APPENDIX I

MONITORING OF MAJOR WATERCOURSES

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The following discusses each of the parameters monitored in this program. Sampling data (where possible) were compared to British Columbia Approved Water Quality Guidelines (BCAWQG) (http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html) established by the Ministry of Environment (MOE) to determine the health of the watercourses. Nitrate-nitrogen (NO_3-N) and phosphorus criteria were taken from the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQPAL) (http://www.ccme.ca/assets/pdf/wqg_aql_summary_table.pdf).

Fecal Coliform is bacteria found in the gut and feces of warm-blooded animals. These bacteria are used as indicators of contamination from sewage, improper manure storage and human/animal presence in and around watercourses. Due to insufficient data, the province has not set criteria for the protection of aquatic life. Rather, criteria for fresh and marine water shellfish harvesting are used to indicate the health of watercourses. Provincial shellfish harvesting criterion require that a minimum of five samples be collected over a 30-day period and the median fecal coliform concentration should not exceed 14 FC/100 mL. Stormwater, Harbours and Watershed Program (SHWP) staff collects a single sample for each sampling season (winter and summer) and compares the results to this provincial criterion. Also, samples are compared to the Stormwater, Harbours and Watersheds program guideline (SHWPG) of 200 FC/100 mL to assess the risk to public health.

Temperature impacts the growth of aquatic plants and animals as well as their resistance to disease, parasites and pollution. The temperature of the water in creeks is usually higher in summer than in winter. An increase in temperature can be caused by a lack of shading over the creek or discharges of warmer water from runoff. The maximum daily water temperature for the protection of freshwater aquatic life (for streams with unknown fish distribution) is 19°C.

pH is a measure of how acidic or basic the water is. The lower the pH the more acidic it is and the higher the pH the more basic (or alkaline) it is. Water that is more acidic can increase the solubility of heavy metals making the water more toxic to aquatic life. Criteria for the protection of freshwater aquatic life range from 6.5 to 9.0 pH units.

Dissolved Oxygen is a measure of the concentration of oxygen in water and indicates the amount of oxygen available for aquatic life. A decrease in oxygen concentrations in a creek can be a result of increased temperature levels or an increase in organic material entering the watercourse. Organic material (such as vegetation, fertilizers or human/animal waste) can cause an increase in aquatic plant growth (also caused by temperature increases) and as these plants die they are consumed by bacteria which deplete oxygen levels. The provincial criterion states that a minimum of 6 mg/L is needed for the protection of freshwater aquatic life.

Specific Conductance is a measure of the ability of water to conduct an electric current. The greater the content of ions in the water, the more current the water can carry. Ions (dissolved materials, including metals) can indicate the presence of contaminants which can be toxic to aquatic life. Specific conductance is temperature compensated conductivity and is reported as micro siemens per centimeter (μS/cm). Specific conductance levels for natural waters are between 50 and 1500 μS/cm.

Turbidity is a measure of the degree to which light is scattered or absorbed by the suspended particulate material and soluble coloured compounds in water. Materials such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms can negatively impact spawning beds, smother benthic habitat, clog or damage sensitive gill structures and potentially interfere with feeding patterns of aquatic organisms. The criterion for the protection of freshwater aquatic life is eight nephelometric turbidity units (NTU) for watercourses with background levels below 80 NTU.

Nitrate is formed when ammonia or other nitrogen sources combine with oxygenated water. It accumulates in the environment as a result of poorly or untreated sewage, runoff from the over-application of fertilizers, animal wastes (including birds and fish), decaying plant debris and discharges from car exhausts and is a natural constituent of plants. High nitrate levels can inhibit plant growth, deplete oxygen levels and cause stress in fish. There is no provincial criterion currently available for nitrate-nitrogen (NO_3-N). Instead, the CCME criterion of 2.95 mg/L NO_3-N (equivalent to 13 mg/L nitrate) was used for the protection of freshwater aquatic life.

Phosphorus can affect the growth of plants and animals and is used in the production of fertilizers, explosives, friction matches, fireworks, pesticides, toothpaste and detergents. This element can also be found in three different chemical forms: orthophosphate (found in sewage and produced by natural processes), metaphosphate (used in detergents it can change to the ortho form in water) and organically-bound phosphate (resulting from the breakdown of organic pesticides). In elemental form, phosphorus is very toxic (but is generally not found in the environment) and is subject to bioaccumulation. Higher phosphate levels can cause eutrophication and algal blooms which can result in the choking of waterways and the depletion of oxygen levels. There is no provincial criterion currently available for phosphorus (P). Instead, a CCME *Trigger Range* of 0.035 to 0.1 mg/L P was used. This freshwater aquatic life criterion is intended to prevent eutrophication in freshwater systems.

Stormwater Quality Report

Sampling of Major Watercourses (for the period of Jan 01, 1998 to Dec 31, 2006)

Creek Name	Station Number	Station Description	Date Visited	Flow Rate (L/min)	Fecal Coliform per/100mL	Temperature (C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Turbidity (NTU)	Nitrate/ Nitrogen (mg/L)	Phosphorous (mg/L)
Bucaneer Creek												
	7004-1											
			Apr 07, 2003	30	6	7.4	7.04	9.03	145.9	5.91		
			Jul 03, 2003	0								
			Mar 17, 2004		2	7.9	7.31	10.69	127.2	5.73		
			Jul 23, 2004	2	128	19.6	7.71	5.37	193.8	5.61		
			Apr 20, 2005	120	0	11.4	6.97	11.32	176.6	3.70	0	0.10
			Aug 18, 2005	5	134	18.2	7.23	9.45	124.0	2.19	0.7	0.03
			Mar 27, 2006	20	2	7.5	6.74	8.71	230.0	5.54	0.3	0.06
			Jul 07, 2006	0								
Lyall Creek												
	7413-1											
			Apr 14, 2003	80	8	7.8	7.08	11.45	101.7	3.19		
			Jul 11, 2003	30	600	15.0		7.59	68.7	8.07		
			Mar 29, 2004	100	11	7.2	7.66	12.28	55.9	1.85		
			Jul 23, 2004	20	1453	16.2	7.43	7.76	232.9	6.73		
			May 11, 2005	100	13	15.7	9.34	12.07	160.2	6.49	0.3	0.07
			Jul 28, 2005	20	74	16.6	7.95	8.95	336.0	1.42	0.5	0.06
			Mar 27, 2006	65	4	6.9	7.61	11.21	165.0	1.77	1.3	0.15
			Aug 01, 2006	10	188	14.6	6.85	8.99		2.16	0.2	0.14
Putter Creek												

Stormwater Quality Report

Sampling of Major Watercourses (for the period of Jan 01, 1998 to Dec 31, 2006)

Creek Name	Station Number	Station Description	Date Visited	Flow Rate (L/min)	Fecal Coliform per/100mL	Temperature (C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Turbidity (NTU)	Nitrate/ Nitrogen (mg/L)	Phosphorous (mg/L)
	7820-1											
			Apr 10, 2003	90	14	8.2	7.75	11.49	83.6	6.02		
			Jul 14, 2003									
			Mar 22, 2004									
			Jul 15, 2004	0								
			Apr 06, 2005	80	56	7.6	6.91	11.78	127.1	12.20	0.3	0.01
			Aug 31, 2005									
			Mar 28, 2006	75	15	7.0	7.15	11.66	158.4	7.68	2.3	0.24
			Sep 29, 2006	0								