Drinking Water Source Quality Monitoring: Skeena Region 2001

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1. Introduction

A provincial Drinking Water Protection Plan initiative was undertaken in late 2001 by the Water Management Branch to monitor drinking water source quality in BC. The Lower Mainland, Vancouver Island and Skeena Region were chosen priorities for monitoring because heavy precipitation is typical during the fall months in coastal BC. Remington Environmental was contracted to monitor and report on water quality guidelines and water quality objectives attainment in the Skeena Region.

A review was conducted of drinking water sources in Skeena region, including water sources for which BC water quality objectives and objectives monitoring locations have been established. A monitoring plan for 20 locations encompassing bacteriological and chemical parameters was developed in consultation with Remi Odense, Impact Assessment Biologist, Skeena Region.

Sampling location selection— In the Skeena Region, objectives have been established for Kathlyn, Seymour, Round and Tyhee Lakes (Boyd et al. 1984). Three drinking water intakes on each of these lakes were included in the sampling list (Figures 1 & 2). McKean (1986) prepared water quality objectives for Lakelse Lake and three drinking water intakes on Lakelse Lake were included in the sampling list (Figure 4).

Nijam (1986) prepared water quality objectives for the Bulkley River. Objectives monitoring sites were established on the upper Bulkley River, near the Houston sewage treatment plant, and the Morice River. Drinking water source utilization from the upper Bulkley at Houston and the Morice River is low to non-existent; therefore, these monitoring locations were omitted from the sampling list. Two other locations on the Bulkley River were considered a priority and were added to the sampling list: Toboggan Creek and the Bulkley River at Telkwa.

Toboggan Creek, a tributary to the Bulkley River near Smithers, has 30+ domestic drinking water intakes in a small agricultural watershed. Eight of the 30 domestic drinking water intakes are located on the Toboggan Creek mainstem within 6 km of the mouth. A location (Figure 1) near the mouth of Toboggan Creek was chosen for sampling. This information will augment other ongoing water quality studies in this watershed.

The Village of Telkwa currently draws its municipal water supply from wells that have inadequate flow during peak demand periods. Therefore, during the summer months, the well water supply is supplemented from an infiltration gallery drawing from the Bulkley River. The village is currently in planning for major infrastructure upgrade, including construction of a new river intake and water treatment plant (G. McIntyre, Chief Administrator, personal communication). The Bulkley River was sampled in front of the Village office, which is the location of the present and proposed future water intakes (Figure 2).

Additional sampling locations were chosen from a North West Community Health Services Society Public Drinking Water System Inventory prepared by L. Drgon, Registered Environmental Health Officer (letter to Ministry of Environment, Lands & Parks, 11 January 2001). Water systems with a health hazard rating of high or medium were reviewed. Three locations were determined feasible for inclusion in this project, given budgetary constraints: The South Hazelton water system (Figure 3), Woodlands Utilities, in Thornhill, and Mt. Layton Hotsprings Resort, near Lakelse Lake (Figure 4).

Water quality sampling and reporting— Sampling at the 20 locations was completed five times in a thirty-day period during October 2001. D. Remington conducted initial site assessments at all sampling locations. Sampling for the Hazelton to Telkwa area was completed by D. Remington and J. Lough of Remington Environmental. Terrace-area sampling was completed by S. Bennett and K. Ohland of BioLogic Consulting, 4214 Thomas St., Terrace BC. Report preparation was by Remington Environmental.

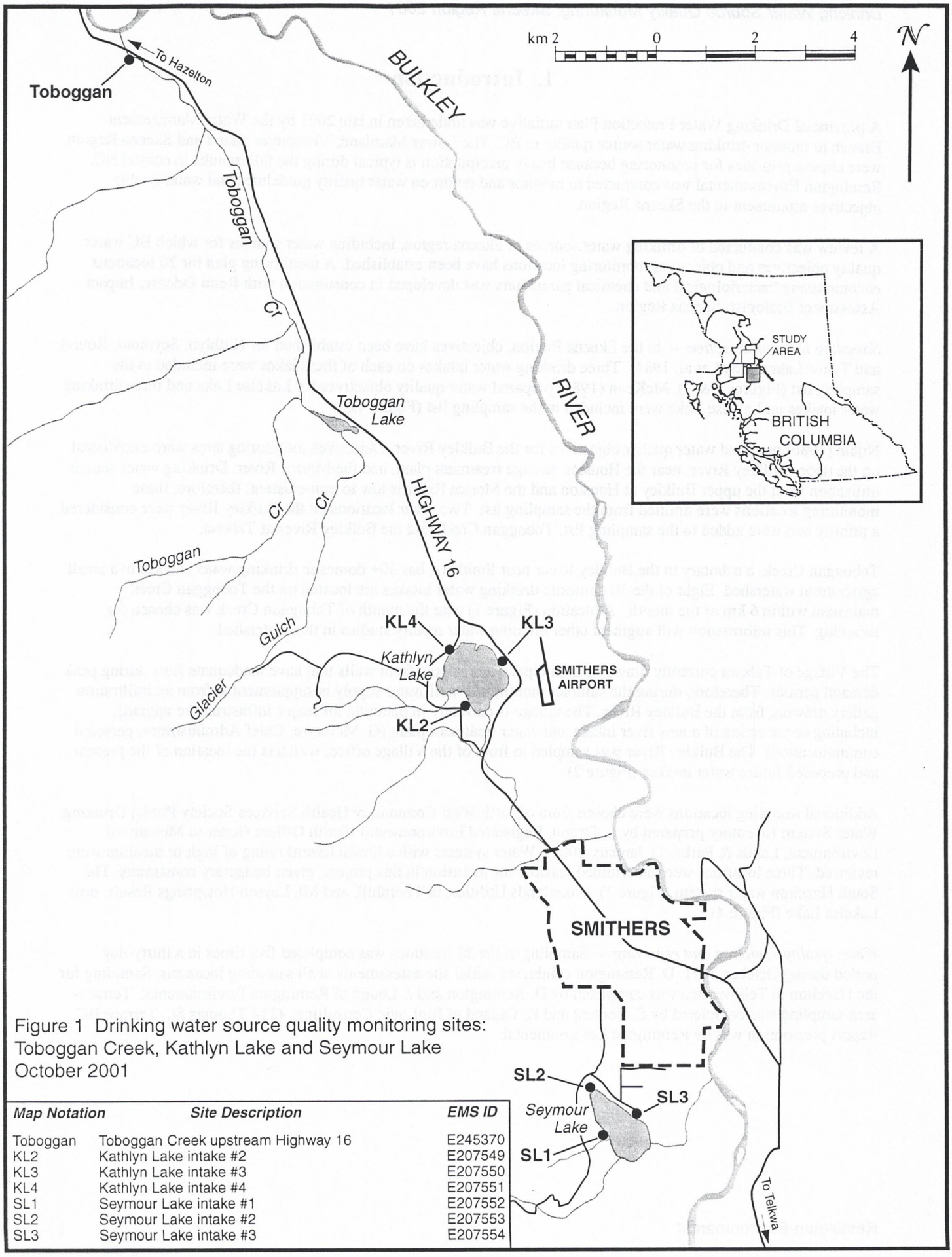

Figure 1 Drinking water source quality monitoring sites: Toboggan Creek, Kathlyn Lake and Seymour Lake October 2001

Map Notation	*Site Description*	*EMS ID*
Toboggan	Toboggan Creek upstream Highway 16	E245370
KL2	Kathlyn Lake intake #2	E207549
KL3	Kathlyn Lake intake #3	E207550
KL4	Kathlyn Lake intake #4	E207551
SL1	Seymour Lake intake #1	E207552
SL2	Seymour Lake intake #2	E207553
SL3	Seymour Lake intake #3	E207554

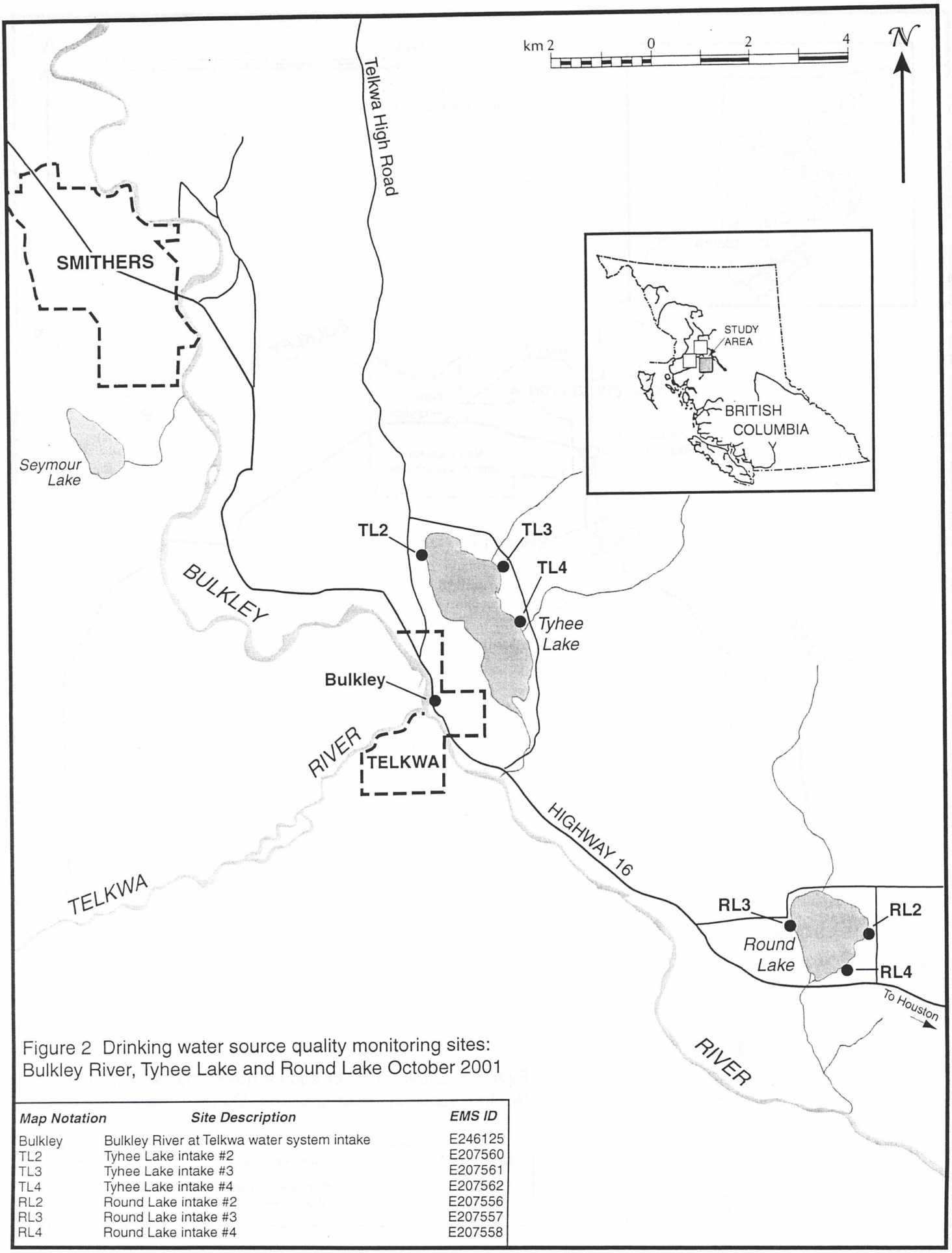

Figure 2 Drinking water source quality monitoring sites: Bulkley River, Tyhee Lake and Round Lake October 2001

Map Notation	*Site Description*	*EMS ID*
Bulkley	Bulkley River at Telkwa water system intake	E246125
TL2	Tyhee Lake intake #2	E207560
TL3	Tyhee Lake intake #3	E207561
TL4	Tyhee Lake intake #4	E207562
RL2	Round Lake intake #2	E207556
RL3	Round Lake intake #3	E207557
RL4	Round Lake intake #4	E207558

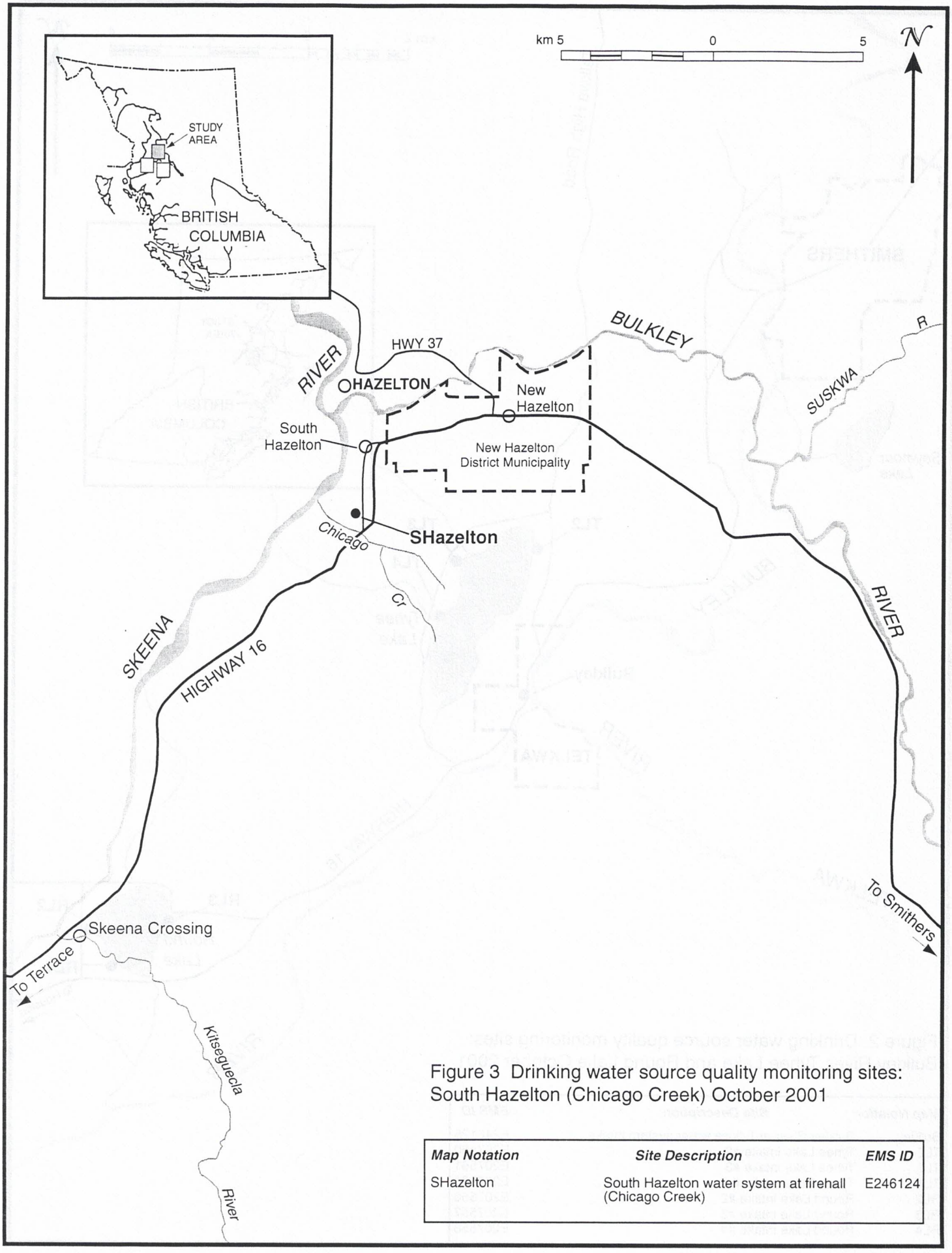

Figure 3 Drinking water source quality monitoring sites: South Hazelton (Chicago Creek) October 2001

Map Notation	*Site Description*	*EMS ID*
SHazelton	South Hazelton water system at firehall (Chicago Creek)	E246124

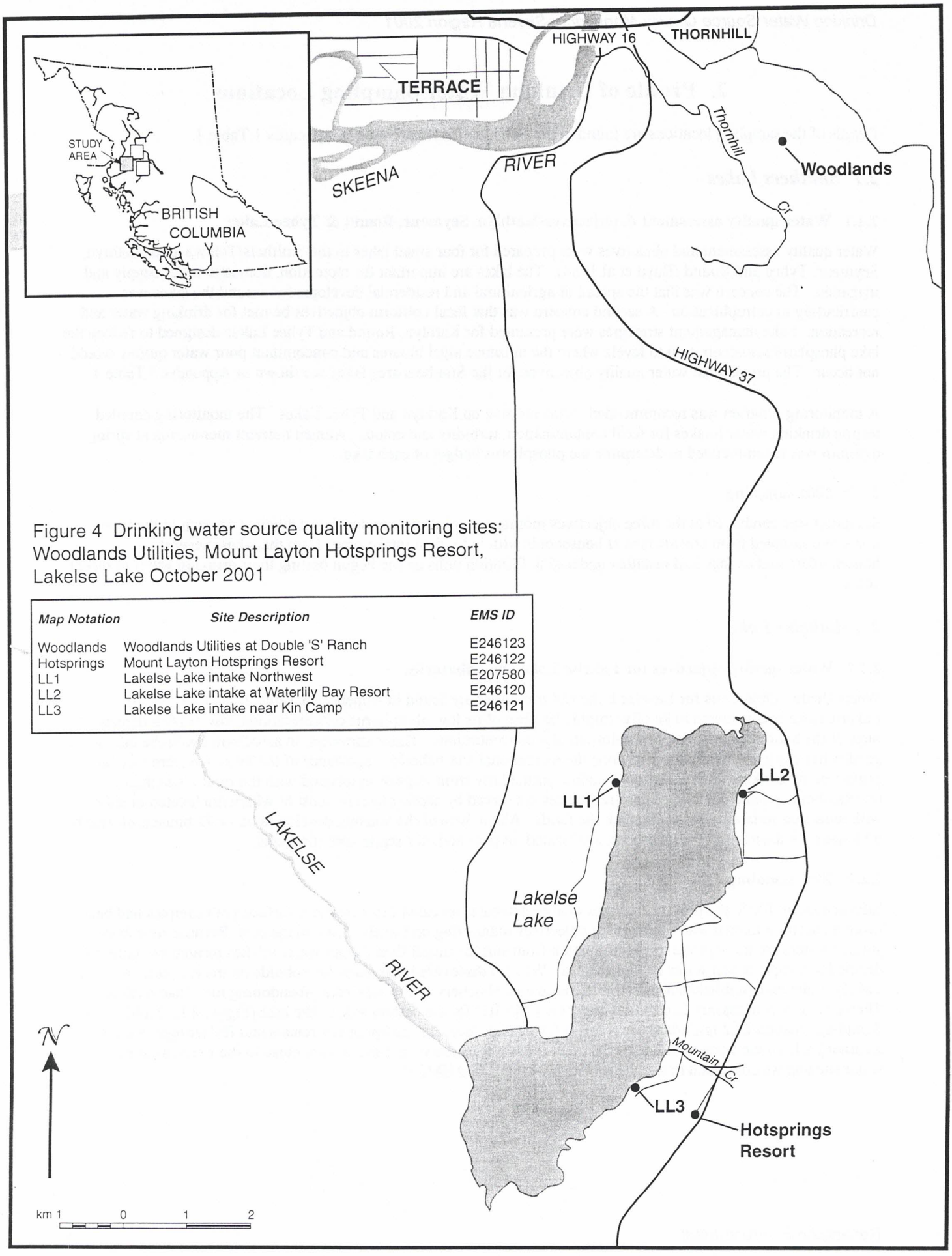

Figure 4 Drinking water source quality monitoring sites: Woodlands Utilities, Mount Layton Hotsprings Resort, Lakelse Lake October 2001

Map Notation	*Site Description*	*EMS ID*
Woodlands	Woodlands Utilities at Double 'S' Ranch	E246123
Hotsprings	Mount Layton Hotsprings Resort	E246122
LL1	Lakelse Lake intake Northwest	E207580
LL2	Lakelse Lake intake at Waterlily Bay Resort	E246120
LL3	Lakelse Lake intake near Kin Camp	E246121

2. Profile of Drinking Water Sampling Locations

Details of the sampling locations are found in the Site Identification Guide in Appendix 1 Table 1.

2.1 Smithers Lakes

2.1.1 Water quality assessment & objectives-Kathlyn, Seymour, Round & Tyhee Lakes

Water quality assessment and objectives were prepared for four small lakes in the Smithers/Telkwa area: Kathlyn, Seymour, Tyhee and Round (Boyd et al.1984). The lakes are important for recreation, domestic water supply and irrigation. The concern was that the spread of agricultural and residential development around the lakes was contributing to eutrophication. A second concern was that fecal coliform objectives be met for drinking water and recreation. Lake management strategies were presented for Kathlyn, Round and Tyhee Lakes designed to reduce the lake phosphorus concentration to levels where the nuisance algal blooms and concomitant poor water quality would not occur. The provisional water quality objectives for the Smithers area lakes are shown in Appendix 3 Table 1.

A monitoring program was recommended, concentrating on Kathlyn and Tyhee Lakes. The monitoring entailed testing drinking water intakes for fecal contamination, turbidity and colour. Annual nutrient monitoring at spring overturn was recommended to determine the phosphorus budget of each lake.

2.1.2 2001 sampling

Sampling was conducted at the three objectives monitoring locations previously established on each of the four lakes. We sampled from outside taps at households with individual intake pipes from the lakes. Several householders told us they had installed under-sink filtration units or had begun boiling their drinking water in recent years.

2.2 Lakelse Lake

2.2.1 Water quality objectives for Lakelse Lake and tributaries

Water Quality Objectives for Lakelse Lake and tributaries are found in Appendix 3 Table 2 (McKean 1986). Lakelse Lake is considered to be oligotrophic because of its low phosphorus concentrations, low oxygen depletion rates of the bottom waters, and low chlorophyll *a* concentrations. These attributes, in association with the lake's good water clarity, collectively determine the recreational and fisheries importance of the lake. Concern was for protection of drinking and recreational waters, particularly from impacts associated with the rural residential developments around the lake. These residences are served by septic systems, most of which are located in soils with moderate suitability for septic tank tile fields. About 30% of the housing development, or 72 houses, of which 60 houses are adjacent to the lakeshore, are located on poor soils for septic tank tile fields.

2.2.2 2001 sampling

Information on EMS, the province's water quality database, revealed that nearshore surface grab samples had been taken adjacent to known water intakes for objectives monitoring on Lakelse Lake in the past. Because nearshore surface waters are more prone to contamination from surface runoff than deeper water intakes located offshore, we decided to sample actual water intakes instead. We also discovered that many households on the east side of Lakelse Lake had established a shared water intake on Hatchery (Salmon) Creek, abandoning their lake intakes. Therefore, it was necessary to establish two new EMS IDs for the eastern side of the lake (Figure 4 LL2 and LL3). Sampling location LL2 is a lakeshore resort offering boat moorage, camping site rentals and RV storage. Sampling location LL1, on the northwest side of the lake, is a water intake we believe is very close to the previous surface water site and we continued to use the previously established EMS ID.

2.3 Bulkley River

2.3.1 Water quality assessment and objectives for the Bulkley River Basin

Water quality objectives for the Bulkley River Basin are shown in Appendix 3 Table 3 (Nijman 1986). Drinking water is a designated use of the Bulkley River mainstem from the Morice River to Smithers.

2.3.2 Toboggan Creek 2001 sampling

The headwaters of Toboggan Creek emanate from two glaciers on the eastern slopes of Hudson Bay Mountain overlooking Smithers. After reaching the valley floor, the creek flows parallel to the main valley for 8.5 km through agricultural lands. Eight of the 30 domestic drinking water intakes in the watershed are located on the Toboggan Creek mainstem within 6 km of the mouth. Remington and Donas (1999) found fecal coliform and fecal streptococci concentrations in Toboggan Creek to exceed provincial drinking water protection guidelines on late summer sampling dates in 1996 and 1997, and recommended further monitoring. A sampling location at the mouth of Toboggan Creek (Figure 1) was chosen to augment an ongoing one-year water quality study in this watershed.

2.3.3 Bulkley River at Telkwa 2001 sampling

The Village of Telkwa currently draws its municipal water supply from wells that have inadequate flow during peak summer demand. Therefore, during the summer months, the well water supply is supplemented from an infiltration gallery drawing from the Bulkley River. Because of high turbidity in the river water during the summer months, a boil water advisory is issued during these periods and water conservation is encouraged. The village is currently in planning for major infrastructure upgrade, including construction of a new river intake and water treatment plant (G. McIntyre, Chief Administrator, personal communication).

In October 2001, the village was distributing well water solely. Therefore, surface grab samples were taken from the Bulkley River in front of the Village office, which is the location of the present and proposed future water intakes (Figure 2).

2.4 South Hazelton water system

The South Hazelton Water Improvement District draws surface water from Chicago Creek, which drains the flanks of the Roucher Deboule Range. Water is drawn from a gravel infiltration gallery constructed in a natural impoundment on the creek and piped under Highway 16 to the village. The distribution system serves approximately 500 residents and there is presently no disinfection or other treatment. Because of high turbidities, a Boil Water Advisory has been in effect for the past 7 years. In October 2001, the South Hazelton water system was sampled from an outside tap at the village fire hall on Aldous Street (Figure 3).

2.5 Woodlands Utilities

Woodlands Utilities is a private water utility in Thornhill, an outlying district of Terrace, which serves approximately 450 households and a golf course. The main water source is a deep (300+ metre) well. During peak summertime demand, the well is supplemented by infiltration galleries drawing from three natural springs emanating from the base of Thornhill Mountain. Chlorination is employed only during the period of annual flushing of the distribution system.

Water samples were drawn from an outside tap at a residence at the distal end of the distribution system (Laurel Street). The only water source during the sampling period was the deep well. The annual flushing of the distribution system was scheduled to take place during the October 2001 sampling period (T. Zeigler, Woodlands Utilities Manager, personal communication).

2.6 Mt. Layton Hotsprings Resort

Mt. Layton Hotsprings Resort, located on the east side of Lakelse Lake (Figure 4), is a hotel and restaurant complex with hot and cold pools and waterslides. Drinking and bathing water for the resort is drawn from a fenced reservoir

constructed on Mountain Creek and piped under the highway to the resort. According to maintenance staff, mechanical problems had been encountered with the water chlorination system in the past. For this reason, a treatment system utilizing ozonation was installed in 2000 and chlorination is no longer employed. During October 2001, water samples were taken from a tap in the restaurant kitchen.

2.7 Human activities of concern in the drinking water source areas studied

Human activities of concern in the drinking water source areas in this study are summarized in Table 1. Human settlement (and septic tank leachate) is the major water quality concern for the five study lakes. Agriculture, in the form of cow-calf beef and dairy operations are a major activity in the Toboggan Creek, Bulkley River, Round Lake and Tyhee Lake watersheds. The Canadian National Rail line and major provincial highways traverse several of the study watersheds. Forestry has historically occurred in all of surface water source areas in this study but, in general, other human activities such as agricultural land clearing and urbanization are the priority issues.

Table 1 Major human activities of concern in the drinking water source areas studied

Activities:	Human settlement (septic tanks)	Agriculture	Cattle grazing	Forestry	Transport	Recreation
Surface water sources:						
Kathlyn Lake	X				X	X
Seymour Lake	X					X
Tyhee Lake	X	X	X	X		X
Round Lake	X	X	X	X		X
Lakelse Lake	X			X	X	X
Toboggan Creek	X	X	X	X	X	
Bulkley River		X	X	X	X	
South Hazelton (Chicago Cr)				X		
Hotsprings Resort (Mountain Cr)				X		
Surface + groundwater sources:						
Woodlands Utilities						

The provincial government is currently considering new drinking water protection legislation. The reader is directed to the auditor general's recent report on protection of drinking-water sources in British Columbia for further discussion on this complex issue. The auditor general's report may be found at the following URL: http://www.oag.bc.ca/.

3. Sampling and Analytical Methods

All water samples were collected following a thorough (at least 3 minute) flushing of the water lines. Water sampling was conducted according to methods outlined in the *Ambient fresh water and effluent sampling manual* and *Biological sampling manual* (Cavanaugh et al. 1994*a,b*). Total metals samples were immediately preserved with nitric acid. Trip and field blanks were collected and retained for future use if needed. Duplicate samples were submitted for analysis for more than 10% of samples.

All samples were immediately placed in a cooler with ice and shipped air courier to Pacific Environmental Science Centre in North Vancouver (chemical analysis) and Cantest Ltd. laboratory in Burnaby (microbiological analysis). Samples for chemical analysis were received by the laboratory within two days and analyses commenced within recommended holding times. All samples for microbiological analysis, except one, were received by Cantest Ltd. within one day and analyses commenced immediately. One microbiology sample was lost in shipment for several days. Data for the lost sample was not included in the summary and assessment for that monitoring location.

4. Drinking Water Quality Guidelines

4.1 BC and Canadian water quality guidelines

The Ministry of Water, Land and Air Protection (WLAP) Water Quality Branch is developing province-wide water quality guidelines for use in assessing water quality data and preparing site-specific water quality objectives. Water quality guidelines (formerly referred to as 'criteria') are environmental benchmarks. They are safe levels of substances for the protection of a given water use, including drinking water, recreation, aquatic life and, agriculture. They are intended to be used as a water quality data-screening tool. If the data do not exceed the guidelines, problems are unlikely. If the data lie outside the guidelines, then a detailed assessment of the data and the guidelines should be done to determine the extent of the problem. Water Quality Branch monitoring protocols and water quality guidelines for microbiological indicators were published in 1988 (Warrington 1988).

The Canadian water quality guidelines (CCREM 1999 with periodic updates) were developed in order to harmonize water quality guidelines used by provinces throughout Canada. The Canadian drinking water quality guidelines were most recently updated in March 2001.

BC and Canadian drinking water quality guidelines for microbiological organisms are summarized in Appendix 3 Table 4. Because coliforms are not uniformly distributed in water and are subject to considerable variation in enumeration, drinking water that fulfils the conditions outlined in Appendix 3 Table 4 is considered to be compliance (CCREM revised 03/01). Selected BC and Canadian guidelines for drinking water quality (physical and chemical parameters) are found in Appendix 3 Table 5.

Indicator organisms, such as coliform bacteria, provide an estimate of the degree of fecal contamination from human and animal wastes that are in the water. The general philosophy associated with using an indicator organism is that if it can be shown that fecal contamination of the water has occurred, then disease-causing organisms may also be present. The maximum acceptable concentration for coliforms in drinking water is zero organisms detectable per 100 mL. The BC Ministry of Health recommends that all drinking water supplies derived from surface waters receive disinfection.

4.2 BC water quality objectives

Water quality objectives are environmental quality conditions set as targets for specific water bodies based on three main factors: 1) the designated use(s) for the water; 2) the water quality criteria that have been adopted for the most sensitive designated use; and 3) the local conditions, including the actual measured water quality in the area. For a specific drainage the appropriate priority uses for the water are chosen. This becomes the designated use to be protected by the objectives. Objectives are chosen for that waterbody based on criteria or guidelines, taking local circumstances into account. Objectives can be chosen above or below the criteria depending on the situation, and what is at risk. The objectives are policy guidelines for decision-makers who issue Water Licenses for water use and Waste Management Permits for waste disposal. Water quality objectives are not themselves legally enforceable. The instrument for enforcement is the Permit, License or Order issued by the regulatory authority.

4.3 Provincial Health Officer's Annual Report

For further discussion on drinking water quality in British Columbia, the reader is directed to the Provincial Health Officer's Annual Report 2000, *Drinking water quality in British Columbia: The public health perspective* at the following URL: http://www.healthplanning.gov.vc.ca/pho/.

The provincial health officer's report contains a good discussion of the microbiological indicators and physical and chemical parameters reported in this study.

5. Results and Drinking Source Water Quality Assessment

Water quality data for each location are found in Appendix 2 Tables 1 through 20. Historical data was extracted from EMS whenever available and included in the data tables. For each site, microbiological and inorganic data are found in table *a* and total metals data are found in table *b*. Nitrate nitrogen was determined by calculation (nitrite + nitrate-N minus nitrite-N).

An annual summary was calculated for each location including maximum and 90th percentile for microbiological indicators and mean (average) for chemical parameters (*in text* Tables 2 through 7). In calculation of the mean, the average of the duplicate samples for that date was used.

The minimum detectable concentration (MDC) is the minimum amount of a substance that can be routinely detected by the analytical instrument or technique with a high degree of confidence. In this study, the MDC for metals was often higher than the guideline concentration for drinking water.

QA— Replicate sampling provides a rough estimate of the overall precision associated with both the field technique and laboratory analysis. One duplicate sample was taken at each location during the course of this study. Analysis of replicate samples is found in Appendix 2 Table 21a and 21b. Precision can be expressed as the relative percent mean difference (see formula in Nagpal et al. 1997). Use of the percent mean difference is limited to analytical values that are at least five times the MDC, which was not the case for many metals values. The 'rule of thumb' criteria for precision values (above which the data should be viewed with caution) is 25% relative difference for duplicates. Turbidity and True Color demonstrated higher variability than 25% on several occasions. Environmental variability in these two parameters is the suspected cause. No QA-related problems were apparent in this dataset.

In the following discussion, federal and provincial water quality guidelines for drinking water will be referred to as 'guidelines'. Most water users in this study told us they drink raw water, although some employ in-house treatments such as boiling or under-sink filtration systems. Even those who boil water for drinking usually admit to using unboiled water for brushing their teeth and, occasional, for drinking. For this reason, the guidelines for raw drinking water with no treatment (zero organisms detectable per 100 mL) are applicable to the following discussion.

Table 2 Drinking water source quality and objectives monitoring summary: Kathlyn Lake 1988 – 2001

Kathlyn Lake intake #2 E207549

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2							7.4	0.84			
1989	10	6.8							5	0.72			
1990	<2	<2							12	1.58			
1991	<2	<2							10	1.22			
1992	<2	<2							10	0.75			
1993	<1	<1							11	0.48			
2001	7	5	3	2.6	<1	<1	7.12	46.4	13.2	1.93	0.010	0.008	<0.002

Kathlyn Lake intake #3 E207550

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2							7.4	0.78			
1989	135	109.4							7	1.36			
1990	50	31.6							14	1.6			
1991	<2	<2							15	1.98			
1992	28	17.6							11	0.62			
1993	<1	<1							12.5	0.48			
2001	139	106.2	139	103	<1	<1	7.40	49.8	12.6	2.05	0.022	0.020	<0.002

Kathlyn Lake intake #4 E207551

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2							6	0.8			
1989	<2	<2							8	1.12			
1993	<1	<1							15	0.84			
2001	5	4.6	5	4.6	<1	<1	7.15	46.4	11.8	1.41	0.008	0.008	<0.002

Table 3 Drinking water source quality and objectives monitoring summary: Seymour Lake 1988 – 2001

Seymour Lake intake #1 E207552

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	10	6.8								4.54			
1989	9	6.2							54	6.44			
1990	<2	<2							54	8.9			
1991	<2	<2								4.18			
1992	9	6.6							55	2.7			
1993	1	<1							80	5.15			
2001	1	<1	1	<1	<1	<1	7.55	110.2	74	10.5	0.005	0.003	<0.002

Seymour Lake intake #2 E207553

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	12	8.8								7.0			
1989	202	145.6							52	2.6			
1990	<2	<2							35	3.1			
1991	4	3.2								7.2			
1992	2	<2							50	0.4			
1993	1	<1							60	0.6			
2001	1	<1	1	<1	<1	<1	7.52	121.8	33	1.96	0.232	0.230	<0.002

Seymour Lake intake #3 E207554

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2								0.76			
1989	9	6.6							34	1.44			
1993	1	<1							60	0.30			
2001	<1	<1	<1	<1	<1	<1	7.50	103.8	25.6	0.80	0.011	0.009	<0.002

Table 4 Drinking water source quality and objectives monitoring summary: Tyhee Lake 1988 – 2001

Tyhee Lake intake #2 E207560

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	12	8.8							<5	0.54			
1989	8	5.6							6.0	1.12			
1990	108	71.6							14.0	0.94			
1991	4	3.2							7.0	1.00			
1992	<2	<2							8.3	0.60			
1993	4	2.8							5.0	0.44			
2001	<1	<1	<1	<1	<1	<1	8.10	284.2	15.5	4.91	0.110	0.108	<0.002

Tyhee Lake intake #3 E207561

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	2	<2							5.2	0.52			
1989	<2	<2							6.0	2.02			
1990	31	19.4							8.4	0.92			
1991	<2	<2							6.0	0.58			
1992	<2	<2							7.4	0.66			
1993	<1	<1							5.0	0.70			
2001	<1	<1	<1	<1	<1	<1	8.09	280.1	9.1	0.689	0.0599	0.0579	<0.002

Tyhee Lake intake #4 E207562

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2							5.2	0.98			
1989	2	<2							7.0	0.76			
1993	<1	<1							12	1.62			
2001	<1	<1	<1	<1	<1	<1	8.11	260.6	9.6	0.56	0.0736	0.0716	<0.002

Table 5 Drinking water source quality and objectives monitoring summary: Round Lake 1988 – 2001

Round Lake intake #2 E207556

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	14	9.2							8.6	1.10			
1989	<2	<2							9.0	1.18			
1990	<2	<2							16.0	1.12			
1991	<2	<2							12.0	1.22			
1992	<2	<2							12.0	0.54			
1993	2	1.6							17.0	0.94			
2001	<1	<1	<1	<1	<1	<1	8.07	266.1	13.4	1.268	0.135	0.133	<0.002

Round Lake intake #3 E207557

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2							25	2.9			
1989	2	<2							13	1.52			
1990	2	<2							19	1.5			
1991	2	<2							26	2.24			
1992	<2	<2							20	1.54			
1993	3	2.2							53	3.4			
2001	1	<1	1	<1	<1	<1	8.09	265.4	14.7	1.69	0.066	0.063	0.003

Round Lake intake #4 E207558

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	4	3.2							15.4	2.3			
1989	<2	<2							15	1.42			
1993	1	<1							17	1.38			
2001	<1	<1	<1	<1	<1	<1	8.01	268	15.7	2.83	0.102	0.094	0.0078

Table 6 Drinking water source quality and objectives monitoring summary: Lakelse Lake 1988 – 2001

Lakelse Lake intake #1 (Northwest) E207580

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	<2	<2								0.78			
1989	2	<2								0.42			
1990	3	2.6								0.58			
1991	<2	<2								0.5			
1992	<2	<2								0.48			
2001	3	<3	3	<3	<1	<1	7.27	51.4	21.6	2.37	0.035	0.033	<0.002

E207582 Lakelse Lake North East (surface water grab between Gainey Pt. and Waterlily Bay Resort)

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E, coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	2	<2								0.54			
1989	2	<2								0.42			
1990	<2	<2								0.54			
1991	<2	<2								0.35			
1992	2	<2								0.56			

Lakelse Lake intake #2 (Waterlily Bay Resort) E246120

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E, coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	22	16	15	11.8	<1	<1	7.42	50.75	23.2	3.56	0.024	0.022	<0.002

E207581 Lakelse Lake - Gainey Pt. (surface water grab) 1988-1992

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E, coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
1988	2	<2								0.48			
1989	2	<2								0.48			
1990	3	<3								0.52			
1991	<2	<2								0.35			
1992	2	<2								0.48			

Lakelse Lake intake #3 E246121

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	100	72.8	100	64.8	<1	<1	7.29	52.3	28.8	5.68	0.033	0.031	<0.002*

* Median

Table 7 Drinking water source quality monitoring summary: Toboggan Creek, Bulkley River at Telkwa, South Hazelton water system (Chicago Cr.), Woodlands Utilities, Mt. Layton Hotsprings Resort, 2001

Toboggan Creek E245370

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	37	31.6	37	31.3	12	8.7	7.67	100.6	11.8	1.19	0.068	0.066	<0.002

Bulkley River at Telkwa E246125

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	2	1.6	2	1.6	<1	<1	7.55	54.7	4.0	0.90	0.004	0.003	<0.002

South Hazelton water system (Chicago Cr.) E246124

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	14	10	12	8.8	<1	<1	7.32	52.5	2.6	0.10	0.125	0.123	<0.002

Woodlands Utilities E246123

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) mean (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	<1	<1	<1	<1	<1	<1	8.01	417.4	2.7	0.16	0.057	0.055	<0.002

Mt. Layton Hotsprings Resort E246122

Date	Fecal coliform maximum (CFU/100ml)	Fecal coliform 90th perc. (CFU/100ml)	*E. coli* maximum (CFU/100ml)	*E. coli* 90th perc. (CFU/100ml)	Enterococci maximum (CFU/100ml)	Enterococci 90th perc. (CFU/100ml)	pH mean (pH units)	Specific Conductance mean (uS/cm)	True Color mean (Col.unit)	Turbidity mean (NTU)	Nitrate + Nitrite (N) (mg/L)	Nitrate (N) mean (mg/L)	Nitrite (N) mean (mg/L)
2001	<1	<1	<2	<1	<1	<1	7.24	36.1	13.7	0.60	0.009	0.007	<0.002*

*Median

5.1 Kathlyn Lake

Microbiological parameters—
Fecal coliforms, mainly of the *E. coli* group, were found in intake water at all three locations on Kathlyn Lake in October 2001. Intakes on the northwest shore (KL4) and south shore (KL2) of the lake recorded fecal coliform and *E. coli* concentrations of <10 CFU/100 mL (90th percentile). With one exception, concentrations at intakes KL2 and KL4 had been less than the MDC in previous years.

In October 2001, fecal coliform and *E. coli* concentrations were greater than 100 CFU/100 mL (90th percentile) at KL3, on the eastern shore. Historically, this location has recorded elevated fecal coliform concentrations in four of 7 years sampled.

It should be noted that previous sampling at Kathlyn Lake had occurred during July and August. The mean turbidity was higher at all sites in October 2001 than recorded in July/August of previous years. Both high turbidity (3.3 NTUs) and high bacterial concentrations were recorded on October 14th at KL3, following heavy rains on preceding days. Turbidity is known to increase during periods of heavy rainfall, when increased surface runoff flows into the water source. Turbidity has been shown to be correlated with contamination with bacteria and other microscopic organisms such as *Cryptosporidium* and *Giardia* (BC Provincial Health Officer 2001). The higher bacterial concentrations seen this year compared to previous years may likely be the result of the timing of the study (autumn) rather than a trend in deteriorating water quality.

Physical and chemical parameters—
The drinking water guideline for turbidity (1 NTU, maximum) was exceeded at every intake on Kathlyn Lake throughout October 2001. Turbid (cloudy) drinking water is aesthetically undesirable. As discussed previously, turbidity is not itself a health hazard. It is an indication of the risk associated with runoff entering the water source. Turbidity can also reduce the effectiveness of disinfectants such as chlorine, ozone or UV light. This is because microscopic organisms that are attached to, or hiding among, particles in the water may be less sensitive to the disinfectant.

The average true colour ranged from 11.8 to 13.2 TCU, and generally did not exceed the aesthetic guideline of 15 TCU. Nitrate nitrogen concentrations were low in all water intakes. In several cases, the MDC for metals was higher than the applicable guideline. Manganese slightly exceeded the aesthetic guideline at KL2. Manganese and iron exceeded their respective guidelines at KL3. The guidelines for these two metals are aesthetic objectives related to the taste of the water, rather than health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.2 Seymour Lake

Microbiological parameters—
In October 2001, fecal coliform and *E. coli* organisms were equal to or less than the detection limit in the three Seymour lake water intakes (1 CFU/100 mL maximum). In 1989, a maximum fecal coliform concentration of >200 CFU/100 mL was recorded at SL2. Other than 1989, fecal coliform concentrations have ranged from less than the MDC to <10 CFU/100 mL (90th percentile).

Physical and chemical parameters—
Mean turbidity in 2001 ranged from 0.8 NTU at SL3 on the eastern shore to 10.5 NTU at SL1 on the western shore of Seymour Lake. The major tributaries to Seymour Lake drain steep mountain slopes west of the lake, and turbidities appear to naturally be higher near these tributaries. Historically, mean turbidity exceeds the drinking water guideline at SL1 and SL2, and is particularly high during rainy months such as October 2001. Seymour Lake has very coloured waters, with average true colour exceeding the aesthetic objective of 15 TCU by several times. Nitrate nitrogen concentrations were low in all intakes. In several cases, the MDC for metals was higher than the applicable guideline. Iron concentrations exceeded the guideline at two intakes. This is an aesthetic objective based on the taste of the water, and is not health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.3 Tyhee Lake

Microbiological parameters—
In October 2001, none of the three microbiological indicator organisms were detectable in the three Tyhee lake water intakes. Historically, a fecal coliform concentration of 72 CFU/100 mL (90th percentile) was recorded in 1990 at TL2.

Physical and chemical parameters—
Mean turbidity in 2001 was low at TL3 and TL4. Mean turbidity at TL2 (5 NTU) exceeded the guidelines for turbidity and was higher than recorded in previous years. Previous sampling at Tyhee Lake had occurred during July and August, which are generally months with less precipitation and runoff than seen in October 2001. Mean true colour generally does not exceed the aesthetic objective of 15 TCU. Nitrate nitrogen concentrations were low in all intakes. In several cases, the MDC for metals was higher than the applicable guideline. No metals concentrations were found to exceed water quality guidelines in the Tyhee Lake water intakes. No other physical or chemical parameters exceeded drinking water guidelines.

5.4 Round Lake

Microbiological parameters—
In October 2001, the three microbiological indicator organisms were equal to or less than the MDC in the three Round Lake water intakes. Historically, fecal coliform concentrations have generally been less than the MDC in the three water intakes. A fecal coliform concentration of 9.2 CFU/100 mL (90th percentile) was recorded in 1988 at RL2.

Physical and chemical parameters—
Mean turbidity in 2001 slightly exceeded the guideline of 1 NTU at all locations. Historically, mean true colour often exceeded the aesthetic objective of 15 TCU. Nitrate nitrogen concentrations were low in all intakes. In several cases, the MDC for metals was higher than the applicable guideline. Manganese exceeded the drinking water guideline at RL3 and RL4. The guideline for manganese is an aesthetic objective related to the taste of the water, rather than health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.5 Lakelse Lake

Nearshore surface water grab samples had been taken adjacent to known water intakes for objectives monitoring on Lakelse Lake in the past. Because nearshore surface waters are more prone to contamination from surface runoff than deeper water intakes located offshore, we decided to sample actual water intakes instead. We also discovered that many households on the east side of Lakelse Lake had established a shared water intake on Hatchery (Salmon) Creek, abandoning their lake intakes. Therefore, it was necessary to establish two new EMS IDs for the eastern side of the lake (LL2 and LL3). Sampling location LL2 is a lakeshore resort offering boat moorage, camping site rentals and RV storage. Location LL3 is a seasonal use cabin. Sampling location LL1, on the northwest side of the lake, is a domestic water intake located very close to the previous surface water site, therefore we continued to use the previously established EMS ID. Data for both the previously established monitoring sites and the newly established ones are found in Table 6.

Microbiological parameters—
Historically, fecal coliform concentrations have been no higher than <3 CFU/100 mL (90th percentile) at any location (including the surface water grab samples). In October 2001, fecal coliform and *E. coli* concentrations were <3 CFU/100 mL (90th percentile) at the LL1 intake on the northwest shore of the lake. Fecal coliform and *E. coli* concentrations were 16 and 12 CFU/100 mL (90th percentile), respectively, at LL2. Fecal coliform and *E. coli* concentrations were 73 and 65 CFU/100 mL (90th percentile), respectively, at LL3. Enterococci concentrations were not detectable at any of the three locations.

It should be noted that previous sampling at Lakelse Lake had occurred July through early September. The mean turbidity was higher at all sites in October 2001 than recorded in the drier summer months of previous years. Both high turbidity (16.4 NTUs) and high bacterial concentrations (100 CFU/100 mL) were recorded on October 29th at

LL3 following rain and sleet on preceding days. Turbidity is known to increase during periods of heavy rainfall, when increased surface runoff flows into the water source. Turbidity has been shown to be correlated with contamination with bacteria and other microscopic organisms such as *Cryptosporidium* and *Giardia*. The higher bacterial concentrations seen this year compared to previous years may likely be the result of the timing of the study (autumn) rather than a trend in deteriorating water quality.

Physical and chemical parameters—
Lakelse Lake is noted for clear waters and mean turbidity recorded during the summer months in previous years has been less than the guideline concentration of 1 NTU. Mean turbidity in 2001 ranged from 2.4 NTU at LL1 to 5.7 NTU at LL3. The lake is moderately coloured (22-29 TCU) and exceeded the aesthetic objective of 15 TCU at all locations. Nitrate nitrogen concentrations were low in all intakes. In several cases, the MDC for metals was higher than the guidelines. Iron and manganese concentrations exceeded their respective guidelines at LL1 and LL3. This is an aesthetic objective based on the taste of the water, and is not health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.6 Toboggan Creek

Microbiological parameters—
The October 4th Toboggan Creek bacteriology sample was lost in shipment longer than the recommended holding time for analysis. Therefore, the October 4th data was not used in calculation of the summary data found in Table 7.

Fecal coliform and *E. coli* concentrations were 31.6 and 31.3 CFU/100 mL (90th percentile), respectively, in the remaining four samples. An Enterococci concentration of 12 CFU/100 mL was recorded on one occasion. Enterococci were not detectable in the remaining samples.

Physical and chemical parameters—
Mean turbidity, at 1.19 NTU, slightly exceeded the turbidity guideline concentration of 1 NTU. The headwaters of Toboggan Creek emanate from glaciers on the slopes of the Hudson Bay Ranges, so some background glacial turbidity is natural for this stream. Toboggan Creek waters are coloured but, on average, did not exceed the True colour guideline of 15 TCU. Iron slightly exceeded the guideline on one sampling date, but was not in exceedence on average. The iron guideline is an aesthetic objective based on the taste of the water, and is not health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.7 Bulkley River at Telkwa

Microbiological parameters—
Fecal coliform and *E. coli* concentrations were 1.6 and 1.6 CFU/100 mL (90th percentile), respectively in October 2001. Enterococci were not detectable during this study.

Physical and chemical parameters—
Mean turbidity, at 0.9 NTU, approximately equals the turbidity guideline concentration of 1 NTU. The October 2001 sampling location was near the riverbank almost directly opposite the confluence of the Telkwa River with the Bulkley in the village of Telkwa. The influence of the more turbid Telkwa River waters would not be felt at this location. The reader is directed to Remington (1996) for further discussion on the differences in water quality in these two rivers. True colour, at 4 TCU, is low in the Bulkley River as compared to other drinking water sources in this study. Mean nitrate nitrogen was low in this study. No other physical or chemical parameters exceeded drinking water guidelines.

5.8 South Hazelton water system

Microbiological parameters—
Fecal coliform and *E. coli* concentrations were 10 and 8.8 CFU/100 mL (90th percentile), respectively in October 2001. Enterococci were not detectable during this study.

Physical and chemical parameters—
Mean turbidity, 0.1 NTU, was approximately one tenth the turbidity guideline concentration of 1 NTU. True colour, at 2.6 TCU, was low in Chicago Creek as compared to other drinking water sources in this study. Iron slightly exceeded the guideline on one sampling date, but was not in exceedence on average. The iron guideline is an aesthetic objective based on the taste of the water, and is not health related. No other physical or chemical parameters exceeded drinking water guidelines.

5.9 Woodlands Utilities

Microbiological parameters—
No microbiological indicator organisms were detectable in the drinking water supply of this utility. The main year-round water source for this water utility is a 300+ m deep well. During the summer peak demand season, surface water is drawn from three springs to augment the water supply. During the sampling period of October 2001, the sole water source was the deep well (T. Zeigler, Woodlands Utilities Manager, personal communication). The annual flushing of the distribution system was scheduled to take place during the October 2001 sampling period, so chlorination may have been employed during the flushing.

Physical and chemical parameters—
The mean Specific conductance, 417 µS/cm, was comparatively high, reflecting the groundwater source of this water supply. True colour, turbidity, and nitrate nitrogen concentrations were low. No physical or chemical parameters exceeded drinking water guidelines at this location.

5.10 Mt. Layton Hotsprings Resort

Microbiological parameters—
Mt. Layton Hotsprings Resort pipes surface water from a small impoundment on Mountain Creek, a tributary to Lakelse Lake. The resort installed an ozonation treatment system approximately one year ago. No microbiological indicator organisms were detectable in the drinking water supply during this study.

Physical and chemical parameters—
The source waters of Mountain Creek are slightly coloured, at 13.7 TCU on average, but do not exceed the True Colour guideline of 15 TCU. Turbidity and nitrate nitrogen concentrations were low. Three metals were found in exceedence of drinking water guidelines, each on one occasion. Aluminum exceeded the guideline very slightly on October 29th, with a concentration of 0.25 mg/L. However, on average, aluminum was approximately half the guideline concentration.

Arsenic and cadmium each exceeded their respective guidelines on October 1, when low-level metals analysis was conducted. However, concentrations of these two metals were very low on October 22 when low-level metals analysis was again conducted. In the remainder of the samples the MDC for metals was higher than the guidelines. It is possible that unusual concentrations of arsenic and cadmium could be associated with a geothermal area, such as the Lakelse Hotsprings. If no previous metals data is available for this water source, resampling is suggested as a precaution. Low level metals analysis (ICPMS) should be utilized in any future metals analysis. No other physical or chemical parameters exceeded drinking water guidelines in this study.

6. Discussion

Microbiological indicator organisms provide an estimate of the degree of fecal contamination from human and animal wastes that are in the water. The general philosophy associated with using an indicator organism is that if it can be shown that fecal contamination of the water has occurred, then disease-causing organisms may also be present. The maximum acceptable concentration for coliforms in drinking water is zero organisms detectable per 100 mL. The BC Ministry of Health recommends that all drinking water supplies derived from surface waters receive disinfection.

Of the twenty Skeena Region locations sampled during October 2001, eight locations complied with the BC raw drinking water guidelines for 'no treatment' of zero (no detectable) microbiological indicator organisms (five

samples taken within 30 days). Eight locations complied with the raw drinking water guideline for 'disinfection only'. Three locations complied with the raw drinking water guidelines for 'partial treatment'. One location exceeded the guidelines for partial treatment.

Recommendations— In the past, objectives monitoring for the Smithers area and Lakelse lakes has been carried out during the summer months. This study has demonstrated that drinking water quality can deteriorate significantly during other seasons during which precipitation and surface runoff are heavier. Most lakeside residents draw drinking water year-round. Monitoring only in mid-summer does not reflect the range of year-round source water quality. It is recommended that a more varied temporal schedule be devised for drinking water quality objectives monitoring, which includes spring and fall periods.

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samples taken within 10 days). Eight locations complied with the raw drinking water guidelines for 'disinfection only'. Three locations complied with the raw drinking water guidelines for 'partial treatment'. One location exceeded the guidelines for partial treatment.

Recommendations — In the past, objectives monitoring for the Similkameen and Okanagan lakes has been carried out during the summer months. This study has demonstrated that drinking water quality can deteriorate significantly during other seasons during which precipitation and surface runoff are heavier. Most lakeside residents obtain drinking water year-round. Monitoring only in mid-summer does not reflect the range of year-round access water quality. It is recommended that a more varied temporal schedule be devised for drinking water quality objectives monitoring, which includes spring and fall periods.

7. References

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Appendix 1 Table 1 Site Identification Guide Drinking Water Source Quality Monitoring

Map notation:	**Figure 1 KL2**		
Domestic water intake:	**Kathlyn Lake intake #2**	***Waterworks Name:***	
Surface water source:	Kathlyn Lake	***Groundwater source:***	
EMS ID:	E207549	***Latitude:***	54.8171
Map sheet	93L084	***Longitude:***	127.2041
Street address	444 Beach Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 KL3**		
Domestic water intake:	**Kathlyn Lake intake #3**	***Waterworks Name:***	
Surface water source:	Kathlyn Lake	***Groundwater source:***	
EMS ID:	E207550	***Latitude:***	54.8206
Map sheet	93L084	***Longitude:***	127.1858
Street address	Highway 16		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 KL4**		
Domestic water intake:	**Kathlyn Lake intake #4**	***Waterworks Name:***	
Surface water source:	Kathlyn Lake	***Groundwater source:***	
EMS ID:	E207551	***Latitude:***	54.8306
Map sheet	93L084	***Longitude:***	127.2061
Street address	4925 Lake Kathlyn Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 SL1**		
Domestic water intake:	**Seymour Lake intake #1**	***Waterworks Name:***	
Surface water source:	Seymour Lake	***Groundwater source:***	
EMS ID:	E207552	***Latitude:***	54.7433
Map sheet	93L075	***Longitude:***	127.1658
Street address	Pidherny Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 SL2**		
Domestic water intake:	**Seymour Lake intake #2**	***Waterworks Name:***	
Surface water source:	Seymour Lake	***Groundwater source:***	
EMS ID:	E207553	***Latitude:***	54.7459
Map sheet	93L075	***Longitude:***	127.1581
Street address	2153 Hudson Bay Mtn Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 SL3**		
Domestic water intake:	**Seymour Lake intake #3**	***Waterworks Name:***	
Surface water source:	Seymour Lake	***Groundwater source:***	
EMS ID:	E207554	***Latitude:***	54.7491
Map sheet	93L075	***Longitude:***	127.1685
Street address	2365 Carr Rd		
Treatment:	none		
Other Observations:	Outside tap		

Appendix 1 Table 1 (continued) Site Identification Guide Drinking Water Source Quality Monitoring

Map notation:	**Figure 2 TL2**		
Domestic water intake:	**Tyhee Lake intake #2**	***Waterworks Name:***	
Surface water source:	Tyhee Lake	***Groundwater source:***	
EMS ID:	E207560	***Latitude:***	54.7216
Map sheet	93L075	***Longitude:***	127.053
Street address	Seaplane Base Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 2 TL3**		
Domestic water intake:	**Tyhee Lake intake #3**	***Waterworks Name:***	
Surface water source:	Tyhee Lake	***Groundwater source:***	
EMS ID:	E207561	***Latitude:***	54.7228
Map sheet	93L075	***Longitude:***	127.0344
Street address	6943 Lake Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 2 TL4**		
Domestic water intake:	**Tyhee Lake intake #4**	***Waterworks Name:***	
Surface water source:	Tyhee Lake	***Groundwater source:***	
EMS ID:	E207562	***Latitude:***	54.7214
Map sheet	93L075	***Longitude:***	127.0344
Street address	6741 Penner Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 2 RL2**		
Domestic water intake:	**Round Lake intake #2**	***Waterworks Name:***	
Surface water source:	Round Lake	***Groundwater source:***	
EMS ID:	E207556	***Latitude:***	54.6631
Map sheet	93L066	***Longitude:***	126.9322
Street address	22709 Woodmere Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 2 RL3**		
Domestic water intake:	**Round Lake intake #3**	***Waterworks Name:***	
Surface water source:	Round Lake	***Groundwater source:***	
EMS ID:	E207557	***Latitude:***	54.6578
Map sheet	93L066	***Longitude:***	126.9127
Street address	Round Lake Rd		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 2 RL4**		
Domestic water intake:		***Waterworks Name:***	**Round Lake Water Supply**
Surface water source:	Round Lake	***Groundwater source:***	
EMS ID:	E207558	***Latitude:***	54.6472
Map sheet	93L066	***Longitude:***	126.928
Street address	Highway 16		
Treatment:	none		
Other Observations:	Outside tap at main house		

Appendix 1 Table 1 (continued) Site Identification Guide Drinking Water Source Quality Monitoring

Map notation:	**Figure 4 LL1**		
Domestic water intake:	**Lakelse Lake intake #1**	***Waterworks Name:***	
Surface water source:	Lakelse Lake	***Groundwater source:***	
EMS ID:	E207580	***Latitude:***	54.4125
Map sheet	103I038	***Longitude:***	128.5544
Street address			
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 4 LL2**		
Domestic water intake:		***Waterworks Name:***	**Waterlily Bay Resort**
Surface water source:	Lakelse Lake	***Groundwater source:***	
EMS ID:	E246120	***Latitude:***	54.4058
Map sheet	103I038	***Longitude:***	128.5286
Street address			
Treatment:	none		
Other Observations:	Outside tap on front of resort office		
Map notation:	**Figure 4 LL3**		
Domestic water intake:	**Lakelse Lake intake #3**	***Waterworks Name:***	
Surface water source:	Lakelse Lake	***Groundwater source:***	
EMS ID:	E246121	***Latitude:***	54.3628
Map sheet	103I038	***Longitude:***	128.5544
Street address	2757 1st Ave		
Treatment:	none		
Other Observations:	Outside tap		
Map notation:	**Figure 1 Toboggan**		
Domestic water intake:	**Eight domestic intakes**	***Waterworks Name:***	
Surface water source:	Toboggan Creek	***Groundwater source:***	
EMS ID:	E245370	***Latitude:***	54.9397
Map sheet	93L094	***Longitude:***	127.3397
Street address			
Treatment:	none		
Other Observations:	Upstream of Highway 16 culvert		
Map notation:	**Figure 2 Bulkley**		
Domestic water intake:		***Waterworks Name:***	**Village of Telkwa Water**
Surface water source:	Bulkley River	***Groundwater source:***	
EMS ID:	E246125	***Latitude:***	54.6964
Map sheet	93L085	***Longitude:***	127.0528
Street address	Riverside St		
Treatment:	none		
Other Observations:	Bulkley River near Telkwa water system intake in front of Village Office		
Map notation:	**Figure 3 SHazelton**		
Domestic water intake:		***Waterworks Name:***	**South Hazelton Waterworks District**
Surface water source:	Chicago Creek	***Groundwater source:***	
EMS ID:	E246124	***Latitude:***	55.2225
Map sheet	93M022	***Longitude:***	127.6622
Street address	1565 Aldous St		
Treatment:	none		
Other Observations:	Outside tap at firehall		

Appendix 1 Table 1 (continued) Site Identification Guide Drinking Water Source Quality Monitoring

Map notation:	**Figure 4 Woodlands**		
Domestic water intake:		***Waterworks Name:***	**Woodlands Utilities Ltd.**
Surface water source:	Three springs (not in use at time of sampling)	***Groundwater source:***	Deep well
EMS ID:	E246123	***Latitude:***	54.4975
Map sheet	103I048	***Longitude:***	128.5239
Street address	1713 Laurel St		
Treatment:	none, except chlorination during annual line flushing		
Other Observations:	Outside tap at Double 'S' Ranch		
Map notation:	**Figure 4 Hotsprings Resort**		
Domestic water intake:		***Waterworks Name:***	**Mt. Layton Holdings Ltd.**
Surface water source:	Mountain Creek	***Groundwater source:***	
EMS ID:	E246122	***Latitude:***	54.3581
Map sheet	103I038	***Longitude:***	128.5419
Street address	Highway 37		
Treatment:	Ozonation		
Other Observations:	Kitchen tap in restaurant		

Appendix 2 Table 1a. Water analysis microbiological & inorganic, E207549 Kathlyn Lake intake #2, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					10	1			
25-Jul-88	< 2					7	0.8			
01-Aug-88	< 2					5	0.7			
07-Aug-88	< 2					10	0.7			
15-Aug-88	< 2					5	1			
17-Jul-89	10					5	0.8			
24-Jul-89	< 2					5	0.6			
31-Jul-89	2									
08-Aug-89	< 2					5	0.8			
14-Aug-89	< 2					5	0.7			
04-Jul-90	< 2					10	3			
10-Jul-90	< 2					15	1			
17-Jul-90	1					10	2			
24-Jul-90	< 2					10	1			
30-Jul-90	< 2					15	0.9			
11-Jul-91	< 2					10	2			
17-Jul-91	< 2					10	1.2			
23-Jul-91	< 2					10	1			
02-Aug-91	< 2					10	0.9			
08-Aug-91	< 2					10	1			
20-Jul-92	< 2					10	0.8			
27-Jul-92	< 2					10	0.6			
04-Aug-92	< 2					10	0.4			
10-Aug-92	< 2					10	1.2			
08-Jul-93	< 1					15	0.4			
14-Jul-93	< 1					5	0.3			
22-Jul-93	< 1					15	0.6			
28-Jul-93	< 1					10	0.4			
05-Aug-93	< 1					10	0.7			
03-Oct-01	< 1	< 1	< 1	7.1	45	16	2.14	0.014	0.012	< 0.002
08-Oct-01	7	3	< 1	7.18	47	13	2.05	0.013	0.011	< 0.002
14-Oct-01	2	2	< 1	6.95	48	13	2.25	0.015	0.013	< 0.002
22-Oct-01	1	1	< 1	7.11	46	13	1.42	0.008	0.006	< 0.002
29-Oct-01	2	2	< 1	7.25	46	11	1.8	0.002	0	< 0.002
29-Oct-01				7.23	46	11	1.8	0.003	0.001	< 0.002

Appendix 2 Table 1b. Water analysis total metals, E207549 Kathlyn Lake intake #2, 22 October 2001

Total metal (mg/L)			Total metal (mg/L)		
Hardness-T		16.9403	Mn-T		0.06
Ag-T	<	0.01	Mo-T		0.02
Al-T	<	0.06	Na-T		1.5
As-T	<	0.06	Ni-T	<	0.02
B--T	<	0.01	P--T	<	0.1
Ba-T		0.008	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.4
Ca-T		5.3	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		2.31
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.028	Sr-T		0.02
Fe-T		0.231	Ti-T	<	0.002
K--T		0.5	V--T	<	0.01
Mg-T		0.9	Zn-T		0.141

Appendix 2 Table 2a. Water analysis microbiological & inorganic, E207550 Kathlyn Lake intake #3, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					10	0.7			
25-Jul-88	< 2					6	0.8			
01-Aug-88	2					10	0.9			
07-Aug-88	< 2					6	0.8			
15-Aug-88	< 2					5	0.7			
17-Jul-89	8					5	1			
24-Jul-89	7					15	0.9			
31-Jul-89	71					5	2			
08-Aug-89	135					5	1.6			
14-Aug-89	60					5	1.3			
04-Jul-90	2					15	2			
10-Jul-90	50					20	1			
17-Jul-90	3					15	3			
24-Jul-90	< 2					10	1			
30-Jul-90	4					10	1			
11-Jul-91	< 2					15	4.5			
17-Jul-91	< 2					20	2.5			
23-Jul-91	< 2					15	0.9			
02-Aug-91	< 2					15	0.8			
08-Aug-91	< 2					10	1.2			
15-Jul-92	1					20	0.8			
20-Jul-92	< 2					10	0.5			
27-Jul-92	28					10	0.5			
04-Aug-92	< 2					10	0.4			
10-Aug-92	< 2					5	0.9			
08-Jul-93	< 1					15	0.3			
21-Jul-93	< 1					10	0.9			
28-Jul-93	< 1					15	0.4			
05-Aug-93	< 1					10	0.3			
03-Oct-01	7	7	< 1	7.12	46	13	2.13	0.03	0.028	< 0.002
08-Oct-01	3	3	< 1	7.67	51	11	1.05	0.002	0	< 0.002
14-Oct-01	139	139	< 1	7.44	49	13	3.31	0.021	0.019	< 0.002
22-Oct-01	57	49	< 1	7.33	49	13	1.65	0.035	0.033	< 0.002
29-Oct-01	< 1	< 1	< 1	7.49	54	13	2.2	0.024	0.022	< 0.002
29-Oct-01				7.39	54	13	2	0.025	0.023	< 0.002

Appendix 2 Table 2b. Water analysis total metals, E207550 Kathlyn Lake intake #3, 22 October 2001

Total metal (mg/L)			Total metal (mg/L)		
Hardness T		18.8503	Mn-T		0.331
Ag-T	<	0.01	Mo-T		0.02
Al-T	<	0.06	Na-T		1.6
As-T	<	0.06	Ni-T	<	0.02
B--T		0.01	P--T	<	0.1
Ba-T		0.015	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.47
Ca-T		5.9	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		2.32
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.031	Sr-T		0.022
Fe-T		0.379	Ti-T	<	0.002
K--T		0.7	V--T	<	0.01
Mg-T		1	Zn-T		0.01

Appendix 2 Table 3a. Water analysis microbiological & inorganic, E207551 Kathlyn Lake intake #4, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. Coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					5	0.9			
25-Jul-88	< 2					5	0.8			
01-Aug-88	< 2					9	0.9			
07-Aug-88	< 2					6	0.7			
15-Aug-88	< 2					5	0.7			
17-Jul-89	< 2					5	1			
24-Jul-89	< 2					10	0.9			
31-Jul-89	< 2					5	1.1			
08-Aug-89	< 2					5	1.3			
14-Aug-89	< 2					15	1.3			
08-Jul-93	< 1					15	0.8			
14-Jul-93	< 1					20	1.4			
22-Jul-93	< 1					15	0.7			
28-Jul-93	< 1					15	0.7			
05-Aug-93	< 1					10	0.6			
03-Oct-01	5	5	< 1	7.18	45	13	1.6	0.014	0.012	< 0.002
08-Oct-01	2	2	< 1	7.23	47	11	1.31	0.008	0.008	< 0.002
14-Oct-01	4	4	< 1	6.83	48	11	1.13	0.01	0.01	< 0.002
22-Oct-01	< 1	< 1	< 1	7.18	46	13	1.4	0.002	0.002	< 0.002
29-Oct-01	< 1	< 1	< 1	7.39	46	11	1.6	0.005	0.005	< 0.002
29-Oct-01				7.29	46	11	1.6	0.005	0.005	< 0.002

Appendix 2 Table 3b. Water analysis total metals, E207551 Kathlyn Lake intake #4, 22 October 2001

		Total metal (mg/L)			Total metal (mg/L)
T Hardness		17.689	Mn-T		0.042
Ag-T	<	0.01	Mo-T		0.02
Al-T	<	0.06	Na-T		1.6
As-T	<	0.06	Ni-T	<	0.02
B--T		0.01	P--T	<	0.1
Ba-T		0.007	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.51
Ca-T		5.6	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		2.36
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.033	Sr-T		0.021
Fe-T		0.192	Ti-T	<	0.002
K--T		0.5	V--T	<	0.01
Mg-T		0.9	Zn-T		0.013

Appendix 2 Table 4a. Water analysis microbiological & inorganic, E207552 Seymour Lake intake #1, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. Coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	10						2			
25-Jul-88	< 2						6			
01-Aug-88	< 2						6			
07-Aug-88	< 2						3.7			
15-Aug-88	< 2						5			
17-Jul-89	< 2					50	4.7			
24-Jul-89	< 2					60	5.1			
31-Jul-89	2					60	8.7			
08-Aug-89	9					50	7.3			
14-Aug-89	2					50	6.4			
04-Jul-90	< 2					60	5			
10-Jul-90	< 2					70	7			
17-Jul-90	< 2					70	12			
24-Jul-90	< 2					50	7.5			
30-Jul-90	1					20	13			
11-Jul-91	< 2						2.3			
17-Jul-91	< 2						5			
23-Jul-91	< 2						4.4			
02-Aug-91	< 2						4			
08-Aug-91	< 2						5.2			
15-Jul-92	< 2						2.4			
20-Jul-92	1					55	2.2			
27-Jul-92	9						2.6			
04-Aug-92	< 2						0.3			
10-Aug-92	3						6			
08-Jul-93	< 1					80	4.7			
14-Jul-93	< 1					80				
22-Jul-93	< 1						6			
29-Jul-93	< 1						4.5			
05-Aug-93	1						5.4			
03-Oct-01	< 1	< 1	< 1	7.86	109	80	7.16	0.008	0.006	< 0.002
08-Oct-01	1	1	< 1	7.5	111	65	8.3	0.005	0.003	< 0.002
14-Oct-01	< 1	< 1	< 1	7.57	111	55	10.9	0.006	0.004	< 0.002
14-Oct-01				7:52	111	55	11.2	0.005	0.003	< 0.002
22-Oct-01	< 1	< 1	< 1	7.36	110	80	13	< 0.002	0	< 0.002
29-Oct-01	< 1	< 1	< 1	7.47	110	90	13	0.004	0.002	< 0.002

Appendix 2 Table 4b. Water analysis total metals, E207552 Seymour Lake intake #1, 22 October 2001

	Total Metal (mg/L)			Total Metal (mg/L)	
T Hardness		51.5528	Mn-T		0.124
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		3.3
As-T	<	0.06	Ni-T	<	0.02
B--T		0.02	P--T	<	0.1
Ba-T		0.045	Pb-T	<	0.06
Be-T	<	0.001	S--T		0.25
Ca-T		12.4	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		1.09
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.015	Sr-T		0.064
Fe-T		2.812	Ti-T	<	0.002
K--T		0.7	V--T	<	0.01
Mg-T		5	Zn-T		0.087

Appendix 2 Table 5a. Water analysis microbiological & inorganic, E207553 Seymour Lake intake #2, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. Coli* CFU/100ml	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	12						4.5			
25-Jul-88	4						11			
01-Aug-88	2						1.5			
07-Aug-88	< 2						3.1			
15-Aug-88	< 2						15			
17-Jul-89	6					50	1.4			
24-Jul-89	15					40	1.5			
31-Jul-89	6					60	3.9			
08-Aug-89	61					70	4.4			
14-Aug-89	202					40	2			
04-Jul-90	< 2					40	6			
10-Jul-90	< 2					< 5	2			
17-Jul-90	< 2					40	0.6			
24-Jul-90	1					40	4.5			
30-Jul-90	< 2					50	2.4			
11-Jul-91	< 2						1.5			
17-Jul-91	< 2						5.4			
23-Jul-91	1						4.5			
02-Aug-91	1						1.5			
08-Aug-91	4						23			
15-Jul-92	< 2						0.5			
20-Jul-92	1					50	0.4			
27-Jul-92	2						0.3			
04-Aug-92	2						0.3			
10-Aug-92	< 2						0.6			
08-Jul-93	< 1					70	0.6			
14-Jul-93	1					50				
22-Jul-93	1						0.5			
29-Jul-93	< 1						0.6			
05-Aug-93	< 1						0.6			
03-Oct-01	< 1	< 1	< 1	7.63	107	25	0.71	0.108	0.106	< 0.002
08-Oct-01	< 1	< 1	< 1	7.56	110	35	0.64	0.09	0.088	< 0.002
14-Oct-01	< 1	< 1	< 1	7.61	114	35	0.94	0.093	0.091	< 0.002
14-Oct-01				7.59	110	25	0.82	0.091	0.089	< 0.002
22-Oct-01	< 1	< 1	< 1	7.47	108	30	1.17	0.088	0.086	< 0.002
29-Oct-01	1	1	< 1	7.33	172	45	6.4	0.78	0.778	0.002

Appendix 2 Table 5b. Water analysis total metals, E207553 Seymour Lake intake #2, 22 October 2001

		Total metal (mg/L)			Total metal (mg/L)
Total Hardness		50.9789	Mn-T		0.053
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		3.5
As-T	<	0.06	Ni-T	<	0.02
B--T	<	0.01	P--T	<	0.1
Ba-T		0.038	Pb-T	<	0.06
Be-T	<	0.001	S--T		0.33
Ca-T		12.5	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.91
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.033	Sr-T		0.066
Fe-T		0.414	Ti-T	<	0.002
K--T		0.6	V--T	<	0.01
Mg-T		4.8	Zn-T		0.029

Appendix 2 Table 6a. Water analysis microbiological & inorganic, E207554 Seymour Lake intake #3, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. Coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2						0.5			
25-Jul-88	< 2						0.6			
01-Aug-88	< 2						1.4			
07-Aug-88	< 2						0.5			
15-Aug-88	< 2						0.8			
17-Jul-89	< 2					40	1.4			
24-Jul-89	3					40	0.7			
31-Jul-89	2					40	1.5			
08-Aug-89	9					30	1.2			
14-Aug-89	2					20	2.4			
08-Jul-93	< 1					70	0.4			
14-Jul-93	1					50				
22-Jul-93	< 1						0.2			
29-Jul-93	< 1						0.3			
05-Aug-93	< 1						0.3			
03-Oct-01	< 1	< 1	< 1	7.62	106	13	0.34	< 0.002		< 0.002
08-Oct-01	< 1	< 1	< 1	7.64	101	35	1.41	0.022	0.020	< 0.002
14-Oct-01	< 1	< 1	< 1	7.22	111	22.5	0.59	0.006	0.004	< 0.002
22-Oct-01	< 1	< 1	< 1	7.43	100	30	0.8	0.012	0.01	< 0.002
22-Oct-01				7.5	100	30	0.73	0.011	0.009	< 0.002
29-Oct-01	< 1	< 1	< 1	7.58	101	27.5	0.91	0.013	0.011	< 0.002

Appendix 2 Table 6b. Water analysis total metals, E207554 Seymour Lake intake #3, 22 October 2001

Total Metal (mg/L)			Total metal (mg/L)		
T Hardness		47.3079	Mn-T		0.005
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		3.2
As-T	<	0.06	Ni-T	<	0.02
B--T		0.02	P--T	<	0.1
Ba-T		0.04	Pb-T	<	0.06
Be-T	<	0.001	S--T		0.3
Ca-T		10.7	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.65
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.08	Sr-T		0.061
Fe-T		0.239	Ti-T	<	0.002
K--T		0.6	V--T	<	0.01
Mg-T		5	Zn-T		0.007

Appendix 2 Table 7a. Water analysis microbiological & inorganic, E207560 Tyhee Lake intake #2, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E.coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
07/18/88	12					5	0.7			
07/25/88	4					< 5	0.5			
08/01/88	2					< 5	0.8			
08/07/88	< 2					< 5	0.4			
08/15/88	< 2					< 5	0.3			
07/17/89	< 2					5	0.7			
07/24/89	< 2					10	1.1			
07/31/89	< 2					5	1.1			
08/08/89	< 2					5	1.2			
08/14/89	8					5	1.5			
07/04/90	17					15	1			
07/10/90	8					15	1			
07/17/90	2					10	0.8			
07/24/90	108					20	0.9			
07/30/90	< 2					10	1			
07/11/91	< 2					10	1.1			
07/17/91	< 2					10	1.4			
07/23/91	1					5	0.6			
08/02/91	< 2					5	1.5			
08/08/91	4					5	0.4			
07/15/92	< 2					10	0.9			
07/20/92	< 2					5	0.4			
07/27/92	< 2					8	0.6			
08/04/92	< 2									
08/10/92	< 2					10	0.5			
07/08/93	< 1					5	0.3			
07/15/93	< 1					5	0.4			
07/22/93	< 1					5	0.4			
07/29/93	4					5	0.5			
08/05/93	< 1					5	0.6			
10/02/01	< 1	<	1 <	1	8.13	281	25	10.8	0.115	0.113 < 0.002
10/02/01					8.15	279	25	13.6	0.118	0.116 < 0.002
10/08/01	< 1	<	1 <	1	8.17	285	17.5	6.32	0.119	0.117 < 0.002
10/14/01	< 1	<	1 <	1	8.1	288	11	1.02	0.052	0.050 < 0.002
10/22/01	< 1	<	1 <	1	7.97	283	13	2.89	0.135	0.133 < 0.002
10/29/01	< 1	<	1 <	1	8.13	285	11	2.1	0.129	0.127 < 0.002

Appendix 2 Table 7b. Water analysis total metals, E207560 Tyhee Lake intake #2, 22 October 2001

Total Metal (mg/L)			Total Metal (mg/L)		
Hardess-T		123.6424	Mn-T		0.103
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		9.5
As-T	<	0.06	Ni-T	<	0.02
B--T		0.01	P--T	<	0.1
Ba-T		0.041	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.89
Ca-T		32.2	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.67
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.077	Sr-T		0.229
Fe-T		0.103	Ti-T	<	0.002
K--T		3.2	V--T	<	0.01
Mg-T		10.5	Zn-T		0.015

Appendix 2 Table 8a. Water analysis microbiological & inorganic, E207561 Tyhee Lake intake #3, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					5	0.5			
25-Jul-88	2					5	0.6			
01-Aug-88	< 2					6	0.5			
07-Aug-88	< 2					< 5	0.5			
15-Aug-88	< 2					< 5	0.5			
17-Jul-89	< 2					5	3.6			
24-Jul-89	< 2					10	0.6			
31-Jul-89	< 2					5	2.5			
08-Aug-89	< 2					< 5	1.7			
14-Aug-89	< 2					< 5	1.7			
04-Jul-90	1					10	1			
10-Jul-90	< 2					10	1			
17-Jul-90	1					10	0.9			
24-Jul-90	31					5	1			
30-Jul-90	< 2					7	0.7			
11-Jul-91	< 2					10	0.9			
17-Jul-91	< 2					5	0.6			
23-Jul-91	< 2					5	0.5			
02-Aug-91	< 2					5	0.5			
08-Aug-91	< 2					5	0.4			
15-Jul-92	< 2					10	0.6			
20-Jul-92	< 2					7	0.4			
27-Jul-92	< 2					10	0.6			
04-Aug-92	< 2					5	0.2			
10-Aug-92	< 2					5	1.5			
08-Jul-93	< 1					5	0.4			
15-Jul-93	< 1					5	0.6			
22-Jul-93	< 1					5	1.6			
29-Jul-93	< 1					5	0.4			
05-Aug-93	< 1					5	0.5			
02-Oct-01	< 1	< 1	< 1	8.15	272	6	0.53	0.020	0.018	< 0.002
08-Oct-01	< 1	< 1	< 1	8.22	283	8	0.54	0.086	0.084	< 0.002
08-Oct-01				8.1	274	8	0.61	0.085	0.083	< 0.002
14-Oct-01	< 1	< 1	< 1	8.04	287	8	0.6	0.035	0.033	< 0.002
22-Oct-01	< 1	< 1	< 1	7.94	282	12.5	0.84	0.111	0.109	< 0.002
29-Oct-01	< 1	< 1	< 1	8.17	281	11	0.9	0.048	0.046	< 0.002

Appendix 2 Table 8b. Water analysis total metals, E207561 Tyhee Lake intake #3, 22 October 2001

		Total metal (mg/L)			Total metal (mg/L)
Hardness-T		124.3039	Mn-T		0.04
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		9.8
As-T	<	0.06	Ni-T	<	0.02
B--T		0.01	P--T	<	0.1
Ba-T		0.04	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.99
Ca-T		32.3	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.56
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.027	Sr-T		0.233
Fe-T		0.019	Ti-T	<	0.002
K--T		3.2	V--T	<	0.01
Mg-T		10.6	Zn-T		0.01

Appendix 2 Table 9a. Water analysis microbiological & inorganic, E207562 Tyhee Lake intake #4, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					< 5	1			
25-Jul-88	< 2					6	0.8			
01-Aug-88	< 2					< 5	0.5			
07-Aug-88	< 2					5	0.6			
15-Aug-88	< 2					< 5	2			
17-Jul-89	< 2					5	0.6			
24-Jul-89	< 2					10	0.7			
31-Jul-89	2					5	1.3			
08-Aug-89	< 2					< 5	0.7			
14-Aug-89	< 2					10	0.5			
08-Jul-93	< 1					40	2.5			
15-Jul-93	< 1					5	0.5			
22-Jul-93	< 1					5	0.9			
29-Jul-93	< 1					5	0.7			
05-Aug-93	< 1					5	3.5			
02-Oct-01	< 1	< 1	< 1	8.24	272	10	0.52	0.032	0.030	< 0.002
08-Oct-01	< 1	< 1	< 1	8.16	283	8	0.49	0.061	0.059	< 0.002
14-Oct-01	< 1	< 1	< 1	7.94	283	11	0.58	0.078	0.076	< 0.002
14-Oct-01				8.07	287	8	0.63	0.080	0.078	< 0.002
22-Oct-01	< 1	< 1	< 1	8.04	180	12.5	0.58	0.109	0.107	< 0.002
29-Oct-01	< 1	< 1	< 1	8.11	283	8	0.62	0.087	0.085	< 0.002

Appendix 2 Table 9b. Water analysis total metals, E207562 Tyhee Lake intake #4, 22 October 2001

Total metal (mg/L)			Total metal (mg/L)		
Hardness T		119.91	Mn-T		0.026
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		9.3
As-T	<	0.06	Ni-T	<	0.02
B--T	<	0.01	P--T	<	0.1
Ba-T		0.038	Pb-T	<	0.06
Be-T	<	0.001	S--T		2.82
Ca-T		31.2	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.56
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.06	Sr-T		0.222
Fe-T		0.011	Ti-T	<	0.002
K--T		3.1	V--T	<	0.01
Mg-T		10.2	Zn-T		0.006

Appendix 2 Table 10a. Water analysis microbiological & inorganic, E207556 Round Lake intake #2, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					10	1			
25-Jul-88	14					10	1.5			
01-Aug-88	< 2					8	1.3			
07-Aug-88	< 2					10	1			
15-Aug-88	< 2					5	0.7			
17-Jul-89	< 2					15	2			
24-Jul-89	< 2					10	0.8			
31-Jul-89	< 2					5	0.7			
08-Aug-89	< 2					5	1			
14-Aug-89	< 2					10	1.4			
04-Jul-90	< 2					15	2			
10-Jul-90	< 2					20	1			
17-Jul-90	< 2					20	1			
24-Jul-90	< 2					15	0.8			
30-Jul-90	1					10	0.8			
11-Jul-91	< 2					10	1.7			
17-Jul-91	< 2					15	1.5			
23-Jul-91	< 2					15	1.5			
02-Aug-91	< 2					10	0.6			
08-Aug-91	< 2					10	0.8			
15-Jul-92	< 2					15	0.7			
20-Jul-92	< 2					15	0.4			
27-Jul-92	< 2					10	0.3			
04-Aug-92	< 2					10	0.6			
10-Aug-92	< 2					10	0.7			
08-Jul-93	< 1					15	0.3			
15-Jul-93	< 1					20	0.7			
22-Jul-93	< 1					20	1.2			
29-Jul-93	< 1					15	0.5			
05-Aug-93	2					15	2			
03-Oct-01	< 1	< 1	< 1	8.08	257	13	1.52	0.105	0.103	< 0.002
08-Oct-01	< 1	< 1	< 1	8.2	266	12.5	0.61	0.087	0.085	< 0.002
14-Oct-01	< 1	< 1	< 1	8.04	273	13	0.73	0.109	0.107	< 0.002
22-Oct-01	< 1	< 1	< 1	7.91	265	13	1.33	0.168	0.166	< 0.002
22-Oct-01				8.01	264	18	1.43	0.168	0.166	< 0.002
29-Oct-01	< 1	< 1	< 1	8.06	270	13	2.1	0.206	0.204	< 0.002

Appendix 2 Table 10b. Water analysis total metals, E207556 Round Lake intake #2, 22 October 2001

	Total metal (mg/L)			Total metal (mg/L)	
Hardness-T		114.3904	Mn-T		0.017
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		8.5
As-T	<	0.06	Ni-T	<	0.02
B--T		0.02	P--T	<	0.1
Ba-T		0.043	Pb-T	<	0.06
Be-T	<	0.001	S--T		1.01
Ca-T		28	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.2
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.038	Sr-T		0.181
Fe-T		0.122	Ti-T	<	0.002
K--T		5.5	V--T	<	0.01
Mg-T		10.8	Zn-T		0.368

Appendix 2 Table 11a. Water analysis microbiological & inorganic, E207557 Round Lake intake #3, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					40	1.5			
25-Jul-88	< 2					20	5.3			
01-Aug-88	< 2					40	2.7			
07-Aug-88	< 2					10	3			
15-Aug-88	< 2					15	2			
17-Jul-89	< 2					10	0.4			
24-Jul-89	< 2					20	2.1			
31-Jul-89	< 2					10	2.5			
08-Aug-89	2					10	1.5			
14-Aug-89	< 2					15	1.1			
04-Jul-90	< 2					20	2			
10-Jul-90	< 2					20	2			
17-Jul-90	2					20	1			
24-Jul-90	1					15	1			
30-Jul-90	1					20	1.5			
11-Jul-91	< 2					15	1.5			
17-Jul-91	< 2					30	1.8			
23-Jul-91	2					20	1.9			
02-Aug-91	2					15	1.5			
08-Aug-91	< 2					50	4.5			
15-Jul-92	< 2					50	4.1			
20-Jul-92	< 2					20	1.9			
27-Jul-92	< 2					10	0.5			
04-Aug-92	< 2					10	0.4			
10-Aug-92	< 2					10	0.8			
08-Jul-93	< 1					15	0.3			
15-Jul-93	< 1					30	1.4			
22-Jul-93	< 1					40	3			
29-Jul-93	3					120	5.8			
05-Aug-93	1					60	6.5			
02-Oct-01	< 1	< 1	< 1	8.17	263	18	1.45	0.029	0.027	< 0.002
08-Oct-01	1	1	< 1	8.22	268	13	0.91	0.037	0.035	< 0.002
14-Oct-01	1	1	< 1	8.03	268	13	1.5	0.052	0.050	< 0.002
22-Oct-01	< 1	< 1	< 1	7.95	265	15	1.5	0.121	0.118	0.003
22-Oct-01				7.95	263	18	4.25	0.135	0.133	0.002
29-Oct-01	< 1	< 1	< 1	8.08	264	13	1.7	0.082	0.078	0.004

Appendix 2 Table 11b. Water analysis total metals, E207557 Round Lake intake #3, 22 October 2001

		Total metal (mg/L)			Total metal (mg/L)
Hardness-T		114.8898	Mn-T		0.061
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		8.4
As-T	<	0.06	Ni-T	<	0.02
B--T	<	0.01	P--T	<	0.1
Ba-T		0.045	Pb-T	<	0.06
Be-T	<	0.001	S--T		1
Ca-T		28.2	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.25
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.045	Sr-T		0.184
Fe-T		0.088	Ti-T	<	0.002
K--T		5.6	V--T	<	0.01
Mg-T		10.8	Zn-T		0.144

Appendix 2 Table 12a. Water analysis microbiological & inorganic, E207558 Round Lake intake #4, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
18-Jul-88	< 2					15	3			
25-Jul-88	< 2					15	3.3			
01-Aug-88	2					12	2.5			
07-Aug-88	< 2					25	1.7			
15-Aug-88	4					10	1			
17-Jul-89	< 2					30	3			
24-Jul-89	< 2					10	1.3			
31-Jul-89	< 2					15	0.6			
08-Aug-89	< 2					10	1.2			
14-Aug-89	< 2					10	1			
08-Jul-93	< 1					15	1.6			
15-Jul-93	1					20	1.4			
22-Jul-93	< 1					20	1.2			
29-Jul-93	< 1					15	1.5			
05-Aug-93	< 1					15	1.2			
02-Oct-01	< 1	< 1	< 1	8.05	266	20	9.52	0.091	0.089	< 0.002
08-Oct-01	< 1	< 1	< 1	8.17	270	12.5	0.65	0.072	0.070	< 0.002
14-Oct-01	< 1	< 1	< 1	7.94	276	13	0.72	0.097	0.071	0.026
22-Oct-01	< 1	< 1	< 1	7.82	264	16	1.3	0.192	0.190	< 0.002
29-Oct-01	< 1	< 1	< 1	8.05	263	16	2.4	0.056	0.049	0.007
29-Oct-01				8.06	265	18	1.5	0.057	0.050	0.007

Appendix 2 Table 12b. Water analysis total metals, E207558 Round Lake intake #4, 22 October 2001

	Total metal (mg/L)			Total metal (mg/L)	
Hardness-T		114.6401	Mn-T		0.139
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		8.6
As-T	<	0.06	Ni-T	<	0.02
B--T	<	0.01	P--T	<	0.1
Ba-T		0.048	Pb-T	<	0.06
Be-T	<	0.001	S--T		1
Ca-T		28.1	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		0.26
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.111	Sr-T		0.18
Fe-T		0.079	Ti-T	<	0.002
K--T		5.5	V--T	<	0.01
Mg-T		10.8	Zn-T		0.012

Appendix 2 Table 13a. Water analysis microbiological & inorganic, E207580 Lakelse Lake intake #1, 1988 - 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
09-Aug-88	< 2						1.8			
15-Aug-88	< 2						0.3			
21-Aug-88	< 2						0.4			
29-Aug-88	< 2						0.9			
05-Sep-88	< 2						0.5			
28-Jun-89	2						0.3			
05-Jul-89	< 2						0.1			
11-Jul-89	< 2						0.5			
19-Jul-89	< 2						0.5			
24-Jul-89	< 2						0.7			
21-Aug-90	< 2						0.7			
26-Aug-90	< 2						0.8			
05-Sep-90	2						0.5			
11-Sep-90	1						0.4			
17-Sep-90	3						0.5			
07-Aug-91	< 2						0.5			
13-Aug-91	< 2						0.5			
11-Aug-92	< 2						0.6			
19-Aug-92	< 2						0.3			
24-Aug-92	< 2						0.5			
31-Aug-92	< 2						0.4			
07-Sep-92	1						0.6			
01-Oct-01	2	< 2	< 1	7.12	52	22.5	2.78	0.026	0.024	< 0.002
01-Oct-01				7.34	52	22.5	3.5	0.028	0.026	< 0.002
09-Oct-01	< 1	< 1	< 1	7.37	52	18	2.62	0.032	0.030	< 0.002
15-Oct-01	1	1	< 1	7.01	50	22.5	2.28	0.037	0.035	< 0.002
22-Oct-01	3	3	< 1	7.28	51	22.5	1.75	0.037	0.035	< 0.002
29-Oct-01	3	3	< 1	7.46	52	22.5	2.06	0.043	0.041	< 0.002

Appendix 2 Table 13b. Water analysis total metals (mg/L), E207580 Lakelse intake #1, 01 October 2001

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Ca-T	Cd-T
01-Oct-01	18.4516	< 0.01	0.1	< 0.06	< 0.01	0.009	< 0.001	6.4	< 0.006
01-Oct-01	18.4516	< 0.01	0.15	< 0.06	0.04	0.013	0.002	6.4	< 0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	K--T	Mg-T	Mn-T	Mo-T	Na-T
01-Oct-01	< 0.006	< 0.006	0.052	0.283	0.3	0.6	0.018	< 0.01	1.9
01-Oct-01	< 0.006	< 0.006	0.041	0.372	0.3	0.6	0.032	< 0.01	1.9

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T
01-Oct-01	< 0.02	< 0.1	< 0.06	0.63	< 0.06	< 0.06	1.97	< 0.06	0.034
01-Oct-01	< 0.02	< 0.1	< 0.06	0.6	< 0.06	< 0.06	2.1	< 0.06	0.036

Date	Ti-T	V--T	Zn-T
01-Oct-01	0.003	< 0.01	0.009
01-Oct-01	0.008	< 0.01	0.01

Appendix 2 Table 14a. Water analysis microbiological & inorganic, E207582 Lakelse Lake intake North East (1988-1992) and E246120 Lakelse Lake intake #2 (2001)

E207582 Lakelse Lake North East (surface water grab between Gainey Pt. and Waterlily Bay Resort)

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
09-Aug-88	2						0.7			
15-Aug-88	< 2						0.4			
21-Aug-88	< 2						0.4			
29-Aug-88	< 2						0.7			
05-Sep-88	2						0.5			
28-Jun-89	< 2						0.3			
05-Jul-89	2						0.6			
11-Jul-89	< 2						0.3			
19-Jul-89	< 2						0.4			
24-Jul-89	2						0.5			
21-Aug-90	< 2						0.5			
26-Aug-90	1						0.5			
05-Sep-90	1						0.6			
11-Sep-90	< 2						0.6			
17-Sep-90	1						0.5			
07-Aug-91	< 2						0.3			
13-Aug-91	< 2						0.4			
11-Aug-92	< 2						0.4			
19-Aug-92	< 2						0.4			
24-Aug-92	< 2						0.5			
31-Aug-92	< 2						0.4			
07-Sep-92	2						1.1			

E246120 Lakelse Lake intake #2 (Waterlily Bay Resort water intake)

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
01-Oct-01	7	< 2	< 1	7.46	48	21	3.49	0.019	0.017	< 0.002
09-Oct-01	22	15	< 1	7.38	51	20	3.75	0.021	0.019	< 0.002
15-Oct-01	4	4	< 1	7.29	52	22.5	3.42	0.023	0.021	< 0.002
22-Oct-01	7	7	< 1			30		0.026	0.024	< 0.002
29-Oct-01	< 1	< 1	< 1	7.54	52	22.5	3.6	0.029	0.027	< 0.002
29-Oct-01				7.54	52	22.5	3.6	0.029	0.027	< 0.002

Appendix 2 Table 14b. Water analysis total metals, E245120 Lakelse intake #2, (Waterlily Bay Resort) 01 October 2001

Total metal (mg/L)			Total metal (mg/L)		
Hardness-T		18.7013	Mn-T		0.022
Ag-T	<	0.01	Mo-T	<	0.01
Al-T		0.17	Na-T		1.7
As-T	<	0.06	Ni-T	<	0.02
B--T		0.02	P--T	<	0.1
Ba-T		0.011	Pb-T	<	0.06
Be-T	<	0.001	S--T		0.58
Ca-T		6.5	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		2.14
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.018	Sr-T		0.033
Fe-T		0.303	Ti-T		0.006
K--T		0.3	V--T	<	0.01
Mg-T		0.6	Zn-T		0.027

Appendix 2 Table 15a. Water analysis microbiological & inorganic, E207581 Lakelse Lake - Gainey Pt. (1988-1992) and E246121 Lakelse Lake Intake #3 (2001)

E207581 Lakelse Lake - Gainey Pt. (surface water grab) 1988-1992

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
09-Aug-88	< 2						0.6			
15-Aug-88	< 2						0.4			
21-Aug-88	2						0.4			
29-Aug-88	2						0.5			
05-Sep-88	< 2						0.5			
28-Jun-89	< 2						0.4			
05-Jul-89	< 2						0.3			
11-Jul-89	< 2						0.4			
19-Jul-89	2						0.5			
25-Jul-89	< 2						0.8			
21-Aug-90	3						0.4			
26-Aug-90	< 2						0.5			
05-Sep-90	< 2						0.6			
11-Sep-90	< 2						0.6			
17-Sep-90	1						0.5			
07-Aug-91	< 2						0.3			
13-Aug-91	< 2						0.4			
11-Aug-92	< 2						0.5			
19-Aug-92	1						0.4			
24-Aug-92	< 2						0.4			
31-Aug-92	< 2						0.3			
07-Sep-92	2						0.8			

E246121 Lakelse Lake Intake #3 (2001)

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
01-Oct-01	< 1	< 2	< 1	7.33	56	11	0.52	0.028	0.025	0.003
09-Oct-01	32	12	< 1	7.12	51	20	2.8	0.021	0.019	< 0.002
15-Oct-01	1	1	< 1	7.27	52	18	2.72	0.043	0.041	< 0.002
22-Oct-01	1	1	< 1	7.22	51	30	4.7	0.047	0.045	< 0.002
22-Oct-01				7.26	52	30	7.22	0.043	0.041	< 0.002
29-Oct-01	100	100	< 1	7.47	51	65	16.4	0.029	0.027	< 0.002

Appendix 2 Table 15b. Water analysis total metals, E246121 Lakelse Water intake #3, 01 October 2001

	Total metal (mg/L)			Total metal (mg/L)	
Hardness-T		20.3616	Mn-T		0.102
Ag-T	<	0.01	Mo-T	<	0.01
Al-T	<	0.06	Na-T		2.1
As-T	<	0.06	Ni-T	<	0.02
B--T		0.02	P--T	<	0.1
Ba-T		0.015	Pb-T	<	0.06
Be-T		0.003	S--T		0.68
Ca-T		7	Sb-T	<	0.06
Cd-T	<	0.006	Se-T	<	0.06
Co-T	<	0.006	Si-T		1.98
Cr-T	<	0.006	Sn-T	<	0.06
Cu-T		0.021	Sr-T		0.042
Fe-T		0.412	Ti-T	<	0.002
K--T		0.3	V--T	<	0.01
Mg-T		0.7	Zn-T		0.016

Appendix 2 Table 16a. Water analysis microbiological and inorganic, E245370 Toboggan Creek, October 2001 Highway 16, October 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
04-Oct-01	1*	1* <	1*	7.41	90	8	1.15	0.048 <	0.046 <	0.002
10-Oct-01	19	18	12	7.69	100 <	13	0.1	0.048 <	0.046 <	0.002
15-Oct-01	12	8 <	1	7.66	103	11	1.23	0.067 <	0.065 <	0.002
22-Oct-01	37	37 <	1	7.55	91	11	1.58	0.082 <	0.08 <	0.002
22-Oct-01				7.78	105	11	1.51	0.081 <	0.079 <	0.002
29-Oct-01	17	8 <	1	7.94	112 <	16	1.9	0.096 <	0.094 <	0.002

* Not analyzed within recommended holding times.

Appendix 2 Table 16b. Water analysis total metals, E245370 Toboggan Creek, October 2001

mg/L

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
10/04/01	34.96267134 <	0.00002	0.0477	0.0006	0.004	0.00979	0.000004 <	0.00002	10.7 <	0.00001
10/10/01	43.4437 <	0.01	0.17 <	0.06 <	0.01	0.012 <	0.001		14.1 <	0.006
10/15/01	47.83732188 <	0.00002	0.036	0.0003	0.005	0.01113	0.000004 <	0.00002	15.4	0.00001
10/22/01	48.2625 <	0.01	0.06 <	0.06 <	0.01	0.011 <	0.001		15.7 <	0.006
10/22/01	49.0116 <	0.01	0.06 <	0.06 <	0.01	0.012 <	0.001		16 <	0.006
10/29/01	45.104 <	0.01	0.08 <	0.06 <	0.01	0.01 <	0.001		14.6 <	0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	Li-T	K--T	Mg-T	Mn-T	Mo-T	Na-T
10/04/01	0.000071	0.009	0.00159	0.221	0.00013	0.3	2.00213	0.019855	0.01143	1.4
10/10/01 <	0.006 <	0.006 <	0.006	0.462		0.5	2	0.034 <	0.01	1.8
10/15/01	0.000047	0.0002	0.00127	0.258	0.00023	0.3	2.27866	0.02567	0.00545	1.8
10/22/01 <	0.006 <	0.006 <	0.006	0.255		0.4	2.2	0.027 <	0.01	1.8
10/22/01 <	0.006 <	0.006 <	0.006	0.256		0.4	2.2	0.026 <	0.01	1.9
10/29/01 <	0.006 <	0.006 <	0.006	0.278		0.4	2.1	0.025 <	0.01	2

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
10/04/01	0.0007 <	0.1	0.00004	3.5	0.000077	0.0003	2.6 <	0.00001	0.044135	0.002
10/10/01 <	0.02 <	0.1 <	0.06	3.82 <	0.06 <	0.06	3.1 <	0.06	0.042	0.004
10/15/01	0.00066 <	0.1	0.00003	3.85	0.000087 <	0.0002	2.94 <	0.00001	0.061654 <	0.002
10/22/01 <	0.02 <	0.1 <	0.06	3.69 <	0.06 <	0.06	3.22 <	0.06	0.045	0.002
10/22/01 <	0.02 <	0.1 <	0.06	3.66 <	0.06 <	0.06	3.25 <	0.06	0.046	0.002
10/29/01 <	0.02 <	0.1 <	0.06	3.33 <	0.06 <	0.06	2.89 <	0.06	0.044 <	0.002

Date	Tl-T	U--T	V--T	Zn-T
10/04/01	0.000005	0.000012	0.0025	0.0003
10/10/01		<	0.01 <	0.002
10/15/01 <	0.000002	0.000024	0.00064	0.0001
10/22/01		<	0.01 <	0.002
10/22/01		<	0.01 <	0.002
10/29/01		<	0.01 <	0.002

Appendix 2 Table 17a. Water analysis microbiological & inorganic, E246125 Bulkley River at Telkwa, October 2001

Date	Fecal coliform (CFU/100ml)	*E. Coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
03-Oct-01	< 1	< 1	< 1	7.43	50	3	1.53	< 0.002	< 0.002	< 0.002
10-Oct-01	2	2	< 1	7.65	54	3	0.54	0.003	0.001	< 0.002
15-Oct-01	< 1	< 1	< 1	7.41	55	3	0.93	0.005	0.003	< 0.002
15-Oct-01				7.53	56	3	0.92	0.004	0.002	< 0.002
22-Oct-01	1	1	< 1	7.45	56	8	0.68	0.005	0.003	< 0.002
29-Oct-01	< 1	< 1	< 1	7.75	58	3	0.81	0.007	0.005	< 0.002

Appendix 2 Table 17b. Water analysis total metals, E246125 Bulkley River at Telkwa, October 2001
mg/L

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
03-Oct-01	21.361 <	0.00002	0.0599	0.0001 <	0.002	0.01891	0.000007 <	0.00002	7.2	0.00001
10-Oct-01	23.520 <	0.01 <	0.06 <	0.06 <	0.01	0.019 <	0.001		8.1 <	0.006
15-Oct-01	25.798 <	0.00002	0.0333 <	0.0001 <	0.002	0.01905	0.000003 <	0.00002	8.6	0.00001
15-Oct-01	25.824 <	0.00002	0.0321 <	0.0001 <	0.002	0.01918	0.000007 <	0.00002	8.6 <	0.00001
22-Oct-01	27.090 <	0.01 <	0.06 <	0.06 <	0.01	0.02 <	0.001		9.2 <	0.006
29-Oct-01	23.682 <	0.01 <	0.06 <	0.06 <	0.01	0.017 <	0.001		8 <	0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	K--T	Li-T	Mg-T	Mn-T	Mo-T	Na-T
03-Oct-01	0.000052	0.007	0.00106	0.103	0.3	0.00012	0.82148	0.006453	0.00051	0.9
10-Oct-01 <	0.006 <	0.006 <	0.006	0.075	0.2		0.8	0.006 <	0.01	0.9
15-Oct-01	0.000007 <	0.0002	0.00091	0.093	0.2	0.00015	1.05006	0.004932	0.00180	1
15-Oct-01	0.000006 <	0.0002	0.00099	0.081	0.2	0.00014	1.05619	0.004863	0.00108	1
22-Oct-01 <	0.006 <	0.006 <	0.006	0.067	0.2		1	0.005 <	0.01	1
29-Oct-01 <	0.006 <	0.006 <	0.006	0.057	0.2		0.9	0.004 <	0.01	0.9

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
03-Oct-01	0.00052 <	0.1	0.00004	1.08	0.000023	0.0005	1.43 <	0.00001	0.033687	0.003
10-Oct-01 <	0.02 <	0.1 <	0.06	1.11 <	0.06 <	0.06	1.38 <	0.06	0.028 <	0.002
15-Oct-01	0.00042 <	0.1	0.00003	1.14	0.000043 <	0.0002	1.61	0.00002	0.041956 <	0.002
15-Oct-01	0.0004 <	0.1	0.00002	1.12	0.000038 <	0.0002	1.57	0.00001	0.041655 <	0.002
22-Oct-01 <	0.02 <	0.1 <	0.06	1.1 <	0.06 <	0.06	1.69 <	0.06	0.03 <	0.002
29-Oct-01 <	0.02 <	0.1 <	0.06	0.91 <	0.06 <	0.06	1.41 <	0.06	0.026 <	0.002

Date	Tl-T	U--T	V--T	Zn-T
03-Oct-01	0.000003	0.000023	0.00204 <	0.0001
10-Oct-01		<	0.01 <	0.002
15-Oct-01 <	0.000002		0.00041 <	0.0001
15-Oct-01 <	0.000002		0.00043 <	0.0001
22-Oct-01		<	0.01 <	0.002
29-Oct-01		<	0.01 <	0.002

Appendix 2 Table 18a. Water analysis microbiological & inorganic, E246124 South Hazelton water system (Chicago Cr.), 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
03-Oct-01	14	12	< 1	7.1	51	< 2.5	0.08	0.12	0.118	< 0.002
10-Oct-01				7.47	54	< 2.5	0.26	0.131	0.129	< 0.002
10-Oct-01	< 1	< 1	< 1	7.49	51	< 2.5	0.15	0.117	0.115	< 0.002
15-Oct-01	< 1	< 1	< 1	7.09	51	< 2.5	0.07	0.126	0.124	< 0.002
22-Oct-01	4	4	< 1	7.24	52	3	0.07	0.128	0.126	< 0.002
29-Oct-01	3	3	< 1	7.71	56	< 2.5	0.08	0.128	0.126	< 0.002

Appendix 2 Table 18b. Water analysis total metals (mg/L), E246124 South Hazelton water system (Chicago Cr.) , 2001

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
10/3/01 11:00	20.32931964 <	0.00002	0.0043	0.0003	0.004	0.00611	0.000004 <	0.00002	7.5	0.00001
10/10/01 12:30	22.8717 <	0.01 <	0.06	0.09 <	0.01	0.006 <	0.001		8.5 <	0.006
10/10/01 12:35	23.3711 <	0.01 <	0.06 <	0.06 <	0.01	0.006 <	0.001		8.7 <	0.006
10/15/01 15:00	23.77355214 <	0.00002	0.0025 <	0.0001	0.003	0.00604	0.000015	0.00004	8.7	0.00003
10/22/01 14:30	26.1178 <	0.01 <	0.06 <	0.06 <	0.01	0.007 <	0.001		9.8 <	0.006
10/29/01 14:00	25.119 <	0.01 <	0.06 <	0.06 <	0.01	0.006 <	0.001		9.4 <	0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	Li-T	K--T	Mg-T	Mn-T	Mo-T	Na-T
10/3/01 11:00	0.000016	0.0071	0.11328	0.008	0.00022	0.4	0.38898	0.000052	0.02764	0.9
10/10/01 12:30 <	0.006 <	0.006	0.069	0.008		0.4	0.4 <	0.001	0.03	0.9
10/10/01 12:35 <	0.006 <	0.006	0.071	0.015		0.3	0.4 <	0.001	0.03	0.9
10/15/01 15:00 <	0.000005	0.0003	0.08114 <	0.006	0.00025	0.4	0.49773	0.000006	0.03239	0.9
10/22/01 14:30 <	0.006 <	0.006	0.193	0.315		0.4	0.4	0.002	0.03	0.9
10/29/01 14:00 <	0.006 <	0.006	0.104	0.01		0.4	0.4	0.002	0.03	0.9

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
10/3/01 11:00	0.00046 <	0.1	0.00053	1.3	0.000405 <	0.0002	1.74	0.00006	0.038767 <	0.002
10/10/01 12:30 <	0.02 <	0.1 <	0.06	1.32 <	0.06 <	0.06	1.78 <	0.06	0.031 <	0.002
10/10/01 12:35 <	0.02 <	0.1 <	0.06	1.36 <	0.06 <	0.06	1.83 <	0.06	0.033 <	0.002
10/15/01 15:00	0.00039 <	0.1	0.0005	1.36	0.00043 <	0.0002	1.81	0.00008	0.045464 <	0.002
10/22/01 14:30 <	0.02 <	0.1 <	0.06	1.38 <	0.06 <	0.06	2.02 <	0.06	0.034 <	0.002
10/29/01 14:00 <	0.02 <	0.1 <	0.06	1.29 <	0.06 <	0.06	1.92 <	0.06	0.035 <	0.002

Date	Tl-T	U--T	V--T	Zn-T
10/3/01 11:00	0.000003	0.001499	0.00227	0.0051
10/10/01 12:30		<	0.01	0.006
10/10/01 12:35		<	0.01	0.004
10/15/01 15:00 <	0.000002	0.001929	0.00067	0.0041
10/22/01 14:30		<	0.01	0.007
10/29/01 14:00		<	0.01	0.007

Appendix 2 Table 19a. Water analysis microbiological & inorganic, E246123 Woodlands Utilities, October 2001

Date	Fecal coliform (CFU/100ml)	*E. coli* (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
01-Oct-01	< 1	< 2	< 1	7.93	303	3	0.17	0.108	0.106	< 0.002
09-Oct-01	< 1	< 1	< 1	7.98	448	< 2.5	0.19	0.036	0.034	< 0.002
09-Oct-01				8.07	416	< 2.5	0.23	0.036	0.034	< 0.002
15-Oct-01	< 1	< 1	< 1	8.01	468	2.5	0.13	0.03	0.028	0.002
22-Oct-01	< 1	< 1	< 1	8	414	3	0.13	0.088	0.086	< 0.002
29-Oct-01	< 1	< 1	< 1	8.08	470	< 2.5	0.18	0.023	0.021	< 0.002

Appendix 2 Table 19b. Water analysis total metals (mg/L), E245123 Woodlands Utilities, October 2001

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
01-Oct-01	83.6151 <	0.01 <	0.06 <	0.06	0.02	0.042 <	0.001		25.9 <	0.006
09-Oct-01	116.0417 <	0.01 <	0.06 <	0.06 <	0.01	0.045 <	0.001		31.3 <	0.006
09-Oct-01	115.5423 <	0.01 <	0.06 <	0.06 <	0.01	0.044 <	0.001		31.1 <	0.006
15-Oct-01	116.379 <	0.01 <	0.06 <	0.06 <	0.01	0.042 <	0.001		31.6 <	0.006
22-Oct-01	111.9430 <	0.00002 <	0.0002	0.0015	0.021	0.04364	0.000004 <	0.00002	30.3 <	0.00001
29-Oct-01	117.5268 <	0.01 <	0.06 <	0.06	0.01	0.047 <	0.001		31.4 <	0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	Li-T	K--T	Mg-T	Mn-T	Mo-T	Na-T
01-Oct-01 <	0.006 <	0.006	0.038	0.034		1.7	4.6	0.003 <	0.01	19.2
09-Oct-01 <	0.006 <	0.006	0.007	0.022		3.6	9.2	0.001	0.01	45.4
09-Oct-01 <	0.006 <	0.006	0.008	0.026		3.5	9.2	0.001	0.01	45.4
15-Oct-01 <	0.006 <	0.006 <	0.006	0.014		3.5	9.1	0.002	0.01	45.7
22-Oct-01	0.000005	0.0019	0.01004	0.027	0.00096	3.2	8.81105	0.002852	0.0045	39.6
29-Oct-01 <	0.006 <	0.006 <	0.006	0.02		3.4	9.5	0.004 <	0.01	44.2

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
01-Oct-01 <	0.02 <	0.1 <	0.06	4.08 <	0.06 <	0.06	4.81 <	0.06	0.103 <	0.002
09-Oct-01 <	0.02 <	0.1 <	0.06	7.9 <	0.06 <	0.06	5.11 <	0.06	0.228 <	0.002
09-Oct-01 <	0.02 <	0.1 <	0.06	7.93 <	0.06 <	0.06	5.07 <	0.06	0.225 <	0.002
15-Oct-01 <	0.02 <	0.1 <	0.06	8.15 <	0.06 <	0.06	4.98 <	0.06	0.249 <	0.002
22-Oct-01	0.00119 <	0.1	0.00022	7.12	0.000012	0.0011	5.64 <	0.00001	0.2424 <	0.002
29-Oct-01 <	0.02 <	0.1 <	0.06	7.89 <	0.06 <	0.06	5.27 <	0.06	0.256 <	0.002

Date	Tl-T	U--T	V--T	Zn-T
01-Oct-01		<	0.01	0.014
09-Oct-01		<	0.01 <	0.002
09-Oct-01		<	0.01	0.002
15-Oct-01		<	0.01 <	0.002
22-Oct-01 <	0.000002	0.00094	0.00059	0.0016
29-Oct-01		<	0.01	0.004

Appendix 2 Table 20a. Water analysis microbiological & inorganic, E246122 Mt. Layton Hotsprings Resort, 2001

Date	Fecal coliform (CFU/100ml)	E. coli (CFU/100ml)	Enterococci (CFU/100ml)	pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
01-Oct-01	< 1	< 2	< 1	7.42	36	16	0.37	0.009	0.007	< 0.002
09-Oct-01	< 1	< 1	< 1	7.2	38	8	0.46	0.009	0.007	< 0.002
15-Oct-01	< 1	< 1	< 1	7.4	36	11	0.47	0.012	0.010	0.002
15-Oct-01				7.28	35	11	0.4	0.011	0.009	< 0.002
22-Oct-01	< 1	< 1	< 1	6.91	43	11	0.51	0.013	0.011	< 0.002
29-Oct-01	< 1	< 1	< 1	7.34	28	22.5	1.2	0.004	0.002	< 0.002

Appendix 2 Table 20b. Water analysis total metals (mg/L), E246122 Mt. Layton Hotsprings Resort, October 2001

Date	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
01-Oct-01	12.7216 <	0.01	0.1	0.11	0.02	0.022	0.011		4.6	0.012
09-Oct-01	15.9677 <	0.01	0.08 <	0.06 <	0.01	0.013 <	0.001		5.9 <	0.006
15-Oct-01	14.9689 <	0.01	0.11 <	0.06 <	0.01	0.013 <	0.001		5.5 <	0.006
15-Oct-01	14.7192 <	0.01	0.12 <	0.06 <	0.01	0.013 <	0.001		5.4 <	0.006
22-Oct-01	17.96133658 <	0.00002	0.1004 <	0.0001 <	0.002	0.01332	0.000015 <	0.00002	6.5 <	0.00001
29-Oct-01	12.2222 <	0.01	0.25 <	0.06 <	0.01	0.013 <	0.001		4.4 <	0.006

Date	Co-T	Cr-T	Cu-T	Fe-T	K--T	Li-T	Mg-T	Mn-T	Mo-T	Na-T
01-Oct-01	0.012	0.012	0.128	0.054	0.3		0.3	0.016 <	0.01	1.3
09-Oct-01 <	0.006 <	0.006	0.113	0.055	0.3		0.3	0.004 <	0.01	1.4
15-Oct-01 <	0.006 <	0.006	0.104	0.096 0	0.096		0.3	0.011 <	0.01	1.3
15-Oct-01 <	0.006 <	0.006	0.107	0.086 0	0.086		0.3	0.008 <	0.01	1.3
22-Oct-01	0.000024	0.0005	0.14519	0.104	0.3 <	0.00005	0.42031	0.0102	0.00167	1.5
29-Oct-01 <	0.006 <	0.006	0.154	0.195	0.2		0.3	0.023 <	0.01	1

Date	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
01-Oct-01 <	0.02 <	0.1 <	0.06	0.37 <	0.06 <	0.06	2.89 <	0.06	0.048	0.002
09-Oct-01 <	0.02 <	0.1 <	0.06	0.42 <	0.06 <	0.06	3.19 <	0.06	0.042	0.005
15-Oct-01 <	0.02 <	0.1 <	0.06	0.42 <	0.06 <	0.06	3.11 <	0.06	0.04	0.002
15-Oct-01 <	0.02 <	0.1 <	0.06	0.42 <	0.06 <	0.06	3.14 <	0.06	0.04	0.003
22-Oct-01	0.00083 <	0.1	0.00279	0.42	0.000015 <	0.0002	3.17 <	0.00001	0.065422 <	0.000002
29-Oct-01 <	0.02 <	0.1 <	0.06	0.35 <	0.06 <	0.06	2.98 <	0.06	0.035	0.005

Date	U--T	V--T	Zn-T
01-Oct-01		0.01	0.025
09-Oct-01	<	0.01	0.009
15-Oct-01	<	0.01	0.009
15-Oct-01	<	0.01	0.009
22-Oct-01	0.000231	0.00051	0.0101
29-Oct-01	<	0.01	0.012

Appendix 2 Table 21a Inorganic chemistry sequential replicate samples analysis: Relative percent mean difference of duplicates

		pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
Kathlyn Lake 2 (KL2)	Duplicate samples	7.25	46	11	1.8	0.002	0.002
		7.23	46	11	1.8	0.003	0.002
	Relative % mean difference	0.3%	0.0%	0.0%	0.0%	-40.0%	0.0%
KL3	Duplicate samples	7.49	54	13	2.2	0.024	0.002
		7.39	54	13	2	0.025	0.002
	Relative % mean difference	1.3%	0.0%	0.0%	9.5%	-4.1%	0.0%
KL4	Duplicate samples	7.39	46	11	1.6	0.005	0.002
		7.29	46	11	1.6	0.005	0.002
	Relative % mean difference	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Seymour Lake 1 (SL1)	Duplicate samples	7.57	111	55	10.9	0.006	0.002
		7.52	111	55	11.2	0.005	0.002
	Relative % mean difference	0.7%	0.0%	0.0%	-2.7%	18.2%	0.0%
SL2	Duplicate samples	7.61	114	35	0.94	0.093	0.002
		7.59	110	25	0.82	0.091	0.002
	Relative % mean difference	0.3%	3.6%	33.3%	13.6%	2.2%	0.0%
SL3	Duplicate samples	7.43	100	30	0.8	0.012	0.002
		7.5	100	30	0.73	0.011	0.002
	Relative % mean difference	-0.9%	0.0%	0.0%	9.2%	8.7%	0.0%
Tyhee Lake 2 (TL2)	Duplicate samples	8.13	281	25	10.8	0.115	0.002
		8.15	279	25	13.6	0.118	0.002
	Relative % mean difference	-0.2%	0.7%	0.0%	-23.0%	-2.6%	0.0%
TL3	Duplicate samples	8.22	283	8	0.54	0.086	0.002
		8.1	274	8	0.61	0.085	0.002
	Relative % mean difference	1.5%	3.2%	0.0%	-12.2%	1.2%	0.0%
TL4	Duplicate samples	7.94	283	11	0.58	0.078	0.002
		8.07	287	8	0.63	0.080	0.002
	Relative % mean difference	-1.6%	-1.4%	31.6%	-8.3%	-2.5%	0.0%
Round Lake 2 (RL2)	Duplicate samples	7.91	265	13	1.33	0.168	0.002
		8.01	264	18	1.43	0.168	0.002
	Relative % mean difference	-1.3%	0.4%	-32.3%	-7.2%	0.0%	0.0%
RL3	Duplicate samples	7.95	265	15	1.5	0.121	0.003
		7.95	263	18	4.25	0.135	0.002
	Relative % mean difference	0.0%	0.8%	-18.2%	-95.7%	-10.9%	40.0%

Appendix 2 Table 21a (continued) Inorganic chemistry sequential replicate samples analysis: Relative percent mean difference of duplicates

		pH (pH units)	Specific Conductance (uS/cm)	Color True (Col.unit)	Turbidity (NTU)	Nitrite + Nitrate (N) Diss. (mg/L)	Nitrite (N) Diss. (mg/L)
Round Lake 4 (RL4)	Duplicate samples	8.05	263	16	2.4	0.056	0.007
		8.06	265	18	1.5	0.057	0.007
	Relative % mean difference	-0.1%	-0.8%	-11.8%	46.2%	-1.8%	0.0%
Lakelse Lake 1 (LL1)	Duplicate samples	7.12	52	22.5	2.78	0.026	0.002
		7.34	52	22.5	3.5	0.028	0.002
	Relative % mean difference	-3.0%	0.0%	0.0%	-22.9%	-7.4%	0.0%
LL2	Duplicate samples	7.54	52	22.5	3.6	0.029	0.002
		7.54	52	22.5	3.6	0.029	0.002
	Relative % mean difference	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LL3	Duplicate samples	7.22	51	30	4.7	0.047	0.002
		7.26	52	30	7.22	0.043	0.002
	Relative % mean difference	-0.6%	-1.9%	0.0%	-42.3%	8.9%	0.0%
Toboggan Creek	Duplicate samples	7.55	91	11	1.58	0.082	0.002
		7.78	105	11	1.51	0.081	0.002
	Relative % mean difference	-3.0%	-14.3%	0.0%	4.5%	1.2%	0.0%
Bulkley R @ Telkwa	Duplicate samples	7.41	55	3	0.93	0.005	0.002
		7.53	56	3	0.92	0.004	0.002
	Relative % mean difference	-1.6%	-1.8%	0.0%	1.1%	22.2%	0.0%
South Hazelton	Duplicate samples	7.47	54	2.5	0.26	0.131	0.002
		7.49	51	2.5	0.15	0.117	0.002
	Relative % mean difference	-0.3%	5.7%	0.0%	53.7%	11.3%	0.0%
Woodlands Utilities	Duplicate samples	7.98	448	2.5	0.19	0.036	0.002
		8.07	416	2.5	0.23	0.036	0.002
	Relative % mean difference	-1.1%	7.4%	0.0%	-19.0%	0.0%	0.0%
Mt. Layton Hotsprings	Duplicate samples	7.4	36	11	0.47	0.012	0.002
		7.28	35	11	0.4	0.011	0.002
	Relative % mean difference	1.6%	2.8%	0.0%	16.1%	8.7%	0.0%

Appendix 2 Table 21b Total metals sequential replicate samples analysis: Relative percent mean difference of duplicates

Toboggan Creek	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Ca-T	Cd-T	Co-T
	48.2625	< 0.01	0.06	< 0.06	< 0.01	0.011	< 0.001	15.7	< 0.006	0.006
	49.0116	< 0.01	0.06	< 0.06	< 0.01	0.012	< 0.001	16	< 0.006	0.006
Relative % mean difference	-1.5%	0.0%	0.0%	0.0%	0.0%	-8.7%	0.0%	-1.9%	0.0%	0.0%

	Cr-T	Cu-T	Fe-T	K--T	Mg-T	Mn-T	Mo-T	Na-T	Ni-T	P--T
	< 0.006	< 0.006	0.255	0.4	2.2	0.027	< 0.01	1.8	0.02	< 0.1
	< 0.006	< 0.006	0.256	0.4	2.2	0.026	< 0.01	1.9	0.02	< 0.1
Relative % mean difference	0.0%	0.0%	-0.4%	0.0%	0.0%	3.8%	0.0%	-5.4%	0.0%	0.0%

	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T	V--T	Zn-T
	< 0.06	3.69	< 0.06	< 0.06	3.22	< 0.06	0.045	0.002	< 0.01	< 0.002
	< 0.06	3.66	< 0.06	< 0.06	3.25	< 0.06	0.046	0.002	< 0.01	< 0.002
Relative % mean difference	0.0%	0.8%	0.0%	0.0%	-0.9%	0.0%	-2.2%	0.0%	0.0%	0.0%

Bulkley R @ Telkwa	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Bi-T	Ca-T	Cd-T
	25.798	< 0.00002	0.0333	< 0.0001	< 0.002	0.01905	0.000003	< 0.00002	8.6	0.00001
	25.824	< 0.00002	0.0321	< 0.0001	< 0.002	0.01918	0.000007	< 0.00002	8.6	< 0.00001
Relative % mean difference	-0.1%	0.0%	3.7%	0.0%	0.0%	-0.7%	-80.0%	0.0%	0.0%	0.0%

	Co-T	Cr-T	Cu-T	Fe-T	K--T	Li-T	Mg-T	Mn-T	Mo-T	Na-T
	0.000007	< 0.0002	0.00091	0.093	0.2	0.00015	1.05006	0.004932	0.00180	1
	0.000006	< 0.0002	0.00099	0.081	0.2	0.00014	1.05619	0.004863	0.00108	1
Relative % mean difference	15.4%	0.0%	-8.4%	13.8%	0.0%	6.9%	-0.6%	1.4%	50.0%	0.0%

	Ni-T	P--T	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T
	0.00042	< 0.1	0.00003	1.14	0.000043	< 0.0002	1.61	0.00002	0.04196	< 0.002
	0.0004	< 0.1	0.00002	1.12	0.000038	< 0.0002	1.57	0.00001	0.04166	< 0.002
Relative % mean difference	4.9%	0.0%	40.0%	1.8%	12.3%	0.0%	2.5%	66.7%	0.7%	0.0%

	Tl-T	V--T	Zn-T
	0.000002	0.00041	< 0.0001
	0.000002	0.00043	< 0.0001
Relative % mean difference	0.0%	-4.8%	0.0%

Appendix 2 Table 21b (continued) Total metals sequential replicate samples analysis: Relative percent mean difference of duplicates

South Hazelton	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Ca-T	Cd-T	Co-T
	22.8717	< 0.01	< 0.06	0.09	< 0.01	0.006	< 0.001	8.5	< 0.006	0.006
	23.3711	< 0.01	< 0.06	< 0.06	< 0.01	0.006	< 0.001	8.7	< 0.006	0.006
Relative % mean difference	-2.2%	0.0%	0.0%	40.0%	0.0%	0.0%	0.0%	-2.3%	0.0%	0.0%

	Cr-T	Cu-T	Fe-T	K--T	Mg-T	Mn-T	Mo-T	Na-T	Ni-T	P--T
	< 0.006	0.069	0.008	0.4	0.4	< 0.001	0.03	0.9	0.02	< 0.1
	< 0.006	0.071	0.015	0.3	0.4	< 0.001	0.03	0.9	0.02	< 0.1
Relative % mean difference	0.0%	-2.9%	-60.9%	28.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T	V--T	Zn-T
	< 0.06	1.32	< 0.06	< 0.06	1.78	< 0.06	0.031	< 0.002	< 0.01	0.006
	< 0.06	1.36	< 0.06	< 0.06	1.83	< 0.06	0.033	< 0.002	< 0.01	0.004
Relative % mean difference	0.0%	-3.0%	0.0%	0.0%	-2.8%	0.0%	-6.3%	0.0%	0.0%	40.0%

Woodlands Utilities	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Ca-T	Cd-T	Co-T
	116.0417	< 0.01	< 0.06	< 0.06	< 0.01	0.045	< 0.001	31.3	< 0.006	0.006
	115.5423	< 0.01	< 0.06	< 0.06	< 0.01	0.044	< 0.001	31.1	< 0.006	0.006
Relative % mean difference	0.4%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.6%	0.0%	0.0%

	Cr-T	Cu-T	Fe-T	K--T	Mg-T	Mn-T	Mo-T	Na-T	Ni-T	P--T
	< 0.006	0.007	0.022	3.6	9.2	0.001	0.01	45.4	0.02	< 0.1
	< 0.006	0.008	0.026	3.5	9.2	0.001	0.01	45.4	0.02	< 0.1
Relative % mean difference	0.0%	-13.3%	-16.7%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T	V--T	Zn-T
	< 0.06	7.9	< 0.06	< 0.06	5.11	< 0.06	0.228	< 0.002	< 0.01	< 0.002
	< 0.06	7.93	< 0.06	< 0.06	5.07	< 0.06	0.225	< 0.002	< 0.01	0.002
Relative % mean difference	0.0%	-0.4%	0.0%	0.0%	0.8%	0.0%	1.3%	0.0%	0.0%	0.0%

Appendix 2 Table 21b (continued) Total metals sequential replicate samples analysis: Relative percent mean difference of duplicates

Mt. Layton Hotsprings	Hardness-T	Ag-T	Al-T	As-T	B--T	Ba-T	Be-T	Ca-T	Cd-T	Co-T
	14.9689	< 0.01	0.11	< 0.06	< 0.01	0.013	< 0.001	5.5	< 0.006	0.006
	14.7192	< 0.01	0.12	< 0.06	< 0.01	0.013	< 0.001	5.4	< 0.006	0.006
Relative % mean difference	1.7%	0.0%	-8.7%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%

	Cr-T	Cu-T	Fe-T	K--T	Mg-T	Mn-T	Mo-T	Na-T	Ni-T	P--T
	< 0.006	0.104	0.096	0 0.096	0.3	0.011	< 0.01	1.3	0.02	< 0.1
	< 0.006	0.107	0.086	0 0.086	0.3	0.008	< 0.01	1.3	0.02	< 0.1
Relative % mean difference	0.0%	-2.8%	11.0%	11.0%	0.0%	31.6%	0.0%	0.0%	0.0%	0.0%

	Pb-T	S--T	Sb-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T	V--T	Zn-T
	< 0.06	0.42	< 0.06	< 0.06	3.11	< 0.06	0.04	0.002	< 0.01	0.009
	< 0.06	0.42	< 0.06	< 0.06	3.14	< 0.06	0.04	0.003	< 0.01	0.009
Relative % mean difference	0.0%	0.0%	0.0%	0.0%	-1.0%	0.0%	0.0%	-40.0%	0.0%	0.0%

Appendix 3 Table 1 Provisional water quality objectives for Kathlyn, Seymour, Round and Tyhee Lakes

Water Bodies		Kathlyn, Round, and Tyhee Lake	Seymour Lake
Designated Water Uses		Drinking water, aquatic life, recreation, irrigation and industrial use	
Fecal Coliforms [1]	Near water intakes	≤10 MPN/100 mL 90th percentile	
	At bathing beaches	≤200 MPN/100 mL geometric mean ≤400 MPN/100 mL 90th percentile	
Turbidity[2]		≤1 NTU average 5 NTU maximum	
Total Phosphorus[3]		≤0.015 mg/L average at spring overturn	not applicable
Colour[4]		15 TCU maximum, near water intakes	not applicable

Source: Boyd and others 1984

1 the geometric mean and 90th percentile are calculated from at least 5 weekly samples taken in a period of 30 days. The drinking water objective (10/100 mL) applies year-round and the recreation objective (200-400/100 mL) applies during the recreation season.

2 the average is calculated from at least 5 weekly samples taken in a period of 30 days and applies to any point of the lake. These are long-term objectives, to be met in the future.

3 the average is calculated from a set of at least 3 samples, including near the surface, at mid-depth and near the bottom, all three at mid-lake. This is a long term objective to be met in the future.

4 this is a long-term objective to be met in the future.

Appendix 3 Table 2 Provisional water quality objectives for the Lakelse Lake and Tributaries

Water Bodies		Lakelse Lake	Tributaries to Lakelse Lake
Designated Water Uses		Drinking water, aquatic life, and recreational	Drinking water, aquatic life, recreation, and irrigation,
Fecal Coliforms [1]	Near water intakes	≤ 10/100 mL 90th percentile	
	At bathing beaches	≤ 200/100 mL geometric mean ≤ 400/100 mL 90th percentile	
Turbidity[2]		≤ 1 NTU average 5 NTU maximum	see footnote 4
Total Phosphorus[3]		≤ 0.10 mg/L average	not applicable
Chlorophyll a[3]		≤ 0.003 mg/L average	not applicable
Dissolved Oxygen		> 6.0 mg/L @ 5m above sediment	not applicable

1 the geometric mean and 90th percentile are calculated from at least 5 weekly samples taken in a period of 30 days. The drinking water objective (10/100 mL) applies year-round and the recreation objective (200-400/100 mL) applies during the recreation season.

2 the average is calculated from at least 5 weekly samples taken in a period of 30 days and applies to any point of the water body. The objectives do not apply during the freshet season.

3 the average is calculated from a set of samples, taken mostly in the period of May to August at a site over the deepest part of the lake. For total phosphorus discrete samples taken at depths of 0.5, 6 and 30 m should be analyzed. For chlorophyll a, a composite of samples taken at depths of 0, 2, 4 and 6 m should be analyzed.

4 for streams with domestic water supplies: ≤ 1 NTU average
5 NTU maximum

for streams without water licences: The induced turbidity shall not exceed 5 NTU when background turbidity is ≤ 50 NTU nor shall the induced turbidity be more than 10% of background when background is > 50 NTU.

Appendix 3 Table 3 Provisional water quality objectives for the Bulkley and Morice Rivers (Nijman 1986)

Water Bodies	Morice River	Bulkley River			
		Bulkley L. to Houston	Houston to Morice R.	Morice R. to Smithers	Smithers to Skeena R.
Designated Water Uses	Drinking water, aquatic life, wildlife, recreation, livestock, irrigation, industrial use	Drinking water, aquatic life, wildlife, recreation, livestock, irrigation, industrial use	Aquatic life, wildlife, recreation, livestock , irrigation, industrial use	Drinking water, aquatic life, wildlife, recreation, livestock, irrigation, industrial use	Aquatic life, wildlife, recreation, livestock, irrigation, industrial use
Fecal Coliforms [1]	≤ 10 MPN/100mL 90th percentile	≤ 10 MPN/100mL 90th percentile	≤ 200 MPN/100mL geometric mean ≤ 400 MPN/100mL 90th percentile	≤ 10 MPN/100mL 90th percentile	≤ 200 MPN/100mL geometric mean ≤ 400 MPN/100mL 90th percentile
Turbidity[2]	5 NTU maximum increase (upstream ≤ 50 NTU), 10% maximum increase (upstream > 50 NTU)				
Suspended Solids[2]	10 mg/L maximum increase (upstream ≤ 100 mg/L), 10% maximum increase (upstream > 100 mg/L)				
Total Chlorine Residual[3]	0.002 mg/L maximum				
Periphyton Standing Crop[4]	< 50 mg/m^2 chlorophyll a				
Un-ionized Ammonia - N[5]	≤ 0.007 mg/L average, 0.030 mg/L maximum				
Nitrite - N[5]	≤0.020 mgL average, 0.060 mg/L maximum				
Dissolved Oxygen	7.8 mg/L minimum				

Note: the objectives apply to discrete samples from all parts of the water body except from initial dilution zones of effluents. These excluded dilution zones are defined as extending up to 100 m downstream from the discharge point and no more than 25 percent across the width of the stream, from surface to bottom.

[1] the geometric mean and 90th percentile are calculated from a least 1 sample per week for 5 weeks in a period no longer than 30 days. The drinking water objective (10/100 mL) applies year-round and the recreation objective (200-400/100 mL) applies during the recreation season.

[2] the increase (in NTU, % or mg/L) is over level measured at a site upstream from a discharge or a series of discharges and as close to them as possible, and applies to downstream levels.

[3] since the objective is less than the minimum detectable concentration, it will be necessary to estimate the receiving water concentration using effluent loading and streamflow. The objective applies only if sewage effluent is chlorinated.

[4] standing crop from natural substrate. Average of at least 10 samples collected at random from the streambed on one day.

[5] the average is calculated from at least 1 sample per week for 5 weeks in a period no longer than 30 days.

Appendix 3 Table 4 BC and Canadian Drinking Water Guidelines for Microbiological Indicators.

(Colonies/100 mL)

BC Guidelines for Raw Drinking Water		Canadian Drinking Water Quality Guidelines
	Fecal coliforms	1. No sample should contain >10 total coliform organisms/100 mL; none of which should be *Escherichia coli* or thermotolerant coliforms: or
-no treatment	0	
-disinfection only	≤10 (90th perc.)	2. No consecutive sample from the same site should show the presence of coliform organisms; and
-partial treatment	≤100 (90th perc.)	
	Escherichia coli	3. For community drinking water supplies:
-no treatment	0	a) not more than one sample from a set of samples taken from the community on a given day should show the presence of coliform organisms; and
-disinfection only	≤10 (90th perc.)	
-partial treatment	≤100 (90th perc.)	
	Enterococci	b) not more than 10% of samples based on a minimum of 10 samples should show the presence of coliform organisms.
-no treatment	0	
-disinfection only	≤3 (90th perc.)	
-partial treatment	≤25 (90th perc.)	
	Pseudomonas aeruginosa	
-no treatment	0	

Fecal coliform criteria which presently exist will apply on an interim basis until use of the other preferred indicators is adopted.

Medians and geometric means are calculated from at least 5 samples in a 30-day period. Ten samples are required for 90th percentiles.

Appendix 3 Table 5 Selected BC and Canadian Guidelines for Drinking Water Quality

MAC Maximum Acceptable Concentration **AO** Aesthetic Objective
IMAC Interim Maximum Acceptable Concentration

Physical & chemical	Unit	MAC	IMAC	AO
pH	pH units			6.5 to 8.5
Specific Conductance	uS/cm	<=700		
True Colour	TCU			<=15
Turbidity	NTU	<=1		<=5
Hardness Total Dissolved	mg/L $CaC0_3$			80 to 100
Nitrate Nitrogen (N)	mg/L	<=10 [1]		
Nitrite Nitrogen (N)	mg/L	<=3.2 [2]		

Total Metals (mg/L)		MAC	IMAC	AO
Ag	Silver			
Al	Aluminum	<=0.2		
As	Arsenic		<=0.025	
B	Boron			<=5
Ba	Barium	<=1		
Be	Beryllium			
Ca	Calcium			
Cd	Cadmium	<=0.005		
Co	Cobalt			
Cr	Chromium	<=0.05		
Cu	Copper			<=1
Fe	Iron			<=0.3
K	Potassium			
Mg	Magnesium	100 taste threshold		
Mn	Manganese			<=0.05
Mo	Molybdenum	<=0.25		
Na	Sodium			<=200
Ni	Nickel			
P	Phosphorus			
Pb	Lead	<=0.01		
S	Sulfur			
Sb	Antimony		<=0.006	proposed
Se	Selenium	<=0.01		
Si	Silicon			
Sn	Tin			
Sr	Strontium			
Ti	Titanium			
V	Vanadium	<=0.1		
Zn	Zinc			<=5.0

Source: BC Environment. 1998 (updated periodically). British Columbia water quality guidelines (criteria). Water Quality Section, Water Management Branch, Victoria.

Source: Canadian Council of Resource and Environment Ministers (CCREM). 1999 updated 2001. Canadian environmental quality guidelines. CCREM, Winnipeg.

[1] Equivalent to 45 mg/L as nitrate.

[2] Where nitrate-nitrogen (N) and nitrite-nitrogen (N) are present, the total of the two should not exceed 10.