
resource and pollution management

May 7, 1987.

Mr. Alex J Davidson
Exploration Manager
Western Canada
Corporation Falconbridge Copper
6415 - 64th Street
Delta, B.C.
V4K 4E2

Dear Mr. Davidson:

Re: Mount Sicker Project, Chemainus, B.C.

As an interim report, I have enclosed for your review the water quality results for samples collected on March 27, 1987 from both the Mount Sicker and Lara Properties. Sample sites are shown on the attached map. Note that sample sites 1,2,3,4, and 5 are common to both studies but only the analytical costs for sites 6,7,8 and 9 are proportioned to Corporation Falconbridge Copper.

I wish to draw your attention to the water quality data for sample sites 4 and 7. These sites are located downstream of the former operations (site 4) and downstream of the abandoned tailings disposal area (site 7). Whereas the natural water quality in the Chemainus watershed is relatively soft (<50 mg/L CaCO₃), low in dissolved and suspended solids (<30 mg/L) and low in conductivity (<50 umhos/cm), sample sites 4 and 7 exhibit abnormally high dissolved solids content (167 to 280 mg/L) and hardness (119 to 165 mg/L CaCO₃). The majority of these high values are reflected in high dissolved calcium and magnesium, but components such as sulphate levels and heavy metals are much above background and are an indication of a leachate source. Metals of concern include arsenic, barium, cadmium, copper, lead and particularly zinc which presently exceeds the provincial standards for an allowable discharge.

Staff gauges were also installed at sites 6,7,8 and 9, and calibrated using Rhodamine WT dye techniques. Flows and corresponding gauge heights were as follows:

Station No. 6 : Nugget Creek	Flow 0.67 ft ³ /s (0.019 m ³ /s) Gauge Reading 0.86 ft (0.26 m)
Station No. 7 : Unnamed Creek	Flow 0.011 ft ³ /s (0.0003 m ³ /s) Gauge Reading 0.18 ft (0.055m)
Station No. 8 : Bonsall Creek	Flow 4.95 ft ³ /s (0.139 m ³ /s) Gauge Reading 0.76 ft (0.23 m)
Station No. 9 : Whitehouse Creek	Flow 14.0 ft ³ /s (0.396 m ³ /s) Gauge Reading 1.94 ft (0.59 m)

Subject to your direction, we are proposing to supply Harold Gibson or Michael Gray with sufficient equipment to complete a second sampling. This would occur later this year in conjunction with a low flow sampling at the Lara Property. At that time we would also provide you with a more complete water quality report.

Should you have any questions on the foregoing please do not hesitate to give me a call.

Yours truly
HATFIELD CONSULTANTS LIMITED

ROBERT L. HALLAM
Associate Biologist

Enclosures (2)

cc Mr. Harold Gibson
Corporation Falconbridge Copper
5215 Hykaway Road
Duncan, B.C.

Table 1
Corporation Falconbridge Copper
Mount Sicker Property, Chemainus, B.C.

Analyses of Water Quality Samples Collected March 27, 1987.

PARAMETER	6	7	8	9
<u>Physical Tests</u>				
pH	5.92	6.54	5.84	6.39
Conductivity (μ mhos/cm)	40.6	331.	74.9	102.
Turbidity (NTU)	<1.0	4.6	<1.0	5.2
Suspended Solids (mg/L)	2.4	14.4	2.4	17.2
Dissolved Solids (mg/L)	28.3	280.	58.3	65.6
Hardness (mg/L) CaCO ₃	16.9	165.	32.8	41.5
<u>Dissolved Anions (mg/L)</u>				
Bicarbonate HCO ₃	17.6	90.3	29.3	39.3
Chloride Cl	<1.0	<1.0	<1.0	<1.0
Sulfate SO ₄	<1.0	63.6	3.75	3.10
Nitrate N	0.072	0.116	0.200	0.602
Nitrite N	<0.001	<0.001	<0.001	0.025
Phosphorus P	0.004	0.004	0.007	0.025
<u>Other Tests (mg/L)</u>				
Ammonia N	<0.005	0.024	<0.005	<0.005
Total Cyanide CN	<0.005	<0.005	<0.005	<0.005
<u>Total Metals (mg/L)</u>				
Aluminum Al	0.036	0.46	0.067	0.29
Arsenic As	<0.0001	0.0033	0.0001	0.0002
Barium Ba	0.005	0.14	0.005	0.009
Cadmium Cd	0.0005	0.0088	<0.0005	<0.0005
Copper Cu	0.001	0.092	<0.001	0.002
Iron Fe	<0.03	0.97	0.07	0.21
Lead Pb	<0.001	0.026	0.001	<0.001
Mercury Hg	<0.000005	0.00007	<0.00005	<0.00005
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	0.004	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	4.66	0.032	0.007
<u>Dissolved Metals (mg/L)</u>				
Calcium Ca	5.44	60.6	10.4	13.4
Magnesium Mg	0.81	3.27	1.65	1.95
Sodium Na	1.41	1.52	2.58	2.65
Potassium K	0.14	0.48	0.20	0.47
Aluminum Al	0.027	0.059	0.038	0.067
Arsenic As	<0.0001	0.0008	<0.0001	<0.0001
Barium Ba	0.005	0.13	<0.005	0.007
Cadmium Cd	<0.0005	0.0067	<0.0005	<0.0005
Copper Cu	<0.001	0.021	<0.001	0.002
Iron Fe	<0.03	<0.03	<0.03	<0.03
Lead Pb	<0.001	<0.001	<0.001	<0.001
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	0.004	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	3.89	0.031	0.005

< = Less than

Results expressed as milligrams of element per liter of sample

Table 2
Abermin Corporation
Lara Property, Chemainus, B.C.

Analyses of Water Quality Samples Collected March 27, 1987.

PARAMETER	1	2	3	4
<u>Physical Tests</u>				
pH	6.43	6.49	6.29	6.41
Conductivity (µmhos/cm)	47.1	31.8	33.9	196.
Turbidity (NTU)	<1.0	<1.0	<1.0	<1.0
Suspended Solids (mg/L)	2.0	<1.0	1.2	<1.0
Dissolved Solids (mg/L)	38.7	27.3	25.3	167.
Hardness (mg/L) CaCO ₃	28.0	14.1	15.4	119.
<u>Dissolved Anions (mg/L)</u>				
Bicarbonate HCO ₃	19.5	14.6	14.6	29.3
Chloride Cl	2.00	2.00	1.50	2.50
Sulfate SO ₄	2.68	1.26	<1.0	78.7
Nitrate N	0.037	0.006	0.028	0.26
Nitrite N	<0.001	<0.001	<0.001	<0.001
Phosphorus P	0.016	0.003	0.006	0.040
<u>Other Tests (mg/L)</u>				
Ammonia N	<0.005	<0.005	<0.005	<0.005
Total Cyanide CN	<0.005	<0.005	<0.005	<0.005
<u>Total Metals (mg/L)</u>				
Aluminum Al	0.072	0.047	0.045	0.063
Arsenic As	0.0002	<0.0001	<0.0001	<0.0001
Barium Ba	0.009	0.007	0.007	0.039
Cadmium Cd	<0.0005	<0.0005	<0.0005	0.012
Copper Cu	<0.001	0.001	<0.001	0.21
Iron Fe	0.07	0.04	<0.03	<0.03
Lead Pb	<0.001	<0.001	<0.001	<0.001
Mercury Hg	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	0.004
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	0.034	<0.005	4.25
<u>Dissolved Metals (mg/L)</u>				
Calcium Ca	9.97	4.61	5.16	38.3
Magnesium Mg	0.80	0.63	0.62	5.91
Sodium Na	1.42	1.25	1.19	1.94
Potassium K	0.11	0.12	0.07	0.29
Aluminum Al	0.037	0.024	0.021	0.036
Arsenic As	<0.0001	<0.0001	<0.0001	<0.0001
Barium Ba	0.008	0.007	0.007	0.036
Cadmium Cd	<0.0005	<0.0005	<0.0005	0.009
Copper Cu	<0.001	<0.001	<0.001	0.17
Iron Fe	<0.03	<0.03	<0.03	<0.03
Lead Pb	<0.001	<0.001	<0.001	<0.001
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	0.007	<0.005	3.96

< = Less than
 Results expressed as milligrams of element per liter of sample

Table 2 (continued)
Abermin Corporation
Lara Property, Chemainus, B.C.

Analyses of Water Quality Samples Collected March 27, 1987.

PARAMETER	5	6	7	8
<u>Physical Tests</u>				
pH	6.36	6.22	6.24	5.68
Conductivity (μ mhos/cm)	55.1	31.8	21.0	15.9
Turbidity (NTU)	<1.0	<1.0	<1.0	<1.0
Suspended Solids (mg/L)	2.0	2.8	1.2	1.2
Dissolved Solids (mg/L)	47.3	25.6	15.7	12.3
Hardness (mg/L) CaCO ₃	26.8	13.1	7.63	8.35
<u>Dissolved Anions (mg/L)</u>				
Bicarbonate HCO ₃	19.5	14.6	7.32	4.88
Chloride Cl	2.00	1.58	1.50	1.00
Sulfate SO ₄	7.93	<1.0	<1.0	<1.0
Nitrate N	0.035	0.042	0.031	<0.005
Nitrite N	<0.001	<0.001	<0.001	<0.001
Phosphorus P	0.007	0.001	0.003	0.007
<u>Other Tests (mg/L)</u>				
Ammonia N	<0.005	<0.005	<0.005	<0.005
Total Cyanide CN	<0.005	<0.005	<0.005	<0.005
<u>Total Metals (mg/L)</u>				
Aluminum Al	0.027	0.038	0.051	0.065
Arsenic As	<0.0001	<0.0001	0.0001	<0.0001
Barium Ba	0.021	0.007	0.007	0.007
Cadmium Cd	0.0015	<0.0005	<0.0005	<0.0005
Copper Cu	0.031	<0.001	0.036	<0.001
Iron Fe	<0.03	<0.03	<0.03	<0.03
Lead Pb	<0.001	<0.001	<0.001	<0.001
Mercury Hg	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	0.46	0.008	0.011	<0.005
<u>Dissolved Metals (mg/L)</u>				
Calcium Ca	9.36	4.29	2.33	2.75
Magnesium Mg	0.84	0.59	0.44	0.36
Sodium Na	1.60	1.11	0.94	0.79
Potassium K	0.09	0.07	0.02	<0.01
Aluminum Al	0.018	0.014	0.033	0.059
Arsenic As	<0.0001	<0.0001	<0.0001	<0.0001
Barium Ba	0.020	0.006	0.005	0.005
Cadmium Cd	0.0005	<0.0005	<0.0005	<0.0005
Copper Cu	0.028	<0.001	0.002	<0.001
Iron Fe	<0.03	<0.03	<0.03	<0.03
Lead Pb	<0.001	<0.001	<0.001	<0.001
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	0.45	0.008	0.011	<0.005

< = Less than
Results expressed as milligrams of element per liter of sample

Table 2 (continued)
Abermin Corporation
Lara Property, Chemainus, B.C.

Analyses of Water Quality Samples Collected March 27, 1987.

PARAMETER	9	10	11	DDH 85-25
<u>Physical Tests</u>				
pH	5.50	6.10	5.80	6.43
Conductivity (µmhos/cm)	18.9	15.9	12.7	106.
Turbidity (NTU)	<1.0	<1.0	<1.0	<1.0
Suspended Solids (mg/L)	2.4	1.3	4.0	14.
Dissolved Solids (mg/L)	18.3	15.2	12.0	79.3
Hardness (mg/L) CaCO ₃	12.1	6.85	8.00	49.3
<u>Dissolved Anions (mg/L)</u>				
Bicarbonate HCO ₃	8.88	6.73	4.88	43.9
Chloride Cl	0.50	1.00	1.50	0.50
Sulfate SO ₄	<1.0	<1.0	<1.0	6.32
Nitrate N	0.016	0.020	0.075	0.010
Nitrite N	<0.001	<0.001	<0.001	<0.001
Phosphorus P	0.004	0.015	0.002	0.013
<u>Other Tests (mg/L)</u>				
Ammonia N	<0.005	<0.005	<0.005	<0.005
Total Cyanide CN	<0.005	<0.005	<0.005	<0.005
<u>Total Metals (mg/L)</u>				
Aluminum Al	0.080	0.042	0.085	0.78
Arsenic As	<0.0001	<0.0001	<0.0001	0.0012
Barium Ba	0.007	0.005	0.007	0.021
Cadmium Cd	<0.0005	<0.0005	<0.0005	0.0042
Copper Cu	<0.001	<0.001	<0.001	0.030
Iron Fe	<0.03	<0.03	0.03	0.46
Lead Pb	<0.001	<0.001	<0.001	0.021
Mercury Hg	<0.00005	<0.00005	<0.00005	0.00008
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	<0.005	0.015	0.11
<u>Dissolved Metals (mg/L)</u>				
Calcium Ca	4.32	2.03	2.66	16.1
Magnesium Mg	0.33	0.45	0.33	2.20
Sodium Na	0.75	1.19	0.84	2.08
Potassium K	0.05	0.10	0.14	0.35
Aluminum Al	0.064	0.041	0.080	0.31
Arsenic As	<0.0001	<0.0001	<0.0001	0.0023
Barium Ba	0.005	0.004	0.004	0.015
Cadmium Cd	<0.0005	<0.0005	<0.0005	0.0030
Copper Cu	<0.001	<0.001	<0.001	0.011
Iron Fe	<0.03	<0.03	<0.03	0.22
Lead Pb	<0.001	<0.001	<0.001	<0.001
Molybdenum Mo	<0.005	<0.005	<0.005	<0.005
Nickel Ni	<0.001	<0.001	<0.001	<0.001
Selenium Se	<0.0005	<0.0005	<0.0005	<0.0005
Silver Ag	<0.0005	<0.0005	<0.0005	<0.0005
Zinc Zn	<0.005	<0.005	0.010	0.080

< = Less than
 Results expressed as milligrams of element per liter of sample

Table 2 (continued)
 Abermin Corporation
 Lara Property, Chemainus, B.C.

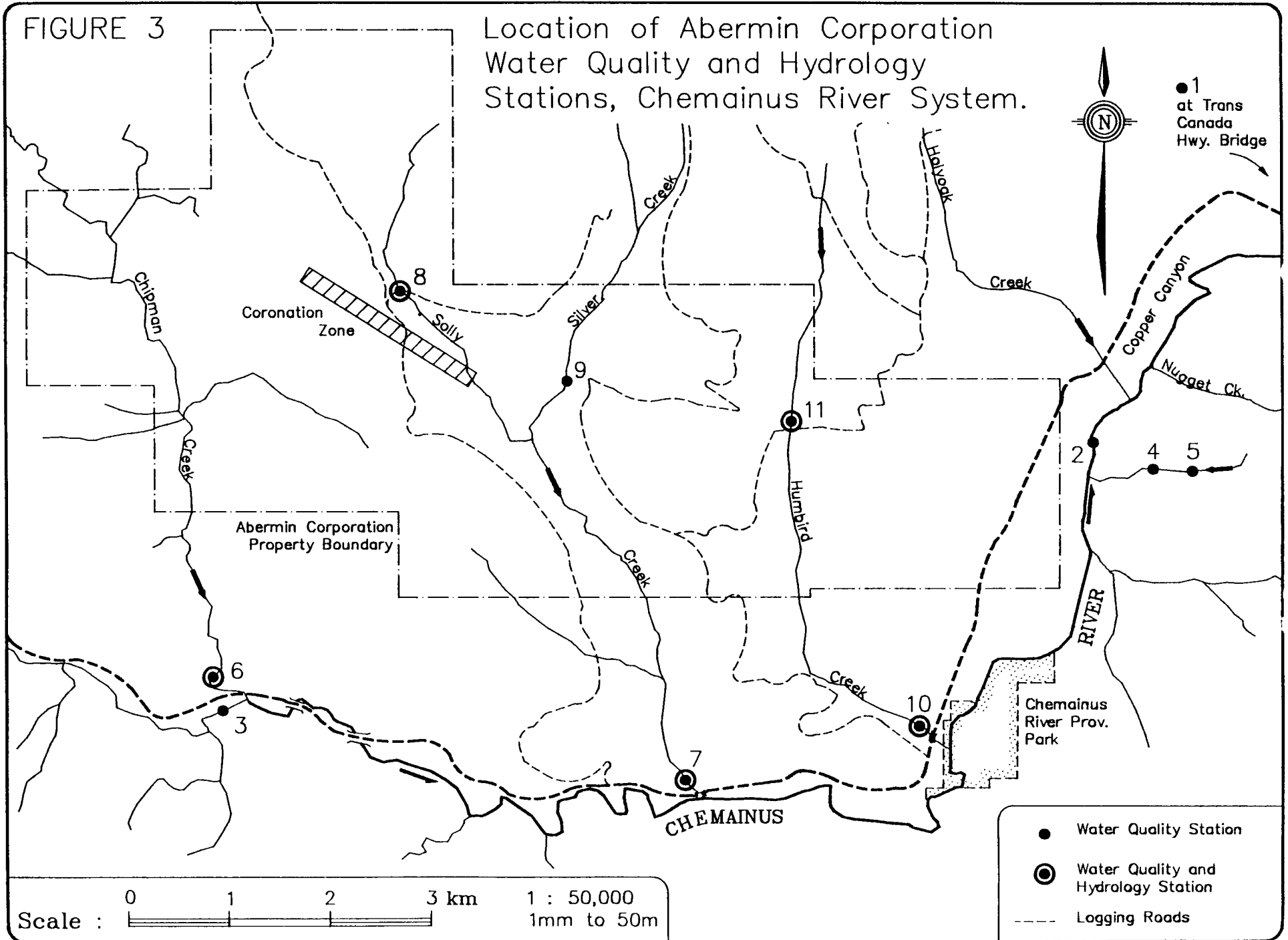
Analyses of Water Quality Samples Collected March 27, 1987.

PARAMETER	DDH 85 - 86
<u>Physical Tests</u>	
pH	7.18
Conductivity (μ mhos/cm)	172.
Turbidity (NTU)	<1.0
Suspended Solids (mg/L)	1.6
Dissolved Solids (mg/L)	165.
Hardness (mg/L) CaCO ₃	76.2
<u>Dissolved Anions (mg/L)</u>	
Bicarbonate HCO ₃	121.
Chloride Cl	2.50
Sulfate SO ₄	4.39
Nitrate N	<0.005
Nitrite N	<0.001
Phosphorus P	0.015
<u>Other Tests (mg/L)</u>	
Ammonia N	<0.005
Total Cyanide CN	<0.005
<u>Total Metals (mg/L)</u>	
Aluminum Al	0.018
Arsenic As	0.0049
Barium Ba	0.061
Cadmium Cd	<0.0005
Copper Cu	<0.001
Iron Fe	<0.03
Lead Pb	<0.001
Mercury Hg	0.0001
Molybdenum Mo	<0.005
Nickel Ni	<0.001
Selenium Se	<0.0005
Silver Ag	<0.0005
Zinc Zn	<0.005
<u>Dissolved Metals (mg/L)</u>	
Calcium Ca	22.5
Magnesium Mg	4.86
Sodium Na	9.24
Potassium K	0.38
Aluminum Al	0.013
Arsenic As	0.0042
Barium Ba	0.055
Cadmium Cd	<0.0005
Copper Cu	<0.001
Iron Fe	<0.03
Lead Pb	<0.001
Molybdenum Mo	<0.005
Nickel Ni	<0.001
Selenium Se	<0.0005
Silver Ag	<0.0005
Zinc Zn	<0.005

< = Less than
 Results expressed as milligrams of element per liter of sample

FIGURE 3

Location of Abermin Corporation
Water Quality and Hydrology
Stations, Chemainus River System.



March 20, 1987

Mr. Alex J. Davidson
Exploration Manager, Western Canada
CORPORATION FALCONBRIDGE COPPER
6415 - 64th Street
Delta, B.C.
V4K 4E2

Dear Mr. Davidson:

**Re: Environmental Programs at Mount Sicker Property
near Chemainus, and Rea Property near Adams Lake, B.C.**

Further to our telephone conversation of March 18, 1987, this will confirm the award of the work outlined in our proposal of February 17, 1987 for a total cost including time and disbursements of \$2,600.00 for both studies.

This will also confirm that the scope of work and budget estimate includes the preparation of a final report for both the Mount Sicker and Rea Properties. As I may have mentioned, the matter of a mutual exchange of water quality data was discussed with Mr. Roger P. Taylor, President and Chief Executive Officer of Abermin Corporation, and we have received his approval. Consequently, I will ask the laboratory to append Abermin's test results to your water quality report. Abermin's earlier data will be included in the final report.

The rental of a flow metre will not be required. It is our experience that a flow metre does not work well in cascading and turbulent mountain streams. We propose to calibrate staff gauges using 20% Rhodamine WT dye dilution techniques. This method is faster, more accurate, and easier for your field staff to use.

I will contact Mr. Harold Gibson and Mr. Michael Gray of your Duncan office to arrange a meeting for Thursday, March 26, 1987 regarding the field program.

We look forward to working with you, and should you have any questions on the foregoing, please do not hesitate to give me a call.

Yours very truly,
HATFIELD CONSULTANTS LIMITED

Robert Hallam

ROBERT L. HALLAM
Associate Biologist

RLH/ems

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