

ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
ENVIRONMENTAL PROTECTION
PACIFIC AND YUKON REGION

BASELINE MONITORING

SULPHURETS PROJECT

- August 9, 1988 -

REGIONAL DATA REPORT DR90-02

By Benoit Godin
and
Vivian Chamberlain

February 1990

LIBRARY
ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
PACIFIC REGION

TABLE OF CONTENTS

	<u>PAGE</u>
TABLE OF CONTENTS	i
INTRODUCTION	1
MATERIAL AND METHODS	3
RESULTS	3
REFERENCE	11

INTRODUCTION

The Sulphurets project is located in the Unuk Valley drainage system. The mine is surrounded by icefields at an elevation of 4500 feet. Brucejack Lake adjacent to the mine, flows westward towards the Unuk River from Brucejack Creek and Sulphurets Creek. Coho salmon are present in the Unuk River. Dolly Varden char were collected at the mouth of Sulphurets Creek. There is no indication that the salmon could not utilise the mouth of the creek for rearing purposes even though salmon catches have not been reported. A canyon located 1 km from the mouth of Sulphurets Creek prevents further migration upstream of the salmon (Figure 1).

The company is developing an underground mine. The gold and silver extraction will be performed by flotation. The tailings will be discharged under water to Brucejack Lake. The lake is devoid of fish resources and will be dammed for hydroelectric power generation.

Site Description

<u>Station</u>	<u>Location</u>	<u>Remarks</u>
1	Unuk River upstream of Sulphurets Creek	Site on the flood plain
2	Unuk River downstream of Sulphurets Creek	Site on the flood plain
3	Sulphurets Creek 850 m upstream of Unuk River	Site on the flood plain
4	Brucejack Creek 700 m downstream of Bjk lake	Site in the intake pond area
5	Mine adit	

LEGEND

● Water quality sampling sites

Scale 1:50,000

TE : Figure modified from Rescan Environmental Services Ltd

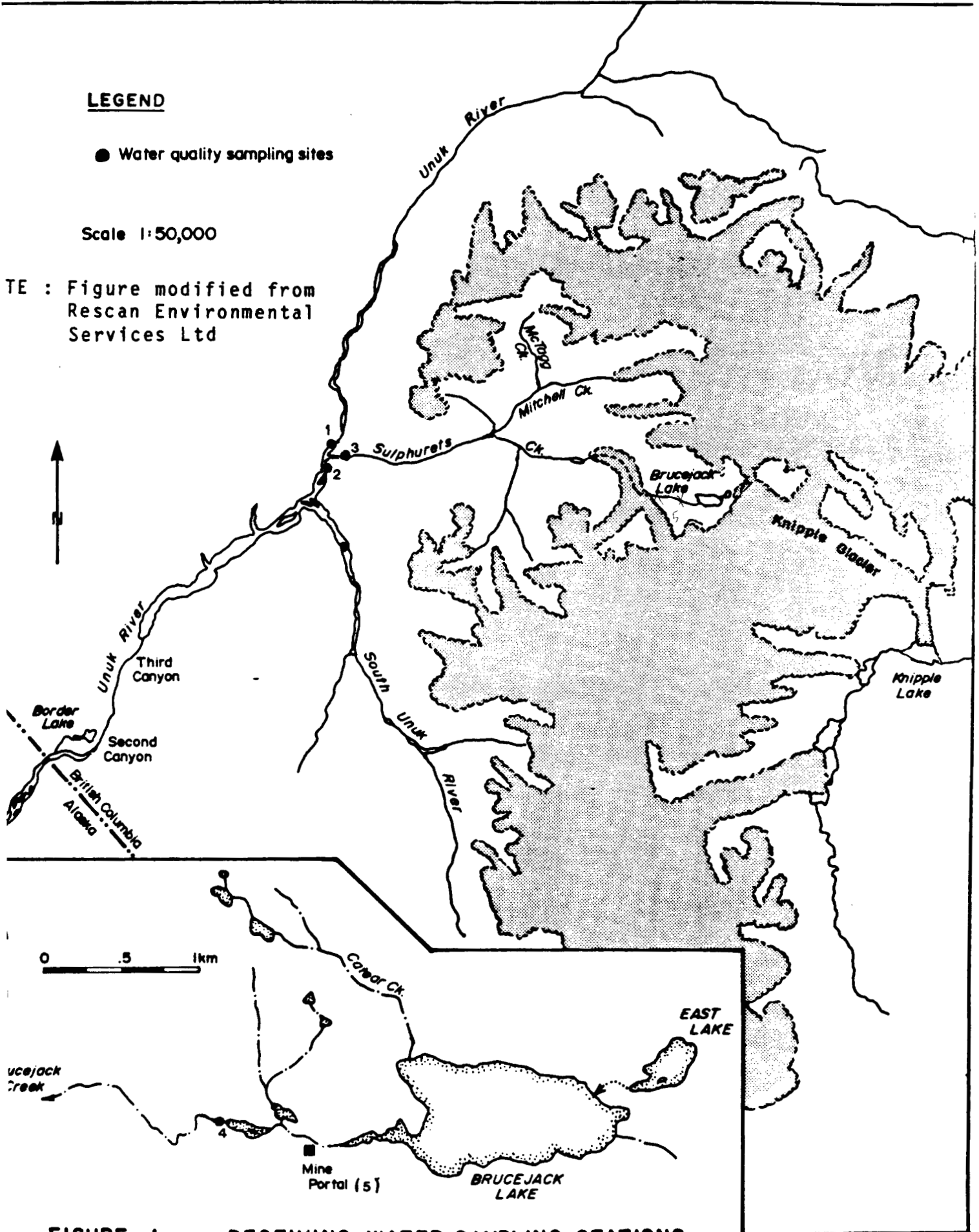


FIGURE 1 RECEIVING WATER SAMPLING STATIONS

MATERIAL AND METHODS

The site was visited on August 8, 1988. No flow measurements were taken at the sites. Water chemistry and sediment samples were collected at the four receiving water stations but only water at the mine adit. The following chemical parameters were analysed: alkalinity, pH, conductivity, total residue, non filterable residue, and sulphate. These samples were kept cool with ice until analysed. Dissolved metals were filtered the same day through a 0.45 micron cellulose nitrate membrane filter. Total and dissolved metals were preserved with nitric acid (0.5 ml/100 ml of sample). All samples were collected with clean polyethelene bottles. The bottles for metal samples were previously acid washed. The hardness was determined from the dissolved metal sample.

Inductively Coupled Argon Plasma (ICAP) was used for the total and dissolved metal analysis and gave a reading of twenty-six metals. For cadmium, copper, and lead the samples were reanalysed with the graphite furnace when the values were below two times the detection limit on the ICAP procedure. For analytical method details refer to the Environment Canada Pacific Region Laboratory Manual (Anon, 1979).

Sediment samples were collected from the streambed, below the water level, with a clean acrylic corer. Four replicates were taken at each sites. The samples were transferred into kraft bags and kept cool until analysed. The samples were air dried, sieved to <150 um, digested with aqua regia, and analysed for heavy metals using ICAP. A portion of the sediments were also ignited at 550° C in a muffle furnace. The loss of weight was reported as volatile residue and the remaining residue was reported as fixed residue.

RESULTS

The water metal results can be found in Table 1, while the other water quality results are found in Table 2. The sediment data are reported in Table 3.

Water quality - Sulphurets Project -
August 8, 1988

Table 1

Station Number	TOTICP AG		DISICP AG		TOTICP AL		DISICP AL		TOTICP AS		DISICP AS		TOTICP BA		DISICP BA		TOTICP CA		DISICP CA		TOTICP CD		DISICP CD		TOTICP CO		DISICP CO		TOTICP CR		DISICP CR	
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L		
1	<.01	<.01	<.01	<.01	<.05	<.05	7.19	<.05	<.05	0.142	0.017	19.6	14.5	<.005	0.0001	<.005	<.0001	0.030	0.030	<.005	0.008	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
2	<.01	<.01	<.01	<.01	<.05	<.05	4.80	<.05	<.05	0.122	0.021	20.4	16.8	<.005	0.0005	<.005	<.0001	0.026	0.026	<.005	0.006	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
3	<.01	<.01	<.01	<.01	<.05	<.05	4.41	<.05	<.05	0.125	0.024	20.5	18.3	<.005	0.0008	<.005	<.0001	0.022	0.022	<.005	0.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
4	<.01	<.01	<.01	<.01	<.05	<.05	0.22	0.05	0.039	0.033	8.6	8.6	8.6	<.005	<.0001	<.005	<.0001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
5	<.01	<.01	<.01	<.01	<.05	<.05	0.22	<.05	0.040	0.032	8.7	8.6	8.6	<.005	<.0001	<.005	<.0001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
6	<.01	<.01	<.01	<.01	<.05	<.05	0.23	<.05	0.039	0.032	8.6	8.5	8.5	<.005	0.0014	<.005	<.0001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
7	<.01	<.01	<.01	<.01	<.05	<.05	0.22	<.05	0.039	0.032	8.6	8.6	8.6	<.005	<.0001	<.005	<.0001	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		
Average	---	---	---	---	---	---	0.01	---	0.001	0.001	0.1	0.1	0.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S.D.	---	---	---	---	---	---	0.01	---	0.001	0.001	0.1	0.1	0.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
8	<.01	<.01	<.01	<.01	<.05	<.05	14.60	0.24	0.341	0.026	56.4	50.2	50.2	<.005	0.0012	<.005	<.0001	0.011	0.011	<.005	0.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005		

Table 1 (cont.)

Water Quality - Sulphurets Property -
August 8, 1988

Station Number	TOTICP PB		DISICP PB		DISGF PB		TOTICP SI		DISICP SI		TOTICP SN		DISICP SN		TOTICP SR		DISICP SR		TOTICP TI		DISICP TI		TOTICP V		DISICP V		TOTICP ZN		DISICP ZN		
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L		
1	<.05	<.0005	<.05	<.0005	12.60	0.78	<.05	<.05	0.138	0.100	0.217	<.002	0.03	<.01	0.019	<.002															
2	<.05	<.0005	<.05	<.0005	7.95	0.78	<.05	<.05	0.114	0.094	0.152	<.002	0.02	<.01	0.031	<.002															
3	<.05	<.0005	<.05	<.0005	7.11	0.79	<.05	<.05	0.099	0.087	0.169	<.002	<.01	<.01	0.043	<.002															
4	<.05	<.0005	<.05	<.0005	0.72	0.48	<.05	<.05	0.048	0.049	0.002	<.002	<.01	<.01	0.003	<.002															
6	<.05	<.0005	<.05	<.0005	0.73	0.47	<.05	<.05	0.048	0.049	<.002	<.002	<.01	<.01	0.004	<.002															
7	<.05	<.0005	<.05	<.0005	0.75	0.47	<.05	<.05	0.048	0.049	<.002	<.002	<.01	<.01	0.003	<.002															
Average	---	---	---	---	0.73	0.47	---	---	0.048	0.049	---	---	---	---	0.003	---															
S.D.	---	---	---	---	0.02	0.01	---	---	0.000	0.000	---	---	---	---	0.001	---															
5	<.05	0.0137	<.05	<.0005	19.20	3.11	<.05	<.05	1.560	1.440	0.066	<.002	0.02	<.01	0.100	<.002															

Water quality - Sulphurets Property -
August 8, 1988

Table 1 (cont.)

Station Number	TOTICP CU MG/L	TOTGF CU MG/L	DISICP CU MG/L	DISGF CU MG/L	TOTICP FE MG/L	DISICP FE MG/L	TOTICP MG MG/L	DISICP MG MG/L	TOTICP MN MG/L	DISICP MN MG/L	TOTICP MO MG/L	DISICP MO MG/L	TOTICP NA MG/L	DISICP NA MG/L	TOTICP NI MG/L	DISICP NI MG/L	TOTICP P MG/L	DISICP P MG/L
1	2	0.008	0.0088	<.005	<.0005	7.12	0.032	4.5	1.7	0.182	0.016	<.01	1.4	0.5	<.02	<.02	0.3	<.1
2	3	0.035	-	<.005	<.0005	5.84	0.014	3.4	1.5	0.195	0.039	<.01	0.9	0.5	<.02	<.02	0.3	<.1
3	4	0.053	-	<.005	<.0005	5.67	<.005	2.9	1.2	0.210	0.061	<.01	0.8	0.4	<.02	<.02	0.3	<.1
4	5	<.005	<.0005	<.005	<.0005	0.207	<.005	0.2	0.3	0.028	0.020	<.01	0.2	0.4	<.02	<.02	<.1	<.1
	6	<.005	<.0005	<.005	<.0005	0.213	<.005	0.3	0.3	0.028	0.019	<.01	0.4	0.4	<.02	<.02	<.1	<.1
	7	<.005	<.0005	<.005	<.0005	0.213	<.005	0.2	0.3	0.028	0.020	<.01	0.4	0.4	<.02	<.02	<.1	<.1
	Average	---	---	---	---	0.211	---	0.2	0.3	0.028	0.020	---	0.3	0.4	---	---	---	---
	S.D.	---	---	---	---	0.003	---	0.1	0.0	0.000	0.001	---	0.1	0.0	---	---	---	---
5	8	<.005	0.0086	<.005	<.0005	3.220	0.024	5.7	5.0	0.383	0.267	<.01	29.2	26.0	<.02	<.02	0.4	<.1

Table 2 Water Quality - Sulphurets Property -
August 8, 1988

Station Number	ALK HC MG/L	DISICP HT MG/L	DISICP MG/L	PH REL.U.	COND UMHO/C	TR MG/L	NFR MG/L	SO4 MG/L
1	2	38.5	43.4	43.7	8.0	93	205	126
2	3	35.0	47.9	48.3	7.9	110	231	149
3	4	31.5	50.7	51	7.9	105	237	155
4	5	15.5	22.8	23.1	7.6	46.5	40	45
	6	15.0	22.6	22.8	7.6	47.5	37	5
	7	15.5	22.6	22.6	7.5	46.5	33	45
	Average	15.3	22.7	22.8	7.6	46.8	37	--
	S.D.	0.3	0.1	0.3	0.1	0.6	4	--
5	8	76.0	146	150	8.2	385	735	439
	89							

Table 3

Sediment Quality - Sulphurets Project -
August 8, 1988

Station Number	SEDICP AG		SEDICP AL		SEDICP AS		SEDICP BA		SEDICP BE		SEDICP CA		SEDICP CD		SEDICP CO		SEDICP CR		SEDICP CU		SEDICP FE		SEDICP HG		SEDICP MN	
	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G
1	Repl.1	<2	17800	20	280	0.6	20600	1.0	<20	46.3	71.4	40600	0.236	13700	850											
	Repl.2	<2	16400	18	367	0.6	22200	0.9	<20	43.9	69.0	40000	0.186	13000	783											
	Repl.3	<2	17900	22	310	0.6	20700	0.9	<20	45.9	74.6	40200	0.215	13500	853											
	Repl.4	<2	16700	18	353	0.6	23000	0.9	<20	43.5	72.0	40000	0.219	13100	820											
	Average	---	17200	20	328	0.6	21625	0.9	---	44.9	71.8	40200	0.214	13325	827											
S.D.	---	762	2	40	0.0	1173	0.0	---	1.4	2.3	283	0.021	330	33												
2	Repl.1	<2	16800	43	300	0.4	21200	1.0	<20	29.7	169.0	50800	0.110	11700	832											
	Repl.2	<2	17200	40	261	0.4	20200	2.0	<20	30.5	166.0	51800	0.100	12100	878											
	Repl.3	<2	13800	73	229	0.4	19000	2.3	<20	25.6	190.0	67800	0.089	9900	698											
	Repl.4	<2	16000	31	262	0.4	20400	2.0	<20	25.9	145.0	47800	0.120	10800	753											
	Average	---	15950	47	263	0.4	20200	1.8	---	27.9	167.5	54550	0.105	11125	790											
S.D.	---	1518	18	29	0.0	909	0.6	---	2.5	18.4	8995	0.013	981	80												
3	Repl.1	<2	12900	44	261	0.3	19100	1.0	<20	17.7	176.0	50100	0.060	8540	633											
	Repl.2	<2	12500	51	244	0.3	18600	2.0	<20	17.3	182.0	50900	0.060	8570	628											
	Repl.3	<2	13400	78	269	0.3	17900	2.1	<20	20.3	243.0	62800	0.084	9070	712											
	Repl.4	<2	13500	57	257	0.3	19200	1.8	<20	19.9	209.0	57800	0.079	9430	715											
	Average	---	13075	58	258	0.3	18700	1.7	---	18.8	202.5	55400	0.071	8903	672											
S.D.	---	465	15	10	0.0	594	0.5	---	1.5	30.6	6024	0.013	428	48												
4	Repl.1	46	9880	220	342	0.5	3530	3.9	<20	6.3	92.4	48000	0.343	3650	963											
	Repl.2	52	10600	233	370	0.6	4640	4.1	<20	11.0	98.4	52200	0.420	4530	1190											
	Repl.3	38	11900	271	413	0.7	3550	3.3	<20	5.6	85.1	54300	0.345	4200	1440											
	Repl.4	56	10800	251	405	0.6	3560	4.4	<20	8.7	101.0	51600	0.317	3590	1110											
	Average	48	10795	244	383	0.6	3820	3.9	---	7.9	94.2	51525	0.356	3993	1176											
S.D.	8	836	22	33	0.1	547	0.5	---	2.5	7.1	2620	0.044	431	200												

Table 3 (cont.)

Sediment Quality - Sulphurets Project -
August 8, 1968

Station Number	SEDICP MO		SEDICP NA		SEDICP MI		SEDICP P		SEDICP PB		SEDICP SI		SEDICP SN		SEDICP SR		SEDICP TI		SEDICP V		SEDICP ZN		SFR		SVR	
	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	UG/G	MG/KG	MG/KG	MG/KG	MG/KG
1	Repl.1	5	320	48	1700	10	1450	<8	103	848	100	159	982000	17200												
	Repl.2	5	290	40	1730	20	1250	<8	107	984	110	115	985000	15300												
	Repl.3	5	340	43	1670	10	1300	<8	103	922	110	138	983000	17100												
	Repl.4	5	300	38	1790	10	1320	<8	112	946	110	127	985000	15000												
	Average	5	313	42	1723	13	1330	---	106	925	108	135	983750	16150												
S.D.	0	22	4	51	5	85	---	4	57	5	19	1500	1162													
2	Repl.1	8	280	31	1810	21	1280	<8	99	1370	100	138	985000	14400												
	Repl.2	9	280	29	1600	19	1320	<8	95	1310	100	167	982000	17500												
	Repl.3	10	240	27	1660	27	1190	<8	87	1130	97	139	973000	26500												
	Repl.4	9	260	24	1500	20	902	<8	97	1360	94	152	984000	16400												
	Average	9	265	28	1643	22	1173	---	94	1293	98	149	981000	18700												
S.D.	1	19	3	130	4	189	---	5	111	3	14	5477	5356													
3	Repl.1	10	220	20	1600	18	845	<8	89	1350	84	114	983000	16600												
	Repl.2	10	200	20	1600	24	922	<8	84	1250	81	123	983000	16200												
	Repl.3	10	210	24	1790	22	1090	<8	80	1350	95	154	978000	22500												
	Repl.4	10	210	31	1670	33	1130	<8	84	1240	88	133	980000	19800												
	Average	10	210	24	1665	24	997	---	84	1298	87	131	981000	18775												
S.D.	0	8	5	90	6	135	---	4	61	6	17	2449	2960													
4	Repl.1	8	200	20	1400	140	707	<8	28	179	32	441	980000	20300												
	Repl.2	10	100	20	1500	150	748	10	35	180	37	493	979000	21400												
	Repl.3	9	170	17	1500	110	833	<8	27	207	45	324	980000	20000												
	Repl.4	10	100	6	1500	160	766	21	28	160	38	434	979000	20600												
	Average	9	143	16	1475	140	764	16	30	182	38	423	979500	20575												
S.D.	1	51	7	50	22	53	8	3	19	5	71	577	602													

The water samples collected at lower elevation on Sulphurets Creek at the mouth and the Unuk River (Station 1, 2, and 3) had a fair amount of non filterable residue which was reflected in the total metal results, mainly Al, Fe, Mn, Si, Ti, and Zn. Most receiving water samples in the dissolved form were near or below the detection limit. Alkalinity and hardness increases as the stream order increased. Water quality on Brucejack Creek is indicative of a pristine environment.

The sediments at station 1, 2, and 3 were generally low in trace metal concentrations. Station 3 on Sulphurets Creek had the highest copper and the lowest mercury concentration of the stations sampled. Station 4 on Brucejack Creek was high for several trace metals such as silver (48 ug/g), arsenic (244 ug/g), cadmium (3.9 ug/g), mercury (0.356 ug/g), lead (140 ug/g), and zinc (423 ug/g). This may reflect the geology of the area as well as the releases from the mine adit. The percentage of organic material in the sediment varied from 1.6 to 2.0 %. These levels are relatively low, and reflect the influence of glaciers on the sediment composition.

REFERENCE

Anonymous. 1979. Laboratory Manual. Department of the Environmental Protection Service. Department of Fisheries and Oceans (Pacific Region).