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COMSTAFF PROPRIETARY LIMITED.

EL 5/63 PART 6, EAST RENISON

WORK CARRIED OUT DURING THE YEAR ENDED 30th JUNE 1985.

OPEN FILE

I.G.P. WILDING.
1st JULY 1985.

COMSTAFF PROPRIETARY LIMITEDEL 5/63 PART 6, EAST RENISONNote on work carried out during
the year ended 30th June 1985

SEARCHED	A.G.	U.G.	E.O.	DATE
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During the year ended 30th June 1985 most of the work in Part 6 of EL 5/63 was carried out on areas now relinquished: that work has been reported separately. Within the area under application for renewal attention has been focussed on the Salmon's Vein - Pieman Tin Vein system. These two mineralised veins, believed to be part of a single system, have been the subject of indicative economic studies which are ongoing. These studies are based on "A review of the tin and base metal resource, East Renison EL 5/63 Area 6" by D.S. Thynne, June 1984, (I.C. Doc. No. 11861), a copy of which report has already been submitted to the Department of Mines.

Further work is required on this prospect area and no formal overall report has been written since the one referred to above. However this folio contains copies of working documents which together form a record of the work undertaken during the past twelve months.

The folio comprises:-

- (1) Update evaluation of East Renison Resource, November 1984, by G.A. Buckett.
- (2) Letter from G.A. Buckett, Manager Technical and Economic Services, to Mr. J.K. Sturgess, Consulting Mining Engineer detailing parameters for an evaluation of the East Renison resource, 3rd December 1984.
- (3) Technical Report - Conceptual studies of mineralisation in the Salmon's and Pieman Veins - J.K. Sturgess, 3rd December 1984.
- (4) Metallurgical assessment - Tin and base metal resource East Renison EL 5/63, Area 6 - N.W. McDonald, 4th December 1984.
- (5) Letter from Mr. J.K. Sturgess, Consulting Mining Engineer to G.A. Buckett, Manager Technical and Economic Services of 7th December 1984.
- (6) Memorandum from R.W.L. Shaw to I.G.P. Wilding on East Renison - Tin and Salmon's Veins, 25th February 1985.



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AUSTRALIAN ANGLO AMERICAN LIMITED

UPDATE EVALUATION OF EAST RENISON RESOURCE

1. Introduction

Under a commission from AAA, a technical report on Comstaff's East Renison project was prepared by Jack K Sturgess entitled "Preliminary Studies of the Fenton's Gar and Godkin Mineralisation" (July 12, 1983). The conclusions of that report were that a "stand alone" operation would not be feasible for either the base metal (Salmon Vein) reserve of Fentons or the tin reserve of Godkin but that a small, ore shipment project working in conjunction with a custom mill might, subject to metallurgy, be feasible on the base metal zone at foreseeable metal prices. A doubling of reserves was identified as being beneficial. The Pieman tin zone in the vicinity of the Salmon's base metal vein was not objectively evaluated at that time.

Since that report, AAA Exploration Division has reconsidered ore reserves and other aspects of the resource and has prepared the report "A Review of the Tin and Base Metal Resource East Renison EL 5/63 Area 6". No further drilling was undertaken in the area in the intervening period. The ore reserve calculation was extended to also cover the Pieman tin zone which lies near to the Salmon's vein base metal resource, but no further work was done on the separate Godkin's tin zone. That zone was held under a separate title and has since been relinquished.

The recent review by Exploration:

- (a) shows an increase in the probable and possible reserves for both vein systems
- (b) recognises a genetic link between the two veins and includes a statement on the Sn content of the Salmon's Vein and
- (c) suggests a spatial relationship between mineralisation and granite emplacement at depth.

The question has been raised as to whether both the tin and base metal zones might be mined together with separation into reliable concentrates being achieved through appropriate, staged flotation (and possibly gravity) circuits in a common mill.

The objective in the current evaluation is to determine whether the resources as outlined in the recent Exploration report can be viably mined and marketed and, if so, by what scheme and at what rate. Also, if uneconomical in its current dimension and grade, to identify the extra tonnage of similar material necessary to give the resource a reasonable chance of viable development.

2. Current Reserves and Gross Insitu Metal Values

The estimated reserves of the combined Salmon's/Pieman ore resource blocks based on a cut off insitu value of US\$35/t (refer Section 4 for base case metal values used) are detailed in the latest Exporation report and in the summary in Table 1.

Table 1

Summary of Geological Reserves per 1984 Exploration Review

Location	Category	Quantity (kt)	Grade				
			Sn (%)	Cu (%)	Pb (%)	Zn (%)	Ag (g/t)
Pieman	Probable	433.4	1.0	0.18	0.06	0.32	8
	Possible	744.9	0.3	0.18	0.06	0.32	8
	Total	1 178.3	0.557	0.18	0.06	0.32	8
Salmon's	Probable ⁽¹⁾	830.2	0.187	0.615	3.173	2.241	104
	Possible ⁽¹⁾	1 016.0	0.104	0.104	1.254	1.369	58
	Total	1 846.2	0.141	0.334	2.117	1.761	78.7

Notes : (1) Includes 200 000 t at \$US69.13/t. Grades calculated pro rata to other possible ore (816 000 t with \$US58.24 insitu metal value).

This reserve compares with the 1983 geological reserve for base metal Salmon's Vein only of 654 282 t at a grade of:

5.35 % Pb
3.32 % Zn
247.4 g/t Ag

Table 2

Comparison of Gross Insitu Metal Values and Metal Contents
in Geological Reserves of 1984 and 1983 Studies

Item	Unit	Salmon's Vein		Pieman Zone	
		1984	1983	1984	1983
<u>Gross Geological Reserve</u>					
Probable	kt	830.2		433.4	
Possible	kt	1 016.0		744.9	
Total	kt	1 846.2	654.3	1 178.3	-
<u>Gross Insitu Metal Value</u> (1)					
Probable	\$US/t	125.66		143.03	
Possible	\$US/t	60.38		50.28	
Total	\$US/t	89.72	174.55	84.37	-
<u>Contained Metal</u>					
Probable	Sn	t	1 553		4 334
	Cu	t	5 106		780
	Pb	t	26 343		260
	Zn	t	18 605		1 387
	Ag	t	86.3		3.5
Possible	Sn	t	1 054		2 235
	Cu	t	1 054		1 340
	Pb	t	12 740		447
	Zn	t	13 907		2 383
	Ag	t	52.7		6.0
Total	Sn	t	2 607	-	6 569
	Cu	t	6 160	-	2 120
	Pb	t	39 083	35 004	707
	Zn	t	32 512	20 937	3 770
	Ag	t	139.0	161.9	9.4

Notes : (1) Gross values calculated by applying base case metal prices detailed in Section 4 to contained metal quantities in geological reserves. No allowance has been made for dilution or any realisation costs.

The general effect of the 1984 reworking has been to substantially increase the quantity of reserves at the expense of grade. In particular, the possible reserves in both the base metal and tin zones are of particularly low grade.

The aggregate value of contained metal has been increased 232% by the 1984 reworking as shown in Table 3, although the inclusion of the Pieman Zone has contributed two-thirds of the increase. Salmon's Vein has been lifted only 45%. If the low valued possible reserves are deleted from Salmon's Vein, the aggregate insitu metal value of the 1984 reserve drops 9.5% compared with the limited, higher grade reserve outlined in 1983. If the probable reserves of the Pieman Zone are added to the probable reserve of Salmon's Vein, the aggregate value of the mixed resource increases 46%, using of course, the same metal prices in each case.

Table 3

Comparison of Aggregate Insitu Values of Contained Metal
in Geological Reserves of 1984 and 1983 Studies

Reserve Item	Reserve (kt)		Unit Value (\$US/t)		Aggregate Value (\$US millions)	
	1984	1983	1984	1983	1984	1983
<u>Salmon's Vein</u>						
Probable	830.2		125.66		104.3	
Possible	1 016.0		60.38		61.3	
Total	1 846.2	654.3	89.72	174.55	165.6	114.2
<u>Pieman Zone</u>						
Probable	433.4		143.03		62.0	
Possible	744.9		50.28		37.4	
Total	1 178.3	-	84.37	-	99.4	-
TOTAL BOTH ZONES	3 024.5	654.3	87.64	174.55	265.0	114.2

3. Current Realisable Values

Very little metallurgical testwork has been undertaken to date and this introduces a major uncertainty to current evaluation. All we can assume at this stage is that metallurgical recoveries to concentrates will equate with those currently prevailing with the proximate Que River ones for lead/zinc/silver metal products and the Cleveland ores for tin and copper. This may prove to be a very heroic assumption, but if realised will give the approximate recoveries to concentrate shown in Table 4.

Table 4

Assumed Recovery Efficiency to Concentrate of Key Metal Components

Metal	Recovery to Concentrate (%)
Sn	65
Cu	60
Pb	70
Zn	90
Ag	70

Since the East Renison grades for base metals are significantly lower than currently mined Cleveland and Que River grades in all metals (except tin ex Pieman), actual recoveries at East Renison may be lower. The above figures should be treated as optimistic.

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4.

For concentrate prices we might, if the concentrates are of clear quality, expect to receive the percentages of refined metal values shown in Table 5. It is to be noted that high arsenic levels are characteristic of the Renison areas and if contained in the East Renison ores clean concentrates with the following realisable values might not be achieved. Further, tin contamination of base metal concentrates could reduce concentrates value through penalties.

Table 5

Assumed Share of Refined Metal Prices
Realisable for Metal Content of Concentrates

Metal	Realisable Share (%)
Sn	70
Cu	50
Pb	65
Zn	50
Ag	90

With the recoveries and realisable shares of metal price assumed in Tables 4 and 5, the net realisable metal values of ores will be in line with the summary figures of Table 6. It is to be emphasised that these values give only a preliminary guide. Actual values will be influenced by mining method, metallurgical performance, processing and marketing routes and metal demands.

Table 6

Preliminary Estimate of Aggregate Net Realisable Values of Ore Components of East Renison Ores (Sold as Concentrates) Based on 1984 Studies

Reserve Item	Aggregate Value Contained Metal (\$US million)	Recovery to Concentrates (%)	Realisable Share of Metal Value (%)	Aggregate Net Realisable Value (as cons) (\$US million)
<u>Salmon's Vein</u>				
Probable	104.3	76.06	57.61	46.03
Possible	61.3	79.11	56.53	27.41
Total	165.6	77.15	57.21	73.09
<u>Pieman Zone</u>				
Probable	62.0	69.74	62.55	27.05
Possible	37.4	74.19	57.45	15.94
Total	99.4	71.91	59.99	42.87
TOTAL BOTH ZONES	265.0	76.41	57.58	116.59

The 1984 aggregate net realisable value as concentrate at \$US116.6 million compares with the corresponding figure in the 1983 study (Salmon's Vein only) of \$A77.7 using the 1983 metal values. It is to be noted the higher grade probable reserves make up 62.7% of aggregate realisable value.

The unit net realisable values of the various ore components on an insitu geological grade basis are shown in Table 7.

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Table 7

Net Realisable Value of Insitu Ore Components

Reserve Item	Net Realisable Value of Insitu Ore (\$US/t)
<u>Salmon's Vein</u>	
Probable	55.44
Possible	26.98
Total	39.59
<u>Pieman Zone</u>	
Probable	62.41
Possible	21.40
Total	36.38
TOTAL BOTH ZONES	38.54

The figures of Table 7 illustrate the inadequate value of the low grade "possible" reserves. Chances of mining, concentrating and leaching concentrate products with even marginal costs approaching \$US21-27/t of insitu ore are indeed remote even if immense reserves were to be outlined. On the other hand, the probable ore values of \$US55-62/t do offer some slim potential for development if sufficient reserves can be found and which can be economically mined and concentrated. It is probable that increased values will need to be found however.

4. Metal Prices

The following metal prices were adopted in the 1984 Exploration Division review:

Sn	\$US13 250/t
Cu	\$US 1 924/t
Pb	\$US 724/t
Zn	\$US 1 058/t
Ag	\$US 12.65/oz

Although well above current prices, these figures have been adopted for base case studies in this evaluation. They are to be regarded as optimistic however, as the comparative figures of Table 8 illustrate.

Table 8

Alternative Metal Price Standards

Metal	Unit	Base Case this Evaluation	Current Price November 1984	Latest AAC Medium Term Projection
Sn	\$US/t	13 250	12 250	12 500 - 13 000
Cu	\$US/t	1 924	1 520	1 790 - 2 020
Pb	\$US/t	724	630	490 - 560
Zn	\$US/t	1 058	1 025	900 - 940
Ag	\$US/oz	12.65	7.12	10

5. General Discussion

In the 1983 study the recoverable net value per tonne of ore at the concentrator was \$A105/t using metal prices of the time. A "stand alone" operation comprising mine and concentrator was found not to be viable but a contracted mining and custom milling showed a basis for marginal operation.

The new reserve assessment shows a substantial lift in tonnage at the expense of grade. Grade appears to have dropped too far for economic mining of the whole reserves. At less than \$US40/t net realisable value insitu, small scale mining and processing would not be economical. The lower ore grade would also appear to preclude custom milling for both Rosebery and Cleveland run on substantially higher feed grades than is projected in 1984 studies for East Renison. The high grade half of the reserves which generally fall within the "probable" category have a net realisable value insitu of almost \$US60/t and this offers better scope. However, after dilution, this value will probably fall to below \$US50/t and that does not appear adequate for the relatively small scale (100-150 000 t/yr) thin vein mining and multiple product concentration that would be necessary. A doubling of reserves to allow mining at a rate of 1 000 t/day would not appear to make sufficient difference economically.

Treatment of both vein systems through a single mine/mill would not appear to contribute any economic advantage. A very marginal reduction in mining operating costs would probably result but concentration costs would increase and concentrate recoveries and grades might fall. Further, there is a strong chance of increasing penalties for impurities in some concentrates (e.g. tin in zinc concentrates would probably attract a penalty). It would also be difficult to secure a quota for tin sales at present.

The best chance for economic development still appears to be contract mining and custom milling of the high grade base metal vein. Treatment through EZ Rosebery would appear to be the best route but that might be mutually attractive only if grades are increased nearer to design grade at that operation; if impurities (particularly tin and arsenic) can be limited; and if a steady output of at least 100 000 t/yr could be achieved. The tin zone might be hauled through a common handling system with the base metal ores and concentrated at Cleveland after reserves from that mine are exhausted in less than 2 years. However the better reserves at Pieman appear inadequate to fully source the Cleveland mill which has an annual capacity of 400 000 t/yr and a normal ore feed of 0.65-0.75% Sn.

A preliminary judgement is that for economic development more than one million tonnes of ore with an insitu realisable value of at least \$US80/t would be necessary for serious development consideration. However, this judgement needs further refinement and such refinement is now in hand.

Nov '84

G A Buckett

GAB:rpb



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3rd December 1984

Mr J K Sturgess
Consulting Mining Engineer
Level 23
459 Collins Street
MELBOURNE 3000

Dear Jack,

Evaluation of East Renison Resource

This letter confirms our discussions of November 20th 1984, when we requested your participation in our update evaluation of the East Renison Resource.

You completed a technical/economic evaluation of a part of this resource in July 1983. Since that time our Exploration Division has reconsidered the reserves (without further drilling) and a copy of their report "A Review of the Tin and Base Metal Resource, East Renison EL 5/63 Area 6" was given to you on November 20th. The effect of the latest work is to increase the reserve tonnage at the expense of grade and to add in the tin resource (through the separate but adjacent Pieman zone and through analysis of tin in the base metal vein).

The attached draft report "Update Evaluation of East Renison Resource" analyses the 1984 reserve statement and contrasts it with the 1983 figures to allow the development of some preliminary conclusions. We request that you review that report and advise:

- a) Whether, and if so how, the higher grade "probable" base metal and tin resources might be economically exploited. Also advise whether, if these higher grade resources can support development, the lower grade "possible" reserves can also be mined and processed at marginal costs under realisable value.
- b) If the reserves as now presented cannot in any way be economically exploited, advise the amount of extra reserves of grades equal to those of the 1983 statement for base metals and the 1984 probable reserve statement for tin which would need to be found in the location and with the type of structure identified to date to make exploitation attractive at the base case metal prices outlined in Section 4 of the enclosed report.

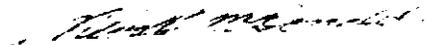
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- c) In conjunction with our metallurgist, Neville McDonald, advise whether common mining and processing of the tin and base metal zones offers net economic advantage compared with separate mining through common access and separate milling.
- d) Any other pertinent matters arising out of your review.

We also request that you specifically comment on the usage of "probable" and "possible" ore reserve categories in the 1984 review in reference to the standard classifications established by Aus I.M.M. What would the reserves be if categorised under the Aus I.M.M. standards.

We trust that you can still complete your assignment by December 7th. Please liaise direct with Neville McDonald in the absence of the writer.

Yours sincerely,



G A Buckett
Manager Technical and
Economic Services

Encl

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DATE: 03/ 12 / 84

TECHNICAL REPORT

TITLE:

**CONCEPTUAL STUDIES OF MINERALISATION IN
THE SALMON'S & PIEMAN VEINS**

CLIENT:

**AUSTRALIAN ANGLO AMERICAN LTD
581 LITTLE COLLINS STREET
MELBOURNE 3000**


JACK K. STURGESS

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1. INTRODUCTION

The purpose of this report is to examine the means by which the mineralisation in the Salmon's & Pieman veins might possibly be commercial. This program was discussed at a meeting between Graham Buckett and Jack Sturgess on November 20th.

Costs and revenues are expressed in fourth quarter 1984 AUD, and are intended to exclude interest, inflation, vendor consideration, contingency, salvage value and site rehabilitation.

2. SUMMARY & CONCLUSIONS

2.1 Course of Action to Determine Possible Economic Viability.

2.1.1 Re-examine drilled reserves and try to establish the following:

Salmon's Vein: Not less than 250,000 tonnes of ore at a grade of not less than 10% lead over a minimum width of three metres.

Pieman Vein: Not less than 350,000 tonnes of ore at a grade of not less than 1% tin over a minimum width of two metres.

2.1.2 In each vein, establish that there is no substantial mineralogical variation with depth in a manner that will effect metallurgical recovery.

2.1.3 Prepare a 100 Kg composite of each vein material of average (approximately 10% lead and 1% tin) grade, and submit it for metallurgical testing. Establish high lead and silver recovery (+ 95%) into a high (+ 70%) lead concentrate. Also establish + 80% tin recovery by gravity into a + 50% tin concentrate.

2.1.4 Make a detailed evaluation of capital and operating costs and revenues on the basis of concepts discussed in this report.

2.2 Comstaff June 1984 Report Requirements (Page 10).

2.2.1 Define the likely economic merits of the resource and a doubled resource.

Salmon's Vein

- resource of 1,646,222 tonnes @ .14% Sn, .36% Cu, 2.20% Pb, 1.78% Zn, 77.23 g/t Ag.

No foreseeable economic merit at this grade.

- resource of 3,300,000 tonnes of similar grade.

No foreseeable economic merit.

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Pieman Vein

- resource of 1,178,285 tonnes @ .56% Sn, .18% Cu, .06% Pb, .32% Zn, 8 g/t Ag.

The tin resource has possible economic merit.

- resource of 2,360,000 tonnes @ .56% Sn, .18% Cu, .06% Pb, .32% Zn, 8 g/t Ag.

Economics, quotas and vein widths direct more emphasis to grade than to tonnes.

2.2.2 Specifically examine the economics of processing the Pieman & Salmon's Vein ores through a single plant.

A common crushing and grinding circuit, thickening and tailings disposal could be feasible, with the deposits being treated sequentially. More metallurgical information is required on both ore types.

Conceptually, a modular plant capable of treating 70,000 tpa might be erected at site for \$4 - 5 million. This plant could treat initially open pit tin ore from the Pieman Vein, then Pieman underground ore, followed by high grade Salmon's Vein lead-zinc-silver ore. The latter would require significant flotation capacity, probably much more than tin recovery would need.

Total capital construction cost could be perhaps \$10 million.

If maximum use is made of contractors employing local labour, this could be initially less if the Pieman Vein can be put into production as an open pit mined with an hydraulic excavator.

Access development to both ore bodies during the pre-production period would offer the possibility of maximising returns according to the best metal prices. This approach would require more initial capital expenditure.

A more detailed examination would require a review of the present tin quota situation.

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3. DISCUSSION

3.1 Salmon's Vein

3.1.1 AAA November 1984 Recoverable Value

This value of \$37 per tonne apparently allows for treatment cost and recovery, and realisation charges of lead, zinc, copper and silver. It does not seem to allow for mining dilution, which would have some impact on a vein width of 2.0 - 3.6. metres.

Of a more serious nature is the inclusion of revenue from tin in the Recoverable Value. The tin is reported by Amdel (Page 3, Report GS1830/81, Part II) to occur as -30 micron stannite in sphalerite and as 2-30 micron cassiterite in carbonate and chalcopryrite. There is very little likelihood of a marketable tin product being produced from such a feed at any recovery.

Without the contribution of the tin, the Recoverable Value of \$37 per tonne is reduced to \$24 per tonne.

It is unlikely that rock of the assumed grades (June 1984 Report) would be economic under any foreseeable circumstances.

3.1.2 Report by Sturgess, 12th July 1983

With the metal prices and recoverable grades used in that report, the recoverable value per tonne of ore mined was calculated to be \$105. Using the "November 1984" metal prices, the comparable value would be \$65. For the tonnage and average ore width considered in that report, such a revenue would not be economic, even if the material could be favourably custom-treated.

3.1.3 Possible Economic Alternative

The Amdel testwork in 1981 revealed that a high grade lead-silver concentrate with very high lead and silver recoveries could be produced from drill core samples containing 15% and 20% lead.

A possible economic course of action for the Salmon's Vein mineralisation could be as follows:

- a) Establish a drilled reserve of 250,000 tonnes at +10% lead.
- b) Establish that recoveries and concentrate grades of lead and silver are comparable with those obtained by Amdel in 1981, without significant penalty elements.
- c) Establish that a zinc concentrate can also be produced without prohibitive contaminants.
- d) Examine in detail the ramifications of mining and treating this material sequentially with the Pieman Vein.
- e) As an alternative to step d) above, determine whether EZ will buy or custom-treat such material at Rosebery, and under what terms.

If the ore is acceptable to EZ under reasonable terms, design a mining plan and call for tenders from contractors to execute it. This could, for example, involve a decline or small shaft, an underground mine, surface establishment, access road, power and water, government approval and environmental report. If the preliminary work was completed, maximum advantage could be taken of the equipment and manpower idled by the possible closure of Mount Lyell.

A contract might be arranged to provide an incentive for the successful tenderer, e.g. he could have a part-interest in a certain percentage of ore over the contracted reserve tonnage and grade.

3.1.4 Comment on Reserves

An appraisal of the drill hole results indicates two vaguely defined groups, a high silver-lead - low tin and low arsenic group (7, 5, 9, 30, 10A, 34, 14) and a low silver-lead - high arsenic group (11, 31, 12, 36, 15, 16). Both groups of holes are internally adjacent, except for hole 14.

EZ head grade at Rosebery contains about 3.5% Pb, 12% Zn, 130 g/t Ag and .60% Cu, with no tin and .15% As. (This is the ore mined at Rosebery).

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3.2 Pieman Vein

3.2.1 AAA November 1984 Recoverable Value

The figure of \$54 per tonne calculated by AAA Ltd appears to contain tin worth \$51 and copper, lead, zinc and silver worth \$3. In fact the sulphides would be removed by a pre-float stage in the plant. This sulphide concentrate might be stored and sent to Capper Pass intermittently as sufficient material became available. Alternatively it would be sent to tailings.

Mineralisation of this width and disposition will have to be mined largely by underground methods. The revenue is not sufficient for this to be done economically.

3.2.2 Possible Economic Alternative

The tin is contained in 100 micron - 200 micron cassiterite. If the sulphides are also relatively coarse grained and can be recovered in the pre-float at a coarse grind, then gravity recovery of tin might be 80% or more. If a finer grind is required, then flotation of gravity tailings may be economical. Such a procedure could be more readily justified if the flotation capacity was required for subsequent treatment of Salmon's Vein ore.

The reserve is stated as 433,948 tonnes @ .9987% Sn, with a minimum vein width of two metres.

The following concept could make this deposit economic.

- a) Establish a drilled reserve of 350,000 tonnes at a mineable grade of 1% Sn; do metallurgical testwork and establish a gravity recovery of 90% into a 55% concentrate.
- b) Evaluate topography, rock hardness and other factors to determine that 70,000 tonnes of this ore is most economically recoverable by an open pit and hydraulic excavator to minimise dilution.
- c) Obtain a tin quota for 630 tpa.

- d) Erect a 70,000 tpa modular treatment plant, including design, civils, power and water for \$4 million. Total pre-production including pre-stripping, contracts, legal, environment, government, etc. is \$5 million.

- e) Commence production. The recoverable net minesite value per tonne of tin concentrate is AUD 13,000.

The RNMV per tonne of ore is \$117; (13,000 x 1.0% x 90%).

Operating costs and replacement capital are \$70 - \$80 per tonne, operating margin is \$40 per tonne and margin per year is \$2.8 million. Theoretical payback time on an all-equity, no tax basis is about 2.5 years; this allows for a further \$2 million to be spent on establishing an underground mine during production year 1.

This underground access could be used for extracting the Salmon's Vein, which would start in Year 6 after a further capital expenditure of \$3 million.

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AUSTRALIAN ANGLO AMERICAN LIMITEDMETALLURGICAL ASSESSMENTTIN AND BASE METAL RESOURCE
EAST RENISON EL 5/63 AREA 61. INTRODUCTION

A review has been conducted on two probable resource blocks referred to as the Pieman's Tin and Salmon's Vein structures.

Metallurgical testing has shown free milling characteristics in the lead rich section of the Salmon's Vein (no tests being conducted on the Pieman's ore). Samples submitted to Amdel (Amdel Report GS 1830/81 - Part II (Final) were tested metallurgically as a composite after individual mineralogical appraisal.

Both samples submitted were analysed to result in the following:

TABLE "A"

Head analyses:	RBE5	RBE10A
Pb, %	20.3	15.4
Zn, %	3.54	3.59
Ag, ppm	543	406
Cu, %	0.18	0.19
As, %	0.58	0.48
Sn, ppm	441	524
Mineralogical analyses:	RBE5	RBE10A
Quartz, %	35-40	30
Siderite-Rhodochrosite, %	25-30	35
Dolomite, %	5	2
Chlorite, %	-	2
Galena, %	23	18
Sphalerite, %	6	6
Chalcopyrite, %	0.5	0.5
Arsenopyrite, %	1.3	1.0
Pyrite*, %	1.5-2.0	1.0-1.5
Pyrrhotite	-	-
Tetrahedrite	Trace	Trace

* includes some marcasite

2. METALLURGICAL TESTING - AMDEL

Amdel summarised the testwork by reporting:

"Flotation testing (lead flotation followed by zinc flotation) indicates that it is possible to obtain extremely high lead and silver recoveries into an extremely high grade lead concentrate. The best result was 98.4% Pb and 95.0% Ag recovery into lead concentrate assaying 77.9% Pb, 1.93% Zn and 2050 g/t Ag."

Amdel also noted;

"The best zinc flotation recovery achieved was 79.7% (90.4% zinc recovery from lead flotation tails) into a concentrate containing 43.7% Zn and 4.45% As. Much of the tin reports to the zinc concentrate."

Amdel also attempted a reverse flotation procedure to produce a zinc concentrate relatively free of arsenopyrite. The tests proved ineffectual and it was concluded that;

"It seems unlikely that concentrate of the composition referred to above (43.7% Zn and 4.45% As) could be marketed."

3. CURRENT METALLURGY

The concept of bulking together the two main ore sources (Salmon & Pieman) offers only minor advantages from a project cost point of view. However, metallurgically, such a scheme would make effective separation of desired concentrates with limited contamination extremely difficult.

Essentially the two sources/reserves are estimated as in Table B below.

TABLE "B"

	Salmon's Vein	Pieman's Vein
tonnes	1 646 222	1 178 285
Sn%	0.14	0.56
Cu%	0.36	0.18
Pb%	2.20	0.06
Zn%	1.78	0.32
Ag g/t	77.23	8.0

In addition, the Salmon East vein sections may contain 233 750 t of ore at \$69.13 US equivalent value total metal per tonne.

4. COMBINED METALLURGICAL TREATMENT

4.1 D S Thynne, July 1984 recommended, ...

"That the study specifically looks at the economics of processing the Pieman and Salmons Vein ore through a single plant."

Such a scheme is relatively simple providing that a single milling/processing complex could be constructed incorporating a mixture of process routes maintaining separation of the Ag, Pb, Zn ore ex Salmon's Vein and tin ore ex Pieman's. The essential components of such an installation would be;

- (a) Gravity circuit for cassiterite recovery (Pieman's Tin Circuit).
- (b) Flotation of tin from gravity circuit tailing.
- (c) Flotation (Differential float) for Lead and Zinc concentrates.
- (d) Arsenic removal from zinc concentrates (reverse flotation of zinc rougher tail).
- (e) Tin concentrate cleaning operations.

The attached preliminary flowsheet (N W McDonald 2/12/84) indicates preliminary processing alternatives. A lack of mineralogical data for the Pieman's Tin Vein prevents a more detailed flowsheet particularly with respect to cassiterite recovery.

- 4.2 Discussions with Dr R Sinclair of EZ highlighted the need to produce a zinc concentrate up to around 50% Zn with less than 0.5% As. The Elura operation uses the reverse flotation procedure although it is apparent that the level of arsenic is most likely above the 0.5% level. EZ is therefore increasing the number of arsenic removal stages at its Risdon works.

No standards are current with respect to contaminant levels of either As or Sn in zinc concentrates. Actual limits are merely determined by the processing requirements and in the case of EZ an upper limit of 0.5% As has been normal.

5. CONCLUSIONS AND RECOMMENDATIONS

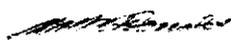
- 5.1 A preliminary flowsheet has been attached to indicate the likely process routes.
- 5.2 No metallurgical studies have been undertaken on Pieman ore and it can only be assumed that a combination gravity/flotation system may be applicable.
- 5.3 Combining both the Salmon & Pieman ores together would be unacceptable. A common crushing circuit and tailings disposal would be satisfactory

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3.

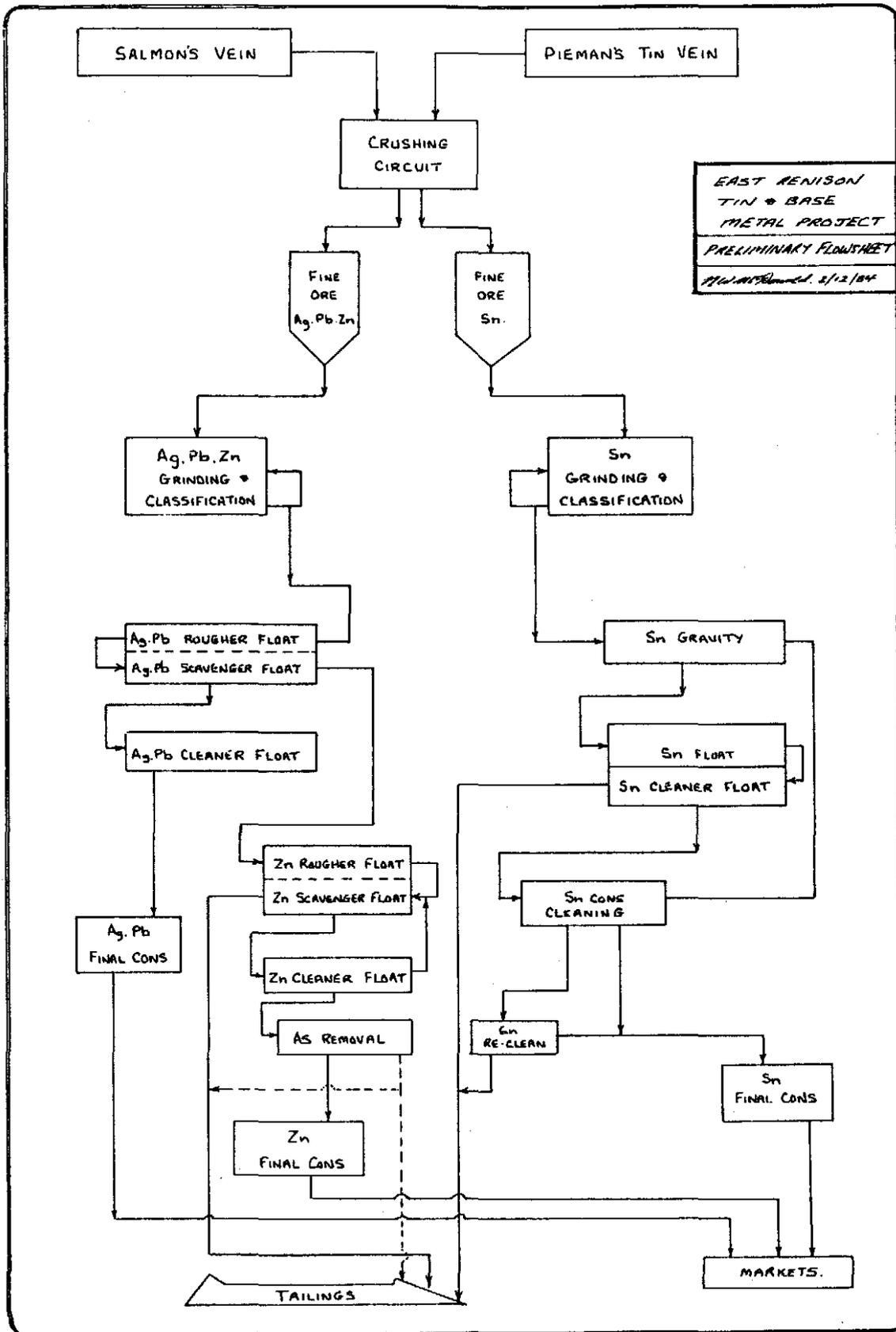
- 5.4 The operation of a multi-circuit plant presents no serious difficulties.
- 5.5 The construction of a process plant in stages is relatively simple and economically attractive.
- 5.6 Bulk sampling should be undertaken to provide adequate material for laboratory scale testing to assist in further flowsheet development.



N W McDonald

Encl
NWMcD:pmck
4.12.84

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JACK K. STURGESS
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TELEPHONE: (03) 62 7425
A/H.: (03) 232 4548
TELEX: AA 38021

LEVEL 23
CITY MUTUAL BLDG.
459 COLLINS STREET
MELBOURNE, 3000

7th December, 1984.

Mr. Graham Buckett,
Australian Anglo American Limited,
581 Little Collins Street,
MELBOURNE, VIC. 3000.

Dear Graham,

By the time I got your letter my report had gone to print. In any case I think I have answered, or commented on, most of the points that you mention. I will refer to items a - d in your letter of November 20th.

a) My comments on lower grade possible reserves at Salmon's vein are that they have no foreseeable economic merit.

At Pieman's vein, lower grade possible reserves would only be of interest if they were present as disseminated mineralisation allowing greater mining widths and efficiencies. This is not the case.

b) My report answers this question indirectly. You don't need more low grade tonnes; you need higher grades and good metallurgical performance.

I have not attempted a detailed DCFROR tabulation because it would not be productive to do so at this stage.

In summary, my report (page 6 and 7) offers the following simplistic cash situation (1984AUD 000s). It does not consider money spent to date.

	Year									
	-1	1	2	3	4	5	6	7	8	9
Pieman	-5000	-2000								
		+2800	+2800	+2800	+2800	+2800				
Salmons					-1000	-2000	?	?	?	?

I have used a recoverable net minesite value of \$13,000 per tonne of tin in a 55% gravity concentrate. Such a concentrate grade returns about 91% or 92% of the Penang tin price at the minesite in Australia.

Because of the nebulous nature of the Salmon's vein reserve and metallurgy under economic restraints, I have not attempted to develop operating costs and revenues. I would expect that the mined grade for my scheme would need to be about 10% Pb, 5% Zn and 250gr. Ag/tonne.

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Conceptual development and construction costs assume that the large international construction and engineering companies would not be used.

The alternative, smaller local organisations with lower costs and overheads will offer less expenditure but higher risk.

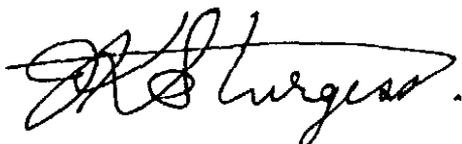
- c) Neville McDonald is considering a flow sheet for treating the ores concurrently. My scheme is to treat them in sequence.
- d) These are mainly covered in my report. A cut-off value for vein mineralisation of this thickness of \$US35.00 is not realistic in 1984.

With reference to your "Update Evaluation of East Renison Resource" Draft report, I once again feel compelled to mention that I regard the use of Gross Insitu Metal Values as being of questionable value.

You also asked me to specifically comment on the usage of "probable" and "possible" ore reserve categories, in relation to the A.I.M.M. classifications. I must say that my involvement in ore reserve calculations and classification has been minimal in Australia, although I did work in that area in North America. For that reason, I don't feel that I am sufficiently informed or experienced on this deposit to offer a professional opinion on the spacing of drill holes, core recoveries, variability of grades and continuity, surveying and assaying accuracy, and other factors which are implicit in the AIMM definition of probable ore reserves and possible ore (reference: page 10, Aus IMM Bulletin No. 452 - May 1981). I would like to emphasise, however, the importance of considering dilution and metallurgical performance in converting geological reserves of whatever classification to economic reality.

In this case, the Pieman vein might be bulk-sampled for proving the mineable grade and the metallurgy from near-surface excavations. Underground access to this vein could be extended to provide detailed information on the Salmon's vein.

Yours faithfully,



Jack K. Sturgess

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Rec'd: 7-3-85

COMSTAFF PROPRIETARY LIMITED

MEMORANDUM

*WPL
JRS 26/3/85*

→ WPL file

To: I G P WILDING
From: R W L SHAW
Subject: E. RENISON - TIN AND SALMONS VEINS
Date: 25 February 1985

I have studied the folio of documents which refer to the up-dated study on the Tin Salmons resource. It is evident that not only are the "Possible" resource category grades hopelessly inadequate - but the "Probable" category grade leaves something to be desired.

GAB and JKS go for contract, high grade mining as the only way to exploit the resource and as we discussed I have had a look at the data with this in mind.

SALMONS VEIN

The criteria for highgrading the Salmons Vein are (JKS) is 0.25×10^6 tonnes at not less than 10% Pb with a minimum width of 3m. A cut-off value is not quoted so the approach taken is to take the Pb/Ag facies of the Salmons Vein which exceeds the previously determined \$35 combined metal insitu value and maximise the lead portion of the system. In all but one hole it has been necessary to dilute either moderate or high grade mineralisation with anomalous vein material to achieve the 3m TW minimum. It should also be noted the paltry contribution of copper and tin in this part of the vein have been discounted.

TABLE 1

Hole	Interval	Est.TW	Pb%	Zn%	Agppm	SG	Est. Tonnes
HIGH GRADE ZONE							
RBE 7	81.5-86	3	8.42	2.77	117	3.4	61200
RBE 5	160.6-168.1	5	14.37	3.44	221	3.6	52200
RBE 9	90-95.7	3	3.89	1.95	126	3.3	37125
RBE 10A	220.4-225.0	3	15.23	4.5	436	3.7	49395
Sub total			10.81	3.22	225		199920
MARGINAL ZONE							
RBE 30	88.4-92.8	3	1.05	3.55	110	3.3	46650
RBE 34	87-91.3	3	2.42	2.87	116	3.3	46530
RBE 11	209.1-213.6	3	1.43	4.21	59.4	3.3	72000
Sub total			1.60	3.55	90		165180
HIGH GRADE & MARGINAL							
			6.64	3.39	164		365100

From the above table it is seen that the minimum requirement of grade can be met with a 20% shortfall in tonnes. However adjacent to the "ore" is a zone of marginal grade material. It has a similar metal budget and there is sufficient room to make up the tonnage shortfall by infill drilling. ✓

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Opportunities for Additional Reserves Elsewhere

Two drillholes suggest the possibility of additional, similar facies reserves:-

Hole	Drill Interval	Pb%	Zn%	Ag ppm	Remarks
RBE 21	214.7-215.8	3.94	3.77	84	South of Murchison Highway beneath strong surface geochemistry
RBE 27	429-429.9	9.59	5.13	462	600m S of RBE 21, in an area of low drill density with partially tested surface geochemistry. True relationship of this deep intercept difficult to judge.

RBE 21 and 27 would constitute targets worth of follow-up in the event exploitation of the Salmons system took place. They are not recommended for investigation in the short term as a means of up grading the Salmons resource itself. ✓?

TIN VEIN

JKS suggests a reserve of 0.35×10^6 at a mineable grade of 1% Sn, with some open cut potential, say 70,000 t of the latter.

The possibility that the desired resource can be achieved is seen in the following tabulation:

Surface/Near Surface

Blocks	Width	Grade Sn%	Tonnes
"C"	2.7m	0.73%	19 500
RBE 48	2.0m	2.4%	18 000
Sub Total		1.53%	37 500

Underground

Blocks X1, RBE 41,25 and 33.		1.23%	283 000
TOTAL		1.27%	320 500

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Further research is required particularly into the distribution of surface material of the desired grade (JKS 3.2.2, b). Several zones, A, B, C and D are blocked out by DST based on 0.3% Sn cut off totaling approximately 80 000 tonnes at about 0.6% Sn.

The cut off must be increased in order to pull up the grade, but it looks possible that the resource required exists.

CONCLUSIONS

Neither the Tin nor the Salmons Vein quite meet the JKS requirements. Both have a good possibility of providing the desired resource with the input of:-

Tin Vein: a detailed review of data to determine near surface potential and what further field work is required to confirm the findings.

Salmons Vein: infill drilling is required between the High Grade and Marginal areas.

Action to implement the conclusions is dependant on discussion to formulate a policy for possible exploitation of the resources.

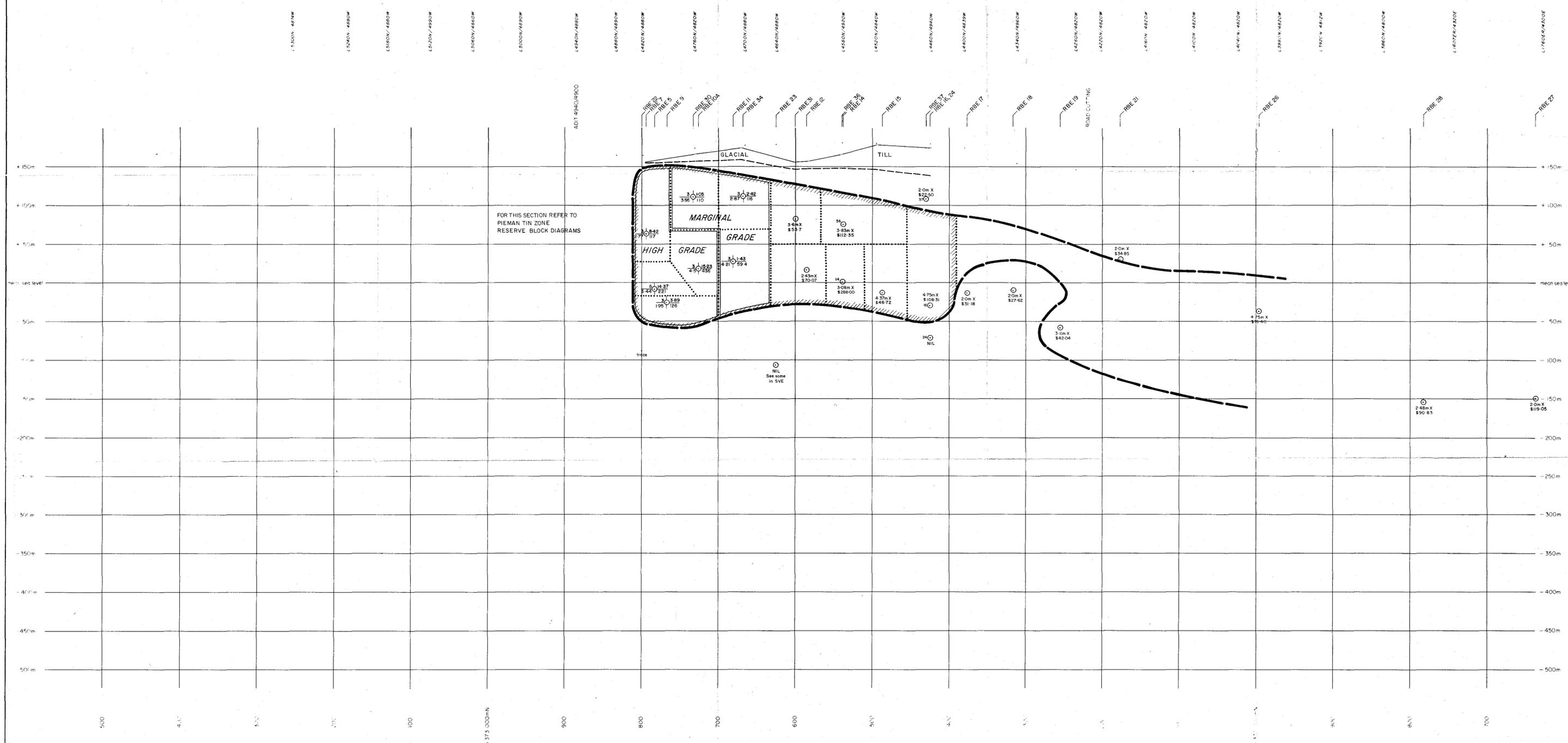
Regards,



R W L SHAW

Attached Long Section Tin Vein
" " Salmons Vein.

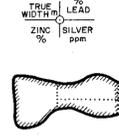
RWLS/hp



PROBABLE ORE

BLOCK	TW	AREA	TONNES S.G. 3.4
RBE 7	2.04	6000	4161.6
RBE 5	6.41	2948	64248.712
RBE 9	2.34	3740	29755.44
RBE 30	2.82	4712	45178.656
RBE 10A	3.47	4460	52619.08
RBE 34	3.02	4692	48177.456
RBE 11	4.21	7276	104148.66
RBE 31	3.6	4864	59535.36
RBE 12	2.43	5460	45110.52
RBE 14	3.08	4100	42935.2
RBE 36	3.83	6608	86049.376
RBE 15	4.37	4730	70278.34
RBE 16	4.75	8704	140569.6

TOTAL 830222.38



Salmons Vein probable ore block
Polymetallic (Pb, Zn, Cu, Ag, Sn)
Dotted line demarks area of influence of each hole.

Probable reserve 0.7325 million tonnes at
 Sn 0.187%
 Cu 0.615%
 Pb 3.173%
 Zn 2.241%
 Ag 104ppm (3.3oz.t)

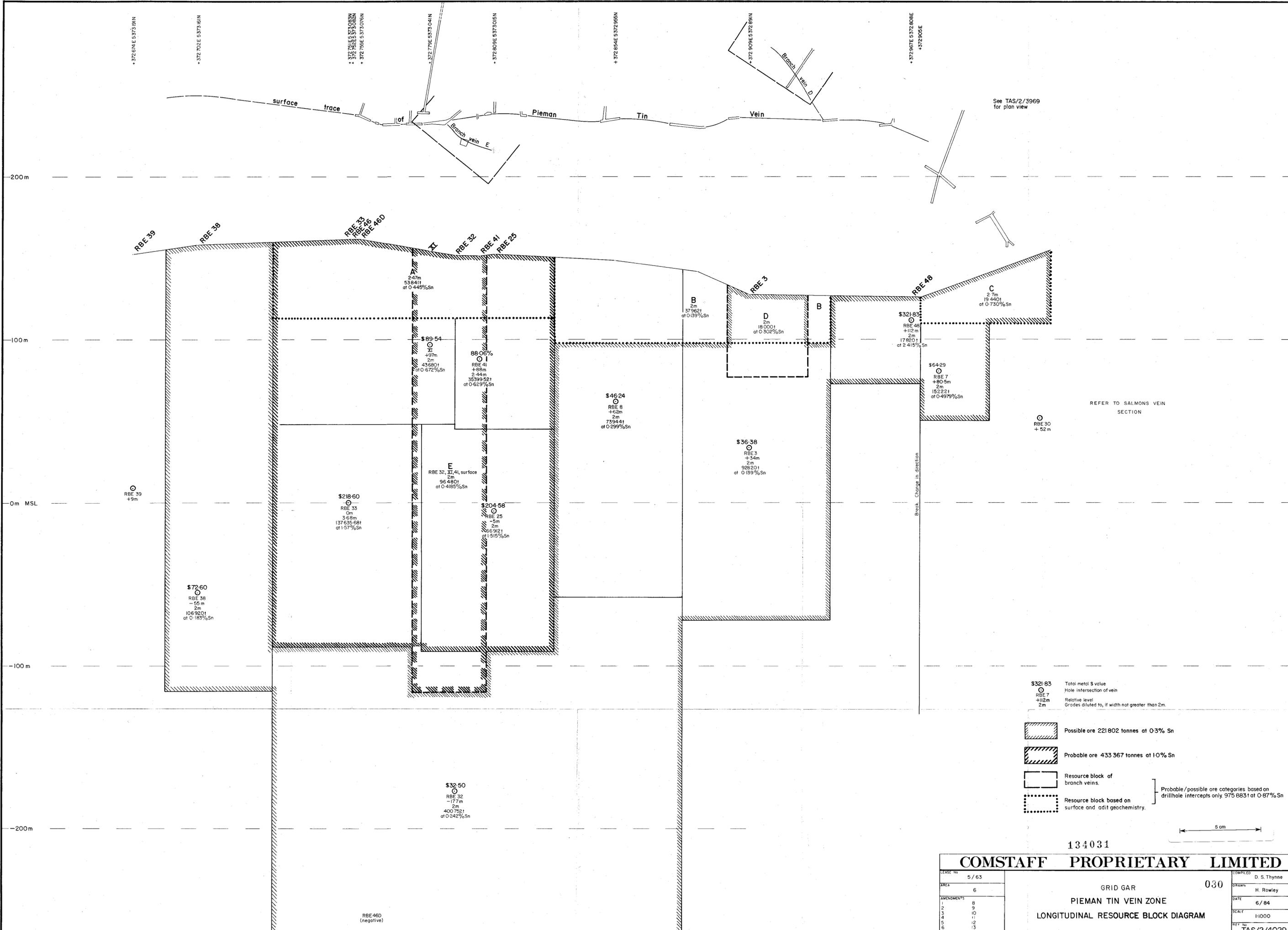
Possible ore 816000 tonnes at length weighted indicated grades 0.1% Sn, 0.1% Cu, 1.213% Pb, 1.317% Zn, 50ppm (1.6oz.t) Ag

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5 cm

For plan view see TAS/2/3970

COMSTAFF PROPRIETARY LIMITED			
PROJECT	RENISON - EL 5/63 AREA 6		
AREA	GAR GRID		
DATA	LONGITUDINAL SECTION ALONG 372.875mE SALMONS VEIN PROBABLE AND POSSIBLE ORE		
DRAWN	RWLS/DST	SCALE	1:2500 029
AMENDED	HR 6/84	REF No	TAS/2/4202
	5/3/85		



See TAS/2/3969 for plan view

REFER TO SALMONS VEIN SECTION

- -
 -
 -
- Probable/possible ore categories based on drillhole intercepts only 975 8831 at 0.87% Sn

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COMSTAFF PROPRIETARY LIMITED

CEASE No	5/63
AREA	6
AMENDMENTS	
1	8
2	9
3	10
4	11
5	12
6	13
7	14

GRID GAR 030
 PIEMAN TIN VEIN ZONE
 LONGITUDINAL RESOURCE BLOCK DIAGRAM

COMPILED	D. S. Thynne
DRAWN	H. Rowley
DATE	6/84
SCALE	1:1000
REF No	TAS/2/4029

-354m base level for RBE 32 block

85-7428