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ENVIRONMENT CANADA
ENVIRONMENTAL PROTECTION SERVICE
PACIFIC & YUKON REGION
WHITEHORSE, YUKON

MOUNT HUNDERE BASELINE STUDY
June 1988 and June 1990

DATA REPORT NO. 94-02

by
Environmental Protection Branch
Yukon Division

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ABSTRACT

Baseline investigations of environmental quality in the Mt. Hundere study area were carried out in June, 1988, and again in June 1990. These studies were in response to mineral exploration and eventual development of the Mt. Hundere (Sa Dena Hes) Lead/Zinc mine. The surveys investigated water quality, sediment chemistry and percent particle size distribution, and benthic invertebrates in the drainages surrounding the mineral development area.

Extractable lead and zinc concentrations found in water samples were at maximum levels recommended for aquatic life. Stream sediment chemistry was comparable to sediment compositions found in other mineralized areas in the Yukon. Benthic invertebrate populations appeared significant in numbers and diversity compared with other recent surveys.

RÉSUMÉ

Une étude de base de la qualité de l'environnement dans la région du Mont Hundere a été conduite en juin 1988 et de nouveau en juin 1990. Ces études répondent à l'exploration minière et l'éventuel développement d'une mine de plomb/zinc (Sa Dena Hes) au Mont Hundere. Les investigations portaient sur la qualité de l'eau, la composition chimique des sédiments, la distribution du pourcentage des dimensions des particules, et des invertébrés benthiques des drainages adjacents au développement minéral de la région.

Les concentrations de plomb et zinc extractable dans les échantillons d'eau étaient au taux recommandé maximum pour la protection de la vie aquatique. La composition chimique des sédiments était comparable à celle des sédiments échantillonnés dans d'autre région minéralisés du Yukon. Les populations benthiques semblent être plus abondantes et diversifiées que d'autre études récentes.

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1.0 INTRODUCTION

The Mt. Hundere lead and zinc deposits were discovered in 1962. Significant exploratory work was done by CIMA Resources between 1979 and 1982, delineating 250,000 tonnes of ore reserves.

Canamax Resources acquired the property in 1984 and completed over 20,000 metres of diamond drilling by 1988. As a result, estimated ore reserves were increased dramatically in a number of zones surrounding Mt. Hundere. A baseline water quality survey was carried out by the Department of Indian and Northern Affairs in August, 1985 (INAC unpublished data).

Frame Mining Corporation and Hillsborough Resources Limited purchased the property in 1989 and conducted definition drilling and an environmental baseline study (Mt. Hundere Joint Venture Initial Environmental Evaluation, May 1990). Frame Mining transferred their interest to Curragh Resources Inc., which became the manager of the joint venture.

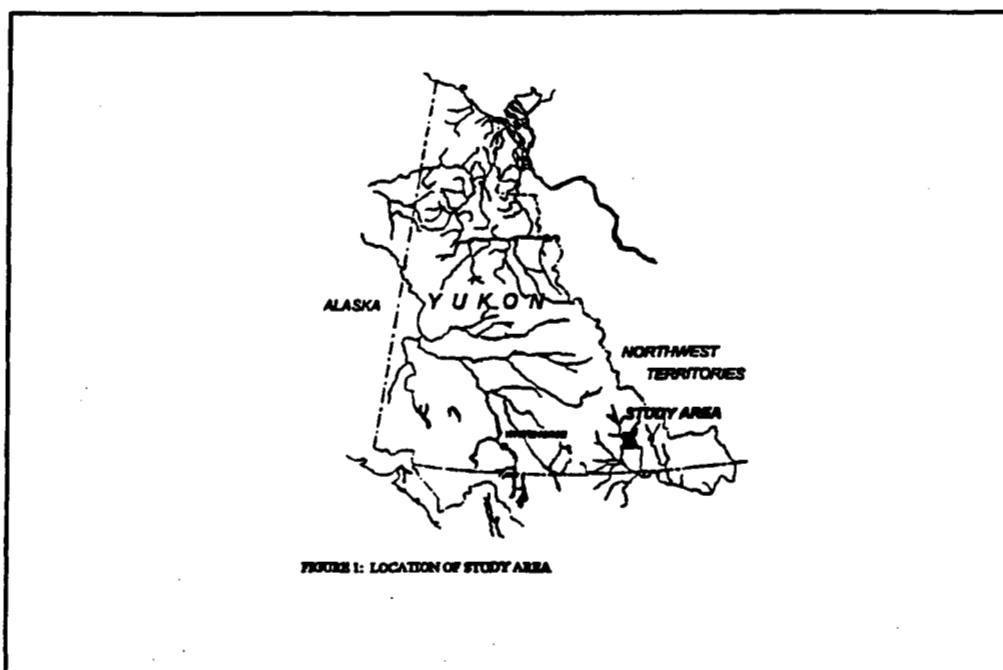
Environmental Protection conducted the first of two baseline investigations in June, 1988 which included sampling of water, sediments and benthic organisms. The Department of Indian and Northern Affairs carried out a second water quality survey in September, 1988 (INAC unpublished data).

Environmental Protection carried out a second baseline survey in June 1990 covering the False Canyon Creek and Tom Creek drainages. Meanwhile, the Mt. Hundere Joint Venture passed through an environmental assessment and review, and was granted a water licence in 1991. The Mt. Hundere (Sa Dena Hes) lead/zinc mine and mill began producing concentrate in August 1991.

1.1 Study Area

Mt. Hundere is approximately 50 km north of Watson Lake, Yukon Territory and has an elevation of 1574 m above sea level (Figure 1). Mineral exploration has occurred above 1219 m. The property is situated on the drainage divide between the Tom Creek and False Canyon Creek catchments. False Canyon Creek drains into the Frances River 55 km upstream of its confluence with the Liard River. Tom Creek flows directly into the Liard River. The average annual precipitation for the region is between 400-600 mm. The average annual daily temperature lies in the range of -9 to -11°C (Wahl, 1987).

Eighteen sample stations were set up within the study area (see Table 1). Stations 1, 2 and 3 were located on an upper circumference of Mt. Hundere, in unnamed creeks. The remaining stations are located in False Creek, Tom Creek, and their tributaries, as well as in the Frances and Liard Rivers (Figure 2).



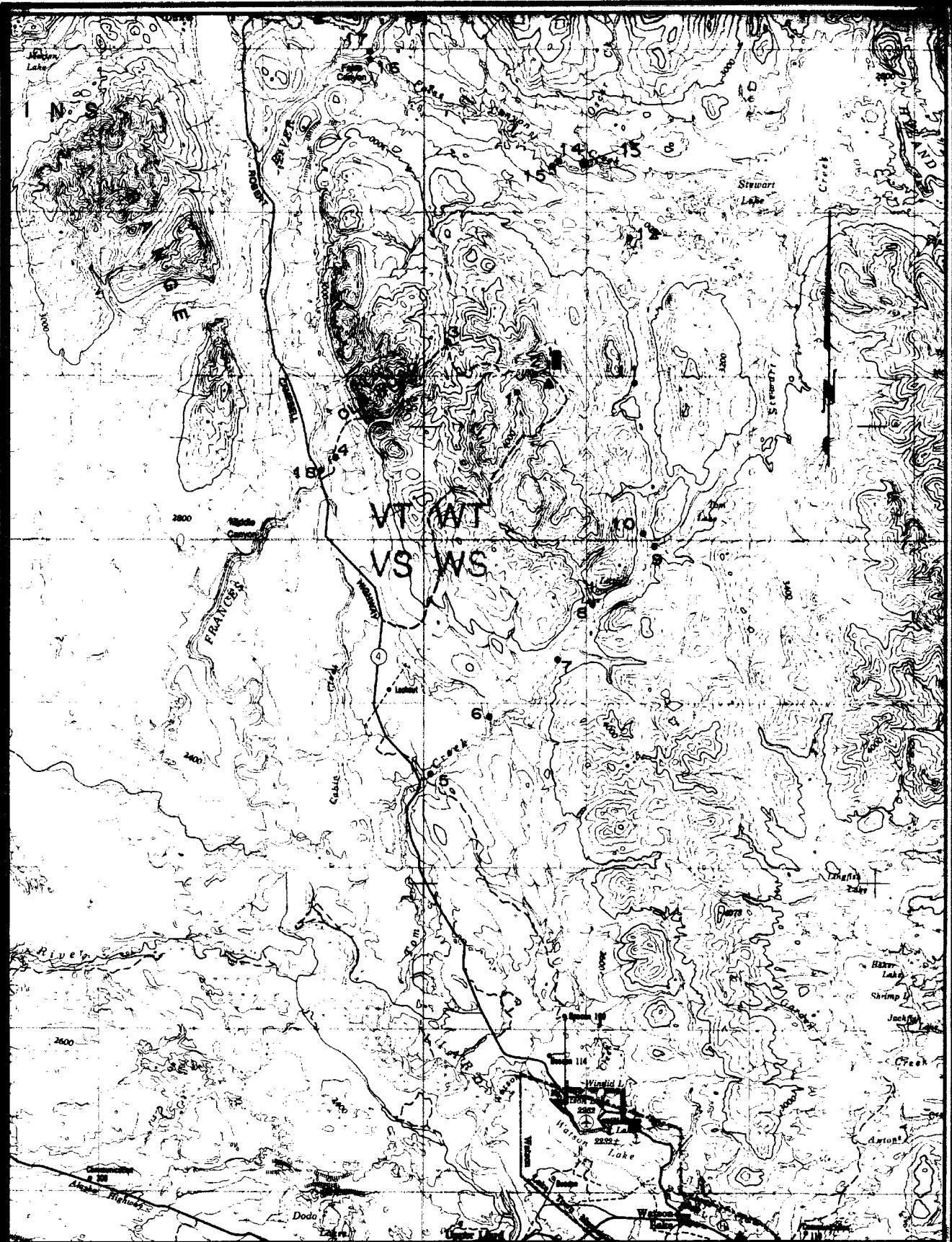


FIGURE 2 : SAMPLE STATION LOCATIONS MT. HUNDERE

A horizontal scale bar with numerical markings at 0, 5, 10, 15, 20, and 25 km. The scale is labeled "km" at both ends.

**SAMPLE STATION
ACCESS ROAD**

**MILL SITE
TAILINGS POND**

TABLE 1 DESCRIPTIONS OF SAMPLE STATIONS IN THE MT. HUNDERE STUDY AREA.

STATION	LOCATION	REMARKS
1	60°31'N by 128°56'W, headwaters of Tom Creek, Tributary 5, 0.5 km from exploration camp, at water supply pump station. Elevation 1190 m.	Samples were taken downstream of camp and upstream of pump station. Banks 10% overhung with Willow. Substrate of mixed cobble.
2	60°32'N by 128°57'W, headwaters of False Canyon Creek 1.0 km north of camp, on mine road 30 m downstream of fill from road construction. Elevation 1220 m.	Substrate of large boulders to 60 cm diameter and smaller cobble. Steep gradient (3.5: 1) has stream cascading in series of pools and falls. Ice at 4 m downstream of station.
3	60°33'N by 129°01'W, headwaters of False Canyon Creek Tributary B at road crossing.	Bank heights 0.25 to 0.5 m, and are erodible and undercut; overhung by Willow. Samples taken below bridge.
4	60°28'N by 129°07'W, Frances River Tributary A 1.75 km from Campbell Hwy, upstream of bridge crossing. Elevation 740 m.	Bank heights, 0.2 to 0.4 m, erodible and undercut but with good grass cover to the bank's edge.
5	60°18'N by 129°00'W, Tom Creek, upstream of Campbell Hwy. Elevation 762 m.	Creek approximately 15m wide. and approximately 0.30 m deep. Willow along banks.
6	60°20'N by 128°56'W, Tom Creek Tributary 2, 200m upstream of Tom Creek. Elevation 780m.	Creek approximately 3m wide and about .4m deep. Willow along bank.
7	60°22'N by 128°51'W, Tom Creek upstream of Tributary 2 approximately 6km. Elevation 810m.	Creek approximately 9m wide and approximately 0.8m deep. Willow along bank.
8	60°23'N by 128°48'W, Tom Creek Tributary 5. Elevation 830m.	Creek approximately 5.5m wide and approximately 0.5m deep. Willow and grasses along bank.
9	60°26'N by 128°44'W, Tom Creek approximately 2.5km downstream of Tom Lake. Elevation 840m.	Creek approximately 3m wide and approximately 0.3m deep. Willow, grasses and spruce along bank.
10	60°26'N by 128°45'W, Tom Creek Tributary 4, upstream of Tom Creek approximately 1km. Elevation 840m.	Creek width and depth not measured. Willow and grasses along bank.

STATION	DESCRIPTION	REMARKS
11	60°31'N by 128°46'W, Upper False Canyon Creek approximately 9km downstream of Station 2. Elevation 880m.	Creek approximately 3.5m wide and approximately 0.4m deep. Bank height 1m with grass and willow cover.
12	60°36'N by 128°46'W, False Canyon Creek. Elevation 790m.	Creek approximately 5m wide and approximately 0.7m deep. Bank height 0.5m with grass and willow cover.
13	60°38'N by 128°49'W, Oscar Creek. Elevation 730m.	Site not sampled. No suitable landing locations nearby for helicopter.
14	60°39'N by 128°53'W, False Canyon Creek. Elevation 720m.	Creek width and depth not measured. No invertebrates were collected because of depth. Bank height 0.5m with grasses and willow cover.
15	60°39'N by 128°53'W, False Canyon Creek Tributary B. Elevation 720m.	Creek approximately 6.5m wide and approximately 0.8m deep. Bank height 1.0m with grasses and willow cover.
16	60°41'N by 129°03'W, False Canyon Creek approximately 60m upstream of Frances River. Elevation 680m.	Creek width and depth not measured. Creek water levels greatly influenced by Frances River levels. No benthic invertebrates or sediments collected because of water depth. bank height 0.2m with spruce, willow and grass cover.
17	60°42'N by 129°03'W, Frances River upstream of False Canyon Creek approximately 1.5km.	Stream width and depth not measured. Benthic invertebrates and sediments were not sampled.
18	60°28'N by 129°07'W, Frances River upstream of the Campbell Hwy. approximately 200m.	Stream width and depth not measured. Benthic invertebrates and sediments were not sampled.

2.0 METHOD

Samples and field measurements at Mt. Hundere were taken on June 21-22, 1988, and June 19-21, 1990. At each sampling site, three replicates samples of water and sediments were taken and a composite of 3 samples for benthic invertebrates. Methods of sample collection, preservation, and analysis or identification are listed in Appendix I.

2.1 Water Chemistry

Water samples were collected at 15 sample sites. A description of water sample collection, preparation, analytical methods, and detection limits are given in Appendix I, Table 1. Measurements of water temperature, conductivity, pH, dissolved oxygen and flow were made at each site. Samples sent to the laboratory were analysed for alkalinity, chloride, fluoride, true colour, conductivity, pH, total hardness and hardness as Ca+Mg, ammonia-N, nitrite+nitrate, total phosphorous, filterable (FR) and non-filterable residues (NFR), sulphate and turbidity. For the 1988 survey, extractable metals analyses were performed (ICP scan), with a request for the higher sensitivity Graphite Furnace procedure on samples where lead and zinc were below ICP detection. The 1990 survey included dissolved, extractable, and total metals analyses, with Graphite Furnace procedure requested on samples where lead, copper, cadmium, or silver were below ICP detection. Both surveys included the following metals:

Aluminum (Al)	Copper (Cu)	Silver (A)
Antimony (Sb)	Iron (Fe)	Sodium (Na)
Arsenic (As)	Lead (Pb)	Strontium (Sr)
Barium (Ba)	Magnesium (Mg)	Tin (Sn)
Beryllium (Be)	Manganese (Mn)	Titanium (Ti)
Boron (B)	Molybdenum (Mo)	Vanadium (V)
Cadmium (Cd)	Nickel (Ni)	Zinc (Zn)
Calcium (Ca)	Phosphorous	
Chromium (Cr)	(P) Selenium (Se)	
Cobalt (Co)	Silicon (Si)	

The analyses were completed at the Environmental Protection Service Laboratory, 4195 Marine Drive, West Vancouver, B.C.

The percent dissolved oxygen saturation point was determined by calculating the dissolved oxygen saturation point (S') from the formula:

$$S' = S \frac{P}{760} \quad (\text{ALPHA et al 1980})$$

where, S' = dissolved oxygen (DO) saturation concentration at the in situ temperature and atmospheric pressure

S = dissolved oxygen (DO) saturation concentration at sea level for the in situ temperature.

P = atmospheric pressure (mm Hg) at site elevation.

The percent dissolved oxygen saturation is the ratio of field DO to the in situ saturation concentration (S'):

$$\frac{\text{field DO}}{S'} \times 100 = \% \text{ DO saturation}$$

where, field DO = dissolved oxygen measured in the field and adjusted for field conditions.

2.2 Sediments

One set of triplicate sediment samples were taken at each station. The samples were shipped to the Environmental Protection Laboratory, 4195 Marine Drive, West Vancouver, B.C. and analysed for leachable metals and percent particle size distribution according to the Wentworth Classification System. A description of sediment collection, preparation and analysis methods are given in Appendix I, Table 2.

2.3 Bottom Fauna

Three benthic invertebrate samples were taken with a Surber sampler (500 μm mesh size). The invertebrates collected from three replicate Surber samples, taken on a short reach of stream at each station, were combined in a 1 litre bottle and considered as the sample for that station. Each sample, therefore consisted of 3 grabs combined. Samples were sorted, identified and enumerated by Dr. C. Low, consulting invertebrate biologist from Nanaimo, British Columbia. The methods of sample collection and preservation are described in Appendix I, Table 3.

Indices of benthic community diversity and evenness were calculated using the following formulae (Pielou 1975):

$$\text{Species Diversity } (H') = - \sum_{i=1}^n (P_i \log_{10} P_i)$$

where, $P_i = n_i / N$

n_i = number of individuals in the i th most specific taxonomic group (ie. genus) at one sample location.

N = total number of individuals identified to specific taxonomic group (ie. genus) at one sample location.

n = total number of taxonomic groups (ie. genus) identified at one sample location.

$$\text{Evenness } (J') = H' / \log_{10} n$$

Percent Similarity Index: The benthic invertebrate communities collected during the two surveys were compared using a percent similarity index (P_{SC}) formula described by Brock (1977):

$$P_{SC} = 100 - 0.5 \sum_{i=1}^k |a-b|$$

where a and b are, for a given genus, percentage of the total samples A and B which that genus represents. The absolute value of their difference is summed over all genera, k . The P_{SC} compares the percentage of genera present at two different locations but is not a comparison of total invertebrate abundance. The information produced by the percent similarity index was plotted into a cluster using the nearest neighbour clustering method.

Table 2 shows the different field activities performed during the surveys of June 1988 and June 1990.

TABLE 2 SAMPLING PROGRAM SUMMARY

SITE	DESCRIPTION	SAMPLE DATE	TYPE OF SAMPLES COLLECTED			
			WATER QUALITY	STREAM SEDIMENTS	BENTHIC INVERTEBRATES	STREAM FLOW
1	Headwaters Tom Cr. Tributary 5	21-Jun-88	X	X	X	X
2	Headwaters of False Canyon Cr.	21-Jun-88	X	X		
3	Headwaters False Canyon Cr. Tributary 8	22-Jun-88	X	X		X
4	Frances River Trib. A @ bridge crossing	22-Jun-88	X	X	X	X
5	Tom Cr. u/s Campbell Hwy. bridge	22-Jun-88	X	X	X	
3	Headwaters of False Canyon Cr. Trib. B	20-Jun-90	X	X	X	X
4	Frances River Trib. A @ bridge crossing	20-Jun-90	X	X	X	X
5	Tom Cr. u/s Campbell Hwy. bridge	21-Jun-90	X	X	X	X
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	19-Jun-90	X	X	X	X
7	Tom Cr.	19-Jun-90	X	X	X	X
8	Tom Cr. Trib. 5	19-Jun-90	X	X	X	X
9	Tom Cr. Outflow from Tom Lake	19-Jun-90	X	X	X	
10	Tom Cr. Trib. 4	19-Jun-90	X			
11	Upper False Canyon Cr.	19-Jun-90	X	X	X	X
12	False Canyon Cr. Trib. 5	19-Jun-90	X	X	X	X
13	Oscar Creek		not done because site is inaccessible			
14	False Canyon Cr. u/s of Trib. 3.	19-Jun-90	X	X		
15	False Canyon Cr. Trib. 3	19-Jun-90	X	X	X	X
16	False Canyon Cr.	21-Jun-90	X			
17	Frances R. u/s of False Canyon Cr.	21-Jun-90	X			
18	Frances R. @ Hwy. Bridge	21-Jun-90	X			

3.0 RESULTS AND DISCUSSION

3.1 Water Quality

The results of water quality analyses are listed in Appendix II, Tables 1 (June, 1988) and 2 (June, 1990). Note that seasonal variability is not accounted for in the data generated by the two surveys.

Water temperatures ranged from 0.5 in the small alpine tributary to 12.5 °C in Tom Creek. Alkalinity ranged from 32 mg/l as CaCO₃, to 192 mg/l as CaCO₃, at station 4, and dissolved calcium was present in concentrations over 20 mg/l in False Canyon and Tom Creeks, indicating good buffering capacity. pH was slightly alkaline throughout the study area, ranging from 7.5 at station 3, to 8.5 at station 4.

Tom Creek and False Canyon Creek contained moderately to very hard water. The Tom Creek catchment ranged in hardness from 81 to 147 mg/l as CaCO₃.

The False Canyon Creek catchment ranged from 107 to 169 mg/l as CaCO₃. Conductivity readings were all less than 250 μ hos/cm. Suspended solids and turbidity were generally very low in both catchments during the June sampling period.

Nutrient levels were at low concentrations throughout False Canyon and Tom Creek catchments. Nitrite was undetectable, and nitrite + nitrate was below 0.050 mg/l throughout the survey area. Two exceptions should however be noted. Station 2 on June 1988 had nitrite + nitrate mean levels of 0.288 mg/l. Also one replicate at Station 5 which was 3.06 mg/l, and appears to be erroneous, as the other two replicates were both below the detection limit of 0.005 mg/l. Ammonia was generally below or near the detection limit, except for a mean value of 0.010 mg/l at the mouth of Tom Creek in the 1988 survey.

Metals concentrations were generally low in both catchments. The metals of interest in the combined data set are primarily copper, lead, and zinc.

Total copper ranged from < 0.0009 mg/l in the Frances River to 0.0023 mg/l in False Canyon Creek at station 12 in 1990. The recommended guideline for total copper is 0.002 mg/l for medium hardness, to 0.004 mg/l for hard water (Appendix 1, Table 4).

Total lead ranged from 0.0010 mg/l in Upper False Canyon Creek to 0.0096 mg/l at station 12 on False Canyon Creek in 1990. The recommended guideline for lead concentration is identical to that of copper. Sub-lethal effects of low levels of lead on various fish species have been demonstrated in lab tests, but generally in soft water for early life stages (Moore and Ramamoorthy, 1984).

Total zinc measurements were all below detection limit of 0.002 mg/l, except for Station 2 in 1998 where the mean zinc concentration was 0.032 mg/l (S.D. 0.007). However, extractable levels were found at Station 3, 11, 15 in 1990 with the values of 0.016, 0.004 and 0.003 mg/l respectively. These could be related to contamination since dissolved metals are also below detection limit. The recommended guideline for zinc concentration is 0.03 mg/l total zinc.

The acute toxicity of the above metals is modified by hardness, but

chronic toxicity is not (CCREM, 1987). Given the low volumes available for dilution in False Canyon Creek combined with background concentrations of metals, particularly lead, contributions from mine effluent would have to be low if the recommended guidelines are to be maintained instream.

3.2 Sediments

Results of the sediment survey are presented in Appendix III, with percent particle size in Table 1 and sediment chemistry in Table 2. Metals were listed as dry weights and recorded in $\mu\text{g/g}$.

Metals appear to exist in high concentrations only in sediments from station 2 collected in 1988. This site was not samples in 1990. All other sediment metals data are comparable to other mineralized areas in the Yukon (see Table 3). Concentrations of lead and zinc in sediments were one to two orders of magnitude lower than those observed in the Ketza River study area (unpublished report, Environmental Protection, 1994).

TABLE 3 COMPARATIVE SEDIMENT VALUES OF OTHER YUKON MINERALIZED AREAS ($\mu\text{g/g}$)

Grew Creek			Mount Nansen			Ketza River		
Metal	Average	Standard Deviation	Metal	Average	Standard Deviation	Metal	Average	Standard Deviation
As	28.66	11.0	As	364	729	As	868	1129
Cd	<0.8	—	Cd	4.2	7.8	Cd	2.6	2.4
Cu	34.5	12.3	Cu	21	15	Cu	73	43
Pb	110	182	Pb	115	224	Pb	820	1500
Zn	184	84	Zn	548	1081	Zn	1156	1012

3.3 Benthic Fauna

A taxonomic list of the benthic organisms found in the study area is presented in Appendix IV, Table 1. Sample site enumeration is in Appendix IV, Table 2. Taxonomic orders have been grouped and presented as total organisms counted and the percentage of the total at each sample station and these results are listed below in Table 4.

A total of fifty taxa were identified in the 1988 survey, which covered 5 sample stations. The 1990 survey identified 89 taxa and covered 10 stations. Both in 1988 and 1990, the dominant orders of the overall sample population were Ephemeroptera, Plecoptera and Diptera (see Table 5).

TABLE 4 SUMMARY TABLE OF INVERTEBRATE ABUNDANCE AND TAXONOMIC DISTRIBUTION FOR 1988 AND 1990

TAXONOMIC GROUP	1988 STA. 1	% STA. 3	1990 STA. 4	% STA. 4	1988 STA. 4	% STA. 5	1988 STA. 5	% STA. 5	1990 STA. 5	% STA. 5	
Plecoptera	21	18	142	47	93	22	92	20	20	7	19
Ephemeroptera	33	28	105	35	223	53	267	59	215	72	136
Trichoptera	10	8	0	0	6	1	26	6	9	3	37
Diptera	45	38	55	18	69	16	64	14	52	17	48
Collembola	0	0	0	0	0	0	1	0	0	0	13
Hymenoptera	0	0	1	0	0	0	0	0	0	0	41
Homoptera	0	0	1	0	1	0	0	0	0	0	0
Hemiptera	0	0	0	0	1	0	0	0	0	1	0
Lepidoptera	0	0	0	0	1	0	0	0	0	0	0
Hydracrina	5	4	0	0	1	0	0	0	0	0	0
Oribatei	0	0	0	0	0	0	0	0	1	0	0
Copepoda	0	0	0	0	1	0	0	0	0	0	0
Cyclopoida	0	0	0	0	0	0	0	0	0	0	0
Calanoida	0	0	0	0	0	0	0	0	0	0	0
Cladocera	0	0	0	0	0	0	0	0	0	0	0
Nematoda	0	0	0	0	0	0	1	0	0	0	0
Turbellaria	0	0	0	0	3	1	2	0	0	2	1
Oligochaeta	5	4	0	0	10	2	1	0	1	0	6
TOTAL NUMBERS	119	304	422	454	422	454	422	454	422	454	365

TABLE 4 (Cont'd)

TAXONOMIC GROUP	1990 STA. 6	% STA. 7	1990 STA. 8	% STA. 9	1990 STA. 11	% STA. 12	1990 STA. 15	% STA. 15
Plecoptera	1	1	52	31	91	20	45	3
Ephemeroptera	7	4	45	27	262	58	78	8
Trichoptera	2	1	0	0	22	5	0	3
Diptera	124	76	64	38	56	12	209	27
Collembola	0	0	0	0	0	1	0	75
Hymenoptera	0	0	0	0	0	0	0	0
Homoptera	1	1	1	1	3	1	0	0
Hemiptera	0	0	0	0	0	0	0	0
Lepidoptera	0	0	0	0	0	0	0	0
Hydracrina	1	1	0	0	0	0	0	0
Oribatei	3	2	1	1	4	1	0	0
Copepoda	0	0	0	0	0	0	0	0
Cyclopoida	3	2	1	1	0	0	0	0
Calanoida	0	0	0	0	0	0	2	3
Cladocera	0	0	1	1	0	0	0	0
Nematoda	15	9	0	0	3	1	0	0
Turbellaria	0	0	1	1	11	2	0	0
Oligochaeta	7	4	1	1	1	0	6	3
TOTAL NUMBERS	164	167	453	348	303	241	36	

TABLE 5 SUMMARY OF BENTHIC INVERTEBRATES SAMPLING FOR 1988 AND 1990

STATION	STA. 1	STA. 3	STA. 4	STA. 4	STA. 5	STA. 5	STA. 6
21-Jun-88 20-Jun-90 22-Jun-88 20-Jun-90 22-Jun-88 21-Jun-90 19-Jun-90							
Sample Date	19	22	34	33	28	43	30
Total # of Taxa	500	500	500	500	500	500	500
Mesh Size (μm)	119	304	422	454	298	365	164
Total # of Invertebrates	0.093	0.093	0.093	0.093	0.093	0.093	0.093
Surber Sampler Area m^2	0.279	0.279	0.279	0.279	0.279	0.279	0.279
Total Area Sampled m^2	427	1091	1514	1629	1069	1310	589
Density # of Individuals m^2	1.05	0.916	1.07	1.099	0.92	1.1316	1.012
Diversity Index (H')	0.87	0.73	0.75	0.751	0.67	0.827	0.778
Evenness Index (J')							
STATION	STA. 7	STA. 8	STA. 9	STA. 11	STA. 12	STA. 15	
19-Jun-90 19-Jun-90 19-Jun-90 19-Jun-90 19-Jun-90 19-Jun-90 19-Jun-90							
Sample Date	34	33	30	23	37	16	
Total # of Taxa	500	500	500	500	500	500	
Mesh Size (μm)	167	453	348	303	241	36	
Total # of Invertebrates	0.093	0.093	0.093	0.093	0.093	0.093	
Surber Sampler Area m^2	0.279	0.279	0.279	0.279	0.279	0.279	
Total Area Sampled m^2	599	1626	1249	1087	865	129	
Density # of Individuals m^2	1.173	1.076	0.913	0.736	0.92	0.913	
Diversity Index (H')	0.811	0.76	0.68	0.598	0.676	0.82	
Evenness Index (J')							

Diptera were clearly the dominant order at station 6 (76%) and 15 (75%) on June 1990 survey while Ephemeroptera were dominant at station 5, 1988 (72%); station 4, 1990 (59%); station 8, 1990 (58%); and station 11, 1990 (79%). Co-dominance between the above groups was found at the other stations. Nematoda were a contributing order of the community at station 6 and 12 in June 1990 with 9 and 10% respectively of the sampled population.

Benthic invertebrate analysis summary can be found in Table 5. It is composed of the total taxa, density of invertebrates, diversity and evenness indicates for each stations. Stations 1 and 15 had the highest evenness level but station 15 had the lowest density of invertebrates with only 129/m². The stations 4 and 8 had the highest density with 1629 and 1626 respectively during the June 1990 survey. Stations 5 and 9 showed also high density with both greater than 1200 individuals/m². Station 5 had the greatest number of taxa (43) followed by station 12 (37).

In comparison with other baseline studies carried out by the department in 1988, which employed the same sampling method, the Mt. Hundere benthic samples are above average in total number of individuals per station, diversity and evenness (see Table 6).

TABLE 6 DIVERSITY AND EVENNESS AT OTHER STUDY AREAS

Grew Creek

STATION	DENSITY (ind. m ²)	H'	J'
1	506	0.66	0.61
2	226	0.72	0.72
3	186	0.55	0.65

Quill Creek

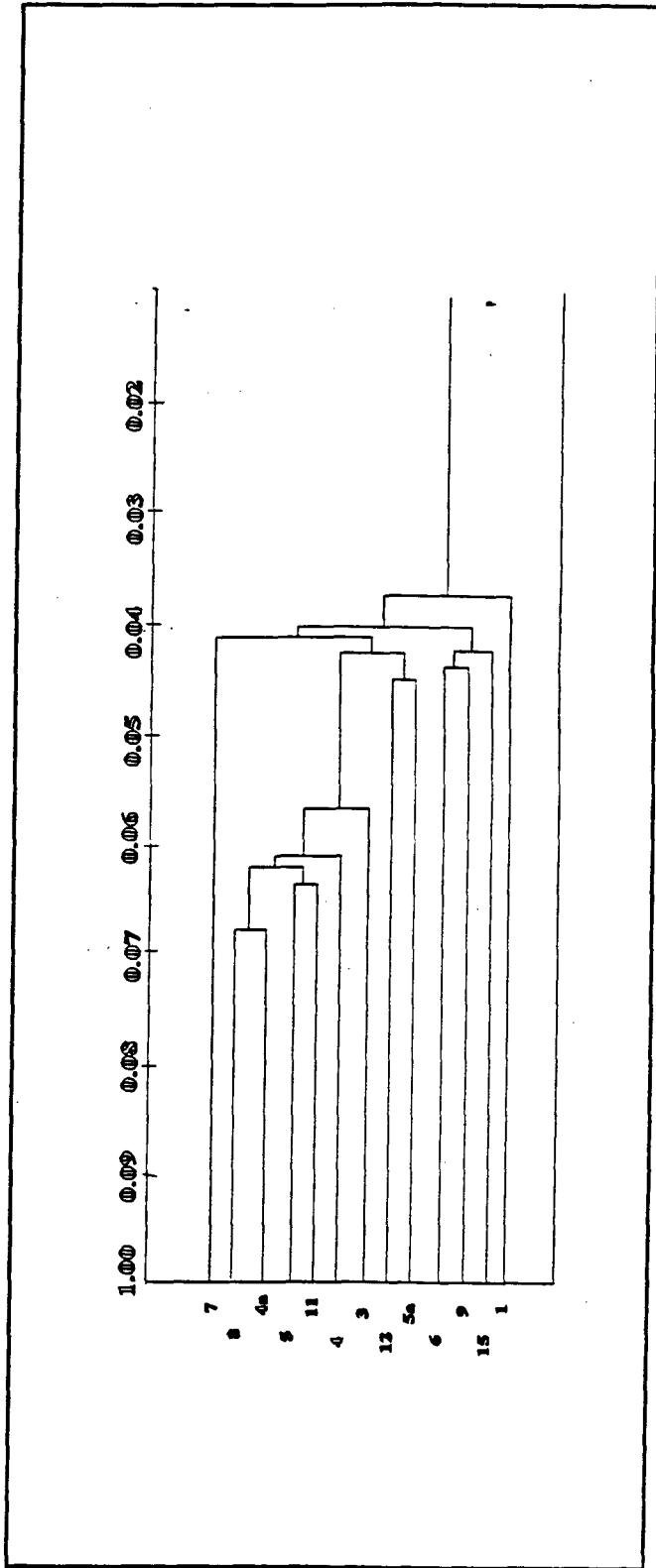
STATION	DENSITY (ind. m ²)	H'	J'
3	331	0.576	0.74
4	1168	0.744	0.618
5	530	0.180	0.257
6	530	0.808	0.808
7	584	0.594	0.763
8	693	0.722	0.669
11	2781	0.842	0.734

The nearest neighbour clustering method was used to show the percent similarity between stations during the two surveys (Table 7, Figure 3). The cluster showed a grouping of stations with similarities greater than 60%. These are composed of stations 8, 4 ,5 and 11. A second grouping consists of stations 6, 9, and 15 with similarities between 42 and 56%.

TABLE 7 PERCENT SIMILARITY INDEX FOR 1988 AND 1990 STATIONS

YEAR	STATION	1990 15	1990 12	1990 11	1990 9	1990 8	1990 7	1990 6	1990 5a	1988 5	1988 4	1988 3	1988 2	1988 1
1988	1	20	22	23	22	24	15	15	22	26	26	39	21	
1990	3	13	13	40	32	46	57	8	22	35	55	45		
1988	4	18	31	56	34	58	30	10	31	58	62			
1990	4	22	34	62	40	67	42	15	43	57				
1988	5	18	33	64	29	47	21	13	37					
1990	5	24	47	36	41	37	41	41	41					
1990	6	22	29	15	46	12	12	12	12					
1990	7	21	30	33	37	42								
1990	8	21	37	63	36									
1990	9	41	28	31										
1990	10	11	18	38										
1990	12													

FIGURE 3 CLUSTER ANALYSIS OF BENTHIC COMMUNITIES BASED ON PERCENTAGE SIMILARITY



4.0 CONCLUSIONS

1. Extractable levels of lead and zinc are near guideline recommendations.

Given the low volumes available for dilution in False Canyon Creek, combined with background concentrations of metals (particularly Pb), contributions from mine effluent would have to be low if the recommended guidelines are to be maintained.

2. Stream sediment chemistry is comparable to other mineralized sites in the Yukon.
3. Benthic invertebrate populations appear significant in numbers and the diversity compared with other recent surveys.

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APPENDIX 1

**COLLECTION, PRESERVATION, ANALYSIS OR
IDENTIFICATION METHODS AND WATER
QUALITY CRITERIA**

APPENDIX 1 TABLE 1 WATER SAMPLE COLLECTION, PRESERVATION AND ANALYSIS METHODS

PARAMETER	DETECTION LIMIT	COLLECTION AND PRESERVATION PROCEDURE	ANALYTICAL PROCEDURE	METHOD SECTION
Temperature	0.1°C	In situ temperature reading.	YSI Conductivity and Temperature Meter. Model 33.	
Flow		In situ flow measurements using a Price-type current meter.	Cross-section of the stream was measured and the velocity of flow was calculated using the standard Price-type current meter method.	
Dissolved Oxygen	1.00 mg/l	In situ measurement. The instrument was calibrated in the field under water-saturated air condition.	YSI Dissolved Oxygen meter (in situ) Orion model 701 pH meter & Orion O ₂ electrode (laboratory)	
pH	0.1 pH units	Small aliquots of sample were taken and read soon after collection. No preservative. Instrument was calibrated using 7.0 buffering solution.	Potentiometric	080
Conductivity	0.2 μ mhos/cm	In situ measurement. Laboratory measurement, specific conductivity at 25°C. No preservative. The measurement was taken from the same sample as NH ₃ below.	YSI Conductivity meter model 33 (in situ). Radiometer conductivity meter (CDM2) (laboratory).	044
Conc. NH ₃	5 μ g/l (dilution limit)	Same sample as NH ₃ .	Platinum-cobalt visual comparison	040
Turbidity	0.1 (FTU)	Same sample as NH ₃ .	Repielometric turbidity	130
Non-Filterable Residue (NFR)	5.0 mg/l	Same sample as NH ₃ .	Filtration, drying and weighing of filtrate	104
Filterable Residue (FR)	10.0 mg/l	Same sample as NH ₃ .	Filtration, drying and weighing of filtrate.	100
Total Alkalinity	1.0 mg/l as CaCO ₃	Same sample as NH ₃ .	Potentiometric titration.	006

APPENDIX 1 TABLE 1 WATER SAMPLE COLLECTION, PRESERVATION AND ANALYSIS METHODS (continued)

PARAMETER	DETECTION LIMIT	COLLECTION AND PRESERVATION PROCEDURE	ANALYTICAL PROCEDURE	METHOD SECTION
Amonia NH ₃ -N	0.005 mg/l	Single samples collected in 2 litre linear polyethylene containers. Each container was rinsed 3 times with sample before it was filled. No preservatives. Stored at 4°C.	<u>Phenol-hypochlorite</u> automated	058
Nitrate NO ₂ -N	0.005 mg/l	Same sample as NH ₃ .	<u>Diazotization-colorimetric</u> automated	070
Nitrate NO ₃ -N	0.005 mg/l	Same sample as NH ₃ .	<u>Cadmium-copper reduction</u> colorimetric-automated	072
Total Phosphate T PO ₄ -P	0.002 mg/l	Same sample as NH ₃ .	<u>Ascorbic acid-persulphate</u> , automated autoclave digestion	086
Sulphate SO ₄	1 mg/l	Same sample as NH ₃ .	<u>Automated methylvthymol-blue</u> colorimetric	122
Chloride Cl	0.5 mg/l	Same sample as NH ₃ .	<u>Thiocyanate-combined reagent</u> colorimetric	024

APPENDIX 1 TABLE 1 WATER SAMPLE COLLECTION, PRESERVATION AND ANALYSIS METHODS (continued)

PARAMETER	DETECTION LIMIT	COLLECTION AND PRESERVATION PROCEDURE	ANALYTICAL PROCEDURE	METHOD SECTION
Extractable/Total Metals	mg/l	Single or triplicate samples collected in 125ml linear polyethylene bottles. Each bottle was rinsed 3 times with sample before filling. Preserved to a pH <1.5 using 1.0ml concentrated HNO ₃ .	Inductively Coupled Argon Plasma	300
Ag	0.01			
Al	0.05			
As	0.05			
B	0.01			
Ba	0.001			
Be	0.001			
Ca	0.1			
Cd	0.005			
Cr	0.005			
Cu	0.005			
Fe	0.005			
Mg	0.10			
Mn	0.001			
Mo	0.01			
Na	0.1			
Ni	0.02			
Pb	0.05			
Sb	0.05			
Se	0.05			
Si	0.05			
Sn	0.05			
Si	0.001			
Ti	0.002			
V	0.01			
Zn	0.002			

APPENDIX 1 TABLE 1 WATER SAMPLE COLLECTION, PRESERVATION AND ANALYSIS METHODS (continued)

PARAMETER	DETECTION LIMIT	COLLECTION AND PRESERVATION PROCEDURE	ANALYTICAL PROCEDURE	METHOD SECTION
Pb	0.0005	Same sample as metals.	Graphite Furnace Atomic Absorption Spectrometry	330

Total Hardness 0.030 mg/l Same sample as metals.

$$\text{Ca/Mg Hardness} = 4.116\text{Mg} + 2.497\text{Ca}$$

¹ As described in Environment Canada (1976).² As described in Department of Environment (1979).

APPENDIX 1 TABLE 2 SEDIMENT COLLECTION, PREPARATION AND ANALYSIS METHODS

PARAMETER	PREPARATION	ANALYSIS	METHODS CODE ₁
All Parameters	Creek and River Stations: Sediment samples were collected using a Teflon scoop to scoop stream sediments into sample bag. Three samples were collected at each station and placed in geochemical paper sample bags. Each sample is then sealed in plastic bags and frozen or kept cool within 24 hours.		
Metals (Leachable)	Sample was freeze-dried for 48 hours to remove water. Sample was sieved through a size 100 mesh (.15mm) stainless steel sieve. The portion passing through was analyzed for leachable metals.		
Al, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Na, Ni, P, Pb, Si, Sn, Sr, Ti, V, Zn	Sample was leached with HCl and HNO ₃ . The sample was heated for 3 hours.	Inductively Coupled Argon Plasma (ICAP)	320
As	Same as other metals.	Hydride Generation ICAP	350
Al	Same as other metals.	Flame Atomic Absorption	330
Particle Size	Sample was freeze-dried.	Standard Sieving Operation	678

Department of Environment, Department of Fisheries and Oceans, Laboratory Manual, Environmental Protection Service, Fisheries and Marine Service (1979).

APPENDIX 1 TABLE 3 BOTTOM FAUNA COLLECTION, PRESERVATION AND IDENTIFICATION METHODS

FIELD COLLECTION, SAMPLING PROCEDURES AND PRESERVATION	LABORATORY PROCEDURES	IDENTIFICATION AND ENUMERATION
Surber Sampler: Creek and river samples were taken using a Surber sampler with a net, 60cm long (mesh size 500 μ m). Area sampled was 929 cm ² (1 ft ²). The sampler was deployed three times, over a short reach of river (approx. 10m), at each site. Replicates were all washed from the net into a 1L bottle. A mixture of 10% formalin was added to preserve the sample.	Bottom fauna was sorted from other material and placed in a vial containing 70% methanol.	Bottom fauna samples were sent to Dr. C. Low, a Consulting Invertebrate Biologist, Nanaimo, B.C. for identification to genus and species if possible and enumeration of sample.

APPENDIX 1 TABLE 4 WATER QUALITY CRITERIA FOR DRINKING WATER AND AQUATIC LIFE (continued)

SUBSTANCE	RECOMMENDED LEVEL(S) FOR DRINKING WATER	REFERENCES(S)	RECOMMENDED LEVEL(S) FOR AQUATIC LIFE	REFERENCE
*Copper (Cu) total mg/l	<1.0 aesthetic objective	1	0.002 at hardness 0-120mg/l CaCO ₃ , 0.004 at hardness 120-180mg/l CaCO ₃ , 0.006 at hardness >180mg/l CaCO ₃ ,	
Dissolved oxygen (% saturation)	Near 100%	4	>5.0mg/l	10
Fluoride (F)mg/l	1.5	1	1.5	7
Hardness (Total) as mg/l CaCO ₃	80-100	1		
Iron (Fe) total mg/l	<0.3 aesthetic objective	1	0.3	
Lead (Pb) total mg/l	0.05	1	0.001 at hardness 0-60mg/l CaCO ₃ , 0.002 at hardness 60-120mg/l CaCO ₃ , 0.004 at hardness 120-180mg/l CaCO ₃ , 0.007 at hardness >180mg/l CaCO ₃ ,	10
Magnesium (Mg)mg/l	50	4	1.0	
Manganese (Mn)mg/l	<0.05 aesthetic objective	1	1.0	
Molybdenum (Mo)mg/l		2		
Nickel (Ni) total mg/l	0.25			
Nitrate (NO ₃ -N)mg/l	10	1	0.025 at hardness 0-60mg/l CaCO ₃ , 0.065 at hardness 60-120mg/l CaCO ₃ , 0.11 at hardness 120-180mg/l CaCO ₃ , 0.15 at hardness >180	10
Nitrite (NO ₂ -N)mg/l	1.0	1		
pH units	6.5-8.5	1	0.06	10
Phosphate (PO ₄)mg/l	0.2	8	6.5-9.0	
*Phosphorus (P)mg/l (Total)			0.020 to prevent algae	5
Residue: Filterable mg/l (Total dissolved solids)	<500 aesthetic objective	4	70-400 with a maximum of 2000	6
Residue: Non-Filterable (mg/l) (TSS)			Increase of 10mg/l with bkgd<100mg/l Increase of 10% above bkgd with bkgd >100.0mg/l	8 10

APPENDIX 1

TABLE 4

WATER QUALITY CRITERIA FOR DRINKING WATER AND AQUATIC LIFE

SUBSTANCE	RECOMMENDED LEVEL (S) FOR DRINKING WATER	REFERENCE (S)	RECOMMENDED LEVEL (S) FOR AQUATIC LIFE	REFERENCE (S)
Physical				
Colour (TCU)	<15	1		
Temperature (°C)	15			
Odour and taste	If offensive	1		
Turbidity NTU	<5	1		
Coliform-Total (count/100ml)	10	1		
fecal coliform	0	1		
Chemical				
*Alkalinity mg/l (Total)	Not considered a public health problem	4	>20	3
*Aluminum (Al) mg/l	Not considered a public health problem	7	0.1 at pH >6.5	5
Ammonia total (NH3-N) mg/l	0.5	4	2.2 at pH 6.5 temp 10°C 1.37 at pH 8.0 temp 10°C	10
Antimony (Sb) mg/l				
Arsenic (As) total mg/l	0.05	1	<0.05	10
Barium (Ba) mg/l	1.0	1	5.0	7
Boron (B) mg/l	5.0	1	0.0002 for hardness 0-60mg/l CaCO ₃	
*Cadmium (Cd) total mg/l	0.005	1	0.0008 for hardness 60-120mg/l CaCO ₃	
Calcium (Ca) mg/l	75-200	7	0.0013 for hardness 120-180 CaCO ₃	10
Chloride (Cl) mg/l	<250 aesthetic objectives	1	0.0018 for hardness >180 CaCO ₃	
*Chromium (Cr) total mg/l	0.05	1	0.02 to protect fish 0.002 to protect aquatic life	10
Cobalt (Co) mg/l				
Conductivity @ 25°C (umhos/cm)	Depends on dissolved salts	7	150-500	6

APPENDIX 1 TABLE 4 WATER QUALITY CRITERIA FOR DRINKING WATER AND AQUATIC LIFE (continued)

SUBSTANCE	RECOMMENDED LEVEL(S) FOR DRINKING WATER	REFERENCES(S)	RECOMMENDED LEVEL(S) FOR AQUATIC LIFE	REFERENCE
**Selenium (Se) total mg/l	0.01	1	0.001	10
Silica (Si)mg/l				
*Silver (Ag) total mg/l		1	0.0001	10
Sodium (Na)mg/l		1		
Strontium (Sr)mg/l	10	1		
Sulphate (SO ₄)mg/l	500	1		
Tin (Sn)mg/l		7		
Not present in natural waters				
Titanium (Ti)mg/l		1		
Vanadium (V)	<5.0 aesthetic objective			
Zinc (Zn)mg/l		0.030	1	10

* Use graphite furnace for the lab detection limit to be less than the recommended levels.

** Lab detection limit > recommended levels.

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2. Inland Waters Directorate. 1980. Guidelines for Surface Water Quality. Vol. 1 Inorganic Chemical Substances. Environment Canada, Ottawa.
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APPENDIX I TABLE 4 WATER QUALITY CRITERIA FOR DRINKING WATER AND AQUATIC LIFE (continued)

SUBSTANCE	RECOMMENDED LEVEL(S) FOR DRINKING WATER	REFERENCE(S)	RECOMMENDED LEVEL(S) FOR AQUATIC LIFE	REFERENCE
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5.	Ontario Ministry of the Environment. 1978. <u>Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment.</u>			
6.	Environment Canada, 1976. <u>Pollution Sampling Handbook.</u> Pacific Region Laboratory Services, Fisheries Operations and Environmental Protection Service, West Vancouver, B.C.			
7.	California State Water Resources Control Board. 1963. <u>Water Quality Criteria.</u> Publication No. 3-A Second Edition by McKee and Wolf.			
8.	Inland Waters Directorate. 1979. <u>Water Quality Source Book a Guide to Water Quality Parameters.</u> Environment Canada, Water Quality Branch, Ottawa, Canada.			
9.	Health and Welfare Canada, 1983. <u>Guidelines for Canadian Recreational Water Quality.</u> Supply and Services Canada.			
10.	CCREM. 1987. <u>Canadian Water Quality Guidelines.</u> Task Force on Water Quality Guidelines of the Canadian Council of Resource and Environment Ministers. Ottawa.			

APPENDIX II

WATER QUALITY

APPENDIX II TABLE 1 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1988

STATION	DESCRIPTION	ER STD (mg/L)	NFR Mean (mg/L)	Ag Mean (mg/L)	Ag STD (mg/L)	Al Mean (mg/L)	Al STD (mg/L)	As Mean (mg/L)	As STD (mg/L)
1	Headwaters of Tom Creek Tributary 5	10	42	29	< 0.01	n/a	< 0.05	n/a	< 0.05
2	Headwaters of False Canyon Creek	7	< 5	n/a	< 0.01	n/a	< 0.05	n/a	< 0.05
3	Headwaters of False Canyon Creek Tributary B	17	72	73	< 0.01	n/a	< 0.05	n/a	< 0.05
4	Frances River Tributary A @ bridge crossing	43	34	3	< 0.01	n/a	< 0.05	n/a	< 0.05
5	Tom Creek u/s Campbell Hwy bridge	10	36	10	< 0.01	n/a	< 0.05	n/a	< 0.05

STATION	DESCRIPTION	B Mean (mg/L)	B STD (mg/L)	Ba Mean (mg/L)	Ba STD (mg/L)	Be Mean (mg/L)	Be STD (mg/L)	Ca Mean (mg/L)	Ca STD (mg/L)	Cd Mean (mg/L)
1	Headwaters of Tom Creek Tributary 5	0.01	n/a	0.009	0.001	0.001	0.001	n/a	38	6 < 0.005
2	Headwaters of False Canyon Creek	0.01	n/a	0.004	0.001	< 0.001	n/a	12	3 < 0.005	
3	Headwaters of False Canyon Creek Tributary B	< 0.01	n/a	0.021	0.008	< 0.001	n/a	38	13 < 0.005	
4	Frances River Tributary A @ bridge crossing	< 0.01	n/a	0.049	0.015	< 0.001	n/a	39	12 < 0.005	
5	Tom Creek u/s Campbell Hwy bridge	< 0.01	n/a	0.055	0.011	< 0.001	n/a	22	4 < 0.005	

metals extractable (ICP scan); low detection analysis for Zn and Pb if below ICP scan STD = standard deviation n/a = analysis not done

APPENDIX II TABLE 1 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1988

STATION	DESCRIPTION	Cd	Co	Cr	Cu	Fe	Fe
		STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)
1	Headwaters of Tom Creek Tributary 5	n/a	< 0.005	n/a	< 0.005	n/a	0.005
2	Headwaters of False Canyon Creek	n/a	< 0.005	n/a	< 0.005	n/a	0.005
3	Headwaters of False Canyon Creek Tributary B	n/a	< 0.005	n/a	< 0.005	n/a	0.005
4	Frances River Tributary A @ bridge crossing	n/a	< 0.005	n/a	< 0.005	n/a	0.005
5	Tom Creek u/s Campbell Hwy bridge	n/a	< 0.005	n/a	< 0.005	n/a	0.005

STATION	DESCRIPTION	Mg	Mg	Mn	Mn	Mo	Mo	Ni
		Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)
1	Headwaters of Tom Creek Tributary 5	1.5	0.2	< 0.001	n/a	< 0.01	n/a	0.6
2	Headwaters of False Canyon Creek	0.4	0.2	< 0.001	n/a	< 0.01	n/a	0.1
3	Headwaters of False Canyon Creek Tributary B	3.5	1.2	< 0.001	n/a	< 0.01	n/a	0.5
4	Frances River Tributary A @ bridge crossing	11.3	3.5	< 0.001	n/a	< 0.01	n/a	0.9
5	Tom Creek u/s Campbell Hwy bridge	6.3	1.2	0.004	0.001	< 0.01	n/a	0.9

metals extractable (ICP scan); low detection analysis for Zn and Pb if below ICP scan

n/a = analysis not done

STD = standard deviation

APPENDIX II TABLE 1 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1988

STATION	DESCRIPTION	Ni	P	Pb(GF)	Sb	Se	Se
		STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)
1	Headwaters of Tom Creek Tributary 5	n/a	< 0.1	n/a	< 0.0005	n/a	< 0.05
2	Headwaters of False Canyon Creek	n/a	< 0.1	n/a	0.0010	0.0002	< 0.05
3	Headwaters of False Canyon Creek Tributary B	n/a	< 0.1	n/a	< 0.0005	n/a	< 0.05
4	Frances River Tributary A @ bridge crossing	n/a	< 0.1	n/a	< 0.0005	n/a	< 0.05
5	Tom Creek u/s Campbell Hwy bridge	n/a	< 0.1	n/a	< 0.0005	n/a	< 0.05

STATION	DESCRIPTION	Si	Si	Sn	Sn	Sr	Ti	Ti	V	
		Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	Mean (mg/L)	STD (mg/L)	
1	Headwaters of Tom Creek Tributary 5	2.52	0.34	< 0.05	n/a	0.115	0.016	< 0.302	n/a	< 0.01
2	Headwaters of False Canyon Creek	0.74	0.15	< 0.05	n/a	0.016	0.003	< 0.302	n/a	< 0.01
3	Headwaters of False Canyon Creek Tributary B	2.49	0.86	< 0.05	n/a	0.092	0.031	< 0.002	n/a	< 0.01
4	Frances River Tributary A @ bridge crossing	1.90	0.63	< 0.05	n/a	0.125	0.039	< 0.002	n/a	< 0.01
5	Tom Creek u/s Campbell Hwy bridge	1.84	0.37	< 0.05	n/a	0.073	0.014	< 0.002	n/a	< 0.01

metals extractable (ICP scan); low detection analysis for Zn and Pb if below ICP scan STD = standard deviation n/a = analysis not done

APPENDIX II TABLE 1 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1988

STATION	DESCRIPTION	V STD (mg/L)	Zn Mean (mg/L)	Zn STD (mg/L)
1	Headwaters of Tom Creek Tributary 5	n/a	< 0.002	n/a
2	Headwaters of False Canyon Creek	n/a	0.032	0.007
3	Headwaters of False Canyon Creek Tributary B	n/a	< 0.002	n/a
4	Frances River Tributary A @ bridge crossing	n/a	< 0.002	n/a
5	Tom Creek u/s Campbell Hwy bridge	n/a	< 0.002	n/a

metals extractable (ICP scan); low detection analysis for Zn and Pb if below ICP scan

STD = standard deviation

n/a = analysis not done

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	SAMPLE DATE	MEAN	STREAM	MEAN	DISCHARGE	TEMP	PH INSTRU	IN SITU COND. ($\mu\text{mhos}/\text{cm}^3$)
			DEPTH (m)	WIDTH (m)	VELOCITY (m/sec)	(m ³ /sec)	(C)		
3	Headwaters of False Canyon Cr. Trib. B	20-Jun-90	0.19	3.5	0.29	0.26	5.1	8.16	142
4	Frances River Trib. A @ Bridge	20-Jun-90	0.30	3.1	0.44	0.48	9.8	8.53	250
5	Tom Creek u/s Campbell Hwy bridge	21-Jun-90	0.33	15.0	0.89	4.76	11.2	8.26	170
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	19-Jun-90	0.25	8.0	0.21	0.44	12.5	7.81	115
7	Tom Cr. Trib. 5	19-Jun-90	0.46	10.0	0.60	3.05	9.0	8.18	178
8	Tom Cr. Outflow from Tom Lake	19-Jun-90	0.40	5.6	0.77	1.83	7.0	8.21	165
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	19-Jun-90	n/a	n/a	n/a	n/a	11.1	8.09	228
10	Tom Cr. Trib. u/s of outflow from Tom Lake	19-Jun-90	n/a	n/a	n/a	n/a	12.5	8.14	200
11	Upper False Canyon Cr.	19-Jun-90	0.26	3.7	0.79	0.81	7.1	8.15	180
12	False Canyon Cr. Trib. @ Air Photo Stn.	19-Jun-90	0.53	5.2	0.49	1.43	8.0	8.07	210
14	False Canyon Cr. u/s of Trib. B. 30m	19-Jun-90	n/a	n/a	n/a	n/a	9.0	8.13	132
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 60m u/s of Frances R.	19-Jun-90	0.41	8.0	0.67	2.22	5.5	8.17	141
16	False Canyon Cr. 300m Frances R. u/s of False Canyon Cr.	21-Jun-90	n/a	n/a	n/a	n/a	11.8	8.13	171
17	Frances R. u/s of False Canyon Cr.	21-Jun-90	n/a	n/a	n/a	n/a	9.3	7.97	90
18	Frances R. @ Hwy. Bridge	21-Jun-90	n/a	n/a	n/a	n/a	10.2	7.99	99

Metals (ICP Scan); low detection analysis (GF) for Ag, Cd, Cu and Pb if below ICP scan. n/a = analysis not done

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	DISSOLVED & DISSOLVED			TURB. (FTU)	(asCaCO ₃) (mg/L)	(Diss.) HARDNESS (mg/L)	(Diss.) TOTAL HARDNESS (mg/L)
		OXYGEN (mg/L)	COLOR SATURATION (REL. U.)	(mg/L)				
3	Headwaters of False Canyon Cr. Trib. B	10.50	93	<5	0.9	133	126	127
4	Frances River Trib. A @ Bridge	10.30	100	5	0.2	192	201	202
5	Tom Creek u/s Campbell Hwy bridge	10.70	105	10	0.6	127	125	125
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	8.73	90	20	0.8	83	79	79
7	Tom Cr.	10.20	98	10	0.5	139	138	138
8	Tom Cr. Trib. 5	11.00	100	5	0.6	133	133	133
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	9.10	91	15	0.4	172	172	173
10	Tom Cr. Trib. u/s of outflow from Tom Lake	6.80	70	10	0.4	139	143	143
11	Upper False Canyon Cr.	10.40	94	5	0.5	155	151	151
12	False Canyon Cr. Trib. @ Air Photo Stn.	10.50	96	5	0.4	168	160	160
14	False Canyon Cr. u/s of Trib. B. 30m	9.40	88	10	1.5	104	100	101
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	10.60	92	5	2.0	160	157	157
16	False Canyon Cr. 60m u/s of Frances R.	n/a	n/a	7	1.7	133	123	124
17	Frances R. u/s of False Canyon Cr.	10.28	97	5	0.6	56	63	63
18	Frances R. @ Hwy. Bridge	10.20	99	5	0.7	60	65	65

STATION	DESCRIPTION	(Extr.) HARDNESS (asCaCO ₃) (mg/L)			TOTAL HARDNESS (mg/L)	SULFATE (mg/L)	CHLORIDE (mg/L)	P NITRATE (mg/L)	NITRITE (mg/L)	NITRATE AMMONIA FLUORIDE (mg/L)
		(Extr.) HARDNESS (asCaCO ₃) (mg/L)	TOTAL HARDNESS (mg/L)	(mg/L)						
3	Headwaters of False Canyon Cr. Trib. B	128	129	3.1	0.3	0.012	<0.002	0.019	0.010	0.08
4	Frances River Trib. A @ Bridge	205	206	23.6	0.5	0.003	<0.002	0.014	0.002	0.09
5	Tom Creek u/s Campbell Hwy bridge	129	130	9.2	0.4	0.004	<0.002	<0.002	0.004	0.02
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	81	82	4.4	0.4	0.010	<0.002	<0.002	0.002	0.07
7	Tom Cr.	140	141	11.1	0.6	0.004	<0.002	0.011	<0.002	0.07
8	Tom Cr. Trib. 5	135	137	8.6	0.3	0.004	<0.002	0.013	0.004	0.06
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	170	171	10.7	0.6	0.005	<0.002	0.042	0.002	0.06
10	Tom Cr. Trib. u/s of outflow from Tom Lake	147	147	12.2	0.4	0.006	<0.002	0.016	0.004	0.08
11	Upper False Canyon Cr.	153	153	5.9	0.3	0.003	<0.002	0.038	<0.002	0.06
12	False Canyon Cr. Trib. @ Air Photo Stn.	167	168	7.8	0.4	0.004	<0.002	0.050	<0.002	0.06
14	False Canyon Cr. u/s of Trib. B. 30m	105	107	6.6	0.4	0.011	<0.002	0.011	<0.002	0.06
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	168	169	9.0	0.4	0.019	<0.002	0.037	<0.002	0.10
16	False Canyon Cr. 60m u/s of Frances R.	128	129	8.0	0.3	0.010	<0.002	0.015	0.002	0.07
17	Frances R. u/s of False Canyon Cr.	65	66	13.0	0.3	0.004	<0.002	0.046	0.003	0.06
18	Frances R. @ Hwy. Bridge	68	68	12.9	0.3	0.004	<0.002	0.045	0.003	0.06

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	FR						NFR						Diss.			
		Diss.	GF	Diss.	Ag	Diss.	Al	Diss.	As	Diss.	B	Diss.	Ba	Diss.	Be	Diss.	Ca
		(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)
3	Headwaters of False Canyon Cr. Trib. B	230	<10	0.0004	<0.05	<0.05	<0.05	<0.01	<0.027	<0.001	0.027	<0.001	0.069	<0.001	0.069	<0.001	44.2
4	Frances River Trib. A @ Bridge	320	<10	0.0007	<0.05	<0.05	<0.05	<0.01	<0.01	0.023	<2	3.9	0.002	<0.01	55.1		
5	Tom Creek u/s Campbell Hwy bridge	283	<10	0.0003	<0.05	<0.05	<0.05	<0.01	<0.01	0.020	<2	15.5	0.002	<0.01	34.1		
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	180	<10	<0.0001	<0.05	<0.05	<0.05	<0.01	<0.01	0.037	<2	9.7	0.009	<0.01	22.1		
7	Tom Cr.	260	<10	0.0004	<0.05	<0.05	<0.05	<0.01	<0.01	0.015	<2	5.8	0.022	<0.01	22.1		
8	Tom Cr. Trib. 5	240	<10	0.0004	<0.05	<0.05	<0.05	<0.01	<0.01	0.012	<2	10.3	0.002	<0.01	36.1		
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	290	<10	0.0005	<0.05	<0.05	<0.05	<0.01	<0.01	0.027	<2	9.3	0.003	<0.01	38.0		
10	Tom Cr. Trib. u/s of outflow from Tom Lake	220	<10	0.0004	<0.05	<0.05	<0.05	<0.01	<0.01	0.010	<2	13.0	0.003	<0.01	47.6		
11	Upper False Canyon Cr.	210	<10	0.0005	<0.05	<0.05	<0.05	<0.01	<0.01	0.098	<2	12.5	0.009	<0.01	45.7		
12	False Canyon Cr. Trib. @ Air Photo Stn.	250	<10	0.0005	<0.05	<0.05	<0.05	<0.01	<0.01	0.118	<2	11.8	0.001	<0.01	47.4		
14	False Canyon Cr. u/s of Trib. B. 30m	130	1.3	0.0003	<0.05	<0.05	<0.05	<0.01	<0.01	0.072	<2	0.072	<0.001	0.072	29.6		
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	193	25	0.0005	<0.05	<0.05	<0.05	<0.01	<0.01	0.087	<2	0.087	<0.001	0.087	45.5		
16	False Canyon Cr. 60m u/s of Frances R.	207	10	0.0003	<0.05	<0.05	<0.05	<0.01	<0.01	0.086	<2	0.086	<0.001	0.086	35.8		
17	Frances R. u/s of False Canyon Cr.	117	<10	<0.0001	<0.05	<0.05	<0.05	<0.01	<0.01	0.025	<2	0.025	<0.001	0.025	18.7		
18	Frances R. @ Hwy. Bridge	157	<10	<0.0001	<0.05	<0.05	<0.05	<0.01	<0.01	0.027	<2	0.027	<0.001	0.027	19.4		

STATION	DESCRIPTION	Diss.						GF						Diss.			
		Cd	Diss.	Cd	Diss.	Cr	Diss.	Cr	Diss.	Cu	Diss.	Cr	Diss.	K	Diss.	Mg	Diss.
		(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)
3	Headwaters of False Canyon Cr. Trib. B	<0.0001	<0.005	<0.005	0.0011	0.0011	0.005	<0.005	<0.005	<0.005	<2	3.9	0.002	<0.01			
4	Frances River Trib. A @ Bridge	<0.0001	<0.005	<0.005	0.0015	0.0015	0.005	<0.005	<0.005	<0.005	<2	15.5	0.002	<0.01			
5	Tom Creek u/s Campbell Hwy bridge	<0.0001	<0.005	<0.005	0.0028	0.0028	0.005	<0.005	<0.005	<0.005	<2	9.7	0.009	<0.01			
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	<0.0001	<0.005	<0.005	0.0017	0.0017	0.013	<0.005	<0.005	<0.005	<2	5.8	0.022	<0.01			
7	Tom Cr.	<0.0001	<0.005	<0.005	0.0011	0.0011	0.013	<0.005	<0.005	<0.005	<2	10.3	0.002	<0.01			
8	Tom Cr. Trib. 5	<0.0001	<0.005	<0.005	0.0017	0.0017	0.008	<0.005	<0.005	<0.005	<2	9.3	0.003	<0.01			
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	<0.0001	<0.005	<0.005	0.0020	0.0020	0.016	<0.005	<0.005	<0.005	<2	13.0	0.003	<0.01			
10	Tom Cr. Trib. u/s of outflow from Tom Lake	<0.0001	<0.005	<0.005	0.0020	0.0020	0.034	<0.005	<0.005	<0.005	<2	12.5	0.009	<0.01			
11	Upper False Canyon Cr.	<0.0001	<0.005	<0.005	0.0014	0.0014	0.023	<0.005	<0.005	<0.005	<2	9.0	0.003	<0.01			
12	False Canyon Cr. Trib. @ Air Photo Stn.	<0.0001	<0.005	<0.005	0.0019	0.0019	0.020	<0.005	<0.005	<0.005	<2	10.1	0.005	<0.01			
14	False Canyon Cr. u/s of Trib. B. 30m	<0.0001	<0.005	<0.005	0.0021	0.0021	0.037	<0.005	<0.005	<0.005	<2	6.4	0.009	<0.01			
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	<0.0001	<0.005	<0.005	0.0035	0.0035	0.015	<0.005	<0.005	<0.005	<2	10.6	0.008	<0.01			
16	False Canyon Cr. 60m u/s of Frances R.	<0.0001	<0.005	<0.005	0.0019	0.0019	0.036	<0.005	<0.005	<0.005	<2	8.3	0.013	<0.01			
17	Frances R. u/s of False Canyon Cr.	<0.0001	<0.005	<0.005	0.0020	0.0020	0.012	<0.005	<0.005	<0.005	<2	3.9	0.003	<0.01			
18	Frances R. @ Hwy. Bridge	<0.0001	<0.005	<0.005	0.0026	0.0026	0.014	<0.005	<0.005	<0.005	<2	4.1	0.004	<0.01			

Metals (ICP Scan); low detection analysis (GF) for Ag, Cd, Cu and Pb if below ICP scan. n/a = analysis not done

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	Diss. Na (mg/L)	Diss. N ₁ (mg/L)	Diss. P (mg/L)	Diss. Pb (mg/L)	Diss. GF (mg/L)	Diss. Se (mg/L)	Diss. Si (mg/L)	Diss. Sn (mg/L)	Diss. Sr (mg/L)
3	Headwaters of False Canyon Cr. Trib. B	0.6 <0.02	<0.1	0.0008	<0.05	<0.05	3.33 <0.05	0.115		
4	Frances River Trib. A @ Bridge	1.3 <0.02	<0.1	0.0011	<0.05	<0.05	2.65 <0.05	0.185		
5	Tom Creek u/s Campbell Hwy bridge	1.3 <0.02	<0.1	0.0013	<0.05	<0.05	2.72 <0.05	0.124		
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	1.5 <0.02	<0.1	<0.0005	<0.05	<0.05	3.54 <0.05	0.090		
7	Tom Cr.	1.1 <0.02	<0.1	0.0009	<0.05	<0.05	2.69 <0.05	0.128		
8	Tom Cr. Trib. 5	0.8 <0.02	<0.1	0.0008	<0.05	<0.05	2.51 <0.05	0.117		
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	2.1 <0.02	<0.1	0.0012	<0.05	<0.05	3.24 <0.05	0.179		
10	Tom Cr. Trib. u/s of outflow from Tom Lake	0.9 <0.02	<0.1	0.0013	<0.05	<0.05	2.23 <0.05	0.129		
11	Upper False Canyon Cr.	0.7 <0.02	<0.1	0.0010	<0.05	<0.05	2.57 <0.05	0.158		
12	False Canyon Cr. Trib. @ Air Photo Stn.	1.0 <0.02	<0.1	0.0007	<0.05	<0.05	2.40 <0.05	0.175		
14	False Canyon Cr. u/s of Trib. B. 30m	0.9 <0.02	<0.1	<0.0005	<0.05	<0.05	2.75 <0.05	0.106		
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	0.7 <0.02	<0.1	0.0006	<0.05	<0.05	2.82 <0.05	0.122		
16	False Canyon Cr. 60m u/s of Frances R.	0.9 <0.02	<0.1	<0.0005	<0.05	<0.05	3.04 <0.05	0.121		
17	Frances R. u/s of False Canyon Cr.	1.0 <0.02	<0.1	0.0011	<0.05	<0.05	2.50 <0.05	0.078		
18	Frances R. @ Hwy. Bridge	1.0 <0.02	<0.1	<0.0008	<0.05	<0.05	2.48 <0.05	0.082		

STATION	DESCRIPTION	Diss. Ti (mg/L)	Diss. V (mg/L)	Diss. Zn (mg/L)	Diss. Ag (mg/L)	Diss. Al (mg/L)	Extr. As (mg/L)	Extr. B (mg/L)	Extr. Ba (mg/L)	Extr. Be (mg/L)
3	Headwaters of False Canyon Cr. Trib. B	<0.002 <0.01	0.002	0.0004	0.10 <0.05	<0.05	<0.01	0.028 <0.001		
4	Frances River Trib. A @ Bridge	<0.002 <0.01	0.002	0.0007	<0.05	<0.05	<0.01	0.073 <0.001		
5	Tom Creek u/s Campbell Hwy bridge	<0.002 <0.01	0.002	0.0004	<0.05	<0.05	<0.01	0.092 <0.001		
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	<0.002 <0.01	0.002	<0.0001	0.06 <0.05	<0.05	<0.01	0.077 <0.001		
7	Tom Cr.	<0.002 <0.01	0.002	<0.0005	0.08 <0.05	<0.05	<0.01	0.095 <0.001		
8	Tom Cr. Trib. 5	<0.002 <0.01	0.002	0.0005	0.14 <0.05	<0.05	<0.01	0.112 <0.001		
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	<0.002 <0.01	0.002	0.0006	<0.05	<0.05	0.01	0.085 <0.001		
10	Tom Cr. Trib. u/s of outflow from Tom Lake	<0.002 <0.01	0.002	0.0004	<0.05	<0.05	<0.01	0.106 <0.001		
11	Upper False Canyon Cr.	<0.002 <0.01	0.002	0.0005	<0.05	<0.05	<0.01	0.103 <0.001		
12	False Canyon Cr. Trib. @ Air Photo Stn.	<0.002 <0.01	0.002	0.0006	<0.05	<0.05	<0.01	0.126 <0.001		
14	False Canyon Cr. u/s of Trib. B. 30m	<0.002 <0.01	0.002	0.0003	0.12 <0.05	<0.05	<0.01	0.082 <0.001		
15	False Canyon Cr. Trib. 300m u/s of False Canyon Cr.	<0.002 <0.01	0.002	0.0006	0.15 <0.05	<0.05	<0.01	0.104 <0.001		
16	False Canyon Cr. 60m u/s of Frances R.	<0.002 <0.01	0.002	0.0004	0.13 <0.05	<0.05	<0.01	0.094 <0.001		
17	Frances R. u/s of False Canyon Cr.	<0.002 <0.01	0.002	<0.0001	0.06 <0.05	<0.05	<0.01	0.027 <0.001		
18	Frances R. @ Hwy. Bridge	<0.002 <0.01	0.002	<0.0001	0.08 <0.05	<0.05	<0.01	0.030 <0.001		

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	Extr. GF						Extr. GF					
		Ca (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	K (mg/L)	Mg (mg/L)	Mn (mg/L)	Si (mg/L)	Sn (mg/L)	
3	Headwaters of False Canyon Cr. Trib. B	44.5	<0.0001	<0.005	0.005	0.0017	0.099	<2	4.1	0.003			
4	Frances River Trib. A @ Bridge	55.6	<0.0001	<0.005	0.009	<0.0005	0.056	<2	16.0	0.008			
5	Tom Creek u/s Campbell Hwy bridge	35.5	<0.0001	<0.005	<0.005	0.0006	0.104	<2	9.9	0.014			
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	22.4	<0.0001	0.010	0.010	0.0013	0.240	<2	6.0	0.029			
7	Tom Cr.	38.7	<0.0001	0.009	0.008	0.0005	0.078	<2	10.6	0.006			
8	Tom Cr. Trib. 5	38.4	<0.0001	<0.005	0.007	0.0009	0.230	<2	9.6	0.011			
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	46.8	<0.0001	<0.005	0.008	<0.0005	0.074	<2	13.0	0.017			
10	Tom Cr. Trib. u/s of outflow from Tom Lake	37.6	<0.0001	<0.005	<0.005	<0.0005	0.133	<2	12.9	0.021			
11	Upper False Canyon Cr.	46.0	<0.0001	<0.005	0.005	<0.0005	0.099	<2	9.2	0.006			
12	False Canyon Cr. Trib. @ Air Photo Stn.	49.5	<0.0001	<0.005	<0.005	<0.0005	0.104	<2	10.6	0.008			
14	False Canyon Cr. u/s of Trib. B. 30m	30.8	<0.0001	<0.005	<0.005	<0.0005	0.401	<2	6.8	0.022			
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	48.3	<0.0001	<0.005	0.007	0.0007	0.328	<2	11.4	0.015			
16	False Canyon Cr. 60m u/s of Frances R.	36.9	<0.0001	<0.005	0.005	0.0005	0.370	<2	8.6	0.027			
17	Frances R. u/s of False Canyon Cr.	19.4	<0.0001	<0.005	<0.005	<0.0005	0.088	<2	4.1	0.006			
18	Frances R. @ Hwy. Bridge	20.0	<0.0001	<0.005	<0.0007	<0.0007	0.122	<2	4.3	0.008			

STATION	DESCRIPTION	Extr. GF						Extr. GF					
		Mn (mg/L)	Na (mg/L)	P (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Extr. Se (mg/L)	Extr. Si (mg/L)	Extr. Sn (mg/L)			
3	Headwaters of False Canyon Cr. Trib. B	<0.01	0.7	<0.02	<0.1	0.0019	<0.05	<0.05	<0.05	3.44	<0.05		
4	Frances River Trib. A @ Bridge	<0.01	1.3	<0.02	<0.1	0.0007	<0.05	<0.05	<0.05	2.71	<0.05		
5	Tom Creek u/s Campbell Hwy bridge	<0.01	1.2	<0.02	<0.1	0.0005	<0.05	<0.05	<0.05	2.84	<0.05		
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	<0.01	1.6	<0.02	<0.1	<0.0005	<0.05	<0.05	<0.05	3.68	<0.05		
7	Tom Cr.	<0.01	1.1	<0.02	<0.1	0.0008	<0.05	<0.05	<0.05	2.80	<0.05		
8	Tom Cr. Trib. 5	<0.01	0.8	<0.02	<0.1	0.0016	<0.05	<0.05	<0.05	2.69	<0.05		
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	<0.01	2.1	<0.02	<0.1	0.0017	<0.05	<0.05	<0.05	3.34	<0.05		
10	Tom Cr. Trib. u/s of outflow from Tom Lake	<0.01	0.9	<0.02	<0.1	0.0016	<0.05	<0.05	<0.05	2.42	<0.05		
11	Upper False Canyon Cr.	<0.01	0.7	<0.02	<0.1	0.0017	<0.05	<0.05	<0.05	2.72	<0.05		
12	False Canyon Cr. Trib. @ Air Photo Stn.	<0.01	1.1	<0.02	<0.1	<0.0005	<0.05	<0.05	<0.05	2.67	<0.05		
14	False Canyon Cr. u/s of Trib. B. 30m	<0.01	0.9	<0.02	<0.1	<0.0005	<0.05	<0.05	<0.05	3.12	<0.05		
15	False Canyon Cr. Trib. B u/s of False Canyon Cr. 300m	<0.01	0.8	<0.02	<0.1	0.0018	<0.05	<0.05	<0.05	3.18	<0.05		
16	False Canyon Cr. 60m u/s of Frances R.	<0.01	1.0	<0.02	<0.1	0.0007	<0.05	<0.05	<0.05	3.28	<0.05		
17	Frances R. u/s of False Canyon Cr.	<0.01	1.0	<0.02	<0.1	0.0007	<0.05	<0.05	<0.05	2.61	<0.05		
18	Frances R. @ Hwy. Bridge	<0.01	1.1	<0.02	<0.1	<0.0011	<0.05	<0.05	<0.05	2.66	<0.05		

Metals (ICP Scan); low detection analysis (GF) for Ag, Cd, Cu and Pb if below ICP scan. n/a = analysis not done

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	Extr. Sr (mg/L)		Extr. Tl (mg/L)		Extr. V (mg/L)		Total Zn (mg/L)		Total Ag (mg/L)		Total Al (mg/L)		Total As (mg/L)		Total B (mg/L)		
		Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total
3	Headwaters of False Canyon Cr. Trib. B	0.120	<0.002	<0.01	0.016	0.0004	0.27	<0.05	<0.01	0.033	<0.05	0.07	0.07	0.05	0.02	0.02	0.079	
4	Frances River Trib. A @ Bridge	0.193	<0.01	<0.01	<0.002	0.0005	0.07	<0.05	<0.01	0.02	<0.05	0.11	<0.05	<0.01	0.01	0.01	0.01	0.102
5	Tom Creek u/s Campbell Hwy bridge	0.126	<0.002	<0.01	<0.002	0.0004	0.11	<0.05	<0.01	0.088	<0.05	0.17	<0.05	0.02	0.02	0.01	0.02	0.088
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	0.094	<0.002	<0.01	<0.002	0.0003	0.15	<0.05	<0.01	0.104	<0.01	0.15	<0.05	<0.01	0.01	0.01	0.01	0.131
7	Tom Cr.	0.132	<0.002	<0.01	<0.002	0.0004	0.35	<0.05	<0.01	0.094	<0.01	0.10	<0.05	<0.01	0.01	0.01	0.01	0.094
8	Tom Cr. Trib. 5	0.120	<0.002	<0.01	<0.002	0.0003	0.35	<0.05	<0.01	0.131	<0.01	0.15	<0.05	<0.01	0.01	0.01	0.01	0.131
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	0.178	<0.002	<0.01	<0.002	0.0005	0.10	<0.05	<0.01	0.094	<0.01	0.14	<0.05	<0.01	0.01	0.01	0.01	0.094
10	Tom Cr. Trib. u/s of outflow from Tom Lake	0.132	<0.002	<0.01	<0.002	0.0005	0.14	<0.05	<0.01	0.119	<0.01	0.14	<0.05	<0.01	0.01	0.01	0.01	0.119
11	Upper False Canyon Cr. Trib.	0.161	<0.002	<0.01	0.004	0.0005	0.09	<0.05	<0.01	0.111	<0.01	0.08	<0.05	<0.01	0.01	0.01	0.01	0.133
12	False Canyon Cr. Trib. @ Air Photo Stn.	0.184	<0.002	<0.01	<0.002	0.0006	0.08	<0.05	<0.01	0.092	<0.01	0.058	<0.05	<0.01	0.01	0.01	0.01	0.117
14	False Canyon Cr. u/s of Trib. B. 30m	0.114	<0.002	<0.01	<0.002	0.0002	0.60	<0.05	<0.01	0.092	<0.01	0.03	<0.05	<0.01	0.01	0.01	0.01	0.117
15	False Canyon Cr. Trib. B u/s	0.132	<0.002	<0.01	<0.003	0.0005	0.58	<0.05	<0.01	0.117	<0.01	0.19	<0.05	<0.01	0.01	0.01	0.01	0.117
16	False Canyon Cr. 300m u/s of Frances R.	0.126	<0.002	<0.01	<0.002	0.0004	0.45	<0.05	<0.01	0.106	<0.01	0.21	<0.05	<0.01	0.01	0.01	0.01	0.106
17	Frances R. u/s of False Canyon Cr.	0.083	<0.002	<0.01	<0.002	<0.0002	0.21	<0.05	<0.01	0.031	<0.01	0.22	<0.05	<0.01	0.01	0.01	0.01	0.031
18	Frances R. @ Hwy. Bridge	0.085	<0.002	<0.01	<0.002	0.0001	0.22	<0.05	<0.01	0.035	<0.01	0.11	<0.05	<0.01	0.01	0.01	0.01	0.035

STATION	DESCRIPTION	Total Be (mg/L)		Total Ca (mg/L)		Total Cd (mg/L)		Total Co (mg/L)		Total Cr (mg/L)		Total Cu (mg/L)		Total Fe (mg/L)		Total K (mg/L)		Total Mg (mg/L)	
		Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	GF	Total	
3	Headwaters of False Canyon Cr. Trib. B	<0.001	50.0	<0.0001	<0.005	0.009	0.0017	0.291	<2	4.3	<0.001	62.3	0.0001	0.0007	0.223	<2	16.8		
4	Frances River Trib. A @ Bridge	<0.001	37.0	<0.0001	<0.005	0.008	0.0014	0.161	<2	10.1	<0.001	25.6	0.0001	0.0005	0.019	<2	6.4		
5	Tom Creek u/s Campbell Hwy bridge	<0.001	43.3	0.0002	<0.005	0.012	0.0020	0.145	<2	11.2	<0.001	41.0	0.0002	<0.005	0.010	<2	10.0		
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	<0.001	51.0	<0.0001	<0.005	0.008	0.0008	0.111	<2	13.4	<0.001	40.0	<0.0001	<0.005	0.008	<2	11.5		
7	Tom Cr.	<0.001	48.8	<0.0001	<0.005	0.010	0.0009	0.132	<2	9.3	<0.001	47.0	<0.0001	<0.005	0.023	<2	9.9		
8	Tom Cr. Trib. 5	<0.001	32.6	<0.0001	0.006	0.012	0.0010	0.677	<2	6.9	<0.001	50.3	<0.0001	0.005	0.014	<2	4.4		
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	<0.001	21.0	<0.0002	<0.005	0.007	0.0010	0.381	<2	4.2	<0.001	22.2	<0.0001	<0.005	0.009	<2	4.4		
10	Tom Cr. Trib. u/s of outflow from Tom Lake	<0.001	21.0	<0.0001	<0.005	0.011	0.0008	0.168	<2	13.2	<0.001	21.0	<0.0001	<0.005	0.009	<2	13.2		
11	Upper False Canyon Cr.	<0.001	40.1	<0.0001	<0.005	0.010	0.0009	0.621	<2	9.0	<0.001	40.1	<0.0001	<0.005	0.142	<2	4.2		
12	False Canyon Cr. Trib. @ Air Photo Stn.	<0.001	21.0	<0.0002	<0.005	0.010	0.0009	0.190	<2	4.4	<0.001	22.2	<0.0001	<0.005	0.009	<2	4.4		
14	False Canyon Cr. u/s of Trib. B. 30m	<0.001	32.6	<0.0001	0.006	0.012	0.0010	0.677	<2	4.4	<0.001	50.3	<0.0001	0.005	0.014	<2	4.4		
15	False Canyon Cr. Trib. B u/s	<0.001	50.3	<0.0001	0.005	0.012	0.0014	0.642	<2	4.4	<0.001	50.3	<0.0001	<0.005	0.009	<2	4.4		
16	False Canyon Cr. 300m u/s of Frances R.	<0.001	40.1	<0.0001	<0.005	0.010	0.0008	0.621	<2	9.0	<0.001	21.0	<0.0002	<0.005	0.142	<2	4.2		
17	Frances R. u/s of False Canyon Cr.	<0.001	21.0	<0.0002	<0.005	0.010	0.0009	0.190	<2	4.4	<0.001	22.2	<0.0001	<0.005	0.009	<2	4.4		
18	Frances R. @ Hwy. Bridge	<0.001	22.2	<0.0001	<0.005	0.011	0.0008	0.168	<2	4.4	<0.001	22.2	<0.0001	<0.005	0.009	<2	4.4		

APPENDIX II TABLE 2 MT. HUNDERE WATER QUALITY DATA FOR JUNE, 1990

STATION	DESCRIPTION	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
		Mn (mg/L)	Mg (mg/L)	Na (mg/L)	Ni (mg/L)	P (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Si (mg/L)		
3	Headwaters of False Canyon Cr. Trib. B	0.006	<0.01	0.6	<0.02	<0.1	0.0026	<0.05	<0.05	<0.05	4.27	
4	Frances River Trib. A @ Bridge	0.009	<0.01	1.3	<0.02	<0.1	0.0016	<0.05	<0.05	<0.05	3.18	
5	Tom Creek u/s Campbell Hwy bridge	0.015	<0.01	1.2	<0.02	<0.1	0.0015	<0.05	<0.05	<0.05	3.22	
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	0.033	<0.01	1.6	<0.02	<0.1	0.0026	<0.05	<0.05	<0.05	4.42	
7	Tom Cr.	0.007	<0.01	1.2	<0.02	<0.1	0.0014	<0.05	<0.05	<0.05	3.27	
8	Tom Cr. Trib. 5	0.012	<0.01	0.9	<0.02	<0.1	0.0018	<0.05	<0.05	<0.05	3.25	
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	0.018	<0.01	2.1	<0.02	<0.1	0.0019	<0.05	<0.05	<0.05	3.72	
10	Tom Cr. Trib. u/s of outflow from Tom Lake	0.023	<0.01	0.9	<0.02	<0.1	0.0013	<0.05	<0.05	<0.05	2.78	
11	Upper False Canyon Cr.	0.006	<0.01	0.7	<0.02	<0.1	0.0010	<0.05	<0.05	<0.05	3.01	
12	False Canyon Cr. Trib. @ Air Photo Stn.	0.008	<0.01	1.0	<0.02	<0.1	0.0096	<0.05	<0.05	<0.05	2.54	
14	False Canyon Cr. u/s of Trib. B. 30m	0.025	<0.01	0.9	<0.02	<0.1	0.0034	<0.05	<0.05	<0.05	3.91	
15	False Canyon Cr. B u/s of False Canyon Cr. 300m	0.017	<0.01	0.8	<0.02	<0.1	0.0012	<0.05	<0.05	<0.05	4.11	
16	False Canyon Cr. 60m u/s of Frances R.	0.030	<0.01	0.9	<0.02	<0.1	0.0019	<0.05	<0.05	<0.05	4.12	
17	Frances R. u/s of False Canyon Cr.	0.006	<0.01	1.0	<0.02	<0.1	0.0014	<0.05	<0.05	<0.05	3.09	
18	Frances R. @ Hwy. Bridge	0.009	<0.01	1.0	<0.02	<0.1	<0.025	<0.05	<0.05	<0.05	3.21	

STATION	DESCRIPTION	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
		Sn (mg/L)	Sr (mg/L)	Ti (mg/L)	(mg/L)	V (mg/L)	Zn (mg/L)					
3	Headwaters of False Canyon Cr. Trib. B	<0.05	0.131	<0.002	<0.01	<0.01	<0.002					
4	Frances River Trib. A @ Bridge	<0.05	0.209	<0.002	<0.01	<0.01	<0.002					
5	Tom Creek u/s Campbell Hwy bridge	<0.05	0.135	<0.002	<0.01	<0.01	<0.002					
6	Tom Cr. Trib. 2 (200m u/s) Tom Cr.	<0.05	0.103	<0.002	<0.01	<0.01	<0.002					
7	Tom Cr.	<0.05	0.146	<0.002	<0.01	<0.01	<0.002					
8	Tom Cr. Trib. 5	<0.05	0.131	<0.002	<0.01	<0.01	<0.002					
9	Tom Cr. Outflow from Tom Lake u/s of Site 10 Trib. (150M)	<0.05	0.191	<0.002	<0.01	<0.002	<0.002					
10	Tom Cr. Trib. u/s of outflow from Tom Lake	<0.05	0.142	<0.002	<0.01	<0.01	<0.002					
11	Upper False Canyon Cr.	<0.05	0.169	<0.002	<0.01	<0.01	<0.002					
12	False Canyon Cr. Trib. @ Air Photo Stn.	<0.05	0.177	<0.002	<0.01	<0.01	<0.002					
14	False Canyon Cr. u/s of Trib. B. 30m	<0.05	0.120	<0.002	<0.01	<0.01	<0.002					
15	False Canyon Cr. B u/s of False Canyon Cr. 300m	<0.05	0.138	<0.002	<0.01	<0.01	<0.002					
16	False Canyon Cr. 60m u/s of Frances R.	<0.05	0.136	<0.002	<0.01	<0.01	<0.002					
17	Frances R. u/s of False Canyon Cr.	<0.05	0.090	<0.002	<0.01	<0.01	<0.002					
18	Frances R. @ Hwy. Bridge	<0.05	0.093	<0.002	<0.01	<0.01	<0.002					

Metals (ICP Scan); low detection analysis (GF) for Ag, Cd, Cu and Pb if below ICP scan. n/a = analysis not done

APPENDIX III

STREAM SEDIMENTS

APPENDIX III TABLE 1 MT HUNDERE PERCENT SEDIMENT PARTICLE SIZE DISTRIBUTION, JUNE 1988

STATION #	SIZE RANGE (%)						TOTAL Weight (grams)
	very fine silt/clay %	fine sand %	medium sand %	course sand %	course sand %	gravel %	
1	0.7	0.7	1.4	5.5	11.2	13.8	66.7
	0.5	0.3	0.8	4.1	10.4	11.4	72.5
	0.8	0.5	0.9	1.8	3.5	5.6	86.9
2	7.8	6.4	7.7	8.1	9.1	8.6	52.3
	11.3	7.1	6.7	6.7	7.2	54.4	100
	4.6	3.3	4.7	6.9	8.5	6.5	144
3	0.7	0.5	1.3	5.1	8.7	10.9	191
	5.0	3.6	7.3	16.2	19.7	12.5	253
	0.5	0.3	0.6	2.0	4.3	6.0	276
4	0.3	0.4	1.1	4.5	9.6	7.4	294
	0.2	0.5	0.9	3.7	7.2	6.9	100
	0.3	0.3	1.0	3.8	8.0	8.3	239
5	2.3	1.5	2.8	6.4	8.2	7.6	230
	0.8	1.2	3.1	9.9	12.3	6.9	267
	0.0	5.8	7.0	8.7	11.3	12.6	331
							100
							253
							237
very fine silt/clay <0.063mm		fine sand 0.063-0.15mm	medium sand 0.15-0.3mm	coarse sand 0.35-0.75mm	very coarse sand 0.5-1.0mm	sand 1.0-2.0mm	gravel >2.0 mm

APPENDIX III TABLE 2 MT. HUNDERE SEDIMENT CHEMISTRY FOR JUNE, 1988

STATION NUMBER	Ag (µg/g)	Al (µg/g)	As (µg/g)	Ba (µg/g)	Be (µg/g)	Ca (µg/g)	Cd (µg/g)	Co (µg/g)	Cr (µg/g)	Cu (µg/g)	Fe (µg/g)	Mg (µg/g)	Mn (µg/g)	Mo (µg/g)
1	< 2	21400	20	152	0.8	9880	3	< 20	41.6	28.5	29800	10900	1160	3
	< 2	20300	23	138	0.7	9100	2.7	< 20	39.5	28.6	29700	10900	1040	3
	< 2	19400	20	182	0.9	11200	2.6	< 20	36.4	37.9	26600	9340	658	4
2	4	25500	75	177	3.2	12800	32.7	20	53.4	73.1	45000	9670	2470	5
	4	25600	80	176	3.3	13700	36.4	< 20	58.7	67.1	48100	10000	2320	8
	4	21400	89	169	2.9	12300	43.5	20	47.7	74.4	48400	7870	2580	6
3	< 2	12400	10	253	0.6	12300	3.1	< 20	42.8	26.8	26000	7410	565	5
	< 2	15000	20	245	0.7	11000	2.2	< 20	32.1	35.9	23700	7470	593	3
	< 2	13700	10	419	0.6	11700	2	< 20	48.5	44.1	23700	7800	541	6
4	< 2	10300	10	279	0.5	10800	1	< 20	35.6	44.9	22200	4720	997	4
	< 2	10700	10	437	0.5	9560	0.9	< 20	43.1	30.7	23500	4790	1360	4
	< 2	10800	10	367	0.5	10300	1	< 20	40.7	25.6	24000	4710	792	2
5	< 2	15600	10	241	0.4	5300	< 0.8	< 20	36.6	61.3	34600	6630	942	6
	< 2	11800	< 8	307	0.4	5960	0.9	< 20	55.1	21.3	20600	5500	712	2
	< 2	13300	10	267	0.5	5390	1	< 20	42.5	26.1	21300	5600	507	3
STATION NUMBER	Na (µg/g)	Ni (µg/g)	P (µg/g)	Ba (µg/g)	Bb (µg/g)	Si (µg/g)	Sn (µg/g)	Sr (µg/g)	Tl (µg/g)	V (µg/g)	Zn (µg/g)			
1	100	32	850	20	476	< 8	49.1	590	48	237				
	80	31	850	33	498	9	45	575	44	220				
	100	29	960	29	487	< 8	48.9	497	51	205				
2	30	69	2070	11700	824	< 8	42	193	207	14300				
	40	63	2460	12400	796	< 8	42	263	230	15400				
	50	58	2860	10000	752	< 8	32.2	154	150	13400				
3	100	32	1000	289	397	< 8	43.4	423	67	413				
	100	29	960	55	433	< 8	44.5	440	59	176				
	100	45	1000	73	371	10	48.2	513	60	174				
4	80	33	1100	24	351	< 8	39	133	35	106				
	90	30	1100	24	357	< 8	37.8	170	45	109				
	80	27	1100	24	340	< 8	41	182	44	107				
5	80	35	710	25	511	< 8	27.9	250	30	69.4				
	90	33	790	10	329	< 8	33	298	38	80.3				
	100	32	760	10	362	< 8	32	309	37	83.1				

APPENDIX III TABLE 3 MT. HUNDERE SEDIMENT CHEMISTRY FOR JUNE, 1990

STATION NUMBER	Hg ($\mu\text{g/g}$)	ICP Hg ($\mu\text{g/g}$)	ICP Ag ($\mu\text{g/g}$)	ICP A1 ($\mu\text{g/g}$)	ICP As ($\mu\text{g/g}$)	ICP Ba ($\mu\text{g/g}$)	ICP Be ($\mu\text{g/g}$)	ICP Ca ($\mu\text{g/g}$)	ICP Cd ($\mu\text{g/g}$)	ICP Co ($\mu\text{g/g}$)	ICP Cr ($\mu\text{g/g}$)	ICP Cu ($\mu\text{g/g}$)	ICP Fe ($\mu\text{g/g}$)	ICP K ($\mu\text{g/g}$)	ICP Mg ($\mu\text{g/g}$)	ICP Mn ($\mu\text{g/g}$)
3	0.028	< 2	11400	20	203	0.6	8260	< 0.8	0.83	< 20	34.5	18.8	24300	1000	6050	492
	0.038	< 2	14100	22	271	0.8	8100	1.0	0.99	< 20	33.3	22.3	24800	1800	6500	534
	0.040	< 2	14600	10	249	0.8	10300	< 0.8	0.98	< 20	38.0	21.8	26400	2000	6890	560
4	0.051	< 2	9800	35	319	0.6	10900	< 0.8	0.53	< 20	28.4	19.8	24200	1800	4390	959
	0.053	< 2	9650	10	289	0.6	10700	< 0.8	0.54	< 20	26.9	25.3	23000	1700	4240	943
	0.037	< 2	9130	24	293	0.6	9510	< 0.8	0.45	< 20	32.6	19.0	24400	1700	4230	920
5	0.046	< 2	9970	17	271	0.4	5530	< 0.8	0.34	< 20	53.2	12.0	19400	1000	4590	640
	0.053	< 2	10400	10	300	0.4	4650	< 0.8	0.44	< 20	87.6	13.0	23300	1000	4720	835
	0.069	< 2	12100	23	333	0.5	5140	< 0.8	0.43	< 20	64.1	16.0	23500	1900	5040	849
6	0.059	< 2	12000	9	360	0.5	5000	< 0.8	0.31	< 20	52.1	15.0	15400	2000	5510	248
	0.039	< 2	10100	25	274	0.4	4780	< 0.8	0.10	< 20	68.8	9.7	17700	1000	4980	296
	0.043	< 2	9730	10	279	0.5	4400	< 0.8	0.17	< 20	50.2	10.0	17800	1000	4990	503
7	0.050	< 2	8920	< 8	377	0.5	3490	< 0.8	0.58	< 20	63.7	16.0	28200	1000	4140	270
	0.057	< 2	10600	< 8	477	0.6	4120	< 0.8	0.63	< 20	68.9	16.0	26200	1700	4160	297
	0.048	< 2	10500	< 8	404	0.5	3500	< 0.8	0.57	< 20	62.4	17.5	26700	2000	4500	309
8	0.056	< 2	10900	< 8	398	0.7	4000	< 0.8	0.93	< 20	42.2	19.3	23800	2000	4620	456
	0.080	< 2	10800	10	412	0.7	4740	1.0	1.30	< 20	37.3	20.0	22300	2000	4410	544
	0.080	< 2	9870	< 8	316	0.6	4070	< 0.8	0.99	< 20	31.6	21.1	22400	1000	4520	554
9	0.055	< 2	12200	10	334	0.6	5410	< 0.8	0.37	< 20	67.7	16.0	20200	2300	5330	342
	0.046	< 2	10100	< 8	338	0.5	5260	< 0.8	0.31	< 20	108.0	12.0	20400	1800	4650	281
	0.067	< 2	10400	10	348	0.5	6180	< 0.8	0.52	< 20	51.7	16.0	17500	1800	4590	764
11	0.085	< 2	16800	26	491	0.8	9430	< 0.8	1.84	< 20	29.7	24.8	26200	2100	6020	1300
	0.076	< 2	14200	25	419	0.7	6850	< 0.8	1.20	< 20	29.9	20.9	26500	2100	5390	489
	0.065	< 2	15000	< 8	475	0.7	7280	1.0	1.29	< 20	42.5	19.7	28000	2300	5420	365
12	0.049	< 2	12800	20	351	0.5	14700	< 0.8	0.66	< 20	37.9	15.0	17300	2000	5290	156
	0.057	< 2	11600	< 8	337	0.6	37100	< 0.8	1.20	< 20	31.7	18.1	18200	1700	5470	160
	0.100	< 2	15600	20	435	0.7	11200	1.0	2.29	< 20	44.6	23.0	25700	1800	5420	107
14	0.033	< 2	10600	10	247	0.7	5780	< 0.8	0.34	< 20	45.9	20.0	24700	1000	7040	351
	0.034	< 2	10400	< 8	210	0.7	5750	< 0.8	0.33	< 20	41.5	19.8	24600	1000	7220	367
	0.035	< 2	12300	< 8	245	0.7	5910	< 0.8	0.35	< 20	44.6	23.0	25700	1800	7680	398
15	0.051	< 2	4650	21	665	0.3	12800	< 0.8	0.83	< 20	25.9	13.0	19000	900	6520	247
	0.054	< 2	5370	17	547	0.4	11100	0.8	0.79	< 20	22.2	13.0	16800	1000	5840	231
	0.056	< 2	5950	20	590	0.5	12900	1.0	0.82	< 20	27.5	15.0	18200	1000	6720	266

Metals analysis ICP n/a = analysis not done

APPENDIX III TABLE 3 MT. HUNDERE SEDIMENT CHEMISTRY FOR JUNE, 1990

STATION NUMBER	ICP			ICP			ICP			ICP			ICP			ICP		
	Mo ($\mu\text{g/g}$)	Na ($\mu\text{g/g}$)	Ni ($\mu\text{g/g}$)	P ($\mu\text{g/g}$)	Pb ($\mu\text{g/g}$)	Pb ($\mu\text{g/g}$)	GF ($\mu\text{g/g}$)	Sb ($\mu\text{g/g}$)	Sb ($\mu\text{g/g}$)	Sn ($\mu\text{g/g}$)	Sn ($\mu\text{g/g}$)	Tl ($\mu\text{g/g}$)	Tl ($\mu\text{g/g}$)	V ($\mu\text{g/g}$)	V ($\mu\text{g/g}$)	Zn ($\mu\text{g/g}$)		
3	3	80	30	900	95	n/a	< 8	654	< 8	33.6	507	53	141.0					
	4	100	33	900	79	n/a	< 8	678	< 8	35.8	534	56	176.0					
	3	100	34	930	130	n/a	< 8	667	< 8	42.5	622	64	165.0					
4	< 2	80	27	1100	10	11.80	< 8	648	< 8	37.8	224	38	101.0					
	< 2	80	25	1000	10	12.00	< 8	630	< 8	36.2	204	33	97.1					
	< 2	90	30	1000	< 8	9.79	< 8	611	< 8	33.0	209	40	95.1					
5	< 2	80	33	670	< 8	7.14	< 8	623	< 8	27.1	340	31	73.5					
	< 2	100	37	710	< 8	7.50	< 8	614	< 8	27.8	386	40	80.5					
	< 2	100	35	800	< 8	9.34	< 8	545	< 8	30.6	367	40	87.5					
6	< 2	90	35	650	< 8	8.99	< 8	590	< 8	30.8	580	29	63.5					
	< 2	70	32	770	< 8	6.27	< 8	560	< 8	28.9	725	31	55.1					
	< 2	80	30	680	< 8	7.12	< 8	582	< 8	27.1	562	28	55.9					
7	2	80	39	760	10	11.10	< 8	548	< 8	22.1	162	41	106.0					
	< 2	100	37	810	10	10.80	< 8	637	< 8	26.9	216	48	121.0					
	2	90	45	720	20	14.50	< 8	641	< 8	25.1	173	40	112.0					
8	< 2	80	40	830	20	16.00	< 8	543	< 8	25.7	146	37	135.0					
	3	90	37	890	10	11.60	< 8	549	< 8	27.5	164	39	146.0					
	4	100	40	850	10	14.10	< 8	512	< 8	24.2	114	33	140.0					
9	< 2	100	41	820	< 8	8.15	< 8	467	< 8	33.0	279	40	99.8					
	< 2	80	34	750	< 8	6.23	< 8	549	< 8	29.8	330	43	82.5					
	< 2	80	31	720	< 8	6.65	< 8	528	< 8	37.8	264	33	84.6					
11	< 2	100	33	1000	20	28.10	< 8	526	< 8	48.9	270	53	200.0					
	2	200	36	1000	23	23.70	< 8	628	< 8	38.7	224	50	193.0					
	2	100	34	1100	20	20.40	< 8	521	< 8	39.5	267	60	196.0					
12	< 2	100	25	910	10	12.10	< 8	512	< 8	49.5	151	36	121.0					
	< 2	100	25	880	10	13.90	< 8	539	< 8	79.5	132	31	131.0					
	< 2	100	28	860	18	20.10	< 8	717	< 8	54.2	205	50	189.0					
14	< 2	200	42	690	< 8	10.50	< 8	577	< 8	47.1	137	33	80.2					
	2	180	43	650	10	9.67	< 8	584	< 8	46.2	120	30	73.3					
	< 2	250	46	660	< 8	10.90	< 8	665	< 8	53.0	138	35	87.2					
15	4	60	26	960	8	10.40	< 8	501	< 8	41.0	129	42	113.0					
	2	50	24	940	< 8	10.30	< 8	529	< 8	36.7	132	35	132.0					
	3	100	37	990	10	11.10	< 8	551	10	44.1	117	43	153.0					

Metals analysis ICP n/a = analysis not done

APPENDIX III TABLE 4 MT. HUNDERE SEDIMENT DATA SUMMARY FOR JUNE, 1988 AND JUNE, 1990

STATION NUMBER	SAMPLE DATE	Hg Mean	Hg STD	Ag Mean	Ag STD	Al Mean	Al STD	As Mean	As STD	Ba Mean	Ba STD	Be Mean	Be STD	Ca Mean	Ca STD	Cd Mean	Cd STD	Cd Mean
		(µg/g)	(µg/g)															
1	21-Jun-88	n/a	< 2	n/a	20367	1002	21	2	157	22	0.8	0.1	10060	1062	2.8	0.2	n/a	
2	21-Jun-88	n/a	n/a	4	0	24167	2397	81	7	174	4	3.1	0.2	12933	709	37.5	5.5	n/a
3	22-Jun-88	n/a	n/a	< 2	n/a	13700	1300	13	6	306	98	0.6	0.1	11667	651	2.4	0.6	n/a
3	20-Jun-90	0.035	0.006	< 2	n/a	13367	1721	17	6	241	35	0.7	0.1	8887	1227	< 0.9	n/a	0.93
4	22-Jun-88	n/a	n/a	< 2	n/a	10600	265	10	0	361	79	0.5	0.0	10220	624	1.0	0.1	n/a
4	20-Jun-90	0.047	0.009	< 2	n/a	9527	352	23	13	300	16	0.6	0.0	10370	751	< 0.8	n/a	0.51
5	22-Jun-88	n/a	n/a	< 2	n/a	13567	1914	< 9	n/a	272	33	0.4	0.1	5550	358	< 0.9	n/a	n/a
5	21-Jun-90	0.056	0.012	< 2	n/a	10823	1126	17	7	301	31	0.4	0.1	5107	441	< 0.8	n/a	0.40
6	19-Jun-90	0.047	0.011	< 2	n/a	10610	1218	15	9	304	48	0.5	0.1	4727	304	< 0.8	n/a	0.19
7	19-Jun-90	0.052	0.005	< 2	n/a	10007	942	< 8	n/a	419	52	0.5	0.1	3703	361	< 0.8	n/a	0.59
8	19-Jun-90	0.072	0.014	< 2	n/a	10523	568	< 9	n/a	375	52	0.7	0.1	4270	409	< 0.9	n/a	1.07
9	19-Jun-90	0.056	0.011	< 2	n/a	10900	1136	< 9	n/a	340	7	0.5	0.1	5617	494	< 0.8	n/a	0.40
11	19-Jun-90	0.075	0.010	< 2	n/a	15333	1332	< 20	n/a	462	38	0.7	0.1	7853	1382	< 0.9	n/a	1.41
12	19-Jun-90	0.069	0.027	< 2	n/a	13333	2053	< 16	n/a	374	53	0.6	0.1	21000	14052	< 0.9	n/a	1.38
14	19-Jun-90	0.034	0.001	< 2	n/a	11100	1044	< 9	n/a	234	21	0.7	0.0	5813	85	< 0.8	n/a	0.34
15	19-Jun-90	0.054	0.003	< 2	n/a	5323	651	19	2	601	60	0.4	0.1	12267	1012	< 0.9	n/a	0.81

STD = standard deviation n/a = analysis not done

APPENDIX IIII TABLE 4 MT. HUNDERE SEDIMENT DATA SUMMARY FOR JUNE, 1988 AND JUNE, 1990

STATION NUMBER	SAMPLE DATE	Cd		Co		Cr		Cu		Fe		K		Mg		Mn		
		Mean ($\mu\text{g/g}$)	STD ($\mu\text{g/g}$)															
1	21-Jun-88	n/a	< 20	n/a	39.2	2.6	31.7	5.4	28700	1819	n/a	n/a	10380	901	953	262	3	1
2	21-Jun-88	n/a	< 20	n/a	53.3	5.5	78.2	7.7	47167	1882	n/a	n/a	9180	1146	2457	131	6	2
3	22-Jun-88	n/a	< 20	n/a	41.1	8.3	35.6	8.7	24467	1328	n/a	n/a	7560	210	566	26	5	2
3	20-Jun-90	0.09	< 20	n/a	35.3	2.4	21.0	1.9	25167	1097	1600	529	6480	420	529	34	3	1
4	22-Jun-88	n/a	< 20	n/a	39.8	3.8	33.7	10.0	23233	929	n/a	n/a	4740	44	1050	288	3	1
4	20-Jun-90	0.05	< 20	n/a	29.3	3.0	21.4	3.4	23867	757	1733	58	4287	90	941	20	< 2	n/a
5	22-Jun-88	n/a	< 20	n/a	44.7	9.5	35.9	22.1	25500	7889	n/a	n/a	5910	626	720	218	4	2
5	21-Jun-90	0.06	< 20	n/a	68.3	17.6	13.7	2.1	22067	2312	1300	520	4783	232	775	117	< 2	n/a
6	19-Jun-90	0.11	< 20	n/a	57.0	10.2	11.6	3.0	16967	1358	1333	577	5160	303	349	136	< 2	n/a
7	19-Jun-90	0.03	< 20	n/a	65.0	3.4	16.5	0.9	27033	1041	1567	513	4267	202	292	20	< 2	n/a
8	19-Jun-90	0.20	< 20	n/a	37.0	5.3	20.1	0.9	22833	839	1667	577	4517	105	518	54	< 3	n/a
9	19-Jun-90	0.11	< 20	n/a	75.8	29.0	14.7	2.3	19367	1620	1967	289	4857	411	462	263	< 2	n/a
11	19-Jun-90	0.37	< 20	n/a	34.0	7.3	21.8	2.7	26900	964	2367	306	5610	355	718	508	< 2	n/a
12	19-Jun-90	0.83	< 20	n/a	31.2	3.3	21.3	8.4	17900	520	2100	458	5393	93	141	30	< 2	n/a
14	19-Jun-90	0.01	< 20	n/a	44.0	2.3	20.9	1.8	25000	608	1267	462	7313	330	372	24	< 2	n/a
15	19-Jun-90	0.02	< 20	n/a	25.2	2.7	13.7	1.2	18000	1114	967	58	6360	461	248	18	3	1

STD = standard deviation n/a = analysis not done

APPENDIX III TABLE 4 MT. HUNDERE SEDIMENT DATA SUMMARY FOR JUNE, 1988 AND JUNE, 1990

STATION NUMBER	SAMPLE DATE	Sr ($\mu\text{g/g}$)	T1 ($\mu\text{g/g}$)	T1 Mean	V ($\mu\text{g/g}$)	Zn Mean	Zn STD
1	21-Jun-88	2.3	554	50	48	4	220.7
2	21-Jun-88	5.7	203	55	196	41	14366.7
3	22-Jun-88	2.5	459	48	62	4	254.3
3	20-Jun-90	4.6	554	60	58	6	160.7
4	22-Jun-88	1.6	162	26	41	6	107.3
4	20-Jun-90	2.4	212	10	37	4	97.7
5	22-Jun-88	2.7	286	31	35	4	77.6
5	21-Jun-90	1.9	364	23	37	5	80.5
6	19-Jun-90	1.9	622	89	29	2	58.2
7	19-Jun-90	2.4	184	29	43	4	113.0
8	19-Jun-90	1.7	141	25	36	3	140.3
9	19-Jun-90	4.0	291	35	39	5	89.0
11	19-Jun-90	5.7	254	26	54	5	196.3
12	19-Jun-90	16.1	163	38	39	10	147.0
14	19-Jun-90	3.7	132	10	33	3	80.2
15	19-Jun-90	3.7	126	8	40	4	132.7

STD = standard deviation n/a = analysis not done

APPENDIX III TABLE 4 MT. HUNDERE SEDIMENT DATA SUMMARY FOR JUNE, 1988 AND JUNE, 1990

STATION NUMBER	SAMPLE DATE	Na Mean ($\mu\text{g/g}$)	Na STD ($\mu\text{g/g}$)	Ni Mean ($\mu\text{g/g}$)	Ni STD ($\mu\text{g/g}$)	P Mean ($\mu\text{g/g}$)	P STD ($\mu\text{g/g}$)	Pb Mean ($\mu\text{g/g}$)	Pb STD ($\mu\text{g/g}$)	Pb Mean ($\mu\text{g/g}$)	Pb STD ($\mu\text{g/g}$)	Sb Mean ($\mu\text{g/g}$)	Sb STD ($\mu\text{g/g}$)	Si Mean ($\mu\text{g/g}$)	Si STD ($\mu\text{g/g}$)	Sn Mean ($\mu\text{g/g}$)	Sn STD ($\mu\text{g/g}$)	St Mean ($\mu\text{g/g}$)	
1	21-Jun-88	93	12	31	2	887	64	27	7	n/a	n/a	487	11	< 8	n/a	47.7			
2	21-Jun-88	40	10	63	6	2463	395	11367	1234	n/a	n/a	n/a	791	36	< 8	n/a	38.7		
3	22-Jun-88	100	0	35	9	987	.23	139	130	n/a	n/a	400	31	< 9	n/a	45.4			
3	20-Jun-90	93	12	32	2	910	17	101	26	n/a	n/a	666	12	< 8	n/a	37.3			
4	22-Jun-88	83	6	30	3	1100	0	23	2	n/a	n/a	349	9	< 8	n/a	39.3			
4	20-Jun-90	83	6	27	3	1033	58	< 10	n/a	11.20	1.22	< 8	630	19	< 8	n/a	35.7		
5	22-Jun-88	90	10	33	2	753	40	15	9	n/a	n/a	401	97	< 8	n/a	31.0			
5	21-Jun-90	93	12	35	2	727	67	< 8	n/a	7.99	1.18	< 8	594	43	< 8	n/a	28.5		
6	19-Jun-90	80	10	32	3	700	62	< 8	n/a	7.46	1.39	< 8	n/a	577	16	< 8	n/a	28.9	
7	19-Jun-90	90	10	40	4	763	45	13	6	12.13	2.06	< 8	n/a	609	53	< 8	n/a	24.7	
8	19-Jun-90	90	10	39	2	857	31	13	6	13.90	2.21	< 8	n/a	535	20	< 8	n/a	25.8	
9	19-Jun-90	87	12	35	5	763	51	< 8	n/a	7.01	1.01	< 8	n/a	515	43	< 8	n/a	33.5	
11	19-Jun-90	133	58	34	2	1033	58	21	2	24.07	3.86	< 8	n/a	558	60	< 8	n/a	42.4	
12	19-Jun-90	100	0	26	2	883	25	13	5	15.37	4.20	< 8	n/a	589	111	< 8	n/a	61.1	
14	19-Jun-90	210	36	44	2	667	21	< 10	n/a	10.36	0.63	< 8	n/a	609	49	< 8	n/a	48.8	
15	19-Jun-90	70	26	29	7	963	25	< 9	n/a	10.60	0.44	< 8	n/a	527	25	< 9	n/a	40.6	

STD = standard deviation n/a = analysis not done

APPENDIX IV

BENTHIC FAUNA DATA

APPENDIX IV TABLE 1 MT. HUNDERE TAXONOMIC LIST FOR 1988 AND 1990

NUMBER	INVERTEBRATE-----	
	Phylum: Arthropoda	68 Cricotopus sp
	Class: Insecta	69 Diamesa sp
	Order: Plecoptera	70 Eukiefferiella sp
1	<i>Capnia</i> sp	71 Euryhapsis sp
2	<i>Isogenoides</i> sp	72 Gymnometriocnemus sp
3	<i>Isoperla</i> sp	73 Heterotrissocladius sp
4	<i>Kogotus</i> sp	74 Micropsectra sp
5	<i>Megarcys</i> sp	75 Monopelopia sp
6	<i>Podmosta</i> sp	76 Orthocladius sp
7	<i>Sweltsa</i> sp group	77 Paratendipes sp
8	<i>Skwala</i> (paralella)	78 Polypedilum sp
9	<i>Utaperla</i> sp	79 Polypedilum (pentapedilum)
10	<i>Zapada</i> sp	80 Potthastia sp
	Order: Ephemeroptera	81 Psectrocladius sp
11	<i>Ameletus</i> sp	82 Psectrocladius sp B
12	<i>Baetis</i> sp	83 Rheocricotopus sp
13	<i>Cinygmulia</i> sp	84 Rheotanytarsus sp
14	<i>Epeorus deceptivus</i>	85 Tanytarsus sp
15	<i>Epeorus (albertae)</i>	86 Thienemanniella sp
16	<i>Epeorus albertae</i>	87 Thienemannimyia sp
17	<i>Epeorus longimanus</i>	88 Trichocladius sp
18	<i>Ephemerella coloradensis</i>	89 Family: Unid. orthocladiinae
19	<i>Ephemerella doddsi</i>	
20	<i>Ephemerella grandis</i>	Order: Collembola
21	<i>Ephemerella inermis</i>	90 Isotomurus sp
22	<i>Ephemerella mollitia</i>	
23	<i>Ephemerella spinifera</i>	Order: Hymenoptera
24	<i>Ephemerella (grandis?)</i>	91 Formicidae
25	<i>Paraleptophlebia</i> sp	
26	<i>Rithrogena</i> sp	Order: Homoptera
	Order: Trichoptera	92 Family: Cicadellidae
27	Unid J/D	93 Family: Psyllidae
28	Unid pupa	94 Family: Aphididae
29	<i>Brachycentrus</i> sp	Order: Hemiptera
30	<i>Glossosoma</i> sp	95 Family: Soldidae
31	<i>Grensia</i> sp	96 Order: Lepidoptera larvae
32	<i>Hydroptila</i> sp	
33	<i>Parapsyche</i> sp	Subclass: Arachnida
34	<i>Pseudostenophylax</i> sp	Order: Hydracrina
35	<i>Rhyacophila angelita</i>	97 Unid J/D
36	<i>Rhyacophila</i> sp	98 Hydracarina sp
37	<i>Rhyacophila vagrita</i>	Order: Oribatei
38	<i>Rhyacophila (vac\acropedes)</i>	99 Lebertia sp
39	<i>Rhyacophila vaccua</i>	100 Newmannia sp
40	<i>Rhyacophila (acropedes)</i>	101 Sperchon sp
	Order: Diptera	102 Wandesia sp
41	<i>Culicidae</i> adult	
	Family: Sciaridae	Class: Crustacea
42	(<i>Corynoptera</i> sp?)	Subclass: Copepoda
	Family: Ephydriidae	103 Diaptomus sp
43	(<i>Hydrelia</i> sp?)	104 Order: Cyclopoida
	Family: Ceratopogonidae	105 Order: Calanoida
44	<i>Palpomyia</i> sp	Order: Cladocera
	Family: Tipulidae	106 <i>Daphnia</i> rosea
45	<i>Antocha</i> sp	107 <i>Eurytemorus lamellatus</i>
46	<i>Dicranota</i> sp	108 <i>Polypheus pediculus</i>
47	<i>Erioptera</i> sp	
48	<i>Hesperoconopa</i> sp	109 Phylum: Nematoda
49	<i>Hexatoma</i> sp	
50	<i>Ormosia</i> sp	
51	<i>Rhabdomastix</i> sp	
52	<i>Tipula</i> sp	
	Family: Empididae	Phylum: Platyhelminthes
53	Pupae	Class: Tubellaria
54	<i>Chelifera</i> sp	Order: Turbellaria
55	<i>Weidemannia</i> sp	110 <i>Polycreis coronata</i>
	Family: Simuliidae	
56	<i>Prosimulium</i> sp.	Phylum: Annelida
57	<i>Prosimulium</i> sp pupa	Class: Oligochaeta
58	<i>Simulium</i> sp	111 Family: Lumbriculidae, unid J/D
59	<i>Simulium</i> sp pupae	112 Family: <i>Kincaidiana hexatheca</i>
	Family: Muscidae	113 Family: Enchytraeidae
60	Adult	114 Family: Tubificidae
	Family: Chironomidae	
61	Adult	
62	Pupae	
63	Unid J/D	
64	<i>Brillia</i> sp	
65	<i>Cardiocladius</i> sp	
66	<i>Constempellina</i> sp	
67	<i>Corynoneura</i> sp	
	TNVRRTFRRAF	

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1988			1990			1988			1990			1988			1990		
	STA. 1	% Tot.	STA. 3	% Tot.	STA. 4	% Tot.	STA. 1	% Tot.	STA. 3	% Tot.	STA. 4	% Tot.	STA. 1	% Tot.	STA. 3	% Tot.	STA. 4	% Tot.
45 Antocha sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46 Dicranota sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47 Erioptera sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48 Hesperoconopha sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49 Hexatoma sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50 Ormosia sp	2	2	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
51 Rhabdomastix sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52 Tipula sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 Pupae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54 Chelifera sp	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55 Weidemannia sp	0	0	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
56 Prosimilium sp	0	0	39	13	0	0	2	0	0	1	0	0	0	0	0	0	0	0
57 Prosimilium sp pupa	1	1	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
58 Simulium sp	0	0	0	0	0	0	0	0	0	3	1	9	3	4	0	0	0	0
59 Simulium sp pupae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
60 Adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61 Adult	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62 Pupae	0	0	3	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0
63 Unid J/D	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
64 Brillia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 Cardiocladius sp	13	11	3	1	13	3	1	13	3	19	4	10	3	11	3	0	0	0
66 Constempellina sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
67 Corynoneura sp	0	0	0	0	0	0	0	7	2	0	0	0	0	0	3	1	0	0
68 Cricotopus sp	10	8	1	0	7	2	0	7	2	11	2	13	4	32	9	0	0	0
69 Diamesa sp	15	13	0	0	3	1	0	3	1	0	0	0	0	0	0	0	0	0
70 Eukiefferiella sp	0	0	2	1	2	0	0	0	0	14	3	0	0	0	0	0	0	0
71 Eurynharsis sp	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72 Gymnotrematocnemus sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
73 Heterotrissocladius sp	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
74 Micropsectra sp	0	0	0	0	0	0	0	0	0	6	1	5	2	30	8	0	0	0
75 Monopelopia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76 Orthocladius sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
77 Paratendipes sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0

APPENDIX IV TABLE 2 MT. HUNDE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1988			1990			1988			1990			1988			1990		
	STA. 1	% Tot.	STA. 3	% Tot.	STA. 4	% Tot.	STA. 1	% Tot.	STA. 3	% Tot.	STA. 4	% Tot.	STA. 5	% Tot.	STA. 5	% Tot.		
78 Polypedilum sp	0	0	0	0	12	3	0	0	0	0	2	1	0	0	0	0	0	
79 Polypedilum (pentapedilum)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
80 Potthastia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
81 Psectrocladius sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
82 Psectrocladius sp B	0	0	0	0	0	0	0	0	3	1	0	0	0	0	3	0	0	
83 Rheocricotopus sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
84 Rheotanytarsus sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
85 Tanytarsus sp	0	0	0	0	0	0	0	0	0	0	4	1	0	0	19	5	0	
86 Thienemanniella sp	0	0	0	0	0	0	0	0	0	0	0	7	2	0	0	0	0	
87 Thienemannimyia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	
88 Trichocladius sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
89 Unid. orthocladiinae	0	0	0	0	0	0	0	0	7	2	0	0	0	0	0	0	0	
90 Isotomurus sp	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	
91 Formicidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
92 Cicadellidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
93 Psyllidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
94 Aphididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
95 Solidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
96 Lepidoptera larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
97 Unid J/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
98 Hydracarina sp	5	4	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	
99 Lebertia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100 Newmannia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
101 Sperchon sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
102 Wandesia sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
103 Diaptomus sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
104 Cyclopoida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105 Calanoida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
106 Daphnia rosea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
107 Euryercus lamellatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
108 Polyphemus pediculus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
109 Nematoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
110 Polycelis coronata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1988			1990			1988			1990			1988			1990			
	STA.1	% Tot.	STA.3	% Tot.	STA.4	% Tot.	STA.4	% Tot.	STA.5	% Tot.									
111 Lumbriculidae, unid J/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2			
112 Kincaidiana hexatheca	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0		
113 Enchytraeidae	5	4	0	0	0	0	7	2	0	0	1	0	0	0	0	0	0		
114 Tubificidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total	119		304		422		100		100		454		298		100		365		100

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1988			1990			1990			1990		
	STA. 6	% Tot.	STA. 6	% Tot.	STA. 7	% Tot.	STA. 8	% Tot.	STA. 9	% Tot.	STA. 11	% Tot.
1 Capnia sp	0	0	0	0	0	0	0	0	0	0	1	0
2 Isogenoides sp	0	0	0	0	0	0	0	0	0	0	0	0
3 Isoperla sp	0	0	0	0	0	0	0	0	0	0	0	0
4 Kogotus sp	0	0	0	0	0	0	0	0	0	0	0	0
5 Megarcys sp	5	1	0	0	0	0	0	0	0	0	0	0
6 Podmosta sp	0	0	0	0	0	0	0	0	0	0	0	0
7 Sweltsa sp group	14	4	1	1	35	21	32	7	40	11	8	3
8 Skwala (paralella)	25	6	0	0	0	0	0	0	0	0	0	0
9 Utaperla sp	73	18	0	0	3	2	18	4	0	0	5	2
10 Zapada sp	14	4	0	0	3	2	30	7	4	1	6	2
11 Ameletus sp	5	1	0	0	4	2	0	0	0	0	0	0
12 Baetis sp	137	35	2	1	2	1	79	17	47	14	102	34
13 Cinygmulia sp	3	1	3	2	14	8	93	21	19	5	106	35
14 Epeorus deceptivus	0	0	0	0	1	1	0	0	0	0	1	0
15 Epeorus (albertae)	0	0	1	1	8	5	55	12	1	0	23	8
16 Epeorus albertae	0	0	0	0	0	0	0	0	0	0	0	0
17 Epeorus longimanus	0	0	0	0	0	0	0	0	0	0	0	0
18 Ephemerella coloradensis	0	0	1	1	11	7	5	1	9	3	2	1
19 Ephemerella doddsi	0	0	0	0	0	0	2	0	0	0	0	0
20 Ephemerella grandis	0	0	0	0	1	1	0	0	1	0	0	0
21 Ephemerella inermis	0	0	0	0	0	0	0	0	0	0	0	0
22 Ephemerella mollitia	0	0	0	0	0	0	0	0	0	0	0	0
23 Ephemerella spinifera	0	0	0	0	0	0	0	0	0	0	0	0
24 Ephemerella (grandis?)	0	0	0	0	0	0	0	0	0	0	0	0
25 Paraleptophlebia sp	0	0	0	0	0	0	0	0	0	0	0	0
26 Rithrogena sp	0	0	0	0	3	2	28	6	1	0	5	2
27 Unid J/D	0	0	0	0	0	0	0	0	0	0	0	0
28 Unid pupa	0	0	0	0	0	0	0	0	0	0	0	0
29 Brachycentrus sp	0	0	0	0	0	0	0	0	0	0	0	0
30 Glossosoma sp	0	0	0	0	0	0	0	0	0	0	1	0
31 Grensia sp	0	0	0	0	0	0	0	0	0	0	0	0
32 Hydroptila sp	0	0	0	0	0	0	0	0	0	0	0	0
33 Parapsyche sp	0	0	0	0	0	0	0	0	0	1	0	0

TABLE 2 MT. HUNDRE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1988			1990			1990			1990		
	STA. 6	\$ Tot.	STA. 6	\$ Tot.	STA. 7	\$ Tot.	STA. 8	\$ Tot.	STA. 9	\$ Tot.	STA. 11	\$ Tot.
100 Newmannia sp	0	0	0	0	0	0	1	0	0	0	0	0
101 Sperchon sp	0	0	1	1	0	0	2	0	0	0	0	0
102 Wandesia sp	0	0	0	0	0	0	1	0	0	0	0	0
103 Diaptomus sp	0	0	0	0	0	0	0	0	0	0	0	0
104 Cyclopoida	0	0	3	2	1	1	0	0	0	0	0	0
105 Calanoida	0	0	0	0	0	0	0	0	0	0	0	0
106 Daphnia rosea	0	0	0	0	0	0	0	0	0	0	0	0
107 Eurycerus lamellatus	0	0	0	0	1	1	0	0	3	1	0	0
108 Polyphemus pediculus	0	0	0	0	0	0	0	0	0	0	0	0
109 Nematoda	0	0	15	9	0	0	3	1	6	2	2	1
110 Polycelis coronata	1	0	0	0	1	1	11	2	0	0	5	2
111 Lumbriculidae, unid J/D	0	0	2	1	1	1	0	0	1	0	0	0
112 Kincaidiana hexatheca	0	0	0	0	0	0	0	0	0	0	0	0
113 Enchytraeidae	1	0	1	1	0	0	1	0	2	1	0	0
114 Tubificidae	0	0	4	2	0	0	0	0	3	1	0	0
TOTALS	395	100	164	100	167	453	100	100	106	100	100	100

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1990			1990		
	STA.12	% Tot.	STA.15	% Tot.	STA.15	% Tot.
1 Capnia sp	0	0	1	3	0	0
2 Isogenoides sp	0	0	0	0	0	0
3 Isoperla sp	0	0	0	0	0	0
4 Kogotus sp	1	0	0	0	0	0
5 Megarcys sp	0	0	0	0	0	0
6 Podmosta sp	2	1	0	0	0	0
7 Sveltsa sp group	0	0	1	3	0	0
8 Skwala (paralella)	0	0	0	0	0	0
9 Utaperla sp	1	0	1	3	0	0
10 Zapada sp	4	2	0	0	0	0
11 Amelitus sp	0	0	0	0	0	0
12 Baetis sp	7	3	3	8	0	0
13 Chrygmula sp	53	22	0	0	0	0
14 Epeorus deceptivus	0	0	0	0	0	0
15 Epeorus (albertae)	0	0	0	0	0	0
16 Epeorus albertae	0	0	0	0	0	0
17 Epeorus longimanus	0	0	0	0	0	0
18 Ephemerella coloradensis	48	20	0	0	0	0
19 Ephemerella doddsii	0	0	0	0	0	0
20 Ephemerella grandis	0	0	0	0	0	0
21 Ephemerella inermis	0	0	0	0	0	0
22 Ephemerella mollitia	0	0	0	0	0	0
23 Ephemerella spinifera	0	0	0	0	0	0
24 Ephemerella (grandis?)	0	0	0	0	0	0
25 Paraleptophlebia sp	0	0	0	0	0	0
26 Rithrogena sp	0	0	1	0	0	0
27 Urid J/D	0	0	0	0	0	0
28 Urid pupa	0	0	0	0	0	0
29 Brachycentrus sp	0	0	0	0	0	0
30 Glossosoma sp	5	2	1	3	0	0
31 Grensia sp	0	0	0	0	0	0
32 Hydroptila sp	0	0	0	0	0	0
33 Parapsyche sp	0	0	0	0	0	0

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC-INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1990			1990		
	STA.12	% Tot.	STA.15	% Tot.	STA.15	% Tot.
34 Pseudostenophylax sp	0	0	0	0	0	0
35 Rhyacophilida angelita	0	0	0	0	0	0
36 Rhyacophilida sp	0	0	0	0	0	0
37 Rhyacophilida vagrita	0	0	0	0	0	0
38 Rhyacophilida (vao\acropedes)	0	0	0	0	0	0
39 Rhyacophilida vaccua	0	0	0	0	0	0
40 Rhyacophilida (acropedes)	0	0	0	0	0	0
41 Culicidae adult	1	0	0	0	0	0
42 (Corynoptera sp?)	0	0	0	0	0	0
43 (Hydrelia sp?)	0	0	0	0	0	0
44 Palpomyia sp	0	0	1	3	0	0
45 Antocha sp	0	0	0	0	0	0
46 Dicranota sp	0	0	3	8	0	0
47 Erioptera sp	2	1	0	0	0	0
48 Hesperocoenopa sp	0	0	0	0	0	0
49 Hexatomida sp	0	0	0	0	0	0
50 Ormosia sp	0	0	0	0	0	0
51 Rhabdomastix sp	0	0	0	0	0	0
52 Tipula sp	1	0	1	3	0	0
53 Pupae	6	2	0	0	0	0
54 Chelifera sp	2	1	0	0	0	0
55 Weidemannia sp	0	0	0	0	0	0
56 Prosimilium sp	0	0	0	0	0	0
57 Prosimilium sp pupa	0	0	0	0	0	0
58 Simulium sp	0	0	0	0	0	0
59 Simulium sp pupae	0	0	0	0	0	0
60 Adult	0	0	0	0	0	0
61 Adult	1	0	0	0	0	0
62 Pupae	4	2	0	0	0	0
63 Unid J/D	0	0	0	0	0	0
64 Brilla sp	0	0	0	0	0	0
65 Cardiocladius sp	28	12	0	0	0	0
66 Constempellina sp	0	0	0	0	0	0

APPENDIX IV TABLE 2 MT. HUNDE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1988 AND 1990

NUMBER INVERTEBRATE	1990			1990		
	STA.12	% Tot.	STA.15	% Tot.	STA.12	% Tot.
67 Corynoneura sp	1	0	0	0	0	0
68 Cricotopus sp	5	2	2	6	0	0
69 Diamesa sp	0	0	0	0	0	0
70 Eukiefferiella sp	1	0	1	3	0	0
71 Euryhapsis sp	0	0	0	0	0	0
72 Gymnometriocnemus sp	0	0	0	0	0	0
73 Heterotriassocadius sp	0	0	0	0	0	0
74 Micropsectra sp	12	5	2	6	0	0
75 Monopelopia sp	2	1	0	0	0	0
76 Orthocladius sp	0	0	0	0	0	0
77 Paratendipes sp	0	0	0	0	0	0
78 Polypedilum sp	0	0	0	0	0	0
79 Polypedilum (pentapedilum)	0	0	3	8	0	0
80 Potthastia sp	0	0	0	0	0	0
81 Psectrocladius sp	1	0	0	0	0	0
82 Psectrocladius sp B	0	0	0	0	0	0
83 Rheocricotopus sp	0	0	0	0	0	0
84 Rhetanytarsus sp	0	0	0	0	0	0
85 Tanytarsus sp	0	0	0	0	0	0
86 Thienemannimyia sp	2	1	10	0	0	0
87 Thienemannimyia sp	0	0	0	0	0	0
88 Trichocladius sp	0	0	0	0	0	0
89 Unid. orthocladiinae	1	1	3	3	0	0
90 Isotomurus sp	0	0	0	0	0	0
91 Formicidae	0	0	0	0	0	0
92 Cicadellidae	1	1	0	0	0	0
93 Psyllidae	2	2	0	0	0	0
94 Aphididae	0	0	0	0	0	0
95 Solidae	0	0	0	0	0	0
96 Lepidoptera larvae	0	0	0	0	0	0
97 Unid J/D	1	1	0	0	0	0
98 Hydracarina sp	0	0	0	0	0	0
99 Lebertia sp	0	0	0	0	0	0

APPENDIX IV TABLE 2 MT. HUNDERE BENTHIC INVERTEBRATE DISTRIBUTION FOR 1968 AND 1990

NUMBER	INVERTEBRATE	1990		1990		Tot.
		STA. 12	#	Tot.	STA. 15	
100	Newmannia sp	0		0	0	0
101	Sperchon sp	1		0	0	0
102	Wandesia sp	0		0	0	0
103	Diaptomus sp	0		0	0	0
104	Cyclopoida	0		0	0	0
105	Calanoida	1		1	1	3
106	Daphnia rosea	2		1	0	0
107	Eury cercus lamellatus	6		2	0	0
108	Polyphemus pediculus	0		0	0	0
109	Nematoda	3		1	0	0
110	Polycelis coronata	25		10	0	0
111	Lumbriculidae, unid J/D	0		0	0	0
112	Kincaidiana hexatheca	4		2	0	0
113	Enchytraeidae	1		0	0	0
114	Tubificidae	0		1	1	3
		2		1	0	0
						100
	TOTALS	241		100	36	100