93A-2-1

Water Well Test No. 3

Boss Mountain

Noranda Mines Limited

W.L. Brown, P.Eng.
R.B. Erdman, Geol.

INTRODUCTION

The third test well was completed in the Valley of Molybdenite Creek on May 1st, 1964.

Drilling and testing of the well were supervised by Robinson, Roberts & Brown Ltd.

DRILLING

The well was drilled to a total depth of 98.5 feet with soil samples collected every two feet in water-bearing formations. These samples were examined and retained by Mr. Erdman of this office.

An abnormal amount of time was spent drilling this test well because of the presence of boulders in the section penetrated.

Three water bearing zones were penetrated in the well. These were from 70 to 79 feet; 80 to 88 feet; and 90 to 97 feet below ground surface.

The lithologic units of the well and general water-bearing characteristics are outlined below.

Depth below Ground Surface	Description
0 - 8 feet	sand, clay and boulders
8 - 47	till-like material with boulders
47 - 51	fine gravel and silty sand; some H_2O
51 - 62	silty sand and gravel clay binder; some H_2O
62 - 70	till-like material
70 - 79	fine to coarse sand, bail tested at 20 US gpm wet flowed
79 - 80	tight silty sand
80 - 88	silty brown sand; some gravel, bail tested @ 12 US gpm
88 - 90	tight silty sand and gravel
91 - 97	fine sand and gravel, bail tested at 40 US gpm
97-98.5 T.D.	boulder

Additional water-bearing zones may be present below the 98.5 feet total depth but the delays in drilling and the collapse of the casing shoe made it necessary to terminate and to test the water-bearing intervals.

TESTING

A 7-foot perforated 6-inch pipe was set from 90 to 97 feet. A minor amount of development work was done to clear the perforation and fine sand from the area adjacent to the well. The test pump was then set and a 70-minute test run on the formation.

The data obtained from this pump test shows that the lower aquifer (90-97 feet) is of large areal extent and is capable of producing up to 110 US gpm.

CONCLUSION and RECOMMENDATION

Available information indicates that:

1. The Valley of Molybdenite Creek contains an aquifer that is capable of producing in excess of 750 Imp. gpm from a group of wells (4 to 6) spaced approximately 1000 feet from eachother;

2. The screening and full development of the complete aquifer (70 to 97 feet) in Test Well No. 3 would most probably bring its productive capacity up to the 150 to 200 Imp. gpm range;

3. The temperature of the ground water is about 48 degrees at this time;

4. To confirm the extent of the aquifer it is recommended that a 4th test hole be drilled in the Valley of Molybdenite Creek, approximately 1000 feet from the existing well. This well could be located on the proposed axis of the dam and therefore be used as a foundation test as well as a water well test. Such a procedure could in no way jeopardize the dam.

5. Wells capable of producing up to 200 Imp. gpm from 100± feet can be constructed for less than $8,000. Thus the total well field (assuming 5 wells) should not cost more than $60,000, including wells, pumps, housing, controls, field piping, etc. The refinement of the cost estimates for pumps, etc., is left for the engineers of Ingledew, Kidd & Associates Ltd.

W.L. Brown, P.Eng.

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PRELIMINARY REPORT

GROUNDWATER POTENTIAL

BOSS MOUNTAIN MINE

Noranda Exploration Co. Ltd.

W.L. Brown, P.Eng.

December, 1963

INTRODUCTION

Robinson, Roberts and Brown Ltd. was authorized to conduct a short office feasibility study to illucidate the groundwater potential of the area immediately adjacent to the Boss Mountain Mine. The data used were obtained from the mill site foundation report, air photos, and published geologic maps.

TOPOGRAPHY and CLIMATE

The markedly straight, north-south trending valley containing the Boss and Molybdenite Creeks probably contains the thickest section of unconsolidate sediments in the area. This valley will obtain water from a considerable area on both sides. This recharge or infiltration area possibly will not coincide with the surface drainage pattern. For example, the divide between Boss and Molybdenite Creek probably does not exist in the subsurface. This divide looks, on air photos, to have been formed by debris from Molybdenite Creek and therefore is relatively extremely young in age.

No exact weather data is available for the area but general information indicates that

Total precipitation is approximately 50 inches;

Temperature fluctuates between approximately 50° below to 90° above

Of interest is the indication that at least one-quarter of the annual precipitation falls during the summer months. This will lessen the effect evaporation and transpiration will have on subsurface water reservoirs.

GROUNDWATER GEOLOGY

The subsurface configuration of bedrock beneath the valley can be interpreted from the results of existing drill holes. It should be noted that DDH No. 1 (1962) and DDH No. 2 (1962) did not encounter bedrock at depths of 50 and 30 feet. On an east-west cross-section DDH No. 1 (1962) is located in the central part of the mill site and DDH No. 2 (1962) is located about 20 feet east of the mill. Unfortunately, the results of DDH No. 3 (1962) are not available. From the available data we interpret that bedrock will lie at depths of 250 to 350 feet at a point in the middle of the valley 1000 feet due east of the mill site.

There is a marked similarity between this valley and the Highland Valley near Bethlehem Copper Corp.Ltd. We have successfully developed wells in the Highland Valley which can produce up to 1400 gpm. The Highland Valley and the Boss - Molybdenite Valley are both narrow mountain valleys which are long and straight and which trend at right-angles to the main direction of glacial ice movement. We know that there is some 700 feet of unconsolidated sediments in the Highland Valley containing two glacial till sheets with good water-bearing sand and gravel filled buried channels at a depth of 300 feet.

Because the Boss-Molybdenite Valley trends athwart the last main direction of glacial movement it is probable that tills, sands and gravels and clays will be preserved in it. The productive capacity of the water-bearing zones cannot, obviously, be predicted. However, if approximately 250 to 350 feet of sediments are present it is most probable that zones capable of producing one to two million gallons per day will exist. Unfortunately, only a properly conceived and executed test drilling program can give a definite answer.

A subsurface reservoir at a depth of about 300 feet will have a recharge area that is greater than the drainage basin available to the surface water supply. The temperature of the groundwater will remain practically constant in the 48 to 50° F. range.

We note that the surface water supply is based in part on obtaining water from the mine and from Molybdenite Creek. We believe that the flow in the creek will be reduced if the mine produces any considerable amount of water.

Reports on the foundation holes indicate that bedrock contains water under a slight artesian head. This indicates that any subsurface reservoirs in the valley are receiving water from the mountain slopes. At this time we cannot evaluate the possibility of obtaining water from bedrock. Such an attempt should only be considered if the unconsolidated sediments in the valley are too thin.

COST ESTIMATES

The following estimates are based upon the successful development of two wells capable of a combined production of 1000 Imp. gpm (If a lower amount is required then the costs may be reduced significantly).

Estimated cost of two wells	$28,000
Estimated cost of two pumps, controls, housing, etc.	20,000
Estimated cost of 1000 feet of 12-inch diameter main	15,000
Total estimated cost	$63,000

The above estimates are considered conservative but should be more firmly based by calling for bids from several capable drilling contractors prior to proceeding with the work.

A test well should be drilled first. Normally, this would be an 8-inch diameter well that would be properly tested and evaluated. Data from the test well would be used to design the production wells. The cost of the test well will range between $5,000 and $10,000. The low figure will be the cost of a totally unpromising, 350-foot well, while the high figure will be the cost of a fully tested, successful well. Obviously, the actual cost can range throughout this scale. A reasonable figure to assign to risk capital would be approximately $7,500.

Some clients wish to add to their risk by drilling a test well that, if successful, can be converted to a production well. Thus, if a large diameter test well is drilled, the testing program will cost approximately $10,000. However, at least an estimated 70% of this amount can probably be applied against the cost of the first final production well. The cost of the pure test well plus the cost of the final wells and attachments is estimated to be $73,000, while the cost of the convertible test well plus the rest, is estimated to be $66,000. The risk for the first is $7,500 and the second $10,000.

CONCLUSIONS and RECOMMENDATIONS

1. We believe that there is a reasonable chance of successfully developing 1000 Imp. gpm from wells located approximately 1000 feet east of the mill site.

2. A properly conceived and executed testing program is necessary to confirm this interpretation which is based upon available data and analogy with a similar area.

3. We believe that about 2.5 billion gallons per year will be available to recharge the subsurface reservoirs of the valley. (1000 Imp. gpm equals .5 billion gallons per year).

4. The water produced from properly designed, constructed, and developed wells will be clear and clean. The chemical quality should be suitable for mill use.

5. A groundwater supply may possibly be more reliable than a surface supply in this area.

Respectfully submitted,

W.L. Brown, P.Eng.
ROBINSON, ROBERTS & BROWN LTD.
Groundwater Geologists

WLB/hb