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PRELIMINARY ECONOMIC REVIEW

OF

THE GRUM AND ASSOCIATED DEPOSITS

YUKON TERRITORY

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Toronto, Ontario
July 31, 1975

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SUMMARY

In drilling to date at the Grum property a continuous and probably mineable reserve of 13,185,075 tons, grading 4.20% Pb, 7.02% Zn and 1.96 oz./ton Ag has been indicated above the 3400 ft. level along a length of 1800 ft. and a width of 800 ft. There is the added potential, on the basis of the current successful step-out drilling, that a similar mineral reserve can be outlined which would be sufficient for production at the rate of 5,000 t.p.d. for 15 years.

The estimated total capital costs, based on 1975 prices, are \$82,955,723. Of this total estimate \$66,834,723 is required for a 5,000 t.p.d. concentrator and surface facilities, and \$16,121,000 is for underground mine development.

Operating costs, based on 1975 prices, are estimated at \$7.76 per ton for mining and \$5.13 per ton for milling and surface facilities. Freight cost are calculated at \$2.00 per ton, based upon shipment of concentrates to Skagway. The total operating cost is, therefore, \$14.89 per ton and includes administrative costs.

A room and pillar mining method is proposed with stoping by horizontal undercut and sand fill. This will permit fairly close grade control. Dilution has been calculated at 10%, grading 4% combined lead-zinc and 0.8 oz./ton silver. The estimated grade of millfeed is, therefore, 3.93% Pb, 6.62% Zn and 1.85 oz./ton Ag.

Only preliminary metallurgical test work has been undertaken by Noranda; however, based upon the reported performance at Anvil and some recent test work by the Dowa Company a recovery of 83% for lead-zinc would appear to be justified. A recovery of 80% is estimated for silver.

Based upon a price of 21¢/lb. for lead, 36¢/lb. for zinc and \$4.20/oz. for silver, the net smelter return per ton of ore is \$30.11. The operating profit is, therefore, \$15.22 per ton or \$26 million per year.

In our forecast of the cash flow, assuming a three year preproduction phase, the capital requirement of \$82,950,000 over three years is increased to \$91,597,000 through interest charges. The debt would be retired in five years and the

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cash flow available for distribution, after debt retirement and after payment of Yukon royalty and income taxes, would vary from \$13 million to \$15 million per year.

The present value, at a discount factor of 10% for a 10 year operation, is \$33 million at the time of commencement of production and similarly, for a 15 year period, is \$52 million. A 15 year operation would entail the mining of 26,000,000 tons of ore.

Our sensitivity study shows that variations in the zinc price and the mill recovery are most critical. Operating costs are moderately significant; however, changes in capital costs are secondary. A change of 10% in the price of zinc creates a difference of \$3,000,000 or 11% in the annual operating profit. A price change of 10% in all metals creates a change of \$5.3 million or 20% in the annual operating profit. A change of 5% in the recovery of zinc from the plant creates a difference of \$1.8 million or 7% in the annual operating profit.

It is, therefore, apparent that, since the price of metals is the most sensitive factor in the operation, a favourable future may be anticipated because the current metal prices are depressed below their historical levels in relation to labour and other costs.


C. E. Michener, Ph.D., P. Eng.

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INTRODUCTION

This report is prepared at the request of AEX Minerals Corporation to obtain an "order-of-magnitude" estimate of the economic potential of the Grum and related lead-zinc-silver deposits currently under exploration in the Faro District, Yukon.

At the Grum deposit development drilling is now in progress to confirm continuity of the mineralization indicated in the 1974 programme. A development decline is being driven towards the mineralized zones, following which two declines will be driven down the plunge of the zone. From the declines detailed underground drilling will be carried out to determine outlines of the mineral reserves for stoping. In addition, considerable surface drilling is in progress to extend the limits of the zone.

This programme is estimated by Kerr Addison to cost about \$6,000,000 by the end of 1975; however, these costs are not treated as part of the capital costs. At this stage no date can be set for production planning and the data on which our forecasts are based is accordingly preliminary.

Following an independent calculation of the Mineral Reserves by I. S. Thompson, P. Eng. of our firm, we requested J. S. Redpath Ltd. to review the reports by Kilborn Engineering Ltd. and by Canadian Mine Services Ltd. concerning capital and operating costs. Canadian Bechtel Ltd. undertook a preliminary review of the metallurgical and marketing data provided by the Noranda Ore Dressing Laboratory and by Noranda Mines. These recent reviews are filed as Appendices A, B, and C to this report.

Our forecast of profitability has been based upon estimates of capital and operating costs in 1975 dollars. No attempt has been made to escalate such costs to start-up date since a decision for production or the date is unknown at this time. We have assumed a production rate of 5,000 tons for a 10 year period based upon the currently drill-indicated reserves and, assuming that success in the present step-out drilling continues, we have also forecast profitability over a 15 year mine life. Federal income taxes and Yukon royalty have been applied to the cash flow for calculation of net profit and present value at a discount factor of 10%.

MINERAL RESERVES

The Grum deposit consists of several zones of lead-zinc sulphide mineralization, with accompanying silver values, which occur in phyllites dipping about 25° SW. The mineralized zones vary from a few feet to over 100 ft. in thickness and have been indicated in drilling over an area 5600 ft. long, 1200 ft. wide and up to 1200 ft. below surface to the 3000 ft. level. Distribution of mineralization is erratic in cross section (NS) owing to complex folding but is more regular in longitudinal section (EW) and appears to plunge about 10° NW.

The area between section 62W and 82W, a length of 2000 ft., has been drilled in more detail and Kerr Addison Mines plans to develop this block above the 3400 ft. level for initial production. In January 1975, based upon a drill hole grid of 400 ft. x 200 ft., Kerr estimated the following mineral reserves: 19,515,502 tons grading 4.15% Pb, 6.94% Zn and 1.92 oz./ton Ag. They suggested that their estimate could be 20% high due to the wide drilling pattern so that reserves could be reduced to about 15,000,000 tons of the same grade.

In a report dated June 27, 1975, I. S. Thompson, P.Eng. of our firm estimated total reserves above the 3400 ft. level between sections 63W and 81W, a length of 1800 ft., and over a width of 800 ft. (7N to 1S) as follows:

<u>Class</u>	<u>Tons</u>	<u>% Pb</u>	<u>% Zn</u>	<u>oz./ton Ag</u>
Drill-indicated zones	10,015,825	4.26	7.22	1.98
Drill-inferred zones	<u>3,169,250</u>	<u>4.01</u>	<u>6.39</u>	<u>1.88</u>
Total Mineable Reserves	<u>13,185,075</u>	<u>4.20</u> *	<u>7.02</u> *	<u>1.96</u> *
Additional Drill-indicated blocks	<u>1,623,500</u>	<u>3.70</u>	<u>5.05</u>	<u>1.71</u>
GRAND TOTAL RESERVES	<u>14,808,575</u>	<u>4.14</u>	<u>6.80</u>	<u>1.93</u>

* Dilution factor applied to this grade in estimate of net smelter returns. Cut-off grade used is 4% Pb+Zn.

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There is a good correlation between the two estimates considering that the latter estimate has the advantage of drill data on a 200 ft. x 200 ft. grid. Details of the reserve estimates are found in Tables II to VI and in the longitudinal sections accompanying Mr. Thompson's report, which is attached as Appendix A.

It is apparent therefore that within this area to be initially developed there are reserves sufficient for at least 8 1/2 years production at the rate of 1,750,000 tons per year. Below the 3400 ft. level additional reserves can probably be developed, and, in addition, it is possible that a further 15,000,000 tons of reserves can be found in the adjacent 1800 ft. of strike length from section 81W to 99W if the current step-out drilling programme shows continuing promise.

In the long term, it is apparent that there is the potential of discovering substantial additional reserves since the area drilled in detail to date represents only 25% of the total length of the lead-zinc mineralization between the Champ and the Firth zones.

MINING CONCEPT AND MINING COSTS

The mining plan, proposed by Canadian Mine Services Ltd., is schematic at present and is basically a room and pillar method with servicing by a vertical shaft connected to a ramp system on the 3400 ft. level, which initially would be the main haulage level. (Levels are related to elevation above sea level and ground surface approximates 4200 ft. a.s.l.). The proposed six-compartment shaft would be sunk to a depth of 1500 ft. on section 84W with primary crushing facilities located below the 3400 ft. level. The main access is by a ramp driven down the plunge of the zone to the production shaft.

A cut and fill mining method has been proposed to avoid excessive dilution from an incompetent phyllite hanging wall.

The stoping method is horizontal ~~under~~ cut and sand fill with pillars, 20 ft. x 20 ft., on a regular pattern and a stope width of 40 ft.; extraction is estimated to be 84%.

A representative block of ore is assumed to be 45 ft. thick. It is developed by means of a horizontal undercut 15 ft. thick followed by sand fill and two subsequent horizontal slices and fill of the same thickness. Dilution is assessed at 10% by C.M.S. (see Grade Control).

Stoping operations are completely mechanized. A typical operating unit consists of two twin boom jumbo drills (probably the new electric jumbo); an 8 yard load haul dump unit; a rock bolt jumbo equipped with a drill boom and an operators basket; and a blaster's service truck. Auxilliary equipment includes personnel vehicles, a road maintenance grader and a mobile shot-crete unit.

The operating costs for mining, as estimated by Canadian Mine Services and Redpath, are shown in the following table: (Estimates are in 1975 Dollars)

Table 1

Mining Costs
(5,000 t.p.d.)

	Cost/ton CMS Report (1974)	Cost/ton Revised Redpath (1975)
Production drilling	0.59	0.95*
" blasting	0.36	0.36
" explosives	0.55	0.55
Mucking	0.48	0.96*
Rockbolting	0.68	1.09*
Screening or shot-crete	0.10	0.10
Handling waste (inclusions, etc.)	0.75	0.75
Backfill	0.50	0.50
Track haulage	0.16	0.20
Primary crushing	0.25	0.25
Hoisting	0.20	0.20
Power	0.50	0.83*
Ventilation & mine heat	0.23	0.23
Pumping	0.05	0.05
Surface labour	0.26	0.28
General administration	1.50	1.08
Cost/ton hoisted	<u>7.16</u>	<u>8.38</u>

* The higher Redpath estimate assumes a lower productivity and consequently increased manpower and number of operating stopes with associated higher power consumption.

MILLING AND SURFACE OPERATING COSTS

Kilborn have estimated the capital and operating costs of the surface plant including an allowance for townsite maintenance. Redpath revised the Kilborn estimate in the context of determining if duplication or omission had occurred between the estimates of surface and underground operating costs. A comparison of the two estimates is shown as Table 2: (Estimates in 1975 Dollars:

Table 2

Operating Cost - Mill & Surface Plant

	<u>Kilborn Cost/ton</u>	<u>Redpath Revised Cost/ton</u>
Administration labour	\$ 0.064	\$ 0.101
Surface maintenance labour	0.250	0.308
Concentrator and assay laboratory labour	0.444	0.502
Engineering and geology labour	0.144	0.230
Surface maintenance supplies	2.286	0.286
Concentrator and assay laboratory supplies	2.253	2.253
Engineering and geology supplies	0.023	0.023
Electrical	1.248	1.248
General expense	-	0.506*
TOTAL COST/TON MILLED	<u>\$ 4.712</u>	<u>\$ 5.457</u>

* The Redpath allowance of \$0.506/ton in general costs includes a cafeteria subsidy of \$0.40/ton which we regard as a contingency factor and difficult to assess at this stage.

To arrive at a suitable cost estimate for our valuation we averaged the Kilborn and Redpath costs after deducting the general expense included by Redpath and then added in a reduced allowance for general expenses

Basic cost - \$4.71 + (5.46 - 51¢) ÷ 2 = \$4.83/ton
Incremental general cost - 60% of 51¢, say 0.30/ton
Total mill and surface cost/ton \$5.13/ton

Bechtel, in their preliminary examination of Kilborn's operating costs, have indicated that an allowance should be made for head office management fees and for possibly higher labour and fuel costs. These comments have been suitably covered, we believe, by the more detailed Redpath study.

A potentially significant cost reduction would be achieved if hydroelectric power could be derived from the Aishibik Falls plant. This should be regarded as a potential "plus factor" in any estimate of operating costs.

Secondly, it is anticipated that as the metallurgy is better known cost savings can be made with respect to the amount of reagents used since these constitute almost 50% of the operating costs.

MARKETING, TREATMENT AND TRANSPORTATION COSTS

The price of lead has declined from a level of 24¢/lb. in January 1975 to 19¢/lb. as of July 1975. We have used a price of 21¢/lb. for our review. The price of zinc has remained high and is assumed to be constant at 36¢. Demand for silver seems to be strong and accordingly a price of \$4.25/oz. has been used in our calculation. (This is \$1.00/oz. below current prices).

Treatment charges used in our study are those which are common in the metal trade although lower costs may be obtained depending upon the location of sale of product. It has been assumed that concentrates are sold F.O.B. Skagway. A derivation of the net smelter return values is shown below:

	<u>Gross Value</u>	<u>Treatment Charge</u>	<u>Net Smelter Return Value</u>
Lead	\$0.21/lb.	\$0.14/lb.	\$0.07/lb.
Zinc	\$0.36/lb	\$0.20/lb.	\$0.16/lb.
Silver	\$4.25/oz.	\$0.21/oz. (5% of value)	\$4.04/oz.

The gold content, which is assumed to be \$20/ton of lead concentrate based on performance at Anvil, will be equivalent to \$2.00/ton of ore treated.

Assuming the concentrates are sold F.O.B. Skagway, there would be a charge of approximately \$25.00/s.d.t. of concentrate for the truck haul from the mine to Whitehorse and for rail shipment from Whitehorse to Skagway plus storage and handling charges.

The transportation charge is thus \$2.00/ton of ore milled. With two large base metal mines in the area there is good reason to extend the Whitepass Railway to Faro. This would be a substantial saving in freight costs.

OPERATING COST SUMMARY

Mining (Average of CMS and Redpath)	\$ 7.76/ton
Milling	5.13/ton
Transportation	<u>2.00/ton</u>
Total	\$14.89/ton*

* Administration costs have been included in both mine and mill figures.

GRADE CONTROL

To maintain grade with an irregular ore outline requires fairly close and accurate mining on both footwall and hanging walls and tight fill. In most cases the overbreak in the hanging wall will be at the limits of the ore so that the diluting material will be poorly mineralized and probably grade less than 2% combined lead-zinc. However in the footwall a gradational contact exists and the overbreak will probably contain 4% to 6% combined lead-zinc; any overbreak into pillars, of course, will be in ore-grade material.

We have therefore estimated that the average material contained in the overbreak will be in the range of 4% Pb+Zn and 0.8 oz./ton Ag. Assuming dilution at 10% the grade of mill feed is calculated to be:

3.93% Pb, 6.62% Zn, 1.85 oz./ton Ag

Grade control can also be used to the advantage of the mining operation. By concentrating on higher-grade ore for the first 3 or 4 years of the operation a more rapid payback of capital could be obtained. It is probable that an average mining grade of 15% combined lead-zinc could be obtainable in the first 3 years of operation against an average overall mine grade of about 11%. This feature has not been taken to account in calculating the grade mill feed or the cash flow from the operation.

METALLURGICAL RECOVERY

Bench tests in 1974 by Noranda's Ore Dressing Laboratory on Grum drill core, assaying 3.55% Pb and 4.14% Zn, showed that separate lead and zinc concentrates could be achieved. The final lead concentrate assayed 53% Pb and 7.4% Zn with a recovery of 77.9% for lead. The final zinc concentrate assayed 51.8% Zn and 3.5% Pb with a recovery of 77.3% of the zinc. The heads were not assayed for silver; however, 23.84 oz./ton Ag reported in the lead concentrate.

Bechtel feel that the above recoveries are conservative and that recoveries will improve with (1) commercial operations; and, (2) treatment of higher grade material approaching diluted mine grade of 10.5% Pb + Zn. In addition, Dowa, a Japanese

smelter company, has reported to Kerr recently that recoveries of 90%+ for both lead and zinc were achieved on Vangorda ore, which is reported to be identical to Grum ore.

A chemical analysis of the lead and zinc concentrates by the Noranda Ore Dressing Laboratory, dated January 1975, follows:

	<u>Pb Conc.</u>	<u>Zn Conc.</u>
Ag	23.840 oz./ton	3.360 oz./ton
Pb	53.600%	3.520%
Zn	7.400%	51.600%
Cu	0.300%	0.220%
As	0.600%	0.050%
Cd	0.017%	0.051%
Fe	7.700%	7.400%
S	19.400%	30.800%
SiO ₂	4.600%	1.600%
Bi	0.009%	0.008%
Sb	0.198%	0.022%
CaO	0.400%	0.420%
Al ₂ O ₃	0.510%	0.230%
Au	0.170 oz./ton	0.002 oz./ton
MgO	0.170%	0.150%
Pyrite	13.920%	3.440%
Pyrrhotite	1.850%	8.850%
Pb as oxides	0.980%	0.430%
Zn as oxides	0.130%	0.340%
Hg	46.400 ppm	416.000 ppm

Bechtel report that provision should be made for more accurate determinations of mercury content in the zinc concentrate, since, for some smelters, this proportion is beyond the allowable limit and penalties may be assessed. Since the tests are preliminary, however, we have not applied any discount factor for mercury.

CAPITAL COSTS

The capital cost estimates for both the surface plant and for underground operations have been calculated on the basis of 1975 figures. No provision has been made for escalation to start-up date. This seems to be the only feasible way to approach the problem inasmuch as the date has not been set for production and this would have an important bearing on both the capital costs and the metal prices. Both these items are unknown quantities when viewed in terms of a minimum three years to commencement of production. We feel that the most rapid period of capital cost escalation has passed and that in the next three or four years capital costs may escalate in the range of 8% per year.

Mining Capital Costs

Table 3 overleaf shows a comparison between capital costs for mining at 3,000 t.p.d. by Canadian Mine Services (1974); a revision of this estimate by J. S. Redpath at 3,000 t.p.d.; and an upgraded estimate for 5,000 t.p.d. As noted previously, the basic increase in costs for 3,000 t.p.d. reflects an additional allowance for lower productivity/man shift and consequent increase in underground staff and related equipment.

In our calculations we have, therefore, used the Redpath estimate of \$16,121,000 for a 5,000 t.p.d. underground operation.

Surface Capital Costs

The capital cost estimates by Kilborn Engineering, later reviewed by Redpath, are both very preliminary, order-of-magnitude estimates and, therefore, caution should be exercised in extrapolation of such estimates. The Kilborn original estimate for a 3,000 t.p.d. operation was "mocked up" from their cost data prepared previously for the Mattagami Lake Mines' plant (3,000 t.p.d.). Their estimate for a 5,000 t.p.d. operation was "factored up" from this estimate and is \$63,238,723.

Redpath have added a further \$3,596,000 to this estimate to arrive at a total capital cost of \$66,834,723. This increase is mainly related to an allowance for additional housing units; however, it is thought that much of the housing could be arranged by separate financing and should not be included in preliminary estimates.

Table 3

CAPITAL COSTS - MINING

<u>Summary:</u>	<u>3,000 tons CMS Estimate</u>	<u>3,000 tons J. S. Redpath</u>	<u>5,000 tons J. S. Redpath</u>
Mining Equipment	\$ 1,470,000.00	\$ 1,822,000.00 *	\$ 2,469,000.00
Track haulage equipment	799,000.00	799,000.00	919,000.00
Primary ventilation & mine heat	100,000.00	250,000.00	300,000.00
	<u>\$ 2,369,000.00</u>	<u>\$ 2,871,000.00 *</u>	<u>\$ 3,688,000.00</u>
<u>Mine Development:</u>			
Track haulage	\$ 1,270,000.00	\$ 1,270,000.00	\$ 1,620,000.00
Access decline-incline	1,024,000.00	1,458,000.00	1,630,000.00
Cross-cut access to ore	684,000.00	684,000.00	1,026,000.00
Ore pass system	581,000.00	842,000.00	1,263,000.00
Sand fill bore-holes	50,000.00	100,000.00	150,000.00
Ground & water control	300,000.00	300,000.00	300,000.00
	<u>\$ 3,909,000.00</u>	<u>\$ 4,654,000.00</u>	<u>\$ 5,989,000.00</u>
<u>Production Shaft (1300')</u> :			
Mobilization	\$ 21,000.00	\$ 21,000.00	\$ 21,000.00
Sinking & installation materials	1,450,000.00	1,450,000.00	1,450,000.00
Collar construction	30,000.00	100,000.00	100,000.00
Equipment for production	255,000.00	255,000.00	255,000.00
Ground & water control	274,000.00	274,000.00	274,000.00
	<u>\$ 2,030,000.00</u>	<u>\$ 2,100,000.00</u>	<u>\$ 2,100,000.00</u>
<u>Crusher & Ancilliary Equipment:</u>			
Excavation - ore bins	\$ 80,000.00	\$ 160,000.00	\$ 160,000.00
- crusher battery, etc.	266,000.00	266,000.00	266,000.00
Equipment purchase & installation	1,111,000.00	1,111,000.00	1,111,000.00
Shotcrete & rockbolt	120,000.00	120,000.00	120,000.00
	<u>\$ 1,577,000.00</u>	<u>\$ 1,657,000.00</u>	<u>\$ 1,657,000.00</u>
	\$ 9,885,000.00	\$11,282,000.00 *	\$13,434,000.00
Management - say 20%	<u>1,977,000.00</u>	<u>2,256,400.00 *</u>	<u>2,687,000.00</u>
ESTIMATED CAPITAL COST	<u>\$11,862,000.00</u>	<u>\$13,538,400.00 *</u>	<u>\$16,121,000.00</u>

* - Addition error Redpath p. 13

On the other hand, Redpath note that an allowance should be made for a further \$3,000,000 capital to cover the cost of a transmission line and for more working capital. It is felt that these various factors will cancel each other so we have used the quoted cost of \$66,834,723 in our forecast of cash flow.

The total capital cost for surface and underground operations of the Grum deposit is, therefore, \$82,955,723. This data is included in the following summary of the economic parameters.

GRUM DEPOSIT

SUMMARY OF ECONOMIC PARAMETERS

Net Smelter Return (1975)

<u>Metal</u>	<u>Head Grade</u>	x	<u>Recovery</u>	x	<u>lb./ton</u>	x	<u>Smelter Return</u>	=	<u>\$/ton</u>	
Lead	3.93%		0.83%		2000		\$0.070(.21-.14)		4.56	
Zinc	6.62%		0.83%		2000		\$0.160(.36-.20)		17.58	
Silver	1.85 oz./t		0.80%		-		\$4.04(4.20 x .95)		5.97	
Gold	(\$20.00/ton lead conc. = \$2.00/ton of ore)									<u>2.00</u>
									<u>30.11</u>	

Operating Cost (1975 Dollars)

Mining (including administration)	7.76
Milling (" ")	5.13
Freight and storage (to Skagway)	<u>2.00</u>
	<u>14.89</u>

Operating Profit (1975 Dollars) 15.22

Capital Costs (1975 Dollars)

Surface	\$66,834,723
Underground	<u>16,121,000</u>
Total	<u>\$82,955,723</u>

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Table 4(a)

GRUM DEPOSIT

FORECAST OF CASH FLOW (\$000's)
 (Assumed 10 year life at 1,750,000 tons/year)

Metal Prices:
 Pb - 21¢/lb.
 Zn - 36¢/lb.
 Ag - \$4.20/oz.

Year	Preproduction			Production										Production Total	
	-3	-2	-1	1	2	3	4	5	6	7	8	9	10		
Operating Profit (before interest and taxes)	-	-	-	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	266,350	
Interest Charges (10%)	500*	2,250*	5,897*	9,160	7,583	5,899	4,094	2,157	353	-	-	-	-	29,246	
Yukon Royalty**	-	-	-	376	865	1,359	1,835	2,299	2,718	2,897	3,004	3,095	3,172	21,620	
Income Tax**	-	-	-	-	-	-	-	2,804	6,426	6,555	6,780	8,799	8,816	40,180	
Cash Flow from Operations	-	-	-	17,099	18,187	19,377	20,706	19,375	17,138	17,183	16,851	14,741	14,647	175,304	
Capital Requirements+ Cumulative Debt	10,000	25,000	47,950	1,335***	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	13,350	
Received (Repaid)°	10,500	37,750	91,597	(15,764)	(16,852)	(18,042)	(19,371)	(18,040)	(3,528)	-	-	-	-	91,597°	
Cash Flow Available for Distribution after Capital and Debt Requirements****	-	-	-	-	-	-	-	-	-	12,275	15,848	15,516	13,406	13,312	70,357
P.V. (10% discount) of Future Cash Flow Available for Distribution, at 3 yrs. before Production, for Successive Years****	24,880	27,367	30,104	33,115	36,427	40,070	44,078	48,486	53,335	46,394	35,186	23,189	12,102		

* - Assumes preproduction capital borrowed in mid-year.

** - Basic calculation sheets for royalty and income taxes available for examination.

*** - Taken as 2% of surface plant and equipment.

**** - AEX interest is 40% of cash flow and present value figure.

+ - Excludes estimated exploration expenditures of \$6,000,000 to the end of 1975.

° - Includes capitalized preproduction interest.

Table 4(b)

GRUM DEPOSIT

FORECAST OF CASH FLOW (\$000's)
 (Assumed 15 year life at 1,750,000 tons/year)

Metal Prices:
 Pb - 21c/lb.
 Zn - 36c/lb.
 Ag - \$4.20/oz.

Year	Preproduction			Production												Production Total				
	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	
Operating Profit (before interest and taxes)	-	-	-	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	26,635	399,525
Interest Charges (10%)	500*	2,250*	5,897*	9,160	7,583	5,899	4,094	2,157	353	-	-	-	-	-	-	-	-	-	-	29,246
Yukon Royalty**	-	-	-	376	865	1,359	1,835	2,299	2,718	2,897	3,004	3,095	3,172	3,237	3,294	3,342	3,382	3,415	3,415	38,290
Income Tax**	-	-	-	-	-	-	-	2,804	6,426	6,555	6,780	8,799	8,816	8,827	8,836	8,841	8,845	8,848	8,848	84,377
Cash Flow from Operations	-	-	-	17,099	18,187	19,377	20,706	19,375	17,138	17,183	16,851	14,741	14,647	14,571	14,505	14,452	14,408	14,372	14,372	247,612
Capital Requirements+	10,000	25,000	47,950	1,335***	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	1,335	20,025
Cumulative Debt Received (Repaid) °	10,500	37,750	91,597	(15,764)	(16,852)	(18,042)	(19,371)	(18,040)	(3,528)	-	-	-	-	-	-	-	-	-	-	91,597 °
Cash Flow Available for Distribution after Capital and Debt Requirements****	-	-	-	-	-	-	-	-	12,275	15,848	15,516	13,406	13,312	13,236	13,170	13,117	13,073	13,037	13,037	135,990
P.V. (10% discount) of Future Cash Flow Available for Distribution, at 3 yrs. before Production, for Successive Years****	39,304	43,235	47,559	52,315	57,547	63,302	69,632	76,595	84,255	80,406	75,599	64,343	57,371	49,796	41,540	32,524	22,659	11,852	-	-

* - Assumes preproduction capital borrowed in mid-year.

** - Basic calculation sheets for royalty and income taxes available for examination.

*** - Taken as 2% of surface plant and equipment.

**** - AEX interest is 40% of cash flow and present value figure.

+ - Excludes estimated exploration expenditures of \$6,000,000 to the end of 1975.

° - Includes capitalized preproduction interest.

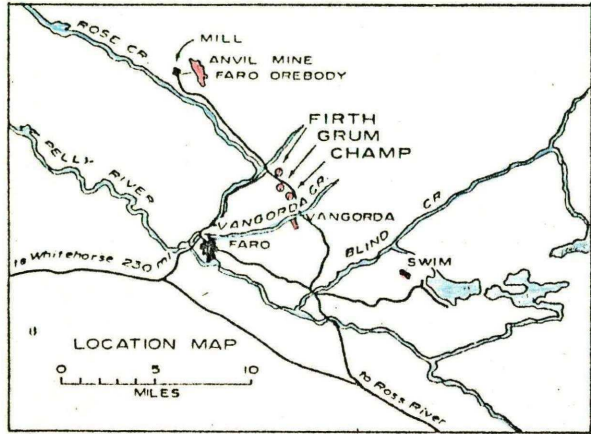
GRUM DEPOSIT

SENSITIVITY ANALYSIS

Effect on Operating Profit of Stated Changes in Variable Factors
in Descending Order of Sensitivity

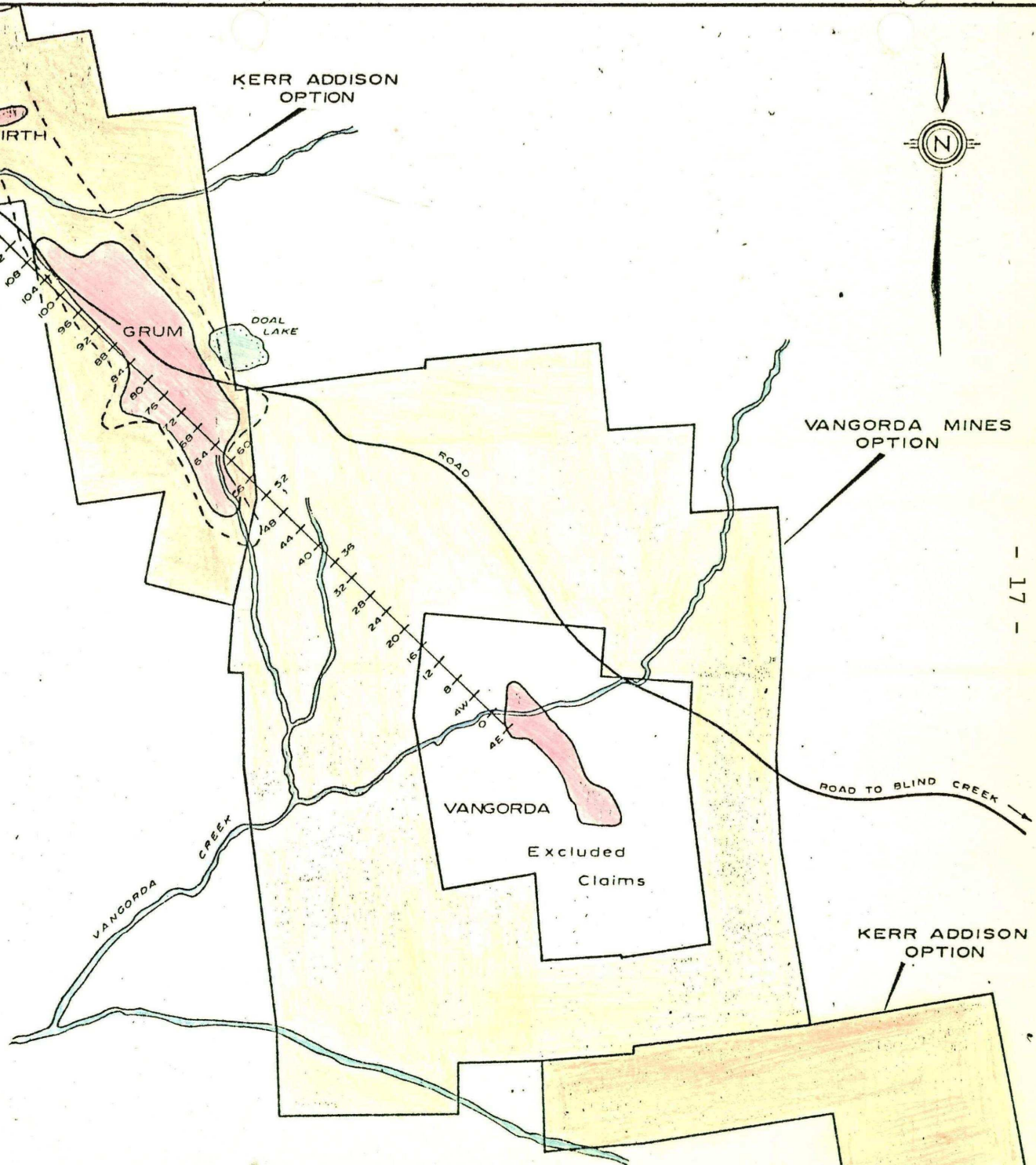
<u>Variable</u>	<u>A Change of</u>	<u>Change in Value per Ton of Ore Milled</u>	<u>Change in Annual Operating Profit - 1.75 m.t.p.a.</u>
Price of All Metals	+ 10%	\$3.03	<u>\$5,303,000</u>
- Price of Zn	+ 10%	1.76	3,080,000
- Price of Ag	+ 10%	0.61	1,068,000
- Price of Pb	+ 10%	0.46	805,000
- Price of Au	+ 10%	0.20	350,000
Recovery of All Metals	+ 5%	1.79	<u>\$3,131,000</u>
- Recovery of Zn	+ 5%	1.06	1,849,000
- Recovery of Ag	+ 5%	0.36	637,000
- Recovery of Pb	+ 5%	0.27	470,000
- Recovery of Au	+ 5%	0.10	175,000
Operating Cost	+ 10%	1.52	<u>2,660,000</u>
Capital Cost	+ 10%	-	<u>\$ 916,000 (1)</u>

(1) Assuming spread over 10 year forecast period. If over 6 year forecast payback period then this becomes \$1,533,000.

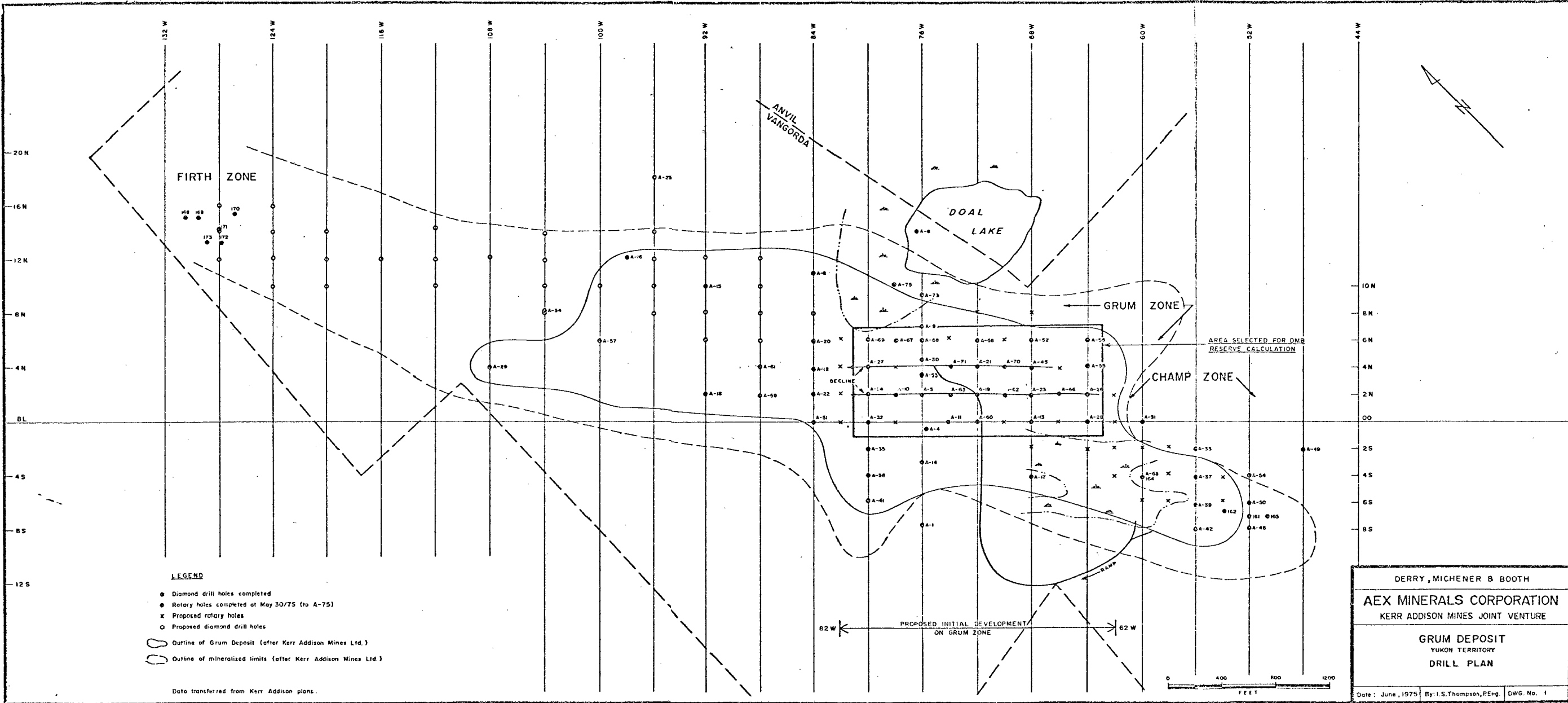


KERR ADDISON MINES LTD.
 VANGORDA CREEK AREA
 PROPERTY MAP

SHOWING CLAIM OUTLINES, OWNERSHIP
 AND Pb-Zn DEPOSITS



Note: Map drawn by Kerr Addison Mines Ltd. - D.M.&B



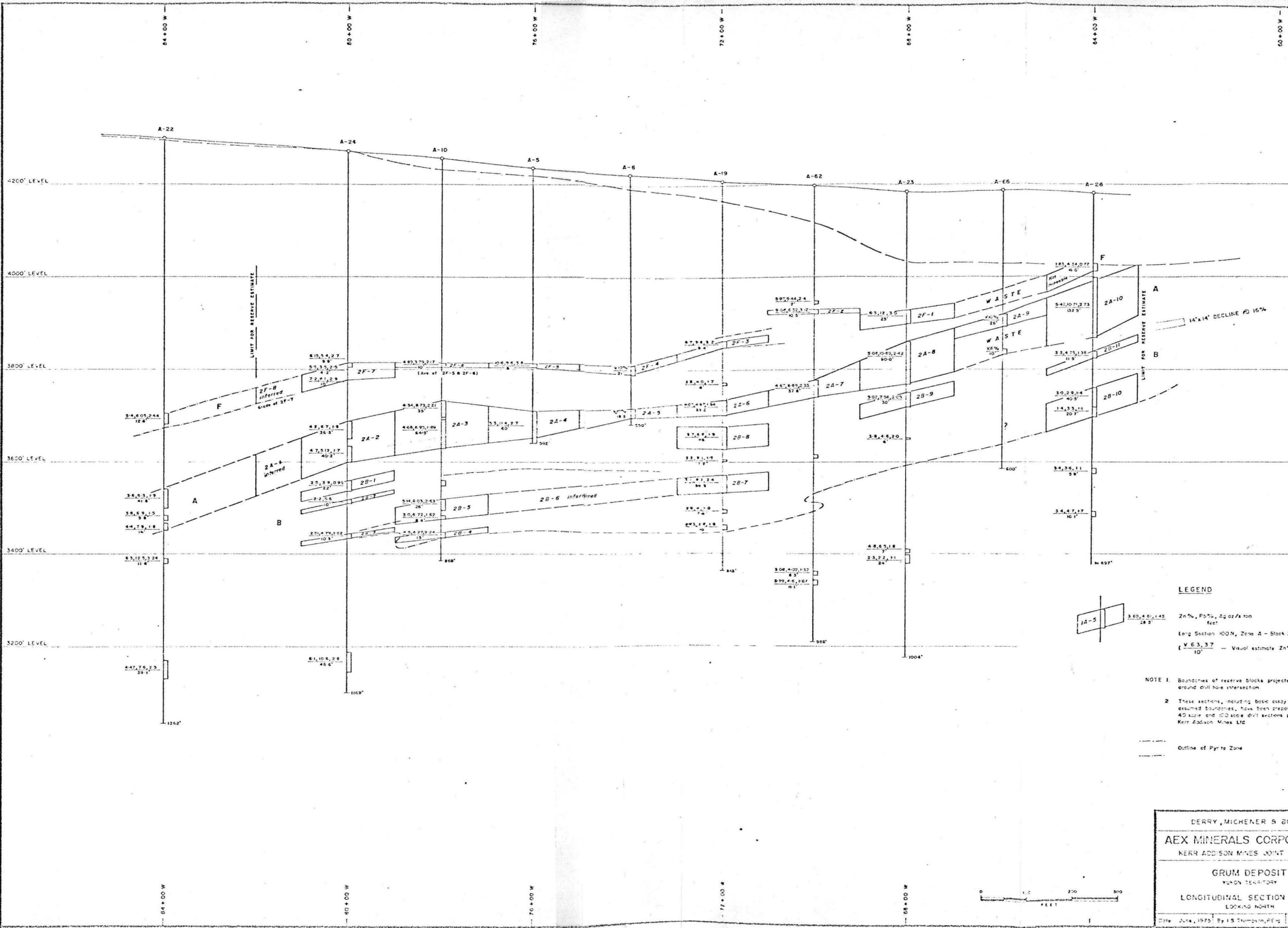
LEGEND

- Diamond drill holes completed
- Rotary holes completed at May 30/75 (to A-75)
- X Proposed rotary holes
- Proposed diamond drill holes
- Outline of Grum Deposit (after Kerr Addison Mines Ltd.)
- Outline of mineralized limits (after Kerr Addison Mines Ltd.)

Data transferred from Kerr Addison plans.



DERRY, MICHENER & BOOTH		
AEX MINERALS CORPORATION		
KERR ADDISON MINES JOINT VENTURE		
GRUM DEPOSIT		
YUKON TERRITORY		
DRILL PLAN		
Date: June, 1975	By: I.S. Thompson, P.Eng.	DWG. No. 1



LEGEND

Zn%, Pb%, 2g oz/ton
 Long Section 100N, Zone A - Block 5
 (V 63.37 — Visual estimate Zn%, Pb%)

NOTE 1: Boundaries of reserve blocks projected for 100 feet around drill hole intersection

NOTE 2: These sections, including basic assay averages and assumed boundaries, have been prepared from 40 zone and 300 scale drill sections provided by Kerr Addison Mines Ltd.

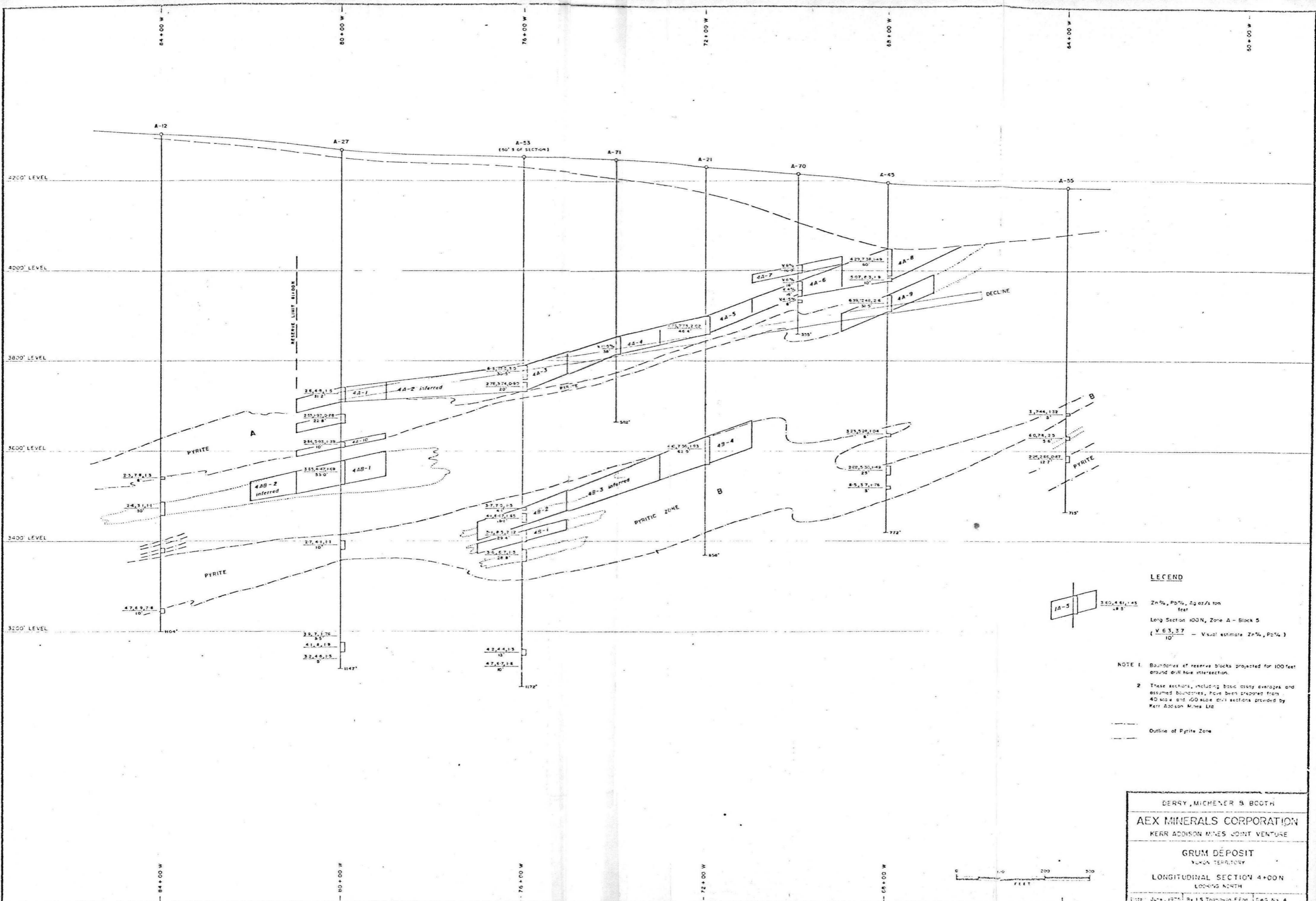
Outline of Pyrite Zone

DERRY, MICHENER S 800TH
AEX MINERALS CORPORATION
 KERR ADDISON MINES JOINT VENTURE


GRUM DEPOSIT
 YUKON TERRITORY
LONGITUDINAL SECTION 2+00N
 LOOKING NORTH

Date: June, 1975 By: I.S. Thompson, P.E. DWG No. 3






LEGEND

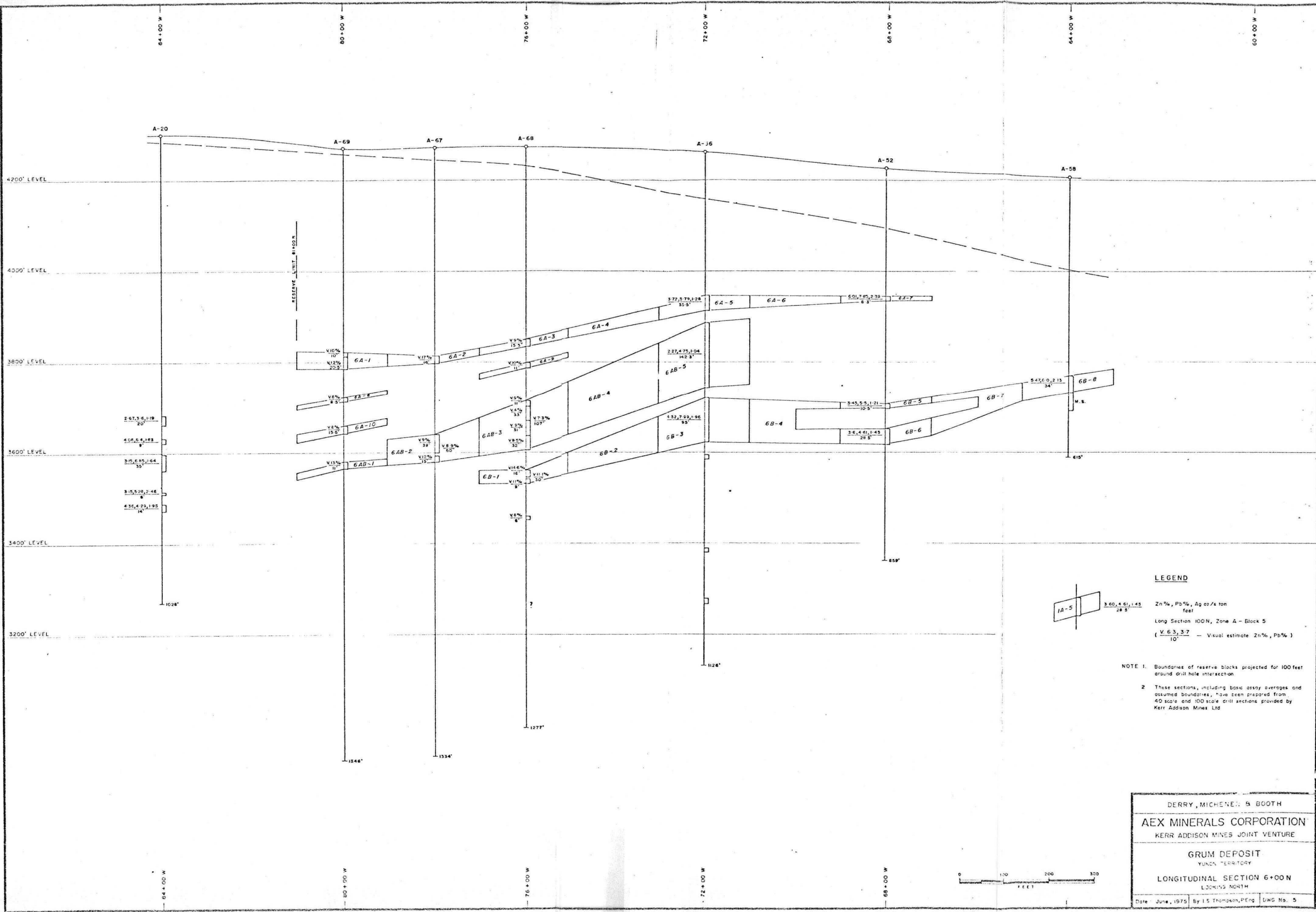

 360,461,45
18.5
 Zn%, Pb%, Ag oz/s ton
 feet
 Long Section 100N, Zone A - Block 5
 (V 63,37 / 10) - Visual estimate Zn%, Pb%)

NOTE 1. Boundaries of reserve blocks projected for 100 feet around drill hole intersection.
 2. These sections, including basic assay averages and assumed boundaries, have been prepared from 40 scale and 100 scale drill sections provided by Kerr Addison Mines Ltd.

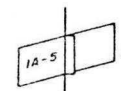

 Outline of Pyrite Zone

BERRY, MICHENER & BOOTH
 AEX MINERALS CORPORATION
 KERR ADDISON MINES JOINT VENTURE
 GRUM DÉPÔT
 YUKON TERRITORY
 LONGITUDINAL SECTION 4+00N
 LOOKING NORTH
 Date: June, 1974 By: I.S. Thompson, FENG DAG No. 4





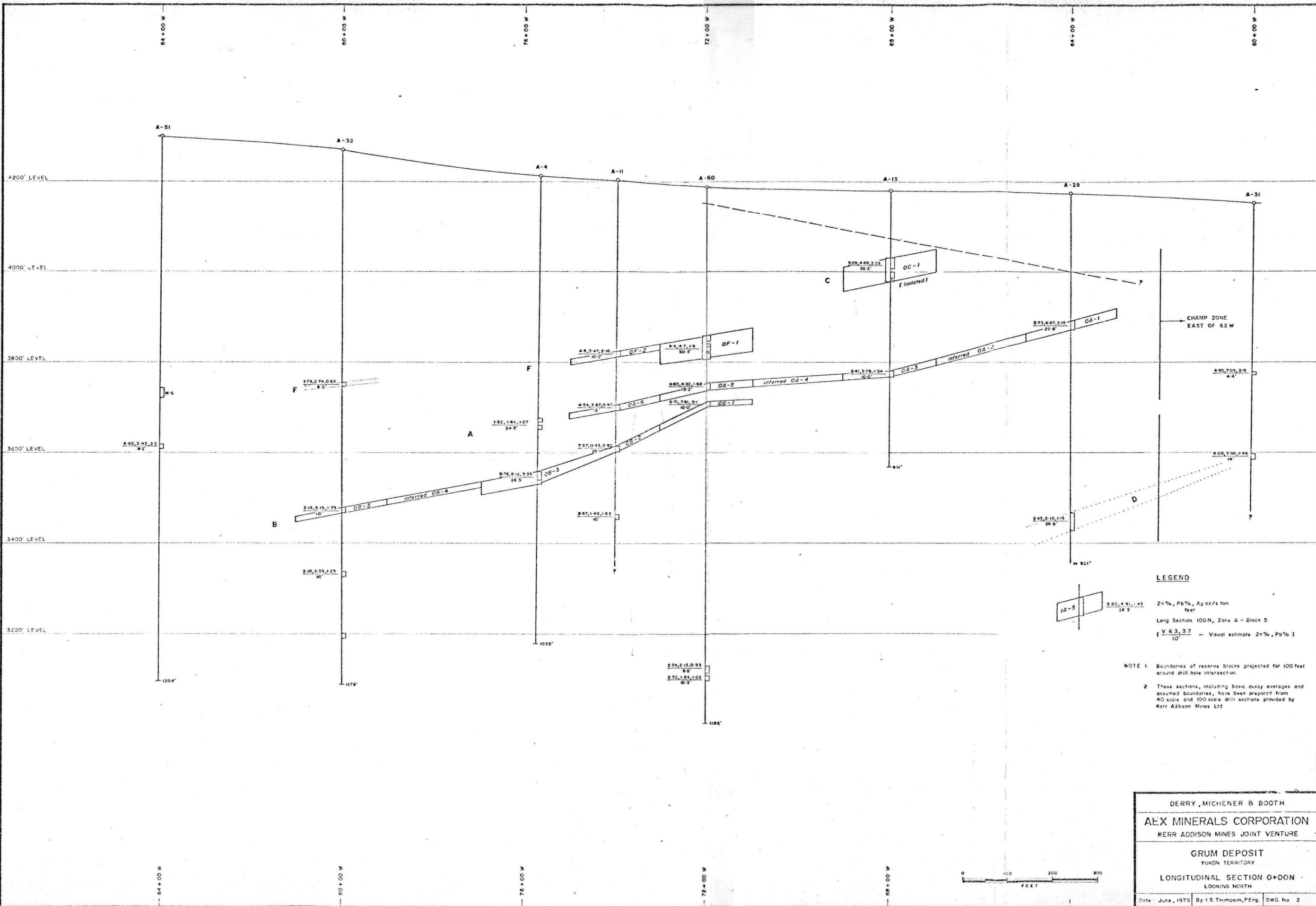
LEGEND


 3.60, 4.61, 1.43
28.5' Zn%, Pb%, Ag oz/t ton
feet
 Long Section 100N, Zone A - Block 5
 ($\frac{V. 6.3, 3.7}{10'}$ - Visual estimate Zn%, Pb%)

NOTE 1. Boundaries of reserve blocks projected for 100 feet around drill hole intersection.
 2. These sections, including basic assay averages and assumed boundaries, have been prepared from 40 scale and 100 scale drill sections provided by Kerr Addison Mines Ltd.

DERRY, MICHENER & BOOTH
AEX MINERALS CORPORATION
 KERR ADDISON MINES JOINT VENTURE
 GRUM DEPOSIT
 YUKON TERRITORY
LONGITUDINAL SECTION 6+00N
 LOOKING NORTH
 Date: June, 1975 By: I.S. Thompson, P.Eng. DWG No. 5





LEGEND

1A-5 $\begin{matrix} 3.60, 4.61, .45 \\ 28' 5" \end{matrix}$ Zn%, Pb%, Ag oz/ton feet

Long Section 100N, Zone A - Block 5

(V 6.3, 3.7 / 10' - Visual estimate Zn%, Pb%)

NOTE 1. Boundaries of reserve blocks projected for 100 feet around drill hole intersection.

2. These sections, including basic assay averages and assumed boundaries, have been prepared from 40 scale and 100 scale drill sections provided by Kerr Addison Mines Ltd.

DERRY, MICHENER & BOOTH
 AEX MINERALS CORPORATION
 KERR ADDISON MINES JOINT VENTURE

GRUM DEPOSIT
 YUKON TERRITORY

LONGITUDINAL SECTION O+00N
 LOOKING NORTH

Date: June, 1975 By: I.S. Thompson, P.Eng. DWG. No. 2

APPENDIX A

Appendix A

GRUM DEPOSIT ESTIMATE OF MINERAL RESERVES

I. S. Thompson, P. Eng., of Derry, Michener & Booth has made an independent estimation of a portion of the mineable reserves of the Grum zinc-lead-silver deposit that are proposed to be developed for initial production. The objective is to provide a reserve figure that can be used with reasonable confidence in an initial review of profitability.

The estimate is based exclusively upon drill hole geological and assay data derived from a set of 40 and 100 scale E-W longitudinal and N-S cross sections prepared by Kerr Addison Mines Limited. The sections show interpretative geology and assay averages which have been accepted at face value since the terms of reference precluded an examination of drill logs or a visit to the property. Kerr provided their report, dated January 1975, on the mineral reserves and AEX made available a report by Canadian Mine Services Ltd. on a schematic mining method.

The Grum deposit, as outlined by vertical drill holes from sections 52W to 108W, is reported to be elliptical in plan, 5600 ft. long, and about 1200 ft. wide. It is composed of several zones of sulphides or of mineralized phyllite rocks, varying from a few feet to over 100 ft. in thickness. These zones strike N-W, parallel to the geological trend, plunge about 10° to the northwest, and dip about 25°SW. The distribution of mineralization is extremely erratic in cross section (N-S), arising from the complex history of structural deformation. Lateral transposition of sulphide lenses has occurred along a series of minor folds and crenulations.

Between sections 62W and 88W, above the 3000 ft. level, Kerr Addison have estimated a Total Mineral Reserve of 25,422,167 tons, grading 4.01% Pb, 6.67% Zn and 1.86 oz./ton Ag with 0.02 oz./ton Au and 0.15% Cu. In addition, there is reported to be a further 1,500,000 tons of zinc-lead mineralization occurring immediately southeast of this and known as the Champ zone.

The area between section 62W and 82W, a length of 2000 ft., has been drilled in more detail and it has been proposed that initial production be derived from this block, from the surface down to the 3400 ft. level, a vertical range

of 800 ft. Mineralization has been intersected below this to the 3000 ft. level. The deposit would be mined by trackless horizontal undercut and sand fill and at present plans are in hand to drive two declines down the plunge of the zone on sections 2N and 4N.

Kerr Addison Reserve Estimate (62W-82W) Above 3400 Level

In January, 1975 Kerr Addison estimated the following reserves for this block:
19,515,502 tons, grading 4.15% Pb, 6.94% Zn, and 1.92 oz./ton Ag.
Their calculation was made assuming a rectangular area of influence, 400 ft. x 200 ft., around each drill hole, which was based upon the drill pattern at that time. It was reported that the reserve estimate could be about 20% high, i.e. it could be reduced to about 15,000,000 tons of the same grade.

Derry, Michener & Booth Estimate

It is estimated that the following continuous drill-indicated and inferred, and probably mineable, reserves are present above the 3400 ft. level, along a length of 1800 ft. between sections 63W and 81W, (see Table I):
13,185,075 tons, grading 4.20% Pb, 7.02% Zn, and 1.96 oz./ton Ag.

The drill-indicated reserves are found over a 300 ft. vertical range as one major (A) and two lesser zones (AB & B), and a smaller, but higher grade, zone (F), about 50 ft. above zone A. Inferred reserves are internal reserves lying within untested portions of the drill-indicated zones. In addition, there are 1,623,500 tons, grading 3.70% Pb, 5.05% Zn and 1.71 oz./ton Ag which are present as several discontinuous blocks which branch from the zones or lie between them.

D. S. S. LTD. A 14672

Table I

Grum Deposit Reserves (63W-81W)
Above 3400 ft. Level

<u>Class</u>	<u>Tons</u>	<u>% Pb</u>	<u>% Zn</u>	<u>oz./ton Ag</u>
Drill-indicated zones	10,015,825	4.26	7.22	1.98
Drill-inferred zones	<u>3,169,250</u>	<u>4.01</u>	<u>6.39</u>	<u>1.88</u>
Total Mineable Reserves	<u>13,185,075</u>	<u>4.20</u>	<u>7.02</u>	<u>1.96</u>
Additional Drill- indicated blocks	<u>1,623,500</u>	<u>3.70</u>	<u>5.05</u>	<u>1.71</u>
GRAND TOTAL RESERVES	<u><u>14,808,575</u></u>	<u><u>4.14</u></u>	<u><u>6.80</u></u>	<u><u>1.93</u></u>

The drill hole data has been plotted on four longitudinal sections (00, 2N, 4N and 6N), representing a cross strike width of 800 ft.; details are provided in the Tables II to V, sections, and drill plan. In this calculation the area of influence of each drill hole is a 200 ft. x 200 ft. square assuming a minimum width of 10 ft. and a minimum average grade over this width of 7.5% Zn-Pb. Following the Kerr practice, a cut-off grade of 4% Zn+Pb has been used. A minimum reserve block is therefore 200 ft. x 200 ft. x 10 ft. ÷ 8 = 50,000 tons. Isolated mineral lenses have been ignored if it was determined that they would not support the cost of their development.

Conclusion

There is a good correlation between the Kerr and Derry, Michener & Booth estimate of mineral reserves when the Kerr estimate is reduced by 20% to 15,500,000 tons. On the basis of 1.75 million tons production per annum the total reserves would accordingly be sufficient for at least 8 1/2 years.

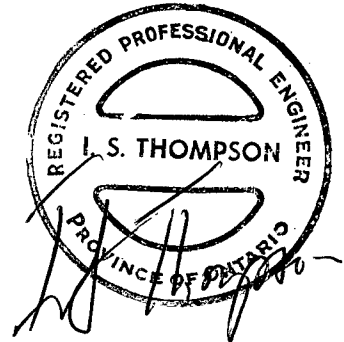
Although there is at present insufficient drill data to predict grades beyond the block from 63W to 81W, it is not unreasonable to expect that there will be an additional reserve of about 15 million tons in the interval 81W to 99W, if the current step-out drilling programme shows continuing promise.

Additional reserves are present between the 3400 ft. and 3000 ft. levels and could be developed at a later stage; the drill holes are too widely spaced to accurately calculate reserves at this stage.

Beyond the zones referred to above, it is probable that additional mineral reserves will be developed within the untested 1/2 mile strike length extending westwards toward the Firth zone.

Finally, the AEX-Kerr joint venture has the right to explore a large block of ground surrounding the original Vangorda deposit, which lies to the southeast of the Grum zone. Over the long term, it is not unreasonable to expect that satellite mineralization, or new mineralized bodies, can be found in detailed drilling beyond the limits of the Vangorda deposit.

B. V. C. LTD. A 14672



I. S. Thompson, P. Eng.

Toronto, Ontario
June 27, 1975

Table II

GRUM DEPOSIT RESERVES
(By Section)

Longitudinal Section 0+00 (63W-81W)		Above 3400 Level		8 cu.ft. = 1 ton	Cut-off Grade 4% Pb+Zn Minimum Mining Width 10 ft.		
<u>Zones & Blocks</u>	<u>Thickness (ft.)</u>	<u>Width (N-S)</u>	<u>Length (E-W)</u>	<u>Tons</u>	<u>Grade</u>		
					<u>% Pb</u>	<u>% Zn</u>	<u>Ag oz./ton</u>
A - Indicated	15.3	200	800	305,000	3.92	5.05	1.66
- Inferred	<u>14.5</u>	<u>200</u>	<u>400</u>	<u>145,000</u>	<u>3.52</u>	<u>5.13</u>	<u>1.82</u>
Total	<u>15.0</u>	<u>200</u>	<u>1200</u>	<u>450,000</u>	<u>3.79</u>	<u>5.01</u>	<u>1.71</u>
B - Indicated	15.4	200	800	307,400	5.57	8.80	3.03
- Inferred	<u>18.3</u>	<u>200</u>	<u>200</u>	<u>91,250</u>	<u>5.04</u>	<u>8.03</u>	<u>2.91</u>
Total	<u>16.0</u>	<u>200</u>	<u>1000</u>	<u>398,650</u>	<u>5.45</u>	<u>8.62</u>	<u>3.00</u>
F - Indicated	30.2	200	400	301,500	4.47	4.83	1.94
TOTAL INDICATED				913,900	4.65	6.24	2.21
TOTAL INFERRED				236,250	4.11	6.25	2.40
C - Blocks	56.3	200	200	282,500	5.29	4.68	2.23
TOTAL SECTION				<u>1,432,650</u>	<u>4.69</u>	<u>5.93</u>	<u>2.22</u>

- 5 -

27/6/75

I. S. Thompson

Table III

GRUM DEPOSIT RESERVES
(By Section)

Longitudinal Section 2+00N (63W-81W)		Above 3400 Level		8 cu.ft. = 1 ton	Cut-off Grade 4% Pb+Zn Minimum Mining Width 10 ft.		
Zones & Blocks	Thickness (ft.)	Width (N-S)	Length (E-W)	Tons	Grade		
					% Pb	% Zn	Ag oz./ton
A - Indicated	65.2	200	1800	2,934,000	4.82	8.59	2.26
- Inferred	84.4	200	100 ⁽¹⁾	167,750	4.62	5.03	1.55
Total	67.1	200	1900	3,101,750	4.81	8.40	2.21
B - Indicated	42.0	200	400	420,000	4.21	6.88	2.09
- Inferred	42.0	200	400	420,000	4.21	6.88	2.09
Total	42.0	200	400	840,000	4.21	6.88	2.09
F - Indicated	18.5	200	1200	555,000	5.58	6.51	2.52
- Inferred	10.0	200	200	50,000	4.89	3.79	2.17
Total	17.3	200	1400	605,000	5.52	6.23	2.49
TOTAL INDICATED				3,909,000	4.86	8.11	2.28
TOTAL INFERRED				637,750	4.31	6.15	1.95
B - Blocks	25.8	200	(1600)	1,032,000	3.29	5.21	1.61
TOTAL SECTION				5,578,750	4.52	7.35	2.12

(1) - Inferred reserves extended to 82W on basis of continuity of zone on 84W.

27/6/75

I. S. Thompson

Table IV

GRUM DEPOSIT RESERVES
(By Section)

Longitudinal Section 4+00N (63W-81W) Above 3400 Level 8 cu.ft.= 1 ton Cut-off Grade 4% Pb+Zn
Minimum Mining Width 10 ft.

<u>Zones & Blocks</u>	<u>Thickness</u> (ft.)	<u>Width</u> (N-S)	<u>Length</u> (E-W)	<u>Tons</u>	<u>Grade</u>		
					<u>% Pb</u>	<u>% Zn</u>	<u>Ag oz./ton</u>
A - Indicated	45.6	200	1400	1,495,475	4.24	7.56	1.85
- Inferred	<u>43.9</u>	<u>200</u>	<u>200</u>	<u>219,250</u>	<u>4.00</u>	<u>7.47</u>	<u>1.76</u>
Total	<u>45.4</u>	<u>200</u>	<u>1600</u>	<u>1,814,725</u>	<u>4.22</u>	<u>7.55</u>	<u>1.84</u>
AB - Indicated	<u>53.0</u>	<u>200</u>	<u>300</u>	<u>397,500</u>	<u>3.85</u>	<u>4.47</u>	<u>1.69</u>
B - Indicated	42.9	200	600	643,950	4.04	6.92	1.82
- Inferred	<u>49.7</u>	<u>200</u>	<u>200</u>	<u>248,500</u>	<u>3.72</u>	<u>6.45</u>	<u>1.15</u>
Total	<u>44.6</u>	<u>200</u>	<u>800</u>	<u>892,450</u>	<u>3.95</u>	<u>6.80</u>	<u>1.64</u>
TOTAL INDICATED				2,636,925	3.94	6.72	1.73
TOTAL INFERRED				467,750	4.94	8.20	1.91
A - Blocks	26.7	200	(400)	<u>133,500</u>	<u>4.19</u>	<u>4.10</u>	<u>1.39</u>
TOTAL SECTION				<u>3,238,175</u>	<u>4.10</u>	<u>6.82</u>	<u>1.74</u>

27/6/75

I. S. Thompson

Table V

GRUM DEPOSIT RESERVES
(By Section)

Longitudinal Section 6+00N (63W-81W) Above 3400 Level 8 cu.ft. = 1 ton Cut-off Grade 4% Pb+Zn
Minimum Mining Width 10 ft.

Zones & Blocks	Thickness (ft.)	Width (N-S)	Length (E-W)	Tons	Grade		
					% Pb	% Zn	Ag oz./ton
A - Indicated	21.3	200	1000	532,500	4.38	7.10	1.50
- Inferred	24.2	200	400	242,000	3.86	5.96	1.50
Total	22.1	200	1400	774,500	4.22	9.33	1.50
AB - Indicated	80.1	200	600	1,201,500	2.69	4.98	- (1)
- Inferred	124.5	200	200	622,500	2.45	4.68	-
Total	89.0	200	800	1,823,000	2.61	4.88	-
B - Indicated	39.6	200	800	792,000	4.33	6.88	1.86
- Inferred	64.2	200	600	963,000	4.37	6.91	1.85
Total	48.8	200	1400	1,755,000	4.35	6.90	1.85
TOTAL INDICATED				2,526,000	3.56	6.81	(1.72)
TOTAL INFERRED				1,827,500	3.65	6.02	(1.78)
A - Blocks	35.0	200	600	175,500	3.18	5.44	- (1)
TOTAL SECTION				4,529,000	3.58	6.44	(1.74)

(1) Data from visual grade estimates of Pb-Zn only. Ratio Zn:Pb - 1:7:1, i.e. 10% Pb-Zn = 6.3% Zn

27/6/75 I. S. Thompson

3.7% Pb

APPENDIX B

Bond Street N.
P. O. Box 810, North Bay, Ont.
P1B 8K1
Telephone: 705-474-2461
Telex: 027-76296



MINING CONTRACTORS
CONSULTING ENGINEERS
PROJECT MANAGERS

26 June, 1975.

Mr. Ian Thompson,
Derry Michener & Booth,
401 Bay Street,
TORONTO, Ontario.

Dear Ian,

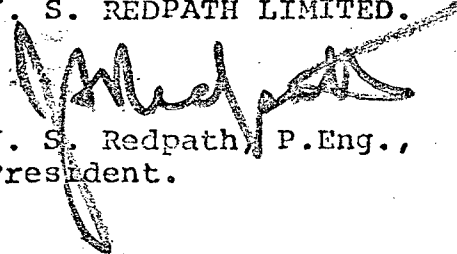
Attached you will find our report on the Grum
Deposit.

Due to the lack of underground knowledge which
will only be available when the underground exploration
programme is complete, we feel that this estimate must
be considered as an order of magnitude estimate at this
time.

We sincerely hope the attached information will
help you with your own report and should any questions
arise in connection with this report, please do not
hesitate to get in touch with either myself or
Jim Proudfoot at this office.

Yours very truly,

J. S. REDPATH LIMITED.


J. S. Redpath, P.Eng.,
President.

JSR:mo
Att.

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INTRODUCTION:

This report was prepared at the request of Doctor Michener of Derry, Michener and Booth. The details regarding the report and the liaison with that firm was carried out with Mr. Ian Thompson.

The basic object of the report was to review a capital and operating cost estimate prepared by Canadian Mine Services Limited on the Grum Project in the Yukon Territory. Canadian Mine Services' report dealt particularly with a 3,000 ton per calendar day underground operation. This report was prepared in March, 1974.

In addition, we were requested to review a cost estimate prepared by Kilborn Engineering concerning the capital and operating costs for the surface facilities for the above operation. The object in reviewing the Kilborn estimate was basically to try to determine if there was any duplication between the underground and surface estimates or any areas where items might have been left out.

We were also asked to estimate the underground capital and operating costs for a 5,000 ton per calendar day operation.

This report was prepared using the following information provided by Derry Michener and Booth:

- 1. A report entitled, "A Grum Deposit - Programme for Continued Exploration and Confirmation of Ore Reserve Outlines", prepared by Kerr-Addison Mines Limited, Vancouver Office Staff in January, 1975.

- 2. A report entitled, "Kerr-Addison Mines Limited Grum Project - Yukon Territory, 3,000 ton per calendar day Underground Operation Cost Estimate", prepared by Canadian Mine Services Limited, March 26, 1975.

- 3. A report entitled, "Kerr-Addison Mines Limited - Grum Joint Venture, Capital and Operating Costs for 3,000 ton per day Surface Facilities", prepared by Kilborn Engineering Limited, April, 1975.

- 4. A report entitled, "Kerr-Addison Mines Limited - Grum Joint Venture, Capital and Operating Costs for a 5,000 ton per day Surface Facility", prepared by Kilborn Engineering, April, 1975.

- 5. A report entitled, "Kerr-Addison Mines Limited - Grum Project, Yukon Territory, 1975 Underground Excavation, 1975 Underground Diamond Drilling, 1975 Surface Diamond Drilling. Programme Plans and Cost Estimates", prepared by Canadian Mine Services, January 31, 1975.

Our report is based entirely on the information provided above and it should be noted that no site visit was made nor was there an opportunity to examine the drill cores or logs. Our opinion as to the anticipated ground conditions is based entirely on comments made in the Kerr-Addison report and on the fact that Canadian Mine Services think that tight cut and fill mining will be required. We have a very high regard for both of the

foregoing named companies, and feel that their judgment in this area is good.

Our attached opinion of the cost estimates is our considered opinion of what costs will be at this time. We do not feel that it would be worthwhile carrying out a more detailed estimate at this time as the results of the underground programme being carried out should be obtained first. We endorse the underground programme being carried out for all the reasons put forth by Kerr-Addison Mines Limited.

ESTIMATING METHOD:

Both the Canadian Mine Services and Kilborn estimates have been reviewed to obtain a feel for the capital costs and operating parameters. Where required, items have been added or deleted from both capital and operating costs. The main change is one of labour increase due to reduced productivity. (See Appendix I - Kilborn Engineering).

The underground capital and operating costs have been revalued to reflect the lower productivity, the increased manpower, and the increased number of operating stopes to support both the 3,000 tons per day and the 5,000 tons per day operations (Appendix II - Canadian Mine Services).

COMPARISON WITH EXISTING OPERATIONS:

Please refer to Table I. In this Table, we have compared the Grum project as projected in the Canadian Mine Services report with other existing operations. This has been done to illustrate why we feel that the productivity as predicted in this report is on the high side.

		<u>Nominal Tonnage/ day</u>	<u>Comp.Plant cfm</u>	<u>Installed H.P. Plant</u>	<u>Heating Plant</u>
Strathcona	90% mech.C.&.F.	8,600 5 day 6,140 7 day	23,815	28,596	25,000,000 BTU
Madeleine	Blast hole	2,450	5,200	6,000	
Mattagami	Blast hole	3,800	12,300	17,000	
Geco	Blast hole & Fill Some C.&.F.	5,500	15,200	25,350	
Brunswick #12	90% mech. C.&.F.	6,700	14,900	50,000	
Grum Project (CMS)		"3,000"	"6,000"	"19,000"	

Labour	<u>u/g staff</u>	<u>u/g stoping</u>	<u>u/g dev.</u>	<u>u/g haul & hoist</u>	<u>total u/g</u>	<u>Mill</u>	<u>Total</u>	<u>Total Employees</u>
Strathcona	111	222	44	62	439	117	556	1,650**
Madeleine	20	26	30	19	95	53	148	-
Mattagami	17	89	36	25	167	61	228	449
Geco	46	115	58	39	258	122	380	625
Brunswick #12	87	365	66	47	565	183	748	1,450 *
Grum Project (CMS)	"15"	"46"	-	"14"	"75"	"44"	"119"	"189"

	<u>Tons/man u/g</u>	<u>Tons/man mill</u>	<u>Tons/man Total u/g mill</u>	<u>Tons/man Total employees</u>
Strathcona	13.9	61.5	11.04	5.87 **
Madeleine	25.8	46.2	16.55	N/A
Mattagami	22.8	62.3	16.66	8.46
Geco	19.4	41.0	13.15	8.00
Brunswick #12	11.8	36.6	8.95	6.79 *
Grum Project (CMS)	"40.0"	"68.0"	"25.2"	"16.04"

* 9,850 TPD #6, #12.

** Total West End 1,650 employees 9,700 tons/day



CONCLUSIONS:

The total capital for surface facilities and mine plant, excluding work in the 1975 programme is estimated at 67 million dollars at 3,000 tons per calendar day, excluding any cost for a transmission line and/or generating plant.

Operating and administration costs before depreciation, depletion and interest are estimated at \$14.88 per ton at 3,000 tons milled per day.

Total manpower requirements are estimated to be 333 men for a productivity of 9 tons per manshift.

At a plant capacity of 5,000 tons per day, the total capital for surface facilities and underground mine plant, excluding work in the 1975 programme, is estimated to be 83 million dollars, excluding any costs for a transmission line and/or generating plant.

Operating and administration costs before depreciation, depletion and interest are estimated to be \$13.84 per ton at 5,000 tons milled per day.

Total manpower at 5,000 tons per day is estimated to be 500 men for an overall productivity of 10 tons per manshift.

Estimated start-up costs appear to be low in the Kilborn report. We would estimate that they could be as high as \$1,000,000 but we expect this would be covered in the area "Contingencies" by anyone doing a full feasibility report.

All quoted capital and operating costs are in current (May, 1975) dollars. No provision has been made for escalation to start up date.

With the foregoing estimated operating costs, we feel that the cut-off grade of 4 per cent combined metals is on the low side. We assume that a revised cut-off grade will be calculated when the information is available from the underground exploration programme. This is a key figure as it has a direct bearing on the risk factor involved in going to a higher tonnage operation as compared to a lower tonnage operation. (We acknowledge here that the cut-off grade is affected directly by the prevailing market prices of the metals concerned).



TOTAL AFTER 1975 PROGRAMRevisedMILLING3,000 TPD5,000 TPDCapitalTransmission Line
or Generating PlantAdditional
± 2,000,000Additional
± 2,000,000

Start-Up

Additional
± 1,000,000Additional
± 1,000,000

Surface

53,951,200

66,834,723

Mine

13,752,00016,121,000

\$67,703,200

\$82,955,723

Operating

Mine/Ton

\$ 7.410

\$ 7.300

Mill

4.985

4.596

Administration

2.4821.940

Total/Ton

14.877

13.836

Manpower

333

500

TPDay/Man

9.0

10.0

KILBORN ESTIMATE

	<u>3,000 TPD</u>	<u>5,000 TPD</u>	
Capital	51,250,200	63,238,723	
<u>Add</u>			±2,000,000
Transmission & Generator	N/A	N/A	
3 Cy. Loader	80,000	80,000	
Cage, Hoist & Conveyance	350,000	350,000	
Additional Compressor Plant	150,000	250,000	
Additional Housing Units	2,310,000	3,155,000	
<u>Less</u>			
Shaft Conveyance included twice	(114,000)	(114,000)	
Start-Up	N/A	N/A	±1,000,000
Revised Capital	54,026,200	66,959,723	
Operating Cost	5.015/ton	4.712	
Revised	5.967/ton	5.457/ton	
Additional	0.952/ton	0.745/ton	

KILBORNOPERATING COSTS (REVISED)

	3,000 TPD		5,000 TPD	
Administration Labour	141,000	0.134	177,159	0.101
Surface Maintenance Labour	507,638	0.483	539,441	0.308
Concentrator Labour	847,561	0.807	878,083	0.502
Engineering & Geology	240,671	0.229	403,045	0.230
Surface Main Supplies	448,022	0.427	500,000	0.286
Concentrator Supplies	2,331,187	2.220	3,942,310	2.253
Engineering & Geology	30,000	0.029	40,000	0.023
Electrical	1,100,000	1.048	2,183,680	1.248
General Expense (Add)	620,000	0.590	885,000	0.506
		<hr/>		<hr/>
		5.967/ton		5.457/ ton

	<u>3,000</u>		<u>5,000</u>	
Administration Labour				
	4		7	
Add 4 Security	<u>4</u>		<u>4</u>	
		8		11
Surface Maintenance	19		26	
Add Machinist	1		-	
Welder	1		-	
Helpers	2		2	
Carpenter	2		1	
Electricians	<u>2</u>		<u>3</u>	
		27		32
Concentrator	44		46	
Shifters	4		4	
Crusher Helpers	<u>2</u>		<u>2</u>	
		50		52
Engineering & Geology	9		15	
Grade Control	4		6	
Samplers	<u>2</u>		<u>3</u>	
		15		24
Surface Maintenance Supplies	N/C		N/C	
Concentrator	2,394,187		N/C	
Dryer $\frac{400}{700}$	(63,000)		N/C	
	<u>2,331,187</u>			
General Expense	445,000		575,000	
Additional Travel	40,000		40,000	
Insurance $\frac{1}{2}\%$ /yr.	130,000		145,000	
Cafeteria Subsidy	<u>450,000</u>		<u>700,000</u>	
	1,065,000		1,460,000	

Administration Labour

Calculation (Example)

Revised Labour	8
Kilborn	4
$\frac{8}{4} \times 7050 =$	141,018

CAPITAL COSTS

Summary:

	<u>3,000 tons CMS estimate</u>	<u>3,000 Revised</u>	<u>5,000 Upgraded</u>
Mining Equipment	1,470,000.00	2,000,000.00	2,469,000.00
Track Haulage equipment	799,000.00	799,000.00	919,000.00
Primary Ventilation & Mine Heat	100,000.00	250,000.00	300,000.00
	<hr/>	<hr/>	<hr/>
	2,369,000.00	3,049,000.00	3,688,000.00

Mine Development:

Track Haulage	1,270,000.00	1,270,000.00	1,620,000.00
Access Decline-Incline	1,024,000.00	1,458,000.00	1,630,000.00
Cross-Cut Access to Ore	684,000.00	684,000.00	1,026,000.00
Ore Pass System	581,000.00	842,000.00	1,263,000.00
Sand Fill Bore-Holes	50,000.00	100,000.00	150,000.00
Ground & Water control	300,000.00	300,000.00	300,000.00
	<hr/>	<hr/>	<hr/>
	3,909,000.00	4,654,000.00	5,989,000.00

Production Shaft (1300'):

Mobilization	21,000.00	21,000.00	21,000.00
Sinking & Installation materials	1,450,000.00	1,450,000.00	1,450,000.00
Collar construction	30,000.00	100,000.00	100,000.00
Equip. for production	255,000.00	255,000.00	255,000.00
Ground & Water control	274,000.00	274,000.00	274,000.00
	<hr/>	<hr/>	<hr/>
	2,030,000.00	2,100,000.00	2,100,000.00

Crusher & Ancilliary Equipment:

Excavation - Ore Bins	80,000.00	160,000.00	160,000.00
- Crusher battery, etc.	266,000.00	266,000.00	266,000.00
Equipment Purchase & Installation	1,111,000.00	1,111,000.00	1,111,000.00
Shotcrete & Rockbolt	120,000.00	120,000.00	120,000.00
	<hr/>	<hr/>	<hr/>
	1,577,000.00	1,657,000.00	1,657,000.00

Management - say 20%

ESTIMATED CAPITAL COST

	9,885,000.00	11,460,000.00	13,434,000.00
	1,977,000.00	2,292,000.00	2,687,000.00
	<hr/>	<hr/>	<hr/>
	<u>\$11,862,000.00</u> =====	<u>\$13,752,600.00</u> =====	<u>\$16,121,000.00</u> =====



MINING EQUIPMENT

	<u>3,000 tons CMS Estimate</u>		<u>Revised 3,000 tons</u>		<u>Upgraded 5,000 tons</u>
Three (3) only Production					
Drill Jumbo		2 boom	219,000.00	3 boom (5)	450,000.00 (6)
Two (2) only Rock Bolt					
Jumbo	166,000.00		(2)	166,000.00 (3)	249,000.00
Three (3) only 8-yd.Loader	399,000.00		(5)	665,000.00 (6)	798,000.00
Two (2) only 5-yd. Loader	182,000.00		(2)	182,000.00 (2)	182,000.00
One (1) only Mine Grader	65,000.00		(1)	64,000.00 (1)	65,000.00
Three (3) only 18 man Carriers	159,000.00		(3)	159,000.00 (4)	212,000.00
Three (3) only 3 man Carriers	42,000.00		(3)	420,000.00 (4)	56,000.00
One (1) only Shotcrete outfit	120,000.00		(1)	120,000.00 (1)	120,000.00
One (1) only Blasters Vehicle	40,000.00		(1)	40,000.00 (2)	80,000.00
Fifteen (15) Secondary Ventilation					
Fans	45,000.00		(20)	60,000.00 (30)	90,000.00
Twenty (20) Jacklegs & Stopers	18,000.00		(20)	36,000.00 (30)	54,000.00
200 Mine Lamps	15,000.00		(200)	15,000.00 (300)	23,000.00
	<u>1,470,000.00</u>			<u>2,000,000.00</u>	<u>2,469,000.00</u>

TRACK HAULAGE EQUIPMENT

Haulage locomotive - Trolley	168,000.00		168,000.00		168,000.00
Trolley Electrics	141,000.00		141,000.00		141,000.00
Mine Cars & Dump Facilities	250,000.00		250,000.00		250,000.00
Mine Chutes 8 @ \$30,000	240,000.00		240,000.00		360,000.00
	799,000.00		799,000.00		919,000.00

PRIMARY VENTILATION

Fans & Accessories (150,000 CFM)	50,000.00	(300,000 CFM)	150,000.00	(450,000 CFM)	200,000.00
Mine Air Heater (10,000,000 BTU/HR)	50,000.00		100,000.00		100,000.00
	100,000.00		250,000.00		300,000.00
	<u>2,369,000.00</u>		<u>3,049,000.00</u>		<u>3,688,000.00</u>



MINE DEVELOPMENT

	3,000 tons <u>CMS estimate</u>	3,000 <u>Revised</u>	5,000 <u>Upgraded</u>
Track Haulage 3400 level			
5980' x 10' x 12' @ 206.00	1,230,000.00	1,230,000.00	1,560,000.00
Miscellaneous Slash	40,000.00	40,000.00	60,000.00
	<u>1,270,000.00</u>	<u>1,270,000.00</u>	<u>1,620,000.00</u>
Access Decline-Incline			
4600' x 14' x 14' @ 217.00	1,000,000.00	1,434,000.00	1,600,000.00
Miscellaneous slash	24,000.00	24,000.00	30,000.00
	<u>1,024,000.00</u>	<u>1,458,000.00</u>	<u>1,630,000.00</u>
Cross-cut Access to Ore			
3670' x 14' x 14' @ 181.00	664,000.00	664,000.00	996,000.00
Miscellaneous Slash	20,000.00	20,000.00	30,000.00
	<u>684,000.00</u>	<u>684,000.00</u>	<u>1,026,000.00</u>
Ore Pass System			
2710' x 6' Diameter @ 122.00	331,000.00	@ 200' 542,000.00	813,000.00
2000 Mill-Hole Liner @ 125.00	250,000.00	150' 300,000.00	450,000.00
	<u>581,000.00</u>	<u>842,000.00</u>	<u>1,263,000.00</u>
Sand Fill Drill Holes	50,000.00	100,000.00	150,000.00
Provision for Grout & Water Control	300,000.00	300,000.00	300,000.00
	<u>3,909,000.00</u>	<u>4,654,000.00</u>	<u>5,989,000.00</u>
	=====	=====	=====



PRODUCTION SHAFT (1300')

	<u>COST/FT</u>		<u>3,000 tons CMS estimate</u>	<u>3,000 Revised</u>	<u>5,000 Upgraded</u>
Labour	345.00				
Rental-Shaft Sinking Equipment	34.00				
Consumable items	69.00				
Muck Disposal	9.00				
Freight	6.00				
Insurance & Communication	5.00				
Installation Materials	227.00				
Power	200.00				
	<hr/>				
Amount - 1300' @	895.00	=	1,450,000.00	1,450,000.00	1,450,000.00
Mobilization			21,000.00	21,000.00	21,000.00
Construct Concrete Collar			30,000.00	100,000.00	100,000.00
Equip Shaft:					
2 skips @ 32,000.00 =	64,000.00				
1 cage	35,000.00				
1 counterweight	10,000.00				
1 loading station	75,000.00				
control system	35,000.00				
freight	16,000.00				
installation labour	20,000.00				
	<hr/>				
			255,000.00	255,000.00	255,000.00
Provision for water & ground control:					
One (1) month labour	71,000.00				
One (1) month rental	7,800.00				
Rock Bolts & Shotcrete	150,000.00				
Power	45,800.00				
	<hr/>				
			274,600.00	274,600.00	274,600.00
			<hr/>	<hr/>	<hr/>
			2,030,600.00	2,100,600.00	2,100,600.00



CRUSHER & ANCILLIARY EQUIPMENT

<u>Excavation:</u>	<u>3,000 tons CMS estimate</u>	<u>3,000 Revised</u>	<u>5,000 Upgraded</u>
Ore bins 16,000' @ 5.00	80,000.00	160,000.00	160,000.00
Crusher 165,000 @ 1.60	266,000.00	266,000.00	266,000.00
	<u>346,000.00</u>	<u>426,000.00</u>	<u>426,000.00</u>
Jaw Crusher 48" x 60"	300,000.00		
Concrete for crusher, bins, etc.	431,000.00		
Structure Steel	87,000.00		
Spares for Crusher	10,000.00		
Installations - Mechanical	58,000.00		
Electrical	20,000.00		
Feeders, crane, gates, liners, dust controls, etc.	196,000.00		
	<u>1,111,000.00 *</u>	<u>1,111,000.00</u>	<u>1,111,000.00</u>
Shot Crete & Rock Bolt	120,000.00	120,000.00	120,000.00
		<u>1,657,000.00</u>	<u>1,657,000.00</u>

* Original Error Addition \$1,102,000.

Underground performance.

	<u>CMS Report</u>	<u>Revised</u>	<u>Upgraded Tonnage</u>
Mill tonnage/day	3,000	3,000	5,000
Mine tonnage/day	4,200	4,200	7,000
Operating stopes	4	7 + 3 filling	12 + 4 filling
Stope haul	600	600	600
Rockbolts/jumbo shift	40	40	40
/manshift	40	20	20
Feet broken/jumbo shift	577	577	577
/manshift	577	300	300
Tons broken/jumbo shift	750	750	750
/manshift	750	375	375
Tons handled/loader shift	750	375	375
Tons blasted/blaster shift	750	750	750
lbs. explosive/ton	0.67	0.67	0.67
Feet drilled/ton	0.77	0.77	0.77

Equipment

Drill jumbo 2 Boom	3	-	-
3 Boom	-	5	6
Rockbolt Jumbo	2	2	3
Loader 8yd.	3	5	6
Loader 5yd.	2	2	2
Grader	1	1	1
Blaster Vehicle	1	1	2
Shotcrete outfit	1	1	1
Vehicle 18 men	3	3	4
Vehicle 3 men	3	3	5

MINING COSTS

SUMMARY:

	<u>Cost/ton CMS Report</u>	<u>Revised 3,000 TPD mill</u>	<u>Upgraded Revised 5,000 TPD mill</u>
Production drilling	0.59	0.95	0.95
blasting	0.36	0.36	0.36
Explosives	0.55	0.55	0.55
Mucking	0.48	0.96	0.96
Rockbolting	0.68	1.09	1.09
Screening or shot-crete	0.10	0.10	0.10
Handling Waste (Inclusions etc.)	0.75	0.75	0.75
Backfill	0.50	0.50	0.50
Track Haulage	0.16	0.20	0.20
Primary Crushing	0.25	0.25	0.25
Hoisting	0.20	0.20	0.20
Power	0.50	0.83	0.83
Ventilation & Mine Heat	0.23	0.23	0.23
Pumping	0.05	0.05	0.05
Surface labour	0.26	0.39	0.28
General Administration	1.50	1.50	1.08
COST/TON HOISTED	7.16	8.91	8.38



APPENDIX C

Canadian Bechtel Limited

155 University Avenue
Toronto, Ontario M5H 3B7
Telephone (416) 862-0211

Telex No. 06-23266



July 17, 1975

Mr. I.S. Thompson, P.Eng.
Derry, Michener and Booth
2302-401 Bay Street
Toronto 1, Ontario

Subject: AEX Minerals Corporation
Grum Deposit
Yukon Territories

Dear Mr. Thompson:

This letter will confirm our recent conversations on the above subject.

Your firm has been retained by AEX Minerals to review technical data supplied them by Kerr Addison Mines Limited pertaining to the "Grum" deposit in the Yukon Territories. You requested that we review this metallurgical, capital cost, operating cost and marketing data. To achieve this, you gave us copies of pertinent reports.

Metallurgy

A report, "Vangorda Project Report No. 2", dated December 19, 1974, prepared by the Noranda Ore Dressing Laboratory was reviewed. Even though it was entitled "Vangorda", you advised that the samples tested came from the "Grum" deposit. Nine single stage flotation tests and one five stage locked cycle test were included. The single stage tests examined grind and reagent combination, whereas the locked cycle test incorporated the best conditions from the single stage tests to simulate plant conditions. It appears that the depression of sphalerite and pyrite during lead flotation is the most difficult aspect of the metallurgy. However, with proper additions of lime, cyanide, and SO₂ gas, good results were obtained.

.... 2

The reported results of the fifth stage of the locked cycle test were:

	<u>Assay</u>		<u>Distribution</u>	
	<u>% Pb</u>	<u>% Zn</u>	<u>% Pb</u>	<u>% Zn</u>
Lead Concentrate	53.6	7.4	77.9	9.2
Zinc Concentrate	3.5	51.8	6.1	77.3

No silver assays were reported in the metallurgical report, but in a memorandum prepared by Noranda Sales Corporation, the following data was included for the above two concentrates.

	<u>Ag oz/ton</u>
Lead Concentrate	23.84
Zinc Concentrate	3.36

It is believed that the above results should be achievable in commercial operation. The ore tested in the locked cycle test was of lower grade, containing 3.55% lead and 4.14% zinc, than the ore zone average which, after dilution, is reported assay about 10% combined lead-zinc. Higher grade ore should result in higher percentage recoveries. Only a limited number of tests have been run and we feel that further work could improve the results, as better separation of the lead and zinc can probably be obtained.

We would suggest that the locked cycle test results be used for the financial analysis of the "Grum" ore, without discounting the grade and recovery.

Marketing

Noranda Sales Corporation has analyzed the concentrates and calculated "Net Smelter Return" values (Memo J. J. L. Davies to M. D. Rowsell, dated January 27, 1975). While a detailed analysis of the calculations is not possible (the smelter schedules were not made available), the results appear to be what might be expected. Both concentrates contain mercury, which has created problems at other operations. We do not know the maximum levels acceptable by the smelters in question, hence would suggest that the maximum allowable mercury limits be determined before the project is given a final "go ahead".

Mr. I.S. Thompson, P.Eng.
July 17, 1975
Page 3 ...

Canadian Bechtel Limited

Capital Costs

While the time available did not allow us to review the capital costs, we did discuss with you escalation and working capital allowances. We also referred to a recent newspaper report regarding the Tara project in Ireland which, for a 7,500 ton per day operation using underground mining, now has a price tag of \$150 million with start-up scheduled for 1977. We also suggested that you check the capital costs of the Greenex mine in Greenland, a 2,000 ton per day lead-zinc operation utilizing second-hand equipment which started production in the second half of 1973. The above data might help you analyze the validity of the capital costs presented.

Operating Costs

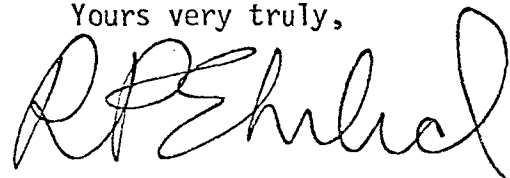
We examined the operating costs developed for the 5,000 ton per day case. While we do not have detailed wage rates prevailing in the area available, it is possible that the salaries and hourly wages assumed could be on the low side.

As an allowance for a townsite has been included in the capital costs, some monies should be included in the operating budget for townsite maintenance such as snow removal. No head office costs have been included but concentrate freight was included in the smelter calculations.

The power will be produced using diesel generators, and power costs are difficult to predict in this period of rising fuel oil costs. Ottawa, for example, has just announced a 23% increase in fuel costs which would be reflected in an almost equivalent increase in power costs.

We hope that we have been of help in your review of the "Grum" deposit, and if we can be of further assistance in this study we would appreciate your advising us.

Yours very truly,



R.P. EHRLICH, P.Eng.

RPE:jl