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FINAL REPORT FOR 1960

on the

PORT RENFREW IRON PROPERTY

PORT RENFREW, B.C.

M.M. MENZIES.

31st Dec. 1960. O.W. NICOLLS.

PROPERTY FILE

Godman Property

121	Max	} Assessed owner
124	Rose	
125	Thorn	
130	Wax	
136	Ax	
140	Little Bobs	
143	Sirdar	
<hr/>		
172	Conqueror	H. W. Coakley.
173	Daniel	1274 Johnson St Victoria.

Above selected "sample" claims  
 information by phone from Gen'l Office, Real Property B.  
 25-1-62.

See map filed for Godman on page 1

EX 1-6

Daniel ore body  
NW 1/4 St Daniel claim

Conqueror - mainly on S  
1/2 St Conqueror claim

Daniel Conqueror  
S1/4 Sec  
L. H. B. B. S.

For position of Daniel & Conqueror  
ore bodies, see claim maps with  
Godman property folder.

25-1-62 HS

# PROPERTY FILE

FINAL REPORT FOR 1960

on the

PORT RENFREW IRON PROPERTY

MORANDA EXPLORATION COMPANY, LIMITED

and

INTERNATIONAL IRON MINES, LTD.

PORT RENFREW, B.C.

31st DECEMBER, 1960

M.M. MENZIES, P.Eng.

and

O.W. NICOLLS, Geologist

DECEMBER 1960

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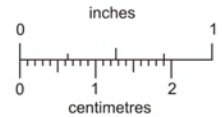
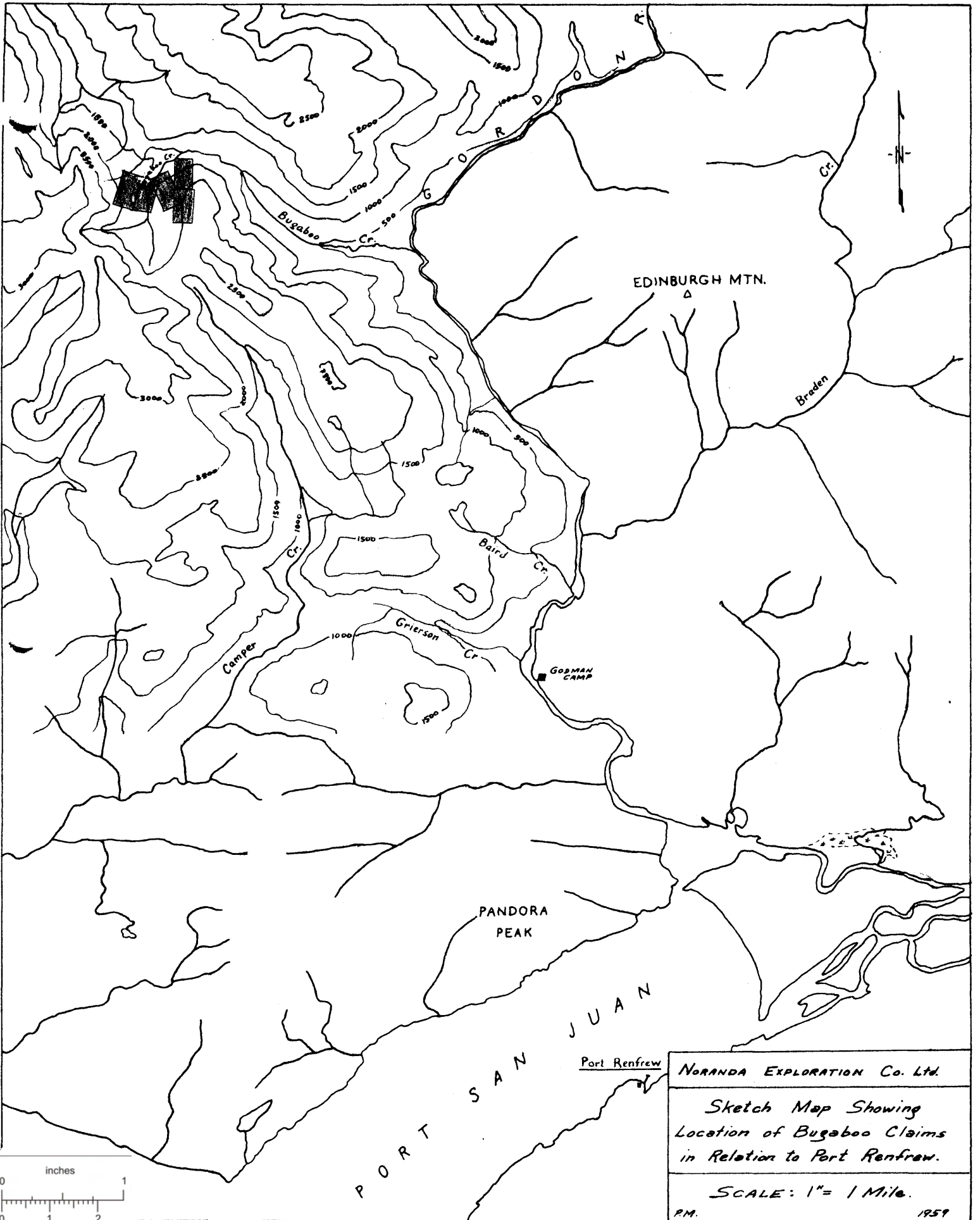
MAPS TO ACCOMPANY REPORT

DANIEL - Scale:- 1" = 50'

1.	Topographic plan with outline of open pit.	
2.	Dip needle survey.	
3.	Magnetometer survey.	
4.	Longitudinal Section	4800 E
5.	" "	4900 E
6.	" "	5000 E
7.	" "	5100 E
8.	" "	5200 E
9.	" "	5300 E
10.	Cross Section	4800 N
11.	" "	4900 N
12.	" "	5000 N
13.	" "	5100 N
14.	" "	5200 N
15.	" "	5300 N
16.	" "	5400 N
17.	" "	5500 N
18.	" "	5600 N
19.	" "	5700 N

CONQUEROR - Scale:- 1" = 50'

1.	Topographic plan.	
2.	Dip needle survey.	
3.	Magnetometer survey.	
4.	Longitudinal Section	5750 E
5.	" "	5800 E
6.	" "	5850 E
7.	" "	5900 E
8.	" "	5950 E
9.	" "	6000 E
10.	" "	6050 E
11.	" "	6100 E
12.	" "	6200 E
13.	Cross Section	3800 N
14.	" "	3900 N
15.	" "	3950 N
16.	" "	4000 N
17.	" "	4050 N
18.	" "	4100 N
19.	" "	4200 N



NORANDA EXPLORATION Co. Ltd.

*Sketch Map Showing  
Location of Bugaboo Claims  
in Relation to Port Renfrew.*

*SCALE: 1" = 1 Mile.*

P.M. 1959



This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

PORT RENFREW IRON

FINAL REPORT

1960

SUMMARY

The 1960 diamond drilling programme was designed to confirm the ore reserves and grades indicated by earlier work and to show sufficient additional tonnages to justify a mining operation. The programme has been successful on both counts.

Work during 1960 was limited to diamond drilling and some surface mapping. The Conqueror and Daniel Crown Grants were tied into a transit survey traverse starting at the Gordon River crossing, 6 miles northerly from Port Renfrew.

A magnetometer survey of the Conqueror and Daniel orebodies was made by Mr. E.L. Stephenson, Consulting Geophysicist, 1701 Lander Street, Reno, Nevada, on behalf of The Standard Slag Company. The survey results have not been made available to Noranda Exploration Company Limited.

Seven AX diamond drill holes were drilled on the Conqueror orebody and 15 on the Daniel. The larger sized core gave much better recovery than that obtained by EX drilling in 1959.



RESERVES

<u>Tonnages</u>	<u>Indicated</u>	<u>Probable</u>	<u>Possible</u>
<u>Daniel</u> (Open Pit)	1,695,000	561,000	
<u>Conqueror</u> (Mainly Under-ground)	<u>1,179,000</u>	<u>500,000</u>	<u>880,350</u>
TOTALS	2,874,000	1,061,000	880,350

Indicated & Probable Ore.....3,935,000 Short Tons

Indicated, Probable & Possible Ore...4,815,000 Short Tons.

<u>Grades</u>	<u>% Fe</u>	<u>% S</u>
<u>Daniel</u>	55.67	3.61
<u>Conqueror</u>	54.31	2.21
<u>Weighted Average</u>	55.2	3.04

(Note: Indicated Tonnages only used in Calculating Grades.)

Showings of magnetite occur on the adjoining Godman Crown Grants and reserves in excess of 500,000 tons are estimated.

The Bugaboo trail was surveyed and improved for pack horse use.



FINAL REPORT FOR 1960

on the

PORT RENFREW IRON PROPERTY

NORANDA EXPLORATION COMPANY, LIMITED

and

INTERNATIONAL IRON MINES, LTD.

PORT RENFREW, B.C.

31st DECEMBER, 1960

REFERENCES

Final Report, 1959, M.M. Menzies.

Bugaboo Creek Iron Deposit, January, 1960, A.M. Bell.

INTRODUCTION

LOCATION

The Port Renfrew Iron Property is near the headwaters of Bugaboo Creek, a tributary of the Gordon River in the Port Renfrew district of British Columbia. The camp, at 1450 feet elevation, is about 12 miles by road and trail from Port Renfrew and the two main orebodies lie between elevations of 1400 and 1700 feet.

ACCESS

A Bell G-1 helicopter was used to fly in all heavy equipment and a large supply of gas, oil and supplies at the start of the season.

A horse trail was constructed to the Port Renfrew Iron camp, commencing at Deakon's farm on the delta of the Gordon River and using the old Bugaboo trail as a base.

Two bridges, one 80 and the other 40 feet in length, were built across creeks and much work was done improving soft sections of the trail. From July to the end of the season the camp was supplied by three horses, later increased to five. About 20,000 pounds of supplies were carried by pack horses during the season.

Heavy rains seriously damaged the trail by November 1st, and horse packing was impractical after that date. A G-2 Bell helicopter was used to fly equipment and supplies to Port Renfrew at the end of the season.

A two mile road connects the Godman base camp with the main logging roads near Port Renfrew. Enough grading and gravelling was done to make it serviceable under all weather conditions. Two wheel drive vehicles can now reach the Godman camp, a half mile beyond Deakon's farm.

Although the Gordon river can easily be forded during dry spells, a crossing was formed by attaching a light fibre glass boat to an endless rope and pulley system. This made the boat available at all times to both sides of the river.

The Port Renfrew Iron camp had radio communication with the Vancouver radio-telephone system and with the Godman camp, the latter by means of a camp frequency and a portable radio telephone at the lower camp.

#### HARBOUR FACILITIES

Preliminary surveys for a breakwater at Wood's Nose, Port Renfrew harbour, have been made. Negotiations are in progress with the Federal Government for assistance in providing minimum breakwater protection to the proposed dock site.

GENERAL GEOLOGY

In general, the description of the Bugaboo geology in the 1959 report is accurate. However, recent work has provided additional information and some previously held views have changed.

Bodies of limestone appear to be completely surrounded by dioritic intrusives and thus may be considered "roof pendants".

Feldspars in the porphyry and lamprophyre dykes are strongly altered suggesting emplacement prior to or during skarn formation. It was previously thought that some dykes were post ore.

Low grade magnetite bodies normally have pyroxene skarn as a gangue while minor remnants of garnet skarn are found in high grade ores. It is possible, therefore, that the bulk of the Bugaboo iron ore was formed by the replacement of garnetite within large bodies of pyroxene skarn. Actinolite is a minor constituent in the zone of alteration.

The dyke rocks were not replaced by magnetite and some have the superficial appearance of post-ore intrusions.

The pyrrhotite content of the Bugaboo ores is finely disseminated throughout the magnetite and may have formed contemporaneously. Late forming sulphide veinlets, mainly pyrite, cut the magnetite.

### SURVEY CONTROL

The 1959 control grid was extended to the northeast of the Daniel orebody and the boundary between the Daniel crown grant and the Land No. 1 located claim established. A transit line was run from the Godman base camp up the Bugaboo trail and tied into the <sup>west</sup> northeast corner of the Conqueror crown grant.

### GEOPHYSICAL WORK

No further geophysical work was done on the Port Renfrew Iron property in 1960 by Noranda Exploration Company Limited. The Standard Slag Company retained E.L. Stephenson, consulting geophysicist, Reno, Nevada, to make a magnetometer survey of the Daniel and Conqueror orebodies using an Askania vertical balance magnetometer. The results have not been made available to Noranda.

### ECONOMIC GEOLOGY

#### DANIEL OREBODY

##### Diamond Drilling

Fifteen AX diamond drill holes, totalling 3239 feet, were drilled during the 1960 season. This drilling yielded 595 feet of ore grade magnetite, 554 feet of which fell within the limits of ore recoverable by open pit mining. Overburden averaged 61.5 feet for the 15 holes.

The average thickness of overburden over the Daniel orebody is 57 feet. Reliable samples of overburden were taken during the casing of the last four holes and the material recovered showed numerous layers of sand and gravel with a few

boulders a foot or so in diameter. These four holes were drilled at the north end of the body and the results are not representative of the mantle farther south where large, angular boulders occur in large numbers.

Summary of Daniel Drilling

<u>Year</u>	<u>D.D. Holes</u>	<u>Total Depth</u>	<u>Total Ore</u>	<u>Average Overburden</u>
1957	2 X-ray (both stopped in C.B.)	84	-	-
1959	13 EX (One stopped in O.B.)	2889	870 or 789 (Pit Area)	56
1960	15 AX	3239	595 or 554 (Pit Area)	61.5
	<hr/>	<hr/>	<hr/>	<hr/>
Total	30 holes	6212	1465 or 1343 (Pit Area)	59.0

Note: Average Overburden depth in Pit Area - 57 feet.

Structure

The shape of the Daniel orebody resembles a flattened cylinder with its axis oriented east of north and plunging about minus 20 degrees to the north. The ore lies on a gently undulating floor of limestone and porphyry rocks. Erosion has removed much of the original orebody leaving a surface sloping at minus 20 degrees to the north. The Daniel orebody is apparently limited on all sides by extensive intrusions of dioritic and porphyritic rocks. However, limestone is found at depth below the ore and if similar structural controls are present a deep iron orebody is a possibility.

### Ore Description

Magnetite drilled this year was similar to that drilled in 1959 but the sulphur content was 3.8 percent compared with 3.22 percent for the earlier drilling. Pyrrhotite and pyrite occurred in roughly equal proportions.

### Tonnages and Grade

The 1960 drilling has increased the indicated tonnage from 1,165,000 tons to 1,695,000 tons. Additional probable ore of 561,000 tons raises the Daniel ore potential to 2,256,000 tons.

Average grade of the Daniel ore is 55.67 percent iron and 3.61 percent sulphur. Other impurities occur as traces only.

### Mining

The preliminary pit area plotted on the accompanying surface plan is very rough but does give a good conception of the amount of waste material to be moved in open pit mining. An estimated 962,000 tons of waste and <sup>1,100,000</sup> ~~3,333,000~~ cubic yards of gravel must be moved. These figures give an ore:waste ratio of 1:1.22 by weight or 1:3.06 by volume. The overburden percentage of total waste is 65.17 percent by weight or 72.22 percent by volume.

### CONQUEROR OREBODY

#### Diamond Drilling

The 7 AX diamond drill holes completed in 1960 totalled 2935 feet of core and out 652 feet of ore grade magnetite. Core recovery in 1960 was better

than 80 percent. The improved recovery was largely due to the use of AX equipment.

Summary of Conqueror Drilling

<u>Year</u>	<u>D.D. Holes</u>	<u>Total Depth</u>	<u>Total Ore</u>	<u>Average Overburden</u>
1957	9 X-Ray	898	354	Collared in outcrop.
1959	15 EX (one lost in O.B.)	3669	1389	43
1960	<u>7 AX</u>	<u>2935</u>	<u>652</u>	<u>36.9</u>
TOTAL	31 holes	7502	2395	39.9 ( '59 & '60 average

Note: Average overburden over the Conqueror orebody is roughly 40 feet.

Structure

The structure of the Conqueror orebody is not very clear in detail and more drilling will eventually be required to fill gaps in existing geological knowledge. Work done so far has revealed certain broad structural features and shown a potential at least equal to that of the Daniel.

In contrast to the Daniel, the Conqueror strikes northwesterly and, on the surface, is divided into "West" and "East" pipe-like orebodies. Conqueror "East" plunges steeply westerly while Conqueror "West" appears to dip steeply to the south. The attitude of the "East" orebody is well established but that of the "West" will remain in doubt until more drilling is done. The inclined x-ray drilling of 1957 strongly suggests a steep southerly dip to the "West" orebody. If subsequent drilling substantiates this southerly dip then both bodies must join at depth as both are open and very strong at the greatest depths yet drilled.



The structure of the Conqueror may be likened to a "Y" lying in a north-westerly striking plane dipping roughly 75 degrees southwesterly. Conqueror "East" is then represented by the easterly striking arm, Conqueror "West" by the northerly striking arm, and the neck, 450 feet in depth, indicating the point of junction. The stem represents a possible continuation to still greater depths of the unified orebodies.

The primary ore control may be a tightly folded syncline of limestone with its axis striking southwesterly and plunging steeply in the same direction. If this is so, the emplacement of magnetite in the limbs of the syncline was controlled by a cross-cutting structure having the attitude of the "Y" described above. Recognizable dips in core range from 60 to 75 degrees and small scale folding and faulting is evident in the limestone walls of Bugaboo creek.

The orebodies are surrounded by recrystallized limestone, cut by porphyry dykes, and contain inclusions of unreplaced skarn. A large mass of diorite lying only 200 feet south of the falls has not been cut in drill holes. It is probable that the Conqueror ore will terminate against this dioritic intrusion at depth.

#### ORE

The Conqueror ore averages 54.31 percent iron and 2.21 percent sulphur, compared with 55.67 percent iron and 3.61 percent sulphur in the Daniel. Impurities other than sulphur occur in negligible amounts. Magnetite is fine grained and massive and the gangue is composed of lime and lime silicates. Actinolite is a minor accessory mineral.

TONNAGES

The 1960 drilling has increased the indicated reserves to 1,179,000 tons from 825,000 tons. Additional possible reserves of 1,380,000 tons have been calculated of which 500,000 tons is classed as probable ore.

MINING

The steeply plunging, pipe-like Conqueror orebodies lend themselves to economical underground mining. A small tonnage can probably be mined to advantage by open pit.

CONCLUSIONS

1. Ore reserves of the Conqueror and Daniel orebodies are adequate for an economic mining operation.
2. The 55 percent iron grade is excellent and the 3 percent sulphur content is sufficiently low to meet the requirements of the Japanese market because of their large and increasing sintering capacity.
3. The Daniel orebody is ideal for open pit operation and the Conqueror is well suited to economical underground mining methods.
4. Although more diamond drilling is required, it can safely be deferred until a road is put into the property.

RECOMMENDATIONS

1. Negotiations with the Federal Government on the proposed San Juan harbour breakwater should be expedited.

It is recommended that a second engineering study of the required harbour facilities be undertaken to determine the probable minimum breakwater length and the most advantageous positioning of the dock. Information now at hand is not adequate for planning and is not sufficiently detailed to convince Public Works that a short breakwater will meet our needs.

2. Assurance of a satisfactory sales contract with Japanese steel interests should be obtained before any more work is done on the property.
3. If negotiations with the Federal Government and the Japanese steel interests are encouraging by mid-summer a road should be built to the Bugaboo orebodies this year. The co-operation and assistance of British Columbia Forest Products should be sought.
4. Preliminary mine layouts and cost studies should be undertaken using the information now at hand.
5. Metallurgical tests should be completed without delay.

6. The access road should be completed before further development work is done.

Respectfully submitted



*M.M. Menzies P. Eng.*

M.M. Menzies, P.Eng.

31st December, 1960

APPENDIX "A"

CALCULATIONS OF ORE AND WASTE FOR DANIEL OREBODY

1960

Section	Area of Waste Rock	Area O.B. Waste	Volume of Waste Rock	O.B. Volume	Total Waste Volume	Indicated		Probable	
						Ore Area	Ore Vol.	Ore Area	Ore Vol.
48 N	11,000	25,520	825,000	3,828,000	2,200	125,000	2,520	13,600	
49 N	25,160	35,800	3,512,000	3,580,000	24,280	2,195,400	—	—	
50 N	33,160	29,760	3,316,000	2,976,000	27,520	2,464,200	2,360	236,000	
51 N	2,040	32,000	204,000	3,200,000	13,560	1,356,000	5,360	536,000	
52 N	360	32,000	27,000	3,200,000	27,040	2,664,800	—	—	
53 N	4,880	28,000	461,000	2,800,000	16,920	1,692,000	—	—	
54 N	2,440	45,800	146,400	4,580,000	15,680	1,572,000	15,840	1,584,000	
55 N	14,600	37,920	1,916,000	3,792,000	16,560	1,242,000	23,880	1,710,800	
56 N	190	24,400	19,000	2,440,000	—	—	—	—	
57 N	—	8,000	—	800,000	—	—	—	—	
<b>TOTAL:-</b>			10,426,400 cu. ft.	31,196,000 cu. ft.	41,622,400 cu. ft.		13,311,400 cu. ft.	4,202,800 cu. ft.	
48 E	22,040	23,120	3,857,000	3,468,000	960	48,000	—	—	
49 E	33,280	36,000	3,328,000	3,600,000	15,440	1,312,400	—	—	
50 E	4,600	56,160	791,000	5,616,000	66,040	5,221,000	20,440	1,142,800	
51 E	28,640	56,120	3,303,200	5,612,000	51,320	4,593,200	52,640	2,833,500	
52 E	14,800	55,200	1,160,000	5,520,000	24,320	2,432,000	6,720	672,000	
53 E	2,720	29,200	204,000	4,380,000	2,460	199,600	2,100	199,500	
<b>TOTAL:-</b>			12,643,200 cu. ft.	28,196,000 cu. ft.	40,839,200 cu. ft.		13,806,200 cu. ft.	4,767,800 cu. ft.	

ORE CALCULATIONS

Indicated Tonnage

North sections @ 8 cu.ft/ton      -  $\frac{13,311,400}{8}$  = 1,660,000 tons

East sections @ 8 cu.ft/ton      -  $\frac{13,806,200}{8}$  = 1,730,000 tons

AVERAGE:                              =  $\frac{3,390,000}{2}$  = 1,695,000 tons

Probable Tonnage

North sections @ 8 cu.ft/ton      -  $\frac{4,202,800}{8}$  = 525,000 tons

East sections @ 8 cu.ft/ton      -  $\frac{4,767,800}{8}$  = 596,000 tons

AVERAGE:                              =  $\frac{1,121,000}{2}$  = 561,000 tons

TOTAL: Indicated and Probable      = 2,256,000 tons

WASTE ROCK CALCULATIONS

Volume by North section              = 10,426,400 cu.ft.

Volume by East section                = 12,643,200 cu.ft.

AVERAGE Volume of Waste Rock      =  $\frac{23,069,600}{2}$  = 11,535,000 cu.ft.

Tonnage of Waste Rock by  
North sections @ 12 cu.ft/ton      =  $\frac{10,426,400}{12}$  = 869,000 tons

Tonnage of Waste Rock by  
East sections @ 12 cu.ft/ton      =  $\frac{12,643,200}{12}$  = 1,054,000 tons

AVERAGE TONNAGE OF WASTE ROCK      =  $\frac{1,923,000}{2}$  = 962,000 tons



OVERBURDEN CALCULATIONS

Volume by North sections = 28,196,000 cu.ft.

Volume by East sections = 31,196,000 cu.ft.

Average volume for pit area =  $\frac{59,392,000}{2}$  cu.ft. = 29,696,000 (assume 30,000,000 cu.ft.)

$\frac{1,100,000}{5,335,000}$  ~~cu. yds.~~

Weight of overburden to be removed (assume 120 lb. per cu.ft.) =  $\frac{3,600,000,000}{2,000}$  lbs. = 1,800,000 tons

TOTAL WASTE CALCULATIONS

Total waste (by volume) = 11,535,000 + 30,000,000 = 41,535,000 cu.ft.

Total waste (by weight) = 2,762,000 tons

Ratio ore/waste (by volume) =  $\frac{41,535,000}{13,559,000}$  = 1:3.06

Ratio ore/waste (by weight) =  $\frac{2,762,000}{2,256,000}$  = 1:1.22

O.B. Percentage of total waste (by volume) =  $\frac{30,000,000}{41,535,000} \times 100 = 72.22\%$

O.B. Percentage of total waste (by weight) =  $\frac{1,800,000}{2,762,000} \times 100 = 65.17\%$





GRADE CALCULATIONS

DANIEL OREBODY - 1960

IRON GRADES

Note: Sections weighted to obtain average grade.

Section	Ore Area (sq.ft.)	Fe. (%)	Section	Ore Area (sq.ft.)	Fe. (%)
48 N	2,200	44.68	48 E	960	54.02
49 N	24,280	52.55	49 E	15,440	55.40
50 N	27,520	57.81	50 E	66,040	52.84
51 N	13,560	59.72	51 E	51,320	55.41
52 N	27,040	57.83	52 E	24,320	61.71
53 N	16,920	56.96	53 E	2,460	62.65
54 N	15,680	56.78			
55 N	16,560	51.54			
56 N	—				
57 N	—				

North Sections  
Average Grade =  $\frac{8,046,506}{143,760} = 55.97\%$

East Sections  
Average Grade =  $\frac{8,895,331}{160,541} = 55.41\%$

Average Grade = 55.67% Fe.



GRADE CALCULATIONS DANIEL OREBODY 1960

Sulphur Grades

Note: Arithmetical average of ore sections within pit area. (Weighted by footage)

	<u>D.D.H. No.</u>	<u>Footage</u>	<u>Grade %</u>
<u>1959 D.D.H.'s</u>	101	109	3.00
	102	108	4.61
	103	25	4.68
	104	38	2.49
	105	10	3.42
	106	101	3.21
	107	54	3.80
	108	—	—
	109	37	3.05
	110	154	3.16
	111	72	2.61
	112	74	2.60
	113	7	16.20
<u>1960 D.D.H.'s</u>	114	15	4.22
	115	57	2.82
	116	62	6.98
	117	62	2.23
	118	65	3.05
	119	77	3.64
	120	95	4.47
	121	63	3.50
	122	7	2.53
	123	12	3.43
	124	39	3.30
	125	—	—
	126	—	—
	127	—	—
	128	—	—

1,343'      4844.63

Average grade -  $\frac{4844.63}{1343}$

= 3.61% S



APPENDIX "B"

ORE CALCULATIONS 1960

CONQUEROR OREBODY

INDICATED:			POSSIBLE:		
Section	Area (sq.ft.)	Volume (cu.ft.)	Section	Area (sq.ft.)	Volume (cu.ft.)
5750 E	11,920	596,000	5750 E	9,930	466,000
5800 E	11,360	568,000	5800 E	32,320	1,616,000
5850 E	13,040	765,600	5850 E	2,050	1,025,000 (Taken to the 1100' Level)
5900 E	21,920	1,238,000	5900 E	39,840	2,102,000
5950 E	33,960	2,408,000	5950 E	36,680	1,834,000 (Taken to the 1100' Level)
6000 E	1,080	54,000	6000 E	16,280	814,000
6050 E	31,220	2,057,200	6050 E	9,120	1,060,600
6100 E	27,400	2,166,400	6100 E	No Additional	
6200 E	13,760	910,000	6200 E	2,240	224,000
	<b>TOTAL</b>	<b>10,763,200 cu.ft.</b>		<b>TOTAL</b>	<b>9,147,600 cu.ft.</b>
3800 N	2,280	114,000	3800 N	5,960	298,000
3900 N	nil	nil	3900 N	37,280	2,796,000
3950 N	10,480	524,000	3950 N	36,000	1,800,000
4000 N	68,400	3,420,000	4000 N	46,640	2,332,000
4050 N	20,840	1,042,000	4050 N	50,520	2,526,000
4100 N	7,400	492,000	4100 N	39,280	2,866,000
4200 N	26,880	2,520,000	4200 N	4,200	320,000
	<b>TOTAL</b>	<b>8,112,000 cu.ft.</b>		<b>TOTAL</b>	<b>12,938,000 cu.ft.</b>

ORE CALCULATIONS

Indicated Ore

Average volume of E & N Sections =  $\frac{10,763,200 + 8,112,000}{2}$  cu.ft.

= 9,437,600 cu.ft.

Assuming 8 cu.ft./ton - Average tonnage

= 1,179,700 tons

Probable and Possible Ore

Average volume for E & N Sections =  $\frac{9,147,600 + 12,938,000}{2}$  cu.ft.

= 11,042,800 cu.ft.

Assuming 8 cu.ft./ton - Average probable and possible tonnages

= 1,380,350 tons

500,000 tons of this figure is classed as "probable" since it is certain that the ore continues strongly beyond the limits of the indicated tonnage.

SUMMARY

Indicated = 1,179,000 tons

Probable = 500,000 tons

Possible = 880,350 tons

TOTALS:

Indicated = 1,179,000 tons

Indicated + probable = 1,679,000 tons

Indicated + probable + possible = 2,559,350 tons



GRADE CALCULATIONS OCTOBER 1960

CONQUEROR OREBODY

IRON GRADES

Note: Sections weighted to obtain average grade.

Section	Ore Area (sq.ft.)	Fe. (%)	Section	Ore Area (sq.ft.)	Fe. (%)
5750 E	11,840	54.97	3800 N	2,280	47.90
5800 E	11,760	56.72	3900 N	nil	nil
5850 E	13,040	59.82	3950 N	10,480	50.05
5900 E	22,920	55.82	4000 N	68,400	56.81
5950 E	22,568	58.01	4050 N	20,840	48.21
6000 E	1,080	55.00	4100 N	7,400	47.89
6050 E	25,720	55.79	4200 N	27,280	56.59
6100 E	27,400	52.00			
6200 E	13,240	39.08			

**East Sections**

Average Grade -  $\frac{8,123,026}{149,568} = 54.31\%$

**North Sections**

Average Grade -  $\frac{7,422,397}{136,680} = 54.30\%$

Average Grade - 54.31% Fe.



GRADE CALCULATIONS OCTOBER 1960

CONQUEROR OREBODY

SULPHUR GRADES

Note: Sulphur grade is based on the arithmetical average of ore sections. Five foot samples were assayed for sulphur in 1959 but only composites were assayed in 1960.

<u>1960 D.D.H.'s</u>	<u>Footage</u>	<u>Sulphur Content (%)</u>
D.D.H. 216	6.0'	2.05
217	0.0	—
218	17.0	1.23
219	134.5	1.97
220	327.0	3.95
221	127.0	1.81
222	<u>40.5</u>	<u>2.20</u>
TOTALS	<u>652.0'</u>	<u>2.93% S. (Weighted by Footage)</u>

SUMMARY

- (1) Conqueror West 1959 Drilling 624.5' @ 1.02% S.
- (2) Conqueror East 1959 Drilling 802.5' @ 2.58% S.
- (3) 1960 Drilling (East & West) 652.0' @ 2.93% S.

AVERAGE GRADE: 2,079.0' @ 2.21% S. (Weighted by Footage)



APPENDIX "C"



SUMMARY

COMBINED DANIEL AND CONQUEROR OREBODIES

INDICATED RESERVES

Daniel Open Pit	1,695,000 tons
Conqueror Underground	<u>1,179,000 tons</u>
TOTAL	2,874,000 tons

PROBABLE RESERVES

Daniel	561,000 tons
Conqueror	<u>500,000 tons</u>
TOTAL	1,061,000 tons

POSSIBLE RESERVES

Conqueror	880,350 tons
-----------	--------------

INDICATED AND PROBABLE RESERVES 3,935,000 tons

INDICATED, PROBABLE AND POSSIBLE RESERVES 4,815,000 tons

COMBINED GRADES

2,874,000 tons at 55.01% Fe.

3.04% S.

Trace Cu.

Other impurities are negligible.



APPENDIX "D"

SUMMARY OF D.D.H.'s ON THE CONQUEROR CROWN GRANT TO DECEMBER

1960

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1957								
X-Ray Holes	1	4252.50 N 5768.50 E	Vertical	1483.0'	7' (Casing)	126'	22-42	20.0'
	2	4252.50 N 5768.50 E	-45°/N44°E	1483.0'	23' "	44'	—	—
	3	4252.50 N 5768.50 E	-75°/N44°E	1483.0'	19' "	54'	32½-34½ 39-49	12.0'
	4	4201.60 N 5799.00 E	-45°/N55°E	1467.0'	0' "	129'	0-13½ 39-125½	100.0'
	5	4215.00 N 5817.00 E	-45°/S05°E	1467.0'	2' "	58'	2-7; 17½-22½	10.0'
	6	4216.00 N 5828.50 E	-30°/N77°E	1467.0'	0' "	114'	0-18; 26-105 109½-111½	99.0'
	9	4264.00 N 5937.00 E	-30°/S25° 08' W	1463.0'	16' "	149'	42-121	79.0'
	10	4264.00 N 5942.50 E	-30°/S20° 40' W	1465.0'	12.5' "	140'	91½-118½	27.0'
	11	4254.00 N 5765.50 E	-45°/S44°W	1483.0'	25' "	84'	30½-36½ 71½-75	7.5'

Two holes started on the Daniel but both abandoned at about 40' in boulders.

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1959 EX-Holes	201	3994.90 N 6112.40 E	Vertical	1530.7'	39.5'	349.8'	39½-95 103½-110 110.0-307	259.0'
	202	3800.00 N 6100.00 E	Vertical	1584.0'	62'	189.0'	62-111 126-132	55.0'
	203	4000.00 N 5900.00 E	Vertical	1560.0'	78'	78.0'	Hole lost due to caving.	
	204	4089.12 N 5901.45 E	Vertical	1544.4'	69.5'	216.0'	76-85 97½-101½ 105½-106½ 131-133; 160-161; 163-178½; 183½-189	40.0'
	205	4205.41 N 5909.65 E	Vertical	1498.3'	25.5'	219.5'	25½-30; 37½-38 41½-131; 132½-187 191½-195.	152.5'
	206	4191.04 N 5989.57 E	Vertical	1519.6'	48'	153.5'	61-66½	5.5'
	207	4105.30 N 6012.47 E	Vertical	1527.8'	50'	200.0'	66-66½; 100-118 146½-150½	22.0'
	208	4093.82 N 6191.50 E	Vertical	1515.9'	24'	194.0'	24-24; 46-47; 55-89; 98-116; 120-123.	57.0'
	209	3927.89 N 6108.55 E	Vertical	1555.2'	49'	165.0'	49-65½; 127½-128½	17.5'

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1959 - cont'd								
EX-Holes	210	3991.40 N 6048.69 E	Vertical	1548.5'	57.5'	487.0'	57½-73; 94½-120 172-174; 210-219½; 237-386½; 387½-414 415-431; 454-468	258.5'
	211	4053.79 N 6104.08 E	Vertical	1526.2'	28'	271.0'	28-36; 59-70; 83-89; 105-160; 162-211½; 217-221; 222-229½.	141.0'
	212	4049.42 N 6195.45 E	Vertical	1530.3'	22.5'	252.0'	22½-42½; 45½-55; 84½-87; 127-140; 156-198.	87.0'
	213	3943.13 N 6052.73 E	Vertical	1559.0'	61.5'	454.0'	99-101½; 108-134½; 288-454.	95.0'
	214	4200.68 N 5852.69 E	Vertical	1491.8'	25'	191.0'	25-51½; 71-73½; 77-92; 96-112; 132½-144½; 147-153½.	78.5'
	215	4207.29 N 5803.69 E	Vertical	1472.3'	nil	250.0'	6-28½; 118-133; 134-137; 138-175; 176-217; 233-235.	120.5'
1960								
AX-Holes	216	4106.60 N 6101.43 E	Vertical	1510.2'	26'	195'	88-94	6.0'
	217	4101.20 N 6300.86 E	Vertical	1510.6'	10'	150'	—	—

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1960 - cont'd								
AX-Holes	218	3952.26 N 6096.51 E	Vertical	1550.6'	49'	300'	49-66½	17'
	219	3848.69 N 6050.50 E	Vertical	1560.3'	61'	647'	84½-93; 98-128; 194½-199; 388-442 459½-480; 547½-564½.	134.5'
	220	4001.37 N 5952.80 E	Vertical	1559.6'	79'	612'	78-88½; 108-115½ 113-210½; 256½-273; 300-516.	327'
	221	4195.99 N 5756.23 E	Vertical	1447.5'	21'	431'	29½-61; 90-100 125½-128; 134-135½; 222½-240; 299-315; 318-333; 342-376.	127'
	222	4146.22 N 5748.55 E	Vertical	1473.5'	10'	600'	10-15; 76-94½; 485-507.	40.5'

SUMMARY

1957	Footage drilled -	898 feet	Magnetite intersected -	354.5 feet
1959	" "	- 3,669 "	" "	- 1,389.0 "
1960	" "	- <u>2,935</u> "	" "	- <u>652.0</u> "
	TOTALS	<u>7,502 feet</u>		<u>2,395.0 feet</u>



SUMMARY OF D.D.H.'s ON THE DANIEL CROWN GRANT TO DECEMBER

1960

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1957 X-ray Holes	7	5035.00 N 4967.00 E	Vertical	1640' (approx)	40'	40'	Stopped in Overburden.	
	8	5192.50 N 4990.00 E	Vertical	1600' (approx)	44'	44'	Stopped in Overburden.	
1959 EX Holes	101	5000.00 N 4999.41 E	Vertical	1638.0'	49'	401'	67-176;181-195; 210-235.	159.0'
	102	5206.71 N 4998.52 E	Vertical	1597.0'	61'	200'	61-169	108.0'
	103	5298.61 N 5001.01 E	Vertical	1583.7'	60'	150'	65-85;95-112;	37.0'
	104	4800.00 N 5000.00 E	Vertical	1682.0'	57'	213'	75-85 $\frac{1}{2}$ ;103-131.6;	39.1'
	105	5001.00 N 4802.00 E	Vertical	1685.0'	33'	301'	180-210	30.0'
	106	5000.00 N 5100.00 E	Vertical	1611.0'	54'	268'	54-100;155-210.	101.0'
	107	5499.88 N 5204.64 E	Vertical	1545.0'	80'	257'	141-195	54.0'
	108	5600.00 N 5100.00 E	Vertical	1540' (approx)	45'	45'	Stopped in Overburden.	
	109	4900.00 N 4900.00 E	Vertical	1695.0'	68'	270'	184-185;194-231; 248-262.	52.0'

Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1959 cont'd								
EX Holes	110	4900.00 N 5000.00 E	Vertical	1659.0'	50.5'	255'	50½-144;157-192 202-210;244-248 213½-218.	145.0'
	111	4900.00 N 5100.00 E	Vertical	1641.0'	46'	225'	138-168;171½-181 200-207.	46.5'
	112	5200.00 N 5100.00 E	Vertical	1584.0'	57'	164'	57-131.	74.0'
	113	5200.00 N 4900.00 E	Vertical	1611.0'	54'	140'	68-93 (Chiefly pyrr'.)	25.0'
1960								
AX Holes	114	5102.33 N 5204.88 E	Vertical	1590.0'	51'	203'	51-68	17.0'
	115	5101.66 N 5097.03 E	Vertical	1601.0'	51'	231'	51-108;153½-156; 161-163.	61.5'
	116	5113.27 N 4994.49 E	Vertical	1618.0'	60'	226'	60-82;90-123; 134-141.	62.0'
	117	5197.12 N 5191.83 E	Vertical	1576.2'	45'	229'	45-107.	62.0'
	118	5293.56 N 5197.78 E	Vertical	1564.6'	50'	218'	58-90;100-138	70.0'
	119	5399.78 N 5151.55 E	Vertical	1557.0'	64'	246'	64-90;111-157; 213-223.	82.0'
	120	5498.78 N 5106.13 E	Vertical	1542.8'	58'	249'	58-121;140-181	104.0'



Year	D.D.H. No.	Location	Attitude	Elevation	Depth O.B.	Depth Hole	Magnetite Sections	Total Mag. Sections
1960 cont'd								
AX Holes	121	5397.17 N 5320.03 E	Vertical	1552.8'	77'	225'	77-140.	63.0'
	122	5297.03 N 5320.14 E	Vertical	1559.0'	59'	201'	59-67;89-90½.	9.5'
	123	5209.81 N 5318.15 E	Vertical	1566.3	45'	104'	45-57.	12.0'
	124	5503.83 N 4990.50 E	Vertical	1545.2'	61'	239'	61-102;112-113½; 156-165.	49.5'
	125	5707.40 N 5098.20 E	Vertical	1530.6'	79'	200'	nil	—
	126	5713.56 N 5293.69 E	Vertical	1519.0'	69'	217'	nil	—
	127	5594.15 N 5302.66 E	Vertical	1529.3'	77'	226'	nil	—
	128	5488.00 N 5300.00 E	Vertical	1548.0'	76'	225'	nil	—

SUMMARY

1957	Footage drilled -	84 feet	Magnetite intersected	nil feet
1959	" "	- 2,889 "	" "	870 "
1960	" "	- <u>3,239</u> "	" "	<u>595</u> "
	TOTALS	<u>6,212 feet</u>		<u>1,465 feet</u>



APPENDIX "E"

Wright Engineers Limited

R E P O R T

on

BREAKWATER REQUIREMENTS ADJACENT  
TO DEEP-SEA DOCK PROPOSED FOR  
PORT OF SAN JUAN, B.C.

for

NORANDA MINES LIMITED - BUGABOO PROPERTY  
PORT OF SAN JUAN, B.C.

PROJECT No. 278

OCTOBER, 1960

NORANDA MINES LIMITED - BUBAROO PROPERTY

SUMMARY

It is our impression that the Department of Public Works favour a 1,000 ft. minimum length of breakwater to provide a safe emergency harbour for the fishing fleet and we have no grounds to dispute this figure.

Our original recommendation for a maximum 400 ft. Breakwater seemed reasonable and should enable ore carriers to dock and to be loaded under a wide range of wind and wave conditions. It was not intended to provide protection under really severe weather conditions.

We feel that both recommendations are sound when the differing objectives are taken into account. To feel justified in changing our recommendation we would need access to further data on the wind and wave action in the area if such is available.

Such data could enable us to predict what effect different lengths of Breakwater would have on the conditions at the dock and weigh the economics of capital investment in the breakwater against the cost of delays, demurrage charges and investment in stockpile facilities.

The cost of a Breakwater is approximately \$1,200,00 per foot or about \$1,200,000.00 for a 1,000 ft. Breakwater.

GENERAL DISCUSSION

We have had several discussions with Mr. W. Walkey, Chief Engineer, British Columbia and Yukon Department of Public Works, Vancouver regarding the proposed Breakwater at San Juan Harbour.

GENERAL DISCUSSION - continued

They have been studying the problem of creating a safe harbour at San Juan for many years and have arrived at a tentative proposal which apparently is based on a study of weather and wave action done by the National Research Council at the request of the Department of Public Works.

We have been informally advised that 1,000 ft. of Breakwater is considered to be minimum to provide a safe anchorage for the gill net fishing fleet. Based on an interpretation of the National Research Council study by Mr. Peter Andrew of the Department, it appears that a Breakwater would dampen waves with a height of 15 ft. and a length of 280 ft. to a surge of 2-1/2 ft. at a point 700 ft. east of the wharf center line shown on Wright Engineers Limited Drawing No. 278-1-3. Under the same conditions the surge was estimated at 2 ft., 700 ft. west of the wharf center line. It has been suggested that 1-1/2 ft. is the maximum which can be considered safe for a ship tied to a dock.

The above data is considered to be very theoretical and would probably require construction of a model for confirmation. Because of the special nature of the problem and the limited information available our comments must be regarded as general rather than specific but without a thorough study we believe the wise course would be to change the natural harbour conditions as little as possible and consequently prefer a minimum Breakwater which could be extended later as conditions warrant.

We are endeavouring to obtain wind and wave data in the vicinity from the U.S. Coast Guard and the Canadian Meteorological Office. From this data we may be able to prove that a Breakwater of lesser length is justified.

To do so we will have to carefully consider the dock occupancy period coupled with the cost of necessary stockpile facilities. Based on a ship every two weeks on a regular schedule it may be possible

GENERAL DISCUSSION - continued

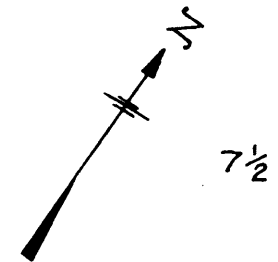
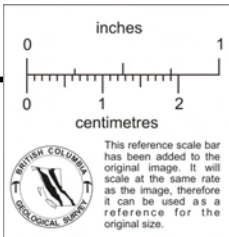
to predict delay and demurrage cost and compare this with the investment required in a Breakwater. If the indicated delays were pronounced seasonal it might even be possible to stop scheduled shipments for a period of time and arrange for extended stockpiling.

CONCLUSION

We are not convinced that a 1,000 ft. Breakwater is required for the intended usage of the dock. Without further data we can find no justification for altering our initial recommendation.

If additional information on wind and wave conditions can be obtained it might be possible to predict the length of Breakwater within the economics of the overall scheme.

H.V. Moller/as



# PORT SAN JUAN

8  
5

7

ORIGINAL MAP PREPARED BY -  
WRIGHT ENGINEERS LIMITED

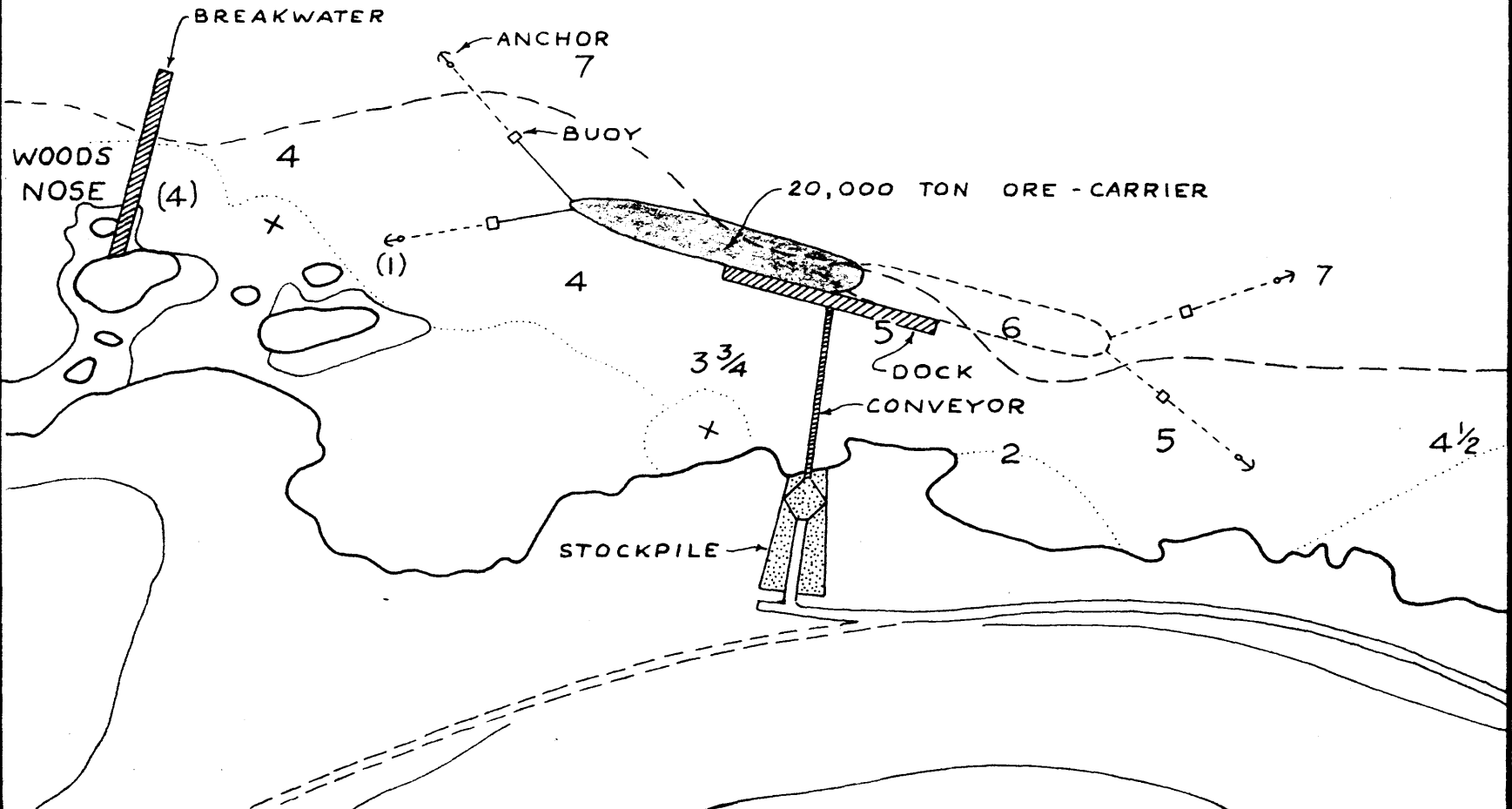
NORANDA MINES LTD. BUGABOO PROP  
PORT SAN JUAN, B. C.

DEEPSEA DOCK AND MOORING  
ARRANGEMENT FOR ORE-CARRIERS

DRAWN BY KVV

SCALE 1" = 340'  
DATE 23/9/60

TRACED BY PMF



APPENDIX "F"



NORANDA MINES LIMITED

NORANDA, P.Q.

BUGABOO PROJECT

REPORT NO. 3

Laboratory Tests on Conqueror Mine Run

Noranda Concentrator Experimental Laboratory

May 4-9, 1960

HIA/ag

Distribution

A.M. Bell  
H.T. Airey  
J.H. Stovel  
C.E. Anderson  
M.M. Menzies

(signed - H.L. Ames)  
H.L. Ames,  
Concentrator Superintendent.

(signed - H. Hryniewich)  
W. Hryniewich,  
Metallurgist

Noranda Mines Limited  
May 19, 1960

BUGABOO PROJECT

REPORT No. 3

BUGABOO SAMPLE NO. 5

1. Sample

About 60 lbs. of sample was received on March 31. According to a covering letter from Mr. M. M. Mensies dated April 8, this material was representative of normal Bugaboo ore. Weighted 1000-gram samples were prepared from this material for testing purposes.

2. Head Analyses

A 500-gram composite was ground, and showed the following chemical composition:

		%
Fe	-	53.8
S	-	2.3
SiO <sub>2</sub>	-	10.4
P	-	0.019
As	-	N.D.

3. Magnetic Separation

Magnetic separation was done on 1000-gram lots utilizing three stages in a very weak magnetic field.

Flowsheet and results of test B49 are appended. The ore was crushed to pass 4 mesh (0.185") in this case.

4. Discussion of Results and Conclusions

(a) Crushing a little finer than the proposed minus 1/4-inch is indicated to affect high iron recovery. With ore passing 3 mesh (.263"), a 57.3% recovery of iron at 63.2% grade was realized. With ore passing 4 mesh (0.185"), iron recovery was 88.4% at a 64.6% grade.

(b) Upgrading and recovery of iron should not be too difficult. Both these factors will be influenced by ore fineness.

4. Discussion of Results and Conclusions, Cont'd:

(c) Due to dilution by gangue the initial sulphur content of the ore was lower than the 3% maximum permissible in the shipping product. However, there was no concentration of sulphur in the concentrate, indicating that sulphides are effectively rejected in a very weak magnetic field.

**BUGABOO Sample No. 5**  
**Test B-49**

**HEAD**  
% FE - 58.1  
% S - 2.3  
% SiO<sub>2</sub> - 8.4

**No 1  
MAGNETIC  
SEPARATION**

**No 1 CONCENTRATE**

WT %	ASSAY %	DIST'N %
60.6	FE - 65.1	67.9
	S - 1.7	44.1
	SiO <sub>2</sub> - 4.2	30.5

**TAILING**

WT %	ASSAYS %	DIST'N %
39.4	FE - 47.3	32.1
	S - 3.3	55.9
	SiO <sub>2</sub> - 14.7	69.5

**No 2  
MAGNETIC  
SEPARATION**

**No 2 CONCENTRATE**

WT %	ASSAY %	DIST'N %
15.3	FE - 63.1	16.6
	S - 2.1	13.7
	SiO <sub>2</sub> - 5.5	10.0

**TAILING**

WT %	ASSAYS %	DIST'N %
24.1	FE - 37.2	15.5
	S - 4.1	42.2
	SiO <sub>2</sub> - 20.5	59.5

**O' ALL CONCENTRATE**

WT %	ASSAY %	DIST'N %
79.4	FE - 64.6	88.4
	S - 1.8	61.1
	SiO <sub>2</sub> - 4.5	42.7

**No 3  
MAGNETIC  
SEPARATION**

**No 3 CONCENTRATE**

WT %	ASSAY %	DIST'N %
3.5	FE - 63.0	3.9
	S - 2.2	3.3
	SiO <sub>2</sub> - 5.2	2.2

**FINAL TAILING**

WT %	ASSAYS %	DIST'N %
20.6	FE - 32.9	11.6
	S - 4.4	38.9
	SiO <sub>2</sub> - 23.2	57.3

NOTE - DISTRIBUTIONS IN TERMS OF HEADS  
- VERY WEAK MAGNETIC FIELD  
- CRUSH MINUS 4 MESH (.105")