

ABERFOYLE

MEMORANDUM

000

Date 30 December, 1980

Re: KGP:GMC

To: M.L. Houston

From: K.G. Palmer

At: Melbourne

At: Melbourne

By: S.M. Richards, J.M.B. Scarborough,  
D.P. McIntyre, E.G. Russell, P McGushin

Keep:

2ND PRELIMINARY ASSESSMENT OF THE VIABILITY OF THE ABERFOYLE OPEN CUT

Percussion drilling of the Aberfoyle vein swarm was terminated on 21 December when it was decided that further drilling was unlikely to substantially change the results of the assessment of the bulk grade of the deposit.

At that time a total of 9 holes had been attempted. Two achieved their planned target. The remainder intersected stopes or in one case had ground. While only two sections (4400 N and 5000 N) were adequately tested, it is considered that the tenor of and consistency of the results make it most unlikely that further drilling will yield markedly different assays.

The results are:

<u>Hole No.</u>	<u>I.W. (Metres)</u>	<u>% Sn</u>	<u>% WO<sub>3</sub></u>
RP1	11.5	0.183	-
RP2	37.5	0.111	-
RP3	42.0	0.126	0.04
RP4	10.0	0.127	-
RP5	5.0	0.038	-
RP6	75.0	0.123	0.01
RP7	21.0	0.093	-
RP8	Abandoned before reaching target		
RP9	"	"	"

The weighted average grade is 0.12% Sn, and less than 0.01% WO<sub>3</sub>.

All drill holes were logged and the contact between the barren Permian sediments and the underlying Mathinna beds was noted.

Prior to completion of the drilling programme, M.L.H. designed an open cut to allow 100% extraction of the "ore" above 4 L. The pit profiles were transferred to the drill sections at 1 inch to 40 feet scale.

..../cont.

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- 2 -

With the results of the drilling available, the upper limits of the mineralisation were located by drawing in the position of the base of the Permian. For each cross-section the areas of waste and ore were measured by planimeter after extending the pit by one bench to allow a trench cut at the bottom. Within the pit, volumes were calculated allowing an area of influence of 300 feet for each cross-section. At each end of the pit the volumes of waste and ore were calculated using the formula:

$$\text{Volume} = \frac{A \times h}{3}$$

where A is the area on the adjacent section and h is half the width of the pit at the surface. The total volume and volume of ore were calculated and the waste derived by subtraction.

Summary of Waste and Ore by Section:

<u>Section</u>	<u>Waste M<sup>3</sup></u>	<u>Ore M<sup>3</sup></u>
North of 6200	529,600	218,000
6200	508,000	245,000
5900	1,027,200	578,800
5600	1,299,000	630,000
5300	1,098,600	626,000
5000	1,360,000	633,800
4700	1,769,600	669,600
4400	689,600	247,500
South of 4400	529,600	218,000
<u>TOTALS</u>	8,811,200	4,066,700

Factors used were  $1\text{m}^3 = 35.31$  cubic feet  
Specific gravity 2.65 tonnes per cubic metre

It was assumed that 1.5 million tonnes has been mined from the vein system above 4L. The total ore before mining was 10.78 million tonnes so the net remaining ore is 9.28 million tonnes.

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Assessment of Operating Costs and Revenue:1 Assumptions

9,250,000 tonnes of ore  
 Mining by open cut  
 Waste to ore ration 2.5 to 1

Pre-concentration with 90% recovery  
 Final concentration with 80% recovery  
 Overall metallurgical recovery assume 70%  
 Waste rejected is 70% in pre-concentration.

Mining rate: 900,000 tonnes per year of ore  
 1,188,700 m<sup>3</sup> per year of waste and ore.

Final concentrator 270,000 tonnes per year.

Assume \$130 per M.T.U.

2 Annual Revenue

% Comb. Met.	0.15	0.20	0.25	0.3
\$10 <sup>6</sup>	12.3	16.38	20.48	24.57

3 Annual Operating Costs

	\$ x 10 <sup>6</sup>
Mining 1.19 x 10 <sup>6</sup> m <sup>3</sup> @ 3.30	3.927
Crushing 900,000 @ 1.50	1.350
Pre-concentration 900,000 @ 1.70	1.530
Concentration 270,000 @ 10.74	2.900
Site overheads	2.530
<hr/>	
Sub-total	12.240
Contingency at 15%	1.84
<hr/>	
Total	14.08
Cost per tonne of ore	<u>\$15.64</u>

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Assessment of Potential for Improvement:Grade

The average grade indicated by the drilling results is 0.12% combined metal. For every 75 tonnes of ore mined from the vein system in the original underground mine it is probable that 25 tonnes of ore are left as pillars. It can be shown that the possible grades of the overall vein system remaining and available for open cut mining are indicated by the following combinations.

Ore remaining as pillars.

200,000 to 350,000 at 0.80% to 1.5%

Vein swarm unmined

9,250,000 at 0.10 to 0.20%

The maximum possible grade (from combining maximum possible tonnes at highest possible grade) is 0.25% combined metal. The chances of this combination occurring is estimated to be:

$\frac{1}{10} \times \frac{1}{100} \times \frac{1}{100}$  or 1 in a million.

The most likely grade is considered to be the combination of 300,000 at 1.00% and 9,250,000 at 0.15%. This is 0.18% C.M.

Recovery

The assumed metallurgical recovery is 70%. Since the metallurgy is not new and a recovery of 80% has already been achieved in the final concentrator the assumption is realistic. To achieve a recovery above 80% in the final concentrator is optimistic. It is unlikely that more than an overall additional 5% recovery can be achieved at acceptable costs.

Operating Costs

The pit design by M.L.H. may not be an optimal one however any optimisation is unlikely to reduce the waste to ore ration below 2 to 1. The effect on operating costs would be significant but of the order of 500,000 dollars.

/....cont.



ABERFOYLE

MEMORANDUM

005

Date 9 September 1980 Ref  
 To D.P. McINTYRE From M.L. HOUSTON  
 At Melbourne At Melbourne  
 Copies to ~~P.J. McCushin~~, J.M.B. Scarborough, I.W. Pond, Keep  
 S.M. Richards, E.C. Russell

Subject ABERFOYLE TIN LIMITED  
BRANDON SHAFT OPEN PIT

The broad economics of this proposal have been assessed with the following results:-

Total ore tonnage, to 120 m below surface,

	3,000,000 tonnes
Overall waste:ore ratio	5.7:1
Annual ore production	400,000 tonnes
Mine life	7.5 years
Head grade	0.15%
Overall recovery	50%
Annual metal production	30,000 MTU
Annual revenue @ \$130/MTU	\$4,000,000
Capital investment, assuming mining contractors are used	\$2,000,000
Annual operating costs, including depreciation but excluding royalty and tax	\$7,900,000

A head grade of 0.46% CM would be required to produce a viable project, i.e. quartz volume would have to be 9 or 10% of rock volume instead of 3% as postulated.

An alternative proposal, mining only to a depth of 60m, with a waste:ore ratio of 1.7:1 and a mine life of 3 years, yielded a headgrade requirement of 0.3% CM, i.e. quartz volume 7% of rock volume.

It should be noted that an expenditure of approximately \$250,000 would be required to sample the top of the Mathinna group in order to obtain bulk samples.

It is not recommended we proceed further with this investigation.

M.L.H.

006

Date 18th September, 1980 Ref

To N.A.Gilberthorpe, J.M.B.Scarborough, S.M.Richards, From P. J. McGushin,  
D.P.McIntyre, M.L.Houston, E.G.Russell. I. W. Keyes

At Melbourne. At Rossarden

Copies to Keep

Subject - M.L.H. Memo - Brandon Shaft Open Pit

We refer to Mike Houston's memo on the above subject.

We disagree with the recommendation. If the parameters as stated were that clear cut we would not be putting forth the proposal. There is not sufficient information to hand to warrant such a dismissal of the project.

We believe the point or direction of our recent presentation in Melbourne has been misunderstood or overlooked. We did not, for example, suggest removal of overburden in order to obtain bulk samples. Rather we suggested transferring the Diamec 250 drill from 13 level to surface so that we could test for quartz content in the area and hence get a better grip on ore grade.

This is outlined in our report which is subsequent to the M.L.H. memo.

Our comments on the various parameters as outlined in the memo are as follows :-

1. Ore Tonnage

The ore tonnage is stated at 3 million tonnes. We disagree.

The calculated tonnage in the described ore block is 3.82 million tonnes. In addition the vein system would extend into the northern face of the pit, increasing the ore tonnage to 4.49 million tonnes.

2. Waste : Ore Ratio

Using an open pit slope of  $45^{\circ}$ , as recommended by M.L.H., the overall waste to ore ratio is shown to be 3.6:1 not 5.7:1. If veining is shown to extend into the southern face of the pit, the waste to ore ratio is reduced to 3:1.

3. Annual Ore Production

Why does the annual production have to be 400,000 tonnes ?

By utilizing the upgrading technique of size sorting, the annual ore production could be 600,000 tonnes.

4. Head Grade

The overall head grade of the block is yet to be defined. This is why the initial 16 diamond drill holes have been recommended. The limited available data indicated a head grade of 0.15% CM as stated. However, an increase in quartz content from 3% to 5% would increase this to 0.25% CM.

Thin quartz veins in the upper levels have commonly been observed to carry heavy contents of metal. This is supported by drill logs of core drilled in the proposed open cut area. The indicated quartz grade of 5% could easily be shown to be too low.

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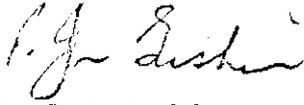
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5. Overall Recovery

Recovery is stated in the memo to be 50%. This is probably correct for a grade of 0.15% CM. However, an increase in the overall head grade, and further upgrading by size sorting would significantly increase the head grade into the mill, with an expected increase in recovery to 60 to 70%.

(not here to sign)

I. W. Keyes  
Production Geologist

  
P. J. McGushin  
Manager.

008

RIFLE RANGE LINE

LUTWYCHE LINE

KOOKABURRA LINE

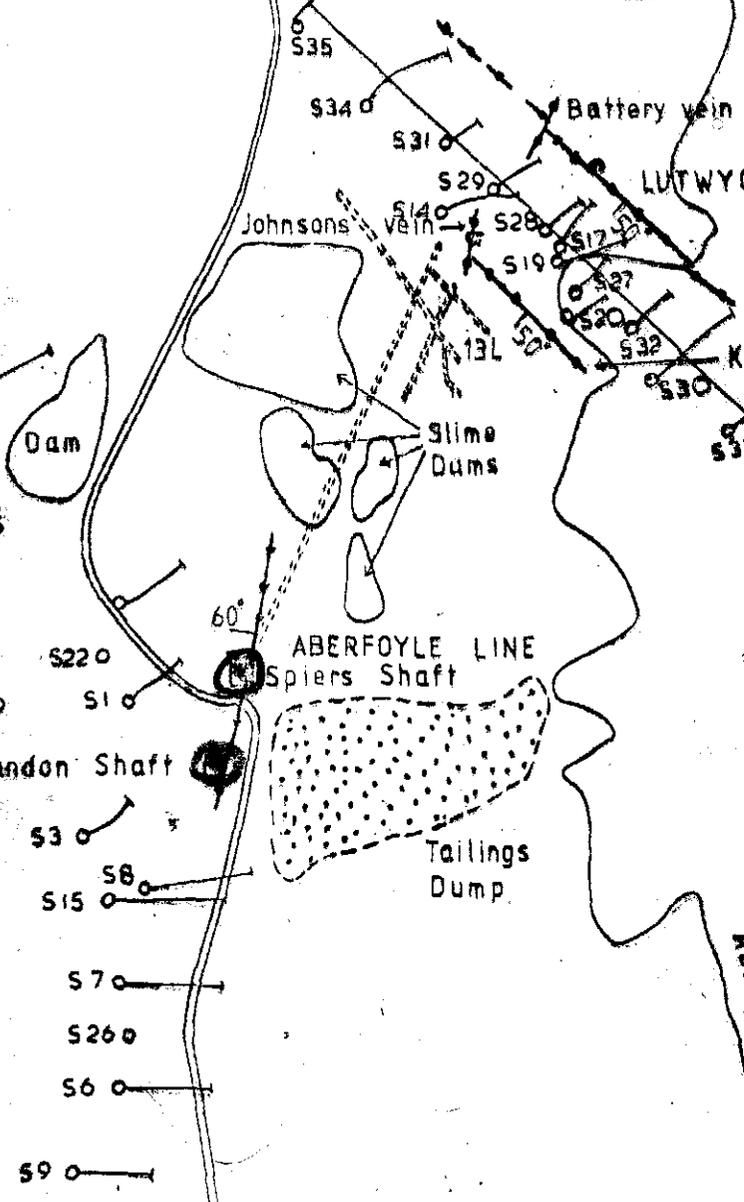
ABERFOYLE LINE

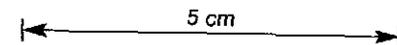
Spiers Shaft

Brandon Shaft

Slime Dams

Tailings Dump



Date 15/8/80	<b>ABERFOYLE TIN LTD</b>	
Drawn I. Keyes	<b>ABERFOYLE REGIONAL PLAN</b>	
Traced		
Refer		DRG. No.  <b>SCALE 1:12000</b>

009

ABERFOYLE TIN LTD.

-2" RECLAIMED ORE FROM BRANDON SHAFT SURFACE AREA TREATED AT  
THE ABERFOYLE MILL.

<u>WEEK ENDED.</u>	<u>EST. TONNES MILLED.</u>	<u>HEAD GRADE.</u>	
		<u>%Sn</u>	<u>%WO<sub>3</sub></u>
8. 7.80	170	0.69	0.13
15. 7.80	525	0.84	0.12
22. 7.80	250	1.05	0.20
29. 7.80	374	1.25	0.24
5. 8.80	151	0.86	0.14
12. 8.80	184	0.92	0.19
19. 8.80	241	0.65	0.12
<u>TOTALS.</u>	1895	0.92	0.16

1.08

Quartz Grade % Cr

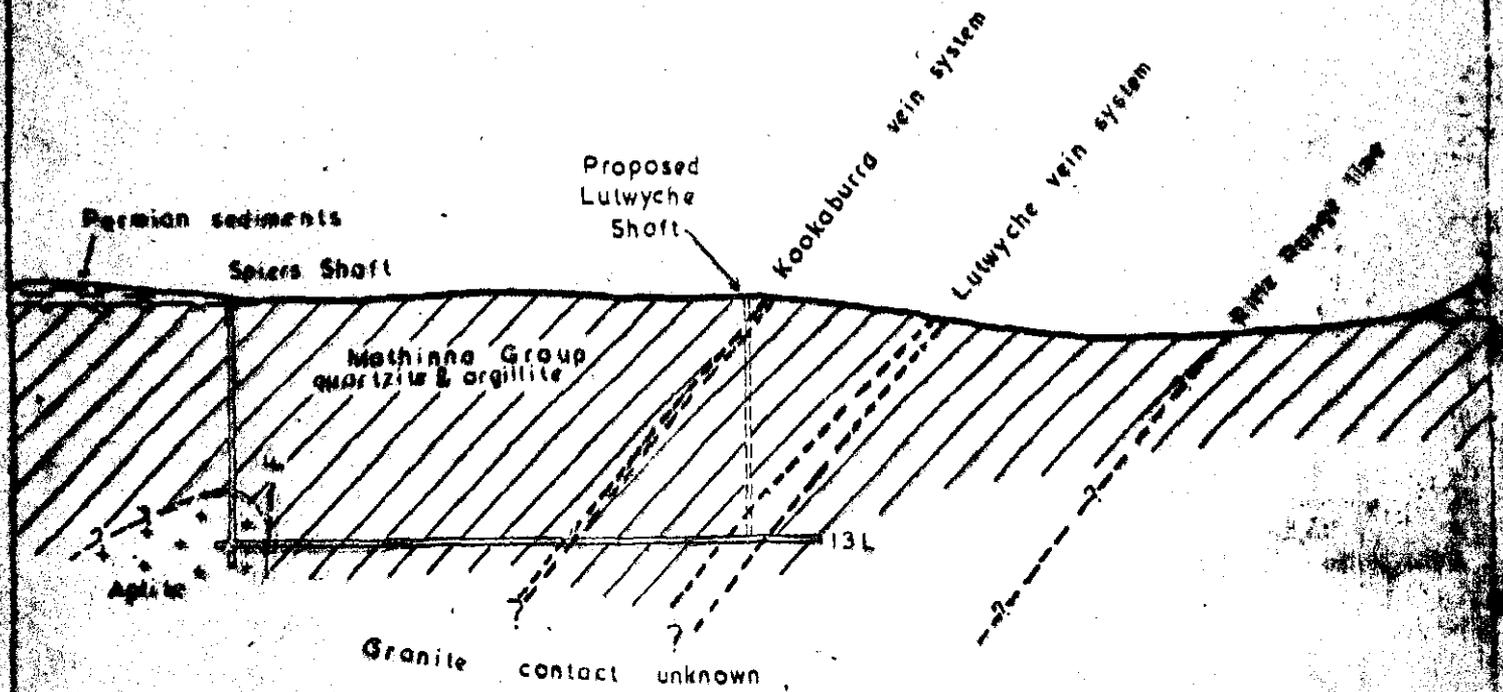
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Quartz Content %

	2%	3%	4%	5%	6%
2%	0.04	0.05	0.08	0.10	0.12
3%	0.06	0.08	0.12	0.15	0.18
4%	0.08	0.12	0.16	0.20	0.24
5%	0.10	0.15	0.20	0.25	0.30
6%	0.12	0.18	0.24	0.30	0.36
7%	0.14	0.21	0.28	0.35	0.42
8%	0.16	0.24	0.32	0.40	0.48
9%	0.18	0.27	0.36	0.45	0.54
10%	0.20	0.30	0.40	0.50	0.60

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SECTION THROUGH LUTWYCHE CROSS CUT  
LOOKING WEST

5 cm

Date	ABERFOYLE TIN LTD.	
Drawn	LUTWYCHE	DRG. No.
Traced	REGIONAL CROSS SECTION	
Refer.		SCALE 1:1000

ABERFOYLE

012

Date	27 October 1980	Re:	
To	N A Gilberthorpe	From	C I Roberts
At	Melbourne	At	Que River
Copies to	J M Scarborough	Keep	

Subject: ABERFOYLE - OPEN CUT PROPOSAL: CAPITAL COSTS

As requested, I have had a look at the Aberfoyle open cut proposals.

ASSUMPTIONS:

1. Ore Body Dimensions.

At 4 Level pit depth and bounded at this level in the south by 4 500 N Section and in the north by 6 120 N Section and with overall 45° pit slopes.

Pit Total Volume - m <sup>3</sup>	15 000 000
Ore Volume - m <sup>3</sup>	4 100 000
Waste Volume - m <sup>3</sup>	10 900 000
S G Ore Zone & Waste	2.63
Tonnes in Pit	32 450 000
Tonnes Waste	28 650 000
Tonnes in Ore Zone	10 800 000
Less Ore Extracted to Date above floor level (estimate)	1 300 000
Remaining Ore Zone	9 500 000
Total Pit to Remaining Ore Zone Ratio - tonnes basis	3.00
Assume	3.50

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2. Mining Rate

Ore Zone	750 000 t/a
Ore Grade	0.25% C M
Waste Rate	2 625 000 t/a
Total Mining Rate	3 375 000 t/a

3. Milling Rate

750 000 t/a to Crushing Plant
750 000 t/a to Pre Concentrator (Ore Sorter)
225 000 t/a to Mill

4. Housing

100 houses on serviced allotments.

5. Site Development

Existing Mill and Service buildings to be razed and new facilities to be constructed.

With these assumptions I make the following order of magnitude estimate of the capital cost of development of a new facility:-

	<u>\$ Million</u>
(a) Mining equipment to drill, blast, haul, dump and dispose of waste and including service equipment. Relatively short haul lead from pit to mill and to waste dump. 3 375 000 t/a @ \$3.00	10.0
(b) Civil works including site preparation and haul road development. 3 375 000 t/a @ \$1.00	3.3
(c) Primary Crushing and Screening Plant 750 000 t/a @ \$3.00	2.2
(d) Pre Concentrating 750 000 t/a @ \$1.33	1.0

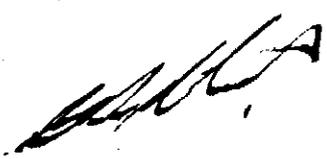
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\$ Million

(e) Processing	
225 000 t/a @ \$30.00	6.7
(f) Workshop, Administration & Service Buildings	
3 375 000 t/a @ \$1.00	3.3
(g) Provision of Services	
3 375 000 t/a @ \$1.00	3.3
(h) Housing	
100 houses @ \$70 000	7.0
	<u>36.8</u>

This estimate has an accuracy of  $\pm 30\%$ , i.e. it covers the range \$26 to \$48 million.

  
C. I. Roberts

015

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**ABERFOYLE**

## APPROPRIATION REQUISITION

No.: EXP/OA80/4

Originating  
Department: NEW PROJECTS GROUP

Date: 8/10/80

Item No.  
In Plan: NIP

Title: EVALUATION OF OPEN CUT POTENTIAL - ABERFOYLE

Amount  
In Plan: -

Classification: NEW VENTURE

Period of  
Expenditure: P12, 1980

Amount: \$92,900

Estimated Return  
on Investment: n.a.

% D.C.F.R.O.R. n.a.

Estimated  
Payback

Years

Statement of Proposal: To evaluate the grade of the Aberfoyle vein swarm above 4L by percussion drilling.

Summary of Proposal: The Aberfoyle vein swarm at and above 4L is demonstrated by exploration and development to have an average width of 60 metres and strike length in excess of 600 metres. Thus a resource in excess of 8.0 million tonnes may exist. Economic viability of mining the total vein system depends on metallurgical characteristics and the grade of the resource.

Initial appraisal of the exploration and development data (which includes drill logs, drill core and underground mapping) confirms that of the 8.0 million tonnes approximately 3% by volume is quartz occurring in veins greater than 6 mm true width. No allowance is made for vein remaining as pillars or for mullock fill, known to be mineralised. All the valuable minerals are concentrated within the quartz veins.

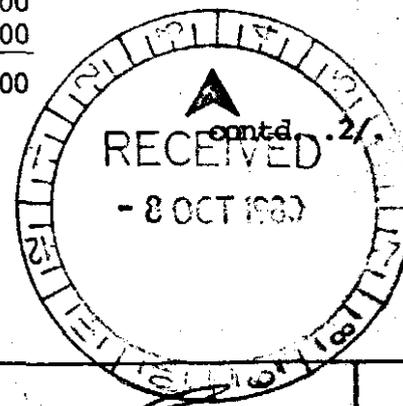
Mined grades from 4L and above indicate that the veins may contain in excess of 8% (Sn + WO<sub>3</sub>). If all the remaining veins contain a similar quantity of tin and wolfram an overall grade of more than 0.20% is likely for the 8.0 million tonnes resource. With preconcentration, either by jigs or photometric sorting and with an improved final concentrator circuit (including flotation) viability is likely.

It is proposed to evaluate the grade of the vein system by drilling seven 165 mm percussion drill holes. An allowance is made for drilling sufficient diamond core to provide samples for preliminary metallurgical investigations.

Consequential Expenditure: It is anticipated that if this programme is successful full scale exploration will be completed in 1981, which will include:-

Drilling	\$270,000
Bulk Sampling	100,000
Metallurgy	30,000
<b>Total</b>	<b>\$400,000</b>

- List of Attachments:
1. List of drill holes
  2. Surface Plan
  3. Cross Section
  4. Expenditure Estimate details



## ENDORSEMENTS

Department Superintendent	Date	Manager	Date
		<i>Michael O'Connell</i>	8/10/80
Site Engineer		Applicant's Signature <i>TC P. Paterson</i>	
Site Asst. Eng.			

Statement of Anticipated Expenditure:

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Geology	16,300
Survey	800
Percussion Drilling	55,200
Metallurgy	4,000
Assays	4,200
Sundries	300
Administration	12,100
	<hr/>
	\$92,900

contd...3/.

\_\_\_\_\_  
 Date :  
 Group Metallurgist /  
 Chief Mining Engineer

Economic and Financial Endorsement

This expenditure is not included in the Form 3 Budget, but is being included in the Form 1 Budget

\* The Budget + Evaluation Committee endorse the request, subject to resolution of organizational arrangements for the proposal. The Committee has assumed that the Aberfyfe property continues to be operated by the Aberfyfe Group.

\* Approved 14/10 that request should be in name of New Project Group Ltd.  
 \_\_\_\_\_ Date :  
 Chief Accountant

APPROVALS

DATE

Manager		
Evaluation Committee	<i>[Signature]</i> * see endorsement above.	13/10/80
Investment Review Committee	GM Response <i>[Signature]</i> <i>[Signature]</i>	20/10/80
Managing Director	C.E.O.	
Chairman's Committee		
For Board of Directors		

Copies to

## 017 Technical Enclosure: (MJI - 1/10/10)

## Aerfoyle Open Cut

Estimated capital cost of the aerfoyle open cut is \$21-25 million.  
Estimated annual operating costs are \$11-15 million.  
Estimated annual throughput is 750,000-1,000,000 tonnes.  
Estimated overall recoveries of total ore treated are 50-70% C.M.

Capital Expenditure	\$21-25 million
Annual Operating Costs	\$11-15 million
Annual Throughput	750,000-1,000,000 tonnes
Overall Recoveries of total ore treated	50-70% C.M.

All these estimates are heavily dependent on the pre-concentration method used. Photometric sorting will require a heavy capital investment, is likely to yield higher recoveries in the pre-concentration phase and would have low operating costs.

H.M. cyclones and spirals are low-capital units but would have high operating costs and lower recoveries.

Given success with this preliminary exploration programme it will be important to conduct metallurgical tests to optimise the pre-concentration method.

Assuming the estimates given above are within the right order of magnitude, an overall head-grade of the resource in excess of 0.2% C.M. would be required to warrant further serious consideration.

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ATTACHMENT NO. 1

## Aberfoyle Vein System

Open Cut Proposal                      0-4 L - List of Drill Holes

6200 N	1487 E	-60	480'
5900 N	1434 E	-60	540'
5600 N	1472 E	-60	480'
5300 N	1455 E	-60	420'
5000 N	1315 E	-70 <sup>o</sup>	480'
4700 N	1255 E	-70 <sup>o</sup>	420'
4400 N	1055 E	-60	400'

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3220'  $\approx$  980 m

019

Expenditure Estimate Details

	\$
000	<u>Sundries</u>
	Mail, freight, office supplies 300
1400	<u>Geology</u>
	District Manager x ½ period 2,100
	Geologist x 2 periods 3,800
	2 Field technicians x 2 periods 5,600
	Drafting x ½ period 600
	Accommodation + Meals @ \$10/manday 2,200
	Vehicles (2 x 4 W.D.) x 2 periods 1,600
	Communications 200
	Airfares (2 x Melbourne - Launceston) 240
1700	<u>Survey</u>
	Mine Surveyors - drill collars 500
	Down hole camera operation and maintenance 300
3101	<u>Percussion Drilling</u>
	980 metres at \$45/metre 44,100
	Contingency 150 metres at \$45/metre 6,750
	(To allow for lost hole in stope)
	Sample Bags 450 @ \$60/100 270
	Sampling Equipment (Riffle Splitter, cyclone, includes travel + manufacturing costs) 4,000
3105	<u>Assays</u>
	420 Percussion samples @ \$10.00 4,200
5100	<u>Metallurgy</u>
	50 metres of underground drilling @ \$40/metre 2,000
	Allowance for preliminary preconcentration tests 2,000
	<b>TOTAL:</b> 80,760
	Administration at 15% 12,114
	<u><u>\$92,874</u></u>