Assessment of the McBride Drinking Water Supply: Source Water Characteristics

James Jacklin, March 2004[1]

Introduction

In British Columbia, drinking water quality is becoming a significant public issue. We all want to have confidence in the quality of the water we consume. Its protection is also important to local purveyors, who act as our water suppliers, and to provincial government ministries responsible for water management. Within the Omineca-Peace region of B.C., our most common potable source is ground water, although many communities do make use of rivers, streams or lakes. Our basic drinking water quality is determined by a number of factors including local geology, climate and hydrology. In addition to these, human land use activities such as urbanization, agriculture and forestry, and the pollution they may cause, are becoming increasingly important influences. Environmental managers have a responsibility to control land use development so as to minimise the effects of these activities on source water quality.

The province's Drinking Water Protection Act, enacted in October, 2002, places the responsibility for drinking water quality protection with the B.C. Ministry of Health and local water purveyors. However, through the B.C. Environmental Management Act, the British Columbia Ministry of Environment (MOE) is responsible for managing and regulating activities in watersheds that have a potential to affect water quality. Accordingly, the Ministry plans to take an active role in protecting drinking water quality at its source.

Plate 1. An upstream view of Dominion Creek near the sample collection site.

MOE implemented a raw water quality and stream sediment monitoring program at selected communities in the Omineca-Peace region in 2002. Community sites were selected using a risk assessment process that considered:

- whether the source supply was surface water or ground water,
- the level of water treatment,
- the population size served,
- the potential for upstream diffuse and point-source pollution,
- the availability of current, high-quality and representative data on each raw water source,
- whether past outbreaks of waterborne illness had been reported,
- the ability/willingness of local purveyors to assist with sampling.

Through this process and with available funding, a total of 18 community water supplies in the Omineca-Peace region were selected for monitoring during 2002/03.

This brief report will summarise water quality data collected from the Village of McBride's raw potable water source, Dominion Creek (Plate 1). The data are compared to current provincial drinking water quality guidelines meant to protect finished water if no treatment other than disinfection is present. This comparison should identify parameters with concentrations that represent a risk to human health. It is intended that this program will lead to the identification of human activities responsible for unacceptable source water quality, and that it will assist water managers to develop measures to improve raw water quality where needed.

[1]A template report was prepared for the author by Todd D. French of TDF Watershed Solutions, Research & Management and Bruce Carmichael, Ministry of Environment.

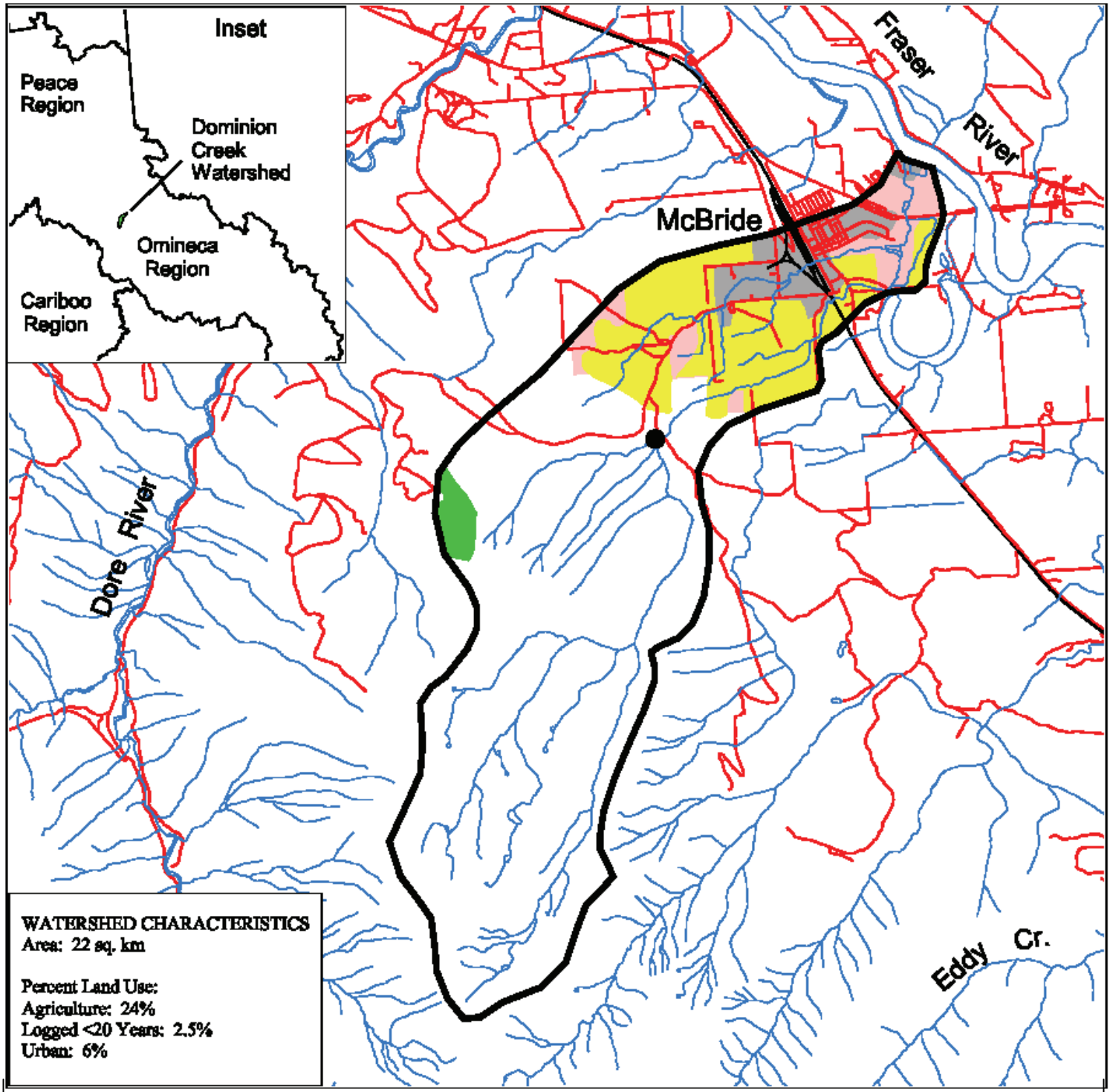

Figure 1. Dominion Creek watershed and associated land-use practices around the Village of McBride.

Site Description

Watershed Overview

The Dominion Creek watershed (Figure 1) lies within three biogeoclimatic zones, the Engleman Spruce-Subalpine Fir, the Interior Cedar Hemlock and the Alpine Tundra. The Engleman Spruce-Subalpine Fir zone has hilly, mountainous terrain, cold and snowy conditions (a snowpack of 2-3 m is common) for 5-7 months of the year, and short cool summers. The Interior Cedar Hemlock zone generally has long warm summers, cool wet winters and productive coniferous forests. The Alpine Tundra zone is characterized by a rugged, treeless environment, amid tall cliffs and snow capped peaks. Much of the landscape is dominated by snow, ice and rock, with shallow bedrock and weathered soils covering much of the ground. This zone normally experiences abundant precipitation, and temperatures are usually cold for most of the year (the mean annual temperature range is 0°C to 4° C) (B.C. Ministry of Forests, 1998).

The Dominion Creek watershed, which is 22 km^2, is located within the Rocky Mountain Trench and drains north towards the Village of McBride. The low to medium stream gradient generates a moderate stream velocity that is dominated by a cobble-gravel substrate. There is an abundance of riparian vegetation adjacent to the stream, observed during sample collection. This vegetation includes large trees that provide both soil stability and excellent forest canopy cover, as well as shrubs, plants, and other herbaceous vegetation. Although this abundance of riparian vegetation exists, high turbidity levels are noticed during large precipitation events, which causes problems for the water users in the Village of McBride (Mr. Laird Ervine, Village of McBride, pers. comm.).

Although Dominion Creek has a recently installed water flow gauging station, the results are highly dynamic and don't give an accurate estimate of stream discharge (Lyle Larson, MOE, pers. comm.). This is due to the reservoir present upstream of the flow station, which affects water levels during the village withdrawal. This generates an unstable hydrograph, and is not representative of real time flow levels. Additionally, a water diversion system has been installed to reroute flow from a nearby stream into Dominion Creek, also intended to help during low flows. Although both of these systems are in place, low flows continue to be a problem for McBride (Ervine, p.c.).

There are no land-use activities upstream of the Dominion Creek water withdrawal site (Figure 1). There is however an abundance of agricultural activity located downstream of the McBride water intake.

At present, there are no water withdrawal licenses upstream of the Village of McBride's water withdrawal site. The village itself has an allocated withdrawal license for 91,000 m^3/year, which equals a withdrawal rate of approximately 2.88 x 10^{-3} m^3/sec (Lands and Water B.C., Water Licensing System, 2003).

Drinking Water Supply & Treatment

The Village of McBride draws its domestic water supply from Dominion Creek. As measured with a GPS, the geographic co-ordinates of the sample site were 53°16.90'N/120°11.809'W. The water from the creek passes through a small settling reservoir and is subsequently disinfected via chlorination (Plate 2). The treated water is then transported to approximately 700 village water users.

Some current concerns regarding the village water supply (Ervine, p.c.) include low flows throughout the winter and the recently damaged diversion system (this diversion system was damaged by a debris flow in 2001). Although there are increased turbidity readings during and after storm events, this is not a major concern for the water users of McBride at this time.

Plate 2. A small settling reservoir that Dominion Creek passes through before the water is treated by chlorination.

Materials & Methods

Sample Collection & Analyses for the 2002/03 Water Monitoring Program

Water Quality

An experienced consultant and/or MOE staff member collected water samples in laboratory certified polyethylene bottles for a variety of chemical and bacterial analyses. Representative grab samples were collected from three locations at the Dominion Creek site (Figure 2): Village of

McBride raw water crossover pipe at pipe outlet (E249347, Water Source ID Tag 1333, Plate 3); Village of McBride raw water u/s of crossover pipe inflow (E249348, Water Source ID Tag 1334, Plate 4); Village of McBride d/s of crossover pipe inflow (E252430, Water Source ID Tag 1335, Plate 5). The crossover pipe (site E249347) originates from a small stream west of Dominion Creek. The chemical results, analytical detection levels and drinking water quality guidelines are provided in Tables 1, 2 and 3, respectively, in Appendix A.

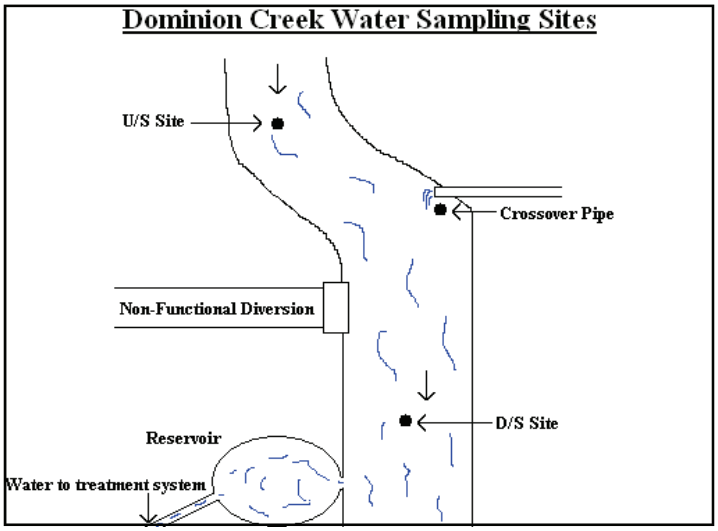

Figure 2. An overview of the three Dominion Creek Sampling Sites.

Plate 4. Dominion Creek upstream of the crossover pipe (site E249348).

Plate 3. The crossover pipe (site E249347) that flows into Dominion Creek just above the water reservoir.

Plate 5. Dominion Creek downstream of the crossover pipe (site E252430).

Bottles used for general ion analyses were rinsed three times with source water prior to sample collection. Metal and bacterial bottles were not rinsed and metal samples were lab preserved. Water samples were shipped by overnight courier in coolers with ice packs to CanTest Ltd. (from September 2002-March 2003) and JR Laboratories Inc. (April 2003 to September 2003) for bacteria and PSC Environmental Services Ltd. for chemistry. Bacterial samples were analysed using membrane filtration. Metals analysis made use of ICPMS technology. Dissolved metal samples were lab filtered within 24 hours after collection through a 0.45 µm membrane filter. Samples for the analysis of cysts and oocysts of the *Giardia* and *Cryptosporidium* parasites were collected using the high volume filtering method described in EPA (1995) (Figure 3). The filtration equipment could not be used during freezing conditions. Filters were shipped by overnight courier in a cooler with ice packs to the B.C. Centre for Disease Control's Enhanced Water Laboratory for analysis.

Bottom Sediment Quality

Bottom sediments were collected from Dominion Creek's downstream site during the October, 2002 low flow. Stream sediment was analyzed to determine the possible presence of upstream sources of contaminants that were not detected in the water samples. Where follow up is deemed to be necessary, additional monitoring will depend on the type and level of contamination. Samples were collected from several submerged silt/clay areas in the stream using two acetone washed stainless steel spoons for organic

analysis, and plastic spoons for metal/grain size analysis. At least one 3-5 cm deep sediment sample was gently scooped from each of a number of these depositional areas with the large spoon. Each of these scoops was subdivided from the larger spoon into jars for grain size, total organic carbon, hydrocarbons and pesticides, using a second, smaller spoon. Sampling proceeded in an upstream direction with each depositional zone contributing a small amount of fine sediment to each container. Sediment samples were kept cool and shipped to PSC Environmental Laboratories Ltd. for analysis within three days of collection. Samples for metals analysis were dried with heat, disaggregated, sieved at 2 mm and leached with a strong acid. Samples for organic analysis were processed wet and without screening. Results are expressed in dry weight. The sample date and sample parameter concentrations are provided in Table 4, Appendix A.

For further details on the analytical methods abbreviated above, refer to Greenberg *et al.* (1992), EPA (1995), PSC (2002) and British Columbia Field Sampling Manual (2003).

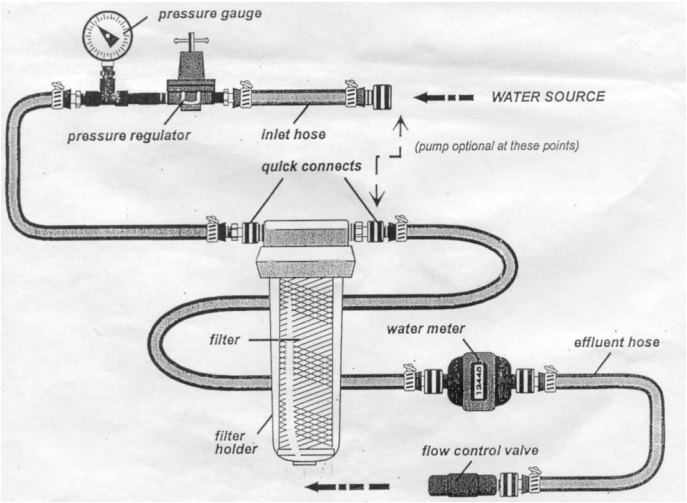

Figure 3. Schematic of the high-volume filtration unit used to sample raw water for Cryptosporidium oocysts and Giardia cysts (from EPA, 1995)

Quality Assessment (QA)

To ensure accuracy and precision of data, quality assurance and control (QA/QC) procedures were incorporated into the monitoring program. This included use of rigorous sampling protocols, proper training of field staff, setting of data quality objectives and the submission of QA samples to the lab. Field QA included duplicate and blind blank samples. Blank samples detect contamination introduced in the field and/or in the lab. A comparison of duplicate results measures the effect of combined field error, laboratory error and real between-sample variability. The blind blank and duplicate program accounted for roughly 20% of the overall chemistry and bacterial sample numbers.

Duplicate sediment samples were collected by distributing sediment from each scoop into both sample jars. Differences between duplicate results indicate collection and/or analytical inconsistency and/or natural variability in physical and chemical properties.

Results

Review of Historical Data

No historical water quality data was found for this site.

Water Monitoring Program (2002/03)

Quality Assessment (QA)

The field blank and duplicate results indicate that no field or lab contamination of samples with bacteria occurred and that acceptable precision in bacterial sampling and analysis was observed. The parasite analysis provided duplicate precision results for *Giardia* of between 7 and 26%. No duplicate *Cryptosporidium* oocyst analysis produced detectable results.

The five water chemistry field blank samples that were prepared either the same day or within one day of the Dominion Creek collections tested positive for some parameters. The concentration of most of these parameters was either very close to or less than 5-fold the minimum detectable concentration, an acceptable threshold as per the lab acceptance criteria. Eight parameters exceeded these acceptance criteria significantly and are listed in Table 5.

Table 5. Blind blank samples that tested strongly positive (≥ 5-fold MDL) for chemical contamination.

Date	Parameter	Measured Concentration	MDL
Sept. 25/02	Total Dissolved Phosphorus	0.031 mg/L	0.002 mg/L
Sept. 25/02	Total Phosphorus	0.038 mg/L	0.002 mg/L
Sept. 25/02	Strontium-Dissolved	0.047 µg/L	0.005 µg/L
Sept. 25/02	Tin-Dissolved	0.23 µg/L	0.1 µg/L
Jan. 21/03	Zinc-Total	1.5 µg/L	0.1 µg/L
Mar. 17/03	Copper-Total	0.33 µg/L	0.05µg/L
Mar. 17/03	Zinc-Total	0.7 µg/L	0.1 µg/L
May 6/03	Copper-Total	0.36 µg/L	0.05 µg/L

Although the levels of some of these results are greater than the concentrations observed in Dominion Creek, they are usually well below provincial raw drinking water guidelines by greater than two orders of magnitude. The contamination that did occur may have resulted during the deionization process in the lab or during the transfer of the deionized water between bottles in the field. Regardless, these levels of blank contamination should not limit the comparison of data to water quality guidelines.

The four water chemistry duplicate samples that were prepared either the same day or within one day of the

Dominion Creek collections did have some values outside the lab acceptance criteria of 25% relative percent difference (Table 6, Appendix A). The differences that are present may be due to problems with collection and/or analytical precision. Of particular concern is the imprecision of copper, which occurred well above its respective detection level. All of the parameters that did have differences greater than 25% between the duplicates were well below recommended drinking water guidelines.

The duplicate sediment samples indicated that the variations between duplicates were most likely the result of natural in-stream variations rather than collection and/or analytical inconsistencies (Table 7, Appendix A). The lab acceptance criteria for duplicate variation is 35% for metals and other inorganics. All duplicate values, as indicated in Table 7, are within this range.

Bacteriology

The 2002/03 bacterial data are summarised in Tables 9-11. Drinking water quality guidelines for *E. coli, Enterococci* and fecal coliforms are ≤ 10/100 CFU/100mL (90th perc.), ≤ 3 CFU/100mL (90th perc.), and ≤ 10 CFU/100mL (90th perc.) respectively, in raw water supplies that undergo disinfection only.

As Table 9 indicates, the source water furthest downstream tested positive for fecal bacteria on two dates, June 10th, 2003 and August 12th, 2003. The presence of these bacteria indicates a raw water that has potential to cause human-related illness should treatment become ineffective.

Table 9. Results of bacterial analyses from Dominion Creek d/s of cross over pipe. Units are CFU/100mL.

Date	Total Coliform	*E. coli*	*Enterococci*	Fecal Coliform
Provincial Guideline	No Provincial Guideline	≤ *10 CFU/100 mL (90th perc.)*	≤*3 CFU/100 mL (90th perc.)*	≤ *10 CFU/100 mL (90th perc.)*
Sep. 26/02*	-	-	-	-
Jan. 22/03	8	-	<1	<1
Mar. 17/03	<1	<1	<1	<1
May 7/03	2	<2	<2	<2
Jun. 10/03	26	**1**	<1	**1**
Aug. 12/03	280	**7**	**10**	**10**

*No sample was collected from the downstream site on this date.

Table 10 shows the bacterial data from Dominion Creek upstream of the crossover pipe and Table 11 shows the bacterial data from the crossover pipe. From the tables, it is apparent that higher concentrations of *E.coli, Enterococci* and fecal coliforms are entering Dominion Creek from the crossover pipe compared to what is found naturally at the upstream site on both September 26th, 2002 and August 12th, 2003. Although the crossover site does supply more water to Dominion Creek that may help with low flows, it appears to also be degrading the water quality.

Table 10. Results of bacterial analyses from Dominion Creek u/s of cross over pipe. Units are CFU/100mL.

Date	Total Coliform	*E. coli*	*Enterococci*	Fecal Coliform
Provincial Guideline	No Provincial Guideline	≤ *10 CFU/100 mL (90th perc.)*	≤*3 CFU/100 mL (90th perc.)*	≤*10 CFU/100 mL (90th perc.)*
Sep. 26/02	18	<1	<1	<1
Jan. 22/03	8	-	<1	<1
Mar. 17/02	<1	<1	<1	<1
May 7/02	2	<2	<2	<2
Jun. 10/03	29	**3**	<1	**1**
Aug. 12/03	560	<1	**7**	**2**

Care must be taken when comparing these data to B.C. drinking water guidelines, as the recommended guidelines for raw water using disinfection as treatment require five samples to be collected in a 30 day period. 90% of these samples would then need to be over the stated guideline for that guideline to be exceeded. This study did not sample five times in a 30 day period, but rather six times throughout the entire year. While these data do not technically exceed the B.C. water quality guidelines, the exceedances suggest that further monitoring should be considered.

Table 11. Results of bacterial analyses from crossover entering Dominion Creek. Units are CFU/100mL.

Date	Total Coliform	*E. coli*	*Enterococci*	Fecal Coliform
Provincial Guideline	No Provincial Guideline	≤ *10 CFU/100 mL (90th perc.)*	≤*3 CFU/100 mL (90th perc.)*	≤*10 CFU/100 mL (90th perc.)*
Sep. 26/02	9	**9**	**2**	**9**
Jan. 22/03*	-	-	-	-
Mar. 17/03	<1	<1	<1	<1
May 7/03	<2	<2	<2	<2
Jun. 10/03	31	**1**	<1	**1**
Aug. 12/03	260	**35**	**51**	**41**

*The site was frozen and no sample was taken

Parasitology

The 2002/03 parasite data are summarised in Table 12. No *Cryptosporidium* oocysts were detected in any of the five samples collected during the 2002/03 program. By comparison, *Giardia* cysts were detected on one occasion, June 10th, when 9.8 cysts/100L was detected. While this density was low relative to several other sites in the program, the data indicate that there is potential for human illness resulting from *Giardia* infection during spring and summer months should treatment become ineffective.

Table 12. Parasite densities observed in Dominion Creek over the period October 17th, 2002 to August 12th, 2003 (samples collected d/s of crossover pipe.

Date	*Cryptosporidium* (oocysts/100L)	*Giardia* (cysts/100L)
Oct. 17/02	<2.2	<2.2
Mar. 17/03	<3.3	<3.3
May 7/03	<4.6	<4.6
Jun. 10/03	<4.9	**9.8**
Aug. 12/03	<3.6	<3.6

The B.C. Ministry of Health, as well as the U.S. Environmental Protection Agency (EPA), recommend a minimal removal or deactivation of 3 log (99.9%) for *Giardia* cysts through filtration and/or disinfection between raw and tap water. The EPA further suggests that it is important to consider multiple barriers of protection: watershed management, filtration, disinfection, and the protection of the integrity of the distribution system. The McBride water treatment system currently uses disinfection as the method of treatment.

Water Chemistry

In 2002/03, Dominion Creek was sampled on six different dates at three sites. Table 1, Appendix A is the crossover pipe, Table 2, Appendix A is Dominion Creek upstream of the crossover pipe and Table 3, Appendix A is Dominion Creek downstream of the crossover pipe. The water samples were analysed for 15 general parameters as well as for the ICPMS low level metals package that includes 27 metals in both the total and dissolved form. Of the chemical parameters tested through the duration of this study at the **crossover site**, two exceeded the provincial guidelines for raw drinking water. A description of these parameters, their concentrations during this study and possible anthropogenic sources are listed below (RIC, 1998).

Colour (TCU) - The mean colour concentration for the year was 17 TCU with a maximum of 40 TCU (the recommended water quality guideline is 15 TCU). The colour of water is a measure of its dissolved compounds (attributed to the presence of organic and inorganic materials). High colour levels are regarded as a pollution problem in terms of aesthetics, and can be produced by agricultural and industrial effluents. Colour can also originate naturally from organic soils and wetlands.

Total Organic Carbon (mg/L) - The maximum TOC concentration was 7.4 mg/L, over the recommended guideline of 4 mg/L. This is a measure of dissolved and particulate organic carbon. TOC can be important in drinking water systems that use chlorination, as high levels can promote the formation of trihalomethanes which are considered carcinogens. Sources of TOC include agricultural, municipal and industrial waste discharges. Natural sources include organic soils and wetlands.

There were two chemical parameters that exceeded guidelines at the **upstream site** and are listed below.

Turbidity (NTU) - The maximum turbidity level of 5.3 NTU exceeded the guideline concentration of 5 NTU.

Iron, Total (mg/L) - The mean iron concentration for the year was 0.38 mg/L with a maximum value of 1.53 mg/L, both exceeding the aesthetic guideline of 0.3 mg/L. Insoluble iron is often found in waters as colloidal material which can be difficult to remove. Additionally, iron has the tendency to colour water.

There were four chemical guideline parameters of interest at the **downstream** Dominion Creek site, which are listed below.

Turbidity (NTU) - The maximum turbidity level if 8.66 NTU exceeded the guideline value of 1 NTU. The mean concentration of 3.43 NTU was approaching the guideline.

Residue, Non-Filterable (mg/L) - The mean level of non-filterable residue collected during the study was 33 mg/L with a maximum of 86 mg/L. This is a measure of the particulate matter suspended within the water column. High levels can increase turbidity as well as damage aquatic habitats. Sources include forest harvesting, road building, industrial effluents and urban development.

Iron, Total (mg/L) - The mean and maximum iron concentrations both exceeded the guideline value of $\leq$ 0.3 mg/L. Their concentrations for the year were 0.71 and 1.84 mg/L, respectively.

Manganese, Total (µg/L) - The maximum manganese concentration was 67.3 µg/L, exceeding the aesthetic objective of 50 µg/L. Similar to iron, manganese can colour water and form colloidal material that can be difficult to remove.

The crossover pipe feeding into Dominion Creek appears to have poorer water quality compared to Dominion Creek itself (the upstream unaffected site). In addition to the high bacterial, colour and TOC concentrations already discussed, the crossover pipe has substantially higher mean concentrations of specific conductance, hardness (total and dissolved), alkalinity, sulphate, calcium (total and dissolved) and strontium (total and dissolved).

For a complete list of the raw data collected during the program, refer to Tables 13-15 in Appendix A.

Bottom Sediment Chemistry

Of the 29 sediment metals analyzed, 21 were detected in one sample and 19 were detected in the duplicate (Table 2, Appendix A). However, water samples collected throughout the duration of this project showed low concentrations relative to existing drinking water guidelines.

No compounds in the following classes (which are or could be man made) were detected in Dominion Creek sediments:

- Total oil & grease
- Chlorinated phenols
- Phenoxy acid herbicides

- Organochlorine pesticides
- Polychlorinated biphenyls
- Organophosphorus pesticides
- Polycyclic aromatic hydrocarbons

Conclusions & Recommendations

Review of the Dominion Creek data indicates an overall moderate raw drinking water quality. Although there are chemical parameters that exceed recommended guidelines, most parameters are aesthetic, and don't pose a significant risk to human health. High TOC concentrations can however result in the formation of trihalomethanes when disinfection is used. Bacteria and *Giardia* were both detected, suggesting that warm-blooded animals or runoff from animal waste are accessing Dominion Creek or tributaries upstream of the water sampling site. Wildlife are likely this source of most of these organisms, as no upstream range activities exist. Regardless, these bacteria and *Giardia* can pose a significant risk to human health should treatment become ineffective.

As previously mentioned, the water entering Dominion Creek from the crossover pipe is of poorer quality than Dominion Creek itself. Although this crossover supplies additional water to the village system, it is at a cost of compromising the quality of that water. If water from this crossover pipe is to continue supplementing Dominion Creek, it is recommended that continued sampling take place that may help to identify when parameters are of greatest concern, and when the village water system should be most carefully managed. Particular care should be taken during late spring and summer, when stream flows are low and bacterial concentrations likely receive minimal dilution. This apparently critical time of year may be appropriate for high frequency bacterial sampling.

Acknowledgements

We thank the Village of McBride for their help and direction around Dominion Creek. Mr. Todd French is recognized for his help in designing and implementing the project (TDF Watershed Solutions, Research & Management). Mr. Mohamad Khan (Enhanced Water Laboratory, B.C. Centre for Disease Control, Vancouver) provided us with the *Cryptosporidium* and *Giardia* sampling equipment, documentation on parasite collection methodologies and information critical to data interpretation.

This project was funded by the B.C. Ministry of Environment.

Contact Information

For more information regarding either this short report, watershed protection and/or drinking water, please contact the Ministry of Environment (Contact: Bruce Carmichael (Prince George), 250-565-6455) or the Northern Health Authority (Contact: Bruce Gaunt (Prince George), 250-565-2150 or Caroline Alexander (Fort St. John), 250-787-3355).

References

EPA. 1995. ICR protozoan method for detecting *Giardia* cysts and *Cryptosporidium* oocysts in water by a fluorescent antibody procedure. United States Environmental Protection Agency, June 1995.

EPA. 1999. Giardia: Drinking Water Health Advisory. United States Environmental Protection Agency, November 1999.

Greenberg, A.E., L.S. Clesceri, and A.D. Eaton (EDS.). 1992. Standard methods for the examination of water and wastewater (18th Edition). Published Jointly by American Public Health Association, American Water Works Association, and Water Environment Federation.

LANDS AND WATER B.C. 2003. Water Licensing System.

Provincial Health Officer. 2001. Drinking water quality in British Columbia: the public health perspective. A report of the health of British Columbians. Provincial Health Officer's Annual Report 2000, B.C. Ministry of Health Planning, Victoria, B.C.. 147 pp.

PSC. 2002. 2002-2006 analysis & pricing information. Prepared by PSC Environmental Services, 8577 Commerce Court, Burnaby, B.C., V5A 4N5, for B.C. Ministry of Water, Land and Air Protection. 47pp.

Resource Inventory Committee. 1998. Guidelines for interpreting water quality data. Province of British Columbia.

The Ecology of the Alpine Tundra Zone. 1998. Ministry of Forests Research Branch, Victoria, B.C.

The Ecology of the Engleman Spruce-Sub Alpine Fir Zone. 1998. Ministry of Forests Research Branch, Victoria, B.C.

The Ecology of the Interior Cedar-Hemlock Zone. 1998. Min istry of Forests Research Branch, Victoria, B.C.

B.C. Ministry of Environment,
1011 - 4th Avenue (3rd Floor),
PRINCE GEORGE, B.C., CANADA,
V2L 3H9
Tel: (250) 565-6135
Fax: (250) 565-6629

Appendix A

Table 1. 2002/03 sample parameters, summaries of current results and associated B.C. drinking water guidelines for the Dominion Creek crossover site.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
General								
pH	5	7.9	8.2	8.0	0.11	0.1	6.5-8.5	aesthetic objective
Colour (TCU)	5	10	40	17	13.0	5	≤ 15	aesthetic objective
Specific Conductance (µS/cm)	5	197	235	216	15.1	1	≤ 700	maximum acceptable concentration
Turbidity (NTU)	4	0.61	1.71	1.14	0.450	0.1	≤ 5	maximum acceptable concentration
Hardness Total (mg/L)	5	107	126	115	7.9			
Hardness Total -Diss. (mg/L)	5	108	127	116	7.0		≤ 500 $CaCO_3$	aesthetic objective
Alkalinity (mg/L)	5	96	111	106	6.3	0.5		
Residue Non-Filterable (mg/L)	5	4	4	4	0.0	4		
Total Organic Carbon (mg/L)								
TOC	5	2.1	7.4	4.0	2.04	0.5	≤ 4	maximum, to control THM production
Anions (mg/L)								
Chloride Dissolved	5	0.5	0.5	0.5	0.00	0.5	≤ 250	aesthetic objective
Fluoride Dissolved	5	0.04	0.06	0.05	0.009	0.01	≤ 1.5	maximum acceptable concentration
Bromide Dissolved	5	0.1	0.1	0.1	0.00	0.1		
Nutrients (mg/L)								
Nitrate+Nitrite	5	0.002	0.031	0.015	0.011	0.002	≤ 45 (Nitrate)	maximum acceptable concentration
Phosphorus Total	5	0.002	0.007	0.005	0.002	0.002		
Phosphorus Total-Diss.	5	0.002	0.004	0.003	0.001	0.002		
Sulphate (mg/L)								
Sulphate	5	9.8	11.4	10.6	0.67	0.5	≤ 500	aesthetic objective
Metals Total (ug/L)								
Aluminum-T	5	8.1	29.9	20.4	8.74	0.3		
Aluminum-D	5	3.1	9	5.5	2.32	0.3	≤ 200	maximum acceptable concentration
Antimony-T	5	0.005	0.025	0.010	0.009	0.005	≤ 6	interim maximum acceptable concentration
Antimony-D	5	0.005	0.01	0.01	0.002	0.005		
Arsenic-T	5	0.1	0.2	0.2	0.05	0.1	≤ 25	interim maximum acceptable concentration
Arsenic-D	5	0.1	0.2	0.1	0.06	0.1		
Barium-T	5	5.61	7.07	6.20	0.590	0.02	≤ 1000	maximum acceptable concentration
Barium-D	5	5.38	5.99	5.70	0.235	0.02		
Beryllium-T	5	0.02	0.02	0.02	0.000	0.02		
Beryllium-D	5	0.02	0.02	0.02	0.000	0.02		
Bismuth-T	5	0.02	0.03	0.02	0.004	0.02		
Bismuth-D	5	0.02	0.02	0.02	0.000	0.02		
Cadmium-T	5	0.01	0.01	0.01	0.000	0.01	≤ 5	maximum acceptable concentration
Cadmium-D	5	0.01	0.02	0.01	0.004	0.01		
Calcium-T (mg/L)	5	36	42.4	38.7	2.72	0.05		
Calcium-D (mg/L)	5	36.3	42.7	39.2	2.38	0.05		
Chromium-T	5	0.2	0.9	0.3	0.31	0.2	≤ 50	maximum acceptable concentration
Chromium-D	5	0.2	0.7	0.3	0.22	0.2		
Cobalt-T	5	0.005	0.06	0.02	0.024	0.005		
Cobalt-D	5	0.005	0.013	0.007	0.004	0.005		
Copper-T	5	0.09	0.22	0.17	0.056	0.05	≤ 1000	aesthetic objective
Copper-D	5	0.08	0.32	0.15	0.103	0.05		
Iron-T (mg/L)	4	0.108	0.182	0.131	0.035	0.005	≤ 0.3	aesthetic objective
Iron-D (mg/L)	4	0.012	0.023	0.016	0.005	0.005		
Lead-T	5	0.01	0.09	0.06	0.031	0.01	≤ 10	maximum acceptable concentration
Lead-D	5	0.01	0.03	0.02	0.009	0.01		
Lithium-T	5	0.05	1.63	1.12	0.626	0.05		
Lithium-D	5	0.05	1.58	1.11	0.624	0.05		

Table 1 Continued.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
Magnesium-T (mg/L)	5	4.11	4.82	4.48	0.284	0.05		
Magnesium-D (mg/L)	5	4.2	4.97	4.53	0.282	0.05	≤ 100	aesthetic objective
Manganese-T	5	2.62	23	14.46	8.412	0.008	≤ 50	aesthetic objective
Manganese-D	5	1.73	2.22	1.89	0.201	0.008		
Molybdenum-T	5	0.39	0.52	0.46	0.046	0.05	≤ 250	maximum acceptable concentration
Molybdenum-D	5	0.41	0.59	0.46	0.074	0.05		
Nickel-T	5	0.05	3.98	0.84	1.758	0.05		
Nickel-D	5	0.05	0.05	0.05	0.000	0.05		
Selenium-T	5	0.2	0.3	0.2	0.05	0.2	≤ 10	maximum acceptable concentration
Selenium-D	5	0.2	0.4	0.2	0.09	0.2		
Silver-T	5	0.02	0.02	0.02	0.000	0.02		
Silver-D	5	0.02	0.02	0.02	0.000	0.02		
Sodium-T (mg/L)	4	1.39	1.69	1.54	0.124	0.05	≤ 200	aesthetic objective
Strontium-T	5	119	159	135	14.765	0.005		
Strontium-D	5	119	143	133	9.5	0.005		
Thallium-T	5	0.002	0.003	0.002	0.000	0.002	≤ 2	maximum acceptable concentration
Thallium-D	5	0.002	0.002	0.002	0.000	0.002		
Tin-T	5	0.01	0.01	0.01	0.000	0.01		
Tin-D	5	0.01	0.05	0.02	0.018	0.01		
Uranium-T	5	1.23	1.63	1.42	0.153	0.002	≤ 100	maximum acceptable concentration
Uranium-D	5	1.02	1.51	1.31	0.204	0.002		
Vanadium-T	5	0.14	0.62	0.33	0.181	0.06	≤ 100	maximum acceptable concentration
Vanadium-D	5	0.16	0.59	0.36	0.176	0.06		
Zinc-T	5	0.1	0.4	0.2	0.13	0.1	≤ 5000	aesthetic objective
Zinc-D	5	0.1	0.6	0.3	0.22	0.1		

Table 2. 2002/03 sample parameters, summaries of current results and associated B.C. drinking water guidelines for the Dominion Creek site U/S of the crossover.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
General								
pH	6	7.4	7.9	7.7	0.18	0.1	6.5-8.5	aesthetic objective
Colour (TCU)	6	5	15	7	4.1	5	≤ 15	aesthetic objective
Specific Conductance (µS/cm)	6	46	118	96	26.9	1	≤ 700	maximum acceptable concentration
Turbidity (NTU)	4	0.3	5.3	1.4	2.20	0.1	≤ 5	maximum acceptable concentration
Hardness Total (mg/L)	6	25.3	60.2	48.7	12.84			
Hardness Total -Diss. (mg/L)	6	21.5	64.9	49.1	15.57		≤ 500 CaCO3	aesthetic objective
Alkalinity (mg/L)	6	22.8	57.8	45.8	12.65	0.5		
Residue Non-Filterable (mg/L)	6	4	68	15	25.8	4		
Total Organic Carbon (mg/L)								
TOC	6	0.8	1.8	1.3	0.36	0.5	≤ 4	maximum, to control THM production
Anions (mg/L)								
Chloride Dissolved	6	0.5	0.5	0.5	0.00	0.5	≤ 250	aesthetic objective
Fluoride Dissolved	6	0.01	0.03	0.02	0.008	0.01	≤1.5	maximum acceptable concentration
Bromide Dissolved	6	0.1	0.1	0.1	0.00	0.1		
Nutrients (mg/L)								
Nitrate+Nitrite	6	0.002	0.057	0.030	0.029	0.002	≤ 45 (Nitrate)	maximum acceptable concentration
Phosphorus Total	6	0.002	0.023	0.006	0.008	0.002		
Phosphorus Total-Diss.	6	0.002	0.004	0.003	0.001	0.002		
Sulphate (mg/L)								
Sulphate	6	1.1	5.8	4.3	1.80	0.5	≤ 500	aesthetic objective

Table 2 Continued.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
Metals Total (ug/L)								
Aluminum-T	6	1.8	190	35.8	75.58	0.3		
Aluminum-D	6	1.2	12.5	4.1	4.18	0.3	≤ 200	maximum acceptable concentration
Antimony-T	6	0.005	0.014	0.008	0.003	0.005	≤ 6	interim maximum acceptable concentration
Antimony-D	6	0.005	0.005	0.005	0.000	0.005		
Arsenic-T	6	0.1	0.5	0.2	0.16	0.1	≤ 25	interim maximum acceptable concentration
Arsenic-D	6	0.1	0.2	0.2	0.06	0.1		
Barium-T	6	1.65	2.46	2.08	0.357	0.02	≤ 1000	maximum acceptable concentration
Barium-D	6	0.99	2.39	1.84	0.514	0.02		
Beryllium-T	6	0.02	0.02	0.02	0.000	0.02		
Beryllium-D	6	0.02	0.02	0.02	0.000	0.02		
Bismuth-T	6	0.02	0.03	0.02	0.004	0.02		
Bismuth-D	6	0.02	0.02	0.02	0.000	0.02		
Cadmium-T	6	0.01	0.01	0.01	0.000	0.01	≤ 5	maximum acceptable concentration
Cadmium-D	6	0.01	0.03	0.02	0.008	0.01		
Calcium-T (mg/L)	6	7.44	19	15.14	4.272	0.05		
Calcium-D (mg/L)	6	6.48	20.6	15.3	5.09	0.05		
Chromium-T	6	0.2	0.3	0.217	0.041	0.2	≤ 50	maximum acceptable concentration
Chromium-D	6	0.2	0.2	0.2	0.00	0.2		
Cobalt-T	6	0.005	0.591	0.128	0.227	0.005		
Cobalt-D	6	0.005	0.042	0.016	0.014	0.005		
Copper-T	6	0.05	2.07	0.51	0.768	0.05	≤ 1000	aesthetic objective
Copper-D	6	0.05	0.34	0.20	0.097	0.05		
Iron-T (mg/L)	5	0.065	1.53	0.38	0.645	0.005	≤ 0.3	aesthetic objective
Iron-D (mg/L)	5	0.007	0.035	0.023	0.013	0.005		
Lead-T	6	0.01	1.56	0.29	0.623	0.01	≤ 10	maximum acceptable concentration
Lead-D	6	0.01	0.07	0.03	0.025	0.01		
Lithium-T	6	0.05	0.77	0.56	0.265	0.05		
Lithium-D	6	0.05	0.73	0.35	0.284	0.05		
Magnesium-T (mg/L)	6	1.64	3.1	2.64	0.531	0.05		
Magnesium-D (mg/L)	6	1.28	3.27	2.63	0.711	0.05	≤ 100	aesthetic objective
Manganese-T	6	7.38	32	13.62	9.196	0.008	≤ 50	aesthetic objective
Manganese-D	6	0.752	11.9	5.942	4.697	0.008		
Molybdenum-T	6	0.05	0.12	0.08	0.026	0.05	≤ 250	maximum acceptable concentration
Molybdenum-D	6	0.05	0.1	0.07	0.020	0.05		
Nickel-T	6	0.05	1	0.22	0.384	0.05		
Nickel-D	6	0.05	0.2	0.09	0.063	0.05		
Selenium-T	6	0.2	0.3	0.2	0.04	0.2	≤ 10	maximum acceptable concentration
Selenium-D	6	0.2	0.3	0.2	0.05	0.2		
Silver-T	6	0.02	0.02	0.02	0.000	0.02		
Silver-D	6	0.02	0.02	0.02	0.000	0.02		
Sodium-T (mg/L)	5	0.33	0.94	0.75	0.251	0.05	≤ 200	aesthetic objective
Strontium-T	6	28.4	66.4	54.2	13.46	0.005		
Strontium-D	6	27.1	65.6	53.1	13.88	0.005		
Thallium-T	6	0.002	0.006	0.003	0.002	0.002	≤ 2	maximum acceptable concentration
Thallium-D	6	0.002	0.002	0.002	0.000	0.002		
Tin-T	6	0.01	0.08	0.03	0.032	0.01		
Tin-D	6	0.01	0.08	0.02	0.029	0.01		
Uranium-T	6	0.166	0.344	0.260	0.077	0.002	≤ 100	maximum acceptable concentration
Uranium-D	6	0.058	0.317	0.202	0.097	0.002		
Vanadium-T	6	0.06	0.39	0.18	0.134	0.06	≤ 100	maximum acceptable concentration
Vanadium-D	6	0.06	0.29	0.14	0.094	0.06		
Zinc-T	6	0.1	1.4	0.4	0.52	0.1	≤ 5000	aesthetic objective
Zinc-D	6	0.1	0.4	0.2	0.13	0.1		

Table 3. 2002/03 sample parameters, summaries of current results and associated B.C. drinking water guidelines for the Dominion Creek site D/S of the crossover.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
General								
pH	6	7.5	8	7.8	0.19	0.1	6.5-8.5	aesthetic objective
Colour (TCU)	6	5	5	5	0.0	5	≤ 15	aesthetic objective
Specific Conductance (µS/cm)	6	49	152	112	41.2	1	≤ 700	maximum acceptable concentration
Turbidity (NTU)	4	0.47	8.66	3.43	3.936	0.1	≤ 5	maximum acceptable concentration
Hardness Total (mg/L)	6	27.8	78.3	57.96	20.510			
Hardness Total -Diss. (mg/L)	6	22.4	83.2	57.2	24.54		≤ 500 CaCO3	aesthetic objective
Alkalinity (mg/L)	6	24.5	71.7	53.4	19.40	0.5		
Residue Non-Filterable (mg/L)	6	4	86	33	40.3	4		
Total Organic Carbon (mg/L)								
TOC	6	1.1	2.3	1.6	0.51	0.5	≤ 4	maximum, to control THM production
Anions (mg/L)								
Chloride Dissolved	6	0.5	0.8	0.6	0.13	0.5	≤ 250	aesthetic objective
Fluoride Dissolved	6	0.01	0.03	0.03	0.009	0.01	≤ 1.5	maximum acceptable concentration
Bromide Dissolved	6	0.1	0.1	0.1	0.00	0.1		
Nutrients (mg/L)								
Nitrate+Nitrite	6	0.002	0.053	0.030	0.024	0.002	≤ 45 (Nitrate)	maximum acceptable concentration
Phosphorus Total	6	0.002	0.054	0.013	0.023	0.002	≤ 1.5	maximum acceptable concentration
Phosphorus Total-Diss.	6	0.002	0.007	0.004	0.002	0.002		
Sulphate (mg/L)								
Sulphate	6	1.2	7.3	5.0	2.4	0.5	≤ 500	aesthetic objective
Metals Total (ug/L)								
Aluminum-T	6	1.8	214	74.3	97.68	0.3		
Aluminum-D	6	1.2	13.7	5.3	4.88	0.3	≤ 200	maximum acceptable concentration
Antimony-T	6	0.006	0.021	0.011	0.006	0.005	≤ 6	interim maximum acceptable concentration
Antimony-D	6	0.005	0.009	0.006	0.002	0.005		
Arsenic-T	6	0.1	0.6	0.3	0.25	0.1	≤ 25	interim maximum acceptable concentration
Arsenic-D	6	0.1	0.2	0.1	0.06	0.1		
Barium-T	6	1.92	5.84	3.23	1.588	0.02	≤ 1000	maximum acceptable concentration
Barium-D	6	1.07	3.43	2.29	1.017	0.02		
Beryllium-T	6	0.02	0.02	0.02	0.000	0.02		
Beryllium-D	6	0.02	0.02	0.02	0.000	0.02		
Bismuth-T	6	0.02	0.05	0.03	0.012	0.02		
Bismuth-D	6	0.02	0.02	0.02	0.000	0.02		
Cadmium-T	6	0.01	0.02	0.01	0.004	0.01	≤ 5	maximum acceptable concentration
Cadmium-D	6	0.01	0.03	0.01	0.009	0.01		
Calcium-T (mg/L)	6	8.29	25.5	18.39	6.976	0.05		
Calcium-D (mg/L)	6	6.81	27.1	18.26	8.252	0.05		
Chromium-T	6	0.2	0.3	0.2	0.05	0.2	≤ 50	maximum acceptable concentration
Chromium-D	6	0.2	0.6	0.3	0.18	0.2		
Cobalt-T	6	0.029	0.947	0.316	0.409	0.005		
Cobalt-D	6	0.005	0.029	0.018	0.010	0.005		
Copper-T	6	0.05	2.38	0.80	0.993	0.05	≤ 1000	aesthetic objective
Copper-D	6	0.05	0.37	0.19	0.120	0.05		
Iron-T (mg/L)	5	0.061	1.84	0.71	0.873	0.005	≤ 0.3	aesthetic objective
Iron-D (mg/L)	5	0.013	0.034	0.023	0.009	0.005		
Lead-T	6	0.01	1.93	0.56	0.838	0.01	≤ 10	maximum acceptable concentration
Lead-D	6	0.01	0.09	0.03	0.033	0.01		
Lithium-T	6	0.65	1.07	0.83	0.173	0.05		
Lithium-D	6	0.15	0.79	0.56	0.251	0.05		
Magnesium-T (mg/L)	6	1.73	3.61	2.92	0.758	0.05		
Magnesium-D (mg/L)	6	1.31	3.76	2.82	0.966	0.05	≤ 100	aesthetic objective

Table 3 Continued.

Parameter	# of Values	Min.	Max.	Mean	Std. Dev.	MDL	D.W. Guideline	Guideline Type
Manganese-T	6	7.47	67.3	28.4	27.90	0.008	≤ 50	aesthetic objective
Manganese-D	6	0.813	9.39	5.83	3.595	0.008		
Molybdenum-T	6	0.05	0.24	0.12	0.075	0.05	≤ 250	maximum acceptable concentration
Molybdenum-D	6	0.06	0.19	0.12	0.063	0.05		
Nickel-T	6	0.05	1.16	0.34	0.481	0.05		
Nickel-D	6	0.05	0.16	0.07	0.048	0.05		
Selenium-T	6	0.2	0.2	0.2	0.00	0.2	≤ 10	maximum acceptable concentration
Selenium-D	6	0.2	0.3	0.22	0.045	0.2		
Silver-T	6	0.02	0.02	0.02	0.000	0.02		
Silver-D	6	0.02	0.02	0.02	0.000	0.02		
Sodium-T (mg/L)	5	0.35	1.14	0.83	0.311	0.05	≤ 200	aesthetic objective
Strontium-T	6	29.6	86.4	62.8	22.66	0.005		
Strontium-D	6	28.7	87.1	60.9	22.71	0.005		
Thallium-T	6	0.002	0.006	0.003	0.002	0.002	≤ 2	maximum acceptable concentration
Thallium-D	6	0.002	0.002	0.002	0.000	0.002		
Tin-T	6	0.01	0.06	0.02	0.022	0.01		
Tin-D	6	0.01	0.06	0.02	0.022	0.01		
Uranium-T	6	0.243	0.78	0.497	0.261	0.002	≤ 100	maximum acceptable concentration
Uranium-D	6	0.075	0.694	0.357	0.257	0.002		
Vanadium-T	6	0.06	0.41	0.25	0.161	0.06	≤ 100	maximum acceptable concentration
Vanadium-D	6	0.06	0.31	0.16	0.095	0.06		
Zinc-T	6	0.1	1.5	0.7	0.68	0.1	≤ 5000	aesthetic objective
Zinc-D	6	0.1	0.4	0.2	0.14	0.1		

Table 4. Sediment sampling results from October 17th, 2002.

Parameter	Unit	Value 1	Value 2	Parameter	Unit	Value 1	Value 2	Parameter	Unit	Value 1	Value 2
% Moisture	(% W/W)	25.4	29.8	2,4-D	(µg/g)	<0.01	<0.01	Fenitrothion	(µg/g)	<0.02	<0.02
>2.00 mm	(% W/W)	12.68	11.33	Dicamba	(µg/g)	<0.005	<0.005	Fensulfothion	(µg/g)	<0.01	<0.01
<2.00 >0.063 mm	(% W/W)	74.42	74.94	Dichlorprop	(µg/g)	<0.01	<0.01	Fenthion	(µg/g)	<0.02	<0.02
<0.063 >0.053 mm	(% W/W)	1.92	1.92	Dinoseb	(µg/g)	<0.1	<0.1	Fonofos	(µg/g)	<0.02	<0.02
<0.053 >0.004 mm	(% W/W)	9.24	10.03	MCPA	(µg/g)	<0.01	<0.01	Iodofenphos	(µg/g)	<0.01	<0.01
<0.004 >0.002 mm	(% W/W)	0.44	0.40	Picloram	(µg/g)	<0.01	<0.01	Malathion	(µg/g)	<0.01	<0.01
<0.002 mm	(% W/W)	1.30	1.37	2,4,5-T	(µg/g)	<0.005	<0.005	Mevinphos-cis	(µg/g)	<0.05	<0.05
Carbon - Tot. Inorg.	(µg/L)	<500	<500	2,4,5-TP	(µg/g)	<0.005	<0.005	Methamidophos	(µg/g)	<0.05	<0.05
Carbon - Tot. Org.	(µg/L)	5000	6300	Triclopyr	(µg/g)	<0.005	<0.005	Naled	(µg/g)	<0.01	<0.01
Carbon - Tot.	(µg/g)	5000	6300	Aldrin	(µg/g)	<0.002	<0.002	Omethoate	(µg/g)	<0.02	<0.02
Phosphorus - Tot.	(µg/g)	647	734	BHC, Alpha-	(µg/g)	<0.002	<0.002	Parathion	(µg/g)	<0.01	<0.01
Aluminum - Tot.	(µg/g)	4710	3740	BHC, Beta-	(µg/g)	<0.002	<0.002	Parathion Methyl	(µg/g)	<0.02	<0.02
Antimony - Tot.	(µg/g)	<0.1	<0.01	BHC, Delta-	(µg/g)	<0.002	<0.002	Phorate	(µg/g)	<0.02	<0.02
Arsenic - Tot.	(µg/g)	4.9	4.1	Chlordane, Alpha-	(µg/g)	<0.01	<0.01	Phosalone	(µg/g)	<0.05	<0.05
Barium - Tot.	(µg/g)	9.9	7.4	Chlordane, Gamma-	(µg/g)	<0.01	<0.01	Phosmet	(µg/g)	<0.03	<0.03
Beryllium - Tot.	(µg/g)	<0.1	<0.1	DDD,p,p'-	(µg/g)	<0.01	<0.01	Phosphamidon	(µg/g)	<0.05	<0.05
Bismuth - Tot.	(µg/g)	0.6	<0.1	DDE-p,p'	(µg/g)	<0.005	<0.005	Sulfotep	(µg/g)	<0.02	<0.02
Cadmium - Tot.	(µg/g)	<0.05	<0.05	DDT-o,p'-	(µg/g)	<0.01	<0.01	Tetrachlorvinphos	(µg/g)	<0.02	<0.02
Calcium - Tot.	(µg/g)	1970	2010	DDT-p,p'-	(µg/g)	<0.02	<0.02	Oil & Grease - Tot.	(µg/g)	<100	<100
Chromium - Tot.	(µg/g)	12	8	Dieldrin	(µg/g)	<0.01	<0.01	Acenaphthene	(µg/g)	<0.01	<0.01
Cobalt - Tot.	(µg/g)	6.1	4.9	Endosulfan I	(µg/g)	<0.01	<0.01	Acenaphthylene	(µg/g)	<0.01	<0.01
Copper - Tot.	(µg/g)	16.3	11.6	Endosulfan II	(µg/g)	<0.01	<0.01	Anthracene	(µg/g)	<0.01	<0.01
Iron - Tot.	(µg/g)	13300	10700	Endosulfan Sulphate	(µg/g)	<0.02	<0.02	Benzo(a)anthracene	(µg/g)	<0.01	<0.01
Lead - Tot.	(µg/g)	6.1	4.9	Endrin	(µg/g)	<0.02	<0.02	Benzo(b)fluoranthene	(µg/g)	<0.01	<0.01
Magnesium - Tot.	(µg/g)	3380	2780	Hepatachlor	(µg/g)	<0.002	<0.002	Benzo(k)fluoranthene	(µg/g)	<0.01	<0.01
Manganese - Tot.	(µg/g)	248	198	Hepatachlor epoxide	(µg/g)	<0.004	<0.004	Benzo(g,hi)perylene	(µg/g)	<0.02	<0.02
Molybdenum - Tot.	(µg/g)	0.2	0.2	Lindane, BHC, Gamma-	(µg/g)	<0.002	<0.002	Benzo(a)pyrene	(µg/g)	<0.01	<0.01
Nickel - Tot.	(µg/g)	16.2	12.4	Methidathion	(µg/g)	<0.02	<0.02	Chrysene	(µg/g)	<0.01	<0.01
Potassium - Tot.	(µg/g)	196	154	Methoxychlor	(µg/g)	<0.02	<0.02	Dibenz(a,h)anthracene	(µg/g)	<0.02	<0.02
Selenium - Tot.	(µg/g)	<0.5	<0.5	Mirex	(µg/g)	<0.02	<0.02	Fluoranthene	(µg/g)	<0.01	<0.01
Silver - Tot.	(µg/g)	<0.05	<0.05	Nonchlor, Trans-	(µg/g)	<0.01	<0.01	Fluorene	(µg/g)	<0.01	<0.01
Sodium - Tot.	(µg/g)	<100	<100	Oxychlordane	(µg/g)	<0.01	<0.01	Indeno(1,2,3-c,d)pyrene	(µg/g)	<0.02	<0.02
Strontium - Tot.	(µg/g)	9.7	9.6	PCBs- Tot.	(µg/g)	<0.05	<0.05	Naphthalene	(µg/g)	<0.01	<0.01
Tellurium - Tot.	(µg/g)	<0.1	<0.1	Acephate	(µg/g)	<0.05	<0.05	C1-Naphthalenes	(µg/g)	<0.01	<0.01
Thallium - Tot.	(µg/g)	0.06	<0.05	Azinphos Methyl	(µg/g)	<0.05	<0.05	C2-Naphthalenes	(µg/g)	<0.02	<0.02
Tin - Tot.	(µg/g)	0.3	0.4	Bromophos	(µg/g)	<0.01	<0.01	Phenanthrene	(µg/g)	<0.01	<0.01
Titanium - Tot.	(µg/g)	69	55	Carbophenothion	(µg/g)	<0.01	<0.01	C1-Phen/Anthracene	(µg/g)	<0.02	<0.02
Vanadium - Tot.	(µg/g)	6	6	Chlorfenvinphos(e)	(µg/g)	<0.01	<0.01	C2-Phen/Anthracene	(µg/g)	<0.02	<0.02
Zinc - Tot.	(µg/g)	25	20.8	Chlorpyrifos	(µg/g)	<0.01	<0.01	Pyrene	(µg/g)	<0.01	<0.01
Zirconium - Tot.	(µg/g)	<0.5	<0.5	Demeton	(µg/g)	<0.02	<0.02	Total PAHs	(µg/g)	<0.01	<0.01
2,3,4,5 - Tetrachlorophenol	(µg/g)	<0.01	<0.01	Diazinon	(µg/g)	<0.02	<0.02	Total Low MW PAHs	(µg/g)	<0.01	<0.01
2346+2356-TeClPhenol	(µg/g)	<0.01	<0.01	Dichlorvos	(µg/g)	<0.01	<0.01	Total High MW PAHs	(µg/g)	<0.01	<0.01
Pentachlorophenol	(µg/g)	<0.005	<0.005	Dimethoate	(µg/g)	<0.02	<0.02				
Bromoxynil	(µg/g)	<0.01	<0.01	Ethion	(µg/g)	<0.05	<0.05				

Table 6. Duplicate samples that exceeded precision acceptability criteria (≤25% difference when >5-fold MDL). All concentrations in µg/L.

Parameter	MDL (µg/L)	Duplicate Acceptance Criteria (RPD%)	September/02			January/03			March/03			August/03		
			Conc. 1	Conc. 2	RPD %	Conc. 1	Conc. 2	RPD %	Conc. 1	Conc. 2	RPD %	Conc. 1	Conc. 2	RPD %
Antimony-T	0.005	25%	0.057	0.034	**50**									
Copper-T	0.05	25%	4.85	8.97	**59.6**							15	6.7	**76.5**
Copper-D	0.05	25%	6.19	3.49	**55.8**							8.53	2.75	**102**
Lithium-D	0.05	25%				0.69	2.15	**103**						
Lead-T	0.01	25%	0.38	0.69	**58**									
Lead-D	0.01	25%										0.52	0.39	**29**
Manganese-T	0.008	25%										1.86	1.42	**26.8**
Tin-T	0.01	25%	0.04	0.09	**77**	0.01	0.1	**164**				0.1	0.06	**50**
Zinc-T	0.1	25%				<0.1	1.7	**178**	0.1	0.7	**150**			
Zinc-D	0.1	25%				<0.1	0.8	**155**						

RPD %=Relative Percent Difference

**Data are presented for the purpose of batch specific QA assessment. Most QA samples were not collected at McBride.*

Table 7. Percent difference in measures taken from duplicate sediment samples.

Parameter	Unit of Measure	% Difference	Parameter	Unit of Measure	% Difference
PART I: PHYSICAL PROPERTIES			PART III. TOTAL METALS		
Moisture	% (W/W)	15%	Aluminum - Total	µg/g	21%
Percent Gravel	% (W/W)	68%	Arsenic - Total	µg/g	11%
Solid Content	%	7%	Barium - Total	µg/g	25%
Percent Coarse Sand	% (W/W)	41%	Calcium - Total	µg/g	2%
Percent Medium Sand	% (W/W)	8%	Chromium - Total	µg/g	34%
Percent Fine Sand	% (W/W)	15%	Cobalt - Total	µg/g	20%
Percent Very Fine Sand	% (W/W)	10%	Copper - Total	µg/g	29%
Percent Silt	% (W/W)	8%	Iron - Total	µg/g	20%
Percent Clay	% (W/W)	8%	Lead - Total	µg/g	20%
PART II. CARBON AND PHOSPHORUS			Magnesium - Total	µg/g	18%
Organic Carbon - Total	µg/g	20%	Manganese - Total	µg/g	20%
Carbon - Total	µg/g	20%	Molybdenum - Total	µg/g	0%
Phosphorus - Total	µg/g	12%	Nickel - Total	µg/g	23%
			Potassium - Total	µg/g	21%
			Strontium - Total	µg/g	1%
			Tin - Total	µg/g	25%
			Titanium - Total	µg/g	20%
			Vanadium - Total	µg/g	0%
			Zinc - Total	µg/g	17%

Table 13. 2002/03 raw water data collected from the crossover pipe that enters Dominion Creek.

Date	Total Coliform (Col./100mL)	Fecal Coliform (Col./100mL)	Enterococci (Col./100mL)	E. Coli (Col./100mL)	pH (pH Units)
26-Sep-02	9	9	2	9	7.9
17-Mar-03	<1	<1	<1	<1	8
07-May-03	<2	<2	<2	<2	8
10-Jun-03	31	1	<1	1	8.1
12-Aug-03	260	41	51	35	8.2

True Colour (Col. Unit)	Specific Conductance (µS/cm)	Residues - NonFilt. (mg/L)	Turbidity (NTU)	Hardness - Total (mg/L)	Hardness - Dissolved (mg/L)
40	197	<4		107	108
10	225	<4	1.1	116	127
15	206	<4	0.61	108	113
10	219	<4	1.12	119	116
10	235	4	1.71	126	118

Alkalinity - T as $CaCO_3$ (mg/L)	Bromide - Diss. (mg/L)	Chloride - Diss. (mg/L)	Fluoride - Diss. (mg/L)	Carbon - Tot. Org. (mg/L)	$NO_2 + NO_3$ (mg/L)
96	<0.1	<0.5	0.06	7.4	0.009
107	<0.1	0.5	0.05	2.1	0.031
103	<0.1	<0.5	0.04	4.2	0.016
111	<0.1	<0.5	0.06	3.2	0.017
111	<0.1	<0.5	0.06	3.1	<0.002

Phosphorus - Tot. Diss. (mg/L)	Phosphorus - Tot. (mg/L)	Sulfate (mg/L)	Aluminum - Tot. (µg/L)	Aluminum - Diss. (µg/L)	Antimony - Tot. (µg/L)
0.003	0.006	10.3	29.9	9	0.025
<0.002	<0.002	11.1	8.1	3.1	<0.005
0.004	0.004	10.2	18.4	6.3	<0.005
<0.002	0.004	11.4	17.8	5.5	0.008
0.004	0.007	9.8	27.7	3.8	0.005

Antimony - Diss. (µg/L)	Arsenic - Tot. (µg/L)	Arsenic - Diss. (µg/L)	Barium - Tot. (µg/L)	Barium - Diss. (µg/L)	Beryllium - Tot. (µg/L)	Beryllium - Diss. (µg/L)
0.009	0.2	0.1	6.49	5.86	<0.02	<0.02
<0.005	<0.1	<0.1	5.61	5.62	<0.02	<0.02
<0.005	0.2	0.2	5.76	5.38	<0.02	<0.02
0.01	0.2	0.2	6.09	5.65	<0.02	<0.02
0.006	0.2	0.1	7.07	5.99	<0.02	<0.02

Bismuth - Tot. (µg/L)	Bismuth - Diss. (µg/L)	Cadmium - Tot. (µg/L)	Cadmium - Diss. (µg/L)	Calcium - Tot. (mg/L)	Calcium - Diss. (mg/L)	Chromium - Tot. (µg/L)
<0.02	<0.02	<0.01	<0.01	36	36.3	<0.2
0.03	<0.02	<0.01	<0.01	38.8	42.7	<0.2
<0.02	<0.02	<0.01	0.02	36.2	38	<0.2
<0.02	<0.02	<0.01	<0.01	40.2	39.1	<0.2
<0.02	<0.02	<0.01	<0.01	42.4	39.9	0.9

Chromium - Diss. (µg/L)	Cobalt - Tot. (µg/L)	Cobalt - Diss. (µg/L)	Copper - Tot. (µg/L)	Copper - Diss. (µg/L)	Iron - Tot. (mg/L)	Iron - Diss. (mg/L)
<0.2	<0.005	<0.005	0.22	0.32		
<0.2	<0.005	<0.005	0.09	0.08	0.108	0.012
<0.2	<0.005	<0.005	0.21	0.16	0.124	0.023
<0.2	0.016	<0.005	0.13	0.09	0.109	0.015
0.7	0.06	0.013	0.19	0.08	0.182	0.013

Lead - Tot. (µg/L)	Lead - Diss. (µg/L)	Lithium - Tot. (µg/L)	Lithium - Diss. (µg/L)	Magnesium - Tot. (mg/L)	Magnesium - Diss. (mg/L)	Manganese - Tot. (µg/L)
0.08	<0.01	<0.05	<0.05	4.11	4.2	22.2
<0.01	<0.01	1.19	1.18	4.57	4.97	2.62
0.09	0.02	1.2	1.2	4.27	4.41	12.6
0.06	0.01	1.51	1.56	4.61	4.51	11.9
0.07	0.03	1.63	1.58	4.82	4.55	23

Manganese - Diss. (µg/L)	Molybdenum - Tot. (µg/L)	Molybdenum - Diss. (µg/L)	Nickel - Tot. (µg/L)	Nickel - Diss. (µg/L)	Selenium - Tot. (µg/L)
1.73	0.39	0.41	<0.05	<0.05	0.2
1.83	0.46	0.42	<0.05	<0.05	<0.2
2.22	0.45	0.43	<0.05	<0.05	<0.2
1.74	0.52	0.59	<0.05	<0.05	0.3
1.92	0.46	0.45	3.98	<0.05	0.2

Selenium - Diss. (µg/L)	Silver - Tot. (µg/L)	Silver - Diss. (µg/L)	Sodium - Tot. (mg/L)	Strontium - Tot. (µg/L)	Strontium - Diss. (µg/L)
<0.2	<0.02	<0.02		129	128
0.2	<0.02	<0.02	1.52	135	139
<0.2	<0.02	<0.02	1.39	119	119
0.4	<0.02	<0.02	1.57	133	135
<0.2	<0.02	<0.02	1.69	159	143

Thallium - Tot. (µg/L)	Thallium - Diss. (µg/L)	Tin - Tot. (µg/L)	Tin - Diss. (µg/L)	Uranium - Tot. (µg/L)	Uranium - Diss. (µg/L)
<0.002	<0.002	<0.01	0.05	1.23	1.02
<0.002	<0.002	<0.01	<0.01	1.63	1.51
0.003	<0.002	<0.01	<0.01	1.33	1.25
<0.002	<0.002	<0.01	<0.01	1.49	1.5
<0.002	<0.002	<0.01	<0.01	1.41	1.26

Vanadium - Tot. (µg/L)	Vanadium - Diss. (µg/L)	Zinc - Tot. (µg/L)	Zinc - Diss. (µg/L)
0.37	0.59	<0.1	0.6
0.62	0.48	0.1	0.1
0.14	0.16	0.2	0.4
0.24	0.32	0.3	0.1
0.3	0.24	0.4	0.2

Table 14. 2002/03 raw water data collected upstream of the crossover pipe entering Dominion Creek.

Date	Total Coliform (CFU/100mL)	Fecal Coliform (CFU/100mL)	Enterococci (CFU/100mL)	E. Coli (CFU/100mL)	pH (pH Units)
26-Sep-02	18	<1	1	<1	7.6
22-Jan-03	8	<1	<1		7.8
17-Mar-03	<1	<1	<1	<1	7.7
07-May-03	2	<2	<2	<2	7.8
10-Jun-03	29	1	<1	3	7.4
12-Aug-03	560	2	7	<1	7.9

True Colour (Col. Unit)	Specific Conductance (µS/cm)	Residues - NonFilt. (mg/L)	Turbidity (NTU)	Hardness - Total (mg/L)	Hardness - Dissolved (mg/L)
5	92	<4		45.7	47.1
5	107	<4	0.49	54.1	51.6
15	118	<4	0.4	59	64.9
5	118	8	0.3	60.2	62.7
5	46	68	5.3	25.3	21.5
5	94	<4	0.35	47.8	46.7

Alkalinity - T as $CaCO_3$ (mg/L)	Bromide - Diss. (mg/L)	Chloride - Diss. (mg/L)	Fluoride - Diss. (mg/L)	Carbon - Tot. Org. (mg/L)	$NO_2 + NO_3$ (mg/L)
44	<0.1	<0.5	0.01	1.3	<0.002
50	<0.1	<0.5	0.03		0.053
56	<0.1	<0.5	0.01	1.2	0.057
57.8	<0.1	<0.5	0.02	1.2	0.057
22.8	<0.1	<0.5	<0.01	1.8	0.004
44.2	<0.1	<0.5	0.01	0.8	0.004

Phosphorus - Tot. Diss. (mg/L)	Phosphorus - Tot. (mg/L)	Sulfate (mg/L)	Aluminum - Tot. (µg/L)	Aluminum - Diss. (µg/L)	Antimony - Tot. (µg/L)
<0.002	<0.002	3.7	6	2.8	<0.005
0.003	0.003	5.6	1.8	1.2	0.009
0.003	0.002	5.8	4.7	2.6	0.014
0.004	0.003	5.5	4.4	2.8	0.007
<0.002	0.023	1.1	190	12.5	0.008
0.003	0.003	3.9	7.8	2.4	<0.005

Antimony - Diss. (µg/L)	Arsenic - Tot. (µg/L)	Arsenic - Diss. (µg/L)	Barium - Tot. (µg/L)	Barium - Diss. (µg/L)	Beryllium - Tot. (µg/L)	Lithium - Diss. (µg/L)
<0.005	0.2	0.2	1.73	1.84	<0.02	<0.05
<0.005	<0.1	<0.1	1.92	1.88	<0.02	0.15
<0.005	<0.1	<0.1	2.46	2.39	<0.02	0.1
<0.005	0.2	0.2	2.4	2.33	<0.02	0.56
<0.005	0.5	0.2	2.32	0.99	0.02	0.5
<0.005	<0.1	<0.1	1.65	1.61	<0.02	0.73

Beryllium - Diss. (µg/L)	Bismuth - Tot. (µg/L)	Bismuth - Diss. (µg/L)	Cadmium - Tot. (µg/L)	Cadmium - Diss. (µg/L)	Calcium - Tot. (mg/L)	Molybdenum - Diss. (µg/L)
<0.02	<0.02	<0.02	<0.01	<0.01	14.1	0.1
<0.02	0.03	<0.02	<0.01	0.03	16.9	0.07
<0.02	<0.02	<0.02	<0.01	<0.01	18.7	0.07
<0.02	<0.02	<0.02	<0.01	0.02	19	0.09
<0.02	<0.02	<0.02	0.01	<0.01	7.44	0.05
<0.02	<0.02	<0.02	<0.01	<0.01	14.7	<0.05

Calcium - Diss. (mg/L)	Chromium - Tot. (µg/L)	Chromium - Diss. (µg/L)	Cobalt - Tot. (µg/L)	Cobalt - Diss. (µg/L)	Copper - Tot. (µg/L)	Silver - Diss. (µg/L)
14.5	<0.2	<0.2	<0.005	<0.005	0.17	<0.02
16.1	<0.2	<0.2	0.035	0.023	<0.05	<0.02
20.6	<0.2	<0.2	0.047	0.042	0.22	<0.02
19.9	<0.2	<0.2	0.031	<0.005	0.33	<0.02
6.48	<0.2	<0.2	0.591	0.008	2.07	<0.02
14.3	0.3	<0.2	0.061	0.013	0.24	<0.02

Copper - Diss. (µg/L)	Iron - Tot. (mg/L)	Iron - Diss. (mg/L)	Lead - Tot. (µg/L)	Lead - Diss. (µg/L)	Lithium - Tot. (µg/L)	Tin - Tot. (µg/L)
0.2			0.02	<0.01	<0.05	<0.01
<0.05	0.081	0.024	<0.01	<0.01	0.65	0.01
0.17	0.108	0.035	<0.01	<0.01	0.55	0.01
0.26	0.097	0.035	0.09	0.07	0.61	0.08
0.34	1.53	0.014	1.56	0.04	0.75	<0.01
0.17	0.065	0.007	0.05	0.01	0.77	0.06

Magnesium - Tot. (mg/L)	Magnesium - Diss. (mg/L)	Manganese - Tot. (µg/L)	Manganese - Diss. (µg/L)	Molybdenum - Tot. (µg/L)
2.55	2.64	9.18	1.59	0.12
2.88	2.78	8.96	8.83	0.08
3	3.27	12.1	11.9	0.09
3.1	3.15	12.1	9.48	0.1
1.64	1.28	32	0.752	<0.05
2.7	2.67	7.38	3.1	0.06

Nickel - Tot. (µg/L)	Nickel - Diss. (µg/L)	Selenium - Tot. (µg/L)	Selenium - Diss. (µg/L)	Silver - Tot. (µg/L)
<0.05	<0.05	<0.2	0.3	<0.02
<0.05	<0.05	<0.2	<0.2	<0.02
0.1	0.13	<0.2	<0.2	<0.02
<0.05	<0.05	<0.2	<0.2	<0.02
1	0.2	0.3	0.3	<0.02
<0.05	<0.05	<0.2	<0.2	<0.02

Sodium - Tot. (mg/L)	Strontium - Tot. (µg/L)	Strontium - Diss. (µg/L)	Thallium - Tot. (µg/L)	Thallium - Diss. (µg/L)	Tin - Diss. (µg/L)
	57.5	57.1	<0.002	<0.002	<0.01
0.84	56.7	54.9	<0.002	<0.002	<0.01
0.92	66.4	65.6	<0.002	<0.002	<0.01
0.94	62.8	63.4	<0.002	<0.002	0.08
0.33	28.4	27.1	0.006	0.002	<0.01
0.71	53.6	50.7	<0.002	<0.002	<0.01

Uranium - Tot. (µg/L)	Uranium - Diss. (µg/L)	Vanadium - Tot. (µg/L)	Vanadium - Diss. (µg/L)	Zinc - Tot. (µg/L)	Zinc - Diss. (µg/L)
0.176	0.17	0.09	0.29	<0.1	0.4
0.243	0.23	0.06	<0.06	<0.1	<0.1
0.344	0.317	0.39	0.23	<0.1	<0.1
0.313	0.293	0.06	0.09	0.6	0.3
0.318	0.058	0.26	0.08	1.4	0.1
0.166	0.144	0.23	0.11	0.2	0.1

Table 15. 2002/03 raw water data collected from Dominion Creek downstream of the crossover pipe.

Date	Cryptosporidium (oocysts/100L)	Giardia (cysts/100L)	Total Coliform (Col./100mL)	Fecal Coliform (Col./100mL)	Enterococci (Col./100mL)
22-Jan-03			8	<1	<1
17-Oct-02	<2.2	<2.2			
17-Mar-03	<3.3	<3.3	<1	<1	<1
07-May-03	<4.6	<4.6	2	<2	<2
10-Jun-03	<4.9	9.8	26	1	<1
12-Aug-03	<3.6	<3.6	280	10	10
12-Aug-03			390		

E. Coli (Col./100mL)	pH (pH Units)	True Colour (Col. Unit)	Specific Conductance (µS/cm)	Residues - NonFilt. (mg/L)	Turbidity (NTU)
	7.8	5	107	<4	0.49
<1	7.8	5	152	<4	0.84
2	7.9	5	146	86	8.66
1	7.5	5	49	67	6.67
7					
	8	5	106	<4	0.47

Hardness - Total (mg/L)	Hardness - Dissolved (mg/L)	Alkalinity - Total as CaCO3 (mg/L)	Bromide - Diss. (mg/L)	Chloride - Diss. (mg/L)	Fluoride - Diss. (mg/L)
54.1	51.6	50	<0.1	<0.5	0.03
78.3	83.2	71	<0.1	0.8	0.03
76	78.3	71.7	<0.1	<0.5	0.03
27.8	22.4	24.5	<0.1	<0.5	<0.01
53.6	50.5	50	<0.1	<0.5	0.03

Carbon - Tot. Org. (mg/L)	NO2 + NO3 (mg/L)	Phosphorus - Tot. Diss. (mg/L)	Phosphorus - Tot. (mg/L)	Sulfate (mg/L)	Aluminum - Tot. (µg/L)	Aluminum - Diss. (µg/L)
	0.053	0.003	0.003	5.6	1.8	1.2
1.6	0.048	<0.002	<0.002	7.3	5.3	4.4
2.3	0.043	0.004	0.054	6.7	141	4.4
1.4	0.006	<0.002	<0.002	1.2	214	13.7
1.1	<0.002	0.007	0.004	4.4	9.6	2.8

Antimony - Tot. (µg/L)	Antimony - Diss. (µg/L)	Arsenic - Tot. (µg/L)	Arsenic - Diss. (µg/L)	Barium - Tot. (µg/L)	Barium - Diss. (µg/L)	Beryllium - Tot. (µg/L)
0.009	<0.005	<0.1	<0.1	1.92	1.88	<0.02
0.012	<0.005	<0.1	<0.1	3.34	3.43	<0.02
0.021	0.006	0.5	0.2	5.84	3.27	<0.02
0.006	0.009	0.6	0.2	3.06	1.07	<0.02
0.006	<0.005	<0.1	0.1	2	1.82	<0.02

Beryllium - Diss. (µg/L)	Bismuth - Tot. (µg/L)	Bismuth - Diss. (µg/L)	Cadmium - Tot. (µg/L)	Cadmium - Diss. (µg/L)	Calcium - Tot. (mg/L)	Calcium - Diss. (mg/L)
<0.02	0.03	<0.02	<0.01	0.03	16.9	16.1
<0.02	0.03	<0.02	<0.01	<0.01	25.5	27.1
<0.02	0.05	<0.02	0.02	0.01	24.5	25.5
<0.02	<0.02	<0.02	0.01	<0.01	8.29	6.81
<0.02	<0.02	<0.02	<0.01	<0.01	16.8	15.8

Chromium - Tot. (µg/L)	Chromium - Diss. (µg/L)	Cobalt - Tot. (µg/L)	Cobalt - Diss. (µg/L)	Copper - Tot. (µg/L)	Copper - Diss. (µg/L)
<0.2	<0.2	0.035	0.023	<0.05	<0.05
<0.2	<0.2	0.029	0.029	0.19	0.21
<0.2	<0.2	0.516	<0.005	1.19	0.19
<0.2	<0.2	0.947	0.008	2.38	0.37
0.3	0.6	0.052	0.023	0.2	0.12

Iron - Tot. (mg/L)	Iron - Diss. (mg/L)	Lead - Tot. (µg/L)	Lead - Diss. (µg/L)	Lithium - Tot. (µg/L)	Lithium - Diss. (µg/L)
0.081	0.024	<0.01	<0.01	0.65	0.15
0.109	0.034	<0.01	<0.01	0.67	0.6
1.48	0.029	0.8	0.03	1.07	0.79
1.84	0.015	1.93	0.09	0.85	0.54
0.061	0.013	0.04	0.03	0.89	0.73

Magnesium - Tot. (mg/L)	Magnesium - Diss. (mg/L)	Manganese - Tot. (µg/L)	Manganese - Diss. (µg/L)	Molybdenum - Tot. (µg/L)	Molybdenum - Diss. (µg/L)
2.88	2.78	8.96	8.83	0.08	0.07
3.55	3.76	9.4	9.39	0.24	0.19
3.61	3.56	67.3	6.39	0.15	0.18
1.73	1.31	49	0.813	<0.05	0.06
2.84	2.69	7.47	3.7	0.09	0.08

Nickel - Tot. (µg/L)	Nickel - Diss. (µg/L)	Selenium - Tot. (µg/L)	Selenium - Diss. (µg/L)	Silver - Tot. (µg/L)	Silver - Diss. (µg/L)	Sodium - Tot. (mg/L)
<0.05	<0.05	<0.2	<0.2	<0.02	<0.02	0.84
<0.05	<0.05	<0.2	<0.2	<0.02	<0.02	1.14
0.39	<0.05	<0.2	<0.2	<0.02	<0.02	1.07
1.16	0.16	0.2	0.3	<0.02	<0.02	0.35
<0.05	0.06	<0.2	<0.2	<0.02	<0.02	0.77

Strontium - Tot. (µg/L)	Strontium - Diss. (µg/L)	Thallium - Tot. (µg/L)	Thallium - Diss. (µg/L)	Tin - Tot. (µg/L)	Tin - Diss. (µg/L)	Uranium - Tot. (µg/L)
56.7	54.9	<0.002	<0.002	0.01	<0.01	0.243
86.4	87.1	<0.002	<0.002	0.06	0.06	0.78
81.5	77.7	<0.002	<0.002	<0.01	<0.01	0.762
29.6	28.7	0.006	0.002	<0.01	<0.01	0.438
59.9	56.3	<0.002	<0.002	<0.01	<0.01	0.264

Uranium - Diss. (µg/L)	Vanadium - Tot. (µg/L)	Vanadium - Diss. (µg/L)	Zinc - Tot. (µg/L)	Zinc - Diss. (µg/L)
0.23	0.06	<0.06	<0.1	<0.1
0.694	0.41	0.31	0.3	0.3
0.556	0.39	0.16	1.3	<0.1
0.075	0.27	0.1	1.5	0.4
0.229	0.1	0.18	0.1	<0.1