Part E:
Appendices

Appendix A

Sediment and Soil Characterization,
Brydon Park Lagoon, Langley: Observations and Results
(August 13, 2012)

Our Project No. 12-6077

Suite 510
3820 Cessna Drive
Richmond
British Columbia
Canada
V7B 0A2
Telephone
(604) 278-7847
Fax
(604) 278-7894

August 13, 2012

City of Langley
20399 Douglas Crescent
Langley, BC
V3A 4B3

Attention: Mr. Gary Vlieg
Director Engineering, Parks, and Environment

Re: Sediment and Soil Characterization, Brydon Park Lagoon, Langley: Observations and Results

Dear Gary,

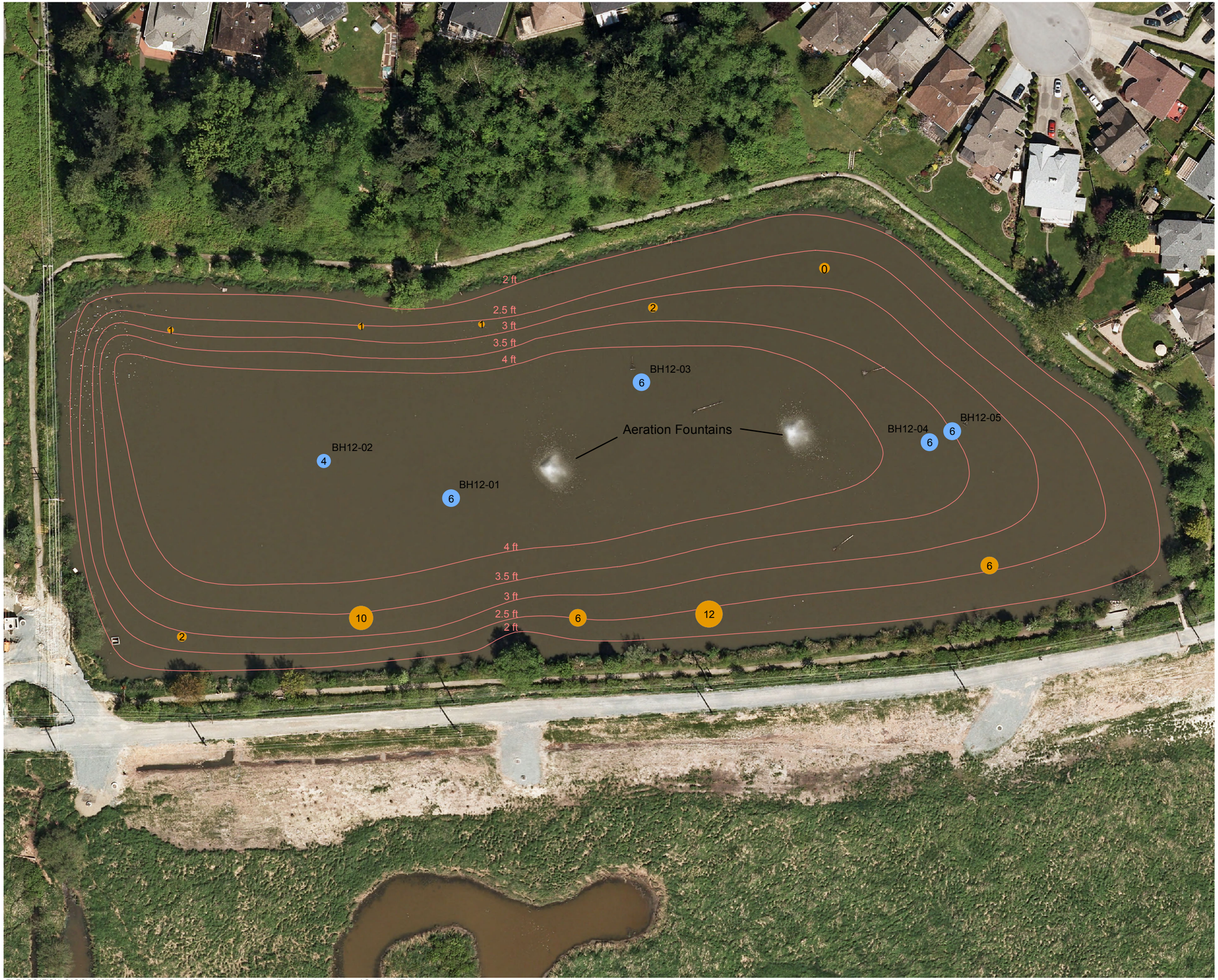
Dillon Consulting Limited (Dillon) is pleased to provide the City of Langley (Langley) with this letter report on the above-captioned site characterization activities at Brydon Park Lagoon (the Lagoon). The investigation was conducted in accordance with our proposal and work plan of June 22, 2012.

Methodology

Sediment and soil characterization was conducted July 19, 2012. Rocky Mountain Soil Sampling Inc. (Rocky Mountain) was retained as a subcontractor to conduct the site investigation.

Before work was begun, a qualified utility locating firm, Able1Call, was retained to locate underground utilities which might be present next to, and potentially underneath, the Lagoon. Able1Call contacted BC One Call to obtain all required written clearances, then performed two sweeps around the pond. The first was to check for the presence of live electrical lines, while the second was an electromagnetic (EM) survey to identify any conductive (metal) structures potentially present (*e.g.*, pipes). Also, City of Langley personnel were contacted and consulted, and met Dillon and Rocky Mountain on site before any drilling or sampling was conducted.

Apart from storm sewer lines next to the Lagoon – some of which apparently report to it – the only underground utility of note consisted of AC power cables, which convey current to the two aeration fountains in the Lagoon (see **Figure 1**). The cables extend from the fountain control panel, which is attached to a power pole at the south side of the pond, across the



CITY OF LANGLEY

CITY OF LANGLEY

Pond Management Strategy

Brydon Lagoon Bore Hole Locations and Sediment Thickness

Figure 1

- Probe Locations
- Bore Hole Locations
- 1
- 5 Sediment Thickness (Inches)
- 10
- Water Depth Contours

0 12.5 25 50 Meters

SCALE 1:1,000

MAP DRAWING INFORMATION:
Data from City of Langley, Dillon Created

MAP CREATED BY: Eric Hertzman
MAP CHECKED BY: Robert Beck
MAP PROJECTION: NAD_1983_UTM_Zone_10N

DILLON CONSULTING

PROJECT: 12-6077

DATE: (8/14/2012)

FILE LOCATION: G:\GIS\126077 City of Langley Ponds\Figure - Brydon Lagoon Bore Hole Locations and Sediment Thickness.mxd

bottom of the Lagoon to the fountains. Langley personnel informed Dillon that these cables had recently been re-installed, and indicated the approximate locations of the cables to Dillon and Rocky Mountain. To minimize the chance of severing a cable, a triangular "no-go area" was established, defined by the cables and by an imaginary line between the fountains, and extending about 10 m beyond these lines in all directions. No drilling or sampling was conducted inside this area.

Also prior to works being conducted, Dillon prepared a site-specific Hazard Assessment and Health and Safety Plan, following Dillon's Health and Safety Manual. Applicable Safe Work Practices (SWPs) were consulted, and provided to and reviewed with Rocky Mountain prior to the investigation. All personnel (Dillon and Rocky Mountain) working on water were equipped with suitable life jackets, while an appropriate rescue plan in case of accident was established and agreed to by all parties.

Using an air-powered direct-push drill rig (Pionjar), mounted on a raft, four boreholes were advanced in the bottom of the pond, as shown in **Figure 1**. A fifth borehole was attempted, but abandoned due to auger refusal, caused by woody debris about 1.2 m (46") below the pond bottom.

To establish stratigraphy to a reasonable depth, the first borehole was advanced to a depth below the pond bottom of about 3.7 m (12'), *i.e.,* to a depth below the water level and surrounding shoreline of about 4.9 m (16'). Subsequent boreholes were typically advanced to depths of about 2.4 m (8') below the pond bottom. Borehole locations (in UTM coordinates) were established with a hand-held GPS unit.

The drill rig was advanced in 1.2 m (4') intervals, with drill core being captured in single-use plastic sleeves which were conveyed to Dillon personnel on shore by a Rocky Mountain worker in a support vessel (Zodiac inflatable). Cores were photographed, logged using standard forms, and sampled.

Two to three soil samples were collected per borehole. Samples were handled with single-use Nitrile gloves, and typically split. One split of each sample was placed in a sealable plastic bag, and then subjected to field screening for hydrocarbon vapours using a standard organic vapour meter (OVM) which was calibrated to hexane and operated in methane-reduction mode. The other split was placed in a glass vessel with Teflon-lined lid supplied by the analytical laboratory (Maxxam Analytics). The sample was then labelled and placed in a chilled cooler overnight, before delivery under chain of custody to Maxxam the following day.

According to the initial work plan agreed to in discussions with Langley, boreholes were to be cased, then backfilled with bentonite grout, or equivalent, following completion of drilling. The rationale was to prevent potential downward migration of water or contaminants, in the

event that the pond bottom was found to consist of a clay liner overlying more conductive material. Instead, as noted, no conductive layer was found. Because of the increase of density of the clay with depth, and its plasticity (see observations, below), it was observed that boreholes tended to "close themselves" as drill rods were withdrawn. It was determined, therefore, that backfilling of boreholes, which in any case was likely impractical under water, would add little value to the project, and backfilling was not attempted. Langley personnel were informed of this recommended scope change via telephone.

After drilling, Dillon and Rocky Mountain conducted a circuit in the pond using the Zodiac, to establish the thickness at various points of the soft unconsolidated (organic) sediment lying atop native soils. Sediment thicknesses were established with a probe at ten locations. The UTM coordinates of each location were determined with the GPS.

Observations

Apparent thickness of unconsolidated (organic) sediment at the pond bottom ranged from about 25 mm (1") to about 300 mm (1'); see attached Figure 1. Unconsolidated organics were not found in at least one location. Below this, in two boreholes (BH12-01 and BE12-02), soils generally consisted of silty clay with trace sand. This material was typically bluish gray or brown-grey, plastic and dense. Density usually increased with depth, to the point where auger refusal was encountered in one borehole (BH12-02). In two boreholes (BH12-03 and BH12-05), a layer of brown to dark brown organic material was encountered, more dense and cohesive than the sediments but less than the clay, and containing some material interpreted to be woody debris or similar (potentially wood waste). This gave way with depth to clay similar to that observed elsewhere. Borehole logs for the four completed boreholes (BH12-01 to -03, and -05) are attached.

Summary of Analytical Data

Per **Table 1**, below, two samples were subjected to grain size analysis. Results indicated that the "clay" soils observed were best described as silty clay with trace sand, while the "organic" soils found included an approximately equal amount of sand- and silt-sized particles, with some clay and trace gravel.

Table 1: Soil Grain Sizes – Sediment and Soil Characterization, Brydon Park Lagoon

Sample Location	BH12-01	BH12-03
Sample Depth (m)[6]	0.9-1.2	0.9-1.2
Soil Type	clay	organics
Sample ID	BH12-01-1	BH12-03-1
Laboratory Sample ID	DZ3765	DZ3772
Sample Date	19-Jul-12	19-Jul-12
Physical Properties		
% sand by hydrometer	5.4	40
% silt by hydrometer	45	37
Clay Content	50	20
Gravel	<2.0	2.7

Units are percent by mass.

Per **Table 2**, (following page) four samples, plus one field duplicate for quality assurance/quality control (QA/QC) purposes, were analysed for extractable petroleum hydrocarbons and metals. Two samples were predominantly clay with silt (see **Table 1**), and two samples predominantly organics. All were collected in the approximate interval 0.9 m-1.2 m (3'-4') below the pond bottom.

Analytical data were compared to standards set out in the BC *Contaminated Sites Regulation* (CSR), specific to parkland (PL) land use. The samples collected in boreholes BH12-02 and BH12-03 reportedly contained arsenic (As) at concentrations exceeding applicable standards. Samples collected in boreholes BH12-01 and BH12-02 reportedly contained chromium (Cr) at concentrations exceeding the applicable standard of 60 µg/g. The reported concentrations, however, were below BC Environment's estimate of normal regional background, for the Lower Mainland, of 80 µg/g.

Finally, extractable petroleum hydrocarbons (EPH) in the "heavy" range (C19-C32) were reportedly detectable in two samples, from boreholes BH12-03 and BH12-05. Reported concentrations were 189 and 314 µg/g, respectively, compared to a detection limit of 100 µg/g, and an applicable CSR standard of 1000 µg/g.

Otherwise, reported concentrations of hydrocarbons and metals in all samples analysed were below CSR standards, or non-detectable.

Discussion of Observations and Results

Stratigraphy and Geology

Observations during and following drilling suggest that there has been relatively little net deposition of soft (unconsolidated) organic sediment on the lagoon bottom since it ceased to be used for sewage settlement (reportedly 1975). Observed sediment thickness ranged from approximately 25 mm (1'), or less, along the north side of the pond, to as much as 300 mm (12") along the south side. The reason for this variability is unknown. Earlier observations by Dillon, however, suggested that at some locations in the pond, immediately adjacent the shoreline, the sediment thickness was greater than 300 mm (per **Appendix B: Memo Sediment and Surface Water Results**, dated June 5, 2012).

Available evidence indicates that the silty clay of the pond bottom consists of native material, similar to that commonly present elsewhere in the City and Township of Langley, and which was not placed as an engineered or installed "liner" during the construction of the original sewage lagoon. The silty clay is dense and plastic, with density increasing to the maximum depth of drilling (about 3.7 m, or 12', below the pond bottom). As noted, density was in fact sufficient to result in auger refusal in at one borehole. Coarser or more permeable underlying native soils, atop which a clay liner could potentially have been installed during pond construction, were not found in any borehole.

TABLE 2: SOIL ANALYTICAL RESULTS, EXTRACTABLE PETROLEUM HYDROCARBONS AND TOTAL METALS
SEDIMENT AND SOIL CHARACTERIZATION, BRYDON PARK LAGOON, CITY OF LANGLEY

Sample Location	CSR PL Standards[1]					BH12-01	BH12-02	BH12-03	BH12-05	BH12-01
Sample Depth (m)[5]	Generic Soil Standards[2]	Matix Numerical Soil Standards[3]				0.9-1.2	0.9-1.2	0.9-1.2	0.9-1.2	0.9-1.2
Soil Type						clay	clay	organics	organics	clay
Sample ID		Intake of Contaminated Soil	Toxicity to Soil Invertebrates and Plants	Groundwater Used for Drinking Water	Groundwater Used by Aquatic Life	BH12-01-1	BH12-02-1	BH12-03-1	BH12-05-1	QC-01
Laboratory Sample ID						DZ3765	DZ3769	DZ3772	DZ3774	DZ3767
Sample Date						19-Jul-12	19-Jul-12	19-Jul-12	19-Jul-12	19-Jul-12
Hydrocarbons										
EPH (C10-C19) (mg/kg)	1000	n.s.	n.s.	n.s.	n.s.	<100	<100	<100	<100	<100
EPH (C19-C32) (mg/kg)	1000	n.s.	n.s.	n.s.	n.s.	<100	<100	189	314	<100
Metals[6]										
Moisture (%)	n.s.	n.s.	n.s.	n.s.	n.s.	28	27	72	75	26.0
pH (pH units)	n.s.	n.s.	n.s.	n.s.	n.s.	7.33	6.7	6.37	6.02	6.25
Antimony (Sb)	20	n.s.	n.s.	n.s.	n.s.	0.48	0.29	0.22	0.35	0.34
Arsenic(As)	n.s.	100	50	15	20	8.85	**41.9**	**53.2**	3.22	6.36
Barium (Ba)	n.s.	6 500	1 000	400	3500	104	108	84.8	146	101
Beryllium (Be)	4	n.s.	n.s.	n.s.	n.s.	<0.40	0.44	<0.40	<0.40	0.41
Cadmium (Cd)	n.s.	35	70							
pH <6.5				1.5				0.591	0.675	0.444
pH 6.5-<7.0				3			0.724			
pH <7.0					2					
pH 7.0-<7.5				15	2.5	0.504				
pH 7.5 -<8.0				200	25					
pH ≥ 8.0				1 000	150					
Chromium (Cr)	n.s.	100	300	60	60 (VI), 65 (III)	67.1[4]	65.1[4]	33	39.9	54.1
Cobalt (Co)	50	n.s.	n.s.	n.s.	n.s.	21.3	19.8	9.26	9.43	13.6
Copper (Cu)	n.s.	50	250	350 000						
pH <5.0					90					
pH 5.0 -<5.5					100					
pH 5.5-<6.0					200					
pH 6.0 -<6.5					1500			27.8	38	26.4
pH≥ 6.5					30000	45.4	44.1			
Lead (Pb)	n.s.	1000	2000	4000						
pH <5.5					150					
pH 5.5 -<6.0					250					
pH 6.0 -<6.5					2000			2.97	8.4	6.35
pH≥ 6.5					40000	6.73	6.88			
Manganese (Mn)	1 800	n.s.	n.s.	n.s.	n.s.	406	349	282	385	339
Mercury (Hg)	n.s.	40	150	100	n.s.	0.052	<0.050	<0.050	0.084	<0.050
Molybdenum (Mo)	10	n.s.	n.s.	n.s.	n.s.	11	10.3	41.9	17.9	8.8
Nickel (Ni)	100	n.s.	n.s.	n.s.	n.s.	57.6	67.2	29.1	32.8	38.9
Selenium (Se)	3	n.s.	n.s.	n.s.	n.s.	<0.50	<0.50	<0.50	<0.50	<0.50
Silver (Ag)	20	n.s.	n.s.	n.s.	n.s.	0.071	0.283	0.132	0.39	0.059
Strontium (Sr)	47 000	n.s.	n.s.	n.s.	n.s.	28.9	42	89.6	59.5	25
Tin (Sn)	50	n.s.	n.s.	n.s.	n.s.	0.55	0.54	0.29	0.9	0.6
Zinc (Zn)	n.s.	30 000	600	15 000						
pH <6.0					150					
pH 6.0 -<6.5					300			81.8	77.2	67.7
pH 6.5 -<7.0					1500		88.3			
pH ≥7.0					3000	82.8				

Units are micrograms per gram (ug/g), except where indicated. **53.2** concentration exceeds applicable standard

Notes:

1. Contaminated Sites Regulation (CSR) (B.C. Reg 375/96); standards for land use indicated.
2. Schedule 4 and 10: Generic Numerical Soil Standards, Industrial land use.
3. Schedule 5: Matrix Numerical Soil Standards.
4. Regional Background Soil Quality Estimate for Chromium is 80 ug/g in the Lower Mainland; observed concentrations not marked as exceedences.
5. Depths given are depths below lagoon bottom.
6. Data for metals which lack applicable regulatory standards (Al, Bi, Ca, Fe, Mg, P, K, Na, Tl, Ti, V, Zr) not tabulated; see original laboratory analytical reports.

< less than analytical detection limit indicated

n.s. no standard listed

The coarser, brown "organic" soils found in two boreholes (see borehole logs in **Appendix A**; **Tables 1** and **2**) are most likely native soils as well. They are more dense, and contain a much higher proportion of woody debris (or wood waste), than would be expected if they had resulted from settling during primary sewage treatment.

Soil Analytical Data

The source or sources of arsenic (As) in the two samples in which reported concentrations exceeded applicable standards is unknown. It is considered unlikely, however, that the As is an indicator of contamination. If it were, concentrations of other typical industrial metals (*e.g.*, Cd, Cr, Cu, Pb, Hg, Ni, and/or Zn) could be expected to be elevated as well. This correlation was previously observed in the soft sediments sampled and analysed by Dillon (Dillon, 2012). Instead, reported concentrations of these metals were consistent with normal background concentrations.

Because of the mineralogy of geologic source materials, elevated As concentrations are sometimes found in native soils, especially fine-grained soils, in the Lower Mainland, to the point where they are associated with naturally elevated As concentrations in groundwater (Wilson *et al*, 2008).

Similarly, concentrations of chromium (Cr) appeared elevated in two samples (see Table 2), relative to the most stringent potentially-applicable CSR standards. As previously noted, however, they did not exceed BC Environment's estimate of regional background concentrations in the Lower Mainland.

Finally, EPH in the "heavy" range (C19-C32) was detected in two "organic" soil samples, although at concentrations below the CSR standard of 1000 µg/g. It was noted that these samples had a relatively high proportion of woody debris (or wood waste). In some such samples, naturally-occurring hydrocarbons including humic acids and resin acids are present, producing misleadingly high EPH concentrations when first analysed. Such samples can be re-analyzed using the "silica gel fractionation" (or "silica gel cleanup") method. This is used to distinguish between petroleum and naturally-occurring hydrocarbons. Should further sampling and analysis be conducted in the development of a pond management strategy (see below), such analysis could be carried out at that time, if desired.

Conclusions and Recommendations

We conclude that the total amount of soft organic sediment in this lagoon is likely small relative to its overall size, and that underlying silty clay soils, and organic soils, are most probably naturally-occurring, rather than constituting an engineered or constructed liner.

Also, there is little or no evidence that these silty clay and organic soils are contaminated with metals originating in urban runoff, as the overlying soft organics apparently are. If they are

not, then the pond could, in principle, be deepened by excavation of these soils, without the necessity for off-site disposal or treatment at an approved facility. In the course of such an endeavour, soil quality would need to be reconfirmed periodically, *e.g.*, by occasional sampling and analysis during excavation.

Yours sincerely,

DILLON CONSULTING LIMITED

Robert Beck, PGeo.
Geoscientist

Chris Dane, ASc.T
Associate

RWB:kel

cc: Mike Thomas, Manager, Engineering Services
Len Walters, Superintendent of Parks Operations

att. Appendix A: Borehole Logs July 19, 2012
Appendix B: Memo Sediment and Surface Water Results

References:

Dillon Consulting Limited. "Summary of Sediment and Surface Water Sampling Results – City of Langley Brydon Lagoon" (memo report). June 5, 2012.

Wilson, J., H. Schreier, S. Brown. *Arsenic in Groundwater in the Surrey-Langley Area.* Institute for Resources and Environment, University of British Columbia, 2008.

Appendix A
Borehole Logs – July 19, 2012

BH12-1

DILLON CONSULTING

Client: City of Langley
Project: Brydon Lagoon
Project No.: 126077
Location: City of Langley
Drilling Co.: Rocky Mtn Sampling
Drilling Method: Direct Push
Supervised by: B. Beck
Date Started: 19/7/12 Date Completed: 19/7/12

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Notes	Sample Method	Sample Number	Sample N Value	Sample Rec %	Sample VOC (ppm or %LEL)	Depth Scale (m)
0.5	Grey-blue clay with some silt and trace sand, plastic				G	1			0	0.5
1.0	Grey-brown clay with some silt and trace sand, plastic		0.8		G	2			0	1.0
1.5										1.5
2.0										2.0
2.5										2.5
3.0					G	3			0	3.0
			3.2							

DILLON BH BRYDON LAGOON BH LOGS JULY 19.2012.GPJ DILLON_MAY13_05.GDT 13/8/12

▽ Water found

LITHOLOGY SYMBOLS: Clay

SAMPLE TYPE: G Grab Sample

* Indicates sample submitted for analysis - all samples collected from single use plastic tubes

BH12-2

DILLON CONSULTING

Client: City of Langley
Project: Brydon Lagoon
Project No.: 126077
Location: City of Langley
Drilling Co.: Rocky Mtn Sampling
Drilling Method: Direct Push
Supervised by: B. Beck
Date Started: 19/7/12 Date Completed: 19/7/12

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Notes	Sample Method	Sample Number	Sample N Value	Sample Rec %	Sample VOC (ppm or %LEL)	Depth Scale (m)
0.5	Dark brown to grey clay with some silt and trace sand, plastic				G	1			0	0.5
1.0					G	2			0	1.0
1.5			1.6							1.5

DILLON BH BRYDON LAGOON BH LOGS JULY 19.2012.GPJ DILLON_MAY13_05.GDT 13/8/12

Water found

LITHOLOGY SYMBOLS: Clay

SAMPLE TYPE: G Grab Sample

* Indicates sample submitted for analysis - all samples collected from single use plastic tubes

BH12-3

DILLON CONSULTING

Client: City of Langley
Project: Brydon Lagoon
Project No.: 126077
Location: City of Langley
Drilling Co.: Rocky Mtn Sampling
Drilling Method: Direct Push
Supervised by: B. Beck
Date Started: 19/7/12 Date Completed: 19/7/12

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Notes	Sample Method	Sample Number	Sample N Value	Sample Rec %	Sample VOC (ppm or %LEL)	Depth Scale (m)
	Clay									
	Brown organics and silt with some clay, woody debris visible in core		0.15							
0.5					G	1			0	0.5
1.0										1.0
1.5										1.5
	Clay		1.6		G	2				
			1.9							

DILLON BH BRYDON LAGOON BH LOGS JULY 19.2012.GPJ DILLON_MAY13_05.GDT 13/8/12

Water found

LITHOLOGY SYMBOLS: Clay, Clay, Organics

SAMPLE TYPE: G Grab Sample

* Indicates sample submitted for analysis - all samples collected from single use plastic tubes

BH12-5

DILLON CONSULTING

Client: City of Langley
Project: Brydon Lagoon
Project No.: 126077
Location: City of Langley
Drilling Co.: Rocky Mtn Sampling
Drilling Method: Direct Push
Supervised by: B. Beck
Date Started: 19/7/12 Date Completed: 19/7/12

Depth Scale (m)	Stratigraphic Description	Lithology	Depth (m)	Notes	Sample Method	Sample Number	Sample N Value	Sample Rec %	Sample VOC (ppm or %LEL)	Depth Scale (m)
0.5	Brown organics with variable grain size, some woody debris visible in core				G	1			0	0.5
1.0										1.0
1.5										1.5
	Clay		1.6		G	1			0	
			1.9							

Water found

LITHOLOGY SYMBOLS: Organics, Clay

SAMPLE TYPE: G Grab Sample

* Indicates sample submitted for analysis - all samples collected from single use plastic tubes

DILLON BH BRYDON LAGOON BH LOGS JULY 19.2012.GPJ DILLON_MAY13_05.GDT 13/8/12

Appendix B
Memo Sediment and Surface Water Results

TECHNICAL MEMORANDUM

TO: Chris Dane

FROM: Dave Young

DATE: June 5, 2012

SUBJECT: Summary of Sediment and Surface Water Sampling Results – City of Langley Brydon Lagoon

OUR FILE: 12-6077

Dear Chris;

On May 2, 2012, Dillon Personnel collected five sediment samples and five surface water samples from the Brydon Lagoon in the City of Langley. The sediment samples were analyzed for extractable petroleum hydrocarbons (EPH) and metals. The surface water samples were analyzed for volatile petroleum hydrocarbons (VPH), benzene, toluene, ethylbenzene, xylene (BTEX), nutrients, biological oxygen demand (BOD), and total suspended solids (TSS).

The results of the sediment sampling indicate that there are reported exceedances of the Contaminated Sites Regulation (CSR) Schedule 9 Sediment Standards for metals concentrations that include the following:

- mercury in "Sites 1 to 4" or four of five samples; and
- arsenic, cadmium, copper, lead, mercury, and zinc in "Site 1"

For the purposes of determining potential disposal options, the sediment samples were also compared to the CSR Schedule 4 and 5 Soil Standards for Industrial Land Use (IL). The reported results indicate that there are the following exceedances:

- copper in all five samples
- arsenic, cadmium, copper, and zinc in "Site 1"; and
- zinc in "Site 5".

All of the sediment samples were taken from a depth of 0 to 0.5 m below the sediment surface. The water depth at these sample locations was approximately 0.6 to 1 m deep.

The results of the surface water sampling were compared to the BC Water Quality Guidelines. The reported results indicate there are several exceedances of metals concentration in water of both chronic and acute standards for the following parameters:

- total silver in all five samples (acute standard);
- total copper in all five samples (chronic standard);
- total cadmium in all five samples; and
- total zinc in samples "Site 1" and "Site 2"

Table A1: Sediment Analytical Results

Sample Location	CSR IL Standards[1]					CSR Sediment Standards [4]	Site 1	Site 2	Site 3	Site 4	Site 5
Sample Depth (m)	Generic Soil Standards[2]	Matix Numerical Soil Standards[3]					0-0.3	0-0.3	0-0.3	0-0.3	0-0.3
Sample ID		Intake of Contaminated Soil	Toxicity to Soil Invertebrates and Plants	Groundwater Used for Drinking Water	Groundwater Used by Aquatic Life	Generic Sediment Criteria Freshwater Typical	Site 1	Site 2	Site 3	Site 4	Site 5
Laboratory Sample ID							DI1336	DI1337	DI1338	DI1339	DI1340
Sample Date							2-May-12	2-May-12	2-May-12	2-May-12	2-May-12
Hydrocarbons											
EPH[8] (C10-C19) (mg/L)	2000	n.s.	n.s.	n.s.	n.s.	n.s.	699	<100	<100	<100	<100
EPH[8] (C19-C32) (mg/L)	5000	n.s.	n.s.	n.s.	n.s.	n.s.	4030	277	568	523	443
Metals											
Moisture (%)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	74	41	58	70	73.0
pH (pH units)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	7.08	6.8	7.32	6.47	5.65
Aluminum (Al)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	23100	22400	20300	28100	21700
Antimony (Sb)	40	n.s.	n.s.	n.s.	n.s.	n.s.	3.52	0.81	0.88	0.81	0.49
Arsenic(As)	n.s.	300	100	15	20	20	36.7	9.2	10.4	11.2	11.4
Barium (Ba)	n.s.	20 000	1500	400	3500	n.s.	106	231	177	218	135
Beryllium (Be)	8	n.s.	n.s.	n.s.	n.s.	n.s.	0.48	0.44	<0.40	0.61	0.41
Bismuth (Bi)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	14.7	1.8	1.74	2.12	0.57
Cadmium (Cd)	n.s.	100	500	15		4.2					
pH <7.0					2			1.4		1.77	0.925
pH 7.0-<7.5					**2.5**		10.3		1.56		
pH 7.5 -<8.0					25						
pH ≥ 8.0					150						
Calcium (Ca)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	6620	4910	6130	5370	4390
Chromium (Cr)	n.s.	300	700	60	60 (VI), 65 (III)	110	**65.1 ***	52.6	**64.5***	**67.7 ***	34.7
Cobalt (Co)	300	n.s.	n.s.	n.s.	n.s.	n.s.	12.1	13.4	12.2	15.8	11.2
Copper (Cu)	n.s.	**50**	250	350 000		240					
pH <5.0					90						
pH 5.0 -<5.5					100						
pH 5.5-<6.0					200						**50.5**
pH 6.0 -<6.5					1500					**119**	
pH≥ 6.5					**30000**		**541**	**98.3**	**139**		
Iron (Fe)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	31500	27800	30200	36800	19500
Lead (Pb)	n.s.	1000	2000	4000		110					
pH <5.5					150						
pH 5.5 -<6.0					250						28.2
pH 6.0 -<6.5					2000					50.7	
pH≥ 6.5					40000		229	35.6	41.5		
Magnesium (Mg)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	7910	7920	7630	8620	5010
Manganese (Mn)	19 000	n.s.	n.s.	n.s.	n.s.	n.s.	622	414	428	641	433
Mercury (Hg)	n.s.	40	150	100	n.s.	0.58	5.11	0.618	0.912	0.919	0.316
Molybdenum (Mo)	40	n.s.	n.s.	n.s.	n.s.	n.s.	18.7	3.88	3.24	3.28	5.51
Nickel (Ni)	500	n.s.	n.s.	n.s.	n.s.	n.s.	41.1	34	33.9	39.7	24.3
Phosphorus (P)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	2230	819	888	1170	1030
Potassium (K)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1270	1210	1650	1530	767
Selenium (Se)	10	n.s.	n.s.	n.s.	n.s.	n.s.	2.24	<0.50	0.65	<0.50	0.52
Silver (Ag)	40	n.s.	n.s.	n.s.	n.s.	n.s.	26.1	11.6	4.72	11.2	1.64
Sodium (Na)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	751	537	532	418	489
Strontium (Sr)	100 000	n.s.	n.s.	n.s.	n.s.	n.s.	40.9	30.4	31.5	30.4	29
Thallium (Tl)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.146	0.106	0.11	0.131	0.137
Tin (Sn)	300	n.s.	n.s.	n.s.	n.s.	n.s.	90.7	14.2	13.7	14.1	2.88
Titanium (Ti)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	589	918	971	950	415
Vanadium (V)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	59.9	62.6	61.5	72.7	47.4
Zinc (Zn)	n.s.	30 000	**600**	15 000		380					
pH <6.0					150						**157**
pH 6.0 -<6.5					300					283	
pH 6.5 -<7.0					1500			220			
pH ≥7.0					**3000**		1620		223		
Zirconium (Zr)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	2.8	4.04	3.68	6.3	2

Notes

Units are micrograms per gram (ug/g), except where indicated.

concentration exceeds sediment standards

concentration exceeds IL soil standard

[1] Contaminated Sites Regulation (CSR) (B.C. Reg 375/96); for land use indicated.

[2] Schedule 4 and 10: Generic Numerical Soil Standards, Industrial land use.

[3] Schedule 5: Matrix Numerical Soil Standards.

[4] Contaminated Sites Regulation, Schedule 9 Column III, Generic Numerical Sediment Criteria for Freshwater Sediment for Typical Habitat

* Regional Background Soil Quality Estimates for Chromium are 100 ug/g in the Vancouver Area

< less than analytical detection limit indicated

n.s. no standard listed

"-" not analyzed for parameter indicated

Table B1: Water Analytical Results - BTEX and Nutrients

Sample ID	BC WQG [1] Aquatic Life	Site 1	Site 2	Site 3	Site 4	Site 5
Date Sampled	Fresh Water	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012
Volatiles						
VPH (VH6 to 10 - BTEX)	n.s.	<300	<300	<300	<300	<300
VH C6-C10	n.s.	<300	<300	<300	<300	<300
Methyl-tert-butylether (MTBE)	3400	<4.0	<4.0	<4.0	<4.0	<4.0
Benzene	40	<0.40	<0.40	<0.40	<0.40	<0.40
Toluene	0.5	<0.40	<0.40	<0.40	<0.40	<0.40
Ethylbenzene	200	<0.40	<0.40	<0.40	<0.40	<0.40
m & p-Xylene	30	<0.40	<0.40	<0.40	<0.40	<0.40
o-Xylene	30	<0.40	<0.40	<0.40	<0.40	<0.40
Styrene	72 [2]	<0.40	<0.40	<0.40	<0.40	<0.40
Xylenes (Total)	30	<0.40	<0.40	<0.40	<0.40	<0.40
Nutrients						
Nitrite (N) (mg/L)	0.02 [3], 0.060 [4]	0.0073	0.0066	0.0095	0.0111	0.0078
Nitrate (N) (mg/L)	3 [3], 32.8 [4]	0.083	0.052	0.073	0.064	0.043
Nitrate plus Nitrite (N) (mg/L)	n.s.	0.091	0.059	0.082	0.075	0.05
Misc. Parameters						
Biochemical Oxygen Demand (mg/L)	n.s.	<10	<10	<10	<10	<10
Total Suspended Solids (mg/L)	n.s.	7	7	7.7	7.3	6.7

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

[1] British Columbia Water Quality Guidelines - Approved and Working

[2] Working BC Water Quality Guidelines

[3] 30 Day Average (Chronic) concentration guideline

[4] Maximum (Acute) concentrations guideline

Table B2: Water Analytical Results - Metals

Sample ID	BC WQG[1] Aquatic Life	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
Date Sampled	Fresh Water	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012
Calculated Parameters											
Total Hardness (mg/L)	n.c.	37.6	37.3	36.9	36.6	38	37.1	37.9	37.6	37.4	35.7
Total Metals											
Total Aluminum (Al)	100 [2]	306	19.5	351	17.5	348	16.6	351	16.1	338	5.2
Total Antimony (Sb)	20 [3]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	5	1.11	1.01	1.08	1.01	1.13	0.97	1.11	1.01	1.09	0.9
Total Barium (Ba)	1 000 [3, 4], 5 000 [5]	35.3	32.3	32.8	26.9	35.3	32.3	35.8	32.4	34.5	28.9
Total Beryllium (Be)	5.3 [3, 4]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Bismuth (Bi)	n.c.	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	1 200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	0.01 [3, 6]	**0.023**	0.023	**0.028**	0.014	**0.03**	0.015	**0.027**	0.016	**0.023**	<0.010
Total Chromium (Cr)		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cr (III)	8.9 [3]										
Cr (VI)	1 [3]										
Total Cobalt (Co)	4 [4], 110 [5]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	2 [4], 5.48 [5, 7]	**4.46**	**3.48**	**4.99**	**3.3**	**4.73**	**3.34**	**4.58**	**3.39**	**4.42**	**2.77**
Total Iron (Fe)	350 [8], 1 000 [9]	430	79.1	421	71.9	434	74.2	432	74.7	433	29.9
Total Lead (Pb)	3	0.74	0.23	0.8	<0.20	0.77	<0.20	0.77	<0.20	0.71	<0.20
Total Lithium (Li)	870 [3]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Manganese (Mn)	948 [10], 768 [11]	84.3	66.6	53.6	24.8	71.5	56	72.4	56.4	67.2	<1.0
Total Mercury (Hg)	0.02 [4]	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Molybdenum (Mo)	1 000 [4], 2 000 [5]	1.1	1.2	1.3	1.4	1.2	1.2	1.3	1.1	1.3	1.1
Total Nickel (Ni)	25 [3]	1.2	1.1	1.2	<1.0	1.3	<1.0	1.2	<1.0	1.2	<1.0
Total Selenium (Se)	2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Silicon (Si)	n.c.	1530	1070	1510	910	2000	1100	1790	1100	1780	923
Total Silver (Ag)	0.05 [4], 0.1 [5]	**0.165**	**0.054**	**0.187**	0.046	**0.194**	**0.064**	**0.188**	**0.057**	**0.186**	0.036
Total Strontium (Sr)	n.c.	51.1	51.5	50.1	49.8	52.3	50.9	51.7	51.3	50.9	50.1
Total Thallium (Tl)	0.3 [3]	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	n.c.	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Titanium (Ti)	2 000 [3]	10.5	<5.0	11.2	<5.0	11.9	<5.0	12.3	<5.0	11.6	<5.0
Total Uranium (U)	300 [3]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	6 [3]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zinc (Zn)	7.5 [4], 33 [5]	**7**	6.1	**11.5**	**15.1**	7.8	5.5	7.4	5.5	6.4	<5.0
Total Zirconium (Zr)	n.c.	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Calcium (Ca) (mg/L)	4 [3]	8.77	8.8	8.44	8.75	8.87	8.82	8.77	8.91	8.64	8.5
Total Magnesium (Mg) (mg/L)	n.c.	3.82	3.73	3.84	3.59	3.84	3.66	3.89	3.72	3.84	3.52
Total Potassium (K) (mg/L)	n.c.	1.02	1.02	1.07	0.981	1.04	1.01	1.04	1.02	1.06	0.961
Total Sodium (Na) (mg/L)	n.c.	16.8	16.2	16.9	16.3	17	16.2	17.2	16.3	17	15.9
Total Sulphur (S) (mg/L)	n.c.	4.1	3.7	4.5	3.9	4	3.9	3.7	3.8	4.2	3.9

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

Indicates Dissolved Metals Results

[1] British Columbia Water Quality Guidelines - Approved and Working - Standards for Total Metals unless indicated otherwise

[2] Standard for Dissolved Aluminum for a pH >6.5

[3] Working BC Water Quality Guidelines

[4] 30 Day Average (Chronic) concentration guideline

[5] Maximum (Acute) concentrations guideline

[6] Standard = 10 exp (0.86(log (hardness))-3.2)

[7] Standard = (0.094(hardness)+2) when $CaCO_3$ <50.0 mg/L

[8] Standard for Dissolved Iron

[9] Standard for Total Iron

[10] Standard for Maximum (acute) = 0.01102 * hardness + 0.54

[11] Standard for 30 day average (chronic) = 0.0044 * hardness + 0.605

n.c. - no criteria

Appendix B

Water and Sediment Quality Results

Brydon Lagoon
Table B-1: Water quality results for volatiles, nutrients, and miscellaneous parameters

Sample ID	BC WQG [1] Aquatic Life	Site 1		Site 2		Site 3	Site 4	Site 5	Site 6	Site 7
Date Sampled	Fresh Water	May 2, 2012	August 28, 2012	May 2, 2012	August 28, 2012	May 2, 2012	May 2, 2012	May 2, 2012		
Location Description		southeast corner of pond		middle of north shore of pond		mid-pond, 50m east of west shore	20m south of middle of pond	50m east of site 4	middle of south shore of pond	southwest corner of pond
Notes			green algae on surface of water, turbid		green algae on surface of water, turbid				water turbid	water turbid
Volatiles										
VPH (VH6 to 10 - BTEX)	n.s.	<300	<300	<300	<300	<300	<300	<300	<300	<300
VH C6-C10	n.s.	<300	<300	<300	<300	<300	<300	<300	<300	<300
Methyl-tert-butylether (MTBE)	3400	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Benzene	40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Toluene	0.5	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Ethylbenzene	200	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
m & p-Xylene	30	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
o-Xylene	30	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Styrene	72 [2]	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Xylenes (Total)	30	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Nutrients										
Nitrite (N) (mg/L)	0.02 [3], 0.060 [4]	0.0073	<0.0050	0.0066	<0.0050	0.0095	0.0111	0.0078	<0.0050	<0.0050
Nitrate (N) (mg/L)	3 [3], 32.8 [4]	0.083	<0.020	0.052	<0.020	0.073	0.064	0.043	<0.020	<0.020
Nitrate plus Nitrite (N) (mg/L)	n.s.	0.091	<0.020	0.059	<0.020	0.082	0.075	0.05	<0.020	<0.020
Misc. Parameters										
Biochemical Oxygen Demand (mg/L)	n.s.	<10	17	<10	13	<10	<10	<10	<10	<10
Total Suspended Solids (mg/L)	n.s.	7	81.5	7	63.3	7.7	7.3	6.7	38	41.5

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

[1] British Columbia Water Quality Guidelines - Approved and Working

[2] Working BC Water Quality Guidelines

[3] 30 Day Average (Chronic) concentration guideline

[4] Maximum (Acute) concentrations guideline

Brydon Lagoon

Table B-2: Water quality results for total and dissolved metals

Sample ID	BC WQG[1] Aquatic Life	Site 1				Site 2				Site 3		Site 4		Site 5		Site 6		Site 7	
Date Sampled	**Fresh Water**	May 2, 2012	May 2, 2012	August 28, 2012	August 28, 2012	May 2, 2012	May 2, 2012	August 28, 2012	August 28, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	May 2, 2012	August 28, 2012	August 28, 2012	August 28, 2012	August 28, 2012
Calculated Parameters																			
Total Hardness (mg/L)	n.c.	37.6	37.3	44.5	41.1	36.9	36.6	41.4	41.4	38	37.1	37.9	37.6	37.4	35.7	40.8	41.8	42.6	41.9
Total Metals																			
Total Aluminum (Al)	100 [2]	306	19.5	234	26.9	351	17.5	132	24.7	348	16.6	351	16.1	338	5.2	196	17.7	194	16
Total Antimony (Sb)	20 [3]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	5 [5]	1.11	1.01	**11**	9.1	1.08	1.01	**10.4**	8.92	1.13	0.97	1.11	1.01	1.09	0.9	**10.6**	8.55	**10.3**	8.6
Total Barium (Ba)	1 000 [3, 4],5 000 [5]	35.3	32.3	55.7	28.5	32.8	26.9	48.6	29	35.3	32.3	35.8	32.4	34.5	28.9	52.3	29.9	47.9	32.2
Total Beryllium (Be)	5.3 [3, 4]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Bismuth (Bi)	n.c.	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	1 200	<50	<50	<50	<50	<50	<50	<50	51	<50	<50	<50	<50	<50	<50	<50	51	<50	51
Total Cadmium (Cd)	0.01 [3, 5, 6]	**0.023**	0.023	**0.071**	<0.010	**0.028**	0.014	**0.106**	<0.010	**0.03**	0.015	**0.027**	0.016	**0.023**	<0.010	**0.055**	0.019	**0.107**	0.031
Total Chromium (Cr)																			
Cr (III)	8.9 [3]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cr (VI)	1 [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cobalt (Co)	4 [4], 110 [5]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	2 [4], 5.48 [5, 7]	**4.46**	3.48	**6.6**	1.84	**4.99**	3.3	**3.69**	1.81	**4.73**	3.34	**4.58**	3.39	**4.42**	2.77	**5.08**	1.82	**5.01**	1.62
Total Iron (Fe)	350 [8], 1 000 [9]	430	79.1	**2070**	**632**	421	71.9	**1570**	**687**	434	74.2	432	74.7	433	29.9	**1720**	**627**	**1550**	**605**
Total Lead (Pb)	3	0.74	0.23	**4.22**	1.58	0.8	<0.20	2.88	1.47	0.77	<0.20	0.77	<0.20	0.71	<0.20	**3.39**	1.3	2.93	1.25
Total Lithium (Li)	870 [3]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Manganese (Mn)	948 [10], 768 [11]	84.3	66.6	355	117	53.6	24.8	334	167	71.5	56	72.4	56.4	67.2	<1.0	431	78.7	346	149
Total Mercury (Hg)	0.02 [4]	<0.050	<0.050	<0.010	<0.010	<0.050	<0.050	<0.010	<0.010	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010
Total Molybdenum (Mo)	1 000 [4], 2 000 [5]	1.1	1.2	5.9	6.8	1.3	1.4	6.4	6.5	1.2	1.2	1.3	1.1	1.3	1.1	5.7	6.5	6.3	6.5
Total Nickel (Ni)	25 [3]	1.2	1.1	1.7	<1.0	1.2	<1.0	1.5	<1.0	1.3	<1.0	1.2	<1.0	1.2	<1.0	1.5	1	1.5	<1.0
Total Selenium (Se)	2	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	0.11	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	0.12	0.14	0.15
Total Silicon (Si)	n.c.	1530	1070	7280	7150	1510	910	7210	7300	2000	1100	1790	1100	1780	923	7380	7380	7200	7140
Total Silver (Ag)	0.05 [4], 0.1 [5]	**0.165**	0.054	**0.123**	0.05	**0.187**	0.046	**0.094**	0.045	**0.194**	0.064	**0.188**	0.057	**0.186**	0.036	**0.162**	0.042	**0.101**	0.043
Total Strontium (Sr)	n.c.	51.1	51.5	54.8	55.1	50.1	49.8	53.4	53.8	52.3	50.9	51.7	51.3	50.9	50.1	52.8	55.7	53.6	56.6
Total Thallium (Tl)	0.3 [3]	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	n.c.	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Titanium (Ti)	2 000 [3]	10.5	<5.0	11.5	<5.0	11.2	<5.0	7.7	<5.0	11.9	<5.0	12.3	<5.0	11.6	<5.0	10.2	<5.0	8	<5.0
Total Uranium (U)	300 [3]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	6 [3]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Zinc (Zn)	7.5 [4], 33 [5]	7	6.1	**12.2**	<5.0	**11.5**	15.1	6.2	<5.0	**7.8**	5.5	7.4	5.5	6.4	<5.0	**8.6**	<5.0	**7.5**	<5.0
Total Zirconium (Zr)	n.c.	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Calcium (Ca) (mg/L)	4 [3]	**8.77**	**8.8**	**10.7**	**9.38**	**8.44**	**8.75**	**9.58**	**9.58**	**8.87**	**8.82**	**8.77**	**8.91**	**8.64**	**8.5**	**9.42**	**9.78**	**10.1**	**9.57**
Total Magnesium (Mg) (mg/L)	n.c.	3.82	3.73	4.35	4.29	3.84	3.59	4.23	4.24	3.84	3.66	3.89	3.72	3.84	3.52	4.2	4.23	4.25	4.38
Total Potassium (K) (mg/L)	n.c.	1.02	1.02	1.71	1.35	1.07	0.981	1.59	1.26	1.04	1.01	1.04	1.02	1.06	0.961	1.38	1.23	1.4	1.28
Total Sodium (Na) (mg/L)	n.c.	16.8	16.2	24	24.1	16.9	16.3	24	23.9	17	16.2	17.2	16.3	17	15.9	23.1	23.9	23.4	23.9
Total Sulphur (S) (mg/L)	n.c.	4.1	3.7	<3.0	<3.0	4.5	3.9	<3.0	<3.0	4	3.9	3.7	3.8	4.2	3.9	<3.0	<3.0	<3.0	<3.0

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

Indicates Dissolved Metals Results

[1] British Columbia Water Quality Guidelines - Approved and Working - Standards for Total Metals unless indicated otherwise

[2] Standard for Dissolved Aluminum for a pH >6.5

[3] Working BC Water Quality Guidelines

[4] 30 Day Average (Chronic) concentration guideline

[5] Maximum (Acute) concentrations guideline

[6] Standard = 10 exp (0.86(log (hardness))-3.2)

[7] Standard = (0.094(hardness)+2) when $CaCO_3$ <50.0 mg/L

[8] Standard for Dissolved Iron

[9] Standard for Total Iron

[10] Standard for Maximum (acute) = 0.01102 * hardness + 0.54

[11] Standard for 30 day average (chronic) = 0.0044 * hardness + 0.605

n.c. - no criteria

Brydon Lagoon
Table B-3: Field Parameters - Water Quality

		Field Parameters				
		Temperature (°C)	Turbidity (NTU)	pH N/A	DO (mg/L)	Conductivity (mS/cm)
BCWQ [1]	**Freshwater Aquatic Life [4]**	**± 1°C from background, Max 19°C**	**8 above b/ground when b/ground is ≤8, 5 above b/ground when b/ground is 8 - 50, 10% above b/ground when b/ground is >50**	**6.5 – 9.0**	**≥5**	**NV**
CCME [2]	**Freshwater Aquatic Life**	**NV**	**8 above b/ground when b/ground is 8 - 80, 10% above b/ground when b/ground is >80**	**6.5 – 9.0**	**5.5 - 9.5 [3]**	**NV**
Site	**Date**					
Site 1	2-May-12	14	6.64	8.62	5.2	na
	28-Aug-12	21.7	**112.3**	**9.17**	13.3	0.19
Site 2	2-May-12	14.9	5.54	8.54	7.2	na
	28-Aug-12	20.9	**164.2**	8.96	12.2	0.19
Site 3	2-May-12	na	na	na	na	na
Site 4	2-May-12	na	na	na	na	na
Site 5	2-May-12	16.3	11.4	7.27	6.0	na
Site 6	28-Aug-12	20.6	64.2	8.41	9.5	0.19
Site 7	28-Aug-12	20.0	68.2	8.07	6.8	0.20

Notes

na- data not available

NV - No guideline value for that parameter.

bold *indicates exceedence of BCWQ guidelines*

highlighted indicates exceedence of CCME standards

[1] *BC Ministry of the Environment - Environmental Protection Division - Water, Air and Climate Change Branch - Approved and Working Water Quality Guidelines*

[2] *Canadian Council of Ministers of the Environment Canadian Environmental Quality Guideline*

[3] *Standard for DO ranges from 5.5mg/L to 9.5mg/L depending on life stage (early, other) and for warm and cold water biota:*

warm water biota: early life stages = 6.0mg/L

water water biota: other life stages = 5.5mg/L

cold water biota: early life stages = 9.5mg/L

cold water biota: other life stages = 6.5mg/L

[4] *Standard for freshwater aquatic life in streams with unknown fish distribution*

Table B-4: Standards Exceeded for Total Metals

Site	Date	Arsenic	Cadmium	Calcium	Copper	Iron	Lead	Silver	Zinc
1	May 2/12		Acute	Acute	Chronic			Acute/Chronic	
	Aug 28/12	Acute	Acute	Acute	Acute/Chronic	Acute	Acute	Acute/Chronic	Chronic
2	May 2/12		Acute	Acute	Chronic			Acute/Chronic	Chronic
	Aug 28/12	Acute	Acute	Acute	Chronic	Acute		Chronic	
3	May 2/12		Acute	Acute	Chronic			Acute/Chronic	Chronic
4	May 2/12		Acute	Acute	Chronic			Acute/Chronic	
5	May 2/12		Acute	Acute	Chronic			Acute/Chronic	
6	Aug 28/12	Acute	Acute	Acute	Chronic	Acute	Acute	Acute/Chronic	Chronic
7	Aug 28/12	Acute	Acute	Acute	Chronic	Acute		Acute/Chronic	Chronic

Table B-5: Standards Exceeded for Dissolved Metals

Site	Date	Calcium	Iron
1	May 2/12	Acute	
	Aug 28/12	Acute	Acute
2	May 2/12	Acute	
	Aug 28/12	Acute	Acute
3	May 2/12	Acute	
4	May 2/12	Acute	
5	May 2/12	Acute	
6	Aug 28/12	Acute	Acute
7	Aug 28/12	Acute	Acute

Brydon Lagoon
Table B-6: Sediment Quality Results

Sample Location	CSR IL Standards[1]					CSR Sediment Standards [4]	Site 1	Site 2	Site 3	Site 4	Site 5
Sample Depth (m)	Generic Soil Standards[2]	Matix Numerical Soil Standards[3]					0-0.3	0-0.3	0-0.3	0-0.3	0-0.3
Sample ID		Intake of Contaminated Soil	Toxicity to Soil Invertebrates and Plants	Groundwater Used for Drinking Water	Groundwater Used by Aquatic Life	Generic Sediment Criteria Freshwater Typical	Site 1	Site 2	Site 3	Site 4	Site 5
Laboratory Sample ID							DI1336	DI1337	DI1338	DI1339	DI1340
Sample Date							2-May-12	2-May-12	2-May-12	2-May-12	2-May-12
Hydrocarbons											
EPH[8] (C10-C19) (mg/L)	2000	n.s.	n.s.	n.s.	n.s.	n.s.	699	<100	<100	<100	<100
EPH[9] (C19-C32) (mg/L)	5000	n.s.	n.s.	n.s.	n.s.	n.s.	4030	277	568	523	443
Metals											
Moisture (%)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	74	41	58	70	73.0
pH (pH units)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	7.08	6.8	7.32	6.47	5.65
Aluminum (Al)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	23100	22400	20300	28100	21700
Antimony (Sb)	40	n.s.	n.s.	n.s.	n.s.	n.s.	3.52	0.81	0.88	0.81	0.49
Arsenic(As)	n.s.	300	100	15	20	20	**36.7**	9.2	10.4	11.2	11.4
Barium (Ba)	n.s.	20 000	1500	400	3500	n.s.	106	231	177	218	135
Beryllium (Be)	8	n.s.	n.s.	n.s.	n.s.	n.s.	0.48	0.44	<0.40	0.61	0.41
Bismuth (Bi)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	14.7	1.8	1.74	2.12	0.57
Cadmium (Cd)	n.s.	100	500	15		4.2					
pH <7.0					2			1.4		1.77	0.925
pH 7.0-<7.5					**2.5**		**10.3**		1.56		
pH 7.5 -<8.0					25						
pH ≥ 8.0					150						
Calcium (Ca)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	6620	4910	6130	5370	4390
Chromium (Cr)	n.s.	300	700	60	60 (VI), 65 (III)	110	**65.1 ***	52.6	**64.5***	**67.7 ***	34.7
Cobalt (Co)	300	n.s.	n.s.	n.s.	n.s.	n.s.	12.1	13.4	12.2	15.8	11.2
Copper (Cu)	n.s.	**50**	250	350 000		240					
pH <5.0					90						
pH 5.0 -<5.5					100						
pH 5.5-<6.0					200						**50.5**
pH 6.0 -<6.5					1500					**119**	
pH≥ 6.5					**30000**		**541**	**98.3**	**139**		
Iron (Fe)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	31500	27800	30200	36800	19500
Lead (Pb)	n.s.	1000	2000	4000		110					
pH <5.5					150						
pH 5.5 -<6.0					250						28.2
pH 6.0 -<6.5					2000					50.7	
pH≥ 6.5					40000		**229**	35.6	41.5		
Magnesium (Mg)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	7910	7920	7630	8620	5010
Manganese (Mn)	19 000	n.s.	n.s.	n.s.	n.s.	n.s.	622	414	428	641	433
Mercury (Hg)	n.s.	40	150	100	n.s.	0.58	**5.11**	**0.618**	**0.912**	**0.919**	0.316
Molybdenum (Mo)	40	n.s.	n.s.	n.s.	n.s.	n.s.	18.7	3.88	3.24	3.28	5.51
Nickel (Ni)	500	n.s.	n.s.	n.s.	n.s.	n.s.	41.1	34	33.9	39.7	24.3
Phosphorus (P)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	2230	819	888	1170	1030
Potassium (K)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1270	1210	1650	1530	767
Selenium (Se)	10	n.s.	n.s.	n.s.	n.s.	n.s.	2.24	<0.50	0.65	<0.50	0.52
Silver (Ag)	40	n.s.	n.s.	n.s.	n.s.	n.s.	26.1	11.6	4.72	11.2	1.64
Sodium (Na)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	751	537	532	418	489
Strontium (Sr)	100 000	n.s.	n.s.	n.s.	n.s.	n.s.	40.9	30.4	31.5	30.4	29
Thallium (Tl)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.146	0.106	0.11	0.131	0.137
Tin (Sn)	300	n.s.	n.s.	n.s.	n.s.	n.s.	90.7	14.2	13.7	14.1	2.88
Titanium (Ti)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	589	918	971	950	415
Vanadium (V)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	59.9	62.6	61.5	72.7	47.4
Zinc (Zn)	n.s.	30 000	**600**	15 000		380					
pH <6.0					150						**157**
pH 6.0 -<6.5					300					283	
pH 6.5 -<7.0					1500			220			
pH ≥7.0					**3000**		**1620**		223		
Zirconium (Zr)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	2.8	4.04	3.68	6.3	2

Notes

Units are micrograms per gram (ug/g), except where indicated.

concentration exceeds sediment standards

concentration exceeds IL soil standard

1. Contaminated Sites Regulation (CSR) (B.C. Reg 375/96); for land use indicated.
2. Schedule 4 and 10: Generic Numerical Soil Standards, Industrial land use.
3. Schedule 5: Matrix Numerical Soil Standards.
4. Contaminated Sites Regulation, Schedule 9 Column III, Generic Numerical Sediment Criteria for Freshwater Sediment for Typical Habitat

* Regional Background Soil Quality Estimates for Chromium are 100 ug/g in the Vancouver Area

< less than analytical detection limit indicated

n.s. no standard listed

"-" not analyzed for parameter indicated

Seniors Centre Pond

Table B-7: Water quality results for volatiles, nutrients, and miscellaneous parameters

Sample ID	BC WQG [1] Aquatic Life	Site 1	Site 2
Date Sampled	**Fresh Water**	**9-May-12**	**9-May-12**
Location Description			
Notes			
Volatiles			
VPH (VH6 to 10 - BTEX)	n.s.	<300	<300
VH C6-C10	n.s.	<300	<300
Methyl-tert-butylether (MTBE)	3400	<4.0	<4.0
Benzene	40	<0.40	<0.40
Toluene	0.5	4.5	2.6
Ethylbenzene	200	<0.40	<0.40
m & p-Xylene	30	<0.40	<0.40
o-Xylene	30	<0.40	<0.40
Styrene	72 [2]	<0.40	<0.40
Xylenes (Total)	30	<0.40	<0.40
Nutrients			
Nitrite (N) (mg/L)	0.02 [3], 0.060 [4]		
Nitrate (N) (mg/L)	3 [3], 32.8 [4]		
Nitrate plus Nitrite (N) (mg/L)	n.s.	0.313	0.371
Misc. Parameters			
Biochemical Oxygen Demand (mg/L)	n.s.	<10	<10
Total Suspended Solids (mg/L)	n.s.	10.3	16.8

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

[1] British Columbia Water Quality Guidelines - Approved and Working

[2] Working BC Water Quality Guidelines

[3] 30 Day Average (Chronic) concentration guideline

[4] Maximum (Acute) concentrations guideline

Seniors Centre Pond

Table B-8: Water quality results for total and dissolved metals

Sample ID	BC WQG[1] Aquatic Life	Site 1		Site 2	
Date Sampled	Fresh Water	Total	Dissolved	Total	Dissolved
Calculated Parameters					
Total Hardness (mg/L)	n.c.	75.1	80.7	74.1	81.7
Metals					
Total Aluminum (Al)	100 [2]	186	19.4	358	58.6
Total Antimony (Sb)	20 [3]	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	5	1.89	1.29	2.02	1.64
Total Barium (Ba)	1 000 [3, 4],5 000 [5]	19.8	19.7	19.2	19.3
Total Beryllium (Be)	5.3 [3, 4]	<0.10	<0.10	<0.10	<0.10
Total Bismuth (Bi)	n.c.	<1.0	<1.0	<1.0	<1.0
Total Boron (B)	1 200	<50	<50	<50	<50
Total Cadmium (Cd)	0.01 [3, 6]	<0.010	<0.010	**0.09**	0.013
Total Chromium (Cr)					
Cr (III)	8.9 [3]	<1.0	<1.0	<1.0	<0.1
Cr (VI)	1 [3]				
Total Cobalt (Co)	4 [4], 110 [5]	<0.50	<0.50	<0.50	<0.50
Total Copper (Cu)	2 [4], 5.48 [5, 7]	**2.66**	1.28	**2.67**	1.54
Total Iron (Fe)	350 [8], 1 000 [9]	**1490**	171	**1450**	**562**
Total Lead (Pb)	3	0.23	<0.20	0.39	<0.20
Total Lithium (Li)	870 [3]	<5.0	<5.0	<5.0	<5.0
Total Manganese (Mn)	948 [10], 768 [11]	177	172	146	149
Total Mercury (Hg)	0.02 [4]	<0.050	<0.050	<0.050	<0.050
Total Molybdenum (Mo)	1 000 [4], 2 000 [5]	<1.0	<1.0	1.1	<1.0
Total Nickel (Ni)	25 [3]	1.1	<1.0	1.2	<1.0
Total Selenium (Se)	2	<0.10	<0.10	0.16	<0.10
Total Silicon (Si)	n.c.	4710	4770	4870	5040
Total Silver (Ag)	0.05 [4], 0.1 [5]	<0.020	<0.020	<0.020	<0.020
Total Strontium (Sr)	n.c.	110	117	106	117
Total Thallium (Tl)	0.3 [3]	<0.050	<0.050	<0.050	<0.050
Total Tin (Sn)	n.c.	<5.0	<5.0	<5.0	<5.0
Total Titanium (Ti)	2 000 [3]	8	<5.0	16.3	<5.0
Total Uranium (U)	300 [3]	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	6 [3]	<5.0	<5.0	<5.0	<5.0
Total Zinc (Zn)	7.5 [4], 33 [5]	5.3	<5.0	6.6	<5.0
Total Zirconium (Zr)	n.c.	<0.50	<0.50	<0.50	<0.50
Total Calcium (Ca) (mg/L)	4 [3,12]	**17**	**18.7**	**17.1**	**19**
Total Magnesium (Mg) (mg/L)	n.c.	7.94	8.24	7.63	8.31
Total Potassium (K) (mg/L)	n.c.	1.94	2.15	1.86	2.14
Total Sodium (Na) (mg/L)	n.c.	58.9	64.1	56.2	63.7
Total Sulphur (S) (mg/L)	n.c.	4.1	5.6	4.3	5.6

measured in ug/L unless otherwise stated

Underline indicate BC WAQG Chronic exceedance

BOLD indicates BC WQG Acute exceedance

Indicates Dissolved Metals Results

[1] British Columbia Water Quality Guidelines - Approved and Working - Standards for Total Metals unless indicated otherwise

[2] Standard for Dissolved Aluminum for a pH >6.5

[3] Working BC Water Quality Guidelines

[4] 30 Day Average (Chronic) concentration guideline

[5] Maximum (Acute) concentrations guideline

[6] Standard = 10 exp (0.86(log (hardness))-3.2)

[7] Standard = (0.094(hardness)+2) when $CaCO_3$ <50.0 mg/L

[8] Standard for Dissolved Iron

[9] Standard for Total Iron

[10] Standard for Maximum (acute) = 0.01102 * hardness + 0.54

[11] Standard for 30 day average (chronic) = 0.0044 * hardness + 0.605

n.c. - no criteria

[12] Dissolved Calcium: Up to 4mg/L aquatic life sensitive to acid input; 4-8mg/L moderately sensitive; and over 8mg/L low sensitivity.

Seniors Centre Pond
Table B-9: Field Parameters - Water Quality

		Field Parameters				
		Temperature (°C)	Turbidity (NTU)	pH N/A	DO (mg/L)	Conductivity (mS/cm)
BCWQ [1]	**Freshwater Aquatic Life [4]**	**± 1°C from background, Max 19°C**	**8 above b/ground when b/ground is ≤8, 5 above b/ground when b/ground is 8 - 50, 10% above b/ground when b/ground is >50**	**6.5 – 9.0**	**≥5**	**NV**
CCME [2]	**Freshwater Aquatic Life**	**NV**	**8 above b/ground when b/ground is 8 - 80, 10% above b/ground when b/ground is >80**	**6.5 – 9.0**	**5.5 - 9.5 [3]**	**NV**
Site	**Date**					
Site 1	May 9th, 2012	14.4	6.13	7.12	6.8	n/a
Site 2	May 9th, 2012	13.8	5.9	7.19	6.7	n/a
General	October 1st, 2012	14.5	5.4	6.98	2.9	0.339

Notes
na- data not available
NV - No guideline value for that parameter.
bold indicates exceedence of BCWQ guidelines
highlighted indicates exceedence of CCME standards

[1] BC Ministry of the Environment - Environmental Protection Division - Water, Air and Climate Change Branch - Approved and Working Water Quality Guidelines
[2] Canadian Council of Ministers of the Environment Canadian Environmental Quality Guideline
[3] Standard for DO ranges from 5.5mg/L to 9.5mg/L depending on life stage (early, other) and for warm and cold water biota:
warm water biota: early life stages = 6.0mg/L
water water biota: other life stages = 5.5mg/L
cold water biota: early life stages = 9.5mg/L
cold water biota: other life stages = 6.5mg/L
[4] Standard for freshwater aquatic life in streams with unknown fish distribution

Table B-10: Standards exceeded for total metals

Site	Date	Cadmium	Calcium	Copper	Iron
1	May 9/12		Acute	Chronic	Acute
2	May 9/12	Acute	Acute	Chronic	Acute

Table B-11: Standards exceeded for dissolved metals

Site	Date	Calcium	Iron
1	May 9/12	Acute	
2	May 9/12	Acute	Acute

Seniors Centre Pond
Table B-12: Sediment Quality Results

Sample Location	CSR IL Standards[1]					CSR Sediment Standards [4]	Site 1	Site 2
Sample Depth (m)	Generic Soil Standards[2]	Matix Numerical Soil Standards[3]						
Sample ID		Intake of Contaminated Soil	Toxicity to Soil Invertebrates and Plants	Groundwater Used for Drinking Water	Groundwater Used by Aquatic Life	Generic Sediment Criteria Freshwater Typical	Site 1	Site 2
Laboratory Sample ID							27936901	27936901
Sample Date							9-May-12	9-May-12
Hydrocarbons								
EPH[8] (C10-C19) (mg/L)	2000	n.s.	n.s.	n.s.	n.s.	n.s.	<100	<100
EPH[8] (C19-C32) (mg/L)	5000	n.s.	n.s.	n.s.	n.s.	n.s.	<100	152
Metals (mg/L)								
Moisture (%)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	20	45
pH (pH units)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	6.68	6.18
Aluminum (Al)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	15500	14200
Antimony (Sb)	40	n.s.	n.s.	n.s.	n.s.	n.s.	0.45	0.42
Arsenic(As)	n.s.	300	100	15	20	20	4.19	5.17
Barium (Ba)	n.s.	20 000	1500	400	3500	n.s.	60.8	62
Beryllium (Be)	8	n.s.	n.s.	n.s.	n.s.	n.s.	<0.40	<0.40
Bismuth (Bi)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	<0.10	<0.10
Cadmium (Cd)	n.s.	100	500	15		4.2		
pH <7.0					2		0.215	0.282
pH 7.0-<7.5					**2.5**			
pH 7.5 -<8.0					25			
pH ≥ 8.0					150			
Calcium (Ca)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	3790	3670
Chromium (Cr)	n.s.	300	700	60	60 (VI), 65 (III)	110	26.9	27
Cobalt (Co)	300	n.s.	n.s.	n.s.	n.s.	n.s.	8.39	8.44
Copper (Cu)	n.s.	**50**	250	350 000		240		
pH <5.0					90			
pH 5.0 -<5.5					100			
pH 5.5-<6.0					200			
pH 6.0 -<6.5					1500			
pH≥ 6.5					**30000**		18.7	18.6
Iron (Fe)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	18500	17400
Lead (Pb)	n.s.	1000	2000	4000		110		
pH <5.5					150			
pH 5.5 -<6.0					250			
pH 6.0 -<6.5					2000			
pH≥ 6.5					40000		4.56	6.21
Magnesium (Mg)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	5640	5440
Manganese (Mn)	19 000	n.s.	n.s.	n.s.	n.s.	n.s.	261	264
Mercury (Hg)	n.s.	40	150	100	n.s.	0.58	<0.050	0.054
Molybdenum (Mo)	40	n.s.	n.s.	n.s.	n.s.	n.s.	0.86	0.91
Nickel (Ni)	500	n.s.	n.s.	n.s.	n.s.	n.s.	18.3	19.5
Phosphorus (P)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	424	471
Potassium (K)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	818	706
Selenium (Se)	10	n.s.	n.s.	n.s.	n.s.	n.s.	<0.50	<0.50
Silver (Ag)	40	n.s.	n.s.	n.s.	n.s.	n.s.	0.068	0.077
Sodium (Na)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	365	338
Strontium (Sr)	100 000	n.s.	n.s.	n.s.	n.s.	n.s.	22.3	19.8
Thallium (Tl)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.083	0.072
Tin (Sn)	300	n.s.	n.s.	n.s.	n.s.	n.s.	0.47	0.49
Titanium (Ti)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	823	766
Vanadium (V)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	44.7	42
Zinc (Zn)	n.s.	30 000	**600**	15 000		380		
pH <6.0					150			
pH 6.0 -<6.5					300			82
pH 6.5 -<7.0					1500		72.2	
pH ≥7.0					**3000**			
Zirconium (Zr)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.91	0.95

Notes

Units are micrograms per gram (ug/g), except where indicated.

concentration exceeds sediment standards

concentration exceeds IL soil standard

[1] Contaminated Sites Regulation (CSR) (B.C. Reg 375/96); for land use indicated.

[2] Schedule 4 and 10: Generic Numerical Soil Standards, Industrial land use.

[3] Schedule 5: Matrix Numerical Soil Standards.

[4] Contaminated Sites Regulation, Schedule 9 Column III, Generic Numerical Sediment Criteria for Freshwater Sediment for Typical Habitat

[*] Regional Background Soil Quality Estimates for Chromium are 100 ug/g in the Vancouver Area

< less than analytical detection limit indicated

n.s. no standard listed

"-" not analyzed for parameter indicated