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August 11, 2014

Alberni-Clayoquot Regional District
3008 5th Avenue
Port Alberni, BC
V9Y 2E3

Attention: Mr. John Thomas, Environmental Services Technician

Dear Sirs:

Re: 2013 Monitoring – West Coast Landfill – Alberni-Clayoquot Regional District

Six suites of samples were collected from the West Coast Landfill monitoring network for the current reporting period, as listed below:

February 13, 2013
April 23, 2013
June 19, 2013
August 20, 2013
October 28, 2013
December 13, 2013

Seven sites (SW-1 through SW-7) were monitored at the West Coast Landfill between 1996 and 2004 prior to the construction of the leachate collection ditch system and leachate storage lagoon in the late summer and autumn of 2004 (Fig. 1). In late 2004, after the leachate management works had been implemented, the sampling sites were adjusted and expanded to a total of ten sites. The sampling sites were reviewed in 2005 and two additional sites were incorporated into the program on July 6, 2005. All sampling sites are shown on Fig. 1. Historical sites that are no longer sampled are shown in a light green shade. Current sites are shown in a dark green shade.

The original seven sites were intended to monitor water quality along preferential surface flow paths from the landfill to Sandhill Creek, background surface water quality at a site to the north of the landfill, and water quality in Sandhill Creek. The additional sites, and modified locations for the original sites, are intended to characterize the leachate quality, to measure impact to Sandhill Creek, and to better document background chemistry.

Three groundwater monitoring wells (MW02-1, -2 and -3) were installed in August 2002. These were sampled in October 2003 and June 2006, and field parameters were measured on a bi-monthly basis. Water levels were monitored on bi-monthly schedules from April 2003 to November 2009; however, no sampling was conducted. The monitoring well locations are also shown on Fig. 1.

A brief description of the sampling sites follows:

SW-1	Receiving creek (Sandhill Creek tributary), immediately downstream of where leachate collected along the cutline discharges into the creek. Not sampled since December 1998.
SW-1a	Sampling point 10m downstream of SW-1, below where overflow from the leachate storage lagoon would enter. Sampled since 1998. Referred to as SW-1.
SW-2	Near downstream end of the west leachate collector ditch, just upstream of the storage lagoon. Prior to December 2004, this site was located along a preferential leachate flow path from the landfill.
SW-3a	Leachate storage lagoon decant. Prior to December 2004, the SW-3 sampling site was a dug out located along the cutline to the west of the landfill, where there was preferential leachate flow.
SW-3b	Leachate storage lagoon at pump intake. Sampled in lieu of SW-3a when decant is not occurring at time of sampling, which is the usual condition.
SW-4	Near downstream end of the south leachate collector ditch, just upstream of the storage lagoon. Prior to December 2004, samples were collected from a dug out in a swampy area to the south of the landfill, near the site of the leachate storage lagoon.
SW-5	Historically this was a dug out in a swampy area to the south of the landfill. It was moved to an area of temporal ponding southeast of the leachate storage lagoon in December 2004. Sampling was not conducted at this location in 2011; however, samples were collected in May and July 2012.
SW-6	Historically this was a dug out into the top of marine clay along the northernmost leachate flow path. Since July 2005, this sampling point has been at an area of temporal water ponding in a low lying area in the buffer zone along the west side of the landfill. There is no apparent surface flow path from this point to Sandhill Creek.
SW-7	Small natural drainage to the north of the landfill. Background site.
SW-8	Located to north of landfill near an abandoned skidder road. Low point in the receiving area for leachate irrigation flow located about 110m downstream of the leachate distribution pipe. Sampled since December 2004.
SW-9	Located 100m from the north property boundary of the landfill, near an abandoned skidder road. Receiving area for leachate irrigation flow located about 150m downstream of the discharge pipe. Sampled since December 2004.
SW-10	Initial site, sampled in December 2004 and February/May 2005, was on north property line, and was intended to provide additional background data. In July 2005,

	this site was moved to Sandhill Creek above a point where leachate could enter the creek, to provide a background (upstream) sampling site on Sandhill Creek.
SW-11	Located west of the landfill, in a natural gulley that exhibits perennial flow characteristics and appears to be receiving leachate that seeps past the west leachate collector ditch. Sampled since July 2005.
SW-12	Located near the south landfill property boundary, downgradient of the leachate storage lagoon, where a small tributary of Sandhill Creek rises when recharged by shallow groundwater flow. Sampled since July 2005.
SW-13	Located inside the south fence line along the south side of the leachate lagoon access road. This location has not been sampled since 2010.
SHC	Sandhill Creek at downstream site, 20m upstream of the Highway 4 culvert.
MW02-1	Monitoring well located near south landfill property boundary.
MW02-2	Monitoring well located near southwest landfill property boundary.
MW02-3	Monitoring well located near northeast landfill property boundary (background site).

Electrical conductance (EC), pH, temperature and oxidation-reduction potential (ORP) were measured in the field, and all sites were sampled for leachate indicator parameters (chloride, sulphate, ammonia, nitrate, and phosphate). The standard sampling program, as performed in 2013, is summarized in Table B-1 in Appendix B. SW-1, SW-3, SW-7, SW-10, and SW-11 were sampled for dissolved and total metals, chemical oxygen demand (COD) and biological oxygen demand (BOD). Metal analyses for the remaining sampling locations were limited to total aluminum, iron, and manganese. Samples from SW-2, SW-4, SW-8, and SW-9 were also analyzed for COD. Volatile organic compound (VOC) analyses were performed on all six samples from SW-3b.

Results of the field measurements and laboratory analyses for the above surface water sampling sites are summarized in Tables I through XIV, and are plotted on Figs. A-1 through A-14 in Appendix A.

LEACHATE FLOW PATHS

Surface Water

Virtually all of the leachate flow from the landfill follows surface pathways, as the effective base of the groundwater flow regime is the top of the unweathered marine clay at a nominal depth of between 0.4 and 1m. Leachate historically seeped from the landfill along four primary flow paths. These paths were routed through the historical SW-2, SW-3, SW-4, and SW-6 sampling sites, towards the cutline indicated on Fig. 1. Once on the cutline, the flow historically concentrated in

tracks left by the dozer used to construct the cutline. Flows then continued south along the cutline, until they intersected the tracks on the east-west cutline between SW-1 and SW-4. Leachate then flowed along this cutline to the Sandhill Creek tributary (Fig. 1). This flow path was only obvious during wet periods, as dry period flow was through the shallow peaty soils towards the tributary.

In the autumn of 1998, measures were taken to prevent concentration of flows along the cutline. This involved constructing storm bars across the cutline to divert surface flow towards the creek at roughly 75m intervals. Approximate locations of the storm bars are shown on Fig. 1.

Based on sampling results collected in 2004, the primary pathways for leachate seepage from the landfill were past sampling sites SW-2, SW-3, SW-4, and SW-6.

The leachate collection ditches and leachate lagoon, shown on Fig. 1, were commissioned in the late summer of 2004, following the August sampling event. This leachate collection system has effectively routed all surface leachate flows into the lagoon since its implementation. Samples collected from the leachate lagoon (SW-3a/b) and the two leachate collector ditches (SW-2 and SW-4), provide a good indication of the average quality of leachate generated by the entire landfill.

Sampling results collected at SW-11 from 2005 through 2013 indicate some leachate impact at this location (see location on Fig. 1), apparently due to shallow seepage under the west leachate collector ditch (Leachate Ditch #2).

A recent BC Ministry of Environment (MOE, 2012)[1] landfill inspection letter indicated concerns that SW-11 was located outside the potential leachate pathway identified by the 2009 EM Survey conducted by Frontier Geosciences Inc. (Frontier, 2009)[2]. Frontier's report indicated that, *"the presence of a small creek that traverses the start of lines A, B, and C and extends northward along line D shallowing into a slough, is reflected in the high conductivity anomaly that extends coincident with the location of this water feature. This anomaly, that extends northeast from the southwest corner of the grid area to the middle of line I, is believed to be related to elevated surface and groundwater conductivities and not to changes in soil conditions."* SW-11 is located in the gulley that drains the area of the conductive anomaly mapped by Frontier. This is also the only natural surface drainage course from the landfill area. Any seepage from the landfill that passes through the conductive anomaly will collect in this channel; hence, monitoring data for this location will be representative of the escaped leachate. Sampling from within the actual extent of the anomaly may result in higher concentrations of leachate indicator parameters, but sampling frequency would be sporadic, as the sampling site would likely be dry during the summer, and the sample would only

[1] Ministry of Environment, 2012. "Inspection of West Coast Landfill." Letter to Alberni-Clayoquot Regional District, December 11, 8p.

[2] Frontier Geosciences Inc., 2009. "Report on EM31 Terrain Conductivity Survey – West Coast Landfill Leachate Investigation – Tofino Area, B.C." Report prepared for Piteau Associates Engineering Ltd., November, 5p.

represent one discrete location in the broad potential leachate seepage zone. The SW-11 site provides a continuous, composite sample of the leachate seepage, and will be representative of the actual leachate loading that is not intercepted by Leachate Ditch #2.

Groundwater

As noted above, three groundwater monitoring wells (MW02-1, -2, and -3) have been installed at three sites along the landfill property boundary (Fig. 1). Monitoring well MW02-3 was located upgradient of the landfill to provide background chemistry data for local groundwater. The other two monitoring wells are located downgradient of the landfill, along interpreted subsurface seepage pathways from the site. A detailed description of the drilling and testing program is provided in a letter to McGill dated November 5, 2002 (Piteau, 2002)[3].

All three monitoring wells encountered marine clay to a nominal 12m depth. The hydraulic conductivity for the clay is estimated to be less than 10^{-9} m/s, and the estimated seepage velocity through the clay is less than 2 cm/year.

The wells were sampled in October 2003, after repeated purging over the previous 12 months. The wells were then purged on six occasions in the 2003/2004 reporting period, and temperature, pH, and EC were measured to be very consistent over this period. The wells were not purged or sampled in 2005, to provide a year of reliable static water level data. The monitoring wells were sampled again on June 13, 2006. The wells have not been sampled since June 2006, but water levels were monitored bi-monthly until June 2011.

The rationale for not continuing the monitoring program is presented below:

- The two suites of water samples obtained from the three monitoring wells in October 2003 and June 2006 (Table XV), and field parameters measured in 2003, 2004 and 2006 (Table XVI), indicate that the chemistry is not changing significantly, and that the two suites of samples obtained from these wells are representative of marine connate water (pore water at time of deposition) within the clay layer.
- Groundwater velocity was calculated to be about 2 cm/year (Piteau, 2002). This very slow flow rate is confirmed with the high TDS of the sampled groundwater, which indicates the connate formation water has only been partially flushed by meteoric recharge since the marine clay was deposited approximately 10,000 to 15,000 years ago. The leachate loading transported by the groundwater flow regime below the surficial peat is therefore extremely small.
- Due to the residual connate water in the clay, concentrations of many of the monitored parameters (TDS, chloride, sodium and ammonia) are similar to or higher in the natural

[3] Piteau, 2002. "Results of Drilling Investigations for West Coast Landfill – Regional District of Alberni-Clayoquot, Tofino, B.C." Letter prepared for McGill Engineering Ltd., November 5, 3p.

groundwater than at the most heavily impacted surface water sampling locations. Monitoring of groundwater will therefore not provide any resolution with regard to the presence or absence of leachate.

The recommendation to not sample the groundwater wells is based on the very high background concentrations of TDS, chloride, sodium, sulphate and ammonia, which are residual from the marine water in the clay pores at the time of deposition, and the very low seepage velocity. Groundwater flow through the marine clay sediments underlying the landfill is not a significant leachate transport pathway, and monitoring groundwater chemistry will not detect the presence of leachate.

DISCUSSION OF SAMPLING RESULTS

Site SW-7 and Site SW-10 (Background Water Quality)

Alkalinity and hardness are low at both sites, with the sampling record to date exhibiting a typical range of 8 to 69 mg/L as $CaCO_3$ (Tables VIIa and Xa).

Background water quality for SW-7 during 2013 was characterized by a total dissolved solids (TDS) range between 40 and 88 mg/L (Fig. A-1 in Appendix A). Sodium concentrations varied from <0.1to 13.7 mg/L, and chloride concentrations ranged between 9 and 23.7 mg/L (Fig. A-3). The above concentration ranges were consistently higher than in 2012, and likely reflect the drier-than-average summer and autumn of 2013. Ammonia concentrations ranged between 0.02 and 0.16 mg/L-N in 2013, which is within the envelope of historical data (Fig. A-5). Two of the six nitrate concentrations measured in 2013 were 0.06 and 0.07 mg/L, and the remainder were below the 0.05 mg/L-N detection limit. All results were well below the freshwater aquatic life (FWAL) guideline of 3 mg/L-N (Fig. A-7).

COD at SW-7 ranged between 13 and 35 mg/L in 2013 (Table VIIa). The highest concentration recorded at this site to date was the 71 mg/L-O result for the June 2000 sample (Fig. A-8).

Historically, samples have been acidic, with pH typically ranging between 5 and 6.4. pH varied between 5.9 and 6.8 in 2013. Low pH is characteristic of peat bogs.

BOD results for the SW-7 site during 2012 were consistently less than the 5 mg/L detection limit.

Background metals concentrations have all been less than the FWAL guidelines during 2013, with the following exceptions:

- Total iron concentrations at SW-7 have historically exceeded the FWAL guideline about 60% of the time, and dissolved iron concentrations about 25% of the time. Updated guidelines for both total and dissolved iron were published in 2008. Total iron concentrations have exceeded the new guideline in 24% of samples taken in the past

three years. In 2013, total iron concentrations ranged between 0.337 and 4.7 mg/L (Table VIIb) and exceeded the FWAL guideline for two of the six sampling suites. Dissolved iron concentrations ranged between <0.005 and 0.958 mg/L, and exceeded the FWAL guideline of 0.35 mg/L in October and December. Historically, iron exceedances at this site usually occur during dry periods. This site was not sampled in August 2012, as it was dry.

- Total lead exhibited an anomalously high concentration of 0.06 mg/L on one occasion in June 2010. This reading was the only time in the historical record when the total lead concentration exceeded the FWAL guideline. The result was interpreted as an error. In 2013, the total lead concentrations ranged between <0.0001 and 0.0001 mg/L, and were less than the FWAL guideline of 0.004 mg/L in all the samples.
- Total copper concentrations have equalled or exceeded the FWAL guideline of 0.002 mg/L on three recent occasions, including September 2003 (0.004 mg/L), April 2004 (0.009 mg/L), and October 2007 (0.006 mg/L). Total copper concentrations complied with the FWAL guideline during the current sampling period. Elevated copper results are likely attributable to sediment in the samples.
- Total manganese concentrations exhibited an anomalously high value of 0.926 mg/L in June 2011, and exceeded the FWAL guideline of 0.074 mg/L. Other than this one exception, historical concentrations for total manganese have always been less than the FWAL guideline; hence, the June 2011 result is considered erroneous. Total manganese concentrations complied with the FWAL guideline during the current reporting period.
- Total cadmium concentrations fluctuated between < 0.00001 and 0.00002 mg/L for the current sampling period, and exceeded the FWAL guideline of 0.00001 mg/L on two occasions in October 2013. Dissolved cadmium concentrations were consistently less than detection, except for the February 2013 results of 0.00002 mg/L which exceeded the FWAL guideline. This result also exceeded the total cadmium concentration on that date, and is considered to be an error. Total cadmium concentrations have exceeded the FWAL guideline in 17% of the samples since the detection limit was moved below the FWAL in 2010.
- Total chromium concentrations varied from <0.0005 to 0.0008 mg/L in the current sampling period and remained below the FWAL guideline (Table VIIb). Historical total chromium concentrations have not exceeded the FWAL guideline of 0.001 mg/L, with the exception of two sampling events in 2011 (June and August).
- Total zinc concentrations exceeded the FWAL guideline of 0.0075 mg/L on ten occasions prior to the 2013 sampling program. Total zinc concentrations ranged between 0.002 and 0.015 mg/L for the current sampling period, with two results exceeding the FWAL guideline of 0.0075 mg/L.
- Prior to 2012, dissolved zinc at SW-7 had only exceeded the FWAL guideline once since 2006 (June 2007). Dissolved zinc concentrations ranged between 0.001 and 0.008 mg/L

during the current sampling period, and slightly exceeded the FWAL guideline of 0.0075 mg/L in June 2013.

- Dissolved aluminum is typically elevated at this background monitoring location, with concentrations chronically exceeding the FWAL guideline of 0.1 mg/L by a considerable margin (Table VIIb and Fig. A-11). Concentrations ranged from 0.058 to 0.156 mg/L in 2013.

For the current reporting period, SW-10 (upstream sampling site on Sandhill Creek) data exhibited concentrations of ammonia that were below or slightly above detection levels, with a maximum of 0.25 mg/L-N measured in February 2013 (Table Xa). Nitrate concentrations were slightly higher, and ranged between 0.2 mg/L-N in April, and 0.82 mg/L-N in December.

Total iron concentrations at SW-10 were below the FWAL guideline for all sampling events in 2013, while dissolved iron concentrations were below the FWAL guideline for all but the August sampling event, which slightly exceeded the guideline with a value of 0.389 mg/L. Total aluminum concentrations exceeded the FWAL guideline in all sampling events in 2013, except for the June sample, and dissolved concentrations exceeded the FWAL guideline in four of the six sampling events, excluding June and October.

SW-10 chloride concentrations ranged from 10.7 to 28.8 mg/L, with the highest concentration occurring in the driest period (October), when groundwater discharge to the creek would have had a significant effect on surface water quality. The above chloride concentrations are therefore considered to be background for Sandhill Creek, which will have a small baseflow component comprised of the naturally brackish groundwater that discharges from marine clay sediments that underlie the area. As per the 2006 to 2012 sampling results (Fig. A-3), the elevated October 2013 chloride concentration is indicative of a summer drought condition, when groundwater will comprise a large proportion of the creek baseflow.

Sites SW-2, SW-3 and SW-4 (Collected Leachate Quality)

Sampling results for these three sites characterize the concentrated leachate chemistry.

Elevated TDS, chloride, and ammonia concentrations (Tables IIa, IIIa, and IVa, Figs. A-1, A-3, A-4, and A-6) are indicative of concentrated leachate. Hardness and alkalinity are also elevated, with SW-2 results ranging from 263 to 443 mg/L as $CaCO_3$ and 350 to 610 mg/L as $CaCO_3$, respectively in 2013. Hardness and alkalinity results for SW-3 ranged from 252 to 384 mg/L as $CaCO_3$ and 290 to 500 mg/L as $CaCO_3$, respectively. Hardness and alkalinity results for SW-4 ranged from 328 to 540 mg/L as $CaCO_3$ and from 370 to 680 mg/L as $CaCO_3$, respectively.

Prior to implementation of the leachate interception measures in 2004, TDS results for the SW-2 and SW-3 sites have varied from highs of about 450 to 1600 mg/L in dry periods (June to September), to less than 300 mg/L in wet periods, when dilution is highest (February). TDS

results for the three leachate sampling sites ranged from 290 to 934 mg/L in 2013, with the high values exceeding the envelope of data collected since 2004 (Fig. A-2). The higher TDS is attributed to the dry weather experienced in the late summer and fall of 2013.

Since 2004, chloride concentrations in the leachate monitored at SW-2 and SW-3 have fluctuated between 7.6 and 80 mg/L, with peak concentrations occurring in the summer/autumn samples. Data for the three leachate sampling sites during the current reporting period fall within the upper part of the historical range, with values ranging between 29.5 and 80 mg/L. The highest concentrations were generally observed during the late summer and fall (Figs. A-3 and A-4), with the highest concentration in the current reporting period observed at SW-2 in August 2013. Similar to previous years other than 2007 and 2008, the SW-2 sample displayed slightly higher chloride concentrations than the SW-4 site, indicating that flows in Leachate Ditch #1 (east side) received more dilution than those in Leachate Ditch #2 (west side). Chloride concentrations for SW-3a/b samples, which represent the mixed leachate for the entire site, ranged between 29.5 and 64 mg/L in 2013. The peak concentration occurred in August, when the background concentrations also peaked due to the significance of the brackish groundwater baseflow in the surface flows.

Ammonia concentrations sampled at SW-2 varied between 12.4 and 33.6 mg/L-N for the current reporting period (Fig. A-6). The monthly results were generally slightly higher than those observed at SW-3 and SW-4, consistent with the data record since late 2004, when the current leachate collection ditches were commissioned. Ammonia concentrations at SW-4 varied from about 11.9 to 34.9 mg/L in 2013. The current SW-3 sampling results are generally similar to the SW-4 results, as opposed to an average of the SW-2 and SW-4 inflow concentrations (Fig. A-6). Ammonia concentrations in the leachate lagoon (SW-3) ranged between 8.1 and 29.7 mg/L-N during 2013 slightly lower than the other two sampling sites. The slight reduction in the SW-3 ammonia concentrations indicates that some nitrification may be occurring in the leachate storage lagoon.

The maximum 2013 nitrate concentration in SW-2 was 1.47 mg/L-N, well below the FWAL guideline of 3 mg/L-N (Table IIa and Fig. A-7). Nitrate concentrations were generally lower at both SW-3 and SW-4. The highest SW-3 and SW-4 nitrate concentrations of 0.6 and 0.28 mg/L-N, respectively, occurred in February. The pattern of nitrate and ammonia concentrations in 2013 suggests that some nitrification occurs in the leachate storage lagoon and possibly within the ditches, during the summer months.

Over the current reporting period, COD concentrations at SW-2 ranged between 47 and 418 mg/L-O (Table IIa and Fig. A-8). COD concentrations ranged from 74 to 317 mg/L-O at SW-3 and from 90 to 569 mg/L-O at SW-4. The relative concentrations of the three sampling sites may reflect the mixing ratio of the SW-2 and SW-4 waters in the storage lagoon. 2013 results for SW-3 displayed a similar range to previous years, whereas the SW-2 and SW-3 results were at the upper end of the historical range. The dry weather was likely responsible for the high COD in the concentrated leachate, and the renovation that occurred in the leachate storage lagoon can likely be attributed to residence time in the leachate storage lagoon.

BOD at SW-2 and SW-4 was only analyzed for the August, October and December samples in 2013. Results varied between 6 and 55 mg/L-O and exhibited different seasonal trends, with the high result measured in the August sample at SW-2 and in the December sample at SW-4. Results at SW-3 ranged between 6.3 and 180 mg/L-O, with the highest value measured in the April sample, and the other results in the lower part of the 2013 SW-2 and SW-4 results (Table IIIa and Fig. A-9). The 180 mg/L-O result for SW-3 is the highest on record, and is anomalous in relation to other data. Historical BOD levels at the three sites are typically less than 40 mg/L-O (Fig. A-9), reflecting the low strength of the leachate.

Dissolved iron concentrations ranged from 0.014 to 3.83 mg/L in SW-3, with the peak concentration exhibited in the April 2013 sample (Table IIIb and Fig. A-10). Dissolved metals were not sampled at SW-2 and SW-4 during the current reporting period. Total iron concentrations at SW-2 fluctuated between 9.38 and 57.8 mg/L and exceeded the FWAL guideline in all six sampling events in 2013. Total iron concentrations at SW-3 and SW-4 ranged between 7.12 and 29.8 mg/L, and 13.8 and 76.8 mg/L, respectively, and also exceeded the FWAL guideline in all six sampling events in 2013 (Tables IIb and IVb).

For the current reporting period, total manganese concentrations at SW-2, SW-3 and SW-4 were above the FWAL guideline concentration in all samples. Dissolved manganese concentrations at SW-3 exceeded the FWAL guideline in February and April during 2013. Dissolved manganese concentrations in SW-2 and SW-4 samples were not analyzed in 2012.

Total chromium concentrations at SW-3 exceeded the FWAL guideline in all sampling events in 2013. Dissolved chromium concentrations at SW-3 exceeded the FWAL guideline in April, August and October. Total and dissolved cadmium concentrations at SW-3 were typically below or near the detection limit (0.00001 mg/L) for all six sampling events in 2013, add did not exceed the FWAL guideline of 0.00003 mg/L.

During 2012, total aluminum concentrations exceeded the FWAL guideline for all sampling events at SW-2, SW-3 and SW-4, except the June sampling event at SW-3. Dissolved aluminum was only analyzed in SW-3 samples, and the concentrations did not exceed the FWAL guideline in any of the five samples collected (Table IIIb). The background concentration of dissolved aluminum (at SW-7) exceeded the FWAL guideline in three of six sampling events in 2012.

There are no year-over-year increasing trends apparent in the concentrated leachate monitoring data. Seasonal low concentrations are often noted in December-January, when dilution effects would be greatest, and highs often occur during the dry summer and early autumn periods.

VOC analyses were performed on all five sample suites collected from SW-3 in 2013. Three of the samples were below or slightly above the detection limit, and two samples exceeded the FWAL guideline of 0.5 µg/L. The April result of 0.6 µg/L marginally exceeded the FWAL guideline of 0.5 µg/L and the August result was significant, at 21.5 µg/L (Table XIV). The result for the following sampling suite in October was less than detection.

The 21.5 µg/L result for August 2013 is the second highest recorded to date, and is only exceeded by the 568 µg/L result sampled in November 1996. Trace concentrations of toluene were reported for 60% of the sampling suites in 2005 through 2008. Since 2008, toluene has only been detected six times, with the previous maximum concentration of 3.3 mg/L recorded in January 2008. The other three detections in addition to the two 2013 detections were in 2012, but only the October 2012 result exceed the FWAL guideline. All of the other toluene results since 2008 have been below the detection limit.

Other than toluene, the only VOC detections since 2008 have been one xylene result of 0.5 µg/L and five benzene results of 0.1 or 0.2 µg/L (Table XIV). These concentrations are well below the respective FWAL guidelines of 37 and 30 µg/L.

The VOC detections in the past two years have been more frequent than in previous years, but exceedances of the FWAL guidelines have not been consecutive. The VOC detections appear to be due to specific events, and have been recorded at times when the leachate lagoon is not discharging.

Sites SW-5 and SW-12 (Receiving Area South of Landfill)

Impacts at SW-5 had been fairly constant from 2002 through 2004, but displayed a significant improvement since Leachate Ditch #1 was commissioned in the autumn of 2004, and this sampling site was moved to the downstream side of the ditch in an area of ephemeral ponded water. This ephemeral ponding area receives water from the diversion ditch around the east side of the landfill, and other local runoff water.

This site is sampled occasionally due to its ephemeral nature. No samples were collected in 2013 and only two samples were collected from SW-5 in 2012 (May and July). TDS at SW-5 dropped from a range of 100 to 600 mg/L prior to implementation of the leachate collector ditches, to between 45 and 170 mg/L in 2006, between 40 and 86 mg/L in 2008 to 2010, and between 40 and 106 mg/L in 2012 (Table Va and Fig. A-1). Chloride concentrations have displayed a similar decline, dropping from the 8 to 55 mg/L range prior to 2004, to between 2.4 and 5.9 mg/L in 2010. The recent data are essentially background levels (Fig. A-2). Chloride has not been sampled since 2010.

Ammonia concentrations, which ranged from 1.2 to 68 mg/L-N prior to the commissioning of the leachate collection system, dropped to detection levels from 2005 to 2007, and ranged between <0.01 and 0.03 mg/L-N in 2012 (Table Va and Fig. A-3). The highest recent ammonia concentration was 0.54 mg/L-N in December 2008. Nitrate concentrations were near or below the detection limit in 2010 and 2011. Nitrate analyses were not performed in 2012 or 2013.

Total aluminum, iron and manganese were the only metals sampled at this site in 2012. Iron was slightly elevated compared to background, which is expected for a stagnant area in a bog environment (Table Vb). Total aluminum concentrations were slightly elevated in 2012.

Site SW-12 is located near the park boundary down gradient from the leachate lagoon. TDS at this site has ranged from 32 to 227 mg/L since the leachate collection ditches were commissioned in late 2004 (Fig. A-1). TDS ranged from 78 to 134 mg/L in the current reporting period (Table XIIa). Ammonia concentrations are also typically low, with a historical range between <0.01 and 0.34 mg/L-N, with the exception of the December 2005, June 2006, and August 2007 results which were 1.84, 1.05, and 0.72 mg/L-N, respectively (Fig. A-5). The six samples collected in 2013 ranged between <0.01 and 0.18 mg/L-N), and remained well below the FWAL criterion of 1.8 mg/L-N.

The historical peak nitrate concentration of 1.94 mg/L-N was coincident with the 1.05 mg/L-N ammonia result in June 2006. For the 2013 reporting period, the highest nitrate concentration measured was 9.96 mg/L-N, in June. This result is anomalous in comparison to all historical data, and was not accompanied by spikes in any other leachate indicators, nor an elevated nitrate concentration in the downstream Sandhill Creek sample. The June 2013 result is the only nitrate concentration that has exceeded the FWAL guideline of 3 mg/L-N at this location. It is considered to be an anomaly, possible related to a calculation error.

All 51 total iron concentrations measured to date ranged between 0.19 and 2.9 mg/L, with approximately 10% of the results exceeding the current FWAL guideline (1 mg/L). The historical peak iron concentration of 2.9 mg/L was sampled in August 2011. All 2013 iron concentrations were in compliance with the FWAL guideline.

Total aluminum concentrations in 2013 ranged from 0.086 to 0.486 mg/L, and exceeded the FWAL guideline in all sampling events except in June 2013 (Table XIIb). Although these concentrations exceed the FWAL guideline, all total aluminum and total iron results have been within the typical envelope for background concentrations.

Results for the SW-5 and SW-12 sampling sites, which represent very small flows, suggest only a very slight leachate impact in relation to the SW-7 background data. Leakage from the leachate lagoon, and southward seepage from the landfill in general, is therefore interpreted to be minimal, indicating that leachate containment provided by Leachate Ditch #1 and the storage lagoon is effective. The June 2013 nitrate result for SW-12 is considered to be an anomaly or an analytical error.

Sites SW-8 and SW-9 (Irrigation Water Receiving Area)

SW-8 was sampled six times and SW-9 was sampled five times in 2013. SW-9 was not sampled in October, due to lack of water. TDS varied between 234 and 338 mg/L at SW-8, and between 316 and 548 mg/L at SW-9 (Table VIIIa and IXa, and Fig. A-1) during the current reporting period. Chloride concentrations ranged between 19.1 and 43.8 mg/L at SW-8, and between 23.2 and 50.4 mg/L at SW-9, with the peak concentrations occurring in the summer months at both SW-8 and SW-9 (Figs. A-3 and A-4). These results indicate significant leachate effect at both sites due to the upslope application of irrigation water.

Ammonia results exhibited concentrations ranging between 0.05 and 2.33 mg/L-N at SW-8, with only the April result of 2.33 mg/L-N exceeding the 30-day average FWAL guideline of 1.84 mg/L-N (Fig. A-5). Four of the five ammonia results for SW-9 exceeded the FWAL guideline, with the higher concentrations ranging from 4.91 to 8.6 mg/L-N. The higher ammonia concentrations occurred during the winter months. The variation between the sampling events suggests that treatment provided by winter irrigation is likely limited to dilution, plus some nitrification. All nitrate concentrations during 2013 for SW-8 and SW-9 were below the FWAL guideline of 3.0 mg/L-N (Fig. A-7).

COD concentrations sampled at the SW-8 and SW-9 sites ranged from 31 to 258 mg/L with all results above detection limits (Fig. A-8). BOD was consistently less than 11 mg/L-O for the three samples collected during the latter half of 2013.

Total iron concentrations at the SW-8 exceeded the FWAL guideline of 1.0 mg/L four times in 2013 (Tables VIIIb and IXb), with a peak concentration of 35.8 mg/L measured in October. Four of the five samples from SW-9 also exceeded the FWAL guideline, with the exceedances ranging from 1.11 to 10.8 mg/L.

Monitoring results for sites SW-8 and SW-9 show varying leachate impact in response to the irrigation of water over the upland area. In general, sampling results indicate that:

- The irrigation system promotes significant nitrification year round,
- Irrigation promotes plant uptake of nutrients and increases evapotranspiration losses of leachate in the summer months, and
- The irrigation system increases leachate dilution prior to discharge to Sandhill Creek in the winter months.

In previous years it was stated that the lagoon/irrigation system promotes oxidation and precipitation of iron. The high total concentrations measured this year suggest this may not be the case, but concentrations were much lower than the concentrated leachate at SW-2, SW-3 and SW-4, indicating iron concentrations are reduced relative to typical leachate.

Overall, the irrigation system does appear to reduce iron and ammonia loading to Sandhill Creek, particularly during the growing season, when ammonia impacts on Sandhill Creek are expected to be the most significant.

Sites SW-6 and SW-11 (Receiving Area West of Landfill)

The SW-6 site is located in an area of ephemeral ponding between Leachate Ditch #2 and Sandhill Creek. This location was sampled six times in 2013, in comparison to previous years when it was often too dry to sample in the summer. As the latter half of 2013 was drier than previous years, the ability to collect samples may relate to more irrigation water reporting to this sampling site.

TDS varied between 236 and 422 mg/L for the 2013 sampling events (Fig. A-2). Ammonia concentrations exceeded the 30-day FWAL guideline of 1.84 mg/L-N three times in 2013, with a peak concentration of 3.26 mg/L-N (Table VIa and Fig. A-6). Nitrate concentrations ranged from 0.37 to 5.02 mg/L, with only the last result, from December, exceeding the FWAL guideline in 2013.

Total aluminum and iron concentrations for the October 2013 sampling event were both elevated, at 9.42 and 17.8 mg/L, respectively. All but one of the aluminum results and two iron results exceeded their respective FWAL guidelines, and were slightly elevated in comparison to background. Other sampling results in 2013 were similar to background.

Overall, historical TDS, chloride, ammonia and nitrate data suggest water quality at SW-6 is slightly impacted by leachate. The 2013 data exceeded the ammonia FWAL criterion on three occasions and nitrate FWAL criterion on one occasion. The nitrate data were within the envelope of historical data at this site. Chloride concentrations were generally elevated in comparison to previous years. The elevated chloride data may be due to some changes to the surface water and shallow groundwater flow paths from the point where irrigation water is applied, or to the drier-than-average weather in the late summer of 2013, but the effects are more significant than in previous years.

SW-11 has been sampled 51 times since it was incorporated into the sampling program in July 2005. TDS and chloride results for this site have exhibited high concentrations, ranging between 54 and 571 mg/L, and 9.6 and 94.7 mg/L, respectively (Fig. A-2). Concentrations for the current reporting period fall within the bottom half of the historical range, with the 2013 peak chloride concentration of 49 mg/L measured in October (Fig. A-4 and Table XIa).

Ammonia concentrations for samples from SW-11 exceeded the FWAL guideline of 1.84 mg/L-N in 17 sampling events from 2005 to 2008, with results varying from 0.42 to 19.6 mg/L-N. The only sampling result to exceed the FWAL guideline since mid-2008 is the 2.1 mg/L-N result for October of 2013 (Fig. A-5). Nitrate concentrations ranged between <0.05 and 0.34 mg/L-N in 2013 (Table XIb and Fig. A-7), with the highest concentration measured in August. Nitrate sampling results have not exceeded 1.0 mg/L-N since mid-2008, and have remained well below the 30-day FWAL guideline of 3 mg/L-N. The 2013 results did not exceed the leachate lagoon concentrations recorded in SW-2, SW-3 and SW-4. However, concentrations were significantly higher than background, indicating some leachate impact.

Total and dissolved metals concentrations were measured at the SW-11 site during the current reporting period. Iron, manganese, aluminum and chromium concentrations exceeded their respective FWAL criteria. Total and dissolved iron concentrations exceeded the respective FWAL guidelines of 1 and 0.35 mg/L for all six and five of the six sampling events in the 2013 reporting period, respectively. Total iron displayed concentrations varying from 2.64 to 21.8 mg/L and dissolved iron ranged from 0.276 to 2.22 mg/L (Table XIb). Iron concentrations chronically

exceed FWAL guidelines at this site, and are greater than background concentrations measured at SW-10. The highest concentrations are observed in the summer months (Fig. A-13).

Total manganese concentrations exceeded the FWAL guideline in June, August, October and December during 2013. Dissolved manganese concentrations only exceeded the FWAL guideline in October. Manganese concentrations have chronically exceeded FWAL guidelines at this sampling site during the summer months, and display seasonal variations similar to the iron data (Fig. A-13).

Total aluminum concentrations ranged from 0.081 to 0.805 mg/L, and exceeded the FWAL guideline of 0.1 mg/L for all months but June. Dissolved aluminum concentrations ranged from 0.01 to 0.082 mg/L and did not exceed the FWAL guideline for any of the six sampling events during 2013 (Table XIb). The aluminum concentrations were similar to the background values measured at SW-7.

Total and dissolved cadmium concentrations did not exceed the FWAL guideline of 0.02 μg/L in 2013. Total chromium concentrations ranged between 0.001 and 0.0016 mg/L, exceeding the Cr(VI) FWAL guideline of 0.001 mg/L in five of the six sampling events in 2013. Dissolved chromium concentrations ranged between 0.0005 and 0.0016 mg/L and exceeded the Cr(IV) FWAL guideline in August October and December during 2013. The highest value of 0.0016 mg/L occurred in October, when a total concentration of 0.001 mg/L was measured, indicating some error in the analysis.

Total and dissolved selenium concentrations remained below the FWAL guideline of 0.002 mg/L during 2013 (Table XIb).

The 2005 to 2013 monitoring results indicate the small gulley in which SW-11 is located represents a seepage pathway for leachate to reach Sandhill Creek. There must therefore be a shallow seepage pathway beneath or around Leachate Ditch #2 at some point along its length. Leachate effects appear to be less than in 2008, and may have been mitigated by recent deepening of Leachate Ditch #2 (Fig. 1). The single slight exceedance of the ammonia FWAL in 2013 is considered to be an anomaly. Leachate effects at SW-11 are not currently significant with respect to FWAL criteria, but the iron and chromium concentrations, and occasionally manganese concentrations, exceed their respective 30-day FWAL guidelines.

Site SW-1 (Receiving Sandhill Creek Tributary)

Sample site SW-1 is located downstream of the leachate irrigation area and the documented leachate discharge past SW-11. All significant leachate impacts should therefore be mixed into the creek flow at this site.

Samples from this site have historically displayed chloride concentrations of up to 100 mg/L (Fig. A-3). In 2013, chloride concentrations were in the lower half of the historical range, with a peak value of 29 mg/L sampled in October (Table Ia). As noted above, the Sandhill Creek upstream result was 32 mg/L on this date; thus, the elevated value can be primarily attributed to natural background, during the extremely dry late summer and autumn of 2013. TDS concentrations ranged from30 mg/L in February to 136 mg/L in June 2013 (see Table Ia and Fig. A-1). Hardness ranged between 24 and 54 mg/L as $CaCO_3$ during 2013, with the highest values occurring in August. Alkalinity ranged from <20 mg/L to 44 mg/L as $CaCO_3$.

Samples from this site have historically displayed ammonia concentrations of up to 7.7 mg/L-N (Table Ia and Fig. A-5). Ammonia results for the current reporting period were similar to 2012, and were in the extreme lower portion of the historical range, with a peak concentration of 0.11 mg/L-N sampled in December. Ammonia concentrations exceeded the FWAL guideline most recently in December 2005 (2.11 mg/L-N). Ammonia concentrations during low-flow periods are due partially to the effect of natural groundwater contributions to streamflow, as ammonia concentrations of about 5 mg/L-N have been documented in the three drilled monitoring wells (see below).

Nitrate concentrations are typically low at this site and did not exceed 0.78 mg/L-N (December) in 2013. The 2.29 mg/L-N nitrate concentration measured in August 2012 was not repeated. The last time the SW-1 nitrate concentration exceeded the current FWAL guideline of 3 mg/L-N was the 3.9 mg/L-N concentration recorded in August 2006. Nitrate concentration appears to be attributable to a background source, based on the 0.82 mg/L-N nitrate concentration measured at the upstream Sandhill Creek site (SW-10) in December 2013 (Table Xa), and the higher nitrate concentrations measured at this site relative to SW-1 in August and October 2013 (Fig. 1).

COD concentrations fluctuated between 24 and 49 mg/L-O in 2013, slightly above the background concentrations recorded at SW-7 (Fig. A-8). The 49 mg/L-O result was sampled in August. BOD at this site remained under the 5 mg/L-O detection limit for all sampling events in 2013 (Table Ia and Fig. A-9).

Dissolved iron concentrations exceeded FWAL guidelines in June, but all other iron concentrations were within compliance throughout the year (Table Ib). Total iron concentration has exceeded the FWAL guideline of 1 mg/L a total of 15 times in the monitoring record, with the highest value of 9.98 mg/L recorded in August 2010 (Fig. A-13). Concentrations at SW-1 typically exceed the SW-10 concentrations (Fig. A-13), indicating the iron loading is entering the creek downstream of SW-10. The peak concentration of 9.98 mg/L exceeds the 4.2 mg/L concentration measured at SW-11 on that day, indicating loading from SW-11 cannot explain the higher concentration in SW-1. SW-7 was dry on that day, indicating flows would have been extremely low. The elevated iron concentration in August 2010 may have been due to naturally elevated iron in baseflow during very dry conditions. The peak SW-1 iron concentration in the summer of 2011 was lower than concentrations at both SW-11 and SW-7, so was likely due to both background and some loading from SW-11. The peak SW-1 iron concentration in the summer of

2013 was very similar to SW-10, indicating no significant iron loading was entering the creek downstream of SW-10.

Total and dissolved manganese results have only exceeded the 0.83 mg/L FWAL guideline five times in the monitoring record, with four of the exceedances and the highest result to date (10.3 mg/L) recorded in the summers of 2010 and 2011 (Fig. A-14). Prior to 2010, manganese concentrations were typically well below the FWAL guideline (Fig. A-14). Peak total and dissolved manganese concentrations recorded during the current sampling period were 0.109 and 0.0396 mg/L, respectively (Table 1b). SW-1 total manganese concentrations in the summers of 2010 and 2011 were greater than the background concentrations sampled at SW-7 and SW-10 on the same date, and were also greater than the SW-11 concentrations (Fig. A-14). These elevated concentrations are therefore attributed to a natural, but undefined, source.

Elevated iron concentrations are attributed to the very sluggish flow regime in the summer months, and to the effect of flow from the drainage course sampled at SW-11. Iron concentrations monitored at SW-11 appear to be high enough to account for most of the elevated iron concentrations at SW-1, but there is also considerable variability in background concentrations, as indicated by the historical SW-10 data and by the peak SW-1 concentrations measured in August 2010 that exceed all other concentrations sampled on that date (Figs. A-10 and A-13). Manganese concentrations are typically below the FWAL guideline at this site, and the high values that have exceeded the FWAL guideline on occasion appear to be anomalous in relation to other monitoring sites, indicating analytical or sampling error, or a background source (Fig. A-14).

During the current reporting period, dissolved aluminum concentrations for SW-1 samples exceeded the FWAL guideline of 0.1 mg/L on four occasions, but the data are consistent with SW-7 results, indicating a background source (Fig. A-11). The elevated aluminum concentrations are attributed to the low pH of the water in the natural peaty environment.

The dissolved cadmium concentration in the February 2013 sample from this site exceeded the 0.00002 mg/L FWAL guideline (0.00005 mg/L). This appears to be an analytical or sampling error, as the value is anomalous with respect to all previous results except a similarly high value in 2012, and exceeded the total cadmium result for the same date (Table Ib). Total cadmium concentrations remained below the detection limits during the current sampling period.

One dissolved copper result for 2013 slightly exceeded the FWAL guideline, but also exceeded the total copper result, which was in compliance (Table Ib). The total zinc concentration sampled on August 2013 also exceeded the FWAL, but could not be attributed to leachate, as SW-11 exhibited much lower concentrations.

Results for the creek sampling program do display a slight leachate impact in relation to the SW-7 background data. The impact is manifested by slightly elevated chloride, ammonia, and nitrate concentrations, and iron and manganese concentrations during the summer months. The

alkalinity in the creek is also higher than values recorded at SW-7 during low flow periods, reflecting the contribution of natural groundwater to the SW-1 flow. Leachate impact is not considered to be significant in comparison to background water quality, especially considering the slightly brackish chemistry of the natural groundwater in the area. The elevated concentrations of iron and manganese measured in the summers of 2010 and 2011 have not been repeated in 2012 or 2013, indicating it was either of a temporal nature, or was associated with sampling or analytical errors.

Site SW-13 (Standing Water beside Access Road to Leachate Lagoon)

Standing water inside the south fence line was interpreted to come from the truck wash area located directly to the north. It was sampled three times in 2009 to check for leachate indicator parameters and metals. Ammonia, nitrate, TDS and chloride concentrations were all similar to background concentrations. Only total aluminum and iron results, and one manganese result, exceeded FWAL criteria. Due to no apparent effects and the stagnant occurrence of this water (no flow), it has not been sampled since June 2009.

Site SHC (Sandhill Creek Upstream of Highway 4)

Three years of data for this site are summarized in Tables XIIIa and XIIIb. Chloride concentrations are similar to SW-7 concentrations (background) for most of the year, but are very elevated during low-flow periods in August (Fig. A-3). The August 2012 concentration of 54 mg/L was the highest on record for this site, and was higher than the approximate 38 mg/L chloride concentrations sampled at SW-1 and SW-10 on the same date. The August result indicates that during very dry baseflow conditions, the lower reaches of Sandhill Creek receive a greater component of groundwater from the marine clay than the upper reaches.

Total manganese concentrations at SHC have always been less than the FWAL guideline. The only two exceedances of the FWAL guideline for iron occurred in August 2010 and August 2011. The exceedances were slight and remain within the envelope of background chemistry for the area.

The chemistry at this sampling site is comparable to background surface water at SW-10. It is also noteworthy that the chloride concentrations sampled at SHC are very comparable to those sampled at SW-1, indicating that the water quality at SW-1 is very similar to the quality of recharge to Sandhill Creek downstream of the landfill. The water quality at this sampling site does not exhibit any leachate effects.

Groundwater Monitoring Wells

Samples have only been collected from the three groundwater monitoring wells (MW02-1, -2, and -3) during the October 29, 2003 and June 13, 2006 sampling events. The data are presented in Tables XVa and XVb. A brief summary of the groundwater chemistry is presented below.

TDS concentrations ranged from 4370 mg/L at MW02-3 up to 7670 mg/L at MW02-1, well above all of the surface water monitoring data collected at the site to date. Chloride concentrations also greatly exceeded the surface water monitoring, with a range of 2610 to 4090 mg/L (MW02-3 and MW02-02, respectively). These levels are more than ten times the Guidelines for Canadian Drinking Water Quality (GCDWQ) Aesthetic Objective (AO) of 250 mg/L, and are much higher than would be expected for even concentrated leachate at this site.

Sulphate and dissolved sodium concentrations also exceeded the receiving water quality criteria at the three groundwater monitoring wells. Sulphate concentrations ranged from 290 to 778 mg/L, exceeding the FWAL criteria of 100 mg/L at all three locations. The highest concentrations, measured in the MW02-1 sample, also exceeded the GCDWQ AO of 500 mg/L. Dissolved sodium concentrations ranged between 1440 and 2010 mg/L, exceeding the AO of 200 mg/L by a factor of 7 to 10.

Ammonia concentration at the monitoring wells ranged from 3.1 to 6.4 mg/L-N and averaged about 5 mg/L-N, which is less than typical concentrations recorded for the concentrated leachate sampling sites, but is still in excess of the FWAL guideline of approximately 1.84 mg/L-N.

Dissolved iron concentrations in the groundwater samples did not exceed the FWAL guideline; however, total iron concentrations were above the FWAL guideline of 1 mg/L in two of the three monitoring wells, with concentrations ranging from 0.58 to 1.65 mg/L.

Both total and dissolved manganese concentrations were in compliance with the 1.9 mg/L FWAL guideline in all three wells. The maximum total and dissolved concentrations were 0.82 and 0.67 mg/L, respectively.

Both suites of samples collected from the monitoring wells, and field chemistry measurements for samples withdrawn from the three monitoring wells in 2003, 2004 and 2006, indicate that the chemistry is not changing significantly, and that the samples obtained from these wells are representative of formation water within the marine clay sediments.

Overall, the chemistry of the groundwater samples collected from the monitoring wells is representative of a very low permeability marine sediment deposit, in which connate pore water has not been completely flushed out by meteoric waters. Groundwater quality within the marine clay deposit exhibits very high TDS, conductance, chloride, sodium, and sulphate concentrations, all interpreted to be residual from pore water derived from the marine depositional environment. Ammonia concentrations in the pore water also exceed the FWAL guideline of 1.84 mg/L-N by a factor of about 2.5. Due to residual connate water in the marine sediments, concentrations of many of the monitored parameters are higher in the natural groundwater than at the most heavily impacted surface water sampling locations, and therefore previous recommendations to discontinue groundwater monitoring and sampling are reiterated.

Groundwater level and field chemistry parameter data measured since the wells were installed in 2003 are listed in Table XVI. Water level data collected since April 2006 have not been affected by purging for sampling, so represent actual groundwater levels. Levels have fluctuated over a range of about 0.35m for the years 2008 through 2011. Water levels were not monitored as part of the 2012 sampling program.

CONCLUSIONS

Overall, the 2013 monitoring data indicate a slight leachate impact. There are no obvious long-term increasing trends apparent in the data that would suggest the effects of the landfill are increasing over time.

Recent chloride and ammonia data for the concentrated leachate display a consistent seasonal variation with monthly precipitation and temperature. Chloride concentrations generally increase when precipitation decreases, due to the absence of surface runoff and the naturally brackish chemistry of the groundwater in the clay sediments that underlie the peat. Ammonia concentrations generally decrease when precipitation decreases, due to less leachate flushing and more residence time, and hence renovation, along seepage pathways.

Results for the past nine years of sampling following the commissioning of the leachate collection and irrigation system have characterized the strength of the collected leachate (SW-3) generated by the landfill, and it is very similar to that indicated by the perimeter sampling sites monitored prior to 2004. Concentrations in the leachate storage lagoon, which represent the mixed quality of all seepage and surface flows from the landfill, varied within the following ranges over the past three years:

TDS	212 to 626 mg/L
Alkalinity	180 to 520 mg/L as $CaCO_3$
Chloride	16.2 to 64 mg/L
Ammonia	<0.01 to 29.7 mg/L-N
Nitrate	<0.05 to 1.2 mg/L-N
Dissolved Iron	0.009 to 3.83 mg/L
Dissolved Manganese	<0.001 to 2.52 mg/L
Dissolved Copper	<0.001 to 0.006 mg/L

In 2013, the only parameters which exceeded receiving water guidelines (FWAL) in the concentrated leachate were ammonia, total aluminum, total and dissolved chromium, total and dissolved iron, total and dissolved manganese, total selenium and total zinc (Tables IIIa and IIIb). Over the history of the monitoring program, cadmium, copper and zinc exceedances are slight and occasional.

Results for sampling site SW-12, located downstream of the leachate storage lagoon and east leachate collector ditch, indicate only a slight leachate effect. One elevated ammonia result of 13.8 mg/L-N in SW-12 in August 2012 is considered an anomaly, and is likely attributable to sampling/analytical error. The highest ammonia concentration sampled at this site in 2013 was 0.09 mg/L-N. Containment provided by the leachate storage lagoon and Leachate Ditch #1 is considered to be adequate to mitigate leachate migration and impact across the south boundary of the site.

Sampling results for sites SW-8 and SW-9, located on the overland flow pathway from the irrigation site to Sandhill Creek, indicate that that flow from the irrigation system was more sustained in 2013 than in previous years, and that some renovation of leachate quality (e.g., nitrification and plant uptake of nutrients) does occur during the growing season, when temperatures are highest. The monitoring record to date for these two sites demonstrates a consistent reduction in ammonia concentration relative to the leachate lagoon (SW-3), indicating that the irrigation system will mitigate ammonia impacts during the summer and early autumn months, when receiving water dilution is lowest and ammonia concentrations present the highest level of risk.

The results of 15 sampling events available for the SW-6 site from 2011 to 2013 indicate some slight but varying leachate impact at this site, apparently due to operation of the irrigation system.

The six recent sampling results for SW-11, located in a natural gulley to the south of SW-6, exhibited a slight leachate impact. Ammonia concentrations have been in compliance with the FWAL guideline of 1.84 mg/L-N for the past three years, except for the slight exceedance to 2.1 mg/L-N in October of 2013. Chloride concentrations in the past two year have been lower in the wet months and higher in the dry months relative to previous years, suggesting a less significant leachate contribution than in the past. Monitoring results from 2011 and previous years indicate that significant amounts of leachate are seeping past or around Leachate Ditch #2, and are not being directed to the leachate storage lagoon. The most significant effects were noted for iron and manganese. Iron concentrations chronically exceed the FWAL guideline, but manganese concentrations only exceeded the FWAL guideline once in 2013. The recent data therefore suggest some improvement relative to 2010/2011. An Electron Magnetic (EM) survey conducted in this area in November 2009 identified a potential seepage pathway (Piteau, 2010)[4]. We understand that work was done on Leachate Ditch #2 to mitigate seepage losses in the summer of 2012. This work may have had a slight effect, based on the 2013 monitoring data.

Sampling results for the receiving water monitoring site (SW-1) indicated only very slight impact during the current reporting period. The only parameter to exceed FWAL criteria in 2013 was aluminum. Based on SW-10 and SW-11 data, elevated manganese concentrations at SW-1 that

[4] Piteau, 2010. Letter report to McGill & Associates Engineering Ltd. Regarding “2009 Leachate Excursion Investigation, West Coast Landfill, Tofino, B.C.”, February 2.

sometimes occur during the summer months may be due to background chemistry, but could also include some effect from the landfill (Fig. A-14).

Bioassay data for SW-1 samples collected in 2007, 2008 and 2009 indicated >100% survival in the undiluted sample. The bioassay sampling program was discontinued in 2010, due to the difficulty in obtaining the large samples that are now required, and the consistent nontoxic results from 2006 through 2009.

Although 2005 to 2013 impacts in Sandhill Creek have generally been within the allowable envelope defined by the FWAL guidelines, and/or typical background concentrations for the area, there have been some apparent changes to the water quality in Sandhill Creek over the past decade. The most significant changes have been the slight increases in ammonia and chloride concentrations, and the elevated iron and manganese concentrations observed in 2010 and 2011. The potential for ammonia concentrations to increase in the future presents the most significant risk, but the recent summer increases in iron and manganese concentrations are also a concern, but as noted below, were not apparent in the 2013 data.

The ammonia risk to Sandhill Creek was partially mitigated with the irrigation system that was fully commissioned prior to the 2005 reporting period. Neither ammonia nor chloride concentrations in Sandhill Creek have shown a statistically significant increase in the past seven years. However, ammonia concentrations may increase gradually over time, as a function of the volume and age of waste that is contained in the landfill, and it is important the irrigation system be properly monitored and managed, to optimize its performance.

The source of the recent elevated iron and manganese concentrations in the SW-1 samples is likely partially attributable to the loading discharged from the drainage course sampled at SW-11. Sampling data for 2013 did not exhibit any exceedances of the iron or manganese FWAL guidelines, suggesting that work on Leachate Ditch #2 may have mitigated leachate seepage losses to the gulley at SW-11. Further assessment of this potential leachate pathway is recommended, as discussed in the recommendations.

Ten years of sampling data for the Sandhill Creek site above Highway 4 do not exhibit any indication of leachate impact in the lower reaches of the creek.

RECOMMENDATIONS

The existing sampling network adequately monitors the effect of leachate on the receiving environment. No sampling site changes are recommended for 2014.

Based on the above discussion, the following items are recommended:

- The current bi-monthly sampling program should be continued through 2014 (Table B-1, Appendix B). The complete list of metals analyses should be continued for the SW-11 sampling suite, until the seepage pathway to this site is fully remediated. As has been the practice since 2010, the bioassay sampling for SW-1 can be omitted, unless leachate effects to Sandhill Creek are noted to change.
- Samples should be collected from SW-5 in 2014, or the reason for not collecting them should be documented. They should be analyzed for the same suite as SW-6.
- The mid-summer sample from SW-3 should be submitted for analysis of a broad spectrum of potential contaminants, to include: LEPH-HEPH, PAHs, Organophosphate pesticides, GC-MS pesticide scan, Chlorinated Phenolics, Non-Chlorinated Phenolics and Nitro-Phenolics. If any contaminants are detected at significant concentrations, samples for those specific analytes should be collected again later in the year.
- Future analyses for cadmium concentrations should continue to request a detection limit of 0.01 µg/L or lower.
- The gauging station established on Sandhill Creek in mid-2005 needs to be upgraded and calibrated to provide reliable flow monitoring data. A conventional gauging station, with a staff gauge and a flow-discharge relationship determined with conventional stream gauging methods, should be established at the flow monitoring site near SW-1. Flow data from a stream flow gauge could then be used to calculate loadings in the creek and relate those to leachate strengths and quantities. A flow gauging site should also be established on the drainage past SW-11, so that the concentrations/loadings past the SW-11 sampling point can be calculated, and compared to the concentrations/loadings at SW-1.
- The seepage pathway past SW-11 currently presents a slight risk to the water quality in Sandhill Creek that may not be managed by the leachate collection, storage and irrigation system. Recent monitoring data for this site indicate less significant leachate effects than prior to 2008, but the increases in iron concentrations at SW-1 during the summers of 2010 and 2011 are likely attributable, at least in part, to the flow past SW-11. Current monitoring data do not indicate any need to further investigate this possible leachate seepage source, other than the flow monitoring recommended above. This flow monitoring will provide some indication of whether the SW-11 drainage course is the primary source of the iron. If the SW-11 flow is determined to be a significant source of the iron at SW-1, further measures to mitigate leachate losses along this pathway would likely involve diverting this flow into the leachate storage lagoon with a pump, during low-flow periods.

We trust this letter report adequately presents the leachate sampling data collected to date. If you wish to discuss the 2013 sampling results, please contact us.

Yours truly,

PITEAU ASSOCIATES ENGINEERING LTD.

Andrew T. Holmes, P.Eng.

ATH/slc

Att.

c. Alan McGill, McGill & Associates (pdf)

TABLES

TABLES

TABLE Ia
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-1A

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	13-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	35.0	10.0	75.0	92.0	17.0	40.0	16.0	14.0	19.0	72.0	16.0	22.0	24.0	46.0	50.0	28	54	47
Total Dissolved Solids	mg/L	-	78	58	142	194	74	90	54.0	74	64	210	92.0	76	30	96	136	92	126	100
pH - Lab	pH	-	6.70	6.33	7.00	7.60	6.60	7.00	6.6	6.30	6.40	6.70	6.0	6.71	6.78	6.80	6.70	6	6.7	6.8
pH - Field	pH	-	6.26	6.49	6.93	6.70	7.37	6.96	7.4	6.81	8.88	5.18	6.5	7.03	-	6.98	7.29	-	-	6.96
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mV	-	140.5	145.9	58.7	77.2	75.0	84.9	128.0	100.3	96.4	209.7	171.1	95.8	111.4	59.6	102.3	-	-	41.8
Conductivity - Lab	µS/cm	-	117	50	277	312	77	152.3	75	63	75	281	74	82.0	91	148	183	126	211	162.0
Conductivity - Field	µS/cm	-	111	50	277	150	36	72	73	56	69	269	66	76	85	141	190	-	-	142
Temperature - Field	ºC	-	4.1	6.4	10.7	13.0	8.1	2.8	5.6	7.3	11.0	12.1	9.5	4.7	6.0	6.9	11.4	-	-	3.6
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	25.0	<10	80.0	91	<20	30.0	<20	<20	<20	42	<20	<20	20.0	44.0	38.0	<20	42	40.0
Chloride	mg/L	150	10.8	6.8	33.3	38.8	11.5	21.6	10.1	9.3	9.3	37.3	9.3	8.2	10.8	14.3	22.1	16.2	29.3	20.6
Sulphate	mg/L	100	8.5	2.2	<2.0	<2.0	2.1	5.5	3.0	2.3	2.3	23.4	5.7	5.4	3.8	3.1	14.7	14.7	11.1	4.1
DISSOLVED CATIONS																				
Calcium	mg/L	-	10.40	3.10	22.10	22.80	4.60	11.20	4.50	3.60	5.20	20.00	4.3	6.70	6.70	13.80	14.20	7.22	14.70	13.50
Magnesium	mg/L	-	2.20	0.90	4.90	6.00	1.40	2.90	1.30	1.10	1.40	5.30	1.37	1.40	1.70	2.76	3.40	2.37	4.14	3.32
Potassium	mg/L	-	1.10	0.60	2.00	2.80	0.70	1.40	0.70	0.50	0.70	2.80	0.6	0.90	1.00	1.60	1.70	0.90	2.20	1.70
Sodium	mg/L	-	8.10	0.01	19.80	27.60	7.10	11.40	6.60	6.30	7.30	24.00	7.1	6.30	8.40	10.90	15.30	10.70	18.90	13.40
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	0.02	<0.01	0.09	0.28	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	0.11	<0.01	0.07	0.06	0.05	<0.02	0.11
Nitrate Nitrogen	mg/L as N	3.0	0.70	0.20	<0.10	<0.1	0.17	0.46	0.44	0.17	0.26	2.29	0.16	0.35	0.43	0.19	0.31	0.15	0.52	0.78
Total Phosphorus	mg/L as P	-	0.01	<0.01	0.02	0.01	2.10	0.01	0.01	0.01	0.01	0.02	0.011	0.01	<0.003	0.01	0.01	0.00	0.012	0.01
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	20	30	40	50	-	20	40	40	60	36	61	28	27	27	28	49	28	24
Biological Oxygen Demand	mg/L as O	-	<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
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE Ib
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-1A

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	13-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.195**	**0.758**	**0.256**	**0.306**	**0.348**	**0.166**	**0.295**	**0.206**	**0.486**	0.1	**0.47**	**0.279**	**0.35**	**0.185**	0.078	**0.385**	**0.194**	**0.243**
Arsenic	mg/L	0.005	<0.0002	<0.0002	0.001	0.0009	<0.0002	0.0004	<0.0002	<0.0002	0.0005	0.0005	0.00021	0.00012	0.0001	0.00015	0.0004	0.0004	0.0004	0.00015
Barium	mg/L	1.0	0.006	0.003	0.018	0.03	0.004	0.006	0.004	<0.001	0.004	0.013	0.00476	0.00393	0.00481	0.0064	0.008	0.007	0.009	0.00747
Boron	mg/L	1.2	0.089	0.028	0.158	0.214	0.04	0.087	0.047	0.034	0.094	0.405	0.058	0.045	0.054	0.078	0.158	0.102	0.14	0.07
Cadmium [5]	mg/L	0.00002	<0.00001	<0.00001	0.00002	0.00002	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	0.00001	0.00002	<0.00001	0.00001
Chromium	mg/L	0.001	<0.0004	0.0005	0.0009	0.001	0.0006	0.0006	0.0007	0.0004	0.0007	0.0005	0.0006	0.0006	<0.0005	<0.0005	0.0006	0.0009	0.0006	0.0008
Copper [5]	mg/L	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0009	0.0007	0.0017	0.0008	<0.001	<0.001	<0.001	0.0005
Iron	mg/L	1	0.233	0.226	**4.42**	**7.35**	0.342	0.422	0.239	0.218	0.5	**1.05**	0.439	0.306	0.28	0.27	0.668	0.701	0.811	0.451
Lead [5]	mg/L	0.005	<0.0001	<0.0001	0.0001	0.0001	<0.0001	0.0001	0.0002	<0.0001	0.0001	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002
Manganese [5]	mg/L	0.83	0.018	0.008	**4.28**	**4.12**	0.021	0.11	0.011	0.008	0.023	0.416	0.0161	0.0128	0.0115	0.0378	0.109	0.0623	0.0945	0.0341
Mercury	ug/L	0.02	<0.01	<0.01	0.01	**<0.01**	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	0.011	<0.01	<0.01
Nickel	mg/L	0.025	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.0007	0.0004	0.0006	0.0007	0.001	0.001	<0.001	0.001
Selenium	mg/L	0.002	<0.0006	<0.0006	**0.0024**	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0007	0.0001	<0.0001	<0.0001	0.0002	<0.0006	<0.0006	<0.0006	<0.0001
Zinc [5]	mg/L	0.0075	0.012	0.003	0.003	0.006	0.002	0.002	0.002	0.001	0.003	0.003	0.0016	0.0021	0.0019	0.0023	0.002	**0.013**	0.003	0.0043
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	**0.125**	**0.128**	0.043	0.028	**0.245**	**0.117**	**0.187**	**0.186**	**0.352**	0.03	**0.424**	**0.193**	**0.187**	**0.117**	0.093	**0.348**	0.068	**0.118**
Arsenic	mg/L	0.005	<0.0002	<0.0002	0.0005	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	0.0005	0.0003	<0.0002
Barium	mg/L	1.0	0.005	0.002	0.015	0.022	0.004	0.006	0.003	0.002	<0.01	0.011	0.004	0.004	**0.005**	**0.006**	**0.007**	**0.006**	**0.007**	**0.006**
Boron	mg/L	1.2	0.086	0.024	0.156	0.202	0.036	0.096	0.047	0.035	0.07	0.46	0.022	0.051	0.053	0.09	0.153	0.106	0.148	0.076
Cadmium [5]	mg/L	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00010	<0.00001	<0.00001	**0.0003** [6]	**0.00005** [6]	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001	<0.0004	<0.0004	0.0004	0.0004	<0.0004	0.0005	0.0005	<0.0004	<0.004	0.0007	0.0006	<0.0005	<0.0005	0.0004	0.0006	0.0008	0.0006	0.0007
Copper [5]	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001	0.002	**0.003**	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.35	0.138	0.148	**0.856**	**1.15**	0.244	0.31	0.14	0.157	**0.377**	**0.417**	0.287	0.182	0.156	0.164	**0.312**	<0.005	0.284	0.229
Lead [5]	mg/L	0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Manganese [5]	mg/L	0.83	0.015	0.007	**3.78**	**3.48**	0.015	0.102	0.01	0.009	0.02	0.115	0.0081	0.01	0.01	0.0178	0.0396	<0.001	0.045	0.023
Mercury	ug/L	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.1	<0.1	<0.01	<0.10	<0.01	<0.01	<0.01
Nickel	mg/L	0.025	<0.001	<0.001	0.002	0.001	<0.001	0.001	<0.001	<0.001	<0.01	0.002	<0.001	<0.0005	0.0012	<0.001	0.001	<0.001	0.001	<0.001
Selenium	mg/L	0.002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.006	<0.0006	<0.0006	<0.2	<0.0002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Zinc [5]	mg/L	0.0075	<0.001	<0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001	**0.01** [6]	<0.001	<0.001	**0.008** [6]	0.005	<0.001	0.001	0.002	<0.001	<0.001

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 40 mg/L-$CaCO_3$
6. These values exceed the total concentrations, and are considered to be sampling or analytical errors.

TABLE IIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-2

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-						
Total Hardness ($CaCO_3$)	mg/L	-	285	239	444	305	326	326	233	324	341	347	281	269	263	414	374	370	443	386
Total Dissolved Solids	mg/L	-	402	338	562	464	502	453	292	494	488	612	460	546	436	676	590	744	722	586
pH - Lab	pH	-	7.50	7.90	7.30	7.40	7.50	7.60	7.50	7.30	7.30	7.70	7.50	7.50	7.60	6.90	7.40	7.40	7.40	7.40
pH - Field	pH	-	7.11	7.64	7.34	6.78	7.08	7.49	6.67	7.07	7.15	6.43	7.24	7.86	-	7.24	7.74	-	-	7.46
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mV	-	20.9	-21.3	-109.8	-84.5	-70.1	-41.8	-34.7	-93.0	-82.5	148.0	-54.1	-52.6	-56.7	-113.3	-67.9	-	-	-12.2
Conductivity - Lab	µS/cm	-	729	585	1128	785	938	883	628	861	902	1031	775	729	801	1091	1046	1230	1394	1104
Conductivity - Field	µS/cm	-	699	569	1171	400	431	419	568	789	826	989	742	700	755	1095	1051	-	-	1003
Temperature - Field	°C	-	5.8	7.9	17.2	15.6	7.5	6.3	7.3	12.1	15.0	15.7	12.2	4.9	9.0	17.7	18.3	-	-	5.9
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	300	250	600	380	420	400	250	370	400	410	300	330	350	480	500	480	610	530
Chloride	mg/L	150	24.4	18.6	45.5	32.1	44.3	36	25.1	37.5	38.9	64.0	39.7	27	34.1	39.1	54.3	80.0	73.0	53.1
Sulphate	mg/L	100	33.0	11.0	<2	<2.0	8.0	22.5	14.0	14.0	4.4	23.4	33.9	19.0	10.0	3.1	1.9	31.6	14.4	6.7
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	**10.0**	0.4	**7.2**	**4.3**	**17.7**	**16.2**	**8.2**	**13.4**	**12.2**	**6.8**	**8.1**	**9.1**	**12.4**	**19.6**	**20.2**	**22.0**	**33.6**	**26.3**
Nitrate Nitrogen	mg/L as N	3.0	0.8	0.8	<0.1	<0.1	0.83	0.9	0.86	0.9	1.04	1.83	1.61	1.42	1.47	0.39	0.17	<0.05	0.86	0.84
Total Phosphorus	mg/L as P	-	0.01	0.02	0.02	0.01	0.01	0.01	0.03	0.03	0.03	0.04	0.03	0.04	<0.0023	0.16	0.10	22.00	0.06	0.18
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	30	20	80	60	70	40	50	140	60	88	68	38	47	418	148	231	203	88
Biological Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	6.4	7.2
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE IIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-2

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	07-Nov-11	19-Dec-11	21-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	0.031	0.164	0.025	0.013	0.034	0.027	**0.29**	0.036	0.03	**1.9**	**0.28**	**0.24**	**0.18**	**190**	**0.66**	**1.2**	**0.233**	**0.763**
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	1	**1.77**	**4.18**	**18.1**	**27.4**	**10.2**	**4.14**	**10.5**	**15.9**	**10.2**	**10.7**	**11.3**	**7.32**	**9.38**	**57.8**	**19.9**	**20.1**	**6.55**	**12**
Lead [5]	mg/L	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	0.977	**1.06**	**8.87**	**9.41**	**2.2**	**1.76**	**1.22**	**2.43**	**2.02**	**2.58**	**1.4**	**1.29**	**1.58**	**3.74**	**2.35**	**1.98**	**3.0**	**2.4**
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE IIIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-3

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	02-May-12	04-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not
Total Hardness ($CaCO_3$)	mg/L	-	233	209	312	225	268	218	150	243	278	266	311	199	273	306	252	285	384	Sampled
Total Dissolved Solids	mg/L	-	344	296	227	370	406	332	212	368	390	438	520	326	376	502	482	574	626	(Frozen)
pH - Lab	pH	-	7.40	7.90	8.10	8.40	7.60	7.90	7.5	7.50	8.14	8.20	7.50	7.47	7.74	7.10	8.10	7.80	7.60	
pH - Field	pH	-	7.51	7.65	8.34	7.72	7.25	7.49	7.47	7.56	7.72	7.95	7.28	7.86	-	7.38	7.96	-	-	
ORP - Lab	mv	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
ORP - Field	mv	-	16.2	22.7	36.5	-8.1	-67.8	-31.2	-28.2	3.1	21.0	41.7	-62.8	24.0	-36.6	-112.4	8.0	-	-	
Conductivity - Lab	µS/cm	-	595	490	768	600	764	611	-	629	716	764	831	516	709	826	767	990	1205	
Conductivity - Field	µS/cm	-	569	486	783	289	353	283	395	574	658	726	792	499	640	769	755	-	-	
Temperature - Field	ºC	-	6.6	9.4	20.8	21.9	7.5	6.2	7.3	13.6	18.9	16.0	13.0	4.2	8.3	17.3	20.7	-	-	
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	230	210	360	250	380	520	180	260	320	300	290	190	290	350	350	360	500	
Chloride	mg/L	150	17.9	16.2	31.3	30.8	39.6	27.9	16.2	26.7	32.6	49.7	36.5	19.4	29.5	29.9	50.9	64	63	
Sulphate	mg/L	100	33.0	14.0	6.5	7.5	9.6	23.1	19.2	18.9	13.7	17.6	73.0	35.7	23.4	10.7	4.9	36.4	19.3	
DISSOLVED CATIONS																				
Calcium	mg/L	-	79.6	71.2	105.0	68.6	89.1	72.3	50.1	82.3	93.4	81.2	104.0	67.4	90.1	105.0	77.7	89.8	123.0	
Magnesium	mg/L	-	8.3	7.4	12	13.1	11	9.1	6	9.2	10.9	15.3	12.8	6.8	9.9	10.9	14.2	14.7	18.8	
Potassium	mg/L	-	7.4	6.7	8.3	8.5	12.6	8.4	5.6	8.2	10.1	11.6	11.8	7.4	9.8	11.4	16.3	19.7	24.1	
Sodium	mg/L	-	20.3	20.5	30.3	37.1	34.7	27.0	15.3	26.4	33.7	48.0	34.7	20.0	30.3	34.6	55.5	60.5	69.3	
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	**9.0**	**1.9**	**5.7**	1.1	**13.8**	**9.9**	**6.97**	**8.0**	**7.3**	<0.01	**9.6**	**4.1**	**9.8**	**10.4**	**8.1**	**14.0**	**29.7**	
Nitrate Nitrogen	mg/L as N	3.0	0.4	0.4	1.2	0.9	<.05	0.51	0.23	0.44	0.41	0.88	0.37	0.64	0.6	<0.05	<0.05	<0.05	0.22	
Total Phosphorus	mg/L as P	-	0.07	0.03	0.06	0.05	0.09	0.03	0.062	0.03	0.00	0.06	0.04	0.08	0.031	0.22	0.20	0.12	0.041	
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	30	90	50	60	150	50	40	80	60	76	101	92	74	317	114	150	122	
Biological Oxygen Demand	mg/L as O	-	<5.0	6.9	<5.0	<5.0	>14	6.4	<5.0	21	6.8	<5.0	>34	>39	20	180	19	16	6.3	
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

H:\Project\1576\CHEM\2013_chem\Updated Tables\[SW3-2013 (Updated).xlsx]NON-VOLATILES

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE IIIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-3

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	07-Nov-11	19-Dec-11	21-Feb-12	02-May-12	04-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum	mg/L	0.1	**0.392**	**0.604**	0.038	**0.536**	0.028	**0.267**	**0.846**	0.063	0.04	**0.64**	**0.148**	**1.3**	**0.751**	**0.393**	0.095	**0.613**	**0.248**	Not sampled
Arsenic	mg/L	0.005	0.0007	0.0007	0.0006	0.0008	0.0014	0.0008	0.0012	0.0007	0.0008	0.0012	0.00149	0.00106	0.00087	0.00109	0.0015	0.0029	0.0018	
Barium	mg/L	1.0	0.041	0.037	0.025	0.027	0.064	0.046	0.039	0.04	0.039	0.046	0.0783	0.0437	0.0536	0.0872	0.054	0.081	0.087	
Boron	mg/L	1.2	0.522	0.383	0.705	0.737	0.685	0.589	0.337	0.514	0.781	0.872	0.829	0.4	0.549	0.468	0.794	0.925	0.916	
Cadmium	mg/L	0.00003	0.00002	0.00002	<0.00001	<0.00001	<0.00001	0.00003	0.00003	0.00002	<0.00001	<0.00001	**0.00008**	**0.0001**	0.00003	0.00003	0.00001	0.00003	0.00002	
Chromium	mg/L	0.001	**0.0011**	**0.0013**	0.0005	0.001	**0.0018**	**0.0012**	**0.0018**	0.001	<0.0005	**0.0014**	**0.0017**	**0.0032**	**0.0016**	**0.0018**	**0.0011**	**0.0027**	**0.0017**	
Copper	mg/L	0.004	0.002	0.003	0.001	0.001	0.001	0.002	0.004	<0.001	0.002	0.001	0.0034	**0.0044**	0.002	0.0018	0.001	0.003	0.001	
Iron	mg/L	1	**3.12**	**3.77**	0.958	**1.2**	**8.04**	**3.76**	**5.36**	**3.72**	**1.76**	**2.92**	**9.06**	**5.38**	**7.47**	**29.8**	**11.9**	**11.6**	**7.12**	
Lead	mg/L	0.006	0.0005	0.001	0.0001	0.0003	0.0006	0.0006	0.0056	0.0002	<0.0001	0.0003	0.001	0.0011	**0.0008**	0.0004	0.0003	0.0005	0.0002	
Manganese	mg/L	1.05	**1.14**	**1.12**	0.482	0.233	**2.12**	**1.12**	**1.21**	**1.27**	0.442	0.284	**1.95**	1.05	**1.55**	**2.51**	**1.16**	**1.65**	**2.12**	
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	<0.10	<0.010	<0.01	
Nickel	mg/L	0.025	0.004	0.003	0.004	0.003	0.004	0.005	0.003	0.003	0.0029	0.004	0.0066	0.005	0.0037	0.0034	0.004	0.007	0.006	
Selenium	mg/L	0.002	<0.0006	<0.0006	**0.0045**	<0.0006	0.0006	<0.0006	<0.0006	<0.0006	0.0003	0.0014	0.0002	0.0001	0.0003	0.0002	<0.0006	**0.0028**	**0.0026**	
Zinc	mg/L	0.015	**0.033**	**0.029**	0.004	0.006	**0.022**	0.014	**0.024**	0.012	0.005	0.006	**0.047**	**0.0921**	**0.0224**	**0.0208**	0.007	**0.016**	0.007	
DISSOLVED METALS																				
Aluminum	mg/L	0.1	<0.005	0.008	<0.005	<0.005	<0.005	0.006	0.013	<0.005	0.004	0.005	**0.364**	0.011	0.007	<0.005	<0.005	<0.005	<0.005	
Arsenic	mg/L	0.005	0.0006	0.0005	0.0006	0.0007	0.001	0.0007	0.0005	0.0005	0.0008	0.0012	<0.2	0.0007	0.0005	0.0007	0.0012	0.0022	0.0013	
Barium	mg/L	1.0	0.033	0.029	0.02	0.023	0.046	0.037	0.029	0.034	0.034	0.036	0.004	0.04	0.046	0.065	0.033	0.044	0.055	
Boron	mg/L	1.2	0.495	0.352	0.742	0.664	0.653	0.633	0.288	0.51	0.667	0.975	0.049	0.486	0.522	0.602	0.724	0.953	0.963	
Cadmium	mg/L	0.00003	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	**0.00017**	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	
Chromium	mg/L	0.001	0.0008	**0.0014**	0.0007	0.0004	**0.0017**	**0.0019**	**0.0026**	**0.0018**	<0.0005	**0.0025**	0.0006	**0.0016**	0.0007	**0.0024**	0.0008	**0.0023**	**0.0042**	
Copper	mg/L	0.004	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.006**	0.003	<0.001	0.007	0.002	<0.001	
Iron	mg/L	0.35	0.041	0.061	0.009	0.01	0.061	0.04	0.096	0.03	0.04	0.058	0.045	0.125	0.044	**3.83**	0.014	0.039	0.015	
Lead	mg/L	0.006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0002	<0.0001	
Manganese	mg/L	1.05	0.898	0.876	0.153	<0.001	**1.86**	0.822	1.05	0.817	0.298	0.137	**1.69**	0.983	**1.43**	**2.52**	0.756	0.0132	0.994	
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	0.01	<0.1	<0.01	<0.01	
Nickel	mg/L	0.025	0.004	0.002	0.003	0.002	0.004	0.005	0.002	0.003	0.002	0.004	<0.001	0.0046	0.0036	0.004	0.025	0.006	0.006	
Selenium	mg/L	0.002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0002	<0.0006	<0.0006	<0.0002	<0.0002	<0.0006	<0.0006	0.0027	<0.0006	
Zinc	mg/L	0.015	0.005	0.009	<0.001	<0.001	0.002	0.003	0.002	0.002	0.002	<0.001	0.002	**0.056**	0.006	<0.001	0.005	0.002	0.002	

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for Al changes with pH
5. FWAL guideline for Cd, Cu, Pb, Mn, and Z changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$
6. Dissolved chromium concentrations exceeded the total concentrations in April and December 2011, and in February, May and August 2012, and are considered to be sampling or analytical errors.

TABLE IVa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-4

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	333	184	376	331	263	316	134	272	380	305	324	339	328	450	505	370	540	432
Total Dissolved Solids	mg/L	-	496	268	528	512	414	440	170	414	560	530	540	70	582	872	934	638	846	644
pH - Lab	pH	-	7.20	7.80	7.40	8.10	7.50	7.60	7.60	7.50	7.40	7.60	7.30	7.20	7.50	6.80	7.00	7.30	7.20	7.30
pH - Field	pH	-	7.40	7.56	7.81	7.72	7.18	7.47	7.28	7.69	7.32	7.03	7.22	7.78	-	7.17	7.36	-	-	7.44
ORP - Lab	mv	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mv	-	-67.5	-46.3	-111.0	-52.3	-94.4	-93.5	-42.3	-96.2	-109.6	-41.0	-78.8	-51.4	-77.4	-110.4	-99.5	-	-	-52.3
Conductivity - Lab	µS/cm	-	812	422	922	877	763	840	353	664	968	909	850	878	969	1241	1438	1165	1574	1213
Conductivity - Field	µS/cm	-	845	428	967	418	362	404	331	615	903	891	824	843	917	1140	1493	-	-	1096
Temperature - Field	ºC	-	3.4	8.2	14.1	14.4	7.5	7.4	7.4	12.0	13.3	15.6	13.1	4.9	9.2	16.3	18.0	-	-	6.4
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	330	170	370	400	310	380	140	280	640	340	300	300	370	530	640	510	680	550
Chloride	mg/L	150	30.7	14.8	37.6	39.2	43.9	34.7	12.8	22.6	39.9	52	36.6	35.7	40	46.5	71	61	75	58.7
Sulphate	mg/L	100	34	20	79	5.2	6.8	16.8	18.8	31.7	11.8	54	87	89	53.0	26.3	32.6	22	65	32
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	**9.00**	0.30	**7.20**	**5.68**	**15.70**	**14.50**	**5.52**	**7.90**	**11.50**	1.26	**9.62**	**8.00**	**11.90**	**15.80**	**32.80**	**20.00**	**34.90**	**26.50**
Nitrate Nitrogen	mg/L as N	3.0	<0.1	0.1	<0.10	0.3	<0.05	<0.05	0.08	<0.05	<0.05	0.22	0.34	0.35	0.28	<0.05	<0.05	<0.05	0.13	0.22
Total Phosphorus	mg/L as P	-	0.05	0.08	0.02	0.01	0.04	0.03	0.05	0.04	0.05	0.05	0.04	0.10	0.06	0.54	0.59	0.17	0.05	0.20
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	150	40	60	60	220	80	30	60	180	57	112	232	194	645	569	90	152	130
Biological Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.5	11	38

H:\Project\1576\CHEM\2013_chem\Updated Tables\[SW4-2013 (Updated).XLS]NON-VOLATILES

Notes:

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2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE IVb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-4

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.118**	**1.69**	0.039	0.012	<0.005	0.069	**1.2**	0.056	**0.21**	**1.34**	**0.187**	**0.324**	**0.198**	**0.178**	**0.519**	**0.359**	**0.245**	**0.348**
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	1	**31.8**	**10.3**	**14**	0.701	**10.3**	**9.21**	**5.57**	**5.89**	**13.9**	**9.59**	**12.7**	**14.3**	**13.8**	**76.8**	**47.1**	**14.8**	**22.7**	**15.9**
Lead [5]	mg/L	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	**3.94**	**1.81**	**3.02**	**3.71**	**2.3**	**2.85**	**1.23**	**1.94**	**2.96**	**1.61**	**2.08**	**2.28**	**2.57**	**4.02**	**3.99**	**1.24**	**3.07**	**2.42**
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

H:\Project\1576\CHEM\2013_chem\Updated Tables\[SW4-2013 (Updated).XLS]Metals

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE Va
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-5

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIODS (Not sampled in 2011)												CURRENT REPORTING PERIOD			
		Aquatic Life (FWAL)[1]	6-Jan-10	3-Mar-10	27-Apr-10	30-Jun-10	18-Aug-10	13-Dec-10	21-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	Not Sampled in 2013			
PHYSICAL TESTS																		
Colour	CU	-		-	-					-	-							
Total Hardness ($CaCO_3$)	mg/L	-	Not Sampled	9.1	13.8	Not Sampled	Not Sampled	Not Sampled	Not Sampled	52	14	Not Sampled	Not Sampled	Not Sampled				
Total Dissolved Solids	mg/L	-		25	44					106	40							
pH - Lab	pH	-		6.79	6.60					7.40	7.50							
pH - Field	pH	-		7.11	6.06					6.78	10.21							
ORP - Lab	mV	-		-	-					-	-							
ORP - Field	mV	-		142.3	132.4					93.4	66.6							
Conductivity - Lab	µS/cm	-		23	52					139	44							
Conductivity - Field	µS/cm	-		23.0	49.0					124	63							
Temperature - Field	ºC	-		8.8	10.3					16.2	20.3							
DISSOLVED ANIONS																		
Alkalinity - Total	mg/L	-		8.40	9.3					-	-							
Chloride	mg/L	150		2.4	5.9					-	-							
Sulphate	mg/L	100		1.5	1.6					-	-							
DISSOLVED CATIONS																		
Calcium	mg/L	-		-	-					-	-							
Magnesium	mg/L	-		-	-					-	-							
Potassium	mg/L	-		-	-					-	-							
Sodium	mg/L	-		-	-					-	-							
NUTRIENTS																		
Ammonia Nitrogen	mg/L as N	1.84		< 0.01	0.03					0.03	<0.01							
Nitrate Nitrogen	mg/L as N	3.0		< 0.05	0.06					-	-							
Total Phosphorus	mg/L as P	-		0.04	0.01					0.021	0.074							
ORGANIC PARAMETERS																		
Chemical Oxygen Demand	mg/L as O	-		-	-					-	-							
Biological Oxygen Demand	mg/L as O	-		-	-					-	-							
BIOASSAYS																		
96 hour LC-50	-	-		-	-					-	-							

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE Vb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-5

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIODS (Not sampled in 2011)												CURRENT REPORTING PERIOD			
		Aquatic Life (FWAL)[1]	6-Jan-10	3-Mar-10	27-Apr-10	30-Jun-10	18-Aug-10	13-Dec-10	21-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	Not Sampled in 2013			
TOTAL METALS																		
Aluminum [4]	mg/L	0.1	Not Sampled	**2.36**	**0.68**	Not Sampled	Not Sampled	Not Sampled	Not Sampled	**0.526**	**0.815**	Not Sampled	Not Sampled	Not Sampled				
Arsenic	mg/L	0.005		-	-					-	-							
Barium	mg/L	1.0		-	-					-	-							
Boron	mg/L	1.2		-	-					-	-							
Cadmium [5]	mg/L	0.00003		-	-					-	-							
Chromium	mg/L	0.001		-	-					-	-							
Copper [5]	mg/L	0.004		-	-					-	-							
Iron	mg/L	1		**3.51**	0.878					**1.1**	**1.16**							
Lead [5]	mg/L	0.006		-	-					-	-							
Manganese [5]	mg/L	1.05		0.042	0.017					0.108	0.025							
Mercury	ug/L	0.02		-	-					-	-							
Nickel	mg/L	0.025		-	-					-	-							
Selenium	mg/L	0.002		-	-					-	-							
Zinc [5]	mg/L	0.015		-	-					-	-							
DISSOLVED METALS																		
Aluminum [4]	mg/L	0.1		-	-					-	-							
Arsenic	mg/L	0.005		-	-					-	-							
Barium	mg/L	1.0		-	-					-	-							
Boron	mg/L	1.2		-	-					-	-							
Cadmium [5]	mg/L	0.00003		-	-					-	-							
Chromium	mg/L	0.001		-	-					-	-							
Copper [5]	mg/L	0.004		-	-					-	-							
Iron	mg/L	0.35		-	-					-	-							
Lead [5]	mg/L	0.006		-	-					-	-							
Manganese [5]	mg/L	1.05		-	-					-	-							
Mercury	ug/L	0.02		-	-					-	-							
Nickel	mg/L	0.025		-	-					-	-							
Selenium	mg/L	0.002		-	-					-	-							
Zinc [5]	mg/L	0.015		-	-					-	-							

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE VIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-6

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	24-Jun-11	16-Aug-11	7-Nov-11	13-Dec-11	20-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	145.0	75.0	Not Sampled	Not Sampled	166.0	160	52.6	110.0	153	Not Sampled	149.0	106	138.0	190.0	263	207	158.0	218
Total Dissolved Solids	mg/L	-	220	136			244	260	94	196	250		290	158	236	260	366	422	280	340
pH - Lab	pH	-	7.30	7.60			7.50	7.30	7.30	6.80	7.40		7.20	7.10	7.30	7.20	6.90	6.80	7.20	7.50
pH - Field	pH	-	6.52	7.18			6.59	6.80	7.17	6.46	7.79		7.05	7.76	-	7.50	7.29	-	-	7.72
ORP - Lab	mV	-	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
ORP - Field	mV	-	151.9	159.7			58.1	87.9	80.6	93.2	69.7		162.6	80.1	56.4	67.6	81.0	-	-	16.8
Conductivity - Lab	µS/cm	-	370	191			454	451	152	307	411		416	280	402	480	546	617	474	577
Conductivity - Field	µS/cm	-	353	187			207	213	141	270	376		385	255	379	445	531	-	-	513
Temperature - Field	ºC	-	4.0	12.0			6.9	3.4	6.5	8.6	13.9		10	4.2	6.3	11.5	15.8	-	-	3.8
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	110	62			-	-	-	-	-		-	-	-	-	-	70.0	130	220
Chloride	mg/L	150	15.4	10.8			-	-	-	-	-		-	-	-	-	-	44.4	41.3	37.9
Sulphate	mg/L	100	36	8.5			-	-	-	-	-		-	-	-	-	-	139	35.8	7.7
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-			0	-	-	-	-		-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-			7.5	-	-	-	-		-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-			6.7	-	-	-	-		-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-			24.8	-	-	-	-		-	-	-	-	-	-	-	-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	0.16	<0.01			0.78	0.44	0.04	0.01	<0.01		<0.01	0.33	1.13	**2.56**	**1.86**	0.06	0.07	**3.26**
Nitrate Nitrogen	mg/L as N	3.0	2.9	1.3			-	-	-	-	-		-	-	-	-	-	2.33	0.37	**5.02**
Total Phosphorus	mg/L as P	-	0.01	<0.01			0.005	0.009	0.028	0.007	0.056		0.026	0.014	<0.003	0.027	0.041	0.009	0.067	0.015
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	-	-			50	-	-	-	-		-	-	-	-	-	-	-	-
Biological Oxygen Demand	mg/L as O	-	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
BIOASSAYS																				
96 hour LC-50	-	-	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE VIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-6

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - CURRENT REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	24-Jun-11	16-Aug-11	07-Nov-11	13-Dec-11	20-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.108**	**0.305**	Not Sampled	Not Sampled	-	**-**	**1.48**	0.082	0.05	Not Sampled	**0.22**	**0.42**	**0.403**	0.033	**0.11**	**0.13**	**9.42**	**0.18**
Arsenic	mg/L	0.005	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Iron	mg/L	1.0	0.21	0.39			-	0.05	**1.35**	0.105	0.26		0.51	0.70	0.71	0.223	**8.37**	0.52	**17.80**	0.32
Lead [5]	mg/L	0.006	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	<0.005	<0.005			-	<0.005	0.03	0.008	0.01		0.02	0.01	0.07	**2.92**	**9.73**	0.08	**1.50**	0.07
Mercury	ug/L	0.02	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.006	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-			-	-	-	-	-		-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE VIIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-7

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
PARAMETERS	units	Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	07-Nov-11	19-Dec-11	21-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	Not Sampled	-							
Total Hardness ($CaCO_3$)	mg/L	-	84.0	45.0	31.0	35.0	14.0	10.0	10.0	10.0	12.0		10.0	11.0	14.0	21.0	29.0	22	29.0	21.0
Total Dissolved Solids	mg/L	-	140	96	52	90	72	66	25	62	20		58	78	40	46	88	80	82	64
pH - Lab	pH	-	7.00	7.30	6.30	7.30	6.70	6.60	6.20	6.06	6.55		5.90	6.35	6.68	6.20	6.10	6.10	6.00	6.10
pH - Field	pH	-	6.62	6.93	7.41	6.79	6.75	7.85	7.95	6.64	7.85		6.31	6.23	-	6.16	6.77	-	-	5.92
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
ORP - Field	mV	-	50.1	136.0	154.7	23.2	65.5	103.2	136.5	109.6	129.0		219.4	165.0	152.6	211.7	160.9	-	-	100.6
Conductivity - Lab	µS/cm	-	233	0	113	123	67	54	50	49	58		57	52	70	88	114	112	140	101
Conductivity - Field	µS/cm	-	224	118	119	66	52	33.0	122	44	50		51	47	77	94	128	-	-	87
Temperature - Field	ºC	-	4.7	6.6	12.2	14.1	8.1	6.8	6.6	7.8	10.9		10	4.8	6.1	7.0	11.8	-	-	3.8
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	70.0	40.0	30.0	39.0	<20	<20	<20	<20	<20		<20	<20	<20	24.0	28.0	<20	22.0	50.00
Chloride	mg/L	150	11.9	7.8	15.2	14.8	10.7	7.7	6.8	6.9	7.5		7.7	7.3	9	10.5	17	15	23.7	16.4
Sulphate	mg/L	100	16.0	3.4	<2	<2.0	1.0	1.6	1.3	1.1	1.0		3.3	2.8	2.0	1.0	1.0	6.9	0.5	1.8
DISSOLVED CATIONS																				
Calcium	mg/L	-	27.4	14.7	9.0	0.0	3.7	2.70	2.5	2.5	3.1		2.5	2.70	3.4	5.5	<0.10	5.5	7.0	5.23
Magnesium	mg/L	-	3.7	2	2	0.0025	1.3	0.90	0.9	0.9	1.1		0.92	0.90	1.3	1.7	<0.1	1.96	2.75	2.05
Potassium	mg/L	-	2.80	1.60	0.60	0.00	0.70	0.40	0.50	0.40	<0.4		0.40	0.60	0.60	1.00	0.10	0.60	0.90	0.80
Sodium	mg/L	-	10.8	7.5	7.4	0.01	6.6	5.1	4.7	4.8	6.2		5.4	5.7	6.8	7.5	<0.1	9.1	13.7	9.5
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	0.80	0.08	0.02	0.11	<0.01	<0.01	0.05	<0.01	0.04		<0.01	<0.01	0.16	0.02	0.03	0.04	0.04	0.03
Nitrate Nitrogen	mg/L as N	3.0	0.9	0.8	<0.1	0.1	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	0.06
Total Phosphorus	mg/L as P	-	0.01	-	-	0.007	0.012	0.012	0.008	0.006	0.028		0.013	0.007	<0.003	0.48	0.012	<0.003	0.006	0.008
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	10	20	30	50	40	20	20	20	20		34	15	16	22	22	22	35	13
Biological Oxygen Demand	mg/L as O	-	<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
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-		-	-	-		-	-	-	-	-		-	

H:\Project\1576\CHEM\2013_chem\Updated Tables\[SW7-2013 (Updated).XLS]NON-VOLATILES

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE VIIb
METALS MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-7

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
PARAMETERS	units	Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	24-Jun-11	16-Aug-11	07-Nov-11	13-Dec-11	21-Feb-12	02-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	0.088	**0.179**	**0.456**	**1.4**	0.09	**0.315**	**0.205**	**0.251**	**0.25**	Not Sampled	**0.364**	**0.299**	**0.224**	**0.153**	**0.28**	**0.204**	**0.234**	**0.168**
Arsenic	mg/L	0.005	0.0002	<0.0002	0.0007	0.0012	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		0.00015	0.00018	0.00021	0.00016	0.0004	0.0003	0.0006	0.00014
Barium	mg/L	1.0	0.01	0.005	0.008	0.012	0.004	0.004	0.004	<0.001	0.004		0.00426	0.00328	0.00468	0.00508	0.006	0.006	0.007	0.00544
Boron	mg/L	1.2	0.191	0.09	0.075	0.094	0.038	0.046	0.035	0.033	0.045		0.053	0.032	0.037	0.036	0.062	0.111	<0.0010	<0.0001
Cadmium [5]	mg/L	0.00001	<0.00001	<0.00001	0.00001	**0.00002**	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		**0.00002**	<0.00001	<0.00001	0.00001	**0.00002**	0.00001	**0.00002**	<0.00001
Chromium	mg/L	0.001	<0.0004	0.0005	**0.0011**	**0.0022**	0.0006	0.0008	0.0009	0.0005	0.0008		0.0007	0.0006	<0.0005	<0.0005	0.0007	0.0008	0.0007	0.0006
Copper [5]	mg/L	0.002	<0.001	<0.001	0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001		0.0009	0.0008	0.0006	0.0007	0.001	<0.001	<0.001	<0.0001
Iron	mg/L	1.0	0.238	0.208	**5.14**	**18**	0.43	0.291	0.327	0.273	0.52		0.269	0.222	0.367	0.337	**1.46**	0.609	**4.7**	0.671
Lead [5]	mg/L	0.004	<0.0001	<0.0001	0.0002	0.0005	<0.0001	0.0002	0.0002	<0.0001	<0.0001		<0.0001	0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001
Manganese [5]	mg/L	0.74	0.016	0.006	0.433	**0.926**	0.049	0.018	0.0015	0.0012	0.004		0.0199	0.0146	0.0672	0.0429	0.229	0.125	0.519	0.102
Mercury	ug/L	0.02	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.00001	<0.01	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<0.01	<0.01
Nickel	mg/L	0.025	0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.0005		0.0007	0.0005	0.0004	0.0008	0.001	<0.001	0.001	0.0007
Selenium	mg/L	0.002	<0.0006	<0.0006	0.0011	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0002		0.0001	0.0002	<0.0001	0.0001	<0.0006	<0.0006	0.0007	<0.0001
Zinc [5]	mg/L	0.0075	0.005	**0.008**	**0.008**	-	0.006	0.003	0.006	0.002	0.003		0.0029	0.0025	0.0022	0.0032	**0.012**	0.004	**0.015**	0.0039
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	0.056	**0.15**	0.1	0.02	**0.172**	**0.242**	**0.217**	**0.196**	**0.166**		0.006	**0.249**	**0.156**	**0.116**	0.095	**0.126**	0.058	0.084
Arsenic	mg/L	0.005	<0.0002	<0.0002	0.0004	0.0002	<0.0002	0.0004	<0.0002	<0.0002	0.0002		0.0012	<0.0002	0.0002	<0.0002	0.0003	0.0004	0.0004	<0.0002
Barium	mg/L	1.0	0.01	0.005	0.005	0.005	0.004	0.003	0.003	0.002	0.004		0.06	0.004	0.006	0.004	0.005	0.006	0.006	0.005
Boron	mg/L	1.2	0.19	0.084	0.074	0.082	0.035	0.039	0.033	0.029	0.04		0.903	0.044	0.039	0.042	0.053	0.106	0.072	0.051
Cadmium [5]	mg/L	0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001	**0.00004** [6]	**0.00002**	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001	0.0004	0.0005	0.0004	0.0004	0.0005	0.0006	0.0005	0.0006	<0.5		**0.0022**	0.0006	<0.0005	0.0005	0.0005	0.0007	0.0006	0.0005
Copper [5]	mg/L	0.002	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.35	0.116	0.13	**1.36**	**0.428**	0.231	0.193	0.129	0.189	0.212		0.191	0.114	0.216	0.211	<0.005	0.281	**0.958**	**0.351**
Lead [5]	mg/L	0.004	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Manganese [5]	mg/L	0.74	0.017	0.008	<0.001	0.187	0.024	0.008	0.008	0.01	0.023		0.0112	0.01	0.044	0.0214	<0.001	0.0185	0.198	0.02
Mercury	ug/L	0.02	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<0.01	<0.1		<0.1	<0.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
Nickel	mg/L	0.025	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005		0.007	0.0007	0.0007	<0.001	0.001	<0.001	0.001	0.001
Selenium	mg/L	0.002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0002		<0.0006	<0.0002	<0.0002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Zinc [5]	mg/L	0.0075	0.002	0.002	0.003	0.001	0.002	0.003	0.003	0.001	0.002		**0.009** [6]	0.007 [6]	0.003	0.002	**0.008**	0.003	0.01	0.003

H:\Project\1576\CHEM\2013_chem\Updated Tables\[SW7-2013 (Updated).XLS]Metals

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 30 mg/L-$CaCO_3$
6. These values exceed the total concentrations, and are considered to be sampling or analytical errors.

TABLE VIIIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-8

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	23-Jun-11	9-Aug-11	07-Nov-11	19-Dec-11	21-Feb-12	2-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	Not Sampled	Not Sampled	-	-	-	-	Not Sampled	Not Sampled	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	207	143			207	169	122	146			132	144	144	205	197	163	187	173
Total Dissolved Solids	mg/L	-	298	222			246	276	174	254			244	206	234	276	338	332	336	266
pH - Lab	pH	-	7.70	7.90			7.50	7.50	7.60	7.20			7.1	7.3	7.30	7.30	7.20	6.90	7.1	7.4
pH - Field	pH	-	7.70	7.90			7.50	7.02	8.10	7.82			6.99	7.60	-	7.63	7.35	-	-	7.23
ORP - Lab	mV	-	7.83	7.82			7.71	702	-	-			-	-	-	-	-	-	-	-
ORP - Field	mV	-	8.3	74.3			21.9	96.0	46.4	47.0			137.2	141.8	155.2	12.3	48.9	-	-	93.9
Conductivity - Lab	µS/cm	-	509	343			418	452	320	376			369	346	403	496	508	508	511	442
Conductivity - Field	µS/cm	-	489	336			194	210	285	327			340	321	375	478	501	-	-	382
Temperature - Field	ºC	-	3.8	7.0			6.6	5.6	6.3	9.8			10.2	3.3	6.4	15.7	13.4	-	-	3.8
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	180.0	130			-	170	110	140			100	120	150	230	210	78	160	100
Chloride	mg/L	150	17.9	13.7			-	25.6	16.0	20.0			23.2	18.6	19.9	21.1	34.8	43.8	35.5	29.8
Sulphate	mg/L	100	35.0	11.0			-	15.7	10.6	12.1			39.5	24.1	12.6	<0.5	8.3	98.0	40.0	7.1
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-			50.70	-	-	-			-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-			6.90	-	-	-			-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-			6.40	-	-	-			-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-			22.00	-	-	-			-	-	-	-	-	-	-	-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	**3.00**	<0.75			1.33	**2.38**	0.72	0.34			0.09	0.94	1.28	**2.33**	0.81	0.05	0.13	0.68
Nitrate Nitrogen	mg/L as N	3.0	2.10	1.90			-	1.92	1.82	1.02			0.99	1.53	1.14	0.22	0.330	0.140	0.45	2.00
Total Phosphorus	mg/L as P	-	0.03	<0.01			0.08	0.01	0.02	0.01			0.01	0.06	<0.003	0.03	0.05	0.01	0.21	0.04
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	20	20			100	20	30	30			44	74	31	52	66	51	258	40
Biological Oxygen Demand	mg/L as O	-	-	-			6.9	-	-	-			-	-	-	-	-	<5.0	11	7.4
BIOASSAYS																				
96 hour LC-50	-	-	-	-			-	-	-	-			-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE VIIIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-8

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	23-Jun-11	9-Aug-11	07-Nov-11	19-Dec-11	21-Feb-12	2-May-12	03-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.142**	0.086			**-**	**0.14**	**0.24**	0.048			**0.109**	**0.86**	0.076	0.035	0.07	**0.13**	**7.17**	0.335
Arsenic	mg/L	0.005	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-	Not	Not	-	-	-	-	Not	Not	-	-	-	-	-	-	-	-
Iron	mg/L	1.0	0.538	0.285	Sampled	Sampled	-	0.304	0.474	0.217	Sampled	Sampled	0.306	**2.84**	0.222	0.6	**2.04**	**1.08**	**35.8**	**1.7**
Lead [5]	mg/L	0.006	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	0.072	0.025			-	0.072	0.077	0.054			0.054	0.447	0.0978	**4.42**	0.89	0.462	**8.84**	0.645
Mercury	ug/L	0.02	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-			-	-	-	-			-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-			-	-	-	-			-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-			0.013	-	-	-			-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-			0.0004	-	-	-			-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-			0.01	-	-	-			-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-			0.384	-	-	-			-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00003	-	-			<0.00001	-	-	-			-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-			0.0008	-	-	-			-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.004	-	-			<0.001	-	-	-			-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-			0.04	-	-	-			-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.006	-	-			<0.0001	-	-	-			-	-	-	-	-	-	-	-
Manganese [5]	mg/L	1.05	-	-			<0.001	-	-	-			-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-			<0.00001	-	-	-			-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-			0.002	-	-	-			-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-			<0.0006	-	-	-			-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.015	-	-			0.001	-	-	-			-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE IXa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-9

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	23-Jun-11	9-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	2-May-12	3-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	Not Sampled	Not Sampled	-	-	-	-	Not Sampled	Not Sampled	-	-	-	-	-	-	Not Sampled	-
Total Hardness ($CaCO_3$)	mg/L	-	197	172			205	210	190	222			211	197	194	268	202	269		299
Total Dissolved Solids	mg/L	-	292	252			302	260	244	356			366	280	316	418	432	548		434
pH - Lab	pH	-	7.80	8.10			7.90	8.00	7.80	7.80			7.60	7.70	7.80	7.50	7.30	7.00		7.80
pH - Field	pH	-	7.88	8.07			7.71	7.10	8.02	7.73			7.31	8.18	-	7.78	7.49	-		7.69
ORP - Lab	mv	-	-	-			-	-	-	-			-	-	-	-	-	-		-
ORP - Field	mV	-	11.8	84.3			9.9	87.7	58.8	47.8			132.0	77.5	138.2	-144.5	21	-		102.2
Conductivity - Lab	µS/cm	-	482	407			536	572	485	570			565	526	543	730	710	755		774
Conductivity - Field	µS/cm	-	463	399			252	268	441	513			529	498	505	691	708	-		689
Temperature - Field	ºC	-	3.2	7.2			6.8	5.4	6.5	10.0			10.6	3.4	7.0	12.5	14.2	-		2.7
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	160	160			-	230	190	230			190	210	230	350	240	62		400
Chloride	mg/L	150	18.3	14.9			-	29.2	21.8	25.7			31.0	20.3	23.2	26.6	43.2	50.4		45.3
Sulphate	mg/L	100	40.0	13.0			-	19.8	15.9	17.4			49.9	34.9	6.0	5.2	84.0	**213.0**		5.7
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-			67.60	-	-	-			-	-	-	-	-	-		-
Magnesium	mg/L	-	-	-			8.70	-	-	-			-	-	-	-	-	-		-
Potassium	mg/L	-	-	-			8.60	-	-	-			-	-	-	-	-	-		-
Sodium	mg/L	-	-	-			27.90	-	-	-			-	-	-	-	-	-		-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	1.20	1.08			**3.94**	**6.53**	**5.38**	**4.20**			1.42	**4.21**	**5.28**	**5.96**	**4.91**	0.06		**8.60**
Nitrate Nitrogen	mg/L as N	3.0	**3.50**	1.80			-	1.65	1.74	1.93			2.03	0.32	0.29	<0.05	0.11	1.98		2.78
Total Phosphate	mg/L as P	-	0.01	0.02			0.01	0.03	0.07	0.03			0.03	0.11	0.00	0.11	0.11	0.03		0.02
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	20	20			50	50	60	50			50	109	40	178	86	52		54
Biological Oxygen Demand	mg/L as O	-	-	-			<5.0	-	-	-			-	-	-	-	-	<5.0		<5.0
BIOASSAYS																				
96 hour LC-50	-	-	-	-			-	-	-	-			-	-	-	-	-	-		-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE IXb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-9

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	12-Apr-11	23-Jun-11	9-Aug-11	7-Nov-11	19-Dec-11	21-Feb-12	2-May-12	3-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	0.042	**0.19**	Not Sampled	Not Sampled	-	**0.22**	**1.47**	0.047	Not Sampled	Not Sampled	**0.144**	**0.71**	**0.65**	**0.24**	0.08	0.09	Not Sampled	0.024
Arsenic	mg/L	0.005	-	-			-	-	-	-			-	-	-	-	-	-		-
Barium	mg/L	1.0	-	-			-	-	-	-			-	-	-	-	-	-		-
Boron	mg/L	1.2	-	-			-	-	-	-			-	-	-	-	-	-		-
Cadmium [5]	mg/L	0.00003	-	-			-	-	-	-			-	-	-	-	-	-		-
Chromium	mg/L	0.001	-	-			-	-	-	-			-	-	-	-	-	-		-
Copper [5]	mg/L	0.004	-	-			-	-	-	-			-	-	-	-	-	-		-
Iron	mg/L	1.0	0.32	0.498			-	0.806	**4.51**	0.97			0.964	**4.36**	**2.91**	**10.8**	**1.11**	**1.63**		0.787
Lead [5]	mg/L	0.006	-	-			-	-	-	-			-	-	-	-	-	-		-
Manganese [5]	mg/L	1.05	0.008	0.077			-	0.682	**2.91**	0.189			0.0898	**2.86**	**2.23**	**23.7**	0.334	0.589		0.462
Mercury	ug/L	0.02	-	-			-	-	-	-			-	-	-	-	-	-		-
Nickel	mg/L	0.025	-	-			-	-	-	-			-	-	-	-	-	-		-
Selenium	mg/L	0.002	-	-			-	-	-	-			-	-	-	-	-	-		-
Zinc [5]	mg/L	0.015	-	-			-	-	-	-			-	-	-	-	-	-		-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-			0.007	-	-	-			-	-	-	-	-	-		-
Arsenic	mg/L	0.005	-	-			0.0005	-	-	-			-	-	-	-	-	-		-
Barium	mg/L	1.0	-	-			0.013	-	-	-			-	-	-	-	-	-		-
Boron	mg/L	1.2	-	-			0.454	-	-	-			-	-	-	-	-	-		-
Cadmium [5]	mg/L	0.00003	-	-			<0.00001	-	-	-			-	-	-	-	-	-		-
Chromium	mg/L	0.001	-	-			0.0009	-	-	-			-	-	-	-	-	-		-
Copper [5]	mg/L	0.004	-	-			-	-	-	-			-	-	-	-	-	-		-
Iron	mg/L	0.35	-	-			0.043	-	-	-			-	-	-	-	-	-		-
Lead [5]	mg/L	0.006	-	-			<0.0001	-	-	-			-	-	-	-	-	-		-
Manganese [5]	mg/L	1.05	-	-			<0.001	-	-	-			-	-	-	-	-	-		-
Mercury	ug/L	0.02	-	-			<0.00001	-	-	-			-	-	-	-	-	-		-
Nickel	mg/L	0.025	-	-			0.003	-	-	-			-	-	-	-	-	-		-
Selenium	mg/L	0.002	-	-			0.0007	-	-	-			-	-	-	-	-	-		-
Zinc [5]	mg/L	0.015	-	-			<0.001	-	-	-			-	-	-	-	-	-		-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved-. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 100 mg/L-$CaCO_3$

TABLE Xa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-10

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
			U/S SANDHILL CREEK												U/S SANDHILL CREEK					
PARAMETERS	units	Aquatic Life (FWAL)[1]	05-Jan-10	02-Mar-10	27-Apr-10 [4]	29-Jun-10	17-Aug-10	13-Dec-10	20-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	16.4	14.9	9.4	0.0	0.0	13	17	13.0	13.0	69.0	16.0	24	24	45.0	48.0	27.0	51.0	48
Total Dissolved Solids	mg/L	-	66	72	36	110	110	40	60	74	42	216	98	106	48	80	124	96	126	118
pH - Lab	pH	-	6.06	6.13	5.20	6.60	6.40	6.3	6.8	6.21	6.20	6.80	6.00	6.73	6.66	6.80	6.70	6.20	6.80	7
pH - Field	pH	-	6.41	6.93	6.23	7.05	7.12	7.26	7.46	7.05	7.26	5.42	6.47	7.03	-	7.52	7.42	-	-	7.68
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mV	-	115.6	83.7	106.9	114.2	212.9	72.3	131.7	119.2	146.0	251.3	188.7	124.3	134.7	94.9	84.8	-	-	62.8
Conductivity - Lab	µS/cm	-	84	65	59	164	192	59.7	74	61	66	279	75	83	91	148	182	126	203	163
Conductivity - Field	µS/cm	-	73	66	45	160	188	84	71	31	59	271	71	87	86	140	180	-	-	157
Temperature - Field	ºC	-	6.3	7.3	7.5	10.1	12.5	8.6	5.8	7.2	10.3	12.0	9.7	4.7	5.8	6.8	11.6	-	-	3.7
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	21.1	13.8	4.4	30	26	-	<20	<20	<20	48	<20	<20	22	44	38	<20	38	40
Chloride	mg/L	150	9.35	9.27	7.6	25	36	6.9	10.1	9.2	10.8	38.9	9.3	8.2	10.7	14.3	22	16.6	28.8	20.4
Sulphate	mg/L	100	4.68	3.25	<0.5	6	<0.5	4.5	2.9	2.2	2	23	5.6	5.5	3.6	2.9	15	16	11	4.1
DISSOLVED CATIONS																				
Calcium	mg/L	-	3.95	3.73	2.27	11.1	8.87	3.4	4.5	3.5	-	19	4.12	6.9	6.9	13.6	14	7.07	14	13.7
Magnesium	mg/L	-	1.17	1.25	0.95	3.27	3.64	1	1.3	1.1	-	5.25	1.3	1.5	1.8	2.72	3.27	2.35	3.96	3.31
Potassium	mg/L	-	0.64	0.67	0.43	1.47	1.5	0.6	0.7	0.4	-	2.7	0.6	0.9	0.9	1.6	1.7	0.9	2.1	2
Sodium	mg/L	-	6.36	6.75	4.87	16	18.2	5.2	6.6	6.2	-	25.5	6.7	6.6	8.4	10.9	14.8	10.5	18.3	14.3
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	0.01	< 0.01	0.15	0.11	0.068	<0.01	0.04	<0.01	0.05	0.13	0.07	0.09	0.25	0.08	0.05	0.04	<0.02	0.12
Nitrate Nitrogen	mg/L as N	3.0	0.6	0.31	0.13	0.08	0.02	0.2	0.45	0.17	0.07	1.22	0.16	0.37	0.47	0.2	0.24	0.18	0.47	0.82
Total Phosphorus	mg/L as P	-	< 0.02	< 0.02	0.01	0.01	0.02	0.006	0.013	0.01	0.01	0.02	0.01	0.006	<0.003	0.01	0.01	0.01	0.01	0.009
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	97	32	51	32	37	30	30	30	40	37	60	28	27	23	26	55	<10	23
Biological Oxygen Demand	mg/L as O	-	< 10	< 10	<10	<10	<10	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   AvAlable: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. Sample exceeded holding time for measurement of ammonia nitrogen.

TABLE Xb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-10

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
PARAMETERS	units	Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.176**	0.094	**0.3**	**0.391**	**0.436**	**0.171**	**0.286**	**0.251**	**0.45**	**0.152**	**0.468**	**0.234**	**0.286**	**0.222**	0.05	**0.444**	**0.205**	**0.253**
Arsenic	mg/L	0.005	<0.0002	<0.0002	0.0004	0.0005	<0.0002	0.0002	<0.0002	<0.0002	-	0.0007	0.00014	0.00014	0.00012	0.00014	0.0002	0.0003	0.0003	0.00014
Barium	mg/L	1.0	0.006	0.003	0.006	0.006	0.004	0.007	0.004	<0.001	-	0.006	0.00479	0.00359	0.00449	0.00695	0.007	0.007	0.008	0.00714
Boron	mg/L	1.2	0.092	0.024	0.073	0.045	0.038	0.087	0.048	0.035	-	0.379	0.055	0.043	0.053	0.081	0.16	0.102	0.137	0.072
Cadmium [5]	mg/L	0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	0.00001	<0.00001	<0.00001	-	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001	<0.0004	<0.0004	0.0007	0.001	0.0007	0.0006	0.0009	<0.0004	-	0.0006	0.0006	<0.0005	<0.0005	0.0005	0.0006	<0.0004	0.0006	<0.0005
Copper [5]	mg/L	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	0.0008	0.001	0.0009	0.0008	<0.001	<0.001	<0.001	0.0011
Iron	mg/L	1.0	0.195	0.197	0.972	**1.73**	0.354	0.234	0.184	0.198	0.45	0.915	0.373	0.221	0.223	0.275	0.461	0.571	0.488	0.343
Lead [5]	mg/L	0.004	<0.0001	0.0001	0.0002	0.0001	0.0001	0.0002	0.0002	<0.0001	-	0.0001	0.0002	0.0001	0.0002	0.0001	<0.0001	0.0002	<0.0001	0.0001
Manganese [5]	mg/L	0.74	<0.005	<0.005	0.142	0.347	<0.005	0.01	0.005	<0.005	0.01	0.232	0.01	0.0126	0.0073	0.0418	0.0258	0.0349	0.0206	0.014
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.010	<0.1	<0.1	<0.1	<0.1	<0.1	0.011	<0.01	<0.01
Nickel	mg/L	0.025	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	-	0.002	0.0006	0.0005	0.0006	0.0006	0.001	0.001	<0.001	0.0008
Selenium	mg/L	0.002	<0.0006	<0.0006	0.0007	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	-	0.0008	0.0002	<0.0001	0.0001	0.0002	<0.0006	<0.0006	<0.0006	<0.0001
Zinc [5]	mg/L	0.0075	0.012	0.006	0.002	0.003	0.003	0.002	0.002	0.001	-	0.003	0.0022	0.0022	0.0014	0.0015	0.001	0.003	0.002	0.0019
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	**0.12**	**0.133**	0.095	0.028	**0.255**	**0.115**	**0.193**	**0.185**	**-**	0.038	**0.38**	**0.174**	**0.188**	**0.12**	0.091	**0.355**	0.073	**0.128**
Arsenic	mg/L	0.005	<0.0002	<0.0002	0.0003	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	-	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	0.0003	0.0002	<0.0002
Barium	mg/L	1.0	0.005	0.002	0.005	0.005	0.004	0.006	0.003	0.002	-	0.005	0.004	0.004	0.005	0.005	0.006	0.006	0.007	0.006
Boron	mg/L	1.2	0.082	0.021	0.076	0.047	0.036	0.085	0.044	0.033	-	0.418	0.047	0.049	0.05	0.094	0.153	0.102	0.137	0.074
Cadmium [5]	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	-	<0.00001	<0.00001	<0.00001	**0.00002**	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001	<0.0004	<0.0004	<0.0004	0.0005	<0.0004	0.0004	0.0004	<0.0004	-	0.0006	0.0006	<0.0005	<0.0005	0.0005	0.0005	<0.0004	0.0005	0.0006
Copper [5]	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.35	0.106	0.144	0.304	**0.764**	0.197	0.162	0.128	0.138	**-**	**0.39**	0.253	0.119	0.14	0.136	0.184	**0.389**	0.177	0.189
Lead [5]	mg/L	0.004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Manganese [5]	mg/L	0.74	0.007	0.003	0.091	0.156	0.001	0.007	0.002	**<0.001**	**-**	0.177	0.0042	**<0.005**	0.006	0.0099	0.0045	0.0246	0.012	0.005
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.01	<0.01	<0.1	<0.1	<0.01	<0.1	<0.01	<0.01	<0.01
Nickel	mg/L	0.025	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	-	0.002	<0.001	<0.0005	0.001	<0.001	0.001	0.001	0.001	<0.001
Selenium	mg/L	0.002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	-	<0.0006	<0.0006	<0.0002	<0.0002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006
Zinc [5]	mg/L	0.0075	<0.001	0.005	0.002	0.001	<0.001	0.001	0.002	<0.001	-	<0.001	0.001	0.003	0.003	<0.001	0.001	0.002	0.001	<0.001

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2011. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 30 mg/L-$CaCO_3$

TABLE XIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-11

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
PARAMETERS	units	Aquatic Life (FWAL)[2]	21-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	2-May-12	3-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	90	46	160	200	90	139	64	60	60	158	42	31	38	44	71	76	132	72
Total Dissolved Solids	mg/L	-	184	132	266	360	194	268	148	146	144	368	144	100	66	100	190	198	280	180
pH - Lab	pH	-	7.1	7	6.8	0.0074	7.1	7.2	7	6.72	6.8	6.9	6.3	6.66	6.7	6.4	6.5	6.8	6.6	6.7
pH - Field	pH	-	7.04	6.71	7.02	6.72	6.97	6.82	5.91	6.66	7.39	5.06	6.56	6.87	-	6.67	7.26	-	-	6.84
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	
ORP - Field	mV	-	97.6	91.5	-27.8	-44.8	20.9	-19.7	51.4	33.1	40.4	12.5	114.4	75.9	81.8	51.6	-0.6	-	-	41.4
Conductivity - Lab	µS/cm	-	276	143.3	513	588	294	442	227	201	212	540	176	122	160	174	290	333	484	279
Conductivity - Field	µS/cm	-	228	144	522	291	137	212	223	184	194	531	159	120	149	162	307	-	-	255
Temperature - Field	ºC	-	4.51	7.15	11.86	16.29	9.08	3.67	5.9	7.63	12.87	12.53	9.73	5.08	6.18	11.85	12.36	-	-	3.69
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	80	43	190	220	100	150	66	74	68	180	36	26	36	46	88	90	170	<20
Chloride	mg/L	150	23.1	12.9	47.1	54.5	26.4	40.1	20.3	17.9	17.7	62	20.8	14	19	19.3	36.1	37	48.5	35.2
Sulphate	mg/L	100	12	4.3	<2	<2.0	5.6	12.3	5.1	3.8	3	1.3	13.2	6	6.4	4.5	2.7	9.9	5.5	6.8
DISSOLVED CATIONS																				
Calcium	mg/L	-	26.4	13.8	47.8	51.1	26.5	41.3	18.7	17.6	17.3	45.9	11.9	8.3	10.7	12.4	20	20.8	36.2	20.3
Magnesium	mg/L	-	5.8	2.8	10	12.1	5.7	8.8	4.3	4	3.9	10.5	3.07	2.1	2.8	3.18	5	5.86	10.2	5.21
Potassium	mg/L	-	3.4	2	4.6	6.1	3.8	4.5	2.7	2.3	2.4	5.8	2.3	1.6	1.9	2.1	3.2	3.6	5.4	3
Sodium	mg/L	-	21.2	12.3	36	49.4	21.1	32.3	16.4	15.6	16.4	45.4	16.6	48	15.8	15	28.2	30	45	27.9
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	1.02	0.25	1.01	1.22	1.42	1.83	1.02	0.73	0.63	1.46	0.09	0.17	0.24	0.19	0.4	1.12	**2.1**	0.75
Nitrate Nitrogen	mg/L as N	3.0	0.6	0.4	<0.10	<0.1	0.4	0.28	0.38	0.25	0.26	<0.05	0.41	0.26	0.26	0.09	<0.05	0.34	<0.05	<0.05
Total Phosphorus	mg/L as P	-	0.029	-	-	0.005	0.025	0.015	0.019	0.023	17.5	0.039	13.3	0.00	40	0.034	0.039	0.009	0.016	0.02
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	-	30	50	70	70	50	40	40	60	73	51	32	32	37	48	54	106	39
Biological Oxygen Demand	mg/L as O	-	-	<5.0	<5.0	-	-	<5.0	<5.0	<5.0	<5.0	5.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2012. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-11

		RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
PARAMETERS	units	Aquatic Life (FWAL)[1]	5-Jan-10	2-Mar-10	27-Apr-10	29-Jun-10	17-Aug-10	13-Dec-10	20-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	20-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.844**	**0.839**	0.065	0.083	**0.51**	**0.141**	**0.108**	**0.408**	**0.504**	**0.13**	**0.596**	**1.08**	**0.805**	**0.532**	0.081	**0.307**	**0.116**	**0.192**
Arsenic	mg/L	0.005	0.0006	0.0004	0.0008	0.0012	0.0006	0.0008	0.0005	0.0004	0.0008	0.0014	0.00038	0.0004	0.00035	0.00044	0.0009	0.001	0.0015	0.00045
Barium	mg/L	1.0	0.014	0.01	0.028	0.034	0.014	0.026	0.012	0.007	0.012	0.038	0.0121	0.00952	0.011	0.011	0.019	0.018	0.033	0.0148
Boron	mg/L	1.2	0.204	0.106	0.375	0.494	0.276	0.338	0.185	0.164	0.246	0.379	0.226	0.097	0.122	0.118	0.267	0.359	0.38	0.216
Cadmium [5]	mg/L	0.00002	0.00002	<0.00001	0.00002	0.00002	0.00001	0.00002	0.00001	0.00002	<0.00001	<0.00001	0.00002	0.00001	<0.00001	0.00001	0.00001	0.00002	0.00001	<0.00001
Chromium	mg/L	0.001	**0.0015**	**0.0015**	0.0008	0.0009	**0.0013**	**0.001**	**0.0014**	**0.0011**	**0.0014**	**0.0012**	**0.0013**	**0.0018**	**0.0014**	**0.0013**	**0.0011**	**0.0016**	0.001	**0.0012**
Copper [5]	mg/L	0.0024	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.002	0.001	0.001	<0.001	0.0016	0.0015	0.0012	0.0011	<0.001	0.001	<0.001	0.0003
Iron	mg/L	1.0	**2.76**	**1.91**	**5.67**	**12.7**	**3.26**	**6.15**	**2.68**	**2.62**	**3.67**	**15.9**	**2.12**	**2.33**	**2.64**	**4.12**	**11.4**	**5.26**	**21.8**	**6.7**
Lead [5]	mg/L	0.005	0.0004	0.0003	<0.0001	<0.0001	0.0002	0.0002	0.0004	0.0001	0.0002	0.0001	0.0002	0.0003	0.0003	0.0002	0.0001	0.0002	<0.0001	0.0001
Manganese [5]	mg/L	1.05	0.452	0.208	**2.47**	**3.96**	0.841	1.75	0.44	0.423	**0.516**	3.3	0.129	**0.158**	0.287	0.62	**1.62**	**1.26**	**2.72**	**1.3**
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.1	<0.1	<0.1	<0.1	<0.10	0.011	<0.01	<0.01
Nickel	mg/L	0.025	0.002	<0.001	0.002	0.002	0.001	0.002	0.001	<0.001	0.001	0.002	0.0009	0.0008	0.0007	0.0007	0.001	0.002	0.002	0.0011
Selenium	mg/L	0.002	<0.0006	<0.0006	**0.0024**	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0008	0.0002	0.0001	<0.0001	0.0002	<0.0006	<0.0006	0.0006	0.0001
Zinc [5]	mg/L	0.0075	0.007	0.006	0.002	0.003	0.004	0.004	0.007	0.003	0.005	0.003	0.0034	0.0047	0.0036	0.0036	0.003	0.005	0.004	0.0033
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	0.055	0.085	0.018	0.006	0.087	0.023	0.081	**0.086**	0.116	**0.01**	**0.129**	0.137	0.08	0.082	0.042	0.042	0.011	0.024
Arsenic	mg/L	0.005	0.0005	<0.0002	0.0006	0.0006	0.0004	0.0006	0.0003	0.0003	0.0003	0.0009	0.0002	0.0002	<0.0002	0.0002	0.0005	0.0007	0.0006	0.0004
Barium	mg/L	1.0	0.013	0.007	0.024	0.025	0.012	0.019	0.009	0.007	0.009	0.021	0.009	0.007	0.009	0.008	0.013	0.014	0.019	0.01
Boron	mg/L	1.2	0.186	0.1	0.392	0.477	0.263	0.345	0.176	0.158	0.197	0.427	0.2	0.108	0.124	0.139	0.25	0.36	0.392	0.214
Cadmium [5]	mg/L	0.00002	<0.00001	**0.00023**	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00006	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium	mg/L	0.001	0.0005	0.0007	0.0007	0.0007	0.0006	**0.0006**	**0.0016** [6]	0.001	**0.0009**	**0.0017** [6]	0.0009	0.0006	0.0005	0.0007	**0.0012**	**0.0012**	**0.0016**	**0.0012**
Copper [5]	mg/L	0.0024	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	**<0.001**	0.009 [6]	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.35	**0.519**	**0.511**	**1.41**	**0.43**	**1.1**	**1.02**	**0.72**	**0.903**	**1.25**	**0.847**	**0.607**	**0.409**	0.276	**1.02**	**2.22**	**0.841**	**0.79**	**0.978**
Lead [5]	mg/L	0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese [5]	mg/L	1.05	0.394	0.043	**2.28**	**3.25**	0.741	**1.71**	0.377	0.144	**0.065**	2.02	0.0699	**0.113**	0.169	0.252	0.825	0.473	**2.14**	1
Mercury	ug/L	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.001	<0.1	<0.1	<0.01	<0.1	<0.1	<0.01	<0.01
Nickel	mg/L	0.025	<0.001	<0.001	0.002	0.002	0.001	0.002	<0.001	<0.001	<0.001	0.002	<0.001	0.0006	0.0009	<0.001	0.001	0.001	0.002	0.001
Selenium	mg/L	0.002	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0008	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0002	<0.0002	<0.0006	<0.0006	0.0011	<0.0006	0.0006
Zinc [5]	mg/L	0.0075	0.002	0.002	0.001	<0.001	0.002	0.002	0.001	0.001	0.002	<0.001	0.001	0.007 [6]	0.004	0.002	0.002	0.002	0.001	<0.001

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2012. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 60 mg/L-$CaCO_3$
6. These values exceed the total concentrations, and are considered to be sampling or analytical errors.

TABLE XIIa
WATER CHEMISTRY DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-12

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	23-Jun-11	9-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	20-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	35.0	10.0	63.0	80.0	24.2	37	17	13	19	59	16	21	21	45	53.1	30.3	57	45
Total Dissolved Solids	mg/L	-	82	64	116	186	74	110	50	60	78	110	92	40	78	90	130	110	134	96
pH - Lab	pH	-	6.80	6.70	6.20	8.00	6.80	6.90	6.80	6.30	6.30	6.50	6.00	6.50	6.60	6.80	6.80	6.30	6.80	7.00
pH - Field	pH	-	7.05	6.29	7.09	6.55	7.52	6.95	7.24	6.63	7.99	5.53	6.47	7.13	-	7.00	7.72	-	-	6.98
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mV	-	110.4	186.4	102.6	152.3	45.4	93.2	136.7	120.5	91	234.2	181	126.5	116.1	85.3	67.1	-	-	62.6
Conductivity - Lab	µS/cm	-	117	47	237	302	104.9	153	76.2	63	75	246	72	81	91	149	181	122	226	160
Conductivity - Field	µS/cm	-	113	46	235	143	49	73.0	73	57	67	240	67	80	85	126	169	-	-	139
Temperature - Field	ºC	-	4.0	6.2	10.3	12.4	7.0	2.8	5.6	7.2	10.7	11.8	9.6	4.6	5.7	6.8	11.3	-	-	3.5
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	27	<10	56	89	24	33	<20	<20	<20	38	<20	20	<20	<20	38	<20	44	<20
Chloride	mg/L	150	10.5	7.0	33.1	38.6	16.8	21.2	10.3	9.3	9.4	35.9	9.2	8.2	10.7	14.2	22.2	16.6	31.1	20.8
Sulphate	mg/L	100	9.9	<2	2.1	<2.0	2.6	5.3	2.9	2.3	2.6	22.2	5.7	5.3	3.6	3.1	14.1	15.6	10.7	4.1
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	<0.01	<0.01	0.05	0.09	<0.01	<0.01	0.06	0.01	<0.01	**13.8**	<0.01	0.20	0.18	0.04	0.04	0.04	<0.02	0.09
Nitrate Nitrogen	mg/L as N	3.0	0.80	0.20	<0.10	0.10	0.17	0.45	0.42	0.17	0.29	1.45	0.16	0.35	0.44	0.19	**9.96**	0.16	0.53	0.76
Total Phosphorus	mg/L as P	-	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.02	0.01	0.01	<0.003	0.01	0.02	0.01	0.01	0.01
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved . Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XIIb
METAL MONITORING DATA SUMMARY FOR SURFACE WATER SAMPLING SITE SW-12

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	21-Feb-11	11-Apr-11	23-Jun-11	9-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	20-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.186**	**<0.005**	**0.23**	0.078	**0.18**	**0.151**	**0.287**	**0.275**	**0.479**	0.082	**0.468**	**0.237**	**0.296**	**0.167**	0.086	**0.248**	**0.175**	**0.486**
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	1.0	0.222	0.234	**1.82**	**2.9**	0.338	0.299	0.233	0.225	0.479	0.849	0.376	0.234	0.274	0.248	0.598	0.668	0.899	0.397
Lead [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	0.74	0.014	0.008	**0.961**	**1.67**	0.014	0.073	0.009	0.009	0.02	0.116	0.0101	0.0093	0.0098	0.0157	0.0437	0.0515	0.0602	0.0225
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 30 mg/L-$CaCO_3$

TABLE XIIIa
WATER CHEMISTRY DATA SUMMARY FOR SANDHILL CREEK SAMPLING SITE (SHC)

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	22-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	02-May-12	04-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
PHYSICAL TESTS																				
Colour	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	14	7	22	26	11.5	17	11	10	11	34	10	10	11	16	17.9	16.4	27	18
Total Dissolved Solids	mg/L	-	54	58	66	112	70	76	42	68	40	262	86	34	70	58	80	76	100	66
pH - Lab	pH	-	6.8	6.2	6.9	7	6.7	6.9	6.6	6.4	6.4	6.6	5.9	6.4	6.7	6.9	6.7	6.4	6.8	6.8
pH - Field	pH	-	5.02	6.33	7.21	5.58	8.12	7.05	8.91	7.64	8.48	7.30	6.49	6.60	-	6.94	6.89	-	-	6.63
ORP - Lab	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ORP - Field	mV	-	171.8	136.7	115.9	219.2	71.8	104.0	159.9	88.7	62.9	214.6	193.1	186.9	143.5	152.5	182.5	-	-	45.7
Conductivity - Lab	µS/cm	-	73.8	40.4	151.3	176.8	63.4	107.3	60.5	56	58	220	57	54	66	85	105	88	159	101
Conductivity - Field	µS/cm	-	71	41	154	85	29	63	256	122	54	272	59	106	349	77	127	-	-	110
Temperature - Field	ºC	-	4.3	6.3	11.1	12.9	8.5	3.1	6.0	7.3	10.3	12.5	9.8	5.7	6.5	6.5	11.2	-	-	3.3
DISSOLVED ANIONS																				
Alkalinity - Total	mg/L	-	12	<10	<20	15	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Chloride	mg/L	150	10.9	7.7	36.1	40.2	11.3	22.5	10.7	9.8	10.6	54	8.9	8.4	10.7	13.5	21.7	15.6	32	19.8
Sulphate	mg/L	100	3.3	<2	2.7	2.5	1.7	3	2	1.7	1.6	3.5	3.1	2.7	2.4	2.2	4.1	6.8	5.6	2.8
DISSOLVED CATIONS																				
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NUTRIENTS																				
Ammonia Nitrogen	mg/L as N	1.84	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	0.05	<0.01	0.05	0.31	0.06	<0.01	0.15	<0.01	<0.01	0.04	<0.02	<0.02
Nitrate Nitrogen	mg/L as N	3.0	0.3	<0.1	<0.10	<0.1	0.05	0.14	0.2	0.12	0.06	0.11	0.07	0.13	0.15	0.09	0.06	0.1	0.63	0.18
Total Phosphorus	mg/L as P	-	0.008	<0.01	0.015	0.006	0.018	0.007	0.009	0.009	0.008	0.020	0.01	0.007	0.008	0.018	0.009	0.004	0.004	0.007
ORGANIC PARAMETERS																				
Chemical Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIOASSAYS																				
96 hour LC-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XIIIb
METAL MONITORING DATA SUMMARY FOR SANDHILL CREEK SAMPLING SITE (SHC)

PARAMETERS	units	RECEIVING WATER CRITERIA	SAMPLING DATE - PREVIOUS REPORTING PERIOD												SAMPLING DATE - CURRENT REPORTING PERIOD					
		Aquatic Life (FWAL)[1]	22-Feb-11	11-Apr-11	23-Jun-11	09-Aug-11	31-Oct-11	13-Dec-11	20-Feb-12	02-May-12	04-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
TOTAL METALS																				
Aluminum [4]	mg/L	0.1	**0.191**	**0.353**	**0.268**	**0.287**	**0.456**	**0.139**	**0.342**	**0.318**	**0.51**	**0.146**	**0.514**	**0.303**	**0.434**	**0.234**	**0.277**	**0.28**	**0.162**	**0.188**
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	1.0	0.242	0.33	0.617	**1.06**	0.411	0.219	0.262	0.28	0.57	0.902	0.42	0.267	**0.363**	0.269	**0.445**	**0.6**	**0.51**	**0.32**
Lead [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	0.83	<0.005	0.008	0.036	0.05	<0.005	0.006	<0.005	<0.005	0.01	0.0555	0.0109	0.0082	0.0075	0.0098	0.0125	0.0149	0.0216	0.0098
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISSOLVED METALS																				
Aluminum [4]	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium [5]	mg/L	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper [5]	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead [5]	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese [5]	mg/L	0.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc [5]	mg/L	0.0075	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.
4. FWAL guideline for indicated parameter changes with pH
5. FWAL guideline for indicated parameter changes with hardness. Value shown appropriate for hardness of 30 mg/L-$CaCO_3$

TABLE XIV
SURFACE WATER CHEMISTRY DATA SUMMARY FOR VOC'S

PARAMETERS	units	ving Water C GCDWQ MAC or AO[1]	RECEIVING WATER CRITERIA Aquatic Life (FWAL)[1]	SAMPLING DATE - PREVIOUS REPORTING PERIODS														SAMPLING DATE - CURRENT REPORTING PERIOD					
				SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3
				06-Jan-10	03-Mar-10	28-Apr-10	30-Jun-10	18-Aug-10	13-Dec-10	21-Feb-11	19-Dec-11	21-Feb-12	2-May-12	4-Jul-12	28-Aug-12	30-Oct-12	18-Dec-12	13-Feb-13	23-Apr-13	19-Jun-13	20-Aug-13	28-Oct-13	11-Dec-13
HALOGENATED VOLATILES																							
Bromodichloromethane	ug/L	-	-	< 0.1	< 0.1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	Not Sampled
Bromoform	ug/L	-	-	< 0.2	< 0.2	<1	<1	<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	
Bromomethane	ug/L	-	-	< 0.8	< 0.8	<1	<1	<1	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
2-Butanone	ug/L	-	-	< 5	< 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbon Tetrachloride	ug/L	5	13.3	< 0.1	< 0.1	<1	<1	<1	<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	
Chlorobenzene	ug/L	-	-	< 0.1	< 0.1	-	<0.5	<0.5	<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	
Chloroethane	ug/L	-	-	< 0.4	< 0.4	<1	<1	<1	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Chloroform	ug/L	-	1.8	< 0.3	< 0.3	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	
Chloromethane	ug/L	-	-	< 0.4	< 0.4	<1	<1	<1	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Dibromochloromethane	ug/L	-	-	< 0.1	< 0.1	-	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	
1,2-Dibromoethane	ug/L	-	-	< 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	
Dibromomethane	ug/L	-	-	< 0.2	< 0.2	-	-	-	<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	
Dichlorodifluoromethane	ug/L	-	-	< 0.2	< 0.2	-	-	-	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
1,2-Dichlorobenzene	ug/L	200	0.7	< 0.1	< 0.1	-	<0.5	<0.5	<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	
1,3-Dichlorobenzene	ug/L	-	150	< 0.1	< 0.1	-	<0.5	<0.5	<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	
1,4-Dichlorobenzene	ug/L	5	26	< 0.1	< 0.1	-	<0.5	<0.5	<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	
1,1-Dichlororethane	ug/L	-	-	< 0.1	< 0.1	<0.5	<0.5	<0.5	<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	
1,2-Dichloroethane	ug/L	5	100	< 0.4	< 0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
1,1-Dichloroethylene	ug/L	14	-	< 0.1	< 0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
cis-1,2-Dichloroethylene	ug/L	-	-	< 0.1	< 0.1	<1	<1	<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	
trans-1,2-Dichloroethylene	ug/L	-	-	< 0.1	< 0.1	<1	<1	<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	
Dichloromethane	ug/L	50	98.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dichloropropane	ug/L	-	-	< 0.1	< 0.1	<0.5	-	-	<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	
cis-1,3-Dichloropropylene	ug/L	-	-	< 0.1	< 0.1	<1	<1	<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	
trans-1,3-Dichloropropylene	ug/L	-	-	< 0.1	< 0.1	<1	<1	<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	
2-Hexanone	ug/L	-	-	< 20	< 20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4-Methyl-2-pentanone	ug/L	-	-	< 2	< 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylene Chloride	ug/L	-	98.1	< 6	< 6	-	-	-	<0.10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	
1,1,2,2-Tetrachloroethane	ug/L	-	-	< 0.2	< 0.2	<0.5	<0.5	<0.5	<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	
Tetrachloroethylene	ug/L	30	111	< 0.1	< 0.1	<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	
1,1,1-Trichloroethane	ug/L	-	11.1	< 0.1	< 0.1	<0.5	<0.5	<0.5	<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	
1,1,2-Trichloroethane	ug/L	-	-	< 0.1	< 0.1	<0.5	<0.5	<0.5	<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	
Trichloroethylene	ug/L	50	21	< 0.1	< 0.1	<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	
Trichlorofluoromethane	ug/L	-	-	< 0.2	< 0.2	<4	<4	<4	<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	
Vinyl Chloride	ug/L	2	-	< 0.2	< 0.2	<0.5	<0.5	<0.5	<0.50	<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	
NON-HALOGENATED VOLATILES																							
Benzene	ug/L	5	40	< 0.1	< 0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.2	<0.1	0.1	<0.1	
Ethylbenzene	ug/L	2.4	200	< 0.1	< 0.1	<0.5	<0.5	<0.5	<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	
Styrene	ug/L	-	72	< 0.1	< 0.1	<0.5	<0.5	<0.5	<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	
Toluene	ug/L	24	0.5	< 0.1	< 0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	0.2	0.3	<0.1	<0.1	**0.7**	<0.1	0.1	**0.6**	0.2	**21.5**	<0.1	
Xylenes	ug/L	300	30	< 0.1	< 0.1	<1	<1	<1	0.5	<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	

Notes:
1. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved Accessed February 2014. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
2. Bolding denotes parameters which exceed water quality criteria.
3. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XVa
WATER CHEMISTRY DATA SUMMARY FOR MONITORING WELLS

PARAMETERS	units	RECEIVING WATER CRITERIA		MW02-1		MW02-2		MW02-3	
		GCDWQ MAC or AO[1]	Aquatic Life (FWAL)[2]	29-Oct-03	13-Jun-06	29-Oct-03	13-Jun-06	29-Oct-03	13-Jun-06
PHYSICAL TESTS									
Colour	CU	15	-	-	-	-	-	-	-
Total Hardness ($CaCO_3$)	mg/L	-	-	957	-	1100	-	480	-
Total Dissolved Solids	mg/L	500	-	**6830**	**7670**	**7000**	**7100**	**4370**	**4730**
pH - Lab	pH	6.5-8.5	-	7.85	8.02	7.84	8.03	8	8.16
pH - Field	pH	6.5-8.5	-	7.4	7.29	6.79	7.73	6.92	6.47
ORP - Lab	mv	-	-	-	-	-	-	-	-
ORP - Field	mv	-	-	-55.1	29	-28.8	27	-40.2	54
Conductivity - Lab	µS/cm	-	-	12700	14400	13300	14500	9340	9250
Conductivity - Field	µS/cm	-	-	11000	11410	11700	8280	7570	7730
Temperature - Field	ºC	-	-	11.8	15.4	11	24.7	12.3	15
DISSOLVED ANIONS									
Alkalinity - Total	mg/L	-	-	259	247	234	242	314	315
Chloride	mg/L	250	-	**3920**	**4030**	**4090**	**3890**	**2610**	**2760**
Sulphate	mg/L	500	100	**778**	**657**	**499**	**496**	**334**	**290**
DISSOLVED CATIONS									
Calcium	mg/L	-	-	112	-	129	-	57.9	-
Magnesium	mg/L	-	-	149	-	168	-	68.5	-
Potassium	-	-	-	35.6	-	35.2	-	27.9	-
Sodium	mg/L	200	-	**2010**	**-**	**1950**	**-**	**1440**	**-**
NUTRIENTS									
Ammonia Nitrogen	mg/L as N	-	~1.84	**5.6**	**4.34**	**6.4**	**3.94**	**5.7**	**3.12**
Nitrate Nitrogen	mg/L as N	10	3	< 0.05	<25	< 0.05	<25	< 0.05	<2.5
Total Phosphate	mg/L as P	-	-	0.15	0.06	0.12	0.13	0.2	0.4
ORGANIC PARAMETERS									
Chemical Oxygen Demand	mg/L as O	-	-	-	-	-	-	-	-
Biological Oxygen Demand	mg/L as O	-	-	< 10	-	< 10	-	< 10	-
BIOASSAYS									
96 hour LC-50	-	-	-	-	-	-	-	-	-

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Notes:

1. GCDWQ = Guidelines for Canadian Drinking Water Quality (Health and Welfare, 2006)
   MAC = Maximum acceptable concentration: AO = Aesthetic objective
2. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environ.
   Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). l
3. Bolding denotes parameters which exceed water quality criteria.
4. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XVb
METAL MONITORING DATA SUMMARY FOR MONITORING WELLS

PARAMETERS	units	RECEIVING WATER CRITERIA		MW02-1	MW02-2	MW02-3
		GCDWQ MAC or AO[1]	Aquatic Life (FWAL)[2]	29-Oct-03	29-Oct-03	29-Oct-03
TOTAL METALS						
Arsenic	mg/L	0.01	0.005	**0.006**	**0.007**	0.005
Barium	mg/L	1.0	1.0	0.11	0.14	0.097
Boron	mg/L	-	1.2	**3.97**	**3.34**	**3.05**
Cadmium	mg/L	0.005	0.00013	< 0.0002	< 0.0002	< 0.0002
Chromium	mg/L	0.05	0.001	**0.002**	**0.002**	0.001
Copper	mg/L	1.0	0.004	0.003	**0.005**	0.003
Iron	mg/L	0.3	0.3	**1.65**	**1.52**	**0.58**
Lead	mg/L	0.01	0.028	< 0.001	< 0.001	< 0.001
Manganese	mg/L	0.05	1.9	0.75	0.82	0.45
Mercury	ug/L	1.0	0.02	< 0.02	< 0.02	< 0.02
Nickel	mg/L	-	0.065	0.011	0.013	0.011
Selenium	mg/L	0.01	0.002	< 0.001	< 0.001	< 0.001
Zinc	mg/L	5.0	0.315	0.016	0.012	0.008
DISSOLVED METALS						
Arsenic	mg/L	0.01	0.005	**0.006**	**0.006**	0.004
Barium	mg/L	1.0	1.0	0.1	0.11	0.086
Boron	mg/L	-	1.2	**3.7**	**3.08**	**2.81**
Cadmium	mg/L	0.005	0.00013	< 0.0002	< 0.0002	< 0.0002
Chromium	mg/L	0.05	0.001	0.001	< 0.001	< 0.001
Copper	mg/L	1	0.020	0.002	0.003	0.003
Iron	mg/L	0.3	0.3	0.24	0.13	0.18
Lead	mg/L	0.01	0.028	< 0.001	< 0.001	< 0.001
Manganese	mg/L	0.05	1.9	0.67	0.67	0.37
Mercury	ug/L	1.0	0.02	< 0.02	< 0.02	< 0.02
Nickel	mg/L	-	0.065	0.01	0.011	0.009
Selenium	mg/L	0.01	0.002	< 0.001	< 0.001	< 0.001
Zinc	mg/L	5	0.315	0.009	0.008	0.006

H:\Project\1576\CHEM\2006_chem\[MWELLS.xls]metals

Notes:

1. GCDWQ = Guidelines for Canadian Drinking Water Quality (Health and Welfare, 2006)
   MAC = Maximum acceptable concentration: AO = Aesthetic objective
2. Approved and Working Water Quality Guidelines, Science and Information Branch, Environmental Protection Division, BC Ministry of Environment. Hardness dependent values assume hardness of 500 mg/L. Available: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html#approved. Guidelines for the Protection of Fresh-Water Aquatic Life ("FWAL"). Lowest guidelines are shown.
3. Bolding denotes parameters which exceed water quality criteria.
4. "-" denotes parameter was not analysed, or a receiving water criteria was not applicable.

TABLE XVI
2003-2012 FIELD MONITORING DATA FOR THE WEST COAST LANDFILL MONITORING WELLS

Site	Date	WELL DEPTH		STATIC ELEVATION		PURGED ELEV		Temp.	pH	Elec. Cond.	ORP	Comments
		Depth (m-asl)	Elevation (m-asl)	Depth to Water (m)	Elevation (m-asl)	WLE (m)	Elevation (m-asl)	(°C)		(mS/cm)	mV	
MW02-1	25-Feb-03	12.20	83.65	1.090	94.756			N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-03	12.20	83.65	1.050	94.796	9.310	86.536	N/A	N/A	N/A	N/A	Bailed approximately 20L
	2-Jul-03	12.20	83.65	1.215	94.631	11.195	84.651	N/A	N/A	N/A	N/A	Bailed approximately 20L
	15-Sep-03	12.20	83.65	1.320	94.526	11.050	84.796	N/A	N/A	N/A	N/A	Bailed approximately 20L
	29-Oct-03	12.20	83.65	1.300	94.546	11.510	84.336	11.8	7.40	11.00	-55.1	Bailed approximately 20L
	18-Dec-03	12.20	83.65	1.210	94.636	10.050	85.796	???	???	10.80	???	Bailed approximately 20L
	26-Feb-04	12.20	83.65	1.100	94.746	10.920	84.926	???	???	11.00	???	Bailed approximately 20L
	27-Apr-04	12.20	83.65	1.180	94.666	9.820	86.026	???	???	10.00	???	Bailed approximately 20L
	28-Jun-04	12.20	83.65	1.230	94.616	11.060	84.786			11.74		Bailed approximately 20L
	30-Aug-04	12.20	83.65	1.210	94.636	11.030	84.816			11.62		Bailed approximately 20L
	26-Oct-04	12.20	83.65	1.080	94.766	9.860	85.986			11.12		Bailed approximately 20L
	14-Dec-04	12.20	83.65	1.000	94.846	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	14-Feb-05	12.20	83.65	0.850	94.996	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-May-05	12.20	83.65	0.980	94.866	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	6-Jul-05	12.20	83.65	1.030	94.816	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Aug-05	12.20	83.65	-----	95.846	------	------	N/A	N/A	N/A	N/A	Field data sheet lost
	24-Oct-05	12.20	83.65	0.980	94.866	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-Dec-05	12.20	83.65	0.840	95.006	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Feb-06	12.20	83.65	0.700	95.146	8.880	86.966	N/A	N/A	N/A	N/A	Bailed approximately 20L
	25-Apr-06	12.20	83.65	0.870	94.976	9.250	86.596	N/A	N/A	N/A	N/A	Bailed approximately 20L
	13-Jun-06	12.20	83.65	1.080	94.766	------	------	15.4	16.4	11.41	29.0	**Conductivity off scale in uS/cm range. Used mS/cm**
	9-Aug-06	12.20	83.65	1.150	94.696	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	25-Oct-06	12.20	83.65	1.220	94.626	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-06	12.20	83.65	0.950	94.896	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Mar-07	12.20	83.65	0.900	94.946	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Apr-07	12.20	83.65	0.600	95.246	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Jun-07	12.20	83.65	0.930	94.916	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	15-Aug-07	12.20	83.65	1.030	94.816	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	16-Oct-07	12.20	83.65	0.990	94.856	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-07	12.20	83.65	0.880	94.966	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	12-Dec-07	12.20	83.65	0.880	94.966	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	20-Feb-08	12.20	83.65	0.830	95.016	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Apr-08	12.20	83.65	0.840	95.006	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	11-Jun-08	12.20	83.65	0.960	94.886	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-08	12.20	83.65	1.060	94.786	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Oct-08	12.20	83.65	1.030	94.816	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Dec-08	12.20	83.65	0.880	94.966	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Feb-09	12.20	83.65	0.880	94.966	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Apr-09	12.20	83.65	0.880	94.966	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Jun-09	12.20	83.65	0.980	94.866	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-09	12.20	83.65	1.150	94.696	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Nov-09	12.20	83.65	1.020	94.826	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	05-Jan-10	12.20	83.65	0.91	94.936	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	03-Mar-10	12.20	83.65	0.82	95.026	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-10	12.20	83.65	0.81	95.036	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Jun-10	12.20	83.65	0.91	94.936	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Oct-10	12.20	83.65	1.10	94.746	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Dec-10	12.20	83.65	1.12	94.726	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	24-Feb-11	12.20	83.65	0.79	95.056	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Apr-11	12.20	83.65	0.82	95.026	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Jun-11	12.20	83.65	0.96	94.886	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	09-Aug-11	12.20	83.65	------	------	------	------	------	------	------	------	No longer measured
	07-Nov-11	12.20	83.65	------	------	------	------	------	------	------	------	
	19-Dec-11	12.20	83.65	------	------	------	------	------	------	------	------	
	21-Feb-12	12.20	83.65	------	------	------	------	------	------	------	------	
	02-May-12	12.20	83.65	------	------	------	------	------	------	------	------	
	04-Jul-12	12.20	83.65	------	------	------	------	------	------	------	------	
	28-Aug-12	12.20	83.65	------	------	------	------	------	------	------	------	
	30-Oct-12	12.20	83.65	------	------	------	------	------	------	------	------	
	18-Dec-12	12.20	83.65	------	------	------	------	------	------	------	------	

TABLE XVI
2003-2012 FIELD MONITORING DATA FOR THE WEST COAST LANDFILL MONITORING WELLS

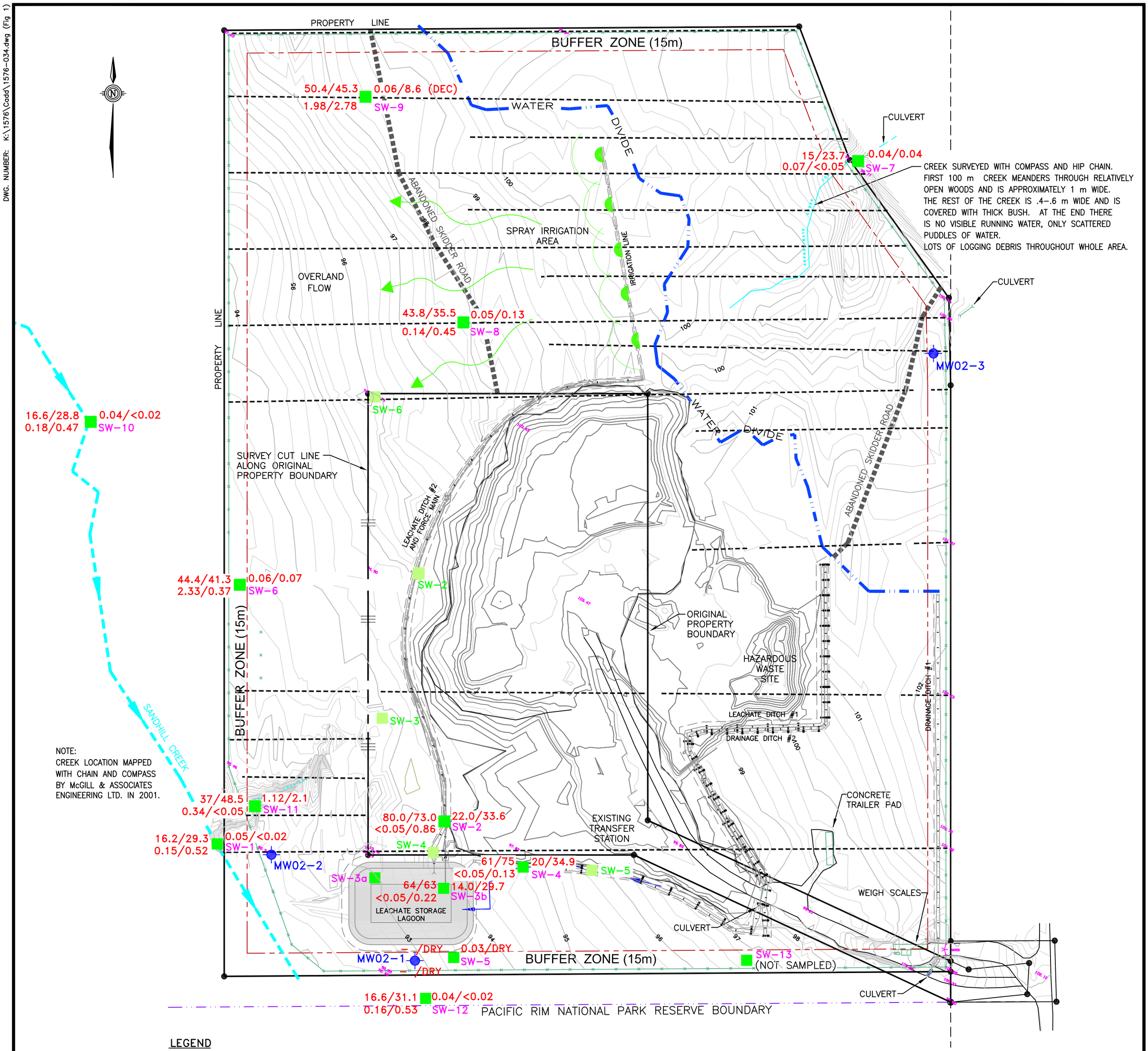
Site	Date	WELL DEPTH		STATIC ELEVATION		PURGED ELEV		Temp.	pH	Elec. Cond.	ORP	Comments
		Depth (m-asl)	Elevation (m-asl)	Depth to Water (m)	Elevation (m-asl)	WLE (m)	Elevation (m-asl)	(°C)		(mS/cm)	mV	
MW02-2	25-Feb-03	12.20	80.86	1.880	91.180			N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-03	12.20	80.86	1.790	91.270	9.680	83.380	N/A	N/A	N/A	N/A	Bailed approximately 20L
	2-Jul-03	12.20	80.86	2.280	90.780	10.625	82.435	N/A	N/A	N/A	N/A	Bailed approximately 20L
	15-Sep-03	12.20	80.86	2.280	90.780	11.440	81.620	N/A	N/A	N/A	N/A	Bailed approximately 20L
	29-Oct-03	12.20	80.86	3.240	89.820	11.730	81.330	11.0	6.79	11.70	-28.8	Bailed approximately 20L
	18-Dec-03	12.20	80.86	3.170	89.890	11.570	81.490	???	???	11.00	???	Bailed approximately 20L
	26-Feb-04	12.20	80.86	2.430	90.630	10.940	82.120	???	???	11.00	???	Bailed approximately 20L
	27-Apr-04	12.20	80.86	2.570	90.490	11.190	81.870	???	???	9.20	???	Bailed approximately 20L
	28-Jun-04	12.20	80.86	2.630	90.430	11.650	81.410			11.69		Bailed approximately 20L
	30-Aug-04	12.20	80.86	2.800	90.260	11.760	81.300			11.80		Bailed approximately 20L
	26-Oct-04	12.20	80.86	3.010	90.050	11.530	81.530			11.38		Bailed approximately 20L
	14-Dec-04	12.20	80.86	3.110	89.950	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	14-Feb-05	12.20	80.86	1.850	91.210	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-May-05	12.20	80.86	1.660	91.400	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	6-Jul-05	12.20	80.86	1.680	91.380	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Aug-05	12.20	80.86	-----	93.060	------	------	N/A	N/A	N/A	N/A	Field data sheet lost
	24-Oct-05	12.20	80.86	1.770	91.290	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-Dec-05	12.20	80.86	1.690	91.370	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Feb-06	12.20	80.86	1.580	91.480	9.030	84.030	N/A	N/A	N/A	N/A	Bailed approximately 20L
	25-Apr-06	12.20	80.86	2.160	90.900	11.010	82.050	N/A	N/A	N/A	N/A	Bailed approximately 20L
	13-Jun-06	12.20	80.86	3.670	89.390	------	------	24.7	25.7	8.28	27.0	**Conductivity off scale in uS/cm range. Used mS/cm**
	9-Aug-06	12.20	80.86	2.320	90.740	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	25-Oct-06	12.20	80.86	2.070	90.990	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-06	12.20	80.86	1.870	91.190	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	17-Apr-07	12.20	80.86	1.760	91.300	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	12-Jun-07	12.20	80.86	1.810	91.250	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	15-Aug-07	12.20	80.86	1.880	91.180	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	16-Oct-07	12.20	80.86	1.870	91.190	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-07	12.20	80.86	1.810	91.250	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	12-Dec-07	12.20	80.86	1.810	91.250	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	20-Feb-08	12.20	80.86	1.760	91.300	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Apr-08	12.20	80.86	1.790	91.270	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	11-Jun-08	12.20	80.86	1.850	91.210	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-08	12.20	80.86	1.940	91.120	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Oct-08	12.20	80.86	1.940	91.120	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Dec-08	12.20	80.86	1.870	91.190	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Feb-09	12.20	80.86	1.820	91.240	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Apr-09	12.20	80.86	1.840	91.220	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Jun-09	12.20	80.86	1.900	91.160	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-09	12.20	80.86	1.980	91.080	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Nov-09	12.20	80.86	1.960	91.100	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	05-Jan-10	12.20	80.86	1.86	91.200	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	03-Mar-10	12.20	80.86	1.80	91.260	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-10	12.20	80.86	1.97	91.090	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Jun-10	12.20	80.86	1.86	91.200	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Oct-10	12.20	80.86	1.99	91.070	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Dec-10	12.20	80.86	1.96	91.100	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	24-Feb-11	12.20	80.86	1.80	91.260	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Apr-11	12.20	80.86	1.71	91.350	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Jun-11	12.20	80.86	1.75	91.310	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	09-Aug-11	12.20	80.86	------	------	------	------	------	------	------	------	No longer measured
	07-Nov-11	12.20	80.86	------	------	------	------	------	------	------	------	
	19-Dec-11	12.20	80.86	------	------	------	------	------	------	------	------	
	21-Feb-12	12.20	80.86	------	------	------	------	------	------	------	------	
	02-May-12	12.20	80.86	------	------	------	------	------	------	------	------	
	04-Jul-12	12.20	80.86	------	------	------	------	------	------	------	------	
	28-Aug-12	12.20	80.86	------	------	------	------	------	------	------	------	
	30-Oct-12	12.20	80.86	------	------	------	------	------	------	------	------	
	18-Dec-12	12.20	80.86	------	------	------	------	------	------	------	------	

TABLE XVI
2003-2012 FIELD MONITORING DATA FOR THE WEST COAST LANDFILL MONITORING WELLS

Site	Date	WELL DEPTH		STATIC ELEVATION		PURGED ELEV		Temp.	pH	Elec. Cond.	ORP	Comments
		Depth (m-asl)	Elevation (m-asl)	Depth to Water (m)	Elevation (m-asl)	WLE (m)	Elevation (m-asl)	(°C)		(mS/cm)	mV	
MW02-3	25-Feb-03	12.20	88.87	1.700	99.370			N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-03	12.20	88.87	1.580	99.490	8.940	92.130	N/A	N/A	N/A	N/A	Bailed approximately 20L
	2-Jul-03	12.20	88.87	1.730	99.340	11.430	89.640	N/A	N/A	N/A	N/A	Bailed approximately 20L
	15-Sep-03	12.20	88.87	1.900	99.170	10.810	90.260	N/A	N/A	N/A	N/A	Bailed approximately 20L
	29-Oct-03	12.20	88.87	2.360	98.710	11.580	89.490	12.3	6.92	7.57	-40.2	Bailed approximately 20L
	18-Dec-03	12.20	88.87	2.300	98.770	11.590	89.480	???	???	7.57	???	Bailed approximately 20L
	26-Feb-04	12.20	88.87	1.850	99.220	10.980	90.090	???	???	7.80	???	Bailed approximately 20L
	27-Apr-04	12.20	88.87	1.890	99.180	11.440	89.630	???	???	6.65	???	Bailed approximately 20L
	28-Jun-04	12.20	88.87	1.970	99.100	10.920	90.150			7.39		Bailed approximately 20L
	30-Aug-04	12.20	88.87	2.080	98.990	11.470	89.600			7.92		Bailed approximately 20L
	26-Oct-04	12.20	88.87	2.140	98.930	11.350	89.720			7.50		Bailed approximately 20L
	14-Dec-04	12.20	88.87	2.270	98.800	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	14-Feb-05	12.20	88.87	1.560	99.510	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-May-05	12.20	88.87	1.480	99.590	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	6-Jul-05	12.20	88.87	1.500	99.570	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Aug-05	12.20	88.87	-----	------	------	------	N/A	N/A	N/A	N/A	Field data sheet lost
	24-Oct-05	12.20	88.87	1.620	99.450	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	19-Dec-05	12.20	88.87	1.520	99.550	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Feb-06	12.20	88.87	1.450	99.620	9.460	91.610	N/A	N/A	N/A	N/A	Bailed approximately 20L
	25-Apr-06	12.20	88.87	1.630	99.440	10.220	90.850	N/A	N/A	N/A	N/A	Bailed approximately 20L
	13-Jun-06	12.20	88.87	1.980	99.090	------	------	15.0	6.47	7.73	54.0	**Conductivity off scale in uS/cm range. Used mS/cm**
	9-Aug-06	12.20	88.87	1.800	99.270	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	25-Oct-06	12.20	88.87	1.750	99.320	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-06	12.20	88.87	1.670	99.400	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Mar-07	12.20	88.87	1.520	99.550	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Apr-07	12.20	88.87	1.430	99.640	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Jun-07	12.20	88.87	1.470	99.600	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	15-Aug-07	12.20	88.87	1.560	99.510	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	16-Oct-07	12.20	88.87	1.650	99.420	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Dec-07	12.20	88.87	1.610	99.460	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	12-Dec-07	12.20	88.87	1.610	99.460	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	20-Feb-08	12.20	88.87	1.470	99.600	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Apr-08	12.20	88.87	1.430	99.640	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	11-Jun-08	12.20	88.87	1.480	99.590	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-08	12.20	88.87	1.610	99.460	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Oct-08	12.20	88.87	1.680	99.390	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Dec-08	12.20	88.87	1.650	99.420	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Feb-09	12.20	88.87	1.530	99.540	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Apr-09	12.20	88.87	1.560	99.510	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Jun-09	12.20	88.87	1.560	99.510	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Aug-09	12.20	88.87	1.720	99.350	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	01-Nov-09	12.20	88.87	1.720	99.350	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	05-Jan-10	12.20	88.87	1.620	99.450	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	03-Mar-10	12.20	88.87	1.550	99.520	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	28-Apr-10	12.20	88.87	1.480	99.590	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	29-Jun-10	12.20	88.87	1.490	99.580	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	18-Oct-10	12.20	88.87	1.700	99.370	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Dec-10	12.20	88.87	1.660	99.410	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	24-Feb-11	12.20	88.87	1.500	99.570	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	13-Apr-11	12.20	88.87	1.430	99.64	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	23-Jun-11	12.20	88.87	1.450	99.62	------	------	N/A	N/A	N/A	N/A	Measurement only - No bailing done
	09-Aug-11	12.20	88.87	------	------	------	------	------	------	------	------	No longer measured
	07-Nov-11	12.20	88.87	------	------	------	------	------	------	------	------	
	19-Dec-11	12.20	88.87	------	------	------	------	------	------	------	------	
	21-Feb-12	12.20	88.87	------	------	------	------	------	------	------	------	
	02-May-12	12.20	88.87	------	------	------	------	------	------	------	------	
	04-Jul-12	12.20	88.87	------	------	------	------	------	------	------	------	
	28-Aug-12	12.20	88.87	------	------	------	------	------	------	------	------	
	30-Oct-12	12.20	88.87	------	------	------	------	------	------	------	------	
	18-Dec-12	12.20	88.87	------	------	------	------	------	------	------	------	

FIGURE

DWG. NUMBER: K:\1576\Cadd\1576-034.dwg (Fig 1)



LEGEND

9.3/37.3 <0.01/0.05 / 0.17/2.29 SW-1	SAMPLING SITE AND PARAMETER CONCENTRATIONS (mg/L) (AUGUST, 2013 / OCTOBER, 2013) EXCEPT AS NOTED CHLORIDE AMMONIA NITRATE SAMPLING SITE
SW-4	HISTORICAL SAMPLING SITES TO OCTOBER 2004
----------	TYPICAL SURVEY LINE
≡	STORM BARS CONSTRUCTED ALONG PROPERTY BOUNDARY AUTUMN 1998 (APPROXIMATE LOCATION)
MW02-2	MONITORING WELL

0 20 40 60 80 100m

SCALE 1:2000

NOTES:

1. LEACHATE POND AND COLLECTION DITCHES CONSTRUCTED LATE SUMMER AND AUTUMN OF 2004.
2. NO RECORDED DECANT EVENTS FOR LEACHATE STORAGE LAGOON IN 2012, HENCE, NO SW-3a RESULTS.
3. SW-5 NOT SAMPLED IN 2013.
4. SW-3 NOT SAMPLED IN DECEMBER 2013. POND FROZEN.
5. SW-9 NOT SAMPLED IN OCTOBER 2013.
6. SHC SAMPLING SITE LOCATED 900m SOUTH, AT HIGHWAY 4 CULVERT.
7. SW-13 SAMPLED IN APRIL AND JUNE 2009, THEN DISCONTINUED DUE TO ABSENCE OF LEACHATE INDICATORS.

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WEST COAST LANDFILL
UCLUELET, BC

PLAN SHOWING PROPERTY BOUNDARIES AND SAMPLING LOCATIONS

BY:	DATE:
MS/lf	APR 14
APPROVED:	FIG:
ATH	1

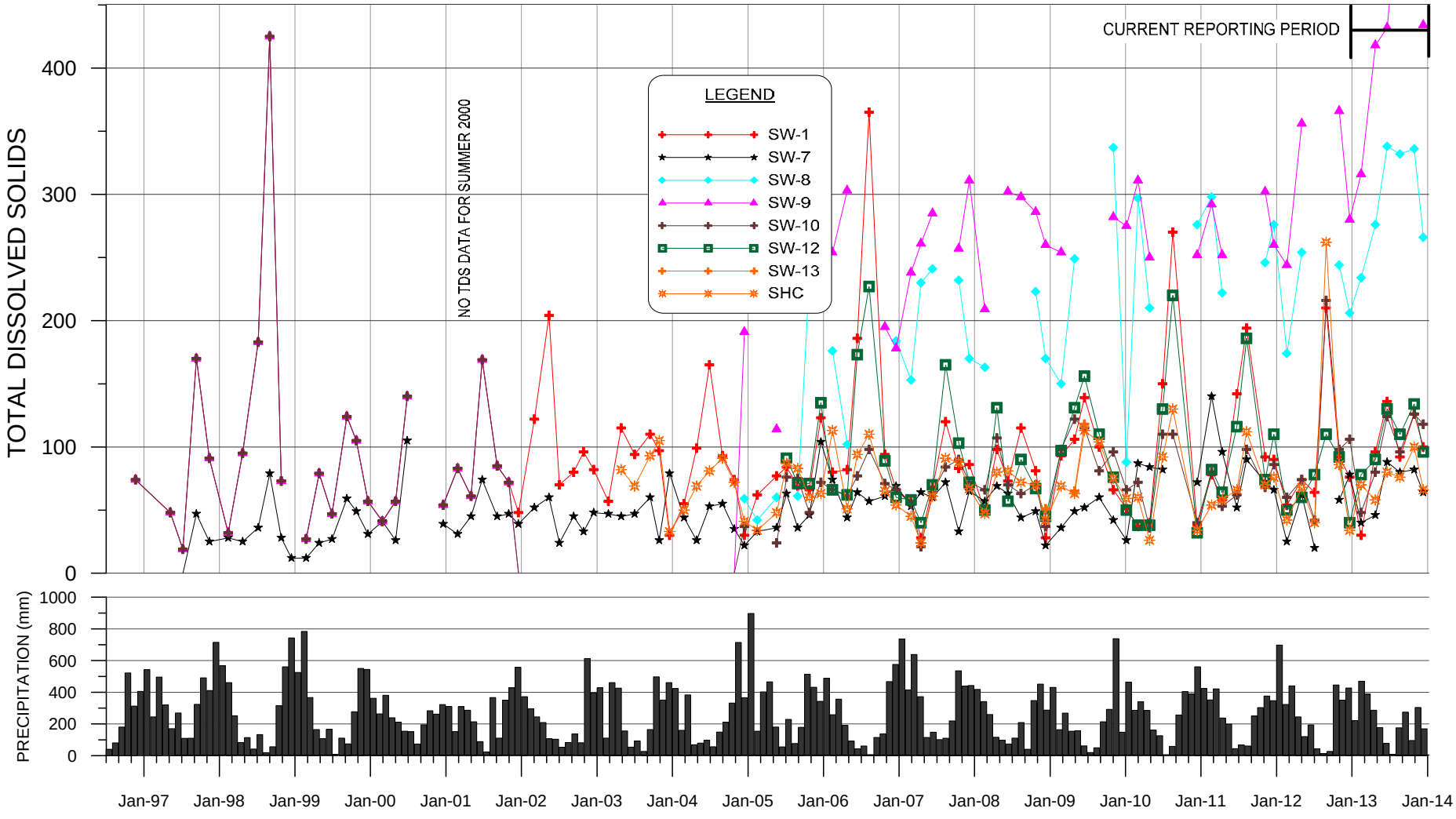
APPENDIX A

MONITORING DATA PLOTS

PLOTS

H:/Project/1576/CHEM/2013_chem/Figures/TDS_2013_lower values.grf

ACTUAL VALUE FOR SW-9 ON AUG 20 IS 548 mg/L



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).

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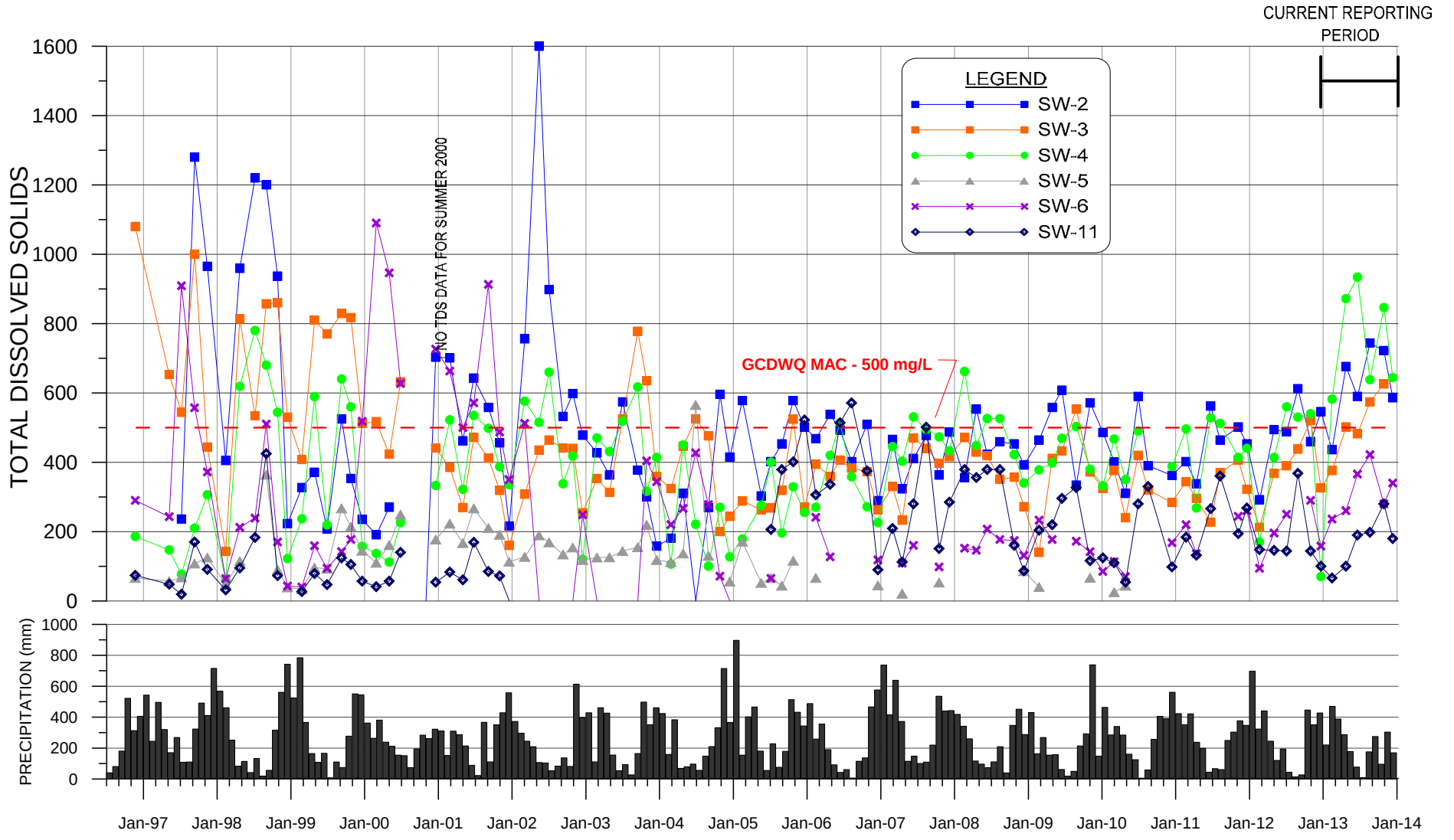
TOTAL DISSOLVED SOLIDS CONCENTRATION PLOT LOWER RANGE VALUES

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-1

H:/Project/1576/CHEM/2013_chem/Figures/TDS_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.

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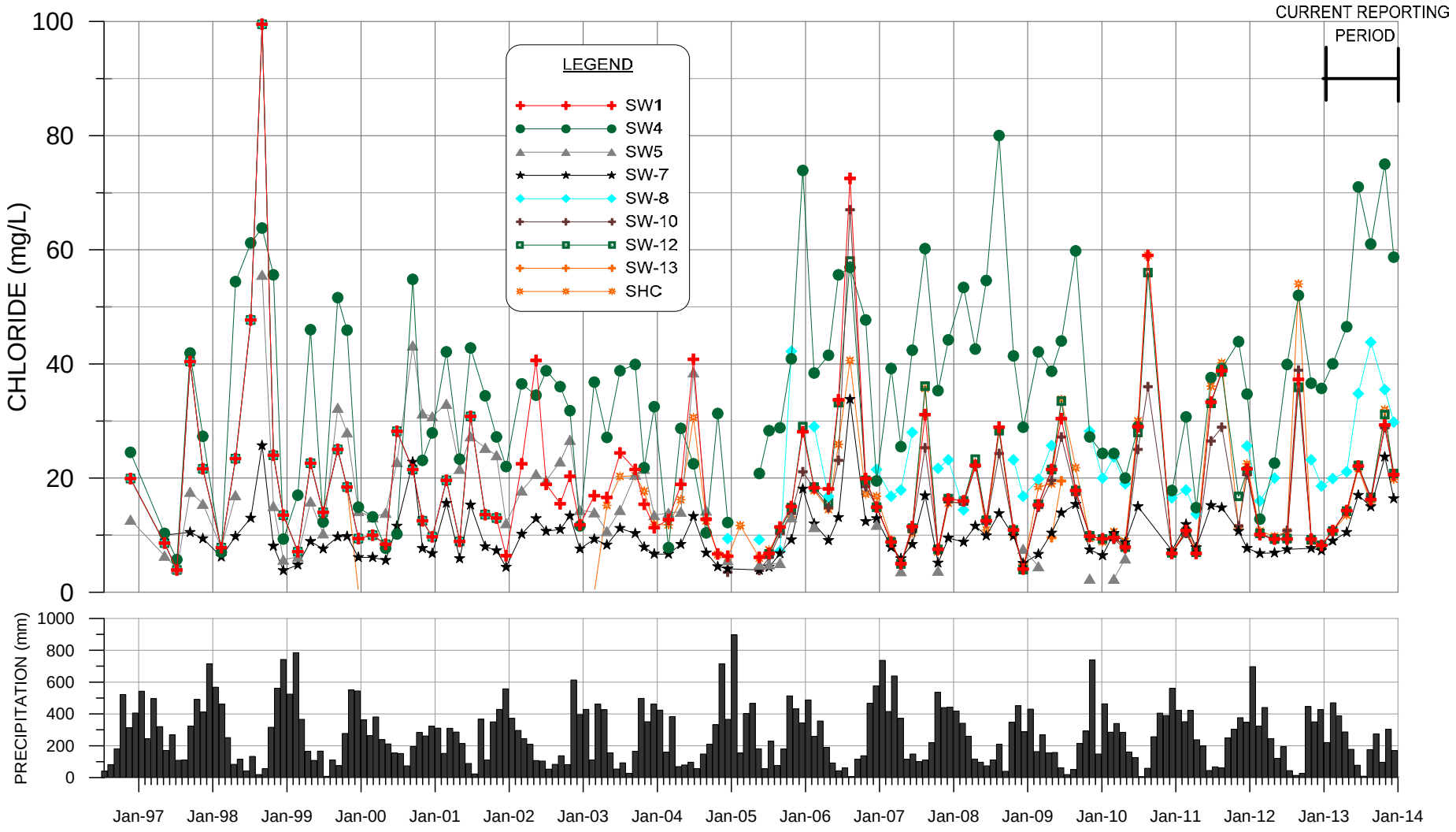
WEST COAST LANDFILL
UCLUELET, BC

TOTAL DISSOLVED SOLIDS CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-2

H:/Project/1576/CHEM/2013_chem/Figures/Cl_2013_lower values.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. BC FWAL = 150 mg/L (30 Day Average)

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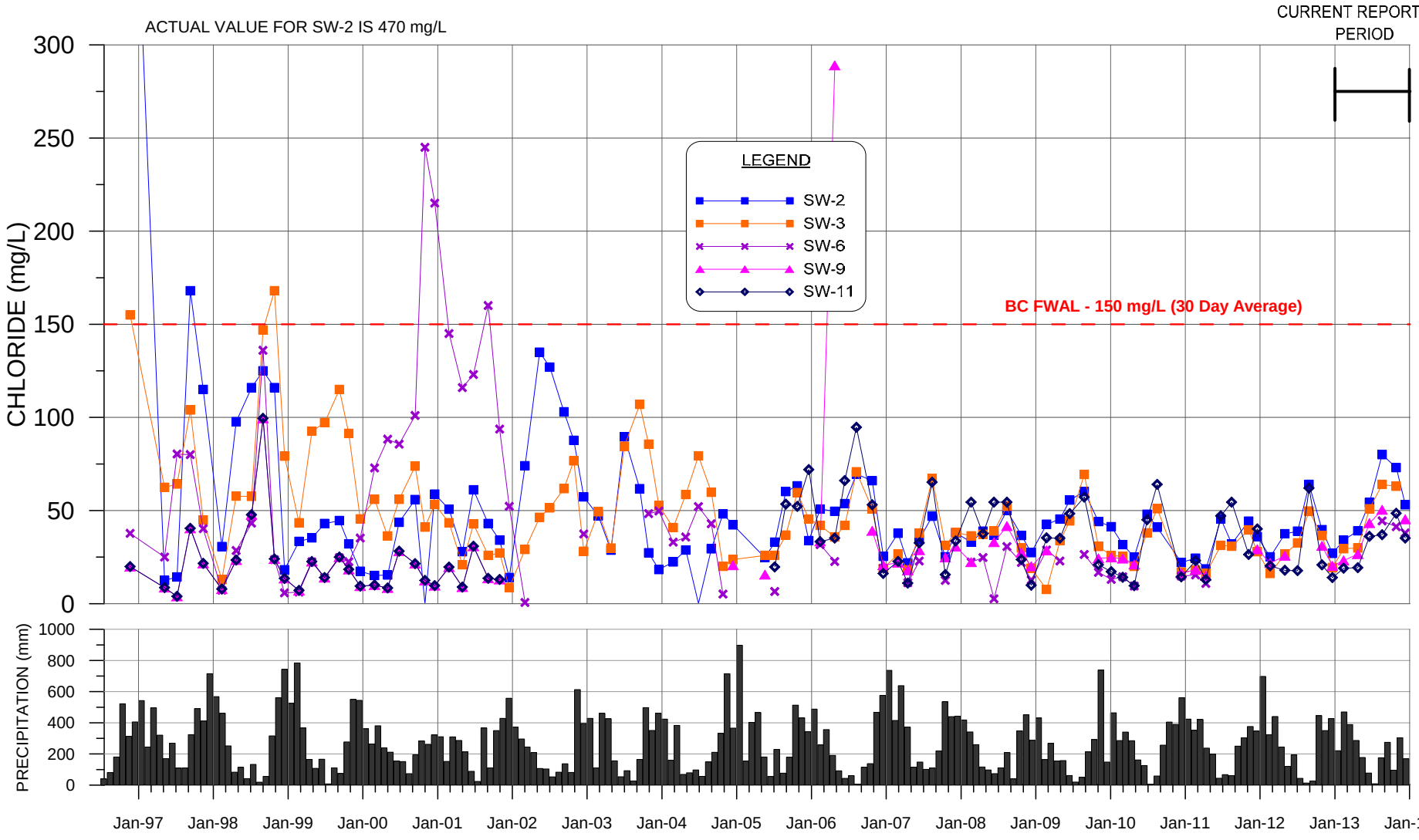
CHLORIDE CONCENTRATION PLOT LOWER RANGE VALUES

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-3

H:/Project/1576/CHEM/2013_chem/Figures/Cl_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data not available).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. BC FWAL = 150 mg/L (30 Day Average)

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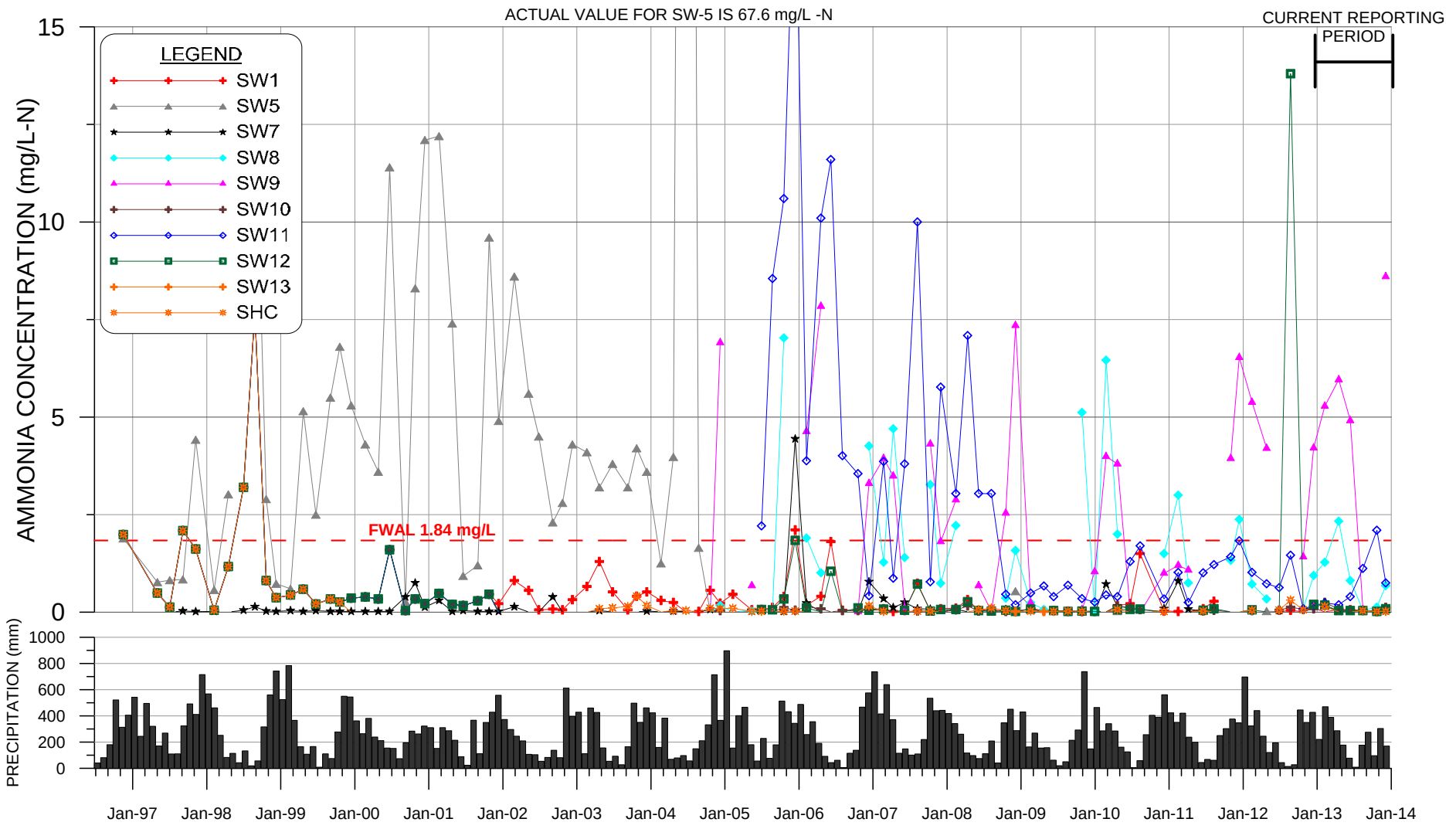
WEST COAST LANDFILL
UCLUELET, BC

CHLORIDE CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-4

H:/Project/1576/CHEM/2013_chem/Figures/NH3_2013_lower values.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. BC FWAL = 1.84 mg/L (30 Day Average)

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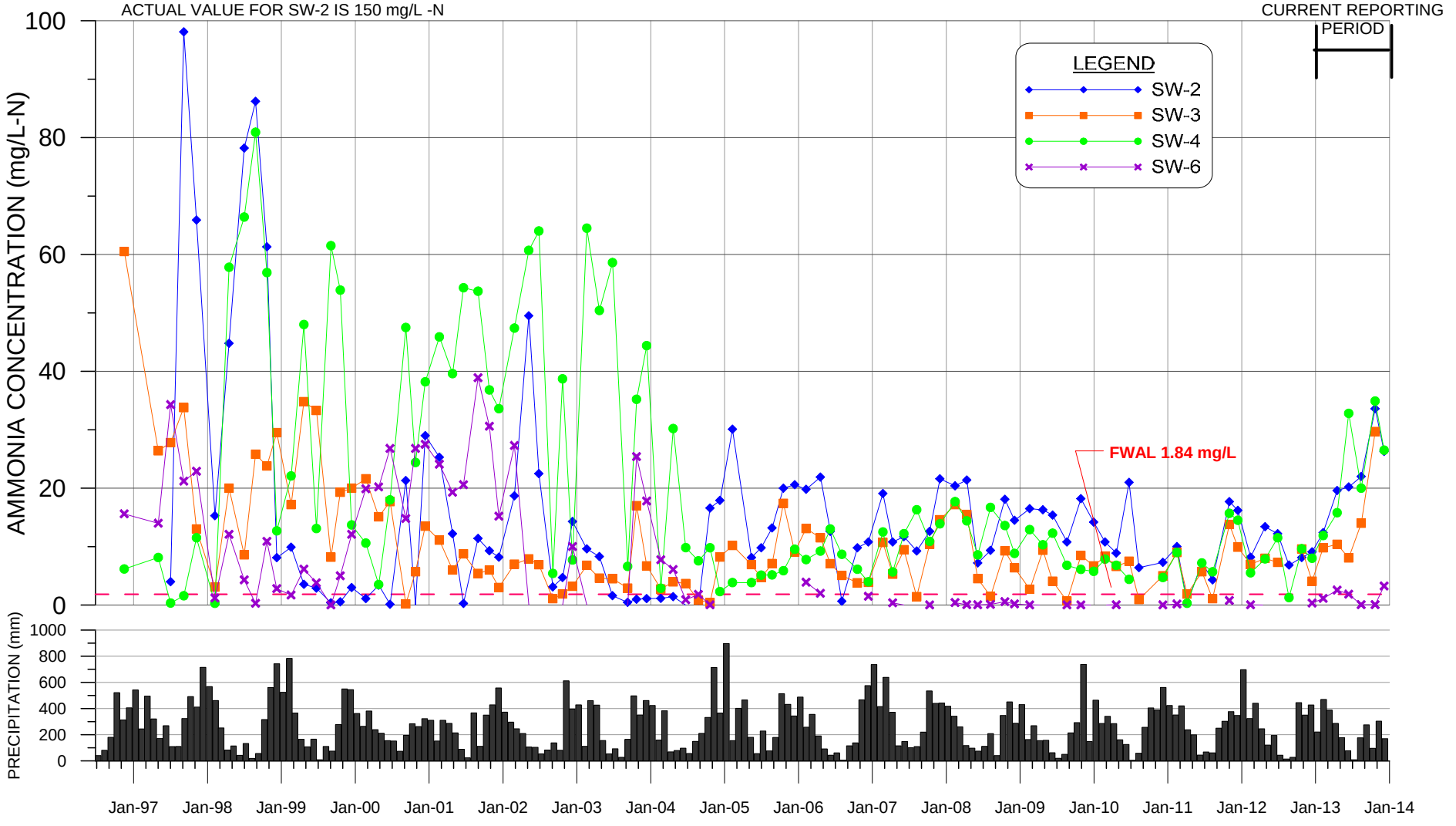
MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

AMMONIA NITROGEN CONCENTRATION PLOT LOWER RANGE VALUES

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-5

H:/Project/1576/CHEM/2013_chem/Figures/NH3_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.
4. BC FWAL = 1.84 mg/L (30 Day Average)

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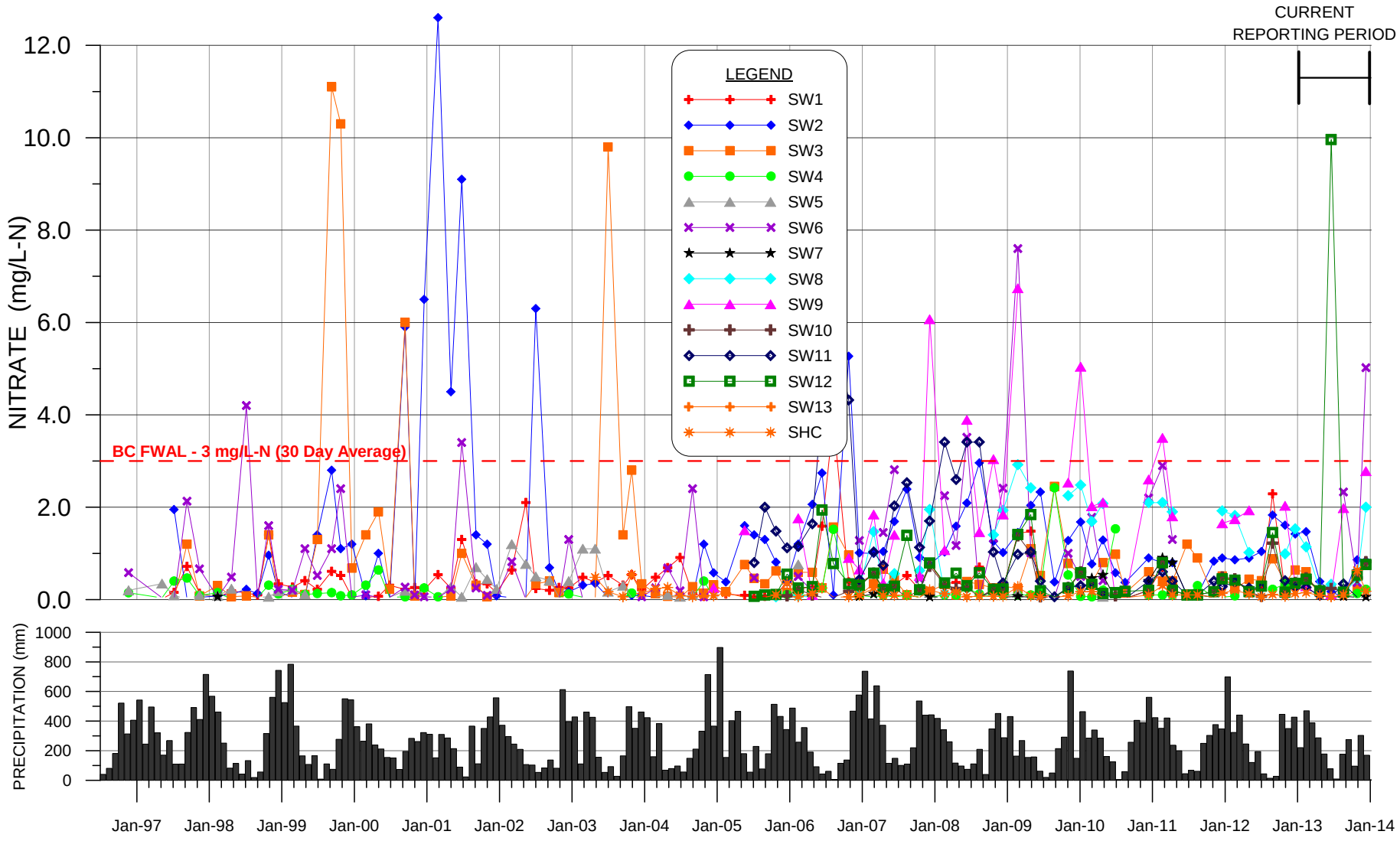
MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

AMMONIA NITROGEN CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-6

H:/Project/1576/CHEM/2013_chem/Figures/NO3_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.
4. BC FWAL = 3 mg/L (30 Day Average)

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WEST COAST LANDFILL
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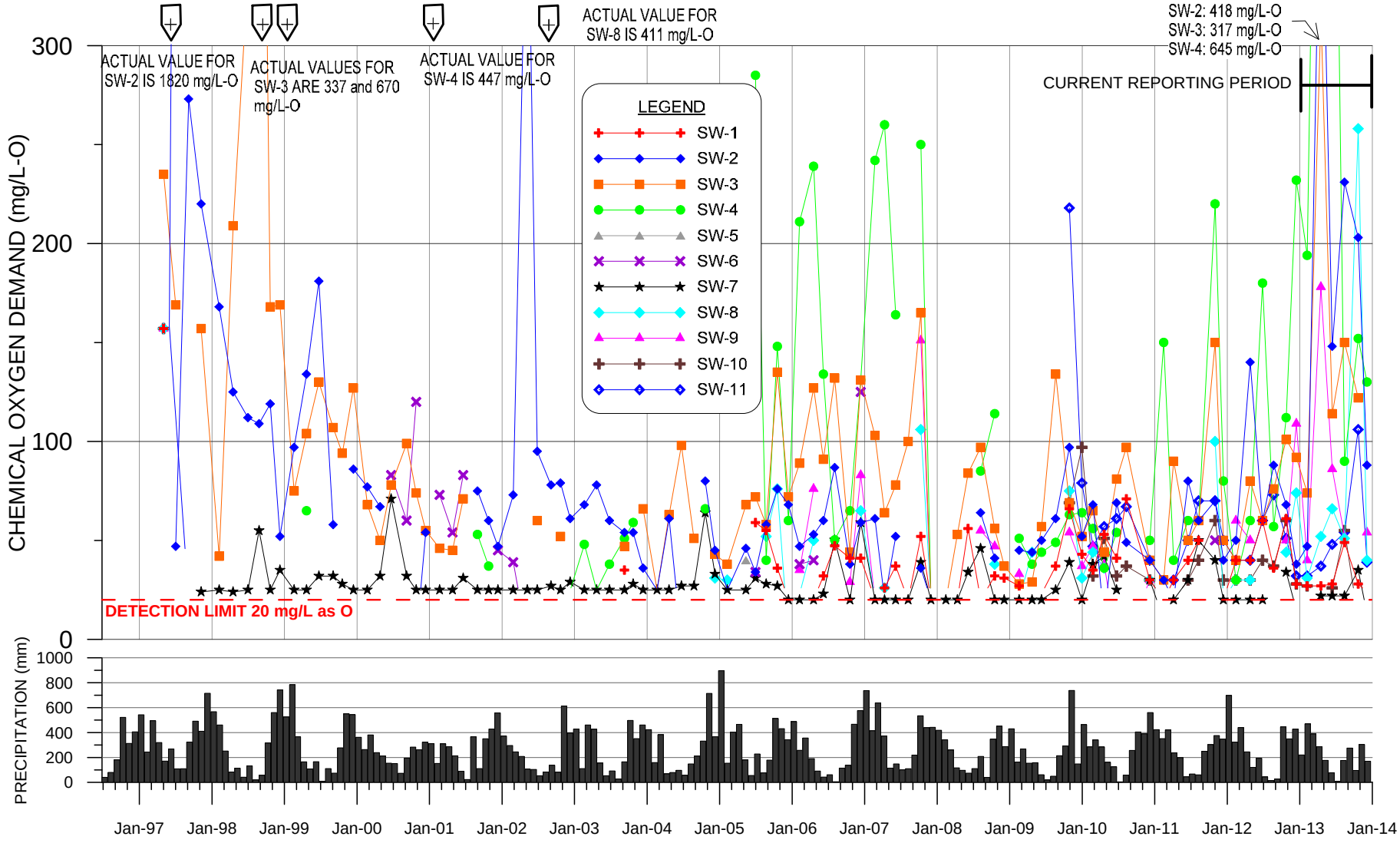
NITRATE (NITROGEN) CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-7

H:/Project/1576/CHEM/2013_chem/Figures/COD_2013.grf



NOTES:

1. Monthly Tofino Airport climate data is plotted in bar chart (farmzon.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.

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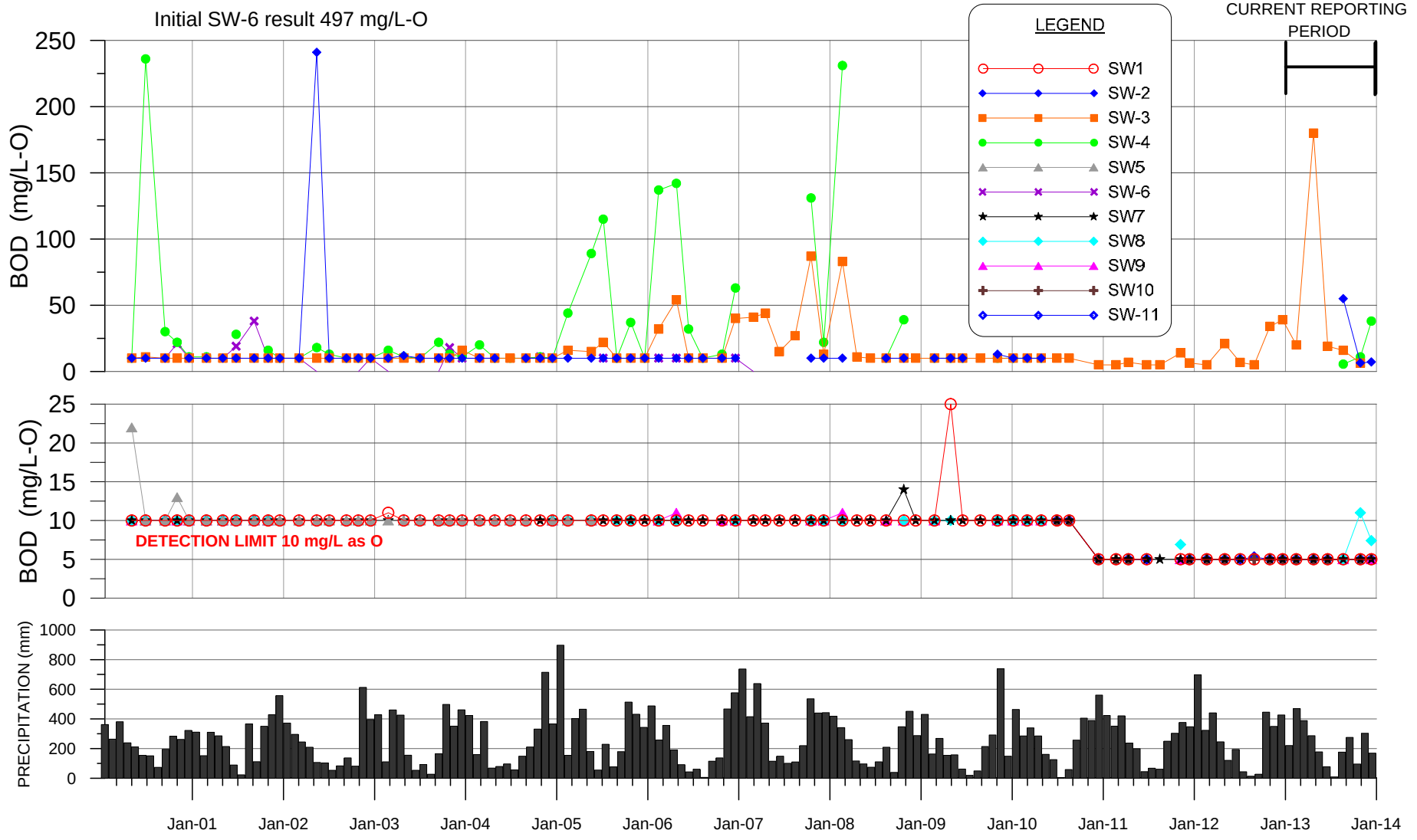
MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

CHEMICAL OXYGEN DEMAND PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-8

H:\Project\1576\CHEM\2013_chem\Figures\BOD_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.

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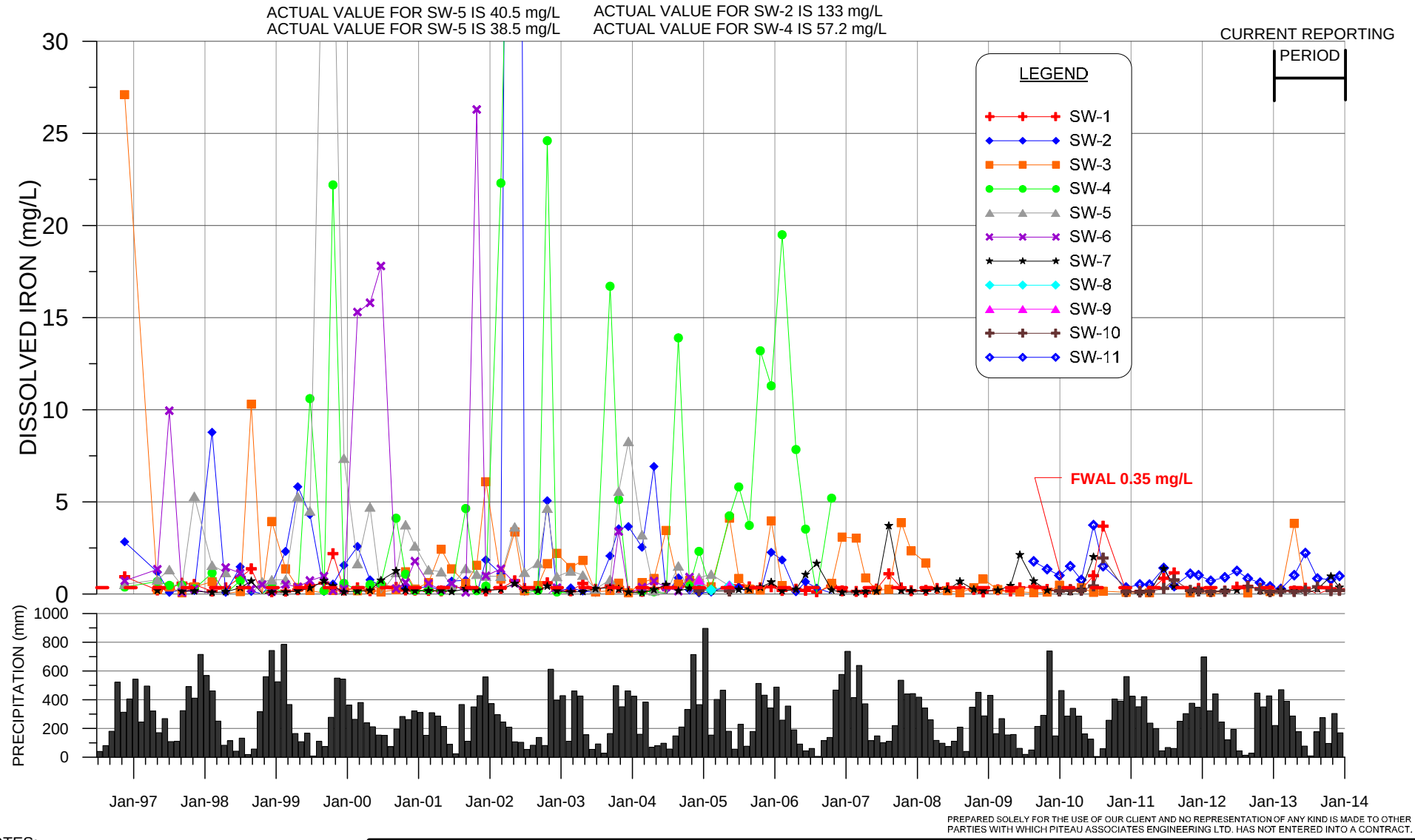
MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

BIOLOGICAL OXYGEN DEMAND PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-9

H:/Project/1576/CHEM/2013_chem/Figures/DissFe_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.
4. BC FWAL = 0.35 mg/L

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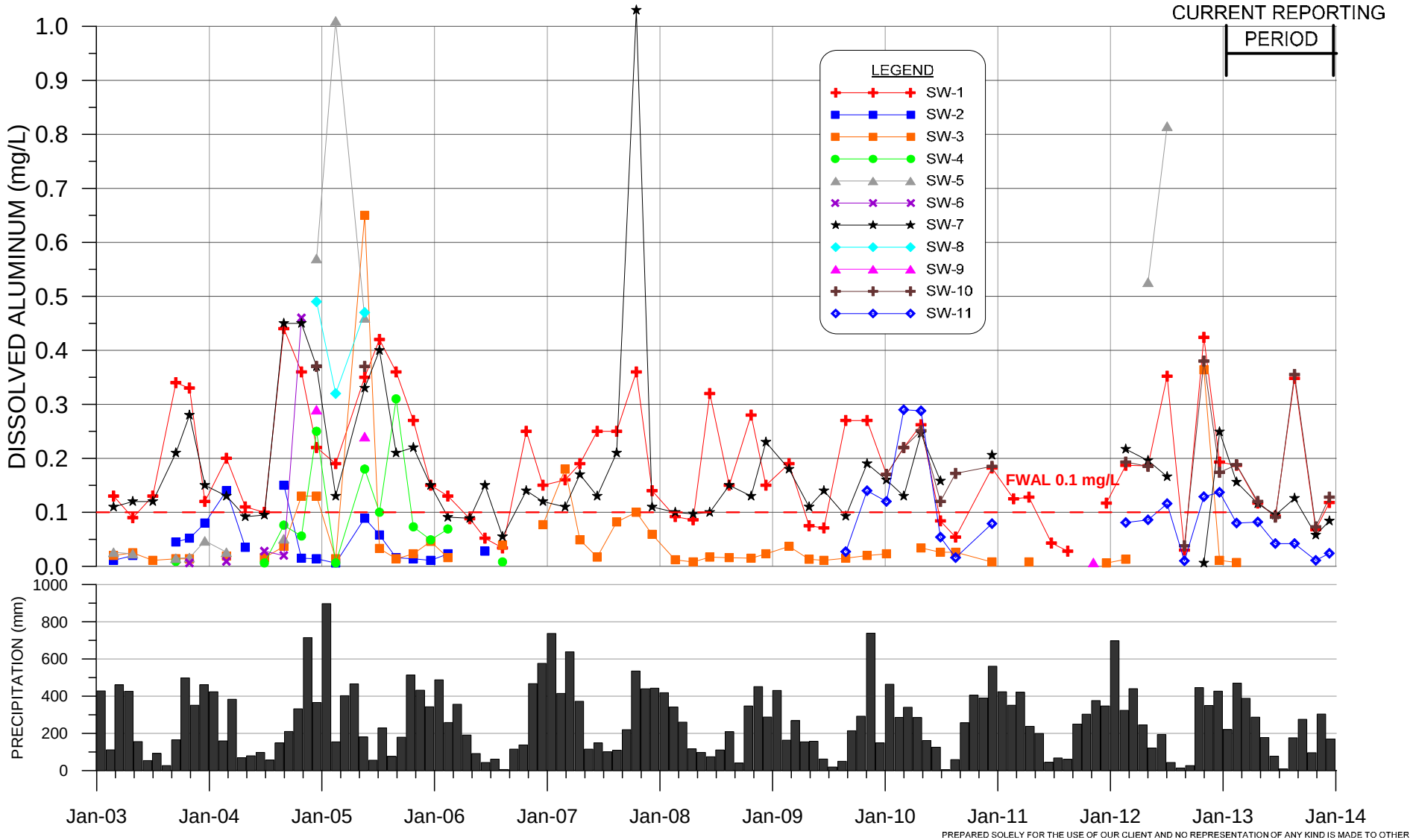
MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

DISSOLVED IRON CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-10

H:/Project/1576/CHEM/2013_chem/Figures/DissAl_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data unavailable).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.

ALBERNI CLAYOQUOT REGIONAL DISTRICT

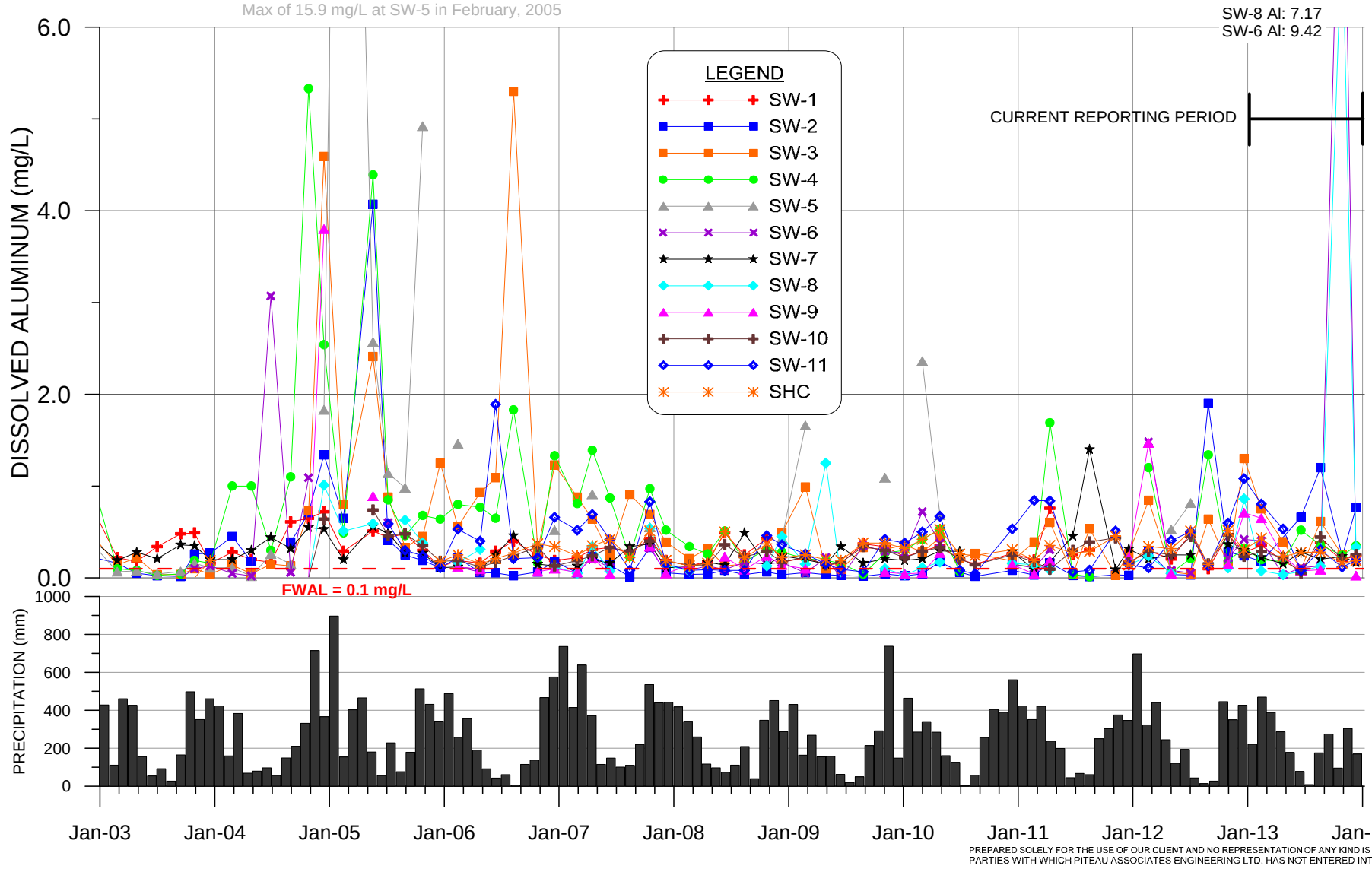
PITEAU ASSOCIATES
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

MONITORING PROGRAM
WEST COAST LANDFILL
UCLUELET, BC

DISSOLVED ALUMINUM CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-11

H:/Project/1576/CHEM/2013_chem/Figures/TotAl_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data not available).
2. SW-2 samples are from west leachate collector commissioned in October 2004.
3. SW-3 samples are from leachate lagoon commissioned in October 2004, and represents average quality of entire leachate flow.
4. BC FWAL = 0.1 mg/L

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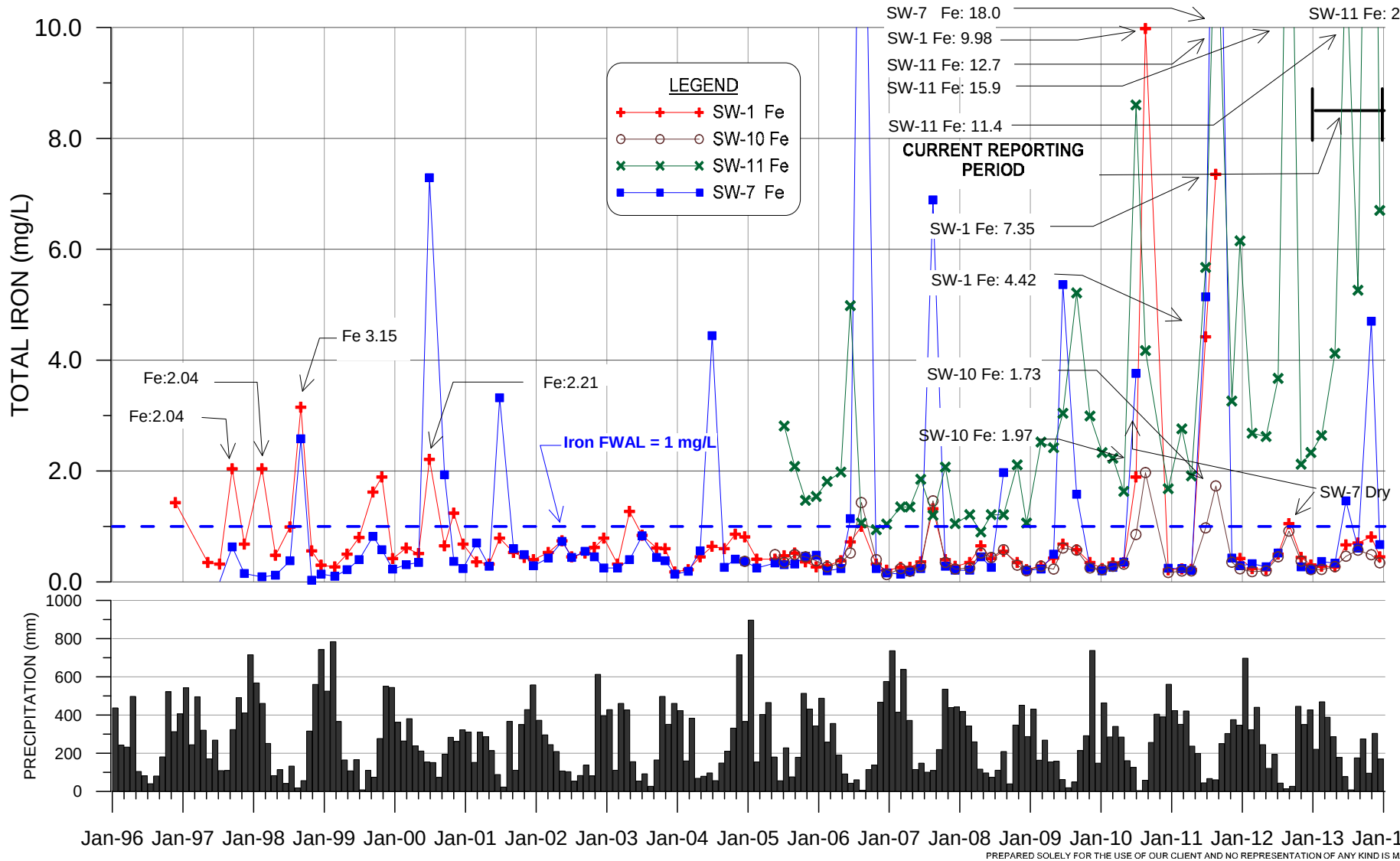
TOTAL ALUMINUM CONCENTRATION PLOT

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-12

H:/Project/1576/CHEM/2013_chem/Figures/Tot_Fe_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data not available).
2. SW-1 concentrations much higher than SW-10 (upstream background) in summers of 2010 and 2011, indicating some leachate effect.

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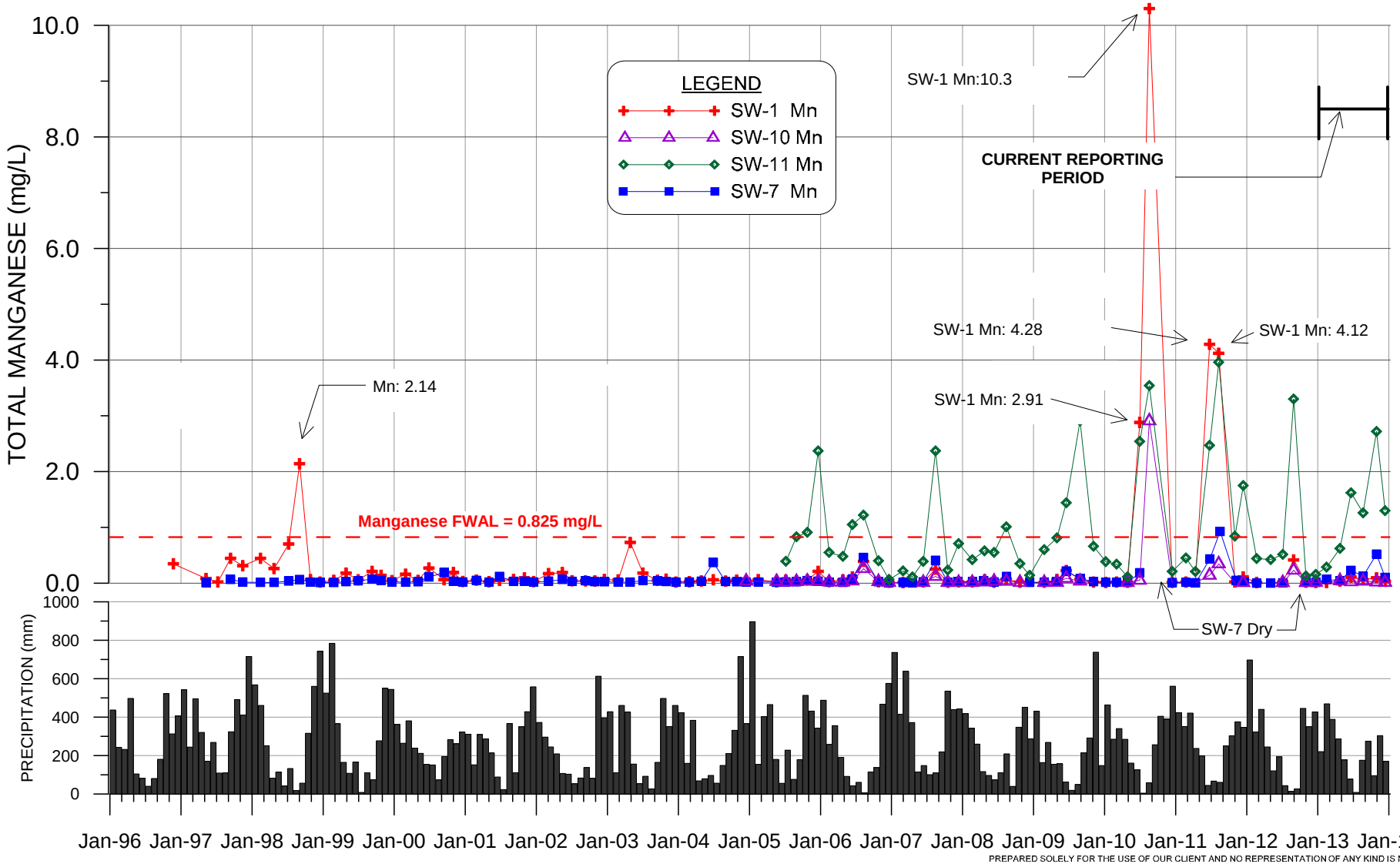
TOTAL IRON CONCENTRATION PLOT SW-1, SW-7, SW-10 AND SW-11

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-13

H:/Project/1576/CHEM/2013_chem/Figures/Tot_Mn_2013.grf



NOTES:
1. Monthly Tofino Airport climate data is plotted in bar chart (farmzone.com where Env Can data not available).
2. SW-1 concentrations much higher than SW-10 (upstream background) in summers of 2010 and 2011, indicating some leachate effect.

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UCLUELET, BC

TOTAL MANGANESE CONCENTRATION PLOT SW-1, SW-7, SW-10 AND SW-11

BY:	DATE:
DRG	JAN 14
APPROVED:	FIG:
ATH	A-14

APPENDIX B

2012 MONITORING PROGRAM SAMPLING SUITE

TABLE B-1
SUMMARY OF WEST COAST LANDFILL SAMPLING SITES AND ANALYTICAL SUITES - 2013 PROGRAM

Site		LABORATORY									
		Field Parameters	Physical Parameters	Anions	Nutrients	Total Metals	Dissolved Metals	BOD	COD	VOC Scan	LC_{50}
		Temp, pH, conductance, colour	pH, Conductance, TDS, total hardness	Alkalinity, chloride, sulphate	Ammonia, nitrate, total phosphate	ICP ICP/MS; FWAL detection limits	ICP ICP/MS; FWAL detection limits				
SW-1	Sandhill Creek near landfill	x	x	x	x	x	x	x	x		
SW-2	West leachate collector ditch	x	x	x	x	Al, Fe and Mn only		x	x		
SW-3	Leachate storage lagoon	x	x	x	x	x	x	x	x	x	
SW-4	West leachate collector ditch	x	x	x	x	Al, Fe and Mn only		x	x		
SW-5 [2]	South property line	Not sampled in 2013									
SW-6 [2]	West property line	x	x	x	x	Al, Fe and Mn only					
SW-7 [2]	Background at east property line	x	x	x	x	x	x	x	x		
SW-8 [2]	Irrigation area	x	x	x	x	Al, Fe and Mn only		x	x		
SW-9 [2]	Irrigation area	x	x	x	x	Al, Fe and Mn only		x	x		
SW-10	Sandhill Creek upstream of landfill	x	x	x	x	x	x	x	x		
SW-11	West drainage at property line	x	x	x	x	x	x	x	x		
SW-12	Sandhill Trib at south property line	x	x	x	x	Al, Fe and Mn only					
SW-13	Standing water along road to leachate lagoon										
Sandhill Creek d/s [1]	Sandhill Creek at Highway	x	x	x	x	Al, Fe and Mn only					

Note: 1) Sandhill Creek d/s has not shown any impact to date.
2) SW-5, SW-6, SW-7, SW-8 and SW-9 not sampled during dry months, due to insufficient water.

H:\Project\1576\SAMPLING\[SAMPLING-SITES.xls]Table B-1_2013