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Report of Examination &  
Estimates of Production  
on the  
Quadra Mining Company Limited (N.P.L.) Property  
Quadra Island, B. C.

for

S. M. Industries Limited  
300 - 890 West Pender Street  
Vancouver 1, B. C.

by

MacDonald Consultants Ltd.  
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S. M. INDUSTRIES LIMITED

Report of Examination

Quadra Mining Company (N.P.L.) Property

Quadra Island, B. C.

1. SUMMARY

1.1 Introduction

Quadra Mining Company Limited (N.P.L.) is a private company principally owned by Mr. Ima. Kitchen of Campbell River, B. C. The company holds a property on Quadra Island, with at least five explored copper deposits.

A leach operation was commenced on the Pommaroy No. 1 deposit in 1968, operated for a short period and shut down for the winter.

S.M. Industries are committed to testing of bacterial leaching of copper ores in situ. This test is currently scheduled at the Skeena property in the Highland Valley but it may be done at a more favourable location.

The Quadra property was examined by G. H. McLeod, P. Eng. and C. V. Dyson, B.Sc. of MacDonald Consultants Ltd. and Dr. C. L. Emery on March 15 - 17, 1969. Mr. Kitchen provided reports and drawings of previous owners, which documented some of the previous exploration work.

1.2 History, Geology, Mineralogy

The presence of copper on Quadra Island was reported by the Geological Survey of Canada in 1913. The area has been worked spasmodically since then, with some ore shipments.

In 1952 - 53 Dodge Copper Company Ltd. carried out a detailed exploration program on some of the deposits on the property. Quadra Mining

acquired it in 1968.

The property is underlain by Tertiary Volcanic rock of the Valdes Series that dip gently to the southeast. The volcanic flows range in thickness from one to more than twelve feet and vary in composition from andesitic to basaltic. Many are highly amygdaloidal and the cavities are mainly filled with calcite, quartz, and chlorite. Regionally the volcanics are traversed by major faults that trend northwesterly and have associated jointing and fracturing.

Distribution of copper mineralization within the volcanics is erratic and occurs mainly along fractures, within quartz-calcite veinlets, in the amygdales, and disseminated in the flows. Chalcocite is the most abundant copper mineral, with some native copper, malachite and azurite.

Ore grade mineralization is present on the property in occurrences distributed over an area one mile long and two hundred feet wide on a belt down the middle of the property.

The known ore deposits occur mainly on the surface and have been extensively drilled, tranced and sampled.

Ore tonnage estimates made by previous operators are:

Pommeroy #1	12,000 tons @ 3.5% Cu
Pommeroy #2 North	6,000 tons @ 2.02% Cu
Pommeroy #2 South	25,000 tons @ 2.5% Cu
Pommeroy #3	50,000 tons @ 2.2% Cu
Pommeroy #4	10,000 tons @ 2.2% Cu
Beaver #1	9,000 tons @ 2.0% Cu

The information on which the above tonnages and grades were based has been reviewed in detail by the writer and he concurs with the figures.

### 1.3 Leach Operations

- 1.3.1 Pommeroy No. 1 has been placed under bacteria leach with a 2,000 lb. per day precipitator plant installed. The whole deposit has not been prepared to date.
- 1.3.2 Pommeroy No. 2 North and South can be placed under leach with short hole drilling and blasting and a circulating system.
- 1.3.3 Pommeroy No. 3 is a mineralized bed under 0 to 65 feet of rock cover and requires detailed engineering for a leach operation.
- 1.3.4 Pommeroy No. 4 has been blasted and bulldozed, and requires sample drilling and site engineering to evaluate for leaching.
- 1.3.5 Beaver No. 1 is on surface and can be leached in a manner similar to Pommeroy No. 2
- 1.3.6 Previous leaching test work - Pommeroy No. 1

The S.M. Industries Laboratory carried out bacteria leaching test on Pommeroy No. 1 ore in 1967 - 68. These tests indicate the ore amenable to bacteria leaching.

### 1.4 Economic Analysis of a Bacterial Leaching Operation

By placing Pommeroy No. 1 under leach, extending the plant and placing Pommeroy No. 2 South under leach, a bacterial leach operation producing 4,000 lbs. of copper per day can be established in about 2 months for a maximum cash outflow of \$140,000.00 and at the end of 20 months return a surplus of \$92,000.00 over total dollars put into the project.

If this test is successful it is possible that a similar operation can be established on Pommeroy No. 3 and No. 4 and Beaver No. 1 with a central precipitator plant. Pommeroy No. 1 and No. 2 may also be treated at this plant. A similar profit margin to Pommeroy No. 1 and No. 2 should exist.

This operation will be a field test of laboratory and pilot plant work that has been proceeding for two to three years.

#### 1.5 Advantages of Quadra Property over Skeena Property

- 1.5.1 Deposits at Quadra are mainly on surface and can be placed under bacterial leach with minimum expenditure on mining-- \$139,000.00 at Quadra versus \$212,000.00 at Skeena.
- 1.5.2 The 20% oxide copper at Quadra will give a high early production of copper reducing required working capital.
- 1.5.3 Due to the high copper grade of small operations at Quadra, 40,000 tons can produce 4,000 lbs. of copper per day with a small staff and low overhead.
- 1.5.4 Weather at Quadra is milder than Skeena making winter operations easier.
- 1.5.5 The leaching program at Quadra is much easier to carry out than the one at Skeena.

#### 1.6 Recommendations

We recommend to S.M. Industries that the next bacterial leaching operation be on these Quadra Island deposits.

Respectfully submitted,  
MACDONALD CONSULTANTS LTD.

  
G. H. McLeod, P. Eng.

S. M. INDUSTRIES LIMITED

Report of Examination and Estimates of Production

Quadra Mining Company Limited (N.P.L.) Property

Quadra Island, B. C.

2. INTRODUCTION

- 2.1 Quadra Mining Company Limited (N.P.L.) is a private company, principally owned by Mr. Wm. Kitchen of Campbell River. The company owns a mining property on Quadra Island, with at least five explored copper deposits.
- 2.2 A leach operation was commenced in 1968 on the Kommeroy No. 1 deposit, and operated for a short period before being shut down for the winter.
- The deposit is partially blasted. The plant can be put into operation with very little work.
- 2.3 S. M. Industries Limited are committed to testing leaching copper ores "In situ". This test project is currently scheduled at the Skaena property in the Highland Valley, but it may be done at a more favourable location.
- 2.4 The Quadra property was examined with permission of Mr. Kitchen by G. H. McLeod, P. Eng. and G. V. Dyson, B.Sc., of MacDonald Consultants Ltd. and Dr. C. L. Emery, on March 15 - 17 and again by G. H. McLeod and F. Hodgson of S. M. I. Processes Ltd. on March 27 - 28. Mr. Kitchen loaned reports and maps of previous owners which mainly document exploration work by Dodge Copper Company Limited in 1952 - 53, and included estimates of proven ore tonnages.

### 3. HISTORY OF QUADRA ISLAND COPPER DEPOSITS

The presence of copper deposits on the island was reported in Memoir 23 of the Geological Survey of Canada by J. A. Bancroft in 1913. Since that time the deposits have been worked spasmodically, with some production being shipped to smelters and mills.

In 1952 - 3 Dodge Copper Mines Limited carried out a detailed exploration program of trenching and diamond drilling, and this recorded information is available. Noranda Mines Ltd. and Falconbridge Nickel Mines Ltd. have also done some work on the area. The Quadra Mining Company property was acquired by the present owners in 1968.

### 4. GEOLOGY AND MINERALOGY

#### 4.1 General Geology

The property area is underlain by Tertiary volcanic rocks of the Valdes series that dip gently southward and southeastward. The flows,-- that range in thickness from one foot to more than twelve feet--vary in composition from andesitic to basaltic. Many of the flows are highly amygdaloidal. The cavities are mainly filled with calcite, quartz and chlorite. All the flows are chloritized to some extent. Regionally the volcanics are traversed by major faults trending in a northwesterly direction, with associated jointing and fracturing. Minor, thin beds of sedimentary material occur at various horizons within the volcanic sequence.

The volcanics are covered to the northeast by a belt of sediments that flank the west margin of the Coast Range Batholith.



Distribution of copper mineralization within the volcanics is erratic and is found along fractures and within quartz-calcite veinlets, and also within the amygdaloids and disseminated in the rock. Chalcocite is the most abundant copper mineral present with some native copper, malachite and azurite. Low values in silver are noted in ore shipments from the property, although no silver minerals were recognized. Vanadium in minor amounts is also reported present.

Mineralization occurs with the quartz-calcite veinlets, as fracturing coating and filling and as replacements with calcite, quartz, epidote and prehnite in amygdaloids.

#### 4.2 Economic Geology

Ore grade mineralization is present on the property in occurrences distributed over an area one mile in length and over two hundred feet in width approximately in a belt down the middle of the property.

Malachite stain is evident on and around mineralized outcrops, with fine grained mineralization under the weathered surface.

The known ore deposits occur mainly on the surface and have been extensively drilled, sampled, and ore tonnage estimates have been made by previous operators.

Ore grade mineralization is present in two different types of occurrences:

- 1.) In individual horizons within the lava flows as disseminations and amygdaloidal fillings.
- 2.) As fracture filling associated with major faulting.

The extent of ore grade mineralization in a flow horizon has been limited topographically by two factors. Firstly, erosion and glaciation

have left the volcanics outstanding as knolls and ridges and thus limited the continuous horizontal extent of a flow. Secondly the surface contour prior to lava flow resulted in local thickening and thinning of the individual flow.

Mineralization is not confined to one horizon in the volcanic series, although several barren flows can separate these horizons.

Mineralization associated with the faulting appears localized close to fault junctions where fracture density is most intense.

The combination of a mineralized lava flow and of a mineralized fracture area appear most favourable for the larger ore occurrences.

#### 4.3 Individual Showings Visited

##### 4.3.1 Pommeroy No. 1

A mineralized basaltic flow dipping gently southwards outcrops on a prominent ridge. Copper mineralization is prominent in the upper part of the flow, and can be traced laterally to the west outside the area outlined by previous drilling. However, the zone appears relatively thin outside the outlined area. Shearing and fracturing trends northwesterly.

Dodge Copper Company give this area a proven reserve of 12,000 tons @ 3.5% Cu. From the plans this appears realistic.

About  $\frac{1}{2}$  of the area was blasted in 1968, and a further portion is drilled off.

Character Sample of blasted rock assayed 0.6% Cu.

Character Chip Sample of mineralized bed assayed 1.05% Cu.

#### 4.3.2 Pommeroy #2

This consists of 2 main showings, north and south about 600 feet apart. Both are strong shearing and fracturing in an east-west direction along fracture planes. Also in Pommeroy No. 2 South a flow structure is mineralized with disseminated chalcocite

Dodge Copper ore reserves:

Pommeroy No. 2 North - 6,000 tons 2.02% Cu

Pommeroy No. 2 South - 25,300 tons 2.3% Cu

There is abundant malachite and chalcocite visible in these areas and ore reserve should be realistic.

There are trenches in between showings, but no assays or reserves.

Character sample assayed 2.44% Cu.

#### 4.3.3 Pommeroy # 3

A combination of strong shearing and fracturing in an east-west direction, and a mineralized flow is visible in outcrop.

Plotting diamond drill holes from records indicates two beds dipping into the hillside, the lower dipping into the hillside at 10° and the upper at 20 - 25°, each 6' - 10' thick, separated by about 60 feet at the outcrop of the upper bed. The lower bed outcrop has been tranced and about 45 drill holes totalling over 2,000 feet drilled through the beds.

Proven ore reserves estimated by Dodge Copper are 50,000 tons at 2.2%. A check with incomplete information gives 46,000 tons at 1.6% Cu in lower bed within 100 feet of outcrop and less than 65 feet from surface.

Character sample assayed 2.14% Cu.

#### 4.3.4 Pommeroy #4

Locally a thickening of a mineralized lava flow with intense fracturing in two main directions from proximity to major faulting. The outcrop - blasted area is about 300 feet long.

The final estimate by Dodge Copper on the zone is not available. A later report states 10,000 tons at 2.2% Cu. In 1963 a shipment of 357 tons, loaded by bulldozer, was made to Britannia mill. This shipment ran 1.63% Cu (1.33% sulphide copper, .3% carbonate-oxide copper).

It appears to be the same bed as Pommeroy #3 outcropping on opposite side of valley.

#### 4.3.5 Beaver #1

A flat lying mineralized flow is prominently exposed on the top of an isolated knoll. Numerous trenches have been cut, up to 6 feet deep and into the barren volcanics below the ore zone.

Proven ore reserves estimated by Dodge Copper are 9,000 tons at 2% Cu.

#### 4.3.6

A new showing opened up by stripping is exposed west of the Beaver No. 1 showing. It is a thick well mineralized basalt flow gently dipping to the south, at the base of a prominent ridge. A second mineralized flow is exposed on top of the ridge. Character sample of the two zones assayed 1.68% Cu.

Several other showings are reported to exist on the property but were not visited.

## 5. BACTERIAL LEACHING APPLICATIONS

5.1 Pommeroy No. 1 zone was partially placed under leach in 1968.

Some 5,000 to 7,000 tons of mineralized zone was drilled and blasted and another one or two thousand tons drilled off, and a collecting sump created.

The blasting broke the drainage barrier, so that over about one half of the blasted pile, the percolating leach solution is lost.

The present precipitator plant requires some revision and addition, and an added warehouse laboratory and office.

5.2 Pommeroy No. 2 North deposit is on surface and may be leached by breaking ore. Circulation and collection of the leach solution may require a short adit driven into the hillside below to provide a collection system.

Pommeroy No. 2 South is on surface and may be leached by breaking ore and providing a solution collection sump below deposit. This should not be difficult.

5.3 Pommeroy No. 3 deposit is a bed dipping into the hillside, and requires long blast holes to break ore for leaching. A detailed engineering study is required to determine the economics of leaching.

5.4 Pommeroy No. 4 - The surface ore has been blasted and bulldozed over an area 300 feet long and 50 feet wide, over rock and gravel base. Further exploration and engineering will be required to devise a leaching site.

5.5 Beaver No. 1 - The deposit is on surface, and requires drilling and blasting and a sump for a leaching set up.

5.6 Previous Leaching Test Work

Leaching tests on the Pomsroy No. 1 ores were done by the now S.M. Industries Ltd. Laboratory and the present leach plant designed on the basis of these tests.

Ore analysis of sample submitted:

Total Copper 3.16%

Acid Soluble Copper 1.05%

Total Acid Consumption - 132 pounds H<sub>2</sub>SO<sub>4</sub>/ton (from oxides silicates)

A 1500 gram sample crushed to -1 inch was placed in a leach circuit with 250 ml of solution containing acid equivalent to 25 pounds H<sub>2</sub>SO<sub>4</sub>/ton ore. The leach circuit was drained periodically and the liquor was analysed and replaced with 250 ml of fresh nutrient medium.

<u>Date</u>	<u>Cu (g/l)</u>	<u>Fe (g/l)</u>	<u>pH</u>	<u>Percent of Total Cu Extracted</u>
Dec. 13/67	Start	-	-	-
Dec. 18/67	14.9	0.1	1.2	5.2
Jan. 2/68	4.65	0.1	3.3	1.6
Jan. 9/68	3.90	-	-	1.2
Jan. 16/68	3.22	-	-	1.1
Jan. 25/68	2.95	-	-	1.0
Feb. 1/68	2.90	-	-	1.0
Feb. 8/68	2.68	-	-	0.9
Feb. 15/68	2.62	-	-	0.9
Feb. 22/68	2.36	-	-	0.8

The test was allowed to run out but on May 27 it was started again and the leach liquor contained 3.2 g/l Cu. Another random sample on July 10 contained 2.7 g/l Cu.

The solutions in between were discarded unassayed.

The design capacity of the plant is 2,000 lbs. of copper per day.

## 6. ECONOMIC ANALYSIS OF A LEACHING OPERATION

6.1 Several alternative methods of placing the deposit in production by bacteria leaching exist. Considering the existing plant, available detailed ore information, and cost factors, the most attractive scheme is:

6.1.1 Place Pommeroy No. 1 in production after completing sampling and blasting the remainder of the zone.

6.1.2 Enlarge the existing plant to a capacity of 4,000 lbs. of copper per day and place Pommeroy No. 2 South in production.

6.1.3 After production by bacterial leaching is successful on 6.1.1 and 6.1.2, design leach operations for Pommeroy No. 3, No. 4 and Beaver No. 1 and operate to a central plant. It is possible Pommeroy No. 1 and No. 2 North and South may also be treated at this plant.

6.1.4 Explore the area for other deposits.

### 6.2 Cost Estimate - Pommeroy No. 1

#### 6.2.1 Initial Preparation Cost

Road Repairs	\$ 3,000.00
Sampling and Testing	2,000.00
Surveys	750.00

Activate Plant	\$ 2,000.00	
Modify Plant Dryer	1,000.00	
Flow Meters	2,000.00	
Warehouse, Dry, Office	6,000.00	
Site Engineering	1,000.00	
Sampling	600.00	
Piping	500.00	
Sumps	2,000.00	
Drilling & Blasting	5,000.00	
Bulldozing	900.00	
Heap Covers	6,000.00	
Living Trailers	9,100.00	
Miscellaneous	<u>900.00</u>	\$44,750.00

Tune-up

Labour	\$ 1,200.00	
Acid	1,000.00	
Vehicles	<u>100.00</u>	<u>2,300.00</u>
		\$47,050.00

6.2.2 Operating Cost/month

At 2,000 lbs. copper per day

Crew	\$ 4,000.00	
Equipment & Lab Parts	300.00	
Lab Supplies	200.00	
Chemicals - Acid	2,400.00	2,000 x 4¢/day
Iron	5,400.00	
Other	100.00	



Power	\$ 210.00
Dryer	120.00
Other Services & Maintenance	500.00
Vehicles	<u>300.00</u>
	\$13,530.00 per month

At 1,200 lbs. copper per day - Cost per month

Operating Crew	\$ 4,000.00	
Equipment & Lab Parts	300.00	
Lab Supplies	200.00	
Chemicals - Acid	1,350.00	(1,200 x 4¢ x 28)
Iron	3,050.00	(1,200 x 9¢ x 28)
Other	100.00	
Power	210.00	
Dryer	100.00	
Other Services & Maintenance	500.00	
Vehicles	<u>300.00</u>	
	\$10,110.00	

6.2.3 Overhead

Vehicle Rental	\$ 300.00
Travel	800.00
Telephones & Telegraph	250.00
Miscellaneous Supplies	200.00
Consulting Engineer	1,200.00
Head Office	<u>3,300.00</u>
	\$ 6,050.00

6.2.4 Summary Pommeroy No. 1

Startup Cost	\$ 47,150.00
1 month - 2,000 lbs./day	19,530.00
16 months - 1,200 lbs./day	<u>258,560.00</u>
Total Cost	\$325,200.00
Contingencies	<u>14,710.00</u>
	\$340,000.00

Income @ 45¢ U.S. Copper = 42¢ Cdn. F.O.B. Mine

12,000 tons @ 3.5% = 840,000 lbs. Cu, 75% Recovery =  
630,000 lbs. Cu

Revenue = 630,000 x 42¢ = \$265,000.00

Apparent Cost = 340,000 - 265,000 = \$75,000.00

6.3 Cost Estimate - Pommeroy No. 2

6.3.1 Start up Cost

Road Repairs	\$ 1,000.00	
Sampling & Testing	500.00	
Site Engineering	500.00	
Sampling & Assaying	1,200.00	
Sumps	500.00	
Drilling & Blasting	15,000.00	
Piping - Supply	5,400.00	
Heaps	1,400.00	
Pump	1,500.00	
Inoculation	2,200.00	
Plant Addition	2,000.00	
Heap Covers	12,000.00	
Dozing	<u>900.00</u>	\$44,100.00

6.3.2 Operating Cost - Additional to Pommeroy No. 1

2 months @ 3,000 lbs./day

Operating Labour	\$	700.00
Equipment & Lab Parts		100.00
Lab Supplies		100.00
Chemicals - Acid		3,360.00 (28 x 3,000 x 4c)
Iron		7,560.00 (28 x 3,000 x 9c)
Other		100.00
Power		210.00
Drying		200.00
Other Services & Maintenance		100.00
Vehicles		<u>100.00</u>
		\$12,530.00

15 months at 1,650 lbs. per day

Operating Labour	\$	700.00
Equipment & Lab Parts		100.00
Lab Supplies		100.00
Chemicals - Acid		1,848.00 (28 x 1,650 x 4c)
Iron		4,158.00 (28 x 1,650 x 9c)
Power		210.00
Drying		200.00
Other Services & Maintenance		100.00
Vehicles		<u>100.00</u>
		\$ 7,516.00

6.4 CASH FLOW AND PRODUCTION FORECAST - POMEROY NO. 1 & 2

See Attached Table