MINE SUPT

Ref. 1.11.1
1.18.1

ABERFOYLE TIN N. L.

16th May, 1978

TO: Mine Manager

FROM: Mine Superintendent

LUTWYCHE PROJECT

The attached report outlines the current Lutwyche situation together with current planning and intentions.

It is restricted to the operational and capital and special expenditure aspects, the assumptions at this stage being that production will be profitable and yield a satisfactory return on investment.

These latter aspects will form part of the 5-year plan currently in preparation.

M. A. Eager
Mine Superintendent

THE LUTWYCHE PROJECT

CURRENT STATUS AND PLANNING

M. A. EAGER
ROSSARDEN, MAY 1978.

THE LUTWYCHE PROJECT

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THE LUTWYCHE PROJECT

1. LUTWYCHE DEVELOPMENT PROGRAMME

Table 1 defines the broad scope of a 4-stage programme to bring the Lutwyche deposit into production in 1978, and to increase production rates to 300 tonnes/day by 1984. Progression to each stage is contingent upon success from the preceding stage, and a primary aim has been to keep financial exposure at a minimum.

The programme commenced in mid 1977 with the rehabilitation and improvement of 13 level services and installations. This was followed in October 1977 with Stage I diamond drilling and development with the dual aims of outlining ore reserves and defining the extent of high pressure groundwater. These activities are still in progress.

2. 13 LEVEL REHABILITATION

Expenditure $19,800, June - October 1977.

(i) Ventilation - Installation of pressure and exhaust fans, and 1000 metres of polythene ducting.

(ii) Transport - A 1½ ton loco, side tipper trucks, Eimco 12B rocker shovel, and battery charging facilities, were reconditioned and installed on 13/L.

(iii) Chutes and Orepasses - Replacement of stope chutes, grizzley installation, repairs to ore and waste pass chutes on 14/L.

(iv) Drainage and Pumping - Settling sumps were constructed at the 13/L No. 2 pump station and the single 50 h.p. pump set was replaced with two 60 h.p. units. No modifications were made to 13/L No. 1 pump station.

<u>Maximum</u> pumping capacity from 13/L to surface via the 10/L sumps and pump station is now 70 l./sec. (900 g.p.m.), whilst the uncontrollable inflow from the Lutwvche section is approximately one tenth of this amount.

<u>Continuous</u> rated pumping capacity from 13/L to surface is 45 l./sec. (600 g.p.m.), this being determined by the continuous rated capacity of the 10/L pump station.

Appendix I gives full details of the mine pumping system.

TABLE I LUTWYCHE DEVELOPMENT PROGRAMME

STAGE	AIMS	METHODS	PLANNED * EXPENDITURE $	TIMING
PRELIMINARY	Preparation of 13 level services and installations.	Installation of fans, ventilation ducting, power cabling. Installation of sumps and pumps. Provision of mucking and transport equipment, chute and track repairs.	20,000	1977 (Completed)
I	Prepare 5000-10,000 tonne block for production. Define groundwater problem and solution. Determine vein extensions on dip above and below 13 level.	Rise and sublevel development. Level development. Diamond drilling. Increased 13 Level pumping capacity.	65,000	Oct. '77 - June'78
II	Commence production. Increase Indicated Ore Reserves.	Drill ventilation borehole, surface to 13 level. Rise and level development - Diamond drilling. Hydraulic fill reticulation and 13/L booster pump. Independent access 13/L - 11/L.	271,000	July '78 July '79
III	Increase production to 120 tonnes/day Increased Indicated Ore Reserves.	Raisebore 1.2m vent shaft to surface. Sink and equip hoisting winze below 13 level. Additional compressed air, electrical and pumping capacity. Development and diamond drilling. Surface fill station.	600,000	Aug. '79 - July'80
IV	Increase production to 300 tonnes/day.	Internal service shaft 13/L - 9/L. Additional production equipment. Extension of hoisting winze etc.,	600,000	Aug. '80 - 1984.

* As at May, 1978

3. STAGE I - EXPLORATORY DRILLING AND DEVELOPMENT

Diamond drilling from October, 1977 to April, 1978 has totalled 282 metres. Ten holes have been drilled with all but three being steeply inclined to gain vein and groundwater information above and below the 13 level horizon. Five holes were terminated after encountering water flows of up to 10 l./sec. (150 g.p.m.) at pressures of 500 p.s.i.

Drilling progress has been slower than anticipated due to :

* Machine breakdown - the Mindrill E500 machine was essentially built up from salvaged items and has required major repairs.

* Reduced drilling performance when drilling steeply inclined holes.

* Training of diamond drillers.

Appendix II summarises the drilling results.
Approximately 150 metres of drilling remains to be completed in Stage I.

Development was commenced on Hangingwall Vein in November, 1977. Initially it was planned to extend the No. 2 rise and then develop a sub-level from the top of both rises. High pressure water flows forced the temporary abandonment of this area and development was commenced in the relatively dry Battery Vein area. Rising and pillar driving in Battery Vein is continuing with the aim of outlining and developing a 5000 - 10,000 tonne ore block.

Total development to April, 1978 was 81 metres and approximately 90 metres of Stage I development remains to be completed.

Total Stage I expenditure is now estimated at $65,000 compared with the planned $40,000. This increase is mainly the result of the additional work which was required following the transfer of development to Battery Vein area.

Recoverable value of ore produced to end of Stage I is conservatively estimated at $45,000 (1,000 tonnes @ 0.6% C.M.U., 75% recovery, $100 average per M.T.U.)

Milling etc. costs reduce this to a net revenue of $34,000.

4. ORE RESERVES

Existing development, including Stage I development to date, has established an Indicated Ore Reserve of 17,100 tonnes with visually estimated grades of 0.2% Sn and 0.7% WO_3 over a 1.2 metre stoping width.

Table II gives details of the Indicated Ore Reserves at April 30, 1978. See also Figure 1. - 13 Level Plan.

There is good potential for large additions to the Indicated Ore Reserve, working from the 13 level horizon. Diamond drilling continues to confirm the dip extensions of the three main veins and also suggests a probable footwall vein system at the southern end of 13 level.

Rise and pillar drive development in Battery Vein continues to increase both the ore tonnage and the confidence in grade estimates and continuity. An en-echelon (?) extension of Battery Vein has been located and is being developed by driving at 13 level.
It is hoped that this development will intersect the footwall vein system thus allowing its access with minimum waste development.

The five year plan currently in preparation assumes the success of the Lutwyche programme and the extraction of 178,000 ore tonnes from Lutwyche to 1983. Thereafter, Lutwyche production is planned at the rate of 72,000 tonnes per annum.

Current estimates put ore potential at 400,000 to 500,000 tonnes i.e. a Lutwyche life of 8-10 years. This ore potential is based on a strike x dip extent of 500m x 300m, these dimensions being generally indicated by all available data.

TABLE II

INDICATED ORE RESERVES - LUTWYCHE

At 30th April, 1978

LOCATION	INDICATED DILUTED MINEABLE ORE RESERVE			COMMENTS
	Tonnes	%Sn	$\%WO_3$	
Hangingwall Vein above 13/L	7800	0.1	0.7	Some rise and stope development. Cessation of rise development due to high pressure groundwater.
Pay Vein above 13/L	500	0.4	0.4	
Battery Vein above 13/L	4400	0.3	0.7	Rise and pillar drive development in progress. Vein near vertical. Relatively free of groundwater problems.
Veining below 13/L	4400	0.2	0.7	Down-dip extensions from 13 level development.
TOTAL	17100	0.19	0.68	

5. GROUNDWATER

The presence of high pressure groundwater has stopped further up-dip development of Hangingwall Vein, and since at this stage it can only be assumed that large volume flows are possible, it becomes essential to accurately define the problem before a decision to mine the area can be made.

The assistance of the Tasmanian Mines Department was sought and their Geological Engineer P. Stevenson and Mines Inspector R. Thomas inspected the area and had discussions with K. Palmer and M. Eager

Summarising the general concensus :

* The area is saturated (typical of the Mathinna sediments) but probably of low permeability.

* It is probable, that on breaking into the system, the initial release of pressure and correspondingly high flow will rapidly subside into a continuous and constant but manageable inflow.

* By drilling into the water zone with a pattern of closely spaced holes, and by measuring pressure and flow as drilling proceeds, it should be possible to accurately predict both initial inflow and final equilibrium conditions.

Appendix III provides details, and the recommended drilling and evaluation is in progress.

Information from both development and diamond drilling suggests a system of several wet zones dipping at up to 60^{o} and trending N.W.-S.E. (Fig. 1).

The area south of the main crosscut, including the Battery Vein area, appears to be relatively dry, the higher pressures and flows being encountered north of the main crosscut and affecting both Pay Vein and the ore grade section of Hangingwall Vein.

Additional drilling is in progress to better define the dip and lateral extent of the wet zones. Priority in the short term being to establish, if possible, that production could commence in Battery Vein without encountering disabling water inflows.

6. LUTWYCHE DRAINAGE

Uncontrollable inflow from the 13 level Lutwyche area is currently 5 - 7 l./sec. (65 - 90 g.p.m.).

Referring to Appendix I, continuous 13 level flows of greater than 45 l./sec. would require additional pumping capacity at 10 level. For short periods a 13 level flow of up to 70 l./sec. can be pumped.

A sudden inrush of say 100 l./sec. (1300 g.p.m.) would flood the mine to the 13 level pumps in 7 hours and to the 10 level pumps in less than 24 hours.

It thus becomes imperative to ensure that the groundwater remains controllable where possible and to take full precautions during development and stoping to avoid significant releases of water.

Precautions currently being practised include the drilling of a pattern of 4m. water cover holes ahead of all development faces and the regular inspection of the 13 level watertight door.

If the 13 level pumps do become flooded, the 10 level pumps cannot dewater below 10 level since they operate with flooded suction inlet from settling dams. To protect these pumps a high capacity low-head submersible pump is required at 10 level. Its capacity should be equal to that of the pumpstation, that is 80 l./sec. (1100 g.p.m.)

7. VENTILATION /

Ventilation of Lutwyche development is currently by a pressure-exhaust system from Aberfoyle shaft using 600 mm polythene ducting.

Measurements on this system indicate approximately 1.4m^3/sec. circulation and an air velocity along the main crosscut of 0.3m/sec.

Mines Inspector R. Thomas' directive is that no stoping shall take place until a through ventilation system is provided.

For production, a minimum velocity of 0.15m/sec. is required in stoping areas, slightly greater for drive development.

Thus, allowing a split of fresh air to service say four working areas (of 3m^2 cross section) a minimum of 2m^3/sec (4200 c.f.m.) would be required. This quantity would be sufficient for a single shift production rate of up to 60 tonnes/day.

In view of the high cost and the time required to drive an additional horizontal opening from Aberfoyle shaft, the only alternative for through ventilation is an opening to surface in the Lutwyche area.

This opening would be equipped with an exhaust fan on surface, Aberfoyle shaft providing the downcast fresh air.

13 level is 390 metres below surface and either raiseboring or large diameter drilling would provide a suitable opening.

Raiseboring to say 1.2m diameter would have the advantages of sufficient ventilation capacity to service up to a 300 tonne/day production rate and of providing emergency access to the Lutwyche area.

However it is probable that significant continuous flows of water would be encountered and these would require sealing off before the shaft could be used for ventilation. This would be likely to involve both high cost and protracted drilling and grouting.

Large diameter drilling (0.4m to 0.6m diameter), and the casing off of any water inflow provides a more controllable and predictable method.

A minimum internal diameter of 0.35m (14 inches) would enable 2m^3/sec. to be exhausted using a high pressure exhaust fan.

Figure 1 shows the proposed borehole location on 13 level and Appendix IV contains the relevant ventilation calculations and fan specifications.

Approaches have been made to a number of drilling contractors, and three (Intairdrill, W.L. Sides, and Vibropile) claim to be able to drill 0.35m to 0.60 m. diameter to the required depth and accuracy.

Requests for quotations have been issued.

At this stage, the following estimates can be made, based on approximate drilling prices supplied by Intairdrill and W. L. Sides. Casing costs have been assumed as $70/metre for 0.38 dia. and $85/metre for 0.46m dia., and the worst case of casing the full length of hole has been assumed.

DRILLED DIAMETER	0.38m		0.46m	
	$		$	
Mobilize/Demobilize	4,000		30,000	
Drilling 390m	66,000		88,000	
Casing 390m	27,000		33,000	
TOTAL	97,000	($250/m)	151,000	($390/m

Underground access development and the supply and installation of a high pressure exhaust fan on surface would total approximately $10,000.

That is provision of through ventilation is likely to cost $107,000 - $161,000.

8. BATTERY VEIN PRODUCTION - FEASIBILITY

Current rise and pillar drive devlopment on Battery Vein is revealing an almost vertical vein with relatively good footwall and hangingwall ground conditions.

Grades are visually estimated 0.3% Sn and 0.7% WO_3. Certainly the grades are as good, if not better than, in any current production stope in Aberfoyle Mine.

The 3S Cross-Section, Fig. 2 (in effect a longitudinal section on (Battery Vein) shows current and proposed development. When completed a mineable block of approximately 6000 tonnes will have been outlined.

It is expected that this block will be mineable without hydraulic sand fill, either by open or shrinkage stoping, and with timber and/or rockbolt support as required.

Aside from the stope development the only other pre-production requirements are : -

(i) The through ventilation system outlined in (7) above.

(ii) Satisfactory groundwater control. As discussed in (5) above, it is anticipated that the Battery Vein area is relatively dry and will need only nominal drainage. However it will still need precautionary water cover drilling ahead of faces advancing into untested ground.

9. BATTERY VEIN PRODUCTION - ECONOMICS

Ore Tonnes	-	6000
Head Grade	-	0.3% Sn, 0.7% WO_3, plus beneficial effect of mullock sorting.
Mill Recoveries	-	75% (conservative)
Metal Prices	-	Sn \$89/M.T.U.; WO_3 \$107/M.T.U. } 1979 Plan Prices

REVENUE ESTIMATE $457,000

EXPENDITURE ESTIMATE

		$	
Remaining Stope Development		18,000	
Mine Production	6000 tonnes @ $18.50	111,000	
Milling	6000 tonnes @ $11.00	66,000	
General Indirects	6000 tonnes @ $2.00	12,000	
		$207,000	
Ventilation Bore-hole		$160,000	
Groundwater Control		10,000	
Miscellaneous Equipment		10,000	
		$180,000	
TOTAL			$387,000
NET PRODUCTION SURPLUS			$ 70,000

That is, initial production at 25 tonnes/day would present approximately a zero net cash requirement over a 12 month period.

This approach will form the basis of an Appropriation Requisition for the borehole which can be issued as soon as quotations are received.

10. ADDITIONAL STAGE II EXPENDITURE

Stage II provides for the establishment of Lutwyche as a 40-50 tonne/day production unit, together with continuing exploration and development.

Thus, in addition to the expenditure outlined in (9) above, the following items of Capital and Special Expenditure will be required:

		$
(i)	Independent Access Rise 13/L - 11/L 65m @ $165/m	11,000
(ii)	Sandfill reticulation	27,000
(iii)	Exploratory Drilling 500m @ $32/m including site excavation	16,000
(iv)	13/L Drive Development 80m @ $260/metre	21,000
(v)	Additional pumping installations 10 level	10,000
(vi)	Additional sump and pump installations 13/L	6,000
		$91,000

That is, total Stage II expenditure $271,000.
Period of expenditure - July 1978 to July 1979.

11. STAGE III

Stage III provides for increasing the production rate to 120 tonnes per day.

This will require increased services (ventilation, compressed air, pumping, fill, power) and continuing exploration.

Additionally, in order to maintain 13 level as the centre of production and so avoid the necessity for a service shaft, reserves below 13 level will be developed from a service and hoisting winze.

Estimated expenditure $600,000 principal items being:

(i) 1.2m dia. raisebored ventilation shaft.

(ii) Sinking and equipping an internal hoisting and service winze.

(iii) 13 level Substation.

(iv) Surface fill station.

(v) Exploratory Drilling.

(vi) Mining production and transport equipment.

12. STAGE IV

Stage IV completes the expansion of Lutwyche and aims at a 300 tonne/day production rate by the end of 1984.

The provisional capital and special expenditure estimate is $600,000 over the period from mid 1980 to the end of 1984.

APPENDIX I

ABERFOYLE SHAFT - MINE PUMPING SYSTEM

The diagram overleaf shows the present mine pumping system.

The following notes are relevant to Lutwyche drainage.

* Total drainage from the Aberfoyle section varies between 15 l./sec. and 25 l./sec. The 10 level pump station with an installed capacity of 83 l./sec. can thus cope with Lutwyche drainage to a maximum of 68 l./sec. With any one pump out of service on 10 level this reduces to 45 l./sec. (600 g.p.m.)

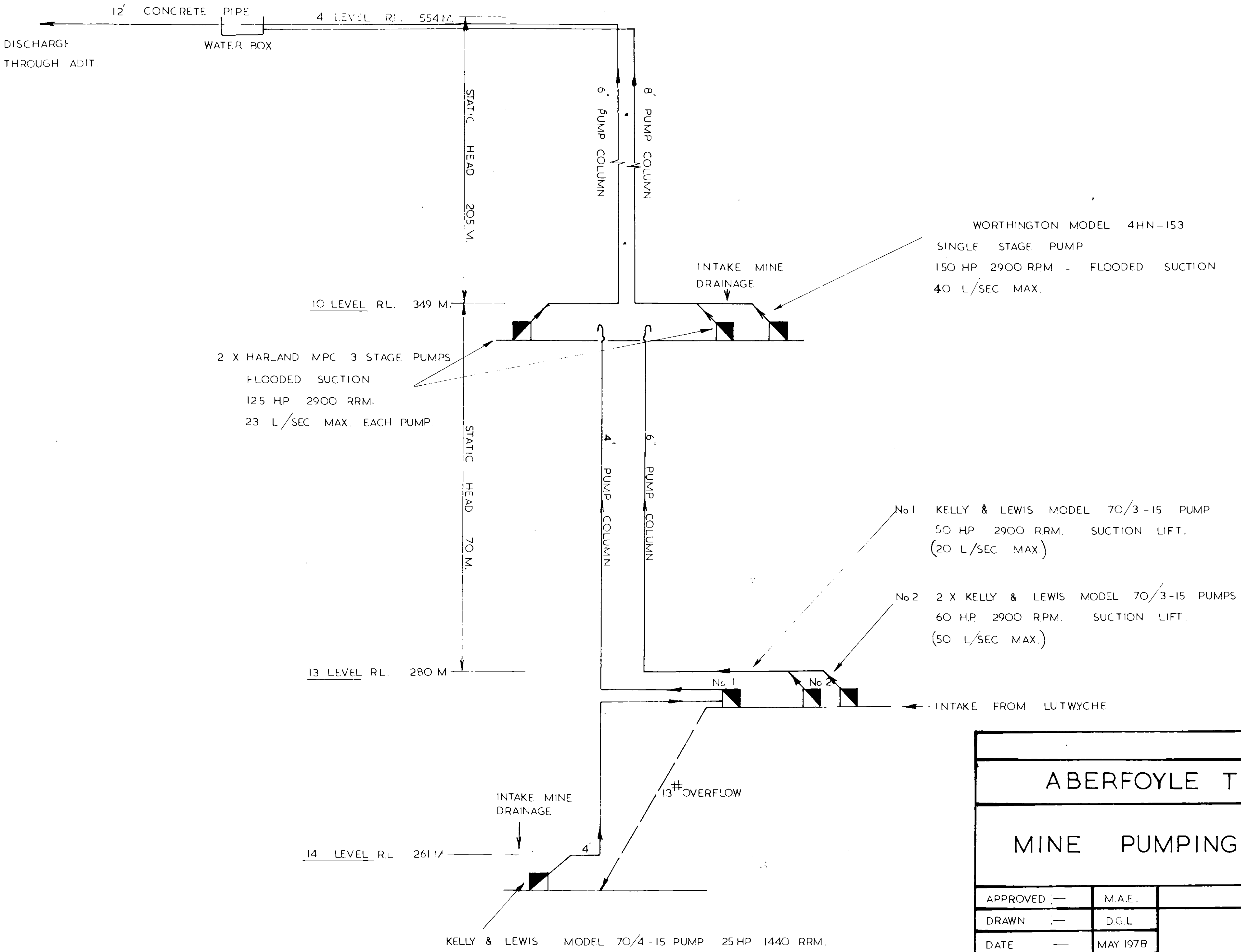
* Column capacity, 10/L - 4/L, is 140 l./sec. for a 15 metre friction head. To utilize this capacity would require an additional pump set at 10 level.

* Column capacity, 13/L - 10/L, is virtually the same as installed pump capacity - 70 l./sec. for 15m friction head.

* With any one pump out of service on 13 level, pump capacity reduces to 50 l./sec.

* Emergency storage below 13 level (i.e. shaft and 14/L flooded) is ¾ million litres. (170,000 gallons)

* Storage below 10 level (i.e. complete flooding) is 9 million litres (2 million gallons).



ABERFOYLE TIN N.L.

MINE PUMPING SYSTEM

APPROVED —	M.A.E.
DRAWN —	D.G.L
DATE —	MAY 1978

APPENDIX II

DIAMOND DRILLING - LUTWYCHE, 13 LEVEL

October, 1977 - April, 1978

(See also Fig. 1.)

HOLE NO.	LENGTH (m.)	INCLINATION	RESULTS
AU13-60	30.9	Horizontal	F/W Vein Intersections.
AU13-61	21.3	Horizontal	45cm (intersected width) vein.
AU13-62	16.0	Horizontal	75cm I.W. En-Echelon Battery Vein Extension
AU13-63	40.1	+ 57°	Major water flow 36.5m above 13/L. 21cm. T.W. vein intersection.
AU13-64	41.3	- 45°	Several mineralised veins. Minor water flow 29.2m below 13/L.
AU13-66	52.9	+ 39°	Pay Vein (?) Approx. 15cm T.W., 26m above 13/L. Major water flow 36m above 13/L.
AU13-67	46.2	+ 57°	-
AU13-68	5.8	+ 42°	Drilled from H/W Vein rise 25 metres above 13/L horizon. All holes struck major water flows approx. 30 metres above 13/L.
AU13-69	3.0	+ 42°	
AU13-70	24.5	+ 14°	
			NOTE : Water flows are described as major if pressure is greater than 200 p.s.i.
TOTAL	282.0		

ABMINCO MEMORANDUM

Date	19th April, 1978	Ref	
To	P. J. McGUSHIN	From	K. G. Palmer
At	Rossarden	At	
Copies to	M.A.E. S. M. R.	Keep	

Subject LUTWYCHE WATER PROBLEMS

Conclusions reached by P. Stephenson, R. Thomas (both from Mines Department) and K. Palmer after surface and underground inspections on 17th & 18th April,'78.

(i) It is recommended that a series of air leg (percussion holes) be drilled to a depth of approx. 4 metres in a 6ft. by 4 ft. pattern. (The pattern is designed to simulate the outline of a rise).

Holes should all be parallel and preferably at 30 cm. spacing around the perimeter of the 6 x 4. It may not be possible to extend the holes to 4 metres initially due to water pressure but it should be possible to extend them in stages.

Each hole on completion should be fitted with a collar and tap.

(ii) Having drilled the pattern of percussion holes, a water pressure gauge should be fitted to a collar pipe and then a flow meter fitted to a pipe attached to the bottom of a 44 gallon drum.

By progressively turning on the taps the pressure decrease should be measured. The flow increase should also be recorded.

By graphing the results it should be possible to extrapolate to obtain an approximation of the total volume which would flow from a 6 x 4 rise. (When the pressure drops to near zero. Zero pressure would indicate no flow at all).

(iii) Having reduced the pressure by turning on the taps in the percussion holes, it will then be possible to drill EX diamond drill holes through the water zone. It is recommended that five holes be drilled each to a depth of 20 metres. Every metre down the hole the rods should be withdrawn and a pressure and volume reading recorded first with the percussion taps on and secondly with all the percussion taps closed (after normal head is recovered).

Particular care should be taken of the drill core, with 1 metre intervals recorded accurately so that core loss and fracture pattern measurements can be obtained.

The holea should be drilled ahead, 30^{o} to each side, 30^{o} up and down.

........../

(iv) It is considered that the demonstration underground confirmed that a limited permeability exists. This indicates that the local storage is limited and that the chances of receiving a massive inflow of water on breaking into the system are poor.

It is also considered that it will not be possible to drain the system since the global storage is effectively unlimited.

(v) The possibility of putting a concrete barrier at the north end of the hanging wall drive, and mining ahead to find the answer to the water problem, is worth considering but only after attempting the work up the rises first.

(vi) The effect of the Aberfoyle rivulet on replenishment of the global water storage system is insignificant.

KGP

K. G. Palmer

32211

NOTE:- ALL CORRESPONDENCE TO BE ADDRESSED TO THE DIRECTOR OF MINES

TASMANIA

DEPARTMENT OF MINES

TELEPHONE: 30 9011

G.P.O. BOX 124 B
HOBART
TASMANIA 7001

COPY:

2nd May 1978

The Director of Mines,
HOBART

Water conditions at Lutwyche Workings, Rossarden

On 17 and 18 April, I visited Rossarden with Mr R. Thomas to discuss the water problems of the Lutwyche workings with Abminco. Our discussions both on the surface and underground were with their geologist Mr Ken Palmer and Mine Superintendent Mike Eager.

The mine rock consists of an apparently tightly folded Mathinna series of fairly cleaved muddy and sandy slates with still-apparent bedding. The bedding does not vary much from 330°, but may dip steeply either way. Sandy beds predominate, and the hydrolic properties depend mainly on bedding fractures and related joints.

The Lutwyche workings are approached on the 13 level. Their wet reputation is, in my opinion, ill deserved as water enters the main drive in only two areas and in no great volume.

Further evidence of the water problem is however to be seen at the end of the main drive where several diamond holes have been collared and provided with valves.

A static pressure of some 460 p.s.i. in the raise and 480 p.s.i. in the drive can be observed in the diamond holes, and this I take to confirm a continuous water table to near surface.

Diverting for a moment to surface, the Aberfoyle Creek flows sinuously across the bedding of the slates 1200 ft above the Lutwyche workings, and diamond holes close to the creek provide flow into it, showing that a hydraulic head exists above the creek, and that the creek is a gaining stream rather than a losing one. This observation is of a normal situation in Mathinna and similar aquifers at all seasons of the year. The deduction is therefore that the formation must supply water to the mine and that the creek, if anything, provides a minor amount of drainage.

The static pressure observed in the mine is due then to an unconfined water situation in the rock fractures, which only rarely reach as far down as the 13 level.

The behaviour of the flow from the drained holes in the raise in conjunction with the resulting pressure changes provides an illuminating insight into the hydrology of the mine rock.

A static pressure of over 400 p.s.i. drops to about 180 p.s.i. when a flow estimated at about 120 g.p.m. is released from the nearby bore holes. This shows that over a span of about 50 ft the fractures penetrated by the six holes provide sufficient hydraulic resistance to drop the static pressure to less than half. This not only indicates that the transmissivity of the rock fractures is very low, but it provides a solution to the problem of drilling further in the presence of high static pressures.

A low transmissivity must in these rocks also indicate a low storage coefficient. This has been estimated independently in groundwater work as in the region of .001 to .003, that is to say that from 1 to 3 parts in 1000 of the volume of the rock consists of useable storage. Low as this value is, when applied to the available volume in the rocks say within a mile of the workings, the volume of water represents 6×10^7 gallons. This volume while not large, could only be drained slowly because of the low transmissivity. A rough estimate gives a period of some decades. Control and not drainage is therefore the best policy.

In discussion, the suggestion arose, and it is no more than a suggestion, that the water encountered is contained in a structure diacordant with the main lineation of the mine and possibly dipping at a shallow angle toward the north-east in the roof of the main drive. Some joint faces of similar orientation were seen. The possibility of this structure should be explored when further drilling is done.

On the question of encountering any great changes in the transmissivity of the formation in any development from 13 level, this does not seem likely, as great changes would require changes in lithology or structural style or both, and no such changes are known from drilling results or surface work. Local high flows could occur and require prudent mining methods but local high volumes do not seem possible.

As drilling proceeds, flow measurements from the holes should be made at one or two metre intervals under full head conditions so that a survey of hydraulic resistance in three dimensions may be compiled in areas where development is intended.

Water samples tested for conductivity in the mine showed low values (equivalent to 22o ppm Na CI), a typical Mathinna water value. No additional salinity was apparent due to transmission through the formation. Samples for chemical analysis were taken but results are not yet available.

(P.C. Stevenson)
SUPERVISING GEOLOGIST
ENGINEERING GEOLOGIST

9 May 1978

The Director of Mines,
HOBART

Water analyses, Rossarden

Further to my recent report on my visit to Rossarden I have examined the analyses of the water samplas then taken. They show by the higher salinity of the water as compared with the water in the Aberfoyle Creek that the water has been in the formation rocks for soam extandad period. This serves to confirm that the transmission of water from the surface is slow, probably amounting to some years, that the transudesivity of the rock mass is low and that the hydraulic connection with the surface is remote.

(P.C. Stevenson)
SUPERVISING GEOLOGIST

APPENDIX IV

VENTILATION BOREHOLE DESIGN

REQUIRED :

Exhaust of $2m^3$/sec. (4200 c.f.m.) through 390m (1280 ft.) of smooth walled borehole.

SOLUTION :

Atkinson formula for flow in a circular airway.

$$H = 1.2 \frac{K L Q^2}{D^5}$$

where H = Total pressure loss - ins. water gauge.

L = Airway length - ft.

Q = Airflow - thousands of c.f.m.

D = Diameter - ft.

K = Friction factor - 0.0015 to 0.003 depending on surface roughness.

Taking a conservative K value of 0.003 the following diameter/fan pressure combinations would be required for a 4200 c.f.m. flow.

Diameter (inches)	H (Fan Pressure) inches water gauge
12	91
15	30
18	11
24	3

Since at the 12 & 15 inch diameter the required pressure is high, an additional 10% pressure loss has been included to allow for the deviation from the Atkinson formula due to compressible flow conditions.

Air velocity for the above conditions ranges from 1300 ft/min. for the 24 inch hole to 5300 ft/min for the 12 inch hole. At these high velocities it will be essential to have a dry borehole otherwise the fan could be severely overloaded with water passing through it.

Richardson's advise that their Type PP high pressure centrifugal blowers would be suitable for duties of up to 45 inches water gauge maximum.

This effectively limits the minimum size borehole to approximately 14 inches (0.35m) inside casing.

This would require a 28 inch centrifugal blower operating at 2900 r.p.m. with a 60 h.p. motor.

Manufacturers Price Estimates :		$
	Fan (Richardson's)	1800
	Motor (Pope)	2300
	Installation etc.,	1900
		6000

FIG 1

Note: Drawing compiled from reduction of 1:200 (4 Sheets Nos SCL 34 A,B,C,D)

See plate SCL 34D 1:200 for details of legend, conversion tables etc.

Abminco Exploration

Geology: G.K.	TASMANIA	Location code:
Drawn: B.R.J.	LUTWYCHE EXPLORATION PROJECT	Date: MAY 1978
Traced: R.J.E.	13 LEVEL	Scale: 1:500
Checked:	PLANNED DEVT. & EXPLORATION	Plate No.
Revised / Date		

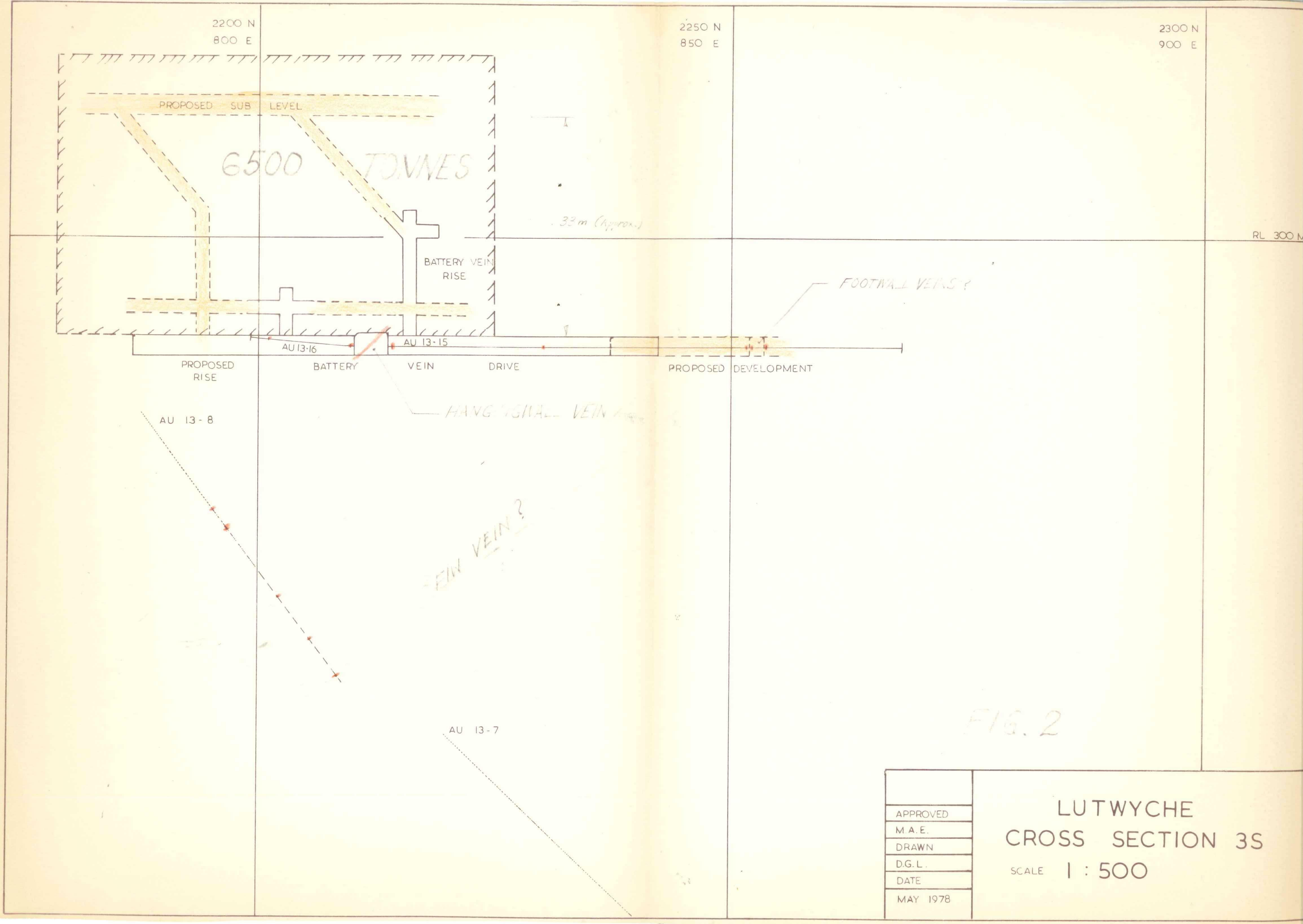

2200 N
800 E
2250 N
850 E
2300 N
900 E
PROPOSED SUB LEVEL
6500 TONNES
33 m (approx.)
RL 300 M
BATTERY VEIN RISE
FOOTWALL VEINS ?
AU 13-16
AU 13-15
PROPOSED RISE
BATTERY VEIN DRIVE
PROPOSED DEVELOPMENT
HANGINGWALL VEIN
AU 13-8
VEIN ?
AU 13-7
APPROVED
M.A.E.
DRAWN
D.G.L.
DATE
MAY 1978
LUTWYCHE
CROSS SECTION 3S
SCALE 1 : 500

FIG. 2

P.J.R.

GA
93180
INTAIR AA93180
ABTIN AA58569

TELEX 546

FOR W CARTER

APOLOGIES FOR NOT CALLING YESTERDAY.

HEREWITH A FEW COMMENTS AND REQUESTS.

1. PRICES

(A) MOBILIZATION AND PILOT HOLE RATES O.K.
(B) DRILL AND REAM PATE STILL $40 HIGHER BUT NOT YET A TRUE COMPARISON AS AWAITING RISE AND FALL ADJUSTMENT FROM OTHERS.
(C) YOUR WORK AND STANDBY RATES MUCH HIGHER (+60%). MAIN AREAS OF CONCERN ARE CUTTINGS MUCKING DELAYS WHILST REAMING AND WORK RATE WHILST GROUTING.

2. DETAILS REQUIRED

(A) EXPECTED REAMING ADVANCE PER HOUR
(B) APPROX. DIMENSIONS OF PAD.
(C) WEIGHTS OF G I R, POWER PACK, BARE REAMER.
(D) POWER SUPPLY - DO YOU REQUIRE DISTRIBUTION BOARD AND FUSED CIRCUITS OR IS 415V 250KVA FROM TRANSFORMER SUITABLE?
(E) FLOODLIGHTING?
(F) IS 90 PSI ADEQUATE FOR PILOT HOLE FLUSHING ?
(G) CAN HEAD BE REMOVED BY BLASTING OUT PAD ON COMPLETION ?
(H) IS GROUTING EQUIPMENT INCLUDED IN MOBILIZATION ?
(I) WHAT SAND GRADE REQUIRED FOR GROUTING.

3. GENERAL

(A) DETAILS BY LETTER OF PROCEDURES YOU PROPOSE FOR GROUTING FROM PILOT HOLE INCLUDING DETECTION OF WATER INFLOW, TIME ESTIMATES FOR TRIPPING RODS, SET-UP TO GROUT, GROUTING, ETC. SPECIAL MATERIALS, ADDITIVES ETC. I EMPHASISE THAT EFFECTIVE SEALING OFF IS OF UTMOST IMPORTANCE.
(B) YOUR PROPOSED FORM OF CONTRACT ETCM.,

WILL PHONE LATE AFTERNOON YOUR TIME TO KEEP INTOUCH.

THANKS AND REGARDS , MIKE EAGER
5/9/78 1.25 PM

INTAIR AA93180
FIN TKS RAE

H. CLAYTON

Ref. 1.13.1. ABERFOYLE TIN N. L. 12th September, 1977

To: Manager.

FROM: Mine Superintendent

COPIES TO: Mine Foreman & Surveyor - Aberfoyle

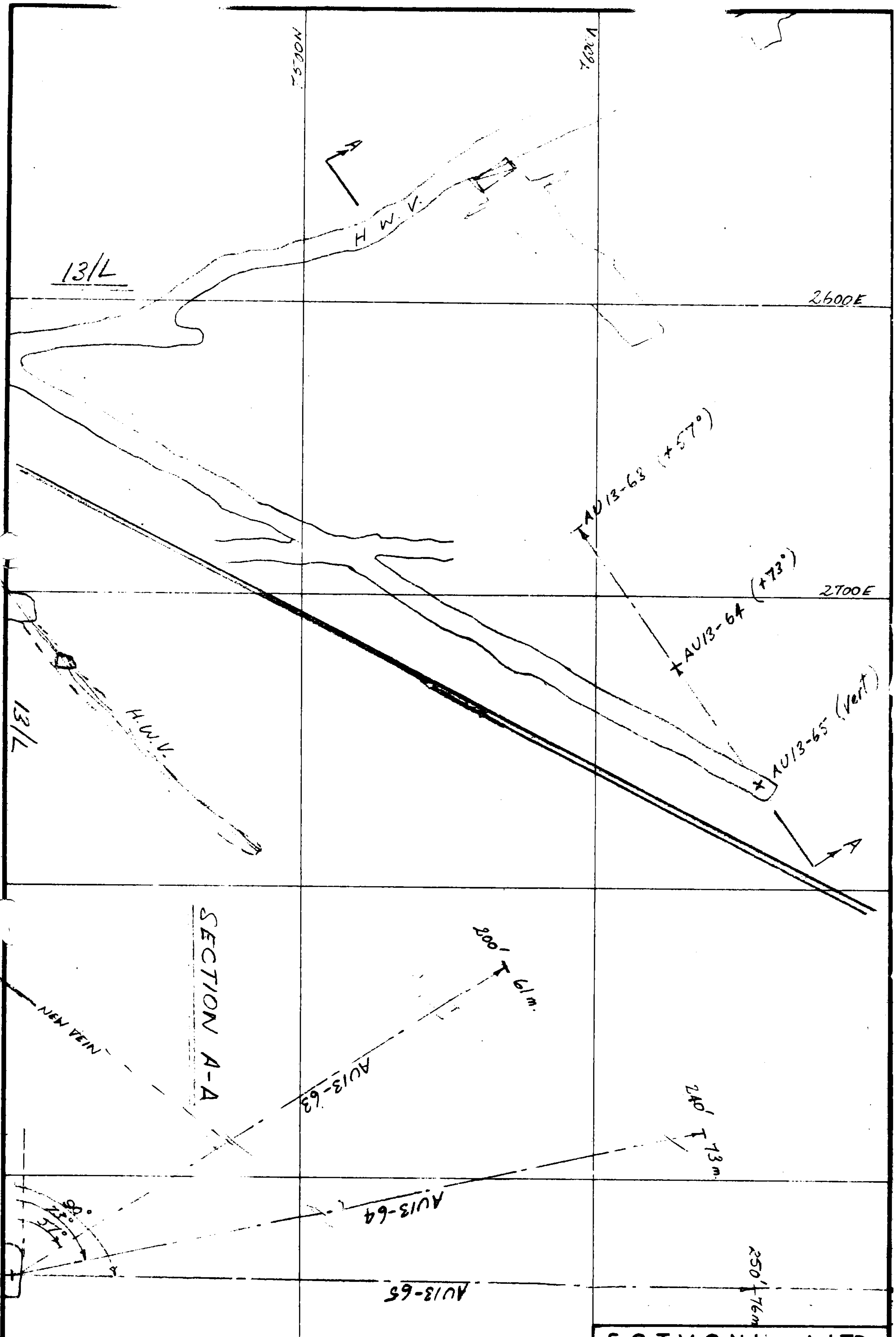
LUTWYCHE 13/L DIAMOND DRILLING

HOLE NOS. AU13 - 63, 64, 65

The attached plan shows proposals for diamond drilling to test for the up dip extensions of the Hangingwall and New veins.

Total length	-	210 metres
Budgeted cost per metre	-	$20
Total estimated cost	-	$4200
Estimated drilling time	-	6-8 weeks, commencing P. 11.

M. A. Eager,
Mine Superintendent



13/L DIAMOND DRILLING PROPOSALS

Holes: AU13-63, 64, 65

S.C.T.M.C.N.L. – A. LTD.

TITLE ______

DRAWN BY M.A.E.

DATE 9/9/77

SCALE 1" = 40'

ABTIN AA58569
GEMCO AA92645

20496 - 19.7.77.

ATTENTION MR EAGER

RE YOUR TELEX NO. 99 REQUESTING PRICES OF 4 TON BATTERY LOCO.
BUDGET PRICES FOR OUR STD 3 1/2 TON LOCO AS FOLLOWS:-

LOCO WITHOUT BATTERY OR CONTAINER	-	$14,300
BATTERY 40 CELL 297 AMP/HR 5 HR RATE	-	$ 3,564
BATTERY CONTAINER LIFT OFF REMOVAL	-	$ 738
7/8 HR RECHARGE OIL FILLED CHARGER WITH PLUG AND LEAD	-	$ 2,550 F.O.R MELBOURNE
CHARGER ON RAIL WHEELS	-	$ 150 EXTRA

TRACTIVE EFFORT AT 1 HR RATE	-	1050 LBS.
SPEED AT 1 HR RATE	-	4 MPH

FITTED WITH THYRISTER CONTROL GIVING STEPLESS SPEED CONTROL AND DYNAMIC ELECTRICAL BRAKING. DRUM TRNAMISSION BRAKE ON MOTOR SPRING APPLIED ON. TRANSMISSION BY WORM GEAR ON DRIVE AXLE AND ADJUSTABLE CHAIN TO TRAIL AXLE. PRICES SUBJECT TO OUR STANDARD VARIATION CLAUSE. PRICES OF BATTERIES AND CHARGERS THOSE RULING AT TIME OF DELIVERY. USUAL DELIVERY 12/14 WORKING WEEKS.

RIPLEY

ABTIN AA58569
GEMCO AA92645

LUTWYCHE

CURRENT SITUATION

ORE TONNES:	INDICATED	20,000
	PROBABLE	100 000
	POTENTIAL	400 000

ORE GRADES: Sn 0.2% – 0.3%
WO_3 0.7% – 0.6%
CONSERVATIVE
NOTHING BETTER AT ABERFOYLE or S/C

RECOVERABLE VALUE: \$80 – \$90 / TONNE
('78 PRICES, 82% REC.)

GROUNDWATER: CONTROLLABLE
PUMPING COSTS UP TO \$3 / TONNE

VENTILATION: BOREHOLE (17½") + FAN
\$205,000

DEVELOPMENT ETC: PROCEEDING – \$ ~~2500~~ 10000 / period

EXPLORATORY DRILLING: PROCEEDING – \$ ~~3500~~ 2500 / period

Mr. Eager

TO - P. J. McGushin, Manager, Aberfoyle

FROM - Alan H. Clark, Professor of Economic Geology, Queen's University, Kingston, Ontario, Canada.

RE - Visit to Storeys Creek and Aberfoyle Mines, April 3-4, 1978.

My visit to the mines formed part of a sabbatical year tour of tungsten and tungsten-tin deposits of Europe, Asia and Australia. This tour is personally financed and I am unaffiliated to any mining company. My main intention is to prepare a "global" account of tungsten metallogenesis, one critical facet of which is the nature of and extent of the association of the two metals. Hopefully, certain systematic relationships will emerge before I return to Canada.

My tours here have been very instructive, especially that with Alan Titley to the Lutwyche Development area on Aberfoyle 13 level. I have discussed my observations very briefly with Mike Eager; although such short visits can be somewhat misleading, I gained the impression that the aplite contact on 13 level has not been strongly faulted. Therefore, the Lutwyche vein centre may be essentially in its original situation vis à vis Aberfoyle.

I am extremely grateful for the assistance and generous hospitality given to me during my stay at Aberfoyle.

Yours sincerely,

A. H. Clark
Dr. Alan H. Clark
April 4, 1978.

SUBJECT	PLAN IDENT.	DESCRIPTION
A. GEOLOGY		Cross Sections
	LU206G to 240G	Vein Geology - Fact (tracing paper) From 20S through 00 to 14N. (complete). Scale 1"=100 feet. Sections show trace of DDH's, location, attitude, widths and analyses of intersected veins - no other 'geology'.
	LU230G	Vein Geology - Fact (tracing paper) Scale 1"=40 feet. IS only. (Shows DDH S21,S29,S14 and drive, rise and wall test holes.) (DDH traces, veins but no other geology.)
		Fact Sections
	LU104G	Scale 1"=100 feet S17, S19, S20 (coloured prints)
	LU105G	Scale 1"=100 feet S21, S14. (coloured prints)
	LU110G	Scale 1"=100 feet S27, S28, S29, S31 (coloured original drawing.
	LU113G	Scale 1"=100 feet S27 (coloured original, some additional surface facts.
	LU11G	Scale 1"=100 feet S34, S35, S36 (coloured original, no assays oblique DDH's not projected to section.
	LU112G	Scale 1"=100 feet Au13-7, 13-8, 13-9. Coloured original with geology, veins assays. (Note these DDH's drilled from 13L Lutwyche.)
	LU114G	Scale 1"=100 feet S28. Coloured original, some additional facts with interpretation of geology.
	LU115G	Scale 1"=100 feet. S30, 32, 33. Original with no geology except veins, assays.

SUBJECT	PLAN IDENT.	DESCRIPTION
		Interpretive Sections
	LU116G	Scale 1"=100 feet. Cross section 00 Composite. Includes projected drill holes to 00 but most data better relates to 1 South.
	LU 106G	Scale 1"=100 feet. Cross section 00 Interpretation - incomplete data - i.e. S29 missing, Au 13-9 missing.
	LU107,8,9G	Scale 1"=100 feet. All have partial data only, and often have incorrect data.
	LU117G	Scale 1"=40 feet. Sections through DDH Au 13-7, 13-8 with interpretation of veining - preliminary only.
B. SURFACE PLANS	G16	(Storey's Creek T.M.C.) Geological fact plan - surface No.3 Scale 1"=200 feet. Lease boundary, survey, topography. Does not show Lutwyche.
	G20	(SCT MC) Geological fact plan surface No.5. Scale 1"=400 feet. As above but included S.T.C, Ab, Ltw, etc.
	LU203G Fig. 2b) LU200G Fig. 2a)	Surface geology Fact. Scale 1"=100 feet. (Includes details of topography, veins, outcrop but no rock types, drill hole locations, and pencilled structural interpretation. Note in detail contours, surface features are not accurately plotted.
	LU101G Fig. 1	Special Aberfoyle Lutwyche Plan-Surface. Shows veins, topography cultural features west of Aberfoyle Rivulet at Lutwyche. Also traces of some DDH's
	LU142G Sheet 1 Fig. 13	Lutwyche Expl. Proj. S.E. area - Self Potential Survey Plan. Contour Interval 50 mv. Scale 1"=40 feet.
	LU143G Sheet 2 Fig. 14	Lutwyche Expl. Proj. S.E. area - Self Potential Survey Plan. Contour Interval 50 mv. Scale 1"=40 feet.

SUBJECT	PLAN IDENT.	DESCRIPTION
	LU140G)Fig. 11) LU141G)Fig. 12)	Lutwyche Expl. Project. S.E. area - Surface Structural interpretation original. 1"=40'.
	LU123G to 129G Sheets 1 - 7	Lutwyche Exploration Project. S.E. area topographic Sheet. Scale 1"=40 feet
C. LONG SECTIONS	LU205G Fig. 7	Lutwyche Exploration Project. Longitudinal section. Krummei 1969.
	LU231G Fig.8	Longitudinal Projection. Total vein width contour diagram. Scale 1"=100 feet. All DDH's except underground.
	LU232G Fig.9	Longitudinal Projection. Vein width contours. Hanging Wall vein.
	LU233G Fig.10	Longitudinal Projection. Contour diagram of % C.M. over 48" H.W. vein.
D. MISCELLANEOUS SECTIONS	LU234G Fig.4	Scale 1"=100 feet Composite cross section. Interpretation. G.K.
	LU23SG	Isometric Projection. Looking North. Scale 1"=100 feet. Drawn prior to drilling DDH's 20 to 36.
E. 13L PLANS	LU58G	Aberfoyle Mine 13L. Scale 1"=40'. 13L cross cut to Stn 13010 and DDH Au 13-6 also note DDH's 13-3,4,5. Structure, quartz veins, description of veins and analyses.
	LU102G Fig.2	13L, DDH Au 13-6 and Surface DD holes. Scale 1"=100 feet. Coloured geology. Also transparency of above.

SUBJECT	PLAN IDENT.	DESCRIPTION
	LU59G	13L Lithology-Fact. Scale 1"=40 feet. Coloured lithology in drive and DDH's for most of 13L work.
	LU60G	13L original fact mapping of backs and walls of cross cut. Scale 1"=40 feet.
	LU61G Fig.5	13L Geology Fact Plan. Scale 1"=40 feet. Tracing paper original of all 13L openings, DDH's, with details of veins, assays.
	LU61G	Print of above with one additional DDH (Au 13-45 at end of cross cut) Veins (red) and faults (blue).
	LU204G	Lutwyche - Vein Geology Fact 1"=100 feet.
	LU62G Fig.6	Krummei. 13 Level Geology. Equal area stereographic Projections.
	LU63G Fig.3	Krummei. 13 Level Geology Fold structures.
	LU64G & LU65G	Original tracing paper drawings of vein geology in 13L crosscut. Scale 1"=10 feet with prints.
F. ASSAY PLANS	LU65 (2 sheets) LU66	13 Level Assay plan composite. Scale 1"=20 feet. 3,4 or 5 samples averaged.
	LU67 & LU68 (2 sheets) Fig. 12a, 12b	13 Level Assay plan Scale 1"=20 feet. Individual samples with vein widths. (Also print of Fig. 12a?)
	LU69G (1 sheet)	13L Rise Section IS Assay Plan Individual samples.
	LU70G	Un-named. Tracing of surface features, adit etc. superimposed on 13L outlines.

SUBJECT	PLAN IDENT.	DESCRIPTION
G. HYDRO-GEOLOGY	LU71G Fig.13	13 Level Hydrogeology. Scale 1"=40 feet. Devt. and DDH outline with details of water flow.
	LU72G	Section 4S. Interpreted water flow and water course locations.
	LU73G	Section 7200N. Interpreted water flow and water course locations.
	LU61G Fig.5	Working Plan. 13L vein geology with comments and interpretation of hydrogeology.
H. MISCELLANEOUS		Untitled - 1976. Plan showing outlines of 13L Dent, rising and pillar driving, proposed 8L access. Scale 1"=100 feet.
	LU50 to 57G in that order	Figures 1 to 8 - Lutwyche Expl. Project. Surface plans around 1"=100 feet. Location, geology and topography, arsenic, copper, tin, tungsten and zinc geochemistry, SP.
	LU123G	Reductions to about 1.1000
	LU129A	Topographic Sheets 1 to 7

Ref. 1.13.1 ABERFOYLE TIN N. L. 12th September, 1977

TO: Manager

FROM: Mine Superintendent

COPIES TO: Foreman & Surveyor - Aberfoyle

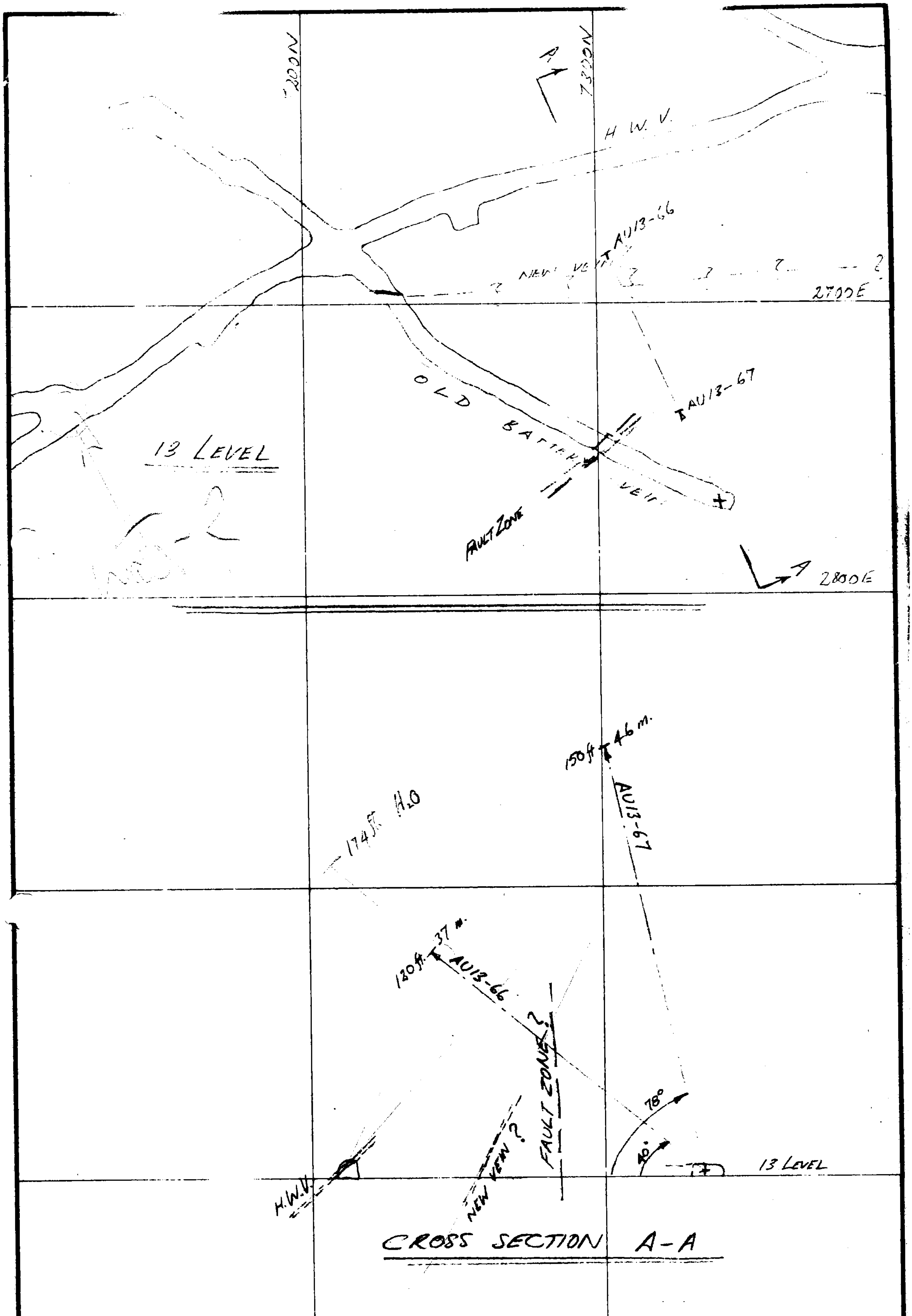
13/L LUTWYCHE DIAMOND DRILLING PROPOSALS

HOLE NOS. AU13-66 and AU13-67

The attached plan shows drilling to test the up dip extensions of the H.W.V. and possible extension of the New Vein. It is anticipated that one or both holes may encounter the fault zone intersected on 13 level.

Total length	-	83 metres
Budget cost/metre	-	$20
Total estimated cost	-	$1700
Estimated drilling time		3-4 weeks commencing P.1 1978.

M. A. Eager
Mine Superintendent



S.C.T.M.C.N.L. – A. LTD.

TITLE ______

DRAWN BY M.A.E

DATE 12/9/77

SCALE 1" = 40'

Ref. 1.13.1 ABERFOYLE TIN N. L. 12th September, 1977.

TO: Manager.

FROM: ✓Mine Superintendent.

COPIES TO: Mine Foreman & Surveyor - Aberfoyle

LUTWYCHE 13/L DIAMOND DRILLING

HOLE NOS. AU13 - 60, 61, 62

The attached plan shows proposals for diamond drilling to test the water-bearing structure ahead of the existing H.W.V. rise.

Total Length 25 metres
Budgeted cost/metre $20

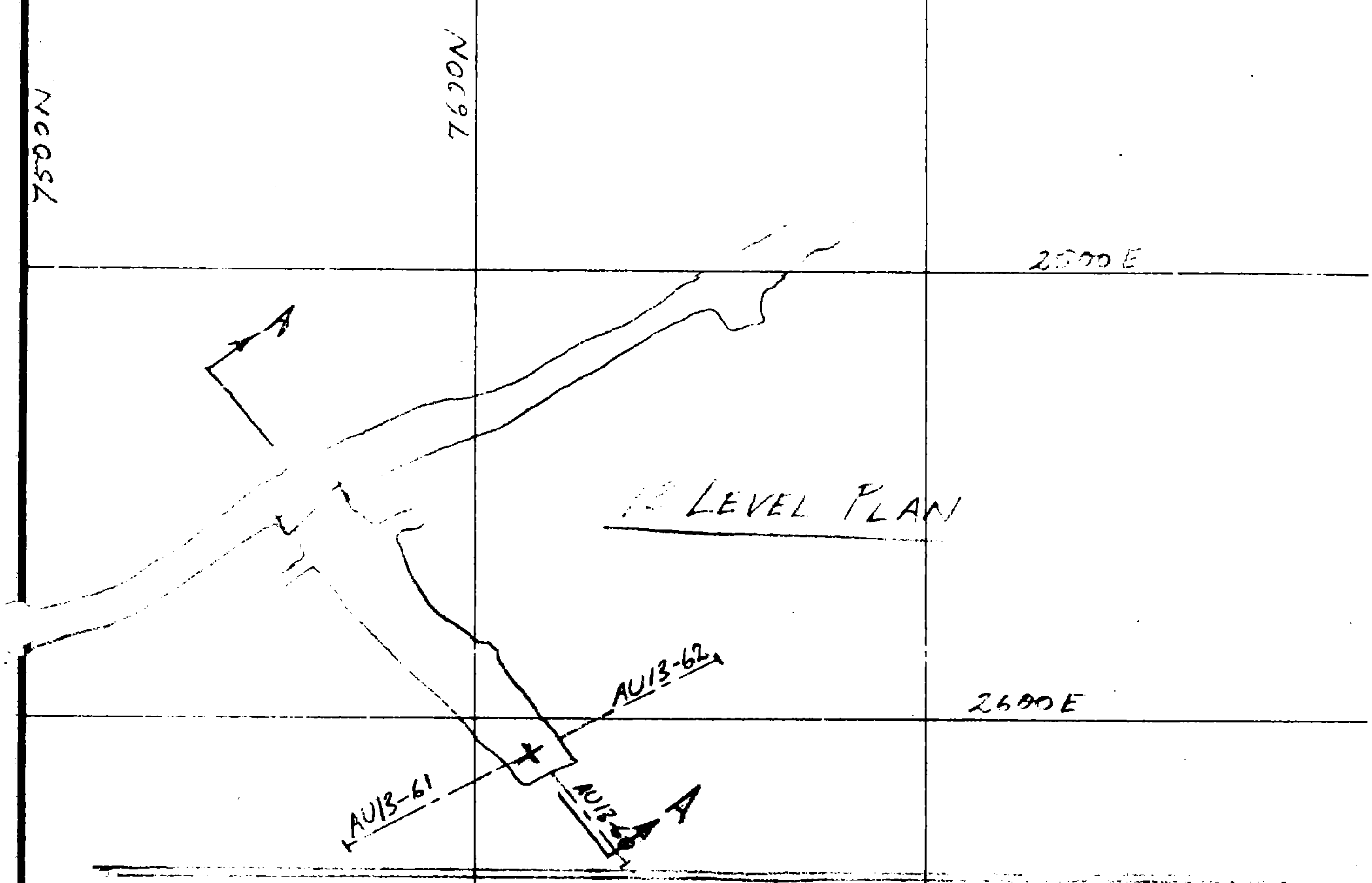
Total estimated cost $500

Estimated drilling time 2-3 weeks commencing P.10

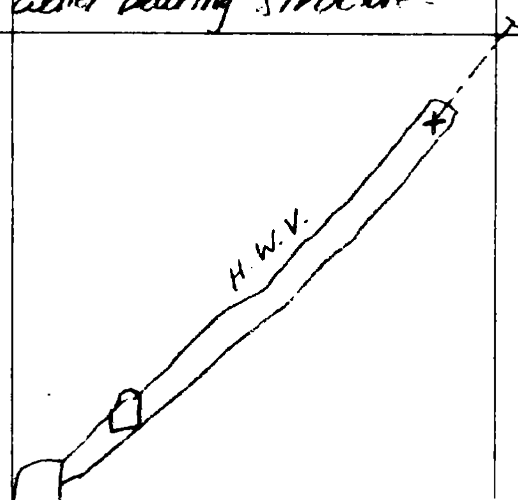
Depending on results, it may be desirable to extend AU13-61 and 62 to say 30 metres each to serve as water cover for the proposed sub level development.

Additional cost - $800-$1000
Additional drilling time - 2 weeks

M. Eager
Mine Superintendent



Hole AU13-60 to be drilled first to intersect water-bearing structure. To be drilled in short (1 ft.) core runs only. Hole AU13-61 or AU13-62 will then be drilled after estimating direction of water bearing structure.



SECTION A-A

13/L DIAMOND DRILLING PROPOSALS

HOLES: AU13-60, 61, 62.

S.C.T.M.C.N.L. – A.LTD.

TITLE ______

DRAWN BY M.A.E.

DATE 9/9/77

SCALE 1" = 40'

Ref. 1.13.1. ABERFOYLE TIN N. L. 12th September, 1977

To: Manager.

FROM: / Mine Superintendent

COPIES TO: Mine Foreman & Surveyor - Aberfoyle

LUTWYCHE 13/L DIAMOND DRILLING

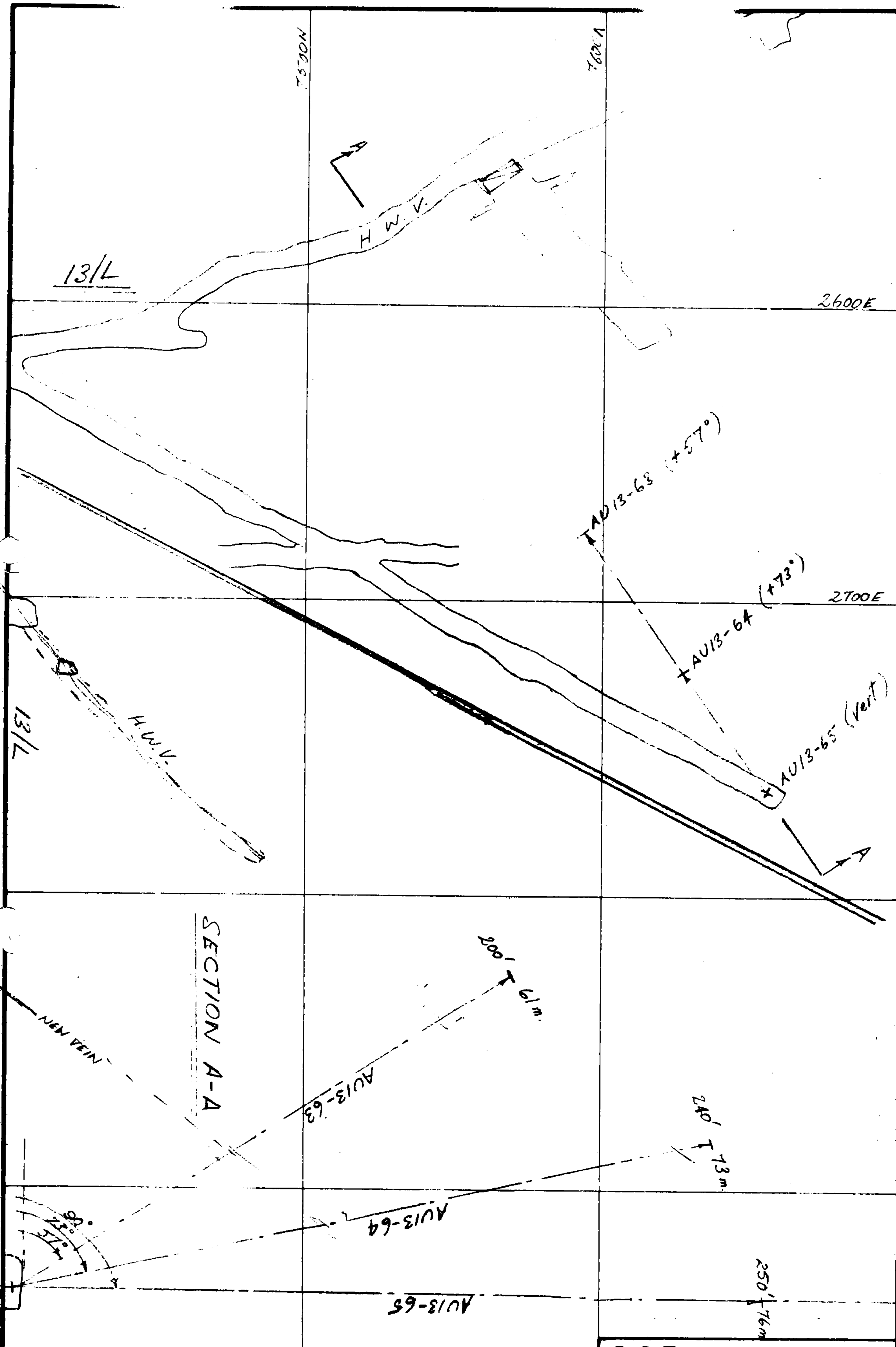
HOLE NOS. AU13 - 63, 64, 65

The attached plan shows proposals for diamond drilling to test for the up dip extensions of the Hangingwall and New veins.

Total length	-	210 metres
Budgeted cost per metre	-	$20
Total estimated cost	-	$4200
Estimated drilling time	-	6-8 weeks, commencing P. 11.

M. A. Eager,
Mine Superintendent

Note Decide on AU13-65 after results from AU13-63, + AU13-64.



13/L DIAMOND DRILLING PROPOSALS

Holes: AU13-63, 64, 65

S.C.T.M.C.N.L. – A. LTD.

TITLE ______

DRAWN BY M.A.E.

DATE 9/9/77

SCALE 1" = 40'

M. EAGER

THE LUTWYCHE PROSPECT

The Lutwyche orebody outcrops as a system of narrow mineralised quartz veins, steeply dipping over a strike length of 400 metres, approximately 900 metres northeast of the Aberfoyle Mine at Rossarden, Tasmania (Fig.1).

Diamond drilling in 1952 indicated that the veining persisted in depth and in 1962 and again in 1968/69 additional drilling (3100m) indicated a tin and wolfram mineralised zone of quartz veining with a strike extent of 300 metres at depth.

In 1966 crosscutting towards these veins commenced from a newly establishe No.13 level of the Aberfoyle Mine, 390 metres below the surface. The main vein ("Hanging Wall Vein") was intersected at approximately 645 metres northeast of the Aberfoyle Shaft. Horizontal development on this vein and other smaller veins totalled 400 metres. This development and associated pattern drilling also revealed the presence of ground water under high pressure.

In 1968 preparations were made for the sinking of a 4.3m x 2.3m hoisting and service shaft to 13 level but this project was terminated before sinking commenced. All work in the Lutwyche area was suspended in 1971.

In developing a 5 year plan for the Aberfoyle Tin N. L. operations it is essential that the Lutwyche ore source will contribute. The present measured and indicated ore reserve, limited to veining which is defined by existing development, is 15,000 tonnes. Ore grades, visually estimated and diluted to a 1.2 metre mining width following standard Aberfoyle practices, are 0.6% WO_3 and 0.2% Sn.

Inferred reserves stand at 300,000 - 500,000 tonnes, this estimate being principally based on drill hole intersections. Visual grade estimates and chemical assays of these intersections yielded values (over a 1.2m mining width) averaging 1.4% Sn and WO_3 combined for the Hanging Wall Vein. However, this grade cannot be validly applied to inferred reserves since drill hole assays of veining with sporadic mineralisation (especially over a small number of vein intersections) are generally not representative of block grades. However, there is no reason why grades similar to those encountered on 13 level, and for that matter elsewhere in the Aberfoyle Mine, could not be inferred for the Lutwyche area.

Figs. 1 and 2 show the currently existing development.

With rapidly diminishing ore reserves at Storeys Creek Mine it is hoped that production from the Lutwyche area and favourable metal prices will enable total production to be maintained at a profitable level for at least the next 5 years, possibly the next ten.

In order to bring Lutwyche into production a four-stage development programme has been commenced. This programme should enable production to begin late in 1978 and build up to 150 tonnes/day by 1981. Capital and special expenditure to 1981 will total $1.2 million, incurre progressively such that the financial commitment at any time is a minimum and commensurate with the risks involved.

The development programme is summarised in the accompanying table.

The principal pre-production requirements are

* Exhaust ventilation to surface.
* Satisfactory groundwater control.
* Initial stope development.
* Provision of hydraulic fill reticulation.

To justify expenditure on these items, the first stage of the programme will involve diamond drilling and development to increase both the ore reserve tonnage and confidence in the ore reserve grade.

The remaining stages of the programme involve the commencement of production and it's progressive increase to 150 tonnes/day.

During these stages there will be the challenge and opportunity to modify our present methods, increase mechanization and so improve productivity..However Lutwyche is a narrow vein deposit and as such will be a relatively labour intensive operation.

As the production areas extend up dip from 13 level, servicing these areas will become increasingly difficult. To enable the provision of a service shaft (not less than $3 million) to be deferred for as long as possible, the programme provides for

(1) Production from reserves below 13 level via an internal hoisting shaft.

(ii) Provision of an internal service shaft extending to approximately 120 metres above 13 level.

Previous drilling from 13 level, although insufficient to delineate an ore reserve, does indicate the possibility of substantial reserves below 13 level. If further drilling confirms this it may be possible to maintain 13 level as the centre of gravity of production through until the early 1980's, by which time it may be more appropriate to commit funds to a hoisting and service shaft.

If Aberfoyle is to survive into the 1980's it needs success from Lutwyche. After the ups and downs of recent years, we at Aberfoyle, with the people of Rossarden and Storeys Creek behind us, are approaching this project with cautious optimism.

LUTWYCHE DEVELOPMENT PROGRAMME

STAGE 1.

Aim:	To increase accessible ore reserves, determine vein extensions up dip from 13/L and find a solution to potential ground water problems.
Methods:	Sub level development, diamond drilling, grouting, increased mine pumping capacity.
Expenditure:	$30,000 - $40,000 September '77 - March '78.
Decision:	Are results satisfactory enough to elevate a further $250,000 - $300,000 to the good risk category?

STAGE 11.

Aim:	To commence production from H/W vein and to further increase ore reserves both above and below 13/L.
Methods:	Ventilation borehole to surface, extension of hydraulic fill system, diamond drilling, additional pumps and sumps.
Expenditure:	$265,000, March 1978 - December 1978.
Decision:	Is a 150 tonnes/day production rate feasible? Is a reserve of 30,000 tonnes below 13/L probable?

STAGE 111.

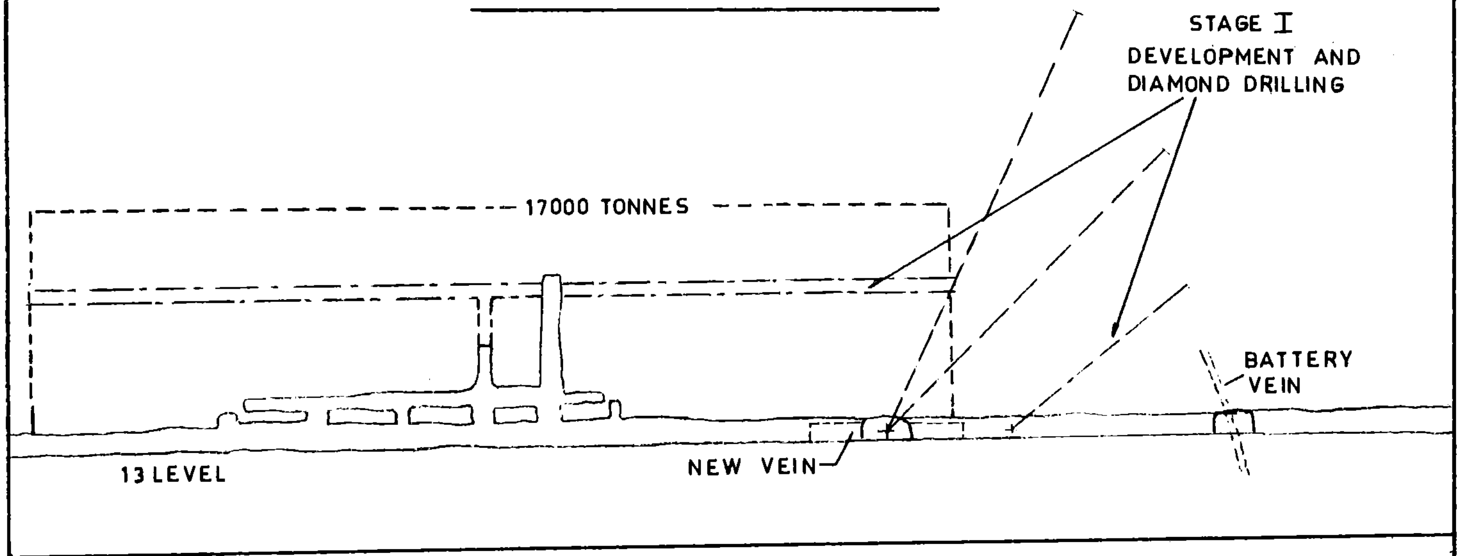
Aim:	Increase production to 50 tonnes/day, develop reserves below 13/L and provide services for a 150 tonnes/day production rate.
Methods:	Sink and equip internal hoisting winze, raisebore 1.2m diameter vent shaft to surface and provide additional power, compressed air pumping and fill services.
Expenditure:	$540,000, 1979.

STAGE IV.

Aim:	150 tonnes/day production.
Methods:	Extension of hoisting winze, internal service shaft 13/L - 9/L, surface fill station.
Expenditure:	$340,000, 1980.

DIAGRAMMATIC LONG. SECTION

HANGINGWALL VEIN



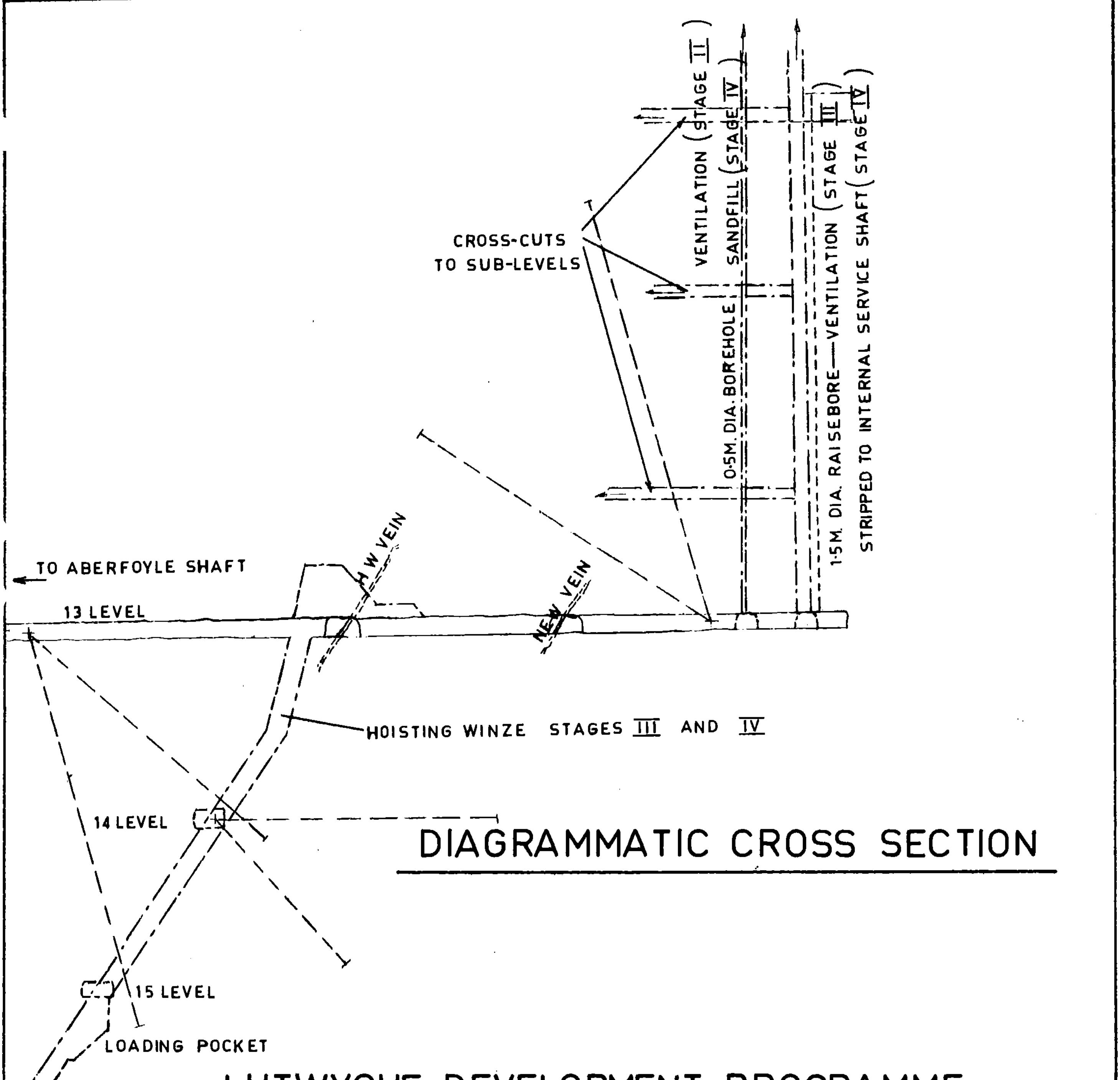
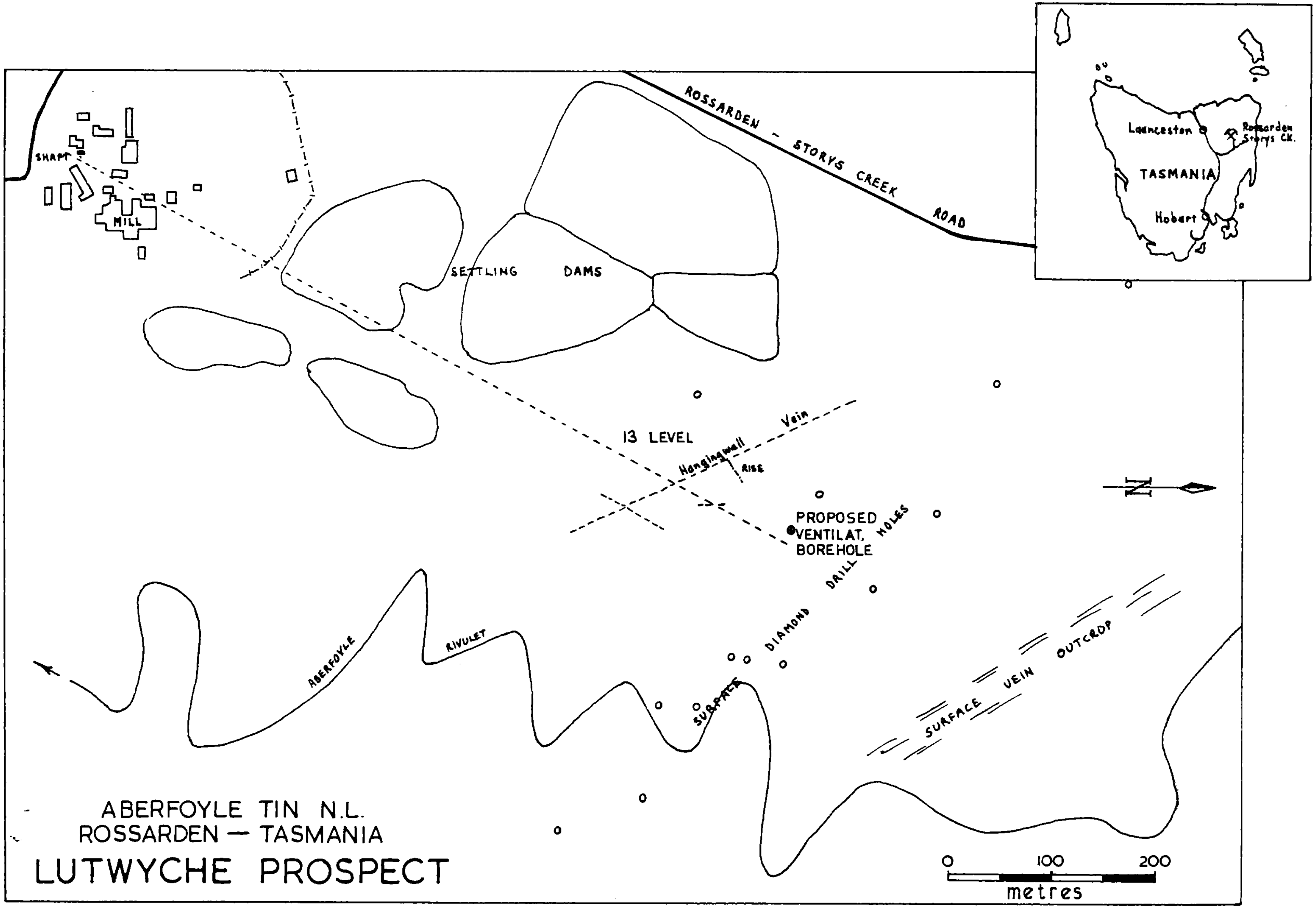


Fig. 2 LUTWYCHE DEVELOPMENT PROGRAMME


SHAFT
MILL
SETTLING DAMS
ROSSARDEN - STORYS CREEK ROAD
Launceston
Rossarden
Storys Ck.
TASMANIA
Hobart
13 LEVEL
Hangingwall Vein
RISE
PROPOSED VENTILAT. BOREHOLE
SURFACE DIAMOND DRILL HOLES
SURFACE VEIN OUTCROP
ABERFOYLE RIVULET
N
0
100
200
metres
ABERFOYLE TIN N.L.
ROSSARDEN — TASMANIA
LUTWYCHE PROSPECT

LUTWYCHE DEVELOPMENT PROGRAMME

STAGE 1.

Aim: To increase accessible ore reserves, determine vein extensions up dip from 13/L and find a solution to potential ground water problems.

Methods: Sub level development, diamond drilling, grouting, increased mine pumping capacity.

Expenditure: $30,000 - $40,000 September '77 - March '78.

Decision: Are results satisfactory enough to elevate a further $250,000 - $300,000 to the good risk category?

STAGE 11.

Aim: To commence production from H/W vein and to further increase ore reserves both above and below 13/L.

Methods: Ventilation borehole to surface, extension of hydraulic fill system, diamond drilling, additional pumps and sumps.

Expenditure: $265,000, March 1978 - December 1978.

Decision: Is a 150 tonnes/day production rate feasible? Is a reserve of 30,000 tonnes below 13/L probable?

STAGE 111.

Aim: Increase production to 50 tonnes/day, develop reserves below 13/L and provide services for a 150 tonnes/day production rate.

Methods: Sink and equip internal hoisting winze, raisebore 1.2m diameter vent shaft to surface and provide additional power, compressed air pumping and fill services.

Expenditure: $540,000, 1979.

STAGE IV.

Aim: 150 tonnes/day production.

Methods: Extension of hoisting winze, internal service shaft 13/L - 9/L, surface fill station.

Expenditure: $340,000, 1980.

LUTWYCHE DEVELOPMENT PROGRAMME

GOALS

1. PRODUCTION @ 25 T.P.D. BY LATE 1978.
2. INCREASE TO 150 T.P.D. BY 1981.
3. MINIMUM FINANCIAL EXPOSURE.

ASSUMING SUCCESS FROM U/G EXPLORATORY DRILLING AND DEVELOPMENT, A 4 STAGE DEVELOPMENT PROGRAMME IS ENVISAGED :

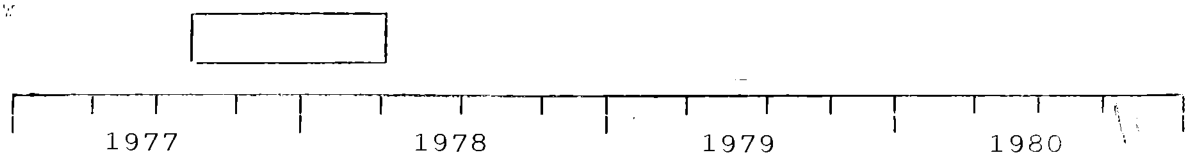
YEAR		CAPITAL EXPENDITURE	CUMULATIVE EXPENDITURE	CUMULATIVE EXPENDITURE/ TONNE	PRODUCTION RATE T.P.D.
1977-1978		$ 297,000	$ 297,000	$75	25
1979		$ 489,000	$ 786,000	$66	40
1980	(A)	$ 226,000	$1,012,000	$28	100
	(B)	$1,110,000	$2,122,000	$57	100
1981	(A)	$ 50,000	$1,062,000	$15	140
	(B)	$1,110,000	$3,232,000	$45	140
1982	(A)	$ 100,000	$1,162,000	$11	150
	(B)	$ 50,000	$3,282,000	$30	150

FROM 1980 DEVELOPMENT OPTION (B) INCLUDES PROVISION FOR A 1700 FT. HOISTING SHAFT.

13 LEVEL AUG/2	D.D. HOLES	WATER PRESSURE	
END H/W	DRIVE	447 lb	(ERROR ON GAUGE 30lb?)
UP RISE	B HOLE	415 "	
	M "	410 "	
"	TOP	410 "	

LUTWYCHE - STAGE I

AIMS	METHODS	COSTS $
1. TO OUTLINE AN ORE RESERVE BLOCK ON H/W VEIN OF 10,000-15,000 TONNES	REHABILITATE 13L SERVICES	10,000
	MINING EQUIPMENT - SERVICE WINCH, DRIFTER	8,000
	DEVELOP 400-500 FT OF SUBLEVEL DRIVE FROM TOP OF EXISTING RAISE, AND DEVELOP ADJACENT RAISE TO THIS SUBLEVEL. YIELDS 900 TONNES DEVELOPMENT ORE.	BREAK-EVEN
2. TO DETERMINE VEIN EXTENSIONS UP DIP FROM 13L	DIAMOND DRILLING FROM 13L APPROXIMATELY 1500 FT	12,000
3. TO DETERMINE ABILITY TO AVOID WATER INFLOW PROBLEMS DURING PRODUCTION	DYE TRACER TO CHECK FOR FLOW FROM SURFACE D/DRILL HOLES TO 13L	?
	IF POSITIVE, GROUT D/D HOLES	?
	GEOLOGICAL INVESTIGATIONS	?



DECISION: ARE RESULTS SATISFACTORY ENOUGH TO ELEVATE A FURTHER $200,000 - $250,000 TO THE "GOOD RISK" CATEGORY ?

LUTWYCHE - STAGE II

AIMS	METHODS	COSTS $
1. 25 TONNES/DAY PRODUCTION FROM H/W VEIN	PILLAR DRIVE DEVELOPMENT - 200 FT	BREAK-EVEN
	13L CHUTES, RAISES ETC.	5000
	RISE ON VEIN (150 FT) AND X/C TO VENT BOREHOLE (60 FT)	5000
	MINING EQUIPMENT - SCRAPERS, SERVICE WINCH, ORE TRUCKS	16000
	DRILL AND CASE VENTILATION BOREHOLE TO 13L (1280 FT, 17½ INCH DIAMETER)	105000
	CROSSCUT ON 13L - 50 FT	5000
	SURFACE FAN INSTALLATION (5000 CFM)	6000
	HYDRAULIC FILL BOREHOLE 9L-11L-13L (350 FT, NX)	7000
	13L FILL STATION, PUMP, FILL LINES, 9L FILL TANK	18000
	GROUND WATER CONTROL	20000
	WATERTIGHT DOOR 13L	4000
	SETTLING SUMPS & SUBMERSIBLE PUMPS UPGRADE 13L PUMPING TO 1000 GPM	13000
		$204000
2. TO INCREASE ORE RESERVES ABOVE AND BELOW 13L	13L DEVELOPMENT - 500 FT @ $30/FT NET	15000
	RAISE DEVELOPMENT - 4 X 100 FT	BREAK-EVEN
	DIAMOND DRILLING - 5000 FT	40000
	CROSSCUTTING FROM H/W VEIN - 100 FT	8000
		$ 63000

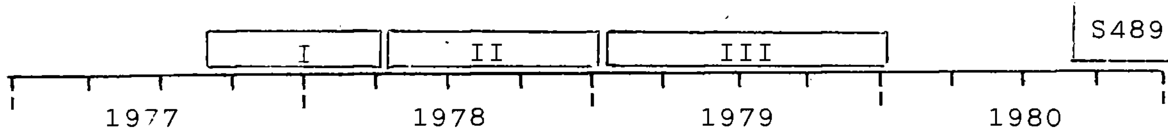
STAGE I | STAGE II

1977 1978 1979 1980

DECISIONS : CAN ADDITIONAL RESERVES BE BROUGHT INTO PRODUCTION ?
IS A 150 TPD PRODUCTION RATE FEASIBLE ?
IS A RESERVE OF 30,000 TONNES BELOW 13L PROBABLE ?

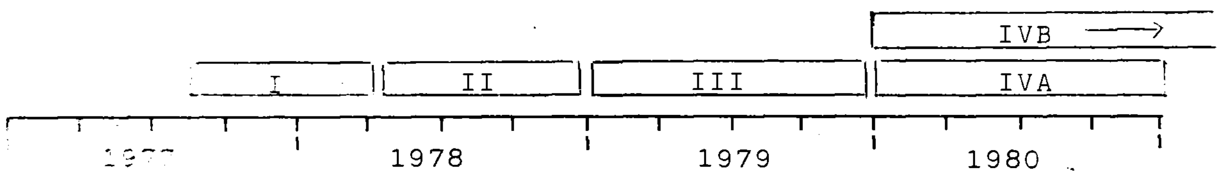
LUTWYCHE - STAGE III

AIMS	METHODS	COSTS $
1. TO INCREASE PRODUCTION TO 40-50 T.P.D.	STOPE DEVELOPMENT ON H/W, NEW AND BATTERY VEINS	BREAK-EVEN
	WASTE DEVELOPMENT (200 FT)	16000
	MINING EQUIPMENT - 4 TON LOCO, SCRAPERS SERVICE WINCHES, ORE TRUCKS	29000
	ENLARGE 13L-14L OREPASS	2000
		$ 47000
2. TO DEVELOP RESERVES BELOW 13L	SINK AND EQUIP 10 FT X 6 FT INTERNAL INCLINED SHAFT FROM 13L. INITIALLY 200'	70000
	ELECTRIC HOIST, EXCAVATION, INSTALL ETC.	18000
	H.T. CABLE, TRANSFORMER (250KVA) SWITCHGEAR FOR 13L SUB-STATION	16000
	MINING EQUIPMENT - ROCKDRILLS, PUMPS	5000
	SKIP LOADING AND DUMPING EXCAVATION AND INSTALLATIONS	18000
		$127000
3. TO INCREASE SERVICES FOR A 150 TONNES/DAY PRODUCTION RATE	VENTILATION : RAISEBORE 13L-SURFACE, 4 FT DIAMETER	204000
	SURFACE FAN INSTALLATION (15000 CFM)	6000
	ACCESS DEVELOPMENT FROM SUB-LEVELS (200FT)	16000
	COMPRESSED AIR : BOOSTER COMPRESSOR 13L	15000
	6 INCH RETICULATION	20000
	PUMPING : 500 GPM PUMP, MOTOR, INSTALLATION 13L	10000
	400 GPM PUMP, MOTOR, INSTALLATION 10L	12000
	ADDITIONAL SUMP & SUMP PUMP 13L	9000
	POWER : ADDITIONAL 250 KVA CAPACITY 13L SUB-STATION	7000
		$299000
4. EXPLORATION	CONTINUED U/G DIAMOND DRILLING-2000 FT	$ 16000
		$489000



LUTWYCHE - STAGE IVA

AIMS	METHODS	COSTS $
1. TO INCREASE PRODUCTION TO 150 TONNES/DAY	STOPE DEVELOPMENT ETC. MINING EQUIPMENT - 4 TON LOCO, SERVICE WINCHES, SCRAPERS	26000
	SURFACE FILL STATION; U/G FILL STATION ADDITIONS	9000
	WASTE DEVELOPMENT - OREPASSES, CROSSCUTS ETC. (1000 FT)	100000
		$155000
2. TO FURTHER DEVELOP BELOW 13L	SINK AND EQUIP INTERNAL SHAFT FURTHER 200 FT	70000
	MINING EQUIPMENT - PUMPS ETC.	5000
		$ 75000
3. EXPLORATION	CONTINUED U/G DIAMOND DRILLING - 2000 FT	$ 16000
		$226000



LUTWYCHE - STAGE IVB

AIMS	METHODS	COSTS $
1. LUTWYCHE HOISTING AND SERVICE SHAFT SURFACE TO 13L	BENCH VENT SHAFT TO SAY 15 FT X 9 FT AND EQUIP FOR HOISTING AND SERVICES 1280 FT @ $1000/FT	1,280,000
	SHAFT COLLAR AND SURFACE WORKS	30,000
	HEADFRAME AND WINDER	300,000
	SKIP LOADING EXCAVATION AND OREPASSES BELOW 13L, AND INSTALLATIONS	80,000
	SURFACE ORE HANDLING FACILITIES	20,000
		$1,710,000
1. EXTEND SHAFT TO 400 FT BELOW 13L	CROSSCUT TO SHAFT SITE (500 FT)	50,000
	RISE AND BENCH TO SHAFT DIMENSIONS AND EQUIP (400 FT)	400,000
	SKIP LOADING EXCAVATION AND INSTALLATIONS	60,000
		$ 510,000
		$2,220,000
		240 000
		2.460 000

5 YEAR OPERATING PLAN

ASSUMPTIONS

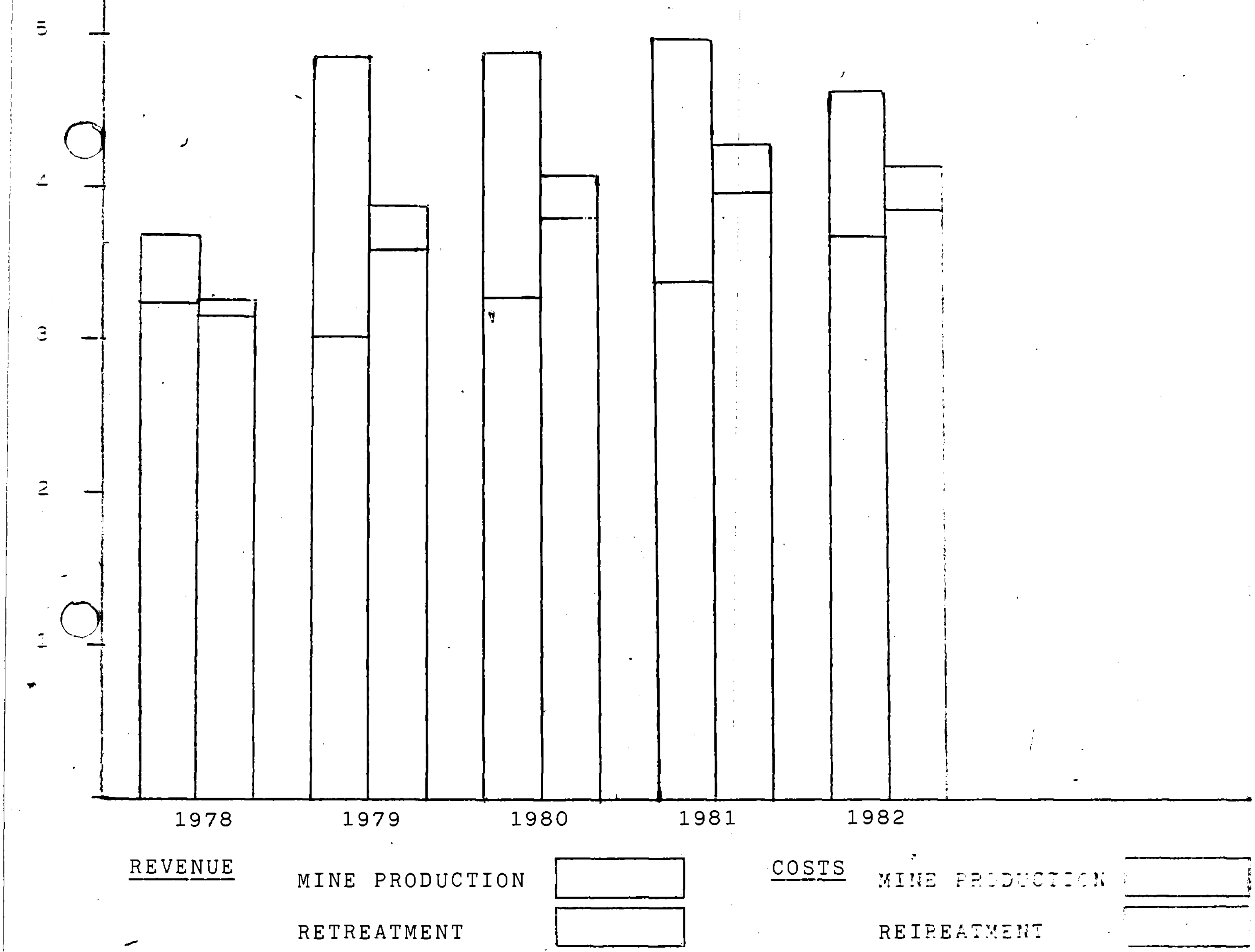
(A) MINING : 200 TONNES/DAY FOR 49,000 TONNES/YEAR
I.E. 250,000 ORE RESERVE.

(B) MILLING: 82% RECOVERIES FROM MID 1978.

(C) RETREATMENT : 3 T.P.H. 65% RECOVERY 1979 →,
90% AVAILABILITY CONTINUOUS OPERATION.

(D) COSTS : MINING & MILLING – PRESENT COSTS + INFLATION.

(E) COSTS : RETREATMENT – $12/TONNE + INFLATION.



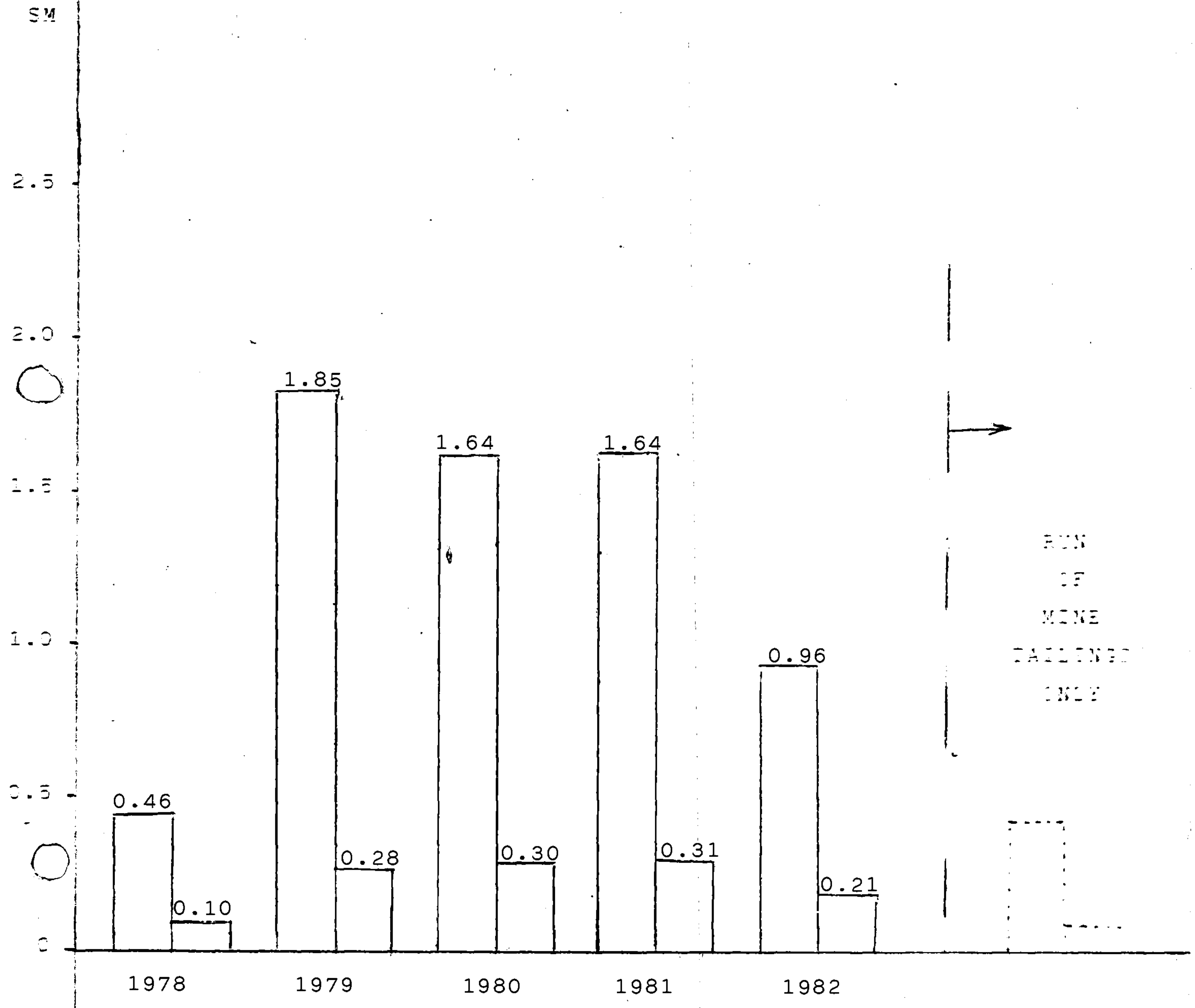
TAILINGS RETREATMENT ASSUMPTIONS

THROUGHPUT 3 T.P.H., 90% AVAILABILITY, CONTINUOUS OPERATION.

RECOVERY 50% (6 MONTHS 1978); 65% THEREAFTER.

MINING AND MILLING CONTINUES.

6000 TONNES PER YEAR FROM RUN-OF-MINE TAILINGS.



TAILINGS RETREATMENT - REVENUE AND COSTS

ABMINCO MEMORANDUM

Date	9 March 1977	Ref	NLL/lh
To	N A Gilberthorpe	From	N L Lindsay
At	Melbourne	At	Melbourne
Copies to	SMR, RJR	Keep	

Subject: Proposal for Bulk Sampling of Hanging Wall and Battery Veins - Lutwyche Project

I have looked at the McGushin/Eager cost estimates for the sampling and they look reasonable. Ther may be a need to add about $500 to $1,000 for some additional surface truck and labour content, but these amounts are well covered by the contingency allowance in the study.

The $36,000 could easily be covered by the metal units won from the ore sample. At most, the net cost would be about $9,000.

It is not certain what this new information will contribute towards the decision as to whether the mining of the Lutwyche veins is economically feasible. Only part of the strike length is being sampled and the sample tells us very little about values up dip in the vein.

Max Richards is personally assembling all of the available information on sampling of the Lutwyche veins. He expects to complete this about March 11. When this is done, we will prepare a submission indicating whether it is worth while going ahead with the sampling project or not.

NLL

To: P McG

For your information. Will advise decision a.s.a.p.

REF. 1.18.1 ABERFOYLE TIN N. L. 13th December 1976.

LUTWYCHE - ECONOMICS OF POTENTIAL ORE

CASE A

Lutwyche production additional to Aberfoyle & Storeys Creek production.

Aberfoyle + Storeys Creek reserves = 109,000 tonnes. At 200 t.p.d. for 1977 and 150 t.p.d. thereafter this is a life of less than 3 years. Optimistically this may increase to 5 years; i.e. 1981 end of life.

Assume then that Lutwyche can contribute 50 t.p.d. in 1978 and 70 t.p.d. from 1979-81 - a total of 60,000 tonnes.

The viability of Lutwyche can then be determined by comparing the value of this production with the operating costs and the pre-production capital expenditure required.

Incremental Mine Cost

i.e. the cost of mining and treating one additional tonne. Mid 1977 budget costs used as the basis.

	Fixed Cost/ Period $	Fixed Cost/ Tonne $	Variable Cost/ Tonne $	Total Cost/ Tonne $
Mining	25,000	6.25	22.60	28.85
Milling	24,400	6.10	3.10	9.20
General Mine Services	17,200	4.30	0.80	5.10
Power	2,400	0.60	2.30	2.90
Mine Overheads	18,000	4.50	0.50	5.00
Inflation	4,000	1.00	1.35	2.35
TOTAL	$91,000	$22.75	$30.65	$53.40

i.e. TOTAL INCREMENTAL MINE COST IS $30.65/TONNE.

Allowing the Incremental Mine Cost 10% p.a. Inflation :-

1977	$30.65 / Tonne
1978	33.80 "
1979	37.10 "
1980	40.80 "
1981	44.90 "

Lutwyche Production Value

Assuming 1:1, Sn:WO_3.

(TAblE ii)

Head Grade C.M.	Recovery (Est.)	Recovered Grade	Production Value per Tonne at average unit prices of :-				
			875	S90	$105	8120	$135
0.5%	69%	0.35	26	31	36	42	47
0.6%	74%	0.44	33	39	46	52	59
0.7%	78%	0.55	41	49	57	66	74
0.8%	81%	0.65	48	58	68	78	87
0.9%	04%	0.76	57	68	79	91	102

Using the above, and allowing a 15% p.a. cash discount rate, the following Net Present Values (N.P.V.) of the future Lutwyche Production are obtained.

(Note that the N.P.V. in effect is the amount of pre-production investment which can be expended in the first year (1977) with the next 3 years production just paying this back including 15% compound interest.)

Head Grade C.M.	Net Present Value of Average Unit Prices of :-				
	$75	$90	$105	8120	$135
0.5	(548,000)	(338,000)	(128,000)	124,000	334,000
0.6	(254,000)	(2,000)	292,000	544,000	838,000
0.7	82,000	418,000	754,000	1,132,000	1,468,000
0.8	376,000	796,000	1,216,000	1,636,000	2,014,000
0.9	754,000	1,216,000	1,678,000	2,182,000	2,644,000

Note however that by end of 1979 average metal prices of 8120/unit or better will be required for Aberfoyle & Storeys Creek to show an operating surplus.

CASE B

Lutwyche production only, from 1981.

At 10% p.a. cost inflation, 1981 costs would be -

at 100 tonnes/day, 8116/tonne

200 " " 78 "

400 " " 62 "

Comparing these costs with the production value (table II) a production surplus would only be achieved with say a 200 t.p.d. production rate, 0.9% head grade and today's metal prices - average 8105/unit.

M. A. Eager

Mines Superintendent

ABMINCO MEMORANDUM

Date	23 March 1977	Ref	NAG/hjb
To	P McGushin	From	N A Gilberthorpe
At	Aberfoyle	At	Melbourne
Copies to	SMR, NLL	Keep	

Subject LUTWYCHE PROJECT

Reference is made to your proposal dated 4th March 1977, for bulk sampling of the Hanging wall and Battery veins.

We have considered this carefully and have concluded that as a basis for decisions on any future development of Lutwyche, the results of the sampling would be of limited value. I realise that this conclusion could be construed as contradictory to those reached at our on-site meeting last December. However, on rethinking we contend that the sampling programme could yield negative and erroneous results that in themselves might not mean anything and which might well lead to the wrong conclusions.

Therefore, I suggest you proceed with an appropriation requisition for a development programme. In the first instance, you should aim to restrict the programme in such a way that financial exposure at any one time is minimised and so that the risk of recovering development expenditure from ore proved and available to be mined is low. All this to be consistent with meeting minimum acceptable engineering standards.

impossible!

In the shorter term if you can see opportunities in the Hanging wall or Battery veins to maximize, particularly wolfram production, then without dissipation of existing effort I suggest you proceed. That is your decision.

For your information a copy of a relevant memorandum from Max Richards is attached.

May I say in conclusion that I was quite impressed with the way in which Mike Eager and you put the proposal together.

NL

NAG

Attach:

Mines Supt.	Surface Supt.	Admin. Supt.	U/G Manager A.L.	U/G Manager S.C.	Geologist	Safety Super.	Assayer	Stores Acctg. Officer	Chief Clerk	Stores Clerk	File						Manager
Date																	

xc PJMcC.

ABMINCO MEMORANDUM

Date	22 March, 1977.	Ref	smr/lo'n
To	N.L. Lindsay	From	S.M. Richards
At	Melbourne	At	Melbourne
Copies to		Keep	

Subject **Lutwyche Sampling Programme**

Resampling of Lutwyche veins is proposed in order to provide data for decisions on future development. The requirements for such a programme to be useful, are

(i) to obtain confidence in existing data ,

(il) to be able to extend the assay values obtained from the sample tonnage, to sufficient larger tonnage on which a feasibility study may be based.

In this case, it will be assumed that, if the Lutwyche bulk sample behaves in the mill in a similar manner to normal Aberfoyle/Storeys Creek production, then the mine staff will increase their confidence in proposals for mine development. This presumably means that the milling recovery, and grade, should be comparable to normal production.

If the grade, in particular, is less than normal, and the subsequent reaction is a loss of confidence in Lutwyche data, support for a development programme may well be eroded for the wrong reasons. It would imply that the grade of the bulk sample can be extended to the whole vein, or at least to a larger tonnage on which economics might be examined. In the case of Lutwyche and veins like it, this process is invalid. Agreed There is really no shortcut to assessing Lutwyche than to follow the normal Aberfoyle/Storeys Creek methods for establishing measured reserves.

so what's new!

McGushin P.J. and Eager M.A. (1977, March 4).

Ref: Proposal for Bulk Sampling of H/W and B Veins: Lutwyche Project.

SM Richards

S.M. Richards.

HANNES WALPOLE PTY. LIMITED

MINERAL INDUSTRY MANAGEMENT AND ADVISORY SERVICES

Directors:
G.S. HANNES B.E. M.I.M.M. M.Aus. I.M.M.
B.P. WALPOLE B.Sc.(Hons) Ph.D. M.Aus. I.M.M.

Suite 902
Australia Square,
N.S.W. 2000
Tel: 27 9758/9
Cables: "HANWALMIN"

18th April 1977.

ATTN: Mr. M. Eager

Mr. P. McGushin,
Manager,
Aberfoyle Tin NL,
ROSSARDEN, TAS 7213.

Dear Peter,

LUTWYCHE

In attempting to assist you with the preparation of a Board submission in respect of the Lutwyche development, we suggest that the following may be an accurate statement of the problem which your proposals should attempt to solve.

PROBLEM - Main

To make available to mining extraction such ore as may be represented by the exposure of the Hanging Wall Vein on 1300 level, as expeditiously as possible and requiring the lowest cash commitment risk commensurate with this achievement.

Subsidiary

To take the best advantage of any exploration opportunities for further ore presented by the access and other development undertaken in the course of mining the Hanging Wall Vein. (Normal exploration considerations will dictate the quantity of such work undertaken, i.e. it must stand on its own feet and the associated costs, if any, cannot properly be ascribed to the HWV extraction.)

In accepting the above as a statement of the problem it is implicitly assumed that at least a quantity of ore exists adjacent and accessible to mining from the 1300 level. L.V. Gentle has calculated such measured and indicated reserves as likely to be 15000 tonnes.

........2/.

PRESENTATION

1. Current Situation

A statement of the current state of affairs concerning production is required here, possibly giving some of the historical background as well as detailing future production difficulties as shown up by the statement of ore reserves and the latest production schedules. As an addendum this could be followed up by an assessment, at present-day tin and tungsten prices and production costs of what would be considered to be the lowest possible break-even production rate on the production schedule and consequently how long economic production could be extended by the introduction of various tonnages and grades ex Lutwyche.

2. Production Constraints to be overcome.

a. Mines Department Inspector has unofficially (?) indicated that no production would be allowed before a second entry to the working places is provided.

b. Mines Department Inspector has unofficially (?) indicated that no production would be allowed without the provision of a through ventilation system.

c. It is inferred from previous development work and geological considerations that a danger of water inflows at rates in excess of those which can be handled by existing drainage and pump installations, may arise during the mining preparation and stoping work.

3. Risks - Financial and Other.

It is clear that a considerable financial exposure will have to be borne in proceeding to production at this time which will hopefully be balanced by the advantages of allowing economic production to continue at a time in the future when costs and prices cannot be estimated with any certainty.

The size of this risk or exposure varies with the capital cost of preparing the Lutwyche area for production and the quantity and grade of the ore blocks brough into production.

It therefore becomes imperative to reduce the capital sums required immediately to the absolute minimum (without surrendering technical flexibility in case of extraordinary exploration successes); to increase the confidence in the estimated ore reserve at an early stage; and to commence production at the earliest possible time, thus

In the latter context it should be noted that the discovery and extraction of ore at Lutwyche will bring into economic consideration more than the tonnages of Lutwyche ore discovered as it will enable Aberfoyle ore which would not be economic to extract because of the low extraction rates possible during the time when few other reserves can be worked to be economically extracted whilst Lutwyche is producing.

4. Proposals and Alternatives.

Ore Reserves

It is suggested that such work as can be undertaken immediately without major cost (and possibly at a profit?) and which would assist in reducing the risk associated with the currently not well defined ore reserves above 1300 level be allowed to proceed at once.

Whichever mining method or procedures are finally decided upon, it is obvious that a number of ore raises will be required.

It is therefore suggested that several (say three sets - each set consisting of two raises thirty (?) feet apart) raises be developed and interconnected at suitable intervals along the presently outlined apparent 'ore' along strike.

In our view, the Mines Department Inspectors will have no objection to such work, suitable labelled exploration development, being carried on under present ventilation and access conditions. If, as anticipated, such work produces ore then an immediate cash return will result from the milling of such ore to compensate for the preparation work required.

Such exploration/development work, raising to 150 or so feet, could prepare between 20,000 to 30,000 tonnes of ore for mining proposals. This suggested requirement is common to all the possible proposals.

Water Safeguards

The state of our knowledge about the possibilities of water inflows from areas in the Lutwyche vein system is very limited and all the data which must be available from previous development work has not been properly assembled and analysed.

It is strongly recommended that such data be assembled and followed up by a study of the flow rates and pressures of water flows from such previous drill holes as are equipped with valves and controls. In any case no development work of any nature must be undertaken without drill hole 'cover'.

All the suggestions below for providing access and ventilation to the proposed Lutwyche workings above the 1300 level involve the provision of openings which could with the imperfect state of our current geological knowledge, intersect either a major faulting system or bring high-pressure-small-fissure water into the vicinity of the workings, with consequent danger to personnel and property.

It is therefore imperative that provision be included in all the alternative plans for the preparation of pumping facilities and water controls on 1300 level (and relay levels if necessary) and the study of all surface drill holes or development openings prior to holing through to the existing workings.

In each particular proposal such detailed plans and their cost should accompany the suggested plan, e.g.

Suggested pumping and sump capacity and ease of extension on each of the relevant levels.
Installation of water-tight doors.
Drilling and other preparation required for test work, etc.

<u>Schemes for provision of Access and Ventilation - Costs - Timing.</u>

a) <u>Ventilation</u> by exhaust from a large diameter drill-hole between surface and 1300 level.

<u>Access</u> to top of stopes
- i) from 1300 ore drive and up ore raises.
- ii) from raise ex 1300 main crosscut connected to a drive across the top of the stopes.

Because of the tentative and small scale nature of initial anticipated production, it is felt that the Mines Department may sanction a mining system giving separate access to the proposed stopes from the point of intersection of the main 1300 crosscut with the ore, but having the main cross cut to this point as the one common access. This would appear to be a completely safe and practical procedure for a limited stoping programme, say for the 150 feet above 1300 level.

A large diameter drill hole could be bored from surface to 1300 level (diameter 12" to 18" depending on equipment) intersecting the 1300 level at a point say 30 feet ahead of the current 1300 crosscut north face in order to allow water problem assessment.

A raise would be put up on this hole to say 150 feet and connected to the top of the ore exploration raises. A high water-gauge fan installed at surface should be capable of exhausting between 3000 and 5000 cfm from such a hole.

This scheme would appear to have many advantages;

i) Fraction of the cost of other schemes.
ii) Minimum waste to be moved.
iii) Water-tight doors (if required) could be placed in the crosscut north extension thus not interfering with possible production.
iv) Speed of implementation (production possible within six months?)
v) Flexibility for enlargement of drill hole for stoping extension or for conversion to shaft if warranted, later.

b) Raise to 800 level - develop 800 crosscut etc.

c) Drill and ream hole to 4 feet diameter ex-surface etc.

Each of the proposals should be costed, scheduled for time and advantages and disadvanatages in the local content of Aberfoyle, noted.

5. Conclusion

We feel sure scheme (a) will best solve the Main Problem submitted for solution on a cost basis above.

6. Recommendation

Get necessary permissions from Mines Department - start work at once - cash requirements.

We hope these abbreviated notes will be of assistance.

Yours sincerely,

HANNES WALPOLE PTY. LIMITED.

BASIC REQUIREMENTS TO START

A. Plans and section of all drilling and development data (fault lines etc) together with such assays or grade estimates as are available - Geologists.

B. Check Contractor costs alternatives and availability for work under schemes a,b and c.

C. Design water control etc. systems.

D. Check ventilation equipment, costs and theory for drill hole exhaust system.

E. Check Mines Department for permission for exploration development (raises) on current layout - do not mention scheme (a) at this time.

LUTWYCHE

Exploration Potential

From a geological reserve point of view Lutwyche easily constitutes the best potential for increased "reserves" in the Aberfoyle-Storeys Creek area. G.N. Moore requested a statement on the best grade estimate. Grade estimates on Lutwyche are various, and are summarised in the following table

		% Contained H.W. Vein	Metal Pay Vein
Kingsbury (1963)	Visual Estimate of Core Intersections	1.20	0.70
Mason (1968)	Assay of Drill Core	1.78	1.22
Krummei (1968)	Assay of Drill Core	1.29	0.71
Krummei (1969)	Channel Sampling, 13L Devel.	0.67	n.devel.

Krummei (1970) made a whole of body assessment, and this is the only study which used all drill core and development data. He estimated the following

	Tonnes	% CM
Indicated	76,200	0.68
Inferred	473,400	0.81

Commenting on Krummei's estimate, D.K. Tester argued for doubling the grade in the H.W. Vein from 0.67 to 1.34 on the basis of a comparative sampling programme.

Indicated	76,200	1.34
Inferred	473,400	1.07

In a review of the Lutwyche project (July 1969), Titcombe described ore reserves between 8-13 level as follows

Hanging Wall Vein 72,000 tonnes @ 0.67% CM

Old Battery Type Vein 48,000 tonnes @ 0.87% CM
120

preferring to use Krummei's estimate, but pointing out that it was conservative.

The grade of Lutwyche will only be positively established by bulk sampling during development. CEPL guess that 1% CM is probably realistic. All grades mentioned herein refer to a 4' mining width, for an average vein width of 15". In evaluation studies, I recommend the grade used be 1% ± 30%. 50/50 Sn/WO3 ?

Potential to improve grade ?

15 December, 1975.
smr/lo'n

ABMINCO MEMORANDUM

Date 11th May, 1977. Ref NLL:JB

To N.A. GILBERTHORPE From N.L. LINDSAY

At MELBOURNE At MELBOURNE

Copies to NLL Keep

Suggest you send this to Peter as input 18/5/77

Subject **G. HANNES' LETTER TO P. McGUSHIN (18.4.77) RE LUTWYCHE DEVELOPMENT SUBMISSION**

I have received a copy of Geoff Hannes' letter on the subject of the Lutwyche development submission. As requested I set out my comments on the letter in this memo.

1. The statement of the problem (page 1) is adequate. To put it in my own words, I would say our objective is to indicate sufficient ore by further development of 13 level to justify the cost of an adequate ventilation connection to the surface or some higher level in the Aberfoyle mine.

   It is unlikely that the Mines Inspector will approve a major production operation at Lutwyche without such a ventilation connection - nor would we be acting responsibly if we attempted it. However, a limited exploration/development programme to block out sufficient ore to justify a major connection should be admissable.

2. Hannes has divided the suggested presentation into six parts:-

   2.1 Statement of current situation

   2.2 Production constraints to be overcome

   2.3 Risks - Financial and other

   2.4 Proposals and alternatives

   2.5 Conclusion

   2.6 Recommendation

   This should be sufficient for the submission but I would recommend that the notes under each heading should be brief summaries with as much supporting information as possible being included as appendices.

   My comments are:

   2.1 The statement of the current situation should indicate how development and production from Lutwyche might key in with the declining Aberfoyle mine production. In particular, some mention should be made of the more optimistic assumptions that led Bill Irvine to forecast a possible doubling or tripling of present resources. I think this is important so that we do not force ourselves into hasty decisions on the basis of the present ore reserves which may prove to be conservatively stated.

   2.2 Three prerequisites for production are mentioned -

   a) provision of second means of entry which will satisfy the Mines Inspector;

Date	
Mines Supt.	
Surface Supt.	
Admin Supt.	
U/G Manager A.L.	
U/G Manager S.C.	
Geologist	
Safety Super.	
Receiver	
Stores Accg. Officer	
Chief Clerk	
Stores Officer	
File	
Manager	

.../2

b) provision of through ventilation systems which will satisfy the Mines Inspector;

c) provision of storage/pumping capacity which will handle likely water inflows.

A further prerequisite would be the availability of adequate skilled labour without lessening the overall ability of the mine to meet the mill's ore requirements.

A fifth might deal with the requirements for a future hydraulic fill system.

2.3 The provision of a ventilation connection to the surface or No. 8 level would entail costs in the range \$140,000 to \$1,000,000 depending on the method used.

These are large amounts of money and it is sensible that sufficient work be done to minimise the risk that the money will not be repaid.

G. Hannes has proposed a programme of exploration/development on the 13 level hanging wall vein to block out 20,000 to 30,000 tonnes of ore by means of twin rises along strike, connected by a sub-level drive in ore at a point about 45 metres above the 13 level. This would merely be an extension of the existing development. Assuming a 1.2 metre (4 feet) average mining thickness, a strike length of 140 metres (460 feet) blocked out to 45 metres above the level would yield about 20,000 tonnes of ore.

$$\frac{140 \times 45 \times 1.2}{0.37} = 20{,}400$$

(0.37 cubic metres per tonne of ore.)

Some of this would be won during development but most by stoping. It is likely that ore won during the development programme would yield sufficient metal to pay for development. It has been estimated that a profit of about \$15 per tonne might be made from stoping the developed ore at present metal prices. Should this be the case, a mining block yielding 20,000 tonnes would have a potential for making a profit of around \$300,000. This would be enough to almost pay for the cost of a 6-foot diameter raise bored access from 13 level to surface, i.e. 450 metres x \$600 = \$270,000.

2.4 Several alternative proposals have previously been considered for the provision of through ventilation and secondary access. Those proposals embodying connections from Lutwyche 13 level to surface or Aberfoyle 8 level have been costed at amounts in the range \$200,000 to about \$1,000,000. Hannes has proposed a new alternative for allowing through ventilation via a large diameter drill hole of 12 to 18 inches diameter between 13 level and the surface, and he allows for secondary access to stoping areas via a rise from the main Lutwyche cross cuts (see Figure 1 attached). A Melbourne drilling contractor has quoted tentatively, \$45 per foot to drill a 15-inch hole from surface to 13 level. A figure of around \$70,000 would cover drilling and such additional items as mobilisation, demobilisation and overhead during drilling.

It would seem reasonable to assume that an amount of \$100,000 would be adequate to cover the complete cost of the drill hole plus ancillary expenditure for ventilation fans and surface facilities.

.../3

Special measures for grouting off water flows during drilling and precautions to keep the hole vertical might cause this amount to be exceeded.

Assuming a limited first objective is the blocking out of 20,000+ tonnes of ore as a preliminary to a major development opening to surface (or 8 level Aberfoyle), by far the cheapest way would be to proceed along the lines of the Hannes' alternative with the exception that the drill hole connection would not be made at this stage. I would prefer to see exhaust ventilation returned to the Spiers shaft as at present via the same rise used for alternative access to the top of the stoping blocks (see rise shaded in blue in Figure 1). The present ventilation tubing could blow air through a ventilation door installed in the hanging wall drive and air would scour the working areas as indicated by the lines of red arrows in Figure 1. It might be possible to rise most of the way from the main cross cut via the pay vein which has a much steeper dip (approximately 70°) than the hanging wall vein dip (approximately 45°). I cannot see any reason why such a programme should be disallowed by the Mines Inspector as long as adequate pumping capacity and storage is maintained for the handling of water inflows and access routes are kept in good order.

2.5 The conclusion should summarise the alternatives and list the advantages and disadvantages of the most favourable alternative.

2.6 Recommendations should flow easily from 2.5.

Before any additional development work is done at Lutwyche, it is vital that storage and pumping facilities to handle 1000 gallons per minute should be restored to good working order (i.e. as was the case for the original Lutwyche development).

For future development of Lutwyche it is important that as much information about ore grades as possible be obtained. This should include comparative sampling by several methods and processing of identifiable parcels of ore through the mill to determine recovery grades. A broad outline of how this will be done should be included in the submission.

As suggested by Hannes, a thoroughly documented proposal should be prepared by Aberfoyle staff for approval by the Mines Inspector. The proposal should describe the <u>limited</u> objectives of the programme and show how ventilation, access and water inflows would be handled.

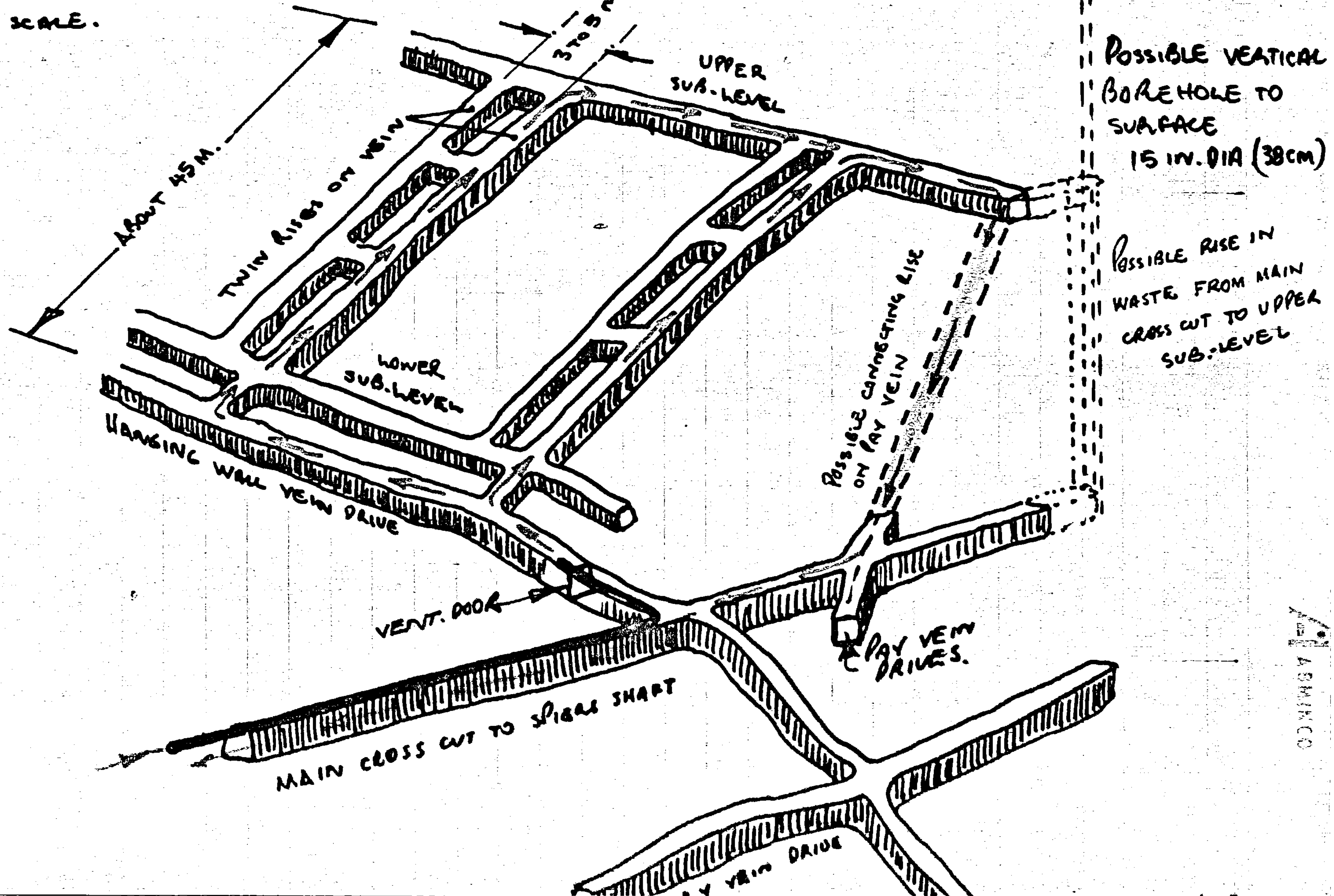
A paragraph or two should be included to indicate what steps would be required to prepare Lutwyche for further development and production after the completion of the programme contemplated now.

N.L.L.

Att.

FIGURE 1 : LUTWYCHE ORE DEVELOPMENT SHOWING PROVISION OF ALTERNATIVE ACCESS TO STOPING AREAS AND THROUGH VENTILATION.

PERSPECTIVE DRAWING NOT TO SCALE.



How to drive high inclined raises

by using an Alimak raise climber and Alitrolley a 2,460-foot long raise was driven in 37 weeks; similar speed for other high raises

by **Roland Granskog,**
Engineer, Alimak-Verken AB
Skelleftea, Sweden

Since the introduction, in 1957, of the Alimak Raise Climber several thousand raises have been driven using it in mines in all parts of the world.

Outstanding records have been achieved with the Climber and it has proven to be safe, fast, and requires a minimum number of miners to use it.

As experience was gained in using the Climber, new models were developed for driving of raises at any angle and for the driving of ever larger cross sectional raises by full face drilling and blasting. Special models have been built for unusual raises. The largest full face raise driven to date, at Stalon, Sweden, has a 376 square foot face area.

The Climber proved to be very efficient for driving high raises and soon 1,000 foot raises became commonplace. However, the initial air motor drive proved to have a practical limit to less than 1,000 feet of raise. Air pressure loss through the long rubber hose was so great that the air motor driving the Climber upward would not operate.

Remember that compressed air for operating the drills is conveyed to the top of the raise through three 1-¼-inch conduits built into the climbing guide rail. A fourth conduit is for drilling water.

The standard guide rail is bolted to the side or roof of the raise, and has a front plate to guide the Climber, and a rack on which the hoist climbs. The sections come in lengths of two and one meter and are fixed to the rock wall by two expansion ended rock bolts. The joints of the sections are sealed by rubber 0-rings. Using curved guide rail sections, the lower part of the guide rail can follow the changes in angles of inclination of raises.

The raise is driven at the end of a drift. A curved guide rail is installed from the horizontal drift to thé raise proper over any arc to vertical (90°).

The Raise Climber and its equipment is placed in this drift for protection during blasting. Just behind the guide rail curve a service guide rail is fitted to make possible quick service of the drive gear and checking of the safety equipment. At the bottom of the raise is located the Raise Climber, a service and emergency hoist type Alitrolley, necessary cable reels, an automatic air and water control system, and a water pump to increase the water pressure to force the water through conduit to top of the raise.

A second drift is driven to the bottom of the raise in such a manner that the blasted rock falls into it. This drift should be large enough to hold several rounds of muck so that it won't have to be cleaned out every day.

Electric Powered Climbers

Experience gained in driving these raises was used to develop the new Model STH-5 with an electric motor drive. It has a designed capacity to drive a 4,300-foot high raise. However, one of the longest driven to date, at Uvdal, Norway, was 2,460 feet at a 45° angle. This raise has a 54 square foot face area.

Electric drive has the advantages of greater Climber speed, 67 feet per minute, as well as greater speed of descent, 100 feet per minute. The new Climber can be used for any inclination and for forward, backward and horizontal curves.

Electric supply to Climbers and Alitrolley is through cables wound on cable reels placed at the bottom of the raise. The cable reels are equipped with a current collector and are rotated by air motors. On and off reeling is automatic. When ascending the raise, the tensioned cable actuates a control arm which starts the air motor and winds the cable off the reel. When descending, the slackening cable operates the motor via the control arm and the cable is wound onto the reel.

The cable reels may be placed alongside or on top of each other, depending on the space available. As the Climber is driven upwards, the trailing power cable rests on cable holders attached to the guide rail. The special multi-circuit cable has a power circuit, a telephone circuit, a remote control circuit, and a water-air valve control circuit. Special magnetic valves are incorporated in the air and water inlet manifold which is attached between the bottom of the guide rail and main supply lines.

The miners can actuate these valves by an electric signal from the top of the raise. Thus, it is possible for them to attach and remove the header plate at the top of the raise without any human assistance at the bottom of the raise.

To eliminate the danger of premature ignition, special steps must be taken before loading when using an electrically driven Climber. After drilling, the electric supply for all equipment including cable reels, is cut off by means of a contact in the cage. As additional security, the current can only be turned on again by a main switch at the bottom of the raise. When the electric power is cut off, it is impossible to telephone from the bottom of the

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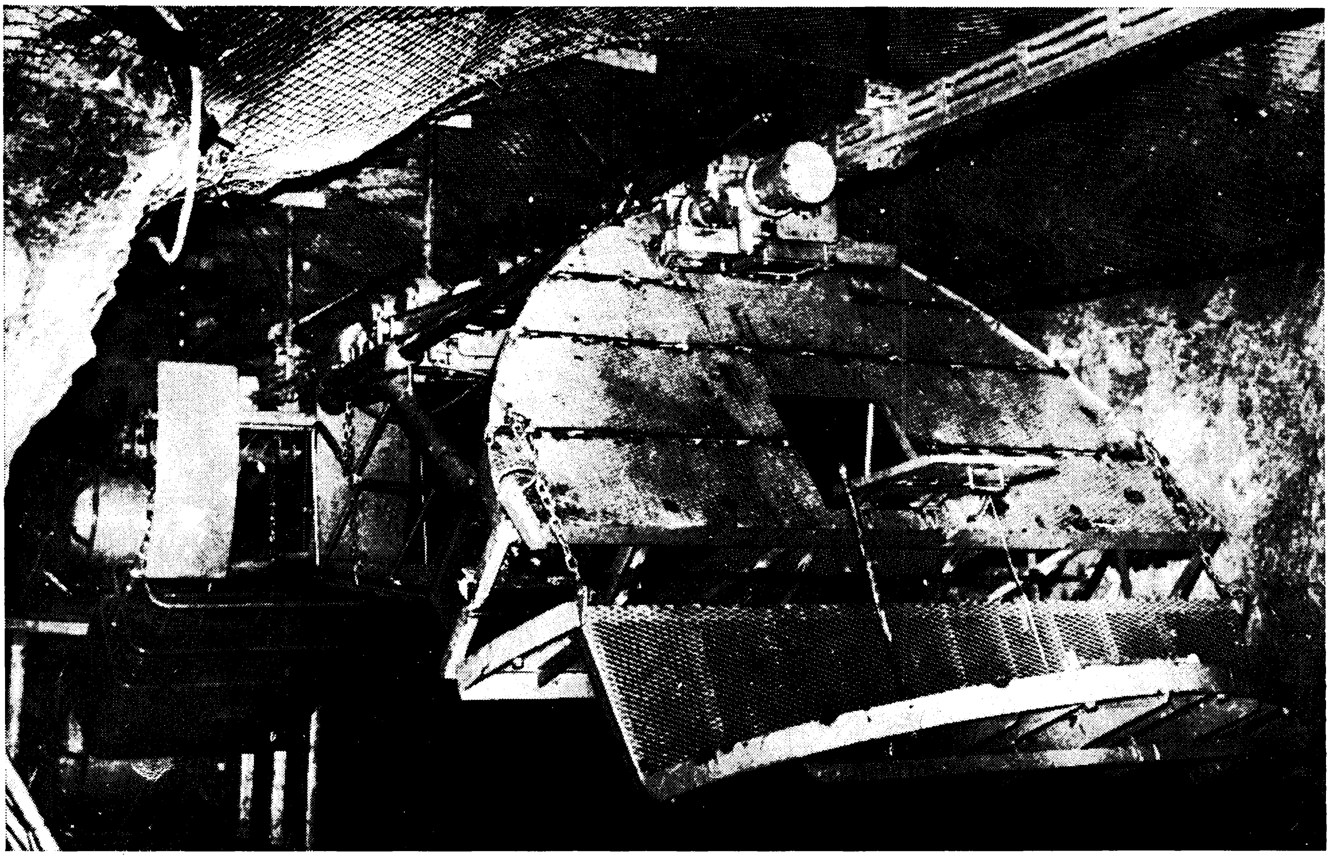


FRONT OR TOP VIEW of Raise Climber parked in the station at the bottom of the raise. The open trap door leads to cage in which men ride to top of raise after blasting. The independently operated Alitrolley is at far left. Platforms can be built for any size or shaped raise and mounted on standard climber mechanism. The platform can easily be positioned to form level surface at any raise angle.

raise to the Climber. On the other hand, a miner can telephone from the Climber to the bottom of the raise. He should, however, make sure that the ignition cables are kept away from the guide rail.

Upon completion of loading the miners descend in the Climber by gravity. The speed is limited to about 100 feet per minute by the safety device. In addition to the control brake, there is also an automatic speed governor which comes into action at overspeed.

Work Cycle As Follows

After a round has been blasted the miners ride the Raise Climber to the top.

After scaling the back and adding a guide rail section, they fit the header plate and the hose connections to the lubricator for the drills.

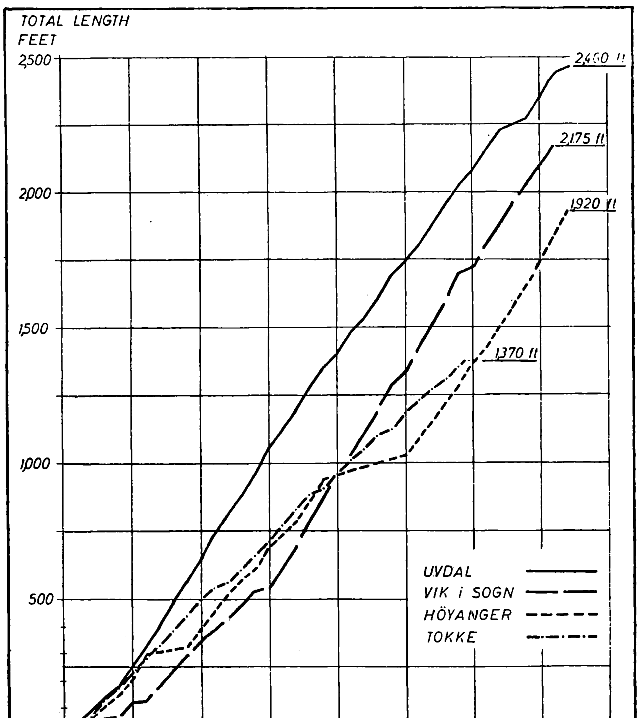
The round is drilled and loaded.

Before descending, the miners replace the regular header plate by a special header with nozzles for ventilation.

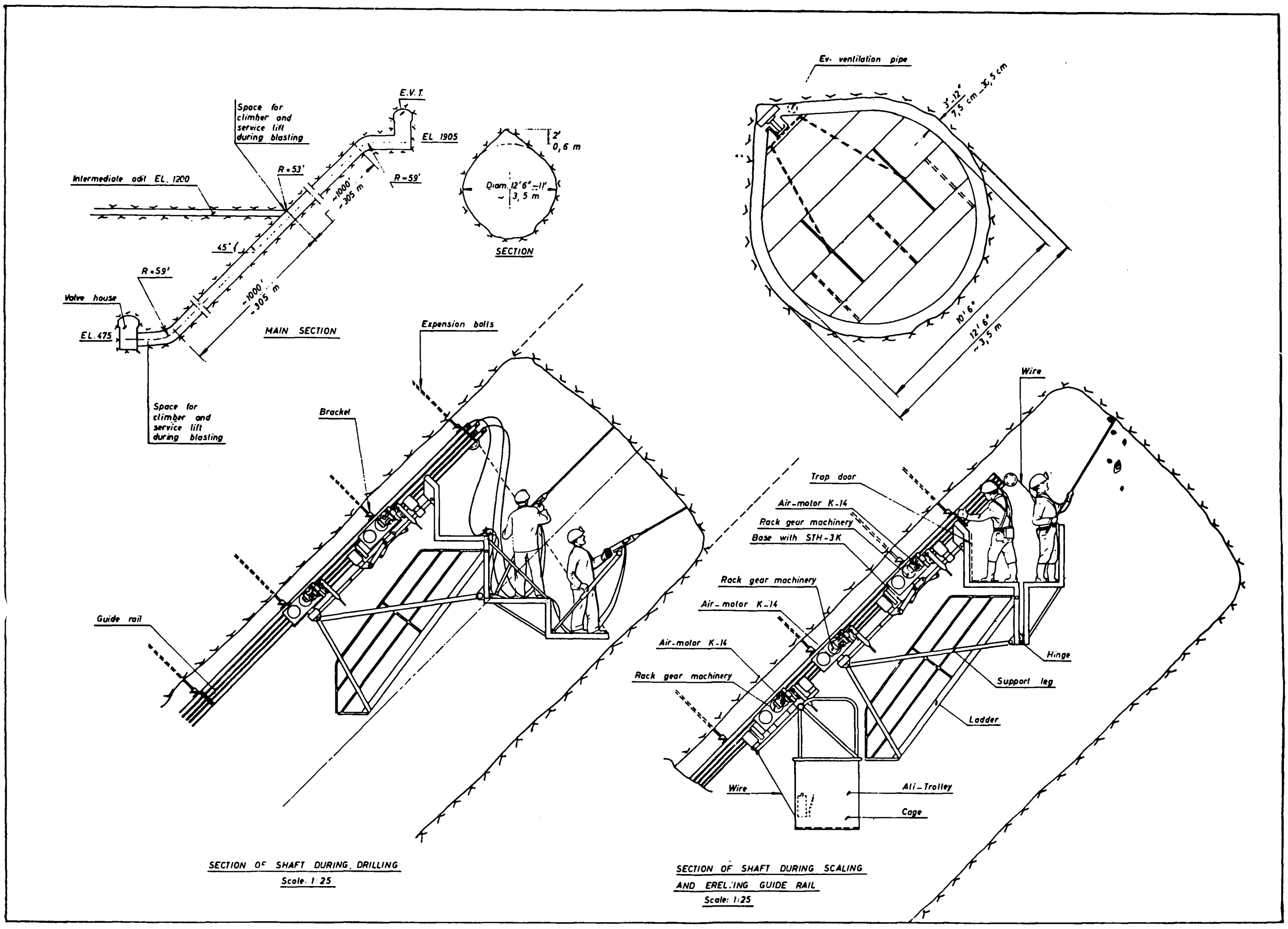
After descent and firing, the raise is ventilated by pumping air and water through the guide rail. A new cycle starts.

Table No. I lists raise driving data at six hydroelectric power plants in Norway. Equipment and methods were pioneered in these raises for use by the mining industry.

Careful planning is necessary to see that one round is completed per shift with allowance for shift changing time. A key item is the depth of round which can be drilled and blasted in available face time. Each crew should complete the exact same cycle each shift. One



FOOTAGE DRIVEN TIME REQUIRED diagrams for four high raises in Norway. The important point to observe for all this these curves is that there is no flattening as raise gets higher. Driving speed is maintained despite the increased height and travel time as miners gain experience.



DRILLING AND SCALING operations at the top of a high raise are shown in this diagram. This is a 10.5-foot diameter circular raise driven at a 45° angle. Two miners are drilling from folded-down platform at left. At right they are extending guide rail and scaling. Note Alitrolley.

man per shift, at the bottom of the raise, grinds drill bits, handles material, makes repairs, etc. Experience has shown that in a 55 square foot face on eight foot round is possible; in larger raises a 10 foot round. Typical drilling patterns are shown. It should be kept in mind that the large number of holes have contributed to a smooth walled raise of uniform size.

It was found that the height of the raise did not slow the rate of driving. The extra travel time was more than offset by the training, and experience of the miners who learned how to do the work more efficiently with practice.

In the 2,000 foot high raise at Hoyanger, Norway, seven men drilled, blasted, and hauled away 50,000 tons of rock. In the two shift per day operation two men per shift were on the Climber, and one at the bottom. The seventh man greased and serviced the equipment.

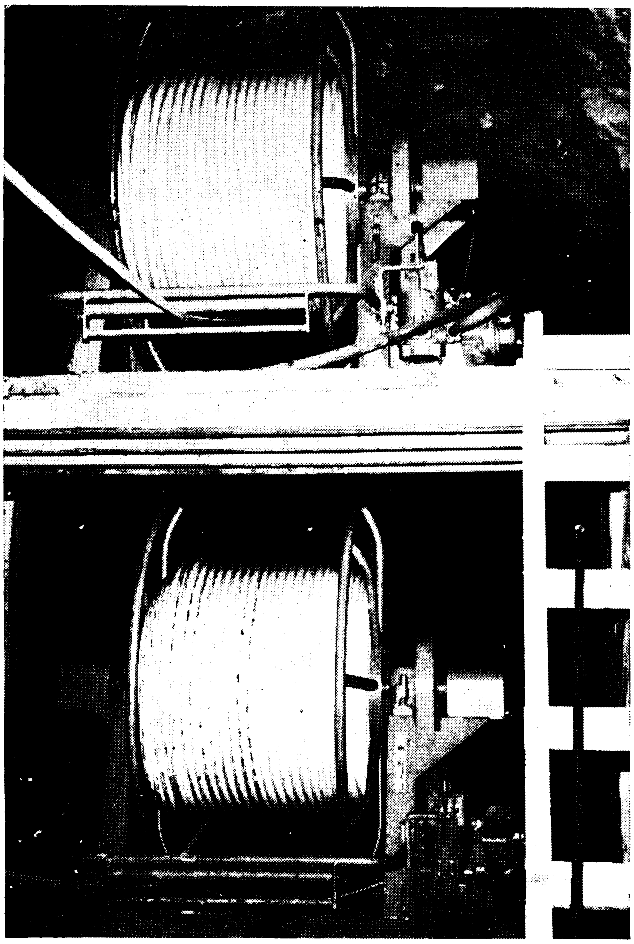
A STH-5 Climber with both electric and air driven powered driving units was used. Electric power, at 380 volts, was used only for climbing. A standard 380-volt power cable was used. Power was cut off during loading to prevent premature firing. The air motor was used only

Table No. I

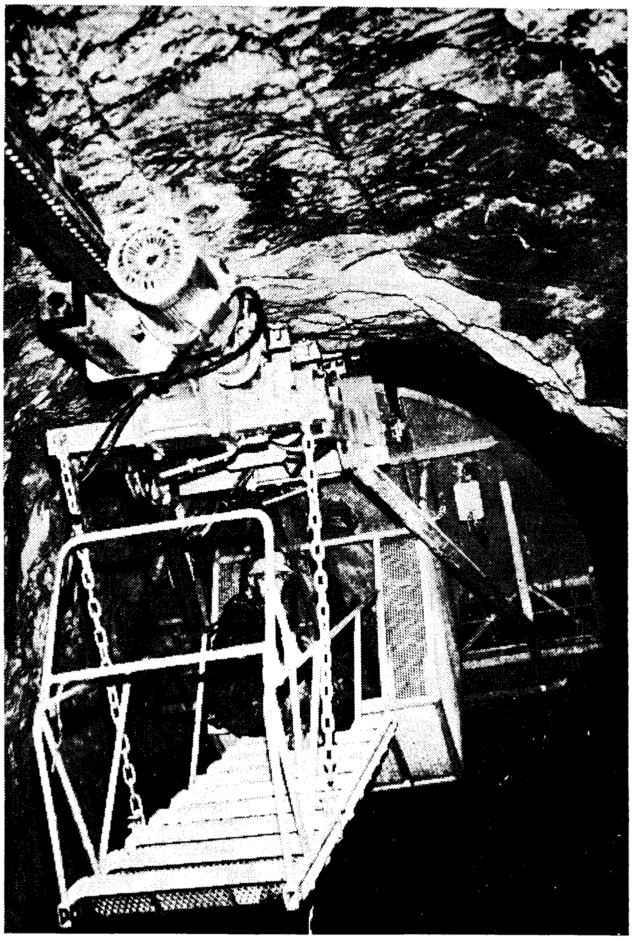
High Raises Driven in Norway With Alimak Raise Climbers

	Uvdal	*Vik i Sogn*	*Høyanger*	*Tokke 6*	*Mo i Rana*	*Inset*
Length, feet	2,450	2,181	1,925	1,411	1,345	955
Area, square feet	56.5	45.4	35.5	45.4	148.5	215.3
Inclination, degrees	45	45	42	45	45	45
Type of rock	granite	slate	gneiss	schist	mica schist	gneiss-granite-slate
Shifts per day	3	3	3	2	2	3
Shifts per week	16	16	16	10	10	15
Miners per shift	2	2	2	2	3	4
Helpers per shift	1	1	1	1	1	1
Hours per man week	40	40	40	40	40	37.5
Installation of base unit, man hours[1]	290	282	275	320	320	
Hours per round, including ventilation at a height of feet	7.0 1,640	7.9 426	7.2	8.3	7.5 820	10.3 492
Average advance, feet per week, including lost time	76.5	65.6	68.9	51.5	51.5	65.6
Maximum advance, feet per week, including lost time	102	98.4	82.0	72.4		

1. Including guide rail curve, transport, and training of men. Installation of equipment by a specialist with the assistance of miners who had not previously seen the equipment. Installation time includes training time.



ELECTRIC CABLE REELS, rotated by air motors, are placed at the bottom of the raise. Pictured are two reels, one above the other, for a high and not wide station. Cable is reeled on or off as Climber moves.



REAR VIEW of Climber on its way to the top of the raise. It is just leaving the horizontal station, turning the bend, into raise proper. Note the two miners operating climber and protected by top platform.

for moving the Climber at the top of the raise using air from the guide rail. Descent, by gravity, was with speed controlled by automatic centrifugal brake connected directly to the two motors. No electric power was used once the Climber reached the top of the raise.

When driving inclined raises, particularly those of large size, the Climber is built in one, or three separate steps. The second and third platforms are hinged so as to fold back onto the uppermost platform. Scaling is started from the top platform with the others folded away. Scaling then proceeds from platform to platform. By using these platforms it is possible to position the stinger end of the Airleg drills equal distance from the face. A surface formed through all stinger end points ideally, would then form a plane parallel to the face of the raise. This makes possible the accurate drilling of the round. The platforms minimize transfer of machines during drilling and obviate the necessity of adjusting the height of the platform during the drilling cycle. Ideally, one man and machine work on each platform.

It has been found that for raises up to a cross sectional area of 75 square feet that one platform is adequate, two are needed for an area to 118 square feet, and three platforms for larger raises. A manually operated winch in the cage is used to lower and raise the folding platforms.

One-platform Climbers are equipped with one driving unit; larger Climbers are usually equipped with two driving units. Each driving unit incorporates a 10-horsepower electrical motor, a centrifugal coupling, two gear boxes, a standard control brake, and three brakes to control the descent, all built into a frame guided by rollers.

Alitrolley Independent of Climber

The Climber is operated from the cage under the work platform by means of a dead-man-type reverse switch. There is a telephone circuit by which contact is maintained with the bottom of the raise during ascent and work period at the top of the raise.

For transportation to the top of the raise during drilling, an Alitrolley passenger and material hoist with a capacity of 1,320 pounds which is used for transport of material, inspection, emergency purposes, and transport of men during changes of shifts, etc. The Alitrolley is built with the same drive unit as the Raise Climber and has a spacious cage for four passengers, a safety roof, and a door to make possible easy access to the Raise Climber.

It is interesting to report that in driving the 955-foot high Inset raise that calculations showed the Climber travelled 47,000 feet (up and down) in the raise and the Alitrolley 114,000 feet. To drive the 2,000-foot high, 35 square foot cross sectional raise at Hoyanger it took exactly eight months. The average round broke 7.5 feet. The Climber is calculated to have travelled 1,635,000 feet.

Development of the electric powered Climber and construction of special climbers have made it possible to speed up the driving of very high raises, at any angle, with large cross sectional areas through component rocks at low cost. END

ABERFOYLE TIN N. L.

LUTWYCHE PROJECT

PROPOSAL FOR BULK SAMPLING OF HANGINGWALL AND BATTERY VEINS

Submitted by : P. J. McGushin
MANAGER

M. A. Eager
MINE SUPERINTENDE

4 MARCH, 1977

INTRODUCTION

The Lutwyche wolfram-and cassiterite-bearing vein system has been partly developed from the 13 level horizon of the Aberfcyle Mine, with access from the Aberfoyle main shaft by a crosscut extending approximately 700 metres to the north-east.

Its exploitation was discussed at a meeting of executive and operating staff at Rossarden, 14-15/12/76.

It was resolved that Aberfoyle staff would prepare, for the Managing Director, a costed proposal for obtaining and treating bulk samples of Lutwyche ore, the results of which would provide a basis for decisions on future development.

Proposals for the preparation of the Lutwyche area for production will be the subject of a separate report for which investigations are currently in progress.

PROPOSAL SUMMARY

1. Rehabilitate 13 level for the purpose of obtaining two 250-300 tonne bulk samples, one from the Hangingwall vein and one from the Battery vein.
   Cost : $9300

2. Mine a 300 tonne sample from the Hangingwall vein by shrinkage stoping (uppers) from the present pillar drive.
   Cost : $10,200

3. Mine a 300 tonne sample from the Battery vein with a leading stope above 13 level.
   Cost : $10,600

4. Treat the two bulk samples separately to establish recovered grades and mill recoveries.
   Cost : $6200

5. | | |
   |---|---|
   | Total expenditure | $36,300 |
   | Probable minimum production value | $27,000 |
   | Maximum net project cost | $ 9,300 |

6. If rehabilitation work was commenced shortly, it is anticipated that sampling results would be available by the end of Period 7 - 5/7/77.

DISCUSSION

1. PRESENT CONDITION of DEVELOPMENT and SERVICES

Figure I shows the existing 13 level development. The area has been recently (February 1977) inspected and the following noted -

(i) The main access crosscut and most of the vein development drives are in good condition. There are a few minor groundfalls in the Hangingwall vein drive near the raises.

(ii) The Hangingwall vein pillar drive and raises, developed in 1971, are in surprisingly good condition. Little rehabilitation will be required.

(iii) Most vein exposure is dry and there has been no significant staining. Visual grading should present no problems.

(iv) High pressure water (controllable) is still evident at a diamond drill hole at the northern end of the Hangingwall vein drive. Pressure is estimated at roughly equivalent to a 50 metre head.

(v) Trackwork is in good condition with no serious corrosion.

(vi) Drains have silted up. Total drainage flow is estimated at 5 l/sec.

(vii) In the Hangingwall vein drive, some set timber and most chute timber has deteriorated and will require replacement.

(viii) Fans, cables, and switchgear will require major repairs. The 600mm diameter ventilation tubing will require replacement.

(ix) Compressed air and water lines are 80% serviceable.

(x) The ore and mullock chutes on 14 level require repairs.

In general then, the area is in quite good condition and will require less rehabilitation than had previously been thought necessary.

2. SAMPLING PROGRAMME

The aim of the sampling programme will be to determine the grades of the Lutwyche veins with a higher level of confidence than has been previously possible using drill core intersections and past development and assay records.

It is proposed that bulk samples of both the Hangingwall and Battery veins be mined, and treated separately, so that the Recoverable Grade can be established. During treatment, measurement of tailing flow rates, and their assay, will enable Mill Recovery and Mining Head Grade to be estimated. To this end we will require the assistance of the group metallurgical facili-

Visual grading of all vein exposures during mining of the samples can then be used to correlate visual grade and head grade - after allowing for mullock sorted.

This correlation can then be applied to all vein exposure in the H/W, Battery, and Pay veins, (currently 450 metres of strike) so that a grade can be assigned to each vein or section of a vein.

3. SAMPLE SIZE

To best represent a recoverable grade the bulk sample from each vein should ideally be sufficient for one week's mill production i.e. 800-1000 tonnes from each area.

However to obtain these samples at an estimated miner productivity of 6 tonnes per manshift would require at least 7 month's mining with 2 miners.

It is therefore proposed that to limit mining time to say 2-3 months, 250-300 tonne samples should be mined from each vein. This would require only 1½ shifts milling time for each sample and would necessitate an extremely thorough mill cleanup both before and after treatment of the sample.

4. SAMPLE MINING - HANGINGWALL VEIN

The main constraints upon mining are :

(i) Inability to sandfill.

(ii) Weak hangingwall conditions.

(iii) Desire to preserve the two raises for possible access development in the future.

(iv) Scarcity of labour in general, and miners in particular.

Working within these constraints, two main alternatives emerge :

Drive a new sublevel [approximately 50 metres] from the top of the existing raise

or

Shrinkage stope from the present pillar drive [three 1.5m lifts over a 25 metre strike length].

Driving from the top of the raise would have the advantage of outlining a 4000 tonne block and would require little ground support. However, shrinkage stoping would show the following relative advantages -

- More efficient mining - not limited to a development cycle,
- Easier to ventilate,
- Easier ore handling,
- Easier access,

But, would require rockbolting of the exposed hangingwall to simulate the support and dilution restraint normally provided by sandfill.

It is proposed that shrinkage stoping be used to mine the bulk samples (fig. 2).

5. SAMPLE MINING - BATTERY VEIN

The main alternatives are either development of raises and a pillar drive, or leading stoping from the 13 level drive.

It is proposed that a leading stope be mined on both sides of the H/W vein drive to a height of approximately 2.2 metres over a total length of 45 metres (fig. 3).

On completion of the sample mining, timbering would be required for hangingwall support.

6. ORE and MULLOCK DISPOSAL

Ore from the H/W vein shrink stope will be scraped to the chutes.

Ore from the Battery vein leading stopes will be scraped to a loading ramp in the H/W vein drive.

Transport to the orepass will require a 1½ tonne loco and six side-tipper trucks.

A grizzley will be required at the orepass to allow mullock sorting.

Chute repairs will be required at the ore and mullock passes on 14 level.

7. COST ESTIMATE

(i) Rehabilitation

	$
Repair 3 fans @ $300 - labour & materials	900
Repair switchgear etc.	300
Replace ventilation tubing - materials	100
Replace ventilation tubing - labour	300
Install fans - labour	300
Air and water reticulation - materials	300
Air and water reticulation - labour	300
Track maintenance - materials	200
Track maintenance - labour	200
Drainage and sump de-sludging - labour	300
Replace 4 chutes (H/W vein) @ $100 - materials	400
Replace 4 chutes (H/W vein) @ $300 - labour	1200
Install orepass grizzley - labour	200
Install orepass grizzley - materials	100
Repair chutes, 14 level - labour	100
Recondition 6 side-tipper trucks @ $400	2400
Install battery charger	200
Level cleanup and ground support, H/W vein north - labour	500
- materials	100
Sub-Total	8400
Contingencies 10%	900
	$9,300

(ii) Sample mining - H/W vein

300 tonnes @ 6 tonnes/manshift	
= 50 shifts @ $43 + 35% oncost	2900
Materials @ 40% of labour cost	1100
60 x 1.5m rockbolts @ $6 installed	400
Ore disposal - 2 men/shift for 15 shifts	
= 30 manshifts @ $36 + 35% oncost	1500
Materials @ 5% of labour cost	100
Hoisting - 3 men for 15 hours at penalty rates, + oncosts	400
Sub-Total	6400
Contingencies 15%	1000
Supervision etc. (see (iv) below)	2800
	$10,200

(iii) Sample mining - Battery vein

300 tonnes @ 6 tonnes/manshift	
= 50 shifts @ $43/shift + 35% oncost	2900
Materials at 40% of labour cost	1100
Ore disposal - 2 men/shift for 20 shifts	
= 40 manshifts @ $36 + 35% oncost	1900
Materials @ 5% of labour cost	100
Hoisting - as in (ii) above	400
Ground support - 6 manshifts	300
Ground support - materials	100
Sub-Total	6800
Contingencies @ 15%	1000
Supervision etc. (see (iv) below)	2800
	$10,600

(iv) Underground Supervision and Services

Leading hand, 3 months (includes Surveying)	2900
Level maintenance, 1 man for 3 months	2400
Materials	300
Sub-Total	5600

(Allocated 50/50 to (ii) and (iii) above and not included in final total)

(v) Milling

2 x 300 tonnes, less 10% mullock sorted	
= 540 tonnes milled @ $10/tonne	5400
Group Metallurgical Services (per R.J.R.)	800
Sub-Total	6200
TOTAL	$36,300

(i.e. Approximately $67 per tonne)

7. PRODUCTION VALUE and NET PROJECT COST

Conservative ore grade estimate = 0.7% combined metals with a $Sn:WO_3$ ratio of 1:1

Assuming, 70% mill recovery,

Sn @ $83.90/unit and WO_3 @ $125/unit,

Then production value would be

$$540 \times 0.7 \times 0.7 \times \frac{83.90 + 125}{2} = \$27,000$$

or, more optimistically with 0.8% head grade and 75% recovery, production value would be $34,000.

Thus the net project cost is likely to be a maximum of $9,300. The project would be better than break even at head grades above 0.8% C.M.

9. Figure 4 shows estimated time and labour requirements, and expenditure.

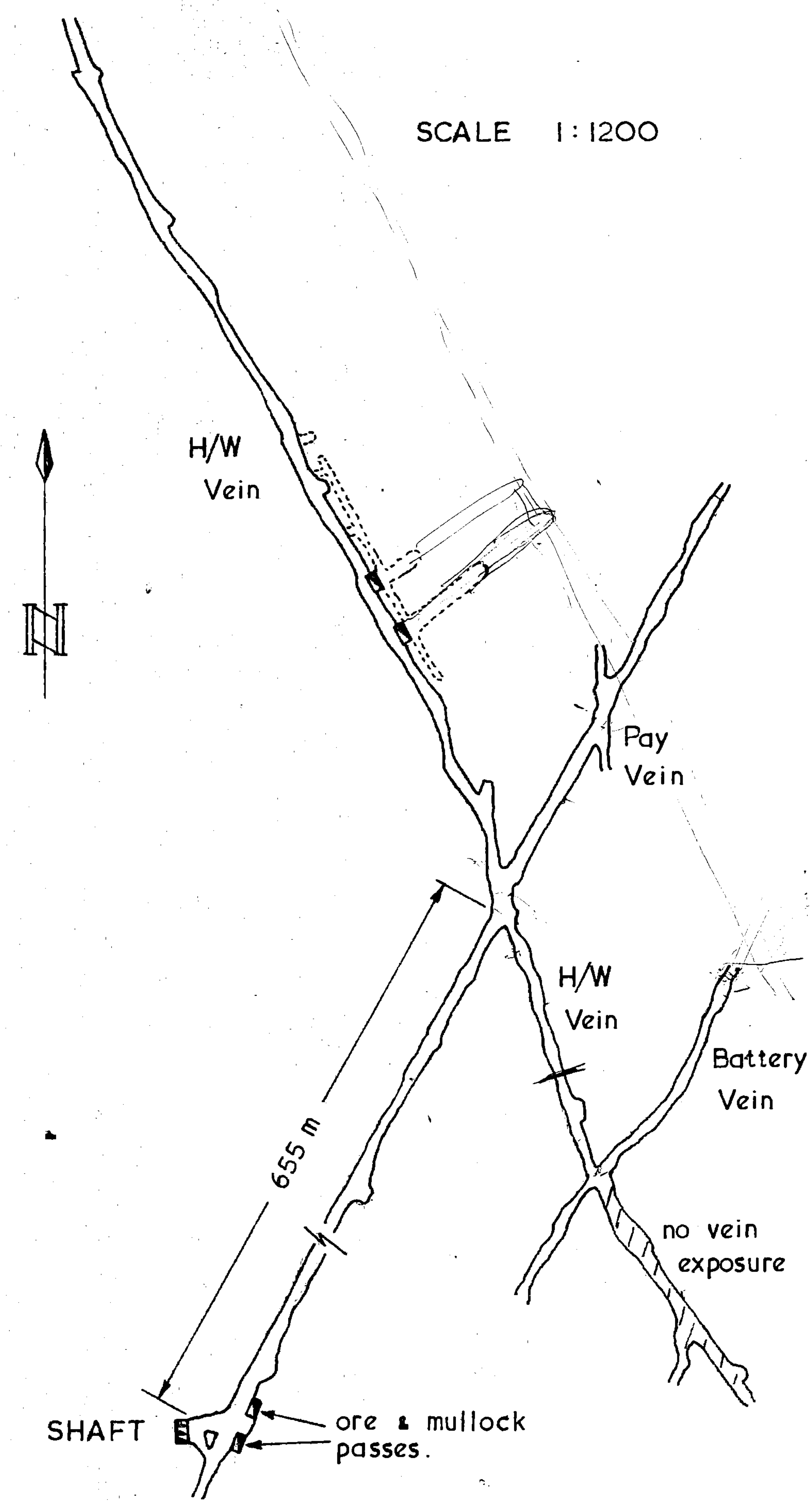
By commencing rehabilitation work immediately, it should be possible to have sample results by the end of period 7 (5/7/77).

From period 5 onwards it will be necessary to have a crew of six on 13 level. Recruitment and training should start as soon as possible so that the proposed Lutwyche crew can be released from other areas at Aberfoyle.

10. FURTHER DEVELOPMENT and EXPLORATION

The results of the bulk sampling programme will form a basis for decisions on further development and/or exploration of Lutwyche. Before the area could be worked as a production entity a second access and ventilation return would be required. A costed proposal for this development is in preparation.

Fig. I LUTWYCHE PROJECT
PLAN - 13 LEVEL



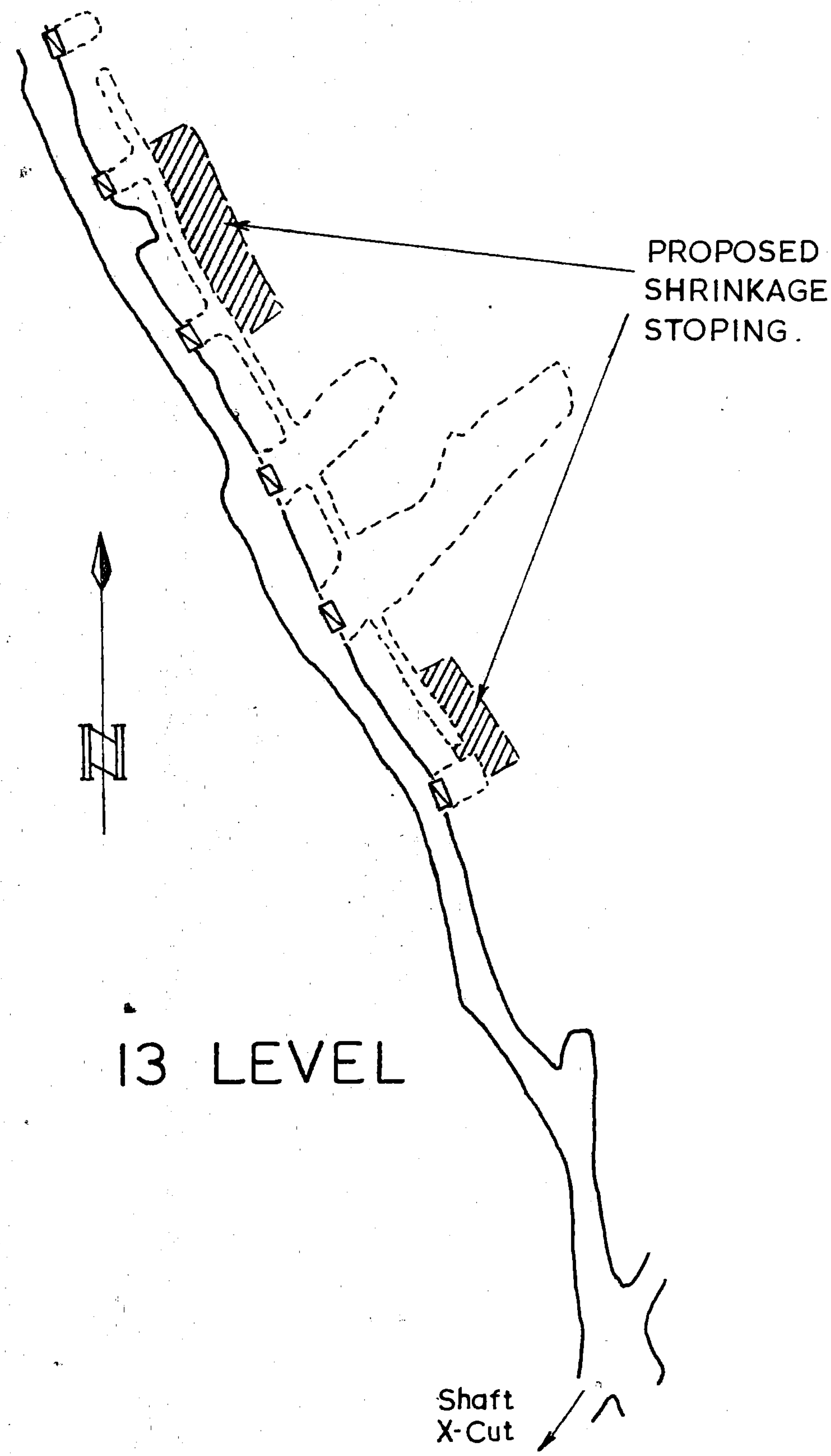
March 1977

Fig. 2 LUTWYCHE PROJECT

HANGINGWALL VEIN

MINING METHOD FOR
300 TONNE BULK SAMPLE.

SCALE 1:480



March 1977

Fig. 3 LUTWYCHE PROJECT
BATTERY VEIN

MINING METHOD FOR
300 TONNE BULK SAMPLE.

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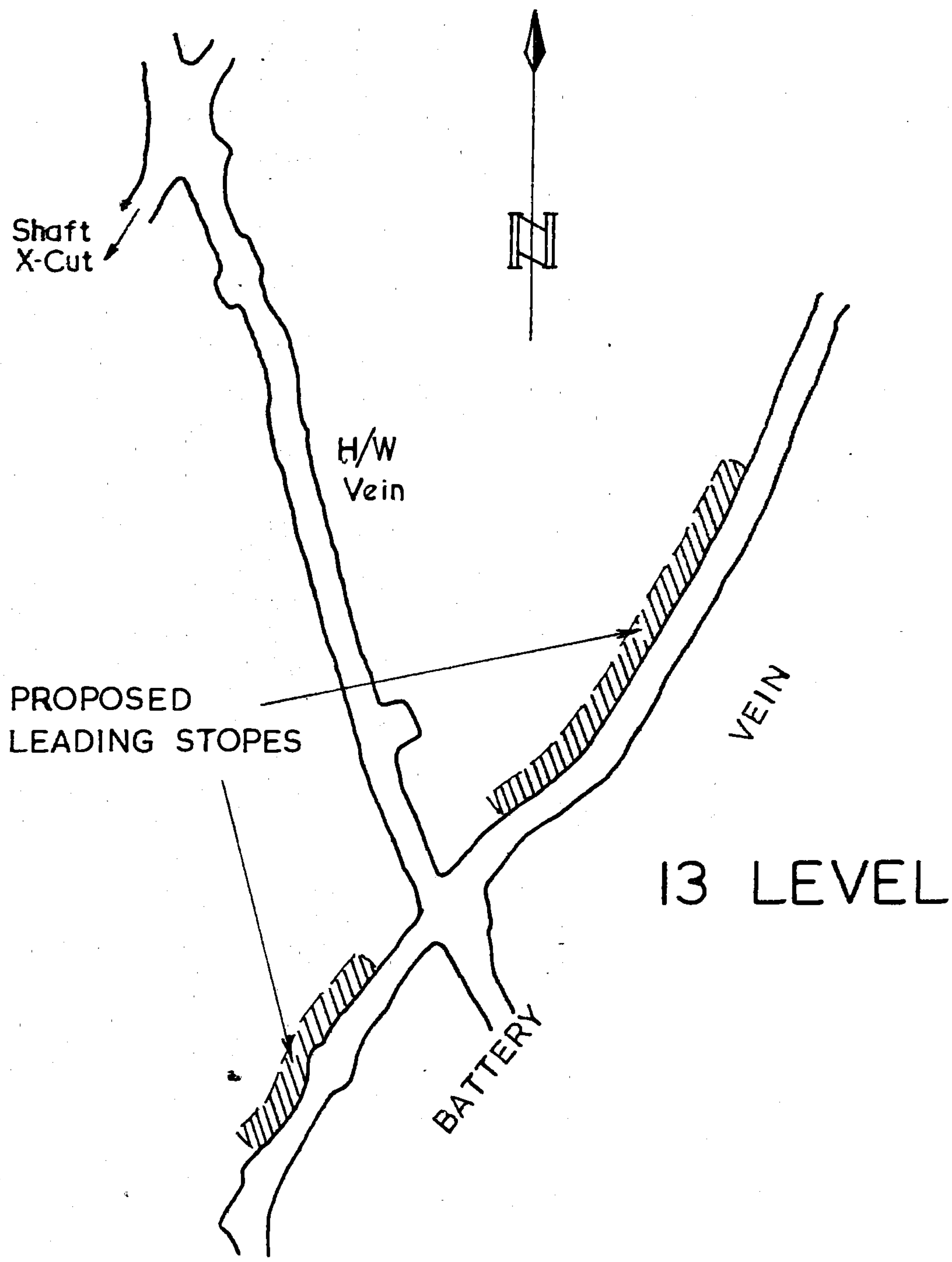

March 1977

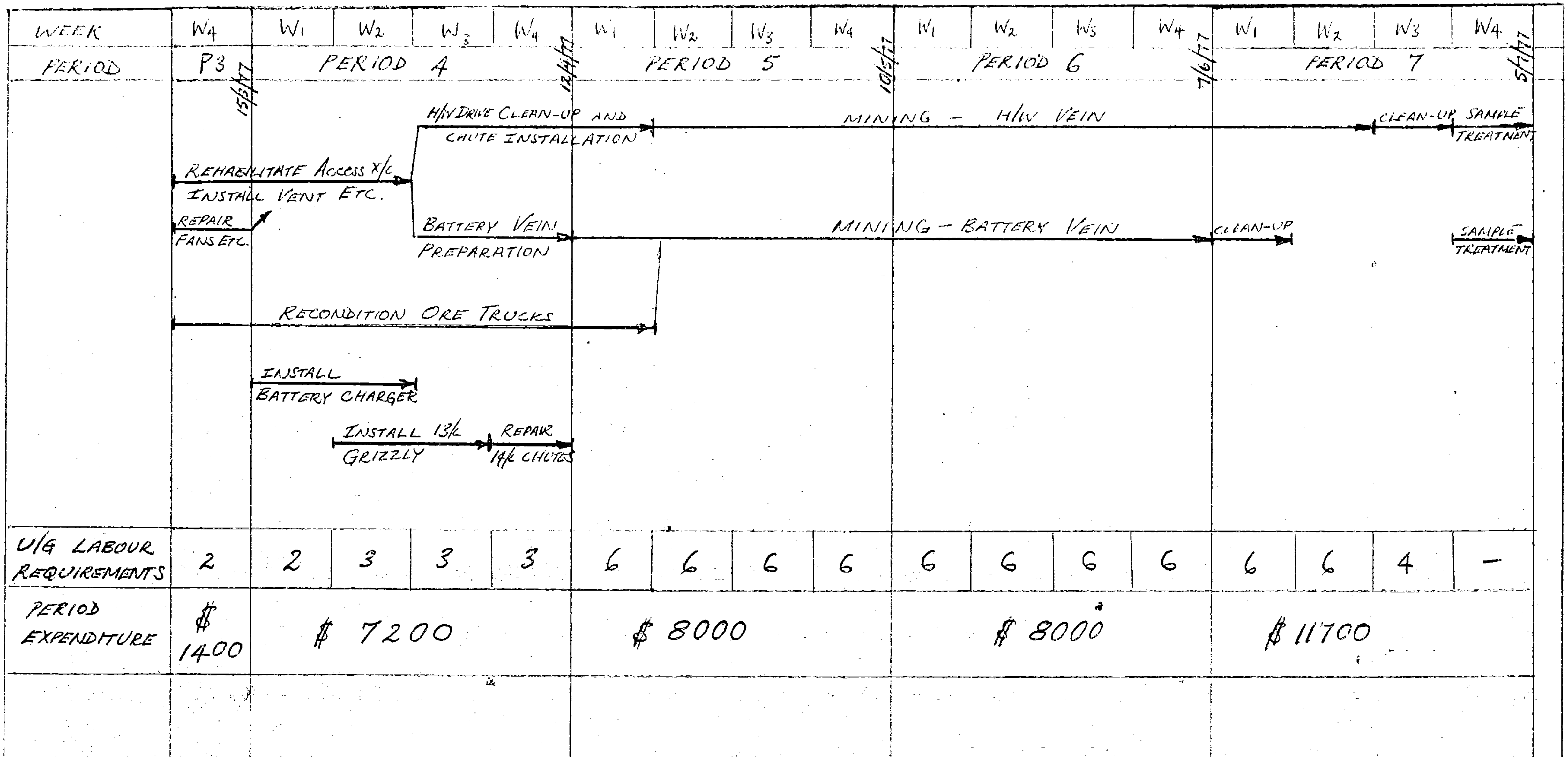

FIG 4
LUTWYCHE SAMPLE MINING
M.A.E. 3/77

[illegible]. 1.11.1 12th September, 196[illegible].

INTRODUCTORY COMMENTS AND ASSESSMENTS OF COST AND TIME ESTIMATES FOR SHAFT SINKING AND RISING AT THE LUTWYCHE PROJECT.

This report was undertaken to cost out and assess the effectiveness of a shaft sinking programme to further develop and ventilate the Lutwyche Ore Reserve with a view to future exploitation.

An earlier cost and time estimate for a production shaft, employing a contractor to perform the bulk of the work, indicated a minimum cost of $884,000 and a time of 86 weeks to reach production. This estimate covered a production hoist, headframe and equipped shaft but did not include level development, sandfilling, mining equipment or stope preparation. The cost without production hoist, headframe, cages and equipment, ore bins, ropes, orepasses, loading equipment, compressors, sub-station and permanent surface buildings, would be in the order of $640,000 minimum.

The next estimate to be made, therefore, was the cost to sink a similar shaft ourselves. The very minimum cost would be $450,000 with a sinking time of 141 weeks excluding serious delays.

Estimates were then drawn up to judge the cost and time saving by partially rising the shaft from 1300 level. The most favourable would include a maximum of rising. To sink 800 ft would cost approximately $316,000 and take 92 weeks. A 500 ft 7 x 7 rise would cost $25,500 and would be done while the shaft was being sunk, however, stripping and timbering would have to be done after the shaft had holed to the rise and the time for this portion of the operation would be additional at 29 weeks at a cost of $56,000.

The total combined cost would therefore be $316,000 + $81,500 = $397,500 and the total time in the order of 92 + 29 = 121 weeks.

Although this combined method is attractive in terms of cost, it must be qualified by -

1. The time taken would be almost 2½ years.
2. We would have to employ two separate crews on non-productive work.
3. If excessive water was encountered in the rise, the cost of grouting it in this location would be exhorbitant and seriously endanger the Aberfoyle Mine. It can be argued that rising on vein for stope development might place us in the same predicament, this, however, is a chance wo must take if the project is to be a success, we do not have to increase the danger by shaft rising.
4. Every ton broken in the rise and subsequent stripping would have to be hoisted through Spiers Shaft. For 500 ft this would be about 5,000 tons. To make the operation successful this mullock would have to bo removed immediately, at the rate of 45 tons per day and would be 45 tons less ore hoisted. If a party were level driving concurrently at 40 tons per day a total of 85 tons of ore

and mullock would be hoisted from Lutwyche, almost a quarter of Spiers Shaft capacity.

Although on comments made so far it appears to be cheaper to sink ourselves, two considerations must be made -

1. The excessive time taken to reach a stage where Lutwyche would be self reliant for pumping and servicing.
2. The diversion of labour, supervision and service and maintenance personnel from the urgent requirements of our two producing mines.

A further estimate was then made to cover the sinking of a small ventilation opening to be sunk by ourselves. A straight sink of 1300 ft would cost in the order of $375,000 and take 101 weeks to complete (equipped with manway, pumps and pipe columns). If sunk to 800 ft and connected with a rise on vein from 1300 Level the vent shaft would cost $265,600 and take 68 weeks to sink. In terms of cost effectiveness the idea is ridiculous.

Three more recent quotes have been obtained from contractors and give an estimated minimum cost (by John Holland & Co. Pty. Ltd.) of $582,300 and a time of 52 weeks for a shaft suitable for production but not equipped with a production winder, headframe, compressors etc. The estimated total coat of a complete shaft complex would be in the order of $052,000.

E. HUGHES

REF. 1.11.1

LUTWYCHE PROJECT

COMMENTS ON SINKING OF SERVICE SHAFT BY ABERFOYLE RESOURCES

The envisaged cross sectional area of the service shaft would be in the order of 125 sq.ft and would be very similar in area to a production shaft. Any reduction in area, say to 100 sq.ft would not reduce costs in like proportion and would give an inferior unit.

The costs and times given should be taken as reasonable minimums and although a 10% contingency has been added this is for normal expected delays. If heavy influxes of water are encountered, the cost of the shaft will rise by the cost of grouting and the completion date by the time taken to grout. The cost of grouting is an intangible without real knowledge of the water.

Cost and time estimates have been given for sinking depths of 800, 1000 and 1300 feet.

L U T W Y C H E   P R O J E C T

SERVICE SHAFT

COST ESTIMATES

LABOUR Cost $/ft.

Assumptions 3 men per shift
3 shifts per day for 5 days
2 shifts for sixth day.

Earnings on contract in order of $25 per man shift
+20% on cost.

Total per week ($25 x 3 men x 3 shifts x 5 days)
+20% on cost
= $1125 +20% = $1350

Overtime shifts $20 x 3 men x 2 shifts +20% = $144

Estimated advance with hand mucking is 15 ft/week

Cost per foot = $\frac{\$1350}{15}$ = $90.00 90.00

Winch drivers 3 at $17 per shift

Weekly earnings, normal time = $17x3x5 = $255
" " overtime = $21x2 = $ 42
$297+20% on cost
= $356

Cost per foot = $\frac{\$356}{15}$ = $24.00 say $ 25.00 25.00

Truck drivers/surface hands

Average weekly earnings $14x3x5 = $210 +20% on cost
= $252

Cost per foot = $\frac{\$252}{15}$ = $16.80 say $ 17.00 17.00

Staff and supervision $400 +20% = $480

Cost per foot = $\frac{\$480}{15}$ = say $ 32.00 32.00

Survey, maintenance, rock drill repair etc. 10.00

Carried Forward 174.00

		Cost $/ft.
Shaft sets		8.00
Shaft lagging		0.60
Shaft ladders		1.00
Manway decking grid		2.50
Pipes. 2x8", 1x6", 1x4" (1.30+1.90+2x2.70) say $9.00		9.00
Shaft skids		1.25
Skid brackets		1.00
Hanging bolts		1.50
Ventilation fluming and maintena nee		4.00
Minor items (oils, greases, small tools)		2.00
Drill steel		2.00
Explosives		10.00
Power		13.00
Bearer sets. $500 per 50 ft = $10.00 per foot		10.00
		65.85
	Brought Forward	174.00
		239.85
	Contingency 10%	24.00
	Total direct sinking costs per foot	263.85

Preparation and Prime Item Costs	Cost $
Compressors	10,000
Rockdrills 4 @ $400	1,600
Airlegs 2 @ $150	300
Oil Bottles 4 @ $ 25	100
Hoses & small items	200
Drill Steel sharpener	1,000
Steel Store, drill shop etc.	2,000
Main Sinking Pumps	6,000
Flyght Sump Pumps or similar 3 @ $2000	6,000
Site shack	1,000
Sub Station & wiring	5,000
Ventilation fans 2 @ $800	1,600
Sinking ropes	3,000
Shaft collar	2,000
Carried Forward	39,800

	Cost $	Cost $/ft.
Brandon Winch, Assemble, repair & install & Winder House	7,000	
Brandon Headframe, dismantle, erect, Sky Shaft	5,000	
Kibbles, bins, safety & dump doors	4,000	
Access Road	500	
Site Clearing	200	
Provision of Temporary water supply	1,000	
Sand & aggregates. Cement	400	
Provision & repair of housing	3,000	
Plats 4 @ $2500 (assuming shaft to 1300 ft plus)	10,000	
Pump Stations 2 @ $4000 (assuming shaft to 1300 ft plus)	8,000	
Pumps & equipment	10,000	
Shaft power cable and fittings	6,000	
	55,100	
Brought Forward	39,800	
	94,900	
Contingency 10%	9,490	
	104,390	

Cost per foot for 800 feet = $130.50 + $263.85
= $394.35

Cost per foot for 1000 ft = $104.40 + $263.85
= $368.25

Cost per foot for 1300 ft = $ 80.30 + $263.85
= $344.15

Total estimated cost for 800 ft -
= $394.35 x 800
= $315,480

Total estimated cost for 1000 ft -
= $368.25 x 1000
= $368,250

Total estimated cost for 1300 ft -
= $344.15 x 1300
= $447,395

The preceeding estimates of costs of shaft sinking if done by A.H.L. should be taken as reasonable minimums and do not include costs increases for heavy water inflows, bad ground conditions etc.

TIME ESTIMATES   Sinking of Service Shaft.

If the service shaft was sunk by A.H.L. the estimated progress would be 15 ft/week.

For a sink of 1300 ft total time would be :-

$\frac{1300}{15}$	=	87	weeks
4 Plats at 4 weeks per Plat	=	16	weeks
½ week per Bearer Set $\frac{1300}{50} \times ½$	=	13	weeks
Preparation	=	12	weeks
		128	weeks
+ 10% Delay Contingency	+	13	weeks
		141	weeks

For a sink of 1000ft total time would be :-

$\frac{1000}{15}$	=	67	weeks
3 Plats at 4 weeks per Plat	=	12	weeks
½ week per Bearer Set $\frac{1000}{50} \times ½$	=	10	weeks
Preparation	=	12	weeks
		101	weeks
+ 10% Delay Contingency	=	10	weeks
		111	weeks

For a sink of 900 ft total time would be :-

$\frac{900}{15}$	=	60	weeks
3 Plats at 4 weeks per Plat	=	12	weeks
½ week per Bearer Set $\frac{900}{50} \times ½$	=	9	weeks
Preparation	=	12	weeks
		93	weeks
+ 10% Delay Contingency	=	9	weeks
		102	weeks

For a sink of 800 ft total time would be :-

$\frac{800}{15}$	=	52	weeks
3 Plats at 4 weeks per Plat	=	12	weeks
½ week per Bearer Set $\frac{800}{50} \times \frac{1}{2}$	=	8	weeks
Preoaration	=	12	weeks
		84	weeks
+ 10% Delay Contingency	=	8	weeks
		92	weeks

Based on quote from Dillinghams total time for sinking of a small production shaft to 1300 feet would be approximately 74 weeks.

A more recent quote from a differing contractor indicates a time for a similar shaft to be nearer 52 weeks.

COMMENTS ON RISING ON VEIN

The rise would have two primary objectives -

1. To explore veining up dip, examine the strength of the ground and obtain an early ventilation opening to the proposed shaft.
2. To prepare a stoping block for extraction.

Irrespective of the method of obtaining a surface opening this rise and similar rises will be a must.

This first rise will have a high cost per foot because it will be necessary to purchase equipment, particularly scraper winches, for succeeding rises this equipment will be available and we shall be faced with an operating cost only.

The width at 15 ft will be a minimum to permit scraping of ore, manway, gear slide and forced ventilation in the same opening.

Selection of a rise position will depend on current exploration results on 1300 level.

RISE ON VEIN FROM 1300 LEVEL

COST ESTIMATE

Rise is taken as being 15 ft wide by 4 ft high.
Advance estimated at 10 ft per 3 shifts, i.e. 33 ft per week.

			Cost $/ft
Labour	-	Breaking $20.00 per foot	20.00
		Scraping & handling ore in rise	3.50
		Trucking costs & hoisting	3.00
		Supervision & survey	3.00
		Provision for cutting cuddies, gear slide, timbering	5.00
Materials	-	Timber, ladders, vent tube, pipes etc.	5.00
		Explosives	3.00
		Drill Steel	0.50
			43.00
		+ 10% Contingency	4.30
		Total Direct Rising Cost per foot	47.30

Initial Equipment Costs -		$
Scraper Winches	2 @ $3,000	6,000
Rock drills	2 @ $ 600	1,200
Ventilation Fans	2 @ $ 400	800
Tugger Hoists	2 @ $ 800	1,600
		9,600

Equipment cost per foot for 400 ft = $\frac{\$9600}{400}$ = $24/ft   24.00

\+ 47.30

Total cost per foot for rise = $71.30

Total cost of 400 ft rise $28,520
Time to rise 14 weeks.

SHAFT RISING - USING ALIMAK CAGE RISING MACHINE

COST ESTIMATE

To purchase an Alimak would cost in the order of $40,000 and has been ruled out as too costly for our present requirements.

The Alimak cage riser can he hired for the short term at $450 per week and for a long term at $300. The short term hire figure of $450 per week has been used in these estimates.

	Cost $/ft.
Estimated advance 7 ft per shift, 14 ft per day	
Cost of machine per day = $450 / 5 = $90/day	
∴Cost of machine per foot = $90 / 14 = $ 6.50	
Including cost of insurance and breakages, say $7.00/ft	7.00
Labour cost. Assume earnings at $25 per shift including loading and trucking of rock	
On two shift operation - $25 x 4 men +20% on cost	
= $100 + $20 = $120 per day	
= $120 / 14 = $8.60. Say $10 including delays	10.00
Supervision and survey	3.00
Servicing and maintenance	1.00
Explosives	3.00
Drill Steel	0.60
Waste rock disposal	5.00
Operating cost of rising per foot	$29.60

<u>Preparation and prime item costs</u>

Autostopers	3 @ $600	$1,800
Freight cost Alimak		500
Drive to site, setting up & installation costs		6,000
		$8,300

			Cost $/ft.
Cost per ft for 300 ft	= $\frac{\$8300}{300}$	= $27.20	27.20
Operating cost per foot		=	29.60
		Total cost of rise per foot	56.80
Cost per ft for 400 ft	= $\frac{\$8300}{400}$	= $20.75	20.75
Operating cost per foot		=	29.60
		Total cost of rise per foot	50.35
Cost per ft for 500 ft	= $\frac{\$8300}{500}$	= $16.60	16.60
Operating cost per foot		=	29.60
		Total cost of rise per foot	46.20

Stripping out rise to shaft size after breakthrough -	
Labour cost. Rock breaking, estimated 3½ ft per man shift maximum	10.00
Labour cost. Installation of timer, pipes, ladders etc. @ 3½ ft per man shift	10.00
Cost of timber sets	8.00
Cost of lagging	0.60
Cost of grid floor	2.50
Cost of piping	9.00
Cost of skids and brackets	2.25
Cost of hanging belts	1.50
Cost of drill steel	1.00
Cost of explosives	6.00
Supervision	3.00
Bearer sets, cost per foot @ 1 per 50 ft	10.00
Waste rock disposal	10.00
Materials, transport on surface & transfer U/ground	15.00
Power cost, including power & compressed air used in initial rise	8.00
Maintenance	1.00
	97.85

		Cost $/ft
Total cost for 300 ft of completed shaft		56.80
	+	97.85
		154.65

= $154.65 x 300 + 2000 (cost of 1300 plat) + 10% contingency

= <u>$53,125</u>

Total cost for 400 ft of completed shaft		50.35
	+	97.85
		148.20

= $148.20 x 400 + 2000 (cost of 1300 plat) + 10% contingency

= <u>$67,410</u>

Total cost for 500 ft of completed shaft		46.20
	+	97.85
		144.05

= $144.05 x 500 + 2000 (cost of 1300 plat) + 10% contingency

= <u>$81,430</u>

TIME ESTIMATE	Weeks
for 300 ft -	
Time to rise @ 14 ft/day $= \frac{300}{14} \times \frac{1}{5} = \frac{60}{14}$ say 5 weeks	5
Set up time and drive to site	6
Pull out time	1
	12
+ 10% contingency	1
	13
Stripping and timbering @ 6 ft/day	10
½ week per bearer set 6 sets	3
1 plat @ 4 weeks	4
	17
+ 10% contingency	2
	19

Total time for 300 ft completed = 13 + 19 = 32 weeks

		Weeks
For 400 ft		
Time to rise @ 14 ft/day $= \frac{400}{14} \times \frac{1}{5}$	Say 7 weeks	7
Set up time and drive to site		6
Pull out time		1
		14
	+ 10% contingency	2
		16
Stripping & timbering at 6 ft/day		13
½ week per bearer set 8 sets		4
1 plat @ 4 weeks		4
		21
	+ 10% contingency	2
		23

Total time for 400 ft completed = 16 + 23 = <u>39 weeks</u>.

		Weeks
For 500 ft		
Time to rise at 14 ft/day $= \frac{500}{14} \times \frac{1}{5}$	Say 8 weeks	8
Set up time & drive to site		6
Pull out time		1
		15
	+ 10% contingency	2
		17
Stripping & timbering @ 6 ft/day		17
½ week per bearer set 10 sets		5
1 plat @ 4 weeks		4
		26
	+ 10% contingency	3
		29

Total time for 500 ft completed = 17 + 29 = <u>46 weeks</u>

SHAFT RISING USING SUSPENDED RISING CAGE

COST ESTIMATE

Due to the size of machine required to drill and/or ream the required large diameter hole, the hole and cage rise would probably have to be commenced after completion of the shaft to a predetermined depth.

		Cost $/ft
Estimated advance 5 ft per shift, 10 ft per day.		
On two shift operation $25 x 4 men +20% on cost		
= $100 + 20	= $120 per day.	
= $120 / 10	= $12	12.00
Winch drivers 2 x $16	= $32 per day	3.20
Supervision and survey		4.00
Servicing and maintenance		1.00
explosives		3.00
Drill Steel		0.60
Ventilation		1.00
Waste rock disposal		5.00
Cost of drill hole		15.00
Operating cost of rising per foot		44.80

Preparation and prime item costs

Cost of winches and ropes	$7,000
Cost of cages	2,000
Signalling equipment	500
Cost to drive to location and setting up cost	6,000
Cost of Autostopers 3 @ $600	1,800
	$17,300

Cost per ft for 300 ft	= $17,300 / 300	= $57.70	57.70
	Operating cost per foot		44.80
	Total cost of rise per foot		102.50
Cost per ft for 400 ft	= $17,300 / 400	= $43.25	43.25
	Operating cost per foot		44.80
	Total cost of rise per foot		88.05

		Cost $/ft.
Cost per ft for 500 ft = $\frac{\$17,300}{500}$ = $34.60		34.60
	Operating cost per foot	44.80
	Total cost of rise per foot	79.40

Stripping & timbering to shaft size. Costs similar to after Alimak rising $97.85

Total cost for 300 ft of completed shaft		102.50
	+	97.85
		200.35

= $200.35 x 300 + 2000 (cost of 1300 level plat)
+ 10% contingency
= $68.316

Total cost for 400 ft of completed shaft		88.05
	+	97.85
		185.90

= $185.90 x 400 + 2000 (cost of 1300 level plat)
+ 10% contingency
= $84,000

Total cost for 500 ft of completed shaft		79.40
	+	97.85
		177.25

= $177.25 x 500 + 2000 (cost of 1300 level plat)
+ 10% contingency
= $99.690

TIME ESTIMATE

	Weeks
For 300 ft.	
Time to set up drill	1
Drilling at 10 ft/shift on 2 shifts/day	3
Set up time, cages, winches etc.	1
Rising time at 10 ft/day	6
Pull out time	1
Time to drive to site	6
	18
+ 10% contingency	2
	20
Stripping & timbering time	19

Total time for 300 ft completed 20 + 19 = 39 weeks

	Weeks
For 400 ft.	
Time to set up drill	1
Drilling at 10 ft/shift on 2 shifts/day	4
Set up time, cages, winches etc.	1
Time to drive to site	6
Rising time at 10 ft/day	8
Pull out time	1
	21
+ 10% contingency	2
	23
Stripping & timbering time	23

Total time for 400 ft completed 23 + 23 = 46 weeks

	Weeks
For 500 ft.	
Time to set up drill	1
Drilling at 10 ft/shift on 2 shifts/day	5
Set up time, cages, winches etc.	1
Time to drive to site	6
Rising time at 10 ft/day	10
Pull out time	1
	24
+ 10% contingency	3
	27
Stripping & timbering time	29

Total time for 500 ft completed = 27 + 29 = 56 weeks

VENTILATION SHAFT 8 x 8 INSIDE TIMBER

COST ESTIMATES

		Cost \$/ft.
LABOUR		
Assumptions.	3 men per shift, 3 shifts per day for 5 days. Advance 20 ft/week.	
Contract earnings per week.	3x3x5x25 + 20% on cost. = \$1350 week.	
Overtime	1 shift 3 x \$20 + 20% = \$75 per week.	
Contract & O.T. costs per foot	= $\frac{\$1350 + 75}{20}$	71.25
Winch drivers	3 @ \$17 per shift	
Earnings \$17 x 3 x 5	= \$255	
Earnings overtime \$20 (1 shift)	= \$ 20	
	= \$275 + 20% on cost	
	= \$330 per week.	
Cost per foot	= \$330 = $\frac{\$16.50}{20}$	16.50
Surface hands	3 @ \$16 per shift	
Earnings 3 x 5 x \$16 + 20% on cost	= \$288 per week	
Cost per foot	= $\frac{\$288}{20}$ = \$14.40	14.40
Survey, supervision, maintenance, drill repair etc.		42.00
Timber sets, lagging, ladders		9.60
Manway decking		2.00
Pipes		9.00
Shaft skids (permanent & temporary), brackets		2.25
Hanging bolts		1.50
Ventilation fluming and maintenance		4.00
Minor items		2.00
Drill steel		1.00
Explosives		7.00
Power		10.00
Bearer sets @ \$250 per 50 ft.		5.00
		197.50
	+ 10% contingency	19.75
	Operating cost per foot	217.25

Preparation and prime item costs	Cost $
Compressors	10,000
Rockdrills 3 @ $400	1,200
Airlegs 1 @ $150	150
Oil Bottles 3 @ $ 25	75
Hoses and small items	200
Main sinking pumps	6,000
Flyght pumps 3 @ $2000	6,000
Site shack	1,000
Sub station and wiring	5,000
Ventilation fans 2 @ $800	1,600
Sinking ropes	3,000
Shaft collar	2,000
Brandon winch	7,000
Brandon Headframe	5,000
Kibbles, bins, safety & dump doors	4,000
Access road	500
Site clearing	200
Provision of temporary water supply	1,000
Sand, aggregates, cement	400
Provision and repair of housing	3,000
Pump stations 2 @ $4000	8,000
Pumps & equipment	10,000
Shaft power cable and fittings	6,000
Plats 4 @ $500 (single sided, small)	2,000
	83,325
+ 10% contingency	8,333
	$91,658

Cost per foot for 800 ft $= \frac{\$91658}{800}$

$= \$114.60$

Cost per foot for 1000 ft $= \frac{\$91658}{1000}$

$= \$91.66$

Cost per foot for 1300 ft $= \frac{\$91658}{1300}$

$= \$70.50$

Total cost per ft for 800 ft = $217.25 + $114.60 = $331.85

Total cost per ft for 1000 ft = $217.25 + $ 91.65 = $308.90

Total cost per ft for 1300 ft = $217.25 + $ 70.50 = $287.75

TIME ESTIMATE		Weeks
For 800 ft -		
Sinking	$\frac{800}{20} = 40$	40
Preparation time		12
Plats	½ x 4 plats	2
Bearer sets	@ ½ week per set $\frac{800}{50} \times \frac{1}{2}$	8
		62
	+ 10% contingency delay	6
		68

Total time for 800 ft = 68 Weeks

		Weeks
For 1000 ft -		
Sinking	$\frac{1000}{20}$	50
Preparation time		12
Plats		2
Bearer sets	$\frac{1000}{50} \times \frac{1}{2}$	10
		74
	+ 10% contingency delay	7
		81

Total time for 1000 ft = 81 weeks

		Weeks
For 1300 ft -		
Sinking	$\frac{1300}{20}$	65
Preparation time		12
Plats		2
Bearer sets	$\frac{1300}{50} \times \frac{1}{2}$	13
		92
	+ 10% contingency delay	9
		101

Total time for 1300 ft = 101 weeks

ABERFOYLE HOLDINGS LIMITED - MINING DIVISION

1. TITLE - LUTWYCHE EXPLORATION PROJECT.

MINING EXPLORATION & DEVELOPMENT - DESIGN & COST ESTIMATES

2. AIM - To carry out underground exploratory development of the Lutwyche ore body to assist in determining its continuity and value and to prepare outline designs and cost estimates with a view to early exploitation of the ore body.

3. SITUATION

(a) Original drilling of the Lutwyche Prospect was from the surface. Mineralised veins were intersected in drill holes S14, S17, S19, S20 and S21 and indicated the existence of two economically interesting veins which were termed "Hanging Wall Vein" and "Pay Vein". These drill holes were completed by August 1962. Between that date and the 25th March 1966 a number of proposals were put forward for gaining entry to the ore body by either sinking a small exploratory shaft from surface or crosscutting from the Aberfoyle Spiers Shaft, this latter put forward in 1965. The ore reserve at the time was estimated to be in the order of 300,000 tons of 1% c.m.u. recovered grade.

(b) In a report dated 28th March 1966 and titled "Exploration Crosscut to Lutwyche Prospect", N. Lindsay proposed crosscutting from Spiers Shaft, the crosscut to be approximately 2,300 ft long and of dimensions 8 ft x 6 ft. The recommendation was adopted and work commenced in March 1966 making good progress until 18th July 1967 when water was intersected in a diamond drill hole being drilled ahead of the face. A second hole (AU13-6) was drilled horizontally from the face of the crosscut and the water retapped. After grouting, crosscutting was recommenced to intersect veins cut in the drill hole. The crosscut was completed at a distance of 2,445 ft from Spiers Shaft. The water flow from the drill hole was measured at 120 gals. per minute at a static head pressure of 360 lb./in^2.

(= 830 ft)

Date

[illegible]es Supt.
[illegible]ace Supt.
[illegible]nin Supt.
[illegible] Manager A.L.
[illegible] Manager S.C.
[illegible]logist
[illegible]ty Super.
[illegible]yer
[illegible]es Acctg. Officer
[illegible]f Clerk
[illegible]es Officer
Manager

(c) The crosscut demonstrated that the veins were of a more complex nature than had been presumed. it had been intended that development initially would be in the footwall rock below the ore with pattern drilling to test veins. See report dated 11th April 1968 from H. Stevenson, titled "Lutwyche Development". The method proved to be impracticable in the circumstances and driving commenced and is continuing on the Hanging Wall Vein, with pattern drilling for control.

(d) The present diamond drilling programme provides for three declined holes from the 13 level crosscut (AU13-7, completed; AU13-8 in progress and AU13-9) to determine the downdip continuity of the vein system and the depth of the granite contact. The total footage for these holes 1600 ft. From surface four holes approximately 500 ft length and four holes approximately 1,000 ft length are planned and work started, giving a footage for surface holes of 6,000 ft. See report dated 5th March 1968 by D. K. Tester titled "Exploration - Lutwyche Area". Although modifications to the initial layout have taken place the essence is still to raise the ore reserve from a published 340,000 tons of 1% c.m.u. recovered grade to 500,000 tons and to 750,000 tons, at which point a considerable lift in expenditure on the project is economically justified. Unofficial ore reserve estimates are now in the order of 370,000 tons at 1% c.m.u. recovered grade.

(e) Present driving on vein on 13 Level will be limited by ventilatio requirements. The chief factors are -

(i) We are ventilating the operation through one opening which employs forced ventilation to the ends through 24 inch ducting with return air through the remaining area of the crosscut.

(ii) Voltage drop in electrical cables in the crosscut is considerable. it will be possible to take the cable to the point where driving on vein has commenced and force ventilate 1,000 ft in each direction given an optimistic strike drive length of 2,000 ft.

(iii) This ventilation would not be sufficient for reasonable stoping operations or greatly increased development.

(f) Driving on vein is closely associated with the geological diamond drilling programme and will permit the following -

YES (i) Assessment of vein continuity.
YES (ii) Assessment of vein widths.
YES (iii) Assessment of ore grade.
YES (iv) Correlation of drill hole intersections.
? (v) Determination of ore block values.
? (vi) Increase of ore reserves.
YES (vii) Provide for stope development and ore haulage.

(g) It is proposed that broadly the method of level development will be to drive as far as possible on the Hanging Wall Vein, to then drive on vein on the Footwall and to connect these two drives with crosscuts at regular (200 ft) intervals, the panel thus blocked out will permit stope development of all exposed veins and give a systematic and efficient haulage system. See reports dated 12th and 16th September, 1968 titled "Proposal of a Method of Development for the Presently Known Veins on the 13 Level, Lutwyche Ore Zone".

In conjunction with this work rising up dip on veins will be required for ventilation and gear and sandfill access and for the up dip exploration of veins.

(h) In recent weeks considerable work has been done on cost and time estimates for developing an opening to surface by several alternative methods -

(i) Sinking an 8 ft x 8 ft Shaft to 13 Level.
(ii) Sinking an 8 ft x 8 ft Shaft to 9 Level.
(iii) Sinking a 15 ft x 9 ft Shaft to 13 Level.
(iv) Sinking a 15 ft x 9 ft Shaft to 9 Level.
(v) Rising on vein to meet a shaft at 9 Level.
(vi) Rising vertically through waste rock to meet a shaft at 9 Level.

Cost and time estimates have been obtained from three contracting companies for the performance of a portion of this work.

4. FACTORS - Affecting the decisions and recommendations.

(a) Ore Production. Aberfoyle has indicated and Inferred ore reserves of 386,800 tons with an estimated recoverable grade of approximately ½% c.m.u. At present prices the operation at Aberfoyle is marginally profitable. Any further fall in prices will lead to a loss on operations. The ore reserve at this

TODAY 130 000 @ 0.7% Rec Grade

mine is sufficient for 4 years at the present scale of operations and prices. Although some further additions to this reserve can be expected they cannot be guaranteed, therefore, a further large source of ore must be found, either at Aberfoyle or in the vicinity of the mine. It has been tentatively suggested by B. Titcombe (Mine Manager) that at some time in the future it may be profitable to bring Aberfoyle back to a one shift operation as at Storeys Creek. This would permit more selective mining, reduce mine and mill maintenance costs and extend the life of the mine considerably. In times of low metal prices the loss made will be a proportionately smaller loss.

We can therefore look at the Lutwyche ore as -

(i) An additional source of ore to extend the life of the Aberfoyle Mine.

(ii) An additional source of ore to compensate for an eventual decline in ore from Aberfoyle.

(iii) An orebody to compensate for the entire loss of production from the Aberfoyle Mine. (Long term).

(iv) A source of higher grade ore to blend with low grade ore from Aberfoyle.

(v) A source of wolfram to make the Aberfoyle Mine more flexible to respond to price fluctuations.

(vi) A means of obtaining revenue for the further exploration of the Aberfoyle Mine area.

It is estimated that two years would be required to bring the Lutwyche Project to an operation capable of producing 400 tons per day, hoisting through its own shaft. Eighteen months would give us an operation capable of producing say 200 tons per day hoisted through Spiers Shaft, with a corresponding drop in Aberfoyle production. (Unless modifications were made to the Spiers Shaft hoisting system.) — i.e. skip hoisting

(b) Ventilation. To produce ore on the scale envisaged (200 - 400 t.p.d.) it is vital that a second ventilation opening be made to provide for a minimum ventilation requirement, using the 13 Level crosscut and the second opening. To effectively ventilate all future workings from 13 Level to near the surface it is essential that this second opening should be of relatively large size and open out to the surface near the Lutwyche ore zone, i.e. a shaft or rise. To produce 200 tons per day at say 10 tons per miner trucker shift the minimum requirement would be 10,000 c.f.m. and for 400 t.p.d. 20,000 c.f.m. would be required. The provision of adequate ventilation is a critical necessity for the success of the venture.

(c) Water. The inflow of water has already seriously delayed operations at Lutwyche. It can be confidently expected that much more water will be encountered during mining operations, particularly as work progresses upwards and towards the Kookaburra Fault. (?) It might be that eventually the inflow of water might reduce as the country is drained, however, we are starting from the bottom up and there is a lot of country to drain. It is also probable that we shall intersect permanent sources of water which will prove troublesome. Present Inflow from Lutwyche at times approaches 350 g.p.m. and leaves Aberfoyle with little spare capacity, particularly if a 10 Level pump is out for maintenance. Therefore we only need to intersect a further 350 g.p.m. and the consequences could be disastrous. It is obvious that eventually we must get an intake of 700 g.p.m. and more if we are unlucky. Even if Immediate steps are taken the minimum time for a useful second opening will be a year and therefore this potentially dangerous situation will be with us for at least a year.

Water Zone

It is this danger which has ruled out the immediate possibility of attempting to rise through to the surface from 13 Level. It is exceedingly difficult and very expensive to grout off a water inflow at the top of a long rise. It is expected that the greatest inflow of water will be met within 600 ft of the surface.

(d) Two main alternatives are thus left open for obtaining a surface opening viz. Sinking a shaft direct to 13 Level and a shaft to 9 Level with a vein rise to intersect the shaft at this level.

(I) Shaft sinking direct to 13 Level. This is feasible and would provide the best means of obtaining pump and ventilation access. If of large enough dimensions (say 15' x 9') it would provide for production hoisting through the shaft if fitted with a suitable headframe and hoist.

Initially it would be the most expensive alternative.

If sunk by the cheapest contractor it would cost a minimum of -

Contractor (J. Holland & Co.)	$423,360
A.H.L. Additional costs	$112,050
Contingency 10% (General)	53,540
	$588,950

This is for a shaft 15 ft x 9 ft excavated dimensions equipped with timber sets, three compartmented, pump columns and ladderway, pumps and plats. The time taken to sink would be a minimum of 52 weeks from the starting time.

If the ore reserve responds well this would be the best long term alternative.

If a contractor was not employed it would cost us $447,400 to sink a similar shaft ourselves but would take 141 weeks, therefore although we might get the shaft cheaper the time disadvantage would be enormous. The delay in obtaining even a ventilation opening would be a year longer than using a contractor and two years longer for a completed job. The cost of general mine and Head Office overheads would increase the cost further.

To sink a smaller dimensioned shaft say 8 ft x 8 ft inside timber for ventilation and pumping only would not be of interest to outside contractors at a price acceptable to us. To sink such a shaft ourselves would cost $373,500 to 13 Level and would take 101 weeks to complete. It can be seen that the cost is not a great deal less for a far inferior opening which would be expensive to convert for production use if required.

(ii) The second alternative is to sink a shaft to 9 Level and to rise on vein from 13 Level to meet the bottom of this shaft to give a ventilation opening, with the option of sinking the shaft deeper if the ore reserve warrants such an extension.

The shaft sinking could be done by a contractor or by ourselves.

The following costs are Indicated for a 15 ft x 9 ft shaft to 900 ft.

By Contractor J. Holland & Co.	$333,360
Additional cost to A.H.L.	$ 90,940
Contingency 10% (General)	$ 42,430
Total	$466,730
Rising on vein 400 ft	$ 28,520
Share of Mine Overheads	$ 3,000
Total	$ 31,520

Total cost of opening, including 10% contingency		$498,250
Time estimate for shaft sinking by J. Holland & Co. to 900 ft	=	40 weeks
Time estimate for vein rise by A.H.L. (concurrent with sink)	=	14 weeks
Time from start to achieve ventilation opening	=	40 weeks

If the shaft was sunk by A.H.L. to 900 ft the cost would be -

Shaft sinking to 900 ft, including 10% contingency	$341,900
Rise on vein	$ 31,520
Total cost of opening	$373,420

Shaft sinking time to 900 ft = 102 weeks
Rising time = 14 weeks
Time from start to achieve ventilation opening 102 weeks

The cost and time estimates for a small 8 ft x 8 ft shaft to 900 ft are -

Cost of shaft including 10% general contingency	$292,000
Cost of rise " " " " "	$ 31,520
Total cost of opening	$323,520

Shaft sinking time to 900 ft = 69 weeks
Rising time = 14 weeks
Time from start to achieve ventilation opening 69 weeks.
The rising on vein will be an integral part of any method of development but will produce ore.

(e) The advantage of using contractors to sink the shaft are -

(I) A speedy completion of the job.

(ii) Our labour resourses are not used on non productive work.

(iii) Considerable equipment of use only for shaft sinking will not have to be bought.

(iv) If water in quantity is encountered we do not have to bring in or buy special equipment.

(v) Due to the early achievement of an opening driving and stoping will not be unnecessarily delayed.

(vi) The bulk of staff, labour and material resources can be put into the proving of ore to assure the money spent on the shaft.

(vii) Factors within the existing mines will not affect the rate of shaft sinking.

(f) The alternatives of an 8 ft x 8 ft opening or a 15 ft x 9 ft opening can be discussed as follows -

(i) A small opening would be cheaper to sink to 900 ft or to 1300 ft therefore if there is little improvement in the ore reserve picture less capital will have been expended.

(ii) A small opening would be just sufficient for mining the present ore reserve.

(iii) A small opening would be of little interest to a contractor and would have to be sunk by ourselves.

(iv) A small opening would be of little value if the ore reserve is increased considerably.

(v) All ore would have to be hoisted through Spiers Shaft if the small shaft was not stripped out.

(vi) With a small shaft a considerable amount of service work would still have to be carried out through Spiers Shaft.

(vii) With a small shaft a breakdown in the Aberfoyle Shaft would halt production from both Aberfoyle and Lutwyche.

(viii) To hoist the required tonnage, modifications would have to be made to the Spiers Shaft haulage system or Aberfoyl production reduced or production from Lutwyche delayed until Aberfoyle production falls off through depletion of ore reserves.

(ix) The larger shaft would cost up to $250,000 more to sink to 13 Level if a contractor was used.

(x) The larger shaft, if equipped with a suitable hoist and headframe etc., would be easily commissioned as a production unit.

(xi) if sunk to 13 Level the shaft could be used for hoisting Aberfoyle ore if so required.

(xii) in the long term the cost of a large shaft will have been spent more wisely if the ore reserve increases.

(xiii) At the present proposed location the 15 ft x 9 ft shaft will be suitably located for a large increase in mineable tonnage.

(xiv) A shaft of the size envisaged (15 ft x 9 ft) could service and hoist the production of a 1,000 ton per day operation.

(xv) The ventilation capabilities of the larger shaft are obvious and would lead to a better operation below ground.

(xvi) We must be reasonably optimistic in the light of drill hole and development results to date.

(xvii) in future years the shaft could become the major producer in the field.

(xviii) The cost of modifications to Spiers Shaft and the inevitable increased maintenance and delay costs would amount to the difference in cost of the large and small shafts over a period of a few years.

(xix) The extra servicing of a production section (Lutwyche) would lead to lower production through Spiers Shaft.

(g) Ore Reserve. The published ore reserve of 340,000 tons has been increased by recent drilling to 370,000 tons. Assuming that the current drilling programme is fully successful the ore reserves should stand at 500,000 tons within four months and if the full project is successful including 13 Level, then the ore reserves could lift to 750,000 tons, excluding any major extension to the south east.

We have, therefore, a present moderate ore reserve which is open at the ends and in depth and is potentially a considerably larger reserve. This potential should be known in twelve months time or at about the time a contractor would have sunk the shaft to 900 ft.

(h) Development of 13 Level is continuing at the rate of up to 180 ft per period of driving, producing 40 tons of ore per day or 800 tons per period for a budget cost of approximately $10,000 per period, or $12.50 per ton at the shaft collar. The ore grade after dilution because of the drive size approxim ates to the Aberfoyle ore grade, particularly if some rise or stope development ore can be included.

Therefore if a mutually satisfactory agreement can be made for the credit of ore won the Lutwyche Project can to some extent become self sustaining, in other words some capital can be diverted to other facets of the operation. The credit could be at a flat rate per ton or varied accordingly to the Aberfoyle production.

Taking for example a nominal figure of say $7.00 per ton the return to Lutwyche would be $7.00 x 800 = $5,600 per period and the drain on capital reduced to $4,400 per period i.e. we can do twice as much work for the total money allocated or purchase additional equipment for increased operations.

Similarly Aberfoyle would benefit by having an additional source of ore cheaper per ton than that mined at Aberfoyle.

Original estimates were to develop 1000 ft of strike length i.e. 500 ft each way off the crosscut. With some modification to the ventilation system it should be possible to drive 1000 f each way giving a total of 2000 ft of strike drive on one vein.

The tonnage obtained from 2000 ft of 8 x 6 drive is 8,000 tons. Stope development of this driven ore should produce a similar figure of 8,000 tons and the initial stoping lift say 10,000 tons without filling, giving a total of 26,000 tons produced. If credited by Aberfoyle at say $7.00 per ton this tonnage would return 26,000 x $7.00 = $182,000 over a period of two years.

Driving on other veins and rising on vein will give additional returns without delay due to ventilation.

The major factor which could halt this progress would be major intersections of water before additional pump capacity is installed.

5. COURSES OPEN.

(a) Aberfoyle must do the underground driving and rising on the Lutwyche ore body. There is no sensible way In which a contractor could be involved in present operations on 13 Level.

(b) The sinking of a shaft will be a separate entity until a connection is made with development on or from 13 Level, it should have no direct effect on Aberfoyle production and therefore could be let to a contractor. If sunk by ourselves it would have the effect of diverting resources from Aberfoyle.

It has been discussed previously that although a contractor would cost us more the time taken for the job would be considerably less, in fact to gain an opening at the right time for ventilation requirements the use of a contractor would be the only means of achieving the target.

The courses open are therefore -

(i) To sink the shaft ourselves. Size 15 ft x 9 ft. Depth 1300 ft. Cost $447,300. Time 141 weeks.

(II) To sink the shaft ourselves. Size 15 ft x 9 ft. Depth 900 ft. Cost $341,900. Time 102 weeks.

(iii) To employ a contractor. Size 15 ft x 9 ft. Depth 1300 ft. Cost $588,950. Time 52 weeks.

(iv) To employ a contractor. Size 15 ft x 9 ft. Depth 900 ft. Cost $466,730. Time 40 weeks.

(v) To sink the shaft ourselves. Size 8 ft x 8 ft. Depth 1300 ft. Cost $373,500. Time 101 weeks.

(vi) To sink the shaft ourselves. Size 8 ft x 8 ft. Depth 900 ft. Cost $292,000. Time 69 weeks.

In all the above cases we would be committed to put up an initial rise on vein for stope development and ventilation. We are also committed to driving on vein to the limit of available money or ventilation.

The method of quoting by contractors is shown on Table I. It can be seen that only Messrs. John Holland & Co. have quoted for two alternative depths. The two other contractors have quoted for depths to 1300 ft only. The cost to 900 ft by a contractor has been obtained by removing the cost of the 400 ft from the total, the cost of many Items will remain static irrespective of the actual depth sunk by the contractor.

Due to the unknowns (water influx, bad ground conditions) the costs of excavation of ancilliary openings, grouting, drilling additional grout holes etc. have been shown as unit rates and provided for by a 10% general contingency. See Tables I & II. A further 10% has been added on Table II to cope with exceptionally bad conditions.

Table III indicates the cost of additional parts of the project other than the shaft, the total project cost being Indicated for a period of two years from the start of this financial year.

6. CONCLUSIONS.

(a) We must develop a surface opening for full exploitation of the orebody.

(b) We must insure against flooding either by developing a surface opening or modifying the Spiers Shaft pumping system.

(c) In any event to carry us over the next year to two years money must be spent at Aberfoyle so that we can carry on meanwhile with level development.

(d) Although a small 8 ft x 8 ft opening would lead to an initial cost saving it would be of no interest to an outside contractor and thus would be a slow opening to obtain.

(e) Should ore reserves increase as optimistically expected we will eventually require a haulage shaft, the small shaft would be of no use for this purpose. The cost of stripping out would be very high, it would be more feasible to sink or rise a second shaft.

(f) A larger shaft (15 ft x 9 ft) would be ideal for our purposes but would be the most expensive initially.

(g) The 15 ft x 9 ft shaft will give us the quickest ventilation opening if sunk by a contractor to 900 ft.

(h) This shaft would be worth deepening.

(i) If required for a haulage shaft a larger winder, headframe and gear will be required.

(j) The ore reserve can be reasonably expected to stand at 500,000 tons In six months time.

(k) If all goes well we should have 750,000 tons within a year.

(l) The cost difference between a large (15 ft x 9 ft) shaft and a small (8 ft x 8 ft) shaft is not great. The difference in utility is enormous.

(m) To mine 750,000 tons will require a haulage shaft.

(n) The total cost of the project for two years would be in the order of $1,000,000 if a 15 ft x 9 ft shaft Is sumk to 900 ft by a contractor.

7. RECOMMENDATIONS.

It is recommended that a shaft of size 15 ft x 9 ft be sunk on the Lutwyche orebody, employing a contractor, to an initial depth of 900 ft, with the option of stopping sooner or sinking further in the light of circumstances existing at ths time.

We should develop 13 Level as rapidly as possible over the next two years.

We should rise to meet the shaft from 13 Level at 900 ft below the surface.

We should modify the Spiers Shaft pumping capacity to give us insurance over the next year.

We should select Messrs. John Holland & Co. as the contractor because -

(a) Their price is the lowest.
(b) Their time is the fastest.
(c) They appear to have unit rates more favourable to us in the event of serious water influxes.

E. N. Hughes
LUTWYCHE PROJECT ENGINEER
ABERFOYLE HOLDINGS LIMITED
27th September, 1968.

This report to supercede the hand written report dated 25.9.68 which should be destroyed.

TABLE II

ESTIMATES OF ALTERNATIVES - SUBJECT TO FURTHER CONFIRMATION & REVISION

SHAFT SIZE & DEPTH	SINKER	SHAFT OR CONTRACT COST	CONTINGENCIES GENERAL 10%	CONTINGENCIES WATER 10%	TOTAL SHAFT	TOTAL DEVELOP. & EXPLORATION	TOTAL 2 YEARS MINING PROJECT	TIME ESTIMATE FOR VENT. OPENING	TIME TO COMPLETE SHAFT	REMARKS
1. 8' x 8' to 1300 ft	A.H.L.	$340,000	$33,500	$33,500	$407,000	$490,708	$897,708	69 weeks	101 weeks	Complete shaft to 1300 ft.
2. 8' x 8' to 900 ft	A.H.L.	$265,000	$27,000	$27,000	$319,000	$490,708	$809,708	69 weeks	69 weeks	Complete shaft to 900 ft. Rise 13 Level to 900ft
3. 15' x 9' to 1300 ft	A.H.L.	$407,000	$40,400	$40,400	$487,800	$490,708	$978,508	102 weeks	141 weeks	Complete shaft to 1300 ft.
4. 15' x 9' to 900 ft	HOLLAND	$333,360 $ 90,940x	$42,430	$42,430	$509,160	$490,708	$999,868	40 weeks	40 weeks	Complete shaft to 900 ft. Rise 13 Level to 900ft
5. 15' x 9' to 1300 ft	HOLLANDS	$423,360 $112,050x	$53,540	$53,540	$642,490	$490,708	$1,133,198	40 weeks	52 weeks	Complete shaft to 1300 ft.

x Additional cost to A.H.L.

To employ Dillinghams as contractor would cost $10,000 more and a time of 64 weeks to 13 Level plus a possible additional cost of up to $20,000 for compressors and/or hire.

TABLE III

ITEM	COST	REMARKS
Underground Exploration and Development	$105,354	As per Lutwyche Budget first year.
Underground Exploration and Development	$105,354	Estimated second year.
Geological Exploration	$170,000	For two years ?
Mine Overheads, Head Office & Management	$ 70,000	For two years.
Cost of equipment for rising and stope develop.	$ 10,000	Used later for stoping.
Modification to Aberfoyle pumping	$ 30,000	
Estimated Total	$490,708	Excluding shaft.

NOTE - No major provision has been made for production equipment, headframe, production hoist, sandfilling etc.
No allowance has been made for the credit of ore won in development.