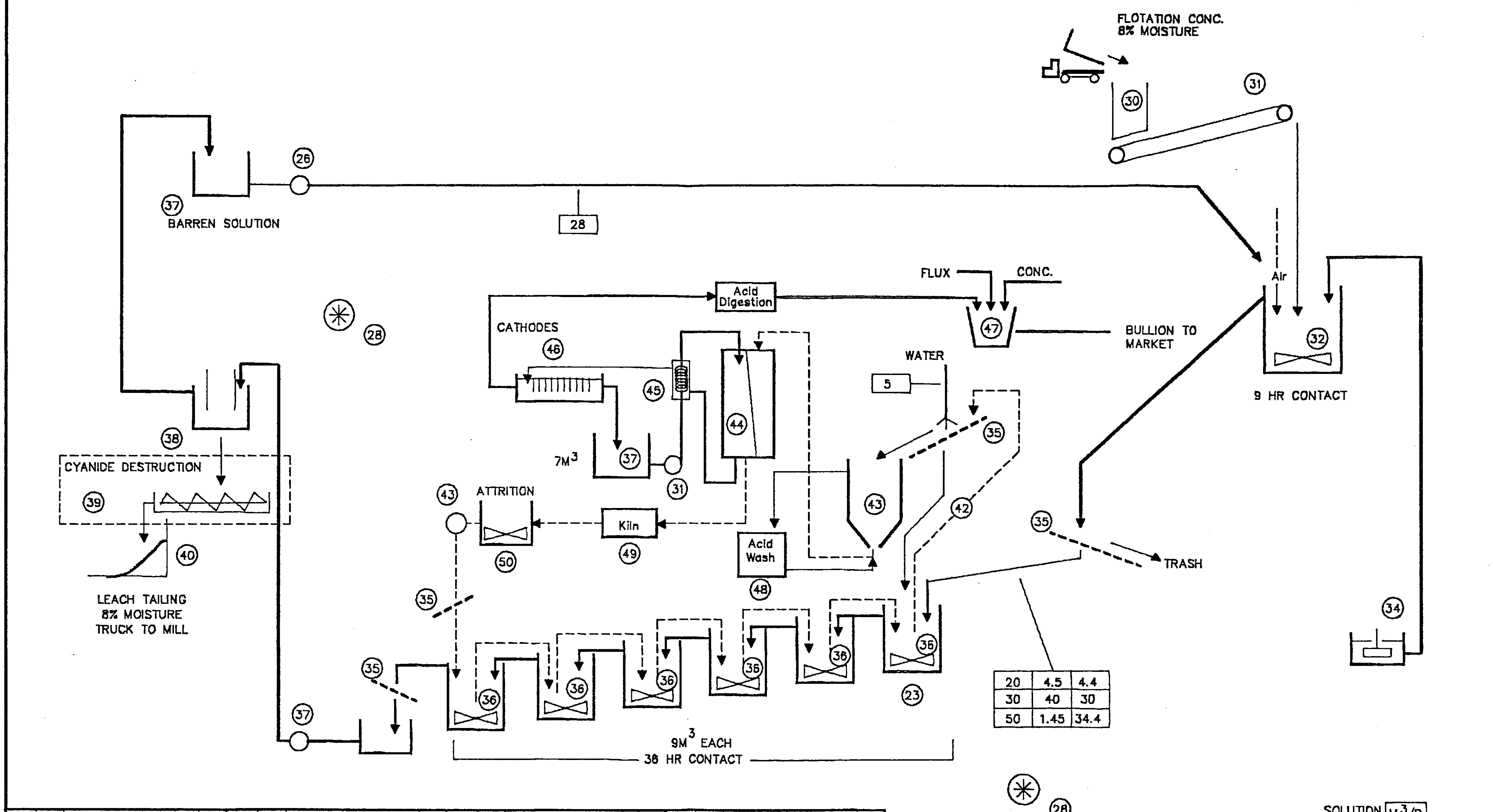
| | |
|---|---|
| Date | 87-11-19 |
| Drawn | Nick LeForte |
| Scale | None |
| Approved | |

# KERR ADDISON

## HARRISON LAKE

PROCESS FLOWSHEET – 1000 MTD

PAGE 1 OF 2 DWG. No. BM 400 – 1 Rev.




| ITEM | QTY. | DESCRIPTION | HP | ITEM | QTY. | DESCRIPTION | HP | ITEM | QTY. | DESCRIPTION | HP | ITEM | QTY. | DESCRIPTION | HP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 14 | | | | 27 | | | | 40 | 1 | 60 TONNE BIN | – |
| 2 | | | | 15 | | | | 28 | | | | 41 | 1 | L.P. BLOWER | 10 |
| 3 | | | | 16 | | | | 29 | | | | 42 | 1 | RECESSED IMP PUMP | 3 |
| 4 | | | | 17 | | | | 30 | 1 | 60 TONNE BIN | – | 43 | 1 | SURGE BIN | – |
| 5 | | | | 18 | | | | 31 | 1 | 24"X20' CONVEYOR | 2 | 44 | 1 | STRIP VESSEL | 40 |
| 6 | | | | 19 | | | | 32 | 1 | 7.5'DIA X8' TANK | 10 | 45 | 1 | HEAT EXCHANGER | – |
| 7 | | | | 20 | | | | 33 | | | | 46 | 1 | ELECTROLYTIC CELL | 5 |
| 8 | | | | 21 | | | | 34 | 1 | 1.5" SUMP PUMP | 1.5 | 47 | 1 | REFINERY FURNACE (PRO) | |
| 9 | | | | 22 | | | | 35 | 4 | 24"DIA. VIB. SCREEN | 4\|1 | 48 | 1 | ACID WASH SYSTEM | 2 |
| 10 | | | | 23 | | | | 36 | 6 | 7.5'øX8' TANK | 6\|10 | 49 | 1 | REACTIVATION FURN. | 30 |
| 11 | | | | 24 | | | | 37 | 1 | 1.5" VERT. PUMP | 1.5 | 50 | 1 | ATTRITIONING CELL | 2 |
| 12 | | | | 25 | | | | 38 | 1 | 6'øX2 DISC FILTER | 3 | 51 | | | |
| 13 | | | | 26 | | | | 39 | 1 | CYANIDE DEST. CIRC. | 3 | 52 | | | |

SOLUTION $M^3/D$

| | MTD | | $M^3/D$ |
|---|---|---|---|
| SOLIDS | | S.G | |
| SOLUTION | | %S | |
| SLURRY | | S.G. | |

G. Hawthorn – P. Eng.
Mineral Processing Engineer

| | |
|---|---|
| Date | 87-11-19 |
| Drawn | Nick LeForte |
| Scale | None |
| Approved | |

*KERR ADDISON*

HARRISON LAKE

CONCENTRATE CYANIDATION

PAGE 2 OF 2 DWG. No. BM 400-2 Rev.

## 4.4 Material Balance and Equipment Sizing

See Drawings BM-400-1 and BM-400-2 by G. Hawthorn, P.Eng., Mineral Processing Engineer, entitled Kerr Addison Harrison Lake Gold Project, Bear Mountain, B.C.

## 4.5 Plant Site Location and Description

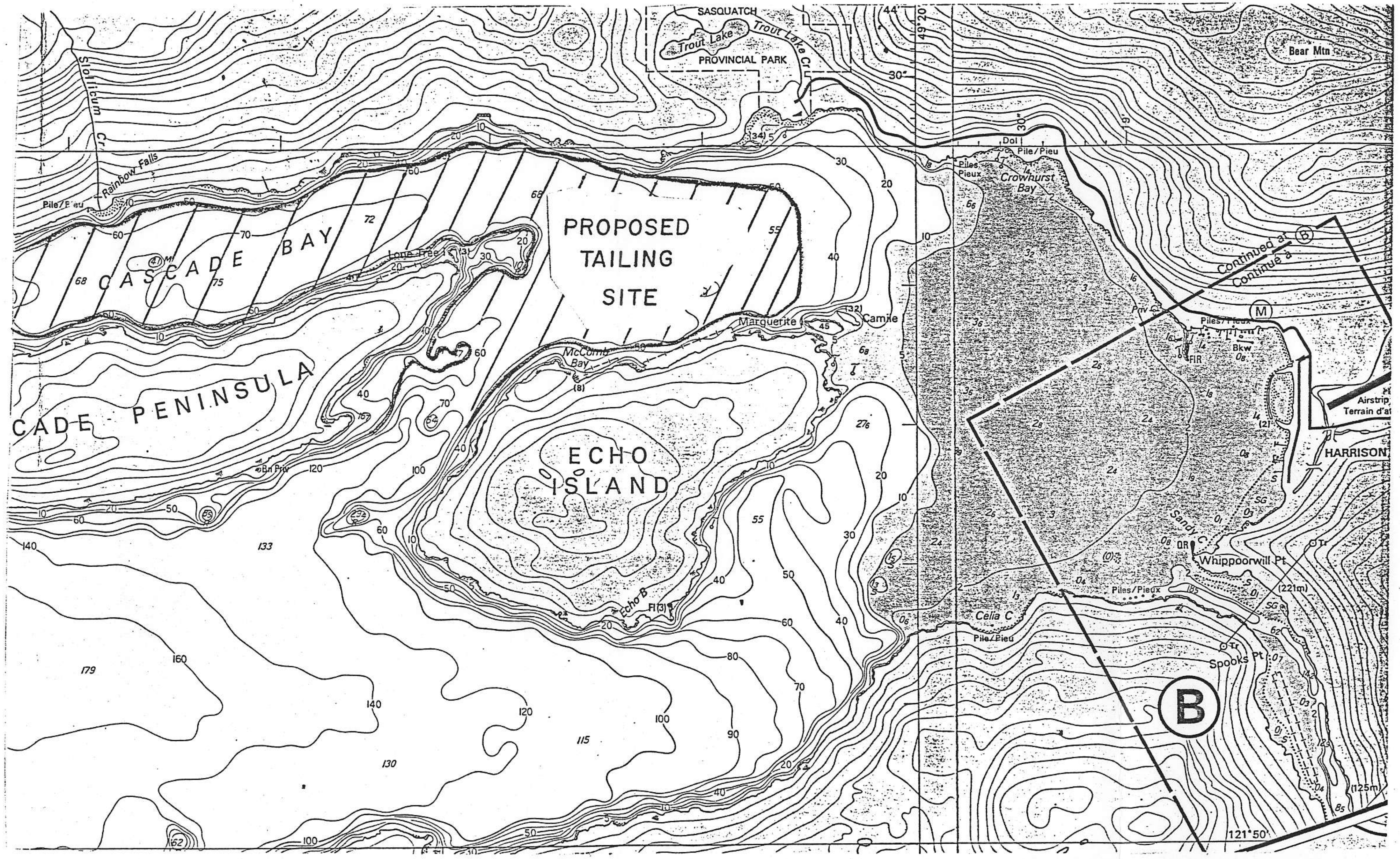
The proposed site for the gravity and flotation concentration facilities would be located near the minesite at an elevation of 45 meters above that of Harrison Lake. The distance from the intersection of Harrison Hot Springs road and Rockwell Street to the mill site is estimated at 5.3 kilometers. The mill site is located on a relatively flat area adjacent to the paved road, approximately 100 meters from Harrison Lake, see Drawing BM-100-1. The cyanidation of the concentrate would be accomplished at a second site in the Agassiz area in an un-designated location, which provides a higher level of environment protection than does the proposed mill site adjacent to Harrison Lake. Both properties must be acquired by purchase from others.

## 4.6 Tailing Disposal

The ideal location for the disposal of tailing from the operation is in Harrison Lake.

Principally, this has occurred because the contained pyrrhotite in both the ore and the tailing will tend to make the ore acid generating. To prevent this condition from ever being realized, the tailing will need to be disposed of in an oxygen depleted environment.

Harrison Lake provides this environment since the lake is very deep within 1 km of the minesite and provides almost




ALL DEPTHS IN METERS

| G. Hawthorn – P. Eng.<br>Mineral Processing Engineer | | KERR ADDISON<br>HARRISON LAKE<br>– TAILING DISPOSAL – |
|---|---|---|
| Date | 87-11-19 | |
| Drawn | Nick LeForte | |
| Scale | None | PAGE 3 OF 4 DWG. No. BM 405-1 Rev. |
| Approved | | |

infinite disposal capacity. In that small portion of the lake shown in Figure BM 405-I there is sufficient capacity to impound +50 million tonnes of tailing below the 50 meter depth. This is substantially in excess of the potential reserves of the mine.

The alternative of on-land disposal is unattractive since it would involve surface truck haulage of slurry pumping through Sasquatch Provincial Park.

Even though the proposed use of Harrison Lake for tailing disposal will meet with some resistance, we are satisfied that its use is both technically feasible, and ought to be reasonable well received by the permitting agencies.

The use of fresh water lake tailing disposal in B.C. has been technically demonstrated with the use of Kootenay Lake by both the Cominco Bluebell operation (+1,000,000 tonnes processed) and Yale Lead and Zinc (Ainsworth, +1,000,000 tonnes).

It is proposed that the tailing be discharged as a slurry using a submerged polyethylene line at a controlled gradient of approximately 1% to terminate approximately 1 km from the shore at a depth of 10 meters at a location in the lake where the depth exceeds 50 meters. The line should be graded to that from the shoreline it drops quickly to a depth below which it will not be a navigational hazard.

The location of the line will need to be well marked on surface so that it will not interfere excessively with sports fishermen, or vice versa.

## 4.7 Cyanide Destruction

Laboratory leaching of flotation concentrate has indicated that providing:

(1) the concentrate is prevented from oxidizing

(2) preaeration is included in the leaching circuit

(3) the solution is changed after preaeration

the cyanidation circuit will operate well, and the solution will not suffer from excessive fouling.

The anticipated barren solution analysis is as follows:

| Material | Analysis |
|---|---|
| Fe | 1900 ppm |
| Cu | 2 ppm |
| CN t | 4000 |
| CN Fe | 3800 |
| CN wa | $<$ 100 |
| CN free | 100 |
| pH | 10.5 |

The inevitable cyanide destruction circuit to treat only the dewatered tailing filter cake, will use either S02/Air or hydrogen peroxide (H202), either one of which will destroy the relatively stable iron cyanide. Alkaline chlorination, which will not destroy Fe cyanide, cannot be used.

No testing has been done with either option, but there has been sufficient industrial application of both of these systems, that success can be insured, at a cost which can be supported by the operation.

## 4.8 Acid Generation Potential

A single acid generation potential test, using the acid/base accounting system, was performed on pilot plant feed. This test determined that the sample was not potentially acid generating, as follows:

| | |
|---|---|
| S | 1.36% |
| Acid potential | 42.5 * |
| Neutralization potential | 54.3 |
| Net potential | 11.8 neutralizing |

* tons calcium carbonate per 1,000 tons material.

Additional sampling and testing will be required to determine whether this characteristic applies to the entire deposit. The pilot plant operation indicates that this is the case.

If the deposit as a whole is not acid generating, the implication for mine operation and site abandonment are significant and favourable. The regulatory authorities will be much more receptive to an application if the ore, waste, and tailing can be demonstrated to be not acid generating, since there will be no risk of environmental damage after the site has been abandoned.

## 4.9 Manpower Requirements - Mill

For purposes of this discussion, it is assumed that the mill operation will extend from the fine ore pile to the tailing disposal system, and that the mine department will operate the underground crushing plant.

| Position | Number |
|---|---|
| Mill Superintendent | 1 |
| Mill Foreman | 1 |
| Grinding Operator | 4 |
| Flotation Operator | 4 |
| Leaching Plant Operator | 4 |
| Total direct operations | 14 |
| Assayer | 1 |
| Assistant Assayer | 1 |
| Mechanical Trades | 3 |
| Electrical Trades | 1 |
| Total | 20 |

## 5.0 SERVICES

### 5.1 Electrical

B. C. Hydro will supply 25KV 3 phase power from its sub-station at the intersection of Highways 7 and 9 west of Agassiz. This will entail some sub-station modifications and construction of approximately 7.0 miles of overhead line. Their service will terminate at the property boundary. They will require the client to provide a circuit recloser (a type of circuit breaker) at this point to co-ordinate with their system protection. This would be a pole mounted device. B.C. Hydro metering would be installed at this point.

The client will build a short 25KV overhead line to the millsite and mine adit area. The main transformer station will be outdoors adjacent to the mill building. Power will be transformed from 25KV to 4.16KV with a capacity of 2000 KVA. Three single phase transformers will be used with a spare unit installed to ensure continuity of service.

Power distribution and motors, 250 hp or larger, will be 4160 volts with unit substations providing 600 volt power for smaller loads. An overhead line at 4160 volts is included for the mill water supply pumphouse.

### 5.2 Water Supply

Harrison Lake will provide an adequate supply source for the plant site process and domestic water due to its proximity to the demand area and its reliability as an economic supply source. The water will be pumped from the lake to a tank at an elevation capable of providing gravity supply to the project area. A water licence application will have to be made and the Health Branch of the Ministry of Environment will have to approve the water design system. All water supplied will be disinfected by clorination prior to delivery to the demand areas. Domestic and fire water supply from the storage tank will be provided through a combination of 8 inch and 6 inch lines. The 8 inch section of the pipeline will be required for the Mill Site fire supply system and will be extended to form a fire loop, complete with hydrants, around the plant buildings. The fire pump for sprinkler application will draw suction from this 8 inch fire loop.

### 5.3 Maintenance Facilities

Maintenance facilities for the surface operations will be housed in an adjunct to the mill building. This shop will be equipped to maintain the mill equipment. Due to the proximity of larger communities with extensive shop facilities, the on-site facilities will be kept to a minimum.

Maintenance facilities for the underground operations will be located at the 47 Level patio. It will be adequate to do the repair and maintenance on the underground equipment. Major rebuild work on the mobile equipment will be performed off site, however, a small service garage will be provided for normal maintenance.

### 5.4 Office and Changehouse

The office and changehouse facilities will be located in semi-portable buildings in the mill complex area. The office facilities will house the management and administration group, mine supervision and mine engineering. The office building will be single storey and will house the mine engineering, mine superintendents and manager's office in one wing. The second wing will contain the personnel, safety, purchasing and accounting group. The mine shift bosses and timekeeper will be located adjacent to the changehouse. Offices for the mill staff will be located within the mill building.

The mine changehouse will be separate from the office building and will be equipped with storage and drying facilities for both clean clothes and work clothes. This facility will be adequate to provide accommodation for both mine crews and service personnel. Adequate facilities for employees to shower and change will be provided. Separate facilities for mill personnel will be located in the mill building.

5.5 Warehousing

A warehouse facility will be part of the main office building. It will have an area of 1000 square feet. It will serve as storage for maintenance and small items used in operation. Larger items and bulk supplies will be stored in their respective areas about the property.

Explosives will be stored in prefabricated magazines licensed to hold 15 tons. These magazines will be located to conform with government regulations.

Bulk materials such as pipe and timber used within the mine will be stored at the mine portals. Items such as drill steel, rock bolts, ventilation ducting pipe fittings will be stored in protected areas near the mine portals.

Major consumables for the mill, such as grinding media and reagents, will be stored in the mill. Major spare parts for the crushing plant will be stored in their respective areas. Small items used within the mill will be kept in the warehouse.

A storage tank will be located behind a berm near the mill to store 15,000 gallons of fuel oil for plant heating.

## 5.6 Plant Heating

The mill and office buildings will be heated by a low pressure hot water heating system, operating through radiators and unit fan heaters. Heat will be generated by a package boiler located in a section of the mill building. The process operates at ambient temperature and therefore no heat is required for the process. Boiler capacity will be 750,000 BTU per hour.

## 5.7 Fire Protection, Safety and First Aid

A gasoline engine equipped fire pump will be located at the fresh water pumphouse, connected in parallel with the mine water supply pump. This pump will be capable of supplying 500/GPM for as required. Stand pipes and hoses will be provided at strategic locations in and around the buildings. Portable fire extinguishers will be installed throughout the main surface complex as well as the required locations underground.

A stench warning system will be installed in the compressed air lines and ventilation intake to be used under emergency conditions to advise the miners to evacuate the mine workings in case of emergency.

The first aid room will be located in the office building adjacent to and under control of the gateman. This first aid room will be equipped to provide initial treatment in the event of an accident on the property.

A mine rescue room will be located in the mine change-house.

A telephone system will provide communications between the various surface facilities and underground locations as required.

## 5.8 Laboratory and Assay Facilities

An analytical laboratory will be located separate from the process building to provide routine assay facilities for the mining and milling operations. The laboratory will have facilities for the crushing and grinding of coarse rock samples. Equipment will be provided for fire assaying and for atomic absorption spectrophotometry. Facilities for metallurgical investigations will be located in a test room within the mill building.

## 5.9 Manpower Requirements Administration

| | |
|---|---|
| **Staff** | |
| Manager | 1 |
| Accountant | 1 |
| Purchasing Agent and Warehouse | 1 |
| Clerk Stenographers | 2 |
| Safety and Training | 1 |
| Environmental and Personnel | 1 |
| Sub Total | 7 |
| **Hourly Rate** | |
| Truck driver | 1 |
| Equipment Operator | 1 |
| Laborers | 2 |
| Gateman - First Aid | 4 |
| Sub Total | 8 |
| Total Administration | 15 |

# 6.0 CAPITAL COSTS MINING

## 6.1 Sub-level Caving Method (Upper Mine Phase I) total mining

### 6.1.1 Main Level Development

| | | |
|---|---|---|
| 47 Level, length 445 meters including rock bolting and ground support, $1,450/meter | | $ 645,250 |
| Portal preparation | | 5,000 |
| 140 Level, length 170 meters x $1,450/meter | | 246,500 |

### 6.1.2 Raises (ore pass and manway 47 Level to 140 Level)

| | | |
|---|---|---|
| Alimak raises 2.0 x 2.0 length 93 meters x 2 = 186 meters, platforms and ladders in manway 186 x 1,050/meter | $ 195,300 | |
| Alimak access crosscuts 2 x 12 x 1,250 | 30,000 | |
| Alimak access raises 2.0 x 2.0 length 10 m x 1,050/meter | 10,500 | |
| Access crosscuts between raises 20 m x 1,500 | 21,000 | 258,800 |
| Chute on ore pass (air operated steel gates) | 6,000 | |
| Manway timber and supplies | 1,300 | 7,300 |
| Ore pass and manway 140 Level to surface, length 75 meters 2 x 75 x $1,050/meter | | 157,500 |

### 6.1.3 Incline from 140 Level to surface

| | |
|---|---|
| 6 sub-levels 3.0 x 4.0 m length 800 m x $1,350 | 1,080,000 |

### 6.1.4 Sub-level Development, develop 4 levels to commence production

| | |
|---|---|
| mining 675 meters per level 3.0 x 4.0 m length 2700 x $1,250 | 3,375,000 |
| Sub Total Development Cost | $ 5,775,350 |

| | | | |
|---|---|---|---|
| 6.1.5 | Mobile Trackless Equipment | | |
| | 3 - LHD units, diesel powered 3 required, 3.5 cubic yard capacity, $170,800 each | $ 512,400 | |
| | 1 - single boom jumbo with hydraulic drill | 245,100 | |
| | 1 - electric hydraulic rock drill for fan drilling in sub-levels, diesel power for tramming and electric for drilling | 330,000 | |
| | 1 - Personnel carrier/service truck | 65,000 | |
| | 1 - Explosives truck | 57,000 | |
| | 1 - 13 ton ore truck (1 required using underground crushing) (2 required using haulage to surface) | 155,000 | $ 1,364,500 |
| 6.1.6 | Pneumatic Drill Equipment | | |
| | 4 - Jack leg drills with leg, hoses and steel | 16,616 | |
| | 4 - Stopers, complete with hoses and steel | 15,704 | |
| | 4 - Utility hoists | 18.740 | |
| | 3 - Portable pumps | 4,800 | 55,860 |
| 6.1.7 | Mine Shop Equipment | | |
| | 1 - 1000 cfm compressor, 100 psi 125 hp electric motor and air receiver | 60,000 | |
| | 1 - Assortment welders, grinders, hoists, portable electric tools | 45,000 | 105,000 |
| 6.1.8 | Ventilation | | |
| | 1 - Vane axial fan 75,000 cfm 48" diam. with 60 hp motor | 14,000 | |
| | 4 - Van axial fans 20,000 cfm 40 hp | 40,000 | |
| | 1 lot - Vent pipe and accessories | 14,000 | |
| | 4 - Vent doors | 12,160 | 80,160 |

6.1.9 Miscellaneous Equipment

| | | |
|---|---|---|
| 1 lot - Survey equipment | $ 10,000 | |
| 1 lot - Stench warning equipment | 5,070 | |
| 5 - Mine rescue apparatus and assorted equipment | 27,900 | |
| 1 lot - Communications | 6,500 | |
| 1 lot - Mine Lamps & Chargers | 11,800 | |
| 1 lot - Tools | 6,000 | $ 67,270 |

6.1.10 Mine Electric Power Service

| | | |
|---|---|---|
| 5 KV underground feeder system (sum) | 168,660 | |
| Unit substation - dry type, 500 KV 4160 V - 600 V 3-phase | 65,380 | |
| Underground fans, pumps, lighting | 138,000 | 372,040 |

| | |
|---|---|
| Equipment Capital Cost, Sub-level I Caving | $ 2,044,830 |

6.2 Estimated Development Cost (Lower Mine Phase II) total mining

Mining will continue down from the 140 Level to the 47 Level with the following development required:

| | |
|---|---|
| 6.2.1 Incline and Sub-level access from the 47 Level through to the 140 Level, 3.0 x 4.0 m, length 1,870 meters, $1,350/meter including ground support and rock bolting | $ 2,524,500 |
| Total Development Cost Lower Mine Phase II | $ 2,524,500 |

Summary

| | |
|---|---|
| Upper Mine Phase I Development | $ 5,775,350 |
| Lower Mine Phase II Development | 2,524,500 |
| Equipment Capital Cost | 2,044,830 |

| | |
|---|---|
| Sub-level Caving, Total Mining Total Capital Cost | $ 10,344,680 |

6.3 Block Caving Mining Method (Upper Mine Phase I) total mining

| | | | |
|---|---|---|---|
| 6.3.1 | Main Level Development<br>4.0 x 3.0 m, 47 Level length 445 meters, $1,450/meter including rock bolting and ground support | $ 645,250 | |
| | Portal preparation | 5,000 | 650,250 |
| 6.3.2 | 140 Level length 170 meters $1,450/meter including rock bolting and roof support | | 246,500 |
| 6.3.3 | Raises (ore pass and manway, 47 Level to 140 Level) Alimak raises (2.0 x 2.0), length 93 meters x 2 = 186 meters, platforms and ladders in manway 186 x $1,050/meter | 195,300 | |
| | Alimak access crosscuts 2x12x$1,250 | 30,000 | |
| | Alimak access raises (2.0 x 2.0 m) length 10 x $1,050/meter | 10,500 | |
| | Access crosscuts between raises 20 x $1,050/meter | 21,000 | 256,800 |
| | Chute on ore pass (air operated steel gates) | 6,000 | |
| | Manway timber and supplies | 1,500 | 7,500 |
| 6.3.4 | Level Haulage System | | |
| | (4.0 x 3.0 m), length 760 meters x $1,450/meter | | 1,102,000 |
| 6.3.5 | Undercut and Sub-level Preparation | | |
| | Haulages 4.0 x 3.0 m, length 940 meters @ $1,250/meter | | 1,175,000 |
| | Ore passes 42, 9m length, 2.50 x 2.50 m 378 x $1,050/meter | | 396,900 |

| | | | |
|---|---|---|---|
| 6.3.5 | Cont'd. | | |
| | Loading slots 42 x 6 x $1,250 including drawpoint reinforcing, etc. | | $ 315,000 |
| | Undercut preparation drilling and blasting, $400 per lineal meter of crosscut, 696 meters | | 278,400 |
| 6.3.6 | Ventilation Raise | | |
| | 2.5 x 2.5 m length, 110 meters Alimak raise 110 x $1,050/meter including rock bolting and ground support | | 115,500 |
| 6.3.7 | Grizzly and Raise at ore pass ( sum ) | | 15,000 |
| Estimated Development Cost, Upper Mine Phase I | | | $ 5,060,744 |
| 6.3.8 | Mobile Trackless Equipment | | |
| | 3 - LHD units, diesel power 3.5 cu. yd. capacity $170,800 each | $ 512,400 | |
| | 1 - Single boom jumbo with hydraulic drill | 245,100 | |
| | 1 - Personnel carrier | 65,000 | |
| | 2 - Service trucks | 57,000 | |
| | 1 - 13-ton ore truck (1 required using underground crushing or 2 required for haulage to surface) | 155,000 | 1,034,500 |
| 6.3.9 | Pneumatic drill equipment | | |
| | 6 - Jack leg drills with leg, hoses and steel | 24,924 | |
| | 6 - Stopers complete with hoses and steel | 23,556 | |
| | 4 - Utility hoists | 18,739 | |
| | 3 - Portable pumps | 4,800 | 72,019 |

| | | |
|---|---|---|
| **6.3.10 Mine Shop Equipment** | | |
| 2 - 1000 cfm compressors 100 psi 125 hp electric motors | $ 120,000 | |
| 1 lot welders grinders, hoists portable electric tools | 45,000 | $ 165,000 |
| **6.3.11 Ventilation** | | |
| 2 - Vane axial fan 75,000 cfm 4" diam. 60 hp motor | 28,000 | |
| 4 - Vane axial fans 20,000 cfm 40 hp | 40,000 | |
| 1 lot vent pipe and accessories | 14,000 | |
| 4 - Vent doors | 12,160 | 94,160 |
| **6.3.12 Miscellaneous Equipment** | | |
| 1 lot survey equipment | 10,000 | |
| 1 lot stench warning system | 5,070 | |
| 5 - mine rescue apparatus and associated equipment | 27,900 | |
| 1 lot communications | 6,500 | |
| 1 lot mine lamps and chargers | 11,800 | |
| 1 lot tools | 6,000 | 67,270 |
| **6.3.13 Mine Electric Power Service** | | |
| 5 KV underground feeder system sum | 168,660 | |
| Unit substation, dry type, 4160-600V 3-phase | 65,380 | |
| Underground fans, lighting switchgear | 138,000 | 372,040 |
| Equipment Capital Cost Block Caving | | 1,804,989 |
| Total Capital Cost Block Caving Phase II Upper Mine | | $ 6,865,733 |

6.4 Estimated Development Cost Block Caving (Lower Mine Phase II) total mining between 47 Level and 140 Level

6.4.1 Development Cost Block Caving

| | | |
|---|---|---|
| Level haulage system | $ 1,102,000 | |
| Undercut & sub-level preparation | 1,175,000 | |
| Muck raises | 396,900 | |
| Loading slots | 315,000 | |
| Undercut preparation | 278,400 | |
| Ventilation raise | 115,500 | |
| Total Development Cost Lower Mine Phase II | | $ 3,382,800 |

Summary

Total Mine Development Cost Block Caving

| | |
|---|---|
| Upper Mine - Phase I Development | $ 5,060,744 |
| Lower Mine - Phase I Development | 3,382,800 |
| Equipment Cost | 1,804,989 |
| Block Caving, Total Mining Capital Cost Sub Total | $ 10,248,533 |

6.5 Sub-level Caving Method (Upper Mine Phase I) selective mining area

The development for the Sub-level Caving Mining to used in the Selected Mining Area would be similar to that used in the Total Mining Area with the exception that the working crosscuts would be reduced in length, therefore, the reductions in the cost in the Upper Mine would be as follows:

| | |
|---|---|
| Delete 167.0 meters development per sub-level, 4 sub-levels plus top levels of spiral ramp 923 x $1,450/meter | 1,338,350 |

| | |
|---|---|
| Estimated Development Cost Total Mining | 6,004,950 |
| Reduction in Development for Selective Mining | 1,338,350 |
| Estimated Development Cost Upper Mine Phase I | $ 4,432,000 |

Mining in the lower section is a continuation of the sub-level caving in the Upper Section. There will be no reduction in preliminary development.

| | |
|---|---|
| Estimated Development Cost<br>Lower Mine Phase II | $ 2,524,500 |
| Total Development Cost Sub-level caving<br>Selective Mining | 7,560,850 |

Summary

| | |
|---|---|
| Sub-level Caving - selective mining<br>Capital Costs | |
| Upper Mine Phase I Development | $ 5,036,350 |
| Lower Mine Phase II Development | 2,524,500 |
| Equipment Capital Cost | 2,044,830 |
| Total Estimated Total Capital Cost<br>selective mining | $ 9,605,680 |

6.6 Block Caving Method (Upper Mine Phase I) selective mining

The development for Block Caving Mining method, to be used in the Selective Mining area would be similar to that used in the Total Mining areas with the exception that the developed areas would be smaller. As a result, the reduction in cost in preparation of the Upper Mine is as shown:

| | | |
|---|---|---|
| Estimated Development Cost Upper Level<br>Phase I | | $ 5,060,744 |
| Less: Haulage system 200 x $1,450 | $ 290,000 | |
| Undercut & sub-level<br>preparation 255 meters | 100,000 | |
| Loading slots & drawpoint | 176,085 | |
| Ore passes | 198,450 | |
| Total reduction in development for<br>selective mining | | 764,535 |
| Cost Development Upper Mine Phase I for Block<br>Caving Selective Mining | | $ 4,296,209 |

Block Caving in the Lower Mine Phase II is similar to that in the Upper Mine, hence development costs will be similar less the following:

| | | |
|---|---|---|
| Development Costs Upper Mine | | $ 4,296,209 |
| Less: 47 Main Level development | $ 650,250 | |
| 140 Level development | 246,500 | |
| Raises | 264,300 | |
| Sub Total | | 1,161,050 |
| Cost of development Lower Mine Phase II for Block Caving selective minine | | $ 3,135,159 |

Summary

Block Caving Selective Mining

| | |
|---|---|
| Upper Mine Phase I Development | $ 4,296,209 |
| Lower Mine Phase II Development | 3,135,159 |
| Equipment Capital Cost | 1,804,989 |
| Block Caving Selective Mining Capital Costs | $9,236,357 |

## 6.7 Capital Costs Underground Crushing

Conveyor #3

| | |
|---|---|
| From fine ore bin to rod mill length 75 meters 30" belt, 50 hp motor installed price per meter $738 | $ 55,350 |

Fine Ore Storage Bin

Estimated total capacity 10,000 tonnes live capacity 30% - 3,000 tonnes, conical building, concrete ringwall & roof support pack, concrete conveyor gallery with 2 draw points with belt feeders

| | |
|---|---|
| Estimated total cost | 325,000 |

Conveyor #2

| | | |
|---|---|---|
| From gyratory crusher to fine ore bin, length 180 meters speed 300'/minute, 30" wide | | |
| Installed cost per meter $640 | | $ 115,200 |

Gyratory Crusher

| | | |
|---|---|---|
| Short head 4½ foot cone opening feed side 4 1/8" discharge opening 1/2' motor 200 hp motor and controls | $ 250,000 | |
| Chutes, liners, walkways etc. | 30,000 | |
| Installed cost | | 280,000 |

Conveyor #1

| | | |
|---|---|---|
| From jaw crusher to gyratory crusher, length 27.0 meters 32" wide. 27 x $640 | | 17,280 |

Jaw Crusher

| | | |
|---|---|---|
| 30" x 42" with 150 hp motors and controls | 150,000 | |
| Chutes, walkways, liners, etc. | 27,600 | 177,600 |

Chain Feeder

| | | |
|---|---|---|
| Ross chain feeder installed sum | 35,000 | |
| Chutes, walkways | 12,000 | 47,000 |

Coarse Ore Bin

| | | |
|---|---|---|
| Capacity 1,500 tonnes Cost of excavation | 83,952 | |
| Grizzly, steel & concrete | 11,048 | 95,000 |

| | | |
|---|---|---|
| **Jaw Crusher Station** | | |
| 31,770 cu. ft.<br>Cost of excavation | $ 95,310 | |
| Shot crete & bolting | 19,062 | $ 114,372 |
| **#1 Conveyor Gallery** | | |
| 3.0 x 3.0 m<br>length 14.0 m @ $300/ft | 13,776 | |
| Rock bolting | 1,377 | 15,153 |
| **Access Tunnel** | | |
| Jaw crusher station to<br>Gyrating crusher station<br>length 13.0 m @ $300/ft | 12,792 | |
| Rock bolting & shotcrete | 2,000 | 14,792 |
| **Gyrating Crusher Station** | | |
| 25,416 cu. ft.<br>Cost of excavation | 75,248 | |
| Rock bolting & shotcrete | 15,249 | 90,497 |
| **Conveyor #2 Gallery** | | |
| 3.0 x 3.0 m, length 180 meters<br>decline grade, minus 25%<br>cost @ $325/ft. or $1,070/meter | 192,600 | |
| Rock bolting | 9,630 | 202,230 |
| **Access Raise** | | |
| Crusher station to haulage level<br>2.0 x 2.0, 20 meters | | 13,120 |
| **Dust Collecting System** | | |
| for crushing area 5,000 cfm<br>complete for both crushers | | 31,060 |
| **Monorail Hoist** | | |
| over crushers, hand operated<br>2 required | | 6,300 |

| | |
|---|---|
| Support Gantry for monorail | $ 5,900 |
| Instrumentation sum | 11,500 |
| Pipes, Valves & Fittings service and washdown | 5,800 |
| Machine and Drive Guards | 2,200 |
| Anchor bolts and Grout | 2,800 |
| Electrical Power Service sum | 104,000 |
| Sump Pump and Discharge Line | 7,500 |
| Estimated Total Cost of Underground Crushing | $ 1,739,654 |

# 7.0 CAPITAL COST - MILL

## 7.1 Processing

### 7.1.1 Summary

| Function | | |
|---|---|---|
| Site preparation | $ 100,000 | |
| Building (1) | 750,000 | |
| Equipment - concentration | 752,000 | |
| - cyanidation | 215,500 | |
| Equipment installation | | |
| - concentration (2) | 2,030,000 | |
| - cyanidation (2) | 538,800 | |
| Electrical (3) | 200,000 | |
| Piping | 100,000 | |
| Total direct construction | | $ 4,686,300 |

### 7.1.2 Overheads

| | | |
|---|---|---|
| Construction management | 300,000 | |
| Engineering - structural | 150,000 | |
| Engineering - electrical | 60,000 | |
| Engineering - process | 20,000 | |
| Purchasing | 20,000 | |
| Freight | 40,000 | |
| Taxes (4) | 300,000 | |
| Administration | 50,000 | |
| Total indirects | | 940,000 |
| Total | | $ 5,626,300 |

Notes:

(1) 15,000 sq. ft. x 50/sq.ft.

(2) 2.5 x equipment cost

(3) 36 drives + grinding mills

(4) 6% of directs

## 7.2 Equipment Cost Details

### 7.2.1 Concentration

| Description | HP | | |
|---|---|---|---|
| Slot feeder conveyor 24" x 150 | 10 | $ 45,000 | |
| Rod mill (7' x 10') | 200 | 100,000 | |
| Jig (24" x 36") | 2 | 15,000 | |
| Ball mill (10' x 11') | 1,000 | 400,000 | |
| Table (4' x 8') | 1 | 8,000 | |
| Sump pump (2.5") | 5 | 3,500 | |
| Cyclone feed pumps (2 - 8" x 6") | 50 | 12,000 | |
| Cyclones ( 2 - 18") | - | 8,000 | |
| Rougher flotation machine | 20 | 75,000 | |
| Flotation blower | 50 | 20,000 | |
| Cleaner flotation machine | 5 | 17,000 | |
| Concentrate pump | 2 | 2,500 | |
| Thickener (10' dia.) | 2 | 15,000 | |
| Thickener underflow pump | 1 | 8,000 | |
| Disc filter (6" dia. x 2 disc) | 3 | 15,000 | |
| Vacuum pump (500 cfm) | 25 | 8,000 | |
| Sub total concentration | 1,381 | | $ 752,000 |

### 72.2. Cyanidation

| Description | HP | | |
|---|---|---|---|
| Feed hopper | - | 5,000 | |
| Feed conveyor (24' x 15') | 2 | 4,500 | |
| Preaeration tank (7.5" dia. x 8') | 10 | 9,000 | |
| Trash screen (24" dia.) | 1 | 4,000 | |
| Leaching tanks (6 - 7.5' dia. x 8') | 60 | 66,000 | |
| Safety screen (24" dia.) | 1 | 4,000 | |
| Filter (6' dia. x 2 disc) | 3 | 15,000 | |
| Vacuum pump (500 cfm) | 25 | 8,000 | |
| Cyanide destruction | 2 | 10,000 | |
| Loadout bin | - | 5,000 | |
| Carbon strip vessel | 60 | 9,000 | |
| Carbon reactivation | 10 | 50,000 | |
| Electrolytic cell & rect. | 5 | 15,000 | |
| Miscellaneous pumps | 5 | 3,000 | |
| Heat exchangers | - | 3,000 | |
| Refinery furnace | - | 2,500 | |
| Sump pump | 2 | 2,500 | |
| Sub total cyanidation | 186 | | $ 215,500 |

## 8.0 CAPITAL COSTS - ANCILLARIES

### 8.1 Electrical Services

| | | |
|---|---|---|
| Electric power supply from Agassiz to mine site. 25 KV overhead power line from substation located at intersection B.C. Hwy 7 and 9 to mine site, distance 7.0 miles, cost $60,000/mile | $ 420,000 | |
| Circuit recloser at B.C. Hydro Terminal at plant site | 18,000 | |
| Substation at plant site | 48,000 | |
| Transformers, single phase 25 to 4.16 KV | 57,600 | |
| Main switchboard and metering | 65,200 | |
| Line to mill water supply | 15,000 | |
| Lighting, etc. | 5,000 | |
| Sub Total | | $ 628,800 |

### 8.2 Water Supply & Sewer Disposal

| | | |
|---|---|---|
| Pump station Harrison Lake and 6" water supply line | 35,000 | |
| Clorination facilities | 6,250 | |
| Diesel powered standby water supply pump | 18,500 | |
| Sewage plant and disposal | 125,000 | |
| Sub Total | | 184,750 |

### 8.3 Maintenance Facilities

| | | |
|---|---|---|
| Shop for small repairs of mining and surface equipment, concrete floor and steel frame building 30 x 40 and tools | 65,000 | |
| Sub Total | | 65,000 |

| | | | |
|---|---|---|---|
| 8.4 | Office, Changehouse and Warehouse | | |
| | An allowance for prefabricated units assembled into office, changehouse, plant warehouse, including foundations, utility services and furniture | $ 450,000 | |
| | Sub Total | | $ 450,000 |
| 8.5 | Plant Heating | | |
| | (Included in Milling Facilities) | | |
| 8.6 | Fire Protection & First Aid | | |
| | Lot first aid room and supplies | 15,000 | |
| | Ambulance | 25,000 | |
| | Hydrants located as required on plant site | 36,000 | |
| | Sub Total | | 76,000 |
| 8.7 | Laboratory and Assay Facilities | | |
| | Assay lab furniture and equipment | 75,000 | |
| | Sub Total | | 75,000 |
| 8.8 | Mobile Equipment | | |
| | 1 - Personnel bus 20 seat capacity | 35,000 | |
| | 1 - Front end loader 1½ cu yd | 83,300 | |
| | 1 - Bulldozer D7 and blade | 167,400 | |
| | 1 - Pick-up truck 4x4 crew cab | 18,000 | |
| | 3 - pick-up trucks 4x4 | 51,000 | |
| | 1 - 5-ton truck with hiab lift | 40,000 | |
| | Sub Total | | 394,700 |
| 8.9 | Construction Indirect Account | | |
| | Course and construction insurance | 60,000 | |
| | Temporary power for construction | 20,000 | |
| | Temporary winter heating | 32,000 | |
| | Off-load and store process equipment | 40,000 | |
| | Final clean-up | 5,000 | |
| | Sub Total | | 157,000 |
| Capital Cost Ancillaries | | | $ 2,031,250 |

## 9.0 OPERATING COSTS - MINE

### 9.1 Operating Cost Summary

Sub-level Caving

| Mine | Annual Cost | Cost Per Tonne |
|---|---|---|
| Supervision | $ 207,900 | $ 0.59 |
| Technical Staff | 288,410 | 0.82 |
| Labor | 1,230,531 | 3.52 |
| Maintenance and Supervision | 360,200 | 1.03 |
| Mine Incentive Bonus | 636,291 | 1.82 |
| Operating Supplies | 1,119,308 | 3.20 |
| Maintenance Materials | 330,600 | 0.94 |
| Sub Total | $ 4,173,240 | $ 11.92 |

Block Caving

| Mine | | |
|---|---|---|
| Supervision | 220,500 | 0.63 |
| Technical Staff | 287,910 | 0.82 |
| Labor | 1,006,596 | 2.87 |
| Maintenance and Supervision | 531,802 | 1.52 |
| Mine Incentive Bonus | 615,359 | 1.76 |
| Operating Supplies | 693,252 | 1.98 |
| Maintenance Materials | 511,000 | 1.46 |
| Sub Total | $ 3,866,419 | $ 11.04 |

## 9.2 Scale of Labor Rates

These labor rates are current at an operating mine, located in a semi-isolated area in British Columbia. The rates in the Harrison Lake area could be slightly, but not materially less.

| | |
|---|---|
| Miner | -$17.66 per hour, plus 26% fringe benefits and 60 % bonus |
| Electrician - Lead hand | -$20.59 per hour, plus 26% fringe benefits |
| Millwright - Lead hand | - $20.59 per hour, plus 26% fringe benefits |
| Surface - Lead hand | - $20.59 per hour, plus 26% fringe benefits |
| Journeyman - with ticket | |
| Electrician | - $17.63 per hour, plus 26% fringe benefits |
| Millwright | |
| Carpenter | |
| Maintenance Mechanic | |
| Equipment Operator | |
| Mill Equipment Operator | - $16.63 per hour, plus 26% fringe benefits |
| Mill Operator | - $16.47 per hour, plus 26% fringe benefits |
| Labour | - $11.77 per hour, plus 26% fringe benefits |
| Sample bucker | - $14.71 per hour, plus 26% fringe benefits |

## 9.3 Basis of Estimate

Manpower rates are based on rates currently in use in a mining operation located in the Caribou Mining District. All fringe benefits are included in the estimate as follows:

Table of Payroll Burdens

| | | |
|---|---|---|
| (a) | Unemployment Insurance | 2.1% |
| (b) | Vacation Pay | 6.3% |
| (c) | Statutory Holidays | 2.1% |
| (d) | Workers Compensation | 6.2% |
| (e) | Canada Pension Plan | 1.0% |
| (f) | Medical | 2.0% |
| (g) | Pension and Life Insurance | 4.0% |
| (h) | Unscheduled Overtime | 2.3% |
| | Total | 26.0% |

In the mine and crushing plants (underground crushing) costs are based on a 40-hour work week.

Milling operations are based on a 40-hour work week with additional personnel as required to operate on a 56-hour work week.

Material costs are based upon budget quotations received from suppliers.

Energy costs are based on average rates of power from B. C. Hydro.

Cost per tonne is based on an annual production rate of 350,000 tonnes.

## 9.4 Mine

### 9.4.1 Sub-level Caving

#### 9.4.1.1 Mine Supervision

| Position | No | Annual Cost |
|---|---|---|
| Mine Superintendent | 1 | $ 55,000 |
| Shift Boss | 2 | 70,000 |
| Maintenance Foreman | 1 | 40,000 |
| Sub Total | 4 | 165,000 |
| Payroll burden 26% | | 42,900 |
| Total Annual Cost | | $ 207,900 |
| Cost per tonne milled | | $ 0.59 |

#### 9.4.1.2 Mine Technical & Clerical Staff

| Position | No | Annual Cost |
|---|---|---|
| Chief Mine Engineer | 1 | $ 45,000 |
| Mine Surveyor | 1 | 37,500 |
| Technicians | 2 | 56,000 |
| Chief Geologist | 1 | 40,000 |
| Sampler | 1 | 24,000 |
| Mine Clerk | 1 | 26,000 |
| Sub Total | 7 | 228,500 |
| Payroll burden 26% | | 59,910 |
| Total Annual Cost | | $ 288,410 |
| Cost per tonne milled | | $ 0.82 |

9.4.1.3 Mine Operating Labor

The costs of the upper four sub-levels were included in preproduction or capital development costs by contractor.

| Position | No. | Average Hourly Wage | Annual Wage | Annual Cost |
|---|---|---|---|---|
| Development Miners | 8 | $ 19.12 | $ 39,865 | $ 318,920 |
| Longhole Drillers and Blasters | 4 | 19.12 | 39,865 | 159,460 |
| Mucking Crew | 8 | 17.66 | 36,821 | 294,568 |
| Tramming Crew | 2 | 17.66 | 36,821 | 73,642 |
| Crusher Operators | 4 | 15.59 | 32,505 | 130,020 |
| Sub Total | 26 | | | 976,610 |
| Payroll Burden 26% | | | | 253,919 |
| Total Annual Cost | | | | $ 1,230,529 |
| Cost per tonne milled | | | | $ 3.51 |

9.4.1.4 Mine Maintenance & Services Labor

| Position | No. | Average Hourly Wage | Annual Wage | Annual Cost |
|---|---|---|---|---|
| Electrician | 1 | $ 19.12 | $ 39,865 | $ 39,865 |
| Electrician | 1 | 17.66 | 36,821 | 36,865 |
| Diesel Mechanic | 1 | 19.12 | 39,865 | 39,865 |
| Diesel Mechanic | 1 | 17.66 | 36,821 | 36,821 |
| Welder | 1 | 19.12 | 39,865 | 39,865 |
| Timberman | 1 | 17.66 | 36,821 | 36,821 |
| Timberman's Helper | 1 | 15.00 | 31,275 | 31,275 |
| Changehouse & Lamproom | 1 | 11.77 | 24,540 | 24,540 |
| Sub Total | 8 | | | 285,873 |
| Payroll burden 26% | | | | 74,327 |
| Total Annual Cost | | | | $ 360,200 |
| Cost per tonne milled | | | | $ 1.03 |

9.4.1.5 Mine Incentive Bonus (Sub-level Caving)

Incentive bonus 40 percent of operating and maintenance wages, to be distributed among mine personnel on an incentive system developed within the operation.

| | |
|---|---|
| Operating Wages | $ 1,230,529 |
| Maintenance Wages | 360,200 |
| Total | 1,590,729 |
| Annual Bonus Allowance | 636,291 |
| Cost per tonne milled | $ 1.82 |

9.4.1.6 Mine Operating Supplies

| Item | |
|---|---|
| Drill steel and bits | |
| - development | 220,200 |
| - stoping | 136,550 |
| Explosives - development | 130,000 |
| - stoping | 290,400 |
| Rock bolts | 10,000 |
| Timber | 20,000 |
| Ventilation ducting | 15,000 |
| Tires | 50,200 |
| Electric Power | 181,958 |
| General consumables | 65,000 |
| Total | 1,119,308 |
| Cost per tonne milled | $ 3.20 |

9.4.1.7 Mine Maintenance Materials

| Item | |
|---|---|
| Drilling equipment | $ 82,500 |
| LHD Units | 116,400 |
| Ore haulage trucks | 26,700 |
| Crushing area | 20,000 |
| Ventilation | 10,000 |
| Electrical maintenance | 25,000 |
| Miscellaneous | 50,000 |
| Total Annual Cost | $ 330,600 |
| Cost per tonne milled | $ 0.94 |

9.4.1.8 Mine Electric Power Requirements (Sub-level Caving)

Crushing & Conveying

| Item | Hp | |
|---|---|---|
| Conveyor #3 | 35 | |
| Belt feeders | 20 | |
| Conveyor #2 | 60 | |
| Gyratory crusher | 200 | |
| Conveyor #1 | 30 | |
| Jaw crusher | 150 | |
| Chain feeder | 25 | |
| Duct collecting | 30 | |
| Lighting | 10 | |
| Total Hp | 550 | |
| Mining (Sub-level Stoping) | | |
| Mine shop equipment | 50 | |
| Compressor | 125 | |
| Ventilation | 140 | |
| Electric drill | 50 | |
| Lighting, etc. | 25 | |
| Total Hp | 390 | |
| Sub Total | | 940 Hp |
| Plus 25% | | 235 |
| Sub-level Caving Total connected power | | 1,175 |
| 1,175 x .746 = | | 877 KW |

9.4.1.8 Cont'd

Assuming continuous operation 240 days per year

877 x 24 x240 x 0.036 =

Total Annual Cost $ 181,958

Cost per tonne milled $ 0.52

9.4.2 Block Caving

9.4.2.1 Mine Supervision

| Position | No | Annual Cost |
|---|---|---|
| Mine Superintendent | 1 | $ 55,000 |
| Shift Boss | 2 | 80,000 |
| Maintenance Foreman | 1 | 40,000 |
| Sub Total | | 175,000 |
| Payroll burden 26% | | 45,500 |
| Total Annual Cost | | $ 220,500 |
| Cost per tonne milled | | $ 0.63 |

9.4.2.2 Mine Technical & Clerical Staff

| Position | No. | Annual Cost |
|---|---|---|
| Chief Mine Engineer | 1 | $ 45,000 |
| Mine Surveyor | 1 | 37,500 |
| Technicians | 2 | 56,000 |
| Chief Geologist | 1 | 40,000 |
| Sampler | 1 | 24,000 |
| Mine Clerk | 1 | 26,000 |
| Sub Total | | 228,500 |
| Payroll burden 26% | | 59,410 |
| Total Annual Cost | | $ 287,910 |
| Cost per tonne milled | | $ 0.82 |

### 9.4.2.3 Mine Operating Labor

| Position | No. | Average Hourly Wage | Annual Wage | Annual Cost |
|---|---|---|---|---|
| Development Miners | 2 | $ 19.12 | $ 39,865 | $ 79,730 |
| Blasters draw-hole | 8 | 17.66 | 36,821 | 294,568 |
| Mucking Crew | 6 | 17.66 | 36,821 | 220,926 |
| Tramming Crew | 2 | 17.66 | 36,821 | 73,642 |
| Crusher Operators | 4 | 15.59 | 32,505 | 130,020 |
| Sub Total | 26 | | | 798,886 |
| Payroll Burden 26% | | | | 207,710 |
| Total Annual Cost | | | | $ 1,006,596 |
| Cost per tonne milled | | | | $ 2.86 |

### 9.4.2.4 Mine Maintenance & Services Labor

| Position | No. | Average Hourly Wage | Annual Wage | Annual Cost |
|---|---|---|---|---|
| Electrician | 1 | $ 19.12 | $ 39,865 | $ 39,865 |
| Electrician | 1 | 17.66 | 36,821 | 36,821 |
| Diesel Mechanic | 1 | 19.12 | 39,865 | 39,865 |
| Diesel Mechanic | 1 | 17.66 | 36,821 | 36,821 |
| Welder | 1 | 19.12 | 39,865 | 39,865 |
| Timbermen | 3 | 17.66 | 36,821 | 110,463 |
| Timbermen | 3 | 15.00 | 31,275 | 93,825 |
| Changehouse & Lamproom | 1 | 11.77 | 24,540 | 24,540 |
| Sub Total | 12 | | | 422,065 |
| Payroll Burden 26% | | | | 109,737 |
| Total Annual Cost | | | | $ 531,802 |
| Cost per tonne milled | | | | $ 1.52 |

### 9.4.2.5 Mine Incentive Bonus

Incentive bonus 40 percent of total operating and maintenance wages to be distributed among mine personnel on an incentive system within the mine operation.

| | |
|---|---|
| Operating Wages | $ 1,006,596 |
| Maintenance Wages | 531,802 |
| Total | $ 1,538,398 |
| Annual Bonus Allowance | $ 615,359 |
| Cost per tonne milled | $ 1.76 |

### 9.4.2.6 Mine Operating Supplies

| Item | | |
|---|---|---|
| Drill steel and bits | | |
| | - development | $ 15,000 |
| | - stoping | 10,000 |
| Explosives | - development | 24,000 |
| | - stoping | 262,500 |
| Rock bolts | | 15,000 |
| Timber | | 20,000 |
| Ventilation ducting | | 15,000 |
| Tires | | 50,200 |
| General consumables | | 65,000 |
| Electrical power | | 216,552 |
| Annual Cost | | $ 693,252 |
| Cost per tonne milled | | $ 1.98 |

### 9.4.2.7 Mine Maintenance Materials

| Item | |
|---|---|
| Drilling equipment | $ 24,000 |
| LHD Units | 96,000 |
| Ore haulage trucks | 26,000 |
| Crushing area | 30,000 |
| Drawpoint maintenance | 250,000 |
| Electrical maintenance | 25,000 |
| Ventilation | 10,000 |
| Miscellaneous | 50,000 |
| Total Annual Cost | $ 511,000 |
| Cost per tonne milled | $ 1.46 |

### 9.4.2.8 Mine Electric Power Requirements (Block Caving)

Crushing & Conveying

| Item | Hp | |
|---|---|---|
| Conveyor #3 | 35 | |
| Belt feeders | 20 | |
| Gyratory crusher | 200 | |
| Conveyor #2 | 60 | |
| Conveyor #1 | 30 | |
| Jaw crusher | 150 | |
| Chain feeder | 25 | |
| Dust collecting | 30 | |
| Lighting | 10 | |
| Total Hp | 560 | |
| Mining (Block Caving | | |
| Mine shop equipment | 50 | |
| Compressor | 125 | |
| Ventilation | 280 | |
| Lighting, etc. | 25 | |
| Total Hp | 480 | |
| Sub Total | | 1,040 |
| Plus 25% | | 260 |
| Block Caving Total connected power | | 1,300 |

## 10.0 OPERATING COSTS - MILL

Data - 350,000 tonnes per year
- labour rates include 26% payroll burden
- operators rate $16.50/hr
- trades rate $17.50/hr.

### 10.1 Labour

| Item | $/tonne | $/year | |
|---|---|---|---|
| Mill superintendent | .157 | 55,000 | |
| Mill foreman | .114 | 40,000 | |
| Mill operators - 8 | .826 | 289,000 | |
| Leaching operators - 4 | .416 | 144,500 | |
| Trades - mechancis - 3 | .312 | 109,200 | |
| Trades - electricians - 1 | .104 | 36,400 | |
| Assayer | .114 | 40,000 | |
| Assayer assistant | .091 | 32,000 | |
| | 2.134 | 746,100 | |
| Payroll burden | .554 | 194,000 | |
| Sub total - labour | 2.69 | | $ 940,100 |

### 10.2 Supplies

| Item | $/tonne | $/year | |
|---|---|---|---|
| Liners - jaw crusher (1) | .040 | 14,000 | |
| Liners - cone crusher (2) | .040 | 14,000 | |
| Liners - rod mill (3) | .045 | 15,800 | |
| Liners - ball mill (4) | .052 | 18,200 | |
| Media - rods (5) | .441 | 154,400 | |
| Media - balls (6) | .937 | 328,000 | |
| Reagents - frother (7) | .250 | 87,500 | |
| Reagents - collector (8) | .038 | 13,100 | |
| Reagents - NaCN (9) | .400 | 140,000 | |
| Reagents - lime (10) | .030 | 10,500 | |
| Reagents - CN destruction (11) | .409 | 143,000 | |
| Assaying (12) | .108 | 37,800 | |
| Miscellaneous operating | .250 | 87,500 | |
| Miscellaneous maintenance | .500 | 175,000 | |
| Sub total - supplies | | | 1,238,800 |
| Power (13) | 1.44 | 504,000 | 504,000 |
| Total Operating Costs Mill | $ 7.67 | | $ 2,682,900 |

Notes:

(5) .15 kg/kwh x 4.2 kwh/t x $0.70/kg

(6) .06 " x 22.3 " x "

(7) 100 g/t x $2.50/kg

(8) 15 g/t x $2.50/kg

(9) 200 g/t x $2.00/kg

(10) 200 g/t x $0.15/kg

(11) 389 g/t $SO_2$ x $0.55/kg + $CuSO_4$ @ $0.20/t ore

(12) 2500 assays/month x $1.30/assay = $3,250

(13) 40 kwh/t x $0.36/kwh - $1.44/t

## 11.0 ADMINISTRATION COSTS

### 11.1 Staff

| Position | No. | Annual Cost |
|---|---|---|
| Manager | 1 | $ 70,000 |
| Accountant | 1 | 50,000 |
| Purchasing and Warehouse | 1 | 35,000 |
| Clerk Stenographers | 2 | 44,000 |
| Safety and Training | 1 | 32,000 |
| Environmental and Personnel | 1 | 36,000 |
| Sub total | | 267,000 |
| Payroll burden 26% | | 69,420 |
| Total Annual Cost | | $ 336,420 |
| Cost per tonne milled | | $ 0.96 |

### 11.2 Hourly Rated

| Position | No. | Hourly Rate | Annual Wage | Annual Cost |
|---|---|---|---|---|
| Truck driver | 1 | $ 16.47 | $ 34,340 | $ 34,340 |
| Equipment Operator | 1 | 17.66 | 36,821 | 36,821 |
| Laborers | 2 | 11.77 | 24,540 | 49,080 |
| Gateman - First Aid | 4 | 16.19 | 33,756 | 135,024 |
| Sub total | | | | 255,265 |
| Payroll burden 26% | | | | 66,369 |
| Total Annual Cost | | | | $ 321,634 |
| Cost per tonne milled | | | | $ 0.92 |

### 11.3 Supplies Annual Cost $ 87,500

Cost per tonne milled $ 0.25

Total Annual Administration Cost $ 746,054

Cost per tonne milled $ 2.13

#1 of 10

PRELIMINARY ENGINEERING STUDY
KERR ADDISON MINES LIMITED
HARRISON LAKE GOLD PROJECT
BEAR MOUNTAIN, B. C.
DECEMBER 1987



#1 of 10 - Kerr Addison - Vancouver File copy.
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