Clover and Macaulay Point outfalls – contaminated sites?

In this Analysis we examined the Capital Regional District's (CRD's) own benthic (sea floor) sediment chemical monitoring data, for the years 2000 – 2004 as reported in the CRD's "Macaulay and Clover Point Wastewater and Marine Environment Program Annual Reports". The raw data presented in these reports include the concentrations of heavy metals and toxic organic chemicals found in marine benthic sediments sampled from 23 locations at and around the Macaulay Point outfall. CRD only reported data from samples collected directly at the Clover Point outfall most years, except for 2003 when data was presented for 14 locations at and around the outfall.

The CRD's analysis of these data brings them to the conclusion that, since very few of these parameters exceed their own Sediment Quality Guidelines, discharge of raw sewage to the marine environment is not adversely impacting the marine environment in the vicinity of the outfalls.

We took a different approach. We compared the CRD's data with the values found in Schedule 9 of the BC *Contaminated Sites Regulation* (CSR). Schedule 9 sets out the concentrations of certain contaminants above which a site would be considered a contaminated site pursuant to the *Contaminated Sites Regulation* and the *Environmental Management Act*. Some interesting facts emerged:

- Of the 33 compounds listed in schedule 9 the BC *Contaminated Sites Regulation*, the CRD reports on 29.
- The "CRD Sediment Quality Guidelines" shown in their 2003 monitoring report are up to **8 times higher** than the *Contaminated Sites Regulation* limits for "Typical Sites" (e.g. acenaphthylene).
- **Of the 29 compounds** tested by the CRD, our analysis (see below) showed that **19** were, at one time or another over the period 2000 – 2004, above the limits specified in the *Contaminated Sites Regulation* for "Typical Sites". These were: cadmium, copper, **lead**, mercury, zinc, **Acenaphthene**, Acenaphthylene, **Anthracene**, Flourene, Naphthalene, **Phenanthrene**, Flouranthene, Pyrene, Benz(a)pyrene, Chrysene, **Benzo-a-anthracene**, Dibenzo[ah]anthracene, 2-methlynaphthalene and Total Polycyclic Aromatic Hydrocarbons. **Five** (5) of these compounds (those bolded) have been detected at **over 20 times** the CSR limits.

Data Analysis

- In 2004, 6 chemicals were found in concentrations higher than the values listed in the CSR at, or in close proximity to, the Macaulay point outfall terminus (M0). Three (3) chemicals exceeding CSR values were found at the Clover Point outfall terminus (C0 - the only Clover Point site sampled in 2004). (Note: CSR exceedances are highlighted in purple on the attached data sheets pages 1-4 for 2000-2003. 2004 data is not detailed because it was only recently made available).
- In 2003, 17 chemicals were found in concentrations higher than the values listed in the CSR at, or in close proximity to, M0. Eleven (11) chemicals exceeding CSR values were found at C0.

- In 2002, 13 chemicals were found in concentrations higher than the values listed in the CSR at, or in close proximity to, M0. One (1) chemical, copper, exceeded CSR values at C0.
- In 2001, 15 chemicals were found in concentrations higher than the values listed in the CSR at, or in close proximity to, M0. Five (5) chemicals exceeded CSR values at C0.
- In 2000, 16 chemicals were found in concentrations higher than the values listed in the CSR at, or in close proximity to, M0.

In summary, in every year examined, there were numerous compounds detected at, or in close proximity to, the Macaulay Point outfall whose concentrations exceeded those specified in the *Contaminated Sites Regulations*. Also, in every year from 2001 through 2004 the data show that the area around the immediate vicinity of the Clover Point outfall is consistently contaminated with one or more prescribed substances. **Therefore the seabed in the vicinity of both outfalls meets the definition of a contaminated site**.

The data show that concentrations of contaminants generally decline with distance from the outfalls, providing clear evidence that the source of the contamination is the outfalls (see pages 5 and 6 of the attached data sheets). In addition, sediment contamination levels measured at the reference stations at Parry Bay and Constance Bank are generally significantly lower than levels measured at and around the outfalls (see page 7). Furthermore, concentrations of several of the contaminants found to be elevated in the sediments at and around the outfalls are also found in high concentrations in the sewage effluent (see page 8), once again demonstrating that the **most likely source of sediment contamination is the outfalls**.

Example: Copper

Copper, a contaminant that is highly toxic to marine life, has been consistently above the *Contaminated Sites Regulation* criteria at and around both outfalls. Clover Point outfall values have consistently increased over the years 2000-2004 (47, 112, 133, 172, 254 mg/kg, respectively), rising above the CSR limit (130 mg/kg) from 2002 onwards (see page 9). Copper contamination at Macaulay Point outfall has shown some annual fluctuations (152, 266, 158, 273, 143 mg/kg, 2000-2004 respectively), but has consistently been over the CSR limit every year.

Copper contamination is highest around the outfalls. In 2003, the only year for which CRD published data at sampling stations around both Clover and Macaulay Point outfalls, a clear 'spike' emerges right over both outfalls (see page 5).

The CRD has set guidelines for copper that are much higher than the CSR limits (three times higher in fact). This demonstrates the out-of-date and unreasonable nature of the CRD guidelines, and the unreasonableness of CRD conclusions that the outfalls are not causing adverse effects on the marine environment. See page 7 for a comparison of the CRD guidelines with various federal and provincial criteria.

Many pipes in the CRD are made of copper. Short of replacing all this piping citywide, the obvious solution to preventing further build up of this contaminant on the seabed is to construct a wastewater treatment plant. Secondary treatment can remove up to 93% of copper from wastewater (see page 10). Because of the copper pipes, source control is not available for this chemical. CRD does undertake source control efforts for some substances, such as mercury, but as shown on page 9, mercury continues to exceed CSR limits.

Priority

Finally, a comparison of the CRD's sediment contamination data with the federal contaminated site methodology for prioritizing contaminated sites reveals that the federal government would

consider the Clover and Macaulay outfalls and their immediate vicinity to be Medium-High priority contaminated sites (see page 11). In fact, as shown on page 11, in 2003 two sample locations in close proximity to the Macaulay outfall would qualify as Highest priority contaminated sites for Polycyclic Aromatic Hydrocarbons (PAHs).

Description of the CRD data and the various criteria, standards and guidelines

CRD reports annually on contaminants found in sediments on the seabed at and around the two outfalls. Appendix F of these reports includes the raw data. The 2000-2003 reports are available at http://www.crd.bc.ca/es/environmental%5Fprograms/wastewater_marine/reports.htm. Sample stations are designated as:

- M (for Macaulay) or C (for Clover)
- 0 for stations situated at the outfall terminus. 1 (for stations at or just outside the Initial Dilution Zone (IDZ) – approximately 100 metres from the outfall terminus) or 2, 4 and 8 respectively (for the stations situated approximately 200m, 400m and 800m from the outfall terminus)
- E, etc. (for the compass direction from the outfall terminus)

Thus C0 means right at the Clover Point outfall, and M1SE means the sampling location approximately 100m southeast of Macaulay Point outfall. In addition, reference sampling stations are located at Parry Bay (PB1, PB2, and PB3) and Constance Bank (CB1, CB2, and CB3) to provide comparison values for the concentrations detected at and around the outfalls.

The data sheets refer to a number of standards, criteria and guidelines:

- CCME ISQG levels – these are the 'interim sediment quality guidelines' as set in the Sediment Quality Guidelines for marine sediments by the Council of Canadian Ministers of the Environment (CCME)[1]. They reflect the level of contamination below which adverse biological effects are not expected.
- CCME PEL – these are the 'probable effect levels' as set in the Sediment Quality Guidelines for marine sediments by the CCME. They reflect the levels above which adverse biological effects are expected to occur frequently.
- BC CSR – these are the criteria specified in Schedule 9 of the BC *Contaminated Sites Regulation* (CSR) for typical marine sites. These were set to be a little over the CCME PEL levels.
- CRD sediment quality guidelines – these are the values the CRD itself uses to compare its data to. They are based on the Washington State Department of Ecology (WDOE) Sediment Management Standards[2]. In December 1999, the WDOE stopped updating their guidelines, planning instead to align with national (NOAA) guidelines. The NOAA guidelines are equivalent to the CCME PELs for the marine sediment contaminants considered here[3].

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[1] "Canadian Environmental Quality Guidelines" for Marine Sediment, updated to Dec 2003, available at http://www.ccme.ca. The CCME sediment quality guidelines are scientific tools that synthesize information regarding the relationships between the sediment concentrations of chemicals and any adverse biological effects resulting from exposure to these chemicals. The majority of the data used to derive the CCME's ISQG and PELs for marine sediments are from studies on field collected sediments that measure concentrations of chemicals in sediments and their associated biological effects. These data are compiled in Environment Canada's Biological Effects Database for Sediments (BEDS). There are literally hundreds of reports for each chemical of concern.

[2] WAC 173-204-520 page 7.

[3] http://response.restoration.noaa.gov/book_shelf/122_squirt_cards.pdf.

Figure 4.1 - Seafloor Sampling and Reference Stations (2003)

Clover Point Seafloor Sampling Stations (station number given)

Macaulay Point Seafloor Sampling Stations (station number given)

Bathemetry (Ocean Contours) - values in meters below sea level

Outfall Pipes

Diffusers

Initial Dilution Zones (130 meters from diffusers)

0 125 250 500 750 1,000 Meters

N

Esquimalt

Macaulay Point

Victoria

Clover Point

M2N M1N M1NW M1NE M2NW M2NE M8W M4W M2W M1W M0 M1E M2E M4E M8E M2SW M1SW M1SE M2SE M1S M4SW M2S M4SE

C2N C1N C4NW C2NW C1NW C1NE C2NE C4NE C8W C4W C2W C1W C0 C1E C2E C4E C8E C1SW C1SE C1S C2S C4SW C4SE

5 10 10 0 20 10 5 0 2 5 2 10 20 30 50 50 100

Metchosin PB3 PB1 PB2

Macaulay Point Reference Stations

0 0.25 0.5 1 1.5 2 Kilometers

CB2 CB3

Clover Point Reference Stations

0 50 100 200 300 400 Meters

Langford Colwood Metchosin Esquimalt Victoria Oak Bay

Macaulay and Clover Point Seafloor Sampling Stations

Macaulay Point Reference Stations

Clover Point Reference Stations

0 1 2 4 6 8 Kilometers

August 17, 2004
CRD Environmental Services
Technologist: SR
Map Document: Marine_Samp_Location_Mac_Clov_2003.mxd

Page 1: CRD Sediment Data from 2000

Macaulay Pt. and Clover Pt.

Revised on November 5, 2005	Units	Al	Sb	As	Be	Cd	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Ni	P	K	Se	Ag	Ti	Zn	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	Naphthalene	Phenanthrene	Fluoranthene	Pyrene	Benzo(a)pyrene	Chrycene	Benzo(a)-anthracene	Dibenz[a,h]anthracene	PAH Total
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ratio of CRD Max to Contaminated Sites Regulation:								**3.0**		**112.3**										**0.7**	**24.5**	**3.3**	**26.2**	**12.4**	**4.7**	**31.8**	**19.6**	**16.6**	**18.4**	**16.6**	**23.6**	**12.5**	**7.5**
CRD "Sediment Quality Guidelines" *		**---**	**150**	**57**	**---**	**5.1**	**260**	**390**	**---**	**450**	**---**	**---**	**0.41**	**---**	**---**	**---**	**---**	**6.1**	**0.5**	**410**	**0.5000**	**1.3000**	**0.9600**	**0.5400**	**2.1000**	**1.5000**	**1.7000**	**2.6000**	**1.6000**	**1.4000**	**1.3000**	**0.23**	
BC Contaminated Sites Regulation Criteria **				**50**		**5.0**	**190**	**130**		**130**			**0.84**					**-**		**330**	**0.1100**	**0.1500**	**0.2900**	**0.1700**	**0.4700**	**0.6500**	**1.8000**	**1.7000**	**0.9200**	**1.0000**	**0.8300**	**0.16**	**20**
Canadian Environmental Quality Guidelines PEL				**41.6**		**4.2**	**160**	**108**		**112**			**0.70**					**-**		**271**	**0.0889**	**0.1280**	**0.2450**	**0.1440**	**0.3910**	**0.5440**	**1.4940**	**1.3980**	**0.7630**	**0.8460**	**0.6930**	**0.135**	
Canadian Environmental Quality Guidelines ISQG		**none**	**none**	**7.24**	**none**	**0.7**	**52.3**	**19**	**none**	**30**	**none**	**none**	**0.13**	**none**	**none**	**none**	**none**	**none**	**none**	**124**	**0.0067**	**0.0059**	**0.0469**	**0.0212**	**0.0346**	**0.0867**	**0.1130**	**0.1530**	**0.0888**	**0.1080**	**0.0748**	**0.00622**	
Ratio of CRD Guidelines to BC Contaminated Sites Reg:								**3.00**		**3.46**										**1.24**	**4.55**	**8.67**	**3.31**	**3.18**	**4.47**	**2.31**	**0.94**	**1.53**	**1.74**	**1.40**	**1.57**	**1.44**	
Actual Max		31400	17.00	20.00	0.50	0.74	87.00	387	39600	14600	10600	324	8.77	27.00	1880	4430	9.00	2.5	0.00	233	2.70	0.500	7.600	2.100	2.200	20.700	35.300	28.200	16.900	16.600	19.600	2.000	151
Actual Mean (averages are for Macaulay only)		**27122**	**1.41**	**6.72**	**0.47**	**0.25**	**39.13**	**58.74**	**32074**	**838.2**	**9849**	**257**	**0.61**	**21.65**	**902**	**3591**	**0.69**	**0.46**		**88.07**	**0.166**	**0.042**	**0.452**	**0.137**	**0.182**	**1.293**	**2.149**	**1.733**	**1.013**	**0.999**	**1.130**	**0.123**	**9.419**
Actual Min		17500	0.00	1.90	0.30	0.11	22.00	16	19400	8	7420	205	0.05	15.00	707	2140	0.20	0.07	0.00	0.50	0.010	0.010	0.010	0.010	0.020	0.040	0.020	0.020	0.010	0.020	0.010	0.010	0.200
Std Dev.		3139	3.38	3.42	0.06	0.17	12.10	80	3857	2981	906	21	1.78	2.37	259	534	1.82	0.60		46.68	0.546	0.099	1.539	0.424	0.448	4.182	7.163	5.719	3.430	3.367	3.977	0.404	30.522
The Clover Pt. rows are hidden - no data from 2000-2002.																																	
C0		17500	0.33	6.0	0.3	0.350	22.0	47.0	19400	18.4	7420	233	0.1300	15	1010	2140	0.2	0.400	<0.5	53.0	0.020	0.020	0.050	0.020	0.060	0.160	0.230	0.200	0.120	0.120	0.120	0.020	1.14
M0		27500	2.5	6.0	0.5	0.610	57.0	152.0	29400	1573	8460	267	1.3200	27	1880	2830	0.2	1.380	<0.5	233.0	0.040	0.090	0.110	0.030	0.160	0.360	0.580	0.460	0.270	0.260	0.270	0.040	2.67
M1E		24100	2.2	10.0	0.4	0.540	87.0	387.0	31100	255	9940	239	1.4200	24	1050	3350	0.4	1.180	<0.5	163.0	0.350	0.020	0.930	0.260	0.180	2.520	5.170	4.150	2.430	2.390	2.530	0.240	21.17
M1N		27600	0.37	5.0	0.5	0.190	37.0	21.0	36100	12.4	10600	324	0.0680	21	756	3680	0.3	0.110	<0.5	62.0	0.010	0.010	0.020	0.010	0.030	0.080	0.090	0.080	0.070	0.060	0.060	0.060	0.58
M1NE		27100	0.34	5.1	0.4	0.180	37.0	23.0	33400	332	10600	258	0.0600	22	806	3840	0.2	0.130	<0.5	64.0	0.020	0.010	0.050	0.020	0.030	0.180	0.250	0.220	0.120	0.120	0.130	0.010	1.16
M1NW		28700	0.27	4.7	0.5	0.150	35.0	19.0	32300	9.3	9930	242	0.0580	20	707	3700	0.3	0.100	<0.5	62.0	0.010	0.010	0.010	0.010	0.020	0.050	0.020	0.020	0.010	0.020	0.010	0.020	0.21
M1S		25700	0	20.0	0.4	0.220	36.0	153.0	32600	14600	10100	243	0.1120	22	848	3450	9	0.410	<4	0.5	2.700	0.500	7.600	2.100	0.500	20.700	35.300	28.200	16.900	16.600	19.600	0.040	150.74
M1SE		23200	0.9	12.0	0.4	0.740	38.0	74.0	31900	103.0	7860	257	8.7700	22	1330	3010	0.5	2.520	<0.5	146.0	0.180	0.030	0.320	0.180	2.200	1.260	1.210	1.000	0.530	0.540	0.560	0.010	8.02
M1SW		25800	0.7	5.5	0.4	0.270	48.0	38.0	32200	22.4	9990	250	0.2730	25	812	3490	0.3	0.300	<0.5	81.0	0.040	0.020	0.090	0.030	0.040	0.300	0.420	0.330	0.170	0.180	0.190	0.010	1.82
M1W		26800	1.3	6.8	0.5	0.420	38.0	90.0	33100	50.3	10500	250	0.2450	22	1200	3650	0.4	1.220	<0.5	106.0	0.090	0.020	0.160	0.070	0.070	0.530	0.640	0.580	0.300	0.310	0.330	0.010	3.11
M2E		28100	0.7	6.9	0.5	0.250	36.0	30.0	31200	36.7	9450	284	0.1440	21	863	3550	0.3	0.470	<0.5	91.0	0.110	0.030	0.320	0.100	0.420	0.960	1.380	1.010	0.660	0.550	0.530	2.000	8.07
M2N		28200	1	6.2	0.5	0.140	35.0	21.0	33500	13.5	10600	265	0.0760	22	791	3760	0.3	0.070	<0.5	69.0	0.010	0.010	0.020	0.010	0.040	0.090	0.140	0.130	0.080	0.080	0.080	0.110	0.80
M2NE		31400	0.42	6.3	0.5	0.210	38.0	22.0	36400	10.8	9660	271	0.1440	22	877	4430	0.3	0.120	<0.5	70.0	0.020	0.010	0.040	0.020	0.050	0.150	0.150	0.110	0.070	0.060	0.060	0.100	0.84
M2NW		29500	0.26	5.0	0.5	0.150	35.0	21.0	30900	10.2	9850	251	0.0740	20	768	4220	0.2	0.210	<0.5	68.0	0.010	0.010	0.010	0.010	0.020	0.060	0.050	0.050	0.040	0.030	0.020	0.010	0.32
M2S		21000	0.47	1.9	0.3	0.130	26.0	21.0	24400	10.3	8120	205	0.1190	17	752	2700	<0.1	0.120	<0.5	52.0	0.010	0.010	0.010	0.010	0.030	0.060	0.040	0.040	0.020	0.020	0.020	0.010	0.28
M2SE		22700	0.7	8.0	0.5	0.360	35.0	64.0	28000	75.3	9080	241	0.3880	21	930	2730	0.3	1.070	<0.5	111.0	0.050	0.020	0.270	0.050	0.070	0.560	2.030	1.700	0.880	0.740	0.780	0.010	7.16
M2SW		28700	0.55	5.3	0.5	0.120	36.0	23.0	31400	12.6	10300	252	0.0570	21	745	4080	0.3	0.100	<0.5	74.0	0.010	0.010	0.010	0.010	0.020	0.050	0.020	0.020	0.010	0.020	0.010	0.010	0.20
M2W		29400	0.31	5.5	0.5	0.150	35.0	27.0	31100	11.1	10400	250	0.0720	21	736	3810	0.3	0.140	<0.5	69.0	0.010	0.010	0.010	0.010	0.020	0.060	0.050	0.050	0.020	0.040	0.030	0.010	0.32
M4E		29000	17	6.4	0.5	0.190	35.0	40.0	32800	95.6	10100	259	0.1900	21	941	3720	0.3	0.320	<0.5	97.0	0.050	0.030	0.210	0.060	0.060	0.480	0.530	0.550	0.240	0.270	0.250	0.010	2.74
M4SE		25400	1.1	7.2	0.5	0.180	37.0	49.0	39600	2000	10000	276	0.1130	24	832	3290	0.3	0.360	<0.5	145.0	0.050	0.040	0.110	0.100	0.110	0.940	0.990	0.760	0.240	0.400	0.280	0.030	4.05
M4SW		28300	0.28	5.1	0.5	0.130	35.0	19.0	31900	10.5	10400	269	0.0790	21	742	4010	0.2	0.090	<0.5	75.0	0.010	0.010	0.010	0.010	0.020	0.040	0.020	0.020	0.010	0.020	0.010	0.030	0.21
M4W		27900	0.27	4.7	0.5	0.160	35.0	18.0	30400	8.9	10400	253	0.0500	20	716	3910	0.2	0.080	<0.5	62.0	0.010	0.010	0.010	0.010	0.020	0.050	0.030	0.030	0.020	0.020	0.020	0.010	0.24
M8E		28000	0.45	5.4	0.5	0.140	35.0	23.0	32700	18.7	9990	257	0.0500	22	908	3480	0.3	0.100	<0.5	65.0	0.020	0.050	0.050	0.030	0.050	0.190	0.260	0.300	0.180	0.220	0.200	0.010	**1.56**
M8W		29700	0.25	5.5	0.5	0.110	34.0	16.0	31300	7.7	10200	254	0.0500	20	749	3910	0.2	0.070	<0.5	60.0	0.010	0.010	0.020	0.010	0.020	0.070	0.060	0.050	0.030	0.030	0.030	0.030	0.37
Parry Bay 1		25000	0.2	4.2	0.4	0.070	31.0	12.0	28800	6.2	8930	285	0.0550	18	575	3150	0.1	0.030	<0.5	50.0	<0.01	<0.01	<0.01	<0.01	0.010	0.030	<0.01	<0.01	<0.01	0.010	<0.01	<0.01	0.05
Parry Bay 2		23300	0.24	5.6	0.4	0.070	32.0	14.0	31600	6.3	9850	279	0.0350	20	662	3010	0.2	0.020	<0.5	55.0	<0.01	0.010	0.030	0.020	0.020	0.100	0.090	0.090	0.030	0.040	0.030	<0.01	0.46
Parry Bay 3		28000	0.22	5.5	0.5	0.070	33.0	14.0	30800	6.7	9880	283	0.0320	19	740	3630	0.2	0.030	<0.5	55.0	<0.01	<0.01	<0.01	<0.01	0.020	0.040	0.010	0.010	<0.01	0.010	<0.01	<0.01	0.09
Constance Bank		17600	0.3	3.9	0.3	0.13	23	12	21200	4.6	7940	258	0.0230	15	556	2430	0.2	0.04	<0.5	37	<0.01	<0.01	<0.01	<0.01	0.010	0.060	0.030	0.050	0.020	0.020	0.020	<0.01	0.21

Page 2: CRD Sediment Data from 2001

Macaulay Pt. and Clover Pt.

Revised on November 5, 2005	Units	Al	Sb	As	Be	Cd	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Ni	P	K	Se	Ag	Ti	Zn	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	Naphthalene	Phenanthrene	Fluoranthene	Pyrene	Benzo(a)pyrene	Chrycene	Benzo(a)-anthracene	Dibenz[a,h]anthracene	PAH Total
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Ratio of CRD Max to Contaminated Sites Regulation:								**2.0**		**0.8**										**0.7**	**28.2**	**1.1**	**21.0**	**10.6**	**1.6**	**25.4**	**8.9**	**7.4**	**7.5**	**6.8**	**10.4**	**6.7**	**4.0**
CRD "Sediment Quality Guidelines" *		**---**	**150**	**57**	**---**	**5.1**	**260**	**390**	**---**	**450**	**---**	**---**	**0.41**	**---**	**---**	**---**	**---**	**6.1**	**0.5**	**410**	**0.5000**	**1.3000**	**0.9600**	**0.5400**	**2.1000**	**1.5000**	**1.7000**	**2.6000**	**1.6000**	**1.4000**	**1.3000**	**0.23**	
BC Contaminated Sites Regulation Criteria **				**50**		**5.0**	**190**	**130**		**130**			**0.84**					**-**		**330**	**0.1100**	**0.1500**	**0.2900**	**0.1700**	**0.4700**	**0.6500**	**1.8000**	**1.7000**	**0.9200**	**1.0000**	**0.8300**	**0.16**	**20**
Canadian Environmental Quality Guidelines PEL				**41.6**		**4.2**	**160**	**108**		**112**			**0.70**					**-**		**271**	**0.0889**	**0.1280**	**0.2450**	**0.1440**	**0.3910**	**0.5440**	**1.4940**	**1.3980**	**0.7630**	**0.8460**	**0.6930**	**0.135**	
Canadian Environmental Quality Guidelines ISQG		**none**	**none**	**7.24**	**none**	**0.7**	**52.3**	**19**	**none**	**30**	**none**	**none**	**0.13**	**none**	**none**	**none**	**none**	**none**	**none**	**124**	**0.0067**	**0.0059**	**0.0469**	**0.0212**	**0.0346**	**0.0867**	**0.1130**	**0.1530**	**0.0888**	**0.1080**	**0.0748**	**0.00622**	
Ratio of CRD Guidelines to BC Contaminated Sites Reg:								**3.00**		**3.46**										**1.24**	**4.55**	**8.67**	**3.31**	**3.18**	**4.47**	**2.31**	**0.94**	**1.53**	**1.74**	**1.40**	**1.57**	**1.44**	
Actual Max		26100	2.00	14.00	0.50	1.34	107.0	266	38167	100	11000	746	2.77	73.00	3960	4020	1.00	3.7	2.00	237	3.100	0.170	6.100	1.800	0.740	16.500	16.000	12.600	6.900	6.800	8.600	1.070	79.5
Actual Mean (averages are for Macaulay only)		**23183**	**0.70**	**6.70**	**0.43**	**0.29**	**35.87**	**45.43**	**33046**	**28.4**	**9095**	**238**	**0.31**	**22.61**	**986**	**3420**	**0.27**	**0.50**		**87.57**	**0.162**	**0.018**	**0.610**	**0.103**	**0.060**	**0.943**	**0.994**	**0.801**	**0.454**	**0.443**	**0.542**	**0.072**	**4.910**
Actual Min		19900	0.10	4.00	0.30	0.08	28.0	16	29400	9	7560	208	0.05	18.00	671	1820	0.20	0.06	0.50	56.00	0.010	0.010	0.020	0.010	0.010	0.040	0.020	0.010	0.010	0.010	0.010	0.010	0.0
Std Dev.		1701	0.59	2.51	0.05	0.28	17.1	55	1830	26	821	105	0.65	10.94	714	464	0.16	0.96		59.31	0.629	0.033	1.664	0.364	0.148	3.340	3.247	2.556	1.398	1.386	1.746	0.216	12.6
The Clover Pt. rows are hidden - no data from 2000-2002.																																	
C0		19900	1.1	7.0	0.3	0.530	107.0	112.0	31300	59.0	11000	746	2.7700	21	2090	1820	0.2	3.680	0.600	224.0	0.010	0.030	0.190	0.030	0.030	0.560	2.100	1.700	0.610	1.220	1.090	0.060	7.63
M0		25267	2	11.0	0.4	1.340	72.0	266.0	32000	100.0	9510	282	1.8100	28	3960	3490	1	3.260	0.700	237.0	0.040	0.020	0.140	0.030	0.030	0.430	0.870	0.760	0.410	0.400	0.440	0.050	3.62
M1E		21300	0.5	14.0	0.4	0.570	35.0	97.0	33200	52.0	8450	222	0.5380	22	980	3310	0.3	1.240	<0.5	90.0	0.060	0.010	0.180	0.050	0.060	0.610	1.070	0.910	0.560	0.510	0.630	0.090	4.74
M1N		24833	0.1	7.0	0.5	0.180	35.0	20.0	38167	13.0	9720	252	0.1000	21	761	3683	0.3	0.140	0.600	64.0	0.010	0.010	0.020	0.010	0.020	0.090	0.150	0.140	0.130	0.100	0.130	0.010	0.82
M1NE		23500	<0.3	5.0	0.4	0.130	32.0	17.0	31700	10.0	9490	231	0.1110	18	715	3640	0.2	0.340	<0.5	57.0	0.010	0.010	<0.01	0.010	0.010	0.040	0.040	0.030	0.020	0.020	0.020	0.010	0.22
M1NW		23300	0.7	4.0	0.4	0.080	33.0	17.0	34000	20.0	9180	236	0.0780	20	722	3460	0.2	0.080	<1	61.0	0.010	0.010	<0.01	0.010	0.010	0.050	0.020	0.020	0.010	0.010	0.010	0.010	0.17
M1S		23100	0.4	6.0	0.4	0.280	38.0	29.0	33400	27.0	8970	236	0.8020	20	840	3550	0.2	0.670	0.600	71.0	0.030	0.010	0.070	0.020	0.030	0.230	0.430	0.350	0.240	0.210	0.230	0.030	1.88
M1SE		22400	2	12.0	0.5	0.660	34.0	86.0	29900	52.0	8610	220	0.5850	23	1440	3020	0.3	1.460	0.600	108.0	0.240	0.010	0.480	0.190	0.160	1.910	2.260	1.810	1.130	1.100	1.310	0.170	10.77
M1SW		23500	0.6	6.0	0.4	0.360	35.0	50.0	33300	30.0	9140	237	0.5110	21	870	3320	0.3	0.390	<0.5	91.0	0.020	0.010	0.050	0.020	0.040	0.210	0.190	0.190	0.090	0.100	0.110	0.010	1.04
M1W		22300	0.6	7.0	0.4	0.480	54.0	71.0	31400	39.0	8730	226	0.6610	20	848	3330	0.3	0.790	<0.5	216.0	0.010	0.020	0.030	0.020	0.030	0.100	0.160	0.150	0.080	0.130	0.100	0.020	0.85
M2E		22300	0.7	7.0	0.4	0.220	33.0	32.0	31900	20.0	8630	233	0.0930	19	757	3230	0.2	0.160	0.600	63.0	3.100	0.020	6.100	1.800	0.020	16.500	16.000	12.600	6.900	6.800	8.600	1.070	79.51
M2N		24100	<0.3	5.0	0.4	0.160	34.0	18.0	33800	12.0	9430	249	0.0530	20	721	3630	0.2	0.480	<0.5	59.0	0.010	0.010	<0.01	0.010	0.010	0.070	0.080	0.060	0.050	0.040	0.050	0.010	0.40
M2NE		22600	0.1	5.0	0.4	0.160	31.0	22.0	31400	12.0	8610	224	0.0490	18	697	3390	0.2	0.120	2.000	58.0	0.010	0.010	<0.01	0.010	0.010	0.050	0.020	0.010	0.010	0.010	0.010	0.010	0.16
M2NW		26000	0.1	4.0	0.5	0.140	35.0	18.0	34100	10.0	9727	243	0.0670	20	740	4013	0.2	0.130	0.600	61.0	0.010	0.010	<0.01	0.010	0.010	0.040	0.020	0.010	0.010	0.010	0.010	0.010	0.15
M2S		26100	<0.3	5.0	0.5	0.160	36.0	20.0	35400	19.0	9960	256	0.0510	21	806	4020	0.3	0.080	<0.5	64.0	0.010	0.010	<0.01	0.010	0.010	0.060	0.030	0.020	0.010	0.010	0.010	0.010	0.19
M2SE		21600	0.8	7.0	0.5	0.470	35.0	68.0	29400	88.0	7910	208	0.7460	21	1710	2840	0.3	1.070	<0.5	98.0	0.020	0.010	0.090	0.020	0.050	0.320	0.660	0.570	0.360	0.290	0.310	0.040	2.74
M2SW		23500	0.2	5.0	0.4	0.130	34.0	23.0	33200	13.0	9820	237	0.0680	20	720	3460	0.2	0.100	0.600	63.0	0.010	0.010	<0.01	0.010	0.020	0.060	0.040	0.040	0.020	0.020	0.020	0.010	0.26
M2W		22600	<0.3	4.0	0.4	0.140	32.0	19.0	31900	10.0	8930	224	0.0900	19	671	3320	0.2	0.130	0.500	59.0	0.010	0.010	<0.01	0.010	0.010	0.070	0.030	0.020	0.010	0.010	0.010	0.010	0.20
M4E		21700	0.7	8.0	0.4	0.210	30.0	34.0	32800	17.0	8440	228	0.0780	19	830	3240	0.3	0.320	0.600	60.0	0.010	0.010	0.030	0.020	0.030	0.140	0.090	0.100	0.040	0.050	0.050	0.010	0.58
M4SE		20400	1.6	7.0	0.4	0.250	28.0	70.0	33600	61.0	7560	250	0.3430	73	828	2720	0.2	0.300	0.500	198.0	0.060	0.170	0.110	0.080	0.740	0.440	0.500	0.440	0.230	0.240	0.290	0.030	3.33
M4SW		24700	0.4	6.0	0.5	0.140	34.0	18.0	35100	13.0	10200	257	0.0520	20	792	3750	0.2	0.070	0.500	63.0	0.010	0.010	<0.01	0.010	0.010	0.050	0.030	0.030	0.020	0.020	0.020	0.010	0.22
M4W		22700	<0.3	5.0	0.4	0.210	32.0	18.0	33100	11.0	9200	234	0.0500	19	707	3360	0.2	0.070	<0.5	59.0	0.010	0.010	<0.01	0.010	0.020	0.050	0.020	0.020	0.010	0.010	0.010	0.010	0.18
M8E		20500	0.4	8.0	0.4	0.110	29.0	16.0	33500	16.0	8360	252	0.0480	18	831	3000	0.2	0.060	<0.5	56.0	0.010	0.010	0.020	0.010	0.030	0.100	0.140	0.140	0.090	0.090	0.080	0.010	**0.73**
M8W		24900	<0.3	6.0	0.5	0.150	34.0	16.0	33800	9.0	10600	245	0.1020	20	734	3890	0.2	0.080	0.500	58.0	0.010	0.010	<0.01	0.010	0.020	0.060	0.020	0.010	0.010	0.010	0.010	0.010	0.18
Parry Bay 1		21800	0.2	6.0	0.4	0.160	34.0	14.0	33700	7.0	9780	270	0.0320	19	654	3350	0.2	0.020	0.500	50.0	<0.01	<0.01	<0.01	<0.01	0.010	0.030	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Parry Bay 2		20700	0.2	6.0	0.4	0.070	32.0	12.0	32200	7.0	8600	259	0.0330	19	633	3150	0.2	0.030	<0.5	48.0	<0.01	<0.01	<0.01	<0.01	0.010	0.030	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Parry Bay 3		21300	0.2	6.0	0.4	0.060	31.0	13.0	32700	8.0	8410	250	0.0350	18	667	3030	0.2	0.040	0.600	51.0	<0.01	<0.01	<0.01	<0.01	<0.01	0.020	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Constance Bank		15500	<0.3	5	0.3	0.23	24	11	24600	5	7130	257	0.0240	15	625	2770	0.3	0.07	<0.5	36	<0.01	<0.01	<0.01	<0.01	<0.01	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01

Page 3: CRD Sediment Data from 2002

Macaulay Pt. and Clover Pt.

Revised on November 5, 2005	Units	Al	Sb	As	Be	Cd	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Ni	P	K	Se	Ag	Ti	Zn	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	Napthalene	Phenanthrene	Fluoranthene	Pyrene	Benzo(a)pyrene	Chrycene	Benzo(a)-anthracene	Dibenz[a,h]anthracene	PAH Total (1)	2-methylnaphthalene
Ratio of CRD Max to Contaminated Sites Regulation:								**1.2**		**1.0**										**1.3**	**1.5**	**0.7**	**1.3**	**1.7**	**0.4**	**2.8**	**1.2**	**1.1**	**1.2**	**1.0**	**1.4**	**0.8**	**0.5**	**0.7**
CRD "Sediment Quality Guidelines" *		**---**	**150**	**57**	**---**	**5.1**	**260**	**390**	**---**	**450**	**---**	**---**	**0.41**	**---**	**---**	**---**	**---**	**6.1**	**0.5**	**410**	**0.5000**	**1.3000**	**0.9600**	**0.5400**	**2.1000**	**1.5000**	**1.7000**	**2.6000**	**1.6000**	**1.4000**	**1.3000**	**0.23**		
BC Contaminated Sites Regulation Criteria **				**50**		**5.0**	**190**	**130**		**130**			**0.84**					**-**		**330**	**0.1100**	**0.1500**	**0.2900**	**0.1700**	**0.4700**	**0.6500**	**1.8000**	**1.7000**	**0.9200**	**1.0000**	**0.8300**	**0.16**	**20**	**0.2400**
Canadian Environmental Quality Guidelines PEL				**41.6**		**4.2**	**160**	**108**		**112**			**0.70**					**-**		**271**	**0.0889**	**0.1280**	**0.2450**	**0.1440**	**0.3910**	**0.5440**	**1.4940**	**1.3980**	**0.7630**	**0.8460**	**0.6930**	**0.135**		**0.2010**
Canadian Environmental Quality Guidelines ISQG		**none**	**none**	**7.24**	**none**	**0.7**	**52.3**	**19**	**none**	**30**	**none**	**none**	**0.13**	**none**	**none**	**none**	**none**	**none**	**none**	**124**	**0.0067**	**0.0059**	**0.0469**	**0.0212**	**0.0346**	**0.0867**	**0.1130**	**0.1530**	**0.0888**	**0.1080**	**0.0748**	**0.00622**		**0.0202**
Ratio of CRD Guidelines to BC Contaminated Sites Reg:								**3.00**		**3.46**										**1.24**	**4.55**	**8.67**	**3.31**	**3.18**	**4.47**	**2.31**	**0.94**	**1.53**	**1.74**	**1.40**	**1.57**	**1.44**		
Actual Max		28700	3.60	10.70	0.50	83.50	52.00	158	53700	130	11600	352	0.52	34.00	2660	4760	0.50	4.8	0.00	431	0.166	0.110	0.370	0.290	0.190	1.800	2.170	1.910	1.080	1.010	1.170	0.130	9.4	0.160
Actual Mean (averages are for Macaulay only)		**25170**	**0.74**	**6.48**	**0.46**	**4.05**	**38.30**	**40.96**	**34316**	**32.6**	**10464**	**259**	**0.12**	**21.74**	**927**	**4068**	**0.30**	**0.33**		**101.83**	**0.036**	**0.015**	**0.070**	**0.046**	**0.043**	**0.306**	**0.410**	**0.347**	**0.175**	**0.191**	**0.184**	**0.025**	**1.851**	**0.06**
Actual Min		15000	0.20	4.30	0.20	0.15	25.00	10	20100	7	6900	223	0.03	16.00	568	1830	0.20	0.09	0.00	34.00	0.005	0.005	0.010	0.010	0.010	0.030	0.020	0.020	0.010	0.010	0.010	0.005	0.2	0.020
Std Dev.		3038	0.85	1.69	0.07	16.62	5.31	38	5749	35	861	26	0.14	3.40	421	644	0.07	0.95		79.34	0.040	0.024	0.085	0.061	0.038	0.416	0.542	0.460	0.237	0.229	0.249	0.028	2.3	0.040
The Clover Pt. rows are hidden - no data from 2000-2002.																																		
C0		18233	3	5.4	0.2	0.620	47.0	133.0	28333	128.3	9683	302	0.5120	20	1367	1830	0.4	4.830	<0.5	147.0	0.031	0.040	0.09	0.03	0.04	0.26	0.48	0.42	0.27	0.21	0.25	0.035	2.156	0.02
M0		25100	1.3	9.4	0.5	0.760	44.0	158.0	29200	130.0	9810	223	0.1860	34	2660	4330	<0.1	1.290	<0.5	132.0	0.166	0.054	0.37	0.10	0.08	1.19	2.17	1.91	1.08	1.01	1.17	0.13	9.430	0.08
M1E		28700	3.6	6.4	0.5	0.650	42.0	58.0	37300	53.4	11300	288	0.2550	25	843	4470	0.3	0.250	<0.5	156.0	0.025	0.005	0.05	0.03	0.04	0.16	0.25	0.21	0.11	0.11	0.12	0.014	1.124	0.05
M1N		28700	0.6	5.0	0.5	0.260	39.0	21.0	36700	40.4	11600	271	0.0260	22	750	4760	0.3	0.340	<0.5	64.0	0.054	0.008	0.09	0.04	0.02	0.33	0.63	0.49	0.25	0.34	0.27	0.043	2.565	0.03
M1NE		25200	0.3	5.3	0.5	0.540	38.0	22.0	35800	13.5	10900	264	0.0560	22	782	3870	0.3	0.250	<0.5	67.0	0.012	0.005	0.02	0.01	0.02	0.08	0.06	0.05	0.02	0.03	0.03	0.005	0.342	0.03
M1NW		26300	0.3	4.6	0.5	0.210	36.0	17.0	31700	9.2	10600	249	0.0330	19	697	4320	0.2	0.090	<0.5	58.0	0.005	0.008	0.01	0.01	0.02	0.04	0.04	0.04	0.02	0.04	0.03	0.005	0.268	0.02
M1S		25100	1.7	5.4	0.5	0.320	35.0	52.0	31700	20.8	10200	247	0.0580	21	855	4190	0.3	0.330	<0.5	79.0	0.010	0.006	0.02	0.01	0.02	0.06	0.09	0.09	0.06	0.09	0.07	0.012	0.538	0.02
M1SE		21400	0.7	10.7	0.4	0.880	41.0	81.0	33700	98.3	10100	232	0.1420	26	1110	3440	0.5	0.370	<0.5	95.0	0.096	0.013	0.17	0.09	0.05	0.71	1.10	0.78	0.37	0.39	0.39	0.047	4.206	0.06
M1SW		27900	1.3	8.0	0.5	83.50	42.0	80.0	34900	43.6	10800	263	0.0910	23	989	4730	0.4	0.480	<0.5	431.0	0.017	0.006	0.04	0.02	0.03	0.16	0.27	0.23	0.12	0.12	0.14	0.016	1.169	0.06
M1W		24667	0.8	7.2	0.4	1.120	52.0	80.0	34900	38.8	10567	248	0.2640	24	962	3987	0.4	1.240	<0.5	116.0	0.059	0.036	0.12	0.05	0.04	0.48	0.91	0.71	0.35	0.39	0.34	0.045	3.530	0.05
M2E		26100	0.5	7.5	0.4	0.480	44.0	32.0	34700	41.1	10600	284	0.1670	21	846	4050	0.3	0.340	<0.5	211.0	0.106	0.110	0.20	0.29	0.10	1.80	1.50	1.30	0.45	0.52	0.41	0.057	6.843	0.16
M2N		25800	0.3	5.1	0.5	0.230	37.0	19.0	33000	18.5	10600	267	0.0320	20	749	4220	0.3	0.110	<0.5	64.0	0.010	0.014	0.03	0.02	0.04	0.17	0.20	0.18	0.11	0.13	0.1	0.018	1.022	0.04
M2NE		24100	0.3	5.2	0.4	0.240	35.0	44.0	31600	11.9	10100	243	0.2240	19	719	4000	0.3	0.360	<0.5	64.0	0.005	0.005	0.01	0.01	0.01	0.03	0.02	0.02	0.01	0.02	0.01	0.005	0.155	0.02
M2NW		24600	0.3	6.1	0.4	0.230	37.0	17.0	31500	10.1	10400	249	0.0280	20	697	4040	0.3	0.120	<0.5	64.0	0.005	0.005	0.01	0.01	0.02	0.04	0.02	0.02	0.01	0.01	0.01	0.005	0.165	0.04
M2S		25400	0.7	4.9	0.5	0.190	37.0	25.0	34000	17.9	9870	252	0.0320	20	702	4210	0.2	0.130	<0.5	62.0	0.007	0.005	0.01	0.01	0.02	0.06	0.04	0.04	0.02	0.03	0.02	0.005	0.267	0.03
M2SE		22000	0.9	7.5	0.4	1.650	33.0	55.0	28600	58.9	10100	241	0.5210	19	1410	3260	0.3	0.580	<0.5	104.0	0.048	0.015	0.12	0.05	0.06	0.38	0.77	0.62	0.36	0.35	0.38	0.046	3.199	0.05
M2SW		23700	0.4	5.5	0.4	0.290	38.0	17.0	29100	11.0	9630	228	0.0320	18	644	4100	0.2	0.200	<0.5	60.0	0.026	0.005	0.05	0.02	0.02	0.14	0.33	0.28	0.17	0.17	0.19	0.022	1.423	0.04
M2W		28000	0.2	5.9	0.5	0.230	36.0	18.0	33500	9.3	11000	263	0.0250	21	744	4570	0.3	0.140	<0.5	62.0	0.020	0.005	0.01	0.01	0.02	0.07	0.06	0.05	0.02	0.03	0.03	0.005	0.330	0.03
M4E		23133	0.6	7.1	0.4	0.240	34.0	29.0	34167	23.3	9900	245	0.0710	21	854	3677	0.3	0.360	<0.5	72.0	0.070	0.006	0.13	0.12	0.19	0.43	0.32	0.33	0.14	0.15	0.17	0.019	2.075	0.15
M4SE		25800	1.2	9.1	0.5	0.270	32.0	46.0	53700	44.6	10100	352	0.0370	22	1250	3490	0.3	0.140	<0.5	88.0	0.030	0.007	0.04	0.07	0.05	0.24	0.15	0.13	0.07	0.12	0.09	0.015	1.012	0.1
M4SW		24300	0.3	5.3	0.5	0.190	37.0	17.0	33100	11.2	10500	258	0.0250	20	727	3920	0.3	0.120	<0.5	63.0	0.005	0.005	0.01	0.01	0.02	0.04	0.02	0.02	0.01	0.01	0.01	0.005	0.165	0.03
M4W		22900	0.3	4.9	0.4	0.210	35.0	17.0	32800	10.7	10700	252	0.2930	20	733	3490	0.2	0.100	<0.5	63.0	0.005	0.005	0.01	0.01	0.02	0.04	0.02	0.02	0.01	0.02	0.01	0.005	0.175	0.03
M8E		25000	0.3	8.0	0.5	0.200	38.0	22.0	41500	22.4	10800	277	0.2100	23	889	4180	0.3	0.120	<0.5	106.0	0.051	0.020	0.09	0.06	0.07	0.34	0.45	0.44	0.26	0.3	0.24	0.043	**2.364**	0.12
M8W		25000	0.2	4.9	0.5	0.180	39.0	15.0	32100	10.6	10500	254	0.0300	20	698	4260	0.3	0.100	<0.5	61.0	0.005	0.005	0.01	0.01	0.04	0.04	0.02	0.02	0.01	0.02	0.01	0.01	0.195	0.04
Parry Bay 1		27000	0.2	5.8	0.5	0.120	37.0	15.0	34700	8.3	10600	276	0.0220	20	665	3560	0.4	0.210	<0.5	48.0	<0.005	<0.005	<0.01	<0.01	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005		0.02
Parry Bay 2		22200	0.3	5.5	0.4	0.130	36.0	12.0	34800	8.8	9860	256	0.0250	20	701	3530	0.2	0.080	<0.5	53.0	<0.005	<0.005	<0.01	<0.01	<0.01	0.02	0.01	0.01	<0.01	0.01	<0.01	<0.005		0.02
Parry Bay 3		22200	0.3	6.1	0.4	0.130	36.0	12.0	33300	7.2	10200	273	0.0200	20	790	4500	0.2	0.070	<0.5	58.0	<0.005	<0.005	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005		0.02

Page 4: CRD Sediment Data from 2003

Macaulay Pt. and Clover Pt.

Revised on November 5, 2005	Units	Al	Sb	As	Be	Cd	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Ni	P	K	Se	Ag	Ti	Zn	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	Naphthalene	Phenanthrene	Fluoranthene	Pyrene	Benzo(a)pyrene	Chrycene	Benzo(a)-anthracene	Dibenz[a,h]anthracene	PAH Total	2-methylnaphthalene
Ratio of CRD Max to Contaminated Sites Regulation:								**2.1**		**1.5**										**1.1**	**31.3**	**1.1**	**23.6**	**13.1**	**1.7**	**29.7**	**11.5**	**10.1**	**9.6**	**9.0**	**11.7**	**6.9**	**4.9**	**1.8**
CRD "Sediment Quality Guidelines" *		**---**	**150**	**57**	**---**	**5.1**	**260**	**390**	**---**	**450**	**---**	**---**	**0.41**	**---**	**---**	**---**	**---**	**6.1**	**0.5**	**410**	**0.5000**	**1.3000**	**0.9600**	**0.5400**	**2.1000**	**1.5000**	**1.7000**	**2.6000**	**1.6000**	**1.4000**	**1.3000**	**0.23**		
BC Contaminated Sites Regulation Criteria **				**50**		**5.0**	**190**	**130**		**130**			**0.84**					**-**		**330**	**0.1100**	**0.1500**	**0.2900**	**0.1700**	**0.4700**	**0.6500**	**1.8000**	**1.7000**	**0.9200**	**1.0000**	**0.8300**	**0.16**	**20**	**0.2400**
Canadian Environmental Quality Guidelines PEL				**41.6**		**4.2**	**160**	**108**		**112**			**0.70**					**-**		**271**	**0.0889**	**0.1280**	**0.2450**	**0.1440**	**0.3910**	**0.5440**	**1.4940**	**1.3980**	**0.7630**	**0.8460**	**0.6930**	**0.135**		**0.2010**
Canadian Environmental Quality Guidelines ISQG		**none**	**none**	**7.24**	**none**	**0.7**	**52.3**	**19**	**none**	**30**	**none**	**none**	**0.13**	**none**	**none**	**none**	**none**	**none**	**none**	**124**	**0.0067**	**0.0059**	**0.0469**	**0.0212**	**0.0346**	**0.0867**	**0.1130**	**0.1530**	**0.0888**	**0.1080**	**0.0748**	**0.00622**		**0.0202**
Ratio of CRD Guidelines to BC Contaminated Sites Reg:								**3.00**		**3.46**										**1.24**	**4.55**	**8.67**	**3.31**	**3.18**	**4.47**	**2.31**	**0.94**	**1.53**	**1.74**	**1.40**	**1.57**	**1.44**		
Actual Max		27000	2.17	10.90	0.49	0.80	56.70	273	36000	190	10800	345	0.55	28.40	2140	3810	0.52	12.5	0.00	369	3.439	0.160	6.836	2.222	0.780	19.287	20.620	17.117	8.815	9.017	9.747	1.104	98.3	0.440
Actual Mean (averages are for Macaulay only)		**22848**	**0.72**	**6.14**	**0.40**	**0.34**	**34.11**	**46.10**	**28404**	**41.8**	**8922**	**245**	**0.18**	**20.53**	**867**	**3134**	**0.25**	**0.57**		**85.23**	**0.197**	**0.016**	**0.379**	**0.158**	**0.068**	**1.284**	**1.349**	**1.126**	**0.561**	**0.580**	**0.606**	**0.077**	**6.401**	**0.06**
Actual Min		11400	0.24	3.60	0.22	0.11	16.70	8	15200	3	5650	201	0.02	11.10	428	1500	0.12	0.03	0.00	27.60	0.002	0.002	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.002	0.1	0.010
Std Dev.		4264	0.49	1.56	0.07	0.19	6.78	50	5020	43	1087	32	0.16	3.34	313	555	0.08	2.00		54.86	0.544	0.026	1.077	0.357	0.123	3.087	3.298	2.728	1.400	1.435	1.543	0.177	15.6	0.073
C0		20900	0.80	7.1	0.25	0.613	37.6	172.0	28600	58.6	9650	345	0.1580	23.6	1480	1500	0.52	12.500	<0.50	105.0	0.294	0.0335	0.522	0.192	0.028	2.070	2.360	1.840	0.945	1.100	1.140	0.173	10.70	0.021
C1NE		15600	0.30	3.9	0.26	0.184	22.3	12.3	18900	5.3	7230	211	0.0261	14.7	661	2170	0.23	0.150	<0.50	35.5	0.007	0.0034	0.013	0.010	0.024	0.056	0.040	0.033	0.013	0.013	0.012	0.002	0.23	0.016
C1NW		15100	0.26	4.0	0.28	0.197	22.6	14.9	18900	6.2	7220	206	0.0282	15.3	765	2600	0.22	0.102	<0.50	37.8	0.008	0.0020	0.010	0.010	0.010	0.020	0.010	0.010	0.010	0.010	0.010	0.002	0.11	0.016
C1SE		14400	0.33	4.8	0.26	0.221	24.8	13.4	20400	5.7	7220	209	0.0630	16.2	647	2240	0.21	0.508	<0.50	39.5	0.020	0.0034	0.047	0.011	0.015	0.130	0.220	0.205	0.108	0.121	0.099	0.016	1.00	0.022
C1SW		14000	0.30	4.4	0.26	0.171	22.1	11.1	17500	4.7	6990	216	0.2980	14	943	2300	0.2	0.204	<0.50	32.7	0.007	0.0020	0.010	0.010	0.010	0.017	0.010	0.010	0.010	0.010	0.010	0.002	0.11	0.012
C2E		15500	0.38	7.1	0.29	0.436	25.8	17.3	19600	8.9	7240	209	0.4410	16.4	883	2470	0.22	0.399	<0.50	43.6	0.020	0.0046	0.055	0.013	0.013	0.136	0.320	0.250	0.185	0.129	0.142	0.032	1.30	0.019
C2S		18600	0.49	4.9	0.31	0.152	28.3	12.3	22200	6.1	8010	241	0.0261	17.6	736	2770	0.23	0.061	<0.50	39.5	0.003	0.0020	0.010	0.010	0.010	0.017	0.010	0.010	0.010	0.010	0.010	0.002	0.10	0.013
C2W		14800	0.24	4.1	0.25	0.179	22.3	12.1	18300	4.8	6940	263	0.0250	15.1	689	2040	0.18	0.058	<0.50	31.6	0.005	0.0020	0.010	0.010	0.023	0.023	0.010	0.013	0.010	0.010	0.010	0.002	0.13	0.040
C4E		12533	0.26	4.3	0.25	0.151	20.8	10.1	16967	5.1	6523	216	0.0223	12.9	479	1783	0.14	0.052	<0.50	30.0	0.009	0.0023	0.021	0.010	0.010	0.033	0.160	0.156	0.050	0.061	0.045	0.008	0.56	0.011
C4SE		20900	0.30	5.1	0.34	0.145	32.3	13.8	24900	6.9	8460	257	0.0259	19.6	628	3090	0.22	0.054	<0.50	43.9	0.007	0.0020	0.010	0.010	0.010	0.019	0.010	0.010	0.010	0.010	0.010	0.002	0.11	0.014
C4SW		17900	0.28	5.2	0.32	0.135	26.6	15.7	22800	55.0	8220	270	0.0253	17.5	656	2460	0.16	0.050	<0.50	37.4	0.002	0.0020	0.010	0.010	0.010	0.016	0.010	0.010	0.010	0.010	0.010	0.002	0.10	0.010
C4W		16800	0.27	4.4	0.34	0.167	24.6	15.1	21600	4.7	8040	262	0.0231	16.3	800	2430	0.23	0.048	<0.50	43.8	0.002	0.0050	0.010	0.010	0.010	0.025	0.030	0.038	0.026	0.020	0.014	0.003	0.19	0.012
C8E		16400	0.25	4.6	0.27	0.134	25.0	12.3	20500	5.0	7400	237	0.0187	16.1	604	2210	0.16	0.046	<0.50	34.2	0.006	0.0020	0.020	0.010	0.010	0.068	0.120	0.119	0.041	0.074	0.063	0.005	0.54	0.010
C8W		16600	0.33	5.1	0.3	0.165	26.0	13.6	21700	6.4	8010	234	0.0311	16.5	757	2680	0.26	0.125	<0.50	39.5	0.005	0.0032	0.010	0.010	0.010	0.035	0.070	0.082	0.052	0.064	0.059	0.011	0.41	0.018
CB2		13100	0.27	3.6	0.22	0.105	19.8	8.7	16100	3.8	6320	225	0.0151	11.8	521	2170	0.14	0.041	<0.50	28.5	0.005	0.0020	0.013	0.010	0.010	0.024	0.040	0.010	0.010	0.028	0.021	0.002	0.18	0.010
CB3		11400	<0.20	3.6	<0.20	0.117	16.7	7.8	15200	3.3	5650	231	0.0152	11.1	428	1870	0.18	0.033	<0.50	27.6	0.005	0.0020	0.010	0.010	0.010	0.011	0.010	0.010	0.010	0.010	0.010	0.002	0.10	0.010
CB1		16800	0.30	5.1	0.28	0.128	27.0	12.1	21600	5.3	8050	275	0.0262	16.2	587	2530	0.24	0.150	<0.50	39.4	0.002	0.0020	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.002	0.10	0.010
M0		25900	2.10	6.4	0.36	0.803	56.7	273.0	30500	64.6	10800	319	0.1140	28.4	2140	2660	0.37	1.200	<0.50	369.0	0.382	0.0117	0.409	0.212	0.058	1.890	2.020	1.830	0.682	0.760	0.775	0.108	9.14	0.069
M1E		19900	2.17	10.9	0.32	0.785	32.0	85.1	28700	55.0	7990	208	0.2760	21.4	916	2820	0.47	1.120	<0.50	95.9	0.204	0.1600	0.390	0.520	0.780	3.940	4.020	2.970	1.380	1.480	1.100	0.211	17.16	0.440
M1N		24700	0.45	5.0	0.41	0.184	34.3	20.3	29500	11.0	9530	246	0.0396	21	713	3390	0.27	0.119	<0.50	70.7	0.005	0.0023	0.010	0.010	0.012	0.025	0.020	0.016	0.010	0.012	0.010	0.006	0.14	0.020
M1NE		24000	0.35	5.1	0.39	0.237	32.3	19.5	26700	9.8	8990	226	0.0370	19.4	681	3440	0.26	0.147	<0.50	59.7	0.008	0.0028	0.014	0.010	0.031	0.074	0.100	0.079	0.038	0.039	0.037	0.007	0.44	0.028
M1NW		20800	0.32	4.6	0.35	0.179	28.0	14.1	23000	8.4	7850	204	0.0325	16.8	572	3440	0.12	0.080	<0.50	48.9	0.010	0.0023	0.016	0.011	0.017	0.074	0.090	0.072	0.038	0.044	0.045	0.048	0.47	0.031
M1S		20500	0.43	6.2	0.37	0.430	32.3	76.8	28200	69.4	8490	242	0.1270	20.1	865	2720	0.23	0.481	<0.50	65.3	0.049	0.0105	0.089	0.041	0.022	0.377	0.560	0.402	0.246	0.010	0.300	0.048	2.15	0.041
M1SE		17333	1.01	9.6	0.33	0.739	30.6	99.6	22433	186.0	7410	201	0.4637	19.1	1670	2503	0.33	0.647	<0.50	118.9	3.439	0.0110	6.836	2.222	0.050	19.287	20.620	17.117	8.815	9.017	9.747	1.104	98.27	0.049
M1SW		24000	0.57	6.2	0.43	0.382	34.2	62.5	27300	40.8	9060	231	0.4920	20.2	844	3400	0.28	0.965	<0.50	93.1	0.030	0.0112	0.049	0.022	0.045	0.177	0.200	0.167	0.099	0.083	0.079	0.017	0.98	0.051
M1W		22600	0.82	6.3	0.42	0.506	33.4	29.8	25800	45.4	8360	231	0.3950	19.7	819	3080	0.26	3.500	<0.50	76.7	0.070	0.0083	0.207	0.058	0.058	0.623	1.050	0.801	0.397	0.436	0.514	0.051	4.27	0.071
M2E		19100	0.96	7.0	0.35	0.368	34.4	32.5	36000	55.2	8470	268	0.2330	19.9	718	2770	0.18	0.328	<0.50	75.5	0.062	0.0087	0.172	0.049	0.026	0.493	1.000	0.994	0.515	0.504	0.501	0.071	4.40	0.029
M2N		24500	1.07	5.5	0.43	0.274	34.7	29.9	29600	24.2	9480	265	0.0694	22.2	781	3340	0.22	0.205	<0.50	67.3	0.005	0.0180	0.035	0.020	0.032	0.125	0.150	0.139	0.085	0.094	0.094	0.014	0.81	0.047
M2NE		27000	0.73	5.4	0.47	0.227	34.8	23.5	31400	11.7	9680	250	0.5490	20.4	973	3650	0.19	0.561	<0.50	57.9	0.006	0.0096	0.015	0.016	0.023	0.078	0.050	0.050	0.019	0.026	0.024	0.003	0.32	0.022
M2NW		23200	0.28	4.7	0.41	0.208	32.9	17.6	26800	8.4	8920	224	0.0654	19	634	3380	0.2	0.125	<0.50	55.8	0.004	0.0024	0.010	0.020	0.018	0.051	0.040	0.033	0.015	0.020	0.017	0.003	0.23	0.035
M2S		23700	0.32	5.1	0.42	0.174	34.0	24.7	28400	12.0	9070	245	0.3470	21.2	734	3150	0.24	0.395	<0.50	61.3	0.003	0.0020	0.010	0.020	0.026	0.042	0.020	0.019	0.010	0.012	0.010	0.002	0.18	0.041
M2SE		21900	0.77	8.0	0.37	0.496	32.3	51.9	27300	79.5	9710	268	0.2310	21	951	2840	0.27	0.956	<0.50	74.2	0.030	0.0200	0.035	0.060	0.043	0.598	0.150	0.159	0.085	0.131	0.098	0.015	1.42	0.049
M2SW		21800	0.3	4.6	0.38	0.208	32.1	22.2	27400	10.7	8700	225	0.2090	19.8	656	2930	0.23	0.394	<0.50	58.8	0.009	0.0047	0.027	0.016	0.018	0.121	0.130	0.111	0.051	0.066	0.063	0.008	0.62	0.029
M2W		20900	0.32	5.1	0.37	0.261	31.8	27.3	26600	9.2	8650	220	0.0458	19.2	688	2830	0.2	0.463	<0.50	60.3	0.008	0.0020	0.017	0.014	0.017	0.081	0.080	0.066	0.027	0.037	0.034	0.004	0.39	0.035
M4E		22200	0.51	5.6	0.49	0.228	32.1	35.0	30200	27.0	8460	323	0.1020	20.5	792	2930	0.26	0.642	<0.50	127.0	0.004	0.0041	0.011	0.010	0.021	0.058	0.050	0.050	0.021	0.034	0.022	0.004	0.29	0.031
M4SE		21400	1.9	8.4	0.4	0.342	31.2	44.8	29800	190.0	8270	254	0.2330	20.1	878	2700	0.28	0.323	<0.50	88.1	0.020	0.0175	0.025	0.050	0.038	0.298	0.090	0.086	0.039	0.058	0.047	0.007	0.78	0.055
M4SW		26000	0.29	5.0	0.44	0.153	36.1	16.8	29300	10.4	9490	249	0.0342	20.1	723	3810	0.24	0.084	<0.50	59.3	0.003	0.0048	0.011	0.010	0.014	0.058	0.070	0.065	0.030	0.028	0.033	0.004	0.33	0.026
M4W		26500	0.29	5.0	0.42	0.182	35.0	16.2	28200	8.6	9170	241	0.0380	19.9	698	3680	0.2	0.102	<0.50	57.2	0.004	0.0046	0.012	0.010	0.011	0.062	0.050	0.044	0.023	0.030	0.026	0.004	0.28	0.024
M8E		22800	0.37	6.4	0.41	0.191	34.7	21.1	30900	14.7	9400	257	0.0470	22.6	791	3220	0.26	0.262	<0.50	61.1	0.174	0.0405	0.290	0.221	0.185	0.931	0.420	0.589	0.255	0.384	0.330	0.033	**3.85**	0.221
M8W		24767	0.28	5.1	0.42	0.165	34.6	16.1	29267	9.2	9257	245	0.0369	20.3	694	3410	0.21	0.112	<0.50	58.4	0.009	0.0057	0.021	0.020	0.012	0.066	0.050	0.045	0.022	0.024	0.026	0.003	0.30	0.025
Parry Bay 1		22600	0.24	5.8	0.39	0.125	33.7	13.4	28200	6.9	9000	252	0.0316	20.2	676	3370	0.17	0.056	<0.50	50.5	0.002	0.0020	<0.010	<0.010	0.010	0.034	0.020	0.014	<0.010	0.012	<0.010	<0.002		0.010
Parry Bay 3		25700	0.3	5.6	0.43	0.112	36.3	16.7	30200	7.8	9720	265	0.0360	21.3	802	3710	0.24	0.066	<0.50	59.0	0.002	0.0056	<0.010	<0.010	0.011	0.037	0.020	0.024	0.019	0.025	0.023	0.002		0.011
Parry Bay 2		21800	0.2	5.9	0.39	0.129	35.1	13.5	28700	6.6	9070	267	0.0319	20.1	652	3010	0.26	0.105	<0.50	53.2	0.003	0.0020	<0.010	<0.010	<0.010	0.031	<0.010	<0.010	<0.010	<0.010	<0.010	<0.002		<0.010

Page 5: Geographical distribution of Copper around outfalls (2003)

Copper (Cu) criteria / standards:

BC *Contaminated Sites Regulation*:	130.0
Canadian PEL:	108.0
Canaadian ISQG:	19.0

Macaulay Point (Copper, 2003)

	West 800	West 400	West 200	West 100	0	East 100	East 200	East 400	East 800
North 200			17.6		29.9		23.5		
North 100				14.1	20.3	19.5			
0	16.1	16.2	27.3	29.8	273.0	85.1	32.5	35.0	21.1
South 100				62.5	76.8	99.6			
South 200			22.2		24.7		51.9		
South 400		16.8						44.8	

Sampling station locations around outfalls:

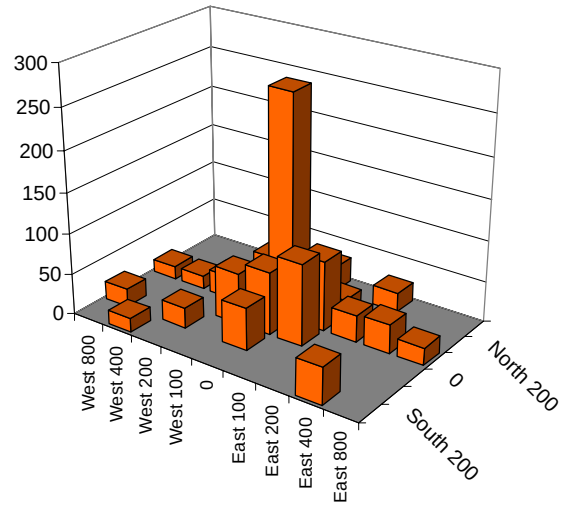
		2NW		2N		2NE		
			1NW	1N	1NE			
8W	4W	2W	1W	0	1E	2E	4E	8E
			1SW	1S	1SE			
		2SW		2S		2SE		
	4SW						4SE	

Clover Point (Copper, 2003)

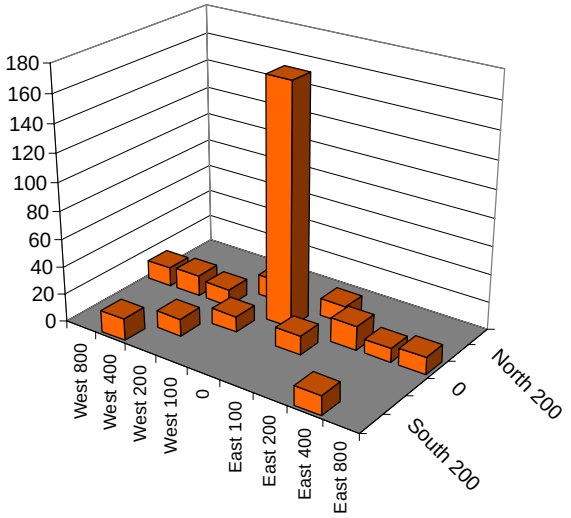
	West 800	West 400	West 200	West 100	0	East 100	East 200	East 400	East 800
North 200									
North 100				14.9		12.3			
0	13.6	15.1	12.1		172.0		17.3	10.1	12.3
South 100				11.1		13.4			
South 200					12.3				
South 400		15.7						13.8	

Graphs are oriented from the point of view of a person on the water, looking north-west

Copper contamination at & around Macaulay Point outfall (2003)



Copper contamination at & around Clover Point outfall (2003)



Page 6: Geographical distribution of Total PAH around outfalls (2003)

Total PAH criteria / standards:

BC *Contaminated Sites Regulation*: 20.0

Macaulay Point (Total PAH, 2003)

	West 800	West 400	West 200	West 100	0	East 100	East 200	East 400	East 800
North 200			0.23		0.81		0.32		
North 100				0.47	0.14	0.44			
0	0.30	0.28	0.39	4.27	9.14	17.16	4.40	0.29	3.85
South 100				0.98	2.15	98.27			
South 200			0.62		0.18		1.42		
South 400		0.33						0.78	

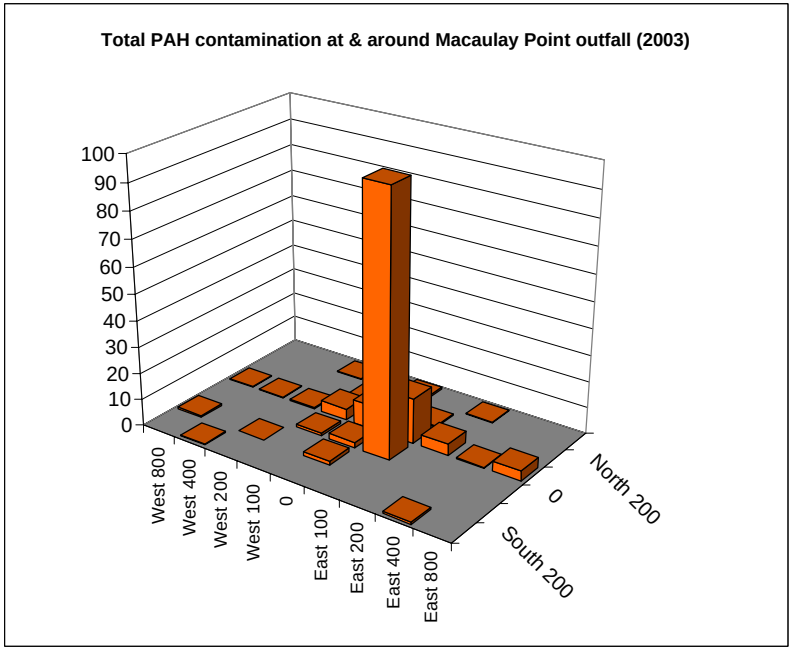
Sampling station locations around outfalls:

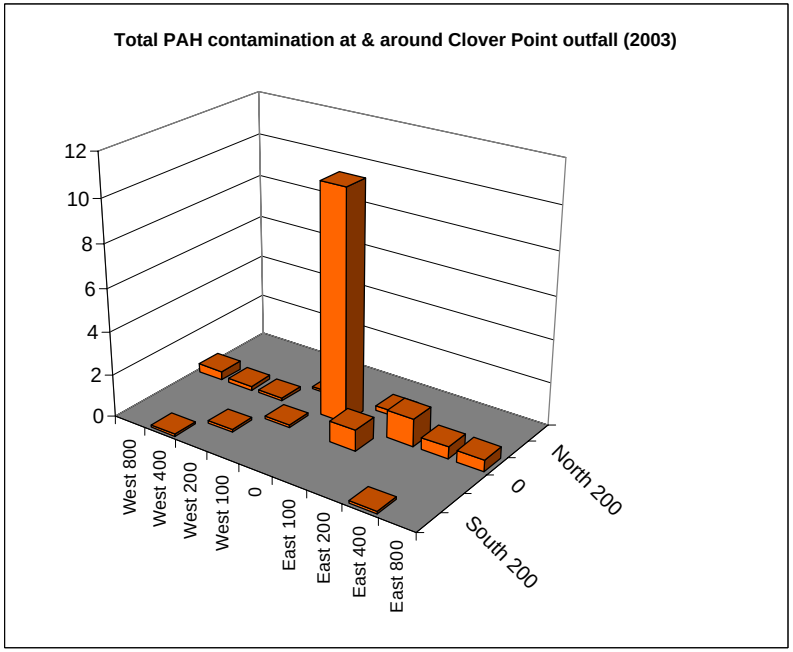
		2NW		2N		2NE		
			1NW	1N	1NE			
8W	4W	2W	1W	0	1E	2E	4E	8E
			1SW	1S	1SE			
		2SW		2S		2SE		
	4SW						4SE	

Clover Point (Total PAH, 2003)

	West 800	West 400	West 200	West 100	0	East 100	East 200	East 400	East 800
North 200									
North 100				0.11		0.23			
0	0.41	0.19	0.13		10.70		1.30	0.56	0.54
South 100				0.11		1.00			
South 200					0.10				
South 400		0.10						0.11	

Graphs are oriented from the point of view of a person on the water, looking north-west

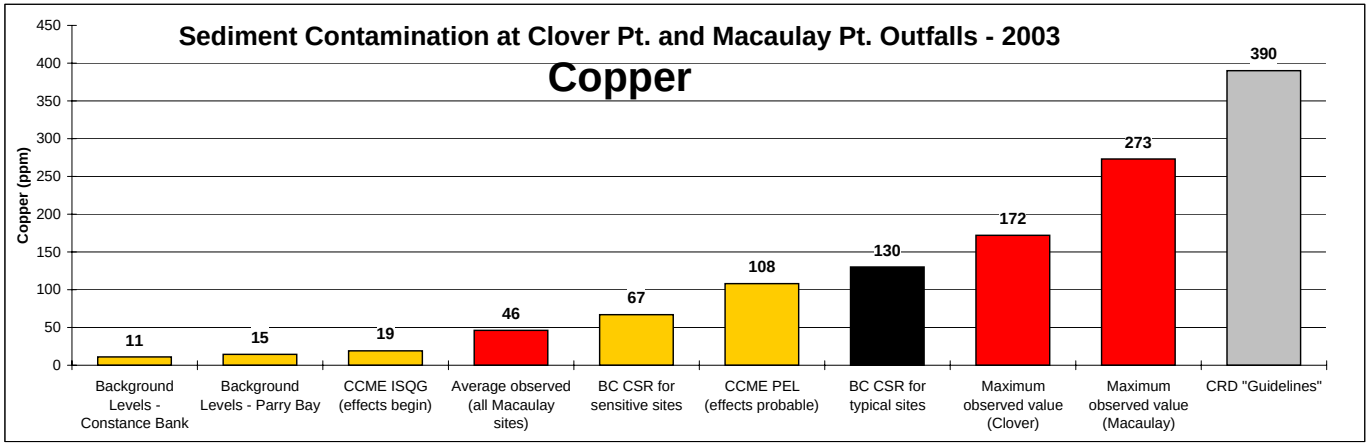




Page 7: Comparing observed background levels, standards/guidelines, and observed levels at & around outfalls (Copper & Phenanthrene, 2003)

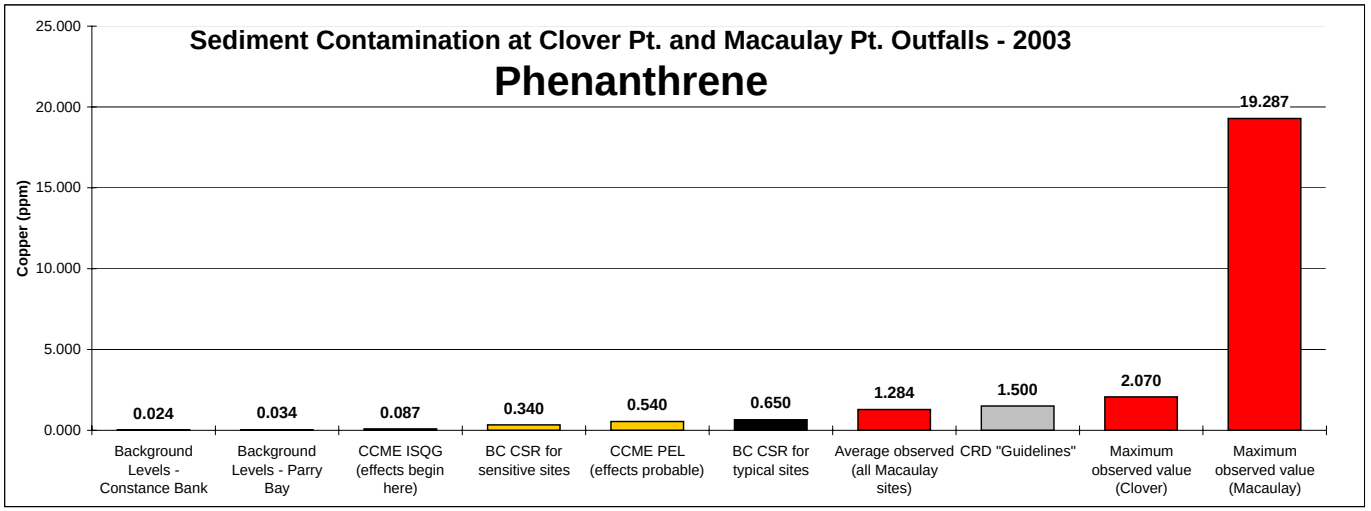
Copper

	mg/kg
Background Levels - Constance Bank	11
Background Levels - Parry Bay	15
CCME ISQG (effects begin)	19
Average observed (all Macaulay sites)	46
BC CSR for sensitive sites	67
CCME PEL (effects probable)	108
BC CSR for typical sites	130
Maximum observed value (Clover)	172
Maximum observed value (Macaulay)	273
CRD "Guidelines"	390



Phenanthrene

	mg/kg
Background Levels - Constance Bank	0.024
Background Levels - Parry Bay	0.034
CCME ISQG (effects begin here)	0.087
BC CSR for sensitive sites	0.340
CCME PEL (effects probable)	0.540
BC CSR for typical sites	0.650
Average observed (all Macaulay sites)	1.284
CRD "Guidelines"	1.500
Maximum observed value (Clover)	2.070
Maximum observed value (Macaulay)	19.287

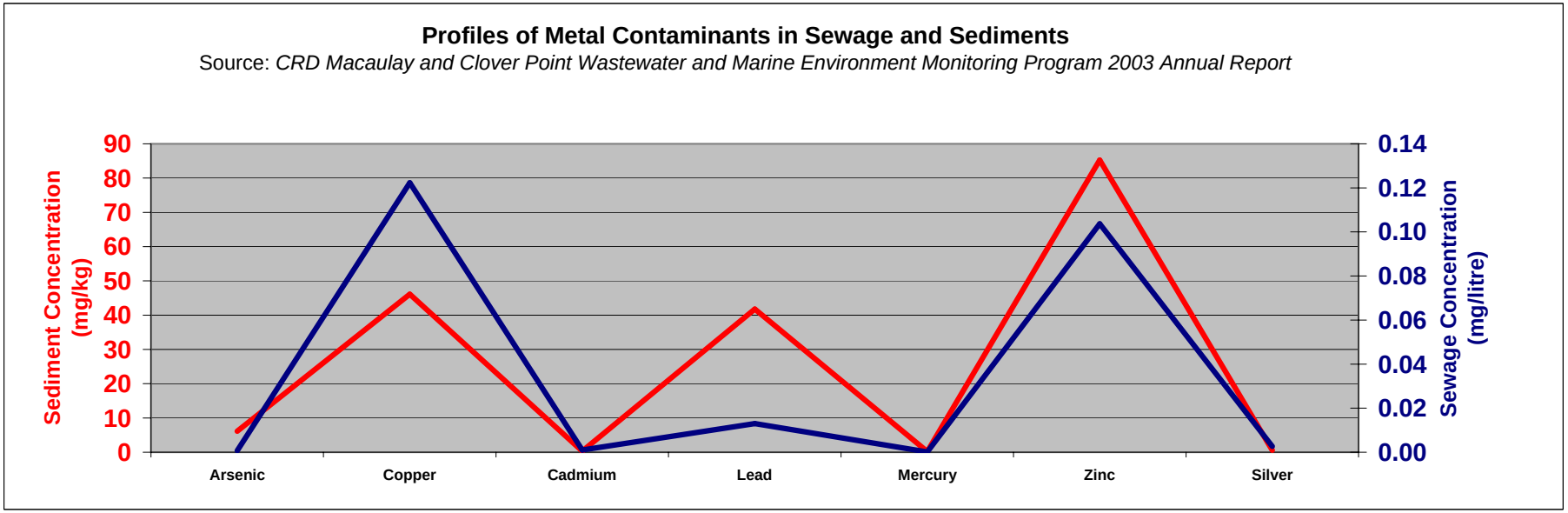


Page 8: Comparing metals in the sewage and sediments at Macaulay Point outfall

This is a "rough science" attempt to show that metals which are high in the sewage effluent are also high in the sediments, suggesting the most likely source of the sediment contamination is the sewage effluent

		Arsenic	Copper	Cadmium	Lead	Mercury	Zinc	Silver	
Macaulay (2003)	Concentration in Sewage	0.0007	0.1223	0.0010	0.0130	0.0001	0.1037	0.0027	mg/L
	Average concentration in Sediment	6.14	46.10	0.34	41.79	0.18	85.23	0.57	mg/Kg

Correlation: 0.821



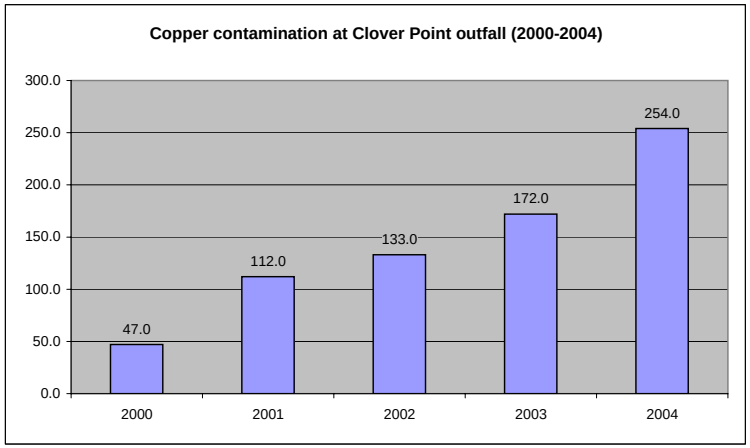
Page 9: Copper and Mercury contamination at outfalls over time (2000 - 2004)

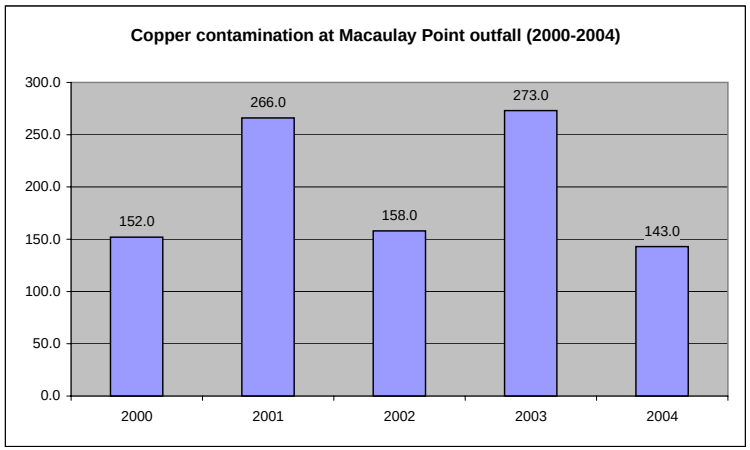
Copper

Copper (Cu) criteria / standards:

BC *Contaminated Sites Regulation*:	130.0
Canadian PEL:	108.0
Canadian ISQG:	19.0

Year:	2000	2001	2002	2003	2004
Copper at Clover Point outfall (C0)	47.0	112.0	133.0	172.0	254.0
Copper at Macaulay Point outfall (M0)	152.0	266.0	158.0	273.0	143.0



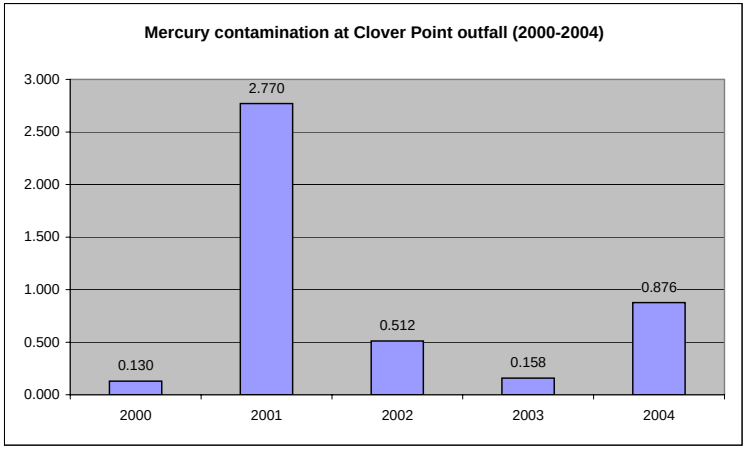


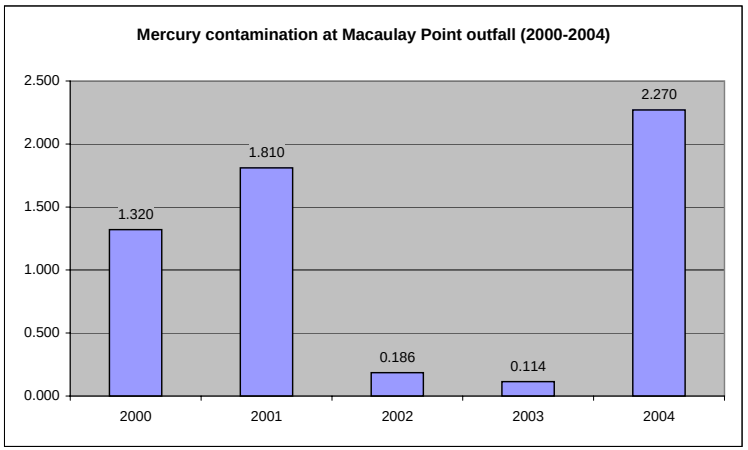
Mercury

Mercury (Hg) criteria / standards

BC *Contaminated Sites Regulation*:	0.84
Canadian PEL:	0.70
Canadian ISQG:	0.13

Year:	2000	2001	2002	2003	2004
Mercury at Clover Point outfall (C0)	0.130	2.770	0.512	0.158	0.876
Mercury at Macaulay Point ourfall (M0)	1.320	1.810	0.186	0.114	2.270





Page 10: Chemical removal by wastewater treatment plants

COMPOUND	Annacis (Secondary)			Iona (Primary)			Lion's Gate (Primary)		
	Influent Loading (g/day)	Effluent Loading (g/day)	%change	Influent Loading (g/day)	Effluent Loading (g/day)	%change	Infuent Loading (g/day)	Effluent Loading (g/day)	%change
Phthalates: Bis-(2ethylexyl)	8,500	1,400	**84**	7,700	6700	**13**	2,400	1,400	**42**
nonylphenols	25,000	3,600	**86**	12,300	13,000	**0**	1,520	2000	**0**
PCBs	7	0.083	**99**	18.9	8.5	**56**	2.2	1.7	**23**
PAHs : (LPAHS)	1,800	9.5	**99.9**	310	120	**62**	86	80	**6**
(HPAHS)	1,980	21	**99**	470	270	**43**	111	108	**3**
Copper	72,000	4,700	**93.5**	82,000	80,000	**3**	26,000	22,000	**16**
Chlorobenzenes	900	110	**87**	320	180	**44**	31	26	**17**
Average percent removal			**92.6**			**31.6**			**15**

Data source: Bertold, S and Stock, P. 1999. GVS&DD Municipal Wastewater Treatment Plant 1997 Monitoring Program: Wastewater Chemistry – Data evaluation. Final Report. Greater Vancouver Regional District, 4330 Kingsway, Burnaby BC.

Page 11: Applying the federal methodology for prioritizing contaminated sites to the Clover and Macaulay Point outfalls (2003)

The federal Contaminated Sites Management Working Group (CSMWG) has developed a methodology to prioritize contaminated sites
(see http://www.ec.gc.ca/etad/csmwg/pub/marine_aquatic/en/chap3_e.htm).
The method is based on BC Ministry of Environment's recommended Sediment Evaluation Methodology.
The approach looks at both the number of substances exceeding CCME PELs (probable effects levels) & the degree to which they exceed those levels (the 'PEL quotient').
If the average PEL quotient is over 2.3 or more than 21 PELs are exceeded, the site is considered Highest Priority.
If the average PEL quotient is over 1.5 or more than 6 PELs are exceeded, the site is considered Medium-high priority.
Lower priority sites are categorized as either Medium-low or Lowest priority.

Based on 2003 data (the only year for which sediment data was collected at sampling stations around both outfalls):

Number of PELs exceeded within 100m of Clover Point outfall:	11	Priority = Medium-high
Number of PELs exceeded within 100m of Macaulay Point outfall:	16	Priority = Medium-high

Applying this methodology to the set of 13 Polycyclic Aromatic Hydrocarbons (PAHs) that have CCME PEL values
(these are the same 13 PAHs in BC's *Contaminated Sites Regulation*) for 2003 data

	Acenaphthene	**Acenaphthylene**	**Anthracene**	**Fluorene**	**Naphthalene**	**Phenanthrene**	**Fluoranthene**	**Pyrene**	**Benzo(a)pyrene**	**Chrysene**	**Benzo(a)-anthracer**	**Dibenz[a,h]anthracene**	**2-methylnaphthalene**
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Canadian PEL	0.0889	0.1280	0.2450	0.1440	0.3910	0.5440	1.4940	1.3980	0.7630	0.8460	0.6930	0.135	0.2010
Observed values (bolded if above PEL)													
C0	**0.294**	0.034	**0.522**	**0.192**	0.028	**2.070**	**2.360**	**1.840**	**0.945**	**1.100**	**1.140**	**0.173**	0.021
M0	**0.382**	0.012	**0.409**	**0.212**	0.058	**1.890**	**2.020**	**1.830**	0.682	0.762	**0.775**	0.108	0.069
M1E	**0.204**	**0.160**	**0.390**	**0.520**	**0.780**	**3.940**	**4.020**	**2.970**	**1.380**	**1.480**	**1.100**	**0.211**	**0.440**
M1SE	**3.439**	0.011	**6.836**	**2.222**	0.050	**19.287**	**20.620**	**17.117**	**8.815**	**9.017**	**9.747**	**1.104**	0.049
PEL quotients (observed value / PEL)													
C0	3.30709	0.26172	2.13061	1.33333	0.07161	3.80515	1.579651941	1.31617	1.23853	1.30024	1.64502	1.28148	0.10448
M0	4.29696	0.09141	1.66939	1.47222	0.14834	3.47426	1.352074967	1.30901	0.89384	0.90071	1.11833	0.8	0.34328
M1E	2.29471	1.25	1.59184	3.61111	1.99488	7.24265	2.690763052	2.12446	1.80865	1.74941	1.5873	1.56296	2.18905
M1SE	38.6873	0.08594	27.902	15.4306	0.12788	35.454	13.80187416	12.2439	11.5531	10.6584	14.0649	8.17778	0.24378

	Number of PELs exceeded	**Average of PEL quotients**	**Priority (just from PAHs)**
C0	10	1.49039	Medium-High
M0	7	1.3746	Medium-High
M1E	13	2.43829	Highest
M1SE	10	14.4947	Highest