M/ NO.:	ASSESSMENT REPORT X	DOCUMENT NO:	092568
	PROSPECTUS	MINING DISTRICT:	Watson Lake
	CONFIDENTIAL X	TYPE OF WORK:	Feasibility Study
95 D 12	OPEN FILE		

REPORT FILED UNDER: Liard River Mining Company

DATE PERFORMED: 27 June, 1969 **DATE FILED:** 27 June 1969

LOCATION: **LAT.:** 60°30'N **AREA:** Quartz Lake

LONG.: 127°57'W **VALUE $:**

CLAIM NAME & NO.: SOUTH NAHANNI; DOROTHY

WORK DONE BY: J.J. Crowhurst (Bacon Crowhurst Ltd)

WORK DONE FOR: Liard River Mining Co.

DATE TO GOOD STANDING:

REMARKS: #3 MACMILLAN
In 1969 a feasibility study was done. Ore reserves were estimated at 1 112 000 tonnes grading 9.00% Zn, 4.27% Pb and 56.2 g/t Ag.

REPORT

on

McMILLAN PROPERTY

WATSON LAKE AREA

YUKON TERRITORY

by

J.J. Crowhurst, B.A.Sc., P. Eng.

Vancouver, B.C. June 27, 1969

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TERMS OF REFERENCE

At a meeting held between Mr. R.W. Wilson, President, Mr. A.C. Ritchie, Vice President, of Silver Standard Mines Ltd., and Mr. J.J. Crowhurst of Bacon & Crowhurst Ltd. held in Vancouver on May 29th, 1969, (subsequent to telephone conversations between Messrs H. Gilleland of Silver Standard, and Dr. W.R. Bacon), the scope and terms of reference of this report were discussed.

It is to be noted that no representative of Bacon & Crowhurst visited the property and that the basic information contained in this report was obtained from a study of various reports maps and letters submitted by American Smelting and Refining.

It was understood that the study was to be of a very broad and preliminary nature only, and that consequently, several assumptions, considered to be reasonable or attainable, would of necessity be made.

Some of the more important ones that have formed the basis for this report are as follows:

(1.) Mineral Claims

Only that block of claims owned by the Liard River Mining Company, which cover the showings and mineralization known as the "McMillan Project" are to be considered.

(2.) Ore Reserves

All diamond drill hole results as submitted by American Smelting and Refining have been accepted without check. Similarly, topography, and the scanty mineralogical and metallurgical information has been assumed to be as presented.

(3.) Rate of Production

1,000 short tons of ore per calendar day, or 350,000 short tons of ore per year - i. e mine the orebody, or orebodies, out rapidly on a salvage basis.

(4.) Metallurgical Performance

The assumption is to be made that no great difficulties exist, by reason of the fine grained nature of the mineralization and the heavy pyrite content and that reasonably good average mill performance can therefore be anticipated.

(5.) Metal Prices are to be as Per Current Figures

Lead	15.000¢	per lb.
Zinc-Prime Western	14.500¢	per lb.
Silver	$1.90	Canadian

(6.) Adequate Water Supply

For a concentrating plant and camp requirements - available at reasonable installation cost from Quartz (Mine) Creek and/or Pyrite Creek, or nearby lakes.

(7.) Mining Methods

Open pit methods would be used on a 9 month basis, with a stock pile established to supply the concentrator for the other 3 months (January to March inclusive) in each year. No investigation has been conducted regarding underground trackless mining, (or a combination of open pit and subsequent trackless mining for those areas where waste to ore ratios are higher.) These alternatives should be considered.

It is assumed in the case of open pit mining that a contract would be given to a reputable firm to avoid equipment purchase, and that Quartz Creek can be diverted by means of a tunnel. No mining contractors have been contacted, and costs used (including stockpiling and reclaiming) are based on judgment.

(8.) Access

Via a 50 mile gravel road to be constructed from the Alaska Highway to the property; (as per comments made in reports by Olson and Coveney.) Sufficient accommodation of a temporary nature would be erected to house the mill crew and a small camp labour force and office and supervisory personnel. It is assumed the mining contractor will provide accommodation for his crew.

(9.) Concentrate Sales

It is assumed that the best alternative would consist of transporting concentrate by trucks in bulk or in cheap disposable containers to the White Pass Railway at Carcross for furtherance to Skagway. Deep sea ocean freighters would then take delivery for shipment to smelters (probably Japanese) under competitive sales arrangements.

SCOPE OF THE REPORT

The scope of this report, in the absence of a personal examination of the property, is to cover appraisal of ore reserve estimates, and possible mining and milling methods, together with approximate estimates regarding capital (preproduction) costs, including warehouse inventory and working capital, operating costs, net smelter returns and operating profit.

It is to be noted that Bacon & Crowhurst have not investigated, nor does this report cover, the following:

(a) Ownership of the mineral claims
(b) Financing arrangements and related costs
(c) Dominion, Provincial, or local taxation
(d) Royalty (or other) payments to American Smelting and Refining, or others.
(e) Cash flow - other than operating profit.

No investigation has been conducted concerning the advantages of extracting the higher grade (and perhaps lower strip-ratio) parts of the mineralised areas during the initial stages of production. It is felt that this procedure would be of substantial benefit, but can only be determined with accuracy after further diamond drilling and other results are available.

Neither have the possibilities of enhancing the financial picture by variations in the treatment rate, (say 500 to 750 T.P.D. for example) been investigated.

SUMMARY AND FINANCIAL

Probable ore reserves are estimated to be approximately 1,225,000 tons assaying 1.64 ounces of silver per ton, 4.27% lead and 9.00% zinc, after allowing for mining dilution calculated at 10% with zero grade.

It is estimated a total investment of $5,714,000 (including inventory of supplies and working capital) will be required to complete the necessary exploration, to prepare the open pit for production by the removal of 500,000 tons of overburden and 250,000 tons of waste rock, and to construct a concentrator together with the related facilities required to process 1,000 tons of ore per day. (350,000 tons per year)

A period of 3½ years operation is indicated at this treatment rate.

The sum of $120,000 representing inventory of supplies, and the sum of $975,000 representing 2½ months operating costs for working capital is included in the $5,714,000 total. The net expenditure is therefore estimated at $4,619,000, after a 10% contingency allowance has been applied to the basic figure.

Operating costs are estimated at $13.37 per ton milled.

With metal prices calculated at $1.90/ounce of silver, 15.00¢/lb. for lead and 14.50¢/lb. for zinc, operating profit, before write off for depletion or depreciation, interest, financing charges, royalties or taxation is estimated to be $2,182,000 per year, or a total of $7,637,000 for the 3½ years of operation contemplated.

ESTIMATED CAPITAL COST

(1.) Exploration		
Stage 1 - diamond drilling	$ 50,000	
Stage 2 - diamond drilling and/or adits.	150,000	$ 200,000
(2.) Mining		
Water diversion tunnel - 980'@$100/ ft.equiv.	98,000	
Preproduction waste (250,000 tons) and overburden stripping (500,000 tons) plus road access - say 750,000 tons @60¢/ton (contracted)	450,000	
Equipment - (bought by mining company)	30,000	578,000
(3.) Crushing Plant, Concentrator - (incl. tailings disposal)		
New Cost*	1,905,000	
Less 1/3 of $521,000 (equipment cost)	174,000	1,731,000
(4.) Water Supply		30,000
(5.) Power		
Diesel generators - (connected HP-1500-continuous KW-753) plus installation, distribution, powerhoue and fuel storage.		400,000
(6.) Plant Services		
Office, warehouses, water, electrical and steam distribution, mobile equipment,etc.		260,000
(7.) Communication		20,000
(8.) Camp Buildings and Housing		300,000

*Taken from another Bacon and Crowhurst study.

(9.) Administration

12 months @ $40,000/ month	$ 480,000
Sub Total	3,999,000
Contingencies @10%	400,000
TOTAL	4,399,000
Engineering @5%	220,000
Sub Total	4,619,000
Inventory of supplies	120,000
Working capital=2½ months operating cost or 2½ x 390,000 - say	975,000
TOTAL	5,714,000

METALLURGY

Ore fed to process - Assay - 1.64 ozs. Ag/ton
4.27 % Pb
9.00 % Zn

Ore fed to process = 350,000 T.P.Y.

It is assumed that 87% of the lead is recovered in a 68% lead concentrate, and 82% of the zinc is recovered in a 54% zinc concentrate, and that the addition of 8% to the dry weight of concentrates covers a moisture content of 6% and the weight of containers.

(a) $\frac{\text{Tons of lead recovered/year}}{100} = \frac{350,000 \times 4.27 \times 87\%}{100} = 13,002$ tons

or, $\frac{13,002 \times 100}{68} = 19,121$ dry tons of lead concentrate/year (20,651 wet tons of lead concentrate/year).

(b) $\frac{\text{Tons of zinc recovered/year}}{100} = \frac{350,000 \times 9.00 \times 82\%}{100} = 25,830$ tons

or, $\frac{25,830 \times 100}{54} = 47,833$ dry tons of zinc concentrate/year (51,660 wet tons of zinc concentrate/year).

Wet weight of concentrates to be transported:

Lead	20,651
Zinc	51,660
Total	72,311

Silver Credit - Per ton of ore milled:

Ore content fed to concentrator - 1.64 ozs. Ag/ton ore
Mill recovery assumed @ 85% or 1.394 ozs. Ag/ton ore.
Silver paid for = 1.394 x 95%= 1.324 Ag/ton ore.
Silver credit = 1.324 x $1.87 = $2.48 per ton ore.

ESTIMATED NET SMELTER RETURNS

Assumptions

Grade of lead concentrate - 68% Pb + 5-7% Zn.
Grade of Zinc concentrate - 54% Zn + 2-3% Pb.
Moisture content - equiv. of 8%.

Net Realised Price -(Canadian)

Lead = 15.00 ¢ - 5.00¢ to allow for smelting, and refining and ocean freight = 10.00¢ per lb.
Zinc = 14.50¢ - 7.00¢ to allow for smelting refining and ocean freight = 7.50¢ per lb.
Silver = $1.90 - 0.03 to allow for refining or $1.87 per ounce.
Gold = nil.

Net Value

(1.) Per short dry ton of concentrate, as at Skagway, Alaska.

(a) Lead Concentrate

Lead contained	1360#	
Lead paid for =	1360 x 95%=1292#	
Lead value =	1292 x 10¢= $129.20	
Zinc content = 120#		
Zinc paid for = 60#		
Zinc value = 60# x 7.50¢	=	4.50
Total Net Value		$133.70 p.s.d.t.of conc.

(b) Zinc concentrate

Zinc contained =	1080#	
Zinc paid for =	1080x85%= 918#	
Zinc value = 918# x 7.50¢ = $68.85		
Lead content =	50#	
Lead paid for =	30#	
Lead Value = 30#x 10.00¢ =	3.00	
	$71.85 p.s.d.t.conc.	

	$Can/year
Lead concentrate = 19,121x $133.70 =	2,556,478
Zinc concentrate = 47,833 x 71.85 =	3,436,801
Silver credit = 2.48 x 350,000 TTY =	868,000
Total Net Smelter Return	6,861,279

(2.) Per Ton of Ore - Calculated approximately, as at Skagway, Alaska.

	Per Ton of Ore
Lead content paid for:	
4.27% x 20# = 85.40 x 90% recovery x 95% =	73.0#
Zinc content paid for:	
9.00% x 20# = 180# x 84% recovery x 85% =	128.5#

Value of lead =73.0# x 10¢/lb.	= $	7.30
Value of zinc = 128.5# x 7.5¢/lb.	=	9.64
Value of silver	=	2.48
		19.42

Total net smelter returns = 350,000 x 19.42 = $6,800,000 per year.

ESTIMATED OPERATING COST - 350,000 tons/yr.

	Amt./yr.	Per ton mill
Mining		
350,000 tons of ore @ 70¢/ton	245,000	
571,000 tons* of waste @ 60¢/ton	342,600	
376,000 tons* of overburden @ 50¢/ton	188,000	
	$ 775,600	$ 2.216
Milling	612,500	1.750
Plant Services and Townsite @ 30,000/month	360,000	1.029
Freight to Skagway		
Concentrate freight to Skagway - 72,311 TPY x 25/ton	1,807,775	5.165
Inbound freight - 2,000 TPY x $100/ton ex Vancouver, B.C.	200,000	0.571
Power		
Approximately 6,600,000 KW hr/yr. x 3.00¢/KWhr.	198,000	0.566
Mine Administration and Head Office		
@ $25,000/month	300,000	0.857
Total	4,253,875	12.154
Contingencies @10%	425,387	1.215
	$ 4,679,262	$ 13.369

Cost per month = $\frac{4,679,262}{12}$ = 390,000 approx.

*Assuming that waste and overburden remaining after preproduction is removed about evenly over the 3.5 years of life related to the Known ore.

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ESTIMATED OPERATING PROFIT

Note - before financing charges, taxes and write offs re depreciation and depletion.

	Per year
Revenue	$6,861,000
Operating Costs	4,679,000
Operating Profit	$2,182,000

Total indicated operating profit for life of ore reserves = 2,182,000 x 315 years

	$7,637,000
Less initial capital investment	4,619,000
Net	$3,018,000

Note: Net figure is before interest on borrowed money, financing charges, taxation and writeoffs.

LOCATION AND ACCESS

The property is located at an approximate elevation of 3,000 to 4,000 feet above sea level in the Whitehorse Mining Division of the Yukon Territory, Canada. It is in the southeast corner of the Yukon at 60°31' North Latitutde and 127°55' West Longitude, on the divide between the Hyland River and the Coal River. It is about 36 miles north of Mile 595 on the Alaska Highway.

Watson Lake, Y.T., Alaska Highway Mile 633, which is situated 40 miles southwest from the property is serviced by Canadian Pacific Airlines five times a week and is the centre for the district.

It is reported by Olson & Coveney that a suitable road route about 50 miles in length may be established from Mile 606 on the Highway to the property. This would follow along the east side of the Hyland River for a large part of the way, on jack pine covered ridges probably underlain by gravel benches. It is believed prt of this road may already have been constructed by other prospecting parties.

A small lake, the centre one of three, to the east of the showings

is suitable for landings by De Havilland, Beaver and Otter type aircraft.

Two basic routes are available to service supplies inbound and concentrate shipments outbound.

A. Skagway, Alaska to property

Skagway via White Pass and Yukon R.R. to Carcross Y.	- 68 miles
Carcross Y.T. to Mile 606, Alaska Highway (?)	- 290 miles
Mile 606 to property	- 50 miles
Total	408 miles

Approximate cost - $40/ton inbound and outbound.

B. Vancouver, B.C. (or Edmonton, Alberta) to property.
Vancouver to Dawson Creek, B.C. via P.G.E. Railroad
Dawson Creek, B.C. to Mile 606, Alaska Highway.
Mile 606, to property.

Approximate cost $25/ton for concentrates outbound.
- $100/ton for freight inbound.

GEOLOGY AND MINERALIZATION

Argillaceous shales constitute the most prevalent rock type observed in the surface exposures. Intermingled light to dark grey limestones and white fine grained quartzites constitute the remaining outcrop areas. Overburden is, however, extensive and outcrops are scarce.

These rocks strike approximately east-west, dip flatly to the north with gentle undulations, and have been folded into an open anticline whose axis strikes a few degrees west of north and plunges gently north. Steep normal post-mineral faulting of small displacement parallels the anticlinal axis. Cross faulting and drag folding also occurs. The rocks in the series are conformable.

The mineralization of interest consists of pyrite, galena and sphalerite occurring as replacement deposits principally in the top and bottom of the limestone beds.

The approximate content is given as pyrite 46%, sphalerite 15% and galena 6%. It appears to be concentrated along a northeast trending trough in the east limb of the anticline.

An excerpt from a report dated 6th March, 1951 by Mr. Arthur O. Hall, geological engineer - American Smelting and Refining reads in part - 'The area within a radius of 70 miles of the property is reported to be underlain by sediments ranging in age from Pre Cambrian to Cenozoic. Of the area, perhaps 90% is made up of shales, argillites, quartzites, limestones of Devonian and Carboniferous periods, the balance being small windows of Cambrian and Pre Cambrian sediments. Igneous rocks, if any, are unknown."

Quoting M.W. Cox, letter to J.E. Berg - 11th of January, 1954, 'The ore deposit is an elongate, gently dipping run about 250' in average width, (maximum 500') nearly 2,000' in length, and from 5' to 80' in thickness. Extensions of the run are believed likely. Other parallel runs may be inferred from geologic evidence."

Again - "From the 1953 work, the structural setting of the McMillan deposit appears to be complex and it should not be considered as a flat lying manto or tri-state type orebody."

There is some question as to whether the favourable limestone horizon (or horizons) has been truncated by erosion toward the southwest. To the northeast the horizon appears to persist, although to date no mineralization comparable to that already found has been discovered. C. Coveney in his report dated 23, November, 1954 states that the absence of other ore shoots to the south has not been conclusively proved, however, and that the ore zone at the north end is terminated by faulting. Some disagreement therefore exists.

ORE RESERVES

Various estimates of ore reserves have been made, some of which are tabulated below:

ENGINEER	YEAR	TONS	OZS. AG/ TON	PB%	ZN%	METHOD
-	1953	-	2.10	5.2	10.0	Averaging drill hole assays.
Hall	1954	936,000	1.80	4.7	10.00	Weighting polygons
Cox	1954	1,079,000	-	-	-	Weighting polygons
Coveney	1954	1,000,000	1.83	4.70	9.97	
Hall and Coveney	1954	935,581	1.80	4.70	9.90	Weighted cross sections and tonnage
Hall and Coveney	1954	935,581	2.09	5.21	9.91	Averge weighted drill hole grades

An extremely quick approximate open pit layout and subsequent calculations by Bacon & Crowhurst (excluding 16 + 00 N mineralization) confirmed these tonnage figures. No attempt was made to calculate the average grade of contained metals. The results are as follows:

Tons of ore in place - 1,114,000 (factor 10 cu.ft/ton)
Tons of overlying waste rock - 2,248,000 (factor 12 cu.ft/to
Tons of overlying overburden - 1,315,000 (factor 13 cu.ft/to

This strip ratio corresponds approximately with an estimate previously made by American smelting in 1952 as follows:

Tons of ore in place - 600,000
Tons of overburden - 850,000
Tons of waste rock - 1,650,000

Prints of the surface plan and sections showing A.S. and R. ore outlines in red, and Bacon & Crowhurst assumed open pit atlines in purple are attached to this report.

At the contemplated 350,000 short tons of ore to be treated per year, almost 3½ years supply to the concentrator can therefore be envisaged, regarding treatment of ore now in sight. It is assumed for the purposes of this report that fill-in diamond drilling will confirm the projection used from the existing drill hole results.

POWER

(a.) Requirements

Plant Section	H.P. Connected	Factor*	H.P. Consumed	K.W. Consumed
Crushing (one shift)	250	28	70	52
Concentrator	1050	80	840	626
Mining	–	–	–	–
Water supply, lighting camp and misc.	200	50	100	75
	1500		1010	753

*Factor = demand factor when operating, x% of operating time, or % of 24 hour continuous operation at full rating.

(b.) Operating Cost

Consumption = 753 x 24 x 365 = 6,600,000 K.W.hr/yr.

Cost @ 3.00¢ /K.W.hr = $198,000 /yr. (.30¢ - 33¢ /Imp. Gallon diesel fuel delivered)

Respectfully submitted,

BACON & CROWHURST LTD.

J.J. Crowhurst

J.J. Crowhurst, P.Eng.

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LIST OF ILLUSTRATIONS